The Dalles, Oregon

TRANSPORTATION SYSTEM PLAN

VOLUME II - TECHNICAL APPENDICES

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VOLUME II: TECHNICAL APPENDICES

APPENDIX A. TECHNICAL MEMORANDUM 1: PLANS AND POLICY REVIEW

Angelo planning group — LAND USE PLANNING • TRANSPORTATION PLANNING • PROJECT MANAGEMENT

Memorandum

Date: December 10, 2015

To: Technical Advisory Committee and Public Advisory Committee

From: Darci Rudzinski, Shayna Rehberg, and CJ Doxsee, Angelo Planning Group

CC: Casey Bergh and Chris Brehmer, Kittelson & Associates, Inc.

Re: City of The Dalles Transportation System Plan (TSP) Technical Memorandum #1: Plans and Policy Review

Overview

This memorandum presents a review of existing plans, regulations, and policies that affect transportation planning in The Dalles Transportation System Plan (TSP) update study area. The review explains the relationship between the documents and planning in this area, identifying key issues that will guide the TSP development process. This memorandum is intended to guide later decisions regarding selection of preferred transportation alternatives and necessary amendments to related documents and regulations.

Some documents included in this review establish transportation-related standards, targets, and guidelines with which the TSP update shall coordinate and be consistent; others contain transportation improvements that will need to be factored into the future demand modeling and otherwise reflected in the draft TSP update. Local policy and regulatory requirements described in this review – such as the Land Use Development Ordinance – may be subject to recommended amendments in order to implement the recommendations in the updated TSP. This memorandum helps set the stage for those potential amendments, which will be prepared as part of project implementation (Task 6.2).

Table 1 provides a list of the documents reviewed in this memorandum, their project relevance, and the page on which they can be found.

Table 1 Summary of Documents Reviewed

Document	Project Relevance	Page
State Documents		
Oregon Transportation Plan (2006)	Projects, policies, and regulations proposed as part of the updated TSP will reflect the policies of the Oregon Transportation Plan and will comply with or move in the direction of meeting the standards and targets established in the OHP related to safety, access, and mobility. State modal plans will inform recommended improvements in the updated TSP; TSP recommendations will be consistent with state policy and requirements.	4
Oregon Highway Plan (2011)		4
Oregon Freight Plan (2011)		8
Oregon Public Transportation Plan (1997)		9
Oregon Rail Plan (2014)		10
Oregon Aviation Plan (2007)		10
Oregon Bicycle/Pedestrian Plan (2011)		11
Oregon Transportation Safety Action Plan (2011)		11
Transportation Planning Rule (OAR 660-012) (2011)		13
Access Management Rule (OAR 734-051) (2014)		14
Statewide Transportation Improvement Program (STIP)	The TSP update analysis will take into account projects that are programmed in the STIP. An expected outcome of this planning process is proposed recommendations to update the STIP to include projects from the updated TSP.	15
ODOT Highway Design Manual (2012)	The ODOT Highway Design Manual provides design standards on state roadways; analysis for the TSP update and final project recommendations will need to reflect state requirements for state facilities. Standards and guidelines adopted by The Dalles should be considered for additional guidance, concepts, and strategies for design.	17
Oregon Resilience Plan (2013)	The Oregon Resilience Plan provides guidance on and sets priorities for Oregon's multi-modal transportation system, as related to its role in rescue and economic recovery after a major seismic event. Transportation policies and standards adopted by The Dalles should be consistent with and supportive of the objectives and recommendations of this plan.	18
Sustainability Executive Orders (EO-00-07, EO-03-03,and EO-06-02)	The TSP planning process will consider ODOT's overall vision for sustainability efforts and consider strategies to create sustainable transportation operations.	20
Governor's Climate Change Initiative	The TSP planning process will consider strategies identified in ODOT's Greenhouse Gas Emissions Reduction Toolkit.	20
Regional/County Documents		
Wasco County Coordinated Transportation Plan (2009-2012)	The TSP planning process will consider the priorities identified in the Wasco County Coordinated Transportation Plan in the development of the transit element of the updated TSP. The TSP transit element will summarize available services in the City and will include recommendations for enhanced transit service.	20
Wasco County Transportation System Plan (2009)	The TSP update process will review goals, objectives, standards, and recommended projects from the Wasco County TSP and incorporate it into The Dalles TSP update.	21

Document	Project Relevance	Page
The Columbia Gorge Regional Airport Master Plan (2010)	The TSP update process will consider the needs and potential expansion and growth of commercial and recreational uses around the Columbia Gorge Regional Airport and will reflect related capacity and access-related improvements to the City's transportation system, as necessary.	23
Columbia River Gorge National Scenic Area Management Plan (2011)	Transportation needs identified for the GMA will be consistent with the Columbia River Gorge National Scenic Area Management Plan	24
City Documents		
The Dalles Comprehensive Plan (2011)	The updated TSP is intended to be adopted as the transportation element of the City's Comprehensive Plan, replacing the 2005 TSP. Recommendations resulting from the TSP update process must either be consistent with existing policies, including those identified above, or the TSP process should include proposed amendments to adopted policies. Amendments to the Zoning and Land Use Development Ordinance will also likely be needed in order to implement the updated TSP; proposed amendments will be based on existing, revised, or new policies related to land use designations, plan and code amendment procedures, land use review coordination, and/or protection of transportation facilities.	24
The Dalles Transportation System Plan (2005)	The TSP update process will review goals, objectives, standards, and recommended projects from the current plan and will determine what to retain or change in the updated TSP. This project will update transportation improvement projects for all modes, based on current and projected needs. Updated data, stakeholder and community involvement, and evaluation criteria will be used in making these determinations.	26
Land Use and Development Ordinance (2015)	Amendment to LUDO provisions related to transportation improvements such as pedestrian and bicycle access and connectivity, transit access, traffic impact analyses, and agency coordination may be recommended as part of this planning process in order to implement the updated TSP, provide consistency between the LUDO, TSP, and local road standards, and strengthen compliance with the TPR.	26
I-84 Chenoweth Interchange Area Management Plan (2009)	Recommended IAMP amendments to the TSP will be considered during the policy amendment, implementing ordinances and findings phase of the TSP update and, where appropriate, incorporated into the TSP.	28
The Dalles Growth Management Report (2013)	The TSP update process will consider the UGB findings and recommendations from The Dalles Growth Management Report. The proposed UGB expansion has not been adopted and therefore will not be reflected in the TSP update analysis. To the extent possible, the updated TSP recommendations will reflect the relative scale and location of proposed UGB expansion in order to limit constraints on future growth in those areas.	29
The Dalles' Economic Opportunities Analysis Report (2011)	The TSP update process will reflect the findings of The Dalles' Economic Opportunity Analysis Report, as it relates to improved multi-modal transportation service and connections to existing employment areas.	29
The Dalles' Current and Past Transportation Budget and Funding Sources	The TSP update process will review and take into consideration the current and past transportation budget and funding sources.	30

Oregon Transportation Plan (2006)

The Oregon Transportation Plan (OTP) is a comprehensive plan that addresses the future transportation needs of the State of Oregon through the year 2030. The primary function of the OTP is to establish goals, policies, strategies, and initiatives that are translated into a series of modal plans, such as the Oregon Highway Plan and the Oregon Bike and Pedestrian Plan.

The OTP emphasizes:

- Maintaining and maximizing the assets in place.
- Optimizing the performance of the existing system through technology.
- Integrating transportation, land use, economic development, and the environment.
- Integrating the transportation system across jurisdictions, ownerships, and modes.
- Creating sustainable funding.
- Investing in strategic capacity enhancements.

The Implementation Framework section of the OTP describes the implementation process and how state multimodal, modal/topic plans, regional and local transportation system plans and master plans will further refine the OTP's broad policies and investment levels. Local transportation system plans can further OTP implementation by defining standards, instituting performance measures, and requiring that operational strategies be developed.

> **Project Relevance:** The City of The Dalles TSP update will be guided by goals and objectives that will be consistent with the OTP. For example, The Dalles will seek to maximize performance of the existing local transportation system by the use of technology and system management before considering larger and costlier additions to the system.

Oregon Highway Plan (2011)

The Oregon Highway Plan (OHP) is a modal plan of the OTP that guides Oregon Department of Transportation's (ODOT's) Highway Division in planning, operations, and financing. Policies in the OHP emphasize the efficient management of the highway system to increase safety and to extend the highway capacity, partnerships with other agencies and local governments, and the use of new techniques to improve road safety and capacity. These policies also link land use and transportation, set standards for highway performance and access management, and emphasize the relationship between state highway and local road, bicycle, pedestrian, transit, rail, and air systems. The following policies, in particular, are relevant to the TSP update process.

Policy 1A: State Highway Classification System

The OHP classifies the state highway system into four levels of importance: Interstate, Statewide, Regional, and District. ODOT uses this classification system to guide management and investment decisions regarding state highway facilities. The system guides the development of the facility plans, as well as ODOT's review of local plan and zoning amendments, highway project selection, design and development, and facility management decisions including road approach permits.

Interstate 84 (Columbia River Highway), US 30 (Mosier-The Dalles), US 197 (The Dalles-California), and US 30 (Historic Columbia River) are classified highways in the state classification system. The purpose and management objectives of these highways are provided in Policy 1A, as summarized below.

- **Interstate highways** (I-84) provide connections between major cities in a state, regions of the state, and other states. A secondary function in urban areas is to serve regional trips within the urban area. Their primary objective is to provide mobility and, therefore, the management objective is to provide for safe and efficient high-speed continuous-flow operation in urban and rural areas.
- **Regional highways** (US 197) typically provide connections and links to regional centers, Statewide or Interstate highways, or economic or activity centers of regional significance. The management objective for these facilities is to provide safe and efficient, high-speed, continuous-flow operation in rural areas and moderate to high-speed operations in urban and urbanizing areas. A secondary function is to serve land uses in the vicinity of these highways.
- **District highways** (US 30: Mosier-The Dalles & US 30: Historic Columbia River) are facilities of county-wide significance and function largely as county and city arterials or collectors. They provide connections and links between small urbanized areas, rural centers and urban hubs, and also serve local access and traffic. The management objective is to provide for safe and efficient, moderate to high-speed continuous-flow operation in rural areas reflecting the surrounding environment and moderate to low-speed operation in urban and urbanizing areas for traffic flow and for pedestrian and bicycle movements.

In addition to the state highway classification system I-84, US 30, and US 197 have been given the following designations:

- I-84 – National Highway System (NHS) and OHP Freight Route.
- US 30: Historic Columbia River Highway – Oregon Scenic Byway.

Policy 1B: Land Use and Transportation

Policy 1B applies to all state highways. It is designed to clarify how ODOT will work with local governments and others to link land use and transportation in transportation plans, facility and corridor plans, plan amendments, access permitting, and project development. Policy 1B recognizes that state highways serve as the main streets of many communities and strives to maintain a balance between serving local communities (accessibility) and the through traveler (mobility). This policy recognizes the role of both the state and local governments related to the state highway system and calls for a coordinated approach to land use and transportation planning.

Policy 1C: State Highway Freight System

The primary purpose of the State Highway Freight System is to facilitate efficient and reliable interstate, intrastate, and regional truck movement through a designated freight system. This freight system, made up of the Interstate Highways and select Statewide, Regional, and District Highways, includes routes that carry significant tonnage of freight by truck and serve as the primary interstate and intrastate highway freight connection to ports, intermodal terminals, and urban areas. Highways included in this designation have higher highway mobility standards than other statewide highways. *I-84 is a designated freight route.*

Policy 1F: Highway Mobility Standards Access Management Policy

Policy 1F sets mobility standards for ensuring a reliable and acceptable level of mobility on the state highway system. The standards are used to assess system needs as part of long range, comprehensive planning transportation planning projects (such as an IAMP), during development review, and to demonstrate compliance with the Transportation Planning Rule (TPR).

Significant amendments to Policy 1F were adopted at the end of 2011. The 2011 revisions were made to address concerns that state transportation policy and requirements have led to unintended consequences and inhibited economic development. Policy 1F now provides a clearer policy framework for considering measures other than volume-to-capacity (v/c) ratios for evaluating mobility performance. Also as part of these amendments, v/c ratios established in Policy 1F were changed from being standards to “targets.” These targets are to be used to determine significant effect pursuant to TPR Section -0060. The Chenoweth IAMP, adopted before the revisions to Policy 1F, may benefit from being revisited to evaluate how changes to Policy 1F affect the area.

Table 2 includes the mobility targets for the state facilities in the TSP study area.

Table 2 – State Facility Mobility Targets

Volume to Capacity Ratio Targets Outside Metro			
Highway Category	Inside Urban Growth Boundary		
	Non-MPO* Outside of STAs** where non-freeway posted speed <= 35mph, or a Designated UBA	Non-MPO Outside of STAs where non-freeway speed >35 mph but <45 mph	Non-MPO where non-freeway speed limit >= 45 mph
Interstate Highways	N/A	N/A	0.80
Statewide (not a Freight Route)	0.90	0.85	0.80
Regional Highways	0.90	0.85	0.85
District/Local Interest Roads	0.95	0.90	0.90

*MPO = Metropolitan Planning Area
**Special Transportation Area

Policy 1G: Major Improvements

This policy requires maintaining performance and improving safety on the highway system by improving efficiency and management on the existing roadway network before adding capacity. The state's highest priority is to preserve the functionality of the existing highway system. Tools that could be employed to improve the function of the existing interchanges include access management, transportation demand management, traffic operations modifications, and changes to local land use designations or development regulations.

After existing system preservation, the second priority is to make minor improvements to existing highway facilities, such as adding ramp signals, or making improvements to the local street network to minimize local trips on the state facility.

The third priority is to make major roadway improvements such as adding lanes to increase capacity on existing roadways. *As part of this TSP process, ODOT will work with The Dalles and other stakeholders to determine appropriate strategies and tools that can be implemented at the local level that are consistent with this policy.*

Policy 2B: Off-System Improvements

This policy recognizes that the state may provide financial assistance to local jurisdictions to make improvements to local transportation systems if the improvements would provide a cost-effective means of improving the operations of the state highway system. *As part of this TSP update process, ODOT will work with the City and project stakeholders to identify improvements to the local road system that support the planned land use designations in the study area and that will help preserve capacity and ensure the long-term efficient and effective operation of high functional class facilities.*

Policy 2F: Traffic Safety

This policy emphasizes the state's efforts to improve safety of all users of the highway system. Action 2F.4 addresses the development and implementation of the Safety Management System to target resources to sites with the most significant safety issues. *The TSP update process will include citywide crash analysis to identify sites with a history of fatal and serious injury crashes and identify potential countermeasures to reduce crashes.*

Policy 3A: Classification and Spacing Standards

It is the policy of the State of Oregon to manage the location, spacing, and type of road intersections on state highways to ensure the safe and efficient operation of state highways consistent with their highway classification.

Action 3A.2 calls for spacing standards to be established for state highways based on highway classification, type of area, and posted speed. Tables in OHP Appendix C present access spacing standards which consider urban and rural highway classification, traffic volumes, speed, safety, and operational needs. The access management spacing standards established in the OHP are implemented by access management rules in OAR 734, Division 51, addressed later in this report. *The TSP update process will include an analysis of how existing ODOT arterials and collectors compare to these standards.*

Policy 4A: Efficiency of Freight Movement

Policy 4A emphasizes the need to maintain and improve the efficiency of freight movement on the state highway system. *I-84 is an OHP designated Freight Route.*

Policy 4B: Alternative Passenger Modes

Policy 4B encourages the development of alternative passenger services and systems as part of broader corridor strategies. The policy promotes the development of alternative passenger transportation services located off the highway system to help preserve the performance and function of the state highway system. Mid-Columbia Council of Government's Transportation Network (The Link), Columbia Area Transit, and Greyhound provide public transportation service in the study area. Improving safety, access, and mobility for pedestrians and bicyclists is an objective of this update process.

> **Project Relevance:** The TSP update is being developed in coordination with ODOT so that projects, policies, and regulations proposed as part of the updated TSP will comply or move in the direction of meeting the standards and targets established in the OHP related to safety, access, and mobility.

Oregon Freight Plan (2011)

The Oregon Freight Plan (OFP) is a modal plan of the OTP and implements the state's goals, and policies related to the movement of goods and commodities. Its purpose statement identifies the state's intent "to improve freight connections to local, Native American, state, regional, national and global markets in order to increase trade-related jobs and income for workers and businesses." The objectives of the plan include prioritizing and facilitating investments in freight facilities (including rail, marine, air, and pipeline infrastructure) and adopting strategies to maintain and improve the freight transportation system.

The plan defines a statewide strategic freight network. *I-84 and parallel railroads are designated as a strategic corridor in the OFP.*

The following policy and strategic direction provided in the OFP prioritizes preservation of strategic corridors as well as improvements to the supply chain achieved through coordination of freight and system management planning.

- Strategy 1.2: Strive to support freight access to the Strategic Freight System. This includes proactively protecting and preserving corridors designated as strategic.
- Action 1.2.1. Preserve freight facilities included as part of the Strategic Freight System from changes that would significantly reduce the ability of these facilities to operate as efficient components of the freight system unless alternate facilities are identified or a safety-related need arises.
- Strategy 2.4: Coordinate freight improvements and system management plans on corridors comprising the Strategic Freight System with the intent to improve supply chain performance.

> **Project Relevance:** Maintaining and enhancing efficiency of the truck and rail freight system in the study area will be an objective of the updated TSP. The project advisory committees include representatives from ODOT and local freight interests.

Oregon Public Transportation Plan (1997)

The Oregon Public Transportation Plan (OPTP) is the modal plan of the OTP that provides guidance for ODOT and public transportation agencies regarding the development of public transportation systems. The vision guiding the OPTP is as follows:

- A comprehensive, interconnected and dependable public transportation system, with stable funding, that provides access and mobility in and between communities of Oregon in a convenient, reliable, and safe manner that encourages people to ride
- A public transportation system that provides appropriate service in each area of the state, including service in urban areas that is an attractive alternative to the single-occupant vehicle, and high-quality, dependable service in suburban, rural, and frontier (remote) areas
- A system that enables those who do not drive to meet their daily needs
- A public transportation system that plays a critical role in improving the livability and economic prosperity for Oregonians.

The OPTP Implementation Plan directs ODOT investments towards commuter and mobility needs in larger communities and urban areas, as well as in smaller communities where warranted. It also prioritizes investments in intercity connections statewide. Long-term implementation and funding is geared toward both modernization and preservation projects while preservation projects are more the focus for short term implementation and funding.

Columbia Area Transit provided by the Hood River County Transportation District provides fixed-route inter-city and intra-city transit service between the cities of Hood River, Mosier, and The Dalles. The Mid-Columbia Transit Regional Transportation Plan is reviewed later in this document.

The Mid-Columbia Council of Government's Transportation Network (The Link) provides dial-a-ride, door-to-door service within the City of The Dalles and select areas in Wasco County. The service connects riders to the Greyhound station in The Dalles for trips to Hood River, Portland to the West and Pendleton, Boise, and other destinations along I-84 to the east.

> **Project Relevance:** The TSP update process will coordinate with and provide information to the Mid-Columbia Council of Government's Transportation Network (formerly known as The Link) and Hood River County Transportation District in the study area.

Oregon Rail Plan (2014)

The Oregon State Rail Plan ("State Rail Plan"), a state modal plan under the OTP, addresses long-term freight and passenger rail planning in Oregon. The State Rail Plan provides a comprehensive assessment of the state's rail planning, freight rail, and passenger rail systems. It identifies specific policies concerning rail in the state, establishes a system of integration between freight and passenger elements into the land use and transportation planning processes, and calls for cooperation between state, regional, and local jurisdictions in planning for rail.

Currently, freight rail service in The Dalles is provided by Union Pacific (UP) Railroad Company as a Class I east-west transcontinental railroad route. The transcontinental route runs between Portland and Hinkle along the southern bank of the Columbia River. The route continues southeast from Hinkle to Granger, Wyoming and Ogden Utah, connecting to UP's historic Central Corridor that links the San Francisco Bay Area with Salt Lake City, Omaha, and Chicago.

The AMTRAK Empire Builder travels along the Washington side of the Columbia River as part of its Portland-Chicago route. Portland is the only stop for the Empire Builder in Oregon, although stops along the north bank of the Columbia River also provide access to nearby Oregon residents. The AMTRAK stations nearest to The Dalles are Bingen-White Salmon and Wishram, Washington.

> **Project Relevance:** The TSP update will consider the needs of the rail freight system within City limits and passenger rail system in nearby Washington cities in developing recommended policies and projects related to improving safety and mobility in the City. In addition, the project technical advisory committee includes ODOT representatives that will advise on rail and freight interests.

Oregon Aviation Plan (2007)

The Oregon Aviation Plan (OAP) is a modal plan of the OTP that defines policies and investment strategies for Oregon's public use aviation system for the next 20 years. The plan addresses the existing conditions, economic benefits, and jurisdictional responsibilities for the existing aviation infrastructure. The plan contains policies and recommended actions to be implemented by Oregon Department of Aviation in coordination with other state and local agencies and the Federal Aviation Administration.

The OAP categorizes airports based on functional role and service criteria. The OAP identifies the Columbia Gorge Regional Airport (across the river in Dallesport, Washington) as a Category III – Regional General Aviation Airport. According to the OAP, the function of a Category III Airport is to accommodate a wide range of general aviation users for large service areas in outlying areas of Oregon and may also accommodate seasonal regional fire response activities.

> **Project Relevance:** The TSP update will consider access to the Columbia Gorge Regional Airport in developing TSP policies and projects.

Oregon Bicycle and Pedestrian Plan (2011)

The intent of the Oregon Bicycle and Pedestrian Plan is to provide safe and accessible bicycling and walking facilities in an effort to encourage increased levels of bicycling and walking. The plan is comprised of two parts: the Policy and Action Plan and the Oregon Bicycle and Pedestrian Design Guide.

Originally adopted in 1995 and reaffirmed as an element of the OTP in 2006, the "Bicycle and Pedestrian Mode Plan" is in the final phases of an update. The Design Guide was updated in 2011 and will remain separate from the policy portion of the plan.

The existing Policy and Action Plan provides background information, including relevant state and federal laws, and includes goals, actions, and implementation strategies proposed by ODOT to improve bicycle and pedestrian transportation. The plan states that bikeway and walkway systems will be established on state highways as follows:

- As part of modernization projects (bike lanes and sidewalks will be included);
- As part of preservation projects, where minor upgrades can be made;
- By restriping roads with bike lanes;
- With improvement projects, such as completing short missing segments of sidewalks;
- As bikeway or walkway modernization projects;
- By developers as part of permit conditions, where warranted.

The Design Guide is the technical element of the plan that guides the design and management of bicycle and pedestrian facilities on state-owned facilities. It has been designated as a companion piece to the Highway Design Manual and includes updated and innovative pedestrian and bicycle treatments.

> **Project Relevance:** The standards and guidelines for pedestrian and bicycle improvements in the Oregon Bicycle and Pedestrian Plan can serve as "best practices" and inform recommended bicycle and pedestrian improvements in the updated TSP.

Oregon Transportation Safety Action Plan (2011)

An element of the OTP, the Oregon Transportation Safety Action Plan (TSAP) establishes a safety agenda to guide the investments and actions of ODOT and the state for the next 20 years. As indicated in the name of the plan, the emphasis of the Oregon TSAP is action and implementation. Actions included in the Oregon TSAP were chosen based on crash data and information provided by transportation safety experts.[1]

[1] In addition to meeting the State's needs, the TSAP serves as Oregon's Strategic Highway Safety Plan (SHSP) as required by federal law. This federal law, now known as MAP-21, requires that SHSPs be updated every five years, and has requirements for inclusion of Highway Safety Improvement Program planning elements. The TSAP is currently being updated; a final updated TSAP is scheduled to be available late 2016.

Actions identified in the TSAP that will guide or be addressed in the TSP process include:

- Focus on "safety areas of interest" such as intersection crashes and pedestrian/bicycle crashes with improvements such as advance signing, roundabouts, access management, signal timing, bulb-outs, refuge islands, bicycle signals, and rapid flashing beacons (Action 23).
- Elevate safety in local system plans by, for example, more widely implementing access management strategies and moving toward compliance with access management standards; and involving engineering, enforcement, and emergency service staff professionals, as well as local transportation safety advocacy groups, in planning (Actions 8 and 9).
- Design improvements for the increased safety of pedestrians, bicyclists, and other non-motorized vehicles, accommodating multiple users on a street and considering the needs of families, seniors, and children using transportation facilities (Action 4).

Roadway Departure Safety Implementation Plan

The Roadway Departure Plan provides specific information and identifies areas regarding roadway departure safety improvements to implement the current TSAP.

- The traditional approach of relying primarily on pursuing major improvements at high-crash roadway departure locations must be complemented with two additional approaches:
  - A systematic approach that involves deploying large numbers of relatively low-cost, cost-effective countermeasures at many targeted segments of roadway with a history of roadway departure crashes, and
  - A comprehensive approach that coordinates an engineering, education, and enforcement (3E)[2] initiative on corridors and in urban areas with high numbers of severe roadway departure crashes.
- The systematic improvement categories to be deployed include the following: sign and marking enhancements on curves, centerline rumble strips on rural two-lane highways, edge line rumble stripes and shoulder rumble strips, alignment delineation, and selective rural tree removal.
- The systematic and comprehensive approaches will generate a higher number of roadway departure improvements statewide, and Region personnel will require training as they are asked to take a more active role in identifying the appropriateness of systematic improvements within their Regions.
- Low-cost, cost-effective countermeasures should be considered on other types of projects, as appropriate (e.g., resurfacing, surface transportation projects), when a crash history exists within the area of the work and the countermeasure can reduce future crash potential. In these cases, safety-specific funding can be used to supplement the project funds when necessary.

The Roadway Departure Plan identifies segments of Dry Hollow Road, Cherry Heights Road, and Scenic Drive for safety improvements, including sign and marking enhancements.[3]

[2] "3E" – Engineering, Education, & Enforcement

Bicycle and Pedestrian Safety Implementation Plan

The Bicycle and Pedestrian Safety Implementation Plan provides a systemic safety planning process to prioritize corridors across all public roads in Oregon. The Plan also identifies corridors with the most potential for reducing frequency and severity of pedestrian and bicycle crashes.

The plan identifies a number of corridors as priority segments from a crash frequency and severity screening process. Corridor segments are listed in Tables 18 through 20 and illustrated in Figure 7 and 8.

Intersection Safety Plan

The Intersection Safety Plan provides specific information and identifies areas regarding intersection safety improvements to implement the current Action Plan. It directs that the traditional approach of relying primarily on pursuing major improvements at high-crash intersections be complemented with an expanded systematic approach. This approach should involve deploying large numbers of relatively low-cost, cost-effective countermeasures at many targeted high-crash intersections and coordinating engineering, education, and enforcement (3E) initiatives on corridors with high numbers of severe intersection crashes.

> *The plan identifies intersections at Cherry Heights Road & 6th Street, Hostetler Way & 6th Street, Webber Street & 6th Street, and Webber Street & 2nd Street for improvements.*
> **Project Relevance:** Consistent with the state's TSAP Action Plan, the TSP update process will apply objective methods to screen, diagnose, and suggest countermeasures to reduce crash potential. The TSP will consider safety in the selection and prioritization of transportation projects to meet the City's future system needs for all modes of transportation.

Transportation Planning Rule (OAR 660-012) (2011)

The Transportation Planning Rule (TPR), OAR 660-012, implements Goal 12 (Transportation) of the statewide planning goals. The TPR contains numerous requirements governing transportation planning and project development, including the required elements of a TSP. In addition to plan development, the TPR requires each local government to amend its land use regulations to implement its TSP (-0045). It also requires local government to adopt land use or subdivision ordinance regulations consistent with applicable federal and state requirements: "to protect transportation facilities, corridors and sites for their identified functions."

Local compliance with -0045 provisions is achieved through a variety of measures, including access control requirements, standards to protect future operations of roads, and notice and coordinated review procedures for land use applications. Local development codes should also include a process to apply conditions of approval to development proposals, and regulations ensuring that amendments to land use designations, densities, and design standards are consistent with the functions, capacities, and performance standards of facilities identified in the TSP.

The TPR does not regulate access management. ODOT adopted OAR 734-051 to address access management and it is expected that ODOT, as part of this project, will coordinate with the City in

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[3] http://www.oregon.gov/odot/hwy/traffic-roadway/pages/roadway_departure.aspx

planning for access management on state roadways consistent with its Access Management Rule. See the review of OAR 734-051 in the next section for a review of these access management rules.

Recent amendments to the TPR (2012) include new language in Section -0060 that allows a local government to exempt a zone change from the "significant effect" determination if the proposed zoning is consistent with the comprehensive plan map designation and the TSP. The amendments also allow a local government to amend a functional plan, comprehensive plan, or land use regulation without applying mobility standards (V/C, for example) if the subject area is within a designated multi-modal mixed-use area (MMA).

> **Project Relevance:** The TPR directs local TSP development and requires specific transportation elements be implemented in the local development ordinance. Local requirements such as access management, coordinated land use review procedures, and transportation facility standards and requirements are meant to protect road operations and safety and provide for multi-modal access and mobility. Implementation measures that will be developed with the TSP update may entail proposed amendments to the Land Use and Development Ordinance to ensure consistency with TPR requirements as well as to reflect TSP recommendations.

Access Management Rule (OAR 734-051) (2014)[4]

Oregon Administrative Rule (OAR) 734-051 defines the State's role in managing access to highway facilities in order to maintain functional use and safety and to preserve public investment. OHP Policy 3A and OAR 734-051 set access spacing standards for driveways and approaches to the state highway system[5]. The most recent amendments presume that existing driveways with access to state highways have written permission from ODOT as required by ORS 734. The standards are based on state highway classification and differ depending on posted speed and average daily traffic volume. The standards for highways in The Dalles are presented in Tables 3, 4 and 5 below.

Table 3 - Spacing Standards for Highways, ADT < or = 5,000 (US 30: Mosier-The Dalles & US 30: Historic Columbia River)

Posted Speed (mph)	Spacing (feet)			
	Regional & District Highways, Rural and Urban	Statewide Highways, Rural Areas	Statewide Highways, Urban Areas	Highways, Unincorporated Communities, Rural Areas
55 & higher	650	1,320	1,320	1,320
50	425	1,100	1,100	1,100
40-45	360	990	360	750
30-35	250	770	250	425
25 & lower	150	550	150	350

[4] Amendments to OAR 734-051 were adopted in early 2014 based on passage of Senate Bill 1024 (2010), Senate Bill 264 (2011), and Senate Bill 408 (2014). The amendments were intended to allow more consideration for economic development when developing and implementing access management rules, and involved changes to how ODOT deals with approach road spacing, highway improvements requirements with development, and traffic impact analyses requirements for approach road permits.
[5] ODOT Access Management Standards – OHP Appendix C Revisions to Address Senate Bill 264 (2011): http://www.oregon.gov/ODOT/TD/TP/docs/ohp_am/apdxc.pdf

Table 4 - Spacing Standards for Regional Highways, ADT > 5,000 (US 197)

Posted Speed (mph)	Spacing (feet)			
	Expressway, Rural Area	Expressway, Urban Area	Rural Area	Urban Area
55 and higher	5,280	2,640	990	990
50	5,280	2,640	830	830
40-45	5,280	2,640	750	500
30-35	-	-	600	350
25 and lower	-	-	450	250

Table 5 - Spacing Standards for District Highways, ADT > 5,000 (US 30 Mosier-The Dalles)

Posted Speed (mph)	Spacing (feet)			
	Expressway, Rural Area	Expressway, Urban Area	Rural Area	Urban Area
55 and higher	5,280	2,640	700	700
50	5,280	2,640	550	550
40-45	5,280	2,640	500	500
30-35	-	-	400	350
25 and lower	-	-	400	250

Project Relevance: Analysis for the TSP update and final project recommendations will need to reflect state requirements for state facilities; the updated TSP will comply or move in the direction of meeting access management standards for state facilities. Implementation measures that will be developed for the TSP update may entail amendments to the Land Use Development Ordinance to ensure that it is consistent with these access management requirements as well as TSP recommendations related to access management.

Statewide Transportation Improvement Program (STIP)

The State Transportation Improvement Program (STIP) is the four-year programming and funding document for transportation projects and programs for state and regional transportation systems, including federal land and Indian reservation road systems, interstate, state, and regional highways, bridges, and public transit. It includes state- and federally-funded system improvements that have approved funding and are expected to be undertaken during the upcoming four-year period. The projects and programs undergo a selection process managed by ODOT Regions or ODOT central offices, a process that is held every two years in order to update the STIP.

The STIP document is organized by county. Projects found in the 2015-2018 STIP as amended and within The Dalles are presented in Table 6 below.

Table 6 - City of The Dalles Projects in the 2015-2018 STIP

Project Name	Description	Project Total	Year(s)	Notes
The Dalles Riverfront Access (15471)	Pedestrian improvements from Union to Laughlin & Pedestrian Plaza & Tunnel under Union Pacific Railroad (UPRR) at Washington St.	$7,140,103	2007-2017	
The Dalles Riverfront Trail (17890)	Construct Remaining 5 segments of trail for a total of 1.38 miles	$1,735,000	2011-2015	
The Dalles Transportation Center	Construct a new transit facility in the City of The Dalles	$3,324,183	2012-2015	Currently under construction
FFO I-84: Three Mile Creek Culvert – Bridge# 09192 (18661)	Replace culvert	$2,350,000	2014-2017	Currently under construction
I84@Brewery Grade/OR197 Illumination & Rufus Variable Message Signs (18691)	Replace existing illumination with Light Emitting Diodes (LEDS) & variable message signs in Rufus	$700,000	2016-2017	
I-84: Mosier – The Dalles (18711)	Single lift inlay (travel lanes) & median barrier replacement	$10,120,000	2014-2016	
Region 4 HSIP Transition Rural (19165)	Sign upgrades, rumble strips, delineators & striping	$2,115,828	2014-2016	
Region 4 HSIP Transition Rural (19166)	Signal upgrades	$1,508,088	2014-2015	
Port of The Dalles IOF	Construct new roadway to extend river trail way	$3,225,710	2015	Construction completed

Project Relevance: The TSP update analysis will take into account projects that are programmed in the STIP. An expected outcome of this planning process is proposed recommendations to eventually amend the STIP to include projects from the updated TSP. The STIP projects will most likely involve improvements that are eligible for funding through the ODOT Enhance program, which awards funding through a competitive application process.

ODOT Highway Design Manual (2012)

The 2012 Highway Design Manual provides ODOT with uniform standards and procedures for planning studies and project development for the state's roadways. It is intended to provide guidance for the design of new construction; major reconstruction (4R); resurfacing, restoration, and rehabilitation (3R); or resurfacing (1R) projects. It is generally in agreement with the American Association of State Highway and Transportation Officials (AASHTO) document *A Policy on Geometric Design of Highways and Streets - 2011*. However, sound engineering judgment must continue to be a vital part in the process of applying the design criteria to individual projects. The flexibility contained in the 2012 Highway Design Manual supports the use of Practical Design concepts and Context Sensitive Design practices.

The Highway Design Manual is to be used for all projects that are located on state highways. National Highway System or Federal-aid projects on roadways that are under local jurisdiction will typically use the 2011 AASHTO design standards or ODOT 3R design standards. Table 7 shows which design standards are applicable for certain projects based on project type, and whether or not the project involves a state route. State and local planners will also use the manual in determining design requirements as they relate to the state highways in TSPs, Corridor Plans, and Refinement Plans. Some projects under ODOT roadway jurisdiction traverse across local agency boundaries. Some local agencies have adopted design standards and guidelines that may differ from the various ODOT design standards. Although the appropriate ODOT design standards are to be applied on ODOT roadway jurisdiction facilities, local agency publications and design practices can also provide additional guidance, concepts, and strategies related to roadway design.

Table 7 - Design Standards Selection Matrix, ODOT Highway Design Manual

Project Type	**Roadway Jurisdiction**				
	State Highways			Local Agency Roads	
	Interstate (I-84)	Urban State Highways (US 197 & US 30)	Rural State Highways	Urban	Rural
Modernization/ Bridge New/Replacement	ODOT 4R/New Freeway	ODOT 4R/New Urban	ODOT 4R/New Rural	AASHTO	
Preservation/ Bridge Rehabilitation	ODOT 3R Freeway	ODOT 3R Urban	ODOT 3R Rural	AASHTO	ODOT 3R Rural
Preventive Maintenance	1R	1R	1R	NA	NA
Safety- Operations- Miscellaneous/ Special Programs	ODOT Freeway	ODOT Urban	ODOT Rural	AASHTO	ODOT 3R Rural

The Highway Design Manual includes mobility standards related to project development and design that are applicable to all modernization projects, except for development review projects (see Table 8). The v/c ratios in the Highway Design Manual are different than those shown in the Oregon Highway Plan (OHP). The v/c ratio values in the OHP are used to assist in the planning phase to identify future system deficiencies; the Highway Design Manual v/c ratio values provide a mobility solution that corrects those previously identified deficiencies and provides the best investment for the State over a 20 year design life.

Table 8 - 20 Year Design Mobility Standards (Volume/Capacity [V/C]) Ratio

20 Year Design-Mobility Standards		
Highway Category	Inside Urban Growth Boundary	
	Non-MPO outside of STAs where non-freeway speed limit <45 mph	Non-MPO where non-freeway speed limit >=45
Interstate Highways and Statewide (NHS) Expressways	0.70	0.65
Statewide (NHS) Non-Freight Routes and Regional or District Expressways	0.75	0.70
Regional Highways	0.75	0.75
District/Local Interest Roads	0.80	0.75

Project Relevance: The ODOT Highway Design Manual provides design standards on state roadways; analysis for the TSP update and final project recommendations will need to reflect state requirements for state facilities. Standards and guidelines adopted by The Dalles should be considered for additional guidance, concepts, and strategies for design.

Oregon Resilience Plan (2013)

The Oregon Resilience Plan provides policy guidance and recommendations to protect lives and keep commerce flowing during and after a Cascadia earthquake and tsunami. The seismic integrity of Oregon's multi-modal transportation was assessed, including bridges and highways, rail, airports, water ports, and public transit systems. For transportation facilities, the study recommends prioritization of seismic lifeline routes according to tiers with associated resilience targets. The report also identifies seismic vulnerabilities of critical facilities and resources and recommends options to improve transportation facility resiliency.

I-84 (between I-5 and US 97) is identified as a Tier 1 Route and part of the transportation *backbone system*, which is considered to provide the greatest benefits for short-term rescue and longer-term economic recovery. Resiliency targets for Tier 1 Routes are to have a minimum level of service restored within 1-3 days, a functional level of service within 3-7 days, and restore the facility to 90% capacity within 1-4 weeks. Other state highways within The Dalles have resilience targets to be providing a minimal level of service within 1-4 weeks and be 90% operational within 6-12 months. Resiliency goals for public transit are set for paratransit on-demand and fixed route service as well, see

Table 9 for details.

Table 9 - Oregon Transportation Resiliency Status

Infrastructure Facilities	Event Occurs	0-24 Hours	1-3 Days	3-7 Days	1-4 Weeks	1-3 Months	3-6 Months	6-12 Months	1-3 Years	3+ Years
Oregon State Highway System										
State Highway Systems – Tier 1 SLR (I-84)			R	Y	G			S	X	
Roadways			R	Y	G		X			
Bridges			R	Y	G		S	X		
Landslides			R	Y	G			S	X	
State Highway Systems – Other Routes					R		Y	G	S	X
Roadways					R		Y	G	X	
Bridges					R		Y	G	S	X
Landslides					R		Y	G	S	X
Airports & Air Transportation										
Airports & Air Transportation (FAA Facility)			R	Y	G					
Oregon Rail Transportation										
Union Pacific Railroad				Y	G	S	X			
Oregon Public Transit										
Admin & Maintenance Facilities						R	Y	G	S	X
Local Area Paratransit On-Demand Service (critical)				R	Y	S	G	X		
Local Area Paratransit On-Demand Service (full)						R	Y	G	S	X
Local Roadway Fixed Route Service (emergency)				R	Y	S	G	X		
Local Roadway Fixed Route Service (regular)						R	Y	G	S	X
Intercity & Commuter Bus						R	Y	G	S	X

Minimal: (A minimum level of service is restored, primarily for the use of emergency responders, repair crews, and vehicles transporting food and other critical supplies.)	R
Functional: (Although service is not yet restored to full capacity, it is sufficient to get the economy moving again— e.g. some truck/freight traffic can be accommodated. There may be fewer lanes in use, some weight restrictions, and lower speed limits.)	Y
Operational: (Restoration is up to 90% of capacity: A full level of service has been restored and is sufficient to allow people to commute to school and to work.)	G
ESTIMATED TIME FOR RECOVERY TO 60% OPERATIONAL GIVEN CURRENT CONDITIONS:	S
ESTIMATED TIME FOR RECOVERY TO 90% OPERATIONAL GIVEN CURRENT CONDITIONS:	X

Project Relevance: The Oregon Resilience Plan provides guidance on and priorities on Oregon's multi-modal transportation system. Policies and standards adopted by The Dalles should be considered for additional guidance, concepts, and strategies for design.

Sustainability Executive Orders (EO-00-07, EO-03-03, and EO-06-02)

The Oregon Sustainability Act of 2001 (ORS 184.421) defines sustainability as using, developing and protecting resources in a manner that enables people to meet current needs while providing for future generations to meet their needs, from the joint perspective of environmental, economic and community objectives. The Oregon Sustainability Executive Orders, enacted between 2000 and 2006, created a sustainability planning process for state agencies to follow, including the creation of Sustainability Plans. The executive orders provided state agencies with sustainability objectives to meet and required the designation of sustainability coordinators. The Oregon Sustainability Board and several interagency teams were also created through the executive orders to address specific sustainability initiatives and provide support and guidance to state agencies. Specific state-wide sustainability initiatives address greenhouse gases, purchasing, electronic waste, and energy.

ODOT's Sustainability Plan, organized into three volumes, responds to the executive order objectives. Volume 1 describes the context for the plan and the vision and framework for ODOT's sustainability goals and strategies. Volume 2 contains goals and strategies for internal ODOT practices. Volume 3, which is not currently available, will focus on the goals and strategies for the management and operation of the statewide transportation system.

> **Project Relevance:** The TSP planning process will consider the State's overall sustainability objectives in the development of plan recommendations.

Governor's Climate Change Initiative

The Governor's Climate Change Initiative was a multi-state collaborative effort to address climate change. Oregon's involvement in the initiative led to the creation of the Oregon Sustainable Transportation Initiative (OSTI), an integrated statewide effort to reduce greenhouse gas (GHG) emissions from transportation while creating healthier, more livable communities and greater economic opportunity.[6] One outcome of the OSTI is the creation of ODOT's Greenhouse Gas Emissions Reduction Toolkit. The toolkit is designed to help local jurisdictions identify and explore the kinds of actions and programs than can be undertaken to reduce vehicle emissions, as well as meet other community goals.

> **Project Relevance:** The TSP planning process will consider strategies identified in ODOT's Greenhouse Gas Emissions Reduction Toolkit in the development of plan recommendations.

Wasco County Coordinated Transportation Plan (2009-2012)

ODOT oversees the Special Transportation Fund (STF) through its Public Transit Division. Every STF Agency is required to develop a written plan that sets out a long-term vision for public transportation in its services area; the Wasco County Coordinated Transportation Plan fulfills this requirement. The Dalles' transportation needs are primarily served by Transportation Network (formerly known as the Link) and operated through Mid-Columbia Council of Governments (MCCOG) and Columbia Area Transit (CAT), the main public transportation provider for Hood River County with services in The Dalles. The Transportation Network provides transportation for seniors, individuals with disabilities, and low-income individuals.

[6] http://www.oregon.gov/odot/td/osti/Pages/index.aspx

The coordinated plan focuses on addressing transportation needs for targeted populations and gaps and priorities in services. It also defined and prioritized general strategies for service providers to use in developing specific projects. The complete prioritized list, found in Appendix I, ranks priorities with the highest priorities receiving an “A” and the lowest priorities receiving a “D”. Notable priorities identified include:

- Expand Transportation Network services to include early morning and evening hours (Category B)
- Enhance and develop connections to Mount Adams Transportation Services, Sherman County Transit, and Columbia Area Transit (Category B)
- Create fixed or deviated route service[7] (Category C)
- Offer weekend service operations through Transportation Network (Category C)

Project Relevance: The TSP planning process will consider the priorities identified in the Wasco County Coordinated Transportation Plan in the development of the transit element of the updated TSP. The TSP transit element will summarize available services in the City and will include recommendations for enhanced transit service.

Wasco County Transportation System Plan (2009)

The Wasco County Transportation System Plan (TSP) is the County’s long-range plan for developing and managing its transportation system. To guide transportation system development, the TSP includes goals that are organized by mobility and connectivity, safety, multimodal users, environment, and planning and funding.

The Wasco County TSP identifies future multimodal transportation needs. The TSP is primarily focused on areas outside of incorporated cities. Information on County roadways within incorporated cities, such as The Dalles, are included, but no future need assessments were conducted. The TSP documents that there were no forecast capacity deficiencies for any major highways during the 20-year planning horizon so future transportation needs are focused on improving roadway and intersection operations.

A set of design standards for County roads within incorporated areas are established according to the functional classification in Table 7-3 of the TSP (see below). The TSP also notes that local roadway design standards may be applied when deemed appropriate. Access management/spacing standards for incorporated areas are included in Table 7-4 of the TSP (below).

[7] Route deviation involves a situation where a transit vehicle operates on a regular schedule along a well-defined path and deviates to serve demand-responsive requests within a zone around the path.

For county-owned transportation facilities in incorporated areas, locally adopted city mobility standards (called traffic operations standards in the TSP) apply.

Table 10 - Urban Wasco County Roadway Design Standards (Wasco County TSP Table 7-3)

	Local Street	Urban Minor Collector	Urban Major Collector	Urban Arterial
Design ADT	<1,000	1,000-3,000	3,000–6,000	>6,000
Design Speed (mph)	25	25-30	25-35	25-35
Max Grade	12%	10%	10%	6%
Minimum ROW Width (ft)	58	64	63-76	90
Number and Width of Lanes	2 12' Travel Lanes	2 12' Travel Lanes	2 12' Travel Lanes	3 Two 12' Travel Lanes 14' Center Turn Lane
Traveled Way Width (ft)	36	40	52	50 or 66
On-Street Parking (ft)	Not striped	8 (each side)	8 (each side)	8 (each side), optional
Sidewalk Width (ft)	5 (each side)	5 (each side)	5 (each side)	5 (each side)
Bike Lane Width (ft)	-	-	6	6
Preferred Access Spacing (ft)[8]	50	150-300	150-300	300-600

Table 11 - ODOT Highway Spacing Standards (Wasco County TSP Table 7-4)

Posted Speed (mph)	ODOT Classification	Urban[9]	
		Expressway	Other
>= 55	Statewide	2,640	1,320
	Regional	2,640	990
	District	2,640	700
50	Statewide	2,640	1,100
	Regional	2,640	830
	District	2,640	550
40 & 45	Statewide Regional District	2,640 2,640 2,640	990 750 500
30 & 35	Statewide Regional District	-	720 425 350
<= 25	Statewide	-	520
	Regional		350
	District		350

[8] Decreased spacing may be allowed when supported by a traffic study and/or approved by the local jurisdiction.
[9] Measurement of the approach road spacing (feet) is from center to center on the same side of the roadway.

Transportation improvement projects on County facilities within The Dalles are identified in Table 12 (TSP Table 7-6 and Figure 7-3).

Table 12 - Wasco County Urban Transportation Improvement Program (Wasco County TSP Table 7-6)

Project Identifier	Project Name	Project Category	Source
AN	US 30/Lower Eightmile Road Intersection	Safety, Operations	The Dalles TSP
AO	US 30 Chenoweth Creek Bridge Rehabilitation	Enhancement	TAC
AP	OR 197/Fremont Street Overpass	Safety, Operations	The Dalles TSP
AQ	Bret Clodfelter Way Reconstruction and Paving	Pavement, Bike	WC TIP
AR	Hostetler Street Widening	Safety, Pedestrian/Bike	The Dalles TSP
AS	Snipes Street Widening	Safety, Operations	The Dalles TSP
AT	West 10th Street Improvements	Enhancement	TAC
AU	West 2nd Street Widening	Enhancement	TAC
AV3	River Road Improvements	Enhancement	TAC

The Wasco County TSP includes a network of bicycle routes for recreational and commuter use. All identified bicycle routes to or through The Dalles are illustrated in Figure 7-4 of the TSP.

> **Project Relevance:** County transportation improvement projects will be reviewed and considered in The Dalles TSP update. Recommendations in the updated City TSP will need to be consistent with the County TSP; if necessary, needed refinements to the County plan will be identified and discussed as part of this update process.

The Columbia Gorge Regional Airport Master Plan (2010)

The Columbia Gorge Regional Airport Master Plan includes objectives and recommendations for the Columbia Gorge Regional Airport, also known as The Dalles Municipal Airport. The airport is located in Dallesport, Washington and is co-owned/sponsored by The City of The Dalles and Klickitat County, Washington. Airport forecasts and development alternatives are evaluated in the Airport Master Plan and included compatibility analysis that considered existing or proposed land use, economic development, and zoning. The Master Plan preferred alternative reserves a southwest portion of the property for the potential future development of a business park. The preferred alternative also includes plans for a golf course and resort on excess airport property in the eastern area.

> **Project Relevance:** The TSP update process will consider the needs and potential expansion and growth of commercial and recreational uses around the Columbia Gorge Regional Airport and, where necessary, reflect capacity and access-related improvements in The Dalles TSP update.

Columbia River Gorge National Scenic Area Management Plan (2004, Last Updated 2011)

The Columbia River Gorge National Scenic Area Management Plan (Management Plan) is divided into three categories of land: Urban Areas, Special Management Areas (SMAs), and General Management Areas (GMAs). The City of The Dalles is designated as an Urban Area and is exempt from the requirements of the management plan, the goal of which is to focus future growth and economic development in cities. Portions of land within The Dalles UGB boundary are designated GMA, which are predominantly devoted to agricultural and forestry uses. GMA designations within and adjacent to The Dalles UGB include A-1 (60), A-2(40), R-5, and Open Space. Lands with GMA designations are regulated by the Management Plan and its goals, objectives, policies, and guidelines for resource protection and enhancement. Lists of transportation facilities allowed without review in GMA areas can be found in Section II, Chapter 7 of the Management Plan.

> **Project Relevance:** Transportation needs identified within a GMA will follow the Management Plan's goals, objectives, policies, and guidelines to protect and enhance scenic resources.

The Dalles Comprehensive Plan (1994, Last Updated 2011)

The Dalles Comprehensive Plan is a long-range policy guide for land use within The Dalles Urban Growth Boundary (UGB). The Dalles Comprehensive Plan was adopted in 1994 with amendments made in 2006 and 2011. It incorporates the adopted 2005 TSP and the City's Bicycle Master Plan by reference. Goals and policies from the Transportation Element of the 1982 Comprehensive Plan as well as policy amendments based on the 2005 TSP are incorporated. Relevant goals, policies, and implementation measures are summarized below.

Goal 2 (Land Use Planning) Policy 5 includes evaluation criteria for Comprehensive Plan amendments. Policy 5d requires adequate public facilities, services and transportation networks be in place, or are planned to be provided with the proposed change.

Goal 7 (Natural Hazards) includes an implementation measure directing the implementation of the City's goal to consider natural hazards in the placement of proposed street layouts and storm water designs in newly developing areas with possible landsides, flooding, and surface run-off potential

Goal 8 (Recreational Needs) Policy 2 directs the incorporation of the Columbia River area policies of The Dalles Riverfront Master Plan. Policy 2b includes language encouraging coordination among local recreation and transportation agencies for transportation and recreation planning when developing bikeways and trails. Policy 4 recommends incorporating multi-modal elements in capital improvements such as sidewalks, streets, and utility corridors. Policy 16 includes language to update the Bicycle Master Plan and to develop a pedestrian plan for The Dalles UGB with the purpose of providing recreation and alternative transportation in defined areas.

Goal 8 (Recreational Needs) Policy 5 encourages the incorporation of public recreational trails and bikeways, as identified in the areas' bikeway and trail systems, in subdivision and site plan regulations and review.

Goal 10 (Housing) Policies 3a, 3b, 11 and 12, include land use concepts for focusing higher density housing in the downtown, along major streets, and neighborhoods centers as well as transitioning to lower density housing at higher elevations and along stream corridors. Policy 6 encourages energy conservation through increased residential density in mixed-use centers and major linear streets that can be served by future transit service.

Goal 12 (Transportation) includes 12 policies that are generally applicable throughout City limits. However, Policy 3 is a site specific policy, directing the adoption of the Columbia Gorge Regional Airport Layout Plan. Transportation policies include encouragement of mass transit (1), pedestrian, bicycle, and horse trails (2), and adequate barge facilities (4); language on the development of streets to relieve congestion (5), accommodate future growth (6), improve vehicular access to the downtown area and outlying areas (9), and improve truck routes between specific destinations (11) while still allowing street standards to be flexible for street trees, sidewalks planting strips, and widths (7); and language supporting mass transit both as an automobile alternative (12) and for transportation disadvantaged residents to reach necessary destination as funds are available (10).

Goal 13 (Energy Conservation) Policy 9 includes language for The Dalles to consider and foster the efficient use of energy in land use and transportation planning. Policy 10 directs the City to implement additional energy conservation measures related to “Urban Form”, “Transportation”, and “Building Codes” as identified in the Implementation Measures section. Urban Form implementation strategies focus on increasing densities, particularly near transit, and promoting a mix of adjacent uses. Transportation implementation strategies include a focus on the creation of and improving the access to a city/regional transit agency, increasing opportunities for walking and bicycling, developing public facility guidelines to include bicycle and pedestrian connectivity, and subsidizing alternative commute modes for public employees. The Comprehensive Plan notes that many of the implementation strategies are currently implemented in The Dalles TSP. In addition, Goal 13 Implementation Measures directs the City to explore the feasibility of a mini-transit system as funds become available.

Goal 14 (Urbanization) Policy 8 includes language requiring public facilities to be built and reviewed in compliance with The Dalles TSP. Policy 13 directs The Dalles to prepare public facility and transportation plans for the UGB and URA once boundaries have been established.

> **Project Relevance:** The updated TSP is intended to be adopted as the transportation element of the City’s Comprehensive Plan, replacing the 2005 TSP. Recommendations resulting from the TSP update process will either be consistent with existing policies, including those identified above, or will inform updated policy language that will be proposed for adoption as part of the TSP update. Amendments to the Zoning and Land Use Development Ordinance will also likely be needed in order to implement the updated TSP; proposed amendments will be based on existing, revised, or new policies related to, among other things, procedures, land use review coordination, strengthening multi-modal connectivity and access, and protection of transportation facilities.

The Dalles Transportation System Plan (1999, Last Updated 2005)

The Dalles Transportation System Plan (TSP) is the City's long-range plan for developing and managing its transportation system. It establishes goals, objectives, and improvements to support planned land uses and population growth over the next 20 years.

Existing objectives are grouped under goals identified as: Enhance Transportation User Safety; Enhance Transportation Mobility; Increase the Use of Alternative Travel Modes through Improved Safety and Service; and Develop a Transportation System that Supports Planned Land Uses. These goals and objectives will be examined and revised as part of Task 2.4 and used in later tasks for setting policy and selecting preferred alternatives.

The TSP establishes a set of standards for the design and management of City roads, primarily based on functional classification designations shown in the TSP Figure 11. Typical street design standards for major and minor arterials, collectors, and local streets are established in the TSP Figures 12 and 13 and Table 5. Likewise, access management/spacing standards are established by functional classification and shown in Tables 6 through 11 in the TSP.

The adopted TSP does not have an established mobility standard such as volume-to-capacity (v/c) or level of service (LOS). The TSP notes that, as part of the City of The Dalles Local Street Master Plan (1999 Administrative Draft Plan), the City's arterials and collector streets function at LOS C or higher, indicating that no identified deficiencies exist for which the local network must compensate.

The TSP identifies a list of street, bicycle, and pedestrian system projects needed to serve long-range mobility and accessibility needs and are summarized in Table 12 and illustrated in Figure 14. Revisions to the list and figure were not included in the 2005 update.

> **Project Relevance:** The TSP update process will review goals, objectives, standards, and recommended projects from the current plan and will determine what to retain or change in the updated TSP. This project will update transportation improvement projects for all modes, based on current and projected needs. Updated data, stakeholder and community involvement, and evaluation criteria will be used in making these determinations.

Land Use and Development Ordinance (1998, Last Updated 2015)

The City of The Dalles Land Use and Development Ordinance (LUDO) regulates development within city limits and implements the long-range land use vision embodied in The Dalles Comprehensive Plan. The LUDO contains several sets of requirements that address the relationship between land use development and transportation system development. Those requirements are discussed below and address access and connectivity, design standards, performance standards, traffic impact studies, parking, and application review and conditions of approval.

Street Access and Connectivity

Access is primarily addressed in Section 6.050 of the LUDO and applies to all arterials, collectors, and local streets within city limits and the UGB and to all properties which abut these roadways. Preferred spacing standards and stopping sight distances are provided in Tables 1 and 2 of Section 6.050

- Access Management (6.050, General Regulations)
- Driveway and Entrance Standards (6.060, General Regulations)

Street Design Standards

Requirements in the Street Design Standards, Section 10.060.J.5, provide right-of-way and improvement widths and standards by street classification for all streets designated in the TSP except for local streets in residential zones.

Pedestrian and Bicycle Access and Connectivity

Bicycle and pedestrian access is addressed in LUDO Sections 10.040-10.050 and also subject to the Residential Street Public Improvement Guidelines (also found in the LUDO). Sidewalks for commercial development, subdivision, multi-family development, and single-family dwellings that abut a designated Network Street are required on both sides of arterial, collector, and local streets. All other single-family dwellings, not on a designated Network Street, do not have street improvement requirements. Bicycle lanes are required on all new or improved arterial and major collector streets. Connectivity requirements for bicycle and pedestrian facilities are included, in order to minimize travel distances and providing connections for non-through streets. Standards for internal pedestrian circulation on new developments are included as well.

Performance Standards and Traffic Impact Studies

The City's TSP does not have an established performance standard. However, traffic impacts studies are required for all development proposals of 16 or more dwelling units, development proposals that will likely generate more than 400 average daily vehicle trips, and for those near an intersection that is already at or below Level of Service D (LUDO 10.060, Street Requirements). In addition, the City may require an initial, limited traffic study to determine the level of service at nearby intersections to determine if a full impact study is warranted.

The TPR requires that a link be provided between adopted performance standards and land use development in the City's development code. Site Plan Review (3.030) requires developments to meet street and sidewalk connectivity standards, consistent with the LUDO and the TSP.

Parking

LUDO Chapter 7 addresses parking standards, including general provisions and design standards (7. 020 & 7.030), bicycle parking design standards (7.040), parking structures (7.050), and minimum/maximum off-street parking requirements (7.060). The general provisions allow for shared parking where facility size and space requirements are met and written evidence upholding the shared parking right is provided.

Application Review and Conditions of Approval

Existing LUDO provisions require notice be sent to any affected governmental agency, department, or public district on complete applications for administrative actions (3.020.040) and quasi-judicial actions (3.020.050). Notice for legislative actions are not required to send notice to affected governmental agencies, however notices are required to be published in a general circulation newspaper.

Review criteria to approve, approve with conditions, or deny are included for site plan review (3.030), neighborhood compatibility review (3.040), conditional use permits (3.050), administrative conditional use permits (3.060), variances, (3.070), adjustments (3.080), zone changes (3.100), and ordinance amendments (3.110). Review criteria for neighborhood compatibility review, conditional use permits, and zone changes require compliance with City ordinances, including street access and connectivity, street design standards, pedestrian and bicycle access and connectivity, and traffic impact studies. Neighborhood compatibility review criteria include additional design standards, applicable to all developments, for parking location and landscaping and pedestrian/bicycle circulation. Zone change review criteria include that the site is, or will be, adequately served by streets for the type and volume of traffic generated.

Section 10.110 allows the City to require the dedication of rights-of-way and easements within or adjacent to development sites when the needs are identified through fulfilling transportation requirements or those identified by the City Engineer.

TPR Compliance

LUDO Section 3.110.030 requires ordinance amendments to be consistent with the Comprehensive Plan and State Laws and Administrative rules. LUDO Section 3.100.030 requires zone changes to be consistent with the Comprehensive Plan and ordinances, but does not currently specify compliance with State Laws and Administrative Rules.

> **Project Relevance:** Amendment to LUDO provisions related to transportation improvements such as pedestrian and bicycle access and connectivity, transit access, traffic impact analyses, and agency coordination may be recommended as part of this planning process in order to implement the updated TSP, provide consistency between the LUDO, TSP, and local road standards, and/or to strengthen compliance with the TPR.

I-84 Chenoweth Interchange Area Management Plan (2009)

The I-84 Interchange Area Management Plan (IAMP) was developed to protect the function of the I-84 Chenoweth Interchange to provide safe and efficient connections with the interstate to and from the city's industrial port area. The City adopted the Chenoweth IAMP by reference as an element of the City's Transportation System Plan. The IAMP Transportation Improvement Plan (Figure 7-1 and Table 7-1 of the IAMP) was included in the recommended transportation improvements project list at that time.

The Interchange Area Management Plan Overlay District identified in the IAMP include the submittal requirements, review standards, and administration fees for IAMP monitoring and updates for land use amendment and design review applications within the district. Also proposed in the plan is a Supplemental Transportation System Development Charge (STSDC) intended to finance transportation improvements in the vicinity of the I-84 Chenoweth Interchange. This new STSDC has not currently been adopted by The Dalles. The IAMP calls for the City to administer it through the City's existing System Development Charge (SDC) program but have its own methodology for assessing fees.[10]

> **Project Relevance:** Adopted policy and transportation improvements in the IAMP will be considered during the policy amendment, implementing ordinances and findings phase of the TSP update and, where appropriate, incorporated into the TSP.

The Dalles Growth Management Report (2013)

The Dalles Growth Management Report provides background information and revised findings for the urban growth boundary/urban area expansion proposal and related comprehensive plan amendments. The Dalles is within the Columbia River Gorge National Scenic Area, adding additional considerations to the standard Oregon buildable lands approach. The report includes a land needs assessment and UGB locational analysis, both considering how Goal 14 and the National Scenic Area influence analysis and priorities.

The revised UGB findings identify an area to the north in Hidden Valley for being able to accommodate urban services. However, this Report did not result in a state-acknowledged UGB amendment and this area is not within city limits.

> **Project Relevance:** The TSP update process will review the UGB findings and recommendations from The Dalles Growth Management Report to ensure that the TSP recommendations do not prohibit the possibility of additional system improvements that may be necessary to serve future growth.

The Dalles' Economic Opportunities Analysis Report (2007, Last Updated 2011)

The Economic Opportunity Analysis report provides technical economic analysis and 20-year employment forecasts, consistent with Planning Goal 9 and OAR 660-009, to help articulate the City's economic development policy and to create an inventory and needs assessment of industrial sites within the UGB. The study finds that there is enough vacant or re-developable land to meet the 20-year projected demand. The study recommends that the City identify and maintain an adequate number of sites within its existing employment areas to accommodate future employment growth. The study also recommends an expansion of the central business district and community zones.

> **Project Relevance:** The TSP update process will reflect the findings of The Dalles' Economic Opportunity Analysis Report, as it relates to improved multi-modal transportation service and connections to existing employment areas.

[10] Because the STSDC involves a new fee, state law and City regulation requires that it be adopted through a formal amendment process that includes a public review and comment period and approval of the new methodology by ordinance [ORD 3-8.4(B)]. Pursuant to the existing City ordinance, the procedure to enact an STSDC improvement fee includes adopting a plan that contains the list of projects needed to serve growth in the fee area (in this case, adoption of the IAMP) and providing written notice at least 30 days prior to adoption of the proposed fee to those who have requested notice [ORD 3- 8.8].

Current and Past Transportation Budget and Funding Sources

The Dalles organizes its transportation budget into three general categories: Street Fund, Public Works Reserve Fund, and Transportation System Reserve Fund. Street Fund expenditure categories include street operations (personnel services, materials and services, and capital outlay) and other uses (operating transfers out and contingency). There are a variety of funding sources for the Street Fund, the majority of which come from the State Motor Vehicle Fund, followed by the local fuel tax, utility funds, and other smaller sources.

The Public Works Reserve fund is entirely budgeted to machinery and vehicles. Revenue sources include transfers from the Street Fund and utility funds. A one-time historical revenue source included funds from loan/bond proceeds in FY13/14.

The Transportation System Reserve Fund is dedicated entirely to capital projects. Revenue sources include FAU exchange funds, transfers from the Street Fund, and connection charges/transportation SDC fees.

Funding Sources

- Northwest Natural
- Local 3 Cent Fuel Tax
- State Motor Vehicle Fund
- Urban Renewal
- Chenoweth PUD (line item, but no historic revenue or proposed budget)
- Copies, Plans, Ordinances
- Miscellaneous Sales and Service
- Interdepartmental Revenue
- Interest Revenue
- Other Miscellaneous Revenue
- General Fund
- Water Utility Fund
- Wasterwater Utility
- Sale of Fixed Assets
- FAU Exchange Funds
- Federal Grants
- Connection Charges/Transportation SDCs
- Street Fund (to the Public Works Reserve Fund and Transportation System Reserve Fund)

APPENDIX B. TECHNICAL MEMORANDUM 2: GOALS AND OBJECTIVES

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The Dalles Transportation System Plan

Technical Memo #2: Goals, Objectives and Evaluation Criteria

Date:	December 16, 2015	Project #: 18495.0
To:	The Dalles TSP Advisory Committee Members	
CC:	Dale McCabe, City of The Dalles Jim Bryant, Oregon Department of Transportation, Region 4 Darci Rudzinski, Angelo Planning Group	
From:	Casey Bergh, P.E. and Chris Brehmer, P.E., Kittelson & Associates, Inc.	

PURPOSE AND INTRODUCTION

This memorandum presents goals, objectives and a draft set of evaluation criteria for the City of The Dalles Transportation System Plan (TSP) update. The goals and objectives will help guide the TSP update to ensure key issues are addressed within this process. The evaluation criteria will be used to set policies and identify "preferred alternatives", which will comprise the list of recommended projects and associated policy, code amendments, and funding actions in the TSP.

This document is organized as follows:

- Background: This section describes the changes in The Dalles following adoption of the 1999 TSP and 2006 update.
- Goals: The desired project goals address transportation deficiencies and needs that support the city's vision for the next 20 years. The project goals were developed based on an evaluation of the goals in the 1999 TSP, the transportation element of the City's Comprehensive Plan, the Transportation Growth Management (TGM) grant application submitted by the City and conversations with City and ODOT staff.
- Evaluation Criteria: The evaluation criteria were developed to measure and respond to the objectives and ultimately to the project goals.

BACKGROUND

The existing City of The Dalles Transportation System Plan was adopted in 1999, and had minor updates made in 2006 to incorporate Transportation Planning Rule (TPR) requirements. Since that time, the City has completed many projects in the previous TSP and others are no longer a priority due to changes in traffic patterns, land use assumptions and available budget. Significant changes in The Dalles have also contributed to the need to reassess network operations and identify opportunities to improve the transportation facilities to accommodate growth over the next 20 years. Specific events and elements that will influence the TSP update include:

- The City has annexed approximately 850-acres of residential and industrial land since 2005 and desires to develop an integrated transportation system to support growth in these areas.
- ODOT transferred jurisdiction of several miles of roadways (W 6th Street and W 2nd Street) to the The Dalles and the City desires to upgrade the facilities to current City and ADA standards, including provision for pedestrian and bicycle facilities.
- The City has completed many projects on the Capital Improvement Plan (CIP) and desires to update the CIP with currently planned and new transportation projects.
- The City has updated its Land Use and Development Ordinances (LUDO) including the street classifications, development standards and design standards.
- The Chenoweth Interchange Area Management Plan (IAMP) was adopted in July 2010 and revised in 2011. It should be acknowledged and integrated into the TSP to increase the life of the interchange and promote economic development in the interchange influence area. The Supplemental Transportation System Development Charge (STSDC) intended to finance transportation improvements in the vicinity of the I-84 Chenoweth Interchange has not been approved and should be revisited.
- The City desires to update the current transportation system development charge (TSDC) and list of SDC-eligible projects. Theses updates will provide developers with an understanding of fees and credits (removing uncertainty that is a common barrier of development) and funding critical infrastructure items.
- The Port of The Dalles is making investments in transportation infrastructure and the City wants to acknowledge and build upon this momentum to spur investment in the developable land within the Port.
- The City and ODOT have discussed the need to increase capacity at the Webber Street interchange and whether an IAMP is necessary to avoid major construction in the long-term. The City has identified several opportunities to utilize existing infrastructure to increase the life of the facility and/or delay the need for improvements. These strategies should be integrated with other local improvements in the TSP to promote optimal use of the various transportation system components and thereby minimize the need for major infrastructure project investments.
- A new community transit center is planned on Chenoweth Loop near W 6th Street. The City would like to plan active transportation facilities to support community access to the transit center and assess localized intersection operations.
- The forthcoming Columbia River Gorge Bike Trail will enhance the need for bicycle connections and infrastructure.
- Transportation patterns and modal needs have changed with the construction of a new community transit center and bicycle connections and infrastructure anticipated with the

forthcoming Columbia River Gorge Bike Trail. The Dalles Marine Terminal became operational in the summer of 2013. This new facility allows passenger ships to dock and encourages tourism.

- The planning horizon of the current TSP (2015) is now shorter than the buildout year of some private development projects and master plans being proposed in the community, including anticipate master plan updates for North Wasco County School District 21 and Mid-Columbia Medical Center.

GOALS AND OBJECTIVES

The TSP goals and objectives will help guide the update process and serve as a basis for the development and evaluation of transportation system alternatives and the selection of a preferred alternative. The evaluation criteria associated with the goals and objectives will be used to compare, select, and prioritize projects for the TSP update.

The goals and objectives presented below are based on an evaluation of the goals in the 1999 City of The Dalles TSP, the transportation element of the current Comprehensive Plan, the Transportation Growth Management (TGM) grant application submitted by the City, and direction provided by the City and ODOT staff.

1999 TSP Goals (2006 Update)

The 1999 City of The Dalles TSP, updated in 2006, includes four goals to achieve the overall transportation goal to develop an urban area transportation system that enhances the livability of The Dalles and accommodates growth and development through careful planning and management of existing and future transportation facilities. The four goals include:

1. Enhance Transportation User Safety,
2. Enhance Transportation Mobility,
3. Increase the Use of Alternative Transportation Modes Through Improved Safety and Service, &
4. Develop a Transportation System that Supports Planned Land Uses.

The Safety goal addresses transportation user safety by developing cross sections that are inclusive of all modes, prioritizing pavement maintenance/rehabilitation and maintaining appropriate roadway width and turning radii for the safe passage of vehicles while integrating bicycle and pedestrians. The Mobility Goal addresses an integrated transportation system that provides additional local access routes, collector and arterial roads to accommodate future growth and improves access to downtown. The mobility goal also incorporates improved intersection operations and planning for the increased air, barge and truck freight traffic in the transportation system. The Increased Use of Alternative Transportation Modes Goal addresses development of a bicycle and pedestrian network that accommodates all users and encourages and provides adequate transit service. The Integration with Planned Land Uses goal identifies steps to preserve rights-of-way and maintain adequate traffic circulation to serve undeveloped areas.

1994 Comprehensive Land Use Plan (Amended May 2011)

The transportation goal of the Comprehensive Land Use Plan is to provide a transportation system that supports the safety and mobility needs of local residents, business and industry, affords choice between transportation modes, is convenient and affordable to use, and supports planned land uses. It states that the transportation plan shall (1) consider all modes of transportation including mass transit, air, water, pipeline, rail, highway, bicycle and pedestrian; (2) be based upon an inventory of local, regional and state transportation needs; (3) consider the social consequences that would result from utilizing differing combinations of transportation modes; (4) avoid principal reliance upon any one mode of transportation; (5) minimize adverse social, economic and environmental impacts and costs; (6) conserve energy; (7) meet the needs of the transportation-disadvantaged by improving transportation services, (8) facilitate the flow of goods and services so as to strengthen the local and regional economy; and (9) conform with local and regional comprehensive land use plans.[1]

Proposed TSP Update Goals

The 1999 TSP goals were reviewed and refined to align with the changes and needs that have occurred or been identified since the 1999 plan. As a result, the following four goals are proposed to help guide the development of the City of The Dalles TSP update, including Safety, Access, Integration, and Economic Development.

1. Safety and Mobility: Ensure a safe and efficient transportation system in a state of good repair for all users.
2. Accessibility and Connectivity: Expand affordable, accessible and multimodal options to improve connections for all users of the transportation system to jobs, services and activity centers.
3. Integration: Integrate land use, financial, and environmental planning to prioritize strategic transportation investments and preserve The Dalles' identity.
4. Economic Development: Build and maintain the transportation system to support economic vitality in the City.

An overarching goal of the TSP update is to satisfy the requirements of the OAR 660-012, or the Transportation Planning Rule (TPR). To ensure that the required elements of The Dalles TSP are reflective of the community, the process will include collaborating with plan area residents and transportation users through the City Council, Planning Commission, public open houses, key participant workshops, and the project website. It also includes ensuring compliance with the TSP

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[1] These plan objectives are distinct from the twelve Transportation Goal (Goal 12) policies that are part of the adopted Comprehensive Plan. The City's adopted transportation policies will be replaced or updated by the TSP update process.

content requirements of the TPR and consistency with the Oregon Transportation Plan (OTP), Oregon Highway Plan (OHP), adopted local, regional and state plans, and ODOT's TSP guidelines.

Objectives

The following objectives were developed based on the Goals for the TSP update.

Goal #1: Safety and Mobility

The Safety goal recognizes the importance of a safe transportation system that is reliable and in a state of good repair. Objectives include:

1A. Reduce the number of fatal and serious crashes in the plan area.

1B. Develop a multi-modal transportation system that incorporates safety and operational improvements for bicyclists and pedestrians.

1C. Satisfy applicable City and/or State operational performance measures.

1D. Preserve and maintain the existing transportation system in a state of good repair.

1E. Improve safety and operational components of existing transportation facilities not meeting agency standards or industry best practices.

Goal #2: Accessibility and Connectivity

The Accessibility and Connectivity goal focuses on providing a transportation system available to all users, regardless of mode of choice, ability, or economic status. It also works to improve the local circulation system to reduce the community's reliance on State Highways to travel to local destinations. Objectives include:

2A. Plan and design an integrated transportation system that includes additional local, collector, and arterial roads, based on future land use needs, that accommodate all users of the transportation system.

2B. Plan and design transportation facilities that complete a route by connecting other existing routes, filling a gap in an existing route, or providing connectivity between modes.

2C. Support transit service to target populations and encourage transit service for The Dalles urban area.

2D. Consider impacts and transportation affordability to low income or minority populations when assessing the impacts of transportation infrastructure projects.

Goal #3: Integration

The Integration goal ensures compatibility with local and regional land use plans or programs while promoting environmental stewardship and financial responsibility. Objectives include:

3A. Develop transportation investments in coordination with local land use, comprehensive and regional plans.

3B. Incorporate Transportation Demand Management (TDM) strategies to reduce the number of single occupancy vehicles, maximize the use of existing infrastructure and reduce parking demands.

3C. Prioritize transportation projects that provide the most benefit for the cost.

3D. Maintain and develop an environmentally sensitive transportation system.

3E. Incorporate new technologies to enhance the transportation system and extend the useful life of the existing facilities.

Goal #4: Economic Development

The Economic Development goal seeks to leverage the transportation system as a catalyst for economic vitality in the City. Objectives include:

4A. Improve the movement of goods and delivery of services throughout the City while balancing the needs of all users with a variety of travel modes.

4B. Prioritize efficient freight movement on identified freight routes.

4C. Develop a transportation system that supports connections to air, rail, marine, or freight transportation, including services provided by the Columbia Gorge Regional Airport, the Port of The Dalles, and The Dalles Marine Terminal.

4D. Identify lower-cost alternatives, phasing opportunities, and/or funding mechanisms for transportation improvements that serve planned development.

4E. Program transportation improvements to facilitate the orderly development of planned land uses.

EVALUATION CRITERIA

Evaluation criteria were developed to provide a qualitative process to evaluate alternatives relative to the TSP goals and objectives. The rating method used to evaluate the alternatives is described below.

- Most Desirable: The concept addresses the criterion and/or makes substantial improvements in the criteria category. (+2)
- Moderately Desirable: The concept partially addresses the criterion and/or makes some improvements in the criteria category. (+1)

- No Effect: The criterion does not apply to the concept or the concept has no influence on the criteria. (0)
- Least Desirable: The concept does not support the intent of and/or negatively impacts the criteria category. (-1)

During the alternative evaluations screening, the criteria will not be weighted; the ratings will be used to inform discussions about the benefits and tradeoffs of each alternative.

Table 1 presents the evaluation matrix that will be used to qualitatively evaluate the recommendations and alternatives developed through the TSP update.

Table 1: Evaluation Matrix

Criteria Number	Evaluation Criteria	Evaluation Measures
Goal 1: Safety and Mobility - Ensure a safe and efficient transportation system for all users in a state of good repair.		
1A1	Estimated number of fatal or serious injury crashes.	To what extent does the alternative reduce the estimated frequency of fatal and serious injury crashes? Whenever possible, estimate the change in predicted crash frequency using Safety Performance Functions from the Highway Safety Manual calibrated for Oregon and/or crash modification factors (CMFs) approved by ODOT for use in the All Roads Transportation Safety (ARTS) program
1A2	Estimated number of bicycle and pedestrian related crashes.	To what extent does the alternative reduce the estimated frequency of pedestrian and bicycle related crashes? Whenever possible, measure using reliable crash modification factors (CMFs) for estimating relative change in predicted crash frequency.
1B1	Number of conflict points between all modes of travel including crossing points for pedestrians and bicyclists along major arterials and vehicular at-grade rail crossings.	To what extent does the alternative increase safety by reducing vehicle to vehicle, vehicle to rail, vehicle to pedestrian/bicycle, or pedestrian/bicycle to pedestrian/bicycle conflict points? Measured as relative impact between alternatives in regards to reducing the number of conflict between modes and speed differential. For example, installing raised medians to provide a physical barrier between modes at intersections.
1B2	Intersection visibility and sight distances available to motorists, pedestrians, and bicyclists at intersections and key decision points.	To what extent does the alternative improve sight distance for all system users, increasing available time to identify and react to potential conflicts? Measured as relative impact between alternatives for providing adequate sight distance based on desired operating speeds.
1C1	Percent of study intersections meeting applicable operational performance measures.	To what extent does the alternative mitigate or improve operational performance relative to applicable targets and standards? Measured by the degree to which an alternative mitigates a failing condition or improves operations.
1D1	Percentage of acceptable pavement conditions based on roadway classification or extended lifespan of pavement.	To what extent will the project preserve or extend the life of the existing pavement condition? Measured by whether or not the project improves the pavement condition index.
1E1	Compliance with agency standards or implementation of industry best practices.	To what extent does the alternative improve the transportation facility to meet or comply with agency design standards or implement an industry best practice? Measured by whether or not an alternative improves the transportation facility to meet or comply with agency design standards or implements an industry best practice.
Goal 2: Expand affordable, accessible and multimodal options to improve connections for all users of the transportation system to jobs, services and activity centers		
2A1	Potential impact on bicycle and pedestrian volumes.	To what degree may the alternative increase pedestrian and bicyclist travel on appropriately-designed facilities? Measured by potential increase in pedestrian and bicyclist volume relative to baseline conditions.
2A2	Compliance with "Complete Streets" concept within urban areas, and appropriate locations within the urban fringe.	To what extent does the alternative provide a "Complete Street" within urban areas, and appropriate locations within the urban fringe? Measured by whether or not an alternative adopts a "Complete Street" approach or incorporates "Complete Street" components within urban areas, and appropriate locations within the urban fringe?
2B1	Impact on system-wide connectivity and availability of more direct routes for each mode of transportation.	To what extent does the alternative improve the connectivity of the existing transportation system or provide a more direct route? Measured by the extent each alternative increases connectivity and provides facilities for each mode. Connectivity includes filling a gap in an existing route and designing new facilities that provide continuous routes between key destinations.

Criteria Number	Evaluation Criteria	Evaluation Measures
2B1	Miles of designated facilities for bicyclists and pedestrians provided.	To what extent does the alternative increase the number of miles of pedestrian and bicycle facilities (on-street and off-street)? Measured by potential expansions of the pedestrian and bicycle systems.
2C1	Impact on transit ridership.	To what degree does the alternative promote transit ridership or make transit a more viable option for all users? Measured by whether or not an alternative is able to increase transit ridership.
2D1	Impact of transportation project on low income and minority populations.	To what extent does the alternative affect low income and minority populations? Measured as relative ability of each alternative to spread the impacts and benefits of transportation improvements equitably to all populations.
2D2	Viability of non-auto travel.	To what degree are transportation facilities (transit service, sidewalks, bicycle lanes, separated mixed-use paths, parks) for non-auto travelers integrated into the alternative? Measured relative to facilities and integration present in baseline conditions.
Goal 3: Integration - Integrate land use, financial, and environmental planning to prioritize strategic transportation investments and preserve The Dalles' identity.		
3A1	Compliance with local land use plans, comprehensive plans, and regional transportation plans.	To what extent does the alternative comply with local or regional land use, comprehensive, and transportation plans? Measured by whether or not an alternative is identified or compatible with an adopted plan.
3B1	Incorporation of Transportation Demand Management (TDM) Strategies.	To what extent are TDM strategies being implemented to improve the transportation system? Measured by the use of TDM strategies incorporated into the alternative.
3C1	Cost/benefit analysis and potential impact on forecasted expenditures.	To what degree does the alternative leverage a positive return on investment? Measured by the calculated cost/benefit analysis and alignment with current funding projections.
3D1	Impacts on air quality, environmentally sensitive areas, and water and soil quality.	To what degree does the alternative impact environmentally sensitive areas? Measured by the potential adverse impacts of the alternative to the environment.
3E1	Incorporation of ITS technology.	To what extent is ITS technology being implemented for system improvements? Measured by the use of ITS devices relative to Baseline.
Goal 4: Economic Development - Build and maintain the transportation system to support economic vitality in the City.		
4A1	Roadway geometry accommodates freight movement where it is warranted.	To what extent does the alternative accommodate the design vehicle for designated freight routes? Measured by whether or not an alternative is able to accommodate the design vehicle without potential adverse impacts to other modes.
4B1	Traffic operations performance on designated freight routes.	To what extent does the alternative provide acceptable performance along designated freight routes? Measured by operational performance along freight routes.
4B2	System-wide congestion and travel time.	To what extent does the alternative relieve congestion or reduce travel times on the transportation system? Measured by whether or not an alternative relieves congestion or reduces travel time.
4C1	Impact on intermodal connectivity and availability of air, rail, barge and freight facilities.	To what extent does the alternative improve the intermodal connectivity of the existing transportation system or provide better access to air, rail, barge or freight facilities? Measured by the extent to which each alternative increases intermodal connectivity and provides better connections to air, rail, barge and freight facilities.

Criteria Number	Evaluation Criteria	Evaluation Measures
4D1	External funding opportunities leveraged and financially responsible development proposals.	To what extent does the alternative leverage other private funding sources or include transportation improvements as part of a development proposal? Measured by whether or not an alternative leverages additional funding sources or is included as part of a development proposal.
4E1	Potential increased attraction to desired businesses and developers.	To what extent does the alternative eliminate roadblocks to development caused by the transportation system? Measured by the critical transportation improvements funded relative to Baseline.

CONCLUSIONS

The Dalles TSP update will be developed to support the goals and objectives summarized in this memorandum. The evaluation criteria and evaluation measures will be used to develop and prioritize alternatives to accomplish the goals and objectives. Accordingly, the evaluation process provides clear objective criteria in a framework that allows for thoughtful consideration and evaluation of alternative improvements.

APPENDIX C. TECHNICAL MEMORANDUM 3: EXISTING CONDITIONS

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THE DALLES TRANSPORTATION SYSTEM PLAN

Technical Memorandum #3: Existing Transportation Conditions

Date:	December 16, 2015	Project #: 18495.0
To:	Public and Technical Advisory Committee Members	
CC:	Project Management Team	
From:	Casey Bergh, PE and Chris Brehmer, PE - Kittelson & Associates, Inc. Darci Rudzinski, AICP and CJ Doxsee - Angelo Planning Group	

This memorandum documents the type, condition, and performance of facilities that provide transportation of people, goods, and services to and through The Dalles in 2015. From this inventory and analysis we have identified opportunities to improve transportation facilities, including roads, bridges, bike lanes, sidewalks, shared-use paths, rail lines, etc. The information documented in this memorandum relates to transportation goals, including: operations, safety, economic development, accessibility and connectivity. The following questions represent a few of the focus areas explored through the analysis:

- How have travel patterns changed since the 1999 Transportation System Plan (TSP) was adopted and can the existing transportation facilities accommodate those changes?
- Are any existing facilities in need of maintenance or replacement?
- Is economic development being limited by existing transportation facilities?
- Where have the most frequent and severe crashes been reported? What factors are contributing to crashes?

The findings of this inventory and analysis include a list of existing needs that reflect opportunities to improve the system. Improvements to the system are defined based on the goals and objectives outlined in Technical Memorandum #2. A summary of the key findings includes:

- The City has annexed 850-acres of residential and industrial land since 2005 and taken jurisdiction of several miles of roadways (W 6th Street and W 2nd Street). These roadways are not designed to current City and ADA standards, including provision for pedestrian and bicycle facilities.
- Vacant land is available within the Port of The Dalles and the Columbia Gorge Industrial Park that represents a significant opportunity for economic development and growth in traffic near the Chenoweth Interchange. The I-84 Chenoweth Interchange Area Management Plan (IAMP) was adopted in July 2010 to protect the function of the interchange to provide safe and efficient connections with the interstate to and from the city's industrial port area.

- Operational analysis of vehicle delay and capacity indicates that one intersection (US 197/I-84 EB Ramp) does not meet City delay standards. Other intersections are approaching City standards for delay and ODOT standards for capacity; these include: Thompson Street/E 10th Street/Old Dufur Rd, I-84 EB Ramps/W 6th Street, and US 197/Lone Pine Lane.
- A review of 5-year crash history at the study intersections identified several intersections with potential for crash reduction. More frequent and severe crashes were reported at these intersections than were reported at similar intersections in The Dalles or throughout Oregon. Countermeasures will be evaluated as part of the alternatives analysis element of the TSP.
- Several roadway segments have been reported with poor pavement conditions, per recent City and ODOT inventory. City and ODOT maintenance schedules will be reviewed and new pavement preservation projects will be included in the alternatives analysis element of the TSP.
- Bicycle and pedestrian facilities are provided on many roadways, but improvements to the existing facilities and construction of new facilities are needed to encourage more use of these modes of travel.
- A new transit center is being constructed near Chenoweth Loop Road and W 7th Street that will create new opportunities for carpooling and use of transit for local and regional trips.
- Bridge inventory conducted by ODOT identified a couple bridges that are weight restricted and/or have functional or structural issues. These include the W 6th Street Bridge over Mill Creek, the US 30 (Hwy 100) Bridge over Chenowith Creek, and the US 197 Bridge over the Columbia River.

The information in this memorandum will be reviewed by the Technical and Public Advisory Committees at a joint meeting on November 18, 2015. After incorporating their input, the project team will evaluate forecast traffic conditions in 2035 and identify what additional improvements will be necessary to satisfy system transportation goals for the next 20 years.

The analysis methodology and data was developed in accordance with guidance and direction provided by The City of The Dalles and the Oregon Department of Transportation (ODOT) Transportation Planning Analysis Unit (TPAU). *Additional information on the key assumptions and methodologies associated with this analysis is provided in Appendix A.*

This document is divided into the following sections.

STUDY AREA

Figure 1 illustrates The Dalles TSP study area and study intersections. The study area includes all roadways within The Dalles Urban Growth Boundary (UGB). The study intersections were identified by City and ODOT staff as representing key intersections within the study area.

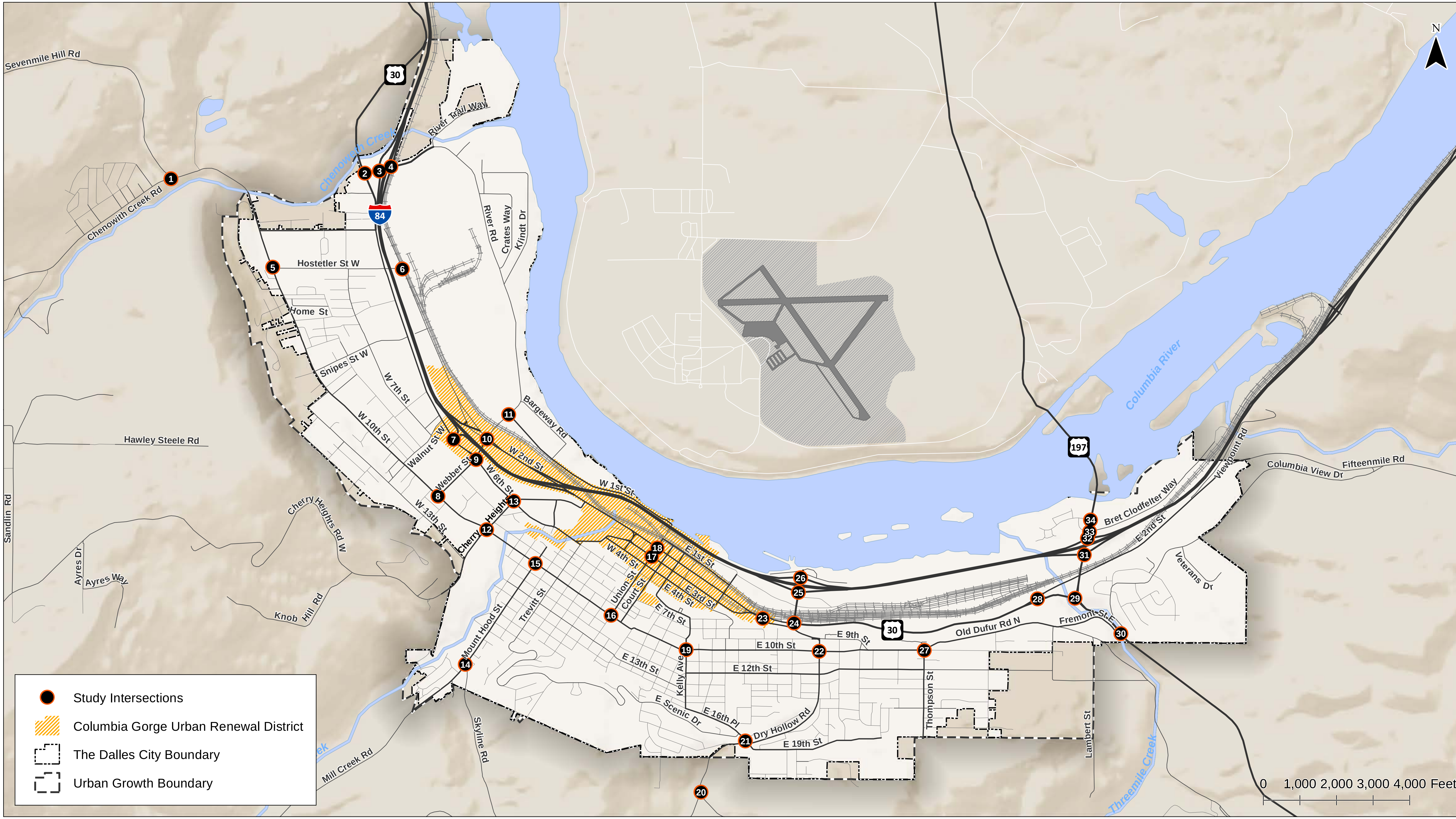
Based on the requirements of the *Oregon Transportation Planning Rule* (TPR – Reference 1), the study of roadways and intersections is generally limited to those with the highest classifications – collectors and arterials – as well as the Interstate. However, local street issues, such as street connectivity and safety are also discussed where appropriate.

EXISTING TRANSPORTATION FACILITY INVENTORY

The transportation facility inventory discussion that follows describes several topical areas by travel mode. The following sections were organized to provide an overview of existing land uses and focus on the functions of various transportation facilities in The Dalles:

Lands and Population Inventory

The inventory of existing lands and population identifies factors that may influence existing travel patterns and growth patterns within The City of The Dalles over the next 20 years. The following sections describe: Zoning, Columbia River Gorge National Scenic Area, Developed and Vacant Land, Natural Resources and Hazards, Activity Centers, and Historic and Projected Population Growth.



Study Area and Intersections
The Dalles, Oregon

Figure
1

H:\projfile\18495 - The Dalles TSP\gis\01 Study Area and Intersections.mxd - jsommerville - 9:06 AM 11/12/2015

Oregon Department of Transportation · Kittelson & Associates, Inc. Transportation Engineering/Planning · APG

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

Zoning

Figure 2 provides the location of zoning districts within the City's Urban Growth Boundary (UGB). There are eleven zones shown on the map, depicting commercial, industrial, residential, open space, parks, and right-of-way zone districts. The zoning map also includes a Neighborhood Center overlay zone wherein a mix of uses is allowed. Generally, industrial, open space, and recreational commercial zones are located between I-84 and the Columbia River. Commercial and residential zones, as well as Neighborhood Center overlay zones, are all located south of I-84.

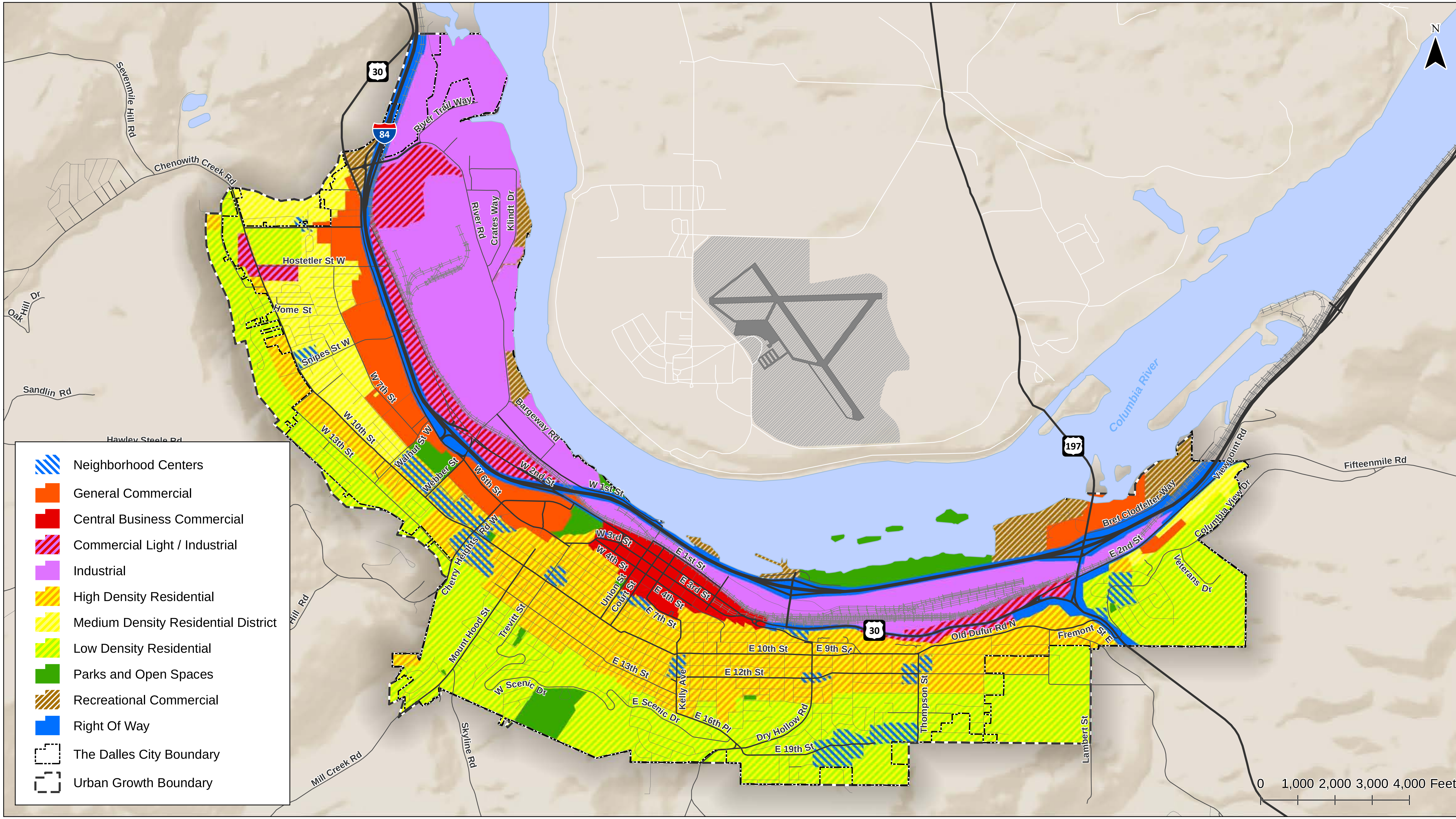
Development regulations for each of the City's zones are provided for in Chapter 5 of the Land Use Development Ordinance (LUDO). Table 1 includes a list of the zones and a summary of the types of development permitted in each.

Table 1 - Zoning Districts

Zoning District	Zoning District Purpose
Residential	
RL – Low Density Residential	Allows for 0-6 single family dwelling units per gross acre
RM – Medium Density Residential	Allows for 7-17 single family and multi-family dwelling units per gross acre
RH – High Density Residential	Allows for 7-25 single family and multi-family dwelling units per gross acre
Commercial	
Central Business Commercial	Allows for commercial, civic, and residential uses subject to additional sub-district design standards
General Commercial	Allows for a wide range of retail, wholesale, and service business
Industrial	
Commercial Light/Industrial	Allows for commercial uses and certain light industrial uses
Industrial	Allows for a variety of commercial and industrial uses
Open Space	
Parks and Open Spaces	Insures sufficient open areas throughout the community to safeguard public needs and provide recreational activities
Recreational Commercial	Allows for mixed business, commercial, service, recreational, and light industrial uses
Overlay	
Neighborhood Centers	Allow for a mix of certain commercial, residential, civic, and light manufacturing within a single building or tax lot

Columbia River Gorge National Scenic Area

The Columbia River Gorge National Scenic Area Management Plan (Management Plan) provides regulations and standards to preserve land for rural and natural uses within the Columbia River Gorge corridor and focus future growth and economic development within urban areas. The Management Plan is divided into three categories of land: Urban Areas, T Management Areas (SMAs), and General Management Areas (GMAs). A summary of GMA acreage within The Dalles TSP is provided in Table 2.



City of The Dalles Zoning
The Dalles, Oregon

Figure
2

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Oregon Department of Transportation

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Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County, 2013 ACS 5-Year Estimate
Sources: Esri, USGS, NOAA

Table 2 – Columbia River Gorge National Scenic Area Management Areas

Management Area	Acres Within The Dalles UGB	Acres within The Dalles City Limits
General Management Areas (GMAs)		
Residential (R-1, R-5)	70.6	18.0
Agricultural (A-1(40), A-1(160), A-2(40))	53.6	19.8
Open Space	3.9	-
Public Recreation	8.4	8.4
Special Management Areas (SMAs)		
Agriculture*	0.1	-
Open Space	9.9	9.9

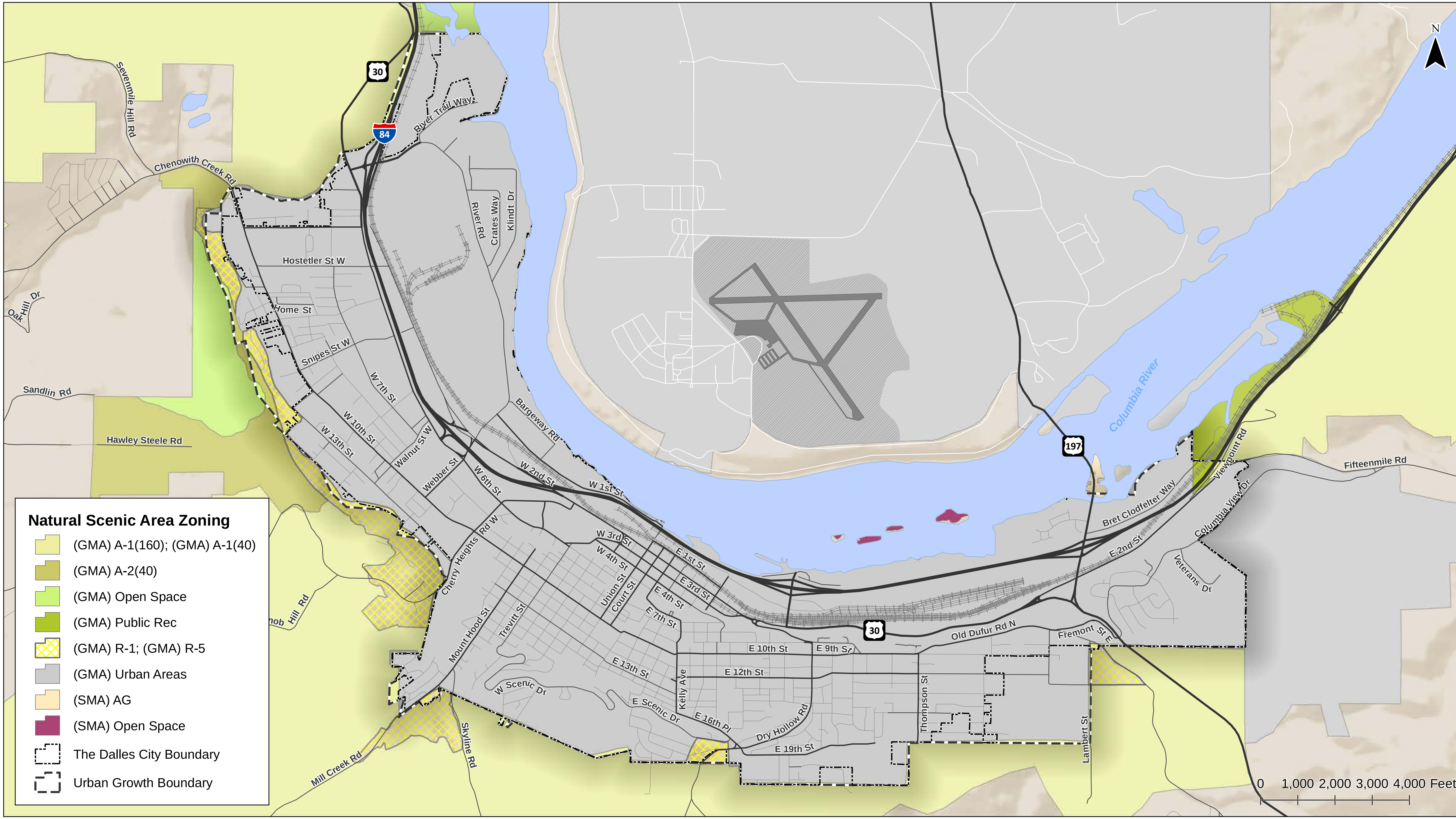
*also designated as a special agricultural area in the GMA.

The majority of the City of The Dalles is designated as an Urban Area and is exempt from the requirements of the management plan. However, as shown in Figure 3, there are limited areas within both the UGB and The Dalles city limits that are included in the management areas governed by the Management Plan. Relevant to land use and transportation planning, areas within the Residential GMA are subject to a review process and have additional criteria for the protection of scenic, cultural, natural, and recreation resources.

Developed & Vacant Land

An inventory of developed and vacant land was produced using assessor property classification data for tax lots within the UGB. Each parcel of property is classified in accordance with ORS 308.215 and, with the exception of specially-assessed properties, the classification is based upon the highest and best use of the property. Tax assessor information for parcels within The Dalles UGB provides a basic inventory of developed and vacant land, which is mapped in Figure 4.

A majority of vacant land available is zoned as Low Density Residential or Industrial, while a smaller portion of vacant land is zoned Recreational Commercial or General Commercial. Vacant Low Density Residential lands are generally characterized as small parcels and are located near the southern and western portion of the UGB. One notable exception to the size and locations of vacant Low Density Residential lands is located near the eastern portion of the UGB, which features large vacant parcels owned by the North Wasco County School District.



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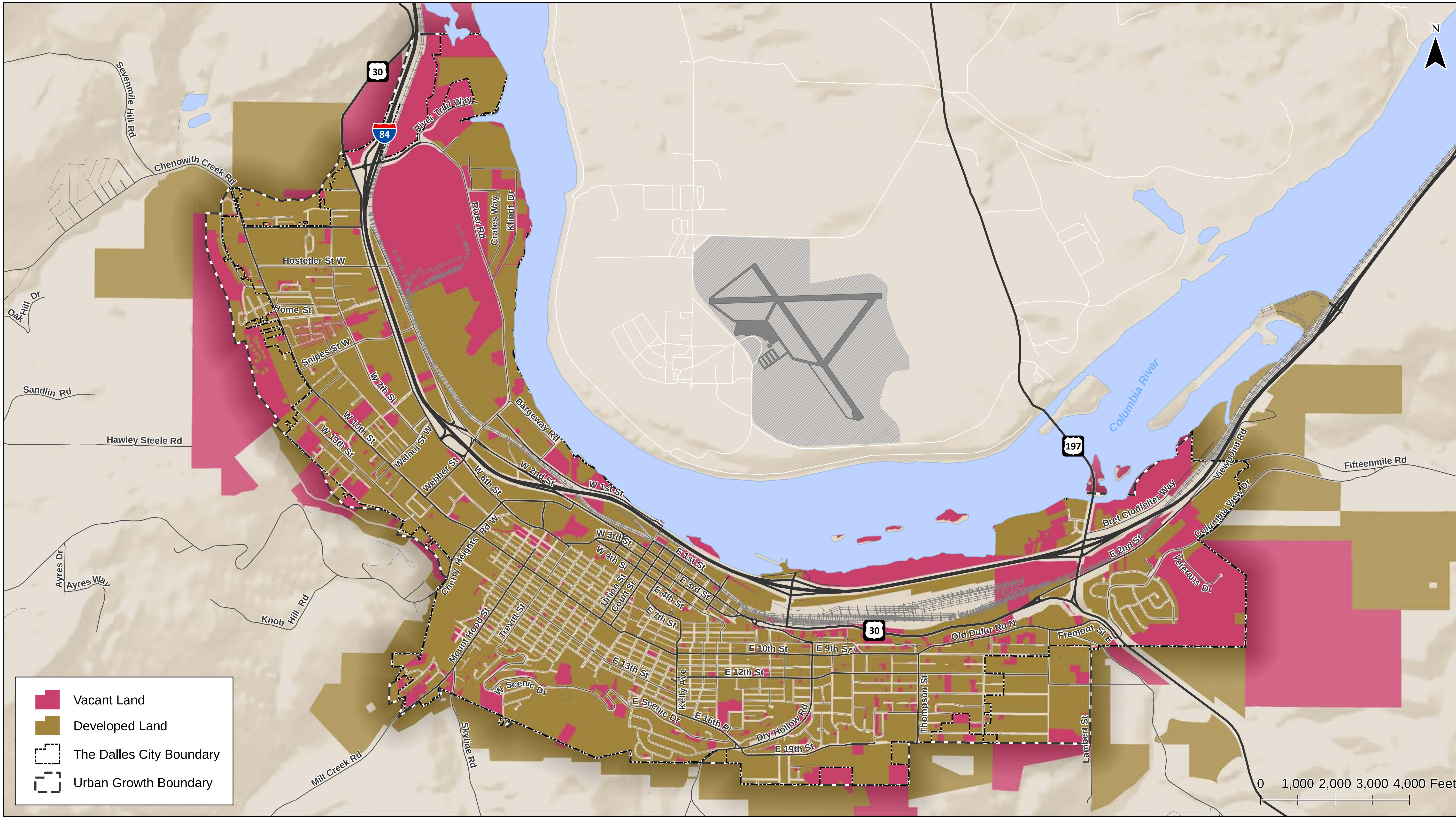
Columbia Gorge Natural Scenic Area Zoning
The Dalles, Oregon

Figure
3

Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA



Vacant & Developed Land
The Dalles, Oregon

Figure
4

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Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning
APG

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

Vacant industrial land is predominantly located in the Chenoweth Industrial area, to the north, and near the I-84/US 197 Chenoweth interchange to the east. The Port of The Dalles is developing infrastructure to serve vacant industrial land in the Chenoweth industrial area, creating "shovel-ready" sites for future tenants (refer to Exhibit 1 and Exhibit 2). As of fall 2015, 26 shovel-ready sites were available in The Columbia Gorge Industrial Center. The vacant Recreational Commercial and General Commercial zoned land is located in the northeastern area of the UGB, concentrated near The Dalles Bridge.

Exhibit 1. Roadway Infrastructure Within the Columbia Gorge Industrial Center (as of 9/17/15)

Exhibit 2. Aerial Photo of the Columbia Gorge Industrial Center (Source: John Fulton)

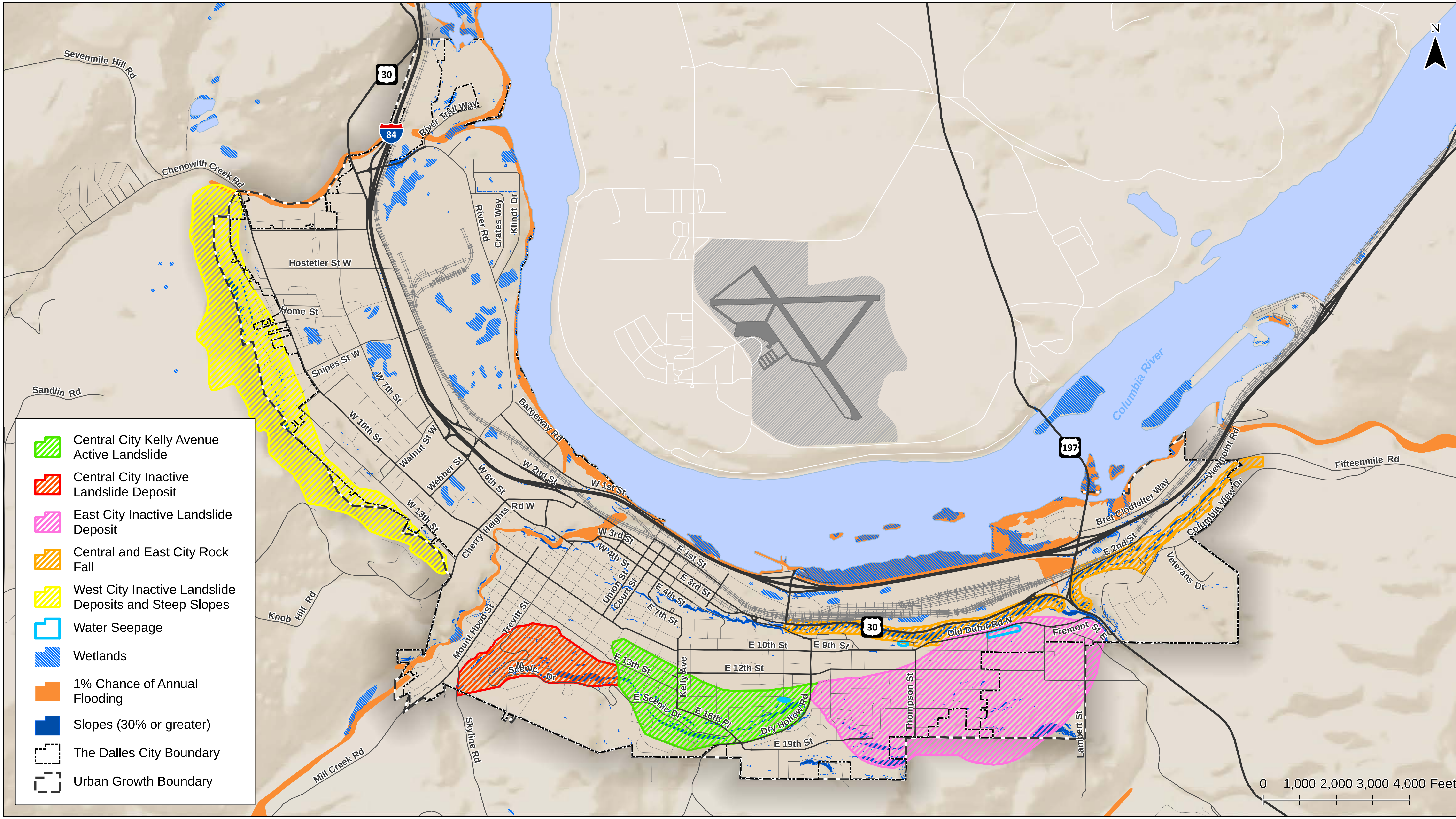
Natural Resources & Hazards

Figure 5 provides the general location of geologic hazards, steep slopes, wetlands and floodplains within The Dalles UGB that will limit development opportunities.

Wetlands

Wetlands identified in Figure 5 are based on data provided by the City of The Dalles. Wetlands are typically small and not concentrated in specific locations within the UGB. The exception is the largest wetland area, which is located between I-84 and the Columbia River on vacant land and zoned as Parks and Open Space. Detailed delineation reports for this area have been prepared by private property owners and The Port. These reports delineate areas that could be designated to mitigate wetland impacts associated with development of larger contiguous parcels.

The City of The Dalles shares a significant portion of its boundary with the Columbia River, an area that is subject to a 1% chance of annual flooding. Areas within floodplains zones, as identified in the Flood Insurance Rate Maps (FIRMS) by FEMA, are subject to LUDO Chapter 8.030 – Flood Control Provision, which contains specific development criteria for physical improvements in the overlay. Underlying land use zones adjacent to the river are primarily Industrial, with General and Recreational Commercial zones near The Dalles Bridge. All of the land zoned Parks and Open Space and adjacent to the river is identified as being within the Floodway zones.



Environmental Constraints: Geologic Hazards, Steep Slopes, Wetlands, & Floodplains
The Dalles, Oregon

Figure
5

Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

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Three smaller river bodies travel through the City before connecting with the Columbia River, providing additional areas subject to 1-percent chance of annual flooding. Chenoweth Creek is located near the northern portion of The Dalles, travelling primarily near or through properties zoned Medium Density Residential, Recreational Commercial, and Industrial. Mill Creek is centrally located within the City, travelling primarily near properties zoned Low and Medium Residential, General Commercial, Central Business Commercial, and Parks and Open Space. Three Mile Creek is in the eastern portion of The Dalles and parallels US 197 until the US 30 junction, at which point it travels west of the Lone Pine development.

Hazards

The City of The Dalles identifies six geologic hazard zones within the UGB that make the ground potentially unstable, as depicted in Figure 5. Provisions for geologic hazard areas, found in LUDO Chapter 8.040, apply to all new development including, but not limited to, transportation facilities. All geologic hazard areas feature lands with slopes of 30 degrees or more. The majority of geologic hazard areas are located near the southern portion of the UGB in Medium and Low Density Residential areas. The exception is a geologic hazard area that exists on US 30 (Mosier-The Dalles Hwy/E. 2nd Street), generally located between Brewery Overpass Rd and US 197.

Activity Centers

It is important to provide safe and efficient multimodal connections to and between major activity centers in the community. The activity centers found in The Dalles include a variety of civic, educational, and recreational uses. As seen in Figure 6, activity centers are generally clustered around downtown and near arterials. Some prominent destinations outside of downtown include the community college and hospital, located near the southern portion of the UGB and outside of the geologic hazard areas. Key attractors in The Dalles include:

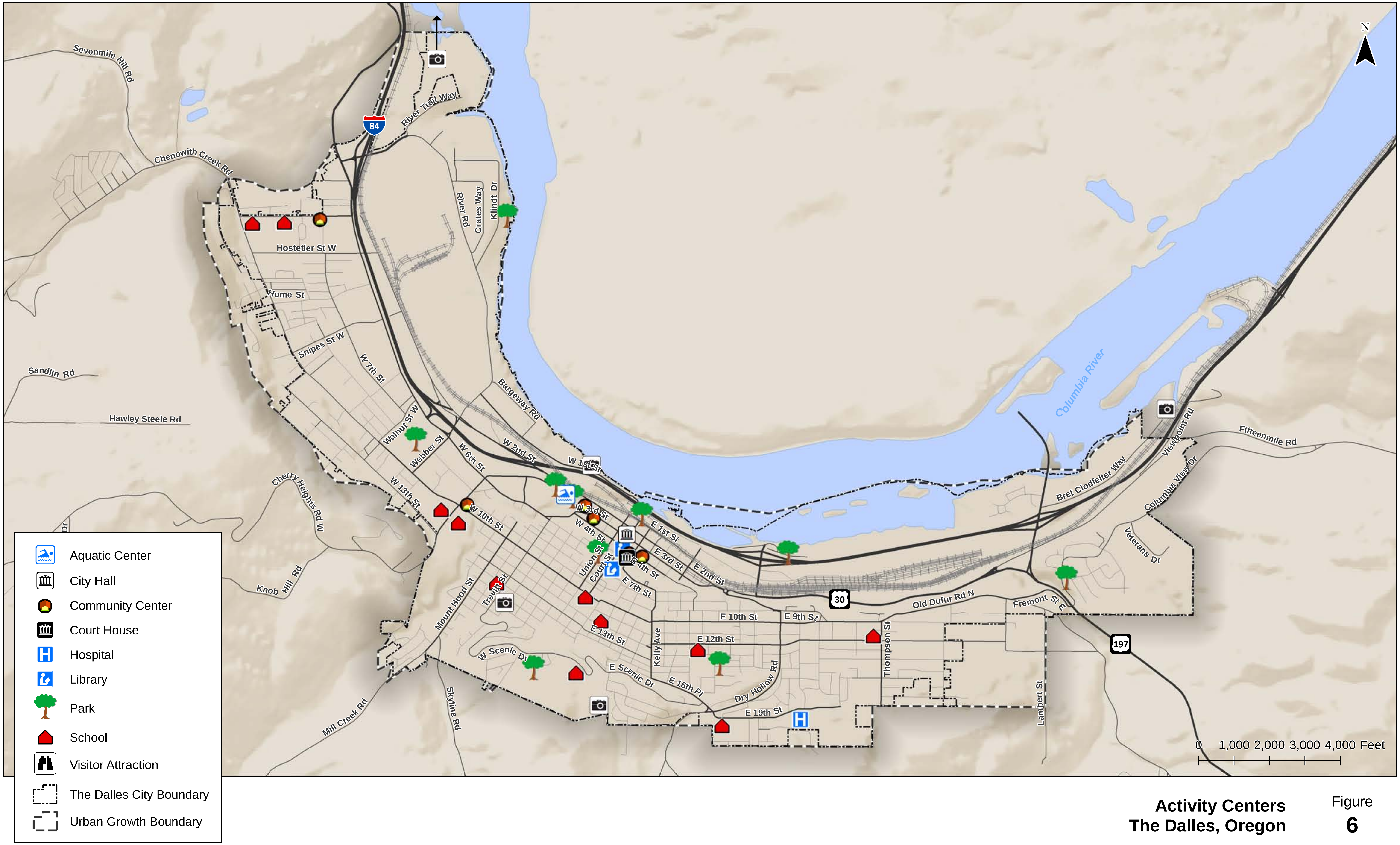
Exhibit 3. The Columbia Gorge Discovery Center and Museum (Source: www.gorgediscovery.org)

- Schools –North Wasco County School District operates three elementary, one middle-school, one high-school, and one community school in The Dalles. There are also three private academies and Columbia Gorge Community College.
- Parks – Developed and undeveloped parks within The Dalles include an aquatic center, Sorosis Park, and two riverfront parks (Kiwanis Park and Riverfront Park).

- Downtown – The Dalles' downtown area includes most of the civic uses within the City, including the Wasco County Court House, The Dalles City Hall, Civic Auditorium, and Art Center, two libraries, and a museum.

- Mid-Columbia Medical Center – The Mid-Columbia Medical Center is located away from the downtown area and major highways. Primary access is provided via a single arterial, E. 19th Street.
- Columbia Gorge Discovery Center & Museum - The official interpretive center for the Columbia River Gorge National Scenic Area is located in the northwest corner of The Dalles. Access is provided via US 30. (See Exhibit 3)
- The Dalles Dam Visitor Center – The U.S. Army Corps of Engineers operates a visitor center and offers tours of The Dalles Dam daily from Memorial Day through Labor Day. Access is provided via Bret Clodfelter Way.
- Fort Dalles Readiness Center is located adjacent to the Columbia Gorge Community College campus and provides a venue for various public events.
- Fort Dalles Museum is located on Garrison Street, between W 15th and 16th Streets. (See Exhibit 4)

Exhibit 4. The Fort Dalles Museum (Source: Google Maps user Mahalofreddy)



Activity Centers
The Dalles, Oregon

Figure
6

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Kittelson & Associates, Inc.
Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

Historic and Projected Population Growth

According the Population Research Center at Portland State University, the certified July 1, 2015 population estimate of The Dalles is 14,515 people. As shown in Table 3, the City experienced 34% population growth between 1980 and 2015 - faster than Wasco County (21%), but slower than the State as a whole (52%). Considering that The Dalles is the largest incorporated city within Wasco County, the historical trends support the idea that the general population is becoming comparatively more urbanized within the County.

Table 3 – The Dalles Historic Population Growth (1980-2015)

	Population					Change 1980 – 2015	
	1980	1990	2000	2010	2015	Number	Percent
Oregon	2,633,105	2,842,321	3,421,399	3,831,074	4,013,845	1,380,740	52.4
Wasco County	21,732	21,683	23,791	25,213	26,370	4,638	21.1
The Dalles	10,820	11,060	12,156	13,620	14,515	3,695	34.2

As shown in Table 4, The Dalles has fewer family households (63%) compared to Wasco County (65%). Of the family households, The Dalles has more households with children under 18 years of age. More details on age and distribution of youth (and seniors) can be found in the Environmental Justice section below.

Table 4 - 2010 Households by Type

Households by Type	Wasco County		The Dalles	
	Population	% of Population	Population	% of Population
Total households	10,031	100.0	5,472	100.0
Family households (families)*	6,540	65.2	3,441	62.9
With own children under 18 years	2,604	26.0	1,503	27.5
Nonfamily households*	3,491	34.8	2,031	37.1
Householder living alone	2,886	28.8	1,696	31.0
Male	1,328	13.2	693	12.7
65 years and over	384	3.8	186	3.4
Female	1,558	15.5	1,003	18.3
65 years and over	865	8.6	584	10.7

* "Family households" consist of a householder and one or more other people related to the householder by birth, marriage, or adoption. They do not include same-sex married couples even if the marriage was performed in a state issuing marriage certificates for same-sex couples. Same-sex couple households are included in the family households category if there is at least one additional person related to the householder by birth or adoption.

Population forecasts for The Dalles were completed in 2006 by ECONorthwest, providing an outlook to the year 2060. The 2006 forecast growth of up to 1.9% annually through 2025 with growth rates declining from 2025 through 2060. Recent data collected by the Portland State University Population

Research Center indicates the population forecasts contained in the 2006 ECONorthwest report exceed current expectations; the City has been using estimates of less than 1.9% annual growth. New population forecast data for The Dalles is being generated by ODOT as part of the network analysis to reflect updated population growth assumptions[1]. Information on updated population growth forecasts will be provided in Technical Memorandum #4. It is expected that amendments to the City's policy documents, including the Comprehensive Plan, will need to be completed as a result of the updated population forecast data.

Street Network

The street network is the backbone of the transportation system in the City of The Dalles. Motor vehicle, bicycle, pedestrian, transit, and freight transportation all rely on the street network to some degree. The street network also provides motor vehicle, bicycle, pedestrian, and transit access to air and rail facilities. The following section describes the street network's jurisdiction, classifications, and characteristics.

Jurisdiction

Streets within The Dalles are owned and maintained by three separate jurisdictions, including the Oregon Department of Transportation (ODOT), Wasco County and the City of The Dalles. All Wasco County roads within The Dalles City Limits are expected to be transferred to The City of The Dalles in 2016. Each jurisdiction is responsible for determining the street's functional classifications, defining its major design and multimodal features, and approving construction and access permits. Coordination is required among the jurisdictions to ensure that the streets are planned, operated, maintained, and improved to safely meet public needs.

State Highways

ODOT owns the following highways within The Dalles:

- Interstate 84 (I-84) is a four-lane, limited access facility that connects The Dalles to Portland, located 85 miles to the west, and then passes through Idaho and Utah to the east. There are currently six interchanges with I-84 in The Dalles. These interchanges connect at several points along old US 30 and at US 197 where it crosses into Washington.
- US 197 (Highway 197) is a two-lane highway that connects to US 97 and Bend located 132 miles to the south. It extends northward into Washington, terminating at State Route 14.
- US 30 (Historic Columbia River Highway) is a two-lane scenic highway connecting Troutdale and The Dalles.

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[1] The City of The Dalles has provided initial authorization and direction to use the updated assumptions in anticipation of population forecast data produced by Portland State University's Population Research Center.

- US 30 (The Dalles-Mosier Highway) is a two- lane highway that connects US 197 to Brewery Overpass Road within The Dalles.

Non-State Roads

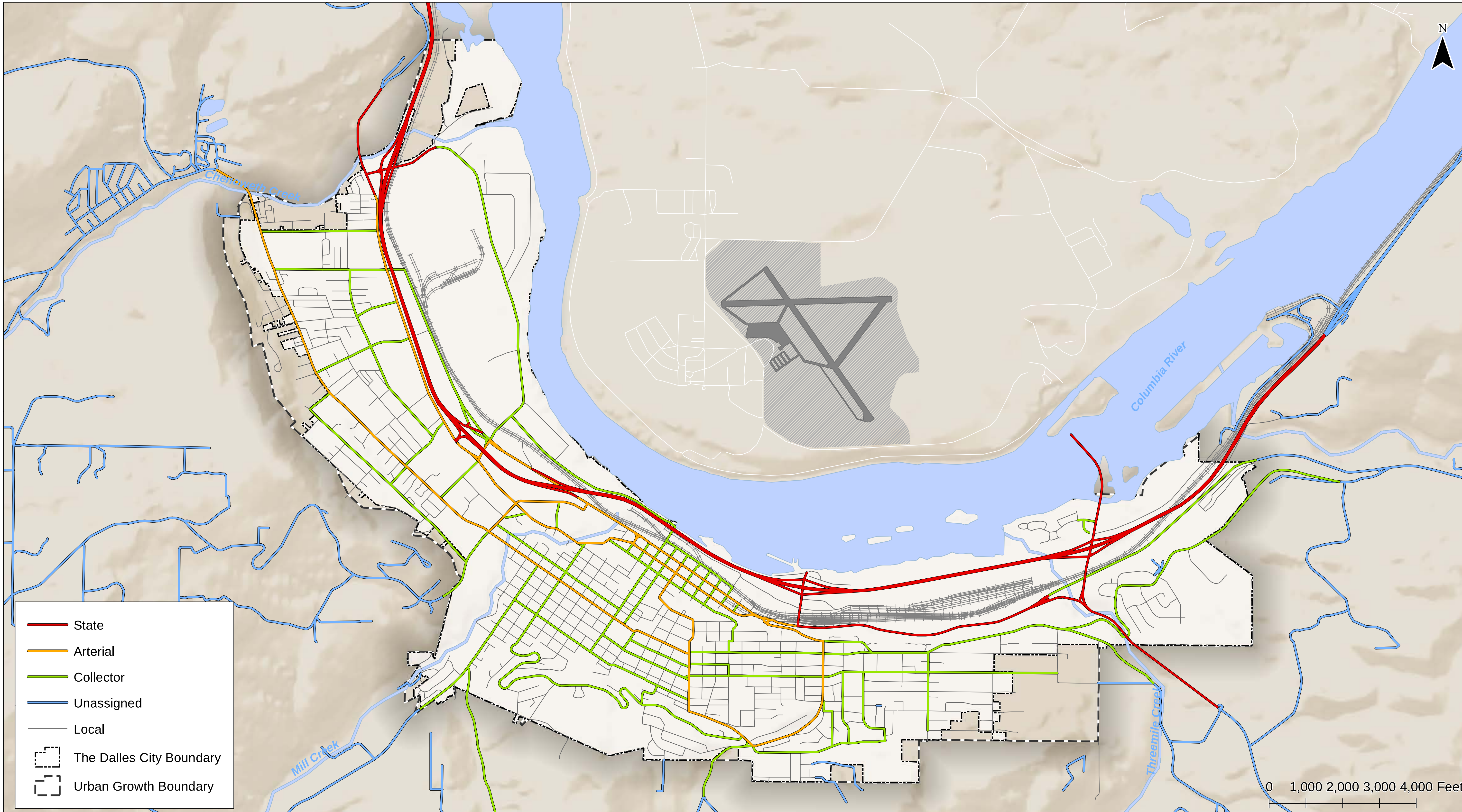
Non-state streets are maintained by the City, County, or private property owners. Local/Public Access Roads within the City that are under City jurisdiction are maintained by the adjacent property owners. Roadway names and lengths obtained from the City and Wasco County GIS are summarized in Appendix B.

Functional Classification

A roadway's functional classification is determined by several factors, including how the facility connects with the rest of the system, the volume of traffic (local or through) it is expected to carry, and the types of trips it is expected to carry. The functional classification considers the adjacent land uses and the kinds of transportation modes that should be accommodated. The public right-of-way should also provide sufficient space for utilities to serve adjacent land uses.

Figure 7 illustrates the Functional Classification of the roadways in the City. The roadways are categorized as Highways, Arterials, Collectors, Unassigned, or Local Streets or Roads. The following functional classifications are defined in the City's current TSP:

- Highways: Highways generally carry long-distance traffic through a region. Some of the traffic on interstate freeways may exit/enter to travel to/from the regional street system. Because of the access restriction, however, short-distance local trips are discouraged. Interstate 84 is the only freeway serving the City of The Dalles.
- Arterial: Arterial streets form the primary roadway network within and through a region. They provide a continuous road system that distributes traffic between neighborhoods and districts. Generally, arterial streets are high capacity roadways that carry high traffic volumes with minimal localized activity.
- Collector: The function of collector streets is equally divided between mobility and access. Collector streets connect local neighborhoods or district traffic to the arterial network. Generally, they do not connect together to form a continuous network because they are not designed to provide alternative routes to the arterial street system.
- Local Street: The function of local streets is to provide direct access to adjacent land uses; characterized by short roadway distances, slow speeds, and low volumes. Local streets typically offers a high level of accessibility; generally serving passenger cars, pedestrians, and bicycles, but not through trucks. Separate pedestrian sidewalk facilities are often provided in urban areas. Local streets generally convey low volumes of freight traffic.



Existing Functional Classifications
The Dalles, Oregon

Figure
7

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

Freight Routes

Motor Carrier Transportation Division (MCTD) Freight Routes

The MCTD division of ODOT promotes a safe, efficient, and responsible commercial transportation industry by simplifying compliance, reducing regulatory requirements, wherever appropriate, preserving the infrastructure, enhancing the private/public partnership, fostering effective two-way communication, and delivering superior customer service while recognizing the vital economic interests of the commercial transportation industry. One of MCTD's functions is to designate freight routes.

The MCTD-designated freight routes in The Dalles are shown in Figure 8. The following bullets provide a description of the different route characteristics assigned per the MCTD Freight Mobility Map (ranging from the most restrictive to the most accessible routes for movement of freight).

- Routes colored black and yellow are highly restricted to truck and oversize load traffic. These routes may be important for local freight access by permit, but not for general use. These routes should not be considered for use as a viable detour route for trucks.
- Routes colored magenta have some restrictions for both length and/or width. These routes will not be viable detour for all tracks/loads.
- Routes colored blue are unrestricted to standard freight truck traffic but are either weight or width restricted for non-divisible and/or heavy haul loads. These routes are viable detour routes for general freight trucks only, but will not accommodate certain oversize and overweight loads.
- Routes colored orange are generally available for use by unrestricted freight and oversize/overweight routes. These are typically the most heavily used truck routes in the state and also usually offer the most viable unrestricted detour route.

Major freight generators within The Dalles are generally located in the industrial areas within the Port of The Dalles and the Columbia Gorge Industrial Park. Access to these areas is primarily provided via River Road and connects to I-84 at the Chenoweth Interchange and the Webber Street Interchange.

Additional freight generators include industrial uses between I-84 and the railroad near the Brewery Overpass Road. This area has convenient access to I-84 via Brewery Overpass interchange terminals.

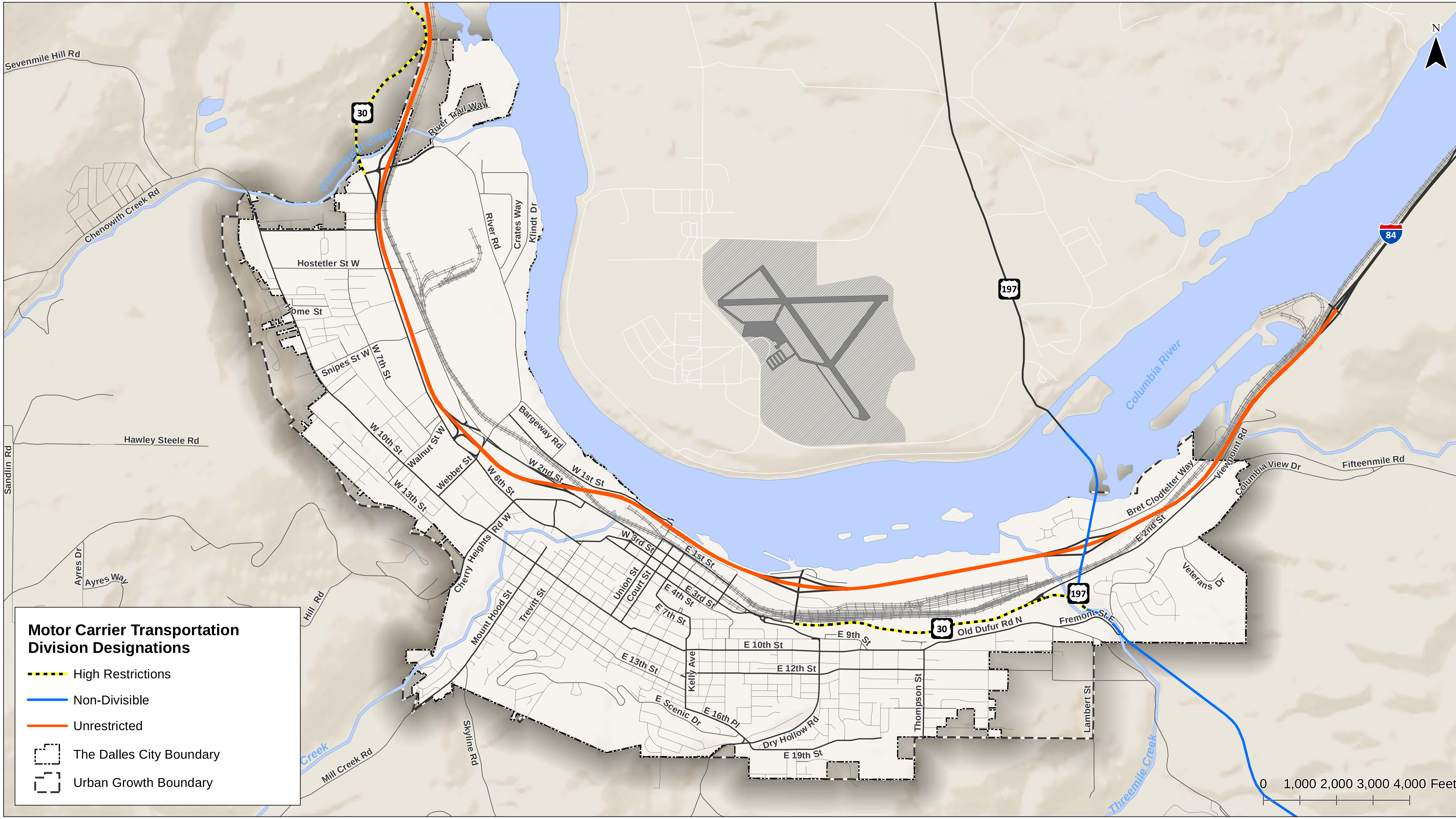
ORS 366.215 (No Reduction of Vehicle-Carrying Capacity)

Under ORS 366.215, the Oregon Transportation Commission (OTC) may not permanently reduce vehicle-carrying capacity of identified freight routes. Exceptions are allowed by statute if the exception is determined to be in the best interest of the state and freight route or for safety and access considerations. ORS 366.215 review shall be completed on any planning, design, or project development on state highways.

Roadway Characteristics

Existing Intersection Traffic Control and Lane Configurations

Of the 34 study intersections, four are signalized, five are two-way stop controlled, and four are all-way stop controlled. Figure 9 illustrates existing traffic control devices and lane configurations at the study intersections.

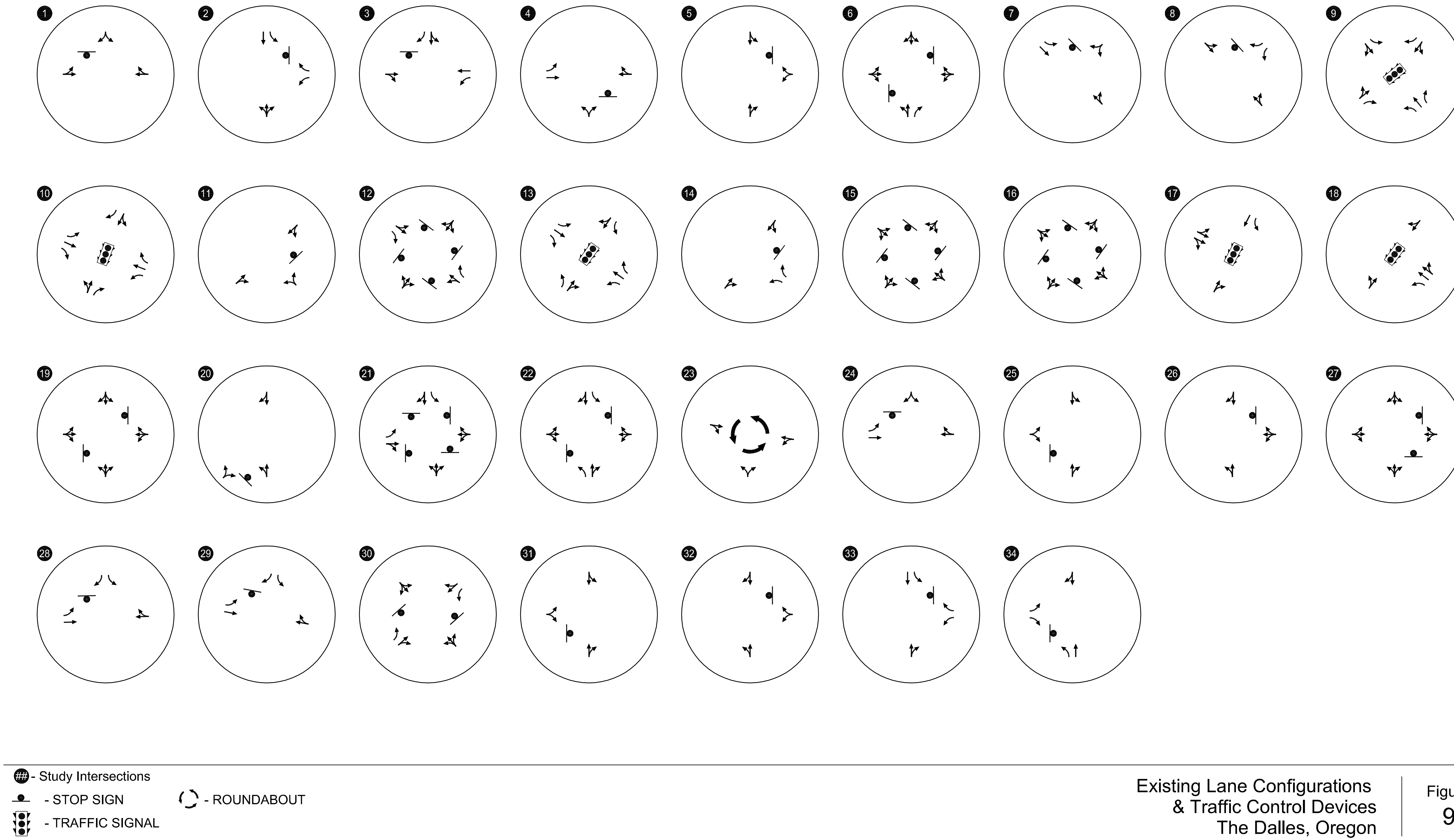


MCTD Freight Mobility Map
The Dalles, Oregon

Figure
8

Oregon Department of Transportation
KITTELSON & ASSOCIATES, INC. TRANSPORTATION ENGINEERING/PLANNING

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA



Existing Lane Configurations & Traffic Control Devices The Dalles, Oregon

Figure 9

National Highway System Facilities

The National Highway System (NHS) consists of roadways that provide important connections for the nation's economy, defense, and mobility. NHS roadways can be interstates, other principal arterials, highways that are a part of the Strategic Highway Network (STRAHNET[2]), major connectors of the STRAHNET, and intermodal connectors. Interstate-84 is the only designated NHS Highway in The Dalles.

On-Street Parking Locations

On-street parking is provided on the majority of the streets within the downtown area and the residential areas south of downtown. Within downtown, parallel on-street parking is provided on the E 2nd Street and E 3rd Street couplet. In addition, a mix of parallel and angle parking is available on cross streets.

The local business community has experimented with a parklet on E 2nd Street between Laughlin and Federal Street. The parklet expands the sidewalk into one or more on-street parking spaces to create people-oriented places, as shown in Exhibit 5.

Exhibit 5. Existing Parklet on E 2nd Street between Laughlin and Federal Street

Pavement Type and Conditions

The majority of public roads in The Dalles are paved. The City implements a Pavement Condition Rating program utilizing the subjective Good-Fair-Poor (GFP) Rating Method. Existing pavement conditions for City roadways, based on 2013 inventory data, are shown in Figure 10.

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[2] This is a network of highways which are important to the United States' strategic defense policy and which provide defense access, continuity and emergency capabilities for defense purposes.

ODOT conducts pavement condition surveys biennially on state-maintained roadways. It employs two separate and distinct pavement rating procedures. For I-84, the only NHS road in The Dalles, ODOT collects detailed data on pavement surface distress types, severity, and quantities. For non-NHS highways, the subjective Good-Fair-Poor (GFP) Rating Method is used, which relies on visual inspection of pavement surface and is rated from 1.0 to 5.0 based on the ride quality and surface distresses. The indexes resulting from both methodologies are then categorized into five conditions: "Very Good", "Good", "Fair", "Poor" and "Very Poor." Existing pavement conditions for ODOT roadways, based on 2014 ODOT inventory data, are shown in Figure 10.

ODOT monitors pavement conditions through its Pavement Management System. The Pavement Management System is a set of tools or methods that can assist decision makers in finding cost-effective strategies for providing, evaluating, and maintaining pavements in a serviceable condition.

As shown in Exhibit 6, ODOT applies preventative maintenance to roadways with fair or better ratings, but roadways with poor ratings require major rehab or reconstruction.

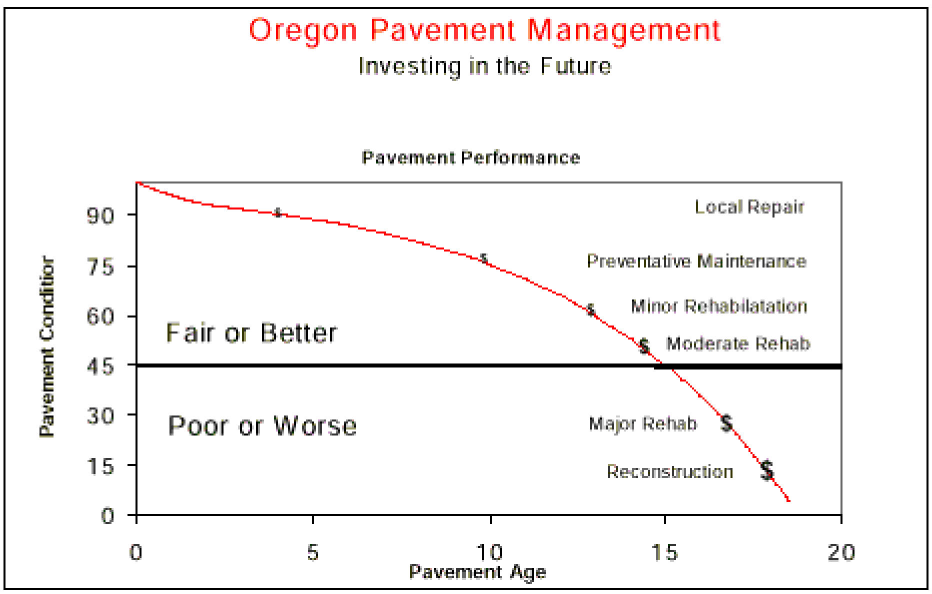
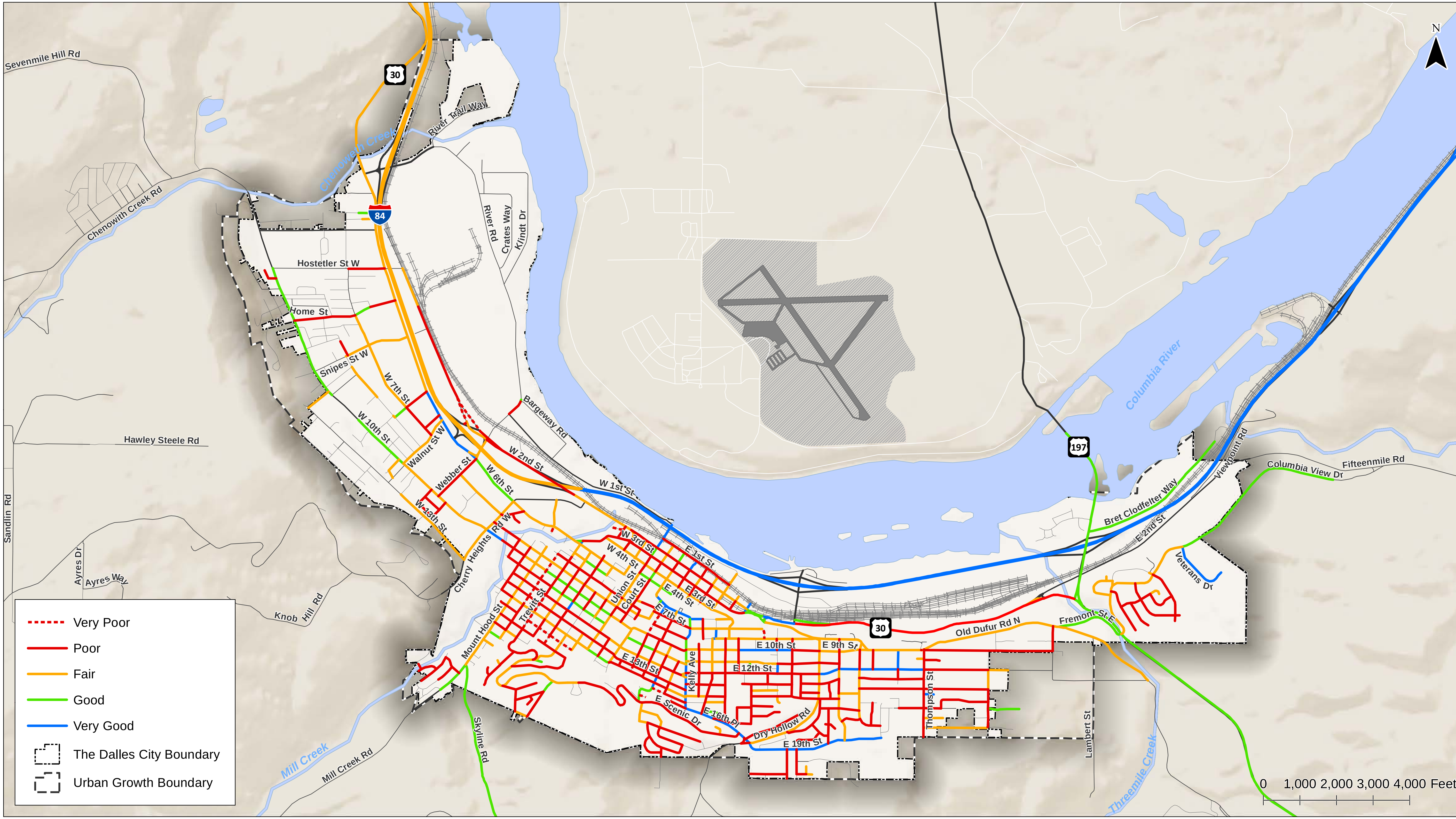


Exhibit 6. Oregon Pavement Management Strategy (Source: http://www.oregon.gov/odot/)

Based on the most recent survey data, US 30 from the Brewery Grade Overpass to US 197 and I-84 received a rating of "poor" within The Dalles. In 2015, ODOT repaved 3.8 miles of Interstate 84 from MP 84.3 (near the Union Pacific railroad overcrossing) to MP 88.1 (Fifteenmile Creek Bridge), to improve a section of pavement. The 2015-2018 Statewide Transportation Improvement Program (STIP) includes a project scheduled for 2016 to provide pavement overlay and median barrier replacement from I-84 milepoint 70.46 to 84.31.



Existing Roadway Pavement Conditions
The Dalles, Oregon

Figure
10

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Oregon Department of Transportation

Kittelson & Associates, Inc. Transportation Engineering/Planning

APG

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County, The City of The Dalles, Oregon Department of Transportation
Sources: Esri, USGS, NOAA

Bicycle/Pedestrian Network

Provision of comprehensive pedestrian and bicycle facilities can enable people to walk and bike safely and efficiently between land uses. Within The Dalles, pedestrian and bicycle facilities primarily serve short trips to major attractors, such as schools, parks, and transit stops. However, bicycle travel can be a viable commuting option for The Dalles residents when supported by facilities such as bicycle lanes or paved shoulders, secure bicycle parking, work-place showers, and bus-mounted bicycle racks.

ODOT is currently in the process of updating the *Oregon Bicycle and Pedestrian Plan.* The Plan will provide a vision for the entire state system, including locally owned facilities, while defining the role of the State and ODOT. The Plan will inform decision making and guide investments strategies made through Transportation System Plans, Facility Plans, the Statewide Transportation Improvement Program and other programs, but will not include the identification of projects.

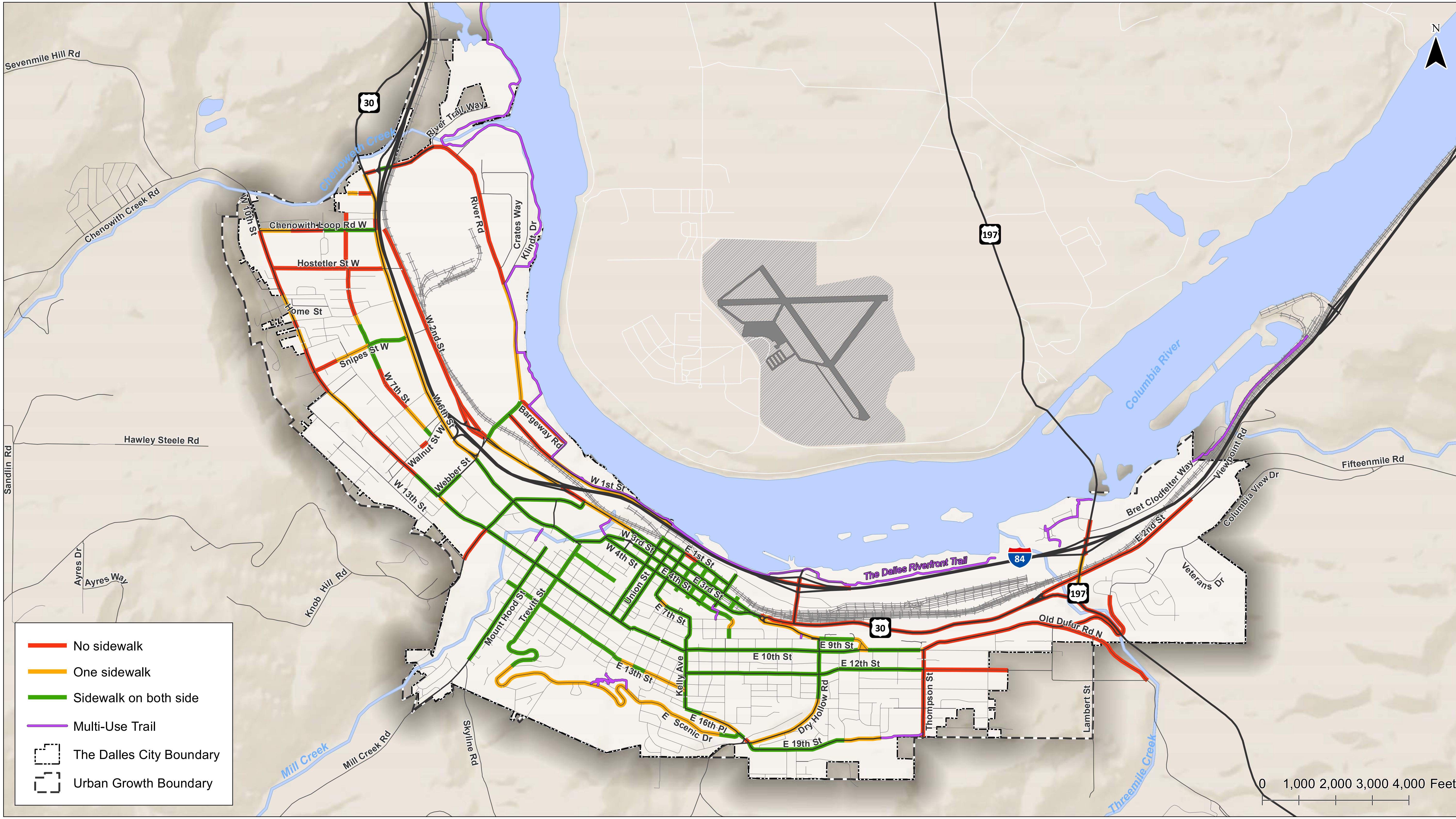
Pedestrian Facilities

Walking can also be a viable commuting option when supported by facilities such as sidewalks, shared-use paths, and trails - or when mixed-use developments give people the option to live near their work.

The *Oregon Bicycle and Pedestrian Design Guide* (Reference 2) identifies two design treatments for accommodating pedestrians on roadways. These include:

> **Sidewalks** — Sidewalks are typically located along roadways, separated with a curb and/or planting strip or swale, and have a hard, smooth surface.
>
> **Shared-use Paths** — Paths are typically used by pedestrians, cyclists, skaters and joggers. Paths can be constructed with a variety of surface types, though materials that provide a relatively smooth and firm surface are typically required to comply with Americans with Disability Act (ADA) requirements.

Figure 11 illustrates the location and type of pedestrian facilities on The Dalles roadways. Generally, sidewalks are provided on both sides of the street throughout The Dalles Historic Downtown and the residential areas south of downtown. Areas to the northwest of Webber Street (south of I-84) and areas east of Thompson Street generally have the fewest pedestrian facilities. As shown in Figure 11, pedestrian facilities are particularly lacking along the 10^{th} Street east-west arterial route.



Existing Sidewalks and Shared-use Paths
The Dalles, Oregon

Figure
11

\\kittelson.com\fs\H_Portland\projfile\18495 - The Dalles TSP\gis\11 Existing Sidewalks and Shared-Use Paths.mxd - mludet - 4:09 PM 11/16/2015

Oregon Department of Transportation

Kittelson & Associates, Inc.
Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

Bicycle Facilities

The *Oregon Bicycle and Pedestrian Design Guide* (Reference 2) identifies four design treatments used to accommodate bicycle travel on roadways and one design treatment used to accommodate bicycle travel that is separated from the roadway. These design treatments are described below.

Shared Roadway — On a shared roadway, bicyclists and motorists share the same travel lanes. A motorist will usually have to cross over into the adjacent travel lane to pass a bicyclist. Shared roadways are common on neighborhood streets and on low volume rural roads and highways and may, or may not, include “sharrows” (pavement marking that indicate the shared use of the roadway). Generally, most collectors and some arterials in The Dalles carry less than 3,000 vehicles per day. Per the *Oregon Bicycle and Pedestrian Design Guide,* these roads could allow bicycle traffic to mix with automobile traffic.

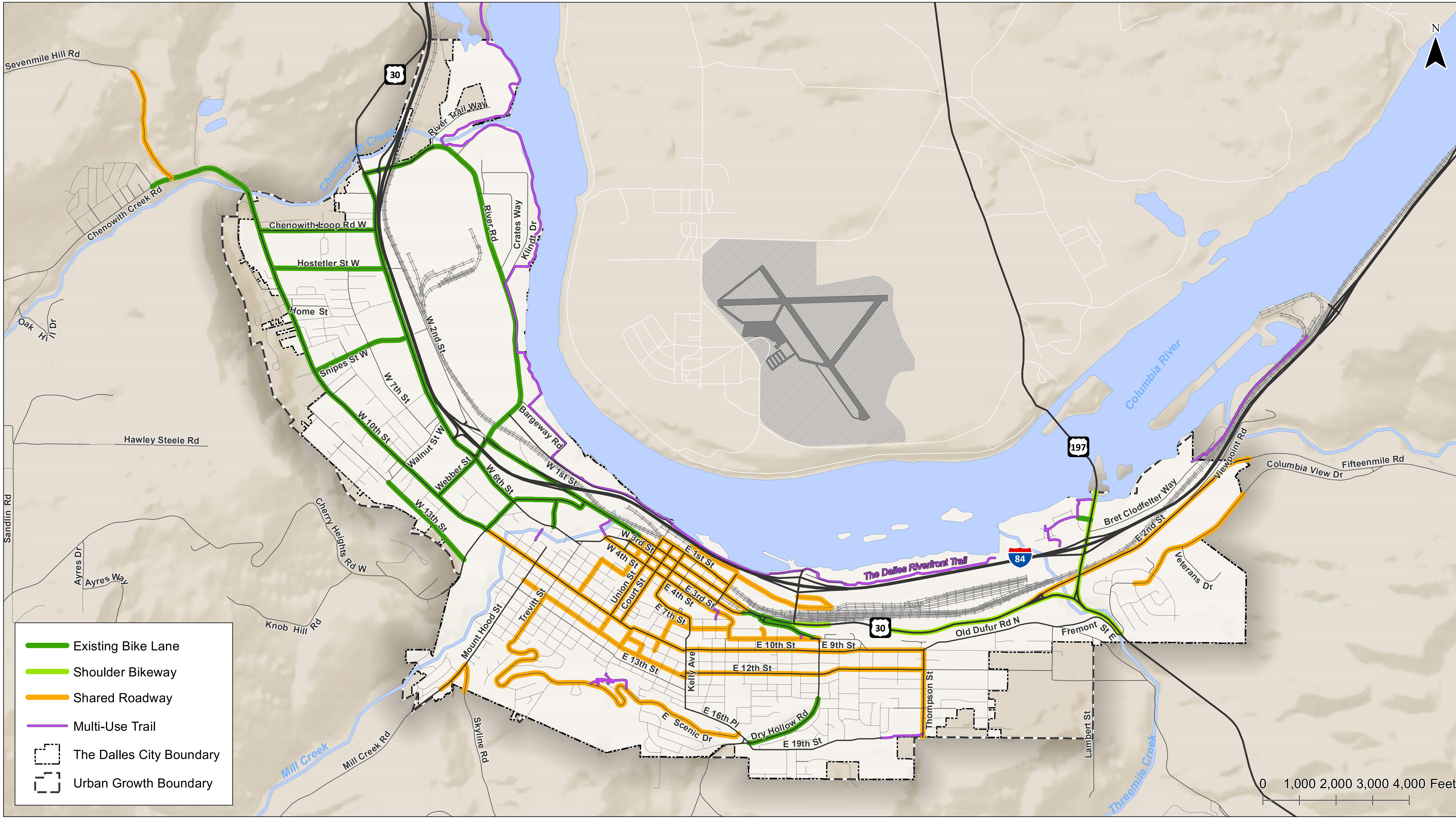
Bicycle Boulevard – The bicycle boulevard is a refinement of the shared roadway treatment. On bicycle boulevards, the typical operation of a local street is modified to function as a through street for bicyclist while maintaining local access for motor vehicles. Traffic calming devices reduce motor vehicle speeds and through trips and traffic controls limit the potential for conflicts between bicyclists and motorists.

Shoulder Bikeway — A shoulder bikeway is a paved shoulder that provides a suitable area for bicycling, reducing the potential for conflicts with motor vehicles. In The Dalles, this includes the roadways transitioning from urban to rural at the southern city limits.

Bike Lane — Some roadways dedicate a portion of the roadway for preferential use by bicyclists. Bike lanes are generally considered appropriate on urban arterials and major collectors where motor vehicle speeds are significantly higher than bicycle speeds. Bike lanes on local streets are appropriate where bicycle volumes are high, vehicle speeds are higher than 25 miles per hour, and/or poor sight distance exists. Bike lanes must always be well-marked to call attention to their preferential use by bicyclists.

Shared-Use Path — Shared-use paths are separated from the roadway by an open space or barrier. Shared-use paths are typically used by pedestrians and bicyclists as two-way facilities. Shared-use paths are appropriate in corridors with high traffic volumes not well served by the street system. Such paths can also be used to create pedestrian and bicycle short cuts and can serve as elements of a community recreational trail system.

The Dalles’ bicycle facilities were inventoried using data from Wasco County’s Geographic Information System (GIS) database, the current TSP, and visual inspection of facilities using Google Earth imagery. Figure 12 illustrates the location and type of bicycle facilities on City arterial and collector roadways.



Existing Bike Facilities
The Dalles, Oregon

Figure
12

Oregon Department of Transportation

Kittelson & Associates, Inc.
Transportation Engineering/Planning

APG

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

Riverfront Trail

The Riverfront Trail is a shared-use, paved trail that parallels the south bank of the Columbia River. Much of the Trail is ADA-accessible. When complete, the Riverfront Trail will span ten miles between The Discovery Center to the northwest and The Dalles Dam Visitor Center at the eastern terminus. Currently, there are missing segments of the trail just west of the Lone Pine Development, and east of US 197 to The Dalles Dam. The asphalt-paved trail is 8- to 12-feet wide, offering an attraction for bicyclists, walkers with dogs or strollers, joggers, and many others. The majority of the Riverfront Trail is ADA accessible.

Restrooms are available along the trail (the Pocket Park and The Dalles Dam Visitor Center) and the trail provides easy access to downtown and numerous benches. In the summer, kayak and bike rentals are available at The Kayak Shack in Riverfront Park, at the 6.5-mile point.

The Riverfront Trail has multiple access points within the first six miles between The Discovery Center and Riverfront Park. There are no access points between the Riverfront Park and the Lone Pine residential development, as the trail runs between I-84 and the Columbia River.

Other Shared-use Paths and Trails

Additional shared-use paths running north-south could provide a comprehensive (off-street) network for recreational and commuter use.

The 2006 TSP proposed two shared-use paths that follow Mill Creek and Chenoweth Creek. The path along the west bank of Mill Creek would connect with the street system at the Cherry Heights Road/13th Street intersection. The path along Chenowith Creek would run along the creek from W 10th Street to the Riverfront Trail, including an at-grade crossing of US 30 (Historic Columbia River Highway) and an undercrossing of I-84. Neither of these paths is currently available or funded for construction.

Public Transit Services Inventory

A new transit center, operated by the Mid-Columbia Council of Governments (MCCOG), is currently under construction on West 7th Street, near the Chenoweth interchange. The transit center is expected to be complete in 2016, with park-and-ride space[3] and bus service provided by Columbia Area Transit, MCCOG's Link, and possibly Greyhound.

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[3] Park & ride lots are transit system components that provide patrons with a connection point to transit service. Patrons typically drive private automobiles (or ride bicycles) to a transit station, transit stop, or car/vanpool waiting area and park the vehicle in the area provided for that purpose.

Public transportation service within The Dalles includes a dial-a-ride, door-to-door service operated by the Mid-Columbia Council of Government's Transportation Network (The Link). In addition, ODOT provides public utility commission (PUC) licenses to private companies and charter service providers. Intercity transit service is provided by Greyhound, Columbia Area Transit, the Hood River County Transportation District and by Amtrak Thruway bus service.

Intercity Bus

Greyhound provides intercity bus service in The Dalles at one bus stop located at 201 Federal Street. Service is provided along I-84 daily. Columbia Area Transit also provides intercity bus service multiple times a day on weekdays along I-84 between the City of Hood River and The Dalles.

Hood River County Transportation District provides service to Hood River and Portland on Tuesdays and Thursdays except for major holidays and if weather conditions make it unsafe or hazardous to travel between The Dalles, Hood River and Portland.

Passenger Rail

Although a ticket office is not provided in The Dalles, Amtrak Thruway provides bus transportation from The Dalles (201 E Federal Street) to the nearest full service station (Portland). This service operates seven days a week, one bus in the morning, one in the afternoon and one in the evening. The next nearest train platforms are in Wishram, WA and Bingen, WA (White Salmon).

Specialized Transportation Services

The Mid-Columbia Council of Government's Transportation Network (The Link) offers Dial-A-Ride, door-to-door transportation services in Wasco County. Dial-A-Ride trips are scheduled in advance, and may include other passengers riding on the bus going to different destinations. The Transportation Network operates lift-equipped buses to serve customers who require the use of a wheelchair, or have difficulty negotiating steps.

Bridges

ODOT maintains an inventory of bridge conditions within The Dalles. State, County, and City owned facilities are assigned a sufficiency rating based on inspections conducted at regular intervals, usually every two years. The sufficiency rating is a measure between 0 and 100 calculated by the Federal Highway Administration (FHWA), based on factors such as condition, materials, load capacity, and geometry (i.e., dimensions). FHWA uses the rating as a tool to prioritize the allocation of funds for bridge repairs. In general, bridges with a sufficiency rating of less than 50 are given priority. The sufficiency rating is used to identify deficiencies, which may include structural issues or functional issues. For example, older bridges may be narrow and not designed to the same width or height clearance of today’s standards. Therefore, a sufficiency rating does not necessarily indicate a structural issue as summarized below.

One bridge within The Dalles city limits and two within the Federal Aid Urban Boundary (outside of the city limits) have sufficiency ratings below 50.

- The Dalles City Limits
  - Structure 00464 - W 6th Street Bridge over Mill Creek (sufficiency rating 48.9). The bridge is open with posted weight restrictions. The bridge inspection report notes that there is "very heavy truck traffic on this bridge and there is a need for additional load posting signs outside of this bridge to limit heavy trucks at this location."
- Federal Aid Urban Boundary
  - Structure 00506 – US 30 (Hwy 100) Bridge over Chenoweth Creek (sufficiency rating 38.2).
  - Structure 06635Q – US 197 Bridge over the Columbia River (sufficiency rating 33.4).

Appendix C includes bridge ratings for 26 bridges within The Dalles from the ODOT Bridge Working Database, and 4 bridges within the Federal Aid Urban Boundary. All bridges, except those noted above, received acceptable ratings.

Rail Inventory

The Union Pacific Railroad (UP) provides freight service along the I-84 corridor, known as the east-west transcontinental route linking Oregon with the mid-west and beyond. Locally, the transcontinental route operates between Portland and Hinkle Rail Yard (near Hermiston, OR) along the southern bank of the Columbia River. Hinkle Rail Yard is a junction point, and the location of UP's primary carload classification yard in the Pacific Northwest. The route continues southeast from Hinkle to Granger, Wyoming and Ogden, Utah, connecting to UP's historic Central Corridor that links the San Francisco Bay Area of California with Salt Lake City, Utah; Omaha, Nebraska; and, Chicago, Illinois.

UP's network in Oregon is predominantly single track with passing sidings. Top inbound commodities include mixed freight handled in containers and trailers, recyclables/waste, fertilizers, soda ash and coal. Top outbound commodities were dominated by mixed freight handled in intermodal service, and lumber/building materials.

According to the *Oregon Rail Plan* (Reference 3), the Federal Railroad Administration (FRA) has established nine track classes, which set maximum speeds for freight and passenger trains, based on the track condition. UP track is maintained to FRA Class 1 conditions with no weight or dimensional restriction through The Dalles. In Oregon, Class 1 railroads have freight train speeds up to 60 mph and passenger speeds up to 79 mph. Within The Dalles, trains are restricted to 40 mph.

There are three at-grade crossings on major roads within the City, including: Webber Street, Union Street (See Exhibit 7), and Madison Street. At-grade crossings result in interaction between fixed-rail and other transportation system users. ODOT Rail regulates all public at-grade highway-railroad grade crossings in Oregon.

Exhibit 7. Existing At-Grade Rail Crossing of Union Street

All three crossings feature “Active Control” crossings that communicate the presence or approach of a train using measures such as flashing lights, bells, and/or a gate system. However, due to geometry and limited spacing between the railroad tracks and 1st Street, the City and ODOT have noted a few potential conflicts. At the rail crossing on Madison Street, ODOT rail has expressed concern that eastbound left-turn traffic from 1st Street do not have a physical crossing barrier in place. This is due to the fact that 1st Street parallels the railroad tracks and 1st Street intersects with Madison Street at the crossing. Additional warning or other device may be needed to enforce the crossing warning system.

At the Union Street rail crossing, southbound traffic turning left onto 1st Street may create a queue across the railroad tracks during peak periods of vehicular traffic. There may be opportunities to encourage queued vehicles to stop in advance of the railroad crossing through signage or other low-cost treatments.

Air, Water, and Pipeline Inventories

Air

The Dalles is served by the Columbia Gorge Regional Airport, also known as The Dalles Airport. Table 5 summarizes the Columbia Gorge Regional Airport as described by the AirNav Airport Information Website.

Table 5 Air Transportation Inventory

Name	Use	Runway Dimension	Surface	# of Based Aircraft	Federal Aviation Administration (FAA) ID
Columbia Gorge Regional Airport	Public	5,097’ x 100’	Asphalt	61	KDLS
		4,647’ x 100’	Asphalt		

The *Oregon Aviation Plan* (Reference 4, prepared by the ODOT Aeronautics Division) assigns all statewide public use airports to the following five categories:

- **Category 1: Commercial Service Airports** – Scheduled commercial service.

- **Category 2: Business or High Activity General Aviation Airports** – 30,000 or more annual operations (i.e., take-offs and landings), of which a minimum of 500 are business-related (turbine) aircraft. Business-use heliports are also included in this category.
- **Category 3 – Regional General Aviation Airports** – Generally less than 30,000 annual operations and geographically significant location with multiple communities in the service area.
- **Category 4: Community General Aviation Airports** – 2,500 or more annual operations, or more than ten based aircraft.
- **Category 5: Low Activity General Aviation Airports** – Less than 2,500 annual operations and no more than ten based aircraft.

The Columbia Gorge Regional Airport is a Category 3 airport with two active runways on the airfield. The primary Runway 13-31 is 5,097 feet long and 100 feet wide and the secondary Runway 7-25 is 4,647 feet long by 100 feet wide.

The airport served 45 operations per day on average, with 59-percent of the operations transient general aviation, 29-percent local general aviation, 11-percent air taxi, and 5-percent military. Of the 61 aircraft based on the field, 60 are single-engine airplanes and 1 is a helicopter.

Water

The Columbia River serves as the northern boundary of The Dalles and provides a valuable resource to the City and the surrounding area. The river provides recreational opportunities and economic development opportunities such as the four private cruise lines that port at The Dalles Marine Terminal near the intersection of W 1st Street and Union Street. Cruises run from March to November each year and result in many passengers connecting to the pedestrian facilities in The Dalles or transferring to buses to visit local tourist destinations.

The Port of The Dalles Marina is located on the Columbia River at River Mile Post 190. The Marina provides space for 62 boathouses and approximately 30 open moorage positions that are leased on a monthly, 6-month or annual basis. A boat launch is located adjacent to the Marina to accommodate boat haul outs with trailers.

Pipeline and Transmission System

Northwest Natural Gas operates a major natural gas distribution line serving The Dalles. This distribution line extends southward from the main transmission line, which runs along the Washington side of the Columbia River Gorge. Northwest Pipeline Corporation operates the main transmission line.

Environmental Justice

Environmental Justice (EJ) populations are a special focus in transportation planning and project development. Identifying EJ populations early on is intended to make participation in transportation planning and project development more inclusive of diverse communities. The analysis is also valuable in identifying the transportation needs that will provide the most benefits to EJ populations. Five population groups are considered for transportation impact susceptibility, representing those who may rely more heavily on public infrastructure or transit for access to day-to-day needs and jobs. They include minority groups, populations under 17 or over 64 years of age, low-income households, low-English proficiency households, and people with disabilities.

Demographic Summary

For EJ evaluation purposes, The Dalles has approximately 14,730 people living within City limits according to 2013 American Community Survey (ACS) 5-Year Estimates.[4] The highest concentration of people is located in census block groups close together near the downtown area, with the highest density being close to 13 people per acre (see Appendix D). Most of the population density outside of the central area of the City is relatively low, ranging between 2-3 people per acre, with a notable exception in the northwest area of the City of 4-5 people per acre. Population and population density are important considerations when evaluating and comparing EJ populations. For example, a census block group may have high percentage of a specific population, but there are relatively fewer people in the area altogether. Conversely, a census block group may have a large concentration of a specific population that may not be as prominently featured in EJ maps (provided in Appendix D) relative to the overall population in that area.

The make-up of specific EJ populations of The Dalles is shown in Exhibit 8.[5] Compared to the whole state of Oregon, The Dalles has a greater portion of people who are 65 or older (19%), 17 or younger (25%), or who are considered to be in poverty (43%). The Dalles has approximately 1% of low-English proficiency households, comparable to the State's figure of 3 percent.[6] The portion of population within The Dalles with disabilities is similar to State of Oregon (approximately 13% and 12% respectively). General location for EJ groups varies as shown in Figures provided in Appendix D.

[4] The US census is conducted once every 10 years to provide an official count of the entire U.S. population to Congress; the American Community Survey (ACS) is conducted every year to provide up-to-date information about the social and economic needs.
[5] EJ population analysis for The Dalles consists entirely of 2013 ACS 5-Year Estimates data. This is the most recent data available to perform analysis at the smallest possible geography (census block group).
[6] Care should be taken when evaluating available data for low-English households within The Dalles due to the small sample size and large margin of error. See the "Limited-English Proficiency" section in Appendix D for more details.

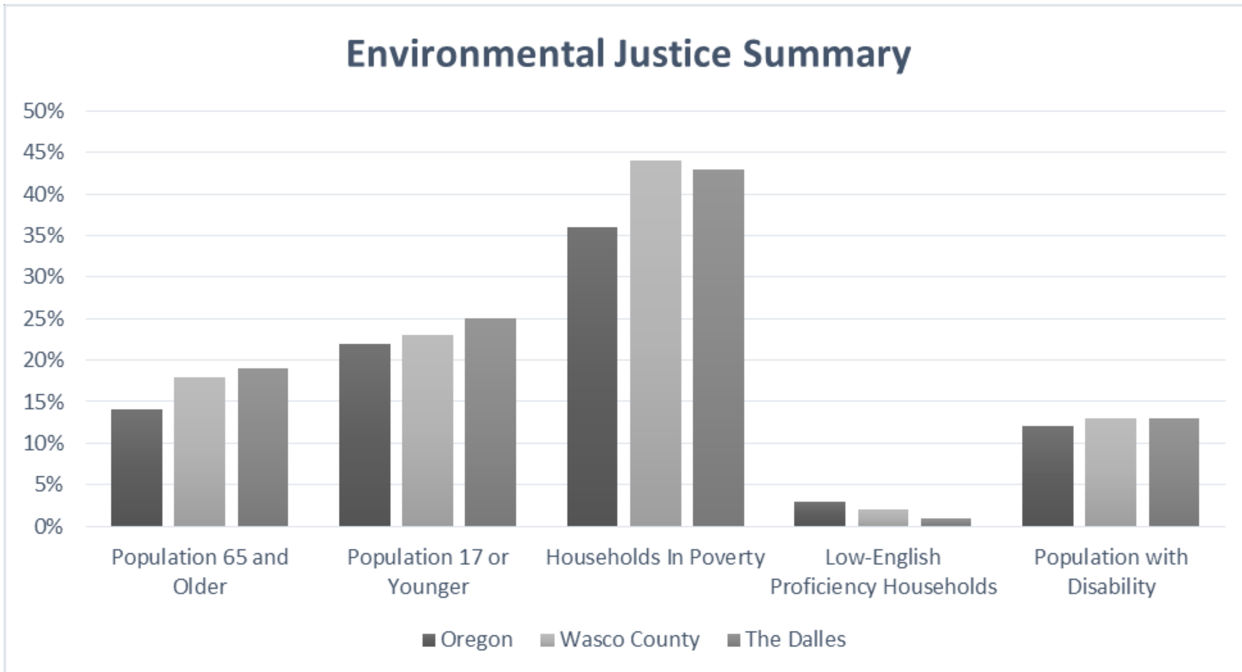


Exhibit 8. Environmental Justice Summary

Appendix D includes maps and statistics summarizing minority populations, low-income populations, persons 65 years and older, persons 17 years and younger, limited-English proficiency, and persons with disabilities within The Dalles relative to Wasco County and Oregon.

EXISTING TRANSPORTATION SYSTEM OPERATIONS ANALYSIS

The existing transportation system operations analysis identifies how the study area's transportation system currently operates based on year 2015 traffic volumes. This analysis includes an evaluation of traffic operations at the study intersections, including non-motorized (pedestrian and bicycle) operations.

Kittelson & Associates, Inc. (KAI) staff visited and inventoried the study area in October 2015. At that time, KAI collected information on existing transportation system conditions along key roadway corridors and at the study intersections.

Traffic Counts

Traffic counts were conducted at the study intersections in April and June 2015. Counts were conducted on typical mid-week days over various time periods (24-hour, 16-hour, or 3-hour). All counts include the total number of pedestrians, bicyclists, and motor vehicles that entered the respective intersections in 15-minute intervals during the evening (2:00 to 6:00 p.m.) peak time period. The traffic counts were reviewed to determine the system-wide peak hour for the operational analysis. The counts were also seasonally adjusted to reflect 30^{th} highest hour traffic volumes and balanced consistent with the methodology provided in the ODOT Analysis Procedures Manual (APM). Figure 13 summarizes the traffic counts at the study intersections during the weekday p.m. peak hour. *The traffic count worksheets are included in Appendix E.*

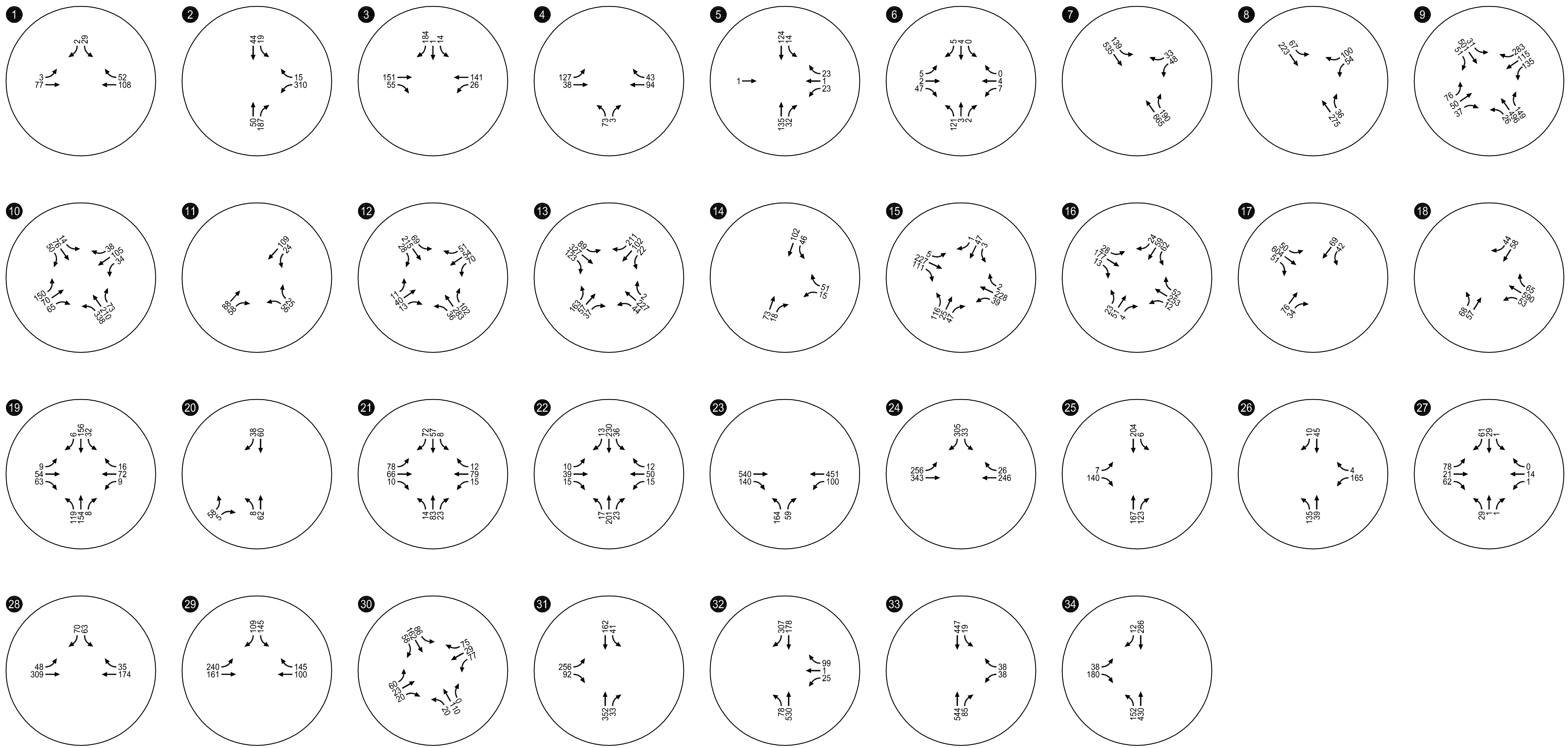
Analysis Methodology and Operational Standards

The intersection operations analysis was conducted using Synchro 8 software, which implements the methodologies outlined in the Highway Capacity Manual (HCM). Based on direction provided by TPAU, the HCM 2000 methodology was used to analyze traffic operations at the signalized intersections while the HCM 2010 methodology was used to analyze traffic operations at the unsignalized intersections.

The intersection operations analysis results were compared to City of The Dalles and ODOT performance standards to identify potential areas for improvement. Performance standards from each agency apply at intersections where the agency has jurisdiction over at least one approaching roadway. The City defines intersection performance based on Level of Service, which correlates with delay. ODOT performance targets are based on volume/capacity (v/c) ratios, a comparative measure of the volume of traffic entering an intersection to the theoretical intersection capacity. By way of example, a v/c ratio of 1.0 indicates that an intersection is operating at capacity while a v/c ratio over 1.0 indicates that the intersection's capacity is exceeded.

The City and ODOT performance thresholds are summarized below.

- The City's current TSP establishes a Level-of-Service D standard, which correlates to a maximum delay of 55 seconds/vehicle at signalized intersections and 35 seconds/vehicle on the minor street approach at unsignalized intersections.
- Table 6 of the *Oregon Highway Plan* (OHP) provides maximum v/c ratios for all signalized and unsignalized intersections located outside the Portland Metro area. The standards vary based on the classification of the roadway (Statewide Highway, Districts Highway, etc.), designation (Freight Route, Expressway, etc.), and posted speed. The intersections subject to ODOT v/c targets within the study area are located along I-84, US 197 and US 30.



- Study Intersections

Existing Traffic Volumes
Weekday PM Peak Hour
The Dalles, Oregon

Figure 13

Intersection Operations

The City of The Dalles intersection operation standards are LOS of D for signalized and unsignalized intersections. ODOT operation standards were found according to Table 6 of the Oregon Highway Plan. The traffic volumes shown in Figure 13 were used to analyze traffic operations at the study intersections. Figure 14 and Table 6 summarize the results of the traffic operations analysis at the study intersections for the weekday p.m. peak hour. Figure 14 illustrates study intersections with yellow circles that are nearing the applicable performance thresholds (within 0.05 of the V/C target or LOS D). All other intersections are shown by green circles, indicating they are operating well below the applicable performance thresholds. *HCM Existing Traffic Condition worksheets are included in Appendix F.* Key findings include:

- All study intersections currently operate acceptably according to their respective performance thresholds.
- The US 197/I-84 EB Ramp intersection currently satisfies applicable ODOT v/c targets during the weekday p.m. peak hour. The intersection has a v/c ratio of 0.79 and is approaching the 0.80 v/c target.
- Two other intersections, I-84 EB Ramps/W 6th Street and US 197/Lone Pine Lane operate at LOS D under existing conditions, which indicates that as volumes grow they will likely exceed the City's performance thresholds.

Intersection Queues

A queuing analysis was conducted at the five signalized study intersections using Synchro 8 software. Table 7 summarizes the 95th percentile queues for turning movements with exclusive lanes during the weekday p.m. peak hour, rounded to the nearest 25 feet (approximately 1 vehicle length). The available storage lengths reflect the striped storage for each movement at the intersections.

Existing Traffic Conditions Weekday PM Peak Hour The Dalles, Oregon

Figure 14

Oregon Department of Transportation

KITTELSON & ASSOCIATES, INC. TRANSPORTATION ENGINEERING/PLANNING

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

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Table 6: Existing Intersection Operations – Weekday PM Peak Hour

Map ID	Intersection	Level of Service (LOS)	Delay (Sec)	Volume/ Capacity (V/C)	Unsignalized Critical Movement	ODOT V/C Target	Meets Applicable Performance Thresholds?
1	Seven Mile Hill Rd/ Chenoweth Rd	B	10.1	0.05	SB	N/A	Yes
2	US 30/River Rd	B	12.7	0.43	WB	0.90	Yes
3	I-84 EB Ramps/River Rd	B	12.1	0.26	WBR/ SB	0.80	Yes
4	I-84 WB Ramps/River Rd	B	14.7	0.21	NB	0.80	Yes
5	W 10th St/Hostetler Rd	B	10.4	0.08	WB	N/A	Yes
6	W 2nd St/Hostetler Rd	B	11.6	0.02	WB	N/A	Yes
7	I-84 EB Ramps/W 6th St	D	25.2	0.33	WB	0.80	Yes
8	Webber St/W 10th St	C	16.0	0.15	WB	N/A	Yes
9	Webber St/W 6th St	C	21.8	0.66	Signalized	N/A	Yes
10	Webber St/W 2nd St	C	23.7	0.68	Signalized	N/A	Yes
11	Webber St/W 1st St	B	10.5	0.11	WB	N/A	Yes
12	Cherry Heights Rd/W 10th St	C	16.1	N/A	AWSC	N/A	Yes
13	Cherry Heights Rd/W 6th St	C	33.4	0.57	Signalized	N/A	Yes
14	Mt Hood St/Skyline Rd	B	10.5	0.06	NBR/ WB	N/A	Yes
15	Mt Hood St/Skyline Rd	C	18.0	N/A	AWSC	N/A	Yes
16	Union St/10th	B	10.7	N/A	AWSC	N/A	Yes
17	Union St/W 3rd St	C	37.5	0.40	Signalized	N/A	Yes
18	Union St/W 2nd St	B	13.0	0.36	Signalized	N/A	Yes
19	Kelly Ave/E 10th St	C	19.7	0.27	WB/NB	N/A	Yes
20	Dry Hollow Rd/3 Mile Rd	A	9.8	0.08	NE	N/A	Yes
21	Dry Hollow Rd/16th Pl/19th St	A	8.5	N/A	AWSC	N/A	Yes
22	Dry Hollow Rd/E 10th St	C	15.3	0.19	WB	N/A	Yes
23	Brewery Grade/US 30	C	20.0	0.80	EB	0.90	Yes
24	Brewery Overpass Rd/US 30	B	13.5	0.49	SB	0.90	Yes
25	Brewery Overpass Rd/ I-84 EB Ramps	B	10.9	0.22	EB	0.80	Yes
26	Brewery Overpass Rd/ I-84 WB Ramps	B	13.3	0.31	WB	0.80	Yes
27	Thompson St/E 10th St/ Old Dufur Rd	B	10.3	0.81	NB	N/A	Yes
28	E 2nd St/US 30	B	10.1	0.09	WBL	0.90	Yes
29	US 197/US 30	D	33.7	0.57	SBL	0.85	Yes
30	US 197/Fremont St/Columbia View Dr	C	19.2	0.43	EBL/ WBL	0.85	Yes
31	US 197/I-84 EB Ramps	E	36.0	0.79	EB	0.80	Yes
32	US 197/I-84 WB Ramps	B	12.1	0.21	WB	0.80	Yes
33	US 197/Bret Clodfelter Wy	C	15.3	0.19	WB	0.85	Yes
34	US 197/Lone Pine Ln	D	27.5	0.27	EB	0.85	Yes

AWSC = All-way stop control, N/A = Not applicable

Table 7: Existing Signalized 95th Percentile Queues – Weekday PM Peak Hour

Map ID	Intersection	Movement	Weekday PM Queue (feet)	Available Storage (feet)	Adequate?
9	Webber St/W 6th St	EBL	25	250	Yes
		EBT	350	705	Yes
		WBL	25	150	Yes
		WBT	300	> 500	Yes
		WBR	50	175	Yes
		NBT	125	495	Yes
		NBR	25	175	Yes
		SBT	225	585	Yes
		SBR	100	60	No
10	Webber St/W 2nd St	EBL	25	125	Yes
		EBT	125	430	Yes
		WBL	200	425	Yes
		WBT	150	635	Yes
		WBR	25	425	Yes
		NBT	225	585	Yes
		NBR	50	25	No
		SBT	150	810	Yes
13	Cherry Heights Rd/W 6th St	EBL	100	100	Yes
		EBT	350	> 500	Yes
		EBR	50	> 500	Yes
		WBL	50	965	Yes
		WBT	250	965	Yes
		WBR	0	75	Yes
		NBL	150	100	No
		NBT	100	360	Yes
		SBL	50	> 500	Yes
		SBT	325	> 500	Yes
17	Union St/W 3rd St	EBT	275	365	Yes
		NBT	100	> 500	Yes
		SBL	75	45	No
		SBT	50	205	Yes
18	Union St/W 2nd St	WBL	50	40	No
		WBT	150	390	Yes
		NBT	75	205	Yes
		SBT	50	385	Yes

As shown in Table 7, all of the signalized study intersections currently have one or more movements where the 95th percentile queues exceed the available storage for that movement. These intersections have the potential for queues to extend into the adjacent through lane and block traffic, with the exception of the southbound left-turn at the Union St/W 3rd St and westbound left-turn at the

Union St/ W 2nd St intersections which have queues that can be accommodated, but extend beyond the striped storage. The queues do not block the adjacent intersections. *The worksheets used to evaluate existing queuing at the signalized study intersections are included in Appendix G.*

Freeway Operations

Freeway operations analysis was conducted for the weekday p.m. peak hour at each merge and diverge location (on- and off-ramps) and each mainline segment of I-84 (no ramps). The analysis was based on HCM 2010 methodologies using HCS 2010 software. The analysis indicates that all segments of I-84 within The Dalles are operating at Level-of-Service A or B. The highest density of vehicles per mile per lane occurs in the eastbound direction at the 6^{th} Street on-ramp and the mainline segment after the on-ramp.

A summary table of results and *worksheets used to evaluate existing freeway operations are included in Appendix H.*

Traffic Safety

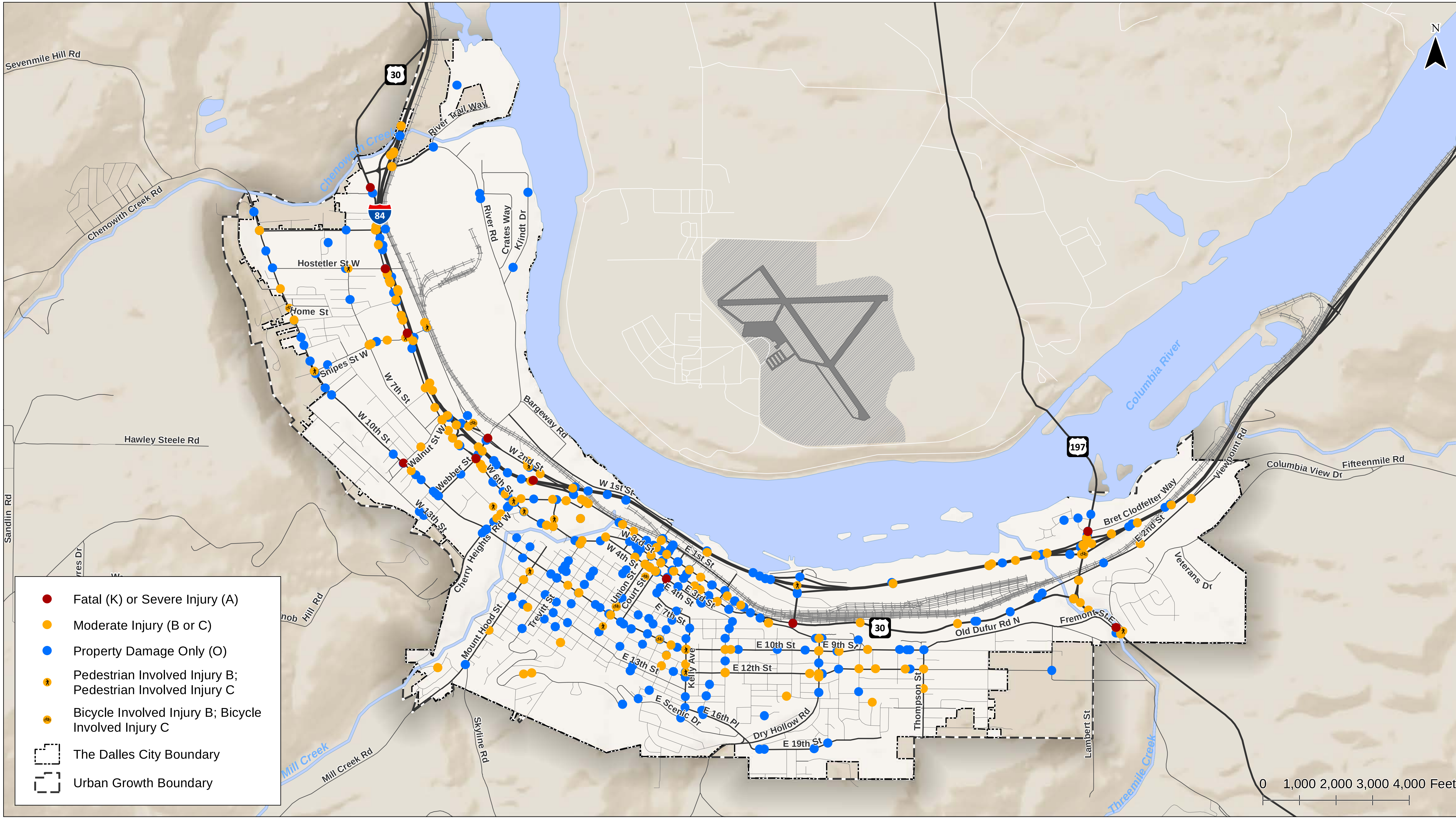
Reported crash data was analyzed at all study intersections in an effort to identify patterns and trends that may indicate an opportunity to reduce crash potential. The data was obtained from ODOT for the five-year period from January 1, 2010 through December 31, 2014. The data includes information about crash location, type, weather, roadway surface conditions, traffic control, and vehicle information. *A summary of the reported crashes by study intersection is provided in Appendix I.*

Figure 15 illustrates the location and severity of 709 reported crashes within the City over the five-year study period. The figure classifies crashes by severity and indicates whether a pedestrian or bicyclist was involved. Crash severity is defined using the KABCO injury-severity scale in the ODOT database. This scale was developed by the National Safety Council (NSC) and is frequently used by law enforcement for classifying injuries as:

- K – Fatal;
- A – Incapacitating injury;
- B – Non-incapacitating injury;
- C – Possible injury; and,
- O – No injury.

Current Federal legislation, Moving Ahead for Progress in the 21st Century Act (MAP-21), prioritizes funding for Fatal and Injury A crashes, shown in red, in Figure 15.

A fatal crash involving a train and a pedestrian was reported at the Union Street/1st Street intersection in 2015. Although outside of the study period, as defined above, this event will be reviewed to identify opportunities to reduce potential for similar events in the future.



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Reported Crash History
January 1, 2010 to December 31, 2014
The Dalles, Oregon

Figure
15

Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA, Oregon Department of Transportation

Crash Type and Severity

Analysis of crash patterns is focused at study intersections, where the highest density of crashes exists. Figure 16 illustrates the frequency of crashes by study intersection. Table 8 summarizes the location, type, severity, and number of crashes that were reported at the study intersections.

Table 8 shows there are more angle and turning crashes than rear-end crashes at multiple intersections. Statewide ODOT research has shown that on average less than 45-percent of multiple vehicle crashes at 4-leg stop-controlled intersections or signals involve angle or turning movements.

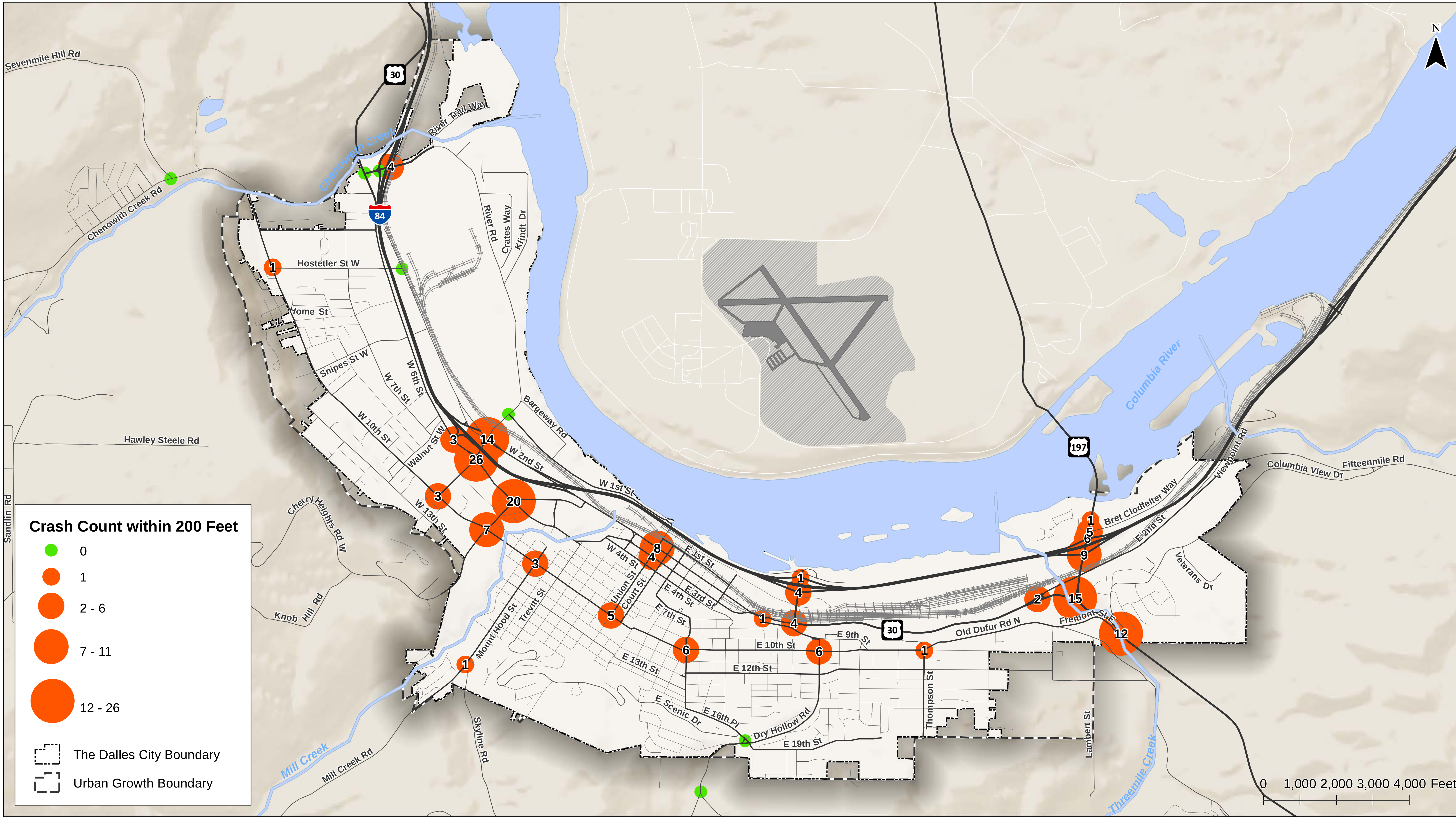
One signalized intersection and four stop-controlled intersections were identified as having over 50 percent of crashes from turning or angle collisions, including:

- #10 - Webber St/W 2nd St - A total of 14 crashes were reported at the intersection over the 5-year period, including 10 crashes caused by angle or turning movement. A majority of these crashes involve a northbound left-turn vehicle.
- #22 - Dry Hollow Road/E 10th Street - A total of 6 crashes were reported at the intersection over the 5-year period, all of them caused by angle or turning movement.
- #31 - US 197/I-84 EB Ramps - A total of 9 crashes were reported at the intersection over the 5-year period, including 6 caused by angle or turning movement. A majority of these crashes involve an eastbound left-turn from the I-84 ramp.
- #32 - US 197/I-84 WB Ramps - A total of 6 crashes were reported at this intersection over the study period, including 3 angle or turning movement collisions. In all three of the angle/turning crashes the driver was cited as not yielding right-of-way or driving recklessly.
- #33 - US 197/Bret Clodfelter Way - A total of 5 crashes were reported at this intersection over the study period, all of them including angle or turning movement collisions where the driver was cited as not yielding right-of-way.

Critical Crash Rate Comparisons

The critical crash rate method was used to identify study intersections that warrant further investigation and may represent opportunities to reduce crash frequency and severity. The Critical Crash Rate method is recommended by ODOT and is consistent with guidance in Part B of the Highway Safety Manual (HSM). The critical rate method establishes a threshold for comparison among intersections with similar numbers of approaches and similar traffic control.

Table 9 summarizes the study intersection crash rates calculated as the number of reported crashes relative to the amount of traffic at the intersection (measured per million entering vehicles). Other intersections were also studied, as requested by the Technical Advisory Committee. The critical crash rates are calculated based on the weighted average crash rate for all similar intersections in The Dalles. *Worksheets from the ODOT critical rate calculator used in this analysis are provided in Appendix J.*



Crash Frequency by Study Intersection
The Dalles, Oregon

Figure **16**

H:\projfile\18495 - The Dalles TSP\gis\16 Crash Frequency by Study Intersection.mxd - jsommerville - 9:08 AM 11/12/2015

Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA, Oregon Department of Transportation

Table 8: Reported Crashes by Study Intersection (1/1/2010 to 12/31/14)

Map ID	Intersection	Collision Type							Severity			Total
		Rear-End	Turning	Angle	Fixed-Object	Pedestrian/ Bicycle	Sideswipe-meeting	Other	Fatal & Severe Injury (K+A)	Moderate & Minor Injury (B+C)	PDO[1] (O)	
4	I-84 WB Ramps/River Rd	1	2		1				2	2		4
5	W 10th St/Hostetler Rd		1						1			1
7	I-84 EB Ramps/W 6th St		1					1	1	1		2
8	Webber St/W 10th St	1	2						3			3
9	Webber St/W 6th St	19	3	4					20	5	1	26
10	Webber St/W 2nd St	4	6	4					9	4	1	14
12	Cherry Heights Rd/W 10th St	1	1	2	1			2	7			7
13	Cherry Heights Rd/W 6th St	15	2		2	1			14	6		20
16	Union St/10th	2	1	2					4	1		5
17	Union St/W 3rd St		1	2	1				3	1		4
18	Union St/W 2nd St	1	2	2				3	7	1		8
19	Kelly Ave/E 10th St			4	1	1			2	4		6
22	Dry Hollow Rd/E 10th St		2	4					4	2		6
23	Brewery Grade/US 30	1					1		1	1		2
24	Brewery Overpass Rd/US 30	1	2	1					3		1	4
25	Brewery Overpass Rd/I-84 EB Ramps		1		2				3			3
26	Brewery Overpass Rd/I-84 WB Ramps			1					1			1
27	Thompson St/E 10th St/Old Dufur Rd				1				1			1
28	E 2nd St/US 30		1	1					2			2
29	US 197/US 30		14					1	11	4		15
30	US 197/Fremont St/Columbia View Dr		2	6	3	1			5	6	1	12
31	US 197/I-84 EB Ramps	3	3	2		1			2	7		9
32	US 197/I-84 WB Ramps	3	1	2					3	3		6
33	US 197/Bret Clodfelter Wy		3	2					4		1	5
34	US 197/Lone Pine Ln	1							1			1

[1] PDO = Property Damage Only

Table 9: Intersection Critical Crash Rate Comparison

Map ID	Intersection	AADT Entering Intersection	Total Crashes	Urban Intersection Population Type	Intersection Crash Rate*	Reference Population Crash Rate	Critical Rate	Exceeds Critical Rate?
4	I-84 WB Ramps/River Rd	3,780	4	4-leg Stop	0.58	0.41	0.88	No
5	W 10th St/Hostetler Rd	3,530	1	3-leg Stop	0.16	0.25	0.65	No
7	I-84 EB Ramps/W 6th St	16,100	2	3-leg Stop	0.07	0.25	0.42	No
8	Webber St/W 10th St	7,550	3	3-leg Stop	0.22	0.25	0.51	No
9	Webber St/W 6th St	19,500	26	4-leg Signal	0.73	0.57	0.79	No
10	Webber St/W 2nd St	12,230	14	4-leg Signal	0.63	0.57	0.85	No
12	Cherry Heights Rd/W 10th St	9,720	7	4-leg Stop	0.39	0.41	0.69	No
13	Cherry Heights Rd/W 6th St	19,420	20	4-leg Signal	0.56	0.57	0.79	No
16	Union St/10th	7,580	5	4-leg Stop	0.36	0.41	0.73	No
17	Union St/W 3rd St	9,260	4	4-leg Signal	0.24	0.57	0.90	No
18	Union St/W 2nd St	9,360	8	4-leg Signal	0.47	0.57	0.89	No
19	Kelly Ave/E 10th St	6,980	6	4-leg Stop	0.47	0.41	0.74	No
22	Dry Hollow Rd/E 10th St	6,610	6	4-leg Stop	0.50	0.41	0.75	No
24	Brewery Overpass Rd/US 30	6,470	4	4-leg Stop	0.34	0.41	0.76	No
25	Brewery Overpass Rd/I-84 EB Ramps	6,470	3	4-leg Stop	0.25	0.41	0.76	No
26	Brewery Overpass Rd/I-84 WB Ramps	3,430	1	4-leg Stop	0.16	0.41	0.91	No
27	Thompson St/E 10th St/Old Dufur Rd	3,260	1	4-leg Stop	0.17	0.41	0.92	No
28	E 2nd St/US 30	6,990	2	4-leg Stop	0.16	0.41	0.74	No
29	US 197/US 30	9,000	15	3-leg Stop	0.91	0.25	0.49	Yes
30	US 197/Fremont St/Columbia View Dr	7,200	12	4-leg Stop	0.91	0.41	0.74	Yes
31	US 197/I-84 EB Ramps	8,050	9	4-leg Stop	0.61	0.41	0.72	No
32	US 197/I-84 WB Ramps	12,180	6	4-leg Stop	0.27	0.41	0.65	No
33	US 197/Bret Clodfelter Wy	11,710	5	3-leg Stop	0.23	0.25	0.45	No
34	US 197/Lone Pine Ln	10,980	1	3-leg Stop	0.05	0.25	0.46	No

* Crash rates are reported as the number of crashes per million entering vehicles.

As shown in Table 9, two intersections exceed critical crash rates. One element that makes these two intersections unique compared to other study intersections in The Dalles is the speed of traffic on US 197 through these intersections. The following provides more detail on the reported crash history at these intersections:

- #29 - US 197/US 30 – A total of 15 crashes were reported at the intersection over the study period. Of the 15 crashes, 4 resulted in an injury B or C, and 11 resulted in PDO. 14 of the 15 reported crashes involved left-turns (primarily southbound left turns and eastbound left-turns). 11 crash reports involving a left-turn crash indicate that the driver did not yield right-of-away. Dedicated left-turn lanes are provided for the southbound and eastbound approaches at the intersection.
- #30 - US 197/Fremont St/Columbia View Drive - A total of 12 crashes were reported at the intersection over the study period. Of the 10 crashes, 1 resulted in an injury A, 6 resulted in an injury B or C, and 5 resulted in PDO. A majority of the crashes were reported as fixed object and turning movement crashes. Three fixed-object and four angle crashes resulted on snow or ice in October, November, and December; these were associated with one Injury A and four Injury C crashes. One crash involved a work zone collision with a worker.

90th Percentile Crash Rate Comparisons

A second method used to identify intersections with more crashes than should be expected is to compare the crash rate to the statewide 90th percentile rates for similar intersection types, as documented in Table 4-1 of the ODOT APM.

Three of the study intersections currently exceed the 90th percentile crash rates for similar intersections:

- #4 - I-84 EB Ramps/River Road – A total of 4 crashes were reported at the intersection over the 5-year period. Of the 4 crashes, 2 resulted in an injury B or C, and 2 resulted in property damage only. Two of the crashes were reported as turning movement, and crash reports indicate the driver didn't yield right-of-away.
- #19 - Kelly Avenue/E 10th Street - A total of 6 crashes were reported at the intersection over the 5-year period. Of the 6 crashes, 4 resulted in an injury B or C, and 2 resulted in property damage only. Four of the crashes were reported as angle and reported crash cause indicates "the driver passed the stop sign."
- #22 - Dry Hollow Road/E 10th Street - A total of 6 crashes were reported at the intersection over the 5-year period. Of the 6 crashes, 2 resulted in an injury B or C, and 4 resulted in property damage only. Four of the crashes resulted in angle collisions, and crash reports indicate the driver didn't yield right-of-away.

Opportunities to improve traffic operations and safety at these intersections, such as signing and striping, separate left- and right-turn lanes, signal timing and phasing, will be evaluated as part of the alternatives analysis and considered as part of the TSP.

Statewide Safety Priority Index System

The ODOT Statewide Priority Index System (SPIS) identifies sites along state highways where safety issues warrant further investigation. The SPIS is a method developed by ODOT for identifying hazardous locations on state highways through consideration of crash frequency, crash rate, and crash severity. There are no SPIS sites identified by ODOT within the top ten percent for 2014 (based on 2010-2013 crash data).

The ODOT All Roads Transportation Safety (ARTS) program has programmed three improvement projects within the City of The Dalles, including:

- 6th Street at Hostetler Way
  - Systemic Sign Upgrades
- US 197 (The Dalles-California Hwy) at the I-84 ramps, US 30, and Fremont Street
  - Systemic Sign Upgrades
- US 197 (The Dalles-California Hwy) at Bret Clodfelter Way
  - Illumination,
  - Systemic Sign Upgrades,
  - Provide a raised Median

These planned ARTS projects will be funded through the 2017-2019 Statewide Transportation Improvement Program (STIP). Additionally, minor signage and striping improvements may be implemented at the following intersections as part of the ARTS transition project:

- 6th Street at Webber Street
- 6th Street at Cherry Heights Road
- 2nd Street at Webber Street

Special Considerations

Based on discussions with City staff, the following issues were identified that may be contributing to crashes:

- Skewed intersection geometry at E 10th Street/Thompson Street
- Skewed intersection geometry and multiple points of conflict at E 2nd Street/US 30

These locations will be evaluated to identify alternatives that may reduce the skew angle and provide intersection traffic control that is consistent with driver expectations.

Bicycle Level of Traffic Stress

The ODOT APM provides a methodology for evaluating bicycle facilities within urban and rural environments that quantifies the perceived safety issue of being in close proximity to vehicles. This methodology, Bicycle Level of Traffic Stress (LTS), is based on the premise that as much as 60 percent of the population of a given City is “interested, but concerned” about cycling as a mode of transportation. The Bicycle LTS methodology seeks to identify road segments and routes that could be improved to remove the “concern” and encourage more bicycling as a mode of transportation.

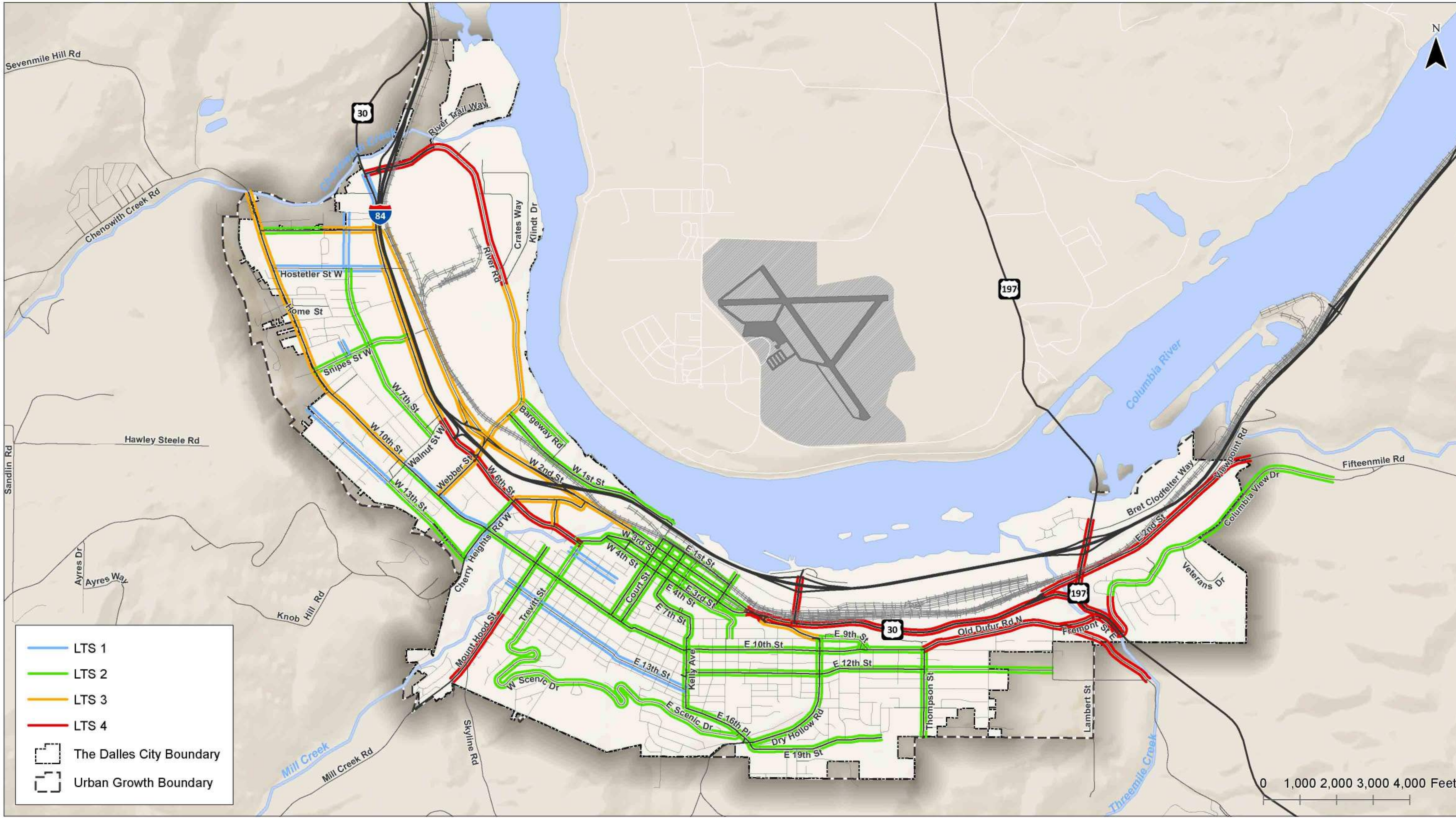
Existing Collector and Arterial streets were evaluated based on the Bicycle LTS methodology. As applied by ODOT, this methodology classifies four levels of traffic stress that a cyclist can experience on the roadway, ranging from LTS 1 (little traffic stress) to LTS 4 (high traffic stress). A road segment with a Bicycle LTS 1 rating generally has low traffic speeds and low volumes and is suitable for all cyclists, including children. A road segment with a Bicycle LTS 4 generally has high speeds, high volumes and is perceived as unsafe by most adults. Bicycle LTS 2 is considered appealing to a majority of the bike-riding population and therefore, is the desired target on most roadways.

Key characteristics that influence the bicycle LTS include:

- Number of lanes per direction
- Width of bike lane
- Separation between travel lane and bike lane (i.e., striped buffer zone or physical barrier such as on-street parking)
- On-street parking
- Posted or prevailing travel speed
- Intersection approach design of turn lanes
- Unsignalized intersection crossings

It is important to note the LTS of the whole segment is based on the worst LTS at any point along the segment because it is what will discourage ridership on the segment; therefore, LTS 3 or 4 segments may reflect the score of only a small portion of a given segment.

Figure 17 illustrates the results of the LTS analysis for The Dalles. Table 10 summarizes the segments with LTS 3 and 4 and provides a brief summary of the primary characteristics that informed the ratings.



Existing Bicycle Level of Traffic Stress
Arterial and Collector Streets
The Dalles, Oregon

Figure
17

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Oregon Department of Transportation | Kittelson & Associates, Inc. Transportation Engineering/Planning | APG

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

Table 10: Segments with Bicycle LTS 3 or 4 Rating

Roadway	LTS Rating	Segment Start-End	Posted Speed (mph)	Presence of Bike Lane
Brewery Overpass Road	4	I-84 WB Ramp to E 2nd Street/US 30	40	Yes
E 2nd Street	4	Brewery Overpass to 700 feet East	30	None
	4	Taylor Street to Brewery Overpass Road	40	None
US 30	4	700 feet East of Brewery Overpass to US 197	40	None
US 197	4	Lone Pine Drive to Fremont Street	45	None
River Road*	4	I-84 to Klindt Drive	40	Yes
	3	Klindt Drive to Bargeway Road	40	Yes
W 6th Street	3	Irvin St to Walnut Street	40	Yes
	4	Walnut Street to W 3rd Place/Trevitt Street	40	Yes
Mount Hood Street	4	Mill Creek Road to 16th Street	35	None**
Dry Hollow Road	4	E 16th Street to E 14th Street	35	Yes
Old Dufur Road	4	Thompson Street to Fremont Street	35	None
Fremont Street E	4	Old Dufur Road to US 197	35	None
W 2nd Street	3	Webber St to north end	30	None
Webber Street	3	Bargeway to 10th Street	30	>7 ft
Cherry Heights Road	3	US 30 to 6th Street	30	Yes
Mountain Hood	3	Entire Roadway	30	Yes
W 6th Street	3	Webber St to Lincoln Street	35	Yes
Brewery Grade	3	US 30 to 9th Street	30	None
Chenowith Loop Road	3	6th Street to 7th Street	25	<5 ft

* The Riverfront Trail could serve as a parallel route
** Pavement width exists, but no bike lane striping is provided

The majority of segments with LTS 3 or 4 have a paved shoulder; however, according to the Bicycle LTS methodology, the bike lane widths are too narrow relative to the posted speeds. The Bicycle LTS methodology indicates that for these segments to be rated LTS 2 or 3 one of the following must occur:

- Provide a 7-foot wide buffered bike lane to give bicyclists a buffer distance between the bike lane and adjacent travel lane,
- Reduce the posted speed limits to 30 miles per hour (mph) or less,
- Provide a paved bike lane where one does not exist today, and/or
- Improve intersection approach design of turn lanes to reduce difficulty for a bicyclist to traverse the intersection without having to change multiple lanes on the approach.

Enhanced facilities, such as separated multi-use paths, may also be considered in some areas where traffic volumes and/or travel speeds are high. *Bicycle LTS analysis worksheets are included in Appendix K.*

Opportunities to improve the bicycle environment along the segments with an LTS 3 or 4, such as providing a buffered bike lane along roadways with posted speeds of 35 mph or higher, will be evaluated as part of the alternatives analysis and considered as part of the TSP update.

SUMMARY OF FINDINGS AND NEXT STEPS

The information provided in this memorandum summarizes the existing transportation facilities provided in The Dalles in terms of characteristics, connections, and function. Based on the information summarized above, we have identified the following opportunities that are expected to help The Dalles progress toward their transportation goals (outlined in Technical Memorandum #2).

Lands and Population Inventory

- Vacant land is available within the Port of The Dalles and the Columbia Gorge Industrial Park.
- Natural resources (floodplains and wetlands) and geologic hazards will influence where growth can occur.
- The Dalles experienced 34.2 percent growth from 1980 to 2015. Historic population growth will inform future population forecasts, which will be integrated with projected employment to estimate future traffic volume.

Street Network Inventory

- *Roadway Ownership:* ODOT, Wasco County, and The City of The Dalles own and maintain the roadways within the study area. The state-owned roadways are intended to serve regional, statewide, and interstate trips. The local roadways should provide off-highway connections for local trips (home-to-work, work-to-retail, retail-to-home, etc.)
- *Roadway Ownership:* All Wasco County roads within The Dalles City Limits are expected to be transferred to The City of The Dalles in 2016, increasing the number of miles of roadway maintained by the City.
- *Freight Routes:* I-84 and US 197 are the primary freight routes through The Dalles. US 197 restricts certain oversize and overweight loads. US 30 has high restrictions for freight and should not be considered for use as a detour route for any trucks.
- *On-street Parking:* The City has on-street parking in the downtown and on many residential streets. Downtown, the City has experimented with parklets, expanding the sidewalk into one or more on-street parking spaces to create people-oriented places.
- *Pavement:* Based on the most recent survey data, many miles of roadway in The Dalles are in need of pavement rehabilitation. City and ODOT maintenance schedules will be reviewed and new pavement preservation projects will be included in the alternatives analysis element of the TSP.
- *Pavement*: Several miles of pavement on I-84 were identified in "poor" condition in the 2014 inventory. In 2015, ODOT repaved 3.8 miles of Interstate 84 from MP 84.3 (near the Union Pacific railroad overcrossing) to MP 88.1 (Fifteenmile Creek Bridge), to improve a section of pavement. The 2015-2018 Statewide Transportation Improvement Program

(STIP) includes a project scheduled for 2016 to provide pavement overlay and median barrier replacement from MP 70.46 to 84.31.

- *Pedestrian Facilities*: Generally, sidewalks are provided on both sides of streets throughout The Dalles Historic Downtown and the residential areas south of downtown. Areas to the northwest of Webber Street (south of I-84) and areas east of Thompson Street are in greatest need of pedestrian facilities.
- *Pedestrian Facilities*: Given it is one of a few east-west arterials in The Dalles, pedestrian improvements to 10th Street may be prioritized to provide an east-west pedestrian route.
- *Bicycle Facilities*: Bicycle facilities in The Dalles include neighborhood streets where bicycles and vehicles can share the road, arterials and collectors with five-foot bicycle lanes, and paved shoulders near the edges of the UGB.
- *Shared-Use Paths*: The majority of The Dalles Riverfront Trail is completed, but a workgroup is tasked with identifying options to complete two short missing segments. Additional shared-use paths along Chenowith Creek and Mill Creek, were identified in the 2006 TSP, but have not been completed.
- *Transit*: A new transit center is currently under construction on West 7th Street, near Chenoweth Loop Road. The transit center is expected to be complete in 2016, with park-and-ride space and bus service provided by Columbia Area Transit, MCCOG's Link, and possibly Greyhound.
- *Bridges:* W 6th Street Bridge over Mill Creek is open with weight restrictions. The bridge inspection report notes that there is "very heavy truck traffic on this bridge and there is a need for additional load posting signs outside of this bridge to limit heavy trucks at this location."
- *Bridges*: The US 30 (Hwy 100) Bridge over Chenowith Creek and the US 197 Bridge over the Columbia River have sufficiency ratings below 50, indicating a functional or structural issue.
- Rail: Concerns associated with specific vehicular movements have been identified at two rail crossings (Union Street and Madison Street). Options to improve the crossings as a proactive means to avoid conflicts will be considered.
- *Environmental Justice*: Compared to the whole state of Oregon, The Dalles has a greater portion of people who are 65 or older (19%), 17 or younger (25%), or who are considered to be in poverty (43%).
- *Environmental Justice:* The TSP will be take into account the areas in The Dalles with the highest proportion of minority groups, populations under 17 or over 64 years of age, low-income households, low-English proficiency households, and people with disabilities. The public involvement efforts will attempt to obtain input from these populations and alternatives developed as part of the TSP will attempt to minimize adverse impacts and maximize positive impacts to these populations.

Existing Transportation System Operations

- *Intersection Operations*: All of the study intersections currently operate acceptably, satisfying applicable performance thresholds.
- *Intersection Operations:* The US 197/I-84 EB Ramp intersection currently operates at a LOS "E", but satisfies applicable ODOT v/c targets during the weekday p.m. peak hour. The intersection has a v/c ratio of 0.79 and is approaching the 0.80 v/c target during the weekday PM peak hour.
- *Intersection Operations:* While it does not exceed that City's LOS standard, the northbound approach at the Thompson Street/E 10th Street/Old Dufur Rd intersection has a volume-to-capacity ratio of 0.81. This represents a condition where the northbound approach delay is likely to vary significantly and may exceed LOS D delay thresholds during portions of a typical day.
- *Intersection Operations:* Two other intersections, I-84 EB Ramps/W 6th Street and US 197/Lone Pine Lane operate at LOS D under existing conditions, indicating that as volumes grow they will likely exceed the City's performance thresholds.
- *Intersection Operations*: One or more movements at all of the signalized study intersections have potential for queues to extend into the adjacent through lane and block traffic. Improvements to address the queue storage will take into account future forecast volumes and other intersection operational improvements.
- *Safety*: Several intersections have a greater proportion of angle and left-turn crashes than rear-end crashes, which can indicate an opportunity to reduce injury or fatal crashes by implementing engineering countermeasures. Countermeasures could include improving sight distance, modifying traffic control, or restricting turn movements.
- *Safety*: The crash rates at two intersections (US 197/US 30 and US 197/Fremont St/ Columbia View Drive) exceed critical crash rate thresholds. Crash patterns at these intersections have been evaluated and additional evaluation will be conducted to identify potential countermeasures. Both intersections are unsignalized and, have high-speed approaches (relative to other intersections in The Dalles).
- *Safety*: Three study intersections exceed the statewide 90th percentile crash rates for similar types of intersections. Countermeasures will be evaluated as part of the alternatives analysis element of the TSP.
- *Safety*: ODOT has programmed systemic safety improvement projects within the 2017-2019 STIP at:
  - 6th Street/Hostetler Way and
  - US 197 at Bret Clodfelter Way, I-84 ramps, US 30, and Fremont Street.

- *Safety*: The following locations have unique geometry and/or traffic control that may be contributing to crashes:
  - Skewed intersection geometry at E 10th Street/Thompson Street
  - Skewed intersection geometry and multiple points of conflict at E 2nd Street/US 30
  - E 16th Place and Dry Hollow Road

NEXT STEPS

Alternatives to address the existing conditions transportation needs identified in this memorandum will be documented in Technical Memorandum #5. The project Advisory Committees will have an opportunity to review the alternatives memorandum in January and February 2016.

APPENDICES

Appendix A **Methodology Memo**

Appendix B **Inventory of City Roadways**

Appendix C **ODOT Bridge Inventory**

Appendix D **Environmental Justice Maps and Tables**

Appendix E **Traffic Counts**

Appendix F **Existing Traffic Conditions Worksheets**

Appendix G **Queuing Worksheets**

Appendix H **Freeway Operations Summary and Worksheets**

Appendix I **Reported Crashes by Study Intersection**

Appendix J **ODOT Critical Crash Rate Calculator Worksheets**

Appendix K **Bicycle Level of Traffic Stress Worksheets**

Appendix A Methodology Memo

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City of The Dalles TSP Update

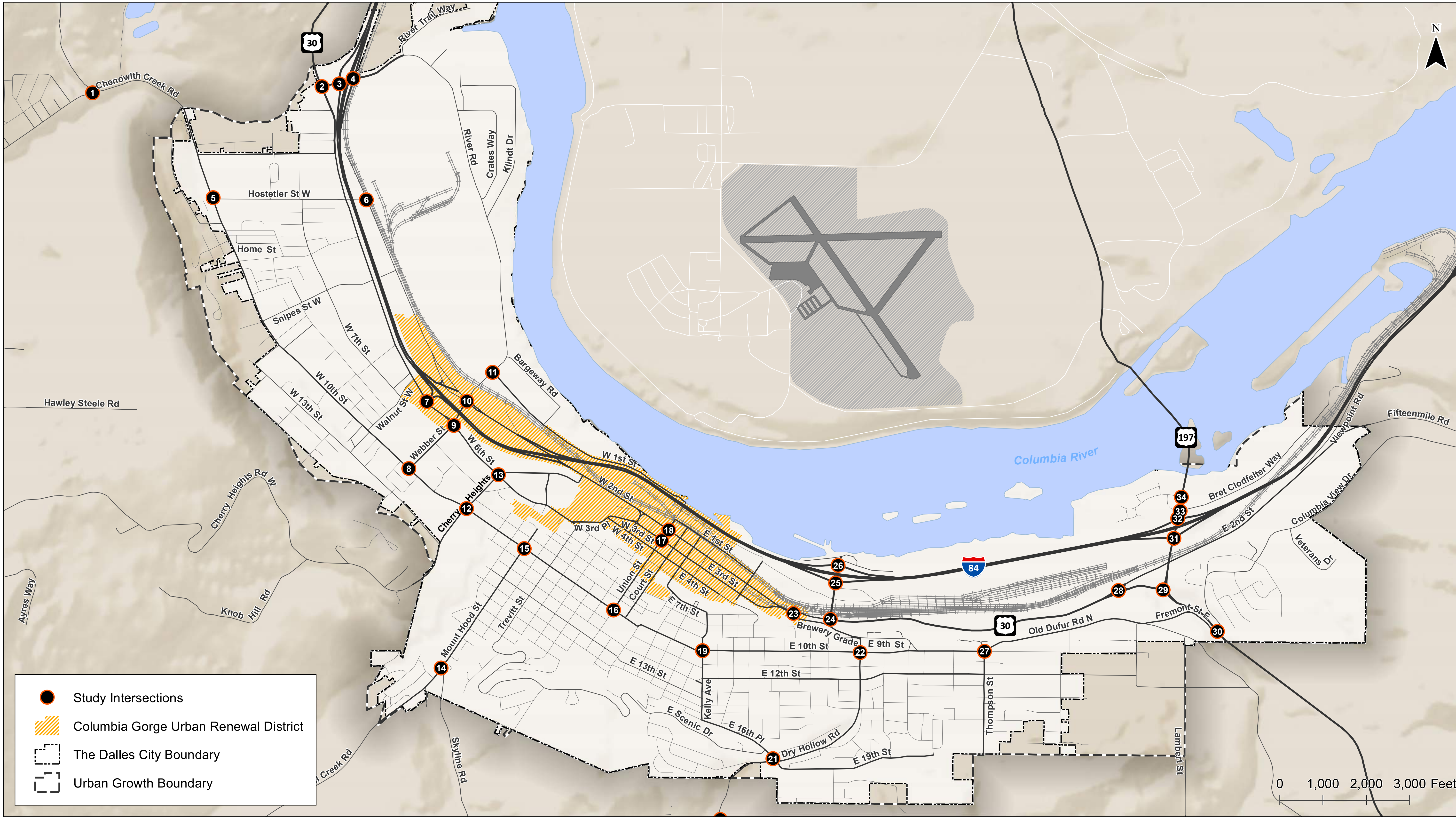
Methodology Memorandum

Date:	October 3, 2015	Project #: 18495
To:	Jim Bryant, ODOT Region 4	
From:	Casey Bergh, PE and Chris Brehmer, PE	
cc:	Peter Schuytema, TPAU; Ryan McKinnis, TPAU Dale McCabe, City of The Dalles	

This memorandum documents the methodology and key assumptions to be used in preparation of the existing and future conditions analyses for The Dalles Transportation System Plan (TSP) Update. The methodologies included in this memorandum are based on guidance provided in the Oregon Department of Transportation (ODOT) *Transportation System Plan Guidelines (2008)* and the *Analysis Procedures Manual* (APM), Versions 1 and 2 as they relate to The Dalles.

STUDY INTERSECTIONS

The traffic count locations for this project are outlined in Task 3.1 of the project Work Order Contract. The majority of the intersection turning movement traffic counts used for this study were conducted by ODOT in April and June 2015. The locations for these intersection counts were agreed upon by ODOT, the City of The Dalles, and the consultant team during the development of the project scope. The counts will be used to provide pedestrian volumes, bicycle volumes, truck volumes, passenger car volumes, and various calculation factors. Figure 1 shows the location of the study intersections and the corresponding Table 1 summarizes the intersection names and count duration (16-hour or 4-hour) at each location.



H:\projfile\18495 - The Dalles TSP\gis\01 Study Area and Intersections.mxd - jsommerville - 5:01 PM 10/22/2015

Study Area and Intersections
The Dalles, Oregon

Figure
1

Oregon Department of Transportation

Kittelson & Associates, Inc.
Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

Table 1. Study Intersections (Location of 16-Hour Intersection Classification Count)

ID Number	East-West Name	North-South Name	Count Duration
1	Seven Mile Hill Rd	Chenoweth Rd	4-hour
2	US 30	River Rd	16-hour
3	I-84 EB Ramps	River Rd	16-hour
4	I-84 WB Ramps	River Rd	16-hour
5	W 10th St	Hostetler Wy	4-hour
6	W 2nd St	Hostetler Wy	4-hour
7	I-84 EB Ramps	W 6th St	16-hour
8	Webber Rd	W 10th St	4-hour
9	Webber Rd	W 6th St	4-hour
10	Webber Rd	W 2nd St	4-hour
11	Webber Rd	W 1st St	4-hour
12	Cherry Hts Rd	W 10th St	4-hour
13	Cherry Hts Rd	W 6th St	4-hour
14	Mt Hood St	Skyline Rd	4-hour
15	Mt Hood St	W 10th St	4-hour
16	Union St	10th	4-hour
17	Union St	W 3rd St	4-hour
18	Union St	W 2nd St	4-hour
19	Kelly Ave	E 10th St	4-hour
20	Dry Hollow Rd	3 Mile Rd	4-hour
21	Dry Hollow Rd	E 16th Pl/19th St	4-hour
22	Dry Hollow Rd	E 10th St	4-hour
24	Brewery Overpass Rd	US 30	16-hour
25	Brewery Overpass Rd	I-84 EB Ramps	16-hour
26	Brewery Overpass Rd	I-84 WB Ramps	16-hour
27	Thompson St	E 10th St/Old Dufur Rd	4-hour
28	E 2nd St	US 30	4-hour
29	US 197	US 30	16-hour
30	US 197	Fremont St/Columbia Vw Dr	4-hour
31	US 197	I-84 EB Ramps	16-hour
32	US 197	I-84 WB Ramps	16-hour
33	US 197	Bret Clodfelter Wy	4-hour
34	US 197	Lone Pine Ln	4-hour

SYSTEM PEAK HOUR DEVELOPMENT

Per Section 5.3 of the APM, Version 2, the evening peak hour counts were reviewed to identify system peak hour trends. The combined total entering vehicle count at all study intersections was calculated at 15-minute increments. Exhibit 1 provides an hourly volume profile at 15-minute increments beginning at 2:00 PM.

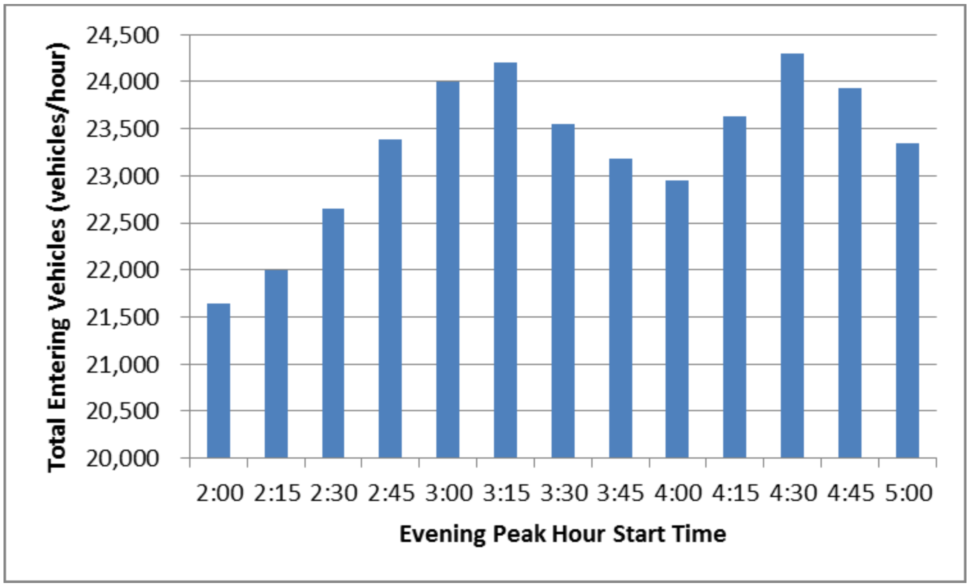


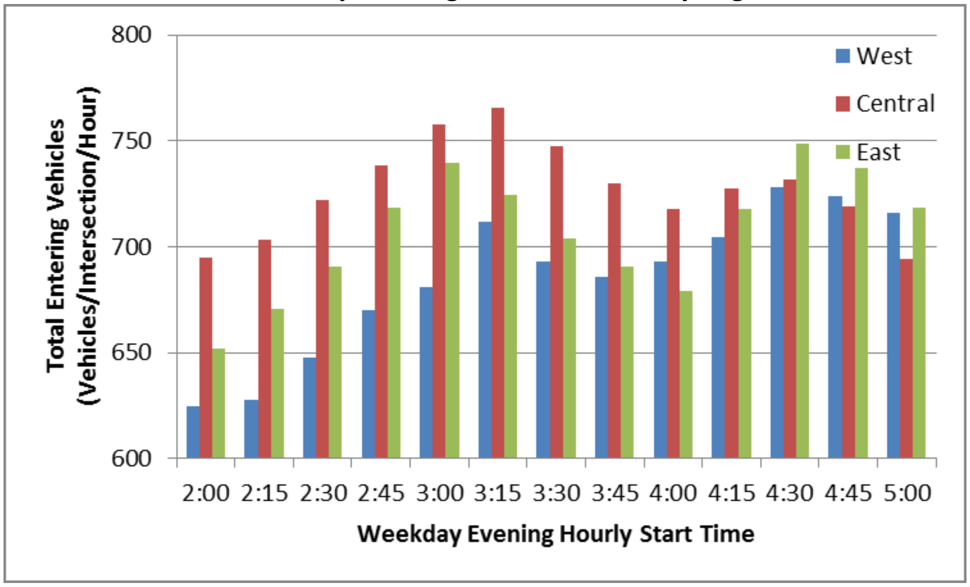
Exhibit 1: Combined Study Intersection Total Hourly Entering Vehicles

Given the presence of two distinct peaks within the afternoon/evening period, we evaluated whether regional, traffic control, or functional classification may be influencing peaking characteristics. The primary factor identified is that intersection volumes on the east and west ends of the City are peaking later than those within the central city. The time-of-day temporal differences in peaking by geographic area in part reflect land use patterns across the City (urban downtown vs. residential/school areas vs. various employment areas with industrial shift traffic vs. traditional office hours, etc.) Based on the trends observed, we recommend the use of three distinct system peak hour analysis periods for assessing intersection operations within the City, as summarized in Table 2. Exhibit 2 illustrates hourly volume trends by region within the City.

Table 2. Recommended System Peak Hours by Region

Region	Peak Hour	Study Intersections Included
West	4:30 to 5:30 PM	#1-9
Central	3:15-4:15 PM	#10-21
East	4:30 to 5:30 PM	#22-34

Exhibit 2: Cumulative Hourly Entering Vehicle Volume by Region



INTERSECTION OPERATIONAL STANDARDS

Per the project scope, we will evaluate and present the following performance measures for the study intersections:

- Turning movement counts;
- Volume-to-capacity (V/C) ratio;
- Level-of-service (LOS);
- Delay; and,
- 95th Percentile queuing (not-simulation based).

Individual study intersection performance will be documented in tables, figures, and/or technical appendices using the measures of effectiveness listed above. Where possible this information will be provided in figures to illustrate the analysis results in a format that is easy-to-understand and relate to the community. Study intersection performance will then be compared to applicable minimum City and ODOT operating standards/performance thresholds.

ODOT Facilities

For reference, Table 3 and 4 summarize the classifications and applicable performance thresholds for study intersections that fall within ODOT's jurisdiction.

Table 3. State Highway Classifications

Route Name (Hwy #)	Posted Speed (MPH)	Highway Classification	NHS	Freight/ Truck Route	Special Designations
I-84, Columbia River Hwy (2)	65	Interstate	Yes	Yes	None
US 197, The Dalles-California Hwy (4)	45	Regional	No	Yes[1]	None
US 30, Historic Columbia River Hwy (100)	40	District	No	No	Scenic Byway
US 30, Mosier-The Dalles Hwy (292)	40	District	No	No	None

NHS = National Highway System
[1] From I-84 to Columbia River

ODOT assesses intersection operations based on V/C ratio. Table 6 of the *Oregon Highway Plan* (OHP) provides V/C ratio targets statewide. The OHP ratios are used to evaluate existing and future no-build conditions, while Table 10-1 of the ODOT *2012 Highway Design Manual* (HDM) provides V/C ratios used to assist in identifying future system deficiencies and evaluating future alternatives on state highways. Table 4 synthesizes the respective ODOT performance requirements into a summary of those applicable to the study intersections.

Table 4. Summary of ODOT Intersection Performance Standards

ID Number	Street 1	Street 2	Traffic Control1	OHP Volume-to-Capacity Ratio Targets	HDM 20-year Design Mobility Standards
2	US 30	River Rd	TWSC	0.90	0.80
3	I-84 EB Ramps	River Rd	TWSC	0.80	0.70
4	I-84 WB Ramps	River Rd	TWSC	0.80	0.70
7	I-84 EB Ramps	W 6th St	TWSC	0.80	0.70
24	Brewery Overpass Rd	US 30	TWSC	0.90	0.80
25	Brewery Overpass Rd	I-84 EB Ramps	TWSC	0.80	0.70
26	Brewery Overpass Rd	I-84 WB Ramps	TWSC	0.80	0.70
28	E 2nd St	US 30	TWSC	0.90	0.80
29	US 197	US 30	TWSC	0.85	0.75
30	US 197	Fremont St/ Columbia Vw Dr	TWSC	0.85	0.75
31	US 197	I-84 EB Ramps	TWSC	0.80	0.70
32	US 197	I-84 WB Ramps	TWSC	0.80	0.70
33	US 197	Bret Clodfelter Wy	TWSC	0.85	0.75
34	US 197	Lone Pine Ln	TWSC	0.85	0.75

[1]TWSC: Two-way stop-controlled (unsignalized)

SEASONAL ADJUSTMENT FACTOR

30th highest hour design volumes will be based on applicable adjustment factors. Version 2 of the APM identifies three methods for identifying seasonal adjustment factors for highway traffic volumes.

All three methods utilize information provided by Automatic Traffic Recorders (ATR) situated in select locations throughout the State Highway System that collect traffic data 24-hours a day/365 days a year. There are two permanent ATR stations near The Dalles, but no ATRs are within The Dalles UGB.

- ATR 33-001: I-84, 0.72 mile west of the Rowena Interchange
- ATR 33-005: US 197, 0.84 mile south of Boyd Market Road

Based on the locations of ATR stations near The Dalles, a combination of all three seasonal adjustment methods outlined in the APM will be applied in developing adjusted study intersection volumes for the TSP update, including:

- US 197 – On-Site ATR Method
- I-84 Ramps – ATR Characteristic Table Method
- US 30 – Seasonal Trend Method

On-Site ATR Method

The On-Site ATR Method requires that the ATR be located within or near the project area. If the ATR is located outside the project area, there should be no major intersections between the ATR and the project area and the Average Annual Daily Traffic (AADT) collected by the ATR must be within 10 percent of the AADT near the project area. *Information on AADT for highway segments throughout Oregon can be found in ODOT's Transportation Volume Tables.*

While not located within The Dalles UGB, ATR 33-005 meets all of the requirements for the On-Site ATR Method for developing seasonal adjustment factors for US 197 approaches to study intersections. No major intersections exist between the ATR location and the study intersections in The Dalles.

Table 5. Seasonal Adjustment Factors for US 197 Approaches

Year	2009	2010	2011	2012	2013
Peak Month (August)	124%	123%	130%	129%	119%
Count Month (June)	111%	110%	108%	107%	109%

Note: Shaded values dropped from average calculation per ODOT methodology.

Based on the data in Table 5, average monthly factors were determined as follows:

- Peak month average: (124% + 123% + 129%) / 3 = 125.3%
- Count month average: (110% + 108% + 109%) / 3 = 109%
- Seasonal adjustment factors: 125.3 / 109 = 1.15

ATR Characteristic Table Method

The Characteristic Table Method requires that the ATR be located on a facility that shares similar characteristics with the facility to be adjusted, such as seasonal traffic trends, area type, and number of lanes. The Characteristic Table Method also requires that the AADT collected by the ATR must be within 10 percent of the AADT near the project area. AADT on I-84 in The Dalles ranges from 18,000 to 22,000 vehicles per day based on I-84 mainline volumes documented in ODOT Interchange Diagrams.

Two ATRs were selected from ODOT's ATR Characteristic Table for developing seasonal adjustment factors for I-84 ramps. ATR #17-001 is located along I-5, 2.08 miles south of the Monument Drive Interchange. At this location, I-5 is classified as an Interstate Highway in a Small Urban Fringe and the weekly traffic trend reflects weekday traffic. ATR #09-025 is located on US 97 within the City of Bend, but is not on an interstate. Therefore, only ATR 17-001 was used to develop a seasonal adjustment factor for the I-84 ramps.

Table 6 summarizes the average weekday traffic percent of average daily traffic (ADT) for the past five years.

Table 6. Seasonal Adjustment Factors for I-84 Ramp Approaches

Year	2009	2010	2011	2012	2013
Peak Month (July)	120%	122%	118%	117%	121%
Count Month (June)	109%	113%	112%	113%	112%

Note: Shaded values dropped from average calculation per ODOT methodology.

Based on the data in Table 6, average monthly factors were determined as follows:

- Peak month average: (120% + 118% + 121%) / 3 = 120%
- Count month average: (112% + 113% + 112%) / 3 = 112%
- Seasonal adjustment factors: 120 / 112 = 1.07

Seasonal Trend Method

The Seasonal Trend Method uses average values from the ODOT ATR Characteristic Table for each seasonal traffic trend. For US 30 approaches in The Dalles, "Summer < 2,500" seasonal traffic trend values were used to derive seasonal adjustment factors. Table 7 summarizes the average values for seasonal traffic trends during the count months (April and June) and the peak period as provided in the ODOT Seasonal Trend Table.

Table 7. Seasonal Adjustment Factors for US 30

Trend	1-Apr	15-Apr	1-Jun	15-Jun	ODOT Peak Period Seasonal Factor
Summer < 2,500	1.0362	0.9932	0.8936	0.8650	0.8089
Average	1.0147		0.8793		

Based on the data in Table 7, the traffic counts at all other study intersections were adjusted by the following factors, by count month:

- April: (1.015/0.809) = 1.25
- June: (0.879/0.809) = 1.09

ANALYSIS MODEL PARAMETERS

The bullets below identify the proposed sources of data and methodologies to be used to analyze traffic conditions in The Dalles. Analyses of all state facilities will be conducted according to the most-recent version of the APM, unless otherwise agreed upon by both ODOT's Transportation Planning and Analysis Unit (TPAU) and the consultant team.

1. *Intersection/Roadway Geometry* (lane numbers and arrangements, cross-section elements, signal phasing, etc.) will be verified for consistency with previous work efforts, reviewed through aerial photography, and confirmed through a site visit. Available as-built data may also be used to verify existing roadway geometry. The analysis models will be built on scaled roadway line work from GIS or aerial photography. ODOT's two-way stop-controlled intersection calculator tool will be used to calculate expected queue lengths for two-way stop-controlled intersections.

2. *Operational Data* (such as posted speeds, intersection control, parking, right-turn on red, etc.) will be field verified. Data will be reviewed during a site visit and supplemented by available GIS data, aerials, photos, and the ODOT Video Log.

3. *Peak Hour Factors* (PHF) will be calculated for each intersection and applied to the existing conditions analyses. PHFs of 0.95 will be used for the future analysis for high-order facilities (arterials), with 0.90 applied to medium-order facilities (collectors) and 0.85 applied to local roads. If the existing PHF is greater than these default future values, the existing PHF will be applied.

TRAFFIC ANALYSIS SOFTWARE AND INPUT ASSUMPTIONS

Synchro 9 software will be used for the intersection analysis. *Highway Capacity Manual* (HCM) 2000 models will be applied for signalized analysis and HCM 2010 models will be applied for unsignalized (stop-controlled) analysis per ODOT requirements. The existing roundabout and any future roundabouts will be analyzed using HCM 2010 models in Excel or Sidra.

Signal timing parameters for the signalized intersections will be obtained from ODOT Region 4 and are reflected in the Synchro model.

The reported results will include level of service, intersection delay, v/c ratios, and 95th percentile queue lengths generated by the HCM report. Analysis assumptions are listed in Table 8.

Table 8. Operations Parameters/Assumptions

Arterial Intersection Parameters	Existing Conditions
Peak Hour Factor	By region and intersection from traffic counts
Conflicting Bikes and Pedestrian per Hour	From traffic counts, as available
Ideal Saturation Flow Rate (for all movements)	1,750 passenger cars per hour green per lane
Lane Width	12 feet unless field observations determine otherwise
Percent Heavy Vehicles	From traffic counts by movement, as available
Bus Blockages	None
95th percentile vehicle queues	Synchro HCM summary output

CRASH ANALYSES

The most-recent five-year period of crash data (November 1, 2009 through October 31, 2014) will be reviewed at the study intersections. Any state highways in The Dalles that are identified as a Safety Priority Index System sites (top 5- or 10-percent) will be included in the crash data. The data will be analyzed for a variety of factors to include type, severity, general conditions, and location to identify potential crash patterns or anomalies. Additional details will be provided on citywide crash trends and any issues that are identified through the overall review at the corridor/segment and intersection level, and will include specific details on fatalities and crashes involving pedestrians and bicyclists.

Study intersection crash rates and critical crash rates will be calculated based on the method outlined in Part B of the *Highway Safety Manual*. If a critical crash rate cannot be calculated due to limited data, the published 90th percentile rates in Table 4-1 of ODOT's APM will be used for comparisons purposes. Project-area K-factors from 12+ hour counts will be used to convert short duration counts to daily traffic approach volumes.

For all areas that exceed the critical crash rate or 90th percentile rate, we will identify and present crash patterns and potential projects, policies, or studies that could address reported crash types and patterns. Countermeasures suggested for mitigation will be identified as having crash reduction potential based on Crash Modification Factors from the *Highway Safety Manual* or FHWA's online

Crash Modification Factor (CMF) Clearinghouse with a star rating of 3 or better. All CMFs must have consistent volumes/parameters as the study intersections.

FORECAST YEAR VOLUME DEVELOPMENT

Future no-build traffic volumes will be generated by The Dalles 2035 Travel Demand Model being prepared by ODOT's Transportation Planning Analysis Unit (TPAU). The model output data will be post-processed using NCHRP Report 255 methodologies.

NON-AUTOMOBILE TRANSPORTATION ANALYSIS

Per the scope, the non-automobile transportation analysis will include a review of collector and arterial roadways to identify deficiencies (availability of sidewalks and bicycle lanes, and gaps in primary routes) based on available GIS data and online mapping.

Quantitative and qualitative analysis of primary non-motorized transportation on collector and arterial roadways will include:

1. Bicycle Level of Traffic Stress as per Agency's *Analysis Procedure Manual v2*
2. Qualitative (multimodal) Assessment for pedestrian and transit modes per Agency's *Analysis Procedure Manual v2*.
3. A qualitative assessment of transit service and identification of underserved areas.
4. Gaps in intermodal connectivity.

NEXT STEPS

Please review the information presented in this memorandum and let us know if you have any questions, comments, or alternative direction. We look forward to working with you as the TSP Update process moves forward.

Appendix 1 On-site ATR Characteristics

Highway Approach	Closest ATR	Method	Trend	Seasonal adjustment	
				June	April
US 197	33-005	On-Site ATR Method		1.15	x
I-84 On- and Off-ramps	33-001	On-Site ATR Method		1.09	x
I-84 On- and Off-ramps	22-013	ATR Characteristic Table Method	Summer, Small urban fringe	1.07	x
I-84 On- and Off-ramps	17-001	On-Site ATR Method		1.07	x
US 30		Seasonal Characteristics	Summer < 2,500	1.07	x
City Streets		Seasonal Characteristics	Summer < 2,500	1.09	1.25

Seasonal Adjustment Factor (ATR #33-005)

Year	2009	2010	2011	2012	2013
Peak Month (August)	124%	123%	130%	129%	119%
Count Month (June)	111%	110%	108%	107%	109%

Average monthly factors
Peak month average: (124% + 123% + 129%) / 3 = 125.3%
Count month average: (110% + 108% + 109%) / 3 = 109%
Seasonal adjustment factors: 125.3 / 109 = 1.15

Seasonal Adjustment Factor (ATR #33-001)

Year	2009	2010	2011	2012	2013
Peak Month (July)	123%	124%	124%	124%	124%
Count Month (June)	114%	114%	111%	113%	114%

Average monthly factors
Peak month average: (124% + 124% + 124%) / 3 = 124%
Count month average: (114% + 113% + 114%) / 3 = 113.7%
Seasonal adjustment: 124 / 113.7 = 1.09

Seasonal Adjustment Factor (ATR #17-001)

Year	2009	2010	2011	2012	2013
Peak Month (July)	120%	122%	118%	117%	121%
Count Month (June)	109%	113%	112%	113%	112%

Average monthly factors
Peak month average: (120% + 118% + 121%) / 3 = 120%
Count month average: (112% + 113% + 112%) / 3 = 112%
Seasonal adjustment: 120 / 112 = 1.07

ATR 17-001 is located near Grant's Pass (I-5, PACIFIC HIGHWAY, 2.08 MILES SOUTH OF MONUME
Its AADT is in a 10% range of our data

Appendix B Inventory of City Roadways

Street Name	Ownership	Number of	Paved Wid	Right-of-W	Bicycle Facilities	Sidewalk
W 6TH ST	City	3	62	108	Existing Bike Facility	1
HOSTETLER ST W	County	2	36	47	Existing Bike Lane	0
W 3RD PL	City	3	36	50	Proposed Bike Lane	2
RIVER RD	County	2	33	60	Existing Bike Lane	0
W 2ND ST	City	2	48	100	Existing Bike Lane	1
WEBBER ST	City	2	44	60	Existing Bike Lane	2
W 10TH ST	County	2	45	56	Existing Bike Lane	1
MOUNT HOOD ST	City	2	42	60	Proposed Bike Lane	2
W 10TH ST	City	2	36	60	Shared Roadway	2
DRY HOLLOW RD	City	2	36	80	Existing Bike Lane	1
W 1ST ST	City	2	28	100	Riverfront Trail	1
THOMPSON ST	City	2	25	60	Shared Roadway	0
OLD DUFUR RD N	City	2	30	60	Proposed Shoulder Bikeway	0
HWY 30	State	2	36	70	Shoulder Bikeway	0
BREWERY OVERPASS	State	2	30	136	Proposed Bike Lane	0
E 1ST ST	City	1	28	42	Shared Roadway	0
E 2ND ST	City	2	40	60	Shared Roadway	2
E 3RD ST	City	2	42	60	Shared Roadway	2
E 4TH ST	City	2	37	60	Shared Roadway	2
UNION ST	City	2	40	60	Shared Roadway	2
COURT ST	City	2	48	78	Shared Roadway	2
E 12TH ST	City	2	37	46	Shared Roadway	2
SNIPES ST W	County	2	44	60	Existing Bike Lane	1
WALNUT ST W	County	2	32	58	No	0
CHERRY HEIGHTS RD W	City	2	44	80	Existing Bike Lane	2
W 6TH ST	City	2	20	60	Proposed Bike Lane	2
W 2ND ST	City	2	50	98	Existing Bike Lane	1
E 2ND ST	County	2	24	60	Shared Roadway	0
HWY 197	State	3	48	200	Shoulder Bikeway	0
KELLY AVE	City	2	36	60	Proposed Bike Lane	2

Appendix C ODOT Bridge Inventory

City of The Dalles
Transportation System Plan

Bridge Inventory – Summary of Bridge Conditions

Oregon’s bridge inspection program collects bridge condition ratings for a number of National Bridge Inventory (NBI) Categories. These ratings indicate the level of deterioration in each element. General condition ratings for listed bridges generally range from six to eight. This indicates that the bridge inventory is in satisfactory, good, or very good condition, with structural elements showing minor to no deterioration.

It is important to note that general condition ratings provide an indication of each elements status relative to its original condition, not its suitability for use today. This suitability is communicated via a structure’s Sufficiency Rating (SR). Sufficiency Rating is essentially an overall rating of a bridge's fitness for the duty that it performs. Sufficiency Ratings are based on factors derived from numerous NBI data fields. These data fields are grouped into four categories, Structural Adequacy and Safety, Serviceability and Functional Obsolescence, Essentiality for Public Use, and Special Reductions.

The following structures have been selected from the bridge inventory due to low sufficiency ratings.

Structure Number 00464 Mill Creek, W 6th Street SR 48.9

This structure is owned by the City of The Dalles.

General condition ratings indicate this structure is in satisfactory condition. The structure’s low sufficiency rating can be attributed to a number of items, including Inventory Rating and Deck Geometry.

The structure has an Inventory Rating of 17.00 tons and is load restricted, primarily due to deficient negative moment capacities at interior bents. Increasing the structure’s Inventory Rating would remove barriers to freight and open this corridor to larger vehicles. In addition, increasing the Inventory Rating to a minimum of 32.4 tons represents a nearly twenty point increase in the structure’s Sufficiency Rating. The Inventory Rating can be readily increases via removal of the dead load (3” asphalt wearing surface”, strengthening, or a combination of the two.

The bridge inspection report indicates the bridge has a bridge roadway width of 20.20 feet, substandard for a two lane structure. This structure is likely historic due to its age and type, limiting the corrective actions available.

Structure Number 07553 Chenoweth Creek, Hwy 2 SR 64.1

This structure is owned by the Oregon Department of Transportation (ODOT).

No work has been proposed for this structure.

Structure Number 08276 Hwy 2 over Hostetler Way Conn SR 57.8

This structure is owned by the Oregon Department of Transportation (ODOT).

No work has been proposed for this structure.

Structure Number 08804 Hwy 2 Brewery Grade Conn over UPRR SR 57.3

This structure is owned by the Oregon Department of Transportation (ODOT).

No work has been proposed for this structure.

Structure Number 00506 Chenoweth Creek, Hwy 100 SR 38.2

This structure is owned by the Oregon Department of Transportation (ODOT).

This structure is programmed for replacement during the 2015-2018 Statewide Transportation Improvement Program (STIP) as a portion of the US30: Mosier Creek & Dry Canyon Creek & Chenoweth Creek Bridges Project. The current project estimate is $3,797,000.

Structure Number 06635Q Columbia River, Hwy 4 (The Dalles) SR 33.4

This structure is owned by the Oregon Department of Transportation (ODOT).

A deck replacement project has been desk scoped for this structure. The scope of work also includes minor modifications to structural elements and minor painting. The current project estimate is $23,500,000.

25 Structures within The Dalles City Limits

Source: ODOT Bridge Working Database (10/20/2015) & ODOT GIS layers as of 10/29/2014 (The Dalles City Limits), 7/28/2015 (Fed. Aid Boundary)

BRIDGE_ID	STRUCNAME	MP	Carries	Crosses	YEARBUILT	Length (ft)	DESIGNMAIN	MATERIALMAIN	CUSTODIAN	NBISLEN	DKRATING	SUPRATING	SUBRATING	CULVRATING	SUFF_RATE
00463	Mill Creek, W 9th St	1.03	W 9TH STREET	MILL CREEK	1987	99.0	5 Prestressed Concrete	02 Stringer/Girder	CTY/MUN Hwy AGCY	Y	6	7	6	N	97.9
00464	Mill Creek, W 6th St	0.59	W 6TH STREET	MILL CREEK	1920	127.0	2 Concrete Continuous	02 Stringer/Girder	CTY/MUN Hwy AGCY	Y	6	6	6	N	48.9
02103	Mill Creek, Hwy 292 & 2nd St (The Dalles)	84.49	I-84 (HWY 002)	MILL CREEK	1938	16.0	1 Concrete	19 Culvert	State Highway Agency	N	N	N	N	5	89
06635	Hwy 4 over UPRR & Frontage Rd	0.76	US 197 (HWY 004)	UPRR & FRONTAGE RD	1954	553.0	4 Steel Continuous	03 Girder-Floorbeam	State Highway Agency	Y	6	6	7	N	72.7
07553	Chenoweth Creek, Hwy 2	81.89	I-84 (HWY 002)	CHENOWETH CREEK	1954	150.0	2 Concrete Continuous	02 Stringer/Girder	State Highway Agency	Y	7	6	7	N	64.1
07719	Gooseberry Spring, Hwy 2	81.18	I-84 (HWY 002) EB	GOOSEBERRY SPRING	1954	6.0	1 Concrete	19 Culvert	State Highway Agency	N	N	N	N	6	82.2
08276	Hwy 2 over Hostetler Way Conn	82.62	I-84 (HWY 002)	HOSTELLER WAY	1957	144.0	2 Concrete Continuous	02 Stringer/Girder	State Highway Agency	Y	7	6	7	N	57.8
08526	Hwy 4 over Hwy 2	0.64	US 197 (HWY 004)	HWY 002	1964	211.0	2 Concrete Continuous	05 Multiple Box Beam	State Highway Agency	Y	7	6	7	N	71.1
08603	Hwy 2 EB over UPRR	84.28	I-84 (HWY 002) EB	UPRR	1964	283.0	3 Steel	02 Stringer/Girder	State Highway Agency	Y	7	6	6	N	86
08603W	Hwy 2 WB over UPRR	84.28	I-84 (HWY 002) WB	UPRR	1964	309.0	3 Steel	02 Stringer/Girder	State Highway Agency	Y	6	6	6	N	73.9
08644	Threemile Creek, Hwy 4 at MP 0.99	0.99	US 197 (HWY 004)	THREEMILE CREEK	1959	10.0	1 Concrete	19 Culvert	State Highway Agency	N	N	N	N	6	84.3
08645	Threemile Creek, Hwy 4 at MP 1.22	1.22	US 197 (HWY 004)	THREEMILE CREEK	1959	10.0	1 Concrete	19 Culvert	State Highway Agency	N	N	N	N	6	83.7
08775	Hwy 2 over Hwy 292 at MP 84.15	84.15	I-84 (HWY 002)	HWY 292 O-XING	1964	454.0	4 Steel Continuous	02 Stringer/Girder	State Highway Agency	Y	6	6	6	N	94
08776	Hwy 2 over UPRR	87.45	I-84 (HWY 002)	UPRR	1964	640.0	4 Steel Continuous	02 Stringer/Girder	State Highway Agency	Y	6	6	6	N	95
08804	Hwy 2 Brewery Grade Conn over UPRR &	85.64	BREWERY GRADE	UPRR & HWY 292 FR	1964	611.0	3 Steel	02 Stringer/Girder	State Highway Agency	Y	7	7	7	N	57.3
08805	Brewery Grade Conn over Hwy 2	85.51	BREWERY GRADE	I-84 (HWY 002)	1964	182.0	5 Prestressed Concrete	02 Stringer/Girder	State Highway Agency	Y	7	8	7	N	76
09192	Three Mile Creek, Hwy 2	86.83	I-84 (HWY 002)	THREE MILE CREEK	1964	14.0	1 Concrete	19 Culvert	State Highway Agency	N	N	N	N	6	76.1
0P139	Culvert, Hwy 2 at MP 82.62	83.55	I-84 (HWY 002)	CREEK	1957	6.0	3 Steel	19 Culvert	State Highway Agency	N	N	N	N	8	83
16010	Mill Creek, W 10th St	0	W 10TH STREET	MILL CREEK	1975	112.0	5 Prestressed Concrete	02 Stringer/Girder	CTY/MUN Hwy AGCY	Y	6	7	7	N	97.5
18153	Hwy 2 River Rd Conn over Hwy 2 (Chenow	82.07	RIVER RD	I-84 (HWY 002)	1997	182.0	5 Prestressed Concrete	05 Multiple Box Beam	State Highway Agency	Y	7	7	6	N	93.8
18154	Hwy 2 River Rd Conn over UPRR (Chenow	82.12	RIVER RD	UPRR	1998	105.5	1 Concrete	05 Multiple Box Beam	State Highway Agency	Y	6	6	8	N	97
19152	Three Mile Creek, Hwy 100	20.2	HWY 100	THREE MILE CREEK	2003	20.6	3 Steel	19 Culvert	State Highway Agency	Y	N	N	N	8	83.3
19156	Hwy 2 over Union St (The Dalles)	84.78	I-84 (HWY 002)	UNION STREET	2003	74.1	6 P/S Conc Continuous	07 Frame	State Highway Agency	Y	7	8	8	N	92.3
19745	Hwy 2 over Hwy 292 at MP 83.67	83.67	I-84 (HWY 002)	US 30 (HWY 292)	2005	170.0	5 Prestressed Concrete	01 Slab	State Highway Agency	Y	7	8	8	N	94
21472	Chenoweth Creek, River Trail Way	1.98	RIVER TRAIL WAY	CHENOWETH CREEK	2009	115.0	5 Prestressed Concrete	05 Multiple Box Beam	County Hwy Agency	Y	8	7	8	N	98.8

5 structures not within The Dalles city limits, but within Federal Aid Urban Boundary

Source: ODOT Bridge Working Database (10/20/2015) & ODOT GIS layers as of 10/29/2014 (The Dalles City Limits), 7/28/2015 (Fed. Aid Boundary

BRIDGE_ID	STRUCNAME	MP	Carries	Crosses	YEARBUILT	Length (ft)	DESIGNMAIN	MATERIALMAIN	CUSTODIAN	NBISLEN	DKRATING	SUPRATING	SUBRATING	CULVRATING	SUFF_RATE
00506	Chenoweth Creek, Hwy 100	72.1	HWY 100	CHENOWETH CREEK	1920	66.0	2 Concrete Continuous	02 Stringer/Girder	State Highway Agency	Y	6	5	5	N	38.2
06635Q	Columbia River, Hwy 4 (The Dalles)	0	US 197 (HWY 004)	COLUMBIA RIVER	1954	3345.0	4 Steel Continuous	10 Truss-Thru	State Highway Agency	Y	5	5	6	N	33.4
07550	Hwy 2 over Taylor-Frantz Rd Conn	80.79	I-84 (HWY 002)	TAYLOR-FRANTZ RD	1954	92.0	2 Concrete Continuous	02 Stringer/Girder							
08646	Equipment Pass, Hwy 4 at MP 1.84	1.84	US 197 (HWY 004)	EQUIPMENT PASS	1959	13.0	1 Concrete	01 Slab	State Highway Agency	N	7	7	7	N	94
09211	Chenoweth Creek, W 10th St	3.41	W 10TH STREET	CHENOWETH CREEK	1965	99.0	2 Concrete Continuous	01 Slab	County Hwy Agency	Y	7	7	5	N	84.3

Appendix D Environmental Justice Maps and Tables

Environmental Justice Maps and Tables

Minority Groups

Overall, The Dalles is less diverse compared to the State of Oregon or Wasco County. As seen in Table D-1, a greater percentage of the population is white within The Dalles (80%) compared to the state and county (78% and 77% respectively). Hispanic or Latino populations comprise of the second largest population with 16% of The Dalles population, which is comparable to Wasco County (16%) and greater than the state (12%). Even though The Dalles has a greater percentage of Hispanic or Latino population compared to the state, all other minority populations are below state average.

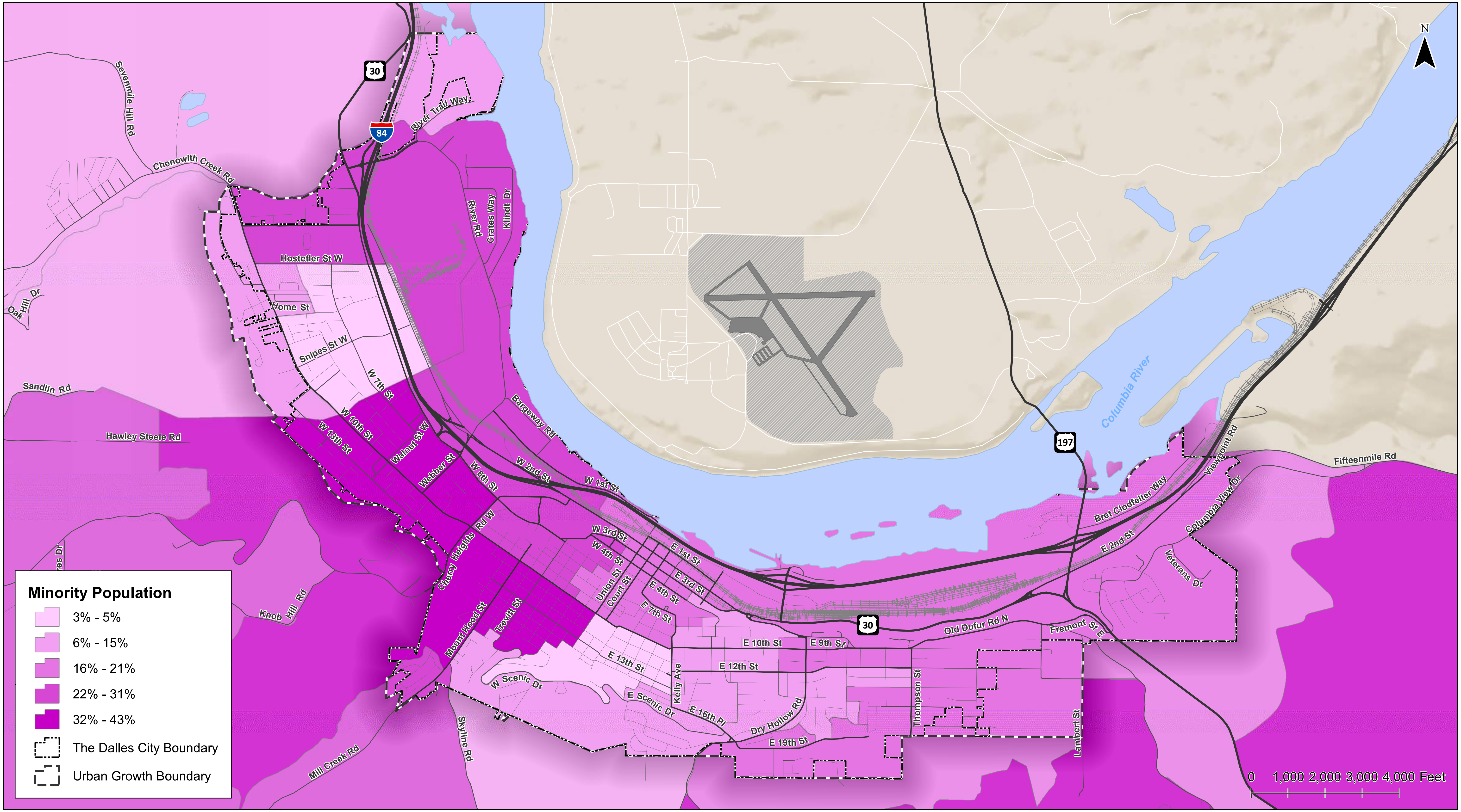
Minority populations are generally located in low-density residential neighborhoods outside of The Dalles' city center (see Figure D-1).

Table D-1. Minority Groups [6]

Geography	Oregon			Wasco County			The Dalles		
	Estimate	%	MOE	Estimate	%	MOE	Estimate	%	MOE
Total	3,868,721			25,281			14,730		41
Not Hispanic or Latino	3,406,820	88%	**	21,344	84%	**	12,436	84%	292
White alone	3,018,414	78%	942	19454	77%	19	11,807	80%	308
Black or African American alone	66,223	2%	1,496	98	0%	60	33	0%	30
American Indian and Alaska Native alone	37,750	1%	1,184	1,068	4%	117	256	2%	135
Asian alone	145,830	4%	1,626	248	1%	51	63	0%	60
Native Hawaiian and Other Pacific Islander alone	14,572	0%	580	157	1%	27	97	1%	61
Some other race alone	6,049	0%	1,064	0	0%	22	0	0%	19
Two or more races	117,982	3%	2,614	319	1%	319	180	1%	92
Hispanic or Latino	461,901	12%	**	3,937	16%	**	2,294	16%	290

* MOE = Margin of Error for the population
**Estimate is controlled. A statistical test for sampling variability is not appropriate

[6] 2013 ACS 5-Year Estimates, Table B03002



Percent of Minority Population (by block group)
The Dalles, Oregon

Figure
D-1

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Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County, 2013 ACS 5-Year Estimate
Sources: Esri, USGS, NOAA

Low-Income

The American Community Survey (ACS) uses the income-to-poverty ratio as a measure of poverty. This includes the population in households where the household income is less than or equal to twice the federal "poverty level."[7] A greater portion of the population falls in this definition of poverty (43%) compared to the State of Oregon (36%) (see Table D-2).

Households with an income-to-poverty ratio of 1.99 or below are widely distributed in residential zones throughout the City. Notable areas include census blocks around the city center and in the western and northwestern area of the UGB (see Figure D-2)[8].

Table D-2 – Ratio of Income to Poverty Level [9]

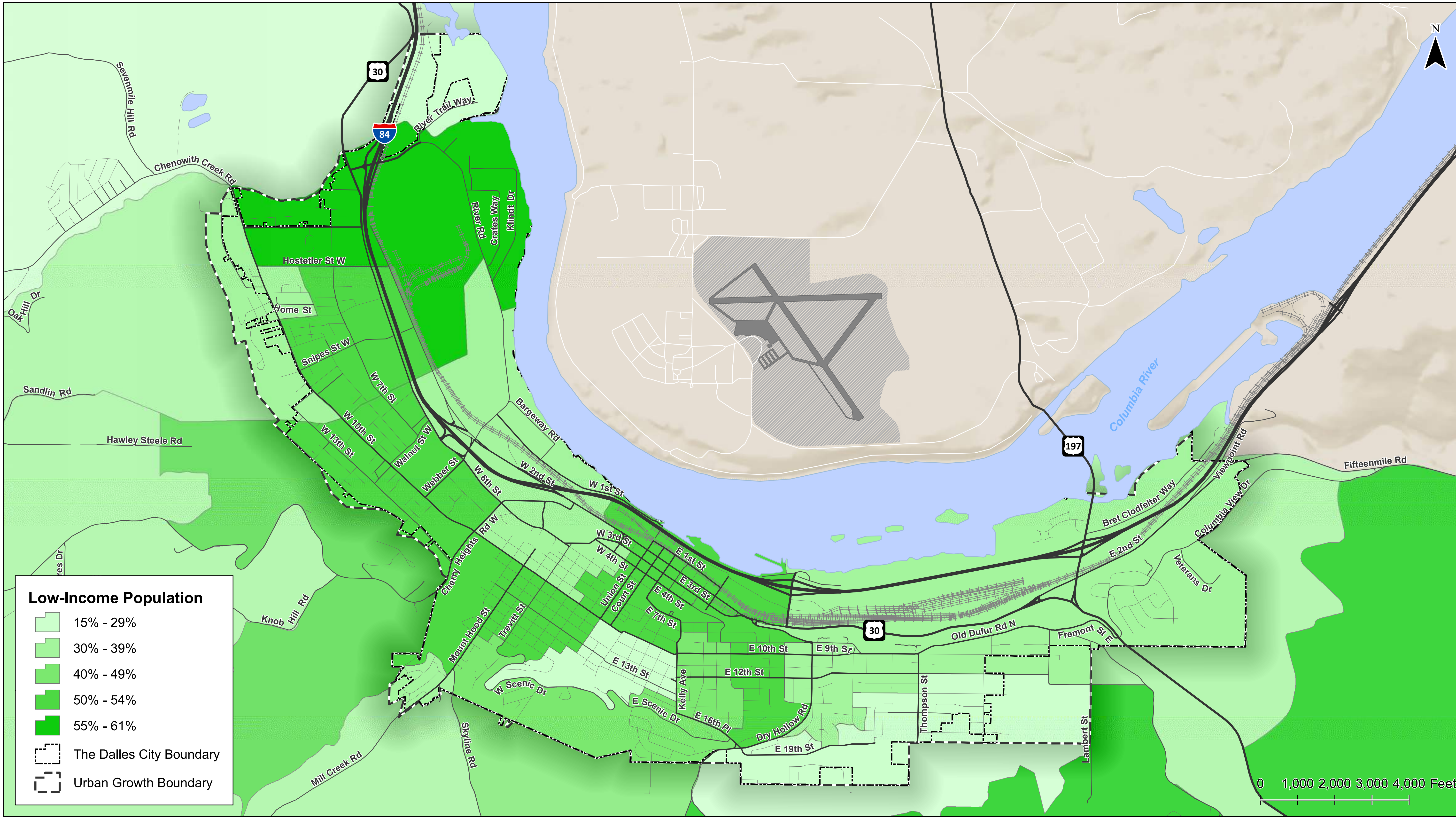
Geography	Oregon			Wasco County			The Dalles		
	Estimate	%	MOE	Estimate	%	MOE	Estimate	%	MOE
Total	3,793,058	100%	1,282	24,750	100%	168	14,264	100%	156
Under 1.99	1,374,319	36%	14,519	10,937	44%	1,082	6,179	43%	886
Under .50	275,594	7%	5,991	2,350	9%	550	1,302	9%	468
.50 to .99	339,184	9%	7,895	2,152	9%	437	853	6%	270
1.00 to 1.24	189,859	5%	5,567	1,757	7%	445	1,070	8%	376
1.25 to 1.49	193,875	5%	4,656	1,745	7%	451	1,048	7%	372
1.50 to 1.84	271,789	7%	6,769	1,770	7%	402	1,090	8%	346
1.85 to 1.99	104,018	3%	3,752	1,163	5%	337	816	6%	306
2.00 and over	2,418,739	64%	13,006	13,813	56%	672	8,085	57%	607

MOE = Margin of Error

[7] U.S. Census Poverty Definitions

[8] Note that the Chenoweth industrial area registers with the highest portion of low-income population, however it is one of the least populated areas within the UGB.

[9] 2013 ACS 5-Year Estimates, Table C17002



Percent of Population with Ratio of Income to Poverty Level 1.99 or Below (by block group)
The Dalles, Oregon

Figure
D-2

Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County, 2013 ACS 5-Year Estimate
Sources: Esri, USGS, NOAA

Person 65 Years and Older

Nearly 1 in 5 people in The Dalles are 65 years of age or older (19%) as seen in Table D-3. This is approximately the same as Wasco County (18%), and represents a greater portion of seniors as compared to the State of Oregon (14%). People 65 years of age or older are generally located within the western and southern areas with the UGB. These areas are typically zoned as low-density residential neighborhoods outside of the city center (see Figure D-3).[10]

Table D-3 – Persons 65 Years and Older [11]

	Oregon			Wasco County			The Dalles		
	Estimate	%	MOE	Estimate	%	MOE	Estimate	%	MOE
Total Population	3,868,721			25,281			14,730		
Person 65 & Older	560,073	14%	3,745	4,570	18%	274	2,866	19%	261

MOE = Margin of Error

Persons 17 Years and Younger

Nearly 1 in 4 people in The Dalles are 17 years of age or younger (25%), as seen in Table D-4. This is a greater portion of youth compared to Wasco County (23%) and the State of Oregon (22%). These populations are heavily concentrated in two census blocks as seen in Figure D-4. The census blocks with the highest concentration of youth are also among the most densely populated census blocks within the UGB.

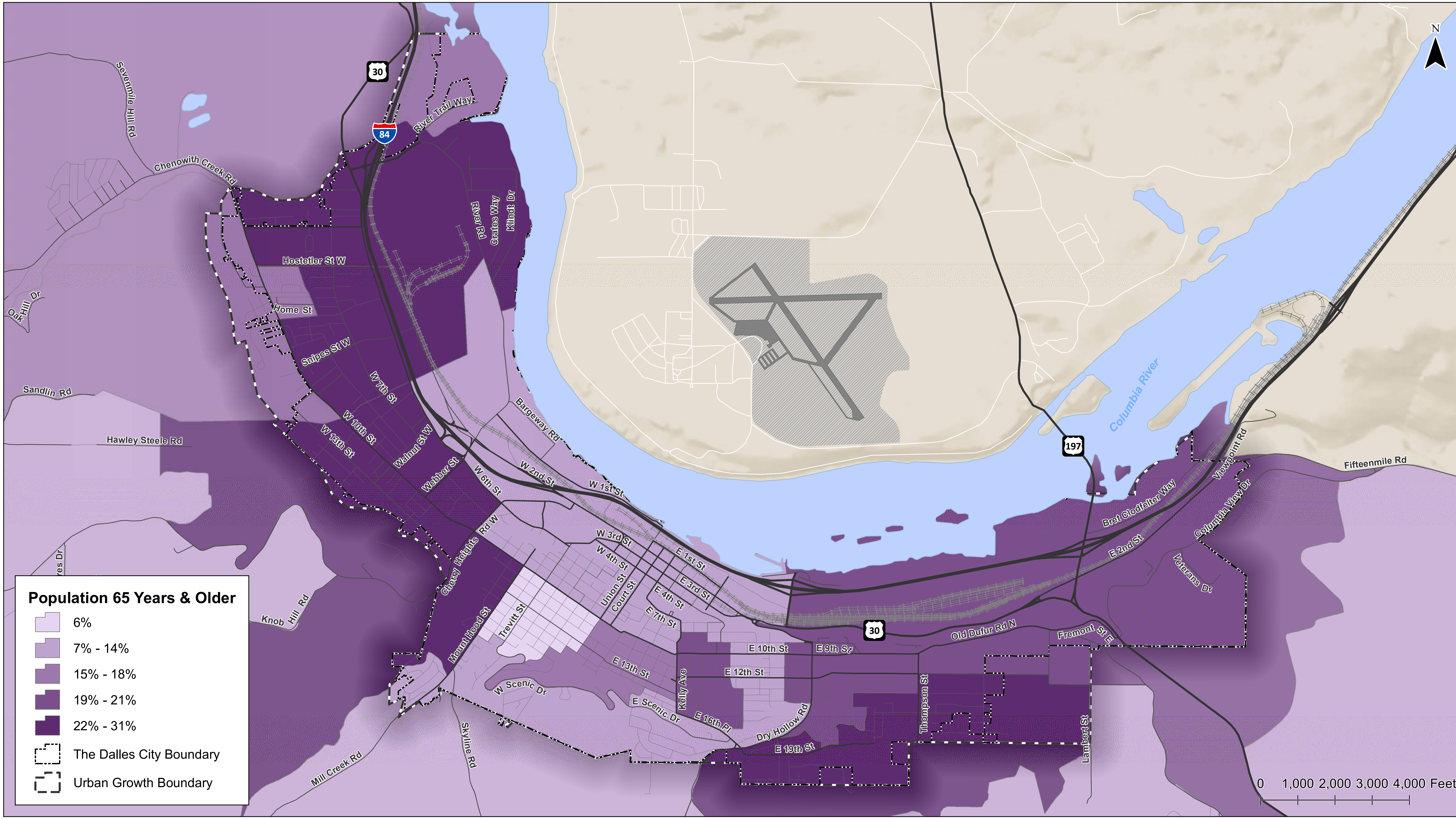
Table D-4 – Persons 17 Years and Younger[11]

	Oregon			Wasco County			The Dalles		
	Estimate	%	MOE	Estimate	%	MOE	Estimate	%	MOE
Total Population	3,868,721			25,281			14,730		
Persons 17 Or Younger	862,288	22%	3,894	5,729	23%	275	3,700	25%	292

MOE = Margin of Error

[10] Note that the Chenoweth industrial area registers with a high percentage of population 65 and older, however it is also one the least populated areas within the UGB.

[11] 2013 ACS 5-Year Estimates, Table B01001

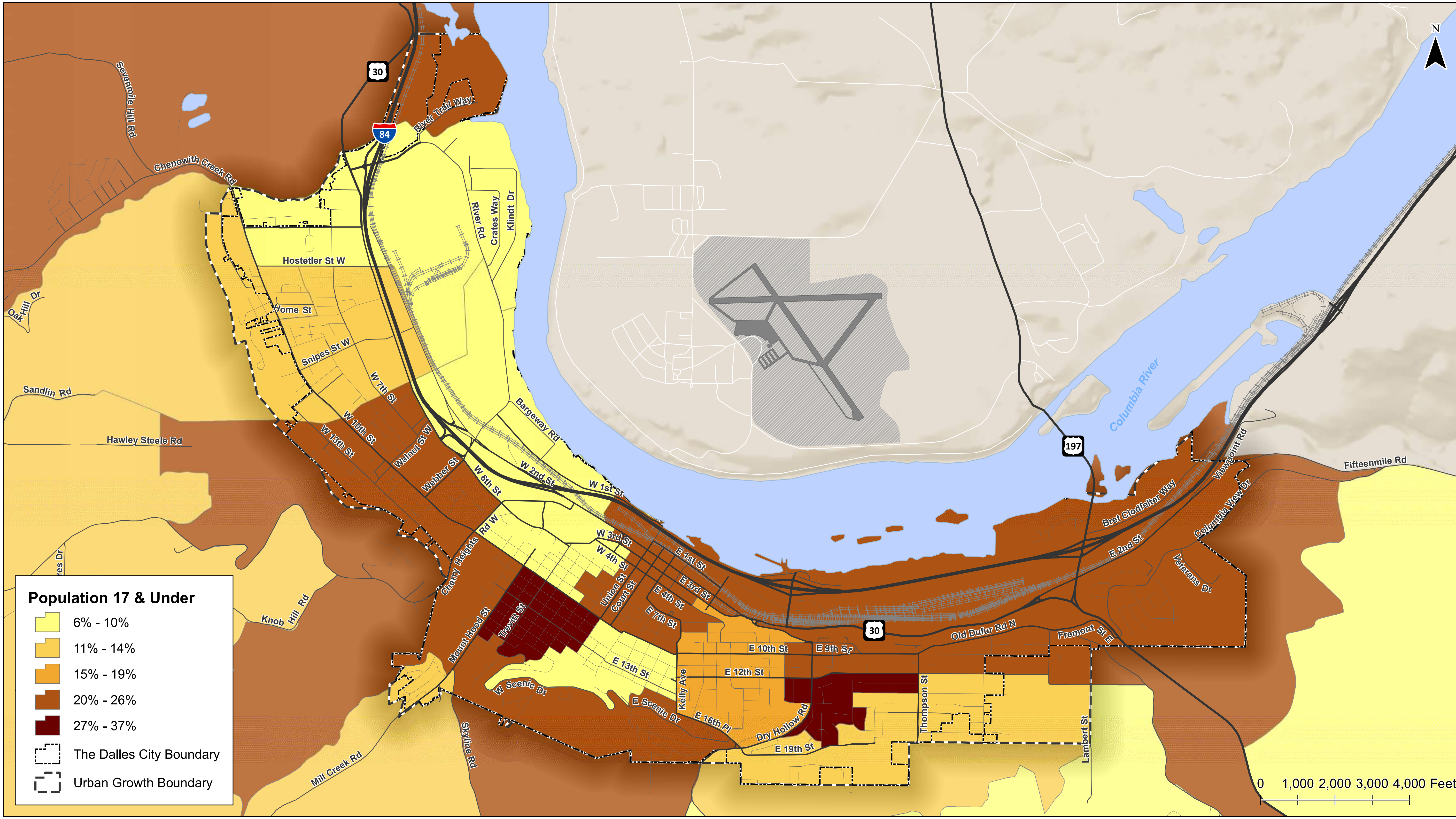


Percent of Population 65 Years of Age and Older (by block group)
The Dalles, Oregon

Figure
D-3

Oregon Department of Transportation
Kittelson & Associates, Inc.
Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County, 2013 ACS 5-Year Estimate
Sources: Esri, USGS, NOAA



Percent of Population 17 Years of Age and Younger (by block group)
The Dalles, Oregon

Figure
D-4

N:\Projects\024047 The Dalles TSP Update\GIS\MXDs\EJ_youth.mxd - cdoxsee - 10:43 AM 11/12/2015

The Hub of the Pacific Northwest — City of The Dalles, Oregon

Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning
APG

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County, 2013 ACS 5-Year Estimate
Sources: Esri, USGS, NOAA

Limited-English Proficiency

The location and number of households with limited-English proficiency is difficult to determine solely based on ACS 5-Year Estimates due to the small sampling size and large margin of error. The available data, shown in Table D-5, estimates 1% of households within The Dalles have limited-English proficiency. Among those, it is likely that people within the household speak only Spanish. Planning for transportation improvements will need to take into account the possibility of unique transportation needs related to access to services and multi-modal transportation.

Table D-5 – Non-English Proficiency [12]

Geography	Oregon			Wasco County			The Dalles		
	Estimate	%	MOE	Estimate	%	MOE	Estimate	%	MOE
Total Households	1,516,456	100%	4,721	9,612	100%	296	6,056	100%	204
English only	1,297,866	86%	4,514	8,416	88%	311	5,304	88%	259
Limited English Proficiency	44,675	3%	1,661	157	2%	79	93	1%	69
Spanish	26,628	2%	1,391	148	2%	75	88	1%	63
Other Indo-European languages	5,337	0%	475	-	0%	22	-	0%	19
Asian and Pacific Island languages	11,291	1%	724	5	0%	9	5	0%	9
Other languages	1,419	0%	272	4	0%	8	-	0%	19

MOE = Margin of Error

Persons with Disabilities

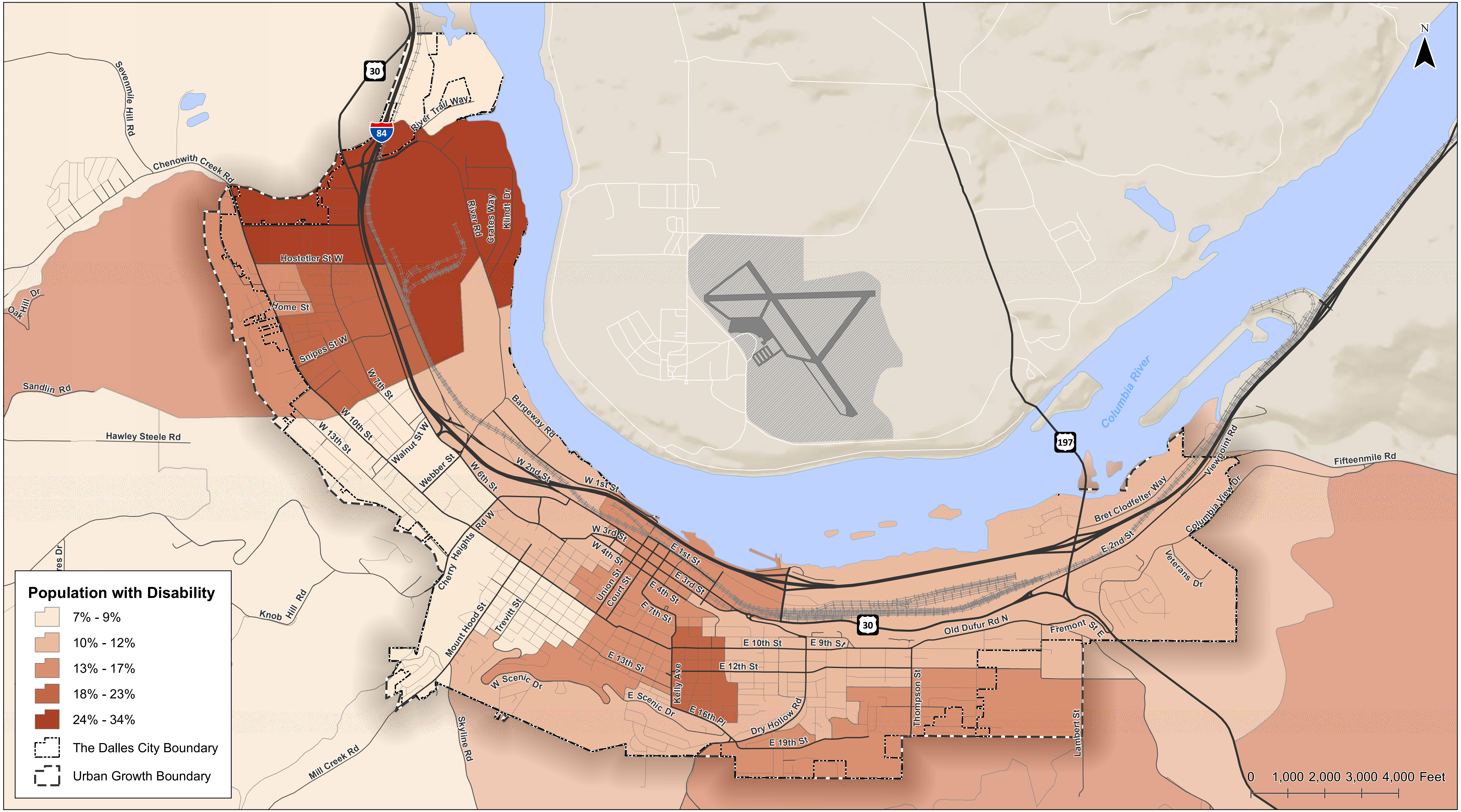
The percent population with disabilities in The Dalles (13%) is similar to the State of Oregon (12%) and Wasco County (13%) as seen in Table D-6. The northwestern area of the UGB and central area south of the city center tend to have a higher concentration of populations with disabilities (see Figure D-5). Note that the census block with the highest percentage of population with disabilities also has the lowest total population and population density. Even taking this into consideration as an outlier, some of the adjacent block groups also have a high percentage of population with disabilities.

Table D-6 – Persons with Disabilities [13]

Geography	Oregon			Wasco County			The Dalles		
	Population Estimate	%	MOE	Population Estimate	%	MOE	Population Estimate	%	MOE
Total	2,545,953	100%	1,439	15,689	100%	108	8,612	100%	212
Total with a Disability	296,082	12%	4,458	2,076	13%	226	1,108	13%	186

MOE = Margin of Error

[12] 2013 ACS 5-Year Estimates, Table B16002
[13] 2013 ACS 5-Year Estimates, Table C23023



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Percent of Population with Disability (by block group)
The Dalles, Oregon

Figure
D-5

Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County, 2013 ACS 5-Year Estimate
Sources: Esri, USGS, NOAA

Appendix E Traffic Counts

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Start Time: 2:00:00 PM
Site Code: 46023
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	7 MILE HILL RD				CHENOWITH RD								CHENOWITH RD					
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	13	0	0	0	0	4	0	0	0	0	0	0	0	8	20	0	45	
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02:30 PM	19	0	1	0	0	4	0	0	0	0	0	0	0	9	10	0	43	
02:45 PM	13	0	0	0	1	3	0	0	0	0	0	0	0	11	22	0	50	186
03:00 PM	11	0	1	0	0	8	0	0	0	0	0	0	0	8	16	0	44	185
03:15 PM	20	0	0	0	0	11	0	0	0	0	0	0	0	10	31	0	72	209
03:30 PM	13	0	1	0	0	8	0	0	0	0	0	0	0	9	19	0	50	216
03:45 PM	12	0	0	0	0	8	0	0	0	0	0	0	0	5	30	0	55	221
04:00 PM	20	0	0	0	1	7	0	0	0	0	0	0	0	10	27	0	65	242
04:15 PM	9	0	0	0	0	5	0	0	0	0	0	0	0	11	29	0	54	224
04:30 PM	22	0	1	0	0	6	0	0	0	0	0	0	0	11	28	0	68	242
04:45 PM	13	0	1	0	0	11	0	0	0	0	0	0	0	12	18	0	55	242
05:00 PM	20	0	1	0	0	8	0	0	0	0	0	0	0	18	34	0	81	258
05:15 PM	22	0	0	0	2	4	0	0	0	0	0	0	0	11	28	0	67	271
05:30 PM	16	0	1	0	1	8	0	0	0	0	0	0	0	9	18	0	53	256
05:45 PM	15	0	0	0	1	8	0	0	0	0	0	0	0	10	17	0	51	252

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
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Start Time: 2:00:00 PM
Site Code: 46022
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	US 30 Southbound				RIVER RD Westbound				US 30 Northbound				Eastbound					
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02:45 PM	0	7	6	0	3	0	50	0	42	13	0	0	0	0	0	0	121	512
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04:15 PM	0	7	1	0	2	0	58	0	36	10	0	0	0	0	0	0	114	589
04:30 PM	0	5	5	0	3	0	75	0	34	12	0	0	0	0	0	0	134	549
04:45 PM	0	11	4	0	5	0	52	0	43	13	0	0	0	0	0	0	128	541
05:00 PM	0	12	3	0	5	0	87	0	51	8	0	0	0	0	0	0	166	542
05:15 PM	0	13	3	0	1	0	76	0	44	14	0	0	0	0	0	0	151	579
05:30 PM	0	33	12	0	3	0	61	0	40	13	0	0	0	0	0	0	162	607
05:45 PM	0	4	4	0	3	0	50	0	43	13	0	0	0	0	0	0	117	596

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
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Comment 1:
Comment 2:
Comment 3:
Comment 4:

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02:30 PM	30	0	5	0	0	29	4	0	0	0	0	0	12	51	0	0	131	
02:45 PM	34	0	5	0	0	23	8	0	0	0	0	0	17	31	0	0	118	460
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03:15 PM	40	0	5	0	0	22	3	0	0	0	0	0	16	34	0	0	120	491
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04:30 PM	39	0	5	0	0	36	5	0	0	0	0	0	10	29	0	0	124	515
04:45 PM	32	1	1	0	0	22	1	0	0	0	0	0	13	34	0	0	104	504
05:00 PM	47	0	2	0	0	46	12	0	0	0	0	0	13	42	0	0	162	506
05:15 PM	52	0	5	0	0	28	6	0	0	0	0	0	15	36	0	0	142	532
05:30 PM	38	1	4	0	0	24	1	0	0	0	0	0	12	38	0	0	118	526
05:45 PM	26	0	4	0	0	24	5	0	0	0	0	0	12	33	0	0	104	526

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
13	1	170	24	132	0	0	0	0	0	141	51	30.8	0.0	6.5	0.0	3.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	5.7	5.9

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Comment 2:
Comment 3:
Comment 4:

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03:15 PM	0	0	0	0	4	13	0	0	5	0	14	0	0	16	25	0	77	319
03:30 PM	0	0	0	0	8	26	0	0	3	0	13	0	0	12	41	0	103	327
03:45 PM	0	0	0	0	7	16	0	0	5	1	13	0	0	8	29	0	79	337
04:00 PM	0	0	0	0	7	30	0	0	0	1	21	0	0	8	37	0	104	363
04:15 PM	0	0	0	0	4	14	0	0	0	0	5	0	0	16	17	0	56	342
04:30 PM	0	0	0	0	11	24	0	0	1	0	20	0	0	13	24	0	93	332
04:45 PM	0	0	0	0	10	13	0	0	2	0	12	0	0	4	29	0	70	323
05:00 PM	0	0	0	0	11	36	0	0	0	0	20	0	0	10	36	0	113	332
05:15 PM	0	0	0	0	11	15	0	0	0	0	17	0	0	7	30	0	80	356
05:30 PM	0	0	0	0	3	9	0	0	0	0	15	0	0	10	36	0	73	336
05:45 PM	0	0	0	0	6	11	0	0	0	0	19	0	0	10	27	0	73	339

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
0	0	0	0	88	43	69	0	3	119	34	0

Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.0	7.0	2.9	#DIV/0!	66.7	5.0	17.6	#DIV/0!

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_10th_&_Hostetler_240731_06-09-2015.ppd
Start Date: 6/9/2015
Start Time: 2:00:00 PM
Site Code: 46025
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	10TH ST				HOSTETLER WAY				10TH ST									
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	0	21	1	0	3	0	2	0	6	26	0	0	0	1	0	0	60	
02:15 PM	0	36	3	0	2	0	4	0	11	24	0	0	0	0	0	0	80	
02:30 PM	0	23	3	0	4	0	5	0	4	30	0	0	0	0	0	0	69	
02:45 PM	0	16	1	0	5	0	3	0	10	27	0	0	0	0	0	0	62	271
03:00 PM	0	25	5	0	6	0	8	0	7	21	0	0	0	0	0	0	72	283
03:15 PM	0	34	5	0	10	0	6	0	6	35	0	0	0	0	0	0	96	299
03:30 PM	0	46	6	0	7	0	3	0	11	21	0	0	0	0	0	0	94	324
03:45 PM	0	25	5	0	4	0	7	0	9	36	0	0	0	0	0	0	86	348
04:00 PM	0	28	3	0	6	1	9	0	6	25	0	0	0	0	0	0	78	354
04:15 PM	0	23	4	0	6	0	3	0	4	23	0	0	0	1	0	0	64	322
04:30 PM	0	37	1	0	7	0	6	0	4	26	0	0	0	0	0	0	81	309
04:45 PM	0	30	3	0	4	1	3	0	10	33	0	0	0	1	0	0	85	308
05:00 PM	0	34	4	0	8	0	9	0	10	42	0	0	0	0	0	0	107	337
05:15 PM	0	23	6	0	4	0	5	0	8	34	0	0	0	0	0	0	80	353
05:30 PM	0	31	7	0	4	0	7	0	13	22	0	0	0	0	0	0	84	356
05:45 PM	0	25	10	0	6	0	15	0	8	24	0	0	0	0	0	0	88	359

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
14	124	0	23	1	23	0	135	32	0	1	0	0.0	2.4	#DIV/0!	0.0	100.0	0.0	#DIV/0!	0.7	0.0	#DIV/0!	0.0	#DIV/0!

File Name: C:\Users\Clay\Documents\Work Documents\Clients\2015\ODOT\Jim Bryant\The Dalles\Regular TMC\Hostetler & 2nd.ppd
Start Date: 6/4/2015
Start Time: 2:00:00 PM
Site Code:
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	2ND ST				HOSTETLER ST				2ND ST				HOSTETLER ST					
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	total	hourly total
14:00	0	0	2	0	0	2	0	0	28	0	2	0	0	0	17	0	51	
14:15	0	2	0	0	0	0	0	0	23	1	0	0	0	0	11	0	37	
14:30	0	3	1	0	0	0	0	0	24	1	1	0	0	1	17	0	48	
14:45	0	0	0	0	0	0	0	0	25	1	0	0	1	0	17	0	44	180
15:00	0	3	2	0	1	1	0	0	20	0	0	0	1	0	12	0	40	169
15:15	0	0	0	0	0	0	0	0	23	1	1	0	0	0	21	0	46	178
15:30	0	0	0	0	2	4	0	0	23	2	2	0	0	1	23	1	57	187
15:45	0	3	1	0	1	3	0	0	34	2	0	0	0	0	12	0	56	199
16:00	0	0	1	0	1	3	0	0	24	2	0	0	2	5	21	0	59	218
16:15	0	1	0	0	3	1	0	0	24	1	2	0	1	0	12	0	45	217
16:30	0	0	1	0	1	0	0	0	29	0	0	0	1	0	13	0	45	205
16:45	0	3	1	0	1	2	0	0	31	2	1	0	2	1	12	0	56	205
17:00	0	1	3	0	2	2	0	0	33	1	0	0	2	1	7	0	52	198
17:15	0	0	0	0	3	0	0	0	20	0	1	0	0	0	12	0	36	189
17:30	0	0	0	0	0	2	0	0	21	1	0	0	0	0	10	0	34	178
17:45	0	1	1	0	0	2	0	0	24	0	0	0	1	0	9	0	38	160

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
0	4	5	7	4	0	113	3	2	5	2	44	#DIV/0!	0.0	0.0	0.0	0.0	#DIV/0!	0.0	0.0	0.0	0.0	50.0	0.0

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_Hwy_30_&_84_EB_240754_06-09-2015.ppd
Start Date: 6/10/2015
Start Time: 6:00:00 AM
Site Code: 46006
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	US 30				I-84 EB RAMPS				US 30									
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	0	104	31	0	5	0	17	0	43	134	0	0	0	0	0	0	334	
02:15 PM	0	116	28	0	6	0	13	0	41	124	0	0	0	0	0	0	328	
02:30 PM	0	127	25	0	6	0	15	0	38	137	0	0	0	0	0	0	348	
02:45 PM	0	122	38	0	4	0	13	0	37	130	0	0	0	0	0	0	344	1354
03:00 PM	0	129	37	0	5	0	8	0	40	123	0	0	0	0	0	0	342	1362
03:15 PM	0	149	27	0	3	0	13	0	34	148	0	0	0	0	0	0	374	1408
03:30 PM	0	134	25	0	8	0	11	0	39	178	0	0	0	0	0	0	395	1455
03:45 PM	0	116	41	0	7	0	7	0	34	146	0	0	0	0	0	0	351	1462
04:00 PM	0	132	22	0	6	0	13	0	43	168	0	0	0	0	0	0	384	1504
04:15 PM	0	116	31	0	5	0	11	0	38	153	0	0	0	0	0	0	354	1484
04:30 PM	0	131	35	0	6	0	14	0	56	153	0	0	0	0	0	0	395	1484
04:45 PM	0	141	35	0	7	0	11	0	47	143	0	0	0	0	0	0	384	1517
05:00 PM	0	130	33	0	15	0	10	0	43	183	0	0	0	0	0	0	414	1547
05:15 PM	0	135	27	0	3	0	13	0	41	169	0	0	0	0	0	0	388	1581
05:30 PM	0	163	33	0	6	0	8	0	41	171	0	0	0	0	0	0	422	1608
05:45 PM	0	140	39	0	8	0	14	0	31	160	0	0	0	0	0	0	392	1616

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
130	537	0	48	0	31	0	648	187	0	0	0	0.8	0.4	#DIV/0!	0.0	#DIV/0!	3.2	#DIV/0!	2.0	1.6	#DIV/0!	#DIV/0!	#DIV/0!

File Name: C:\Users\Clay\Documents\Work Documents\Clients\2015\ODOT\Jim Bryant\The Dalles\Regular TMC\Weber & 10th.ppd
Start Date: 6/4/2015
Start Time: 2:00:00 PM
Site Code:
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	10TH ST				WEBER ST				10TH ST				WEBER ST					
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	total	hourly total
14:00	10	50	0	0	10	0	20	0	0	55	7	1	0	0	0	0	152	
14:15	14	47	0	0	3	0	26	0	0	54	12	0	0	0	0	0	156	
14:30	9	60	0	0	8	0	20	0	0	52	7	0	0	0	0	0	156	
14:45	14	43	0	0	7	0	27	0	0	52	6	0	0	0	0	0	149	613
15:00	12	48	0	0	15	0	17	0	0	50	9	1	0	0	0	0	151	612
15:15	13	49	0	0	12	0	17	0	0	53	15	0	0	0	0	0	159	615
15:30	21	61	0	0	12	0	21	0	0	47	8	0	0	0	0	0	170	629
15:45	20	54	0	0	11	0	15	0	0	55	7	0	0	0	0	0	162	642
16:00	19	52	0	0	13	0	20	1	0	61	13	0	0	0	0	0	178	669
16:15	5	47	0	0	13	0	14	0	0	58	8	0	0	0	0	0	145	655
16:30	19	57	0	0	13	0	21	1	0	69	8	1	0	0	0	0	187	672
16:45	17	61	0	0	7	0	21	0	0	75	7	0	0	0	0	0	188	698
17:00	15	48	0	0	14	0	32	0	0	82	10	0	0	0	0	0	201	721
17:15	16	57	0	0	20	0	26	0	0	49	11	0	0	0	0	0	179	755
17:30	21	48	0	0	9	0	22	0	0	51	9	0	0	0	0	0	160	728
17:45	16	59	0	0	10	0	17	0	0	61	7	0	0	0	0	0	170	710

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
67	223	0	54	0	100	0	275	36	0	0	0	0.0	1.8	#DIV/0!	1.9	#DIV/0!	1.0	#DIV/0!	1.8	2.8	#DIV/0!	#DIV/0!	#DIV/0!

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_Weber_&_6th_240738_06-09-2015.ppd
Start Date: 6/9/2015
Start Time: 2:00:00 PM
Site Code: 46021
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	WEBBER ST				6TH ST				WEBBER ST				6TH ST					
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	57	23	32	0	39	109	9	0	11	18	14	0	13	95	10	0	430	
02:15 PM	48	18	36	0	51	96	8	0	8	20	18	0	6	117	11	0	437	
02:30 PM	49	26	44	0	34	112	6	0	6	13	17	0	10	116	14	0	447	
02:45 PM	52	15	32	0	28	107	9	0	9	20	13	0	4	125	11	0	425	1739
03:00 PM	41	21	29	0	40	113	6	0	7	7	12	0	14	123	11	0	424	1733
03:15 PM	71	14	38	0	37	99	7	0	12	23	13	0	13	123	21	0	471	1767
03:30 PM	71	22	43	0	31	122	10	0	11	19	18	0	14	118	12	0	491	1811
03:45 PM	57	18	36	0	36	111	7	0	15	21	13	0	12	106	9	0	441	1827
04:00 PM	75	18	37	0	39	130	11	0	5	19	17	0	14	111	18	0	494	1897
04:15 PM	65	14	27	0	38	122	10	0	8	7	11	0	10	108	11	0	431	1857
04:30 PM	73	31	39	0	39	123	4	0	10	17	19	0	12	122	9	0	498	1864
04:45 PM	67	24	32	0	44	105	6	0	11	10	22	0	17	127	8	0	473	1896
05:00 PM	56	28	35	0	35	155	8	0	11	13	15	0	8	127	5	0	496	1898
05:15 PM	83	32	29	0	31	108	8	0	5	10	15	0	14	125	9	0	469	1936
05:30 PM	56	11	22	0	34	143	9	0	17	15	8	0	19	129	17	0	480	1918
05:45 PM	51	15	32	0	19	131	10	0	9	13	9	0	12	125	14	0	440	1885

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
135	115	279	26	491	149	71	50	37	31	501	51

Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
0.7	0.9	5.7	0.0	0.6	2.0	2.8	4.0	0.0	0.0	1.0	0.0

File Name: C:\Users\Clay\Documents\Work Documents\Clients\2015\ODOT\Jim Bryant\The Dalles\Regular TMC\Weber & 2nd.ppd
Start Date: 6/4/2015
Start Time: 2:00:00 PM
Site Code:
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	WEBER ST				2ND ST				WEBER ST				2ND ST					
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	total	hourly total
14:00	10	26	8	0	72	44	10	3	36	17	14	0	1	20	15	0	273	
14:15	7	19	5	0	73	44	16	0	49	18	13	0	5	14	7	0	270	
14:30	5	24	8	0	82	49	20	0	33	16	15	0	4	16	10	0	282	
14:45	7	13	4	0	67	53	10	1	33	12	16	0	6	11	13	0	245	1070
15:00	13	23	5	0	59	25	9	8	31	10	16	0	1	10	16	0	218	1015
15:15	5	21	5	0	97	48	21	0	38	27	16	0	6	23	7	0	314	1059
15:30	6	33	11	0	79	51	18	0	37	8	15	1	2	17	20	0	297	1074
15:45	12	23	9	1	84	52	20	1	37	15	12	0	3	19	10	1	296	1125
16:00	11	28	13	0	78	59	14	1	38	20	22	0	3	17	13	0	316	1223
16:15	9	18	5	0	69	42	22	1	31	10	12	0	4	17	19	1	258	1167
16:30	9	53	9	0	76	45	10	0	32	14	21	0	4	10	11	1	294	1164
16:45	15	32	6	0	80	47	13	0	33	12	14	0	2	14	14	0	282	1150
17:00	23	48	4	0	74	63	9	0	29	7	15	0	3	21	13	0	309	1143
17:15	11	23	2	0	92	62	5	0	37	3	14	0	1	14	11	0	275	1160
17:30	6	10	2	0	61	44	9	0	28	12	22	0	5	5	15	0	219	1085
17:45	3	9	2	0	90	43	15	0	24	7	16	0	2	13	12	0	236	1039

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
34	105	38	338	210	73	150	70	65	14	76	50	0.0	2.9	5.3	4.4	4.3	11.0	2.0	4.3	1.5	7.1	1.3	0.0

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_Weber_&_1st_240735_06-09-2015.ppd
Start Date: 6/9/2015
Start Time: 2:00:00 PM
Site Code: 46022
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	WEBBER ST				1ST ST				WEBBER ST				1ST ST					
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	0	17	4	0	3	0	12	0	8	19	0	0	0	0	0	0	63	63
02:15 PM	0	19	5	0	5	0	10	0	9	26	0	0	0	0	0	0	74	137
02:30 PM	0	20	6	0	1	0	13	0	13	23	0	0	0	0	0	0	76	213
02:45 PM	0	13	2	0	4	0	11	0	11	8	0	0	0	0	0	0	49	262
03:00 PM	0	23	8	0	6	0	9	0	8	21	0	0	0	0	0	0	75	274
03:15 PM	0	30	13	0	6	0	17	0	21	24	0	0	0	0	0	0	111	311
03:30 PM	0	25	12	0	7	0	13	0	11	16	0	0	0	0	0	0	84	319
03:45 PM	0	28	6	0	9	0	15	0	12	24	0	0	0	0	0	0	94	364
04:00 PM	0	26	5	0	3	0	11	0	14	24	0	0	0	0	0	0	83	372
04:15 PM	0	21	7	0	4	0	10	0	12	22	0	0	0	0	0	0	76	337
04:30 PM	0	33	6	0	9	0	12	0	19	19	0	0	0	0	0	0	98	351
04:45 PM	0	38	10	0	4	0	11	0	7	18	0	0	0	0	0	0	88	345
05:00 PM	0	47	15	0	2	0	9	0	3	9	0	0	0	0	0	0	85	347
05:15 PM	0	18	6	0	2	0	7	0	4	12	0	0	0	0	0	0	49	320
05:30 PM	0	8	7	0	7	0	5	0	5	17	0	0	0	0	0	0	49	271
05:45 PM	0	11	8	0	5	0	3	0	1	14	0	0	0	0	0	0	42	225

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
24	109	0	56	0	25	0	88	58	0	0	0	8.3	0.9	#DIV/0!	5.4	#DIV/0!	16.0	#DIV/0!	3.4	10.3	#DIV/0!	#DIV/0!	#DIV/0!

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_Cherry_Heights_&_10th_225596_04-21-2015.ppd
Start Date: 4/21/2015
Start Time: 6:00:00 AM
Site Code: 46018
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	CHERRY HEIGHTS RD				10TH ST				CHERRY HEIGHTS RD				10TH ST					
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	13	13	26	0	18	41	4	0	9	18	0	0	7	32	15	0	196	
02:15 PM	7	13	18	0	20	53	8	0	4	4	2	0	10	52	20	0	211	
02:30 PM	10	19	26	0	14	55	14	0	7	8	3	0	7	50	14	0	227	
02:45 PM	16	18	25	0	29	49	11	0	18	23	4	0	7	46	20	0	266	900
03:00 PM	19	20	23	0	30	55	8	0	3	8	4	0	3	37	23	0	233	937
03:15 PM	9	14	17	0	24	86	12	0	5	10	2	0	5	53	14	0	251	977
03:30 PM	15	9	25	0	26	75	10	0	2	7	3	0	9	63	22	0	266	1016
03:45 PM	13	15	17	0	27	65	8	0	2	13	1	0	7	46	12	0	226	976
04:00 PM	14	16	18	0	25	57	6	0	4	10	5	0	5	39	21	0	220	963
04:15 PM	17	22	14	0	17	60	10	0	3	8	4	0	6	38	23	0	222	934
04:30 PM	15	14	21	0	25	47	7	0	5	10	1	0	4	42	6	0	197	865
04:45 PM	11	17	21	0	30	60	11	0	4	7	3	0	5	47	19	0	235	874
05:00 PM	21	18	19	0	27	77	6	0	3	10	3	0	6	61	11	0	262	916
05:15 PM	23	15	28	0	29	83	3	0	2	11	13	0	4	52	17	0	280	974
05:30 PM	12	23	26	0	30	61	8	0	4	13	5	0	9	46	21	0	258	1035
05:45 PM	13	18	25	0	26	49	3	0	5	12	4	0	7	49	10	0	221	1021

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
70	54	51	36	283	102	11	40	13	69	201	26

Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
2.9	1.9	0.0	8.3	2.1	1.0	9.1	2.5	15.4	1.4	4.0	0.0

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_Cherry_Heights_&_6th_225600_04-21-2015.ppd
Start Date: 4/21/2015
Start Time: 6:00:00 AM
Site Code: 46019
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	CHERRY HEIGHTS RD				6TH ST				CHERRY HEIGHTS RD				6TH ST					
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	62	25	4	0	10	62	7	0	8	11	28	0	31	84	17	0	349	
02:15 PM	57	23	1	0	1	50	6	0	6	12	26	0	23	77	25	0	307	
02:30 PM	48	25	6	0	0	60	5	0	5	14	25	0	35	80	20	0	323	
02:45 PM	46	14	4	0	0	54	5	0	5	24	38	0	39	86	22	0	337	1316
03:00 PM	41	33	6	0	0	55	12	0	3	7	39	0	32	85	20	0	333	1300
03:15 PM	50	22	5	0	1	53	7	0	7	15	41	0	24	81	25	0	331	1324
03:30 PM	50	22	6	0	0	58	13	0	9	17	38	0	35	78	17	0	343	1344
03:45 PM	62	33	7	0	0	58	16	0	8	12	43	0	31	73	28	0	371	1378
04:00 PM	49	25	9	0	1	58	8	0	13	13	40	0	33	95	19	0	363	1408
04:15 PM	46	34	4	0	3	48	9	0	8	13	24	0	21	86	16	0	312	1389
04:30 PM	43	34	2	0	2	55	5	0	7	13	31	0	36	93	12	0	333	1379
04:45 PM	38	23	7	0	2	50	11	0	5	12	26	0	29	68	19	0	290	1298
05:00 PM	51	25	2	0	0	73	9	0	5	8	41	0	34	72	14	0	334	1269
05:15 PM	63	32	2	0	0	62	8	0	9	10	32	0	35	64	12	0	329	1286
05:30 PM	40	28	5	0	0	71	5	0	7	9	44	0	38	73	19	0	339	1292
05:45 PM	41	20	4	0	1	56	7	0	6	4	40	0	43	85	12	0	319	1321

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
22	102	211	44	227	2	162	57	37	89	327	123	0.0	4.9	0.0	0.0	0.4	0.0	1.9	1.8	0.0	3.4	1.8	0.8

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_Hood_&_Skyline_240724_06-09-2015.ppd
Start Date: 6/9/2015
Start Time: 2:00:00 PM
Site Code: 46030
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	MT HOOD ST				SKYLINE RD				MT HOOD ST									
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	0	17	6	0	17	0	4	0	4	20	0	0	0	0	0	0	68	
02:15 PM	0	14	11	0	16	0	4	0	2	19	0	0	0	0	0	0	66	
02:30 PM	0	24	10	0	24	0	9	0	8	22	0	0	0	0	0	0	97	
02:45 PM	0	22	14	0	18	0	12	0	6	16	0	0	0	0	0	0	88	319
03:00 PM	0	21	11	0	17	0	3	0	6	15	0	0	0	0	0	0	73	324
03:15 PM	0	20	16	0	16	0	0	0	7	15	0	0	0	0	0	0	74	332
03:30 PM	0	32	20	0	12	0	5	0	6	28	0	0	0	0	0	0	103	338
03:45 PM	0	25	11	0	14	0	5	0	4	10	0	0	0	0	0	0	69	319
04:00 PM	0	25	13	0	9	0	5	0	1	20	0	0	0	0	0	0	73	319
04:15 PM	0	20	15	0	8	0	2	0	4	22	0	0	0	0	0	0	71	316
04:30 PM	0	18	7	0	20	0	1	0	2	16	0	0	0	0	0	0	64	277
04:45 PM	0	20	12	0	18	0	4	0	2	24	0	0	0	0	0	0	80	288
05:00 PM	0	34	10	0	12	0	7	0	2	24	0	0	0	0	0	0	89	304
05:15 PM	0	29	9	0	13	0	1	0	2	10	0	0	0	0	0	0	64	297
05:30 PM	0	25	19	0	13	0	2	0	2	18	0	0	0	0	0	0	79	312
05:45 PM	0	22	7	0	10	0	3	0	1	17	0	0	0	0	0	0	60	292

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
46	102	0	15	0	51	0	73	18	0	0	0	2.2	3.9	#DIV/0!	6.7	#DIV/0!	11.8	#DIV/0!	4.1	11.1	#DIV/0!	#DIV/0!	#DIV/0!

File Name: C:\Users\Clay\Documents\Work Documents\Clients\2015\ODOT\Jim Bryant\The Dalles\Regular TMC\Hood & 10th.ppd
Start Date: 6/4/2015
Start Time: 2:00:00 PM
Site Code:
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	MT HOOD ST				10TH ST				MT HOOD ST				10TH ST					
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	total	hourly total
02:00 PM	0	8	0	0	10	58	1	0	24	8	15	3	0	47	19	0	190	
02:15 PM	2	14	1	0	7	59	1	0	26	8	5	0	2	48	13	0	186	
02:30 PM	0	14	2	0	8	40	0	0	39	9	11	1	0	53	27	0	203	
02:45 PM	0	7	0	0	5	50	1	0	24	13	14	0	1	44	30	0	189	768
03:00 PM	0	10	1	0	5	50	0	0	27	6	12	1	0	66	23	0	200	778
03:15 PM	3	11	0	0	8	59	0	0	31	4	14	0	1	50	23	0	204	796
03:30 PM	0	10	0	0	7	47	0	0	30	9	13	0	4	67	38	0	225	818
03:45 PM	0	16	1	1	13	63	1	0	24	5	12	1	0	59	23	0	217	846
04:00 PM	0	10	0	0	11	59	1	0	31	7	8	0	0	51	27	0	205	851
04:15 PM	0	12	0	0	12	66	1	0	27	10	5	0	1	48	28	0	210	857
04:30 PM	1	8	0	1	7	66	1	0	25	5	10	0	1	51	22	1	197	829
04:45 PM	1	15	2	0	11	51	0	0	46	8	10	0	0	56	21	0	221	833
05:00 PM	0	22	1	0	16	72	1	0	17	7	8	1	0	60	27	0	231	859
05:15 PM	0	23	0	0	6	49	0	1	27	5	7	0	0	53	24	0	194	843
05:30 PM	1	21	1	0	9	47	1	0	35	8	8	0	0	59	27	3	217	863
05:45 PM	0	11	0	0	6	64	1	0	25	7	3	0	1	62	22	0	202	844

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
3	47	1	39	228	2	116	25	47	5	227	111	0.0	8.5	0.0	2.6	2.2	50.0	5.2	4.0	2.1	0.0	2.2	0.0

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_Union_&_10th_225593_04-21-2015.ppd
Start Date: Apr-15
Start Time: 6:00:00 AM
Site Code: 46017
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	UNION ST				10TH ST				UNION ST				10TH ST					
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	6	14	10	0	5	37	2	0	1	11	2	0	4	45	9	0	146	
02:15 PM	12	9	8	0	5	49	2	0	2	9	7	0	3	37	4	0	147	
02:30 PM	6	16	7	0	10	40	4	0	3	14	5	0	4	43	4	0	156	
02:45 PM	1	15	19	0	16	43	3	0	5	11	3	0	4	68	9	0	197	646
03:00 PM	5	13	16	0	12	49	2	0	4	11	10	0	6	49	2	0	179	679
03:15 PM	6	11	11	0	17	70	6	0	0	15	12	0	3	51	8	0	210	742
03:30 PM	8	14	11	0	10	66	3	0	1	13	3	0	5	45	7	0	186	772
03:45 PM	7	20	9	0	12	65	2	0	2	14	5	0	2	46	4	0	188	763
04:00 PM	3	14	15	0	13	52	1	0	1	9	3	0	3	35	9	0	158	742
04:15 PM	4	13	18	0	11	50	3	0	1	11	5	0	0	37	4	0	157	689
04:30 PM	2	6	20	0	7	44	1	0	2	10	5	0	3	35	1	0	136	639
04:45 PM	9	16	16	0	8	57	2	0	1	13	3	0	3	35	6	0	169	620
05:00 PM	15	19	20	0	9	55	4	0	1	13	7	0	7	44	4	0	198	660
05:15 PM	3	14	9	0	5	58	2	0	2	10	9	0	6	39	8	0	165	668
05:30 PM	6	12	14	0	12	47	1	0	4	13	5	0	6	52	2	0	174	706
05:45 PM	4	19	12	0	7	35	3	0	0	9	5	0	3	42	2	0	141	678

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
62	59	24	12	253	52	23	51	4	28	177	13	0.0	1.7	0.0	0.0	2.8	0.0	4.3	3.9	0.0	0.0	5.1	0.0

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_Union_&_3rd_225591_04-21-2015.ppd
Start Date: 4/21/2015
Start Time: 6:00:00 AM
Site Code: 46016
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	UNION ST				3RD ST				UNION ST				3RD ST					
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	0	19	8	0	0	0	0	0	13	11	0	0	15	139	18	0	223	
02:15 PM	0	14	7	0	0	0	0	0	10	13	0	0	15	159	14	0	232	
02:30 PM	0	15	8	0	0	0	0	0	10	13	0	0	15	153	14	0	228	
02:45 PM	0	15	8	0	0	0	0	0	13	21	0	0	10	150	12	0	229	912
03:00 PM	0	19	11	0	0	0	0	0	10	21	0	0	16	162	14	0	253	942
03:15 PM	0	10	10	0	0	0	0	0	6	14	0	0	10	148	10	0	208	918
03:30 PM	0	25	14	0	0	0	0	0	18	20	0	0	8	139	12	0	236	926
03:45 PM	0	18	8	0	0	0	0	0	4	21	0	0	18	175	11	0	255	952
04:00 PM	0	16	11	0	0	0	0	0	6	20	0	0	15	142	16	0	226	925
04:15 PM	0	14	14	0	0	0	0	0	7	13	0	0	15	156	18	0	237	954
04:30 PM	0	25	9	0	0	0	0	0	6	12	0	0	5	161	19	0	237	955
04:45 PM	0	15	11	0	0	0	0	0	5	22	0	0	10	163	15	0	241	941
05:00 PM	0	25	7	0	0	0	0	0	9	20	0	0	16	148	1	0	226	941
05:15 PM	0	9	8	0	0	0	0	0	10	15	0	0	13	150	3	0	208	912
05:30 PM	0	14	6	0	0	0	0	0	7	17	0	0	10	137	9	0	200	875
05:45 PM	0	9	8	0	0	0	0	0	6	12	0	0	13	135	6	0	189	823

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
42	69	0	0	0	0	0	75	34	49	604	51

Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
2.4	1.4	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	6.7	5.9	2.0	2.5	0.0

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_Union_&_2nd_225588_04-21-2015.ppd
Start Date: 4/21/2015
Start Time: 6:00:00 AM
Site Code: 46015
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	UNION ST				2ND ST				UNION ST				2ND ST					
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	8	16	0	0	19	125	11	0	0	14	18	0	0	0	0	0	211	
02:15 PM	7	7	0	0	10	141	12	0	0	15	13	0	0	0	0	0	205	
02:30 PM	7	8	0	0	11	140	13	0	0	15	19	0	0	0	0	0	213	
02:45 PM	6	10	0	0	15	127	9	0	0	15	14	0	0	0	0	0	196	825
03:00 PM	9	19	0	0	17	145	13	0	0	16	19	0	0	0	0	0	238	852
03:15 PM	12	5	0	0	12	153	14	0	0	13	14	0	0	0	0	0	223	870
03:30 PM	10	22	0	0	19	137	15	0	0	14	19	0	0	0	0	0	236	893
03:45 PM	11	12	0	0	14	153	11	0	0	18	15	0	0	0	0	0	234	931
04:00 PM	11	16	0	0	20	147	11	0	0	12	21	0	0	0	0	0	238	931
04:15 PM	10	12	0	0	21	152	11	0	0	15	16	0	0	0	0	0	237	945
04:30 PM	9	28	0	0	11	137	11	0	0	17	15	0	0	0	0	0	228	937
04:45 PM	7	13	0	0	9	139	9	0	0	18	20	0	0	0	0	0	215	918
05:00 PM	13	17	0	0	8	160	16	0	0	6	17	0	0	0	0	0	237	917
05:15 PM	11	9	0	0	10	147	9	0	0	4	14	0	0	0	0	0	204	884
05:30 PM	5	13	0	0	10	109	7	0	0	7	21	0	0	0	0	0	172	828
05:45 PM	6	5	0	0	3	108	12	0	0	2	19	0	0	0	0	0	155	768

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
0	55	44	51	590	65	69	57	0	0	0	0

Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
#DIV/0!	0.0	2.3	0.0	3.1	13.8	4.3	5.3	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_Kelly_&_10th_240722_06-09-2015.ppd
Start Date: 6/9/2015
Start Time: 2:00:00 PM
Site Code: 46031
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	KELLY AVE				10TH ST				KELLY AVE				10TH ST					
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	1	18	2	0	4	18	3	0	4	33	32	0	17	11	4	0	147	
02:15 PM	2	37	6	0	11	22	3	0	2	27	40	0	16	13	5	0	184	
02:30 PM	4	21	6	0	7	17	1	0	4	43	22	0	17	11	2	0	155	
02:45 PM	2	27	4	0	7	17	4	0	2	27	26	0	13	11	3	0	143	629
03:00 PM	1	29	0	0	8	9	4	0	4	27	34	0	12	22	4	0	154	636
03:15 PM	2	39	5	0	4	18	3	0	2	40	23	0	13	19	1	0	169	621
03:30 PM	1	37	2	0	3	16	3	0	2	44	30	0	17	11	4	0	170	636
03:45 PM	1	37	12	0	2	18	1	0	1	42	32	0	21	10	3	0	180	673
04:00 PM	2	43	8	0	7	20	2	0	3	28	34	0	12	14	1	0	174	693
04:15 PM	1	23	9	0	2	12	2	0	0	36	24	0	20	12	4	0	145	669
04:30 PM	4	36	3	0	4	13	5	0	1	30	38	0	15	14	4	0	167	666
04:45 PM	5	46	2	0	6	8	2	0	5	37	25	0	14	12	2	0	164	650
05:00 PM	3	61	12	0	4	20	1	0	3	27	42	0	10	15	3	0	201	677
05:15 PM	0	39	9	0	8	4	3	0	4	23	35	0	29	14	3	0	171	703
05:30 PM	4	34	4	0	5	14	2	0	2	26	28	0	10	6	2	0	137	673
05:45 PM	2	38	4	0	4	19	3	0	1	21	23	0	14	20	2	0	151	660

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
32	156	6	9	72	16	119	154	8	9	54	63	0.0	0.0	16.7	0.0	1.4	0.0	2.5	0.0	12.5	0.0	1.9	3.2

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_Dry_Hollow_&_3_Mile_240725_06-09-2015.ppd
Start Date: 6/9/2015
Start Time: 2:00:00 PM
Site Code: 46029
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	DRY HOLLOW RD				3 MILE RD				DRY HOLLOW RD									
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	0	6	24	0	15	0	2	0	1	11	0	0	0	0	0	0	59	
02:15 PM	0	7	17	0	21	0	2	0	1	10	0	0	0	0	0	0	58	
02:30 PM	0	12	20	0	15	0	2	0	4	14	0	0	0	0	0	0	67	
02:45 PM	0	6	12	0	13	0	0	0	1	14	0	0	0	0	0	0	46	230
03:00 PM	0	7	24	0	19	0	3	0	2	10	0	0	0	0	0	0	65	236
03:15 PM	0	7	16	0	16	0	3	0	1	12	0	0	0	0	0	0	55	233
03:30 PM	0	13	16	0	16	0	4	0	2	22	0	0	0	0	0	0	73	239
03:45 PM	0	11	17	0	12	0	0	0	0	8	0	0	0	0	0	0	48	241
04:00 PM	0	7	17	0	18	0	1	0	2	16	0	0	0	0	0	0	61	237
04:15 PM	0	7	12	0	17	0	0	0	1	9	0	0	0	0	0	0	46	228
04:30 PM	0	8	14	0	14	0	1	0	1	13	0	0	0	0	0	0	51	206
04:45 PM	0	14	17	0	13	0	0	0	2	7	0	0	0	0	0	0	53	211
05:00 PM	0	13	18	0	12	0	4	0	0	8	0	0	0	0	0	0	55	205
05:15 PM	0	13	20	0	14	0	0	0	1	10	0	0	0	0	0	0	58	217
05:30 PM	0	9	13	0	14	0	1	0	0	1	0	0	0	0	0	0	38	204
05:45 PM	0	2	25	0	16	0	1	0	1	9	0	0	0	0	0	0	54	205

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
60	38	0	8	0	62	0	58	5	0	0	0	5.0	10.5	#DIV/0!	12.5	#DIV/0!	4.8	#DIV/0!	5.2	0.0	#DIV/0!	#DIV/0!	#DIV/0!

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_Dry_Hollow_&_16th_240727_06-09-2015.ppd
Start Date: 6/9/2015
Start Time: 2:00:00 PM
Site Code: 46028
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	16TH PL				DRY HOLLOW RD				19TH ST				DRY HOLLOW RD					
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	24	13	4	0	0	16	6	0	10	12	3	0	2	13	23	0	126	
02:15 PM	19	21	2	0	2	11	3	0	6	18	1	0	3	8	22	0	116	
02:30 PM	21	15	2	0	3	18	9	0	5	19	2	0	0	18	23	0	135	
02:45 PM	16	8	3	0	2	11	3	0	5	9	1	0	4	15	9	0	86	463
03:00 PM	25	8	1	0	0	21	7	0	7	20	2	0	3	14	21	0	129	466
03:15 PM	17	15	3	0	3	25	6	0	7	16	0	0	3	23	14	0	132	482
03:30 PM	18	13	5	0	3	15	2	0	6	25	8	0	2	15	23	0	135	482
03:45 PM	17	17	3	0	2	20	4	0	5	26	3	0	1	11	19	0	128	524
04:00 PM	20	12	1	0	4	19	3	0	5	16	3	0	4	17	22	0	126	521
04:15 PM	15	11	1	0	1	19	4	0	1	11	4	0	1	7	19	0	94	483
04:30 PM	18	13	3	0	1	32	2	0	7	23	3	0	3	16	18	0	139	487
04:45 PM	22	9	5	0	3	21	4	0	2	17	9	0	4	15	15	0	126	485
05:00 PM	24	13	4	0	6	18	3	0	2	16	5	0	3	19	17	0	130	489
05:15 PM	27	9	4	0	3	22	3	0	1	14	4	0	2	14	17	0	120	515
05:30 PM	21	9	3	0	6	14	1	0	3	15	4	0	1	17	17	0	111	487
05:45 PM	18	7	1	0	5	15	3	0	1	11	3	0	0	13	17	0	94	455

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
8	57	72	15	79	12	14	83	23	78	66	10	0.0	3.5	5.6	6.7	1.3	0.0	0.0	1.2	4.3	2.6	12.1	0.0

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_Dry_Hollow_&_10th_225603_04-21-2015.ppd
Start Date: 4/21/2015
Start Time: 6:00:00 AM
Site Code: 46020
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	DRY HOLLOW RD				10TH ST				DRY HOLLOW RD				10TH ST					
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	3	39	6	0	4	5	8	0	5	45	0	0	1	6	2	0	124	
02:15 PM	2	34	4	0	1	8	10	0	4	47	0	0	2	10	1	0	123	
02:30 PM	2	45	5	0	2	11	8	0	4	45	0	0	2	6	3	0	133	
02:45 PM	2	38	9	0	2	7	2	0	9	48	0	0	3	12	0	0	132	512
03:00 PM	2	40	10	0	3	16	10	0	3	45	5	0	4	10	0	0	148	536
03:15 PM	4	41	5	0	1	9	6	0	12	57	9	0	4	10	1	0	159	572
03:30 PM	4	48	10	0	2	12	3	0	8	55	4	0	3	16	4	0	169	608
03:45 PM	2	40	9	0	4	18	6	0	1	28	0	0	7	7	2	0	124	600
04:00 PM	7	46	7	0	2	18	3	0	3	47	3	0	4	12	1	0	153	605
04:15 PM	3	42	9	0	3	17	4	0	4	34	9	0	3	12	3	0	143	589
04:30 PM	0	50	13	0	3	8	0	0	4	51	6	0	4	8	2	0	149	569
04:45 PM	2	66	9	0	2	17	6	0	13	54	3	0	4	10	2	0	188	633
05:00 PM	7	57	5	0	4	16	6	0	4	54	5	0	5	10	3	0	176	656
05:15 PM	4	57	9	0	3	9	3	0	2	42	3	0	2	11	3	0	148	661
05:30 PM	5	50	7	0	4	8	4	0	4	32	4	0	0	8	5	0	131	643
05:45 PM	4	38	4	0	3	16	8	0	3	29	3	0	3	8	5	0	124	579

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
36	230	13	15	50	12	17	201	23	10	39	15

Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_Brewery_&_Hwy_30_240746_06-09-2015.ppd
Start Date: 6/9/2015
Start Time: 6:00:00 AM
Site Code: 46013
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	BREWERY RD				US 30								US 30					
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	44	0	6	0	8	56	0	0	0	0	0	0	0	64	43	0	221	
02:15 PM	55	0	3	0	11	52	0	0	0	0	0	0	0	67	50	0	238	
02:30 PM	70	0	4	0	5	38	0	0	0	0	0	0	0	70	40	0	227	
02:45 PM	60	0	9	0	3	57	0	0	0	0	0	0	0	67	58	0	254	940
03:00 PM	67	0	6	0	11	57	0	0	0	0	0	0	0	82	43	0	266	985
03:15 PM	51	0	5	0	5	54	0	0	0	0	0	0	0	78	54	0	247	994
03:30 PM	66	0	5	0	2	49	0	0	0	0	0	0	0	78	65	0	265	1032
03:45 PM	70	0	6	0	3	65	0	0	0	0	0	0	0	81	54	0	279	1057
04:00 PM	68	0	8	0	3	54	0	0	0	0	0	0	0	76	45	0	254	1045
04:15 PM	45	0	8	0	4	56	0	0	0	0	0	0	0	81	45	0	239	1037
04:30 PM	72	0	8	0	3	47	0	0	0	0	0	0	0	76	62	0	268	1040
04:45 PM	52	0	6	0	0	66	0	0	0	0	0	0	0	67	52	0	243	1004
05:00 PM	80	0	8	0	8	69	0	0	0	0	0	0	0	99	68	0	332	1082
05:15 PM	81	0	9	0	13	48	0	0	0	0	0	0	0	79	57	0	287	1130
05:30 PM	68	0	2	0	5	49	0	0	0	0	0	0	0	72	50	0	246	1108
05:45 PM	64	0	3	0	5	42	0	0	0	0	0	0	0	63	42	0	219	1084

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
31	0	285	0	230	24	0	0	0	239	321	0	6.5	#DIV/0!	3.5	#DIV/0!	1.3	0.0	#DIV/0!	#DIV/0!	#DIV/0!	0.0	0.6	#DIV/0!

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_Brewery_&_84_EB_240755_06-09-2015.ppd
Start Date: 6/11/2015
Start Time: 6:00:00 AM
Site Code: 46008
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	BREWERY RD				I-84 EB ON / OFF RAMPS				BREWERY RD				I-84 EB ON / OFF RAMPS					
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	0	32	1	0	0	0	0	0	17	36	0	0	25	0	4	0	115	
02:15 PM	0	35	1	0	0	0	0	0	31	40	0	0	22	0	1	0	130	
02:30 PM	0	35	1	0	0	0	0	0	17	43	0	0	20	0	2	0	118	
02:45 PM	0	44	1	0	0	0	0	0	21	33	0	0	26	0	3	0	128	491
03:00 PM	0	35	3	0	0	0	0	0	19	40	0	0	36	0	2	0	135	511
03:15 PM	0	39	3	0	1	0	0	0	31	38	0	0	21	0	0	0	133	514
03:30 PM	0	54	0	0	0	0	0	0	33	41	0	0	20	0	4	0	152	548
03:45 PM	0	50	1	0	0	0	0	0	24	38	0	0	26	0	2	0	141	561
04:00 PM	0	51	0	0	0	0	0	0	23	28	0	0	26	0	6	0	134	560
04:15 PM	0	33	2	0	0	0	0	0	26	27	0	0	19	3	2	0	112	539
04:30 PM	0	54	2	0	0	0	0	0	33	34	0	0	26	0	2	0	151	538
04:45 PM	0	34	0	0	0	0	0	0	23	30	0	0	27	0	1	0	115	512
05:00 PM	0	50	2	0	0	0	0	0	29	48	0	0	36	0	1	0	166	544
05:15 PM	0	52	2	0	0	0	0	0	30	43	0	0	42	0	2	0	171	603
05:30 PM	0	45	0	0	0	0	0	0	21	32	0	0	30	1	0	0	129	581
05:45 PM	0	46	2	0	0	0	0	0	18	33	0	0	24	0	3	0	126	592

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
6	190	0	0	0	0	0	155	115	6	0	131	0.0	1.1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.6	0.9	0.0	#DIV/0!	8.4

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_Riverfront_PArk_&_84_WB_240741_06-09-2015.ppd
Start Date: 6/9/2015
Start Time: 6:00:00 AM
Site Code: 46011
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	RIVERFRONT PARK RD				I-84 WB ON / OFF RAMPS				RIVERFRONT PARK RD				I-84 WB ON / OFF RAMPS					
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	3	8	0	0	1	0	26	0	0	11	27	0	0	0	0	0	76	
02:15 PM	3	8	0	0	3	0	26	0	0	11	31	0	0	0	0	0	82	
02:30 PM	6	7	0	0	1	0	30	0	0	9	34	0	0	0	0	0	87	
02:45 PM	0	8	0	0	0	0	35	0	0	12	23	0	0	0	0	0	78	323
03:00 PM	4	12	0	0	0	0	28	0	0	16	26	0	0	0	0	0	86	333
03:15 PM	2	11	0	0	2	1	28	0	0	7	28	0	0	0	0	0	79	330
03:30 PM	2	9	0	0	3	2	45	0	0	10	34	0	0	0	0	0	105	348
03:45 PM	6	9	0	0	0	0	40	0	0	13	26	0	0	0	0	0	94	364
04:00 PM	1	14	0	0	3	0	37	0	0	12	19	0	0	0	0	0	86	364
04:15 PM	6	8	0	0	2	0	27	0	0	7	21	0	0	0	0	0	71	356
04:30 PM	1	13	0	0	2	0	44	0	0	9	29	0	0	0	0	0	98	349
04:45 PM	3	9	0	0	1	0	25	0	0	7	24	0	0	0	0	0	69	324
05:00 PM	5	7	0	0	1	0	44	0	0	12	36	0	0	0	0	0	105	343
05:15 PM	0	13	0	0	0	0	41	0	0	8	37	0	0	0	0	0	99	371
05:30 PM	3	6	0	0	1	0	39	0	0	10	23	0	0	0	0	0	82	355
05:45 PM	3	9	0	0	2	0	36	0	0	9	27	0	0	0	0	0	86	372

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
0	42	9	154	0	4	126	36	0	0	0	0	#DIV/0!	0.0	0.0	2.6	#DIV/0!	0.0	0.8	0.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_Thompson_&_10th_240721_06-09-2015.ppd
Start Date: 6/9/2015
Start Time: 2:00:00 PM
Site Code: 46032
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	OLD DUFUR RD				10 ST ST				THOMPSON ST				10 ST ST					
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	15	3	1	0	0	2	0	0	0	2	7	0	10	5	17	0	62	
02:15 PM	27	10	1	0	1	3	0	0	0	1	9	0	7	1	19	0	79	
02:30 PM	39	8	0	0	0	1	0	0	0	10	10	0	11	4	17	0	100	
02:45 PM	21	5	0	0	0	2	0	0	0	8	6	0	7	3	10	0	62	303
03:00 PM	28	5	0	0	0	3	0	0	0	6	7	0	11	5	28	0	93	334
03:15 PM	36	8	1	0	1	7	1	0	3	3	7	0	7	2	22	0	98	353
03:30 PM	17	6	0	0	0	4	1	0	0	9	11	0	7	6	19	0	80	333
03:45 PM	24	4	0	0	0	2	0	0	0	6	5	0	8	2	15	0	66	337
04:00 PM	20	9	0	0	0	0	1	0	0	6	5	0	11	5	16	0	73	317
04:15 PM	15	5	0	0	0	2	0	0	1	7	3	0	12	4	19	0	68	287
04:30 PM	18	6	0	0	0	5	0	0	0	8	5	0	8	5	16	0	71	278
04:45 PM	13	9	0	0	0	4	1	0	0	9	3	0	19	7	17	0	82	294
05:00 PM	13	8	0	0	0	4	0	0	0	6	9	0	14	4	24	0	82	303
05:15 PM	17	6	1	0	0	1	0	0	1	6	12	0	21	5	21	0	91	326
05:30 PM	10	8	0	0	0	4	1	0	0	7	10	0	20	8	17	0	85	340
05:45 PM	12	6	1	0	0	8	0	0	1	3	12	0	22	3	18	0	86	344

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
1	29	61	1	14	0	29	29	1	78	21	62	0.0	0.0	4.9	0.0	0.0	#DIV/0!	0.0	0.0	0.0	0.0	0.0	0.0

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_2nd_&_Hwy_30_240719_06-09-2015.ppd
Start Date: 6/9/2015
Start Time: 2:00:00 PM
Site Code: 46033
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	2ND ST				US 30								US 30					
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	11	0	12	0	9	37	0	0	0	0	0	0	0	73	17	0	159	
02:15 PM	15	0	8	0	12	46	0	0	0	0	0	0	0	59	9	0	149	
02:30 PM	6	0	5	0	9	35	0	0	0	0	0	0	0	58	13	0	126	
02:45 PM	11	0	12	0	8	53	0	0	0	0	0	0	0	58	16	0	158	592
03:00 PM	9	0	15	0	10	43	0	0	0	0	0	0	0	68	15	0	160	593
03:15 PM	11	0	9	0	10	47	0	0	0	0	0	0	0	78	9	0	164	608
03:30 PM	7	0	6	0	20	42	0	0	0	0	0	0	0	63	14	0	152	634
03:45 PM	11	0	16	0	14	51	0	0	0	0	0	0	0	74	14	0	180	656
04:00 PM	13	0	5	0	12	40	0	0	0	0	0	0	0	67	14	0	151	647
04:15 PM	17	0	13	0	13	44	0	0	0	0	0	0	0	68	16	0	171	654
04:30 PM	11	0	9	0	8	35	0	0	0	0	0	0	0	66	15	0	144	646
04:45 PM	7	0	10	0	10	51	0	0	0	0	0	0	0	55	9	0	142	608
05:00 PM	27	0	19	0	8	36	0	0	0	0	0	0	0	88	10	0	188	645
05:15 PM	20	0	21	0	6	36	0	0	0	0	0	0	0	80	11	0	174	648
05:30 PM	8	0	14	0	3	33	0	0	0	0	0	0	0	59	16	0	133	637
05:45 PM	10	0	6	0	13	29	0	0	0	0	0	0	0	46	21	0	125	620

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
59	0	65	0	158	32	0	0	0	45	289	0	3.4	#DIV/0!	1.5	#DIV/0!	1.3	0.0	#DIV/0!	#DIV/0!	#DIV/0!	0.0	0.7	#DIV/0!

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_197_&_30_240743_06-09-2015.ppd
Start Date: 6/9/2015
Start Time: 6:00:00 AM
Site Code: 46014
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	US 197				US 30								US 30					
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	29	0	27	0	28	16	0	0	0	0	0	0	0	29	59	0	188	
02:15 PM	31	0	36	0	30	30	0	0	0	0	0	0	0	30	40	0	197	
02:30 PM	21	0	25	0	33	24	0	0	0	0	0	0	0	24	42	0	169	
02:45 PM	27	0	31	0	26	30	0	0	0	0	0	0	0	29	39	0	182	736
03:00 PM	27	0	31	0	31	27	0	0	0	0	0	0	0	37	48	0	201	749
03:15 PM	39	0	27	0	34	17	0	0	0	0	0	0	0	29	58	0	204	756
03:30 PM	33	0	33	0	48	31	0	0	0	0	0	0	0	28	41	0	214	801
03:45 PM	35	0	24	0	35	30	0	0	0	0	0	0	0	39	54	0	217	836
04:00 PM	30	0	28	0	31	21	0	0	0	0	0	0	0	36	42	0	188	823
04:15 PM	35	0	29	0	28	22	0	0	0	0	0	0	0	33	54	0	201	820
04:30 PM	18	0	25	0	28	23	0	0	0	0	0	0	0	23	52	0	169	775
04:45 PM	35	0	30	0	27	27	0	0	0	0	0	0	0	29	40	0	188	746
05:00 PM	22	0	41	0	33	16	0	0	0	0	0	0	0	43	62	0	217	775
05:15 PM	20	0	30	0	38	21	0	0	0	0	0	0	0	45	55	0	209	783
05:30 PM	16	0	30	0	32	19	0	0	0	0	0	0	0	25	48	0	170	784
05:45 PM	24	0	33	0	29	15	0	0	0	0	0	0	0	24	30	0	155	751

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
126	0	95	0	87	126	0	0	0	209	140	0	3.2	#DIV/0!	1.1	#DIV/0!	3.4	6.3	#DIV/0!	#DIV/0!	#DIV/0!	1.4	0.7	#DIV/0!

File Name: C:\Users\Clay\Documents\Work Documents\Clients\2015\ODOT\Jim Bryant\The Dalles\Regular TMC\197 & Freemont.ppd
Start Date: 6/4/2015
Start Time: 2:00:00 PM
Site Code:
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	HWY 197				FREEMONT ST				HWY 197				FREEMONT ST					
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	total	hourly total
14:00	17	31	5	0	0	9	16	0	3	23	0	0	5	4	2	0	115	
14:15	19	32	18	0	0	15	20	0	1	30	3	0	11	5	2	0	156	
14:30	17	20	11	0	0	9	21	0	6	25	1	0	9	1	7	0	127	
14:45	14	31	15	0	0	5	18	0	4	30	1	0	12	3	1	0	134	532
15:00	15	36	16	0	0	3	16	0	6	28	0	0	12	10	3	0	145	562
15:15	12	28	17	0	1	13	8	0	6	21	3	0	22	5	2	0	138	544
15:30	13	28	19	0	2	7	30	0	4	28	0	0	20	4	3	0	158	575
15:45	17	34	10	0	1	5	20	0	2	32	0	0	14	1	3	0	139	580
16:00	15	32	18	0	3	8	19	0	5	27	0	0	10	5	2	0	144	579
16:15	17	32	13	0	1	0	16	0	2	24	1	0	6	7	2	0	121	562
16:30	17	27	7	0	0	6	12	0	3	27	0	0	14	4	7	0	124	528
16:45	21	27	11	0	1	6	17	0	4	26	0	0	10	3	3	0	129	518
17:00	22	42	15	0	1	8	19	0	5	18	0	0	14	6	3	0	153	527
17:15	14	44	17	0	1	5	19	0	5	28	0	0	16	7	4	0	160	566
17:30	14	31	12	0	0	1	21	0	2	23	2	0	9	4	4	0	123	565
17:45	15	30	12	0	1	0	11	0	2	20	2	0	15	6	2	0	116	552

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
74	140	50	67	25	67	17	99	0	54	20	17	1.4	2.9	0.0	0.0	0.0	1.5	5.9	8.1	#DIV/0!	1.9	5.0	0.0

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_197_&_84_EB_240745_06-09-2015.ppd
Start Date: 6/10/2015
Start Time: 6:00:00 AM
Site Code: 33022009
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	US 197				I-84 EB ON / OFF RAMPS				US 197				I-84 EB ON / OFF RAMPS					
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	0	41	6	0	0	0	0	0	8	78	0	0	16	0	42	0	191	
02:15 PM	0	47	10	0	0	0	0	0	9	63	0	0	24	0	32	0	185	
02:30 PM	0	36	5	0	0	0	0	0	8	66	0	0	8	0	34	0	157	
02:45 PM	0	38	7	0	0	0	0	0	8	61	0	0	16	0	46	0	176	709
03:00 PM	0	49	8	0	0	0	0	0	7	70	0	0	13	2	53	0	202	720
03:15 PM	0	48	6	0	0	0	0	0	7	84	0	0	13	0	49	0	207	742
03:30 PM	0	50	9	0	0	0	0	0	10	76	0	0	18	0	52	0	215	800
03:45 PM	0	46	5	0	0	0	0	0	7	83	0	0	12	0	47	0	200	824
04:00 PM	0	42	6	0	0	0	0	0	4	68	0	0	18	0	32	0	170	792
04:15 PM	0	48	2	0	0	0	0	0	5	78	0	0	12	0	51	0	196	781
04:30 PM	0	27	9	0	0	0	0	0	7	72	0	0	20	0	64	0	199	765
04:45 PM	0	44	8	0	0	0	0	0	7	59	0	0	19	0	53	0	190	755
05:00 PM	0	45	10	0	0	0	0	0	11	87	0	0	16	0	57	0	226	811
05:15 PM	0	35	11	0	0	0	0	0	6	91	0	0	14	0	65	0	222	837
05:30 PM	0	38	7	0	0	0	0	0	8	74	0	0	10	0	45	0	182	820
05:45 PM	0	36	3	0	0	0	0	0	3	58	0	0	22	0	49	0	171	801

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
38	151	0	0	0	0	0	309	31	239	0	69

Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
13.2	2.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	2.3	3.2	5.4	#DIV/0!	1.4

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_197_&_84_WB_240744_06-09-2015.ppd
Start Date: 6/9/2015
Start Time: 6:00:00 AM
Site Code: 33012009
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	US 197				I-84 WB ON / OFF RAMPS				US 197				I-84 WB ON / OFF RAMPS					
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	68	45	0	0	26	0	3	0	0	98	18	0	0	0	0	0	258	
02:15 PM	62	53	0	0	17	0	1	0	0	81	16	0	0	0	0	0	230	
02:30 PM	81	39	0	0	23	0	3	0	1	79	18	0	0	0	0	0	244	
02:45 PM	63	40	0	0	11	0	4	0	0	96	8	0	0	0	0	0	222	954
03:00 PM	74	53	0	0	17	0	7	0	0	107	19	0	0	0	0	0	277	973
03:15 PM	78	53	0	0	17	1	2	0	0	114	18	0	0	0	0	0	283	1026
03:30 PM	71	49	0	0	13	3	9	0	0	107	23	0	0	0	0	0	275	1057
03:45 PM	83	46	0	0	8	0	4	0	0	104	26	0	0	0	0	0	271	1106
04:00 PM	62	40	0	0	22	0	7	0	0	84	19	0	0	0	0	0	234	1063
04:15 PM	53	45	0	0	11	0	6	0	0	109	14	0	0	0	0	0	238	1018
04:30 PM	68	33	0	0	18	0	1	0	0	125	13	0	0	0	0	0	258	1001
04:45 PM	67	52	0	0	17	0	7	0	0	89	17	0	0	0	0	0	249	979
05:00 PM	79	42	0	0	22	1	10	0	0	130	17	0	0	0	0	0	301	1046
05:15 PM	73	39	0	0	15	0	5	0	0	128	24	0	0	0	0	0	284	1092
05:30 PM	67	38	0	0	16	0	6	0	0	100	19	0	0	0	0	0	246	1080
05:45 PM	65	32	0	0	12	0	4	0	0	89	16	0	1	0	0	0	219	1050

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
0	166	287	23	1	72	71	472	0	0	0	0	#DIV/0!	5.4	5.6	0.0	0.0	4.2	7.0	2.8	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

File Name: C:\Users\Clay\Documents\Work Documents\Clients\2015\ODOT\Jim Bryant\The Dalles\Regular TMC\197 & Bret Clodfelter.ppd
Start Date: 6/4/2015
Start Time: 2:00:00 PM
Site Code:
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	HWY 197				BRET CLODFELTER				HWY 197				BRET CLODFELTER					
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	total	hourly total
14:00	4	90	0	0	24	0	7	0	0	98	20	0	0	0	0	0	243	
14:15	5	95	0	0	19	0	8	0	0	79	23	0	0	0	0	0	229	
14:30	3	106	0	0	13	0	8	0	0	76	19	0	0	0	0	0	225	
14:45	4	84	0	0	14	0	5	0	0	85	25	0	0	0	0	0	217	914
15:00	11	101	0	0	31	0	5	0	0	100	27	0	0	0	0	0	275	946
15:15	3	103	0	1	24	0	8	0	0	110	19	0	0	0	0	0	267	984
15:30	5	95	0	0	27	0	7	0	0	96	26	0	0	0	0	0	256	1015
15:45	3	111	0	0	14	0	8	0	0	91	18	0	0	0	0	0	245	1043
16:00	5	83	0	0	17	0	12	0	0	81	24	0	0	0	0	0	222	990
16:15	5	88	0	0	19	0	7	0	0	93	23	0	0	0	0	0	235	958
16:30	1	72	0	1	19	0	5	0	0	125	26	0	0	0	0	0	248	950
16:45	7	104	0	0	26	0	9	0	0	86	19	0	0	0	0	0	251	956
17:00	5	97	0	0	17	0	7	0	0	139	14	0	0	0	0	0	279	1013
17:15	2	82	0	0	29	0	12	0	0	123	15	0	0	0	0	0	263	1041
17:30	4	91	0	0	17	0	7	0	0	94	25	0	0	0	0	0	238	1031
17:45	1	83	0	0	14	0	4	0	0	81	18	0	0	0	0	0	201	981

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
15	355	0	33	0	33	0	473	74	0	0	0	0.0	5.4	#DIV/0!	15.2	#DIV/0!	0.0	#DIV/0!	3.2	8.1	#DIV/0!	#DIV/0!	#DIV/0!

File Name: Z:\NATHAN TMCS\2015\OR\FORMATTED\9398_-_197_&_Lone_Pine_240716_06-09-2015.ppd
Start Date: 6/9/2015
Start Time: 2:00:00 PM
Site Code: 46034
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	US 197								US 197				LONE PINE					
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	total	hourly total
02:00 PM	8	50	0	0	0	0	0	0	0	75	40	0	36	0	7	0	216	
02:15 PM	7	69	0	0	0	0	0	0	0	49	34	0	31	0	9	0	199	
02:30 PM	5	76	0	0	0	0	0	0	0	51	36	0	33	0	6	0	207	
02:45 PM	4	67	0	0	0	0	0	0	0	66	21	0	28	0	6	0	192	814
03:00 PM	3	65	0	0	0	0	0	0	0	63	37	0	32	0	4	0	204	802
03:15 PM	9	86	0	0	0	0	0	0	0	83	41	0	28	0	10	0	257	860
03:30 PM	6	68	0	0	0	0	0	0	0	74	29	0	31	0	8	0	216	869
03:45 PM	7	86	0	0	0	0	0	0	0	65	33	0	35	0	7	0	233	910
04:00 PM	9	54	0	0	0	0	0	0	0	65	28	0	36	0	8	0	200	906
04:15 PM	4	56	0	0	0	0	0	0	0	79	23	0	24	0	8	0	194	843
04:30 PM	1	55	0	0	0	0	0	0	0	86	39	0	29	0	9	0	219	846
04:45 PM	3	59	0	0	0	0	0	0	0	77	22	0	39	0	8	0	208	821
05:00 PM	3	64	0	0	0	0	0	0	0	102	34	0	42	0	5	0	250	871
05:15 PM	3	64	0	0	0	0	0	0	0	108	36	0	30	0	11	0	252	929
05:30 PM	4	54	0	0	0	0	0	0	0	79	23	0	26	0	6	0	192	902
05:45 PM	7	69	0	0	0	0	0	0	0	61	26	0	24	0	10	0	197	891

Southbound Vehicles			Westbound Vehicles			Northbound Vehicles			Eastbound Vehicles			Southbound HV %			Westbound HV %			Northbound HV %			Eastbound HV%		
Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	SB LT	SB TH	SB RT	WB LT	WB TH	WB RT	NB LT	NB TH	NB RT	EB LT	EB TH	EB RT
0	242	10	0	0	0	131	373	0	33	0	140	#DIV/0!	8.7	0.0	#DIV/0!	#DIV/0!	#DIV/0!	0.8	4.3	#DIV/0!	0.0	#DIV/0!	0.7

Appendix F Existing Traffic Conditions Worksheets

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	501	51	26	496	149	76	50	37	135	115	283
Future Volume (vph)	31	501	51	26	496	149	76	50	37	135	115	283
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0		4.0	4.0		5.0	5.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.97	1.00		0.97	1.00
Satd. Flow (prot)	1805	1857		1805	1881	1583		1784	1615		1832	1524
Flt Permitted	0.33	1.00		0.27	1.00	1.00		0.72	1.00		0.76	1.00
Satd. Flow (perm)	627	1857		513	1881	1583		1315	1615		1434	1524
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	32	516	53	27	511	154	78	52	38	139	119	292
RTOR Reduction (vph)	0	4	0	0	0	87	0	0	27	0	0	170
Lane Group Flow (vph)	32	565	0	27	511	67	0	130	11	0	258	122
Heavy Vehicles (%)	0%	1%	0%	0%	1%	2%	3%	4%	0%	1%	1%	6%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6		6	8		8	4		4
Actuated Green, G (s)	25.7	24.0		25.9	24.1	24.1		15.7	15.7		14.7	14.7
Effective Green, g (s)	25.7	24.0		25.9	24.1	24.1		15.7	15.7		14.7	14.7
Actuated g/C Ratio	0.46	0.43		0.47	0.43	0.43		0.28	0.28		0.26	0.26
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		4.0	4.0		5.0	5.0
Vehicle Extension (s)	2.0	4.5		2.5	4.5	4.5		2.5	2.5		2.0	2.0
Lane Grp Cap (vph)	326	803		281	816	687		371	456		379	403
v/s Ratio Prot	0.00	c0.30		c0.00	0.27							
v/s Ratio Perm	0.04			0.04		0.04		0.10	0.01		c0.18	0.08
v/c Ratio	0.10	0.70		0.10	0.63	0.10		0.35	0.02		0.68	0.30
Uniform Delay, d1	8.6	12.8		8.9	12.2	9.3		15.8	14.4		18.3	16.3
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.0	3.2		0.1	1.9	0.1		0.4	0.0		4.0	0.2
Delay (s)	8.7	16.1		9.0	14.1	9.4		16.3	14.4		22.3	16.5
Level of Service	A	B		A	B	A		B	B		C	B
Approach Delay (s)		15.7			12.9			15.8			19.2	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	15.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	55.5	Sum of lost time (s)	15.0
Intersection Capacity Utilization	62.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	14	76	50	338	210	73	150	70	65	34	105	38
Future Volume (vph)	14	76	50	338	210	73	150	70	65	34	105	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0		4.0	4.0		5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	
Frt	1.00	0.94		1.00	1.00	0.85		1.00	0.85		0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.97	1.00		0.99	
Satd. Flow (prot)	1805	1728		1626	1827	1553		1790	1583		1775	
Flt Permitted	0.61	1.00		0.51	1.00	1.00		0.67	1.00		0.90	
Satd. Flow (perm)	1159	1728		870	1827	1553		1242	1583		1605	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	16	86	57	384	239	83	170	80	74	39	119	43
RTOR Reduction (vph)	0	29	0	0	0	44	0	0	53	0	10	0
Lane Group Flow (vph)	16	114	0	384	239	39	0	250	21	0	191	0
Heavy Vehicles (%)	0%	1%	7%	11%	4%	4%	2%	4%	2%	6%	3%	0%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6		6	8		8	4		
Actuated Green, G (s)	17.0	16.1		34.3	28.4	28.4		17.5	17.5		16.5	
Effective Green, g (s)	17.0	16.1		34.3	28.4	28.4		17.5	17.5		16.5	
Actuated g/C Ratio	0.28	0.26		0.56	0.47	0.47		0.29	0.29		0.27	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		4.0	4.0		5.0	
Vehicle Extension (s)	2.0	4.5		2.5	4.5	4.5		2.5	2.5		2.0	
Lane Grp Cap (vph)	333	457		654	853	725		357	455		435	
v/s Ratio Prot	0.00	0.07		c0.13	0.13							
v/s Ratio Perm	0.01			c0.20		0.02		c0.20	0.01		0.12	
v/c Ratio	0.05	0.25		0.59	0.28	0.05		0.70	0.05		0.44	
Uniform Delay, d1	15.9	17.6		7.9	9.9	8.9		19.3	15.6		18.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	0.0	0.5		1.1	0.3	0.1		5.7	0.0		0.3	
Delay (s)	15.9	18.1		9.0	10.2	8.9		25.0	15.7		18.6	
Level of Service	B	B		A	B	A		C	B		B	
Approach Delay (s)		17.9			9.4			22.8			18.6	
Approach LOS		B			A			C			B	

Intersection Summary			
HCM 2000 Control Delay	14.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	60.8	Sum of lost time (s)	15.0
Intersection Capacity Utilization	64.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	89	327	123	44	227	2	162	57	37	22	102	211
Future Volume (vph)	89	327	123	44	227	2	162	57	37	22	102	211
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1752	1863	1599	1805	1900	1615	1770	1766		1805	1680	
Flt Permitted	0.45	1.00	1.00	0.42	1.00	1.00	0.26	1.00		0.69	1.00	
Satd. Flow (perm)	822	1863	1599	790	1900	1615	485	1766		1311	1680	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	98	359	135	48	249	2	178	63	41	24	112	232
RTOR Reduction (vph)	0	0	90	0	0	1	0	17	0	0	60	0
Lane Group Flow (vph)	98	359	45	48	249	1	178	87	0	24	284	0
Heavy Vehicles (%)	3%	2%	1%	0%	0%	0%	2%	2%	0%	0%	5%	0%
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8			4		
Actuated Green, G (s)	34.2	27.7	27.7	28.4	24.8	24.8	36.9	29.9		24.2	22.2	
Effective Green, g (s)	34.2	27.7	27.7	28.4	24.8	24.8	36.9	29.9		24.2	22.2	
Actuated g/C Ratio	0.41	0.33	0.33	0.34	0.30	0.30	0.44	0.36		0.29	0.27	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	2.0		2.0	2.0	
Lane Grp Cap (vph)	410	620	532	313	566	481	364	634		393	448	
v/s Ratio Prot	c0.02	c0.19		0.01	0.13		c0.06	0.05		0.00	c0.17	
v/s Ratio Perm	0.08		0.03	0.05		0.00	0.16			0.02		
v/c Ratio	0.24	0.58	0.08	0.15	0.44	0.00	0.49	0.14		0.06	0.63	
Uniform Delay, d1	15.6	22.9	19.0	18.8	23.6	20.5	15.8	18.0		21.2	26.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	1.3	0.1	0.1	0.5	0.0	0.4	0.0		0.0	2.2	
Delay (s)	15.7	24.2	19.1	18.8	24.1	20.5	16.2	18.0		21.2	29.1	
Level of Service	B	C	B	B	C	C	B	B		C	C	
Approach Delay (s)		21.7			23.3			16.9			28.6	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	22.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	83.2	Sum of lost time (s)	20.0
Intersection Capacity Utilization	66.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	604	51	0	0	0	0	76	34	42	69	0
Future Volume (vph)	50	604	51	0	0	0	0	76	34	42	69	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		4.5						4.5		4.0	4.5	
Lane Util. Factor		0.95						1.00		1.00	1.00	
Frt		0.99						0.96		1.00	1.00	
Flt Protected		1.00						1.00		0.95	1.00	
Satd. Flow (prot)		3218						1571		1630	1733	
Flt Permitted		1.00						1.00		0.95	1.00	
Satd. Flow (perm)		3218						1571		1630	1733	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	57	686	58	0	0	0	0	86	39	48	78	0
RTOR Reduction (vph)	0	7	0	0	0	0	0	19	0	0	0	0
Lane Group Flow (vph)	0	794	0	0	0	0	0	106	0	48	78	0
Heavy Vehicles (%)	2%	2%	0%	0%	0%	0%	0%	7%	6%	2%	1%	0%
Turn Type	Perm	NA						NA		Prot	NA	
Protected Phases		2						8		7	4	
Permitted Phases	2											
Actuated Green, G (s)		30.0						30.0		15.5	49.5	
Effective Green, g (s)		30.0						30.0		15.5	49.5	
Actuated g/C Ratio		0.34						0.34		0.18	0.56	
Clearance Time (s)		4.5						4.5		4.0	4.5	
Lane Grp Cap (vph)		1090						532		285	969	
v/s Ratio Prot								c0.07		c0.03	0.05	
v/s Ratio Perm		0.25										
v/c Ratio		0.73						0.20		0.17	0.08	
Uniform Delay, d1		25.7						20.7		31.0	9.0	
Progression Factor		1.00						1.00		1.00	1.00	
Incremental Delay, d2		4.3						0.8		1.3	0.2	
Delay (s)		30.0						21.6		32.3	9.2	
Level of Service		C						C		C	A	
Approach Delay (s)		30.0			0.0			21.6			18.0	
Approach LOS		C			A			C			B	

Intersection Summary			
HCM 2000 Control Delay	27.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	88.5	Sum of lost time (s)	13.0
Intersection Capacity Utilization	38.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	53	590	65	69	57	0	0	58	44
Future Volume (vph)	0	0	0	53	590	65	69	57	0	0	58	44
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width	12	12	12	12	12	12	12	16	12	12	12	12
Total Lost time (s)				4.5	4.5			4.5			4.5	
Lane Util. Factor				1.00	0.95			1.00			1.00	
Frt				1.00	0.99			1.00			0.94	
Flt Protected				0.95	1.00			0.97			1.00	
Satd. Flow (prot)				1662	3147			1848			1635	
Flt Permitted				0.95	1.00			0.81			1.00	
Satd. Flow (perm)				1662	3147			1533			1635	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	0	0	0	58	648	71	76	63	0	0	64	48
RTOR Reduction (vph)	0	0	0	0	12	0	0	0	0	0	30	0
Lane Group Flow (vph)	0	0	0	58	707	0	0	139	0	0	82	0
Heavy Vehicles (%)	0%	0%	0%	0%	3%	14%	4%	5%	0%	0%	0%	2%
Turn Type				Perm	NA		Perm	NA			NA	
Protected Phases					6			8			4	
Permitted Phases				6			8					
Actuated Green, G (s)				33.0	33.0			26.0			26.0	
Effective Green, g (s)				33.0	33.0			26.0			26.0	
Actuated g/C Ratio				0.49	0.49			0.38			0.38	
Clearance Time (s)				4.5	4.5			4.5			4.5	
Lane Grp Cap (vph)				806	1527			586			625	
v/s Ratio Prot					c0.22						0.05	
v/s Ratio Perm				0.03				c0.09				
v/c Ratio				0.07	0.46			0.24			0.13	
Uniform Delay, d1				9.3	11.6			14.3			13.7	
Progression Factor				1.00	1.00			1.00			1.00	
Incremental Delay, d2				0.2	1.0			1.0			0.4	
Delay (s)				9.5	12.6			15.2			14.1	
Level of Service				A	B			B			B	
Approach Delay (s)		0.0			12.4			15.2			14.1	
Approach LOS		A			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	13.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	68.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	41.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	5.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Traffic Vol, veh/h	108	52	29	2	3	77
Future Vol, veh/h	108	52	29	2	3	77
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	84	84	84	84	84	84
Heavy Vehicles, %	1	0	7	50	0	3
Mvmt Flow	129	62	35	2	4	92

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	37	0	-	0	355	36
Stage 1	-	-	-	-	36	-
Stage 2	-	-	-	-	319	-
Critical Hdwy	4.11	-	-	-	6.4	6.23
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.209	-	-	-	3.5	3.327
Pot Cap-1 Maneuver	1580	-	-	-	647	1034
Stage 1	-	-	-	-	992	-
Stage 2	-	-	-	-	741	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1580	-	-	-	592	1034
Mov Cap-2 Maneuver	-	-	-	-	592	-
Stage 1	-	-	-	-	992	-
Stage 2	-	-	-	-	678	-

Approach	EB	WB	SB
HCM Control Delay, s	5	0	9
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1580	-	-	-	1006
HCM Lane V/C Ratio	0.081	-	-	-	0.095
HCM Control Delay (s)	7.5	0	-	-	9
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0.3	-	-	-	0.3

Intersection	
Int Delay, s/veh	6.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	310	15	50	187	19	44
Future Vol, veh/h	310	15	50	187	19	44
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	Yield	-	None
Storage Length	150	0	-	-	300	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	87	87	87	87	87	87
Heavy Vehicles, %	4	0	2	6	7	0
Mvmt Flow	356	17	57	215	22	51

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	151	57	0	0	57	0
Stage 1	57	-	-	-	-	-
Stage 2	94	-	-	-	-	-
Critical Hdwy	6.44	6.2	-	-	4.17	-
Critical Hdwy Stg 1	5.44	-	-	-	-	-
Critical Hdwy Stg 2	5.44	-	-	-	-	-
Follow-up Hdwy	3.536	3.3	-	-	2.263	-
Pot Cap-1 Maneuver	836	1015	-	-	1516	-
Stage 1	960	-	-	-	-	-
Stage 2	925	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	824	1015	-	-	1516	-
Mov Cap-2 Maneuver	824	-	-	-	-	-
Stage 1	960	-	-	-	-	-
Stage 2	912	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.5	0	2.2
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	824	1015	1516	-
HCM Lane V/C Ratio	-	-	0.432	0.017	0.014	-
HCM Control Delay (s)	-	-	12.7	8.6	7.4	-
HCM Lane LOS	-	-	B	A	A	-
HCM 95th %tile Q(veh)	-	-	2.2	0.1	0	-

Intersection	
Int Delay, s/veh	4.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	0	151	55	26	141	0	0	0	0	14	1	184
Future Vol, veh/h	0	151	55	26	141	0	0	0	0	14	1	184
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Free	-	-	None	-	-	None	-	-	Stop
Storage Length	-	-	-	115	-	-	-	-	-	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	82	82	82	82	82	82	82	82	82	82	82	82
Heavy Vehicles, %	0	6	6	0	3	0	0	0	0	31	0	6
Mvmt Flow	0	184	67	32	172	0	0	0	0	17	1	224

Major/Minor	Major1			Major2						Minor2		
Conflicting Flow All	172	0	-	184	0	0				419	419	172
Stage 1	-	-	-	-	-	-				235	235	-
Stage 2	-	-	-	-	-	-				184	184	-
Critical Hdwy	4.1	-	-	4.1	-	-				6.71	6.5	6.26
Critical Hdwy Stg 1	-	-	-	-	-	-				5.71	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-				5.71	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-				3.779	4	3.354
Pot Cap-1 Maneuver	1417	-	0	1403	-	-				539	528	861
Stage 1	-	-	0	-	-	-				740	714	-
Stage 2	-	-	0	-	-	-				782	751	-
Platoon blocked, %		-			-	-						
Mov Cap-1 Maneuver	1417	-	-	1403	-	-				527	0	861
Mov Cap-2 Maneuver	-	-	-	-	-	-				527	0	-
Stage 1	-	-	-	-	-	-				723	0	-
Stage 2	-	-	-	-	-	-				782	0	-

Approach	EB	WB	SB
HCM Control Delay, s	0	1.2	10.7
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1417	-	1403	-	-	527	861
HCM Lane V/C Ratio	-	-	0.023	-	-	0.035	0.261
HCM Control Delay (s)	0	-	7.6	-	-	12.1	10.6
HCM Lane LOS	A	-	A	-	-	B	B
HCM 95th %tile Q(veh)	0	-	0.1	-	-	0.1	1

Intersection	
Int Delay, s/veh	5.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	127	38	0	0	94	43	73	0	3	0	0	0
Future Vol, veh/h	127	38	0	0	94	43	73	0	3	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	160	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	79	79	79	79	79	79	79	79	79	79	79	79
Heavy Vehicles, %	5	18	0	0	0	7	3	0	67	0	0	0
Mvmt Flow	161	48	0	0	119	54	92	0	4	0	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	173	0	0	48	0	0	516	543	48
Stage 1	-	-	-	-	-	-	370	370	-
Stage 2	-	-	-	-	-	-	146	173	-
Critical Hdwy	4.15	-	-	4.1	-	-	6.43	6.5	6.87
Critical Hdwy Stg 1	-	-	-	-	-	-	5.43	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.43	5.5	-
Follow-up Hdwy	2.245	-	-	2.2	-	-	3.527	4	3.903
Pot Cap-1 Maneuver	1386	-	-	1572	-	-	517	450	864
Stage 1	-	-	-	-	-	-	696	624	-
Stage 2	-	-	-	-	-	-	879	760	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1386	-	-	1572	-	-	457	0	864
Mov Cap-2 Maneuver	-	-	-	-	-	-	457	0	-
Stage 1	-	-	-	-	-	-	615	0	-
Stage 2	-	-	-	-	-	-	879	0	-

Approach	EB	WB	NB
HCM Control Delay, s	6.1	0	14.7
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR
Capacity (veh/h)	466	1386	-	-	1572	-	-
HCM Lane V/C Ratio	0.206	0.116	-	-	-	-	-
HCM Control Delay (s)	14.7	7.9	-	-	0	-	-
HCM Lane LOS	B	A	-	-	A	-	-
HCM 95th %tile Q(veh)	0.8	0.4	-	-	0	-	-

Intersection	
Int Delay, s/veh	1.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	23	23	135	32	14	124
Future Vol, veh/h	23	23	135	32	14	124
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	0	0	1	0	0	2
Mvmt Flow	28	28	165	39	17	151

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	369	184	0	0	204	0
Stage 1	184	-	-	-	-	-
Stage 2	185	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	635	864	-	-	1380	-
Stage 1	852	-	-	-	-	-
Stage 2	852	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	627	864	-	-	1380	-
Mov Cap-2 Maneuver	627	-	-	-	-	-
Stage 1	852	-	-	-	-	-
Stage 2	841	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.4	0	0.8
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	727	1380	-
HCM Lane V/C Ratio	-	-	0.077	0.012	-
HCM Control Delay (s)	-	-	10.4	7.6	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Intersection	
Int Delay, s/veh	7.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	5	2	47	7	4	0	121	3	2	0	4	5
Future Vol, veh/h	5	2	47	7	4	0	121	3	2	0	4	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	75	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	84	84	84	84	84	84	84	84	84	84	84	84
Heavy Vehicles, %	0	50	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	6	2	56	8	5	0	144	4	2	0	5	6

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	302	300	8	329	303	4	11	0	0	4	0	0
Stage 1	8	8	-	292	292	-	-	-	-	-	-	-
Stage 2	294	292	-	37	11	-	-	-	-	-	-	-
Critical Hdwy	7.1	7	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	6	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	6	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4.45	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	654	540	1080	628	613	1085	1621	-	-	1631	-	-
Stage 1	1019	802	-	720	675	-	-	-	-	-	-	-
Stage 2	719	592	-	984	890	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	606	492	1080	553	558	1085	1621	-	-	1631	-	-
Mov Cap-2 Maneuver	606	492	-	553	558	-	-	-	-	-	-	-
Stage 1	928	802	-	656	615	-	-	-	-	-	-	-
Stage 2	650	539	-	930	890	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9	11.6	7.1	0
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1621	-	-	967	555	1631	-	-
HCM Lane V/C Ratio	0.089	-	-	0.066	0.024	-	-	-
HCM Control Delay (s)	7.4	0	-	9	11.6	0	-	-
HCM Lane LOS	A	A	-	A	B	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	0.2	0.1	0	-	-

Intersection	
Int Delay, s/veh	2.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	48	33	665	190	139	535
Future Vol, veh/h	48	33	665	190	139	535
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	125	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	0	3	2	2	1	0
Mvmt Flow	51	35	700	200	146	563

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1656	800	0	0	900	0
Stage 1	800	-	-	-	-	-
Stage 2	856	-	-	-	-	-
Critical Hdwy	6.4	6.23	-	-	4.11	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.327	-	-	2.209	-
Pot Cap-1 Maneuver	109	383	-	-	759	-
Stage 1	446	-	-	-	-	-
Stage 2	420	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	88	383	-	-	759	-
Mov Cap-2 Maneuver	215	-	-	-	-	-
Stage 1	446	-	-	-	-	-
Stage 2	339	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	25.2	0	2.2
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	262	759	-
HCM Lane V/C Ratio	-	-	0.325	0.193	-
HCM Control Delay (s)	-	-	25.2	10.9	-
HCM Lane LOS	-	-	D	B	-
HCM 95th %tile Q(veh)	-	-	1.4	0.7	-

Intersection	
Int Delay, s/veh	3.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	54	100	275	36	67	223
Future Vol, veh/h	54	100	275	36	67	223
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	175	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	1	2	2	0	0	2
Mvmt Flow	57	106	293	38	71	237

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	692	312	0	0	331	0
Stage 1	312	-	-	-	-	-
Stage 2	380	-	-	-	-	-
Critical Hdwy	6.41	6.22	-	-	4.1	-
Critical Hdwy Stg 1	5.41	-	-	-	-	-
Critical Hdwy Stg 2	5.41	-	-	-	-	-
Follow-up Hdwy	3.509	3.318	-	-	2.2	-
Pot Cap-1 Maneuver	411	728	-	-	1240	-
Stage 1	744	-	-	-	-	-
Stage 2	694	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	384	728	-	-	1240	-
Mov Cap-2 Maneuver	384	-	-	-	-	-
Stage 1	744	-	-	-	-	-
Stage 2	648	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.6	0	1.9
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	384	728	1240	-
HCM Lane V/C Ratio	-	-	0.15	0.146	0.057	-
HCM Control Delay (s)	-	-	16	10.8	8.1	0
HCM Lane LOS	-	-	C	B	A	A
HCM 95th %tile Q(veh)	-	-	0.5	0.5	0.2	-

Intersection	
Int Delay, s/veh	2.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	56	25	88	58	24	109
Future Vol, veh/h	56	25	88	58	24	109
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	5	16	3	10	8	1
Mvmt Flow	58	26	91	60	25	112

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	283	121	0	0	151	0
Stage 1	121	-	-	-	-	-
Stage 2	162	-	-	-	-	-
Critical Hdwy	6.45	6.36	-	-	4.18	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	3.444	-	-	2.272	-
Pot Cap-1 Maneuver	701	894	-	-	1394	-
Stage 1	897	-	-	-	-	-
Stage 2	860	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	688	894	-	-	1394	-
Mov Cap-2 Maneuver	688	-	-	-	-	-
Stage 1	897	-	-	-	-	-
Stage 2	844	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.5	0	1.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	741	1394	-
HCM Lane V/C Ratio	-	-	0.113	0.018	-
HCM Control Delay (s)	-	-	10.5	7.6	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0.1	-

Intersection	
Intersection Delay, s/veh	16.1
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Traffic Vol, veh/h	0	69	215	28	0	36	283	102	0	11	40	13
Future Vol, veh/h	0	69	215	28	0	36	283	102	0	11	40	13
Peak Hour Factor	0.92	0.84	0.84	0.84	0.92	0.84	0.84	0.84	0.92	0.84	0.84	0.84
Heavy Vehicles, %	2	1	4	0	2	8	2	1	2	9	3	15
Mvmt Flow	0	82	256	33	0	43	337	121	0	13	48	15
Number of Lanes	0	0	1	1	0	0	1	1	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	2	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	2
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	2
HCM Control Delay	17	17.4	11.1
HCM LOS	C	C	B

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1
Vol Left, %	17%	24%	0%	11%	0%	40%
Vol Thru, %	62%	76%	0%	89%	0%	31%
Vol Right, %	20%	0%	100%	0%	100%	29%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	64	284	28	319	102	175
LT Vol	11	69	0	36	0	70
Through Vol	40	215	0	283	0	54
RT Vol	13	0	28	0	102	51
Lane Flow Rate	76	338	33	380	121	208
Geometry Grp	2	7	7	7	7	2
Degree of Util (X)	0.146	0.59	0.051	0.653	0.179	0.365
Departure Headway (Hd)	6.913	6.287	5.503	6.188	5.315	6.309
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	522	571	646	581	670	567
Service Time	4.913	4.061	3.276	3.956	3.083	4.394
HCM Lane V/C Ratio	0.146	0.592	0.051	0.654	0.181	0.367
HCM Control Delay	11.1	17.8	8.6	20	9.3	13
HCM Lane LOS	B	C	A	C	A	B
HCM 95th-tile Q	0.5	3.8	0.2	4.7	0.6	1.7

Intersection				
Intersection Delay, s/veh				
Intersection LOS				

Movement	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	0	70	54	51
Future Vol, veh/h	0	70	54	51
Peak Hour Factor	0.92	0.84	0.84	0.84
Heavy Vehicles, %	2	3	2	0
Mvmt Flow	0	83	64	61
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	2
HCM Control Delay	13
HCM LOS	B

Lane

Intersection	
Int Delay, s/veh	3.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	15	51	73	18	46	102
Future Vol, veh/h	15	51	73	18	46	102
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	75	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	7	12	4	11	2	4
Mvmt Flow	16	54	77	19	48	107

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	290	86	0	0	96	0
Stage 1	86	-	-	-	-	-
Stage 2	204	-	-	-	-	-
Critical Hdwy	6.47	6.32	-	-	4.12	-
Critical Hdwy Stg 1	5.47	-	-	-	-	-
Critical Hdwy Stg 2	5.47	-	-	-	-	-
Follow-up Hdwy	3.563	3.408	-	-	2.218	-
Pot Cap-1 Maneuver	690	946	-	-	1498	-
Stage 1	925	-	-	-	-	-
Stage 2	818	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	667	946	-	-	1498	-
Mov Cap-2 Maneuver	667	-	-	-	-	-
Stage 1	925	-	-	-	-	-
Stage 2	790	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.3	0	2.3
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	667	946	1498	-
HCM Lane V/C Ratio	-	-	0.024	0.057	0.032	-
HCM Control Delay (s)	-	-	10.5	9	7.5	0
HCM Lane LOS	-	-	B	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0.2	0.1	-

Intersection	
Intersection Delay, s/veh	18
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Traffic Vol, veh/h	0	5	227	111	0	39	228	2	0	116	25	47
Future Vol, veh/h	0	5	227	111	0	39	228	2	0	116	25	47
Peak Hour Factor	0.92	0.77	0.77	0.77	0.92	0.77	0.77	0.77	0.92	0.77	0.77	0.77
Heavy Vehicles, %	2	4	2	0	2	50	2	3	2	2	4	5
Mvmt Flow	0	6	295	144	0	51	296	3	0	151	32	61
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	19.3	20.3	14.1
HCM LOS	C	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	62%	1%	14%	6%
Vol Thru, %	13%	66%	85%	92%
Vol Right, %	25%	32%	1%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	188	343	269	51
LT Vol	116	5	39	3
Through Vol	25	227	228	47
RT Vol	47	111	2	1
Lane Flow Rate	244	445	349	66
Geometry Grp	1	1	1	1
Degree of Util (X)	0.428	0.675	0.632	0.128
Departure Headway (Hd)	6.307	5.455	6.514	6.943
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	566	655	552	519
Service Time	4.407	3.539	4.603	4.943
HCM Lane V/C Ratio	0.431	0.679	0.632	0.127
HCM Control Delay	14.1	19.3	20.3	11
HCM Lane LOS	B	C	C	B
HCM 95th-tile Q	2.1	5.2	4.4	0.4

Intersection				
Intersection Delay, s/veh				
Intersection LOS				

Movement	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	0	3	47	1
Future Vol, veh/h	0	3	47	1
Peak Hour Factor	0.92	0.77	0.77	0.77
Heavy Vehicles, %	2	0	9	0
Mvmt Flow	0	4	61	1
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	11
HCM LOS	B

Lane

Intersection	
Intersection Delay, s/veh	10.7
Intersection LOS	B

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	0	28	177	13	0	12	253	52	0	23	51	4	0	62	59	24
Future Vol, veh/h	0	28	177	13	0	12	253	52	0	23	51	4	0	62	59	24
Peak Hour Factor	0.92	0.95	0.95	0.95	0.92	0.95	0.95	0.95	0.92	0.95	0.95	0.95	0.92	0.95	0.95	0.95
Heavy Vehicles, %	2	0	5	0	2	0	3	0	2	4	4	0	2	0	2	0
Mvmt Flow	0	29	186	14	0	13	266	55	0	24	54	4	0	65	62	25
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	10.3	11.5	9.5	10
HCM LOS	B	B	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	13%	4%	43%
Vol Thru, %	65%	81%	80%	41%
Vol Right, %	5%	6%	16%	17%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	78	218	317	145
LT Vol	23	28	12	62
Through Vol	51	177	253	59
RT Vol	4	13	52	24
Lane Flow Rate	82	229	334	153
Geometry Grp	1	1	1	1
Degree of Util (X)	0.129	0.313	0.437	0.23
Departure Headway (Hd)	5.665	5.018	4.717	5.424
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	636	721	754	665
Service Time	3.67	3.018	2.81	3.428
HCM Lane V/C Ratio	0.129	0.318	0.443	0.23
HCM Control Delay	9.5	10.3	11.5	10
HCM Lane LOS	A	B	B	A
HCM 95th-tile Q	0.4	1.3	2.2	0.9

Intersection	
Int Delay, s/veh	6.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	9	54	63	9	72	16	119	154	8	32	156	6
Future Vol, veh/h	9	54	63	9	72	16	119	154	8	32	156	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	98	98	98	98	98	98	98	98	98	98	98	98
Heavy Vehicles, %	0	2	3	0	1	0	3	0	13	0	0	17
Mvmt Flow	9	55	64	9	73	16	121	157	8	33	159	6

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	677	636	162	691	635	161	165	0	0	165	0	0
Stage 1	228	228	-	404	404	-	-	-	-	-	-	-
Stage 2	449	408	-	287	231	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.52	6.23	7.1	6.51	6.2	4.13	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.52	-	6.1	5.51	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.52	-	6.1	5.51	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4.018	3.327	3.5	4.009	3.3	2.227	-	-	2.2	-	-
Pot Cap-1 Maneuver	369	395	880	362	397	889	1407	-	-	1426	-	-
Stage 1	779	715	-	627	601	-	-	-	-	-	-	-
Stage 2	593	597	-	725	715	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	277	348	880	269	350	889	1407	-	-	1426	-	-
Mov Cap-2 Maneuver	277	348	-	269	350	-	-	-	-	-	-	-
Stage 1	705	696	-	567	544	-	-	-	-	-	-	-
Stage 2	456	540	-	603	696	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	15.1	17.9	3.3	1.3
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1407	-	-	486	377	1426	-	-
HCM Lane V/C Ratio	0.086	-	-	0.265	0.263	0.023	-	-
HCM Control Delay (s)	7.8	0	-	15.1	17.9	7.6	0	-
HCM Lane LOS	A	A	-	C	C	A	A	-
HCM 95th %tile Q(veh)	0.3	-	-	1.1	1	0.1	-	-

Intersection	
Int Delay, s/veh	2.9

Movement	NBL	NBT	SBT	SBR	NEL	NER
Traffic Vol, veh/h	8	62	60	38	58	5
Future Vol, veh/h	8	62	60	38	58	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	67	65	41	63	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	107	0	-	0	171	86
Stage 1	-	-	-	-	86	-
Stage 2	-	-	-	-	85	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1484	-	-	-	819	973
Stage 1	-	-	-	-	937	-
Stage 2	-	-	-	-	938	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1484	-	-	-	814	973
Mov Cap-2 Maneuver	-	-	-	-	814	-
Stage 1	-	-	-	-	937	-
Stage 2	-	-	-	-	932	-

Approach	NB	SB	NE
HCM Control Delay, s	0.9	0	9.8
HCM LOS			A

Minor Lane/Major Mvmt	NELn1	NBL	NBT	SBT	SBR
Capacity (veh/h)	825	1484	-	-	-
HCM Lane V/C Ratio	0.083	0.006	-	-	-
HCM Control Delay (s)	9.8	7.4	0	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.3	0	-	-	-

Intersection	
Intersection Delay, s/veh	8.5
Intersection LOS	A

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Traffic Vol, veh/h	0	0	66	10	0	15	79	12	0	14	83	23
Future Vol, veh/h	0	0	66	10	0	15	79	12	0	14	83	23
Peak Hour Factor	0.92	0.81	0.81	0.81	0.92	0.81	0.81	0.81	0.92	0.81	0.81	0.81
Heavy Vehicles, %	2	3	12	0	2	7	1	0	2	0	1	4
Mvmt Flow	0	0	81	12	0	19	98	15	0	17	102	28
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	8.4	8.6	8.5
HCM LOS	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	12%	0%	14%	12%
Vol Thru, %	69%	87%	75%	88%
Vol Right, %	19%	13%	11%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	120	76	106	65
LT Vol	14	0	15	8
Through Vol	83	66	79	57
RT Vol	23	10	12	0
Lane Flow Rate	148	94	131	80
Geometry Grp	1	1	1	1
Degree of Util (X)	0.183	0.123	0.168	0.103
Departure Headway (Hd)	4.44	4.708	4.619	4.631
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	809	761	776	774
Service Time	2.465	2.737	2.647	2.66
HCM Lane V/C Ratio	0.183	0.124	0.169	0.103
HCM Control Delay	8.5	8.4	8.6	8.2
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.7	0.4	0.6	0.3

Intersection				
Intersection Delay, s/veh				
Intersection LOS				

Movement	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	0	8	57	0
Future Vol, veh/h	0	8	57	0
Peak Hour Factor	0.92	0.81	0.81	0.81
Heavy Vehicles, %	2	0	4	6
Mvmt Flow	0	10	70	0
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	8.2
HCM LOS	A

Lane

Intersection	
Int Delay, s/veh	3.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	10	39	15	15	50	12	17	201	23	36	230	13
Future Vol, veh/h	10	39	15	15	50	12	17	201	23	36	230	13
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	50	-	-	250	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	10	41	16	16	52	13	18	209	24	38	240	14

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	610	590	246	606	585	221	253	0	0	233	0	0
Stage 1	321	321	-	257	257	-	-	-	-	-	-	-
Stage 2	289	269	-	349	328	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	409	423	798	412	426	824	1324	-	-	1346	-	-
Stage 1	695	655	-	752	699	-	-	-	-	-	-	-
Stage 2	723	690	-	671	651	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	352	405	798	361	408	824	1324	-	-	1346	-	-
Mov Cap-2 Maneuver	352	405	-	361	408	-	-	-	-	-	-	-
Stage 1	686	637	-	742	689	-	-	-	-	-	-	-
Stage 2	649	681	-	599	633	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	14.5	15.3	0.5	1
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1324	-	-	446	431	1346	-	-
HCM Lane V/C Ratio	0.013	-	-	0.149	0.186	0.028	-	-
HCM Control Delay (s)	7.8	-	-	14.5	15.3	7.8	-	-
HCM Lane LOS	A	-	-	B	C	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.5	0.7	0.1	-	-

Intersection	
Int Delay, s/veh	5.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Traffic Vol, veh/h	256	343	246	26	33	305
Future Vol, veh/h	256	343	246	26	33	305
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	175	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	301	404	289	31	39	359

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	320	0	-	0	1311	305
Stage 1	-	-	-	-	305	-
Stage 2	-	-	-	-	1006	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1251	-	-	-	177	740
Stage 1	-	-	-	-	752	-
Stage 2	-	-	-	-	357	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1251	-	-	-	134	740
Mov Cap-2 Maneuver	-	-	-	-	134	-
Stage 1	-	-	-	-	752	-
Stage 2	-	-	-	-	271	-

Approach	EB	WB	SB
HCM Control Delay, s	3.8	0	13.5
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1251	-	-	-	820
HCM Lane V/C Ratio	0.241	-	-	-	0.485
HCM Control Delay (s)	8.8	-	-	-	13.5
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0.9	-	-	-	2.7

Intersection	
Int Delay, s/veh	2.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	7	0	140	0	0	0	0	167	123	6	204	0
Future Vol, veh/h	7	0	140	0	0	0	0	167	123	6	204	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	0	0	8	0	0	0	0	1	1	0	1	0
Mvmt Flow	8	0	159	0	0	0	0	190	140	7	232	0

Major/Minor	Minor2			Major1			Major2		
Conflicting Flow All	505	575	232	232	0	0	330	0	0
Stage 1	245	245	-	-	-	-	-	-	-
Stage 2	260	330	-	-	-	-	-	-	-
Critical Hdwy	6.4	6.5	6.28	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	5.4	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.4	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.372	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	530	431	792	1348	-	-	1241	-	-
Stage 1	800	707	-	-	-	-	-	-	-
Stage 2	788	649	-	-	-	-	-	-	-
Platoon blocked, %					-	-		-	-
Mov Cap-1 Maneuver	527	0	792	1348	-	-	1241	-	-
Mov Cap-2 Maneuver	527	0	-	-	-	-	-	-	-
Stage 1	795	0	-	-	-	-	-	-	-
Stage 2	788	0	-	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.9	0	0.2
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	SBL	SBT	SBR
Capacity (veh/h)	1348	-	-	773	1241	-	-
HCM Lane V/C Ratio	-	-	-	0.216	0.005	-	-
HCM Control Delay (s)	0	-	-	10.9	7.9	0	-
HCM Lane LOS	A	-	-	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.8	0	-	-

Intersection	
Int Delay, s/veh	5.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	0	0	0	165	0	4	135	39	0	0	45	10
Future Vol, veh/h	0	0	0	165	0	4	135	39	0	0	45	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	0	0	0	3	0	0	1	0	0	0	0	0
Mvmt Flow	0	0	0	188	0	5	153	44	0	0	51	11

Major/Minor	Minor1			Major1			Minor2		
Conflicting Flow All	382	351	44	0	0	0	353	351	0
Stage 1	351	351	-	-	-	-	0	0	-
Stage 2	31	0	-	-	-	-	353	351	-
Critical Hdwy	6.43	6.5	6.2	-	-	-	6.4	6.5	-
Critical Hdwy Stg 1	5.43	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.4	5.5	-
Follow-up Hdwy	3.527	4	3.3	-	-	-	3.5	4	-
Pot Cap-1 Maneuver	618	577	1032	-	-	-	649	577	-
Stage 1	710	636	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	716	636	-
Platoon blocked, %					-	-			
Mov Cap-1 Maneuver	618	0	1032	-	-	-	649	0	-
Mov Cap-2 Maneuver	618	0	-	-	-	-	649	0	-
Stage 1	710	0	-	-	-	-	-	0	-
Stage 2	-	0	-	-	-	-	716	0	-

Approach	WB	NB	SB
HCM Control Delay, s	13.3		
HCM LOS	B		-

Minor Lane/Major Mvmt	NBL	NBT	NBR	WBLn1	SBLn1
Capacity (veh/h)	-	-	-	624	-
HCM Lane V/C Ratio	-	-	-	0.308	-
HCM Control Delay (s)	-	-	-	13.3	-
HCM Lane LOS	-	-	-	B	-
HCM 95th %tile Q(veh)	-	-	-	1.3	-

Intersection	
Int Delay, s/veh	3.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR	SEL	SER
Traffic Vol, veh/h	78	62	1	29	29	61	0	1
Future Vol, veh/h	78	62	1	29	29	61	0	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	-	-	-
Storage Length	0	-	0	-	-	0	-	0
Veh in Median Storage, #	0	-	-	0	0	-	0	-
Grade, %	0	-	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	0	5	0	0
Mvmt Flow	87	69	1	32	32	68	0	1

Major/Minor	Major1		Minor1		Major2		Minor2	
Conflicting Flow All	69	0	309	301	0	0	317	68
Stage 1	-	-	168	168	-	-	133	-
Stage 2	-	-	141	133	-	-	184	-
Critical Hdwy	4.1	-	7.1	6.5	-	-	7.1	6.2
Critical Hdwy Stg 1	-	-	6.1	5.5	-	-	6.1	-
Critical Hdwy Stg 2	-	-	6.1	5.5	-	-	6.1	-
Follow-up Hdwy	2.2	-	3.5	4	-	-	3.5	3.3
Pot Cap-1 Maneuver	1545	-	647	615	-	-	640	1001
Stage 1	-	-	839	763	-	-	875	-
Stage 2	-	-	867	790	-	-	822	-
Platoon blocked, %		-			-	-		
Mov Cap-1 Maneuver	1545	-	617	591	-	-	599	1001
Mov Cap-2 Maneuver	-	-	617	591	-	-	599	-
Stage 1	-	-	826	751	-	-	861	-
Stage 2	-	-	833	772	-	-	780	-

Approach	EB	NB	SB	SE
HCM Control Delay, s	1	10.3	2.4	8.8
HCM LOS		B		A

Minor Lane/Major Mvmt	NBLn1	EBL2	EBL	EBR	SELn1	SBT	SBR	SBR2
Capacity (veh/h)	740	1545	-	-	952	1436	-	-
HCM Lane V/C Ratio	0.089	0.015	-	-	0.018	0.022	-	-
HCM Control Delay (s)	10.3	7.4	0	-	8.8	7.6	0	-
HCM Lane LOS	B	A	A	-	A	A	A	-
HCM 95th %tile Q(veh)	0.3	0	-	-	0.1	0.1	-	-

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Traffic Vol, veh/h	0	0	0	0	174	0	0	0	48	0	0	0
Future Vol, veh/h	0	0	0	0	174	0	0	0	48	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	92	92	92	92	92	92
Heavy Vehicles, %	0	1	0	0	1	0	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	202	0	0	0	52	0	0	0

Major/Minor	Major2			Minor1		
Conflicting Flow All	0	0	0	202	202	0
Stage 1	-	-	-	0	0	-
Stage 2	-	-	-	202	202	-
Critical Hdwy	-	-	-	7.12	6.52	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	6.12	5.52	-
Follow-up Hdwy	-	-	-	3.518	4.018	-
Pot Cap-1 Maneuver	-	-	-	756	694	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	800	734	-
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	-	-	-	756	0	-
Mov Cap-2 Maneuver	-	-	-	756	0	-
Stage 1	-	-	-	-	0	-
Stage 2	-	-	-	800	0	-

Approach	WB	NE
HCM Control Delay, s	0	
HCM LOS		-

Minor Lane/Major Mvmt	NELn1	WBL	WBT	WBR
Capacity (veh/h)	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-
HCM Control Delay (s)	-	0	-	-
HCM Lane LOS	-	A	-	-
HCM 95th %tile Q(veh)	-	-	-	-

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBR	SBL	SBR	NWL	NWR
Traffic Vol, veh/h	240	161	145	109	100	0
Future Vol, veh/h	240	161	145	109	100	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Stop	Stop	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	175	0	0	100	0	-
Veh in Median Storage, #	0	-	0	-	0	-
Grade, %	0	-	0	-	0	-
Peak Hour Factor	90	90	90	90	92	92
Heavy Vehicles, %	1	0	3	1	2	2
Mvmt Flow	267	179	161	121	109	0

Major/Minor	Major1		Minor2		Major2	
Conflicting Flow All	0	0	0	0	0	-
Stage 1	-	-	0	-	-	-
Stage 2	-	-	0	-	-	-
Critical Hdwy	-	-	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	-
Pot Cap-1 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Platoon blocked, %		-				-
Mov Cap-1 Maneuver	-	-	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	SB	NW
HCM Control Delay, s			
HCM LOS		-	

Minor Lane/Major Mvmt	NWL	NWR	EBL	EBR	SBLn1	SBLn2
Capacity (veh/h)	-	-	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-	-
HCM Control Delay (s)	-	-	-	-	-	-
HCM Lane LOS	-	-	-	-	-	-
HCM 95th %tile Q(veh)	-	-	-	-	-	-

Intersection	
Int Delay, s/veh	8.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	60	23	20	77	29	75	20	110	0	86	162	58
Future Vol, veh/h	60	23	20	77	29	75	20	110	0	86	162	58
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	175	-	-	260	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	0	5	2	1	0	0	0	8	6	0	3	1
Mvmt Flow	68	26	23	88	33	85	23	125	0	98	184	66

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	643	583	217	607	615	125	250	0	0	125	0	0
Stage 1	413	413	-	170	170	-	-	-	-	-	-	-
Stage 2	230	170	-	437	445	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.55	6.22	7.11	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.55	-	6.11	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.55	-	6.11	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4.045	3.318	3.509	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	389	420	823	410	409	931	1327	-	-	1474	-	-
Stage 1	620	588	-	834	762	-	-	-	-	-	-	-
Stage 2	777	752	-	600	578	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	309	385	823	354	375	931	1327	-	-	1474	-	-
Mov Cap-2 Maneuver	309	385	-	354	375	-	-	-	-	-	-	-
Stage 1	609	549	-	820	749	-	-	-	-	-	-	-
Stage 2	663	739	-	519	540	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	19.2	17.9	1.2	2.1
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1327	-	-	370	482	1474	-	-
HCM Lane V/C Ratio	0.017	-	-	0.316	0.427	0.066	-	-
HCM Control Delay (s)	7.8	-	-	19.2	17.9	7.6	-	-
HCM Lane LOS	A	-	-	C	C	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	1.3	2.1	0.2	-	-

Intersection	
Int Delay, s/veh	13.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	256	0	92	0	0	0	0	352	33	41	162	0
Future Vol, veh/h	256	0	92	0	0	0	0	352	33	41	162	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	5	0	1	0	0	0	0	2	3	13	2	0
Mvmt Flow	275	0	99	0	0	0	0	378	35	44	174	0

Major/Minor	Minor2			Major1			Major2		
Conflicting Flow All	658	676	174	174	0	0	414	0	0
Stage 1	262	262	-	-	-	-	-	-	-
Stage 2	396	414	-	-	-	-	-	-	-
Critical Hdwy	6.45	6.5	6.21	4.1	-	-	4.23	-	-
Critical Hdwy Stg 1	5.45	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.45	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.545	4	3.309	2.2	-	-	2.317	-	-
Pot Cap-1 Maneuver	424	378	872	1415	-	-	1088	-	-
Stage 1	775	695	-	-	-	-	-	-	-
Stage 2	673	597	-	-	-	-	-	-	-
Platoon blocked, %					-	-		-	-
Mov Cap-1 Maneuver	405	0	872	1415	-	-	1088	-	-
Mov Cap-2 Maneuver	405	0	-	-	-	-	-	-	-
Stage 1	740	0	-	-	-	-	-	-	-
Stage 2	673	0	-	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	36	0	1.7
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	SBL	SBT	SBR
Capacity (veh/h)	1415	-	-	472	1088	-	-
HCM Lane V/C Ratio	-	-	-	0.793	0.041	-	-
HCM Control Delay (s)	0	-	-	36	8.4	0	-
HCM Lane LOS	A	-	-	E	A	A	-
HCM 95th %tile Q(veh)	0	-	-	7.2	0.1	-	-

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	0	0	0	25	1	99	78	530	0	0	178	307
Future Vol, veh/h	0	0	0	25	1	99	78	530	0	0	178	307
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Stop	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	0	0	0	0	0	4	7	3	0	0	5	6
Mvmt Flow	0	0	0	27	1	109	86	582	0	0	196	337

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	1118	1287	582	533	0	0	582	0	0
Stage 1	754	754	-	-	-	-	-	-	-
Stage 2	364	533	-	-	-	-	-	-	-
Critical Hdwy	6.4	6.5	6.24	4.17	-	-	4.1	-	-
Critical Hdwy Stg 1	5.4	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.4	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.336	2.263	-	-	2.2	-	-
Pot Cap-1 Maneuver	231	166	509	1010	-	-	1002	-	-
Stage 1	468	420	-	-	-	-	-	-	-
Stage 2	707	528	-	-	-	-	-	-	-
Platoon blocked, %					-	-		-	-
Mov Cap-1 Maneuver	202	0	509	1010	-	-	1002	-	-
Mov Cap-2 Maneuver	202	0	-	-	-	-	-	-	-
Stage 1	409	0	-	-	-	-	-	-	-
Stage 2	707	0	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.1	1.1	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1010	-	-	643	1002	-	-
HCM Lane V/C Ratio	0.085	-	-	0.214	-	-	-
HCM Control Delay (s)	8.9	0	-	12.1	0	-	-
HCM Lane LOS	A	A	-	B	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	0.8	0	-	-

Intersection	
Int Delay, s/veh	1.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	38	38	544	85	19	447
Future Vol, veh/h	38	38	544	85	19	447
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	-	-	-	50	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	0	5	3	0	0	5
Mvmt Flow	41	41	585	91	20	481

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1153	631	0	0	676	0
Stage 1	631	-	-	-	-	-
Stage 2	522	-	-	-	-	-
Critical Hdwy	6.4	6.25	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.345	-	-	2.2	-
Pot Cap-1 Maneuver	220	476	-	-	925	-
Stage 1	534	-	-	-	-	-
Stage 2	599	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	215	476	-	-	925	-
Mov Cap-2 Maneuver	215	-	-	-	-	-
Stage 1	534	-	-	-	-	-
Stage 2	586	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15.3	0	0.4
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	430	925	-
HCM Lane V/C Ratio	-	-	0.19	0.022	-
HCM Control Delay (s)	-	-	15.3	9	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	0.7	0.1	-

Intersection	
Int Delay, s/veh	4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Vol, veh/h	38	180	152	430	286	12
Future Vol, veh/h	38	180	152	430	286	12
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	75	0	50	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	1	1	4	9	0
Mvmt Flow	41	196	165	467	311	13

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1115	317	324	0	-	0
Stage 1	317	-	-	-	-	-
Stage 2	798	-	-	-	-	-
Critical Hdwy	6.4	6.21	4.11	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.309	2.209	-	-	-
Pot Cap-1 Maneuver	232	726	1241	-	-	-
Stage 1	743	-	-	-	-	-
Stage 2	447	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	201	726	1241	-	-	-
Mov Cap-2 Maneuver	201	-	-	-	-	-
Stage 1	743	-	-	-	-	-
Stage 2	388	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	14.5	2.2	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1241	-	201	726	-	-
HCM Lane V/C Ratio	0.133	-	0.205	0.269	-	-
HCM Control Delay (s)	8.3	-	27.5	11.8	-	-
HCM Lane LOS	A	-	D	B	-	-
HCM 95th %tile Q(veh)	0.5	-	0.7	1.1	-	-

Appendix G Queuing Worksheets

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	32	569	27	511	154	130	38	258	292
v/c Ratio	0.07	0.67	0.07	0.59	0.19	0.33	0.07	0.65	0.50
Control Delay	7.0	17.8	6.9	16.0	3.3	20.3	0.5	28.2	8.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.0	17.8	6.9	16.0	3.3	20.3	0.5	28.2	8.8
Queue Length 50th (ft)	4	102	3	88	0	28	0	63	13
Queue Length 95th (ft)	15	314	14	268	30	89	2	175	81
Internal Link Dist (ft)		703		1481		491		582	
Turn Bay Length (ft)	250		150		175		175		60
Base Capacity (vph)	565	1161	670	1337	1170	684	883	715	876
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.06	0.49	0.04	0.38	0.13	0.19	0.04	0.36	0.33

Intersection Summary

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBT
Lane Group Flow (vph)	16	143	384	239	83	250	74	201
v/c Ratio	0.04	0.37	0.60	0.26	0.10	0.66	0.14	0.42
Control Delay	10.1	19.8	14.2	11.9	4.2	26.4	4.7	18.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.1	19.8	14.2	11.9	4.2	26.4	4.7	18.3
Queue Length 50th (ft)	2	31	71	39	0	73	0	51
Queue Length 95th (ft)	12	83	170	131	25	146	22	104
Internal Link Dist (ft)		430		634		582		810
Turn Bay Length (ft)	125		425		425		25	
Base Capacity (vph)	723	1262	666	1324	1148	697	922	879
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.02	0.11	0.58	0.18	0.07	0.36	0.08	0.23

Intersection Summary

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	98	359	135	48	249	2	178	104	24	344
v/c Ratio	0.22	0.54	0.21	0.13	0.43	0.00	0.48	0.15	0.05	0.75
Control Delay	16.4	27.4	5.6	16.0	28.2	0.0	20.0	16.1	15.5	33.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.4	27.4	5.6	16.0	28.2	0.0	20.0	16.1	15.5	33.2
Queue Length 50th (ft)	26	146	0	12	97	0	51	21	6	112
Queue Length 95th (ft)	73	307	43	41	217	0	119	75	24	265
Internal Link Dist (ft)		1481			965			356		1149
Turn Bay Length (ft)	100					75	100			
Base Capacity (vph)	547	914	853	549	932	843	558	1094	648	954
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.18	0.39	0.16	0.09	0.27	0.00	0.32	0.10	0.04	0.36

Intersection Summary

Lane Group	EBT	NBT	SBL	SBT
Lane Group Flow (vph)	801	125	48	78
v/c Ratio	0.73	0.23	0.17	0.08
Control Delay	30.1	17.4	32.9	9.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	30.1	17.4	32.9	9.3
Queue Length 50th (ft)	201	38	23	19
Queue Length 95th (ft)	262	77	53	38
Internal Link Dist (ft)	364	557		202
Turn Bay Length (ft)			45	
Base Capacity (vph)	1096	551	285	969
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.73	0.23	0.17	0.08

Intersection Summary

Lane Group	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	58	719	139	112
v/c Ratio	0.07	0.47	0.24	0.17
Control Delay	9.7	12.5	15.7	9.5
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	9.7	12.5	15.7	9.5
Queue Length 50th (ft)	12	94	38	17
Queue Length 95th (ft)	29	136	75	47
Internal Link Dist (ft)		390	202	385
Turn Bay Length (ft)	40			
Base Capacity (vph)	806	1539	586	654
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.07	0.47	0.24	0.17

Intersection Summary

Appendix H Freeway Operations Summary and Worksheets

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*Marjorie Ludet*
Agency or Company	
Date Performed	*11/11/2015*
Analysis Time Period	

Site Information

Highway/Direction of Travel	*I-84/WB*
From/To	*Exit 85/Exit 86*
Jurisdiction	*The Dalles*
Analysis Year	*2015*

Project Description *The Dalles TSP*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1340*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*25*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	f_{HV} = $1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.889*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*793*	pc/h/ln
S	*65.0*	mph
D = v_p / S	*12.2*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		**Site Information**	
Analyst	*Marjorie Ludet*	Highway/Direction of Travel	*I-84/EB*
Agency or Company		From/To	*Exit 85/Exit 86*
Date Performed	*11/11/2015*	Jurisdiction	*The Dalles*
Analysis Time Period		Analysis Year	*2015*

Project Description *The Dalles TSP*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1440*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*25*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.889*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*853*	pc/h/ln
S	*65.0*	mph
D = v_p / S	*13.1*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*Marjorie Ludet*
Agency or Company	
Date Performed	*11/11/2015*
Analysis Time Period	

Site Information

Highway/Direction of Travel	*I-84/WB*
From/To	*Exit 84/Exit 85*
Jurisdiction	*The Dalles*
Analysis Year	*2015*

Project Description *The Dalles TSP*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1300*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*25*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	f_{HV} = $1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.889*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*770*	pc/h/ln
S	*65.0*	mph
D = v_p / S	*11.8*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		**Site Information**	
Analyst	*Marjorie Ludet*	Highway/Direction of Travel	*I-84/EB*
Agency or Company		From/To	*Exit 84/Exit 85*
Date Performed	*11/11/2015*	Jurisdiction	*The Dalles*
Analysis Time Period		Analysis Year	*2015*

Project Description *The Dalles TSP*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1600*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*25*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.889*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*947*	pc/h/ln
S	*65.0*	mph
D = v_p / S	*14.6*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*Marjorie Ludet*
Agency or Company	
Date Performed	*11/11/2015*
Analysis Time Period	

Site Information

Highway/Direction of Travel	*I-84/WB*
From/To	*Exit 83/Exit 84*
Jurisdiction	*The Dalles*
Analysis Year	*2015*

Project Description *The Dalles TSP*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*880*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*25*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	f_{HV} = $1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.889*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*521*	pc/h/ln
S	*65.0*	mph
D = v_p / S	*8.0*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*Marjorie Ludet*
Agency or Company	
Date Performed	*11/11/2015*
Analysis Time Period	

Site Information

Highway/Direction of Travel	*I-84/EB*
From/To	*Exit 83/Exit 84*
Jurisdiction	*The Dalles*
Analysis Year	*2015*

Project Description *The Dalles TSP*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1870*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*25*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.889*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1107*	pc/h/ln
S	*65.0*	mph
D = v_p / S	*17.0*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*Marjorie Ludet*
Agency or Company	
Date Performed	*11/11/2015*
Analysis Time Period	

Site Information

Highway/Direction of Travel	*I-84/WB*
From/To	*Exit 82/Exit 83*
Jurisdiction	*The Dalles*
Analysis Year	*2015*

Project Description *The Dalles TSP*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1200*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*25*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.889*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*65.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*65.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*711*	pc/h/ln
S	*65.0*	mph
D = v_p / S	*10.9*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*Marjorie Ludet*	Highway/Direction of Travel	*I-84/EB*
Agency or Company		From/To	*Exit 82/Exit 83*
Date Performed	*11/11/2015*	Jurisdiction	*The Dalles*
Analysis Time Period		Analysis Year	*2015*

Project Description *The Dalles TSP*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1180*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*25*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.889*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*2*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*65.0*	mph	FFS	*65.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*699*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	*65.0*	mph	S	mph
D = v_p / S	*10.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*A*		Required Number of Lanes, N	

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits 11-10, 11-12
E_T - Exhibits 11-10, 11-11, 11-13
f_p - Page 11-18
LOS, S, FFS, v_p - Exhibits 11-2, 11-3
f_{LW} - Exhibit 11-8
f_{LC} - Exhibit 11-9
TRD - Page 11-11

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Marjorie Ludet	Freeway/Dir of Travel	I-84/WB
Agency or Company	Kittelson	Junction	On Ramp: Chenowith - Exit 82
Date Performed	11/11/2015	Jurisdiction	The Dalles
Analysis Time Period		Analysis Year	2015

Project Description The Dalles TSP

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1200
Deceleration Lane Length L_D	
Freeway Volume, V_F	1090
Ramp Volume, V_R	250
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1090	0.95	Level	25	0	0.889	1.00	1291
Ramp	250	0.95	Level	25	0	0.889	1.00	296
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1291 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1587	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1587	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$$

D_R = 10.2 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.256 (Exibit 13-11)

S_R= 59.1 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 59.1 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Marjorie Ludet	Freeway/Dir of Travel	I-84/WB
Agency or Company		Junction	Exit 82
Date Performed	11/11/2015	Jurisdiction	The Dalles
Analysis Time Period		Analysis Year	2015

Project Description The Dalles TSP

Inputs

Upstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	1180
Freeway Volume, V_F	1090
Ramp Volume, V_R	120
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1090	0.94	Level	25	0	0.889	1.00	1305
Ramp	120	0.79	Level	25	0	0.889	1.00	171
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1305 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1305	Exhibit 13-8	4700	No
$V_{FO} = V_F - V_R$	1134	Exhibit 13-8	4700	No
V_R	171	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1305	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 4.9 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.443 (Exhibit 13-12)

S_R= 54.8 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 54.8 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Marjorie Ludet	Freeway/Dir of Travel	I-84/EB
Agency or Company	Kittelson	Junction	On Ramp: Chenowith - Exit 82
Date Performed	11/11/2015	Jurisdiction	The Dalles
Analysis Time Period		Analysis Year	2015

Project Description The Dalles TSP

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1070
Deceleration Lane Length L_D	
Freeway Volume, V_F	1080
Ramp Volume, V_R	160
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1080	0.95	Level	25	0	0.889	1.00	1279
Ramp	160	0.95	Level	25	0	0.889	1.00	189
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1279 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1468	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1468	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$$

D_R = 10.1 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.263 (Exibit 13-11)

S_R= 59.0 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 59.0 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Marjorie Ludet	Freeway/Dir of Travel	I-84/EB
Agency or Company		Junction	Exit 82
Date Performed	11/11/2015	Jurisdiction	The Dalles
Analysis Time Period		Analysis Year	2015

Project Description The Dalles TSP

Inputs

Upstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off; L_{up} = ft; V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	1260
Freeway Volume, V_F	1080
Ramp Volume, V_R	315
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off; L_{down} = ft; V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1080	0.94	Level	25	0	0.889	1.00	1293
Ramp	315	0.82	Level	25	0	0.889	1.00	432
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1293 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1293	Exhibit 13-8	4700	No
$V_{FO} = V_F - V_R$	861	Exhibit 13-8	4700	No
V_R	432	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1293	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$$

D_R = 4.0 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.467 (Exhibit 13-12)

S_R= 54.3 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 54.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Marjorie Ludet	Freeway/Dir of Travel	I-84/WB
Agency or Company	Kittelson	Junction	Exit 83
Date Performed	11/11/2015	Jurisdiction	The Dalles
Analysis Time Period		Analysis Year	2015

Project Description The Dalles TSP

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	500
Deceleration Lane Length L_D	
Freeway Volume, V_F	880
Ramp Volume, V_R	330
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	880	0.95	Level	25	0	0.889	1.00	1042
Ramp	330	0.95	Level	25	0	0.889	1.00	391
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F\,(P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1042 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1433	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1433	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$$

D_R = 13.3 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.302 (Exibit 13-11)

S_R= 58.0 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 58.0 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Marjorie Ludet	Freeway/Dir of Travel	I-84/EB
Agency or Company	Kittelson	Junction	Exit 83
Date Performed	11/11/2015	Jurisdiction	The Dalles
Analysis Time Period		Analysis Year	2015

Project Description The Dalles TSP

Inputs

Upstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	700
Deceleration Lane Length L_D	
Freeway Volume, V_F	1020
Ramp Volume, V_R	850
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1020	0.95	Level	25	0	0.889	1.00	1208
Ramp	850	0.95	Level	25	0	0.889	1.00	1007
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1208 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2215	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2215	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 17.9 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.308 (Exibit 13-11)

S_R= 57.9 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 57.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Marjorie Ludet	Freeway/Dir of Travel	I-84/EB
Agency or Company		Junction	Exit 83
Date Performed	11/11/2015	Jurisdiction	The Dalles
Analysis Time Period		Analysis Year	2015

Project Description The Dalles TSP

Inputs

Upstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off; L_{up} = ft; V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	700
Freeway Volume, V_F	1020
Ramp Volume, V_R	150
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off; L_{down} = ft; V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1020	0.94	Level	25	0	0.889	1.00	1221
Ramp	150	0.95	Level	25	0	0.889	1.00	178
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1221 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * $V_{12}/2$ ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1221	Exhibit 13-8	4700	No
$V_{FO} = V_F - V_R$	1043	Exhibit 13-8	4700	No
V_R	178	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1221	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 8.5 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.444 (Exhibit 13-12)

S_R= 54.8 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 54.8 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Marjorie Ludet	Freeway/Dir of Travel	I-84/WB
Agency or Company		Junction	Exit 84
Date Performed	11/11/2015	Jurisdiction	The Dalles
Analysis Time Period		Analysis Year	2015

Project Description The Dalles TSP

Inputs

Upstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	1030
Freeway Volume, V_F	880
Ramp Volume, V_R	415
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	880	0.95	Level	25	0	0.889	1.00	1042
Ramp	415	0.95	Level	25	0	0.889	1.00	491
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1042 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1042	Exhibit 13-8	4700	No
$V_{FO} = V_F - V_R$	551	Exhibit 13-8	4700	No
V_R	491	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1042	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 3.9 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.472 (Exhibit 13-12)

S_R= 54.1 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 54.1 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Marjorie Ludet	Freeway/Dir of Travel	I-84/EB
Agency or Company		Junction	Exit 84
Date Performed	11/11/2015	Jurisdiction	The Dalles
Analysis Time Period		Analysis Year	2015

Project Description The Dalles TSP

Inputs

Upstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off; L_{up} = ft; V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	1050
Freeway Volume, V_F	1600
Ramp Volume, V_R	270
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off; L_{down} = ft; V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1600	0.95	Level	25	0	0.889	1.00	1895
Ramp	270	0.95	Level	25	0	0.889	1.00	320
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1895 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1895	Exhibit 13-8	4700	No
$V_{FO} = V_F - V_R$	1575	Exhibit 13-8	4700	No
V_R	320	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1895	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 11.1 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.457 (Exhibit 13-12)

S_R= 54.5 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 54.5 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	Marjorie Ludet
Agency or Company	Kittelson
Date Performed	11/11/2015
Analysis Time Period	

Site Information

Freeway/Dir of Travel	I-84/WB
Junction	Exit 85
Jurisdiction	The Dalles
Analysis Year	2015

Project Description The Dalles TSP

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1220
Deceleration Lane Length L_D	
Freeway Volume, V_F	1090
Ramp Volume, V_R	210
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1090	0.95	Level	25	0	0.889	1.00	1291
Ramp	210	0.88	Level	25	0	0.889	1.00	268
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1291 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1559	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1559	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 9.9 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.254 (Exibit 13-11)

S_R= 59.2 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 59.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Marjorie Ludet	Freeway/Dir of Travel	I-84/WB
Agency or Company		Junction	Exit 85
Date Performed	11/11/2015	Jurisdiction	The Dalles
Analysis Time Period		Analysis Year	2015

Project Description The Dalles TSP

Inputs

Upstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off; L_{up} = ft; V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	1175
Freeway Volume, V_F	1090
Ramp Volume, V_R	255
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off; L_{down} = ft; V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1090	0.95	Level	25	0	0.889	1.00	1291
Ramp	255	0.88	Level	25	0	0.889	1.00	326
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1291 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1291	Exhibit 13-8	4700	No
$V_{FO} = V_F - V_R$	965	Exhibit 13-8	4700	No
V_R	326	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1291	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 4.8 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.457 (Exhibit 13-12)

S_R= 54.5 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 54.5 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Marjorie Ludet	Freeway/Dir of Travel	I-84/EB
Agency or Company	Kittelson	Junction	Exit 85
Date Performed	11/11/2015	Jurisdiction	The Dalles
Analysis Time Period		Analysis Year	2015

Project Description The Dalles TSP

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1300	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1230	
	Ramp Volume, V_R: 200	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1230	0.95	Level	25	0	0.889	1.00	1457
Ramp	200	0.88	Level	25	0	0.889	1.00	256
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1457 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1713	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1713	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 10.6 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.252 (Exibit 13-11)

S_R= 59.2 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 59.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Marjorie Ludet	Freeway/Dir of Travel	I-84/EB
Agency or Company		Junction	Exit 85
Date Performed	11/11/2015	Jurisdiction	The Dalles
Analysis Time Period		Analysis Year	2015

Project Description The Dalles TSP

Inputs

Upstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	1150
Freeway Volume, V_F	1230
Ramp Volume, V_R	360
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1230	0.95	Level	25	0	0.889	1.00	1457
Ramp	360	0.88	Level	25	0	0.889	1.00	460
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F\,(P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\,v_R + 0.0078\,V_{12} - 0.00627\,L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1457 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1457	Exhibit 13-8	4700	No
$V_{FO} = V_F - V_R$	997	Exhibit 13-8	4700	No
V_R	460	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1457	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\,V_{12} - 0.009\,L_D$

D_R = 6.4 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.469 (Exhibit 13-12)

S_R= 54.2 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 54.2 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	Marjorie Ludet	Freeway/Dir of Travel	I-84/WB
Agency or Company	Kittelson	Junction	Exit 87
Date Performed	11/11/2015	Jurisdiction	The Dalles
Analysis Time Period		Analysis Year	2015

Project Description The Dalles TSP

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A	1230	☑ No	☐ Off
		Deceleration Lane Length L_D			
		Freeway Volume, V_F	800		
L_{up} =	ft	Ramp Volume, V_R	540	L_{down} =	ft
		Freeway Free-Flow Speed, S_{FF}	65.0		
V_u =	veh/h	Ramp Free-Flow Speed, S_{FR}	35.0	V_D =	veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	800	0.95	Level	25	0	0.889	1.00	947
Ramp	540	0.91	Level	25	0	0.889	1.00	668
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 947 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1615	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1615	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$$

D_R = 10.1 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.255 (Exibit 13-11)

S_R= 59.1 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 59.1 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Marjorie Ludet	Freeway/Dir of Travel	I-84/WB
Agency or Company		Junction	Exit 87
Date Performed	11/11/2015	Jurisdiction	The Dalles
Analysis Time Period		Analysis Year	2015

Project Description The Dalles TSP

Inputs

Upstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off; L_{up} = ft; V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	940
Freeway Volume, V_F	800
Ramp Volume, V_R	150
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off; L_{down} = ft; V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	800	0.95	Level	25	0	0.889	1.00	947
Ramp	150	0.91	Level	25	0	0.889	1.00	185
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 947 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	947	Exhibit 13-8	4700	No
$V_{FO} = V_F - V_R$	762	Exhibit 13-8	4700	No
V_R	185	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	947	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 3.9 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.445 (Exhibit 13-12)

S_R= 54.8 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 54.8 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Marjorie Ludet	Freeway/Dir of Travel	I-84/EB
Agency or Company	Kittelson	Junction	Exit 87
Date Performed	11/11/2015	Jurisdiction	The Dalles
Analysis Time Period		Analysis Year	2015

Project Description The Dalles TSP

Inputs

Upstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off; L_{up} = ft; V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	970
Ramp Volume, V_R	100
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off; L_{down} = ft; V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	970	0.95	Level	25	0	0.889	1.00	1149
Ramp	100	0.93	Level	25	0	0.889	1.00	121
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1149 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1270	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1270	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 5.9 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.230 (Exibit 13-11)

S_R= 59.7 mph (Exhibit 13-11)

S_0= N/A mph (Exhibit 13-11)

S = 59.7 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Marjorie Ludet	Freeway/Dir of Travel	I-84/EB
Agency or Company		Junction	Exit 87
Date Performed	11/11/2015	Jurisdiction	The Dalles
Analysis Time Period		Analysis Year	2015

Project Description The Dalles TSP

Inputs

Upstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	2
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	1120
Freeway Volume, V_F	970
Ramp Volume, V_R	470
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	970	0.95	Level	25	0	0.889	1.00	1149
Ramp	470	0.93	Level	25	0	0.889	1.00	569
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1149 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1149	Exhibit 13-8	4700	No
$V_{FO} = V_F - V_R$	580	Exhibit 13-8	4700	No
V_R	569	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1149	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$$

D_R = 4.1 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.479 (Exhibit 13-12)

S_R= 54.0 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 54.0 mph (Exhibit 13-13)

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Appendix I Reported Crashes by Study Intersection

Intersection No	Intersection Name	Crash_ID	Crash Month	Crash Year	Collision Type	Highest Severity
4	I-84 EB Ramps/River Rd	1442865	September	2011	Fixed-Object or Other-Object	Inj-B
4	I-84 EB Ramps/River Rd	1490234	November	2012	Turning Movement	Inj-C
4	I-84 EB Ramps/River Rd	1544856	May	2013	Rear-End	PDO
4	I-84 EB Ramps/River Rd	1568406	May	2014	Turning Movement	PDO
5	W 10th St/Hostetler Wy	1585085	August	2014	Turning Movement	PDO
7	I-84 EB Ramps/W 6th St	1392128	August	2010	Non-collision	Inj-B
7	I-84 EB Ramps/W 6th St	1499876	December	2012	Turning Movement	PDO
8	Webber St/W 10th St	1397833	December	2010	Turning Movement	PDO
8	Webber St/W 10th St	1537619	October	2013	Rear-End	PDO
8	Webber St/W 10th St	1584411	August	2014	Turning Movement	PDO
9	Webber St/W 6th St	1356654	January	2010	Rear-End	PDO
9	Webber St/W 6th St	1356741	January	2010	Turning Movement	PDO
9	Webber St/W 6th St	1367339	April	2010	Angle	PDO
9	Webber St/W 6th St	1378284	July	2010	Turning Movement	Inj-B
9	Webber St/W 6th St	1383758	August	2010	Rear-End	PDO
9	Webber St/W 6th St	1386251	September	2010	Rear-End	PDO
9	Webber St/W 6th St	1411101	March	2011	Rear-End	Inj-C
9	Webber St/W 6th St	1423105	May	2011	Rear-End	PDO
9	Webber St/W 6th St	1442190	September	2011	Angle	Inj-A
9	Webber St/W 6th St	1442209	August	2011	Rear-End	PDO
9	Webber St/W 6th St	1442696	November	2011	Rear-End	Inj-C
9	Webber St/W 6th St	1442838	November	2011	Rear-End	Inj-C
9	Webber St/W 6th St	1454434	January	2012	Rear-End	PDO
9	Webber St/W 6th St	1468501	April	2012	Rear-End	PDO
9	Webber St/W 6th St	1474689	July	2012	Angle	PDO
9	Webber St/W 6th St	1481395	August	2012	Rear-End	PDO
9	Webber St/W 6th St	1513180	April	2013	Rear-End	Inj-C
9	Webber St/W 6th St	1533269	August	2013	Angle	PDO
9	Webber St/W 6th St	1534550	September	2013	Turning Movement	PDO
9	Webber St/W 6th St	1541076	December	2013	Rear-End	PDO
9	Webber St/W 6th St	1541242	December	2013	Rear-End	PDO
9	Webber St/W 6th St	1579521	July	2014	Rear-End	PDO
9	Webber St/W 6th St	1579679	July	2014	Rear-End	PDO

Intersection No	Intersection Name	Crash_ID	Crash Month	Crash Year	Collision Type	Highest Severity
9	Webber St/W 6th St	1584158	August	2014	Rear-End	PDO
9	Webber St/W 6th St	1590112	August	2014	Rear-End	PDO
10	Webber St/W 2nd St	1383698	August	2010	Rear-End	PDO
10	Webber St/W 2nd St	1386088	September	2010	Rear-End	Inj-C
10	Webber St/W 2nd St	1386553	October	2010	Angle	PDO
10	Webber St/W 2nd St	1417646	April	2011	Turning Movement	PDO
10	Webber St/W 2nd St	1441841	September	2011	Turning Movement	Inj-C
10	Webber St/W 2nd St	1448174	August	2011	Angle	PDO
10	Webber St/W 2nd St	1468406	April	2012	Turning Movement	PDO
10	Webber St/W 2nd St	1474589	July	2012	Rear-End	PDO
10	Webber St/W 2nd St	1481316	August	2012	Angle	Inj-B
10	Webber St/W 2nd St	1537683	September	2013	Turning Movement	Inj-B
10	Webber St/W 2nd St	1551975	January	2014	Turning Movement	Inj-A
10	Webber St/W 2nd St	1569179	April	2014	Angle	PDO
10	Webber St/W 2nd St	1576334	June	2014	Turning Movement	PDO
10	Webber St/W 2nd St	1590188	September	2014	Rear-End	PDO
12	Cherry Hts Rd/W 10th St	1403068	February	2011	Rear-End	PDO
12	Cherry Hts Rd/W 10th St	1456504	February	2012	Angle	PDO
12	Cherry Hts Rd/W 10th St	1551943	January	2014	Non-collision	PDO
12	Cherry Hts Rd/W 10th St	1551944	January	2014	Non-collision	PDO
12	Cherry Hts Rd/W 10th St	1561466	March	2014	Angle	PDO
12	Cherry Hts Rd/W 10th St	1568946	April	2014	Fixed-Object or Other-Object	PDO
12	Cherry Hts Rd/W 10th St	1576387	June	2014	Turning Movement	PDO
13	Cherry Hts Rd/W 6th St	1356703	January	2010	Rear-End	PDO
13	Cherry Hts Rd/W 6th St	1367171	April	2010	Rear-End	Inj-C
13	Cherry Hts Rd/W 6th St	1386542	September	2010	Rear-End	PDO
13	Cherry Hts Rd/W 6th St	1391773	September	2010	Pedestrian	Inj-B
13	Cherry Hts Rd/W 6th St	1411060	March	2011	Turning Movement	PDO
13	Cherry Hts Rd/W 6th St	1436205	June	2011	Rear-End	Inj-C
13	Cherry Hts Rd/W 6th St	1442444	October	2011	Rear-End	PDO
13	Cherry Hts Rd/W 6th St	1454445	January	2012	Rear-End	Inj-C
13	Cherry Hts Rd/W 6th St	1468500	April	2012	Rear-End	PDO
13	Cherry Hts Rd/W 6th St	1472332	June	2012	Rear-End	PDO

Intersection No	Intersection Name	Crash_ID	Crash Month	Crash Year	Collision Type	Highest Severity
13	Cherry Hts Rd/W 6th St	1481228	August	2012	Rear-End	Inj-C
13	Cherry Hts Rd/W 6th St	1481322	August	2012	Fixed-Object or Other-Object	PDO
13	Cherry Hts Rd/W 6th St	1486275	September	2012	Rear-End	PDO
13	Cherry Hts Rd/W 6th St	1488038	October	2012	Rear-End	PDO
13	Cherry Hts Rd/W 6th St	1499911	December	2012	Rear-End	PDO
13	Cherry Hts Rd/W 6th St	1501178	January	2013	Rear-End	PDO
13	Cherry Hts Rd/W 6th St	1525909	July	2013	Turning Movement	PDO
13	Cherry Hts Rd/W 6th St	1534436	September	2013	Fixed-Object or Other-Object	PDO
13	Cherry Hts Rd/W 6th St	1537676	October	2013	Rear-End	PDO
13	Cherry Hts Rd/W 6th St	1568794	May	2014	Rear-End	Inj-C
16	Union St/10th	1400698	January	2011	Rear-End	PDO
16	Union St/10th	1402971	February	2011	Angle	Inj-C
16	Union St/10th	1417803	April	2011	Turning Movement	PDO
16	Union St/10th	1468439	April	2012	Angle	PDO
16	Union St/10th	1561640	March	2014	Rear-End	PDO
17	Union St/W 3rd St	1367334	April	2010	Angle	PDO
17	Union St/W 3rd St	1411039	March	2011	Fixed-Object or Other-Object	Inj-C
17	Union St/W 3rd St	1533161	August	2013	Angle	PDO
17	Union St/W 3rd St	1576231	May	2014	Turning Movement	PDO
18	Union St/W 2nd St	1378140	July	2010	Turning Movement	PDO
18	Union St/W 2nd St	1383673	August	2010	Rear-End	PDO
18	Union St/W 2nd St	1417876	April	2011	Turning Movement	PDO
18	Union St/W 2nd St	1521720	June	2013	Sideswipe-overtaking	PDO
18	Union St/W 2nd St	1533315	August	2013	Angle	PDO
18	Union St/W 2nd St	1551969	January	2014	Angle	PDO
18	Union St/W 2nd St	1556095	February	2014	Sideswipe-overtaking	Inj-C
18	Union St/W 2nd St	1556481	February	2014	Sideswipe-overtaking	PDO
19	Kelly Ave/E 10th St	1367307	April	2010	Angle	PDO
19	Kelly Ave/E 10th St	1423068	May	2011	Angle	PDO
19	Kelly Ave/E 10th St	1436174	July	2011	Fixed-Object or Other-Object	Inj-C
19	Kelly Ave/E 10th St	1442920	December	2011	Pedestrian	Inj-C
19	Kelly Ave/E 10th St	1525851	July	2013	Angle	Inj-C
19	Kelly Ave/E 10th St	1568498	May	2014	Angle	Inj-B

Intersection No	Intersection Name	Crash_ID	Crash Month	Crash Year	Collision Type	Highest Severity
22	Dry Hollow Rd/E 10th St	1411045	March	2011	Angle	Inj-B
22	Dry Hollow Rd/E 10th St	1443009	December	2011	Turning Movement	PDO
22	Dry Hollow Rd/E 10th St	1474852	July	2012	Turning Movement	PDO
22	Dry Hollow Rd/E 10th St	1501311	January	2013	Angle	PDO
22	Dry Hollow Rd/E 10th St	1501331	January	2013	Angle	Inj-C
22	Dry Hollow Rd/E 10th St	1569185	April	2014	Angle	PDO
23	Brewery Grade/US 30	1472349	June	2012	Sideswipe-meeting	Inj-C
23	Brewery Grade/US 30	1561440	March	2014	Rear-End	PDO
24	Brewery Overpass Rd/US 30	1360927	February	2010	Turning Movement	PDO
24	Brewery Overpass Rd/US 30	1442311	October	2011	Angle	PDO
24	Brewery Overpass Rd/US 30	1533060	August	2013	Rear-End	PDO
24	Brewery Overpass Rd/US 30	1537629	October	2013	Turning Movement	Inj-A
25	Brewery Overpass Rd/I-84 EB Ramps	1392143	October	2010	Fixed-Object or Other-Object	PDO
25	Brewery Overpass Rd/I-84 EB Ramps	1442465	October	2011	Fixed-Object or Other-Object	PDO
25	Brewery Overpass Rd/I-84 EB Ramps	1490145	November	2012	Turning Movement	PDO
26	Brewery Overpass Rd/I-84 WB Ramps	1435970	July	2011	Angle	PDO
27	Thompson St/E 10th St/Old Dufur Rd	1436210	May	2011	Fixed-Object or Other-Object	PDO
28	E 2nd St/US 30	1386526	October	2010	Angle	PDO
28	E 2nd St/US 30	1417858	April	2011	Turning Movement	PDO
29	US 197/US 30	1358426	January	2010	Turning Movement	PDO
29	US 197/US 30	1368532	May	2010	Turning Movement	PDO
29	US 197/US 30	1384214	August	2010	Turning Movement	Inj-C
29	US 197/US 30	1386165	September	2010	Turning Movement	PDO
29	US 197/US 30	1406414	February	2011	Turning Movement	PDO
29	US 197/US 30	1417565	April	2011	Turning Movement	PDO
29	US 197/US 30	1453804	January	2012	Turning Movement	Inj-C
29	US 197/US 30	1463535	March	2012	Turning Movement	PDO
29	US 197/US 30	1468571	May	2012	Non-collision	Inj-C
29	US 197/US 30	1480802	August	2012	Turning Movement	PDO
29	US 197/US 30	1534229	August	2013	Turning Movement	PDO
29	US 197/US 30	1534591	September	2013	Turning Movement	PDO
29	US 197/US 30	1534626	September	2013	Turning Movement	PDO
29	US 197/US 30	1537318	November	2013	Turning Movement	Inj-C

Intersection No	Intersection Name	Crash_ID	Crash Month	Crash Year	Collision Type	Highest Severity
29	US 197/US 30	1579441	July	2014	Turning Movement	PDO
30	US 197/Fremont St/Columbia Vw Dr	1386121	September	2010	Angle	PDO
30	US 197/Fremont St/Columbia Vw Dr	1386556	October	2010	Angle	Inj-C
30	US 197/Fremont St/Columbia Vw Dr	1391921	November	2010	Fixed-Object or Other-Object	PDO
30	US 197/Fremont St/Columbia Vw Dr	1393324	November	2010	Fixed-Object or Other-Object	Inj-C
30	US 197/Fremont St/Columbia Vw Dr	1422777	May	2011	Angle	PDO
30	US 197/Fremont St/Columbia Vw Dr	1436356	May	2011	Pedestrian	Inj-B
30	US 197/Fremont St/Columbia Vw Dr	1468513	May	2012	Turning Movement	PDO
30	US 197/Fremont St/Columbia Vw Dr	1487890	October	2012	Angle	Inj-C
30	US 197/Fremont St/Columbia Vw Dr	1537671	October	2013	Turning Movement	Inj-B
30	US 197/Fremont St/Columbia Vw Dr	1541348	December	2013	Fixed-Object or Other-Object	Inj-A
31	US 197/I-84 EB Ramps	1378343	July	2010	Turning Movement	Inj-C
31	US 197/I-84 EB Ramps	1378399	July	2010	Turning Movement	Inj-B
31	US 197/I-84 EB Ramps	1406434	February	2011	Turning Movement	Inj-B
31	US 197/I-84 EB Ramps	1411147	March	2011	Angle	Inj-C
31	US 197/I-84 EB Ramps	1442941	December	2011	Rear-End	PDO
31	US 197/I-84 EB Ramps	1468361	April	2012	Angle	Inj-B
31	US 197/I-84 EB Ramps	1521577	June	2013	Rear-End	PDO
31	US 197/I-84 EB Ramps	1537327	November	2013	Angle	Inj-C
32	US 197/I-84 WB Ramps	1435846	July	2011	Angle	Inj-C
32	US 197/I-84 WB Ramps	1435926	July	2011	Angle	PDO
32	US 197/I-84 WB Ramps	1453806	January	2012	Rear-End	PDO
32	US 197/I-84 WB Ramps	1579447	July	2014	Rear-End	PDO
32	US 197/I-84 WB Ramps	1594528	October	2014	Turning Movement	Inj-C
33	US 197/Bret Clodfelter Wy	1435853	July	2011	Angle	PDO
33	US 197/Bret Clodfelter Wy	1435946	July	2011	Angle	PDO
33	US 197/Bret Clodfelter Wy	1439473	August	2011	Turning Movement	PDO
33	US 197/Bret Clodfelter Wy	1508502	March	2013	Turning Movement	Inj-A
33	US 197/Bret Clodfelter Wy	1517662	May	2013	Turning Movement	PDO
34	US 197/Lone Pine Ln	1555887	February	2014	Rear-End	PDO
9	Webber St/W 6th St	1599731	December	2014	Rear-End	PDO
30	US 197/Fremont St/Columbia Vw Dr	1599734	December	2014	Angle	Inj-C
30	US 197/Fremont St/Columbia Vw Dr	1599808	December	2014	Angle	PDO

Intersection No	Intersection Name	Crash_ID	Crash Month	Crash Year	Collision Type	Highest Severity
31	US 197/I-84 EB Ramps	1595637	November	2014	Rear-End	Inj-B
32	US 197/I-84 WB Ramps	1599686	November	2014	Rear-End	Inj-C

Appendix J ODOT Critical Crash Rate Calculator Worksheets

General & Site Information	
Analyst:	Marjorie Ludet
Agency/Company:	Kittelson
Date:	10/1/2015
Project Name:	18495 - The Dalles TSP

Intersection Crash Data

Intersection	Intersection Type	Year 2010	2011	2012	2013	2014	Total
4	Urban 4ST		1	1	1	1	4
5	Urban 3ST					1	1
7	Urban 3ST	1		1			2
8	Urban 3ST	1			1	1	3
9	Urban 4SG	6	6	4	5	5	26
10	Urban 4SG	3	3	3	1	4	14
12	Urban 4ST		1	1		5	7
13	Urban 4SG	4	3	8	4	1	20
16	Urban 4ST		3	1		1	5
17	Urban 4SG	1	1		1	1	4
18	Urban 4SG	2	1		2	3	8
19	Urban 4ST	1	3		1	1	6
22	Urban 4ST		2	1	2	1	6
23				1		1	2
24	Urban 4ST	1	1		2		4
25	Urban 4ST	1	1	1			3
26	Urban 4ST		1				1
27	Urban 4ST		1				1
28	Urban 4ST	1	1				2
29	Urban 3ST	4	2	4	4	1	15
30	Urban 4ST	4	2	2	2	2	12
31	Urban 4ST	2	3	1	2	1	9
32	Urban 4ST		2	1		3	6
33	Urban 3ST		3		2		5
34	Urban 3ST					1	1
	Total	26	31	26	24	27	134

Intersection Population Type Crash Rate				
Average Crash Rate per intersection type				
Intersection Pop. Type	Sum of Crashes	Sum of 5-year MEV	Avg Crash Rate for Ref Pop.	INT in Pop
Rural 3SG	0	0		
Rural 3ST	0	0		
Rural 4SG	0	0		
Rural 4ST	0	0		
Urban 3ST	27	107	0.2513	6
Urban 3SG	0	0		
Urban 4ST	66	162	0.4076	13
Urban 4SG	72	127	0.5655	5

Critical Rate Calculation								
Intersection	AADT Entering Intersection	5-year MEV	Crash Total	Intersection Population Type	Intersection Crash Rate	Reference Population Crash Rate	Critical Rate	Over Critical
4	3,780	6.9	4	Urban 4ST	0.58	0.41	0.88	Under
5	3,530	6.4	1	Urban 3ST	0.16	0.25	0.65	Under
7	16,100	29.4	2	Urban 3ST	0.07	0.25	0.42	Under
8	7,550	13.8	3	Urban 3ST	0.22	0.25	0.51	Under
9	19,500	35.6	26	Urban 4SG	0.73	0.57	0.79	Under
10	12,230	22.3	14	Urban 4SG	0.63	0.57	0.85	Under
12	9,720	17.7	7	Urban 4ST	0.39	0.41	0.69	Under
13	19,420	35.4	20	Urban 4SG	0.56	0.57	0.79	Under
16	7,580	13.8	5	Urban 4ST	0.36	0.41	0.73	Under
17	9,260	16.9	4	Urban 4SG	0.24	0.57	0.90	Under
18	9,360	17.1	8	Urban 4SG	0.47	0.57	0.89	Under
19	6,980	12.7	6	Urban 4ST	0.47	0.41	0.74	Under
22	6,610	12.1	6	Urban 4ST	0.50	0.41	0.75	Under
24	6,470	11.8	4	Urban 4ST	0.34	0.41	0.76	Under
25	6,470	11.8	3	Urban 4ST	0.25	0.41	0.76	Under
26	3,430	6.3	1	Urban 4ST	0.16	0.41	0.91	Under
27	3,260	5.9	1	Urban 4ST	0.17	0.41	0.92	Under
28	6,990	12.8	2	Urban 4ST	0.16	0.41	0.74	Under
29	9,000	16.4	15	Urban 3ST	0.91	0.25	0.49	**Over**
30	7,200	13.1	12	Urban 4ST	0.91	0.41	0.74	**Over**
31	8,050	14.7	9	Urban 4ST	0.61	0.41	0.72	Under
32	12,180	22.2	6	Urban 4ST	0.27	0.41	0.65	Under
33	11,710	21.4	5	Urban 3ST	0.23	0.25	0.45	Under
34	10,980	20.0	1	Urban 3ST	0.05	0.25	0.46	Under

Appendix K Bicycle Level of Traffic Stress Worksheets

Description	Functional Class	Class	*Bike lane width (ft)	Speed (mph)	# of Lanes**	LTS	Notes
Brewery Overpass Rd from I84 WB Ramp to E 2nd St	Arterial	Mixed Traffic		40	2	**4**	
E 2nd St from Brewery Overpass to 700ft East	Arterial	Mixed Traffic		30	2	**4**	Shoulder could be used as bike lane
US30 from St 700ft East of Brewery Overpass to US197	Arterial	Mixed Traffic		40	2	**4**	Shoulder could be used as bike lane
US197 from Lone Pine Dr to Fremont St	Arterial	Mixed Traffic		45	2	**4**	
US30 from Irvine St W to River Rd	Arterial	Bike lane without parking	7.5	30	1	**1**	
River Rd from US30 to 2000ft East	Collector	Bike lane without parking	6	40	1	**4**	
Division St	Collector	Mixed Traffic		35	2	**3**	Unmarked centerline
Rest of River Rd	Collector	Mixed Traffic		35	2	**4**	
Bargeway Rd	Collector	Mixed Traffic		30	2	**2**	Unmarked centerline
W 2nd St from Webber St to north end	Collector	Mixed Traffic		30	2	**3**	
Webber St from Bargeway to US30	Collector	Bike lane without parking	7	30	1	**3**	LTS 3 because of Right turn on Bargeway Rd
Webber St from US30 to 10th St NB							
Webber St from US30 to 10th St SB	Collector	Bike lane with parking	14.5	30	1	**3**	
Chenowith Loop Rd	Arterial	Bike lane with parking	13	25	1	**3**	
Hostetler Way W	Collector	Bike lane without parking	7	30	1	**1**	
W 7th ST	Collector	Mixed Traffic		25	2	**1**	unmarked center line
Walnut St from W 7th St to US30	Collector	Mixed Traffic		35	2	**4**	
Snipes St	Collector	Bike lane without parking		35	1	**2**	
W 8th St from Snipes St to Morrel Dr	Collector	Mixed Traffic		25	2	**1**	Unmarked centerline
W 6th St from Irvin St to Cherry Heights Rd	Arterial	Bike lane without parking	6.5	35	1	**4**	Right/Left lane turn increase LTS
W 6th St from Cherry Heights Rd to W 3rd St	Arterial	Mixed Traffic		35	2	**4**	Right/Left lane turn increase LTS
Trevitt St from Scenic Dr to W 6th St	Collector	Mixed Traffic		25	2	**2**	
Scenic Dr from Trevitt St to E 16th St	Collector	Mixed Traffic		25	2		
E 13th St from Jordan St to Kelly Ave	Collector	Mixed Traffic		25	2	**1**	Unmarked centerline
10th from Walnut St to Cherry Heights Rd NB	Arterial	Bike lane with parking	15	25	1	**1**	
10th from Walnut St to Cherry Heights Rd SB		Bike lane without parking	5			**2**	

Description	Functional Class	Class	*Bike lane width (ft)	Speed (mph)	# of Lanes**	LTS	Notes
10th from Cherry Heights Rd to Old Dufur Rd	Arterial	Mixed Traffic		25	2	**2**	
Mount Hood St from 16th St to 8th St							
Mount Hood St from Milk Creek Rd to 16th St	Arterial	Mixed Traffic		35	2	**4**	
Cherry Heights Rd from W 6th St to W 13th St SB	Arterial	Bike lane without parking	5	25	1	**2**	20 mph in the south because of school zone
Cherry Heights Rd from W 6th St to W 13th St NB		Bike lane with parking	15			**1**	
Cherry Heights Rd from US30 to 6th St	Arterial	Bike lane without parking	5	30	2	**3**	TWLTL
Mountain Hood							
W 3rd Pl	Arterial	Mixed Traffic		20	2	**2**	
3rd St from W 3rd Pl to Taylor St							
4th St from W 3rd Pl to Taylor St							
US30 from Lincoln St to Taylor St							
E 1st St from Union St to Madison St							
Union St from E 1st St to E 10th St							
Court St from E 1st St to Madison St							
Washington St from E 1st St to E 7th St							
Madison St							
Federal St	Collector						
E 7th St from Washington St to Kelly Ave	Arterial	Mixed Traffic					
Kelly Ave				25	2	**2**	
W 1st St	Arterial	Mixed Traffic		30	2	**2**	A multiuse trail parallel this road
US30 from Webber St to Lincoln St EB	Arterial	Bike lane without parking	6.5				
US30 from Webber St to Lincoln St EB		Bike lane with parking	14	35	1	**3**	
E 16th Pl from Kelly Ave to Dry Hollow Rd	Arterial	Mixed Traffic					
E 19th St from E 16th St to East end				25	2	**2**	20 during school
Dry Hollow Rd from E 16th St to E 14th St	Arterial	Mixed Traffic		35	2	**4**	
Dry Hollow Rd from E 9th St to E 14th St	Arterial	Mixed Traffic		25	2	**2**	
E 12th St from Kelly Ave to Thompson St	Arterial	Mixed Traffic		25	2	**2**	
Thompson St							

Description	Functional Class	Class	*Bike lane width (ft)	Speed (mph)	# of Lanes**	LTS	Notes
E 12th St from Thompsons St to Richmond St	Collector	Mixed Traffic		25	2	**2**	
Old Dufur Rd from Thompson St to Fremont St	Arterial	Mixed Traffic		35	2	**4**	
Fremont St E from Old Dufur Rd to US197							
E 4th St from Jefferson St	Collector	Mixed Traffic		25	2	**2**	
US30 from Taylor St to Brewery Overpass Rd	Arterial	Mixed Traffic		40	2	**4**	
Brewery Grade from US30 to 9th St	Arterial	Mixed Traffic		30	2	**3**	Shoulder could be used as bike lane
E 9th St from Brewery Grade to E 10th St	Collector	Mixed Traffic		25	2	**2**	
Columbia View Dr from E Knoll Dr to Summit Ridge Dr							

* includes width of parking if there is street parking

** for lanes, counts both direction if mixed traffic, one direction if bike lane

APPENDIX D. TECHNICAL MEMORANDUM 4: FUTURE TRAVEL DEMAND

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THE DALLES TRANSPORTATION SYSTEM PLAN

Final Technical Memorandum #4: Future Systems Conditions

Date:	February 23, 2016	Project #: 18495.0
To:	The Dalles TSP Project Advisory Committee and Technical Advisory Committee	
CC:	Darci Rudzinski and CJ Doxsee – Angelo Planning Group	
From:	Casey Bergh, PE; Michael Eagle, and Chris Brehmer, PE	

This memorandum summarizes transportation system needs anticipated for The Dalles over a 20-year period from 2015 through 2035. These needs include existing deficiencies identified in Technical Memorandum #3 (and supplemental feedback from citizens and residents), improvements to achieve goals identified in Technical Memorandum #2, and forecast needs associated with traffic growth through 2035. The analyses and findings contained in this memorandum will inform the identification and evaluation of future multimodal transportation system alternatives that address the needs.

Technical analyses summarized herein assume The Dalles will continue to see growth in employment and population between 2016 and 2035 within the existing Urban Growth Boundary (UGB). At the same time, the analyses assume all modal transportation systems will remain as they exist today, except where planned improvement projects are considered funded and certain to be implemented. This "do nothing" or "no-build" scenario is commonly used as a foundation that communities can compare to alternatives that include various projects, policies, pilot studies, and programs.

The remainder of this memorandum outlines the analyses and findings of the "no build" future transportation conditions. In addition, preliminary examples of improvement strategies the City and ODOT may consider to address some of the needs in the future are also highlighted.

DEVELOPMENT OF YEAR 2035 TRAFFIC FORECASTS

Estimates of future traffic demand are based on population and employment forecasts in the year 2035, existing travel patterns, and transportation infrastructure (existing system and planned/funded improvements). The following section summarizes key aspects of The Dalles 2035 traffic volume estimate.

Land Use and Population Projections

Land use plays an important role in developing a comprehensive transportation system. The amount of land that is planned to be developed, the type of land uses, and how the land uses are mixed together will have a direct impact on how the transportation system will be used in the future. Understanding land use is critical to taking actions to maintain or enhance the transportation system.

Travel Demand Modeling Tool

Based on a variety of data sources, ODOT's Transportation Planning Analysis Unit (TPAU) has created a travel demand model specific to The Dalles to help inform future demand and travel patterns. The travel demand model is comprised of multiple Transportation Analysis Zones (TAZs) that encompass defined geographic areas and the land uses within them. The arterial and collector roadway network is integrated with the TAZs to reflect the existing motor vehicle transportation system.

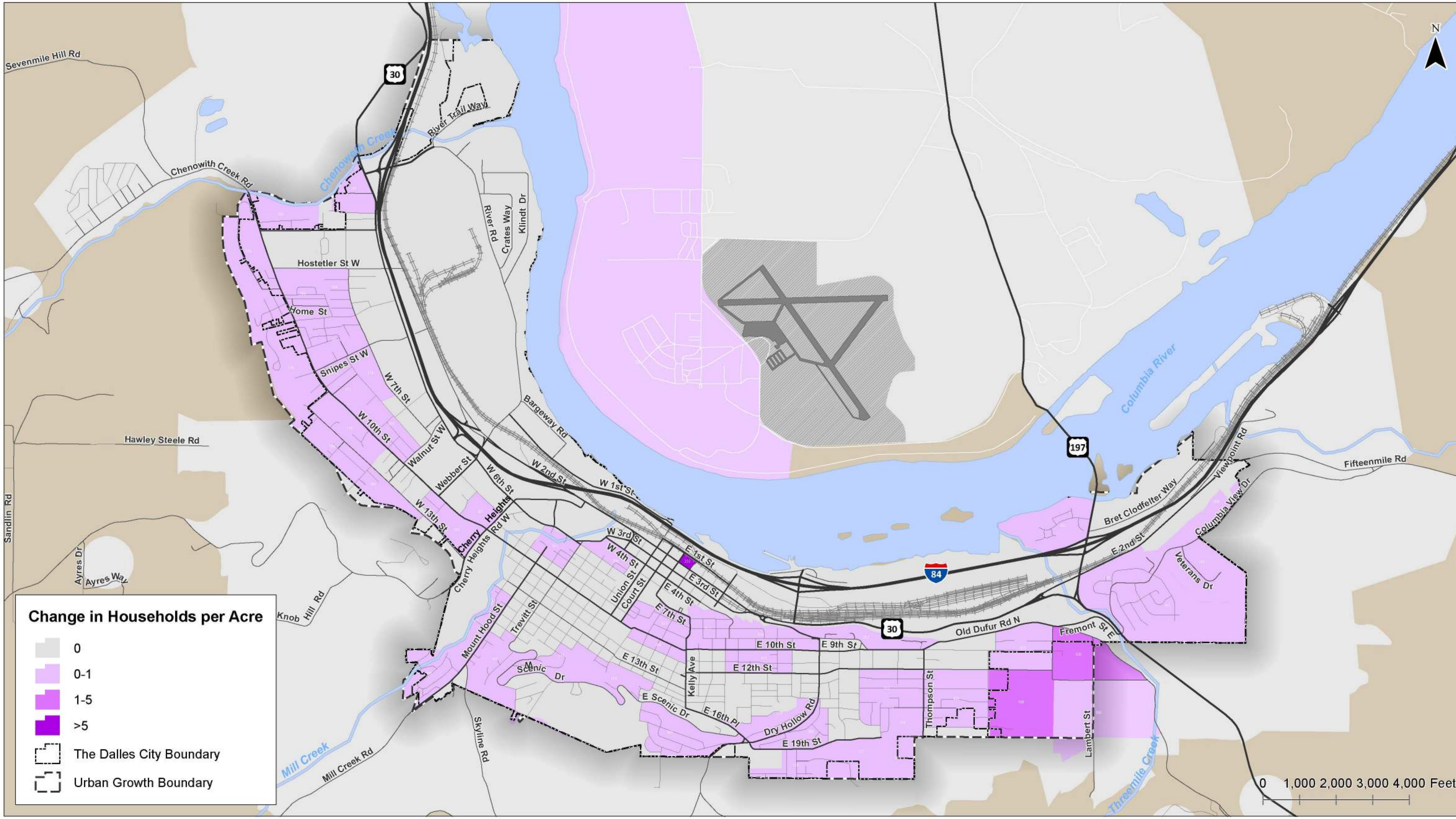
Travel patterns between land uses in each TAZ and to and from the broader region have been estimated by City staff for both existing and long-term future conditions and integrated into the TPAU modeling effort. Each TAZ has been coded with a unique set of characteristics for land use, population, employment and households in the geographic area represented by the TAZ. The travel demand model in turn uses the coded information to predict future travel patterns between TAZs and the regional roadway network. The inputs into the model and TAZs are coded to represent the existing transportation system and anticipated future changes as accurately as possible. Each TAZ area is individually coded to reflect anticipated changes in population, businesses/employment opportunities and/or households.

Growth Projections

The Dalles travel demand model is coded to assess travel patterns for base year 2010 and forecast year 2036 population, household, and employment (retail, service, and other) estimates for The Dalles by TAZ. Figures 4-1 and 4-2 illustrate the percent change in households and employment expected per acre between base year 2010 and forecast year 2036. Table 1 summarizes the collective changes in population, households, employment community-wide. As shown in Table 4-1, the change in population is projected to be 11.8 percent over the 26-year period while the corresponding percent change in households is projected to be 13.4 percent and the change in employment is projected to be 15.2 percent.

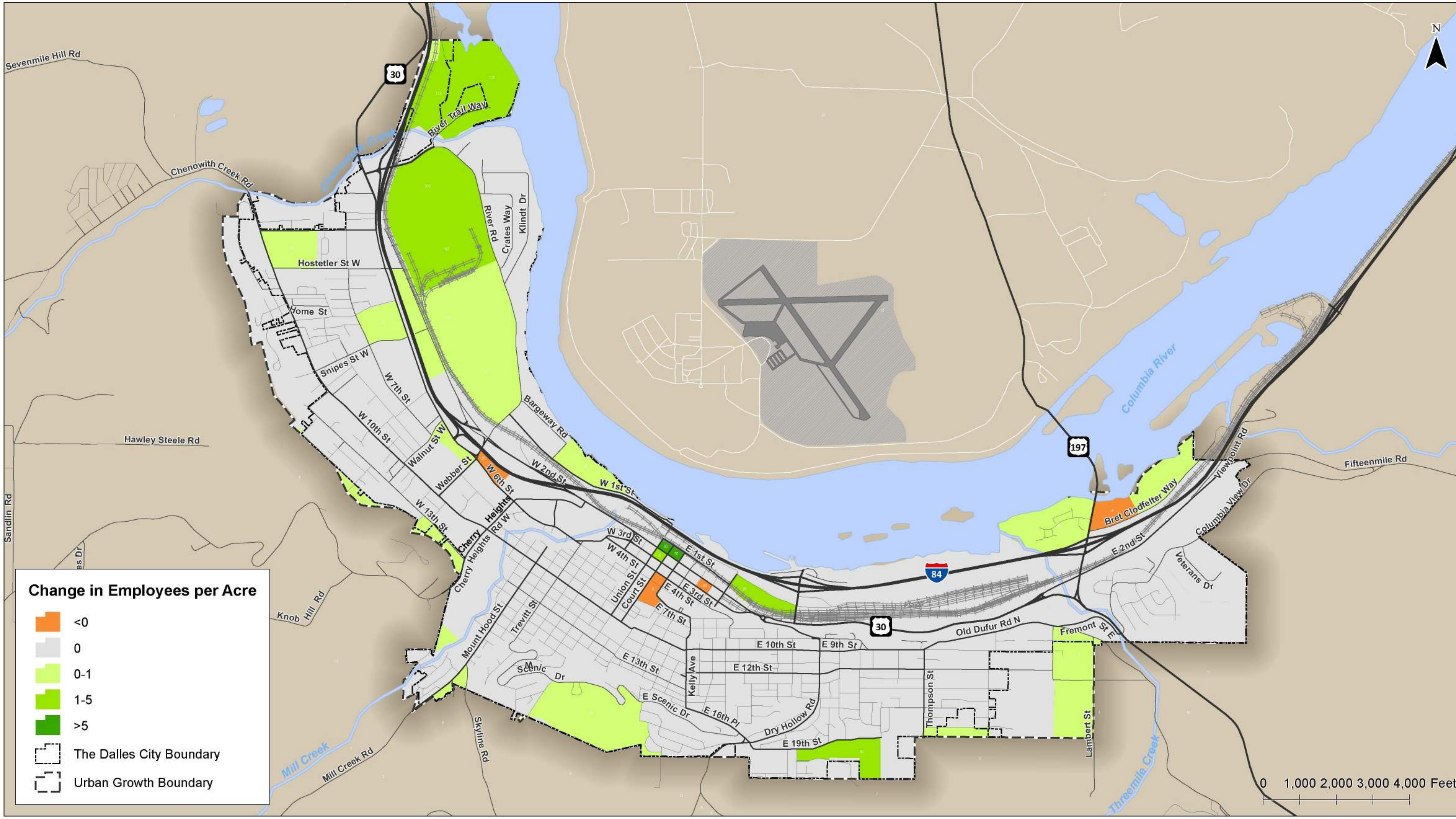
Table 4-1: The Dalles Land Use Summary

Land Use	2010	2036	Change	Percent Change
Population	18,479	20,660	2,181	11.8%
Households	7,378	8,369	991	13.4%
Employment	8,435	9,714	1,279	15.2%



Change in Households from 2010 to 2036
The Dalles, Oregon

Figure
4-1



Change in Employment from 2010 to 2036
The Dalles, Oregon

Figure
4-2

H:\projfile\18495 - The Dalles TSP\gis\4-2 Change in Employment.mxd - jsommerville - 2:07 PM 2/4/2016

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County

Travel Trends and Modeling Observations

In reviewing the future traffic volume projections, several trends and relationships should be considered as follows.

- The greatest increase in housing and employees per acre (density) is projected within several blocks of The Dalles Downtown where redevelopment is anticipated.
- While the downtown TAZs have the highest increase in density of anticipated housing and employees, these areas are relatively small.
- The total increase in employment projected by the travel demand model is highest in the industrial areas.
- As land uses change in proportion to each other (i.e., a more significant increase in employment relative to population and household growth), there will be a shift in the overall operation of the transportation system.
  - By way of illustration, retail land uses typically generate a higher number of trips per acre of land than residential, industrial, or other land uses. As a result, the location and design of retail land uses in The Dalles has the potential to substantially affect localized transportation system operations (for example, at a traffic signal or driveway serving as a gateway to a retail development). Even within retail uses, the trip impact can vary between destination retail (businesses whose customers drive significant distances to reach the site – for example, a large home improvement store) vs. convenience retail (business who rely largely on traffic passing by the site to shop as a function of convenience – for example, a gas station or convenience market)
- Areas of The Dalles that are homogeneous in land use character can also affect transportation system design and operations.
  - For example, the Port area primarily has employment-based land uses and, as a result, the local transportation system must support significant trips coming to or from that area during peak commuter periods (especially if shift changes coincide among employers).
  - Similarly, residential subdivisions tend to have a relatively heavy egress travel pattern during the morning peak hour and a relatively heavy return-to-home travel pattern during the p.m. peak hour.
  - Promoting a mix of residential, commercial, and employment land uses so that some residents may work and shop locally reduces the need for residents to travel longer distances (for example, as is being developed within the Lone Pine area).
  - Parking demand is also heavily impacted by land use – mixed-use areas have the potential to make better use of shared parking arrangements (for example, office

space may use parking during the day that is shared with local residents overnight and on weekends when residential is highest and office demand lowest).

- Areas with significant future development potential may substantially impact the transportation system and should be thoughtfully considered. ODOT's travel demand model specifically considered the following local high-growth potential areas:
  - Lands north of I-84, at the far west and east ends of the city, at the boundaries of the UGB;
  - Vacant industrial land located near the I-84/ Chenoweth interchange;
  - Land zoned for industrial/commercial uses at the Columbia Gorge Regional Airport; and,
  - Future mixed-use development within the Lone Pine area.

Planned and Funded Projects Assumed in the Travel Demand Model

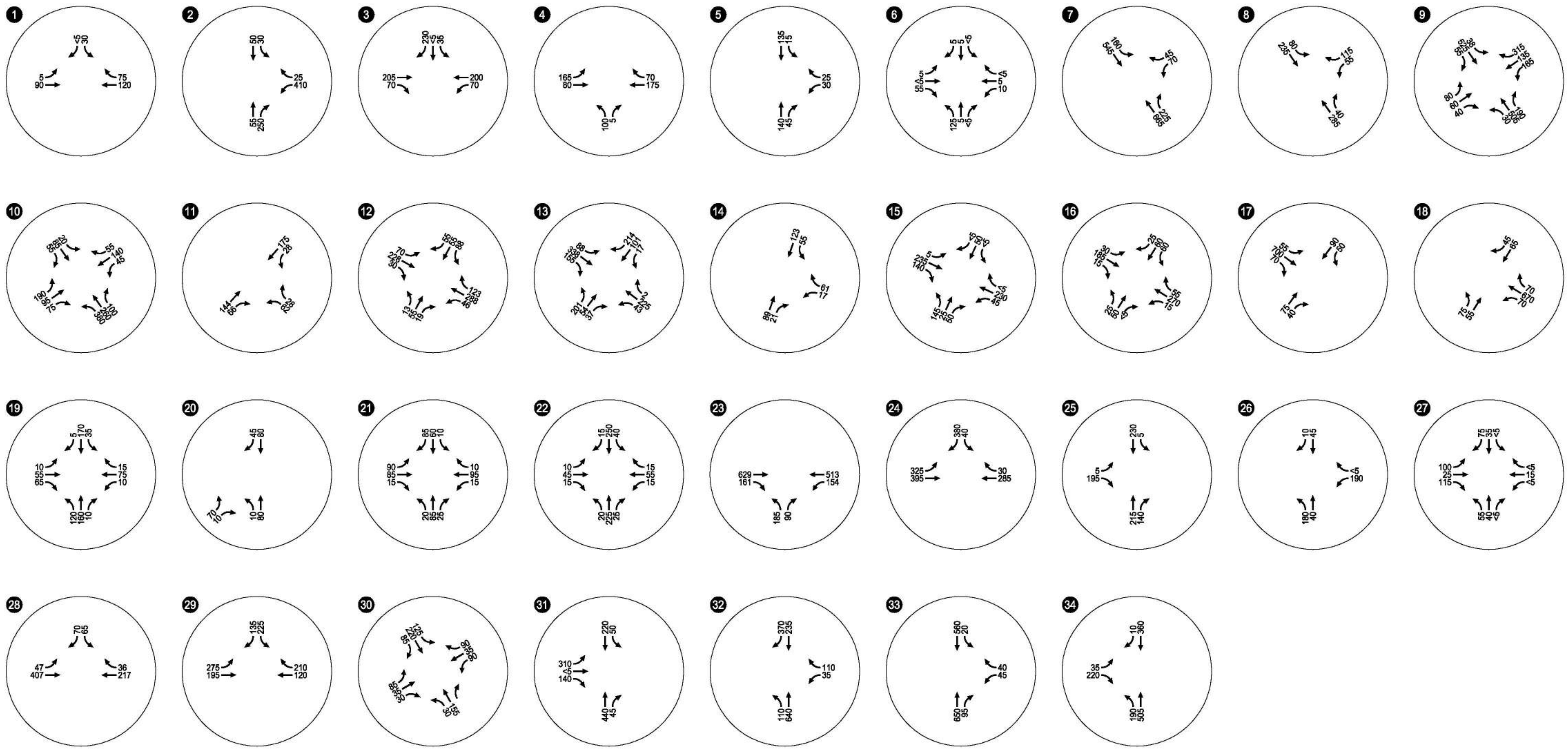
The initial year 2035 modeling presented in this memorandum assumes that only new transportation projects that are both developed and funded will be available for use in 2035. Typically, such future projects could be part of the ODOT Statewide Transportation Improvement Program (STIP), or City/County projects. While ODOT's 2015-2018 STIP includes several projects within The Dalles, such as improvements to the Riverfront Trail, sign upgrades, signalization upgrades, and safety improvements, no capacity or operational projects are planned and funded at the study intersections. Accordingly, the Year 2035 modeling presented in this report reflects operations of the existing transportation system with year 2035 traffic volumes.

FUTURE TRAFFIC CONDITIONS AND NEEDS

Year 2035 Forecast Traffic Volumes

Year 2035 forecast traffic volumes on the arterial and collector street system were projected using the travel demand model to reflect anticipated land use changes assuming continued use of the existing transportation network. Turning and through movement volumes at the study intersections were derived from the travel demand model projections using the post-processing methodology presented in the National Cooperative Highway Research Program (NCHRP) Report 255 *Highway Traffic Data for Urbanized Area Project Planning and Design*, in conjunction with engineering judgment and knowledge of the study area.

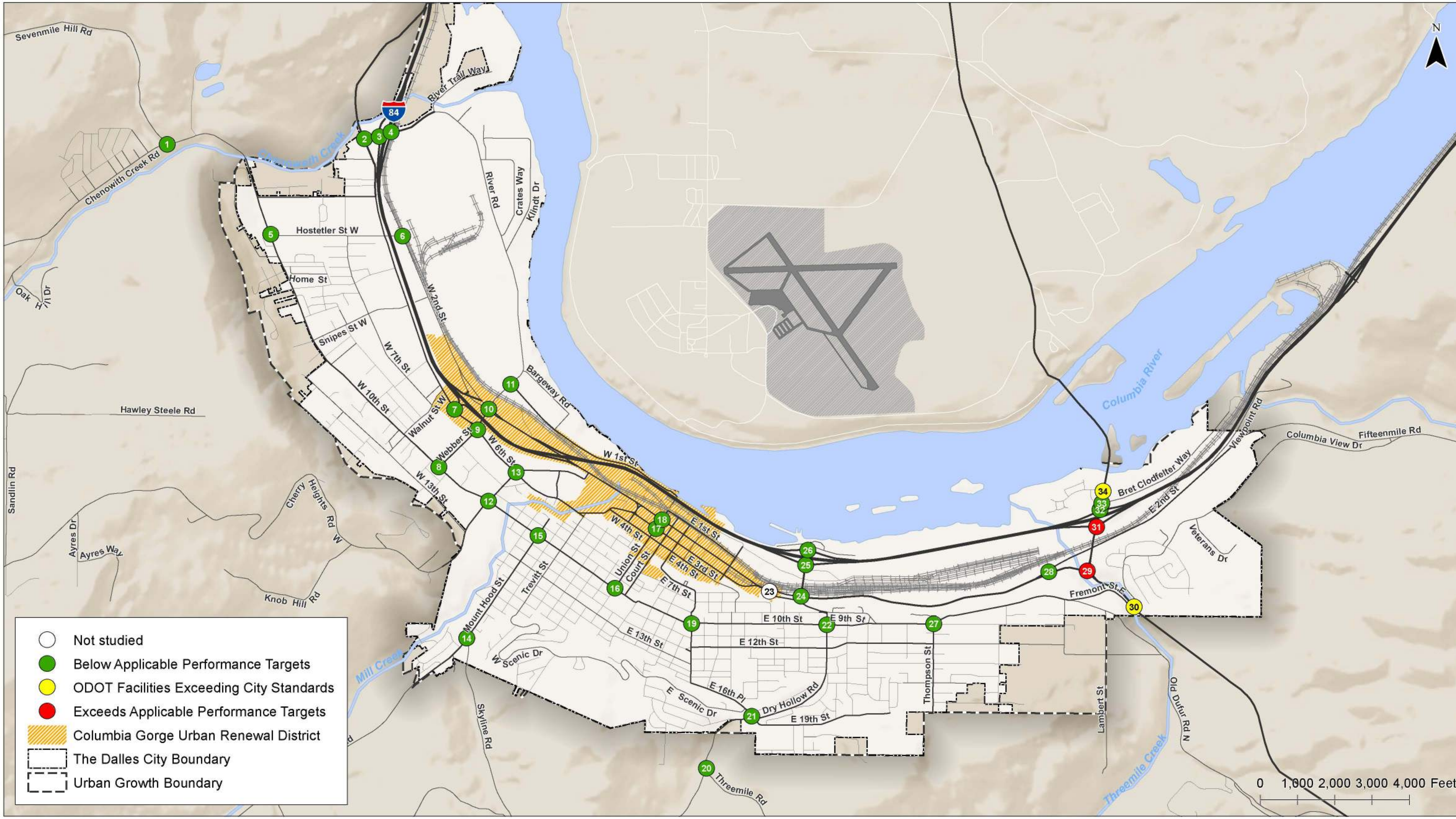
Figure 4-3 illustrates the year 2035 traffic volumes at the study intersections located within The Dalles UGB during the weekday p.m. peak hour while Figure 4-4 illustrates the corresponding intersection locations.



- Study Intersections

Future 2035 Traffic Volumes
Weekday PM Peak Hour
The Dalles, Oregon

Figure 4-3



Future Traffic Conditions Weekday PM Peak Hour The Dalles, Oregon

Figure 4-4

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

Year 2035 Forecast Operations

The City of The Dalles seeks to maintain LOS D or better at signalized and unsignalized intersections. ODOT operation standards for existing and no-build future scenarios were previously documented in Technical Memorandum #3 and are defined in Table 6 of the *Oregon Highway Plan*.

The traffic volumes shown in Figure 4-3 were used to analyze traffic operations at the study intersections. Figure 4-4 and Table 4-2 summarize the results of the traffic operations analysis at the study intersections for the weekday p.m. peak hour. Figure 4-4 illustrates study intersections that exceed the applicable operational standards with red circles. Those intersections shown with yellow circles satisfy ODOT performance targets, but do not meet City standards. All other intersections are shown by green circles, indicating they are operating below the applicable performance thresholds. Note that the color-coding shown in Figure 4-4 only represents delay- and capacity-based performance measures. Additional performance measures and considerations including queuing and safety are addressed later in this memorandum. *Year 2035 Future Traffic Condition operations analysis worksheets are included in Appendix A.*

Key findings from the forecast weekday p.m. peak hour operational analysis includes:

- Compared to existing conditions, the forecast traffic conditions do not indicate a substantial increase in traffic demand and congestion, except along the US 197 corridor.
- The unsignalized US 197/I-84 EB Ramp intersection (Intersection #31) has a volume-to-capacity (v/c) ratio of greater than 1.0 on the eastbound approach. This finding indicates eastbound I-84 off-ramp volumes are projected to exceed both the intersection's capacity and the intersection's 0.85 v/c target.
- The unsignalized US 197/US 30 intersection (Intersection #29) has a v/c ratio of greater than 1.0 on the southbound left-turn approach lane. This finding indicates southbound volumes turning left to continue on US 197 are projected to exceed both the intersection's capacity and the intersection's 0.85 v/c target.
- While satisfying ODOT's mobility standard, the Lone Pine Boulevard eastbound left-turn movement at US 197 (Intersection #34) is forecast to exceed the City's LOS D threshold. The projected delay impacts less than 50 vehicles during the weekday p.m. peak hour.
- The minor-street approaches to US 197 at Fremont Street/Columbia View Drive (Intersection #30) are forecast to exceed the City's LOS D threshold but satisfy ODOT's mobility standard.
- The signals at the Webber Street interchange (at 6th Street and 2nd Street) operate with permitted left-turn phasing on the north and south approaches. This signal phasing does not provide for the most efficient signal operations resulting in excess delay and queuing on the north and south approaches at both signals.

Table 4-2: Forecast 2035 Intersection Operations – Weekday PM Peak Hour

Map ID	Intersection	Level of Service (LOS)	Delay (Sec)	Volume/ Capacity (V/C)	Unsignalized Critical Movement	ODOT V/C Target*	Meets Applicable Performance Thresholds?
1	Seven Mile Hill Rd/ Chenoweth Rd	B	10.5	0.05	SB	N/A	Yes
2	US 30/River Rd	C	16.5	0.61	WB	0.90	Yes
3	I-84 EB Ramps/River Rd	C	16.6	0.13	SB	0.85	Yes
4	I-84 WB Ramps/River Rd	D	25.2	0.43	NB	0.85	Yes
5	W 10th St/Hostetler Rd	B	10.8	0.09	WB	N/A	Yes
6	W 2nd St/Hostetler Rd	B	11.9	0.03	WB	N/A	Yes
7	I-84 EB Ramps/W 6th St	D	33.2	0.49	WB	0.85	Yes
8	Webber St/W 10th St	C	17.1	0.17	WB	N/A	Yes
9	Webber St/W 6th St	C	20.4	0.76	Signalized	N/A	Yes
10	Webber St/W 2nd St	C	22.2	0.87	Signalized	N/A	Yes
11	Webber St/W 1st St	B	11.7	0.15	WB	N/A	Yes
12	Cherry Heights Rd/W 10th St	C	19.8	N/A	AWSC	N/A	Yes
13	Cherry Heights Rd/W 6th St	C	25.5	0.65	Signalized	N/A	Yes
14	Mt Hood St/Skyline Rd	B	11.1	0.03	WB	N/A	Yes
15	Mt Hood St/Skyline Rd	C	23.4	N/A	AWSC	N/A	Yes
16	Union St/10th	B	11	N/A	AWSC	N/A	Yes
17	Union St/W 3rd St	C	31.8	0.46	Signalized	N/A	Yes
18	Union St/W 2nd St	B	13.5	0.4	Signalized	N/A	Yes
19	Kelly Ave/E 10th St	C	18.9	0.29	WB	N/A	Yes
20	Dry Hollow Rd/3 Mile Rd	B	10	0.1	EB	N/A	Yes
21	Dry Hollow Rd/16th Pl/19th St	A	8.7	N/A	AWSC	N/A	Yes
22	Dry Hollow Rd/E 10th St	C	16.7	0.22	WB	N/A	Yes
24	Brewery Overpass Rd/US 30	B	11.8	0.30	EB	0.90	Yes
25	Brewery Overpass Rd/ I-84 EB Ramps	C	15.9	0.40	WB	0.85	Yes
26	Brewery Overpass Rd/ I-84 WB Ramps	C	16.2	0.25	NB	0.85	Yes
27	Thompson St/E 10th St/ Old Dufur Rd	B	10.4	0.10	SB	N/A	Yes
28	E 2nd St/US 30	B	10.4	0.10	SBL	0.90	Yes
29	US 197/US 30	**F**	**>50**	**1.13**	SBL	0.85	**No**
30	US 197/Fremont St/Columbia View Dr	**F**	**50.3**	0.71	EB	0.90	**City No, ODOT Yes**
31	US 197/I-84 EB Ramps	**F**	**>50**	**1.08**	EB	0.85	**No**
32	US 197/I-84 WB Ramps	A	9.6	0.14	WB	0.85	Yes
33	US 197/Bret Clodfelter Wy	C	22.8	0.31	WB	0.90	Yes
34	US 197/Lone Pine Blvd	**E**	**40.4**	0.26	EB	0.90	**City No, ODOT Yes**

AWSC = All-way stop control, N/A = Not applicable, EB=Eastbound, WB=Westbound, SB=Southbound, NB=Northbound

* For critical movement at unsignalized intersections

As shown in Table 4-2, there is a need to increase capacity at two intersections that exceed their applicable v/c targets. At two other intersections on ODOT facilities, the delay exceeds City thresholds, but not ODOT's v/c target.

Congestion has been reported at several other intersections within The Dalles, although the forecast conditions do not indicate the delay and capacity will exceed applicable performance thresholds. Pedestrian and bicycle facilities and safety projects may be identified at these locations, as described below.

Intersection Queues

A queuing analysis was conducted at the five signalized study intersections using Synchro 8 software. Table 4-3 summarizes the 95th percentile queues for movements with exclusive lanes during the weekday p.m. peak hour, rounded to the nearest 25 feet (approximately 1 vehicle length). The available storage lengths reflect the striped storage for each movement at the intersections.

Table 4-3: Forecast 2035 Signalized 95th Percentile Queues – Weekday PM Peak Hour

Map ID	Intersection	Movement	Weekday PM Queue (feet)	Available Storage (feet)	Adequate?
9	Webber St/W 6th St	EBL	25	250	Yes
		EBT/R	<400	705	Yes
		WBL	25	150	Yes
		WBT	300	> 500	Yes
		WBR	50	175	Yes
		NBL/T	100	495	Yes
		NBR	5	175	Yes
		SBL/T	250	585	Yes
		SBR	125	50	**No**
10	Webber St/W 2nd St	EBL	25	125	Yes
		EBT	100	430	Yes
		WBL	275	425	Yes
		WBT	200	635	Yes
		WBR	50	425	Yes
		NBL/T	275	585	Yes
		NBR	50	25	No
		SBL/T	150	810	Yes
13	Cherry Heights Rd/W 6th St	EBL	100	100	Yes
		EBT	375	> 500	Yes
		EBR	50	> 500	Yes
		WBL	50	965	Yes
		WBT	250	965	Yes
		WBR	0	75	Yes
		NBL	150	100	**No**
		NBT/R	75	360	Yes
		SBL	25	200	Yes
		SBT/R	300	200	**No**
17	Union St/W 3rd St	EBT	350	365	Yes
		NBT	100	> 500	Yes
		SBL	75	75	Yes
		SBT	50	205	Yes
18	Union St/W 2nd St	WBL	50	50	Yes
		WBT	175	390	Yes
		NBT	100	205	Yes
		SBT	50	385	Yes

EB=Eastbound, WB=Westbound, SB=Southbound, NB=Northbound, L=Left-turn Lane, T=Through Lane, R=Right-turn Lane, L/T=Shared Left-Through Lane, T/R= Shared Through-Right Lane L/R=Shared Left and Right-turn Lane

As shown in Table 4-3, all of the signalized study intersections are forecasted to have one or more movements where the 95th percentile queues exceed the available storage for that movement. *The worksheets used to evaluate future queuing at the signalized study intersections are included in Appendix G.*

Based on the forecast queuing analysis, the following signalized intersection improvement needs were identified:

- *Webber Street Interchange (Intersections #9 and #10)* - Queue storage to accommodate forecast demand queues at the Webber/6th Street and Webber/2nd Street intersections would require extending the right-turn lane beyond the queue in the shared through/left lanes. Due to restrictions in width under the I-84 overpass, extending these turn lanes beyond 100 feet is not feasible within the constraints of the existing structure.
- *Cherry Heights Road/W 6th Street (Intersection #13)* – The southbound queue extends beyond the left-turn lane storage length, reducing the approach capacity. Review of approach volumes indicates an imbalance in lane utilization between the left lane (20 vehicles/hour) and shared through/right lanes (346 vehicles/hour). The northbound left-turn lane needs to be extended to 150 feet by reallocating existing pavement width.

Unsignalized Intersection Queues

The operational analysis of unsignalized intersections estimates queuing at unsignalized intersections. Based on review of the analysis results, we did not identify any unsignalized queues that exceed available storage. Additional consideration of storage lengths and turn lane needs at unsignalized intersections are identified as safety needs.

Roadway Connectivity

Within most of the City, the existing grid network generally provides users with a variety of travel options and serves as emergency access routes during incidents. A review of the existing street connectivity needs and constraints revealed the following:

- There is an established grid system within and adjacent to the downtown core. Outside of the downtown area, connectivity is limited by topography, the I-84 corridor, the US 197 corridor, and the Union Pacific Railroad corridor and undeveloped properties. Specific constraints include:
    - Access to/from residential areas off of Columbia View Drive is limited to a single unsignalized intersection at US 197.
    - Access to the mixed-use development off of Lone Pine Boulevard is limited to a single point of access on US 197.
    - Connections from The Dalles to The Dalles Municipal Airport and the surrounding industrial areas are limited to US 197.

    - Railroad crossings and I-84 concentrate north-south travel to/from The Port industrial area to River Road (Chenoweth Interchange) and Webber Street.
- Despite the grid system in the downtown area and to the south, there are limited east-west connections from the west side of the City to the east side, with the exception of I-84.
- Significant grade changes limit connections across the southern UGB boundary, although current connections provide adequate capacity.
- The Mid-Columbia Medical Center (MCMC) has limited collector or arterial connection options to the east to Thompson Street (refer to Figure 4-5). Completing a connection to Thompson Street could improve emergency response time by providing alternative routes to the hospital and could alleviate other north/south routes currently in use. Examples of connections that could be considered for completion are:
    - Extend E 19th Street from MCMC to Thompson Street
    - Extend E 16th Street from Oakwood Drive to Quinton Street
    - Extend Oakwood Drive from E 16th Street to E 14th Street
    - Complete E 16th Street from Golden Way to Thompson Street
- The downtown core of The Dalles includes a one-way couplet (East 2nd Street and East 3rd Street). There have been requests to evaluate the impacts to the downtown area if the one-way couplet was converted into two-way streets. Consideration will need to be given to the roundabout at East 2nd Street and Brewery Grade as the west leg of the roundabout currently accommodates the one-way couplet configuration. Consideration will also need to be given to the costs of upgrading the signalized intersections along both streets to allow for two-way travel. The evaluation of this concept will be provided in Technical Memorandum #5.
    - Traffic volume
    - Roundabout
    - Signal modifications
    - Loading/unloading, freight.

Roadway Safety Needs & Considerations

Several study intersections were identified in Technical Memorandum #3 as exceeding the critical crash rate, the 90th percentile crash rate, or having more than 50-percent left-turn or angle crash type proportion. These include:

- US 197/Fremont Street/Columbia View Drive (Intersection #30)
    - Exceeds Critical Crash Rate during the study period. The posted speed on the uncontrolled US 197 approaches is 45 miles per hour (MPH). Fourteen of the 15 reported crashes (93 percent) were left-turn crashes. Safety improvement needs may include changes to traffic control or speed reduction on US 197.
- US 197/US 30 (Intersection #29)
    - Exceeds Critical Crash Rate during the study period. The posted speed on the uncontrolled US 197 approaches is 45 miles per hour (MPH). Speed and weather factors

have been indicated in the 12 reported crashes at this intersection. Safety improvement needs may include changes to traffic control or speed reduction measures.

- I-84 EB Ramps/River Road (Intersection #3)
    - This intersection exceeded the 90th percentile crash rates for similar intersections throughout the state. Two of the four crashes at this location were injury B and C. Two of the four crashes were turning movement related; indicating that sight distance may need to be evaluated.
- Kelly Avenue/East 10th Street (Intersection #19)
    - This intersection exceeded the 90th percentile crash rates for similar intersections throughout the state. Four of the six reported crashes resulted in injury B or C. Four crashes were angle collisions with reports that the driver failed to obey the stop sign. Advanced stop-ahead warning signage or larger stop signs may be needed to reduce potential for running the stop sign.
- Dry Hollow Road/East 10th Street (Intersection #22)
    - This intersection exceeded the 90th percentile crash rates for similar intersections throughout the state with a total of six crashes. Four crashes were angle collisions and two crashes resulted in injuries. Advanced stop-ahead warning signage may be needed to reduce potential for running the stop sign.
- US 197/I-84 Eastbound Ramps (Intersection #31)
    - Six of the nine reported crashes were either angle or turning movement related. The majority of these involved an eastbound vehicle making a left-turn from the ramp. Turn lanes or changes in traffic control may be needed to address the reported crash types.
- US 197/I-84 Westbound Ramps (Intersection #32)
    - Three of the six reported crashes were angle or turning movement related. No exclusive left-turn or right-turn lanes are provided along any approach to the intersection. Turn lanes or changes in traffic control may be needed to address the reported crash types.
- Webber St/W 2nd Street (Intersection #10)
    - 14 crashes were reported at the intersection over the 5-year period, including 10 crashes caused by angle or turning movement. A majority of these crashes involve a northbound left-turn vehicle. Converting the northbound left-turn phase to protected only phasing may be needed to address reported crash types.
- US 197/Bret Clodfelter Way (Intersection #33)
    - 5 crashes were reported at this intersection over the study period, all of them including angle or turning movement collisions where the driver was cited as not yielding right-of-way. Turn lanes or changes in traffic control may be needed to address the reported crash types.

Increases in congestion associated with the forecast employment and population growth could affect crash patterns observed at the aforementioned intersections and throughout the City. Based on input from the Technical and Public Advisory Committee members, additional safety improvement needs identified for mitigation include:

- W 6th Street from River Road to Chenoweth Loop Road and from Hostetler Street to Snipes Street
    - A two-way left-turn lane is provided on W 6th Street from Snipes to Webber Street, but is not provided along this segment of W 6th Street. A TWLTL is expected to reduce left-turn and rear-end crashes related to traffic turning at public and private accesses.
    - As shown in Figure 4-5, there were 27 crashes along the segments of W 6th Street where no TWLTL or left-turn lane exists today. Of these 27 crashes, the majority were rear-end crashes (14) or angle/left-turn crashes (12). Of the 14 rear-end crashes, 10 occurred in the northbound direction.
- 1st Street/Union Street
    - At this rail crossing, southbound traffic turning left onto 1st Street has the potential to create a queue across the railroad tracks during peak periods of vehicular traffic. (See Exhibit 4-1)
- 1st Street/Madison Street
    - 1st Street parallels the railroad and intersects with Madison Street at the railroad crossing. Because the existing traffic gate blocks the northbound lane along Madison Street, the geometry of the intersection allows vehicles attempting an eastbound left-turn movement from 1st Street to avoid the traffic gate when a train is present. (See Exhibit 4-2)

Exhibit 4-1 UPRR Railroad Crossing at Union Street

Exhibit 4-2 UPRR Railroad Crossing at Madison Street

Figure 4-5 – Reported Crashes on W 6th Street

- E 10th Street/Thompson Street
  - While projected to satisfy the City and ODOT's intersection capacity standard, stakeholder comments indicate the Old Dufur Road skewed approach and the undefined nature of the intersection contribute to driver confusion and influence the perceived safety of pedestrians and bicyclists (see Exhibit 4-3). The existing configuration includes stop sign control on the northbound Thompson Street and westbound East 10th Street approaches.
- E 2nd Street/US 30
  - The intersection has eastbound and westbound free-flow through movements; however, the eastbound left-turn, westbound right-turn, and southbound movements are all stop-controlled. Westbound vehicles along US 30 are shifted to the north to allow for an easier eastbound left-turn movement onto East 2nd Street. Exhibit 4-4 illustrates the existing intersection configuration.
  - The current intersection has drainage and lack of storm inlets.

Exhibit 4-3 Existing Alignment at E 10th Street/Old Dufur Road/Thompson Street Source: Google Maps

Exhibit 4-4 Existing Alignment of US 30/State Road (E 2nd Street) Source: Google Maps

ODOT ARTS Program

In addition to the projects listed above, the ODOT All Roads Transportation Safety (ARTS) program has programmed systemic sign upgrades and illumination along US 197 and West 6th Street.

Access Management

Spacing requirements for public roadways and private driveways can have a profound impact on transportation system operations as well as land development. As the City continues to grow, its street system will become more heavily traveled. Consequently, it will become increasingly important to manage access on the arterial and collector street system as new development occurs in order to preserve those streets' function for carrying through traffic.

Future access management on highways and City collector and arterial facilities could benefit both safety and operations; however, access management strategies and implementation require careful consideration to balance the needs for access to developed land with the need to ensure movement of traffic in a safe and efficient manner. Future streetscape projects, redevelopment, or changes in land use may provide opportunities for shared access, creation of easements for future shared access, reduction in the number of driveways, or alternative connectivity to lower-order facilities. These topics will be addressed later in the TSP update process.

As part of the I-84 Chenoweth Road IAMP, future access locations and public street connections were evaluated for properties and streets located in the IAMP Access Study Area. Access locations were evaluated based on ODOT's Division 51 Access Management standards, the City of The Dalles access spacing standards, and an assessment of traffic operations and safety as described in Action 3C.3 of the 1999 Oregon Highway Plan.

Under ODOT's current access management policy, the 1999 Oregon Highway Plan stipulates that the desired distance between an interchange ramp terminal and the first major approach (public or private) on the crossroad should be 1,320 feet (¼ mile). Currently there are four private accesses and two public street connections within 1,320 feet of the interchange ramp terminals. Public street connections are located on River Road at West 6th Street, and West 6th Street at Division Street. Existing private accesses are located on West 6th Street and US 30.

Bicycle Needs

Bicycle needs were evaluated at a qualitative level in the context of future system needs.[1] The Dalles Bicycle Advisory Committee provided extensive feedback and guidance related to bicycle system needs. The Advisory Committee feedback was reviewed along with those bicycle facilities identified in Technical Memorandum #3 as having a bicycle level of traffic stress (LTS) rating of 3 or 4[2].

Downtown Bicycle Considerations

Bicycle corridor needs through the downtown area were noted in light of the lack of existing facilities on the East 2nd Street and East 3rd Street corridors. Given current right-of-way and building constraints in the downtown area, opportunities to widen East 2nd Street or East 3rd Street to provide dedicated bicycle facilities are limited. While many cyclists share the roadway with motor vehicles, there is a need to accommodate bicycle travel for a wider range of users through downtown.

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[1] Future forecast volumes are not expected to increase to a great enough degree on a typical weekday to warrant a future conditions evaluation of bicycle level of traffic stress.

[2] Bicycle needs aim to reduce the LTS to a rating of 2, which is considered appealing to a majority of the bike-riding population and therefore, is the desired target on most arterials and collectors.

East-West Bicycle Connectivity Considerations

The existing conditions analysis documented that there are limited east-west bicycle connections through The Dalles. The northwest side of the City has several schools, a new transit center (under construction on West 7th Street), a new aquatic center, and may be home to the Gorge Youth Center in the future. A high priority has been placed on providing safe and efficient bicycle facilities between these locations and to residential areas.

Input from The Dalles Ad-Hoc Bicycle Advisory Committee identified several specific needs, including new bicycle routes and right-of-way for multi-use paths based on their discussion during a November 18, 2015 meeting. The needs are generally illustrated in Figure 4-6. The type of treatments (bicycle lanes, shared roadway, bicycle boulevard, etc.), an evaluation of need for pavement widening, and cost estimates for each project will be described in Technical Memorandum #5.

Pedestrian Needs

Within The Dalles, sidewalks are provided on one or both sides of some of the arterials and collectors, as summarized in Technical Memorandum #3. Generally, sidewalks are provided on both sides of the street throughout The Dalles Historic Downtown and on at least one side of residential streets south of downtown. Ideally, future plans for improvements to the pedestrian system should focus on strategic improvements to improve east-west connectivity throughout The Dalles and connectivity between residential areas and schools as identified in the Safe Routes to School (SRTS) Action Plans, and trail improvements to complete The Dalles Riverfront Trail.

Pedestrian needs identified to date include:

- Areas to the west of Webber Street (and south of I-84) and areas east of Thompson Street generally have the fewest pedestrian facilities. The areas to the west of Webber Street in need of pedestrian facilities have some key attractors and generators (school, transit center, and planned youth center).
- Given it is one of a few east-west arterials in The Dalles, pedestrian improvements to 10th Street and/or 7th Street (West of Cherry Heights Rd) may be prioritized to provide an east-west pedestrian route and align with future bicycle route needs.
- Improvements to the shared-use paths within The Dalles could also be considered.
    - The majority of The Dalles Riverfront Trail is completed, but a workgroup is tasked with identifying options to complete two short missing segments.
    - Additional shared-use paths along Chenowith Creek and Mill Creek, were identified in the 2006 TSP, but have not been completed. Constructing new accesses to the trail should also be considered in the future.
- Needs previously identified through SRTS plans include:

- Sidewalk and sidewalk connections around Chenoweth Elementary on W 10th Street, W 7th Street, Hostetler Street, and Chenowith Loop Road
- Sidewalk and sidewalk connections around Dry Hollow Elementary on E 16th Place and E 19th Street – add sidewalk on side with gravel up Dry Hollow
- Intersection signage and pavement markings, including crossing warning signs and markings at:
  - West 10th Street/Hostetler Street (Chenowith Elementary)
  - East 16th Place/East 19th Street/Dry Hollow Road (Dry Hollow Elementary)
  - West 14th Street/Bridge Street (Colonel Wright Elementary)
  - West 14th Street/Trevitt Street (Colonel Wright Elementary)
  - West 16th Street/Bridge Street (Colonel Wright Elementary)
  - West 16th Street/Trevitt Street (Colonel Wright Elementary)

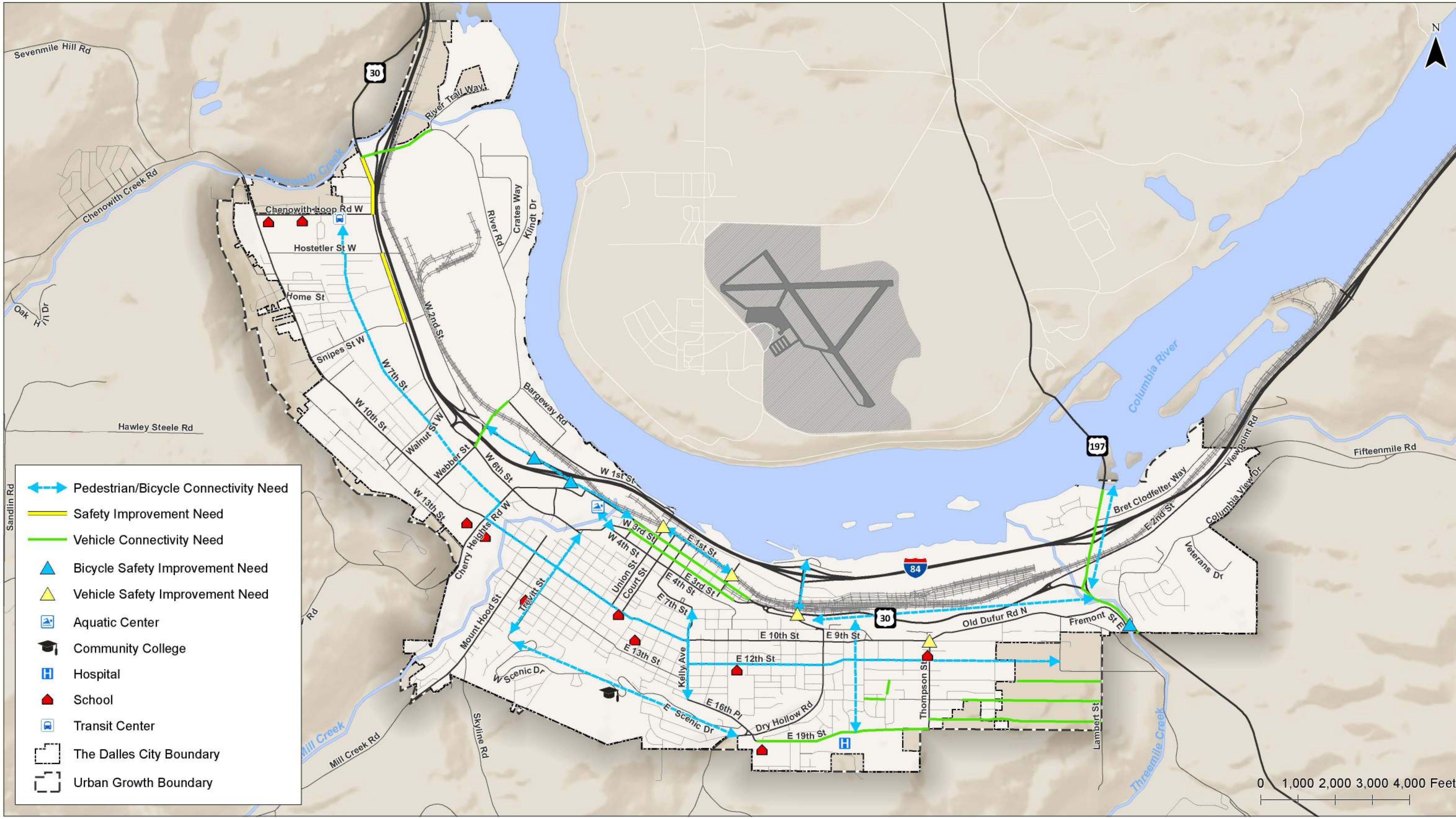
Transit

A new transit center is currently under construction in the southwest corner of the West 7th Street/ Chenoweth Loop Road intersection. West 7th Street has been widened and extended to Chenowith Loop Road. The transit center is expected to be completed in 2016, with park-and-ride space and bus service provided by Columbia Area Transit, Mid-Columbia Council of Government (MCCOG) Link, and possibly Greyhound. There is a high priority to provide pedestrian and bicycle connectivity between the new transit center's location on the west side of the City to the Downtown area. As noted in the previous Pedestrian and Bicycle Needs sections, a priority on improving pedestrian and bicycle facilities on West 7th Street will provide east-west connectivity between the transit center, proposed youth center, schools, and the Downtown area.

MCCOG's Link service provides dial-a-ride service (door-to-door, on request). The City could consider investing in a fixed-route service to provide regular services to key destinations (e.g., MCMC, Columbia Gorge Community College, downtown, Aquatic Center, etc.). A fixed route system could help reduce single-occupant motor vehicle trips and provide accessibility and connectivity, consistent with TSP Goal #2C.

SUMMARY AND NEXT STEPS

The needs identified in this memorandum are generally reflected in Figure 4-6. They include needs identified in the existing analysis and inventory, needs based on feedback from various stakeholders, and capacity analyses prepared based on modeling of projected future traffic volumes.



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The Hub of the Pacific Northwest · City of The Dalles · Oregon

Future Needs
The Dalles, Oregon

Figure **4-6**

Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning
APG

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

The preliminary needs identified include improvements to pedestrian and bicycle facilities to enhance east-west connectivity throughout the City and between key attractors and destinations. The needs also consider intersection capacity improvements, vehicular connectivity, and safety improvements. The needs included as part of this memorandum were reviewed by the Project Advisory Committee (PAC) and Technical Advisory Committee (TAC) members as well as at the February 10 Public Workshop. Alternatives to address the identified needs are provided in Technical Memorandum #5, with additional information to facilitate evaluation of the alternatives.

APPENDICES

Appendix A Year 2035 Future Traffic Conditions Worksheets

Appendix B 2035 Future Queuing Worksheets

Appendix A Year 2035 Future Traffic Condition Worksheet

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	38	525	51	27	503	192	75	63	40	165	133	313
Future Volume (vph)	38	525	51	27	503	192	75	63	40	165	133	313
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0		4.0	4.0		5.0	5.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.97	1.00		0.97	1.00
Satd. Flow (prot)	1662	1711		1662	1733	1458		1647	1488		1686	1403
Flt Permitted	0.30	1.00		0.27	1.00	1.00		0.65	1.00		0.75	1.00
Satd. Flow (perm)	533	1711		464	1733	1458		1095	1488		1301	1403
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	39	541	53	28	519	198	77	65	41	170	137	323
RTOR Reduction (vph)	0	4	0	0	0	110	0	0	29	0	0	155
Lane Group Flow (vph)	39	590	0	28	519	88	0	142	12	0	307	168
Heavy Vehicles (%)	0%	1%	0%	0%	1%	2%	3%	4%	0%	1%	1%	6%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6		6	8		8	4		4
Actuated Green, G (s)	33.4	30.3		31.6	29.4	29.4		19.5	19.5		18.5	18.5
Effective Green, g (s)	33.4	30.3		31.6	29.4	29.4		19.5	19.5		18.5	18.5
Actuated g/C Ratio	0.51	0.46		0.48	0.45	0.45		0.30	0.30		0.28	0.28
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		4.0	4.0		5.0	5.0
Vehicle Extension (s)	2.0	4.5		2.5	4.5	4.5		2.5	2.5		2.0	2.0
Lane Grp Cap (vph)	322	785		262	771	649		323	439		364	393
v/s Ratio Prot	c0.01	c0.34		0.00	0.30							
v/s Ratio Perm	0.06			0.05		0.06		0.13	0.01		c0.24	0.12
v/c Ratio	0.12	0.75		0.11	0.67	0.14		0.44	0.03		0.84	0.43
Uniform Delay, d1	9.2	14.7		10.2	14.5	10.8		18.8	16.5		22.4	19.4
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.1	4.6		0.1	2.8	0.2		0.7	0.0		15.5	0.3
Delay (s)	9.2	19.3		10.3	17.3	11.0		19.5	16.5		37.9	19.7
Level of Service	A	B		B	B	B		B	B		D	B
Approach Delay (s)		18.7			15.3			18.9			28.6	
Approach LOS		B			B			B			C	

Intersection Summary			
HCM 2000 Control Delay	20.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	66.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	71.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	18	84	54	378	260	97	190	95	76	45	137	55
Future Volume (vph)	18	84	54	378	260	97	190	95	76	45	137	55
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0		4.0	4.0		5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	
Frt	1.00	0.94		1.00	1.00	0.85		1.00	0.85		0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.97	1.00		0.99	
Satd. Flow (prot)	1662	1594		1498	1683	1430		1650	1458		1632	
Flt Permitted	0.58	1.00		0.49	1.00	1.00		0.62	1.00		0.89	
Satd. Flow (perm)	1014	1594		769	1683	1430		1052	1458		1460	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	20	95	61	430	295	110	216	108	86	51	156	62
RTOR Reduction (vph)	0	30	0	0	0	66	0	0	46	0	10	0
Lane Group Flow (vph)	20	126	0	430	295	44	0	324	40	0	260	0
Heavy Vehicles (%)	0%	1%	7%	11%	4%	4%	2%	4%	2%	6%	3%	0%
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6		6	8		8	4		
Actuated Green, G (s)	17.7	16.6		36.3	30.2	30.2		30.2	30.2		29.2	
Effective Green, g (s)	17.7	16.6		36.3	30.2	30.2		30.2	30.2		29.2	
Actuated g/C Ratio	0.23	0.22		0.48	0.40	0.40		0.40	0.40		0.39	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		4.0	4.0		5.0	
Vehicle Extension (s)	2.0	4.5		2.5	4.5	4.5		2.5	2.5		2.0	
Lane Grp Cap (vph)	247	350		511	673	572		420	583		564	
v/s Ratio Prot	0.00	0.08		c0.16	0.18							
v/s Ratio Perm	0.02			c0.24		0.03		c0.31	0.03		0.18	
v/c Ratio	0.08	0.36		0.84	0.44	0.08		0.77	0.07		0.46	
Uniform Delay, d1	22.4	24.9		15.0	16.5	14.0		19.7	14.0		17.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	0.1	1.1		11.8	0.8	0.1		8.2	0.0		0.2	
Delay (s)	22.4	26.0		26.7	17.3	14.1		27.9	14.0		17.5	
Level of Service	C	C		C	B	B		C	B		B	
Approach Delay (s)		25.6			21.7			25.0			17.5	
Approach LOS		C			C			C			B	

Intersection Summary			
HCM 2000 Control Delay	22.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	75.5	Sum of lost time (s)	15.0
Intersection Capacity Utilization	78.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	88	338	155	43	225	2	201	54	37	18	101	214
Future Volume (vph)	88	338	155	43	225	2	201	54	37	18	101	214
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1614	1716	1473	1662	1750	1488	1630	1623		1662	1547	
Flt Permitted	0.43	1.00	1.00	0.39	1.00	1.00	0.26	1.00		0.69	1.00	
Satd. Flow (perm)	739	1716	1473	682	1750	1488	451	1623		1212	1547	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	97	371	170	47	247	2	221	59	41	20	111	235
RTOR Reduction (vph)	0	0	114	0	0	1	0	18	0	0	61	0
Lane Group Flow (vph)	97	371	56	47	247	1	221	82	0	20	285	0
Heavy Vehicles (%)	3%	2%	1%	0%	0%	0%	2%	2%	0%	0%	5%	0%
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA		pm+pt	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8			4		
Actuated Green, G (s)	37.1	30.1	30.1	30.5	26.8	26.8	42.1	35.2		26.8	24.9	
Effective Green, g (s)	37.1	30.1	30.1	30.5	26.8	26.8	42.1	35.2		26.8	24.9	
Actuated g/C Ratio	0.41	0.33	0.33	0.34	0.29	0.29	0.46	0.39		0.29	0.27	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0	3.0	2.0	2.0		2.0	2.0	
Lane Grp Cap (vph)	368	568	487	268	515	438	367	628		366	423	
v/s Ratio Prot	c0.02	c0.22		0.01	0.14		c0.08	0.05		0.00	c0.18	
v/s Ratio Perm	0.09		0.04	0.05		0.00	0.20			0.01		
v/c Ratio	0.26	0.65	0.12	0.18	0.48	0.00	0.60	0.13		0.05	0.67	
Uniform Delay, d1	17.4	25.9	21.1	21.0	26.3	22.6	16.9	18.0		22.9	29.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	2.7	0.1	0.1	0.7	0.0	1.9	0.0		0.0	3.3	
Delay (s)	17.5	28.6	21.2	21.1	27.0	22.6	18.8	18.0		22.9	32.7	
Level of Service	B	C	C	C	C	C	B	B		C	C	
Approach Delay (s)		25.0			26.1			18.6			32.2	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	25.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	90.9	Sum of lost time (s)	20.0
Intersection Capacity Utilization	73.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	54	701	67	0	0	0	0	76	37	47	88	0
Future Volume (vph)	54	701	67	0	0	0	0	76	37	47	88	0
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)		4.5						4.5		4.0	4.5	
Lane Util. Factor		0.95						1.00		1.00	1.00	
Frt		0.99						0.96		1.00	1.00	
Flt Protected		1.00						1.00		0.95	1.00	
Satd. Flow (prot)		3215						1568		1630	1733	
Flt Permitted		1.00						1.00		0.95	1.00	
Satd. Flow (perm)		3215						1568		1630	1733	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	61	797	76	0	0	0	0	86	42	53	100	0
RTOR Reduction (vph)	0	7	0	0	0	0	0	20	0	0	0	0
Lane Group Flow (vph)	0	927	0	0	0	0	0	108	0	53	100	0
Heavy Vehicles (%)	2%	2%	0%	0%	0%	0%	0%	7%	6%	2%	1%	0%
Turn Type	Perm	NA						NA		Prot	NA	
Protected Phases		2						8		7	4	
Permitted Phases	2											
Actuated Green, G (s)		30.0						30.0		15.5	49.5	
Effective Green, g (s)		30.0						30.0		15.5	49.5	
Actuated g/C Ratio		0.34						0.34		0.18	0.56	
Clearance Time (s)		4.5						4.5		4.0	4.5	
Lane Grp Cap (vph)		1089						531		285	969	
v/s Ratio Prot								c0.07		c0.03	0.06	
v/s Ratio Perm		0.29										
v/c Ratio		0.85						0.20		0.19	0.10	
Uniform Delay, d1		27.2						20.8		31.1	9.1	
Progression Factor		1.00						1.00		1.00	1.00	
Incremental Delay, d2		8.4						0.9		1.4	0.2	
Delay (s)		35.6						21.6		32.6	9.3	
Level of Service		D						C		C	A	
Approach Delay (s)		35.6			0.0			21.6			17.4	
Approach LOS		D			A			C			B	

Intersection Summary			
HCM 2000 Control Delay	31.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	88.5	Sum of lost time (s)	13.0
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	70	677	69	74	56	0	0	65	43
Future Volume (vph)	0	0	0	70	677	69	74	56	0	0	65	43
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Width	12	12	12	12	12	12	12	16	12	12	12	12
Total Lost time (s)				4.5	4.5			4.5			4.5	
Lane Util. Factor				1.00	0.95			1.00			1.00	
Frt				1.00	0.99			1.00			0.95	
Flt Protected				0.95	1.00			0.97			1.00	
Satd. Flow (prot)				1662	3152			1847			1643	
Flt Permitted				0.95	1.00			0.80			1.00	
Satd. Flow (perm)				1662	3152			1512			1643	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	0	0	0	77	744	76	81	62	0	0	71	47
RTOR Reduction (vph)	0	0	0	0	11	0	0	0	0	0	29	0
Lane Group Flow (vph)	0	0	0	77	809	0	0	143	0	0	89	0
Heavy Vehicles (%)	0%	0%	0%	0%	3%	14%	4%	5%	0%	0%	0%	2%
Turn Type				Perm	NA		Perm	NA			NA	
Protected Phases					6			8			4	
Permitted Phases				6			8					
Actuated Green, G (s)				33.0	33.0			26.0			26.0	
Effective Green, g (s)				33.0	33.0			26.0			26.0	
Actuated g/C Ratio				0.49	0.49			0.38			0.38	
Clearance Time (s)				4.5	4.5			4.5			4.5	
Lane Grp Cap (vph)				806	1529			578			628	
v/s Ratio Prot					c0.26						0.05	
v/s Ratio Perm				0.05				c0.09				
v/c Ratio				0.10	0.53			0.25			0.14	
Uniform Delay, d1				9.4	12.1			14.3			13.7	
Progression Factor				1.00	1.00			1.00			1.00	
Incremental Delay, d2				0.2	1.3			1.0			0.5	
Delay (s)				9.7	13.4			15.3			14.2	
Level of Service				A	B			B			B	
Approach Delay (s)		0.0			13.1			15.3			14.2	
Approach LOS		A			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	13.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	68.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	44.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Traffic Vol, veh/h	4	91	118	76	30	2
Future Vol, veh/h	4	91	118	76	30	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	84	84	84	84	84	84
Heavy Vehicles, %	1	0	7	50	0	3
Mvmt Flow	5	108	140	90	36	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	231	0	-	0	304	186
Stage 1	-	-	-	-	186	-
Stage 2	-	-	-	-	118	-
Critical Hdwy	4.11	-	-	-	6.4	6.23
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.209	-	-	-	3.5	3.327
Pot Cap-1 Maneuver	1343	-	-	-	692	854
Stage 1	-	-	-	-	851	-
Stage 2	-	-	-	-	912	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1343	-	-	-	689	854
Mov Cap-2 Maneuver	-	-	-	-	689	-
Stage 1	-	-	-	-	851	-
Stage 2	-	-	-	-	908	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	10.5
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1343	-	-	-	697
HCM Lane V/C Ratio	0.004	-	-	-	0.055
HCM Control Delay (s)	7.7	0	-	-	10.5
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Intersection	
Int Delay, s/veh	8.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	409	23	57	249	29	51
Future Vol, veh/h	409	23	57	249	29	51
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	Yield	-	None
Storage Length	150	0	-	-	300	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	87	87	87	87	87	87
Heavy Vehicles, %	4	0	2	6	7	0
Mvmt Flow	470	26	66	286	33	59

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	191	66	0	0	66	0
Stage 1	66	-	-	-	-	-
Stage 2	125	-	-	-	-	-
Critical Hdwy	6.44	6.2	-	-	4.17	-
Critical Hdwy Stg 1	5.44	-	-	-	-	-
Critical Hdwy Stg 2	5.44	-	-	-	-	-
Follow-up Hdwy	3.536	3.3	-	-	2.263	-
Pot Cap-1 Maneuver	793	1003	-	-	1505	-
Stage 1	952	-	-	-	-	-
Stage 2	896	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	776	1003	-	-	1505	-
Mov Cap-2 Maneuver	776	-	-	-	-	-
Stage 1	952	-	-	-	-	-
Stage 2	876	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.1	0	2.7
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	776	1003	1505	-
HCM Lane V/C Ratio	-	-	0.606	0.026	0.022	-
HCM Control Delay (s)	-	-	16.5	8.7	7.4	-
HCM Lane LOS	-	-	C	A	A	-
HCM 95th %tile Q(veh)	-	-	4.2	0.1	0.1	-

Intersection	
Int Delay, s/veh	5.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	0	207	71	71	200	0	0	0	0	36	2	232
Future Vol, veh/h	0	207	71	71	200	0	0	0	0	36	2	232
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	Free	-	-	None	-	-	None	-	-	Stop
Storage Length	-	-	-	115	-	-	-	-	-	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	82	82	82	82	82	82	82	82	82	82	82	82
Heavy Vehicles, %	0	6	6	0	3	0	0	0	0	31	0	6
Mvmt Flow	0	252	87	87	244	0	0	0	0	44	2	283

Major/Minor	Major1			Major2			Minor2		
Conflicting Flow All	244	0	-	252	0	0	669	669	244
Stage 1	-	-	-	-	-	-	417	417	-
Stage 2	-	-	-	-	-	-	252	252	-
Critical Hdwy	4.1	-	-	4.1	-	-	6.71	6.5	6.26
Critical Hdwy Stg 1	-	-	-	-	-	-	5.71	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.71	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.779	4	3.354
Pot Cap-1 Maneuver	1334	-	0	1325	-	-	381	381	785
Stage 1	-	-	0	-	-	-	607	595	-
Stage 2	-	-	0	-	-	-	727	702	-
Platoon blocked, %		-			-	-			
Mov Cap-1 Maneuver	1334	-	-	1325	-	-	356	0	785
Mov Cap-2 Maneuver	-	-	-	-	-	-	356	0	-
Stage 1	-	-	-	-	-	-	567	0	-
Stage 2	-	-	-	-	-	-	727	0	-

Approach	EB	WB	SB
HCM Control Delay, s	0	2.1	12.7
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1334	-	1325	-	-	356	785
HCM Lane V/C Ratio	-	-	0.065	-	-	0.13	0.36
HCM Control Delay (s)	0	-	7.9	-	-	16.6	12.1
HCM Lane LOS	A	-	A	-	-	C	B
HCM 95th %tile Q(veh)	0	-	0.2	-	-	0.4	1.6

Intersection	
Int Delay, s/veh	6.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	167	78	0	0	173	69	100	0	6	0	0	0
Future Vol, veh/h	167	78	0	0	173	69	100	0	6	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	160	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	79	79	79	79	79	79	79	79	79	79	79	79
Heavy Vehicles, %	5	18	0	0	0	7	3	0	67	0	0	0
Mvmt Flow	211	99	0	0	219	87	127	0	8	0	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	306	0	0	99	0	0	785	828	99
Stage 1	-	-	-	-	-	-	522	522	-
Stage 2	-	-	-	-	-	-	263	306	-
Critical Hdwy	4.15	-	-	4.1	-	-	6.43	6.5	6.87
Critical Hdwy Stg 1	-	-	-	-	-	-	5.43	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.43	5.5	-
Follow-up Hdwy	2.245	-	-	2.2	-	-	3.527	4	3.903
Pot Cap-1 Maneuver	1238	-	-	1507	-	-	360	309	805
Stage 1	-	-	-	-	-	-	593	534	-
Stage 2	-	-	-	-	-	-	779	665	-
Platoon blocked, %		-	-		-	-			
Mov Cap-1 Maneuver	1238	-	-	1507	-	-	299	0	805
Mov Cap-2 Maneuver	-	-	-	-	-	-	299	0	-
Stage 1	-	-	-	-	-	-	492	0	-
Stage 2	-	-	-	-	-	-	779	0	-

Approach	EB	WB	NB
HCM Control Delay, s	5.8	0	25.2
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR
Capacity (veh/h)	310	1238	-	-	1507	-	-
HCM Lane V/C Ratio	0.433	0.171	-	-	-	-	-
HCM Control Delay (s)	25.2	8.5	-	-	0	-	-
HCM Lane LOS	D	A	-	-	A	-	-
HCM 95th %tile Q(veh)	2.1	0.6	-	-	0	-	-

Intersection	
Int Delay, s/veh	1.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	31	20	138	43	14	133
Future Vol, veh/h	31	20	138	43	14	133
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	0	0	1	0	0	2
Mvmt Flow	38	24	168	52	17	162

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	391	195	0	0	221	0
Stage 1	195	-	-	-	-	-
Stage 2	196	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	617	851	-	-	1360	-
Stage 1	843	-	-	-	-	-
Stage 2	842	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	608	851	-	-	1360	-
Mov Cap-2 Maneuver	608	-	-	-	-	-
Stage 1	843	-	-	-	-	-
Stage 2	830	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.8	0	0.7
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	685	1360	-
HCM Lane V/C Ratio	-	-	0.091	0.013	-
HCM Control Delay (s)	-	-	10.8	7.7	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0	-

Intersection	
Int Delay, s/veh	7.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	5	2	57	8	4	0	127	3	2	0	5	5
Future Vol, veh/h	5	2	57	8	4	0	127	3	2	0	5	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	75	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	84	84	84	84	84	84	84	84	84	84	84	84
Heavy Vehicles, %	0	50	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	6	2	68	10	5	0	151	4	2	0	6	6

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	317	315	9	350	318	4	12	0	0	4	0	0
Stage 1	9	9	-	306	306	-	-	-	-	-	-	-
Stage 2	308	306	-	44	12	-	-	-	-	-	-	-
Critical Hdwy	7.1	7	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	6	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	6	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4.45	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	640	529	1079	608	602	1085	1620	-	-	1631	-	-
Stage 1	1017	801	-	708	665	-	-	-	-	-	-	-
Stage 2	706	583	-	975	890	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	590	479	1079	527	545	1085	1620	-	-	1631	-	-
Mov Cap-2 Maneuver	590	479	-	527	545	-	-	-	-	-	-	-
Stage 1	921	801	-	641	602	-	-	-	-	-	-	-
Stage 2	635	528	-	911	890	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9	11.9	7.2	0
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1620	-	-	977	533	1631	-	-
HCM Lane V/C Ratio	0.093	-	-	0.078	0.027	-	-	-
HCM Control Delay (s)	7.5	0	-	9	11.9	0	-	-
HCM Lane LOS	A	A	-	A	B	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	0.3	0.1	0	-	-

Intersection	
Int Delay, s/veh	3.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	69	45	664	222	159	545
Future Vol, veh/h	69	45	664	222	159	545
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	125	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	0	3	2	2	1	0
Mvmt Flow	73	47	699	234	167	574

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1724	816	0	0	933	0
Stage 1	816	-	-	-	-	-
Stage 2	908	-	-	-	-	-
Critical Hdwy	6.4	6.23	-	-	4.11	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.327	-	-	2.209	-
Pot Cap-1 Maneuver	99	375	-	-	738	-
Stage 1	438	-	-	-	-	-
Stage 2	397	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	77	375	-	-	738	-
Mov Cap-2 Maneuver	199	-	-	-	-	-
Stage 1	438	-	-	-	-	-
Stage 2	307	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	33.2	0	2.6
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	244	738	-
HCM Lane V/C Ratio	-	-	0.492	0.227	-
HCM Control Delay (s)	-	-	33.2	11.3	-
HCM Lane LOS	-	-	D	B	-
HCM 95th %tile Q(veh)	-	-	2.5	0.9	-

Intersection	
Int Delay, s/veh	3.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	56	115	283	37	78	235
Future Vol, veh/h	56	115	283	37	78	235
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	175	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	1	2	2	0	0	2
Mvmt Flow	60	122	301	39	83	250

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	737	321	0	0	340	0
Stage 1	321	-	-	-	-	-
Stage 2	416	-	-	-	-	-
Critical Hdwy	6.41	6.22	-	-	4.1	-
Critical Hdwy Stg 1	5.41	-	-	-	-	-
Critical Hdwy Stg 2	5.41	-	-	-	-	-
Follow-up Hdwy	3.509	3.318	-	-	2.2	-
Pot Cap-1 Maneuver	387	720	-	-	1230	-
Stage 1	738	-	-	-	-	-
Stage 2	668	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	357	720	-	-	1230	-
Mov Cap-2 Maneuver	357	-	-	-	-	-
Stage 1	738	-	-	-	-	-
Stage 2	616	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13	0	2
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	357	720	1230	-
HCM Lane V/C Ratio	-	-	0.167	0.17	0.067	-
HCM Control Delay (s)	-	-	17.1	11	8.1	0
HCM Lane LOS	-	-	C	B	A	A
HCM 95th %tile Q(veh)	-	-	0.6	0.6	0.2	-

Intersection	
Int Delay, s/veh	2.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	62	28	144	66	28	175
Future Vol, veh/h	62	28	144	66	28	175
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	5	16	3	10	8	1
Mvmt Flow	64	29	148	68	29	180

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	420	182	0	0	216	0
Stage 1	182	-	-	-	-	-
Stage 2	238	-	-	-	-	-
Critical Hdwy	6.45	6.36	-	-	4.18	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	3.444	-	-	2.272	-
Pot Cap-1 Maneuver	584	826	-	-	1319	-
Stage 1	842	-	-	-	-	-
Stage 2	795	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	570	826	-	-	1319	-
Mov Cap-2 Maneuver	570	-	-	-	-	-
Stage 1	842	-	-	-	-	-
Stage 2	776	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.7	0	1.1
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	631	1319	-
HCM Lane V/C Ratio	-	-	0.147	0.022	-
HCM Control Delay (s)	-	-	11.7	7.8	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.5	0.1	-

Intersection	
Intersection Delay, s/veh	19.8
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Traffic Vol, veh/h	0	70	228	30	0	46	288	123	0	13	55	19
Future Vol, veh/h	0	70	228	30	0	46	288	123	0	13	55	19
Peak Hour Factor	0.92	0.84	0.84	0.84	0.92	0.84	0.84	0.84	0.92	0.84	0.84	0.84
Heavy Vehicles, %	2	1	4	0	2	8	2	1	2	9	3	15
Mvmt Flow	0	83	271	36	0	55	343	146	0	15	65	23
Number of Lanes	0	0	1	1	0	0	1	1	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	2	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	2
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	2
HCM Control Delay	21.3	21.9	12.4
HCM LOS	C	C	B

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1
Vol Left, %	15%	23%	0%	14%	0%	42%
Vol Thru, %	63%	77%	0%	86%	0%	33%
Vol Right, %	22%	0%	100%	0%	100%	25%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	87	298	30	334	123	208
LT Vol	13	70	0	46	0	88
Through Vol	55	228	0	288	0	68
RT Vol	19	0	30	0	123	52
Lane Flow Rate	104	355	36	398	146	248
Geometry Grp	2	7	7	7	7	2
Degree of Util (X)	0.212	0.672	0.06	0.74	0.236	0.467
Departure Headway (Hd)	7.36	6.818	6.034	6.696	5.806	6.785
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	487	529	593	541	618	530
Service Time	5.424	4.565	3.781	4.441	3.551	4.834
HCM Lane V/C Ratio	0.214	0.671	0.061	0.736	0.236	0.468
HCM Control Delay	12.4	22.5	9.2	26.2	10.3	15.7
HCM Lane LOS	B	C	A	D	B	C
HCM 95th-tile Q	0.8	5	0.2	6.3	0.9	2.5

Intersection				
Intersection Delay, s/veh				
Intersection LOS				

Movement	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	0	88	68	52
Future Vol, veh/h	0	88	68	52
Peak Hour Factor	0.92	0.84	0.84	0.84
Heavy Vehicles, %	2	3	2	0
Mvmt Flow	0	105	81	62
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	2
HCM Control Delay	15.7
HCM LOS	C

Lane

Intersection	
Int Delay, s/veh	3.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	17	61	89	21	55	123
Future Vol, veh/h	17	61	89	21	55	123
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	75	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	7	12	4	11	2	4
Mvmt Flow	18	64	94	22	58	129

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	350	105	0	0	116	0
Stage 1	105	-	-	-	-	-
Stage 2	245	-	-	-	-	-
Critical Hdwy	6.47	6.32	-	-	4.12	-
Critical Hdwy Stg 1	5.47	-	-	-	-	-
Critical Hdwy Stg 2	5.47	-	-	-	-	-
Follow-up Hdwy	3.563	3.408	-	-	2.218	-
Pot Cap-1 Maneuver	637	923	-	-	1473	-
Stage 1	907	-	-	-	-	-
Stage 2	784	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	610	923	-	-	1473	-
Mov Cap-2 Maneuver	610	-	-	-	-	-
Stage 1	907	-	-	-	-	-
Stage 2	751	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.6	0	2.3
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	610	923	1473	-
HCM Lane V/C Ratio	-	-	0.029	0.07	0.039	-
HCM Control Delay (s)	-	-	11.1	9.2	7.5	0
HCM Lane LOS	-	-	B	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0.2	0.1	-

Intersection	
Intersection Delay, s/veh	23.4
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Traffic Vol, veh/h	0	5	236	142	0	44	230	2	0	143	26	52
Future Vol, veh/h	0	5	236	142	0	44	230	2	0	143	26	52
Peak Hour Factor	0.92	0.77	0.77	0.77	0.92	0.77	0.77	0.77	0.92	0.77	0.77	0.77
Heavy Vehicles, %	2	4	2	0	2	50	2	3	2	2	4	5
Mvmt Flow	0	6	306	184	0	57	299	3	0	186	34	68
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	27.8	24.3	17.1
HCM LOS	D	C	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	65%	1%	16%	4%
Vol Thru, %	12%	62%	83%	96%
Vol Right, %	24%	37%	1%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	221	383	276	49
LT Vol	143	5	44	2
Through Vol	26	236	230	47
RT Vol	52	142	2	0
Lane Flow Rate	287	497	358	64
Geometry Grp	1	1	1	1
Degree of Util (X)	0.532	0.798	0.692	0.132
Departure Headway (Hd)	6.676	5.776	6.948	7.442
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	540	627	520	480
Service Time	4.728	3.822	4.999	5.518
HCM Lane V/C Ratio	0.531	0.793	0.688	0.133
HCM Control Delay	17.1	27.8	24.3	11.7
HCM Lane LOS	C	D	C	B
HCM 95th-tile Q	3.1	7.9	5.3	0.5

Intersection				
Intersection Delay, s/veh				
Intersection LOS				

Movement	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	0	2	47	0
Future Vol, veh/h	0	2	47	0
Peak Hour Factor	0.92	0.77	0.77	0.77
Heavy Vehicles, %	2	0	9	0
Mvmt Flow	0	3	61	0
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	11.7
HCM LOS	B

Lane

Intersection	
Intersection Delay, s/veh	11
Intersection LOS	B

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	0	31	186	15	0	13	270	53	0	24	51	4	0	59	62	25
Future Vol, veh/h	0	31	186	15	0	13	270	53	0	24	51	4	0	59	62	25
Peak Hour Factor	0.92	0.95	0.95	0.95	0.92	0.95	0.95	0.95	0.92	0.95	0.95	0.95	0.92	0.95	0.95	0.95
Heavy Vehicles, %	2	0	5	0	2	0	3	0	2	4	4	0	2	0	2	0
Mvmt Flow	0	33	196	16	0	14	284	56	0	25	54	4	0	62	65	26
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	10.6	12	9.7	10.2
HCM LOS	B	B	A	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	30%	13%	4%	40%
Vol Thru, %	65%	80%	80%	42%
Vol Right, %	5%	6%	16%	17%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	79	232	336	146
LT Vol	24	31	13	59
Through Vol	51	186	270	62
RT Vol	4	15	53	25
Lane Flow Rate	83	244	354	154
Geometry Grp	1	1	1	1
Degree of Util (X)	0.133	0.336	0.467	0.236
Departure Headway (Hd)	5.772	5.067	4.858	5.517
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	624	713	746	655
Service Time	3.78	3.067	2.858	3.521
HCM Lane V/C Ratio	0.133	0.342	0.475	0.235
HCM Control Delay	9.7	10.6	12	10.2
HCM Lane LOS	A	B	B	B
HCM 95th-tile Q	0.5	1.5	2.5	0.9

Intersection	
Int Delay, s/veh	7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	8	57	67	11	74	17	119	162	9	34	169	5
Future Vol, veh/h	8	57	67	11	74	17	119	162	9	34	169	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	98	98	98	98	98	98	98	98	98	98	98	98
Heavy Vehicles, %	0	2	3	0	1	0	3	0	13	0	0	17
Mvmt Flow	8	58	68	11	76	17	121	165	9	35	172	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	703	661	175	721	660	170	178	0	0	174	0	0
Stage 1	244	244	-	413	413	-	-	-	-	-	-	-
Stage 2	459	417	-	308	247	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.52	6.23	7.1	6.51	6.2	4.13	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.52	-	6.1	5.51	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.52	-	6.1	5.51	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4.018	3.327	3.5	4.009	3.3	2.227	-	-	2.2	-	-
Pot Cap-1 Maneuver	355	383	866	345	384	879	1392	-	-	1415	-	-
Stage 1	764	704	-	620	595	-	-	-	-	-	-	-
Stage 2	586	591	-	706	704	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	263	337	866	251	338	879	1392	-	-	1415	-	-
Mov Cap-2 Maneuver	263	337	-	251	338	-	-	-	-	-	-	-
Stage 1	691	685	-	560	538	-	-	-	-	-	-	-
Stage 2	446	534	-	579	685	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	15.5	18.9	3.2	1.2
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1392	-	-	477	362	1415	-	-
HCM Lane V/C Ratio	0.087	-	-	0.282	0.288	0.025	-	-
HCM Control Delay (s)	7.8	0	-	15.5	18.9	7.6	0	-
HCM Lane LOS	A	A	-	C	C	A	A	-
HCM 95th %tile Q(veh)	0.3	-	-	1.1	1.2	0.1	-	-

Intersection	
Int Delay, s/veh	2.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Vol, veh/h	69	7	11	78	77	45
Future Vol, veh/h	69	7	11	78	77	45
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	0	0	0	5	11	0
Mvmt Flow	72	7	11	81	80	47

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	208	104	127	0	-	0
Stage 1	104	-	-	-	-	-
Stage 2	104	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	785	956	1472	-	-	-
Stage 1	925	-	-	-	-	-
Stage 2	925	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	779	956	1472	-	-	-
Mov Cap-2 Maneuver	779	-	-	-	-	-
Stage 1	925	-	-	-	-	-
Stage 2	918	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10	0.9	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1472	-	793	-	-
HCM Lane V/C Ratio	0.008	-	0.1	-	-
HCM Control Delay (s)	7.5	0	10	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.3	-	-

Intersection	
Intersection Delay, s/veh	8.7
Intersection LOS	A

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Traffic Vol, veh/h	0	0	82	13	0	16	93	11	0	18	83	25
Future Vol, veh/h	0	0	82	13	0	16	93	11	0	18	83	25
Peak Hour Factor	0.92	0.81	0.81	0.81	0.92	0.81	0.81	0.81	0.92	0.81	0.81	0.81
Heavy Vehicles, %	2	3	12	0	2	7	1	0	2	0	1	4
Mvmt Flow	0	0	101	16	0	20	115	14	0	22	102	31
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	8.7	8.9	8.7
HCM LOS	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	14%	0%	13%	12%
Vol Thru, %	66%	86%	78%	88%
Vol Right, %	20%	14%	9%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	126	95	120	69
LT Vol	18	0	16	8
Through Vol	83	82	93	61
RT Vol	25	13	11	0
Lane Flow Rate	156	117	148	85
Geometry Grp	1	1	1	1
Degree of Util (X)	0.197	0.155	0.193	0.112
Departure Headway (Hd)	4.55	4.766	4.699	4.745
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	787	751	763	754
Service Time	2.584	2.804	2.735	2.784
HCM Lane V/C Ratio	0.198	0.156	0.194	0.113
HCM Control Delay	8.7	8.7	8.9	8.4
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.7	0.5	0.7	0.4

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	0	8	61	0
Future Vol, veh/h	0	8	61	0
Peak Hour Factor	0.92	0.81	0.81	0.81
Heavy Vehicles, %	2	0	4	6
Mvmt Flow	0	10	75	0
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	8.4
HCM LOS	A

Lane

Intersection	
Int Delay, s/veh	0

Movement	WBL	WBR	NBL	NBR	SEL	SER
Traffic Vol, veh/h	0	94	86	0	69	84
Future Vol, veh/h	0	94	86	0	69	84
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Stop	Stop	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	0	-	0	-
Veh in Median Storage, #	0	-	0	-	0	-
Grade, %	0	-	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	102	93	0	75	91

Major/Minor	Major2		Minor1		Major1	
Conflicting Flow All	91	-	0	0	0	0
Stage 1	-	-	0	-	-	-
Stage 2	-	-	0	-	-	-
Critical Hdwy	-	-	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	-
Pot Cap-1 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Platoon blocked, %		-				-
Mov Cap-1 Maneuver	-	-	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SE
HCM Control Delay, s	0		
HCM LOS		-	

Minor Lane/Major Mvmt	NBLn1	WBL	WBR	SEL	SER
Capacity (veh/h)	-	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	-	0	-	-	-
HCM Lane LOS	-	A	-	-	-
HCM 95th %tile Q(veh)	-	-	-	-	-

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	86	95	111	0	0	84
Future Volume (Veh/h)	86	95	111	0	0	84
Sign Control		Free	Free		Yield	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	93	103	121	0	0	91
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	121				410	121
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	121				410	121
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				100	90
cM capacity (veh/h)	1467				560	930

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	196	121	91
Volume Left	93	0	0
Volume Right	0	0	91
cSH	1467	1700	930
Volume to Capacity	0.06	0.07	0.10
Queue Length 95th (ft)	5	0	8
Control Delay (s)	3.9	0.0	9.3
Lane LOS	A		A
Approach Delay (s)	3.9	0.0	9.3
Approach LOS			A

Intersection Summary			
Average Delay	3.9		
Intersection Capacity Utilization	19.8%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	4.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	12	44	17	16	54	13	19	225	24	39	252	15
Future Vol, veh/h	12	44	17	16	54	13	19	225	24	39	252	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	50	-	-	250	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	13	46	18	17	56	14	20	234	25	41	263	16

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	673	651	270	669	645	247	278	0	0	259	0	0
Stage 1	352	352	-	286	286	-	-	-	-	-	-	-
Stage 2	321	299	-	383	359	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	372	390	774	374	393	797	1296	-	-	1317	-	-
Stage 1	669	635	-	726	679	-	-	-	-	-	-	-
Stage 2	695	670	-	644	631	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	312	372	774	320	375	797	1296	-	-	1317	-	-
Mov Cap-2 Maneuver	312	372	-	320	375	-	-	-	-	-	-	-
Stage 1	659	615	-	715	669	-	-	-	-	-	-	-
Stage 2	616	660	-	564	611	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	15.8	16.7	0.6	1
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1296	-	-	408	395	1317	-	-
HCM Lane V/C Ratio	0.015	-	-	0.186	0.219	0.031	-	-
HCM Control Delay (s)	7.8	-	-	15.8	16.7	7.8	-	-
HCM Lane LOS	A	-	-	C	C	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.7	0.8	0.1	-	-

Intersection	
Int Delay, s/veh	9.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Traffic Vol, veh/h	324	395	285	32	40	382
Future Vol, veh/h	324	395	285	32	40	382
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	175	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	381	465	335	38	47	449

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	373	0	-	0	1581	354
Stage 1	-	-	-	-	354	-
Stage 2	-	-	-	-	1227	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1197	-	-	-	121	694
Stage 1	-	-	-	-	715	-
Stage 2	-	-	-	-	280	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1197	-	-	-	82	694
Mov Cap-2 Maneuver	-	-	-	-	82	-
Stage 1	-	-	-	-	715	-
Stage 2	-	-	-	-	191	-

Approach	EB	WB	SB
HCM Control Delay, s	4.2	0	26.5
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1197	-	-	-	647
HCM Lane V/C Ratio	0.318	-	-	-	0.767
HCM Control Delay (s)	9.4	-	-	-	26.5
HCM Lane LOS	A	-	-	-	D
HCM 95th %tile Q(veh)	1.4	-	-	-	7.2

Intersection	
Int Delay, s/veh	3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	4	0	197	2	0	0	2	214	141	3	230	0
Future Vol, veh/h	4	0	197	2	0	0	2	214	141	3	230	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	0	0	8	0	0	0	0	1	1	0	1	0
Mvmt Flow	5	0	224	2	0	0	2	243	160	3	261	0

Major/Minor	Minor2			Major1			Major2		
Conflicting Flow All	596	676	261	261	0	0	403	0	0
Stage 1	268	268	-	-	-	-	-	-	-
Stage 2	328	408	-	-	-	-	-	-	-
Critical Hdwy	6.4	6.5	6.28	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	5.4	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.4	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.372	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	470	378	763	1315	-	-	1167	-	-
Stage 1	782	691	-	-	-	-	-	-	-
Stage 2	734	600	-	-	-	-	-	-	-
Platoon blocked, %					-	-		-	-
Mov Cap-1 Maneuver	468	0	763	1315	-	-	1167	-	-
Mov Cap-2 Maneuver	468	0	-	-	-	-	-	-	-
Stage 1	780	0	-	-	-	-	-	-	-
Stage 2	733	0	-	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	11.8	0	0.1
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	SBL	SBT	SBR
Capacity (veh/h)	1315	-	-	754	1167	-	-
HCM Lane V/C Ratio	0.002	-	-	0.303	0.003	-	-
HCM Control Delay (s)	7.7	0	-	11.8	8.1	0	-
HCM Lane LOS	A	A	-	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	1.3	0	-	-

Intersection	
Int Delay, s/veh	6.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	0	0	0	188	0	3	178	40	0	0	45	10
Future Vol, veh/h	0	0	0	188	0	3	178	40	0	0	45	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	0	0	0	3	0	0	1	0	0	0	0	0
Mvmt Flow	0	0	0	214	0	3	202	45	0	0	51	11

Major/Minor	Minor1			Major1			Minor2		
Conflicting Flow All	481	450	45	0	0	0	452	450	0
Stage 1	450	450	-	-	-	-	0	0	-
Stage 2	31	0	-	-	-	-	452	450	-
Critical Hdwy	6.43	6.5	6.2	-	-	-	6.4	6.5	-
Critical Hdwy Stg 1	5.43	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.4	5.5	-
Follow-up Hdwy	3.527	4	3.3	-	-	-	3.5	4	-
Pot Cap-1 Maneuver	542	508	1031	-	-	-	569	508	-
Stage 1	640	575	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	645	575	-
Platoon blocked, %					-	-			
Mov Cap-1 Maneuver	542	0	1031	-	-	-	569	0	-
Mov Cap-2 Maneuver	542	0	-	-	-	-	569	0	-
Stage 1	640	0	-	-	-	-	-	0	-
Stage 2	-	0	-	-	-	-	645	0	-

Approach	WB	NB	SB
HCM Control Delay, s	15.9		
HCM LOS	C		-

Minor Lane/Major Mvmt	NBL	NBT	NBR	WBLn1	SBLn1
Capacity (veh/h)	-	-	-	546	-
HCM Lane V/C Ratio	-	-	-	0.398	-
HCM Control Delay (s)	-	-	-	15.9	-
HCM Lane LOS	-	-	-	C	-
HCM 95th %tile Q(veh)	-	-	-	1.9	-

Intersection	
Int Delay, s/veh	6.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	100	23	114	75	0	36	54	39	1	16	0	1
Future Vol, veh/h	100	23	114	75	0	36	54	39	1	16	0	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	0	0	0	5	0	0	0	0	0	0	5
Mvmt Flow	111	26	127	83	0	40	60	43	1	18	0	1

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	40	0	0	152	0	0	498	518	89	520	561	20
Stage 1	-	-	-	-	-	-	311	311	-	187	187	-
Stage 2	-	-	-	-	-	-	187	207	-	333	374	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.25
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.345
Pot Cap-1 Maneuver	1583	-	-	1441	-	-	486	465	975	470	439	1049
Stage 1	-	-	-	-	-	-	704	662	-	819	749	-
Stage 2	-	-	-	-	-	-	819	734	-	685	621	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1583	-	-	1441	-	-	436	403	975	388	381	1049
Mov Cap-2 Maneuver	-	-	-	-	-	-	436	403	-	388	381	-
Stage 1	-	-	-	-	-	-	649	610	-	755	705	-
Stage 2	-	-	-	-	-	-	770	691	-	586	573	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.1	5.2	16.2	14.4
HCM LOS			C	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	424	1583	-	-	1441	-	-	403
HCM Lane V/C Ratio	0.246	0.07	-	-	0.058	-	-	0.047
HCM Control Delay (s)	16.2	7.4	0	-	7.7	0	-	14.4
HCM Lane LOS	C	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	1	0.2	-	-	0.2	-	-	0.1

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Traffic Vol, veh/h	0	0	0	0	217	0	0	47	0	0	0	0
Future Vol, veh/h	0	0	0	0	217	0	0	47	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	92	92	92	92	92	92
Heavy Vehicles, %	0	1	0	0	1	0	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	252	0	0	51	0	0	0	0

Major/Minor	Major2			Minor1		
Conflicting Flow All	0	0	0	252	252	0
Stage 1	-	-	-	0	0	-
Stage 2	-	-	-	252	252	-
Critical Hdwy	-	-	-	7.12	6.52	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	6.12	5.52	-
Follow-up Hdwy	-	-	-	3.518	4.018	-
Pot Cap-1 Maneuver	-	-	-	701	651	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	752	698	-
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	-	-	-	701	0	-
Mov Cap-2 Maneuver	-	-	-	701	0	-
Stage 1	-	-	-	-	0	-
Stage 2	-	-	-	752	0	-

Approach	WB	NE
HCM Control Delay, s	0	
HCM LOS		-

Minor Lane/Major Mvmt	NELn1	WBL	WBT	WBR
Capacity (veh/h)	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-
HCM Control Delay (s)	-	0	-	-
HCM Lane LOS	-	A	-	-
HCM 95th %tile Q(veh)	-	-	-	-

Intersection	
Int Delay, s/veh	3.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR	NEL	NER
Traffic Vol, veh/h	0	0	0	70	0	36	0	47
Future Vol, veh/h	0	0	0	70	0	36	0	47
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop	Free	Free
RT Channelized	-	-	-	None	-	None	-	-
Storage Length	-	-	10	-	-	0	-	0
Veh in Median Storage, #	0	-	-	0	0	-	0	-
Grade, %	0	-	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	76	0	39	0	51

Major/Minor	Major2		Minor1		Major1	
Conflicting Flow All	51	0	51	51	0	0
Stage 1	-	-	51	-	-	-
Stage 2	-	-	0	-	-	-
Critical Hdwy	4.12	-	6.42	6.22	-	-
Critical Hdwy Stg 1	-	-	5.42	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	2.218	-	3.518	3.318	-	-
Pot Cap-1 Maneuver	1555	-	958	1017	-	-
Stage 1	-	-	971	-	-	-
Stage 2	-	-	-	-	-	-
Platoon blocked, %		-				-
Mov Cap-1 Maneuver	1555	-	914	1017	-	-
Mov Cap-2 Maneuver	-	-	914	-	-	-
Stage 1	-	-	971	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	NE
HCM Control Delay, s	3.6	8.7	0
HCM LOS		A	

Minor Lane/Major Mvmt	NEL	NER	NER2	NBLn1	WBL2	WBL	WBT
Capacity (veh/h)	-	-	-	1017	1555	-	-
HCM Lane V/C Ratio	-	-	-	0.038	0.045	-	-
HCM Control Delay (s)	0	-	-	8.7	7.4	-	-
HCM Lane LOS	A	-	-	A	A	-	-
HCM 95th %tile Q(veh)	-	-	-	0.1	0.1	-	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBR	SBL	SBR	NEL	NET	SWT	SWR
Traffic Vol, veh/h	0	0	65	0	0	407	0	217
Future Vol, veh/h	0	0	65	0	0	407	0	217
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	-	-	None	-	-
Storage Length	-	-	0	-	-	-	-	0
Veh in Median Storage, #	0	-	0	-	-	0	0	-
Grade, %	0	-	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	71	0	0	442	0	236

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	255	255	275	0	0	0
Stage 1	255	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	734	784	1288	-	-	-
Stage 1	788	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	734	784	1288	-	-	-
Mov Cap-2 Maneuver	734	-	-	-	-	-
Stage 1	788	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	SB	NE	SW
HCM Control Delay, s	10.4	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NEL2	NEL	NET	SBLn1	SWT	SWR	SWR2
Capacity (veh/h)	1288	-	-	734	-	-	-
HCM Lane V/C Ratio	-	-	-	0.096	-	-	-
HCM Control Delay (s)	0	-	-	10.4	0	-	-
HCM Lane LOS	A	-	-	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.3	-	-	-

Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBT	WBT	WBR	SWL	SWR
Traffic Vol, veh/h	0	0	217	0	0	70
Future Vol, veh/h	0	0	217	0	0	70
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	236	0	0	76

Major/Minor	Major2		Minor2	
Conflicting Flow All	-	0	236	236
Stage 1	-	-	236	-
Stage 2	-	-	0	-
Critical Hdwy	-	-	7.12	6.22
Critical Hdwy Stg 1	-	-	6.12	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	718	803
Stage 1	-	-	767	-
Stage 2	-	-	-	-
Platoon blocked, %	-	-		
Mov Cap-1 Maneuver	-	-	718	803
Mov Cap-2 Maneuver	-	-	718	-
Stage 1	-	-	767	-
Stage 2	-	-	-	-

Approach	WB	SW
HCM Control Delay, s	0	10
HCM LOS		B

Minor Lane/Major Mvmt	WBT	WBR	SWLn1
Capacity (veh/h)	-	-	803
HCM Lane V/C Ratio	-	-	0.095
HCM Control Delay (s)	-	-	10
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	0.3

Intersection	
Int Delay, s/veh	38

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Traffic Vol, veh/h	275	197	120	0	226	133
Future Vol, veh/h	275	197	120	0	226	133
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	175	-	-	-	0	100
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	1	1	3	6	3	1
Mvmt Flow	306	219	133	0	251	148

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	133	0	-	0	963	133
Stage 1	-	-	-	-	133	-
Stage 2	-	-	-	-	830	-
Critical Hdwy	4.11	-	-	-	6.43	6.21
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.209	-	-	-	3.527	3.309
Pot Cap-1 Maneuver	1458	-	-	-	282	919
Stage 1	-	-	-	-	891	-
Stage 2	-	-	-	-	426	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1458	-	-	-	~ 223	919
Mov Cap-2 Maneuver	-	-	-	-	~ 223	-
Stage 1	-	-	-	-	891	-
Stage 2	-	-	-	-	337	-

Approach	EB	WB	SB
HCM Control Delay, s	4.7	0	94.4
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1458	-	-	-	223	919
HCM Lane V/C Ratio	0.21	-	-	-	1.126	0.161
HCM Control Delay (s)	8.1	-	-	-	144.3	9.7
HCM Lane LOS	A	-	-	-	F	A
HCM 95th %tile Q(veh)	0.8	-	-	-	11.6	0.6

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	18.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	85	33	28	89	37	91	30	155	0	123	219	86
Future Vol, veh/h	85	33	28	89	37	91	30	155	0	123	219	86
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	175	-	-	260	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	0	5	2	1	0	0	0	8	6	0	3	1
Mvmt Flow	97	38	32	101	42	103	34	176	0	140	249	98

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	894	821	298	856	870	176	347	0	0	176	0	0
Stage 1	577	577	-	244	244	-	-	-	-	-	-	-
Stage 2	317	244	-	612	626	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.55	6.22	7.11	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.55	-	6.11	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.55	-	6.11	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4.045	3.318	3.509	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	264	306	741	279	292	872	1223	-	-	1412	-	-
Stage 1	506	497	-	762	708	-	-	-	-	-	-	-
Stage 2	698	699	-	482	480	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	185	268	741	216	256	872	1223	-	-	1412	-	-
Mov Cap-2 Maneuver	185	268	-	216	256	-	-	-	-	-	-	-
Stage 1	492	448	-	741	688	-	-	-	-	-	-	-
Stage 2	562	680	-	381	432	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	50.3	42.8	1.3	2.2
HCM LOS	F	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1223	-	-	235	328	1412	-	-
HCM Lane V/C Ratio	0.028	-	-	0.706	0.752	0.099	-	-
HCM Control Delay (s)	8	-	-	50.3	42.8	7.8	-	-
HCM Lane LOS	A	-	-	F	E	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	4.7	5.8	0.3	-	-

Intersection	
Int Delay, s/veh	30.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	311	0	141	0	0	0	0	439	47	51	218	0
Future Vol, veh/h	311	0	141	0	0	0	0	439	47	51	218	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	5	0	1	0	0	0	0	2	3	13	2	0
Mvmt Flow	334	0	152	0	0	0	0	472	51	55	234	0

Major/Minor	Minor2			Major1			Major2		
Conflicting Flow All	841	867	234	234	0	0	523	0	0
Stage 1	344	344	-	-	-	-	-	-	-
Stage 2	497	523	-	-	-	-	-	-	-
Critical Hdwy	6.45	6.5	6.21	4.1	-	-	4.23	-	-
Critical Hdwy Stg 1	5.45	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.45	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.545	4	3.309	2.2	-	-	2.317	-	-
Pot Cap-1 Maneuver	~ 331	293	808	1345	-	-	990	-	-
Stage 1	711	640	-	-	-	-	-	-	-
Stage 2	605	534	-	-	-	-	-	-	-
Platoon blocked, %					-	-		-	-
Mov Cap-1 Maneuver	~ 310	0	808	1345	-	-	990	-	-
Mov Cap-2 Maneuver	~ 310	0	-	-	-	-	-	-	-
Stage 1	665	0	-	-	-	-	-	-	-
Stage 2	605	0	-	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	80	0	1.7
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	SBL	SBT	SBR
Capacity (veh/h)	1345	-	-	310	808	990	-	-
HCM Lane V/C Ratio	-	-	-	1.079	0.188	0.055	-	-
HCM Control Delay (s)	0	-	-	111.5	10.5	8.8	0	-
HCM Lane LOS	A	-	-	F	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	12.8	0.7	0.2	-	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	0	0	0	35	0	107	112	638	0	0	234	372
Future Vol, veh/h	0	0	0	35	0	107	112	638	0	0	234	372
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Stop	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	0	0	0	0	0	4	7	3	0	0	5	6
Mvmt Flow	0	0	0	38	0	118	123	701	0	0	257	409

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	1409	1613	701	666	0	0	701	0	0
Stage 1	947	947	-	-	-	-	-	-	-
Stage 2	462	666	-	-	-	-	-	-	-
Critical Hdwy	6.4	6.5	6.24	4.17	-	-	4.1	-	-
Critical Hdwy Stg 1	5.4	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.4	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.336	2.263	-	-	2.2	-	-
Pot Cap-1 Maneuver	154	105	435	900	-	-	905	-	-
Stage 1	380	342	-	-	-	-	-	-	-
Stage 2	638	460	-	-	-	-	-	-	-
Platoon blocked, %					-	-		-	-
Mov Cap-1 Maneuver	120	0	435	900	-	-	905	-	-
Mov Cap-2 Maneuver	120	0	-	-	-	-	-	-	-
Stage 1	295	0	-	-	-	-	-	-	-
Stage 2	638	0	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13.5	1.4	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	900	-	-	577	905	-	-
HCM Lane V/C Ratio	0.137	-	-	0.27	-	-	-
HCM Control Delay (s)	9.6	0	-	13.5	0	-	-
HCM Lane LOS	A	A	-	B	A	-	-
HCM 95th %tile Q(veh)	0.5	-	-	1.1	0	-	-

Intersection	
Int Delay, s/veh	1.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	44	40	652	93	20	562
Future Vol, veh/h	44	40	652	93	20	562
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	-	-	-	50	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	0	5	3	0	0	5
Mvmt Flow	47	43	701	100	22	604

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1398	751	0	0	801	0
Stage 1	751	-	-	-	-	-
Stage 2	647	-	-	-	-	-
Critical Hdwy	6.4	6.25	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.345	-	-	2.2	-
Pot Cap-1 Maneuver	157	406	-	-	831	-
Stage 1	470	-	-	-	-	-
Stage 2	525	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	153	406	-	-	831	-
Mov Cap-2 Maneuver	153	-	-	-	-	-
Stage 1	470	-	-	-	-	-
Stage 2	511	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	22.8	0	0.3
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	292	831	-
HCM Lane V/C Ratio	-	-	0.309	0.026	-
HCM Control Delay (s)	-	-	22.8	9.4	-
HCM Lane LOS	-	-	C	A	-
HCM 95th %tile Q(veh)	-	-	1.3	0.1	-

Intersection	
Int Delay, s/veh	4.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Vol, veh/h	33	220	188	504	362	12
Future Vol, veh/h	33	220	188	504	362	12
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	75	0	50	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	1	1	4	9	0
Mvmt Flow	36	239	204	548	393	13

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1357	400	407	0	-	0
Stage 1	400	-	-	-	-	-
Stage 2	957	-	-	-	-	-
Critical Hdwy	6.4	6.21	4.11	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.309	2.209	-	-	-
Pot Cap-1 Maneuver	166	652	1157	-	-	-
Stage 1	681	-	-	-	-	-
Stage 2	376	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	137	652	1157	-	-	-
Mov Cap-2 Maneuver	137	-	-	-	-	-
Stage 1	681	-	-	-	-	-
Stage 2	310	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	17.2	2.4	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1157	-	137	652	-	-
HCM Lane V/C Ratio	0.177	-	0.262	0.367	-	-
HCM Control Delay (s)	8.8	-	40.4	13.7	-	-
HCM Lane LOS	A	-	E	B	-	-
HCM 95th %tile Q(veh)	0.6	-	1	1.7	-	-

Appendix B Year 2035 Future Queuing Worksheet

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBT	SBR
Lane Group Flow (vph)	39	594	28	519	198	142	41	307	323
v/c Ratio	0.10	0.72	0.08	0.66	0.26	0.42	0.08	0.81	0.57
Control Delay	7.5	21.4	7.4	20.5	3.3	23.8	0.9	41.1	12.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.5	21.4	7.4	20.5	3.3	23.8	0.9	41.1	12.2
Queue Length 50th (ft)	7	150	5	177	0	46	0	116	34
Queue Length 95th (ft)	18	#406	15	297	35	101	4	#259	113
Internal Link Dist (ft)		703		1481		491		582	
Turn Bay Length (ft)	250		150		175		175		60
Base Capacity (vph)	470	878	544	987	916	445	659	508	679
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.68	0.05	0.53	0.22	0.32	0.06	0.60	0.48

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBT
Lane Group Flow (vph)	20	156	430	295	110	324	86	270
v/c Ratio	0.07	0.50	0.87	0.41	0.16	0.73	0.13	0.45
Control Delay	12.6	25.7	35.8	17.7	4.4	30.1	5.2	17.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.6	25.7	35.8	17.7	4.4	30.1	5.2	17.9
Queue Length 50th (ft)	5	47	138	82	0	114	2	77
Queue Length 95th (ft)	15	97	#279	180	30	#255	27	150
Internal Link Dist (ft)		430		634		582		810
Turn Bay Length (ft)	125		425		425		25	
Base Capacity (vph)	526	909	499	943	849	457	676	622
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.17	0.86	0.31	0.13	0.71	0.13	0.43

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	97	371	170	47	247	2	221	100	20	346
v/c Ratio	0.25	0.62	0.27	0.15	0.47	0.00	0.60	0.15	0.05	0.78
Control Delay	19.4	32.9	5.9	18.9	32.7	0.0	23.1	15.4	15.9	37.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.4	32.9	5.9	18.9	32.7	0.0	23.1	15.4	15.9	37.4
Queue Length 50th (ft)	30	174	0	14	110	0	72	21	6	130
Queue Length 95th (ft)	82	370	51	46	247	0	149	70	21	287
Internal Link Dist (ft)		1481			965			356		1149
Turn Bay Length (ft)	100					75	100			
Base Capacity (vph)	478	778	761	470	793	729	500	941	595	821
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.48	0.22	0.10	0.31	0.00	0.44	0.11	0.03	0.42

Intersection Summary

Lane Group	EBT	NBT	SBL	SBT
Lane Group Flow (vph)	934	128	53	100
v/c Ratio	0.85	0.23	0.19	0.10
Control Delay	36.0	17.3	33.1	9.5
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	36.0	17.3	33.1	9.5
Queue Length 50th (ft)	249	38	26	24
Queue Length 95th (ft)	#322	78	57	46
Internal Link Dist (ft)	364	557		202
Turn Bay Length (ft)			45	
Base Capacity (vph)	1097	551	285	969
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.85	0.23	0.19	0.10

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	77	820	143	118
v/c Ratio	0.10	0.53	0.25	0.18
Control Delay	9.9	13.4	15.8	9.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	9.9	13.4	15.8	9.8
Queue Length 50th (ft)	16	113	40	19
Queue Length 95th (ft)	37	162	78	49
Internal Link Dist (ft)		390	202	385
Turn Bay Length (ft)	40			
Base Capacity (vph)	806	1540	578	656
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.10	0.53	0.25	0.18

Intersection Summary

APPENDIX E. TECHNICAL MEMORANDUM 5: ALTERNATIVES ANALYSIS

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THE DALLES TRANSPORTATION SYSTEM PLAN

Technical Memorandum #5: Alternatives Analysis and Funding Program

Date:	March 29, 2016	Project #: 18495.0
To:	Public Advisory and Technical Advisory Committees	
CC:		
From:	Casey Bergh, PE and Chris Brehmer, PE - Kittelson & Associates, Inc. Darci Rudzinski, AICP and CJ Doxsee - Angelo Planning Group	

This memorandum presents transportation alternatives for addressing the multimodal transportation needs that were identified through:

1. Analysis of existing and future (2035) traffic conditions, as documented in Technical Memorandums #3 and #4.
2. Input during and as follow-up to the November 18, 2015 and February 10, 2016 meetings of the Technical and Public Advisory Committees.
3. Comments submitted via the online interactive map.

Alternatives are evaluated independently, by mode, to allow for comparison of projects. The recommendations in this memorandum were provided to the Technical Advisory Committee (TAC) and the Public Advisory Committee (PAC) members for input and guidance on a set of preferred projects. The material presented in this memorandum was refined based on feedback received from the Committee and community member.

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TRANSPORTATION NEEDS

Technical Memorandums #3 and #4 identified multimodal transportation needs related to safety, operations, and connectivity through the year 2035. These specific needs, as well as comments and input from the advisory teams, are addressed within this memorandum. This document addresses system-wide issues, pedestrian and bicycle connectivity needs (trails, sidewalks, bicycle lanes, etc.), and individual intersection improvements.

RECOMMENDED ROADWAY DESIGN GUIDELINES

The City's Roadway Functional Classification system identifies where collector and arterial roadways will be located and how they will be connected to accommodate forecast growth within The Dalles urban growth boundary. Functional classification also characterizes a roadway's intended purpose, amount and type of vehicular traffic it is expected to carry, provisions for non-auto travel, and its design standards. Recommendations related to functional classification influence the TSP as follows:

- Identify City connectivity and general alignment needs to serve urban development.
- Inform right-of-way preservation and roadway construction needs as part of property development or redevelopment.
- Provide guidance on priorities.
- Identify a process for exceptions or deviations from the standards based on area-specific context or other considerations.

Functional Classification System Background

Proposed classifications identified for The Dalles include: State (Interstate and Highways), Arterial, Major Collector, Minor Collector, and Local Road. Table 5-1 describes the roadway functional classifications to be applied within The Dalles. This recommended functional classification system categorizes the City's primary roadways as *Arterials* and *Collectors.* All other roadways are classified as *Local Roads.*

Changing the functional classification of a given roadway does not in and of itself warrant the need to construct, extend, or improve specific corridors to meet the roadway standard. Improvement of a road to meet functional classification standards is often required upon development of adjacent land, or when land sales occur (particularly in developing or redeveloping areas). The overall functional classification system is intended to serve as a blueprint that provides an orderly plan for growth, so that right-of-way and connectivity will be preserved when development occurs. Functional Classification map edits that result in the need for construction of a new roadway connection are identified in the Roadway Improvements subsection of the Transportation Alternatives section of this memorandum.

Table 5-1. The Dalles Functional Classification Descriptions

Functional Classification	Description
State	State highways provide mobility and serve long-distance travel. These roadways are high-speed roadways with limited access. These can include interstates that link urban areas across the United States.
Arterial	Arterials are the primary roadways within an urban area. They provide less access, but carry more volume than collectors. Travel speeds are relatively high, and serving through-movements is the priority on Arterials. Arterials include all roads designated by The Dalles as "Commercial Network Streets", indicating they are the most critical to providing connections to and circulation within, residential areas.
Major Collector	Collectors connect local roads and arterials. These roads seek to balance access with through movement mobility, maintaining circulation for all users. Major Collectors carry lower traffic volumes at slower speeds than arterials. Major collectors include all roads designated by The Dalles as "Residential Network Streets", indicating they are the most critical to providing connections to, and circulation within, residential areas. Within The Dalles, the only Major Collector that is not designated as a "Residential Network Street" is River Road/Webber Street (north of W 2nd Street).
Minor Collector	Minor Collectors serve a similar purpose as Major Collectors, except they carry less traffic. They typically have lower speeds and fewer signalized intersections than Major Collectors.
Local Road	Local roads account for the largest percentage of all roadways in terms of mileage within the City. Their primary function is to provide direct access to adjacent land uses. They are characterized by short roadway distances, slow speeds, and low volumes. Local roads offer a high level of accessibility, serving passenger cars, pedestrians, and bicycles. Use of local roads by large trucks should only be for local deliveries, not though movements.
Public Access Road	Add description. City jurisdiction, but maintained. These are on the West End of The Dalles between 6th and 10th St. (e.g., Floral Ct) Dale to send a PDF map, if not in our GIS map.

Functional Classification Recommendations

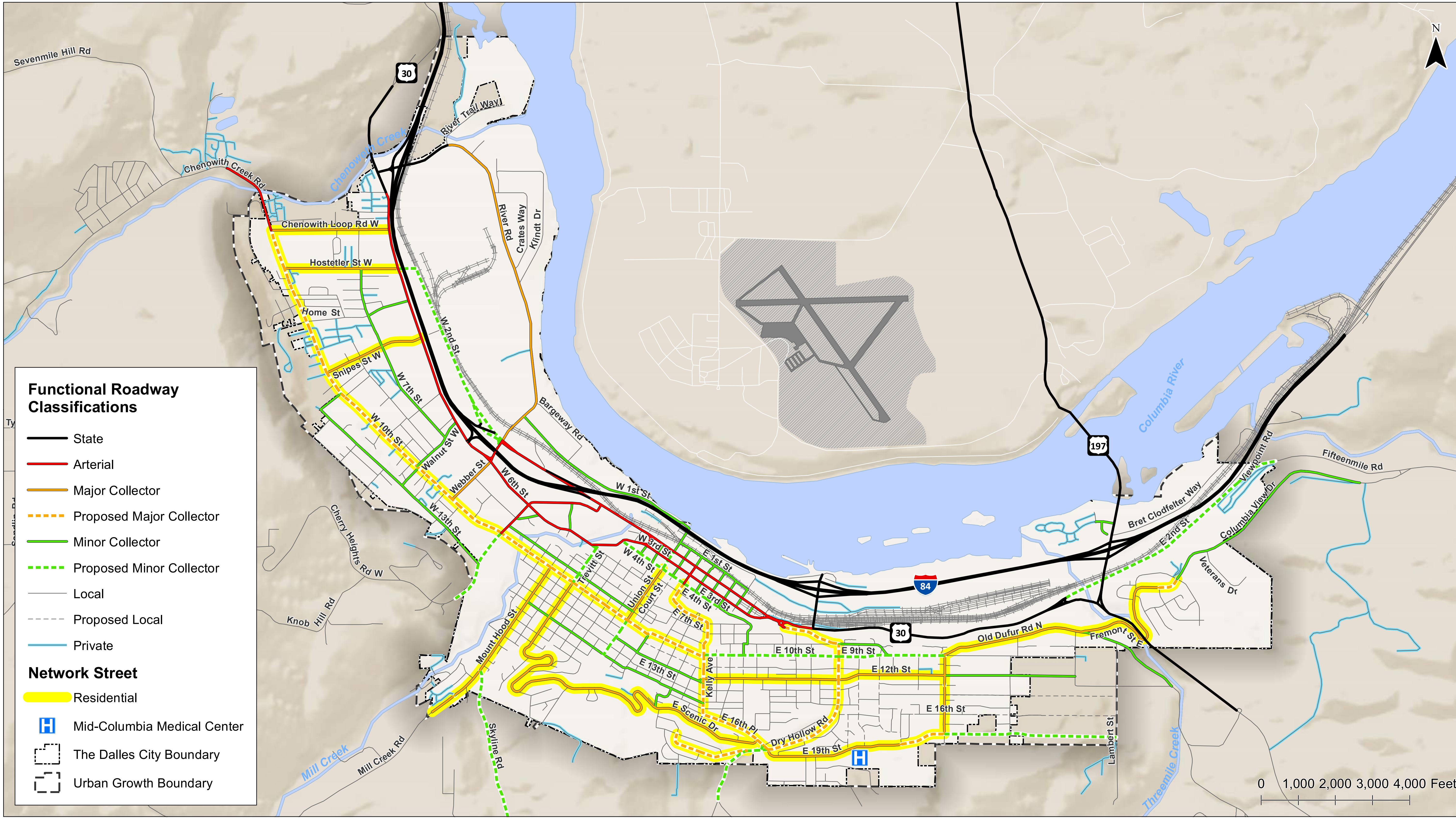
Figure 5-1 illustrates the recommended functional classifications for roadways within the City. Generally, the following changes are being recommended:

- Establish Major and Minor Collector categories to provide differentiation for roadways previously identified by The Dalles as "Residential Network Streets".
- Reclassify several Collectors (Nevada St., Oregon Ave., and Oakwood Dr/Quinton St.) near the Mid-Columbia Medical Center (MCMC) as local streets. These routes currently serve as lower-order enter/exit routes for MCMC traffic. However, the alignment, topography, and grade of these roadways and existing cross-sections reflect their purpose of providing access to individual residential properties more than that of a collector. Alternative access to MCMC is proposed through a new Major Collector connection to Thompson Street.
- Extend E 19th Street to provide a new connection to Thompson Street (i.e., filling a gap in the Major Collector network and improving circulation to MCMC).

- Provide new east-west connections between Thompson Street to Lambert Street as development occurs, including:
    - E 18th Street as a minor collector
    - E 14th and E 16th Streets as local streets
- Designate a single east-west route as a Major Collector route and prioritize roadway improvements to that route over other east-west Minor Collectors. These roadways include 10th Street (from west UGB to Kelly Avenue) and 12th Street (from Kelly Avenue to Thompson Street) to serve as an east-west alternative to I-84 for all modes of travel.

Proposed Roadway Cross-sections

Roadway cross-sections, together with access spacing standards, identify the function of a road and its balance between mobility and accessibility. Establishment of these standardized sections is intended to provide consistent performance along a roadway for a given mode, and to help establish consistent guidance and an understanding of costs as new development occurs. The sections presented are intended to allow flexibility for a roadway to fit within its surrounding context (for example, whether that context is a location within an industrial complex, in a new or built-out neighborhood, along a sensitive environmental area, or adjacent to a school) and do not represent a rigid standard. The standards are also intended to convey the priority of service provided to a given travel mode.



Proposed Functional Classifications
The Dalles, Oregon

Figure
5-1

K:\H_Portland\projfile\18495 - The Dalles TSP\gis\TM #5\5-1 Proposed Existing Functional Classifications.mxd - agriffin - 3:37 PM 3/24/2016

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

Elements that comprise typical roadway cross-sections are listed below, along with their intended function.

- **Median**: The median can serve a variety of purposes and take a variety of forms. Raised medians for access control may only be appropriate on Arterials or State facilities where throughput is a priority. Painted medians may be appropriate for designated turn lanes or continuous two-way left-turn lanes. Medians may also be used to provide landscaping, water/snow storage or treatment, or pedestrian refuge areas. There are a variety of functions a median can provide. Medians can also reduce crashes by reducing conflict points, physically separating opposing motorists, removing stopping or decelerating vehicles from the higher-speed through lanes, and allowing pedestrians improved opportunities to cross a roadway. The design and dimensions of medians can vary significantly depending on the desired landscape/hardscape treatment, intended purpose, and type of facility.
- **Travel lanes**: Travel lanes provide width for motor vehicles and freight traffic, and in lower speed environments may serve as a shared area for bicyclists. Travel lanes should provide a minimum width of 11 feet and a maximum width of 14 feet along straight roadway sections, and may require a larger minimum width along curves. The travel lane width should consider the posted speed, type of user (trucks, cars, bicyclists), location and design of storm grates, adjacent vegetation, and presence of on-street parking to allow these widths to serve as a clear and unimpeded travel way.
- **Bicycle lanes**: Bicycle lanes provide a separate designated travel lane for bicyclists to travel in, allowing them to operate independently from auto traffic. Bicycle lanes also serve as a buffer for pedestrians by designating the limits of a travel lane to motorists. Design guidance of bicycle lanes (to include minimum effective widths, height, grades, and obstructions) should be based on information contained in the current edition of the *Oregon Pedestrian and Bicycle Design Guide*.
- **Curb**: Curbing provides a physical barrier between parked or moving cars, bicyclists, and pedestrians. It also serves a function in channelizing storm runoff.
- **Planter Strip/Swale**: Planter strips can serve several purposes such as containing above or underground utilities, luminaires, and signs, providing runoff pre-treatment or storage, beautification, shade/comfort to pedestrians, and buffering between vehicles and pedestrians.
- **Sidewalks**: Dimensions for sidewalks should follow the *Oregon Pedestrian and Bicycle Design Guide*, and consider both horizontal and vertical clearance. Of particular importance along sidewalks is the clear space around poles, utilities, and other obstructions. The design of sidewalks should also consider accessibility design guidance, accounting for slopes and vertical displacement.
- **Shared***-Use Path: A facility separated from motor vehicle traffic by an open space or barrier, either within the roadway right-of-way or within an independent right-of-way. These are typically used by pedestrians, joggers, skaters and bicyclists. Shared-use paths are appropriate in corridors not well served by the street system, to create short cuts that link origin and*

destination points and as elements of a community trail plan. (as defined in the Oregon Bicycle and Pedestrian Design Guide)

- **Right-of-way**: The right-of-way contains all of the elements described above for public use, and typically provides additional space either for future improvements or utilities.

Exhibits 5-1 through 5-4 are the existing cross-sections by functional classification, as documented in the The Dalles TSP (1999). Recommended changes to each cross-section are provided for each functional classification. These cross-sections apply to all roadways, except streets designated by The Dalles as “Residential Network Streets.” Each Residential Network Street is shown in Figure 5-1 and the adopted cross-sections are provided in *Appendix A*. In addition to the recommendations for cross-section design, consideration should be given to:

- Review/modify City design specifications to require flush-mounted storm grates compatible with bicyclists.
- Review/modify City design specifications to require clearance around signs, utilities, and other obstructions on curb-tight sidewalks.

Arterial/State

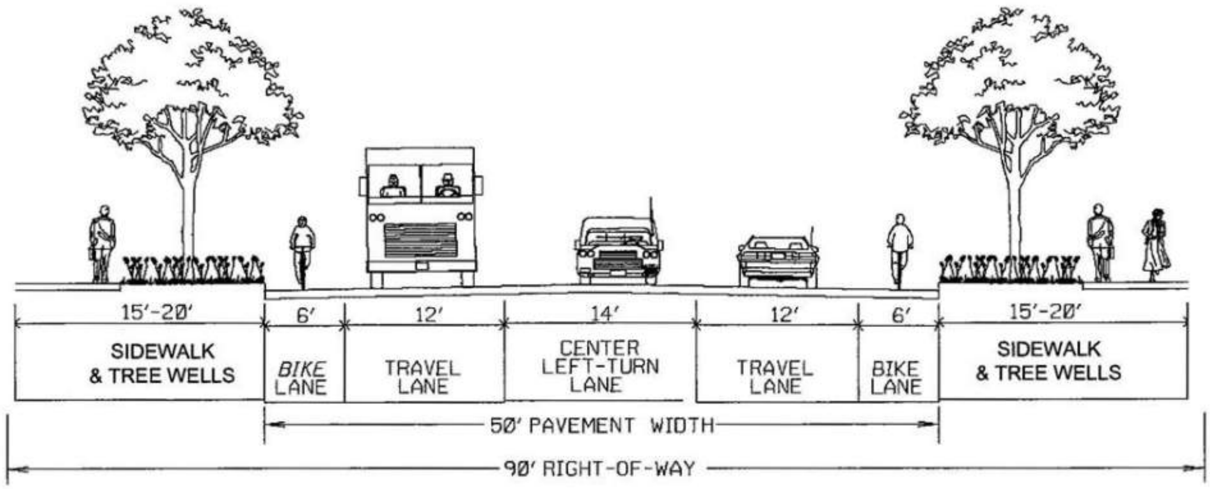


Exhibit 5-1: Existing Cross-section Standards for Arterial/State Roadways.
(Source: *The Dalles TSP - 1999*)

Recommended changes:

- Provide a minimum sidewalk width of 5 feet, except on state highways where the minimum is 6 feet.
- Remove landscape buffer.
- Include on-street parking on west side of 6th Street.
- Incorporate buffers between travel lanes and bicycle lanes, wherever possible.
- Travel lanes along freight routes should include 14-foot travel lanes or a 2-foot striped buffer between the travel lane and the bicycle lane.
- Roadways that may require deviation from this standard are limited to US 30 and 2nd and 3rd Streets within the downtown couplet.

Major Collector

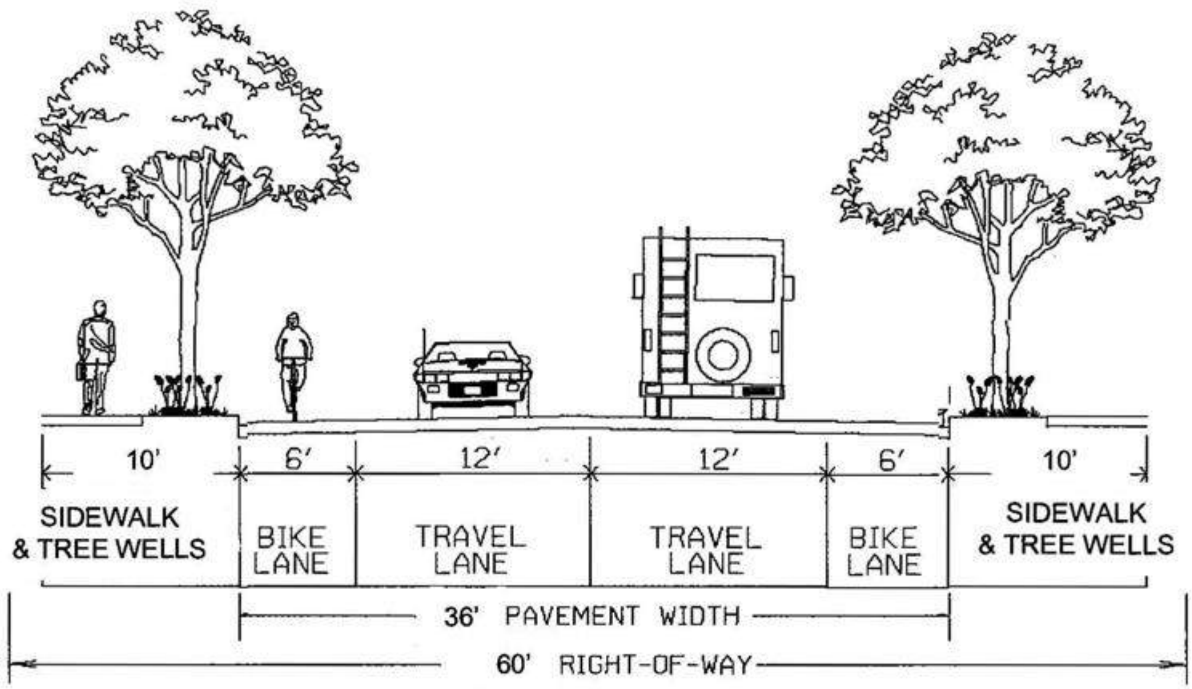


Exhibit 5-2: Existing Cross-section Standards for Major Collector Roadways.
(Source: *The Dalles TSP - 1999*)

Recommended changes:

- Provide a minimum sidewalk width of 5 feet, remove landscape buffer.
- Consider curb bulb-outs at intersection corners with on-street parking areas to improve pedestrian visibility, and reduce roadway crossing widths.
- Replace bicycle lane with 8-foot parking lane when adjacent to residential properties with primary access to the Major Collector.
- Include widening for turn lanes (with a minimum width of 12 feet) at major intersections with other collector and arterial facilities as deemed appropriate.
- All major collectors, except for Webber Street and River Road are identified as Residential Network Streets and have specific cross-sectional standards.

Minor Collector

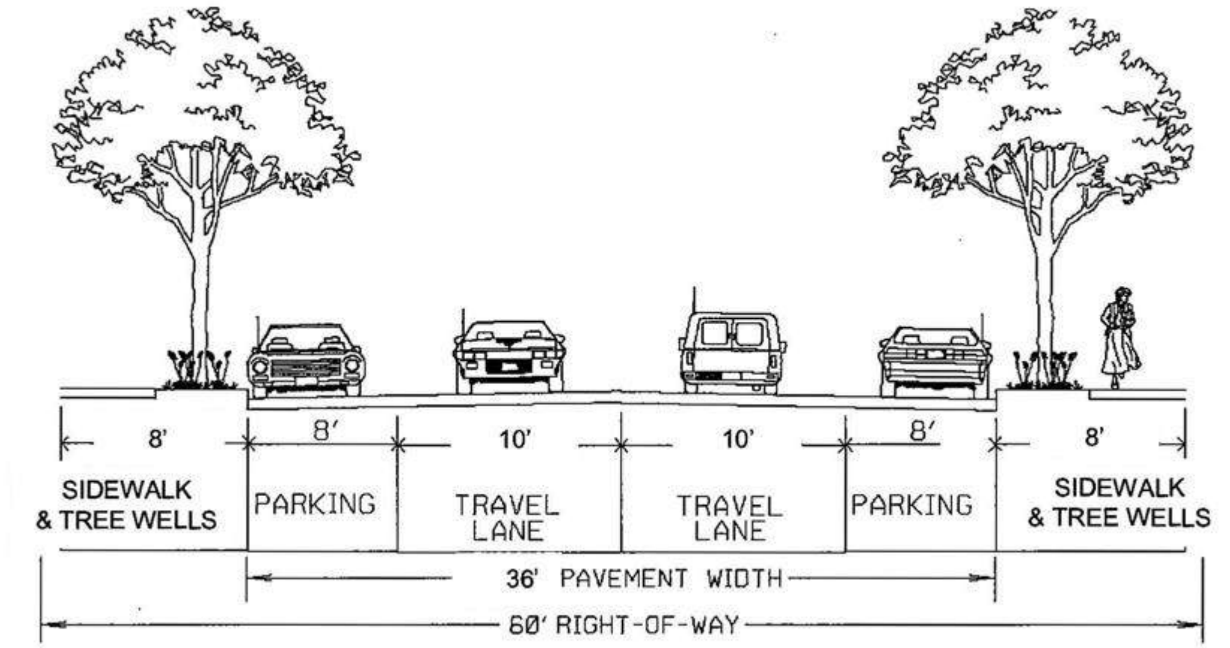


Exhibit 5-3: Existing Cross-section Standards for Minor Collector Roadways.
(Source: *The Dalles TSP - 1999*)

Recommended changes:

- Replace parking lane with 6-foot wide bicycle lane. Allow exceptions to replace the bicycle lane with 8-foot on-street parking lane when adjacent to residential properties with primary access to the Minor Collector.
- Provide a minimum sidewalk width of 6 feet, remove landscape buffer.
- Consider curb bulb-outs at intersection corners where on-street parking to improve pedestrian visibility, and reduce roadway crossing widths.

Local

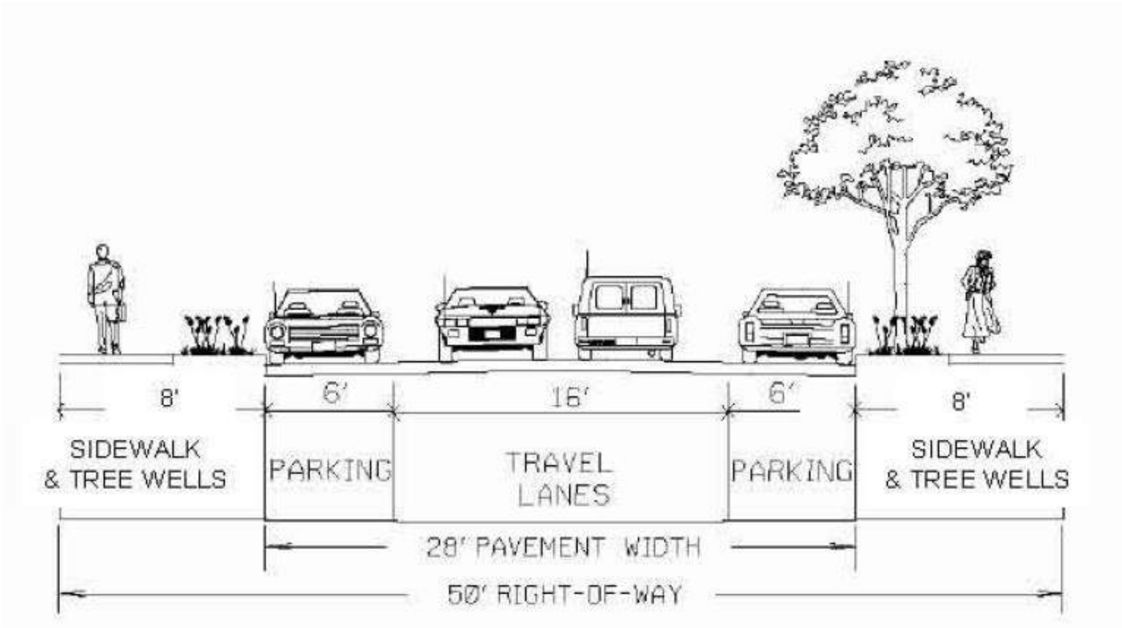


Exhibit 5-4: Existing Cross-section Standards for Local Roadways.
(Source: *The Dalles TSP - 1999*)

Recommended changes:

- Increase pavement width to 32 feet, with on-street parking.
- Allow removal of on-street parking lane in industrial areas to accommodate two 16-foot travel lanes for heavy vehicles.
- Provide a minimum sidewalk width of 6 feet, remove landscape buffer.
- Consider curb bulb-outs at intersection corners to define parking areas, improve pedestrian visibility, and reduce roadway crossing widths (except in industrial areas).

Local Street Policies

In addition to the functional classification for major roadways, it is also recommended that the City adopt local roadway policies and access spacing standards to support and preserve the function of major roadways. These policies[1] should accomplish the following:

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[1] Policy topics addressed in this memo are not exhaustive. Goal 12 Transportation policies in the adopted Comprehensive Plan will be replaced or amended as part of TSP adoption. Specific policies to guide future land use and development decisions will be proposed later, as part of the implementation phase of the TSP update.

- Enable direct trips to and from nearby compatible uses with shorter block lengths; this can be provided with shared-use paths, roadways, or other types of connections designed primarily for non-motorized users.
- Ensure local streets are interconnected to form a grid network, providing redundancy and reducing reliance on higher-order roadways. For example, in The Dalles there is an established grid network south of downtown, but limited east-west connections from the west side of the city to the east side, except via I-84.
- Driveway policies, as outlined in the Land Use Development Ordinance (LUDO), promote access from the lowest-order (or lowest-volume where classifications are the same) roadway adjacent to a parcel. For example, this would encourage the majority of access to any new commercial development on 6th Street to be provided on the nearest minor street. Exhibit 5-5 illustrates how this principle was applied to the development around K-Mart; three accesses are provided on Snipes Street and only one is provided on 6th Street.
- Discourage cul-de-sacs while providing other options for traffic calming.

Exhibit 5-5: Example of Promoting Access on the Lowest-order Roadway Adjacent to a Parcel. (Source: Google Earth)

Engineering Options Assessments

An engineering option assessment is recommended that will allow the City to review proposed cross-sections that deviate from the standards. This system is intended to adapt to the surrounding context, and allow the City to consider deviations based on adjacent land use, topographical, environmental (natural and man-made), historical, or other contextual opportunities and constraints. Options should not be allowed for self-imposed hardships, but to provide alternative ways to meet the functional purpose. The deviation process should specifically address the code standard, the proposed option, and how the functional intent will continue to be met or why it would be unreasonable to do so. The options evaluated should include the longitudinal considerations. For example, if an eight-foot wide shared-use path were proposed on one side of the roadway in lieu of sidewalks on both side, the process should consider how and where pedestrian crossings would be accommodated.

LAND USE DEVELOPMENT ORDINANCE AMENDMENTS

Elements of The Dalles' Transportation System Plan (TSP) are implemented in the requirements of the Land Use Development Ordinance (LUDO). The LUDO regulates development within City limits and implements the long-range land use vision embodied in The Dalles' Comprehensive Plan, of which the TSP is a part.

The LUDO has been audited to ensure that City requirements reflect the goals and objectives of the TSP update, as well as address transportation-related issues that have been raised over the course of the project to date. The intent of this exercise is to identify potential consistency issues between local code requirements and the TSP goals and objectives, as well as note any possible Oregon Transportation Planning Rule (TPR) compliance concerns, early in the planning process. Table 5-2 is a preliminary list of recommendations resulting from this audit. Information provided includes an overview of existing requirements and how these provisions may be modified in order to better implement the City's new TSP. Note that this list may be modified to reflect advisory committee and City staff feedback, as well as to be responsive to issues that develop during the TSP update planning process. Specific "adoption-ready" amendments to the LUDO will be drafted later in the project to coincide with the compilation of the TSP document.

Table 5-2. Land Use Development Code Recommendations

	Recommendation	LUDO Section	Relevant TSP Goal/Objective
1.	**Permit outright transportation improvements that are consistent with the adopted TSP.** Specific transportation facilities, services, and improvements are commonly not subject to land use regulation due to the minimal impact on land use.[2] These should be listed as permitted outright in individual zones, or made exempt through a provision added to land use regulations in LUDO Chapter 3 (Application Review Procedures) or Chapter 10 (Improvements Required with Development).	Applications Review Procedures 3.020 (Review Procedures) Or General Regulations 10.060 (Street Requirements)	Goal #3: Integration OAR 660-012-0045(1)
2.	**Require ordinance amendments to be consistent with the TSP.** Review criteria for ordinance amendments can be strengthened by directly referencing the TSP as part of required conformance with the Comprehensive Plan. In addition, the City should consider adopting language requiring proposals that "significantly affect" an existing or planned transportation facility (pursuant to the TPR, Section OAR 660-012-0060) demonstrate consistency with the identified function, capacity, and performance standards of the facility.	Ordinance Amendments 3.110.030 (Review Criteria)	Goal #3: Integration OAR 660-012-0045(2)(g) OAR 660-012-0060
3.	**Modify site plan review and conditional use permit evaluation criteria to include multi-modal transportation and safety considerations.** Both conditional use review and site plan review (which is a condition of approval for a CUP) approval require consistency with the transportation system. Requirements in both Sections can be improved to include bike and pedestrian access and circulation improvements, as well as reference to TSP access	Site Plan Review 3.030.040.B (Public Facilities Capacity) Conditional Use Permits 3.050.040.C (Impact)	Goal #3: Integration Goal #4: Economic Development OAR 660-012-0045(2)(e)

[2] Operation, maintenance, and repair of existing transportation facilities identified in the TSP, such as road, bicycle, pedestrian, port, airport and rail facilities, and major regional pipelines and terminals. Dedication of right-of-way, authorization of construction and the construction of facilities and improvements, where the improvements are consistent with clear and objective dimensional standards. Changes in the frequency of transit, rail, and airport services.

	Recommendation	LUDO Section	Relevant TSP Goal/Objective
	management and spacing standards.		
4.	**Develop clear and objective standards for the Airport Approach Zone.** Provisions are in place in LUDO 5.120 and 6.090(B) to prevent development that would negatively impact the airport. However, clear and objective standards are not currently included, and the LUDO states that regulations should be developed.	Zone District Regulations 5.120 (Airport Approach Zones)	Goal #4: Economic Development OAR 660-012-0045(2)(c)
5.	**Ensure access management requirements are consistent with the updated TSP.** Where new or modified access management and spacing standards are proposed in the updated TSP, the LUDO will need to be updated to be consistent with the standards.	General Regulations 6.050 (Access Management)	Goal #2: Accessibility and Connectivity OAR 660-012-0045(2)(a)
6.	**Allow for the redevelopment of existing parking areas for transit-oriented uses.** The City currently allows existing developments to replace up to 10% of existing parking spaces with landscaping, pedestrian amenities, or bicycle parking. This provision should be expanded to allow for transit amenities, such as bus stops and pullouts, bus shelters, and park and ride stations.	Parking Standards 7.020.040(C) (Reductions for Existing Uses)	Goal #2: Accessibility and Connectivity OAR 660-012-0045(4)(e)
7.	**Review traffic study requirements and modify to be consistent with the recommendations of the updated TSP.** Thresholds for requiring a traffic impact study to be submitted as part of development proposal, as well as the requirements of the analysis, should be evaluated for consistency with TSP findings. Improvements to existing code language could include clarifying the thresholds and requirements of the “limited traffic study” vs. “full traffic study.” Site Plan Review Traffic System Impact requirements (Section 3.030.020 Review Procedures) may also need to be revised for consistency, or to include a cross-reference to Section 10.060.	General Regulations 10.060.A (Traffic Studies)	Goal #1 Safety and Mobility OAR 660-012-0045(2)(b)

	Recommendation	LUDO Section	Relevant TSP Goal/Objective
8.	**Update local street standards to be consistent with the updated TSP.** In updating the City's street requirements, consider the following: • Removing street standards from the LUDO and referencing the (updated) table in the TSP. Adopting the TSP standards into the LUDO by reference would eliminate the need to modify standards in both documents in the future. If design standards are to be retained in both the TSP and the LUDO, the LUDO should also include local street standards (not just arterial and collector). • Incorporating the "network streets" from the Residential Street Public Improvement Guidelines in the TSP street classifications. If these streets are addressed in the TSP, the list can be removed from the LUDO. In addition, the City should distinguish "guidelines" from development requirements, eliminating or modifying the resolution language so that the LUDO retains only relevant applicability provisions and development requirements.	Improvements Required with Development 10.060 (Street Requirements)	Goal #1: Safety and Mobility OAR 660-012-0045(7)
9.	**Consider incorporating transit-supportive development requirements.** The Dalles' is evaluating fixed-route transit within City limits, with a new transit center under construction on Chenoweth Loop near W 6th Street. Transit stops are permitted outright as accessory uses; however, there are no additional transit supportive provisions in the LUDO. Amendments to increase transit supportive language should be discussed and considered given the current transit improvements underway in the City and the enhanced emphasis on multi-modal transportation in the TSP update project.	Chapter 10 Improvements Required with Development (new Section)	Goal #2: Accessibility and Connectivity OAR 660-012-0045(4)(a)

TRANSPORTATION ALTERNATIVES

As summarized in Technical Memorandums #3 and #4, the greatest transportation needs within The Dalles relate to traffic operations, safety, and multimodal facilities. The following sections identify several alternatives to address these needs. The alternatives were identified by the Project Management Team for review by the Technical and Public Advisory Committees. The alternatives are grouped by project type to allow for evaluation and prioritization of projects that address each of the key areas of need.

The traffic conditions analyses indicate few intersections will exceed City or ODOT operational performance thresholds in 2035, warranting improvements. Priority operational improvements focus on providing additional capacity to minor-street (stop-controlled) traffic approaching US 197 and addressing existing and projected future capacity needs at the Webber Street interchange.

Safety improvements are identified throughout the City, including improvements to reduce crash risk and conflict points on W 6th Street and at the US 197/Fremont Street/Columbia View Drive intersection.

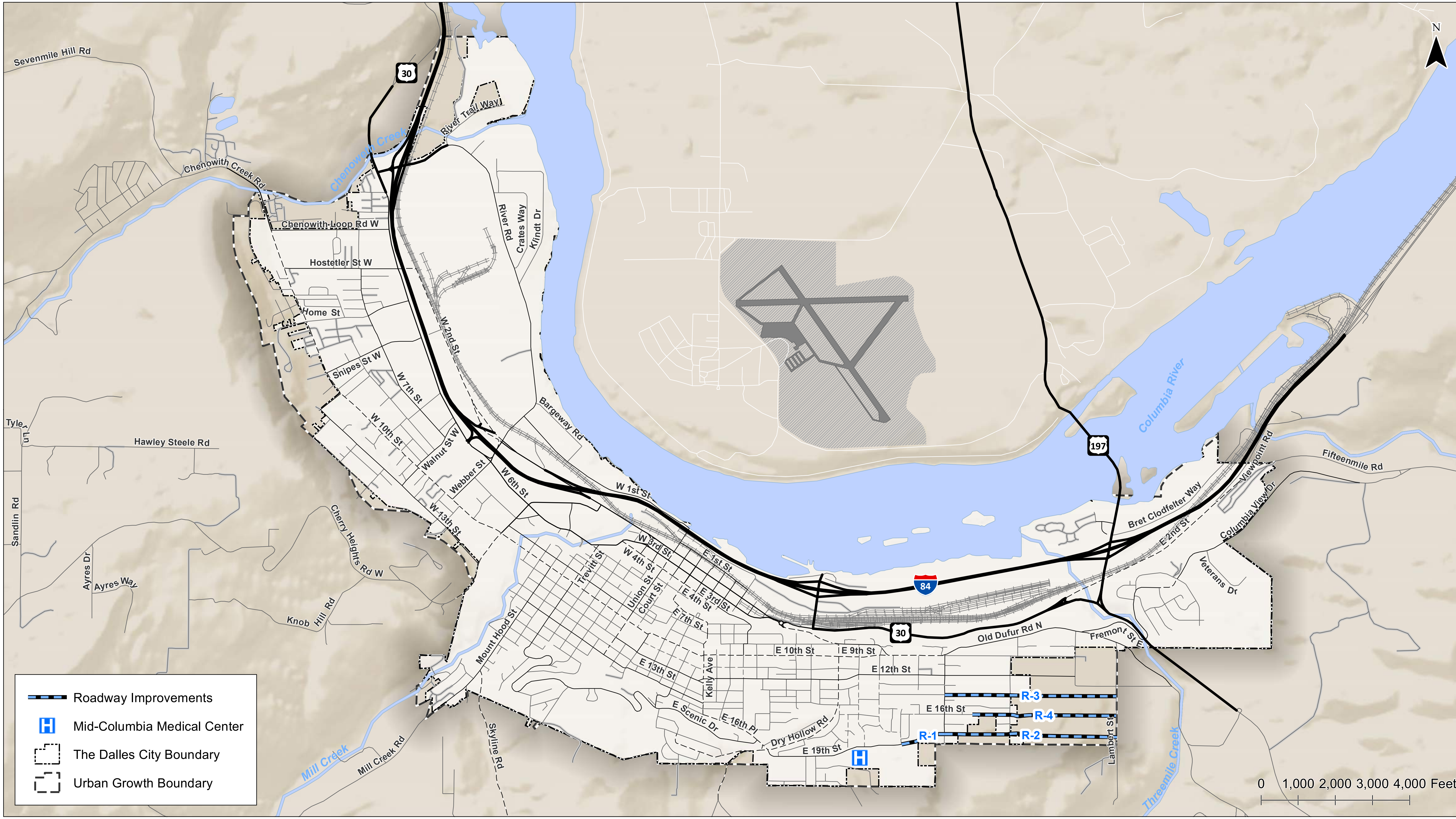
Providing alternative modes, particularly bicycle, pedestrian, and transit is a priority considering the construction of The Dalles Transit Center, increasing numbers of tourists arriving in The Dalles via The Dalles Marine Terminal, and a continued need to provide transportation options for all residents. An east-west bicycle route connecting to the Transit Center will include several improvements ranging from new shared-use paths to new bicycle lanes.

Roadway Improvements

Roadway improvements were identified for the major roadways with proposed functional classification changes and new connections identified in the functional classification map. The roadway improvements are summarized in Table 5-3 and shown in Figure 5-2. These roads may be serving or expected to serve higher traffic volumes than they were originally intended to serve. These upgrades cannot be conducted as part of regular maintenance activities and may include activities such as widening or full reconstruction of a roadway. Some of these projects include new roadway construction to improve connectivity and circulation within the city. These improvements are intended to capture the major upgrades or new connections needed to support the functional classification changes and may not include all changes associated with the functional classification changes. Other upgrades may occur over time as development occurs or in conjunction with other roadway projects.

Table 5-3. Roadway Improvements

Project No.	Project Name	Project Description	Cost Estimate	Recommended Priority	Potential Funding Source		
					ODOT	City	Private
R-1	E 19th Street Extension	Construct new Major Collector between Thompson Street and MCMC	$900,000	Near-Term		✓	
R-2	E 18th Street Connection	Construct new Minor Collector between Lambert Street and Morton Street, as development occurs	$1.9 million	Long-Term/As Development Occurs		✓	✓
R-3	E 14th Street Connection	Construct new local street between Morton Street and Lambert Street	$2.0 million	Long-Term/As Development Occurs		✓	✓
R-4	E 16th Street Connection	Construct new local street between Morton Street and Lambert Street	$1.3 million	Long-Term/As Development Occurs		✓	✓



Roadway Improvements The Dalles, Oregon

Figure 5-2

K:\H_Portland\projfile\18495 - The Dalles TSP\gis\TM #5\5-2 Roadway Improvements.mxd - agriffin - 4:39 PM 3/24/2016

Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning

Operational Improvements

Preliminary intersection improvement alternatives were identified throughout the City, based upon operational, safety, or geometric needs. The alternatives have been evaluated to confirm they will meet City and ODOT operational performance thresholds based on forecast 2036 traffic conditions.[3]

The City's level of service (LOS) standard of "D" correlates to a maximum delay of 55 seconds/vehicle for signalized intersections and 35 seconds/vehicle on the minor street approach at unsignalized intersections.

Table 10-1 of the ODOT *2012 Highway Design Manual* (HDM) provides volume-to-capacity (v/c) ratios used to assist in evaluating future alternatives on state highways. Oregon Highway Plan (OHP) mobility targets were used to determine future deficiencies, as summarized in Technical Memorandum #4. However, HDM standards should be considered when potentially investing significant funds to enhance the capacity of the roadway system. HDM standards are not applicable when addressing safety issues as they are not significant capacity enhancements. Table 5-4 summarizes the respective ODOT performance requirements applicable to the study intersections.

Table 5-4. Summary of ODOT Intersection Performance Standards

ID Number	Street 1	Street 2	Traffic Control[1]	HDM 20-year Design Mobility Standards
2	US 30	River Road	TWSC	0.80
3	I-84 EB Ramps	River Road	TWSC	0.65
4	I-84 WB Ramps	River Road	TWSC	0.65
7	I-84 EB Ramps	W 6th Street	TWSC	0.65
24	Brewery Overpass Road	US 30	TWSC	0.80
25	Brewery Overpass Road	I-84 EB Ramps	TWSC	0.65
26	Brewery Overpass Road	I-84 WB Ramps	TWSC	0.65
28	East 2nd Street	US 30	TWSC	0.80
29	US 197	US 30	TWSC	0.75
30	US 197	Fremont Street/ Columbia View Drive	TWSC	0.75
31	US 197	I-84 EB Ramps	TWSC	0.65
32	US 197	I-84 WB Ramps	TWSC	0.65
33	US 197	Bret Clodfelter Way	TWSC	0.75
34	US 197	Lone Pine Blvd	TWSC	0.75

[1]TWSC: Two-way stop-controlled (unsignalized)

[3] Although future deficiencies were identified in Technical Memorandum #4 using the 2035 forecast traffic conditions (the 20-year horizon from the existing conditions analysis conducted with 2015 traffic counts), future alternatives were evaluated using 2036 forecast volumes to result in a Plan that serves the 20-year horizon from the expected adoption year of 2016.

Intersection projects are summarized in Table 5-5 and their locations are illustrated in Figure 5-3. A description of the need for individual projects and improvement elements is presented after the referenced tables and figures. The table also includes a column indicating whether the project is related to other projects in this Plan. For example, US 197/US 30 was identified for an intersection improvement based on both operational and safety needs. It is included in both sections of this memorandum but will only result in one project.

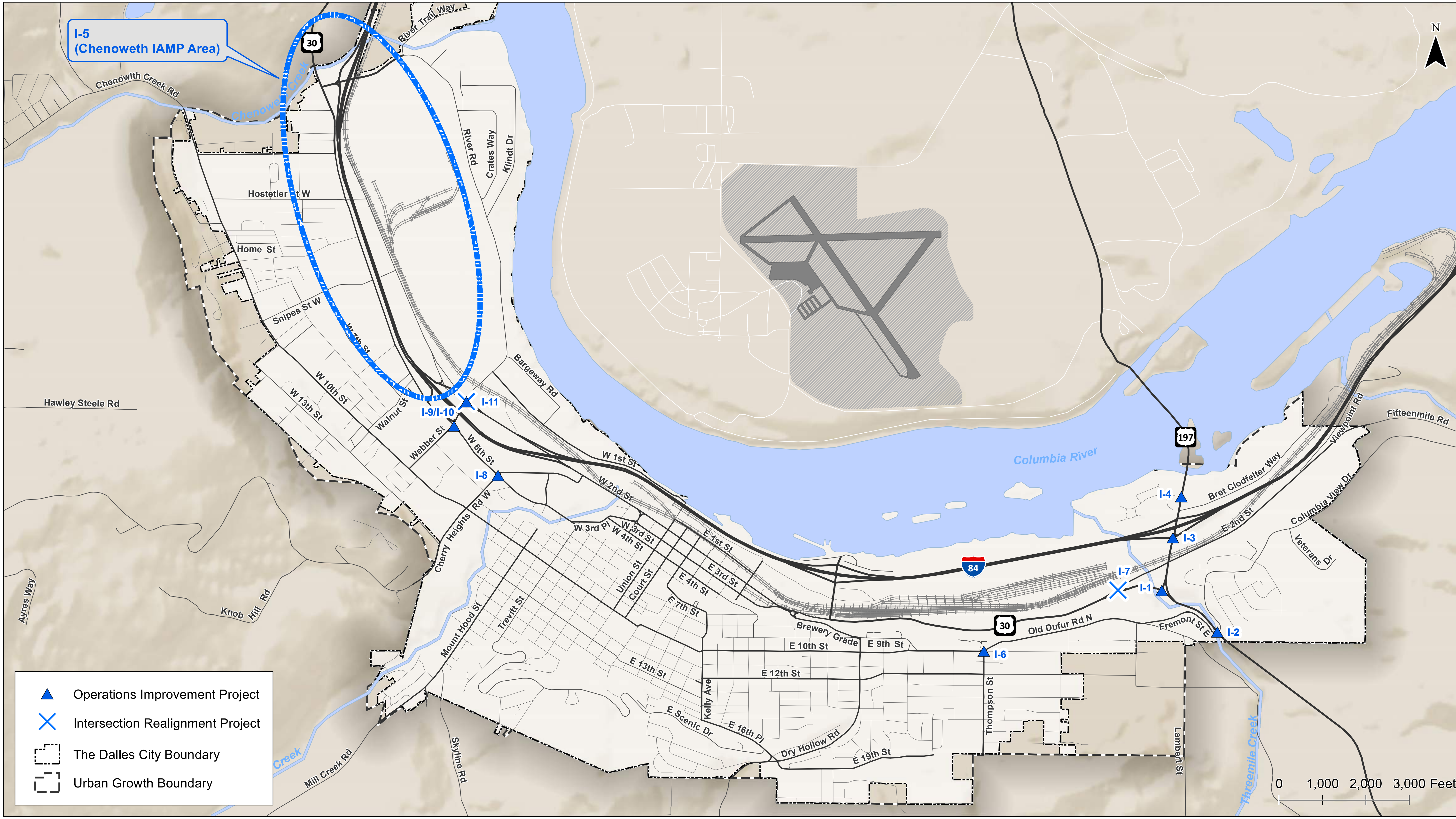
Several intersection projects should be coordinated with one another. For example, the J-turn at US 197/Fremont Street may only be successful if it is coordinated with a roundabout to the north to allow full access throughout the US 197 corridor. Recommended coordination is also indicated below each project description.

When multiple alternatives are available for a specific location, the evaluation criteria summarized in Technical Memorandum #2: Goals and Objectives were used to evaluate each alternative. The full evaluation criteria is provided in *Appendix B*, and a summary of the results by each project goal is provided at the end of each section below when relevant. The evaluation criteria and the input received from the advisory committee and public were used to determine a preferred alternative, which is described in *italic text*.

Table 5-5. Preliminary Intersection Alternatives

Project No.	Project Name	Project Description	Related Projects	Cost Estimate[1]	Source	Recommended Priority	Potential Funding Source		
							ODOT	City	Private
I-1a	Intersection Traffic Control Improvements at US 197/US 30	Install a traffic signal to increase capacity.	S-1	$1.5 to $2.0 million	KAI	Medium-Term	✓		✓
I-1b	Intersection Traffic Control Improvements at US 197/US 30	Install a single-lane roundabout to increase capacity.	S-1	$2.0 to $2.5 million	KAI	Medium-Term	✓		✓
I-2a	Intersection Traffic Control Improvements at US 197/Fremont Street/ Columbia View Drive	Restrict left-turns from minor-street approaches with raised median and construct median U-turn to south on US 197 (install a J-turn) to improve safety.	S-2	See Project S-2	KAI	See Project S-2	✓	✓	
I-2b	Intersection Traffic Control Improvements at US 197/Fremont Street/ Columbia View Drive	Install a single-lane roundabout to increase capacity and improve safety.	S-2	>$2 million	KAI	Long-Term	✓	✓	
I-2c	Intersection Traffic Control Improvements at US 197/Fremont Street/ Columbia View Drive	Install an overpass/interchange over US 197 and improve safety.	S-2	>$1.3 million	Previous TSP	Long-Term	✓	✓	
I-3	Intersection Traffic Control Improvements at US 197/ I-84 EB Ramps	Install a traffic signal to increase capacity.	S-8 S-9	$1.25 to $1.5 million	KAI	Medium-Term	✓		✓
I-4	Intersection Traffic Control Improvements at US 197/ Lone Pine Boulevard	Construct single-lane roundabout.	None	$1.5 to $2.0 million	Lone Pine TIA	Long-Term	✓		✓
I-5	I-84 Chenoweth Interchange Area Management Plan (IAMP)	Implement projects from the I-84 Chenoweth Interchange Area Management Plan.	None	--	IAMP	Vision	✓	✓	✓
I-6a	Intersection Improvements at Thompson St/E 10^{th} St/ Old Dufur Road	Convert the existing two-way stop controlled configuration to two offset "T" intersections.	None	$85,000	KAI	Near-Term		✓	
I-6b	Intersection Improvements at Thompson St/E 10^{th} St/ Old Dufur Road	Convert the existing two-way stop controlled configuration to two mini roundabouts.	None	$175,000	KAI	Medium-Term		✓	
I-6c	Hybrid of Alternatives I-6a and I-6b	Convert the existing intersection to an off-set "T" and a mini-roundabout.	None	$130,000	KAI	Medium-Term		✓	
I-6d	Intersection Improvements at Thompson St/E 10^{th} St/ Old Dufur Road	Convert the existing two-way stop controlled configuration to all-way stop and provide curb and sidewalks on all approaches.	None	$40,000	KAI	Medium-Term		✓	
I-7	Intersection Realignment at E 2^{nd} St/US 30	Realign this intersection into a more traditional T-intersection.	None	$100,000	Previous TSP	Long-Term	✓	✓	
I-8	Signal Modifications and Lane Reallocation at Cherry Heights Rd/W 6^{th} Street	Convert the southbound approach to a shared left-through lane and an exclusive right-turn lane and modify the signal to provide permitted left-turn phasing. Extend the northbound left-turn lane on Cherry Heights Rd to accommodate future queue lengths.	None	$20,000	KAI	Near-Term		✓	
I-9	Signal Timing Modifications at W 2^{nd} St/ Webber Road and W 6^{th} St/Webber Road	Modify signal phasing to provide split phasing in combination with signal coordination for northbound and southbound movements.	None	$20,000	KAI	Near-Term	✓	✓	
I-10	Increase Queue Storage at W 2^{nd} St/ Webber Road and W 6^{th} Street/ Webber Road	Extend the northbound right-turn lane at W 2nd Street and the southbound right-turn at W 6th Street as far as possible without impacting the I-84 overpass structure.	None	$100,000	KAI	Near-Term	✓	✓	
I-11a	Realign Webber Street approaches at W 2^{nd} Street and W 6^{th} Street (Phase 1)	Realign north and south approaches to provide dedicated left-turn lanes. Modify signal timing to provide protected/permitted left-turn phasing with Flashing Yellow Arrow display.	S-5	$500,000	KAI	Medium-Term	✓	✓	
I-11b	Realign Northbound Webber Street approach at W 2^{nd} Street (Phase 2)	Extend northbound left-turn storage lane by widening intersection to the west	S-5	$200,000	KAI	Long-Term	✓	✓	

[1] Preliminary cost estimates do not include Right-of-Way and include 30% contingency.



The Hub of the Pacific Northwest
City of The Dalles Oregon

Intersection Alternatives
The Dalles, Oregon

Figure
5-3

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Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning
APG

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

Project I-1: Intersection Traffic Control Improvements at US 197/US 30 (Intersection #29)

The southbound left-turn movement is forecast to exceed ODOT's v/c ratio targets in 2035 and exceed capacity on the southbound US 197 approach. In addition, the intersection exceeded the statewide critical crash rate. Capacity could be increased by installing a signal or by constructing a roundabout. Each would have a varying level of costs and impacts on operations and safety. The relative difference in cost between the two alternatives generally reflects the size of the intersection and the amount of pavement required.

Forecast 2036 operations for the no-build condition were compared to a signalized control alternative and a roundabout improvement alternative. The results are summarized in Table 5-1. The roundabout was analyzed with single lanes on all approaches and the signal was analyzed assuming existing lane configurations.

Table 5-1. US 197 at US 30 – 2036 Operational Summary

Intersection Scenario	Eastbound			Westbound			Southbound		
	Delay (sec/veh)	v/c ratio	Queue (ft)	Delay (sec/veh)	v/c ratio	Queue (ft)	Delay (sec/veh)	v/c ratio	Queue (ft)
No Build	8.1 (A)	0.21	25	-	-	-	>50 (F)	>1.0	310
Signal Control Alternative	15.1 (B)	0.70	200	16.9 (B)	0.33	75	18.2 (B)	0.63	150
Roundabout Alternative	13.9 (B)	0.62	100	10.9 (B)	0.47	75	8.5 (A)	0.42	50

*Note: Performance measures (delay, LOS, v/c ratio, 95th percentile queue) reported for the critical lane group on each approach

As shown in Table 5-1, both alternatives are expected to meet City and ODOT performance thresholds. The signalized alternative and roundabout are both projected to operate at LOS B or better during the 2036 PM peak hour. Queue lengths are expected to be less for the roundabout configuration compared to the signalized configuration. Operational Analysis worksheets are provided in *Appendix C*.

Consistent with the ODOT roundabout policy, further discussion of a roundabout would need to include a range of stakeholders given US 197 serves as a critical freight route, particularly for over-dimensional loads. As discussed as part of roundabout evaluations on other state highways in Oregon, consideration of a gated central "pass-through" lane could be useful in accommodating these over-dimensional users, while still maintaining the safety a roundabout provides for other highway users.

If a traffic signal were to be installed at this intersection the design would need to provide special accommodation of the rural nature of the highway and the expectancy of drivers to encounter a traffic signal. Similar to the roundabout, the design of the traffic signal would need to include a high degree of roadside context to help inform approaching drivers of the potential need to stop, which could include dynamic feedback signs, advance warning signs, longer all-red and yellow signal clearance intervals, and changes to the physical approach geometry and aesthetics. Installation of a traffic signal requires that the signal meet warrants outlined in the Manual on Uniform Traffic Control Devices (MUTCD) and is subject to State Traffic Engineer review and approval.

Alternatives Evaluation and Recommendation

Alternatives 1a (traffic signal) and 1b (roundabout) were evaluated against the evaluation criteria based on the project goals and objectives. The results are summarized in Table 5-6; the full evaluation criteria results are provided in *Appendix B*.

Table 5-6. Project I-1 Evaluation Criteria Summary

	Evaluation Criteria Score by Goal				
Project ID	Goal 1: Safety and Mobility	Goal 2: Multimodal Options	Goal 3: Integration	Goal 4: Economic Development	Total Score
Alternative I-1a (Signal)	8	1	3	6	18
Alternative I-1b (Roundabout)	12	1	2	7	22

The roundabout received positive feedback during discussions with the Public Advisory Committee (PAC) and Technical Advisory Committee (TAC) as an alternative to improve both operations and safety. In addition, the roundabout was discussed to potentially help reduce the speeds and acceleration taking place heading southbound up the grade along US 197. The roundabout could also serve as a gateway feature into the City.

Recommendation: Based on the alternatives evaluation and the public input, a roundabout is recommended as the preferred alternative at this location. The intersection is expected to continue functioning within ODOT's mobility standards during the PM peak hour for approximately 10 years under the existing two-way stop-controlled (TWSC) configuration. This project could be considered as a short-term to medium-term project based on operations, but a short-term need has been identified since it was also identified as a safety need. The design of this project should consider the fact that trucks currently use this route to gain momentum when traveling uphill on US 197 towards the landfill.

Coordination: Construction of this project should be coordinated with the recommended J-turn alternative at the intersection of US 197 at Fremont Street/Columbia View Drive because the roundabout will operate in conjunction with the J-turn to provide access to side streets and properties along the US 197 corridor.

Project I-2: Intersection Traffic Control Improvements at US 197/Fremont Street/Columbia View Drive

The eastbound and westbound approaches along Fremont Street and Columbia View Drive (Intersection #30) are forecast to exceed the City's LOS "D" standard in 2035. The eastbound approach is estimated to operate at LOS F during the future PM peak hour with the westbound approach expected to operate at LOS E. However, the intersection is expected to satisfy ODOT's v/c target. Vehicles attempting through or left-turn movements from the side street are projected to experience the majority of the delay on the approach.

This intersection was also identified as a key intersection to improve due to safety (the intersection exceeded the statewide critical crash rate) and is a potential connection for a new school along Columbia View Lane. Project S-2 further describes the safety issue.

A J-Turn intersection provides an at-grade alternative that could effectively reduce left-turn and angle conflicts at the intersection. This project would be implemented in conjunction with a roundabout at the US 197/US 30 intersection (Project I-1). The alternative would allow right-in, right-out movements from Fremont Street and right-in, left-in, right-out movements at Columbia View Drive. The restricted turn movements would be enforced with a directional raised median. All drivers approaching the highway from Fremont Street or Columbia View Drive would make a right-turn at US 197. Traffic from Columbia View Drive could use the proposed roundabout at US 197/US 30 to make a U-turn to go south on US 197. Traffic from Fremont Street could make a U-Turn at a median opening proposed south of the intersection to return north on US 197. The U-turning traffic would be accommodated by using a bulb-out or loon at the U-turn crossover location. The loon can be sized accordingly to accommodate the selected design vehicle.

Figure 5-4 provides a conceptual sketch of a J-Turn intersection at US 197/Fremont Street/Columbia View Drive. This treatment has proven effective at reducing high-speed angle and turning-related crashes and will be discussed in further detail as part of Project S-2 in the Safety Alternatives section.

A single lane roundabout was also considered at this location. However, there are geometric constraints due to elevation that would add significant costs to the roundabout. There is a large cut area on the northeast corner of the intersection between US 197 and Columbia View Lane that would need to be filled in order to accommodate a roundabout. There are also constraints limiting the approach alignments of Fremont Street and Columbia View Lane, as illustrated by the concept sketch in Figure 5-5.

Another alternative is an overpass/interchange at this location. There are several options for the design of the overpass. One option would include maintaining the existing intersection as it is today to provide full access to US 197, while another would combine the J-turn with the overpass to reduce left-turn conflicts at the intersection of US 197/Fremont Street. For the purpose of this analysis, the overpass was analyzed without the J-turn and it was assumed that only the eastbound and westbound through movements along Fremont Street and Columbia View Lane would utilize the overpass.

The future 2036 PM peak hour operational results for the no-build scenario, J-turn, single-lane roundabout, and overpass are summarized in Table 5-7. All three alternatives are expected to improve operations over the existing stop-controlled approaches along Fremont Street and Columbia View Lane. The alternatives are also expected to meet the 20-year design-mobility standards established in the *Highway Design Manual.*

Table 5-7. US 197 at Fremont Street/Columbia View Lane – 2036 Operational Summary

Intersection Scenario	Eastbound			Northbound			Westbound			Southbound		
	Delay (sec/veh)	v/c ratio	Queue (ft)	Delay (sec/veh)	v/c ratio	Queue (ft)	Delay (sec/veh)	v/c ratio	Queue (ft)	Delay (sec/veh)	v/c ratio	Queue (ft)
No Build	55.2 (F)	0.74	125	8.0 (A)	0.03	<25	46.1 (E)	0.78	155	7.8 (A)	0.10	<25
J-Turn	11.3 (B)	0.22	25	8.0 (A)[1]	0.10[1]	<25[1]	11.2 (B)	0.30	35	7.9 (A)	0.10	<25
Roundabout	8.4 (A)	0.25	25	7.5 (A)	0.27	25	8.0 (A)	0.31	25	10.8 (B)	0.53	75
Overpass	20.1 (C)	0.35	40	8.0 (A)	0.03	<25	18.4 (C)	0.44	55	7.8 (A)	0.10	<25

*Note: Performance measures (delay, LOS, v/c ratio, 95th percentile queue) reported for the critical lane group on each approach

[1] These operations are for the northbound U-turn movement associated with the J-Turn. U-turns are not analyzed as part of the HCM; therefore, this movement was analyzed as a left-turn movement as vehicles could utilize the loon as a staging area to perform a two-stage maneuver.

Alternatives Evaluation and Recommendation

Alternatives 2a (J-turn), 2b (roundabout), and 2c (overpass) were evaluated against the evaluation criteria based on the project goals and objectives. The results are summarized in 0; the full evaluation criteria results are provided in *Appendix B*.

Table 5-8. Project I-2 Evaluation Criteria Summary

	Evaluation Criteria Score by Goal				
Project ID	Goal 1: Safety and Mobility	Goal 2: Multimodal Options	Goal 3: Integration	Goal 4: Economic Development	Total Score
Alternative I-2a (J-Turn)	7	1	1	5	14
Alternative I-2b (Roundabout)	10	2	0	5	17
Alternative 1-2c (Overpass)	8	3	0	6	17

The J-turn was well received during the discussions with the PAC/TAC members based on the ability to improve safety.

Recommendation: Based on the evaluation criteria, relative cost, and public input, a J-turn is the preferred project in the near-term, and either an overpass or roundabout is recommended in the long-term. The J-turn should include an acceleration lane to allow for safer merging back into traffic along northbound US 197. The bulb-out or loon will need to accommodate emergency vehicles and school buses.

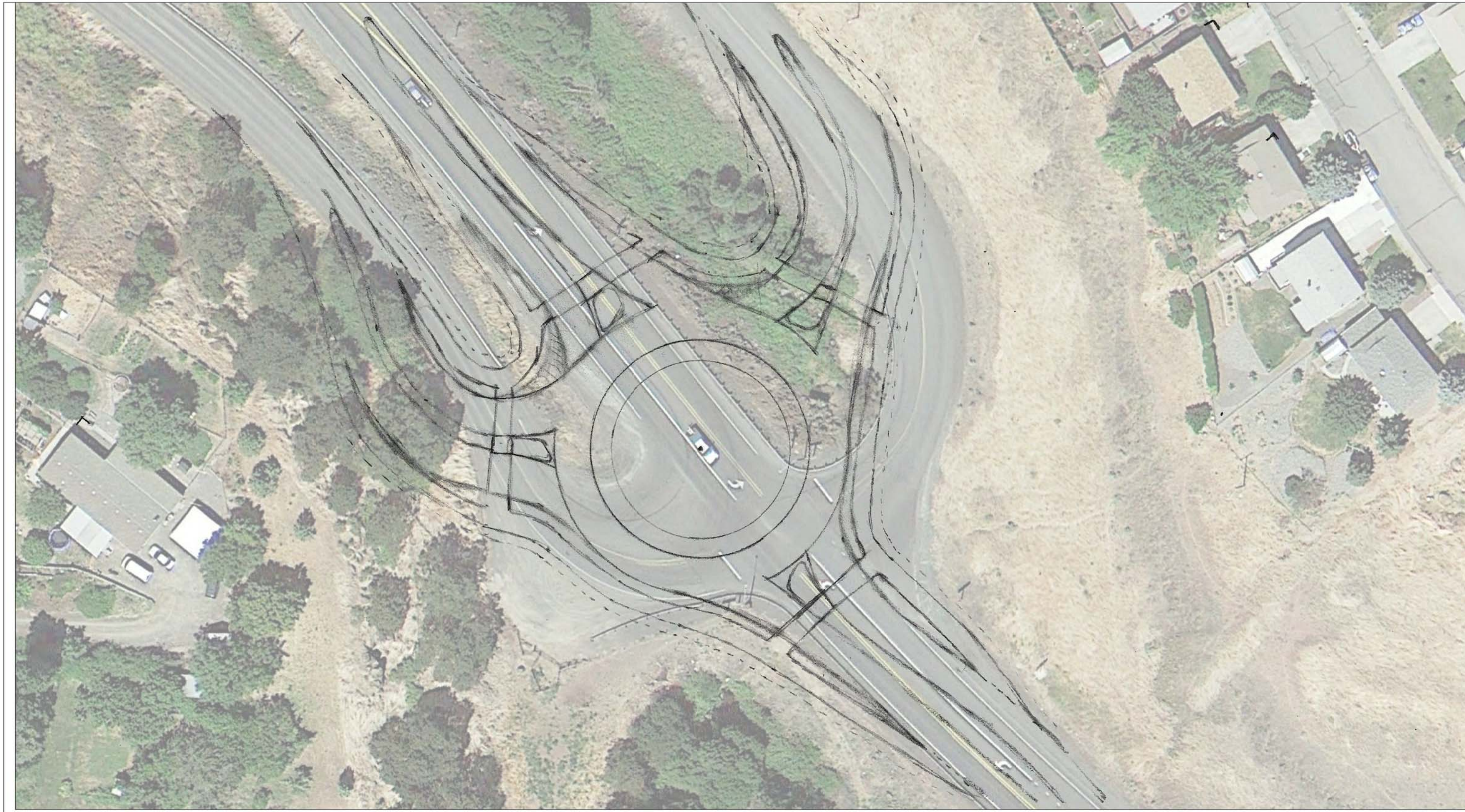
A roundabout was discussed at this location; however, due to constraints with the grade and the approach alignments, a roundabout may not be a feasible option at this location. An overpass was also discussed at this location but would also be relatively high in cost due to the structure. A feasibility study is recommended to determine whether a roundabout or overpass is feasible and preferred in the *long-term at the location. If considered in the future, a more detailed cost estimate will need to be developed that considers the amount of fill or structures needed to allow a roundabout in this location.*

The intersection improvements at this location could be phased. The J-turn should be considered as a short-term priority project due to the safety benefits this at-grade, lower cost configuration could provide, and an overpass or roundabout should be considered as a long-term solution. If the overpass were to be constructed, the J-turn could remain in place to provide access to and from US 197 while the overpass served as a connection between the City and the Columbia View Lane area.

Coordination: The J-turn should be coordinated with Project I-1, the roundabout at the intersection of US 197 and US 30, which would provide an opportunity for U-turn maneuvers from Columbia View Drive. The proposed roundabout at US 197 and US 30 was also analyzed to include the new traffic distribution from the turn restrictions at the J-turn. A single-lane roundabout is still expected to provide adequate operations and meet the 20-year design-mobility standards established in the Highway Design Manual. Ideally, the roundabout and J-turn intersection improvements at US 30 and Fremont Street/Columbia View Drive, respectively, would be programmed as one project.

PROJECT I-2: CONCEPTUAL J-TURN ALTERNATIVE
US 197/FREMONT ST/COLUMBIA VIEW DR
THE DALLES, OR

Figure
5-4



PROJECT I-2: CONCEPTUAL ROUNDABOUT ALTERNATIVE
THE DALLES, OR

Figure
5-5

Project I-3: Intersection Traffic Control Improvements at US 197/I-84 EB

The 2035 no-build analysis projects the eastbound I-84 off-ramp volumes will exceed both the intersection's capacity and the intersection's v/c target. This intersection was also identified as a safety project and is further discussed in projects S-8 and S-9.

This intersection is located between two bridges so any widening of US 197 would require reconstructing the 275-foot long I-84 overpass structure. An option for increasing capacity on the eastbound approach is the installation of a signal. Installation of a traffic signal requires that the signal meet warrants outlined in the Manual on Uniform Traffic Control Devices (MUTCD) and is subject to State Traffic Engineer review and approval. Roundabouts were considered at the US 197/I-84 ramp intersections, but are not recommended to move forward due to the extensive fill, reconstruction of the ramps, and widening of the two nearby overcrossings likely required.

Intersection operations were analyzed under no-build and signalized alternatives, as summarized in Table 5-9. The signal was analyzed assuming the existing lane configurations.

Table 5-9. US 197 at I-84 EB Ramps – 2036 Operational Summary

Intersection Scenario	Eastbound			Northbound			Southbound		
	Delay (sec/veh)	v/c ratio	Queue (ft)	Delay (sec/veh)	v/c ratio	Queue (ft)	Delay (sec/veh)	v/c ratio	Queue (ft)
No Build	>50 (F)	>1.0	350	-	-	-	8.9 (A)	0.06	<25
Signal Control Alternative	12.8 (B)	0.61	175	11.0 (B)	0.65	200	8.0 (A)	0.35	100

*Note: Performance measures (delay, LOS, v/c ratio, 95th percentile queue) reported for the critical lane group on each approach

As shown in Table 5-9, the signalized alternative is expected to provide adequate operations, and the 95th percentile queue length for the southbound approach is projected to be accommodated within the length of the existing bridge. Operational Analysis worksheets are provided in *Appendix D*.

Alternatives Evaluation and Recommendation

The summary of the evaluation for the traffic signal alternative is provided in Table 5-10.

Table 5-10. Project I-3 Evaluation Criteria Summary

Project ID	Evaluation Criteria Score by Goal				Total Score
	Goal 1: Safety and Mobility	Goal 2: Multimodal Options	Goal 3: Integration	Goal 4: Economic Development	
Alternative I-3 (Signal)	8	2	1	7	18

Recommendation: The traffic signal alternative for project I-3 is the preferred alternative for project I-3. The eastbound left-turn movement at this intersection is expected to exceed ODOT's v/c mobility target near year 2022.

The timing and need for this improvement will likely be heavily dependent upon the build-out of the development in the Lone Pine Village area. This location was briefly discussed with the PAC/TAC members; however, a clear alternative (roundabout vs. signal) was not decided on. Due to the constraints associated with installing a roundabout at this location, a traffic signal was determined to be the preferred solution for this location.

Coordination: The improvements at this location will likely need to occur at the WB off-ramp intersection to provide consistency within the interchange area. The improvements should also consider any potential improvements along the US 197 corridor (US 30 and Lone Pine Blvd).This location should be considered as a short-term to medium-term priority project.

Project I-4: Intersection Traffic Control Improvements at US 197/Lone Pine Boulevard

While satisfying ODOT's mobility target, the Lone Pine Boulevard eastbound left-turn movement at US 197 (Intersection #34) is forecast to exceed the City's LOS D threshold. The projected delay impacts less than 50 vehicles during the weekday PM peak hour.

ODOT and the developer of the Lone Pine project have an agreement which identifies a roundabout as the appropriate solution at this intersection and to be funded by Lone Pine. The timing of the improvement is dependent on the build-out of the project and future traffic conditions.

Alternatives Evaluation and Recommendation

Table 5-11 provides a summary of the evaluation criteria scores for project I-4.

Table 5-11. Project I-4 Evaluation Criteria Summary

	Evaluation Criteria Score by Goal				
Project ID	**Goal 1: Safety and Mobility**	**Goal 2: Multimodal Options**	**Goal 3: Integration**	**Goal 4: Economic Development**	**Total Score**
Alternative I-4 (Roundabout)	8	2	3	5	18

Recommendation: The appropriate solution identified for this location is a roundabout. The PAC/TAC members identified that development will drive the need for an intersection improvement at this location. This location is not expected to exceed ODOT's mobility target over the 20-year period. This project should be considered as a long-term priority or Vision Project.

Considerations: Consideration should be given to the potential for queue spillback into the upstream intersections of Bret Clodfelter Way and the westbound I-84 off ramp in the near- and mid-term. Currently, there is approximately 300 feet and 500 feet between the intersections, respectively.

Project I-5: I-84 Chenoweth Interchange Area Management Plan

An Interchange Area Management Plan (IAMP) was completed and adopted for the I-84 Chenoweth Interchange in 2009. The IAMP identified transportation improvements that would be needed to support development in the area. The TSP did not identify a need for all of these improvements because the model assumed growth was spread throughout the city. However, if development were to occur more quickly in this area, these projects may be needed. Therefore, the IAMP projects are included as Vision projects which may not be needed in the 20-year horizon unless development patterns occur more quickly than anticipated.

Intersection Realignment

Several intersections within The Dalles have skewed approach geometry, which has been correlated to increased crash potential (1). The following locations have unique geometry that could be considered for realignment.

Project I-6: Intersection Improvements at Thompson Street/East 10th Street/Old Dufur Road

This intersection (Intersection #27) does not exceed the City or ODOT's operational standard but was identified as an issue via community feedback. The skew at this intersection creates sight distance issues for drivers facing westbound when approaching the intersection from East 10th Street or Old Dufur Road. The existing configuration includes stop sign control on the northbound Thompson Street and westbound East 10th Street approaches.

The following alternatives could improve operations and safety at this intersection:

a) Realign the westbound Old Dufur Road approach to intersect E 10th Street at a 90-degree angle, creating two off-set "T" intersections, as shown in Figure 5-6.
b) Construct two mini roundabouts, as shown in Figure 5-7.
c) Construct an off-set "T" intersection and a mini-roundabout, as shown in Figure 5-8.
d) Conversion of the TWSC variation to an all-way stop-control (AWSC) configuration with new sidewalks and crossing treatments.

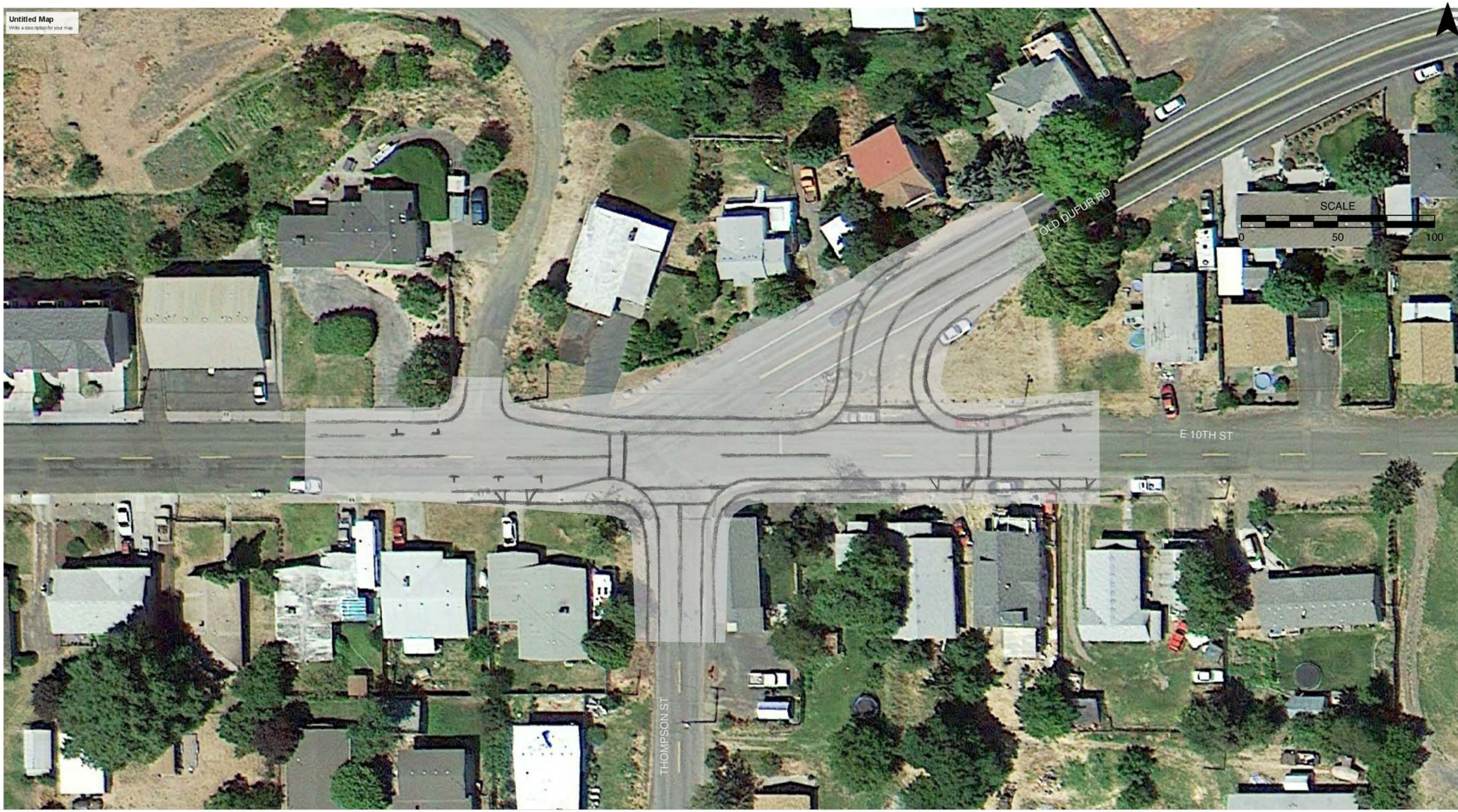
Alternatives Evaluation and Recommendation

This intersection was identified to be an issue for all roadway users (vehicles, pedestrians, and bicyclists) due to a lack of sidewalks, crosswalks, and sight distance. Two alternatives were initially discussed at this location with the TAC/PAC. The first included two offset T-intersections. The second included two roundabouts. Based on PAC/TAC feedback, it was suggested to create an additional concept that is a hybrid of the two concepts. This would include an offset T-intersection along the Thompson Street approach with Old Dufur Road and the east leg of East 10th Street tying into a roundabout, as illustrated in Figure 5-8. Table 5-12 summarizes the evaluation criteria for each alternative.

Table 5-12. Project I-6 Evaluation Criteria Summary

Project ID	Evaluation Criteria Score by Goal				Total Score
	Goal 1: Safety and Mobility	Goal 2: Multimodal Options	Goal 3: Integration	Goal 4: Economic Development	
Alternative I-6a (two off-set "T" intersections)	4	1	1	0	6
Alternative I-6b (two mini roundabouts)	10	4	1	1	16
Alternative I-6c (Hybrid of Alternatives I-6a and I-6b)	8	4	1	1	14
Alternative I-d (AWSC)	4	3	1	0	8

Recommendation: Based on the evaluation criteria and public input, the hybrid concept that includes an offset T-intersection and a roundabout is the preferred alternative.
The concept provides sidewalks, defined crossings for pedestrians, improves sight distance, and will help slow speeds making it more comfortable for bicyclists. This refined concept should be considered as a short-term to medium-term priority project.



PROJECT I-6a: CONCEPTUAL OFFSET "T" INTERSECTION
THOMPSON ST/E 10TH ST/OLD DUFUR RD
THE DALLES, OR

Figure
5-6

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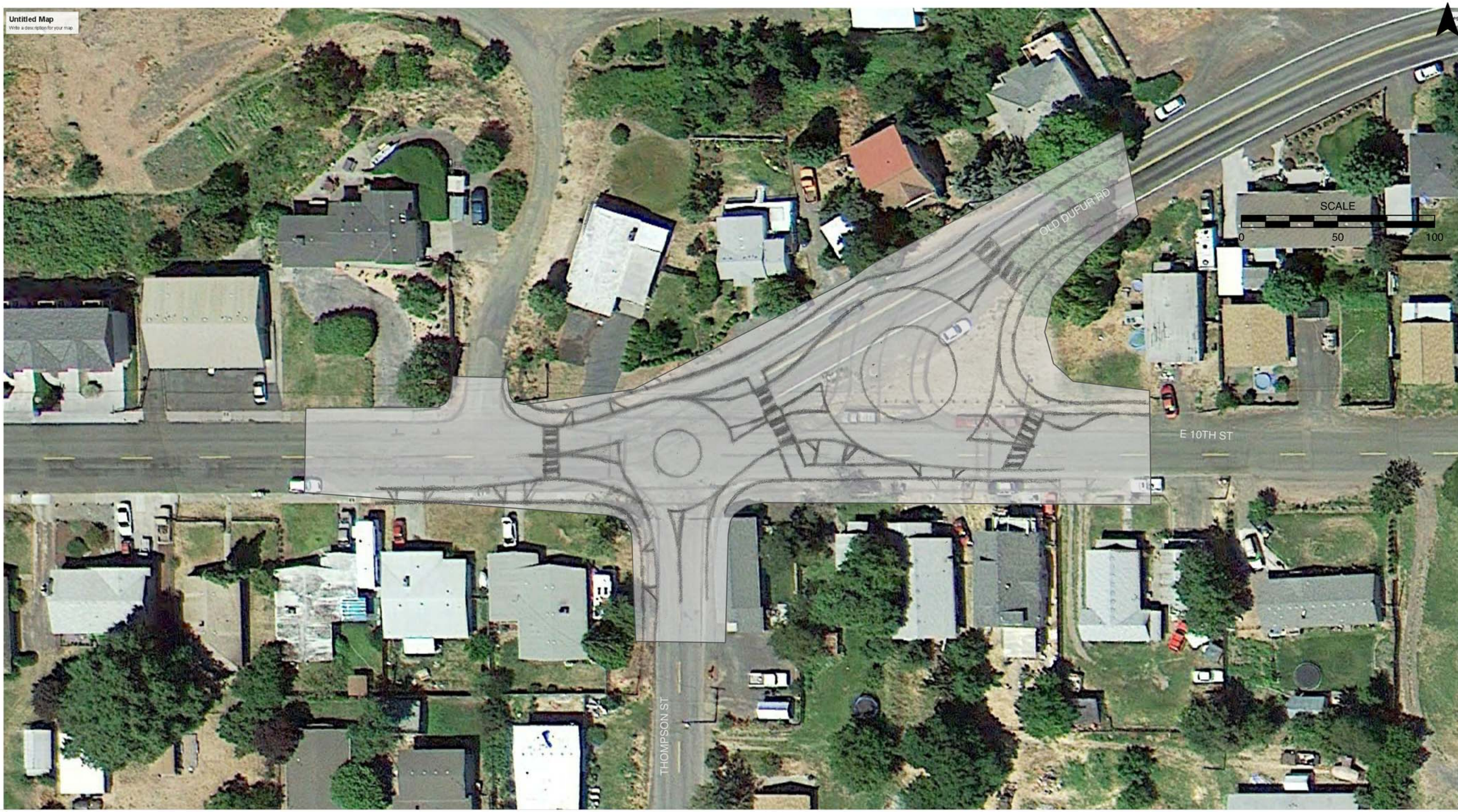
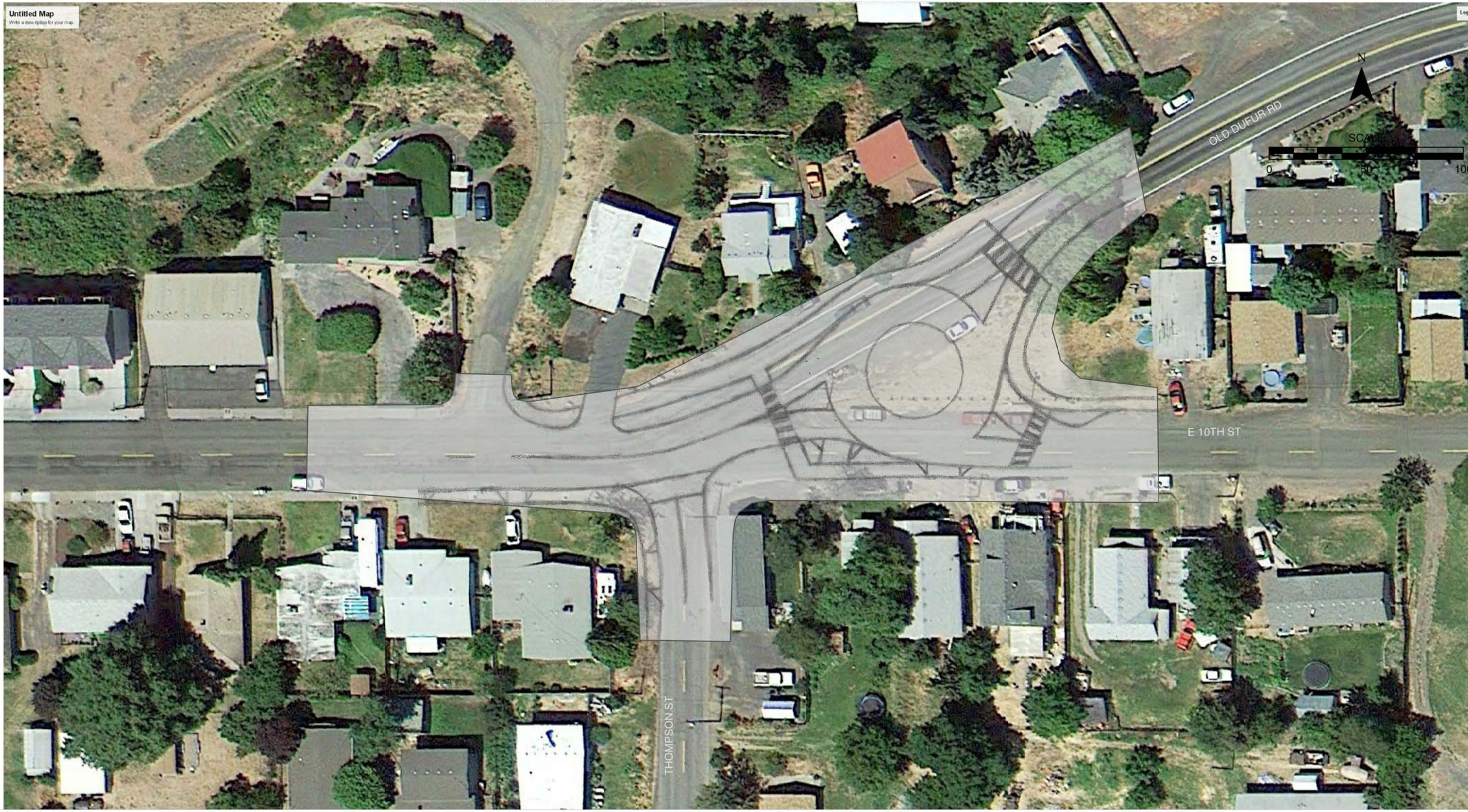


PROJECT I-6b: CONCEPTUAL MINI ROUNDABOUT INTERSECTION
THOMPSON ST/E 10TH ST/OLD DUFUR RD
THE DALLES, OR

Figure
5-7



PROJECT I-6: CONCEPTUAL ROUNDABOUT & T-INTERSECTION
THOMPSON ST/E 10TH ST/OLD DUFUR RD
THE DALLES, OR

Figure
5-8

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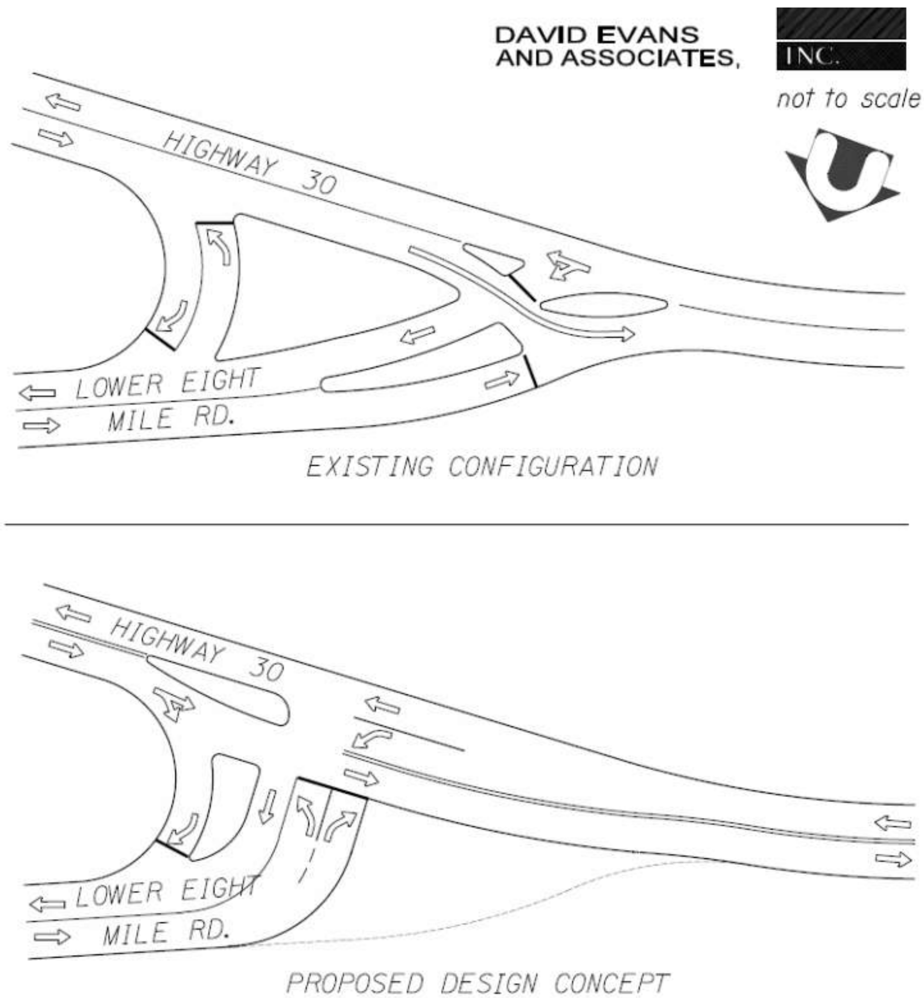
Project I-7: Intersection Realignment at East 2nd Street/US 30

The intersection of East 2nd Street and US 30 (Intersection #28) has a unique TWSC configuration. The eastbound and westbound through movements are free-flow; however, the eastbound left-turn, westbound right-turn, and southbound movements are all stop-controlled. Westbound vehicles along US 30 are shifted to the north to accommodate the eastbound left-turn movement onto East 2nd Street.

As shown in Exhibit 5-6, realignment of the intersection was proposed in the 1999 The Dalles TSP. Realignment would eliminate the shift in alignment experienced by westbound vehicles.



Source: 1999 The Dalles TSP
Exhibit 5-6: East 2nd Street/US 30 Intersection Geometry

Alternatives Evaluation and Recommendation

Table 5-13 summarizes the evaluation criteria for this project.

Table 5-13. Project I-7 Evaluation Criteria Summary

	Evaluation Criteria Score by Goal				
Project ID	Goal 1: Safety and Mobility	Goal 2: Multimodal Options	Goal 3: Integration	Goal 4: Economic Development	Total Score
Alternative I-7 (Realignment)	5	0	2	1	8

Recommendation: This intersection realignment project was carried forward from the previous TSP through this update since it has not been constructed and is still needed. Based upon feedback from the PAC/TAC members, this intersection is not a major priority. The realignment to a traditional T-intersection was proposed in the City's previous TSP, but was not constructed. Operations are not anticipated to be a factor in the next 20 years and a safety need has not been identified based upon the historical crash data. This project should be considered as a long-term project.

Intersection Queue Length

Based upon the future operational analysis completed as part of Technical Memorandum #4, there were three signalized intersections identified with 95th percentile queue lengths expected to exceed the existing available queue storage lengths during the 2035 PM peak hour. No unsignalized queues are expected to exceed the available queue storage.

As shown in Table 5-14, the future 95th percentile queues lengths exceed storage at three study intersections. The following projects were identified to address these queue spillover issues.

Table 5-14. Comparison between 95th Percentile Queues and Available Storage

Intersection	Movement Exceeding the Existing Available Queue Storage	Weekday PM 95th Percentile Queue Length (feet)	Available Queue Storage (feet)	Length Exceeding Available Storage (feet)
Cherry Heights Road/West 6th Street	Northbound left	150	100	50
Webber Street/W 6th Street	Southbound right	125	50	75
Webber Street/W 2nd Street	Northbound right	50	25	25

Project I-8: Signal Modifications and Lane Reallocation at Cherry Heights Rd/W 6th Street

The southbound right-turn volume exceeds the total volume of the through and left-turns, indicating that an exclusive right-turn lane is needed. A near-term alternative is to reallocate the southbound approach to provide a shared left-through lane and an exclusive right-turn lane. The southbound left-turn phasing at the signal will need to be modified to accommodate this change.

The existing shared through/right lane has a storage length of approximately 150 feet. If the northbound left-turn queue extends past 150 feet, through and right-turning vehicles are prevented from entering the lane. In order to provide intersection continuity consistent with the proposed lane configurations on the southbound approach, the existing shared through/right lane should be converted to an exclusive right-turn lane. Northbound through vehicles and left-turning vehicles will be able to utilize the 400 feet of available distance between West 6th Street and West 8th Street. The northbound left-turn phasing will also need to be modified to accommodate the proposed change.

This intersection was analyzed with the proposed lane configurations, as shown in Figure 5-9, and with split signal timing phasing for the northbound and southbound approaches. The results showed similar intersection operations and all queue lengths are expected to be accommodated at the intersection. It is anticipated that the City's Maintenance Department could complete this project as part of routine restriping.

Alternatives Evaluation and Recommendation

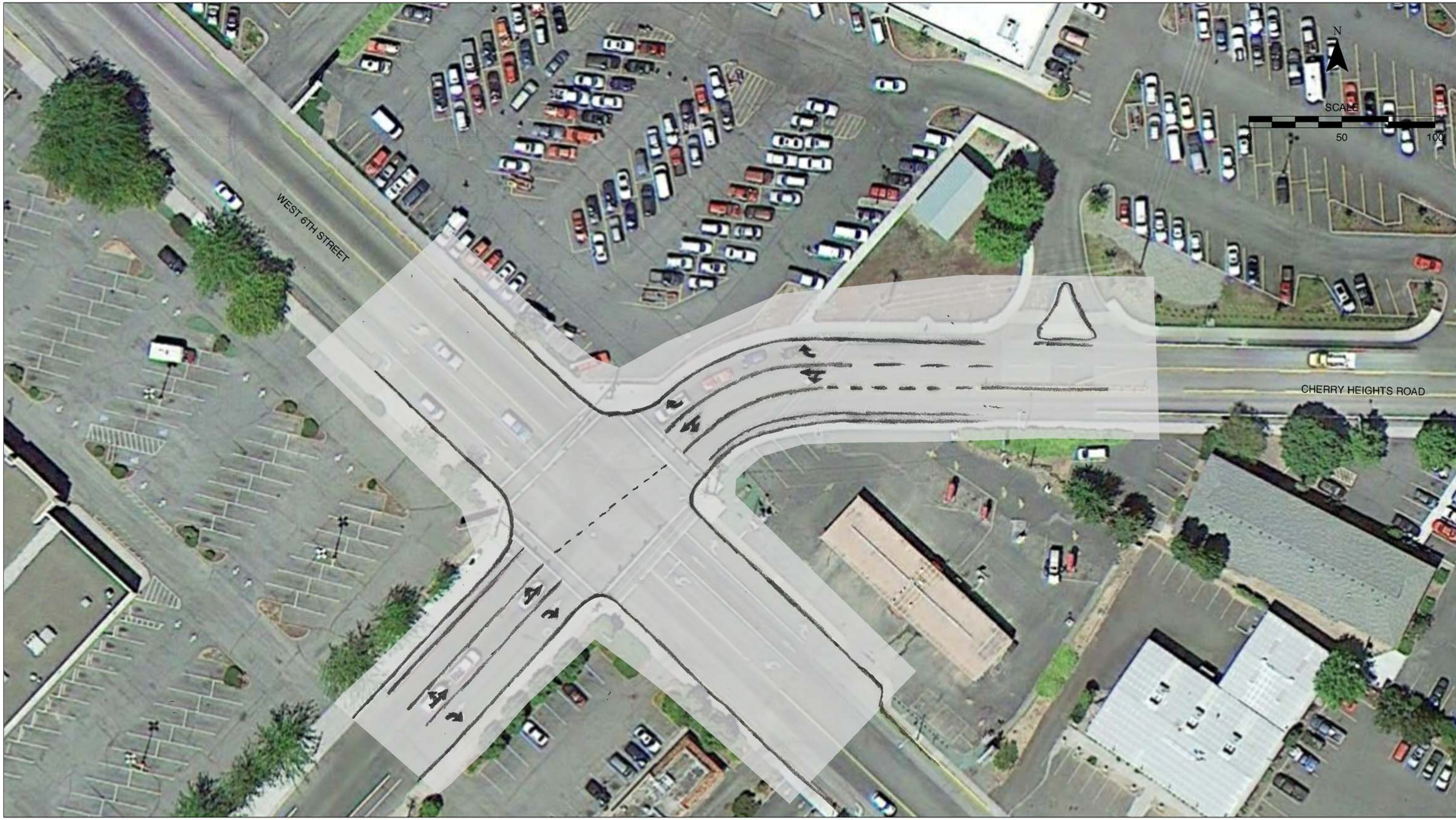
Table 5-15 summarizes the evaluation criteria for Project I-8.

Table 5-15. Project I-8 Evaluation Criteria Summary

	Evaluation Criteria Score by Goal				
Project ID	**Goal 1: Safety and Mobility**	**Goal 2: Multimodal Options**	**Goal 3: Integration**	**Goal 4: Economic Development**	**Total Score**
Alternative I-8 (Lane Reallocation)	3	0	1	1	5

This project was not discussed during the PAC/TAC meeting. However, feedback received indicated that they would like to see this improvement implemented. It is expected that this project could be completed in the short-term at a relatively low cost to the City.

Recommendation: Modifications to the lane configurations and signal timing phasing for the northbound and southbound approaches are recommended at this location.



**PROJECT I-8: CONCEPTUAL LANE RESTRIPING
CHERRY HEIGHTS ROAD/W 6TH STREET
THE DALLES, OR**

Figure
5-9

Projects I-9 through I-11: Lane Alignment and Signal Optimization at Webber Street Signals

City staff has observed southbound queues from W 6th Street backing through the W 2nd Street intersection during midday peak periods due to the delay associated with permitted southbound left-turns. Ideally, the existing right-turn lanes would be extended beyond the queue in the shared through/left lanes to accommodate forecast demand queues at the Webber/6th Street (Intersection #9) and Webber/2nd Street (Intersection #10) intersections. Due to restrictions in width under the I-84 overpass, extending these turn lanes beyond 100 feet may not be feasible within the constraints of the existing structure.

To increase capacity at the intersections, the north and south approaches should be realigned to provide exclusive left-turn lanes, as shown in Figure 5-10 and Figure 5-11. Providing left-turn lanes would facilitate running concurrent left-turn phases and provide a protected left-turn phase. Additional alternatives include signal coordination of the north and southbound through traffic to minimize queueing between the signals.

Alternatives Evaluation and Recommendation

Table 5-16. Table 5-16 summarizes the evaluation criteria for projects associated with the queues at Webber Street/2nd Street and Webber Street/6th Street. Projects I-9 through I-11 Evaluation Criteria Summary

	Evaluation Criteria Score by Goal				
Project ID	**Goal 1: Safety and Mobility**	**Goal 2: Multimodal Options**	**Goal 3: Integration**	**Goal 4: Economic Development**	**Total Score**
Alternative I-9 (Signal Timing Modifications)	2	0	1	2	5
Alternative I-10 (Extend right-turn lanes for queue storage)	2	0	1	2	5
Alternative I-11a (Realign Webber Street approaches to provide dedicated north and southbound left-turn lanes)	2	0	1	2	5
Alternative I-11b (Realign northbound Webber Street approach to extend northbound left-turn storage lane))	2	0	1	2	5

The TAC/PAC discussion and the feedback received about these locations was positive.

Recommendation: This project could be a phased project as follows:

Short-Term

- *Extend the northbound right-turn lane at the Webber and 2nd Street intersection and the southbound right-turn lane at the Webber and 6th Street intersection.*

Medium-Term to Long-Term

- *Add an exclusive northbound and southbound left-turn lane at the 2nd and 6th Street intersections, respectively.*
- *Alter the signal timings to accommodate the new lane configurations.*
- *Coordinate the signals.*

The medium-term to long-term improvements at these intersections will require some right-of-way to accommodate the additional lanes.

PROJECT I-11a: CONCEPTUAL REALIGNMENT
WEBBER STREET/W 2ND STREET
THE DALLES, OR

Figure
5-10

KITTELSON & ASSOCIATES, INC.
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PROJECT I-11a: CONCEPTUAL REALIGNMENT
WEBBER STREET/W 6TH STREET
THE DALLES, OR

Figure
5-11

DOWNTOWN COUPLET CIRCULATION

Within The Dalles downtown, the roadway system operates as a one-way couplet with westbound traffic on 2nd Street and eastbound traffic on 3rd Street. While there are few issues with the couplet today, the City is making efforts to revitalize downtown and attract new businesses that could be supported by a conversion.

Successful one-way to two-way conversions have been documented in several Oregon cities, one of the most notable being downtown Oregon City. Oregon City's conversion resulted in a complete street project that filled gaps in transportation infrastructure by linking transit, pedestrian, and bicycle networks. The project has been credited as "bolstering Oregon City's downtown, with 37 new downtown businesses opening in…32 months."

The advantages and disadvantages of a one-way to two-way conversion in The Dalles have been qualitatively evaluated relative to economic development, and motorized and non-motorized travel. Table 5-17 provides a general summary of the factors to be considered by the City and its stakeholders. If the consensus is that the conversion warrants further review after reviewing this qualitative comparison, additional quantitative evaluations of projects and costs could be completed to further inform decisions. An operational analysis of a two-way street couplet would require a new model run by ODOT's Transportation Planning Analysis Unit (TPAU) to understand how changes in traffic patterns would influence operations.

Table 5-17. Qualitative Evaluation of a One-Way to Two-Way Street Conversion in Downtown The Dalles

Evaluation Category	Advantages of Conversion	Disadvantages of Conversion
Motor Vehicles	• Easy-to-navigate network	• Impacts to existing local circulation downtown, potentially reducing traffic on 3rd Street while increasing through traffic on 2nd Street. • Increases congestion by introducing more conflicting movements at every intersection • Upgrades required to existing signals and intersections, including: ○ Westbound left-turn lane at 2nd Street/Lincoln Street ($100,000) ○ Signal modifications at 4 existing signals ($30,000), assuming permissive only left-turn phasing • New signals may be required to accommodate increased left-turn demand on 2nd Street at Taylor Street and Lincoln Street ($400,000)
Economic Development	• Supports other ongoing economic development efforts • Increases the visibility and accessibility of retail offerings • Slower speeds and congestion may make downtown appear busy, which could attract more retail customers	• Not a stand-alone catalyst for economic development.
Pedestrian/Bicycle	• Reduced speeds due to congestion may encourage more bicyclists to share the road with motor vehicles • Reduced potential for multi-threat crossing conflicts	• Additional delay at intersections.

Economic Development

Economic development is often cited as a primary benefit of a conversion and is associated with making the streets more "customer friendly" and "easier to navigate" – especially for tourist and infrequent customers. The level of these benefits is difficult to estimate, but given that The Dalles downtown is only 10 blocks long within the couplet, these benefits to potential customers appear minimal.

The conversion of one-way to two-way streets should not be considered a catalyst for economic development, but it could support other downtown revitalization efforts currently underway by The Dalles Main Street organization. According to the National Trust for Historic Preservation (www.preservationnation.org) the retail area affected by the conversion should be "experiencing a comeback" before a conversion can be effective.

Pedestrian and Bicycles

Experts from the Pedestrian and Bicycle Information Center within the University of North Carolina Highway Safety Research Center (www.pedbikeinfo.org) suggest one-way to two-way street conversions can "also help reduce motor vehicle speeds and vehicle miles traveled and provide improved conditions and access for bicyclists."

For pedestrians the potential for a multiple-threat crossing conflict is reduced by providing two-way traffic. This conflict occurs when a pedestrian is crossing a two-lane roadway and the vehicle in the lane nearest to the pedestrian stops for the pedestrian and a vehicle in the second lane does not stop. A two-way traffic flow eliminates this conflict since both drivers theoretically have an unobstructed view of the crosswalk on the approach.

Other pedestrian and bicycle enhancements, such as bulb-outs at intersections to reduce crossing distance, can be implemented without a conversion to two-way traffic.

Public Input and Recommendation

The Downtown Couplet conversion was not discussed with the PAC/TAC members due to time constraints; however, this was discussed as part of the public open house. The feelings were mixed with some people for the conversion and some against it. Both sides agreed that a comprehensive economic impact assessment needs to be completed before any decisions are made. Many of the supporters of the conversion stated that if the study did not indicate an economic benefit they would change their views on the conversion.

Recommendation: A study should be conducted as a short-term to medium-term term priority project as more information will be needed before making a decision on the potential conversion.

SAFETY ALTERNATIVES

The TSP Safety goal recognizes the importance of a safe transportation system that is reliable and in a state of good repair. Objectives include:

1A. Reduce the number of fatal and serious crashes in the plan area.

1B. Develop a multi-modal transportation system that incorporates safety and operational improvements for bicyclists and pedestrians.

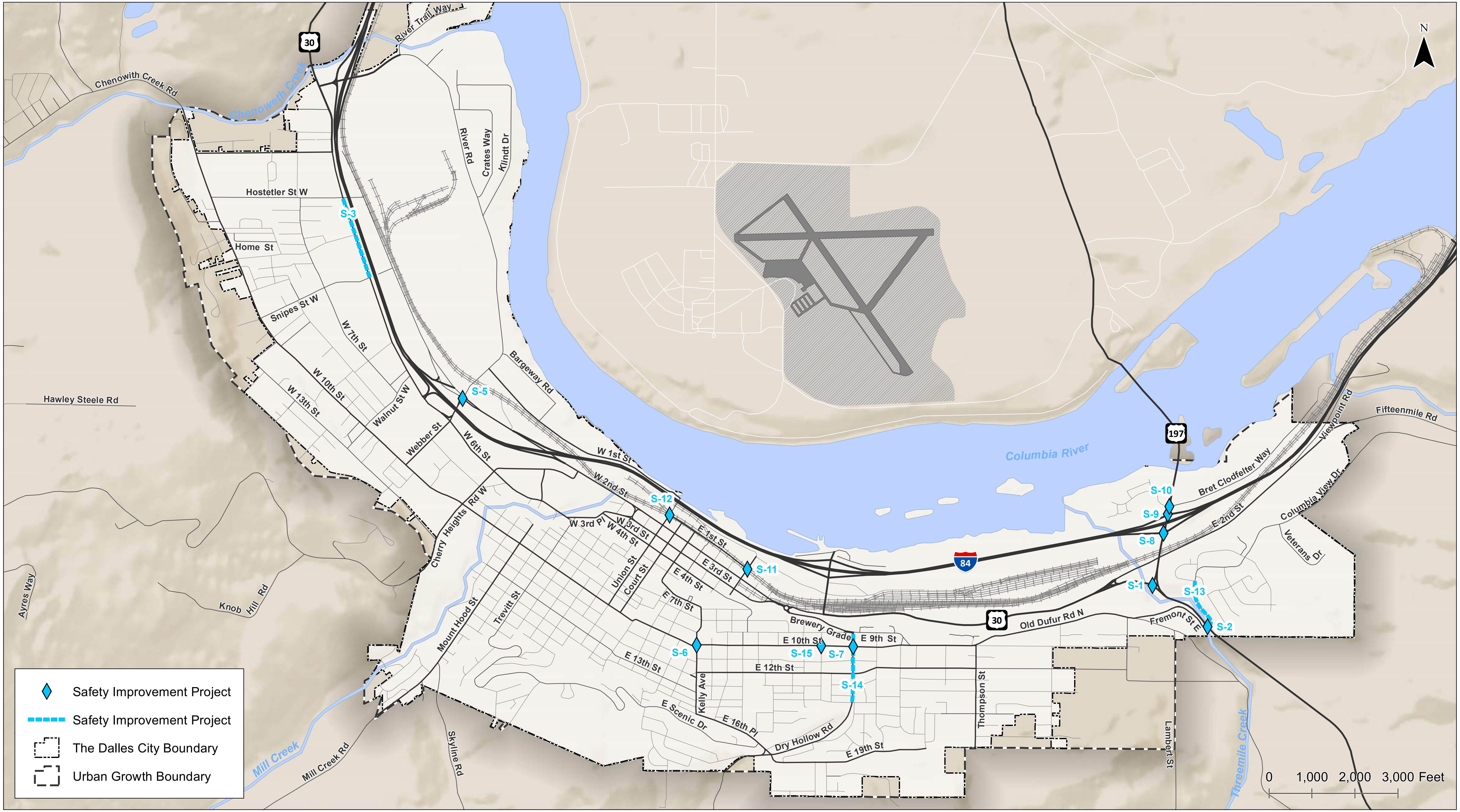
1E. Improve safety and operational components of existing transportation facilities not meeting agency standards or industry best practices.

Based upon the crash trends and safety needs documented in Technical Memorandum #4, a range of safety alternatives were identified to address the crash patterns and trends observed during the five-year historical crash review period. Suggested countermeasures are provided in Table 5-18 and project locations are illustrated in Figure 5-12. Individual projects are described in further detail after the table and figure. Some of the safety projects identified were also identified through the operational analysis and are therefore included in both sections. These projects have a corresponding number in the “Related Projects” column to indicate the operations project ID.

Table 5-18. Preliminary Safety Alternatives

Project No.	Project Name	Project Description	Related Projects	Reported Crash History	Recommended Priority	Cost Estimate[4]	Potential Funding Source		
							ODOT	City	Private
S-1	US 197/US 30	Systemic safety improvements (signing and markings)	I-1	14 of 15 crashes were left-turn/angle related.	Short-term	$2,000	✓		
S-2	US 197/Fremont Street/Columbia View Drive	Safety improvements including sign upgrades, rumble strips, dynamic message signage, and a J-Turn intersection conversion. As identified in project I-2, an overpass or roundabout may be a longer-term solution.	I-2	8 of 12 crashes were left-turn/angle related. One crash resulted in Injury A. A top 15% SPIS site; crash rate exceeded the critical crash rate.	Short-term / Long-term	$350,000	✓	✓	
S-3	West 6th Street from Snipes Street to Hostetler Street	Restripe roadway and widen, as necessary, to provide a consistent 3-lane section with center two-way, left-turn lane. Further study is needed to determine the preferred solution.	B-27	Rear-end and angle/turning movement crashes are the most-frequent crash types along this segment.	Medium-term	$250,000	✓	✓	
S-5	Webber Street at W 2nd Street and W 6th Street	Realign approaches to provide protected left-turn phasing to reduce left-turn crashes on the Webber Street approaches.	I-11	10 of 14 crashes were reported as angle or turning movement.	Medium-term	See Project I-11	✓	✓	
S-6	Kelly Avenue/East 10th Street	Potential safety improvements include installing Stop Ahead signage (W3-1) on the East 10th Street approaches, use of a larger stop sign size, use of retroreflective tape on the sign post, and/or addition of Light Emitting Diode (LED) lights on the STOP sign border.	None	4 of the 6 crashes were reported as angle and the crash cause identified in half of those crashes indicated that "the driver passed the stop sign."	Short-term	$2,000		✓	
S-7	Dry Hollow Road/East 10th Street	Potential safety improvements include the use of a larger stop sign size, use of retroreflective tape on the sign post, or addition of LED lights on the STOP sign border.	None	All six crashes were angle or turning movement related.	Short-term	$2,000		✓	
S-8	US 197/I-84 EB Ramps	Systemic sign upgrades as potential candidates for the ODOT All Roads Transportation Safety (ARTS) Program.	I-3	6 of 9 crashes were reported as angle or turning movement.	Short-term	$1,000	✓		
S-9	US 197/I-84 WB Ramps	Systematic sign upgrades as potential candidates for the ODOT ARTS program.	I-3	3 of 6 reported crashes were angle or turning movement.	Short-term	$1,000	✓		
S-10	US 197/Bret Clodfelter Way	Illumination and systemic sign upgrades as potential candidates for the ODOT ARTS program.	None	All 5 reported crashes at this intersection were angle or turning movement where the driver failed to yield the right-of-way.	Short-term	$14,000	✓		
S-11	1st St/Madison Street	Potential options include installation of part time restriction signage (sign that illuminates with railroad crossing activation) restricting eastbound left-turns during the approach and passage of trains.	None	N/A	Short-term	$2,000		✓	
S-12	1st St/Union Street	Installation of signage prohibiting drivers from stopping on the railroad tracks similar to Do Not Block Intersection signage.	None	A fatal crash was reported on July 5, 2015.	Short-term	$1,000		✓	
S-13	Columbia View Drive Guardrail	Install guardrail along Columbia View Drive as it ascends the hill east of Highway 197.	None	N/A	Medium-Term	$60,000		✓	
S-14	Dry Hollow Road Corridor Study	Conduct a corridor study of Dry Hollow Road between E 9th Street and E 14th Street to evaluate speeds and determine whether corridor and/or intersection treatments such as mini-roundabouts or low-cost treatments such as signing and striping enhancements are needed.	None	Public comments indicated a perceived safety concern at Dry Hollow Road/10th Street and Dry Hollow Road/12th Street. Six crashes were reported at Dry Hollow Road/10th Street.	Medium-Term	$10,000		✓	
S-15	Lewis Street/10th Street Intersection Enhancements	Stripe stop bars on Lewis Street at the approaches to 10th Street; Install advanced warning signage for the Lewis Street approaches.	None	Public comments indicated a perceived safety concern at this intersection.	Short-Term	$5,000		✓	

[4] Cost estimates include a 30% contingency



Preliminary Safety Alternatives
The Dalles, Oregon

Figure
5-12

Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

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Project S-1: US 197/US 30

This intersection is a potential candidate for systematic sign upgrades as part of the ODOT All Roads Transportation Safety (ARTS) program. Some other mitigation options in addition to sign upgrades to consider could include the following:

- Install retroreflective tape on the sign post to increase sign visibility.
- Install transverse rumble strips to alert drivers of the intersection ahead.
- Convert the painted medians and channelizing right-turn bypass island into raised curb to reduce speeds and create an urban-like environment at the intersection.
- Reduce lane widths within the intersection influence area.
- Change in traffic control to alternative form such as:
    - Traffic signal
    - Roundabout

Roundabouts have proven to be an effective intersection treatment for improving safety – particularly for reducing severe and fatal crashes. NCHRP Report 572 found that converting a minor-road stop controlled intersection to a modern roundabout can reduce total crash frequency by 44 percent and injury crashes by 82 percent.

Project S-2: US 197/Fremont Street/Columbia View Drive

The majority of crashes occurring at unsignalized intersections on high-speed rural highways are right-angle crashes resulting from turning movements (1). The proportion of reported angle and turning crashes suggests that drivers may be accepting inadequate gaps when turning onto US 197 from Fremont Street or Columbia View Drive. The 6-percent grade on US 197 is expected to influence vehicle speed on uncontrolled approaches.

As described by Project I-2, a J-turn provides one at-grade alternative to reduce crash potential at this intersection. The J-Turn has been proven effective in reducing total crash frequency in other states, including Maryland (44% reduction) and North Carolina (27.2% reduction) (2, 3).

This intersection is also for a potential candidate for systematic sign upgrades as part of the ODOT ARTS program. The following alternative mitigation options could be considered in addition to the J-Turn intersection:

- Install retroreflective tape on the sign post to increase sign visibility.
- Install dynamic message signs that indicate when the roadway is icy or snowy.
- Install variable speed signs that display a lower advisory speed when the roadway is icy or snowy.
- Install transverse rumble strips to alert drivers of the intersection ahead.
- Reduce uncontrolled-approach lane widths and install rumble strips within the lane lines. This option has been effective in reducing crashes at rural two-lane stop-controlled intersections.
- As described in Project I-2, an overpass or roundabout may be a potential long-term solution.

Project S-3: West 6th Street from Snipes Street to Hostetler Street

There are 11 driveways along W 6th Street between Snipes Street and Hostetler Street (a 1,900 foot segment). Within this same segment 27 crashes were reported over the 5-year crash data review period. Restriping the existing pavement and widening the pavement, as needed, to provide a two-way left-turn lane (TWLTL) could reduce conflicts between northbound through and northbound left-turning vehicles.

The addition of a center TWLTL would also provide a refuge for vehicles exiting a driveway to travel northbound on West 6th Street. Vehicles attempting an eastbound left-turn would be able to perform a two-stage crossing, meaning they would look for a gap in southbound traffic and then a gap in northbound traffic rather than waiting to find a simultaneous gap in both directions. Creating a two-stage crossing could help reduce the number of angle crashes along the corridor and would also provide an operational benefit by reducing the delay for the vehicles exiting the driveways. Providing a center TWLTL in this section would also provide overall corridor continuity given West 6th Street includes a center TWLTL from Walnut Street to a point south of the Snipes Street intersection.

As parcels with access to 6th Street redevelop, the City should also pursue access consolidation, restrictions, and other access management strategies to reduce the number of vehicle-vehicle and vehicle-pedestrian conflicts.

As illustrated by the photos in Exhibit 5-7 and Exhibit 5-8, the existing cross section of 6th Street could allow for the addition of a center TWLTL. Where sidewalk has been constructed on W 6th Street there is approximately 75 feet from the edge of the sidewalk to the edge of pavement. Right-of-way dedication will be required on two parcels to obtain width for the TWLTL. Filling sidewalk gaps on these two parcels is identified as Project P-14.

Exhibit 5-7***: 6th Street 700 feet north of 6th Street/Snipes Street intersection***

Exhibit 5-8**: 6th Street in front of Bi-Mart**

There are several options for how to assign the available pavement width to include a TWLTL while maintaining on-street parking and enhancing bicycle facilities. One alternative cross-section is shown in Exhibit 5-9. A conceptual view of this cross-section on W 6th Street is illustrated in Figure 5-13.

PROJECT S-3: CONCEPTUAL CROSS-SECTION ON W 6TH STREET
SNIPES ST TO HOSTETLER ST
THE DALLES, OR

Figure
5-13

H:\projfile\18495 - The Dalles TSP\dwgs\figs\memo #5\WebberSt_W6th_Memo#5_mpe.dwg Mar 25, 2016 - 9:15am - openbnd Layout Tab: 5-13_W 6th Street

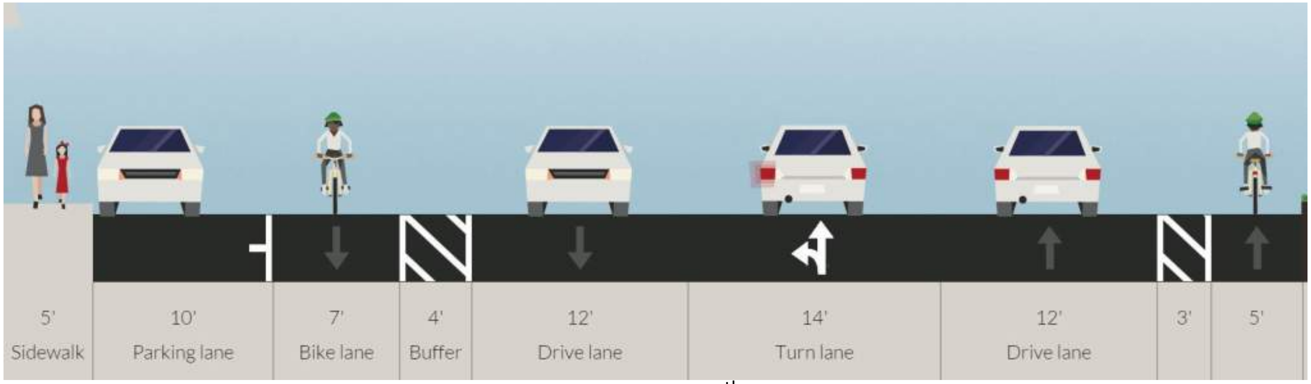


Exhibit 5-9: Example Cross-section Looking North on W 6th Street Between Snipes Street and Hostetler Street (Source: www.streetmix.net)

Public Input and Recommendation

The PAC/TAC members were positive to the idea of making changes to the existing cross section. The members indicated that in addition to the rear-end crashes, they have observed near misses involving northbound drivers using the southbound travel lane as a left-turn lane. The section of 6th Street to the south includes a center TWLTL. The members of the PAC/TAC were supportive including a center TWLTL and bike lanes along this section.

There were also discussions of including a buffered two-way cycle track on the west side of the road since there are no destinations on the east side of 6th Street. Due to the existing right-of-way and pavement width, there are many options to consider. One potential cross section that includes a center TWLTL and a buffered two way bicycle area is shown in Exhibit 5-10. This project should be further evaluated as a feasibility study and considered as a medium-term priority project.

Exhibit 5-10: *6th Street 700 feet north of 6th Street/Snipes Street intersection*

ACTIVE TRANSPORTATION ALTERNATIVES

Active transportation options, including walking and bicycling, are transportation alternatives that not only provide physical benefits to people but also reduce traffic and congestion on roadways. In order for people to choose walking and bicycling as viable modes of transportation, adequate facilities are needed to provide separation from motor vehicles and connectivity throughout the City.

Several pedestrian, bicycle, and transit projects have been identified in the following sections. Preliminary cost estimates are provided, but no evaluation has been prepared to prioritize these projects. Input from the Technical and Public Advisory Committees, general public, and an evaluation of how well each project meets goals established in Technical Memorandum #2 will inform prioritization. Project priorities will be summarized in Technical Memorandum #6.

Pedestrian System Alternatives

Pedestrian system alternatives were identified based on pedestrian facilities needs summarized in Technical Memorandum #4. Additional inventory data on accessible pedestrian ramps, obtained from the City on January 6, 2016, is summarized in *Appendix E*.

Pedestrian facilities could include sidewalks, shared-use paths, signing/striping at pedestrian crossings, and enhanced pedestrian crossing treatments (e.g., Rapid Rectangular Flashing Beacon). Pedestrian system alternatives serve a variety of needs, including:

- Relatively short trips (generally considered to be under a mile) to major pedestrian attractors, such as schools, parks, and public facilities;
- Recreational trips (e.g., jogging or hiking) and circulation within parks;
- Access to transit (generally trips under 1/2 –mile to bus stops); and,
- Commute trips, where mixed-use development is provided and/or people have chosen to live near where they work.

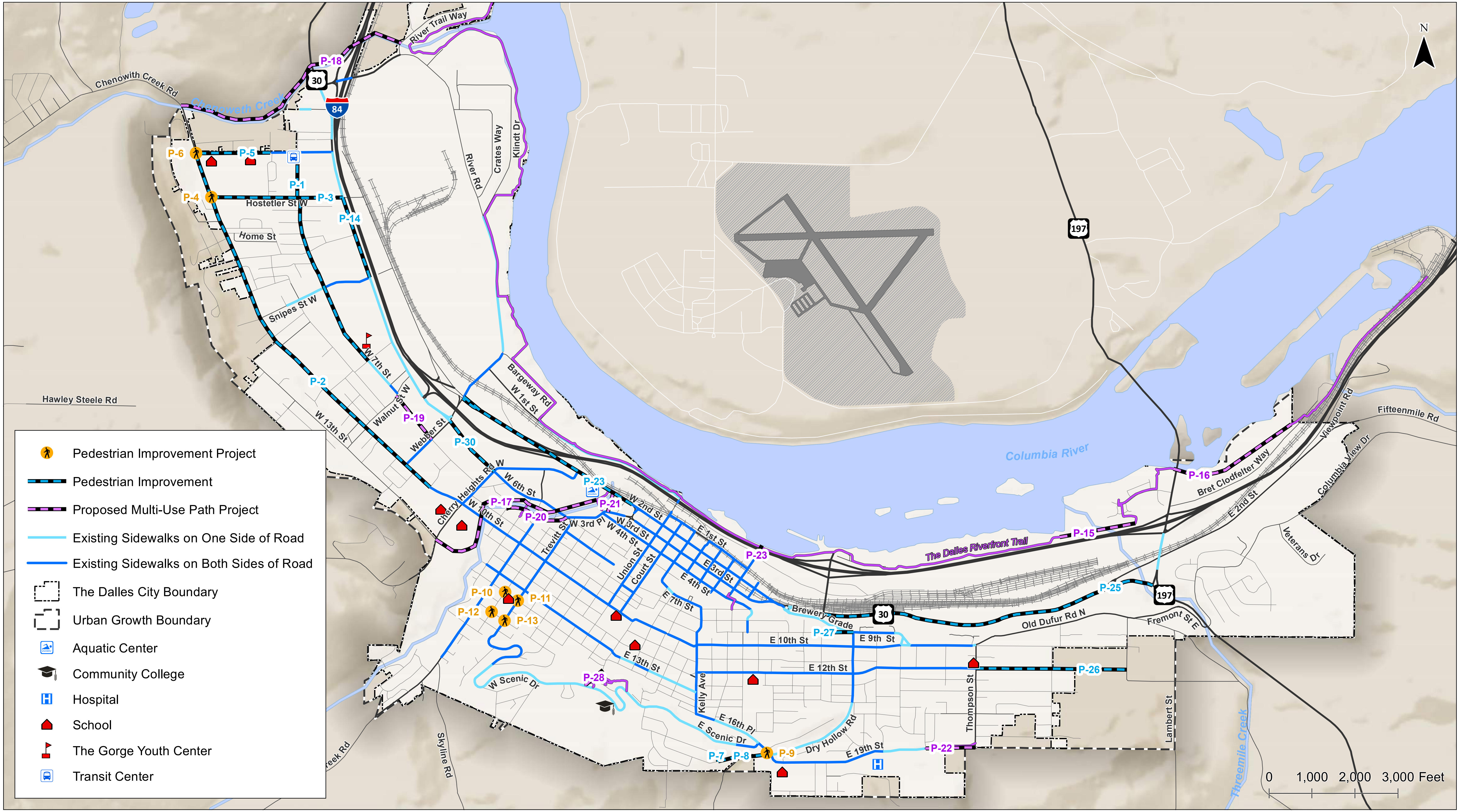
Future pedestrian facilities identified in Table 5-19 and illustrated in Figure 5-14 include strategic improvements to provide east-west connectivity throughout The Dalles, connectivity between residential areas and key destinations (transit center, aquatic center, and schools), crossing and route enhancements consistent with recommendations from Safe Routes to School Action Plans, and trail improvements to complete The Dalles Riverfront Trail.

Table 5-19. Proposed Pedestrian Facilities

Project No.	Project Name	Project Description	Project Category	Cost Estimate*	Source	Recommended Priority	Potential Funding Source		
							ODOT	City	Private
P-1	W 7th Street Sidewalk	Add a sidewalk on both sides of the street to fill sidewalk gaps from Chenowith Loop Road to Walnut Street.	Sidewalk	$ 330,000	KAI	Long-Term		✓	
P-2	W 10th Street Sidewalk	Add a sidewalk on both sides of the street to fill sidewalk gaps from Chenowith Loop Road to Vey Way	Sidewalk	$ 611,000	KAI	Long-Term		✓	
P-3	Hostetler Street Sidewalk	Add a sidewalk on both sides of the street from West 10th Street to West 6th Street	Sidewalk	$ 200,000	KAI	Long-Term		✓	
P-4	W 10th Street/Hostetler Street intersection	Stripe high emphasis crosswalk markings and install appropriate school crossing signal	Crossing	$ 2,000	SRTS	Near-Term		✓	
P-5	Chenowith Loop Road Sidewalk	Add sidewalk on the south side of the street from Chenowith Elementary School to W 10th Street	Sidewalk	$ 46,000	SRTS	Medium-Term		✓	
P-6	W 10th Street/Chenowith Loop Road Crosswalk	Stripe crosswalk markings and install appropriate school crossing signage	Crossing	$ 2,400	SRTS	Near-Term		✓	
P-7	E 18th Street Sidewalk	Complete the sidewalk connection on both sides of the street along East 18th Street to East 19th Street.	Sidewalk	$ 64,000	KAI	Medium-Term		✓	
P-8	E 19th Street Sidewalk	Add sidewalk on the north side of the street from East 18th Street to Dry Hollow Road	Sidewalk	$ 30,000	KAI	Medium-Term		✓	
P-9	E 16th Place/E 19th Street/Dry Hollow Road Crosswalk	Stripe crosswalk markings and install upgraded school crossing signage	Crossing	$ 2,500	SRTS	Near-Term		✓	
P-10	W 14th Street/Bridge Street Crosswalk	Stripe crosswalk markings and install upgraded school crossing signage	Crossing	$ 2,200	SRTS	Near-Term		✓	
P-11	W 14th Street/Trevitt Street Crosswalk	Stripe crosswalk markings and install upgraded school crossing signage	Crossing	$ 2,200	SRTS	Near-Term		✓	
P-12	W 16th Street/Bridge Street Crosswalk	Stripe crosswalk markings and install upgraded school crossing signage	Crossing	$ 2,200	SRTS	Near-Term		✓	
P-13	W 16th Street/Trevitt Street Crosswalk	Stripe crosswalk markings and install upgraded school crossing signage	Crossing	$ 2,200	SRTS	Near-Term		✓	
P-14	W 6th Street Sidewalk	Fill gaps between Snipes Street and Hostetler Street	Sidewalk	$34,000	KAI	Near-Term		✓	
P-15	The Dalles Riverfront Trail	Fill gap in Riverfront Trail from Lone Pine to existing trail. *Note that this project has been opposed by one of the tribes and is unlikely to be developed.*	Shared-Use Path	Unknown	City	Vision		✓	
P-16	The Dalles Riverfront Trail	Complete Riverfront Trail from US 197 to The Dalles Dam	Shared-Use Path	Unknown	City	Medium-Term		✓	
P-17	Mill Creek Trail	Construct path on the west bank of Mill Creek from Cherry Heights Road/13th Street intersection to The Dalles Riverfront Trail	Shared-Use Path	Unknown	1999 TSP	Long-Term		✓	
P-18	Chenoweth Creek Trail	Construct trail along the creek from W 10th Street to the Riverfront Trail, including an at-grade crossing of US 30 (Historic Columbia River Highway) and an undercrossing of I-84.	Shared-Use Path	Unknown	1999 TSP	Long-Term		✓	
P-19	Shared Use Path between West 7th Street and West 8th Street	Construct a shared-use path between West 7th Street and West 8th Street (from Walnut to Webber)	Shared-Use Path	$30,000	KAI	Medium-Term		✓	
P-20	Shared-Use Path along between W 8th Place and West 6th Street	Construct a shared-use path between Wright Street and West 6th Street. Pre-engineering for part of this trail has begun. Further plans should be coordinated with The Dalles Watershed Council and the Riverfront Trail Committee.	Shared-Use Path	$37,000	KAI	Near-Term		✓	
P-21	Shared-Use Path to the Aquatic Center	Construct a shared-use path between the intersection of West 3rd Place and West 4th Street to connect to the Aquatic Center and the Thompson City Park	Shared-Use Path	$7,000	KAI	Medium-Term		✓	
P-22	Shared-Use Path between East 19th Street and Thompson Street	Construct a shared-use path that connects East 19th Street to Thompson Street	Shared-Use Path	$26,000	KAI	Medium-Term		✓	

Project No.	Project Name	Project Description	Project Category	Cost Estimate*	Source	Recommended Priority	Potential Funding Source		
							ODOT	City	Private
P-23	W 2nd Street: Lincoln Street to Webber Street	Add a sidewalk on both sides of the street from Lincoln Street to Webber Street.	Sidewalk	$250,000	KAI	Medium-Term		✓	
P-24	Bike Hub	Install bike hub.	Bike Hub	$70,000	ODOT	Near-Term	✓	✓	✓
P-25	E 2nd Street Sidewalks	Construct sidewalks on one side of East Second Street between Brewery Overpass Road and Highway 197	Sidewalk	$380,000	KAI	Long-Term	✓	✓	
P-26	E 12th Street Sidewalks	Construct sidewalks on E 12th Street between Thompson and Richmond	Sidewalk	$170,000	KAI	Long-Term		✓	
P-27	E 9th Street Sidewalk Infill	Construct sidewalks on E 9th Street from Lewis Street to Brewery Grade to provide a complete connection.	Sidewalk	$13,000	KAI	Long-Term		✓	
P-28	Sorosis Park Trail Connection Study	Study the feasibility of improving the trail connections between Sorosis Park and Washington Street.	Study	$20,000	KAI	Long-Term		✓	
P-29	Pedestrian Access Study	Evaluate the best locations for pedestrian/bicycle connections across the interstate and railroad to access the river, Riverfront trail, and Lonepine.	Study	$20,000	KAI	Near-Term	✓	✓	
P-30	6th Street/Cherry Heights Road Pedestrian Access Study	Complete a study to examine pedestrian access in the area and determine the appropriate location and design for a mid-block crossing of 6th Street between Cherry Heights Road and Webber Street.	Study	$5,000	KAI	Medium-Term	✓	✓	

SRTS = Safe Routes to School
*Cost estimates do not include right-of-way costs and include 30% contingency.



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Future Pedestrian Facilities
The Dalles, Oregon

Figure
5-14

Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

Bicycle System Alternatives

Bicycle system alternatives on roadway segments include: markings and signs, shared lanes, dedicated bicycle lanes, protected bicycle lanes, and bicycle boulevards. Each range in the level of perceived safety and comfort provided to the bicyclist. Bicycle system alternatives considered at intersections include: signing and striping, bicycle signals, bike boxes, and median refuge islands.

The bicycle system alternatives include many bicycle routes and intersections where new or enhanced bicycle facilities are needed to provide additional connections, address safety concerns, or improve a route to encourage more users, as reflected by the transportation needs identified in Technical Memorandum #4.

As included in Technical Memorandum #3, there were several roadways throughout The Dalles that had a bicycle level of traffic stress (LTS) of 3 or 4. Bicycle LTS 2 is considered appealing to a majority of the bike-riding population and therefore, is the desired target on most roadways. A range of low-cost countermeasures were considered to address the segments with a bicycle level of stress of 3 or 4. The following improvements would allow the segments to have a bicycle LTS of 2 or less:

- Provide a 7-foot wide buffered bike lane to give bicyclists a buffer distance between the bike lane and adjacent travel lane,
- Reduce the posted speed limits to 30 miles per hour (mph) or less[5],
- Provide a paved bike lane where one does not exist today, and/or
- Improve intersection approach design of turn lanes to reduce difficulty for a bicyclist to traverse the intersection without having to change multiple lanes on the approach.

Proposed Bicycle Facilities

The proposed bicycle facilities were developed by identifying gaps in existing bicycle facilities, where additional east-west or north-south connectivity was needed, and where connectivity to local schools was requested in the Safe Routes to School Action Plans. Input was also received from the Bicycle Advisory Committee with their recommended bicycle network. The recommendations from the Bicycle Advisory Committee are summarized in Table 5-20 and illustrated in Figure 5-15.

Several projects were identified as high priority projects based on their ability to provide increased connectivity within the City and between residential areas and schools. These routes include many of

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[5] Reducing the posted speed limit requires an engineering investigation and State Traffic Engineer Approval unless it meets the statutory speed zone criteria. Posted speeds are based on the existing 85th percentile speed. This recommendation to reduce the posted speed limit is subject to ORS processes.

the future connections shown on the east side of the urban area. The priority routes for constructing bike lanes could include:

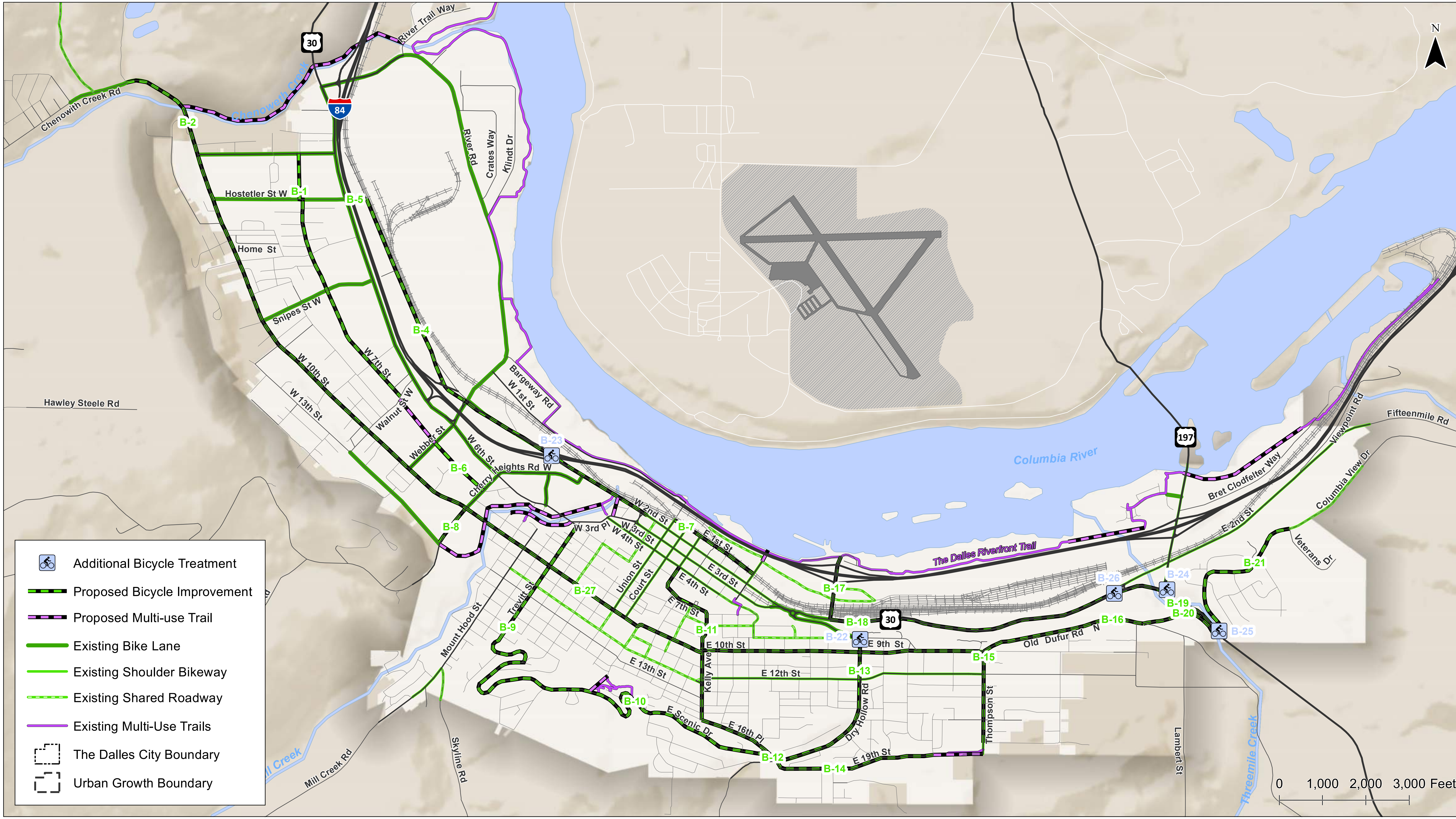
- West 7th Street (B-1): Add a bicycle lane to provide connectivity between local schools and the proposed Gorge Youth Center and to provide alternative east-west connectivity.
- East and West 10th Street (B-2, B-28): Add a bicycle lane or widen the existing bicycle lane to provide east-west connectivity and connectivity to residential areas of the City.

The following are additional roadways or intersections identified by the Bicycle Advisory Group for consideration for improvements including, new primary bicycle routes, new shared-used paths, and intersection improvements. These routes and associated improvements will be prioritized in Technical Memorandum #6 based on input from the Advisory Committees at the February 10, 2016 meeting.

Table 5-20. Bicycle Improvement Project Summary

Project No.	Project Name	Project Description	Project Category	Cost Estimate[1]	Source	Recommended Priority	Potential Funding Source		
							ODOT	City	Private
B-1	West 7th Street from the new Transit center to Walnut Street	Add a bicycle lane(s) along West 7th Street from Chenowith Loop Road to Hostetler Street	Shared Use Path	$31,000	Bicycle Advisory Committee	Short-Term		✓	
		Add a bicycle lane(s) along West 7th Street from Hostetler Street to Pomona Street	Shared Roadway	$1,000					
		Add a bicycle lane(s) along West 7th Street from Pomona Street to Walnut Street	Bicycle Lane without Pavement Widening	$10,000					
B-2	West 10th Street from Foley Lakes to Cherry Heights Road	Widen the existing bicycle lane to a 7-ft buffered bicycle lane from Foley Lakes to Cherry Heights Road	Bicycle Lane without Pavement Widening	$7,000	Bicycle Advisory Committee	Medium-Term		✓	
B-3	West 2nd Street from Hostetler Street to Webber Street	Add a bicycle lane(s) along West 2nd Street from Hostetler Street to Webber Street	Bicycle Lane with Pavement Widening	$800,000	Bicycle Advisory Committee	Long-term		✓	
B-4	West 2nd Street from Webber Street to Lincoln Street	Add a bicycle lane(s) along West 2nd Street from Webber Street to Lincoln Street	Bicycle Lane with Pavement Widening	$1,250,000	Bicycle Advisory Committee	Long-term		✓	
B-5	Hostetler Street from West 2nd Street to West 6th Street	Add a bicycle lane(s) along Hostetler Street from West 2nd Street to West 6th Street	Bicycle Lane with Pavement Widening	$67,000	Bicycle Advisory Committee	Medium-Term		✓	
B-6	West 8th Street from Webber Street to Cherry Height Road	Add a bicycle lane(s) along West 8th Street from Webber Street to Cherry Height Road	Bicycle Lane without Pavement Widening	$6,000	Bicycle Advisory Committee	Short-Term		✓	
B-7	East 1st Street from Union Street to Madison Street	Add a bicycle lane(s) along East 1st Street from Union Street to Madison Street	Bicycle Lane without Pavement Widening	$5,000	Bicycle Advisory Committee	Medium-Term		✓	
B-8	Cherry Heights Road from West 13th Street to West 10th Street	Add a bicycle route Cherry Heights Road from West 13th Street to 525ft north	Bicycle Lane with Pavement Widening	$111,000	Bicycle Advisory Committee	Long-term		✓	
		Add a bicycle route Cherry Heights Road from 525ft north of West 13th Street to W 10th Street	Bicycle Lane without Pavement Widening	$1,000					
B-9	Trevitt Street from West 6th Street to West 17th Street	Add a bicycle route along Trevitt Street from West 6th Street to W 10th Street	Bicycle Lane without Pavement Widening	$1,000	Bicycle Advisory Committee	Medium-Term		✓	
		Add a bicycle route along Trevitt Street from West 10th Street to W 17th Street	Bicycle Lane without Pavement Widening	$4,000					
B-10	Scenic Drive from West 17th Street to E16th Street	Add a bicycle route on Scenic Drive from West 17th Street to E 19th Street	Bicycle Lane without Pavement Widening	$14,000	Bicycle Advisory Committee	Medium-Term		✓	
B-11	Kelly Avenue from East 5th Street to E 16th Place	Add a bicycle route along Kelly Avenue from East 5th Street to E 7th Street	Shared Roadway	$4,000	Bicycle Advisory Committee	Short-Term		✓	
		Add a bicycle route along Kelly Avenue from East 7th Street to E 10th Street	Shared Roadway	$1,000					
		Add a bicycle route along Kelly Avenue from E 10th Street to East 14th St	Shared Roadway	$4,000					
		Add a bicycle route along Kelly Avenue from East 16th Street to East 14th St	Shared Roadway	$1,000					
B-12	E 16th Place from Kelly Avenue to Dry Hollow Road	Add a bicycle route along East 16th Street from Kelly Avenue to East 17 Street	Uphill Bicycle Lane with Pavement Widening	$39,000	Bicycle Advisory Committee	Short-Term		✓	

Project No.	Project Name	Project Description	Project Category	Cost Estimate[1]	Source	Recommended Priority	Potential Funding Source		
							ODOT	City	Private
		Add a bicycle route along East 16th Street from East 17 Street to Dry Hollow Road	Bicycle Lane without Pavement Widening	$3,000					
B-13	Dry Hollow Road from East 16th Street to Brewery Grade	Add a bicycle route along Dry Hollow Road from East 16th Street to Montana St	Bicycle Lane without Pavement Widening	$1,000	Bicycle Advisory Committee	Short-Term		✓	
		Add a bicycle route along Dry Hollow Road from Montana St to East 14th Street	Bicycle Lane without Pavement Widening	$3,000					
		Add a bicycle route along Dry Hollow Road from East 14th Street to Brewery Grade	Shared Roadway	$1,000					
B-14	East 19th Street from Dry Hollow Road to Oakwood Drive	Add a bicycle route along East 19th Street from Dry Hollow Road to Oakwood Drive	Bicycle Lane without Pavement Widening	$7,000	Bicycle Advisory Committee	Short-Term		✓	
B-15	Thompson Street from East 18th Street to East 10th Street	Add a bicycle route along Thompson Street from East 18th Street to East 10th Street	Bicycle Lane with Pavement Widening	$144,000	Bicycle Advisory Committee	Short-Term		✓	
B-16	Old Dufur Road from Fremont Street to East 10th Street	Add a bicycle route along Old Dufur Road from Fremont Street to East 10th Street	Bicycle Lane with Pavement Widening	$400,000	Bicycle Advisory Committee	Long-term		✓	
B-17	Brewery Overpass	Add a bicycle route along Brewery Overpass	Shared Roadway	$1,000	Bicycle Advisory Committee	Short-Term		✓	
B-18	US 30 from US 197 to Brewery Overpass	Add a bicycle route along East 2nd Street from US 197 to Brewery Overpass	Bicycle Lane with Pavement Widening	$979,000	Bicycle Advisory Committee	Long-term	✓		
B-19	US 197 from Fremont Street/Columbia View Drive to Lone Pine Boulevard	Add a bicycle route along US 197 from Fremont Street/Columbia View Drive to US30	Bicycle Lane without Pavement Widening	$5,000	Bicycle Advisory Committee	Medium-Term	✓		
B-20	Fremont Street	Add a bicycle route along Fremont Street	Shared Roadway	$1,000	Bicycle Advisory Committee	Short-Term		✓	
B-21	Columbia View Drive	Add a bicycle route along Columbia View Drive from US197 to East Knoll Drive	Uphill Bicycle Lane without Pavement Widening	$2,000	Bicycle Advisory Committee	Short-Term		✓	
		Add a bicycle route along Columbia View Drive from East Knoll Drive to Summit Ridge Drive	Bicycle Lane without Pavement Widening	$5,000					
		Add a bicycle route along Columbia View Drive from Summit Ridge Drive to Veterans Drive	Bicycle Lane without Pavement Widening	$3,000					
B-22	Dry Hollow at Brewery Grade	Additional bike treatment to improve bicycle safety	Bicycle	$3,000	Bicycle Advisory Committee	Short-Term		✓	
B-23	I-84 and 2nd Street	Additional bike treatment to improve bicycle safety	Bicycle	$3,000	Bicycle Advisory Committee	Short-Term	✓		
B-24	US 197 at US 30	Additional bike treatment to improve bicycle safety	Bicycle	$2,000	Bicycle Advisory Committee	Short-Term	✓		
B-25	US 197 at Fremont Street/Columbia View Drive	Additional bike treatment to improve bicycle safety	Bicycle	$3,000	Bicycle Advisory Committee	Short-Term	✓		
B-26	US 30 and E 2nd Street	Additional bike treatment to improve bicycle safety	Bicycle	$2,000	Bicycle Advisory Committee	Short-Term	✓		
B-27	E 10th Street Bike Lanes	Install bike lanes on E 10th Street between Cherry Heights Road and Old Dufur Road to create complete east-west connection, as identified in the network streets cross sections.	Bicycle Lane without Pavement Widening	$30,000	KAI	Medium-Term		✓	



Future Bicycle Facilities
The Dalles, Oregon

Figure **5-15**

Oregon Department of Transportation

Kittelson & Associates, Inc. Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

East-West Connectivity

An emphasis has been placed on east-west connectivity through The Dalles. As mentioned in the previous sections, there are schools on the northwest side of the City as well as a new transit center currently under construction and a planned youth center. A high priority has been placed on providing safe and efficient bicycle facilities to connect these locations and to provide connection to the Downtown area.

West 7th Street (Project B-1)

West 7th Street was also identified as a high priority segment as it provides an alternative east-west roadway to West 10th Street and W 6th Street. With the recently completed connection to Chenowith Loop Road, this would provide a direct east-west connection from the new transit center currently under construction. Currently there are no marked bicycle lanes along West 7th Street from Chenowith Loop Road to Walnut Street.

The existing pavement width along the segment of West 7th Street varies from approximately 30 feet to 55 feet. Approximately 36 to 38 feet of pavement would be needed to provide two 11- or 12-foot travel lanes and a 7-foot buffered bike lane. Lane widths could be narrowed to encourage lower speeds and on-street parking could be removed to provide for bike lanes. In the locations where only 30 feet of pavement exists, an additional 6 to 8 feet of pavement could be added to provide for bike lanes. Right-of-way would need to be assessed in these locations; however, based on aerial imagery, it appears that the right-of-way on the south side of the roadway is approximately 10 feet off of the existing edge of pavement.

Downtown Historic Area (Project B-7)

The Downtown Historic Area currently does not provide bicycle lanes. Some bicyclists traveling in this area along 2nd Street or 3rd Street have indicated they do not feel comfortable sharing the lanes with vehicular traffic. One alternative to provide bicycle lanes along the east-west segments of Downtown would remove on-street parking on one side of 2nd Street and 3rd Street to provide a 7-foot buffered bike lane. Based on feedback from the City, this option is not feasible due to the value of on-street parking for local businesses.

A second option would use a parallel route on E 1st Street to provide a two-way bicycle boulevard. As shown in Exhibit 5-11, E 1st Street currently is a one-way street with a wide lane and on-street parking. The existing cross-section and one option to be considered are shown in Exhibits 5-12 and 5-13. Given the current use of E 1st Street for industrial purposes, a 14-foot minimum lane width is assumed.

Exhibit 5-11: Looking West on E 1st Street at Court Street (Source: Google Streetview)

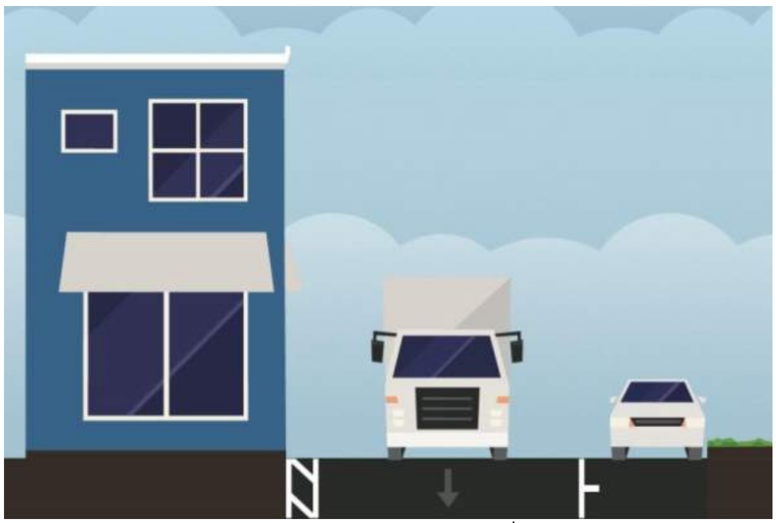


Exhibit 5-12: Existing Cross-section Looking West on E 1st Street (Source: www.streetmix.net)

Exhibit 5-13: Alternative #1: Protected Bike Lane on E 1st Street (Source: www.streetmix.net)

Transit

MCCOG's Link service provides dial-a-ride service (door-to-door, on request). To enhance transit service within The Dalles, the City should evaluate the feasibility of implementing a fixed-route service. The service should prioritize routes between residential areas and key destinations (e.g., MCMC, Columbia Gorge Community College, downtown, Aquatic Center, etc.). A fixed route system could help reduce single-occupant motor vehicle trips and provide accessibility and connectivity, consistent with TSP Goal #2C.

Additional evaluation of fixed-route services will be conducted in summer 2016 and specific recommendations will be included in the final TSP.

COLUMBIA REGIONAL AIRPORT

The Columbia Gorge Regional Airport – Airport Master Plan, completed in August 2010, includes plans to construct new hangars, replace the existing terminal building, expand the runway ramps, install a new fuel farm, and utilize excess airport property for revenue generation. A plan to generate revue includes a planned business park area located in the southwest corner of the airport property. The Master Plan also identified a unique opportunity to utilize the excess airport property for a golf course and resort.

The business park is currently in a phase of development including the completion of 35 acres and 17 lots. The lots are shovel-ready for construction with the completed roadway infrastructure and utilities (water, sewer, electricity, cable, and high speed internet. *Appendix F* includes an exhibit of the recommended Master Plan Concept from the Airport Master Plan.

FUNDING PROGRAMS

Funding for the implementation of the projects identified in the Transportation System Plan will be shared between the City of The Dalles, ODOT, and private development. The proportional contributions are to be determined at the time that development occurs or some land use change triggers the need for implementation. Contributions of each agency, if any, should reflect facility usage by local, regional, or statewide trips.

To assist with the future implementation efforts, this section of the TSP outlines the existing revenue stream for transportation funding in the City of The Dalles, summarizes project costs by type for the recommended projects, and potential funding sources.

For the City of The Dalles, there are two strategic considerations related to transportation funding:

- The City's existing transportation System Development Charge (SDC) program should be updated following adoption of the TSP. The City Council needs to carefully consider the implications on the future rate assessed on both economic development potential and the percentage of future transportation revenue needs that can be reasonably relied upon for funding by SDC.

- Due to declining revenue, both traditional and non-traditional partnerships and funding sources should actively be pursued by the City of The Dalles. This can include volunteer efforts to initiate trail construction, staff pursuit of grants, public/private partnerships, and coordination with State and County interests to help fund transportation projects.

Estimated Revenue

The City of The Dalles has three primary sources for funding transportation projects: a three-cent fuel tax, the State Motor Vehicle Fund, and the FAU Exchange Funds. The Transportation SDC Fund accounts for the receipt and expenditures of revenues to construct collector and arterial street improvements and is funded by SDC fees assessed on new development.

The primary sources of revenue for the Transportation Fund have been the State of Oregon gas tax and, to a lesser extent, state revenue sharing and the FAU fund exchange program. Recognizing the impact that the installation of public utilities have on the need for street repairs, the City of The Dalles recently established two new revenue sources for the Transportation Fund: franchise fees from the City's water and wastewater funds. The Transportation Fund covers the City's street, bike lane, right-of-way, and storm water maintenance. Table 5-21 summarizes transportation-related funding for the past five fiscal years (FY) as well as projections for the most recent fiscal year, which ends June 2016.

Table 5-21. Transportation Revenue

	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16
State Motor Vehicle Fund	$658,647	$783,286	$789,715	$825,100	$835,291	$832,610
FAU Exchange Funds	$303,202		$304,776		$566,438	$303,202
Local Fuel Tax	$396,102	$434,026	$442,468	$449,660	$476,806	$498,814
System Development Charges	$39,010	$168,629	$276,341	$95,479	$35,334	$100,000
Other Local Revenue Sources	$286,779	$290,878	$284,792	$296,364	$409,895	$581,231
Total	$ 1,683,740	$ 1,676,819	$ 2,098,092	$ 1,666,603	$ 2,242,777	$ 1,781,253

Based on the information provided in Table 5-21, the city has an average of $1.87 million per year in transportation revenues. The City's FY 15-16 budget for Street Fund Revenues is $2.27 million.

Records provided by the City indicate revenues have exceeded expenditures in FY 12-13 and FY 13-14 (FY 14-15 was not complete at the time of review). Budgeted Expenditures for FY 15-16 are summarized in Table 5-22.

Table 5-22. Fiscal Year 2015-2016 Budgeted Transportation Expenditures

	FY 12-13	FY 13-14	FY 14-15	FY 15-16
Personnel	$646,000	$600,000	$718,700	$759,700
Materials and Services	$442,000	$384,500	$605,300	$626,000
Capital Outlay	$121,900	$284,000	$249,200	$299,200
Other	$302,600	$538,300	$438,200	$585,600
Total	$1,512,500	$1,806,800	$2,011,400	$2,270,500

Based on records of expenditures in the current budget, the City anticipates spending 13 percent of the annual Street Fund budget on capital projects. If this level of funding is maintained for capital projects over the 20-year planning horizon, the City could fund approximately $6 million in capital projects.

Local Funding Mechanisms

At the local level, the City can draw on a number of potential funding mechanisms to increase funding for the TSP improvements.

Typically, as properties with road frontage develop, developers are required to build the road frontage along their property, consistent with City standards. This allows the transportation system to be developed incrementally at the same time as land develops. Property owners are only required to pay for improvements in proportion to the development's impact on the transportation system.

Table 5-23 outlines other potential funding sources at the local level that could be implemented in the future in the City of The Dalles. In general, local funding sources are more flexible than funding obtained from state or federal grant sources.

Table 5-23. Potential Local Funding Mechanisms

Funding Source	Description	Potential Application in Prineville
User Fee	Fees tacked on to a monthly utility bill or tied to the annual registration of a vehicle to pay for improvements, expansion, and maintenance on the street system.	Preliminary street improvements
Street Utility Fees/Road Maintenance Fee	The fee is based on the number of trips a particular land use generates and is usually collected through a regular utility bill.	System-wide transportation facilities including streets, sidewalks, bike lanes, and trails
Stormwater SDCs, Grants, and Loans	Systems Development Charges, Grants, and Loans obtained for the purposes of making improvements to stormwater management facilities.	Primarily street improvements
Optional Tax	A tax that can be used to fund improvements, and gives the taxpayer the option to pay. Generally paid at the same time other taxes are collected, optional taxes are usually less controversial and easily collected since they give the taxpayer a choice whether or not to pay the additional tax.	System-wide transportation facilities including streets, sidewalks, bike lanes, trails, and transit
Public/Private Partnerships	Public/private partnerships have been used in several places around the country to provide public transportation amenities within the public right-of-way in exchange for operational revenue from the facilities. These partnerships could be used to provide services such as charging stations, public parking lots, bicycle lockers, or carshare facilities.	System-wide transportation facilities including streets, sidewalks, bike lanes, trails, and transit
Tax Increment Financing (TIF)	A tool cities use to create special districts (tax increment areas) where public improvements are made in order to generate private-sector development. During a defined period, the tax base is frozen at the pre-development level. Property taxes for that period can be waived or paid, but taxes derived from increases in assessed values (the tax increment) resulting from new development can go into a special fund created to retire bonds issued to originate the development or leverage future improvements. A number of small-to-medium sized communities in Oregon have implemented, or are considering implementing, urban renewal districts that will result in a TIF revenue stream.	System-wide transportation facilities including streets, sidewalks, bike lanes, trails, and transit
Local Improvement Districts (LID)	A local improvement district is a geographic area where local property owners are assessed a fee to cover the cost of a public improvement in that area.	Improvements to the transportation system in a local area where local property owners will benefit from the improvement.

State and Federal Grants

In addition to local funding sources, the City of The Dalles can seek to leverage opportunities for funding from grants at the State and Federal levels for specific projects. The current Federal transportation bill, Fixing America's Surface Transportation (FAST) Act, was signed into law on December 4, 2015 providing long-term funding certainty for surface transportation.

In Oregon, most federal monies are administered through ODOT and regional planning agencies. Most, but not all, of these programs are oriented toward transportation versus recreation, with an emphasis on reducing auto trips and providing inter-modal connections. Federal funding is intended for capital improvements and safety and education programs, and projects must relate to the surface transportation system.

Table 5-24 outlines those sources and their potential applications.

Table 5-24. Potential State and Federal Grants

Source ID	Source Title	Award Cycle	Intended Use	Applicable Project Types	Administration Agency	Deadline	Local Match	Website
1	STIP - Enhance	Biennial	Activities that enhance, expand, or improve the transportation system. Projects that improve or enhance the state's multimodal transportation system.	All	ODOT	August	10%	http://www.oregon.gov/ODOT/TD/STIP/Pages/WhatsChanged.aspx
2	*Connect*Oregon	Biennial	Non-highway transportation projects that promote economic development in Oregon.	Non-highway modes	ODOT	November	20%	http://www.oregon.gov/ODOT/TD/TP/pages/connector.aspx
3	Immediate Opportunity Funds	Biennial	Support primary economic development through the construction and improvement of street and roads.	All	ODOT	On-going	50%	http://www.oregon.gov/ODOT/TD/EA/reports/IOF_PolicyGuidelines2015%20doc.pdf
4	All Roads Transportation Safety (ARTS)	Biennial	Address safety needs on all public roads in Oregon; reduce fatal and serious injury crashes.	All hot spot and systemic safety projects	ODOT	Varies	8%	http://www.oregon.gov/ODOT/HWY/TRAFFIC-ROADWAY/Pages/ARTS.aspx
5	Federal Transit Administration Discretionary Grant Programs	Varies	Fund design, construction, and maintenance of pedestrian and/or bicycle projects that enhance or are related to public transportation facilities.	Pedestrian projects within one-half mile and bicycle projects within three miles of a public transit stop	FTA	Varies	Varies	http://www.fta.dot.gov/grants/FAST.html
6	Rivers, Trails, and Conservation Assistance Program	Annual	Technical assistance for recreation and conservation projects.	Shared-use paths	National Park Service	August	None	http://www.nps.gov/ncrc/programs/rtca/contactus/cu_apply.html
7	Oregon Parks and Recreation Local Government Grants	Annual	Primary use is recreation; transportation allowed. Construction limited to outside road right-of-way, only in public parks or designated recreation areas	Shared-use paths	OPRD	Varies	20%	http://www.oregon.gov/oprd/grants/pages/local.aspx
8	Recreational Trails Program	Annual	Recreational trail-related projects, such as hiking, running, bicycling, off-road motorcycling, and all-terrain vehicle riding.	Shared-use paths	OPRD	Varies	20%	http://www.oregon.gov/oprd/grants/pages/trails.aspx
9	Land and Water Conservation Fund	Annual	Acquire land for public outdoor recreation or develop basic outdoor recreation facilities	Shared-use paths, bikeways, sidewalks	OPRD	Varies	50%	http://www.oregon.gov/oprd/grants/pages/lwcf.aspx

Many funding opportunities target specific project types, including bicycle and pedestrian projects. In order to utilize City and State funding as efficiently as possible, these alternative funding opportunities should be considered for specific projects, as applicable.

The following sections provide more detail on some of the identified funding sources.

1) Statewide Transportation Improvement Program - Enhance

The Statewide Transportation Improvement Program (STIP) is ODOT's short-term capital improvement program, providing project funding and scheduling information for the department and Oregon's metropolitan planning organizations. STIP project lists are updated every two years, with four-year project lists. Project lists are developed through the coordinated efforts of ODOT, federal and local governments, Area Commissions on Transportation, tribal governments, and the public.

In developing this program, ODOT must verify that the identified projects comply with the Oregon Transportation Plan, ODOT Modal Plans, Corridor Plans, local comprehensive plans, and FAST Act planning requirements. The STIP must fulfill federal planning requirements for a staged, multi-year, statewide, intermodal program of transportation projects. Specific transportation projects are prioritized based on federal planning requirements and the different state plans. ODOT consults with local jurisdictions before highway-related projects are added to the STIP. Stand-alone bicycle/pedestrian projects are an eligible funding category, and multi-modal roadway projects that contain a planned pedestrian or bicycle improvement can also be funded through this mechanism.

In 2012, the Oregon Transportation Commission (OTC) and ODOT changed how the State Transportation Improvement Program (STIP) is developed. The STIP is no longer developed as a collection of projects for specific pools of funding dedicated to specific transportation modes or specialty programs. The STIP primarily divided into two broad categories: Fix-It and Enhance. Enhance activities expand or improve the transportation system and Fix-It activities preserve the transportation system.

The Fix-It project selection process is similar to prior STIPs, as these projects are developed mainly from ODOT management systems that help identify needs based on technical information for things like pavement and bridges.

The Enhance process was a significant change and reflects ODOT's goal to become a more multimodal agency and make investment decisions based on the system as a whole, not for each mode or project type separately. The agency has requested assistance from our local partners in developing the STIP and identifying those projects that assist in moving people and goods through the transportation system.

More information: http://www.oregon.gov/ODOT/TD/STIP/Pages/WhatsChanged.aspx

Surface Transportation Program

The Surface Transportation Program (STP) provides states with flexible funds that may be used for a variety of projects on any Federal-Aid Highway including the National Highway System, bridges on any public road, and transit facilities. Bicycle and pedestrian improvements are eligible activities under the STP.

The STIP-Enhance statewide multi-modal selection process awards STP funds in conjunction with TAP and other funds.

Transportation Alternative Program

The Transportation Alternative Program (TAP) is intended to promote projects that improve all modes of transportation. A federal program administered by ODOT, the TE program is funded by a set-aside of Surface Transportation Program (STP) monies. Ten percent of STP funds are designated for Transportation Enhancement (TE) activities, which include the "provision of facilities for pedestrians and bicycles, provision of safety and educational activities for pedestrians and bicyclists," and the "preservation of abandoned railway corridors (including the conversion and use thereof for pedestrian and bicycle trails).

The STIP-Enhance statewide multi-modal selection process awards TAP funds in conjunction with STP and other funds.

2) ConnectOregon

*Connect*Oregon is a lottery-backed bond initiative to invest in air, rail, marine, transit, and bicycle/pedestrian infrastructure to ensure Oregon's transportation system is strong, diverse, and efficient.

*Connect*Oregon projects are eligible for up to 70% of project costs for grants. A minimum 30% cash match is required from the recipient for all grant funded projects. Projects eligible for funding from state fuel tax revenues (section 3a, Article IX of the Oregon Constitution, the Highway Trust Fund), are not eligible for *Connect*Oregon funding. If a highway or public road element is essential to the complete functioning of the proposed project, applicants are encouraged to work with their ODOT region, city, or county to identify the necessary funding sources.

All Oregonians will reap the benefits from enhancing Oregon's transportation infrastructure. People and businesses, as well as the environment, will benefit by having a more efficient, productive transportation system that improves Oregon's business environment, ultimately leading to more jobs and a more sound economy.

3) Immediate Opportunity Funds

The purpose of the "Immediate Opportunity Fund" (IOF) is to support primary economic development in Oregon through the construction and improvement of streets and roads. The 1987 Oregon

Legislature created state funding for immediate economic opportunities with certain motor vehicle gas-tax increases. Access to this fund is discretionary and the fund may only be used when other sources of financial support are unavailable or insufficient. The IOF is not a replacement or substitute for other funding sources. The IOF is designed to meet the following objectives:

A. Provide needed street or road improvements to influence the location, relocation or retention of a firm in Oregon.
B. Provide procedures and funds for the Oregon Transportation Commission (OTC) to respond quickly to economic development opportunities.
C. Provide criteria and procedures for Business Oregon, other agencies, local governments and the private sector to work with the Oregon Department of Transportation (ODOT) in providing road improvements needed to ensure specific job development opportunities for Oregon or to revitalize business or industrial centers.

4) ODOT All Roads Transportation Safety (ARTS) program

In late 2012 ODOT reached out to the League of Oregon Cities (LOC) and the Association of Oregon Counties (AOC) to mutually agree upon principles for a program that allocates funding for safety improvement projects to all agencies throughout the state. The program applies Federal Highway funding from the Highway Safety Improvement Program (HSIP) to roads managed by Oregon Counties and Cities.

ARTS currently splits funding between hot-spot and systemic safety projects. Hot spot safety projects are individual locations where a unique countermeasure could be applied to reduce the frequency and severity of crashes. Systemic safety projects include multiple locations where many low-cost countermeasures can be applied. Hot spot projects are most-likely to be funded if the project addresses a crash location with a history of fatal or debilitating (Injury A) crashes, consistent with the FAST Act.

ARTS project funding will be allocated through the Statewide Transportation Improvement Program (STIP).

5) Federal Transit Administration Discretionary Grant Programs

The Federal Transit Administration (FTA) views walking and bicycling as modes that complement public transit, as many people either begin or end a trip on public transportation, on foot, or by bicycle. The FTA issued a policy statement that defines a catchment area around transit stops within which bicycle and pedestrian projects are eligible for FTA financial support. All pedestrian projects within one-half mile and bicycle projects within three miles of a public transit stop are considered to have a de facto relationship with public transportation. Projects within this catchment area are thereby eligible for one of the grant programs administered by the FTA to fund the design, construction, and maintenance of pedestrian and/or bicycle projects that enhance or are related to public transportation facilities.

More information: http://www.fta.dot.gov/grants/FAST.html

6) Rivers, Trails, and Conservation Assistance Program

The Rivers, Trails, and Conservation Assistance Program (RTCA) is a National Parks Service (NPS) program providing technical assistance via direct NPS staff involvement to establish and restore greenways, rivers, trails, watersheds and open space. The RTCA program provides only for planning assistance—there are no implementation monies available. Projects are prioritized for assistance based on criteria including conserving significant community resources, fostering cooperation between agencies, serving a large number of users, encouraging public involvement in planning and implementation, and focusing on lasting accomplishments. This program may benefit trail development in The Dalles indirectly through technical assistance, particularly for community organizations, but should not be considered a future capital funding source.

More information: http://www.nps.gov/ncrc/programs/rtca/contactus/cu_apply.html

7) Oregon Parks and Recreation Local Government Grants

The Oregon Parks and Recreation Department (OPRD) administers a Local Government Grants program using Oregon Lottery revenues. The grants may pay for acquisition, development, and major rehabilitation projects for public outdoor park and recreation areas and facilities. The amount of money available for grants varies depending on the approved OPRD budget. Grants are available for three categories of projects: small projects (maximum $50,000 request), large projects (maximum $750,000 request, or $1,000,000 for land acquisition), and small community planning projects (maximum $25,000 request). Several projects identified in this Plan would meet the grant eligibility requirements.

More information: http://www.oregon.gov/OPRD/GRANTS/local.shtml

8) Recreational Trails Program

OPRD administers Recreational Trails Grants for recreational-related projects including trails for hiking, biking, running, all-terrain vehicle riding, etc. The grants are administered by the Oregon Parks and Recreation Department (OPRD) and awarded annually.

More information: **http://www.oregon.gov/OPRD/GRANTS/Pages/trails.aspx**

9) Land and Water Conservation Fund

OPRD administers The Land and Water Conservation Fund grants to state and local governments for developing outdoor recreation areas for public use. These grants require the local governments to match the funding.

More information: http://www.oregon.gov/OPRD/GRANTS/Pages/lwcf.aspx

FINDINGS AND RECOMMENDATIONS

The improvement alternatives presented herein are not intended to be an all-inclusive list, but represent a range of suggestions. Prioritization of these alternatives will be established through evaluation of the goals, policies, and criteria that were previously developed to help guide the development of the City's Transportation System Plan, and input from the Project Management Team, Public Advisory Committee, and Technical Advisory Committee.

APPENDICES

A. The Dalles Network Streets
B. Evaluation Criteria Matrix
C. Future Alternatives Operational Analysis Worksheets, US 197/US 30
D. Future Alternatives Operational Analysis Worksheets, US 197 at I-84 EB Ramps
E. Pedestrian Ramp Accessibility Inventory
F. Columbia Gorge Regional Airport Master Plan

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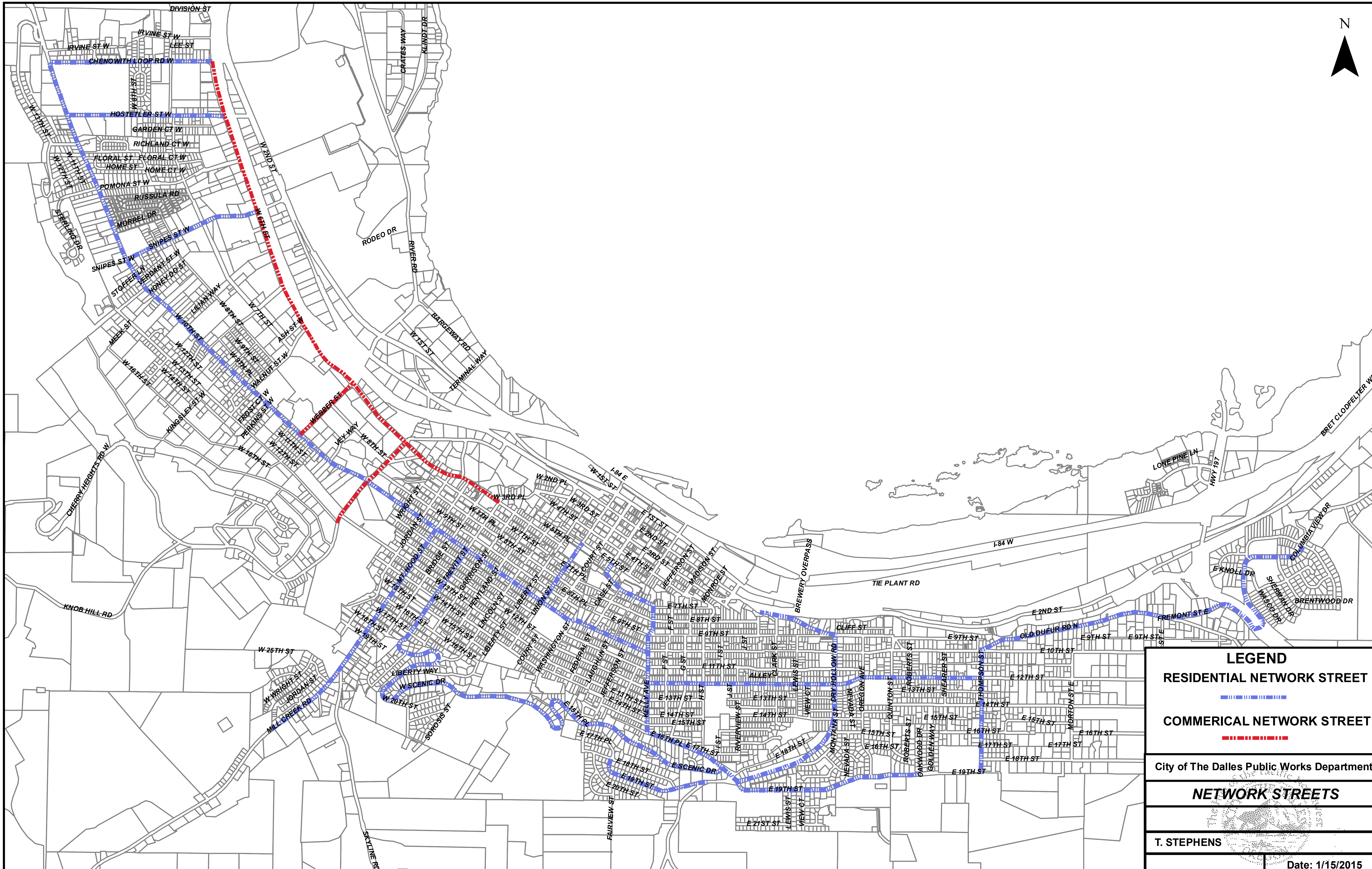
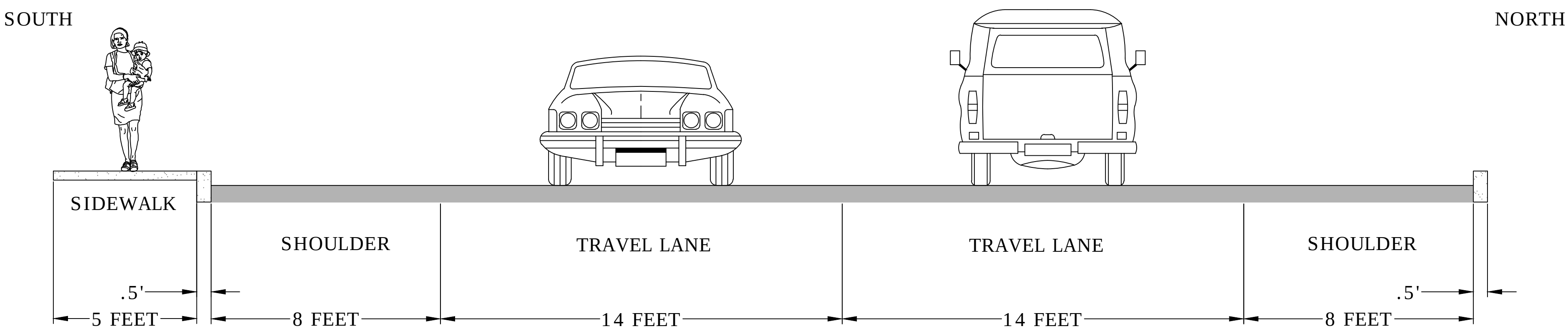
1) *Highway Safety Manual*. AASHTO. Washington, D.C., 2010.
2) Maze, T., J. Hochstein, R. Souleyrette, H. Preston, and R. Storm. *Median Intersection Design for* 34 *Rural High-Speed Divided Highways.* Publication NCHRP Report 650: Project 15-30. National 35 Cooperative Highway Research Program, Transportation Research Board of the National Academies, 36 Washington, D.C., 2010.
3) Inman, V.W., and R. P. Haas. *Field Evaluation of a Restricted Crossing U-turn Intersection*. 38 Publication FHWA-HRT-11-067. FHWA, U.S. Department of Transportation, 2012.
4) Hummer, J. E., R. L. Haley, S. E. Ott, R. S. Foyle, and C. M. Cunningham. *Superstreet Benefits and* 44 *Capacities*, Publication FHWA/NC/2009-06, Project: 2009-06, FHWA, NCDOT, 2010.

Appendix A The Dalles Network Streets


N
LEGEND
RESIDENTIAL NETWORK STREET
COMMERICAL NETWORK STREET
City of The Dalles Public Works Department
NETWORK STREETS
T. STEPHENS
Date: 1/15/2015
DIVISION ST
IRVINE ST W
LEE ST
CHENOWITH LOOP RD W
HOSTETLER ST W
GARDEN CT W
RICHLAND CT W
FLORAL ST
FLORAL CT W
HOME ST
HOME CT W
POMONA ST W
RUSSULA RD
MORREL DR
SNIPES ST W
STERLING DR
STOFFER LN
VERDANT ST W
HONEY DO ST
LILIAN WAY
W 13TH ST
W 12TH ST
W 11TH ST
W 10TH ST
W 8TH ST
W 7TH ST
W 2ND ST
W 6TH ST
ASH ST W
WALNUT ST W
MEEK ST
W 16TH ST
KINGSLEY ST W
FROST CT W
PERKINS ST W
WEBBER ST
VEY WAY
CHERRY HEIGHTS RD W
RODEO DR
RIVER RD
CRATES WAY
KLINDT DR
BARGEWAY RD
W 1ST ST
TERMINAL WAY
W 2ND PL
W 3RD PL
I-84 E
I-84 W
W 3RD ST
W 4TH ST
W 5TH ST
W 7TH PL
W 9TH ST
WRIGHT ST
JORDAN ST
MT HOOD ST
BRIDGE ST
TREVITT ST
GARRISON ST
PENTLAND ST
LINCOLN ST
LIBERTY ST
UNION ST
COURT ST
WASHINGTON ST
FEDERAL ST
LAUGHLIN ST
JEFFERSON ST
CASE ST
KELLY AVE
E 1ST ST
E 2ND ST
E 3RD ST
E 4TH ST
E 5TH ST
E 7TH ST
E 8TH ST
E 9TH ST
E 11TH ST
E 12TH ST
E 13TH ST
E 14TH ST
E 15TH ST
E 16TH PL
E 17TH ST
E 18TH ST
E 19TH ST
E 20TH ST
E 21ST ST
E SCENIC DR
MADISON ST
MONROE ST
BREWERY OVERPASS
TIE PLANT RD
CLIFF ST
ALLEY
CLARK ST
LEWIS ST
VIEW CT
DRY HOLLOW RD
MONTANA ST
NEVADA ST
OREGON AVE
QUINTON ST
ROBERTS ST
OAKWOOD DR
GOLDEN WAY
SHEARER ST
THOMPSON ST
MORTON ST E
RIVERVIEW ST
OLD DUFUR RD N
FREMONT ST E
E 10TH ST
E KNOLL DR
SHERMAN DR
WASCO DR
BRENTWOOD DR
COLUMBIA VIEW DR
BRET CLODFELTER WAY
LONE PINE LN
HWY 197
KNOB HILL RD
W 25TH ST
W WRIGHT ST
JORDAN ST
MILL CREEK RD
LIBERTY WAY
W SCENIC DR
W 20TH ST
SOROSIS ST
SKYLINE RD
FAIRVIEW ST
E 17TH PL
E 15TH PL

BREWERY GRADE CROSS SECTION



CITY OF THE DALLES

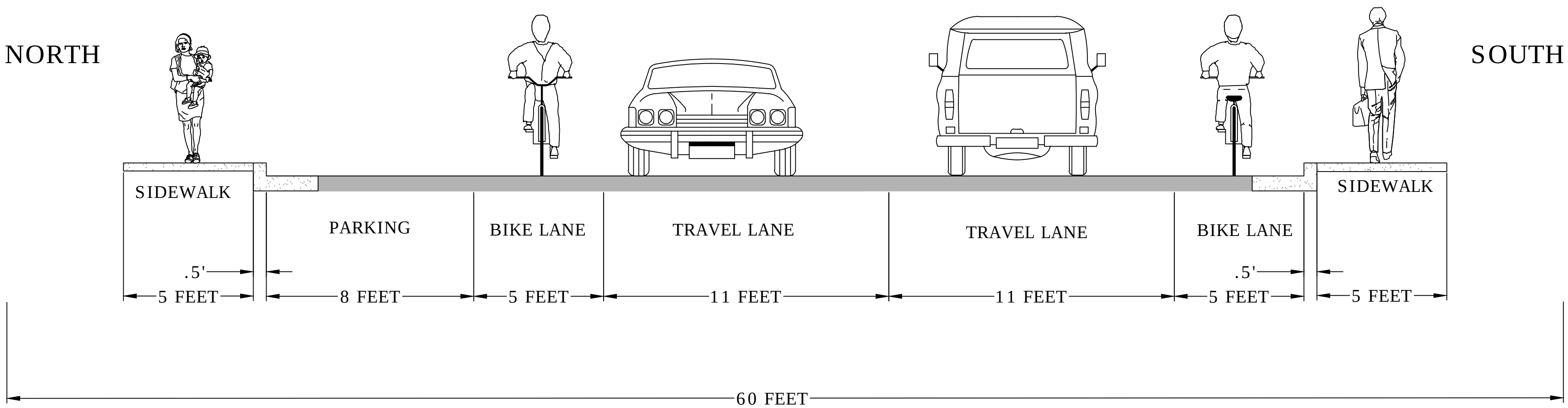
GRID STREET CROSS SECTION

DATE: 10/17/2014

STREET: BREWERY GRADE

CHENOWITH LOOP ROAD CROSS SECTION

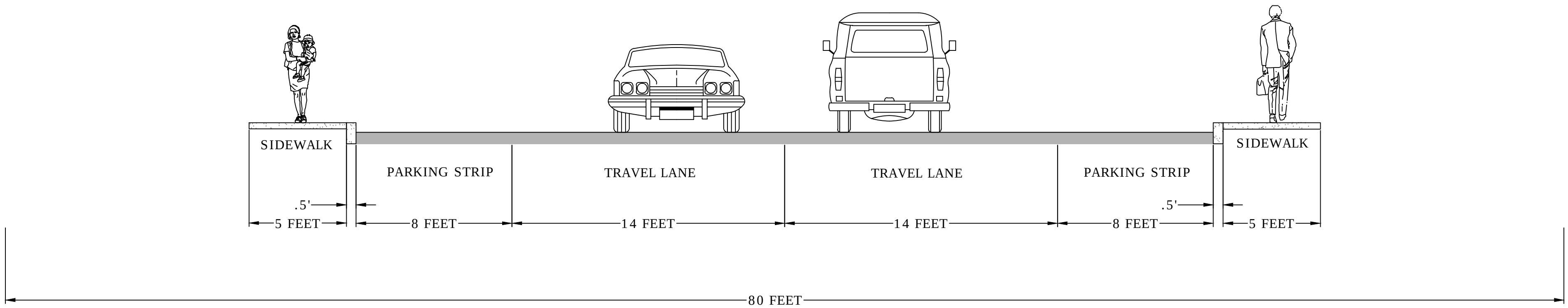
CHENOWITH LOOP ROAD RIGHT-OF-WAY = 60 FEET



CITY OF THE DALLES	
	GRID STREET CROSS SECTION
	DATE: 10/17/2014
STREET: CHENOWITH LOOP ROAD	

COLUMBIA VIEW DRIVE CROSS SECTION

RIGHT-OF-WAY = 80 FEET



CITY OF THE DALLES

GRID STREET CROSS SECTION

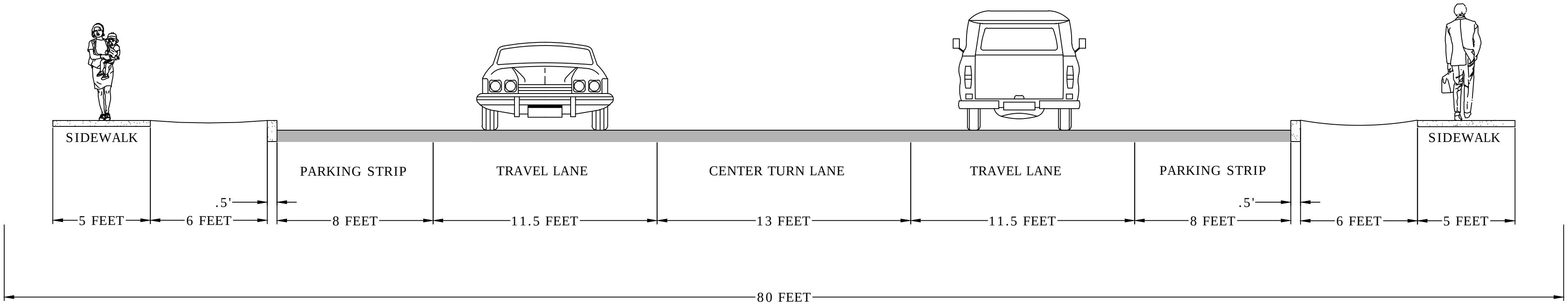
DATE: 10/17/2014

STREET: COLUMBIA VIEW DRIVE

DRY HOLLOW ROAD CROSS SECTION

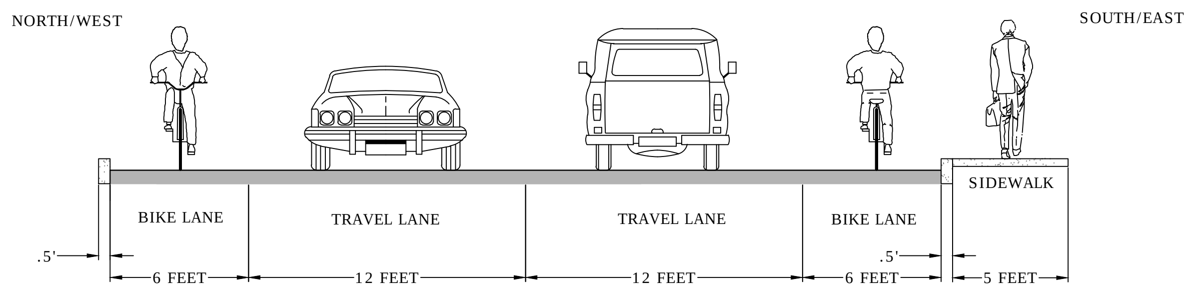
RIGHT-OF-WAY = 80 FEET

14TH TO 9TH STREET



DRY HOLLOW ROAD CROSS SECTION

19TH TO 14TH STREET



CITY OF THE DALLES

The Hub of the Pacific Northwest CITY of THE DALLES OREGON

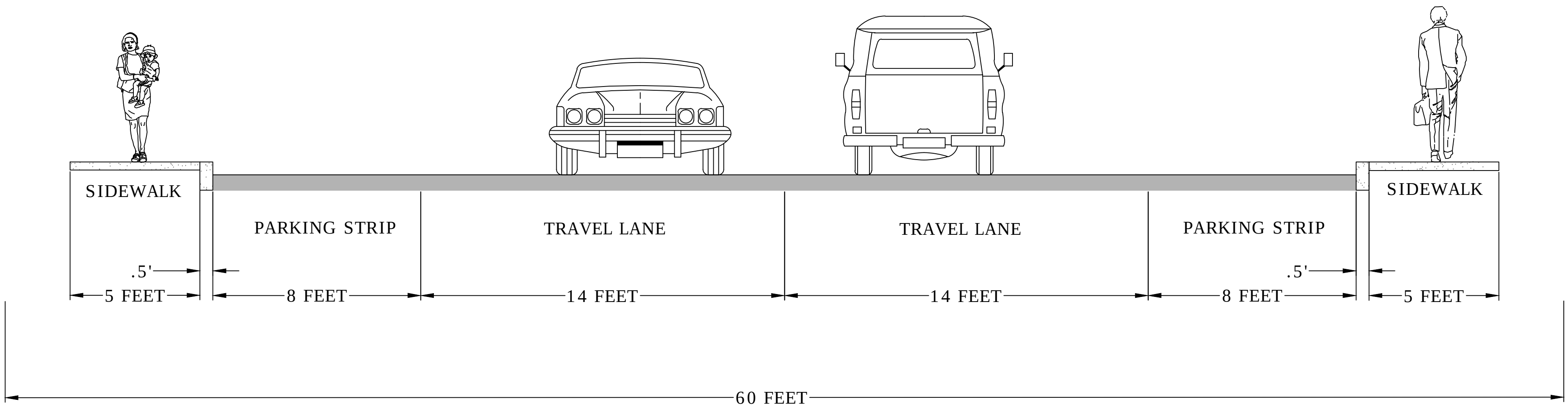
GRID STREET CROSS SECTION

DATE: 10/17/2014

STREET: DRY HOLLOW ROAD

EAST 19TH STREET CROSS SECTION

RIGHT-OF-WAY = 60 FEET
EAST OF DRY HOLLOW ROAD

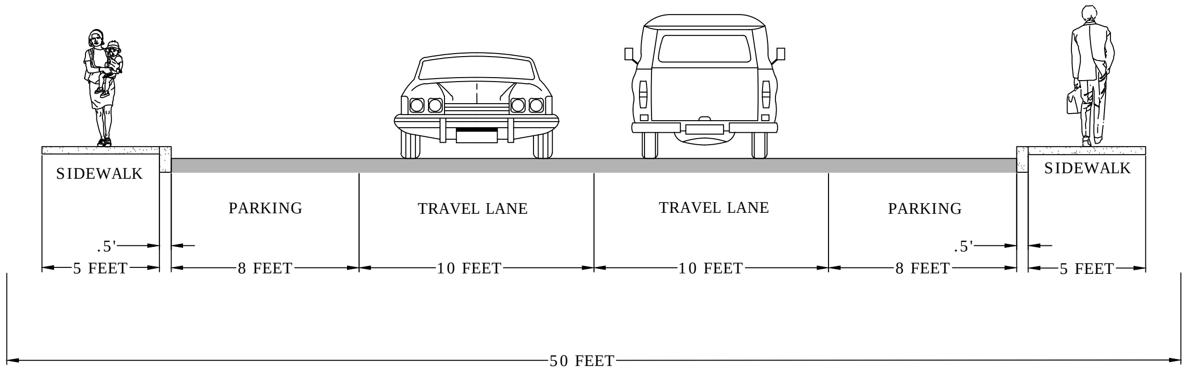


CITY OF THE DALLES	
	GRID STREET CROSS SECTION
	DATE: 10/17/2014
STREET: EAST 19TH STREET - EAST	

EAST 19TH STREET CROSS SECTION

RIGHT-OF-WAY = 50 FEET

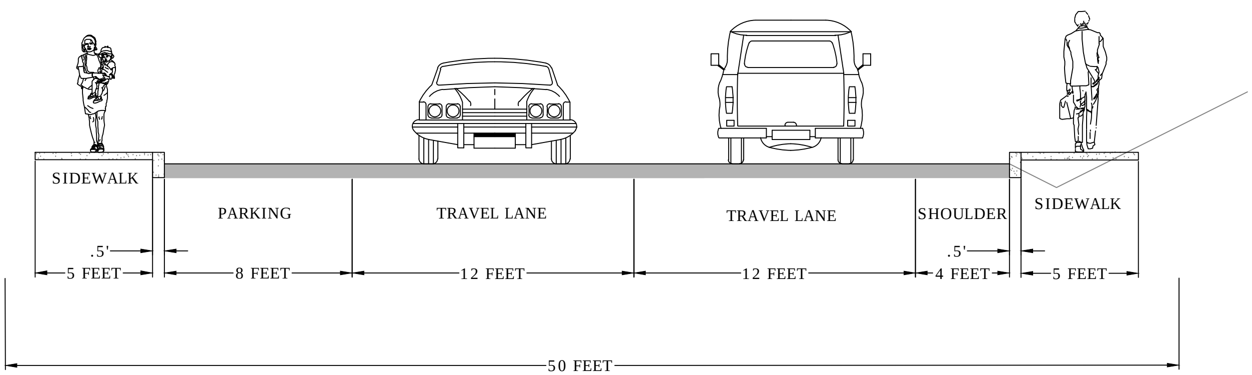
18TH TO 18TH STREET (WEST OF DRY HOLLOW ROAD)



EAST 19TH STREET CROSS SECTION

RIGHT-OF-WAY = 50 FEET

EAST 18TH TO DRY HOLLOW ROAD



CITY OF THE DALLES

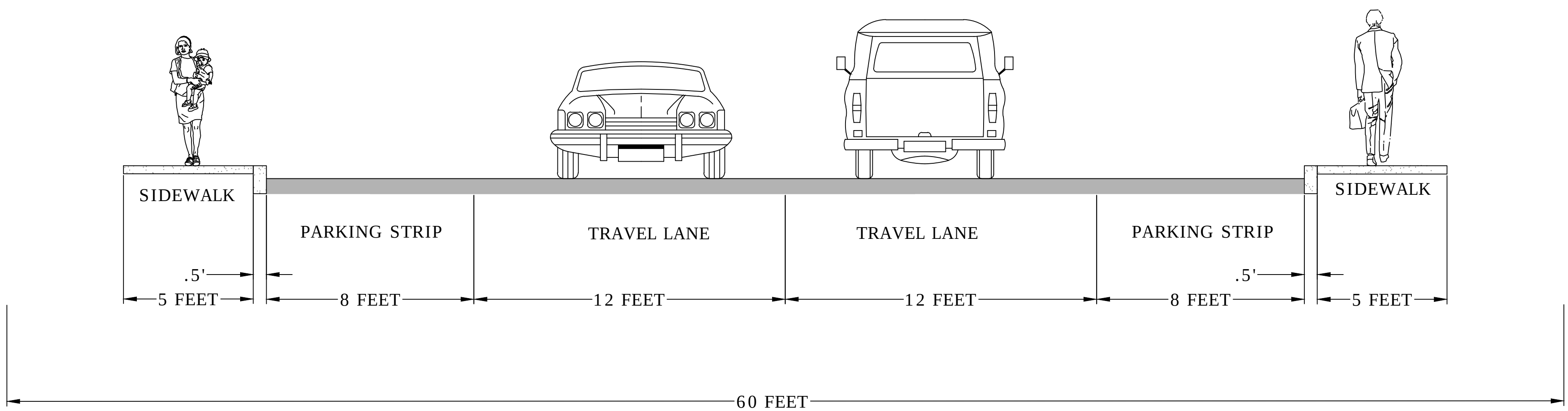
GRID STREET CROSS SECTION

DATE: 10/17/2014

STREET: SNIPES STREET

EAST 7TH PLACE CROSS SECTION

RIGHT-OF-WAY = 60 FEET



CITY OF THE DALLES

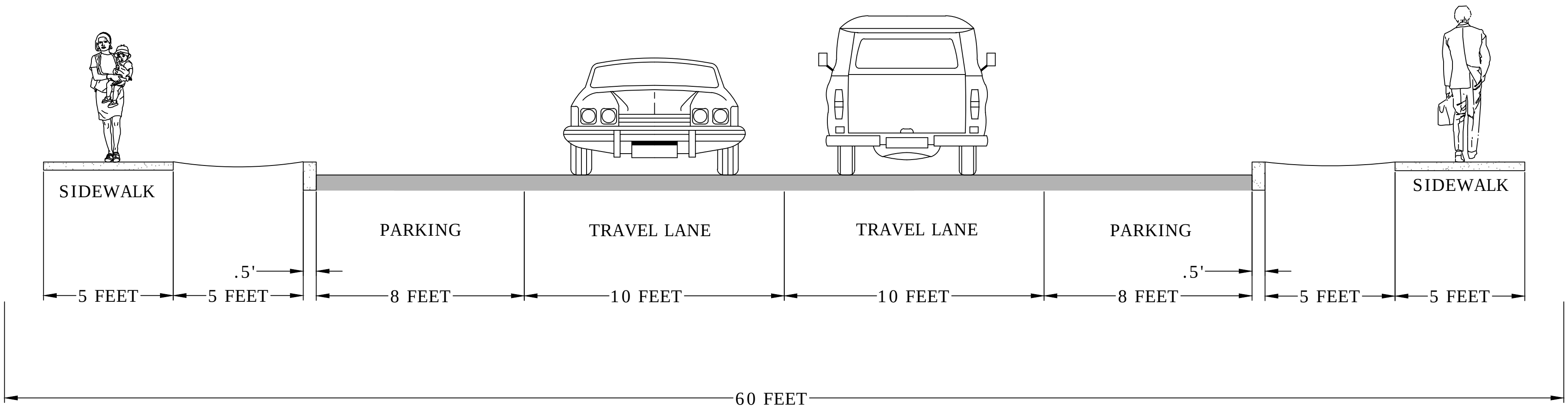
GRID STREET CROSS SECTION

DATE: 10/17/2014

STREET: EAST 7TH PLACE

EAST 12TH STREET CROSS SECTION

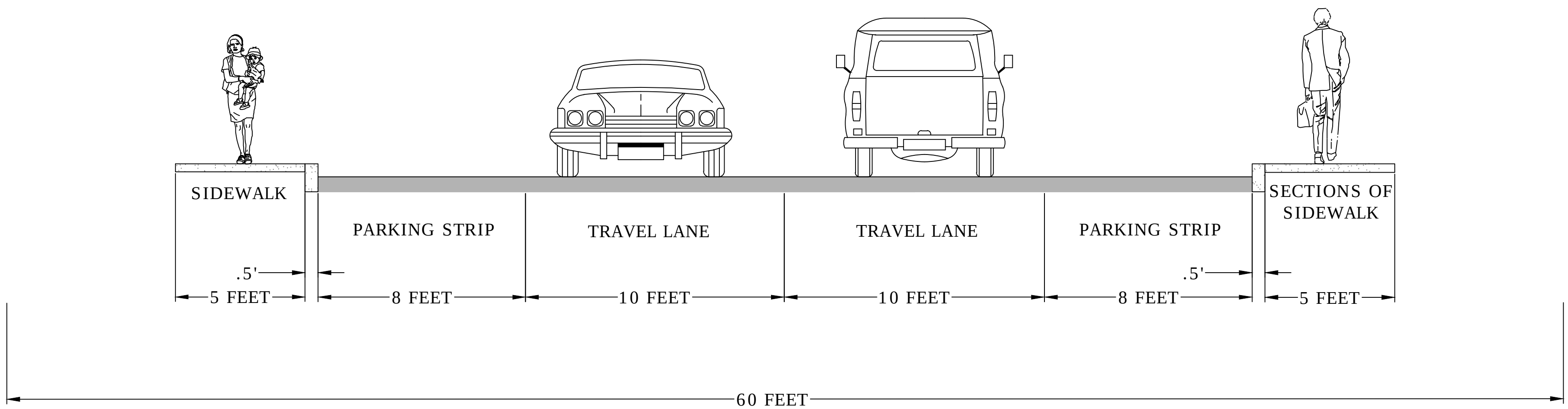
RIGHT-OF-WAY = 60 FEET



CITY OF THE DALLES	
	GRID STREET CROSS SECTION
	DATE: 10/17/2014
STREET: EAST 12TH STREET	

EAST 16TH PLACE CROSS SECTION

RIGHT-OF-WAY = 60 FEET



CITY OF THE DALLES

GRID STREET CROSS SECTION

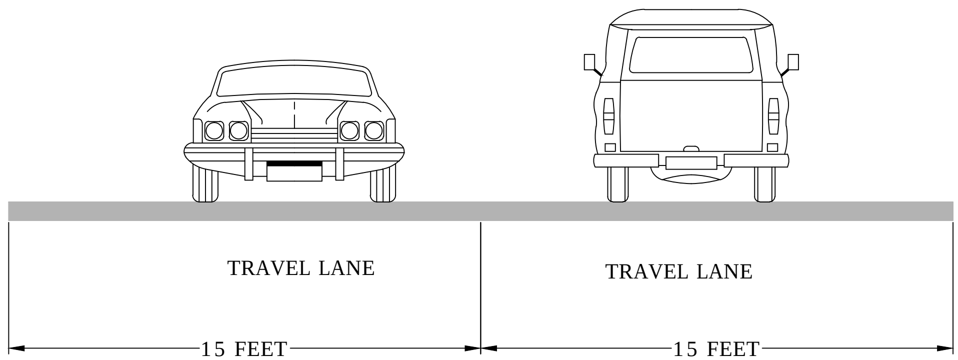
DATE: 10/17/2014

STREET: EAST 16TH PLACE

FREMONT STREET E CROSS SECTION

FREMONT STREET RIGHT-OF-WAY = VARIES

CURRENT CROSS SECTION



CITY OF THE DALLES

GRID STREET CROSS SECTION

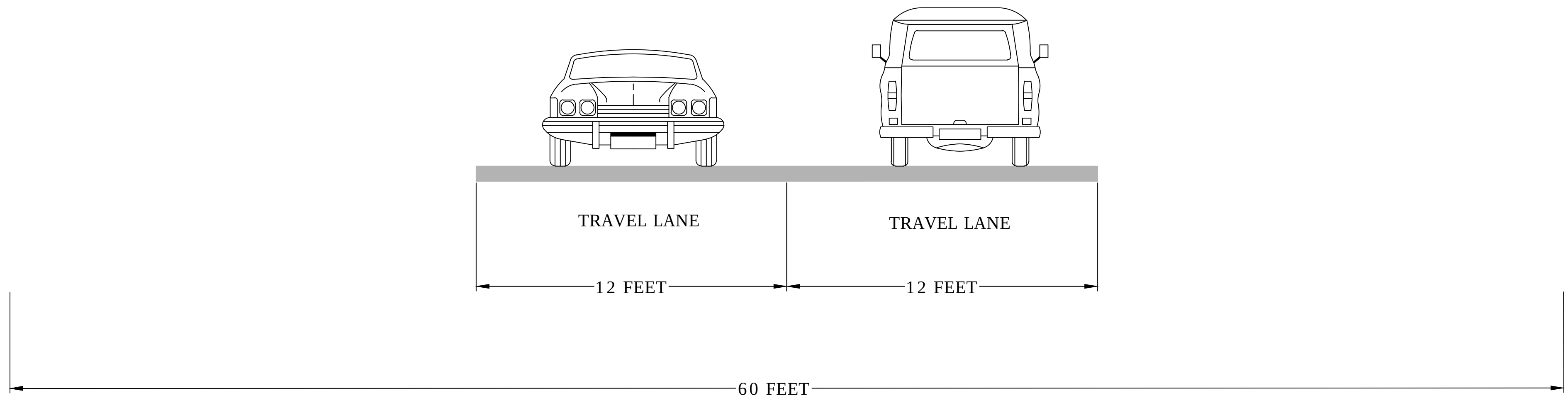
DATE: 10/17/2014

STREET: FREMONT STREET - EAST

FREMONT STREET W CROSS SECTION

FREMONT STREET RIGHT-OF-WAY = 60 FEET

CURRENT CROSS SECTION



CITY OF THE DALLES

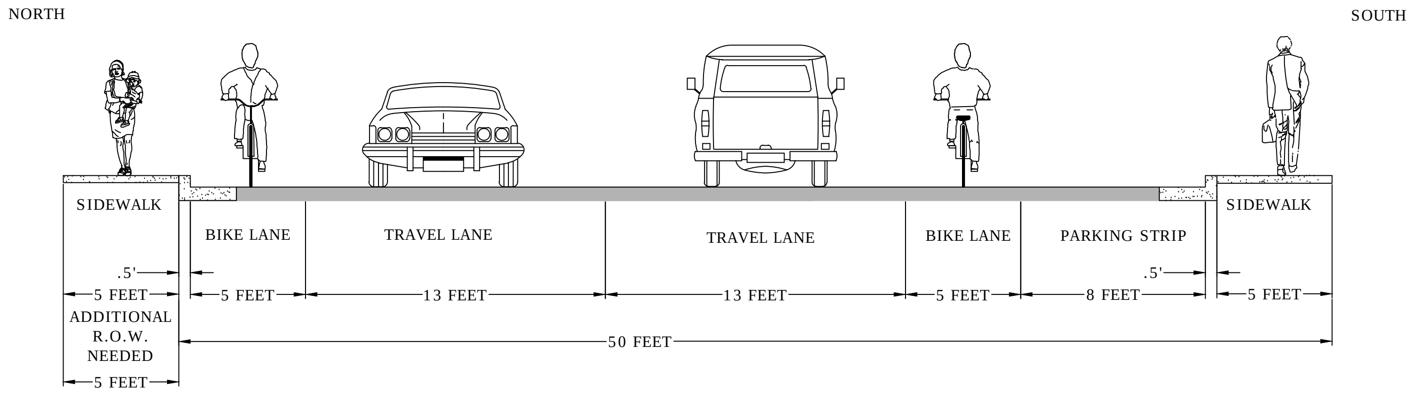
GRID STREET CROSS SECTION

DATE: 10/17/2014

STREET: FREMONT STREET - WEST

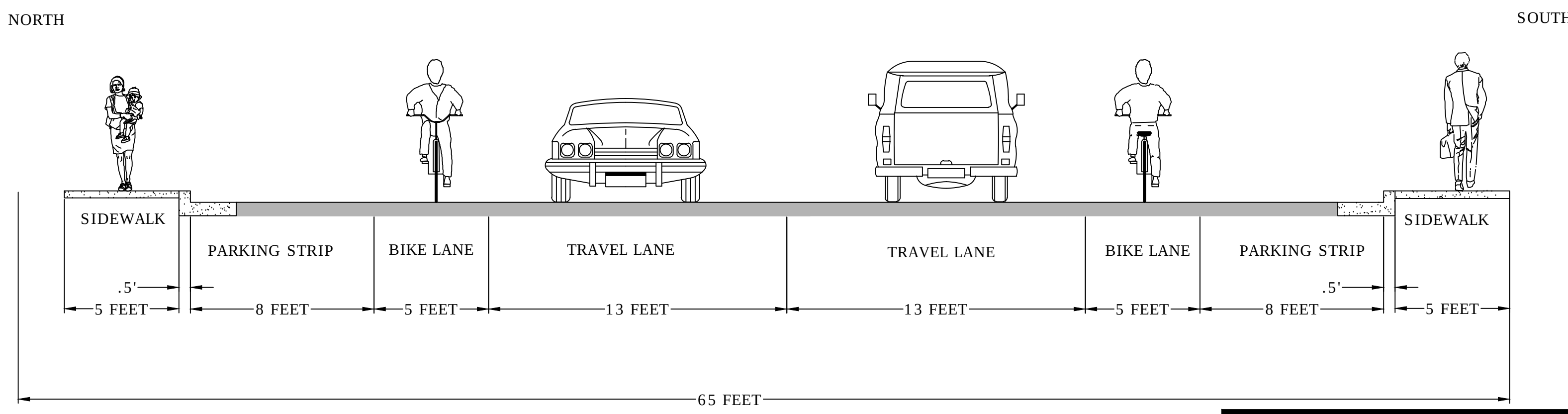
HOSTETLER STREET CROSS SECTION

PROPOSED STREET SECTION WITHIN 50 FT RIGHT OF WAY



HOSTETLER STREET CROSS SECTION

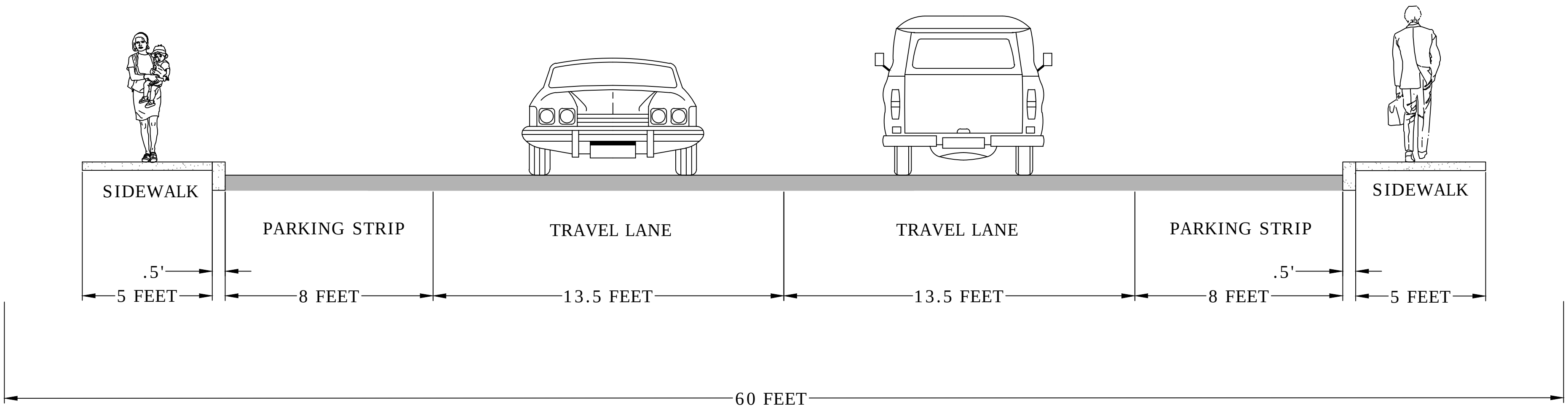
PROPOSED STREET SECTION WITH 65 FT RIGHT OF WAY



CITY OF THE DALLES	
The Hub of the Pacific Northwest CITY of THE DALLES OREGON	GRID STREET CROSS SECTION
	DATE: 10/17/2014
STREET: HOSTETLER STREET	

KELLY AVENUE CROSS SECTION

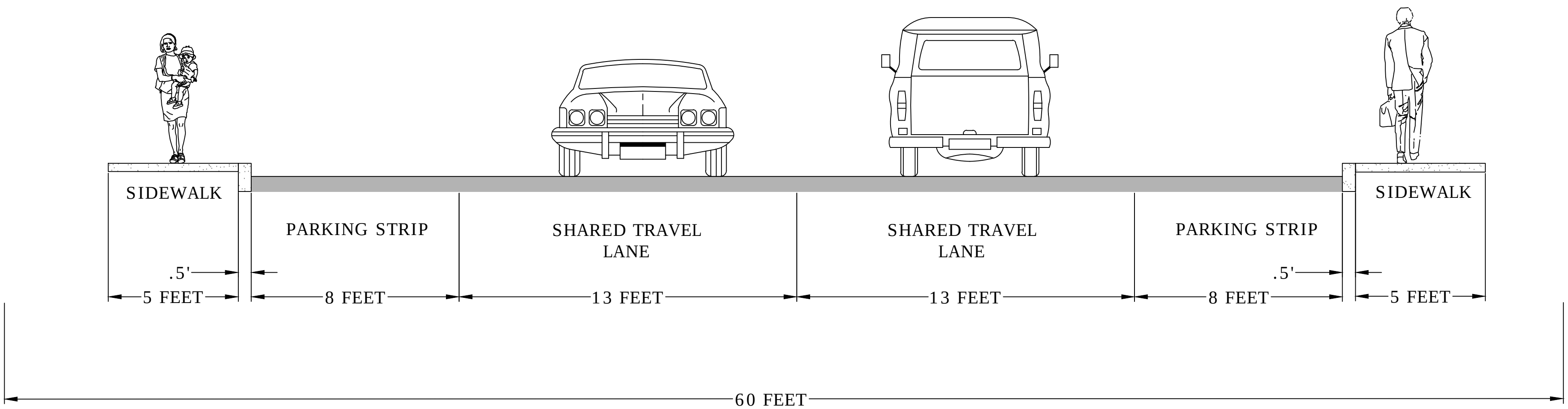
RIGHT-OF-WAY = 60 FEET



CITY OF THE DALLES	
	GRID STREET CROSS SECTION
	DATE: 10/17/2014
STREET: KELLY AVENUE	

MT. HOOD STREET CROSS SECTION

MT HOOD STREET ROAD RIGHT-OF-WAY = 60 FEET



CITY OF THE DALLES

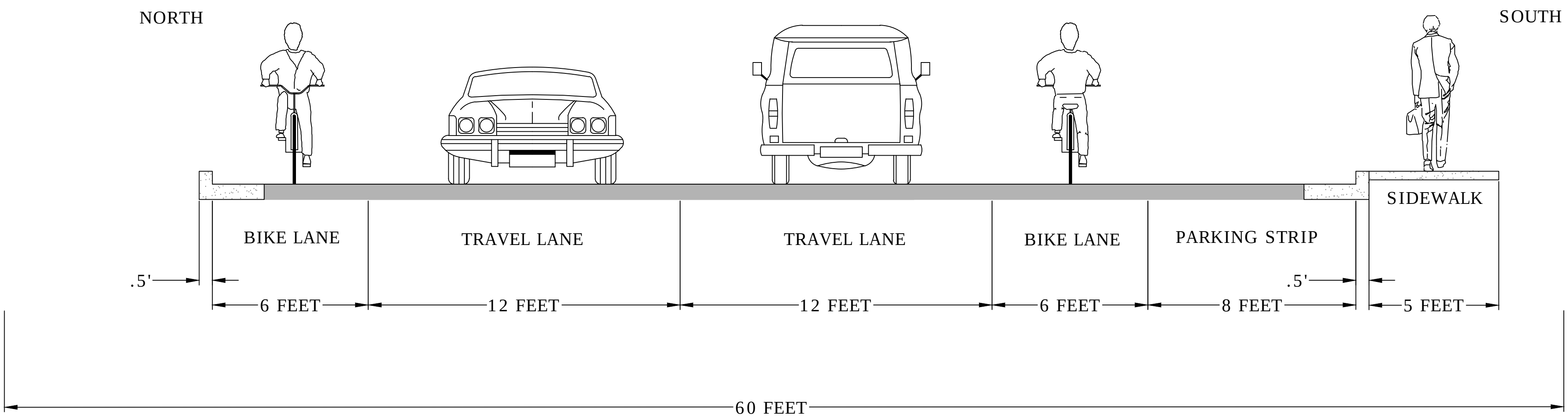
GRID STREET CROSS SECTION

DATE: 10/17/2014

STREET: MT. HOOD STREET

OLD DUFUR ROAD CROSS SECTION

RIGHT-OF-WAY = 60 FEET



CITY OF THE DALLES

GRID STREET CROSS SECTION

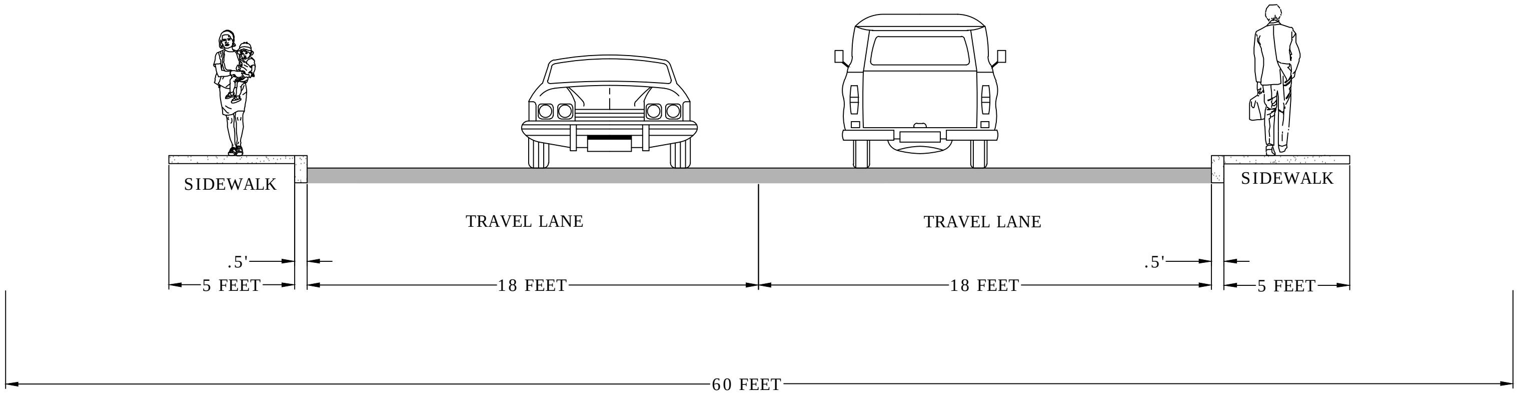
DATE: 10/17/2014

STREET: OLD DUFUR ROAD

SCENIC DRIVE CROSS SECTION

RIGHT-OF-WAY = 60 FEET

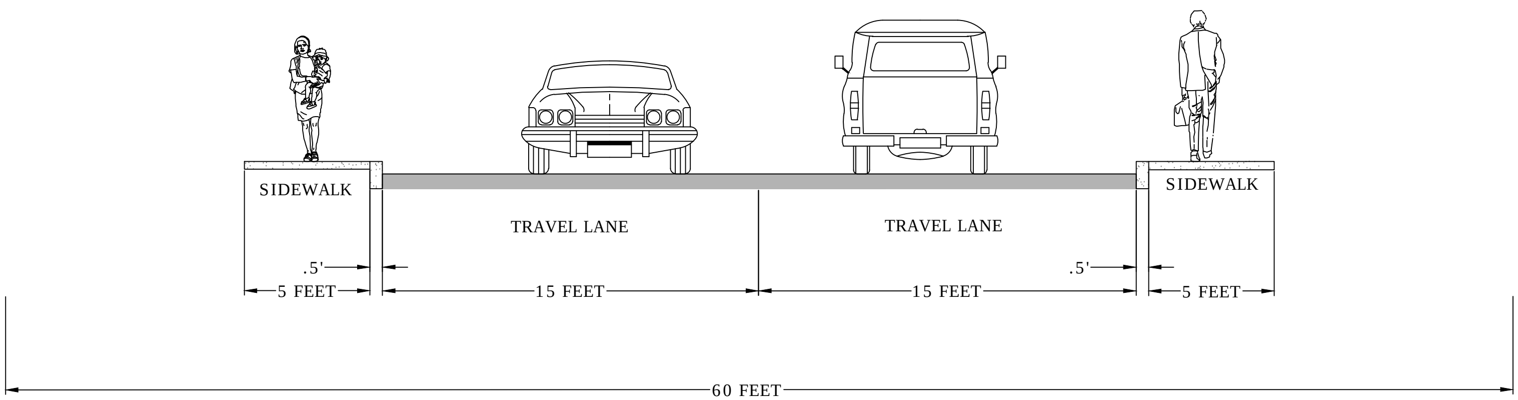
36 FT ROAD SECTION



SCENIC DRIVE CROSS SECTION

SCENIC DRIVE RIGHT-OF-WAY = 60 FEET

30 FT ROAD SECTION



CITY OF THE DALLES

The Hub of the Pacific Northwest CITY of THE DALLES OREGON

GRID STREET CROSS SECTION

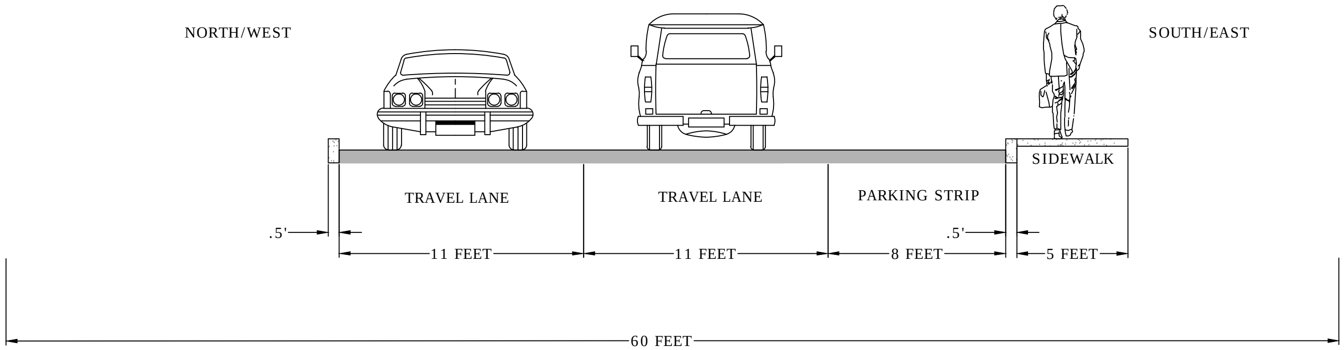
DATE: 10/17/2014

STREET: SCENIC DRIVE

SCENIC DRIVE CROSS SECTION

RIGHT-OF-WAY = 60 FEET

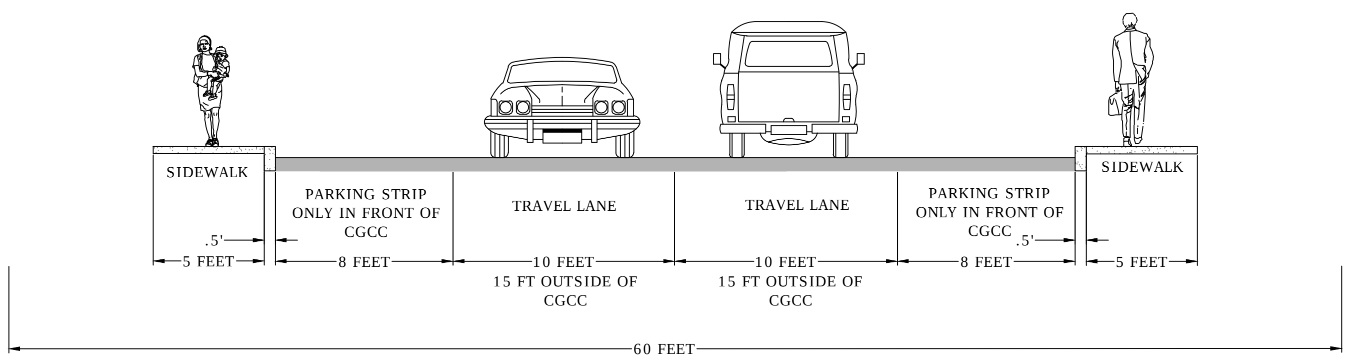
20TH STREET TO VIEW POINT



SCENIC DRIVE CROSS SECTION

RIGHT-OF-WAY = 60 FEET

VIEW POINT TO JEFFERSON STREET



CITY OF THE DALLES

GRID STREET CROSS SECTION

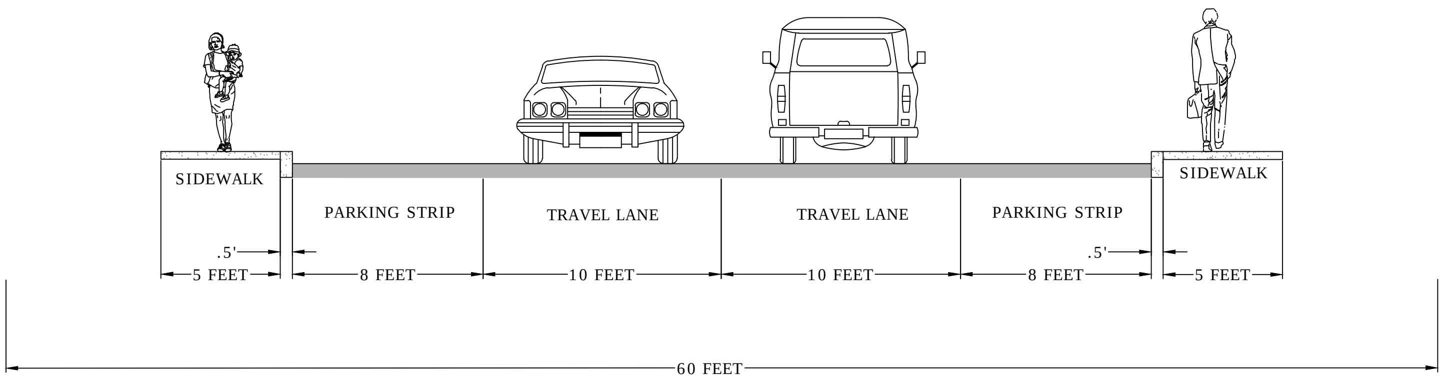
DATE: 10/17/2014

STREET: SCENIC DRIVE - EAST

SCENIC DRIVE CROSS SECTION

RIGHT-OF-WAY = 60 FEET

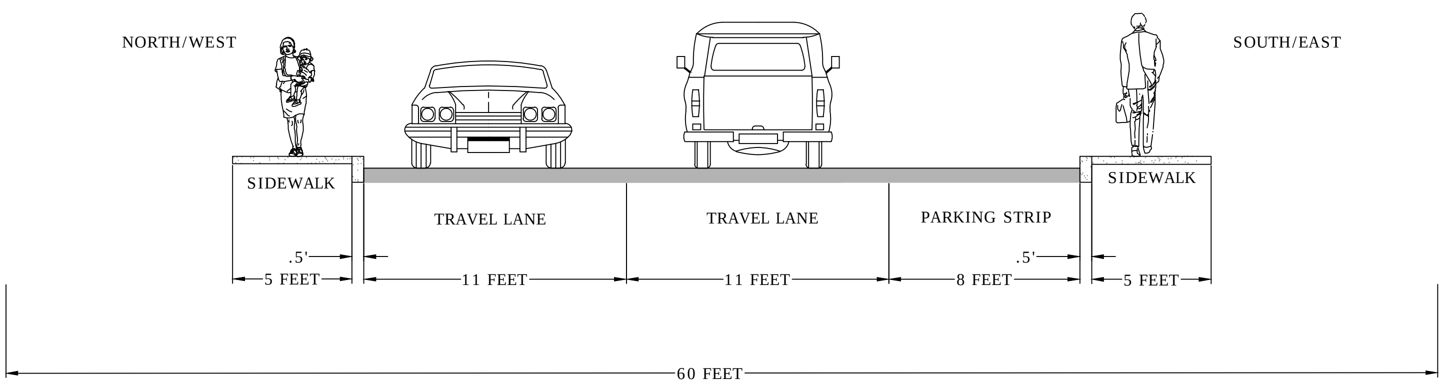
17TH STREET TO LIBERTY WAY



SCENIC DRIVE CROSS SECTION

RIGHT-OF-WAY = 60 FEET

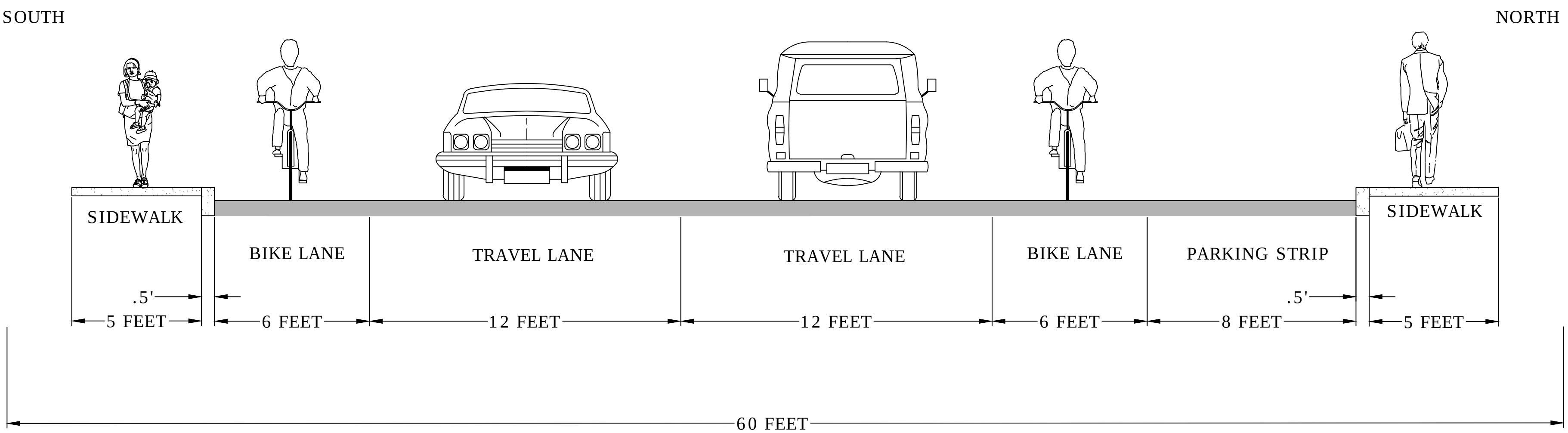
LIBERTY WAY TO 20TH STREET



CITY OF THE DALLES	
	GRID STREET CROSS SECTION
	DATE: 10/17/2014
STREET: SCENIC DRIVE - WEST	

SNIPES STREET CROSS SECTION

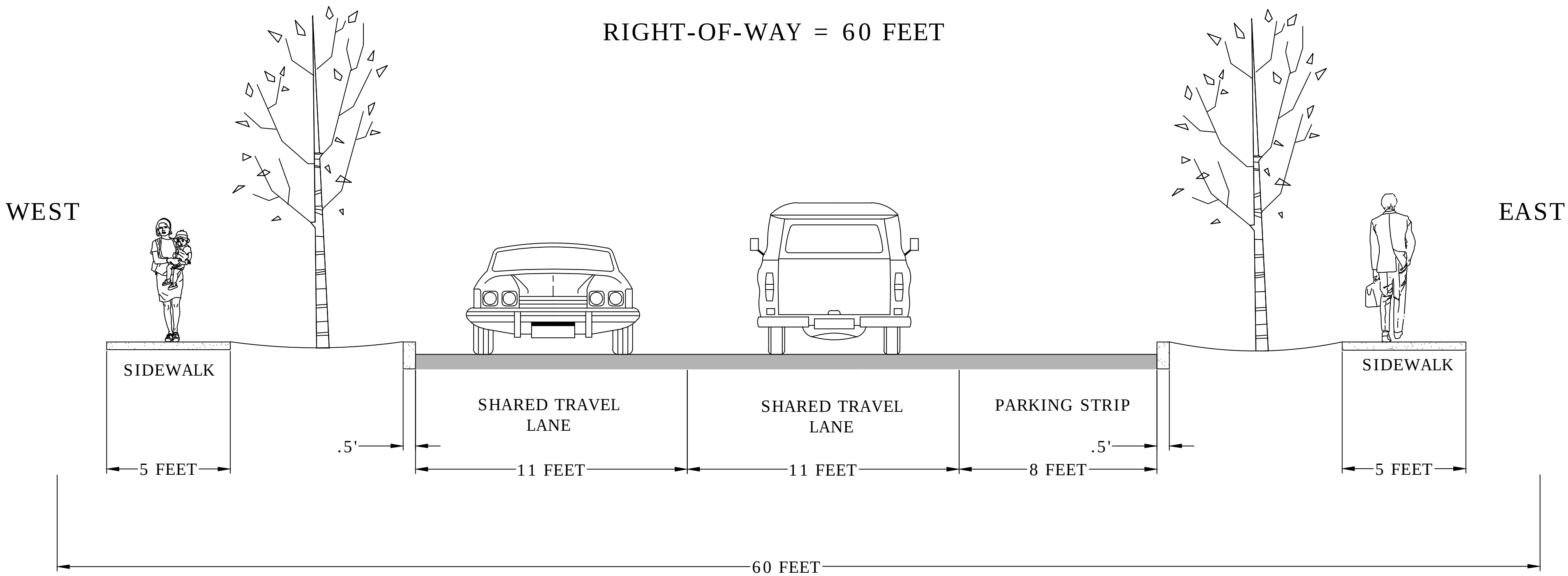
RIGHT-OF-WAY = 60 FEET



CITY OF THE DALLES	
	GRID STREET CROSS SECTION
	DATE: 10/17/2014
STREET: SNIPES STREET	

TREVITT STREET CROSS SECTION

RIGHT-OF-WAY = 60 FEET



CITY OF THE DALLES

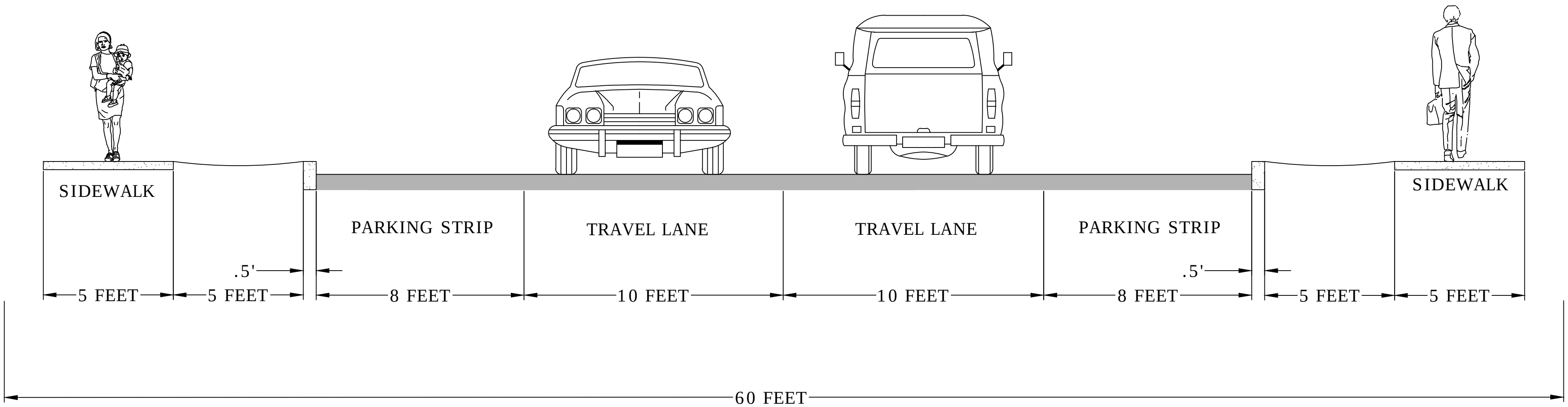
GRID STREET CROSS SECTION

DATE: 10/17/2014

STREET: TREVITT STREET

UNION STREET CROSS SECTION

RIGHT-OF-WAY = 60 FEET



CITY OF THE DALLES

GRID STREET CROSS SECTION

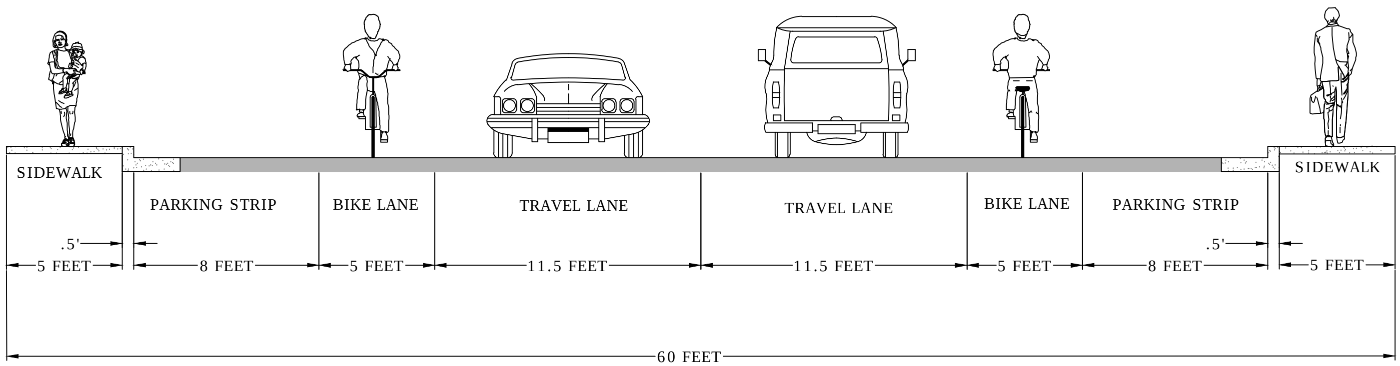
DATE: 10/17/2014

STREET: EAST 7TH PLACE

WEST 10TH STREET CROSS SECTION

WEST 10TH STREET ROAD RIGHT-OF-WAY = 60 FEET

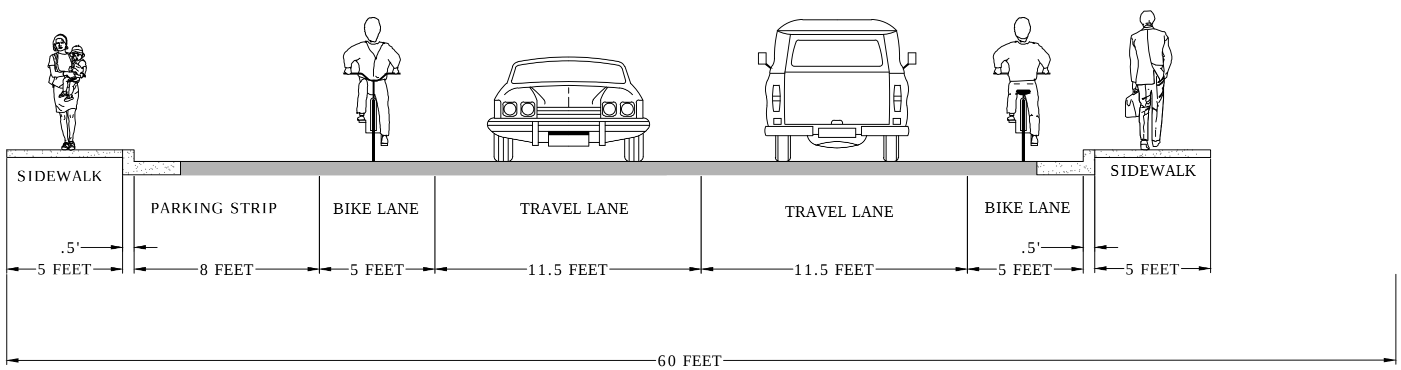
PROPOSED SECTION - PARKING BOTH SIDES



WEST 10TH STREET CROSS SECTION

WEST 10TH STREET ROAD RIGHT-OF-WAY = 60 FEET

PROPOSED SECTION - PARKING ONE SIDE



CITY OF THE DALLES

The Hub of the Pacific Northwest
CITY of THE DALLES
OREGON

GRID STREET CROSS SECTION

DATE:
10/17/2014

STREET:
WEST 10TH STREET

Appendix B Evaluation Criteria Matrix

Criteria Number	Evaluation Criteria	Evaluation Measures	Project I-1 (US 197/US 30)		Project I-1 (US 197/Fremont Street)			Project I-3 (US 197/I-84 EB)	Project I-4 (US 197/Lone Pine Boulevard)	Project I-6 (Thompson St/E 10th St/Old Dufur Road)				Project I-7 (East 2nd Street/US 30)	Project I-8 (Cherry Heights Rd/W 6th St)	Project I-9 (W 2nd St/Webber Rd, W 6th St/Webber Rd)	Project I-10 (W 2nd St/Webber Rd, W 6th St/Webber Rd)	Project I-11 (W 2nd St/Webber st)	
			I-1a	I-1b	1-2a	1-2b	1-2c	1-3	1-4	1-6a	1-6b	1-6c	1-6d	I-7	I-8	I-9	I-10	1-11a	1-11b
			(Signal)	(Roundabout)	J-Turn	Roundabout	Overpass	Signal	Roundabout	T-intersections	Mini-roundabouts	Hybrid of 6a and 6b	All-way Stop	Realignment	Lane reallocation	Signal Timing Modifications	Extend right-turn lanes for queue storage	Dedicated left-turn lanes with protected/permitted phasing	Extend northbound left-turn storage
Goal 1: Safety and Mobility - Ensure a safe and efficient transportation system for all users in a state of good repair.			8	12	7	10	8	8	8	4	10	8	4	5	3	2	2	2	2
1A1	Estimated number of fatal or serious injury crashes.	To what extent does the alternative reduce the estimated frequency of fatal and serious injury crashes? Whenever possible, estimate the change in predicted crash frequency using Safety Performance Functions from the Highway Safety Manual calibrated for Oregon and/or crash modification factors (CMFs) approved by ODOT for use in the All Roads Transportation Safety (ARTS) program	1	2	2	2	2	2	2	1	2	1	2	1	1	1	1	1	1
1A2	Estimated number of bicycle and pedestrian related crashes.	To what extent does the alternative reduce the estimated frequency of pedestrian and bicycle related crashes? Whenever possible, measure using reliable crash modification factors (CMFs) for estimating relative change in predicted crash frequency.	1	2	0	1	1	2	1	1	2	2	2	1	0	0	0	0	0
1B1	Number of conflict points between all modes of travel including crossing points for pedestrians and bicyclists along major arterials and vehicular at-grade rail crossings.	To what extent does the alternative increase safety by reducing vehicle to vehicle, vehicle to rail, vehicle to pedestrian/bicycle, or pedestrian/bicycle to pedestrian/bicycle conflict points? Measured as relative impact between alternatives in regards to reducing the number of conflict between modes and speed differential. For example, installing raised medians to provide a physical barrier between modes at intersections.	0	2	0	1	2	0	1	0	2	1	0	1	0	0	0	0	0
1B2	Intersection visibility and sight distances available to motorists, pedestrians, and bicyclists at intersections and key decision points.	To what extent does the alternative improve sight distance for all system users, increasing available time to identify and react to potential conflicts? Measured as relative impact between alternatives for providing adequate sight distance based on desired operating speeds.	2	2	2	2	0	0	1	2	2	2	0	1	0	0	0	0	0
1C1	Percent of study intersections meeting applicable operational performance measures.	To what extent does the alternative mitigate or improve operational performance relative to applicable targets and standards? Measured by the degree to which an alternative mitigates a failing condition or improves operations.	2	2	2	2	2	2	1	0	0	0	0	0	1	1	1	1	1
1D1	Percentage of acceptable pavement conditions based on roadway classification or extended lifespan of pavement.	To what extent will the project preserve or extend the life of the existing pavement condition? Measured by whether or not the project improves the pavement condition index.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1E1	Compliance with agency standards or implementation of industry best practices.	To what extent does the alternative improve the transportation facility to meet or comply with agency design standards or implement an industry best practice? Measured by whether or not an alternative improves the transportation facility to meet or comply with agency design standards or implements an industry best practice.	2	2	1	2	1	2	2	0	2	2	0	1	1	0	0	0	0
Goal 2: Expand affordable, accessible and multimodal options to improve connections for all users of the transportation system to jobs, services and activity centers			1	1	1	2	3	2	2	1	4	4	3	0	0	0	0	0	0
2A1	Potential impact on bicycle and pedestrian volumes.	To what degree may the alternative increase pedestrian and bicyclist travel on appropriately-designed facilities? Measured by potential increase in pedestrian and bicyclist volume relative to baseline conditions.	0	0	0	0	1	1	1	0	1	1	1	0	0	0	0	0	0
2A2	Compliance with "Complete Streets" concept within urban areas, and appropriate locations within the urban fringe.	To what extent does the alternative provide a "Complete Street" within urban areas, and appropriate locations within the urban fringe? Measured by whether or not an alternative adopts a "Complete Street" approach or incorporates "Complete Street" components within urban areas, and appropriate locations within the urban fringe.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2B1	Impact on system-wide connectivity and availability of more direct routes for each mode of transportation.	To what extent does the alternative improve the connectivity of the existing transportation system or provide a more direct route? Measured by the extent each alternative increases connectivity and provides facilities for each mode. Connectivity includes filling a gap in an existing route and designing new facilities that provide continuous routes between key destinations.	0	0	1	2	2	1	1	1	2	2	1	0	0	0	0	0	0
2B1	Miles of designated facilities for bicyclists and pedestrians provided.	To what extent does the alternative increase the number of miles of pedestrian and bicycle facilities (on-street and off-street)? Measured by potential expansions of the pedestrian and bicycle systems.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2C1	Impact on transit ridership.	To what degree does the alternative promote transit ridership or make transit a more viable option for all users? Measured by whether or not an alternative is able to increase transit ridership.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2D1	Impact of transportation project on low income and minority populations.	To what extent does the alternative affect low income and minority populations? Measured as relative ability of each alternative to spread the impacts and benefits of transportation improvements equitably to all populations.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2D2	Viability of non-auto travel.	To what degree are transportation facilities (transit service, sidewalks, bicycle lanes, separated mixed-use paths, parks) for non-auto travelers integrated into the alternative? Measured relative to facilities and integration present in baseline conditions.	1	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0
Goal 3: Integration - Integrate land use, financial, and environmental planning to prioritize strategic transportation investments and preserve The Dalles' identity.			3	2	1	0	0	1	3	1	1	1	1	2	1	1	1	1	1
3A1	Compliance with local land use plans, comprehensive plans, and regional transportation plans.	To what extent does the alternative comply with local or regional land use, comprehensive, and transportation plans? Measured by whether or not an alternative is identified or compatible with an adopted plan.	1	1	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0
3B1	Incorporation of Transportation Demand Management (TDM) Strategies.	To what extent are TDM strategies being implemented to improve the transportation system? Measured by the use of TDM strategies incorporated into the alternative.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3C1	Cost/benefit analysis and potential impact on forecasted expenditures.	To what degree does the alternative leverage a positive return on investment? Measured by the calculated cost/benefit analysis and alignment with current funding projections.	2	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1
3D1	Impacts on air quality, environmentally sensitive areas, and water and soil quality.	To what degree does the alternative impact environmentally sensitive areas? Measured by the potential adverse impacts of the alternative to the environment.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3E1	Incorporation of ITS technology.	To what extent is ITS technology being implemented for system improvements? Measured by the use of ITS devices relative to Baseline.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Goal 4: Economic Development - Build and maintain the transportation system to support economic vitality in the City.			6	7	5	5	6	7	5	0	1	1	0	1	1	2	2	2	2
4A1	Roadway geometry accommodates freight movement where it is warranted.	To what extent does the alternative accommodate the design vehicle for designated freight routes? Measured by whether or not an alternative is able to accommodate the design vehicle without potential adverse impacts to other modes.	2	1	1	1	1	2	1	0	0	0	0	1	0	0	0	0	0
4B1	Traffic operations performance on designated freight routes.	To what extent does the alternative provide acceptable performance along designated freight routes? Measured by operational performance along freight routes.	1	2	2	1	2	2	2	0	0	0	0	0	0	1	1	1	1
4B2	System-wide congestion and travel time.	To what extent does the alternative relieve congestion or reduce travel times on the transportation system? Measured by whether or not an alternative relieves congestion or reduces travel time.	1	2	1	2	2	2	1	0	1	1	0	0	1	1	1	1	1
4C1	Impact on intermodal connectivity and availability of air, rail, barge and freight facilities.	To what extent does the alternative improve the intermodal connectivity of the existing transportation system or provide better access to air, rail, barge or freight facilities? Measured by the extent to which each alternative increases intermodal connectivity and provides better connections to air, rail, barge and freight facilities.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4D1	External funding opportunities leveraged and financially responsible development proposals.	To what extent does the alternative leverage other private funding sources or include transportation improvements as part of a development proposal? Measured by whether or not an alternative leverages additional funding sources or is included as part of a development proposal.	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4E1	Potential increased attraction to desired businesses and developers.	To what extent does the alternative eliminate roadblocks to development caused by the transportation system? Measured by the critical transportation improvements funded relative to Baseline.	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Total Score			18	22	14	17	17	18	18	6	16	14	8	8	5	5	5	5	5

Appendix C Future Alternatives Operational Analysis Worksheets, US 197/US 30

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	275	197	120	211	226	133
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1787	1881	1845	1524	1752	1599
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1787	1881	1845	1524	1752	1599
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	306	219	133	234	251	148
RTOR Reduction (vph)	0	0	0	183	0	114
Lane Group Flow (vph)	306	219	133	51	251	34
Heavy Vehicles (%)	1%	1%	3%	6%	3%	1%
Turn Type	Prot	NA	NA	Perm	Prot	Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Actuated Green, G (s)	12.1	27.9	10.8	10.8	11.5	11.5
Effective Green, g (s)	12.1	27.9	10.8	10.8	11.5	11.5
Actuated g/C Ratio	0.24	0.56	0.22	0.22	0.23	0.23
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	437	1062	403	333	407	372
v/s Ratio Prot	c0.17	0.12	c0.07		c0.14	
v/s Ratio Perm				0.03		0.02
v/c Ratio	0.70	0.21	0.33	0.15	0.62	0.09
Uniform Delay, d1	17.0	5.3	16.3	15.6	17.0	14.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.0	0.1	0.5	0.2	2.8	0.1
Delay (s)	22.0	5.4	16.7	15.8	19.7	15.0
Level of Service	C	A	B	B	B	B
Approach Delay (s)		15.1	16.2		18.0	
Approach LOS		B	B		B	

Intersection Summary			
HCM 2000 Control Delay	16.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	49.4	Sum of lost time (s)	15.0
Intersection Capacity Utilization	42.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

US 197 at US 30
2035 PM
DRAFT TOPR 34

Parameter	Approach															
	EB (West Leg): US 30				WB (East Leg): US 197				NB (South Leg):				SB (North Leg): US 197			
INPUTS																
Lane Configuration																
Entry Lane(s) Configuration (Note: This assumes 4 legs.)	Case:	LTR 1			Case:	LTR 1			Case:	LTR 1			Case:	LTR 1		
RT bypass configuration (Note: This is in addition to the entry lane(s))			Case:	None 1			Case:	None 1			Case:	None 1			Case:	1 None
Number of conflicting circ lanes		1				1				1				1		
Number of conflicting exit lanes for bypass lane (if used)																
Vehicular Volumes	U (v1U)	L (v1)	T (v2)	R (v3)	U (v4U)	L (v4)	T (v5)	R (v6)	U (v7U)	L (v7)	T (v8)	R (v9)	U (v10U)	L (v10)	T (v11)	R (v12)
Flow (veh/h)		275	197	0		0	120	211		0	0	0		226	0	133
% HV		1	1	0		0	3	6		0	0	0		3	0	1
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pedestrian Volumes (crossing leg)																
n_p	0				0				0				0			
Constants																
Time period, T (h)	0.25															
PCE for HV	2															
SUMMARY																
Entry lane volume (veh/h)	N/A	525	N/A		N/A	374	N/A		N/A	0	N/A		N/A	396	N/A	
Entry lane capacity (veh/h)	N/A	1050	N/A		N/A	978	N/A		N/A	693	N/A		N/A	1217	N/A	
x (v/c ratio)	N/A	0.50	N/A		N/A	0.38	N/A		N/A	0.00	N/A		N/A	0.33	N/A	
Lane control delay (s/veh)	N/A	9.3	N/A		N/A	7.9	N/A		N/A	5.2	N/A		N/A	6.0	N/A	
Lane LOS	N/A	A	N/A		N/A	A	N/A		N/A	A	N/A		N/A	A	N/A	
Approach control delay (s/veh)	9.3				7.9				0.0				6.0			
Approach LOS	A				A				N/A				A			
Intersection control delay (s/veh)	7.9															
Intersection LOS	A															
95th percentile queue (veh)	N/A	2.9	N/A		N/A	1.8	N/A		N/A	0.0	N/A		N/A	1.4	N/A	

Appendix D Future Alternatives Operational Analysis Worksheets, US 197 at I-84 EB Ramps

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	311	0	141	0	0	0	0	439	47	51	218	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0			5.0	
Lane Util. Factor		1.00	1.00					1.00			1.00	
Frt		1.00	0.85					0.99			1.00	
Flt Protected		0.95	1.00					1.00			0.99	
Satd. Flow (prot)		1719	1599					1836			1808	
Flt Permitted		0.95	1.00					1.00			0.84	
Satd. Flow (perm)		1719	1599					1836			1538	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	334	0	152	0	0	0	0	472	51	55	234	0
RTOR Reduction (vph)	0	0	54	0	0	0	0	7	0	0	0	0
Lane Group Flow (vph)	0	334	98	0	0	0	0	516	0	0	289	0
Heavy Vehicles (%)	5%	0%	1%	0%	0%	0%	0%	2%	3%	13%	2%	0%
Turn Type	Perm	NA	Perm					NA		Perm	NA	
Protected Phases		4						2			6	
Permitted Phases	4		4							6		
Actuated Green, G (s)		13.2	13.2					17.9			17.9	
Effective Green, g (s)		13.2	13.2					17.9			17.9	
Actuated g/C Ratio		0.32	0.32					0.44			0.44	
Clearance Time (s)		5.0	5.0					5.0			5.0	
Vehicle Extension (s)		3.0	3.0					3.0			3.0	
Lane Grp Cap (vph)		552	513					799			669	
v/s Ratio Prot								c0.28				
v/s Ratio Perm		0.19	0.06								0.19	
v/c Ratio		0.61	0.19					0.65			0.43	
Uniform Delay, d1		11.8	10.1					9.1			8.1	
Progression Factor		1.00	1.00					1.00			1.00	
Incremental Delay, d2		1.9	0.2					1.8			0.4	
Delay (s)		13.6	10.3					10.9			8.5	
Level of Service		B	B					B			A	
Approach Delay (s)		12.6			0.0			10.9			8.5	
Approach LOS		B			A			B			A	

Intersection Summary			
HCM 2000 Control Delay	11.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	41.1	Sum of lost time (s)	10.0
Intersection Capacity Utilization	70.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

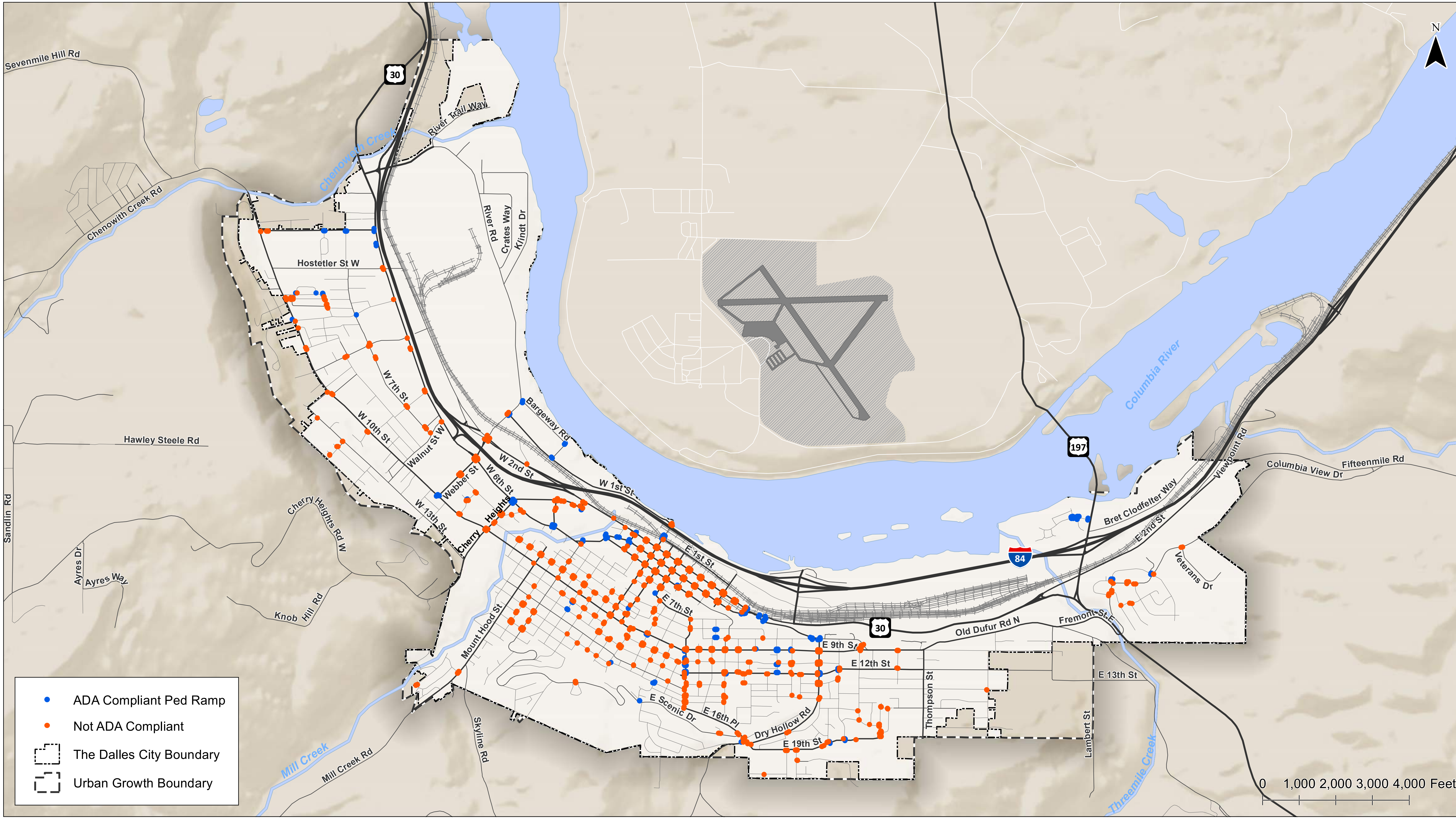
US 197 at I-84 EB Ramps
2035 PM
DRAFT TOPR 34

Parameter	Approach															
	EB (West Leg): I-84 EB Ramp				WB (East Leg):				NB (South Leg): US 197				SB (North Leg): US 197			
INPUTS																
Lane Configuration																
Entry Lane(s) Configuration		LTR				LTR				LTR				LTR		
(Note: This assumes 4 legs.)	Case:	1			Case:	1			Case:	1			Case:	1		
RT bypass configuration			None				None				None					None
(Note: This is in addition to the entry lane(s))			Case:	1			Case:	1			Case:	1			Case:	1
Number of conflicting circ lanes		1				1				1				1		
Number of conflicting exit lanes for bypass lane (if used)																
Vehicular Volumes	U (v1U)	L (v1)	T (v2)	R (v3)	U (v4U)	L (v4)	T (v5)	R (v6)	U (v7U)	L (v7)	T (v8)	R (v9)	U (v10U)	L (v10)	T (v11)	R (v12)
Flow (veh/h)		311	0	141		0	0	0		0	439	47		51	218	0
% HV		5	0	1		0	3	6		0	2	3		13	2	0
PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Pedestrian Volumes (crossing leg)																
n_p	0				0				0				0			
Constants																
Time period, T (h)	0.25															
PCE for HV	2															
SUMMARY																
Entry lane volume (veh/h)	N/A	481	N/A		N/A	0	N/A		N/A	524	N/A		N/A	289	N/A	
Entry lane capacity (veh/h)	N/A	967	N/A		N/A	591	N/A		N/A	956	N/A		N/A	1364	N/A	
x (v/c ratio)	N/A	0.50	N/A		N/A	0.00	N/A		N/A	0.55	N/A		N/A	0.21	N/A	
Lane control delay (s/veh)	N/A	9.8	N/A		N/A	6.1	N/A		N/A	11.0	N/A		N/A	4.4	N/A	
Lane LOS	N/A	A	N/A		N/A	A	N/A		N/A	B	N/A		N/A	A	N/A	
Approach control delay (s/veh)	9.8				0.0				11.0				4.4			
Approach LOS	A				N/A				B				A			
Intersection control delay (s/veh)	9.1															
Intersection LOS	A															
95th percentile queue (veh)	N/A	2.8	N/A		N/A	0.0	N/A		N/A	3.4	N/A		N/A	0.8	N/A	

Appendix E Pedestrian Ramp Accessibility Inventory

Pedestrian Ramp Accessibility Inventory

Sidewalks within The Dalles constructed in the last five years have been built to accommodate all users with accessible ramps at intersections. However, many intersections have not been updated. In 2015, the City of The Dalles inventoried all curb ramps at Arterials and Collector street intersections to identify curb ramps that meet American Disability Act (ADA) requirements. Figure E-1 illustrates the ramps that are compliant with ADA standards for accessible curb ramps.



ADA Compliant Pedestrian Ramps
The Dalles, Oregon

Figure
E-1

K:\H_Portland\projfile\18495 - The Dalles TSP\gis\TM #5\E-1 ADA Ramps.mxd - agriffin - 2:20 PM 3/29/2016

Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County, City of the Dalles
Sources: Esri, USGS, NOAA

Appendix F Columbia Gorge Regional Airport Master Plan

Columbia Gorge Regional Airport

Airport Master Plan

Airport Master Plan

for

COLUMBIA GORGE REGIONAL AIRPORT

Prepared for

THE CITY OF THE DALLES, OR
and
KLICKITAT COUNTY, WA

by
Precision Approach Engineering, Inc.
and
Coffman Associates, Inc.

Approved by The City of The Dalles on July 26, 2010
Approved by Klickitat County on July 27, 2010

August 2010
Final Printing

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Columbia Gorge Regional Airport

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Columbia Gorge Regional Airport

INTRODUCTION

INTRODUCTION

In the fall of 2008, the City of The Dalles and Klickitat County provided direction to the airport's consulting engineer, Precision Approach Engineering, to begin the process of preparing a grant application and scope of services for an *Airport Master Plan Update* for Columbia Gorge Regional /The Dalles Municipal Airport (DLS). Following development of a scope of services, budget, and schedule, the City of The Dalles and Klickitat County subsequently received a grant from the Federal Aviation Administration (FAA) in February 2009 to conduct the study.

The study was designed to provide guidance for future development and provide updated justification for projects for which the airport may receive funding participation through federal and state airport improvement programs. Working with Precision Approach Engineering was Coffman Associates, an airport consulting firm which specializes in master planning and environmental studies.

The *Airport Master Plan Update* was prepared in accordance with FAA requirements, including Advisory Circular 150/5300-13, *Airport Design* (as amended), and Advisory Circular 150/5070-6B, *Airport Master Plans* (2005). The scope of services, budget, and schedule were approved by the City of The Dalles and the Klickitat County Board of Commissioners, following review by the FAA. A notice-to-proceed was issued to the consultants on August 21, 2009. The following paragraphs outline the study background, objectives, study elements and process, coordination and recommendations.

BACKGROUND

The City of The Dalles, Oregon and Klickitat County, Washington are co-owners/sponsors of the Columbia Gorge Regional Airport, also known as The Dalles Municipal Airport. The airport is managed by Aeronautical Management, Inc. (AMI) under contract with the City of The Dalles and Klickitat County. Located in Dallesport, Washington, the airport lies adjacent to the Columbia River (on the north bank) and at the east end of the Columbia Gorge Scenic Area. The airport provides support to approximately 60 commercial and private aircraft. Services and facilities available include: hangar storage, tiedowns, fixed base operator services, flight instruction, aircraft rental, aircraft maintenance, and fueling.

Nearly 200 acres of the 1,000-acre site have been reserved for general aviation development. An airport industrial park lies adjacent to the airport, providing convenient multi-modal access to air, rail, highway, and river transportation. Interstate 84 follows the Columbia River to Portland and east to Boise (and points beyond), while U.S. Highway 197/97 provides access to points north and south. The Burlington Northern Santa Fe (BNSF) railroad runs adjacent to the airport, while the Union Pacific railroad runs on the south side of the river. East of the airport lies the Klickitat Port area, providing access to the Columbia River.

The current runway system consists of Runway 12-30, a 5,097-foot by 100-foot asphalt runway with medium intensity edge lighting and Runway 7-25, a 4,647-foot by 100-foot asphalt runway with medium intensity edge lighting. Over the past few years, several improvements have been made at the facility, including:

- New drainage facilities along runways and taxiways.
- An automated surface observation system (ASOS) - for weather observations.
- New hangars and lead-in ramp.
- New runway lighting and lighted signs.
- New runway resurfacing and marking.

MASTER PLAN OBJECTIVES

The overall objective of the *Airport Master Plan Update* was to provide the co-sponsors with guidance for future development of the airport, meeting the needs of existing and future users, while also being compatible with the environment. The most recent planning effort related to the airport was the 2004 *Airport Layout Plan and Report*. *The Airport Master Plan Update* provides justification for new priorities. The plan was closely coordinated with other existing or ongoing planning studies in the area, and with aviation plans developed by the FAA and the two states. Specific objectives of the study included:

- Research factors likely to affect air transportation demand in the Columbia Gorge area over the next 20 years and develop new operational and basing forecasts.

- Determine projected needs of airport users, taking into consideration recent FAA design standards, global positioning (GPS) aircraft approach capability, and transitions in the type of aircraft flown by corporate and general aviation users.

- Recommend improvements which enhance Columbia Gorge Regional Airport's ability to satisfy future aviation needs: runway extensions and/or realignment, increases in weight bearing capacity, and upgraded approaches (two-dimensional lateral navigation, vertical navigation, or localizer performance with vertical guidance).

- Determine the circumstances, ability, and operational costs of 14 Code of Federal Aviation Regulation Part 139 compliance requirements; operation as a commercial service airport.

- Establish a schedule of development priorities, a financial program for implementation of development, and analyze potential funding sources consistent with FAA planning.

- Provide specific recommendations for aviation and non-aviation related land uses on airport property and review existing or proposed land use, economic development, and zoning documents to ensure future compatibility with off-airport development.

- Develop active and productive public involvement throughout the planning process.

MASTER PLAN ELEMENTS AND PROCESS

To achieve the objectives described above, the *Airport Master Plan Update* was prepared in a systematic fashion pursuant to the scope of services that has been coordinated with the co-sponsors and the FAA. The study included nine elements:

1.0 **Study Initiation** - Development of the scope of services, budget, and schedule. A kickoff meeting with an advisory committee was held at the study's initiation to obtain a more comprehensive understanding of local issues.

2.0 **Inventory** - Inventory of facility and operational data, wind data, distribution of user surveys, environmental inventory, population and economic data, airport financial data, and new aerial photography and mapping. All of the inventory data was organized in a working paper which was distributed to the advisory committee for review and comment.

3.0 **Forecasts** - Forecasts for based aircraft, operations, and peaking characteristics of the airport over a 20-year period. The forecasts were organized in a working paper which was distributed to the advisory committee for review and comments and forwarded to the FAA for review and approval.

4.0 **Facility Requirements** - After establishing critical aircraft and physical planning criteria, facility needs assessments were developed for airside and landside facilities. An evaluation of the circumstances, ability, and operational costs for operating the facility as a commercial service airport were evaluated, although the co-sponsors do not wish to pursue certification at this time. The facility requirements were organized in a working paper, distributed to the committee, and a meeting will be held with the advisory committee to review previous working paper submittals.

5.0 **Airport Development Alternatives** - Potential airside and landside alternatives were developed for meeting long-term needs. Each of the alternatives were subjected to engineering and environmental analysis and summarized in a working paper. Following distribution of the working paper to committee members, a review meeting was held to discuss the alternatives and preliminary master plan concept.

6.0 **Airport Plans/Land Use Compatibility** - Airport layout plans were developed to depict existing and proposed facilities. The drawings set will meet the requirements of the FAA Northwest Mountain Region. In addition, noise exposure contours were developed for existing and future conditions to determine the extent of critical noise exposure in the airport vicinity. The analysis was summarized in an appendix for distribution to the committee.

7.0 **Environmental Overview** - Environmental concerns and potential mitigation requirements were identified consistent with the *National Environmental Policy Act* (NEPA). The working paper appears as an appendix to the master plan report.

8.0 **Financial Management and Development Program** - Development schedules and cost estimates were prepared for the development program, and a financial analysis were included to identify potential federal and state aid for specific projects. Following development of the financial management working paper, a final meeting was held with the advisory committee, and an open public workshop was held for the general public.

9.0 **Final Reports** - Final report documentation will include technical reports (printed and digital formats), an executive summary of the study, and full size/full color copies of report exhibits and drawings produced for the study. The FAA will review and approve the final airport layout plan drawings.

STUDY COORDINATION

The study process included local participation through the formation of a Planning Advisory Committee (PAC). The PAC consisted of federal, state, and local agencies, airport tenants, and general public representatives. The co-sponsors decided the final makeup of the committee, with the assistance of the consultant. The study schedule called for four points in the study where the PAC convened to discuss draft working paper submittals. A kickoff meeting was held during the initial inventory process (September 24, 2009), with other meetings following facility requirements (December 2, 2009), development alternatives (February 17, 2010), and the financial management program (May 19, 2010). Following the final meeting with the PAC, an "open house" workshop for the general public was held to present the preliminary findings and to solicit public comment. The Draft Final report will be available on-line at www.columbiagorge.airportstudy.com for the duration of the study.

RECOMMENDATIONS

The recommended master plan concept addresses both airside and landside needs for a 20-year planning horizon. The top priority on the airside is to meet runway safety design standards – initially for Runway 12-30, then for Runway 7-25. To meet the needs of 75 percent of the business jet fleet at 60 percent useful load, the ultimate length of Runway 12-30 is planned for 5,500 feet, with improved pavement strength and pilot line-of-sight along the runway. Several taxiway improvements have been recommended. To improve the safety area on the west end of Runway 7-25, a relocation of Dallesport Road has been recommended.

A variety of hangar types have been recommended to meet future needs: T-hangars, box hangars, and conventional hangars. A new terminal building has been recommended to replace the existing facility and a new aboveground fueling facility to replace the underground tanks.

Development grants are projected to cover 83 percent of the projects included in the capital development program. The federal grant program is supported directly by aviation users through the collection of fuel taxes and other user fees.

Columbia Gorge Regional Airport

Chapter One

INVENTORY

INVENTORY

Columbia Gorge Regional Airport

The initial step in the preparation of the airport master plan update for Columbia Gorge Regional Airport is the collection of information that will provide a basis for the analysis to be completed in subsequent chapters. For the master plan, information is gathered regarding both the airport and the region it serves. This chapter will begin with an overview of the airport location, competing airports, and typical weather conditions. This will be followed by a discussion of demographic and socioeconomic factors relevant to the region. A comprehensive overview of the national aviation system for general aviation airports and the role of Columbia Gorge Regional Airport in the national system are also presented. Finally, an inventory of the existing facilities at the airport will be discussed.

The information outlined in this chapter was obtained through on-site inspections of the airport, including interviews with the airport sponsors, management, tenants, and representatives of various government agencies. Information was also obtained from existing studies, including the *2004 Airport Layout Plan Report*. A general list of document sources is provided at the end of this chapter.

AIRPORT HISTORY AND ADMINISTRATION

The Columbia Gorge region has a long aviation history. The original airport, known as Case Field, was constructed in the 1920s. The airport originally had a 1,000-foot long grass strip with 200-foot diameter turnarounds at each end. The City of The Dalles acquired

the airport in 1942 from approximately 30 individual owners at a total cost of $39,000.

During World War II, the U.S. Army Corps of Engineers began construction of The Dalles Military Base, which would ultimately include three paved runways. A terminal building was completed in 1943 at a cost of $7,000.

As depicted on **Exhibit 1A**, Columbia Gorge Regional Airport is located on approximately 950 acres of property on the north side of the Columbia River. The airport is located in Klickitat County, Washington, to the immediate east of the unincorporated town of Dallesport. The City of The Dalles is located on the south side of the Columbia River in the State of Oregon. The closest major metropolitan area is the City of Portland, Oregon, located approximately 80 miles to the west. The airport is located at the eastern end of the Columbia River Gorge National Scenic Area, a protected scenic area managed by the U.S. Forest Service.

In 2000, the City of The Dalles, Oregon and Klickitat County, Washington signed a co-ownership agreement, which resulted in sharing operating costs and planning for the future of the airport. The airport is managed jointly by a regional airport board consisting of seven members, with three members being appointed by Klickitat County, three by the City of The Dalles, and the seventh member being appointed by the board itself. The airport board has contracted with Aeronautical Management, Inc. (AMI) to provide for daily airport management. AMI employs a full-time airport manager and a line technician/security officer.

AREA TRANSPORTATION MODES

Airports are a significant part of the national transportation infrastructure. Other modes of transportation can work in synergy with airports to promote access and economic development. The following discussion presents information related to the various transportation modes in the Columbia Gorge Region.

HIGHWAYS

Interstate 84 passes through The City of The Dalles providing access to points east and west. U.S. Highway 197 extends from the City of The Dalles north across the Columbia River. Dallesport Road extends from U.S. Highway 197, providing direct access to the airport. Vehicular transportation is the dominant mode in the region.

RAIL

The Burlington Northern Santa Fe Railroad runs along the north side of the Columbia River just to the south of the airport. The Union Pacific Railroad runs along the south side of the Columbia River, through the City of The Dalles. Both of these rail lines are maintained in Federal Railroad Association (FRA) Class 5 condition that permits operation of freight trains at up to 80 mph and passenger trains at up to 90 mph.

08MP04-1A-10/27/09

Exhibit 1A
LOCATION MAP

Although there is no Amtrak station in The Dalles, Amtrak does provide a throughway bus service from The Transportation Center in The Dalles. The service provides bus transport to Amtrak stations in Wishram, Washington, approximately 15 miles east of The Dalles, and Bingen, Washington, approximately 16 miles to the west. Both stations are on the Amtrak Empire Builder route, which provides connections to: Portland, Oregon; Vancouver, Washington; Spokane, Washington; West Glacier, Montana; Fargo, North Dakota; St. Paul/Minneapolis, Minnesota; Milwaukee, Wisconsin; and Chicago, Illinois.

MARINE FACILITIES

The Port of Klickitat is located in Bingen, Washington, approximately 15 miles to the west of the airport. The Port manages two distinct industrial lease properties; Bingen Point Business Park and Dallesport Industrial Park. Bingen Point Business Park is a 104 acre area comprised of a 22 acre boat basin, 52 developable acres, and 30 acres of lake and wetlands. The Bingen Point property includes over 65,000 square feet of building space. The Dallesport Industrial Park encompasses 660 acres. It is located two miles north of the City of The Dalles. Rail service from Burlington Northern/Santa Fe is available immediately at the Dallesport Industrial Park and is ½-mile from Bingen Point. The following is a list of businesses leasing from the Port of Klickitat:

- Columbia Phyto Technology
- James Dean Construction
- Underground Specialties, LLC
- Columbia Hills RV Park
- Dallesport Foundry
- Dallesport Log Yard
- Dallesport Specialty Lumber
- Eternal Rest Pet Service
- Innovative Composite Engineering
- The Insitu Group (Boeing)
- Pellissier Trucking
- Underwood Fruit

The Port of The Dalles is located on the Columbia River, although it is primarily a marketing entity for industrial land in the region. In general, the Port owns industrial and commercial sites, some with riverfront barge access. Currently, no known marine freight is loaded from sites within the Port of The Dalles, but the potential for such facilities exists. The Port also owns and operates a 120-slip marina facility with moorage for all types of boats with drafts up to 14 feet. A public boat launch ramp is also available at the marina.

Adjacent to the Port of The Dalles is a private facility that currently provides storage and transport of wheat via the Columbia River. Approximately 800,000 bushels of wheat can be stored on site and a barge can transport up to 120,000 bushels. Opportunities to more fully utilize marine transport resources available to Wasco County residents and farmers will require development of additional facilities. (*Source: Wasco County Transportation System Plan – Draft 2009*)

PUBLIC TRANSIT SERVICE

Public transportation service in the region is provided by Gorge TransLink, which is an alliance of providers offering transportation services throughout the Mid-Columbia River Gorge region. Gorge TransLink provides linkage between communities in Klickitat, Skamania, Hood River, Wasco, and Sherman counties. Gorge TransLink provides two basic kinds of service: dial-a-ride and fixed-route service.

Mount Adams Transportation Service is the main public transportation service for Klickitat County providing both dial-a-ride and a fixed route service. This service is operated by Klickitat County Senior Services, a county department, Monday through Friday from 6:00 a.m. to 6:00 p.m. This service originates in The Dalles and includes scheduled stops in Dallesport, Wishram, Maryhill, and Goldendale. Other service is available to points to the east and west.

The Gorge TransLink provides a connection to Greyhound stops located in Biggs, The Dalles, Hood River, Portland, Vancouver, and points east. This is an intercity bus service that travels along Interstate 84 through the Columbia River Gorge. Four to six trips are provided by Greyhound each day. Riders can connect to the national Greyhound network from this regional line.

REGIONAL CLIMATE AND GEOLOGY

Weather conditions must be considered in the planning and development of an airport, as daily operations are affected by local weather patterns. Temperature is a significant factor in determining runway length needs, while local wind patterns (both direction and speed) dictate the optimal orientation of the runway.

The climate in the region can vary greatly over just a few miles. The airport is located approximately 25 miles to the east of the summits of Mount Hood and Mount Adams. As a result, the airport is in the rain shadow of these Cascade volcanoes. The area is significantly drier than the Portland metropolitan area to the west. Annual precipitation to the west of the Cascades is as much as 45 inches per year, while to the east it is as little as 10 inches per year. The airport averages approximately 14 inches of precipitation per year.

During the summer months, the airport averages 88 degrees for a high temperature. The highs in the winter months are in the low 40s. The area experiences approximately 300 days of sunshine per year. A summary of climactic data is presented in **Table 1A**.

TABLE 1A
Climate Summary
The Dalles, OR

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
High Temp. Avg.	41	48	57	65	74	80	88	88	81	67	50	42
Low Temp. Avg.	30	32	37	43	50	56	61	61	52	42	35	30
Precip. Avg.(in.)	2.64	1.86	1.15	0.74	0.56	0.43	0.17	0.32	0.52	1.00	2.20	2.69

Source: The Weather Channel, www.weather.com

The airport is located within the Columbia Lava rock formation. This formation covers approximately 250,000 square miles and is the result of volcanic eruptions and lava flows from Mount Hood and Mount Adams. The official airport elevation is 247 feet above mean sea level (MSL), with portions of the airport elevation decreasing down to 200 feet MSL. As a point of reference, the normal elevation of the Columbia River nearest the airport is 74 feet MSL.

The western portion of airport property is relatively flat and accommodates the developed portions of the airport. The northern and southeastern portions of the airport have moderate slopes. The area to the east of the airport, approximately 100 feet from Runway 25 (elevation 242 feet) has a steep 40-foot drop to a gully. The terrain then rises again to an elevation of 240 feet approximately 700 feet from the runway end.

AIRPORT SYSTEM PLANNING ROLE

Airport planning exists on many levels: local, state, and national. Each level has a different emphasis and purpose. On the national level the Columbia Gorge Regional Airport is included in the *National Plan of Integrated Airport Systems* (NPIAS). On the state level the airport is included in both the *Oregon Aviation Plan* (2007) and in the Washington State Long-Term Air Transportation Study (LATS) that encompasses the *Washington Aviation System Plan* (2009). The local planning document is the airport master plan.

FEDERAL AIRPORT PLANNING

On the national level, the Columbia Gorge Regional Airport is included in the *National Plan of Integrated Airport Systems* (NPIAS). This federal plan identifies 3,356 existing airports which are considered significant to the national air transportation system. The NPIAS is published and used by the Federal Aviation Administration (FAA) in administering the Airport Improvement Program (AIP), which is the source of federal funds for airport improvement projects across the country. The AIP program is funded exclusively by user fees and user taxes, such as those on fuel and airline tickets. The 2009-2013 NPIAS estimates $49.7 billion is needed for airport development across the country over the next five years. An airport must be included in the NPIAS to be eligible for federal funding assistance through the AIP.

The NPIAS supports the FAA's strategic goals for safety, system efficiency, and environmental compatibility by identifying specific airport improvements. The current issue of the NPIAS identifies approximately $19.6 million in development needs over the next five years for Columbia Gorge Regional Airport. This figure is not a guarantee of federal funding; instead, this figure represents development needs as presented to the FAA in the annual airport capital improvement program.

Airports that apply for and accept AIP grants must provide grant assurances. These assurances include maintaining the airport facility safely and efficiently in accordance with specific conditions. The duration of the assurances depends on the type of airport, the useful life of the facility being developed, and other factors. Typically, the useful life for an airport development project is a minimum of 20 years. Thus, when an airport accepts AIP grants, they are obligated to maintain that facility in accordance with FAA standards for at least that long.

Of the $49.7 billion in airport development needs nationally, approximately 19 percent is designated for the 2,564 general aviation airports, as shown in **Table 1B**. General aviation airports average 35 based aircraft and account for 41 percent of the nation's general aviation fleet. Columbia Gorge Regional Airport is designated as a general aviation airport.

TABLE 1B
NPIAS Distribution of Activity

Number of Airports	Airport Type	% of Enplanements	% of Based Aircraft	% NPIAS Costs
522	Commercial Service	99.9	21	71
270	Relievers	0	28	10
2,564	General Aviation	0	41	19
3,356	Existing NPIAS Airports	99.9	90	100
16,459	Non-NPIAS Airports	0.1	10	0

Source: 2009-2013 National Plan of Integrated Airport Systems (NPIAS)

STATE AIRPORT PLANNING

Columbia Gorge Regional Airport is unusual in that the airport sponsor is comprised of two governmental entities in two different states. As a result both Washington and Oregon actively participate in planning for the airport.

Oregon Airport Planning

The airport is included in the *Oregon Aviation Plan 2007* (OAP). The OAP is a comprehensive evaluation of Oregon's aviation system and serves as a guide for future aviation development. The OAP defines the specific role of each airport in the state's aviation system and establishes funding and development needs. The OAP is periodically updated, with the previous version having been completed in 2000. Columbia Gorge Regional Airport is one of 97 public use airports within the state's aviation system plan.

The State of Oregon classifies public use airports by functional classification. They utilized the FAA's Airport Reference Code classification system (described in detail in Chapter Three - Facility Requirements), which is based on operational and physical criteria, and developed a unique set of performance measures to clearly demonstrate the types of facilities and services that should be provided at each airport category. The five airport classifications in the state are defined as follows:

- **Category I – Commercial Service Airports**

These airports support some level of scheduled commercial airline service in addition to a full range of general aviation aircraft. This includes both domestic and international destinations.

- **Category II – Urban General Aviation Airports**

These airports support all general aviation aircraft and accommodate corporate aviation activity, including business jets, helicopters, and other general aviation activity. The primary users are business related and service a large geographic region, or they experience high levels of general aviation activity.

- **Category III – Regional General Aviation Airports**

These airports support most twin and single engine aircraft, may accommodate occasional business jets, and support regional transportation needs.

- **Category IV – Local General Aviation Airports**

These airports primarily support single engine, general aviation aircraft, but are capable of accommodating smaller twin-engine general aviation aircraft. They also support local air transportation needs and special use aviation activities.

- **Category V – RAES (Remote Access/Emergency Service) Airports**

These airports primarily support single engine, general aviation aircraft, special use aviation activities, and access to remote areas or provide emergency service access.

The Columbia Gorge Regional Airport is classified as a Regional General Aviation Airport in the *Oregon Aviation Plan 2007*. The applicable design and performance criteria are listed in **Table 1C**.

Washington Airport Planning

The Columbia Gorge Regional Airport is included in the *Washington Aviation System Plan* (WASP). The WASP includes 138 public use airports, 65 of which are included in the federal NPIAS (including Columbia Gorge Regional Airport). The WASP classifies airports according to their roles in the state air transportation system in the following manner:

- **Commercial Service:** At least 2,500 scheduled passenger enplanements (boardings) per year for at least three years.

- **Regional Service:** Serve large or multiple communities; all NPIAS reliever airports; at least 40 based aircraft; a minimum runway length of 4,000 feet.

- **Community Service:** Serves a community; at least 25 based aircraft, paved runway

- **Local Service:** Serves a community, less than 20 based aircraft, has a paved runway.

- **Rural Essential Service:** Other land-based airports, including residential airparks.

- **Seaplane Bases:** Identified by the FAA as a seaplane base, unless it is a Commercial Service Airport.

TABLE 1C
Oregon Aviation Plan 2007
Design Criteria for Regional General Aviation Airports

	Minimum Criteria	Desired Criteria
Airside Facilities		
FAA-ARC	B-II	Varies
Runway Length	4,000	Varies
Runway Width	75	Varies
Pavement Type	Concrete or Asphalt	Concrete or Asphalt
Taxiways	Partial or Turnarounds	Full Parallel
Approach Type	Non-Precision	Precision
Visual Aids	One Runway End	Both Runway ends
Runway Lighting	MIRL	MIRL/HIRL
Taxiway Lighting	MITL	MITL/HITL
General Facilities		
Rotating Beacon	Yes	Yes
Lighted Wind Indicator	Yes	Yes
Weather Reporting	AWOS/ASOS	AWOS/ASOS
Hangared Aircraft Storage	75% of based aircraft	100% of based aircraft
Apron Parking/Storage	30% of daily transient	50% of daily transient
Terminal Building	Small meeting area	Yes
Auto Parking	Minimal	Moderate
Fencing	Terminal Area	Perimeter
Cargo	Space on existing apron	Designated apron area
Services		
Fuel	AvGas and Jet A	AvGas, Jet A, 24-hour
FBO	Full Service	Full Service, 24-hour
Ground Transportation	Courtesy Car	Rental, Taxi, or Other
Food Service	Vending	Vending
Restrooms	Yes	Yes
Pilot Lounge	Yes w/ weather reporting station	Yes w/ weather reporting station
Snow Removal	Yes	Yes
Telephone	Yes	Yes

Source: Oregon Aviation Plan 2007

The WASP identifies Columbia Gorge Regional Airport as a Regional Service airport. Regional Service Airports meet the following criteria:

- Have at least 40 based aircraft, unless the airport is required for coverage of lower density population areas.

- Have a runway at least 4,000 feet long, unless the airport is designated as a NPIAS *reliever*.
- Be separated from another Regional Service Airport or a comparable Commercial Service Airport by at least 30 minutes driving time, unless closer airports are justified by large population numbers within the service area.
- Have a minimum service area population of approximately 5,000 (90-minute driving time) and a maximum service area population of approximately 400,000 (60-minute driving time).

The Washington State airport classification system not only assigns airports based on their function and role, but also sets performance objectives. The performance objectives are used to evaluate facilities, services, and other factors important to preserving the airport system. **Table 1D** presents the performance objectives for Regional Service Airports such as Columbia Gorge Regional Airport.

TABLE 1D
Performance Objectives for Regional Service Airports
Washington Aviation System Plan

Operational Factors	
	Standard runway safety area
	Standard obstacle free zone
	Runway condition exceeds 75 PCI
	Taxiway condition exceeds 70 PCI
	Apron condition exceeds 70 PCI
	Clear threshold siting surface
Planning Document	
	Planning documents less than 7 years old
Land Use Compatibility Protection	
	Compatibility policies in local comprehensive plan
	Appropriate zoning designation for airport
	Land use controlled in runway protection zones
	Height and hazard zoning
	Zoning discourages incompatible development
Facilities	
	5,000 foot long runway
	Full length parallel taxiway
	Lower than 3/4-mile visibility minimum
	Visual glide slope indicators
	Weather reporting capability
Services	
	Jet A and Avgas
	Major maintenance services

PCI: Pavement Condition Index

Source: Washington Aviation System Plan (2009)

LOCAL AIRPORT PLANNING

The airport master plan is the primary local planning document. The master plan is intended to provide a 20-year vision for airport development based on aviation demand forecasts. Forecasts beyond five years become less reliable. It has been five years since the airport has prepared aviation demand forecasts. As a result, this is an appropriate time to update these forecasts and revisit the development assumptions from the previous airport master plan. This document is intended to replace/update the *2004 Airport Layout Plan Report* as the primary airport planning document for the City of The Dalles and Klickitat County.

ECONOMIC IMPACT

The airports in Oregon and Washington provide the states with a safe and efficient air transportation system and provide an important stimulus for economic development. Many of the state's businesses, large and small, rely on the aviation system to rapidly transport personnel, equipment, and supplies. In addition, the tourism industries in Oregon and Washington rely on aviation to support activities such as lodging, dining, retail, and entertainment.

As part of the Oregon Aviation Plan 2007, the economic contributions of airports and the aviation industry to the state was analyzed. The economic impacts of airports include direct on-airport impacts, off-airport visitor spending, and spin-off impacts (economic multipliers). The study also quantified economic impacts that were generated by the presence of the airport but may not be aviation-related, such as industrial or business parks. The economic impact is measured in terms of employment, wages, and business sales.

The aviation industry in Oregon accounted for 197,040 jobs, $6.8 billion in wages, and $24.4 billion in business sales. This figure includes the impact of the Port of Portland airports which account for approximately 30 percent of the state aviation impact. The Columbia Gorge Regional Airport contributed 38 jobs, $829,000 in wages, and $2.4 million in business sales.

The Washington State Department of Transportation – Aviation completed an economic impact study for the states airports in 2002. The methodology utilized is consistent with analytical models used by the Federal Aviation Administration (FAA), and employs the use of direct survey information and an input/output model (IMPLAN) as developed by the U.S. Department of Commerce to determine multipliers specific to the state of Washington for "secondary" economic impacts. In 2002, the airport supported 14 jobs, $218,000 in payroll, and $814,000 in economic activity (sales output. In 2010, WSDOT Aviation is updating the economic impact study for the states airports.

AIRSIDE FACILITIES

Airport facilities can be functionally classified into two broad categories:

airside and landside. The airside category includes those facilities which are needed for the safe and efficient movement of aircraft, such as runways, taxiways, lighting, and navigational aids. The landside category includes those facilities necessary to provide a safe transition from surface-to-air transportation, including aprons, hangars, terminal buildings, and various other support facilities.

Existing airside facilities are identified on **Exhibit 1B**. **Table 1E** summarizes airside facility data for Columbia Gorge Regional Airport.

TABLE 1E
Airside Facility Data
Columbia Gorge Regional Airport

	RUNWAY 12-30	RUNWAY 7-25
Runway Length	5,097’	4,647’
Runway Width	100’	100’
Runway Surface Material (Condition)	Asphalt (Good)	Asphalt (Good)
Runway Markings (Condition)	Basic (Good)	Basic (Good)/Precision (Good)
Runway Lighting	Medium Intensity (MIRL)	Medium Intensity (MIRL)
Displaced Threshold	200’ (12)	440’ (7)/196’ (25)
Runway Load Bearing Strength (pounds) Single Wheel Loading (SWL)*	18,000	4,000
Taxiway Lighting	Reflectors	
Taxiway, Taxilanes & Apron Lighting	Centerline marking, Tie-down area marking	
Traffic Pattern	Standard Left	Standard Left
Approach Aids	REIL (30)	NA
Instrument Approach Aids	RNAV GPS-A (Circling)	RNAV GPS-A (Circling) LDA/DME – Rwy 25 (Copter) LDA/DME – Rwy. 25
Weather and Navigational Aids	Automated Surface Observation System (ASOS) Lighted Wind Cone Segmented Circle Airport Beacon Localizer Klickitat VOR/DME Remote Communications Outlet	

PAPI - Precision Approach Path Indicator
GPS - Global Positioning System
VOR - Very High Frequency Omni-directional Range
REIL - Runway End Identifier Lights
MALSR - Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights

* Estimate based on July 23, 2008 report, *Load Rating Analysis*, prepared by Pavement Services, Inc.

Source: Airport/Facility Directory – Northwest U.S. (August 27, 2009); Airport records.

RUNWAYS

Columbia Gorge Regional Airport is served by a two-runway system, both of which are constructed of asphalt. The primary runway, Runway 12-30, is 5,097 feet long by 100 feet wide. The Runway 12 end has an elevation of 210 feet MSL and the Runway 30 end is 239 feet MSL. This is a runway gradient of 0.6 percent. It is estimated that this runway accommodates approximately 70 percent of operations.

Crosswind Runway 7-25 is 4,647 feet long and 100 feet wide. This runway is strength rated at 4,000 pounds. The Runway 7 end has an elevation of 211 feet MSL and the Runway 25 end is 243 feet MSL. This is a runway gradient of 0.7 percent. It is estimated that this runway accommodates 30 percent of operations.

The landing threshold to Runway 12 is displaced 200 feet meaning those landing to Runway 12 have 4,897 feet available. Runway 7 is displaced 440 feet, and Runway 25 is displaced 196 feet. The Runway 25 displacement is intended to provide the required 300-foot runway safety area prior to landing. The other displacements are intended to provide clearance over potential obstructions on the approach to the runway ends.

The identified obstructions include the approach to Runway 12 which has 50-foot tall trees located 970 feet from the runway end and which require a 15:1 slope to clear. On the approach to Runway 7, there are 17-foot tall trees located 500 feet from the runway end which require a 17:1 slope to clear.

It should be noted that a third runway, Runway 2-20, was closed in 2005, as it was no longer needed to provide for crosswind coverage. A portion of this runway was converted to a taxiway to provide access to the Runway 25 threshold.

Both runways are "shed section" runways. This term means that the runways slope to one side to allow runoff. A more modern construction is to create a crown section, which provides drainage to either side of the runway, allowing runoff to both sides of the runway.

PAVEMENT STRENGTH

Current publications, including the FAA Airport/Facility Directory, place the pavement strength for both runways at 30,000 pounds single wheel loading (SWL), and 30,000 pounds dual wheel loading (DWL). These strength ratings refer to the configuration of the aircraft landing gear. For example, SWL indicates an aircraft with a single wheel on each landing gear.

In 2008, the airport engineer was contracted to conduct a pavement evaluation to determine the actual pavement condition. Utilizing deflection testing and runway core sampling, it was determined that the runways consist of approximately 2.5 inches of asphalt concrete over approximately 6.5 inches of sandy gravel.

Based on the results of the core sampling and deflection testing, the single wheel load bearing capacity for Runway 7-25 is estimated at 4,000 pounds. For Runway 12-30, the load bearing capacity is estimated at 18,000 pounds. These strength ratings do not preclude operations by aircraft with greater weight, but it does indicate that the life of the pavement will be significantly reduced. The airport does require prior permission for aircraft weighing more than the published 30,000 pounds.

PAVEMENT CONDITION

Every three years, the Oregon Department of Aviation performs inspections of the pavement conditions at

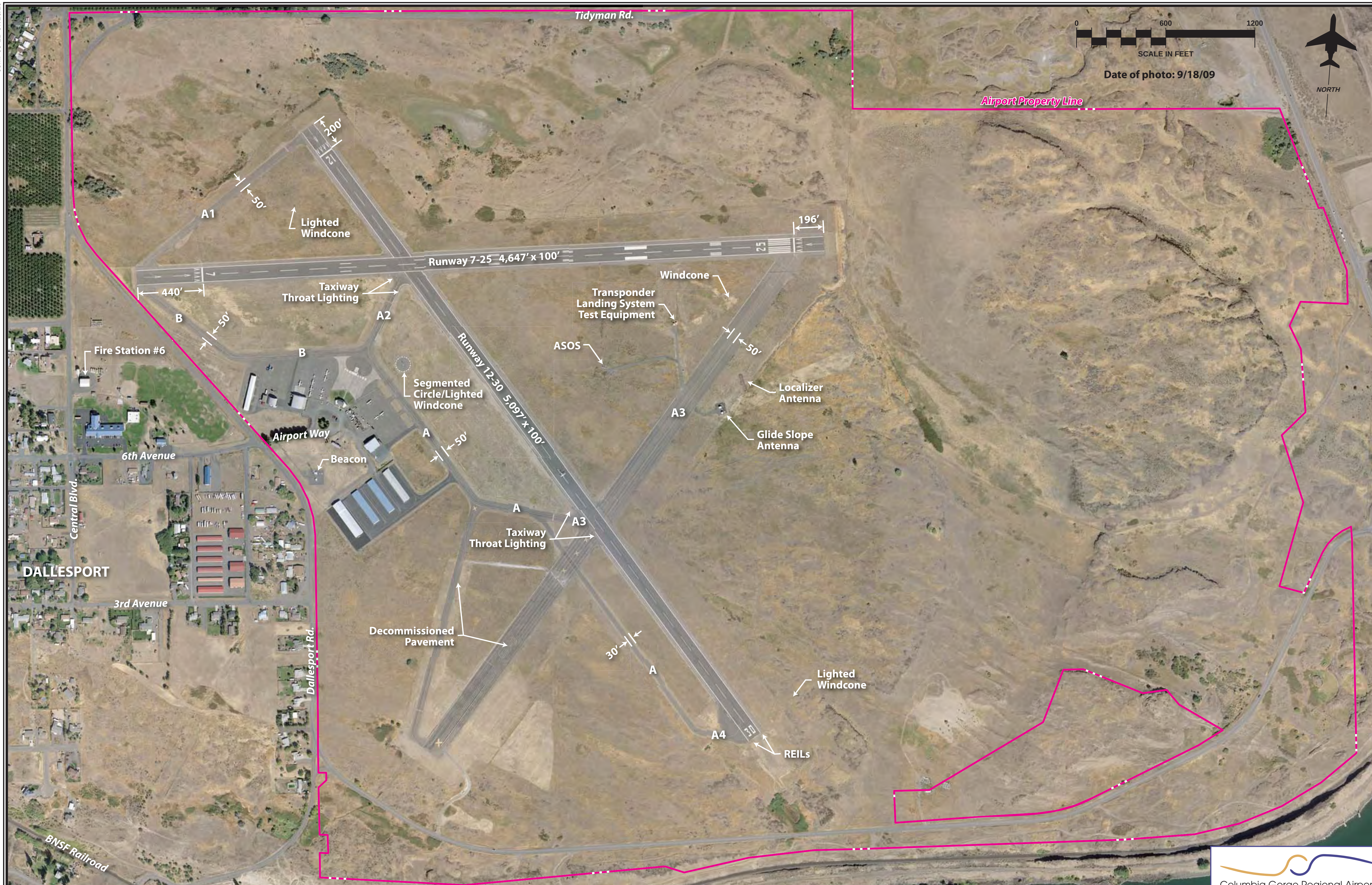

Exhibit 1B
AIRSIDE FACILITIES

the public use airports under its jurisdiction, including Columbia Gorge Regional Airport. The pavement maintenance management program was developed as part of the Oregon Continuous Aviation System Plan sponsored in part by the Oregon Department of Aviation and the FAA. The information and data generated ensures airport sponsors are in compliance with the requirements of FAA Grant Assurance Number 11, which states that any airport requesting federal funds for pavement improvement projects must have implemented a pavement maintenance management program.

The most recent inspection was on October 3, 2009. The inspections are conducted in compliance with FAA Advisory Circular (AC) 150/5380-6, *Guidelines and Procedures for Maintenance of Airport Pavements*. The inspection data is entered into the MicroPAVER software for analysis. Maintaining a MicroPAVER database ensures that the airport complies with the "record keeping and information retrieval" requirements of the FAA grant assurances.

The MicroPAVER software calculates a Pavement Condition Index (PCI) for each section of pavement on the airfield (runways, taxiway, and aprons). The program also generates forecasts of pavement condition five and 10 years into the future. The pavement condition index map for Columbia Gorge Regional Airport is presented on **Exhibit 1C**.

As of 2006, the majority of pavement composing the runways and taxiways was in "excellent" condition. This is to be expected since both runways received surface treatments and were striped in 2005. Over time the pavements can be expected to deteriorate. Still, by 2016, the runways and taxiways are forecast to still be in "good" condition, and the center and northwest aprons may be in "fair" condition. Generally, the runways and taxiways should be maintained at 70 PCI or greater and the other pavements should be at 55 or better. The MicroPAVER software also produces detailed reports on what on-going routine maintenance should be performed in order to maintain these condition levels.

Washington State conducts pavement condition inspections every five years. They conduct the inspections in much the same manner as Oregon utilizing the Pavement Condition Index. Currently, Washington State utilized the Oregon inspections for Columbia Gorge Regional Airport.

TAXIWAYS

In 2007, the airport installed new lighted taxiway directional signs. As a result, the taxiway designations have changed since the last airport layout plan was approved. Taxiway A1 is 50 feet wide and extends from the Runway 7 threshold to the Runway 12 threshold. Taxiway A2 is 50 feet wide and extends from the main terminal apron to the intersection of the two runways. Taxiway A3 is 50 feet wide and extends from the intersection with Taxiway A across Runway 12-30 and continues to the Runway 25 threshold.

The portion of Taxiway A3 to the east of Runway 12-30 is the converted portion of Runway 2-20. Taxiway A4 is 30 feet wide and is the angled portion of the taxiway leading to the Runway 30 threshold.

Taxiway A is the terminal area taxiway and it extends from near the fuel island southeast to the Runway 30 threshold. The portion of Taxiway A that extends from the main apron to the intersection with Taxiway A3 is 50 feet wide. From the intersection with Taxiway A3, Taxiway A is 30 feet wide and extends to Taxiway A4. Taxiway B is 50 feet wide and traverses the northwest apron edge, connecting the Runway 7 threshold to the intersection of Taxiway A2 and Taxiway A.

The layout and separation distance of the taxiways from the runway is an important consideration. At its maximum separation, Taxiway B is 575 feet from Runway 7-25. The portion of Taxiway B that extends to the Runway 7 threshold is angled. Taxiway A is 575 feet from Runway 12-30. Taxiway A, southeast of the intersection with Taxiway A3, is separated from Runway 12-30 by 300 feet. Taxiway A4 angles to meet the Runway 30 threshold. Taxiways A1 and A3 meet the threshold for Runways 7 and 25, respectively, at an angle. The taxilane providing access to the southwest T-hangar complex is designated Taxiway D and is 35 feet wide.

PAVEMENT MARKINGS

Pavement markings aid in the movement of aircraft along airport surfaces and identify closed or hazardous areas on the airport. Runway 25 has precision markings that include runway designations, threshold, fixed-distance aiming points, touchdown zone, edges, and centerline. Runway 7 has non-precision markings that include threshold, designation, centerline, and aiming point. Runway 12-30 provides basic markings which include the runway designations, runway centerline markings, and runway edge markings. Runways 7, 12, and 25 have displaced threshold markings as well.

Taxiway and apron centerline markings assist pilots when moving on these surfaces. The taxiways have standard yellow centerline markings.

In the northeast corner of the main apron, a white "H" designation is painted to identify the location for helicopter landings.

AIRFIELD LIGHTING

Airfield lighting systems extend an airport's usefulness into periods of darkness and/or poor visibility. A variety of lighting systems are installed at the airport for this purpose. These lighting systems, categorized by function, are summarized as follows:

Identification Lighting: The location of the airport at night is universally identified by a beacon. The rotating beacon projects two beams of light, one white and one green, 180 degrees apart. The beacon at Columbia Gorge Regional Airport is situated on the top of a 115-foot tall steel lat-

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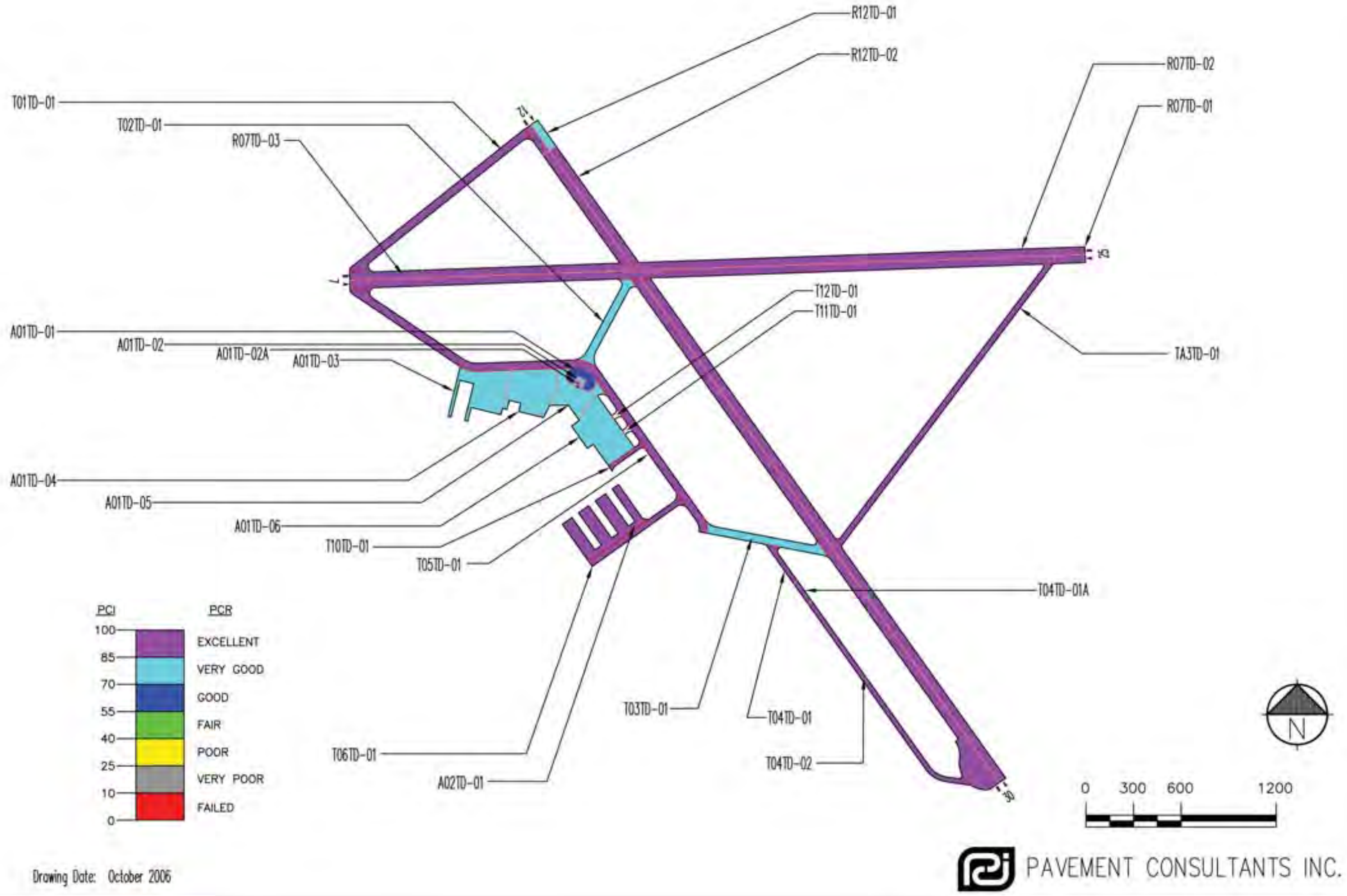
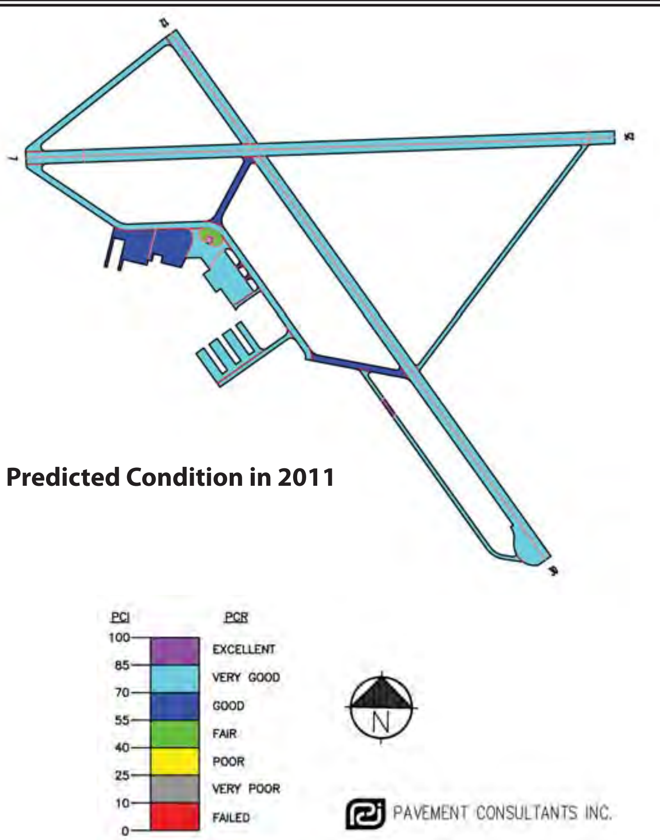
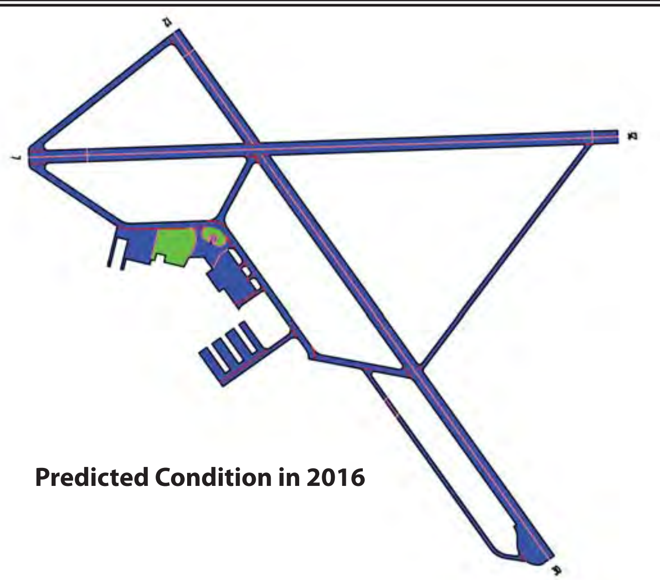
Pavement Condition in October 2006





Predicted Condition in 2011



Predicted Condition in 2016

Columbia Gorge Regional Airport

Exhibit 1C

CURRENT AND FUTURE PAVEMENT CONDITION

tice tower structure located at the western edge of the terminal area near the entrance road.

Runway and Taxiway Lighting: Runway lighting utilizes light fixtures placed near the edge of the pavement to define the lateral limits of the pavement. This lighting is essential for safe operations during night and/or times of low visibility in order to maintain safe and efficient access to and from the runway and aircraft parking areas.

Both runways are equipped with medium intensity runway lighting (MIRL). These are lights set atop poles that are approximately one foot above the ground. The light poles are frangible, meaning if one is struck by an object, such as an aircraft wheel, they can easily break away, thus limiting the potential damage to an aircraft. The runway lights are standard white in color. Some precision instrument runways have caution zone yellow edge lights in the last 2,000 feet of the runway. There are no caution zone lights at the airport. Runway threshold lighting identifies each runway end.

There is partial taxiway lighting located at the intersections of Taxiway A2 and A3 with Runway 12-30. This lighting, referred to as "throat lighting," does not extend the full length of these taxiways. This lighting is intended to provide positive visual verification of the location of these taxiway exits from the runway. There is no other taxiway lighting at the airport.

Visual Approach Lighting: Common visual approach aids include precision approach path indicator (PAPI) and visual approach slope indicator (VASI) lights. These approach aids consist of a system of lights located at various distances from the runway threshold, which when interpreted by the pilot, give them an indication of being above, below, or on the correct descent path to the runway. There are no visual approach lighting aids currently available at the airport.

Runway End Identification Lighting: Set to either side of the Runway 30 threshold is runway end identification lighting (REIL). REILs provide a visual identification of the runway end for landing aircraft. The system consists of two flashing light assemblies located approximately 40 feet to either side of the runway landing threshold. These flashing lights can be seen day or night for up to 20 miles depending on visibility conditions. Runway 30 is the only runway end equipped with REILs. The REILs are owned and maintained by the FAA.

Airfield Signs: Airfield identification signs assist pilots in identifying their location on the airfield and direct them to their desired location. The airfield signs are located at various intersections at the airport. Both runways have distance-to-go signs at 1,000-foot intervals to the side of the runways. All airfield signs are lighted.

Pilot-Controlled Lighting: The airfield lights are turned off at nighttime. Pilots can utilize the pilot-controlled lighting system (PCL) to activate the airfield lights from their aircraft through a series of clicks of their radio transmitter utilizing the CTAF frequency (123.0 MHz). The lights for both runways and the REILs are controllable through the system. Typically, the airfield lights will remain on for approximately 15 minutes.

WEATHER AND COMMUNICATION AIDS

Columbia Gorge Regional Airport has four wind socks, three of which are lit, on the airfield. Wind socks provide information to pilots regarding wind conditions, such as direction and speed. The main lighted windsock is located within the segmented circle immediately to the northeast of the terminal area apron. There are three additional supplemental wind cones. One is located to the northeast of the Runway 30 threshold and is lighted; one is to the southwest of the Runway 25 threshold and is also lighted; and the third is south of Runway 25 between the runway and Taxiway A3. Having four wind indicators spread out along the runway system is advantageous because pilots can determine wind conditions from anywhere on the runway/taxiway system.

A segmented circle provides traffic pattern information to pilots. The segmented circle is centrally located between Taxiway C and Runway 12-30.

Columbia Gorge Regional Airport is equipped with an Automated Surface Observing System (ASOS). An ASOS will automatically record weather conditions such as wind speed, wind gust, wind direction, temperature, dew point, altimeter setting, visibility, fog/haze condition, precipitation, and cloud height. This information is then transmitted at regular intervals (usually once per hour). Aircraft in the vicinity can receive this information if they have their radio tuned to the correct frequency (135.175 MHz). In addition, pilots and individuals can call a published telephone number and receive the information via an automated voice recording. The next closest automated weather broadcast is from the automated weather observation system (AWOS) located 16 nautical miles to the west at Ken Jernstedt Airfield (4S2) in Hood River, Oregon.

Columbia Gorge Regional Airport also utilizes the common traffic advisory frequency (CTAF). This radio frequency (123.0 MHz) is used by pilots in the vicinity of the airport to communicate with each other about approaches or take-offs from the airport. This frequency is also utilized to contact the airport fixed base operator (FBO). Seattle Center Approach and Departure Control are available via frequency 119.65 MHz.

The airport is also equipped with a Remote Communications Outlet (RCO). Due to the location of the airport, some aircraft on the ground may not be able to reach Seattle Center via the published frequency. The RCO provides a direct link with Seattle Center Approach and Departure Control via a different frequency (122.65 MHz). The RCO was established to provide ground-to-ground communications between air traffic control specialists and pilots at satellite airports for delivering enroute clearances, departure clearances, and acknowledging instrument flight rule cancellation or departure/landing times.

NAVIGATIONAL AIDS

Navigational aids are electronic devices that transmit radio frequencies, which pilots of properly equipped aircraft can translate into point-to-point guidance and position information. The types of electronic navigational aids available for aircraft flying in the vicinity of Columbia Gorge Regional Airport include a very high frequency omni-directional range (VOR) facility and the global positioning system (GPS).

The very high omni-directional range (VOR), in general, provides azimuth readings to pilots of properly equipped aircraft transmitting a radio signal at every degree to provide 360 individual navigational courses. Frequently, distance measuring equipment (DME) is combined with a VOR facility (VOR/DME) to provide distance as well as direction information to the pilot. Military tactical air navigation aids (TACANs) and civil VORs are commonly combined to form a VORTAC. The VORTAC provides distance and direction information to both civil and military pilots. The Klickitat VOR/DME is located approximately six miles to the north of the airport.

Global Positioning System (GPS) is an additional navigational aid for pilots. GPS was initially developed by the United States Department of Defense for military navigation around the world. GPS differs from a VOR in that pilots are not required to navigate using a specific ground-based facility. GPS uses satellites placed in orbit around the earth that transmit electronic radio signals, which pilots of properly equipped aircraft use to determine altitude, speed, and other navigational information. With GPS, pilots can navigate directly to any airport in the country and are not required to navigate using a ground-based navigational facility.

Loran-C is another point-to-point navigation system available to pilots. Where GPS utilizes satellite-based transmitters, Loran-C uses a system of ground-based transmitters.

AREA AIRSPACE

The Federal Aviation Administration (FAA) Act of 1958 established the FAA as the responsible agency for the control and use of navigable airspace within the United States. The FAA has established the National Airspace System (NAS) to protect persons and property on the ground and to establish a safe environment for civil, commercial, and military aviation. The NAS is defined as the common network of U.S. airspace, including air navigational facilities; airports and landing areas; aeronautical charts; associated rules, regulations, and procedures; technical information; and personnel and material. System components shared jointly with the military are also included as part of this system.

To ensure a safe and efficient airspace environment for all aspects of aviation, the FAA has established an airspace structure that regulates and establishes procedures for aircraft using the National Airspace System. The U.S. airspace structure provides for categories of airspace, controlled and uncontrolled, and identifies them as Classes A, B, C, D, E, and G as described below. **Exhibit 1D** generally illustrates each airspace type in three-dimensional form.

- Class A airspace is controlled airspace and includes all airspace from 18,000 feet MSL to Flight Level 600 (approximately 60,000 feet MSL).

- Class B airspace is controlled airspace surrounding high-activity commercial service airports (i.e., Seattle-Tacoma International Airport).

- Class C airspace is controlled airspace surrounding lower-activity commercial service (i.e., Portland, OR) and some military airports.

- Class D airspace is controlled airspace surrounding low-activity commercial service and general aviation airports with an airport traffic control tower (ATCT), such as Hillsboro Airport to the west of Portland.

All aircraft operating within Classes A, B, C, and D airspace must be in constant contact with the air traffic control facility responsible for that particular airspace sector.

- Class E airspace is controlled airspace surrounding an airport that encompasses all instrument approach procedures and low-altitude federal airways. Only aircraft conducting instrument flights are required to be in contact with air traffic control when operating in Class E airspace. While aircraft conducting visual flights in Class E airspace are not required to be in radio contact with air traffic control facilities, visual flight can only be conducted if minimum visibility and cloud ceilings exist.

- Class G airspace is uncontrolled airspace that does not require communication with an air traffic control facility.

Airspace within the vicinity of Columbia Gorge Regional Airport is depicted on **Exhibit 1E**. The airport operates in Class E airspace with a floor of 700 feet above ground level (AGL) and extending to 18,000 feet MSL. The terrain in the area helps define the limits of the Class E airspace. It should be noted that traditional transponder contact with air traffic control is not available below 500 feet in the airport vicinity because of the terrain.

Victor Airways

Victor Airways are designated navigational routes extending between VOR facilities. Victor Airways have a floor of 1,200 feet AGL and extend upward to an altitude of 18,000 feet MSL and are eight nautical miles wide. There

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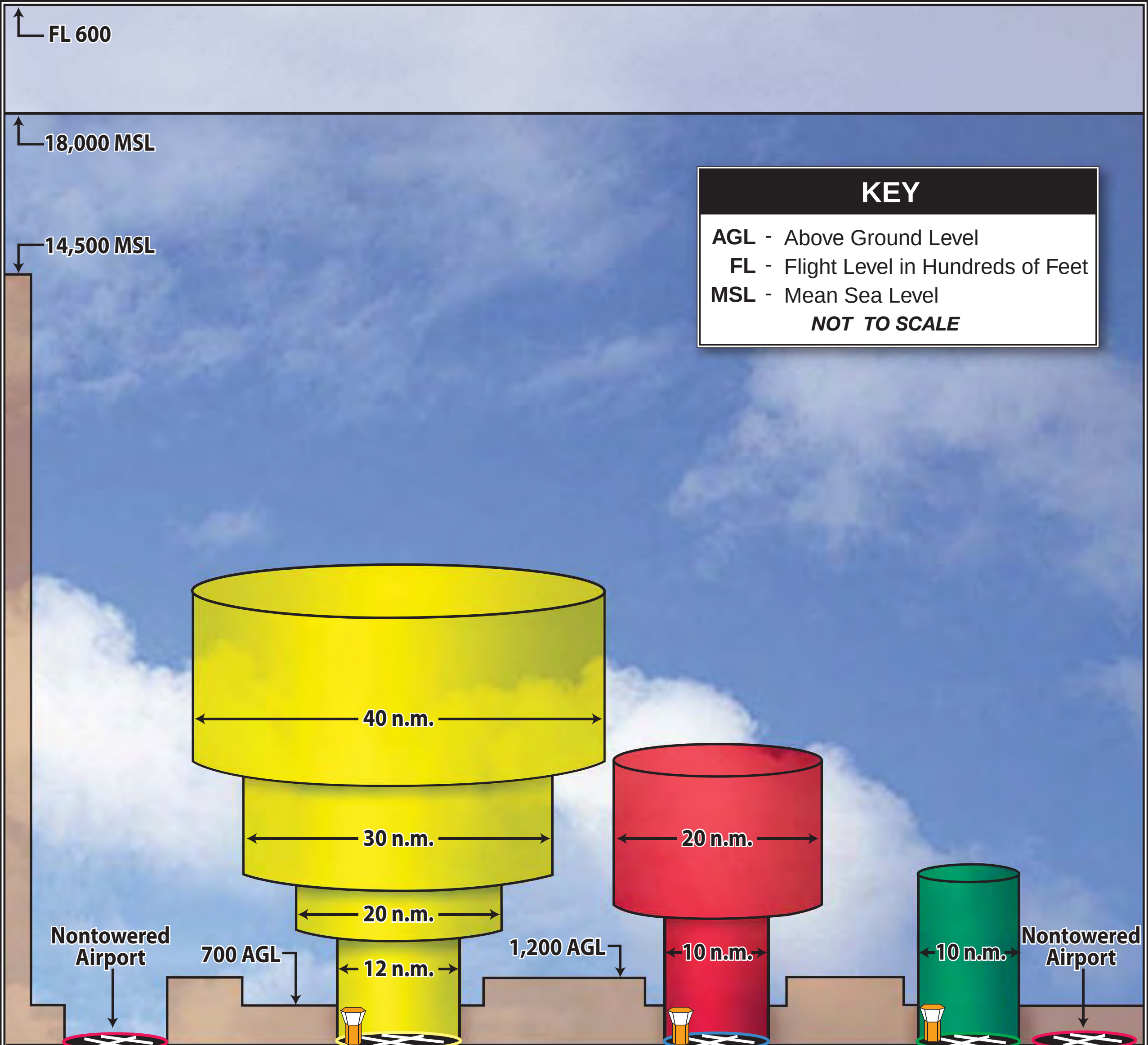
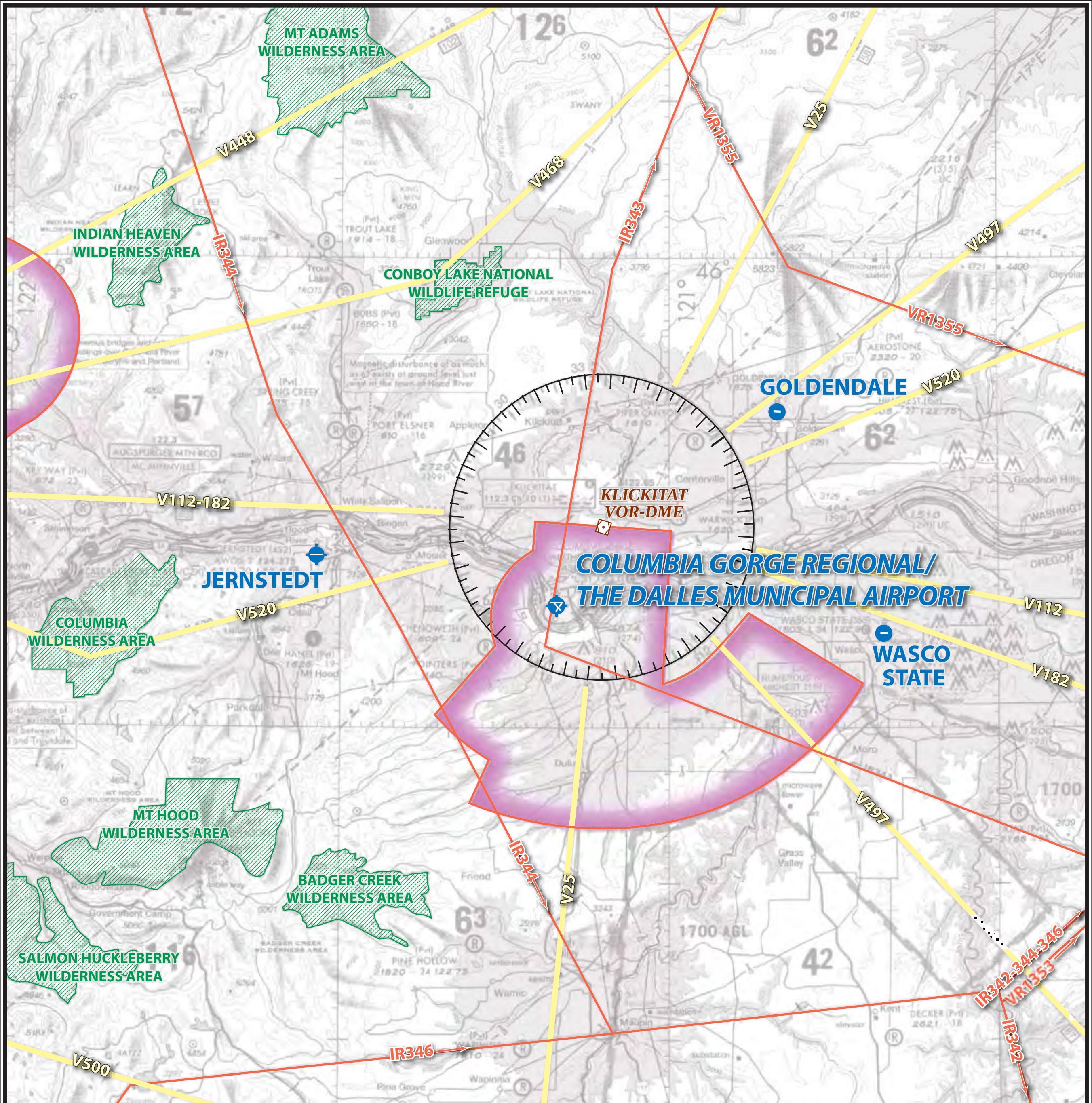


CLASSIFICATION	DEFINITION
CLASS A	Generally airspace above 18,000 feet MSL up to and including FL 600.
CLASS B	Generally multi-layered airspace from the surface up to 10,000 feet MSL surrounding the nation's busiest airports.
CLASS C	Generally airspace from the surface to 4,000 feet AGL surrounding towered airports with service by radar approach control.
CLASS D	Generally airspace from the surface to 2,500 feet AGL surrounding towered airports.
CLASS E	Generally controlled airspace that is not Class A, Class B, Class C, or Class D.
CLASS G	Generally uncontrolled airspace that is not Class A, Class B, Class C, Class D, or Class E.

Source: "Airspace Reclassification and Charting Changes for VFR Products," National Oceanic and Atmospheric Administration, National Ocean Service. Chart adapted by Coffman Associates from AOPA Pilot, January 1993.

Columbia Gorge Regional Airport

Exhibit 1D
AIRSPACE CLASSIFICATION



LEGEND

Airport with hard-surfaced runways 1,500' to 8,069' in length	Class E Airspace with floor 700 ft. above surface
Compass Rose	Victor Airways
VOR-DME	Military
Wilderness Area	

NORTH

NOT TO SCALE

Source: Seattle South Sectional Charts, US Department of Commerce, National Oceanic and Atmospheric Administration 12/18/08

Columbia Gorge Regional Airport

Exhibit 1E
AIRSPACE MAP

are numerous Victor Airways in the vicinity due to the location of the Klickitat VOR/DME located six miles to the north of the airport.

Military Operations Areas (MOAs)

A Military Operations Area (MOA) is an area of airspace designated for military training use. This is not restricted airspace as civil pilots can use the airspace. However, they should be on alert for the possibility of military traffic. A pilot may need to be aware that military aircraft can be found in high concentrations, conducting aerobatic maneuvers, and possibly operating at high speeds at lower elevations. The activity status of a MOA is advertised by a *Notice to Airmen* (NOTAM) and noted on Sectional Charts. The closest MOA to Columbia Gorge Regional Airport is the Boardman MOA located approximately 60 nautical miles to the east.

Military Training Routes

A Military Training Route, or MTR, is a specified training route for military pilot proficiency. Aircraft operate on the MTR at speeds in excess of 250 knots and up to 10,000 feet MSL. There are several MTRs in the vicinity, including IR343 that goes directly over the airport. General aviation pilots should be aware of the locations of the MTRs and exercise special caution if they need to cross them.

Restricted Areas

According to the FAA, "Restricted areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Penetration of restricted areas without authorization from the using or controlling agency may be extremely hazardous to the aircraft and its occupants." There is a designated restricted area (R-5701/5706) located within the Boardman MOA approximately 60 nautical miles to the east. The restricted area is associated with the Naval Weapons Systems Training Facility commonly referred to as the Boardman Bombing Range.

INSTRUMENT APPROACH PROCEDURES

Instrument approach procedures are a series of predetermined maneuvers established by the FAA using electronic navigational aids to assist pilots in locating and landing at an airport during low visibility and cloud ceiling conditions. The capability of an instrument approach is defined by the visibility and cloud ceiling minimums associated with the approach. Visibility minimums define the horizontal distance the pilot must be able to see to complete the approach. Cloud ceilings define the lowest level a cloud layer (defined in feet above the ground) can be situated for a pilot to complete the approach. If the observed visibility or cloud ceiling is below the minimums prescribed for the approach, the pilot cannot complete the instrument approach.

There are three instrument approaches for Columbia Gorge Regional Airport as presented in **Table 1F**.

TABLE 1F
Instrument Approach Data
Columbia Gorge Regional Airport

	WEATHER MINIMUMS BY AIRCRAFT TYPE					
	Category A		Category B		Categories C & D	
	CH	VIS	CH	VIS	CH	VIS
RNAV (GPS)-A						
Circling	1,100	1¼	1,000	1½	1,000	3
LDA/DME Rwy 25						
S-LDA/GS 25	1,200	2¾	1,200	2¾	NA	NA
Circling	1,200	3	1,200	3	NA	NA
Copter LDA/DME Rwy 25						
H-LDA/GA 25	600	1½				

Aircraft Categories are based on 1.3 times the stall speed in landing configuration as follows:
Category A: 0-90 knots (Cessna 172)
Category B: 91-120 knots (Beech craft King Air)
Category C: 121-140 knots (Canadair Challenger)
Category D: 141-166 knots (Gulfstream IV)

Abbreviations:
CH - Cloud Height (in feet above ground level)
VIS - Visibility Minimums (in miles)
GPS - Geographic Positioning System
Source: U.S. Terminal Procedures, Northwest (August 27, 2009)

The first instrument approach listed is the circling RNAV GPS approach. Utilizing on-board GPS, pilots can approach the airport and circle to the optimal runway for landing.

The next approach is a sophisticated variant of an instrument landing system (ILS) called the Localizer type Directional Aid (LDA). The Localizer Directional Aid (LDA) is an electronic beam used to guide aircraft to a specific point in space. It works similar to the localizer beam of an Instrument Landing System (ILS). Unlike an ILS, the LDA is not aligned with a runway. The beam is used as guidance through the clouds. After descending clear of the clouds, the pilot then abandons the course guidance and executes a sidestep type of maneuver to the runway of intended landing. At Columbia Gorge Regional Airport, the localizer antenna is offset from the runway by six degrees.

The last instrument approach is designed to be utilized by helicopters. The Copter LDA/DME Runway 25 approach utilizes the localizer antenna to guide helicopters to a specific point from which visual approaches are then permissible.

RUNWAY USE AND TRAFFIC PATTERNS

Columbia Gorge Regional Airport is situated at 247 feet MSL. All runways have a standard left hand traffic pattern. The traffic pattern altitude for all fixed-wing aircraft is 1,000 feet

AGL. The helicopter traffic pattern is designated at 500 feet AGL.

Runway use is dictated by prevailing wind conditions. Ideally, it is desirable for aircraft to land directly into the wind. The prevailing wind is from the northwest to the southeast. Therefore, Runway 12-30 is the primary runway experiencing approximately 70 percent of operations. Of this percentage, Runway 30 experiences approximately 65 percent of the operations while Runway 12 experiences approximately five percent. Runway 30 is also the calm wind runway. Runway 7-25 accommodates approximately 30 percent of the remaining operations, with an even split between the two ends.

LANDSIDE FACILITIES

Landside facilities are the ground-based facilities that support the aircraft and pilot/passenger handling functions. These facilities typically include the FBOs, aircraft storage hangars, aircraft maintenance hangars, aircraft parking aprons, and support facilities such as fuel storage, automobile parking, roadway access, and aircraft rescue and firefighting. Landside facilities are identified on **Exhibit 1F**.

AIRPORT BUSINESSES

The airport terminal building is centrally located, facing the main terminal area apron. The terminal building was constructed in 1943 and is two stories high. The main level includes a central gathering area, FBO desk, restrooms, and a small restaurant. The second floor is where airport administration is located. The terminal building is approximately 2,500 square feet.

The FBO is **Gorge Aviation Services**. Gorge Aviation Services offers fuel, ground support services, and pilot supplies. Gorge Aviation Services leases space within the terminal building as well as the conventional hangar immediately northwest of the terminal building. They sub-let this hangar to American Aerospace Engineering. They have two courtesy cars on-site. The FBO operates a flight school.

American Aerospace Engineering (AAE) occupies the 8,000 square-foot conventional hangar immediately north of the terminal building. AAE provides a comprehensive list of aviation related engineering services, including avionics, electrical engineering, flight testing, aerospace engineering, aircraft maintenance and repair, and mechanical engineering.

Life Flight Network occupies the 3,000 square foot Quonset hangar to the north of the terminal building. From this location, they base both a helicopter and a fixed wing aircraft (Aero Commander) for transport of critical patients for medical services. Life Flight has operations at several airports in Washington, Oregon, and Idaho and is a consortium of Oregon Health & Science University, Legacy Health, Saint Alphonsus Regional Medical Center, and Providence Health and Services.

Shearer Sprayers is an aerial application company that occupies the 6,000 square-foot hangar to the south of the terminal building. This hangar is currently used to store two turbine-powered single engine Air Tractor aircraft (models AT-402). Chemical loading of the aircraft takes place off-airport.

AIRCRAFT HANGAR FACILITIES

The airport has available either T-hangar units or bulk storage in conventional hangars. There are five T-hangar facilities. The oldest facility located on the north end of the main apron is of wood-frame construction and provides eight units. This facility, locally referred to as the Otis Hangars, is owned by the airport.

On the south end of the terminal area are four relatively new T-hangar facilities. These are identified as buildings A, B, C, and D. Building A was privately constructed in 1999 and provides 11 individual spaces. Buildings B and C have 11 units each and were constructed in 2004 by the airport. T-hangar building D was privately constructed in 2009 and provides 8 units. Three of the units have 42-foot bi-fold doors, one unit has a 45-foot bi-fold door, three units have 48-foot bi-fold doors, and one unit has a 60-foot bi-fold door. There are also two storage units with 12-foot garage doors.

There are three other hangars at the airport. To the south of the terminal building is a 6,000 square-foot hangar currently leased by Shearer Sprayers. To the immediate north is an 8,000 square-foot hangar currently leased by Gorge Aviation Services and sub-let to AAE. The Quonset hangar to the north of the AAE hangar is approximately 3,000 square feet and is leased by Life Flight Network. **Table 1G** summarized airport buildings.

TABLE 1G
Building Inventory
Columbia Gorge Regional Airport

Number	Building Type	Storage Units	Year Constructed	Condition	Ownership	Approx. Square Footage
1	T-Hangar (Otis Hangar)	8	1940s	Poor	Airport	9,600
2	Quonset Hut	Up to 2	1940s	Poor	Airport	3,000
3	Conventional	Up to 5	1940s	Poor	Airport	8,000
4	Terminal	NA	1943	Poor	Airport	2,400
5	Conventional	Up to 3	1950s	Poor	Airport	6,000
6	T-Hangar (A)	11	1999	Good	Private (Land lease)	12,500
7	T-Hangar (B)	11	2004	Excellent	Airport	12,500
8	T-Hangar (C)	11	2004	Excellent	Airport	12,500
9	T-Hangar (D)	10	2005	Excellent	Private (Land lease)	12,500

Source: Airport Records/Interviews

While most aircraft owners would prefer to store their aircraft in an enclosed hangar, some will elect to utilize outside aircraft tie-down positions. It is estimated that there are seven

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Exhibit 1F
LANDSIDE FACILITIES

aircraft that permanently utilize tie-down positions.

AIRCRAFT PARKING APRON

The total apron area is approximately 28,350 square yards. There are four distinct adjoining aprons that make up the total apron area. The south apron area is designated for transient aircraft parking. This apron is approximately 7,900 square yards and has 24 transient positions. These positions are spaced out to accommodate smaller single and multi-engine piston aircraft. This apron is constructed of asphalt.

The next apron area is centered on the airport terminal building and is approximately 7,000 square yards. The fuel farm and self serve pumps are located on this apron. This apron is utilized for circulation purposes and does not have any marked tie-down positions. This apron is primarily constructed of concrete.

The north apron area serves local tie-down needs and ingress/egress to two conventional type hangars. The apron fronting the AAE hangar is approximately 7,650 square yards. The apron fronting the Life Flight hangar is estimated at 5,800 square yards. These two aprons have 37 marked local tie-down positions.

AUTOMOBILE PARKING

There are approximately 45 terminal area vehicle parking spaces, including unmarked spaces. As with many general aviation airports, aircraft owners will typically drive their vehicle to their hangar location. There are no dedicated parking spaces near the hangars.

AIRCRAFT RESCUE AND FIREFIGHTING (ARFF)

As a general aviation facility, the airport is not required to have on airport firefighting capability. The closest fire station is Volunteer Fire District No. 6, located less than a minute from the airport in Dallesport. Through surplus government acquisition, four Oshkosh ARFF crash vehicles are stored at the fire station. At the time of this writing (October 2009), only one of these vehicles is operational. The intent is to have two of the vehicles operational with the remaining two available as parts vehicles.

These vehicles have storage capacity for water, dry chemical and aqueous firefighting foam (AFFF). One of the energy companies that utilize the airport maintains a supply of AFFF that can be quickly loaded to the crash vehicle in case of an emergency.

AIRPORT MAINTENANCE

The airport has a covered maintenance structure that is attached to the west side of the hangar occupied by AAE. Mowers and other equipment are stored here. The airport also utilizes space facing the main apron, immediately southeast of the terminal building, for outdoor storage of equipment.

UTILITIES

The developed areas on the west side of the airfield have water, sanitary sewer, electrical, and telephone service. Water is provided by the Dallesport Water District. A water well was dug and capped in the planned industrial/business park area to the south of the terminal area.

Sewer service was extended to the airport terminal area in 2002 by Klickitat County as part of a sewer upgrade project for Dallesport. The 8-inch sewer line enters the airport at the intersection of Dallesport Road and 6th Avenue. It extends approximately 650 feet to the airport terminal building. The main sewer line runs along the west side of Dallesport Road.

The Klickitat County Public Utility District provides electrical service to the airport. Telephone and data service is available from several carriers, but the airport currently uses Embarq through the city services network. Natural gas is not available at the airport, so a propane tank is located on the side of the terminal building primarily for use by the restaurant. The nearest natural gas pipeline is located along US Highway 197, approximately two miles by road from the terminal area.

FUEL FACILITIES

The airport owns an underground fuel storage system located under the main terminal area apron. Self serve Jet A and Avgas are available from these tanks. The Avgas tank has a 12,000 gallon capacity, and the Jet A tank is 10,000 gallons. The tanks were installed in 1999. The airport has a 3,000 gallon Jet A delivery truck. The airport FBO, Gorge Aviation Services, maintains the fuel farm and pays a $0.07 cent fuel flowage fee to the airport sponsors for the right to sell fuel on the airfield.

Table 1H presents the annual fuel sales for the airport for the last four years. From 2005 to 2006, there was a noticeable 38 percent jump in sales. This is the result of new T-hangars being completed and leased. Fuel sales dropped off slightly in 2007 and gained slightly in 2008. This trend appears to track with the overall national economy, which began a slowdown in 2007 and has been in an extended recession since December 2007.

TABLE 1H
Historic Fuel Sales (in gallons)
Columbia Gorge Regional Airport

	Jet A	100LL	Total
2005	NA	NA	60,989
2006	64,588	33,192	97,780
2007	59,534	26,325	85,859
2008	58,773	28,215	86,988

Source: Airport Records

FENCING

Portions of the terminal area are fenced with chain link with the majority of the perimeter fenced with three strand barbed wire. There are two access gates with key pads allowing authorized people to enter the north and south hangar areas. A manual vehicle gate is located to the immediate south of the terminal building.

SECURITY

The terminal building has four closed circuit security cameras located on each corner of the terminal building. Airport management is able to view the cameras from a terminal station located in the administrative offices in the terminal building. There is an additional camera on the second floor exterior of the terminal building that faces northwest. This camera was purchased by the airport through a security grant from the State of Washington. The airport is responsible for maintenance of this camera. Through an internet portal, the public can see images from the camera at http://www.wsdot.wa.gov/aviation/WebCam/Dalles.htm.

There is a residential manufactured home on the airport property near the airport entrance. This mobile home is occupied by an airport employee. After normal business hours, this employee is responsible for airport security and after-hours aircraft fueling.

ADDITIONAL AIRPORT DOCUMENTATION

The airport maintains several procedural documents which provide guidance for airport management on airport issues. The Rules and Regulations have been adopted for the orderly, safe, and efficient operation of the Columbia Gorge Regional Airport. Minimum standards for aeronautical activities have been made a part of the Rules and Regulations.

AREA LAND USE AND ZONING

Land uses in the vicinity of the airport can have a significant impact on airport operations and growth. The following section identifies baseline information relating to both existing and future land uses in the vicinity of Columbia Gorge Regional Airport. By understanding the land use issues surrounding the airport, more appropriate recommendations can be made for the future of the airport.

STATE AUTHORITY

The Washington State Department of Transportation – Aviation Division (WSDOT – Aviation) plays an active role in the preservation of general aviation airports. WSDOT Aviation assists local jurisdictions, airports, and other interests to protect public use airports from incompatible development by providing technical assistance and resources to support local decision making. The *Airport and Compatible Land Use Program* is continually being updated to reflect new research and planning methods to assist local jurisdictions. The most recent version was released May 6, 2010.

As outlined in the *Airport and Compatible Land Use Program*, the airport sponsor is responsible for implementing airport land use compatibility measures. Airport compatibility issues can be addressed in Countywide Planning Policies, Comprehensive Plans, Sub-Area Plans, Development Regulations/Zoning, and Environmental Documentation.

Two sections of the Revised Code of Washington (RCW) provide the legal framework for local jurisdictions to develop and enforce airport land use compatibility guidelines. The first is the Growth Management Act (GMA). Among other things, the GMA defines planning requirements for "essential public facilities" and designates airports as facilities of this type. The second law made land use compatibility a mandatory consideration in local planning. The details of these laws are codified in RCW Sections 36.7A.200 and 36.70.547, respectively.

FEDERAL AUTHORITY

All airports that accept federal development funds must agree to certain Grant Assurances. First and foremost the assurance that airport sponsors will continue to operate the airport as an airport. Grant Assurance No.21 relates to land use compatibility. It states, the airport sponsor "will take appropriate action, to the extent reasonable, including the adoption of zoning laws, to restrict the use of land adjacent to or in the immediate vicinity of the airport to activities and purposes compatible with normal airport operations, including landing and takeoff of aircraft."

The scope of an airport master plan is limited to airport property and the imaginary surfaces surrounding the runway system. Development of comprehensive land use policies and appropriate zoning ordinances is the responsibility of the local sponsor.

Because of the location of the airport on the north side of the Columbia River in Washington, it is important to identify land use considerations for both Klickitat County and the City of The Dalles. **Exhibit 1G** presents current land use zoning for portions of Klickitat County surrounding the airport and for the City of The Dalles.

The airport is located in the Airport Development District according to the Klickitat County Zoning Ordinance No. 62678, as amended. The intent of the District is to insure compatibility with adjacent properties and to enhance economic development. Permitted uses include airport facilities, aviation related businesses, aviation research and development, and aviation schools. Other conditionally permitted uses include restaurants, commercial recreation, offices, public utility facilities, fire and police stations, light industrial uses dependent on air transportation, and any other uses judged by the Board of Adjustment to be consistent with the airport's primary function. All planned uses of airport property must be consistent with applicable federal regulations.

Land use in the vicinity of the airport is a mixture of residential, commercial, industrial, and open space. To the immediate west of the airport is the unincorporated town of Dallesport with a 2007 population estimate of 1,239 residents. To the south are the Columbia River and the City of The Dalles. To the east are designated Open Space, Industrial Parks and General land uses. To the north is

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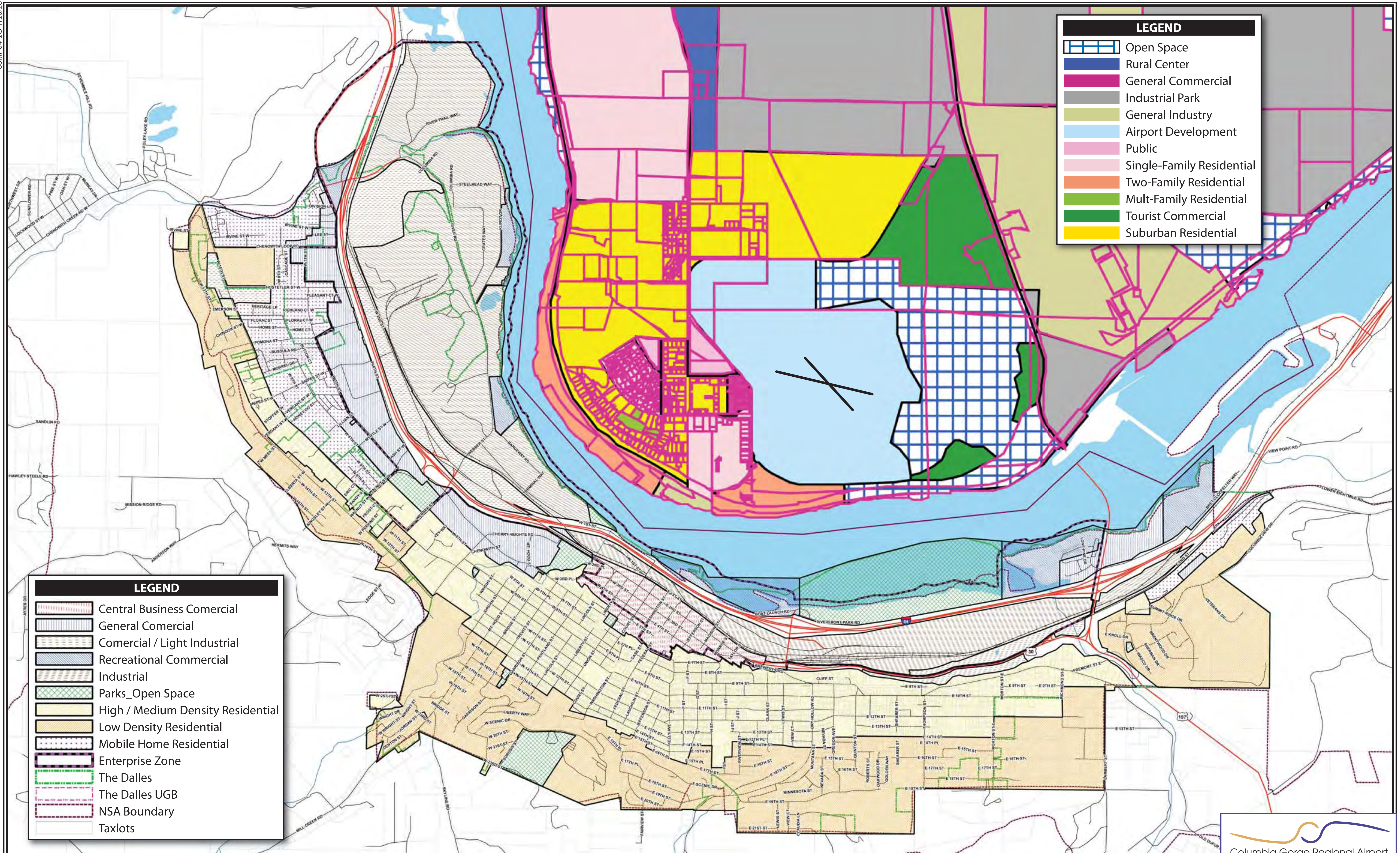

Exhibit 1G
AREA LAND USE ZONING

Suburban Residential, and Industrial Parks. A Tourist Commercial land use designation is located to the immediate northeast of the airport.

Section 2.17 of the Klickitat County Zoning Ordinance identifies the Airport Approach (AA) Zone. The purpose and function is to safeguard the public safety and welfare, and properties in, adjacent to, and surrounding the airport by placing height restrictions and other regulations. The AA zone is superimposed upon the zoning district and regulates the various types of potential airspace obstructions and other hazards which may interfere with safe airport operations. The definition of the AA zone is as follows:

- **AA Airport Approach Zones** - One foot in height for each 20 feet in horizontal distance beginning at a point 200 feet from and at the centerline elevation of the end of the runway and extending to a point 5,200 feet from the end of the runway; the AA approach zone is 250 feet wide at the point of beginning (200 feet past the end of the runway), broadening to 700 feet wide at a distance of 2,250 feet from the point of beginning, continuing at 700 feet wide from there to the end of the zone, this zone being bisected by the centerline of the runway.

Title 14 of the Code of Federal Regulations (CFR) Part 77, *Objects Affecting Navigable Airspace*, defines a series of imaginary surfaces surrounding airports. The imaginary surfaces consist of the approach zone, conical zones, transitional zones, and horizontal zones. Objects such as trees, towers, buildings, or roads which penetrate any of these surfaces may be considered by the FAA to be obstructions to safe air navigation. The AA zone generally conforms to these federal regulations.

PLANNED FUTURE LAND USE

The Columbia Gorge Regional Airport encompasses approximately 950 acres of property. The FAA requires that any airport property that could potentially be needed for long term aviation development be reserved. Typically, this includes property that could provide primary access to the runway and taxiway system.

WASHINGTON STATE LAND USE COMPATIBILITY

WSDOT Aviation assists local jurisdictions, airports, and other interests to protect public use airports from incompatible development by providing technical assistance and resources to support local decision-making. In 1996, the Washington State Legislature amended the *Washington State Growth Management Act* to require cities and counties to protect airports from incompatible development. Senate Bill 6422 was codified to RCW 35.63.250, 35A.63.270, 36.70.547, and 36.70A.510 to reflect these changes.

Through Washington State Senate Bill 6422, the state recognizes the inherent social and economic benefits of aviation. The law requires sponsors of public use airports to discourage the siting of land uses that are incompatible with the airport.

The property to the south of the terminal area has been planned as an airport industrial/business park. A binding site plan has been submitted to the county and is presented on **Exhibit 1H**. This site plan includes revisions based upon the recommended master plan concept presented in Chapter Five. The necessary revisions were identified during the alternatives analysis contained within Chapter Four.

Planning for the property to the east of the runway system, approximately 542 acres, includes a high-end golf course and resort facility. **Exhibit 1J** presents a draft of the concept. As can be seen, an 18-hole golf course is planned. The approach area leading to Runway 25 has been left as Open Space.

Three areas have been identified for residential development. The northernmost development area is planned for 145 single family homes. Just south of this is a planned community center and 22 attached villas (two residences per villa). Further to the south, west of the intersection of Dallesport Road and US Highway 197 is a complex of approximately 28 villas. On the bluff overlooking the Columbia River is a planned time-share complex containing 28 villas.

A vision for an on-airport executive hangar complex that provides access to the golf course clubhouse is also depicted on the exhibit. Several hangars are depicted, but much of the space is identified for transient aircraft parking. Under this vision, business executives could fly themselves and clients to the airport for business meetings that may include utilization of the golf course.

SERVICE AREA AND REGIONAL AIRPORTS

The proximity of other airports is largely the defining factor when describing an airport's service area. A review of public use airports in the region was made to identify and distinguish the types of air services provided in the region. Information pertaining to each airport was obtained from FAA Form 5010, *Airport Master Record*, as well as the web site www.airnav.com.

It is important to consider the capabilities and limitations of other airports when planning for future changes or improvements at Columbia Gorge Regional Airport. The following are those public use airports with asphalt or concrete runways that can serve general aviation aircraft. These airports are listed by their proximity to Columbia Gorge Regional Airport. **Table 1J** identifies the major characteristics of each airport.

Goldendale Municipal Airport (S20) is located 21 miles to the northeast of Columbia Gorge Regional Airport. Runway 7-25 is 3,491 feet long and constructed of asphalt. There are 10 based aircraft. There are no instrument approach procedures. Goldendale is a non-NPIAS airport.

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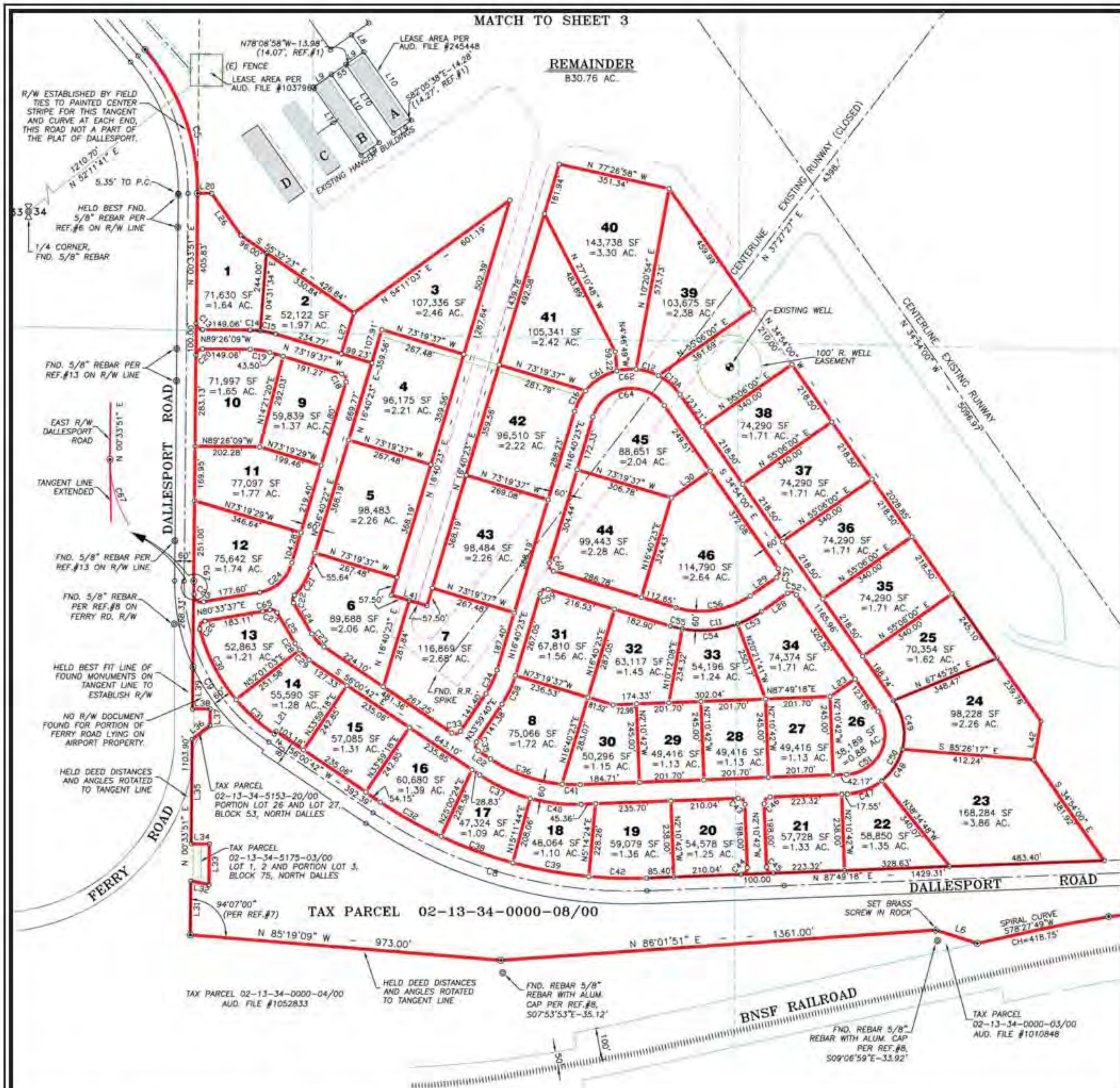

"BINDING SITE PLAN NO. BSP2007-01"

IN SECTIONS 26, 27, 28, 33, 34 AND 35,
TOWNSHIP 2 NORTH, RANGE 13 EAST, W.M.
DALLESPORT, KLICKITAT COUNTY, WASHINGTON

TENNESON ENGINEERING CORP.
CONSULTING ENGINEERS
3313 W. 2nd STREET, SUITE 100
THE DALLES, OREGON 97058
PH. 541-296-9177 FAX 541-296-6657

Survey	Calculation	Design	Date	Scale
B.R.H.	B.B.B.		3/16/2010	1"=200'
Drawn	**DWG. No.**	**Checked & App.**	**Work Order No.**	**Sheet**
S.D.H.	12694binding		12694	9 of 12

DATED THIS ______ DAY OF ______________, 20____.
BINDING SITE PLAN FILED FOR RECORD AT THE REQUEST OF BENJAMIN B. BESEDA THIS ____ DAY OF __________, 20____, AT ________ AND RECORDED IN VOLUME ____ OF BINDING SITE PLANS, PAGE ____ RECORDS OF KLICKITAT COUNTY.

KLICKITAT COUNTY AUDITOR AUDITOR NO.

LEGEND:

- SET 5/8"ø X 30" REBAR WITH YELLOW PLASTIC CAP, "B BESEDA PLS 35092"
- FOUND MONUMENTS, AS NOTED.
- CALCULATED CORNERS, NOT SET.
- SET HUB & TACK.
- SET P.K. NAIL OR AS NOTED.
- SET BRASS SCREW AND WASHER, "PLS #35092"
- EXISTING FENCE LINE.

0' 100' 200' 400'
SCALE IN FEET

FOR REVIEW ONLY

BENJAMIN B. BESEDA — STATE OF WASHINGTON — 35092 — REGISTERED PROFESSIONAL LAND SURVEYOR

OFFICE COPY

Columbia Gorge Regional Airport

Exhibit 1H
PROPOSED BUSINESS PARK

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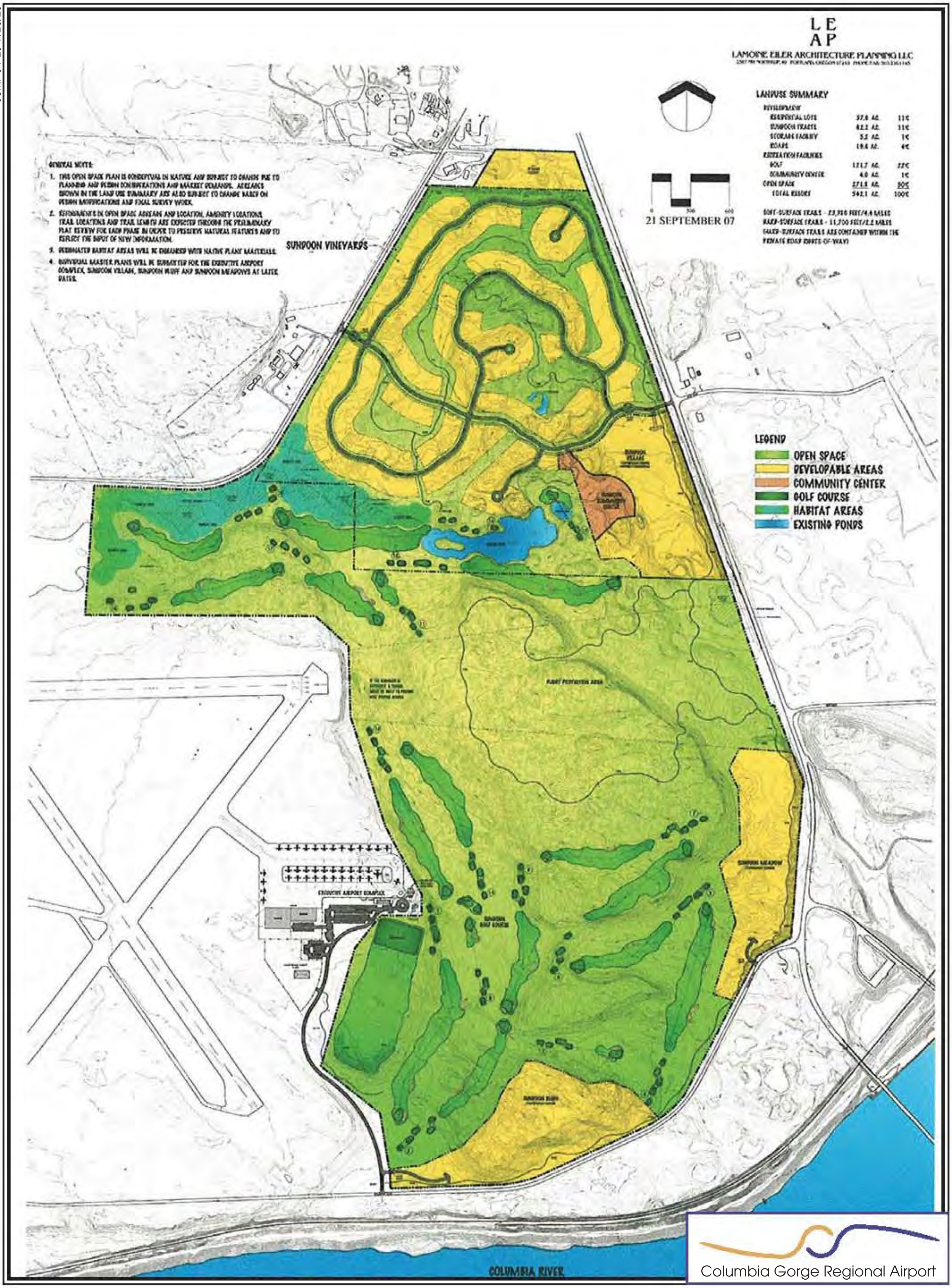


Exhibit 1J
PROPOSED
GOLF COURSE/RESORT

TABLE 1J
Public-Use Airport in the Columbia Gorge Region

Airport Name	Distance (miles)	Type	Longest Runway	Based Aircraft	Annual Ops	Services	IAP
Goldendale (S20)	21 NE	GA	3,491	10	5,100	Tie-downs; No fuel	No
Yakima Air Terminal (YKM)	72 NE	Comm.	7,604	162	50,000	Full GA	Yes
Ken Jernstedt (4S2)	16 W	GA	3,040	91	14,000	Avgas, maintenance, tie-downs	No
Wasco State (35S)	24 E	GA	3,450	6	2,400	Tie-downs; No fuel	No
Cascade Locks (CZK)	35 W	GA	1,800	0	1,500	Tie-downs; No fuel	No
Condon State (3S9)	48 SE	GA	3,500	11	3,800	Tie-downs; No fuel	No
Madras (S33)	65 S	GA	5,089	52	10,600	Full GA	Yes
Troutdale (TTD)	60 W	Reliever	5,399	154	105,000	Full GA	Yes

Source: www.airnav.com as accessed on 10-16-09

Yakima Air Terminal (YKM) is located 72 miles to the northeast. Yakima is a commercial service airport with a control tower. Horizon Air provides four flights per day to Seattle. The primary runway, Runway 9-27, is 7,604 feet long, and the crosswind runway, Runway 4-22, is 3,835 feet long. There are 162 based aircraft, including four jets. There are several instrument approach procedures including an ILS approach to Runway 27 that offers visibility minimums not lower than ½-mile.

Ken Jernstedt Airfield Airport (4S2) is located 16 miles to the west of Columbia Gorge Regional Airport. Runway 7-25 measures 3,040 feet in length, and there are 91 based aircraft. The airport offers Avgas, but Jet A fuel is not available. There are no instrument approaches.

Wasco State Airport (35S) is owned by the State of Oregon and is 24 miles to the east of Columbia Gorge Regional Airport. Wasco State Airport is within Sherman County, Oregon and is approximately 110 miles east of Portland. It serves the City of Wasco (year 2000 population of 381), a rural agricultural town in north central Oregon. The airport offers a 3,450-foot long asphalt runway. There are six single engine piston powered aircraft based at the airport. There is not an on-site manager or FBO, and fuel is not available. There are no published instrument approaches.

Cascade Locks State Airport (CZK) is located in Hood River County, Oregon, approximately 35 miles to the west of Columbia Gorge Regional Airport. Cascade Locks is not a NPIAS airport and is therefore not eligible for federal development grants. The runway is 1,800 feet in length and constructed of asphalt. There is no airport FBO or on-site management. There are no based aircraft. This airport primarily serves to provide access to the Columbia Gorge National Scenic Area and to provide air ambulance service as needed.

Condon State Pauling Field Airport (3S9) is 48 miles to the east-southeast of Columbia Gorge Regional Airport. It offers a 3,500-foot long concrete runway. The airport is owned by the state of Oregon and is home to 11 based single engine planes. There are no instrument approaches to the airport.

Madras Municipal Airport (S33) is approximately 65 miles south of The Dalles. Madras provides a two runway system with the longest runway being 5,089 feet in length. There are 52 based aircraft. The airport has a full service FBO offering both fuel types, aircraft parking, aircraft rental, minor maintenance, and aerial tours. They have a circling GPS instrument approach.

Portland-Troutdale Airport (TTD) is located on the eastern development ring of Portland, approximately 60 miles to the west of Columbia Gorge Regional Airport. Runway 7-25 is 5,399 feet long and constructed of asphalt. The airport is owned by the Port of Portland and provides an airport traffic control tower. It is estimated that there are 154 based aircraft, including two jets, 14 multi-engine, and nine helicopters. The airport experiences approximately 75,000 annual operations. One instrument approach is available, a GPS or NDB circling approach with visibility minimums not lower that 1¼-mile. The airport also has a full service FBO. Troutdale is nine miles to the east of Portland International Airport, and often experiences delays due to commercial traffic utilizing PDX.

The south parallel taxiway is planned to be relocated in order to meet FAA separation distance requirements. This will necessitate the removal of several T-hangar structures and one conventional hangar. It is estimated that 25 existing covered hangar positions will be lost in the short term. The airport has plans to replace these hangars with new hangars at another location on the field.

AIRPORT SERVICE AREA

The airport service area is a baseline geographical area from which future aviation demand (particularly based aircraft) is most likely to originate. Columbia Gorge Regional Airport is located in the state of Washington on the border with Oregon. Therefore, the service area will include portions of both states.

Different service areas for an airport can be defined for operators of smaller piston powered aircraft versus operators of larger turboprop and business jet aircraft. The Columbia Gorge Regional Airport is capable of accommodating most aircraft in the general aviation fleet, including the largest business jets on a limited basis. The closest airports that can also accommodate business jets are Yakima to the northeast (72 miles), Tri-Cities to the east (140 miles), Madras to the south (65 miles), and Portland to the west (69 miles). All of these are more than 60 miles away. At the same time, business jet operators are generally located in business centers. Therefore, the size or extent of the service area is not as important as the economy of the primary business center, which in this case, is The Dalles.

Owners of smaller piston powered aircraft have more choices. Jernstedt would limit the westward service area. Goldendale and Wasco State could limit the eastward service area. There is no comparable general aviation airport within 40 miles to the south as this is a sparsely populated area. Since none of these airports offer the full range of general aviation services that Columbia Gorge Regional Airport does, the service area would overlap with these airports to a certain extent.

Exhibit 1K presents a generalized service area for the Columbia Gorge Regional Airport. The service area would, at a minimum, include all of Klickitat County in Washington and Wasco County in Oregon. The distances to other airports with similar capabilities is so great in all directions that Columbia Gorge Regional Airport is somewhat unencumbered from attracting new based aircraft if facilities are available. This is evidenced by the fact that all the new hangars are currently full.

AIRPORT CAPITAL IMPROVEMENT HISTORY

As a NPIAS airport, Columbia Gorge Regional Airport is eligible for Federal Airport Improvement Program (AIP) grants as administered by the FAA. Over the last several years the FAA has participated in capital projects at the airport. The major projects have included the installation of airfield guidance signage including extension of electricity for lighting purposes. New runway lighting was installed on Runway 7-25 and replacement runway edge lighting was installed on Runway 12-30. The FAA is also participating in this master plan study.

Both the Oregon Department of Aviation and the Washington Aviation Department participate in development projects at the airport. Although the airport was not sponsored by a Washington entity until the year 2000 when Klickitat County joined in partnership with The Dalles, Oregon, the State of Washington has participated in development projects since the early 1970s. **Table 1K** presents the various development grants accepted by the airport since 2000.

TABLE 1K Recent Development Grants Columbia Gorge Regional Airport			
Year	**Source**	**Project**	**Total**
2000	PMP-Oregon	Pavement Rehab	$39,660
2000	Washington	Replace MIRL Runway 12-30	$8,000
2001	FAM-Oregon	Terminal building improvement for ADA compliance	$10,000
2002	Washington	Directional Signs, Reflectors, Striping	$4,111
2003	FAA Grant 16 Administered by Oregon	Install Runway 12-30 MIRL (phase 1)	$450,000 ($405,000 from FAA)
2004	FAA Grant 18 Administered by Oregon	Runway 12-30 rehab, MIRL (phase 1), MIRL Runway 7-25 (phase 1)	$194,737 ($185,000 from FAA)
2004	PMP-Oregon	Pavement Rehab	$52,426 ($5,242 from FAA)
2004	Washington	Water and Sewer Line Extension	$18,000
2005	FAA AIP Entitlement	Install Airfield Guidance Signs	$100,000
2005	FAA AIP Entitlement	Update Master Plan	$25,000
2005	FAA AIP Entitlement	Install Airfield Guidance Signs	$79,610
2005	FAA AIP Entitlement	Install Runway Lighting	$80,000
2005	FAA Grant 20- Administered by Oregon	Pavement Rehab	$230,303 ($23,030 from FAA)
2006	FAM-Oregon	Water and sewer to hangars	$15,000
2007	Washington	Security Camera System	$4,750
2008	PMP-Oregon	Pavement Rehab	$18,223 ($1,822 from FAA)
2008	Washington	Radios, Signs, Flashing Beacon	$2,500
2009	FAA AIP Entitlement	Update Master Plan	$150,000
2009	FAA AIP Entitlement	Update Master Plan	$75,000

PMP: Pavement management program
FAM: Financial Aid to Municipalities
FAA: Federal Aviation Administration
AIP: Airport Improvement Program
MIRL: Medium intensity runway lighting

Source: Federal grants from www.subsidyscope.com, state grants from Oregon and Washington

ENVIRONMENTAL INVENTORY

A review of the potential environmental impacts associated with proposed airport projects is an essential consideration in the Airport Master Plan process. The intent of this inventory is to identify potential environmental sensitivities or resources that might affect future improvements at the airport. The information contained in this section was obtained from internet resources, agency maps, and existing literature.

Research was conducted for each of the 23 environmental impact categories described within the FAA's *Environmental Desk Reference for Airport*

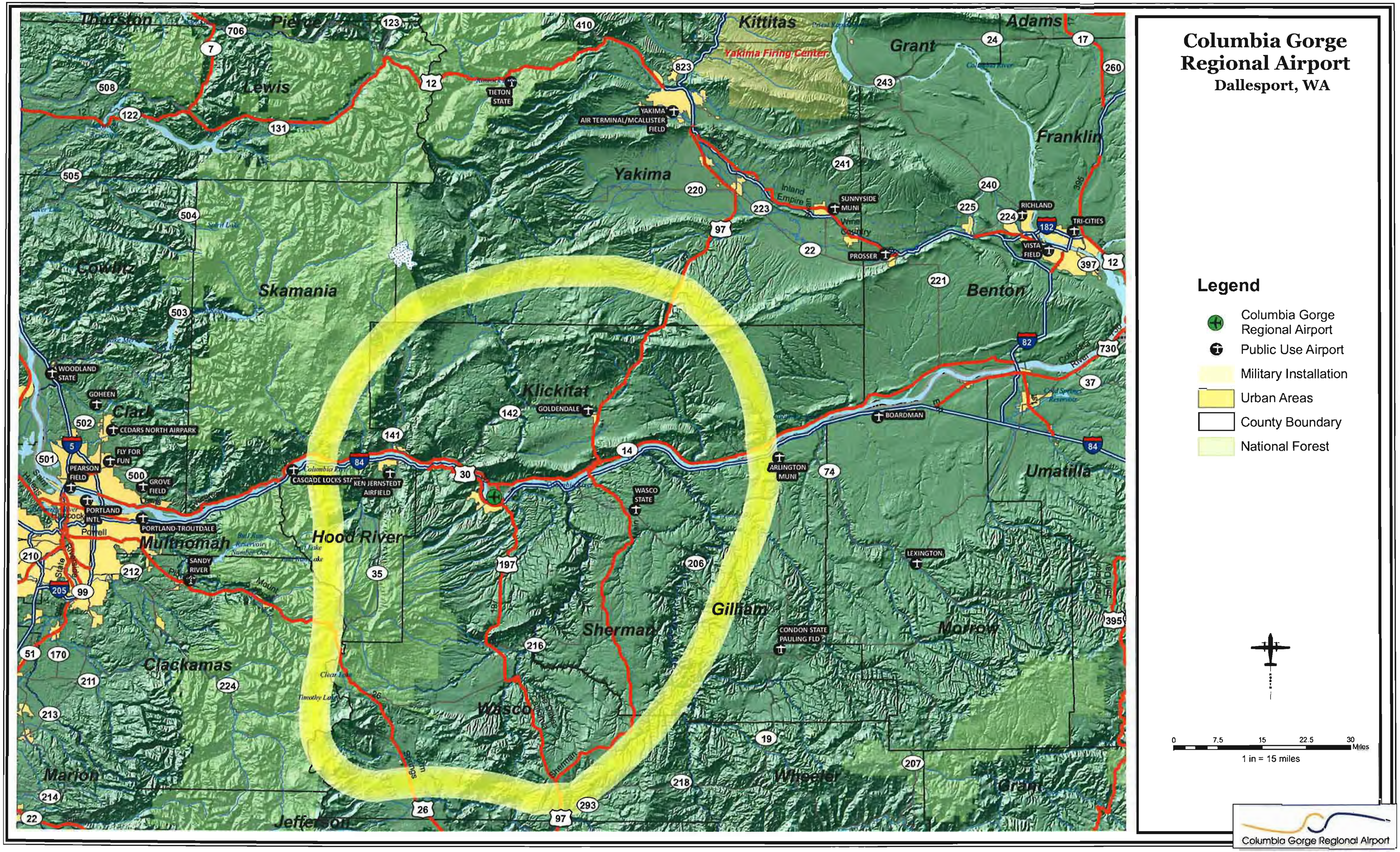


Exhibit 1K
AIRPORT SERVICE AREA

Actions. It was determined that the following resources are not present with the airport environs or cannot be inventoried:

- Resources Not Present
  - Coastal Resources (Coastal Barriers and Coastal Zones) – the airport is inland and not subject to any coastal restrictions.
  - Wild and Scenic Rivers – no federally designated wild or scenic rivers are located in proximity to the airport.
- Resources that were not inventoried
  - Construction Impacts
  - Energy Supply and Natural Resources
  - Noise
  - Social Impacts

The following sections provide a discussion of the remaining resource categories.

Air Quality

The U.S. Environmental Protection Agency (EPA) has adopted air quality standards that specify the maximum permissible short-term and long-term concentrations of various air contaminants. The National Ambient Air Quality Standards (NAAQS) consist of primary and secondary standards for six criteria pollutants which include: Ozone (O_3), Carbon Monoxide (CO), Sulfur Dioxide (SO_2), Nitrogen Oxide (NO), Particulate matter (PM_{10} and $PM_{2.5}$), and Lead (Pb). Various levels of review apply within both *National Environmental Policy Act* (NEPA) and permitting requirements. Potentially significant air quality impacts associated with an FAA project or action would be demonstrated by the project or action exceeding one or more of the NAAQS for any of the time periods analyzed.

According to the EPA's Greenbook, Klickitat County is in attainment for all criteria pollutants.[1]

Compatible Land Use

The compatibility of existing and planned land uses in the vicinity of an airport is usually associated with the extent of the airport's noise impacts. Typically, significant impacts will occur over noise-sensitive areas within the 65 DNL noise contour.

Land uses to the north-northeast, east, and south of the airport are undeveloped. The area immediately south of the airport is also undeveloped and beyond the undeveloped area is the Columbia River. West of the airport is the community of Dallesport, which primarily consists of residential land uses located on the west side of Dallesport Road. Additionally, industrial and commercial land uses are located along Dallesport Road within the vicinity of the airport. Immediately west of the airport on the east side of Dallesport Road is an undeveloped area planned for an airport business park.

Compatible land use also addresses nearby features that could pose a threat to safe aircraft operations by

[1] Environmental Protection Agency's (EPA) Greenbook, http://www.epa.gov/oar/oaqps/greenbk/, accessed November 2009

attracting wildlife (e.g., landfills and ponds). Located approximately one mile northeast of the airport is a solid waste transfer station that accepts solid and household hazardous waste; however, no solid or household hazardous waste is permanently stored at the site. Wetland areas, which may contain water, are located along the northern edge of the property. Additionally, as previously discussed, the Columbia River is located south and west of the airport. There are no data available regarding the past or present potential of wildlife hazards from any of these sources.

Department of Transportation: Section 4(f)

Section 4(f) properties include publicly owned land from a public park, recreational area, or wildlife and waterfowl refuge of national, state, or local significance; or any land from a historic site of national, state, or local significance.

The airport is surrounded by the Columbia River Gorge National Scenic Area which provides a wide range of recreation opportunities. No wildlife or waterfowl refuges are located in proximity to the airport. Further discussion regarding historic sites can be found later in this section.

Farmland

Under the *Farmland Protection Policy Act* (FPPA), federal agencies are directed to identify and take into account the adverse effects of federal programs on the preservation of farmland, to consider appropriate alternative actions which could lessen adverse effects, and to assure that such federal programs are, to the extent practicable, compatible with state or local government programs and policies to protect farmland. The FPPA guidelines developed by the U.S. Department of Agriculture (USDA) apply to farmland classified as prime or unique, or of state or local importance as determined by the appropriate government agency, with concurrence by the Secretary of Agriculture.

Information obtained from the Natural Resource Conservation Service's (NRCS) Web Soil Survey indicates soils of statewide importance are located throughout the airport property except for the western portions near the terminal area. The northern portion of the terminal area is classified as prime farmland if irrigated and the southern portion is classified as not prime farmland. The important farmlands are depicted on **Exhibit 1L**.

Fish, Wildlife, and Plants

A number of regulations have been established to ensure that projects do not negatively impact protected plants, animals, or their designated habitat. Section 7 of the *Endangered Species Act* (ESA), as amended, applies to federal agency actions and sets forth requirements for consultation to determine if the proposed action may affect a federally endangered or threatened species. The *Sikes Act* and various amendments authorize states to prepare statewide wildlife conservation plans for resources under their jurisdiction.

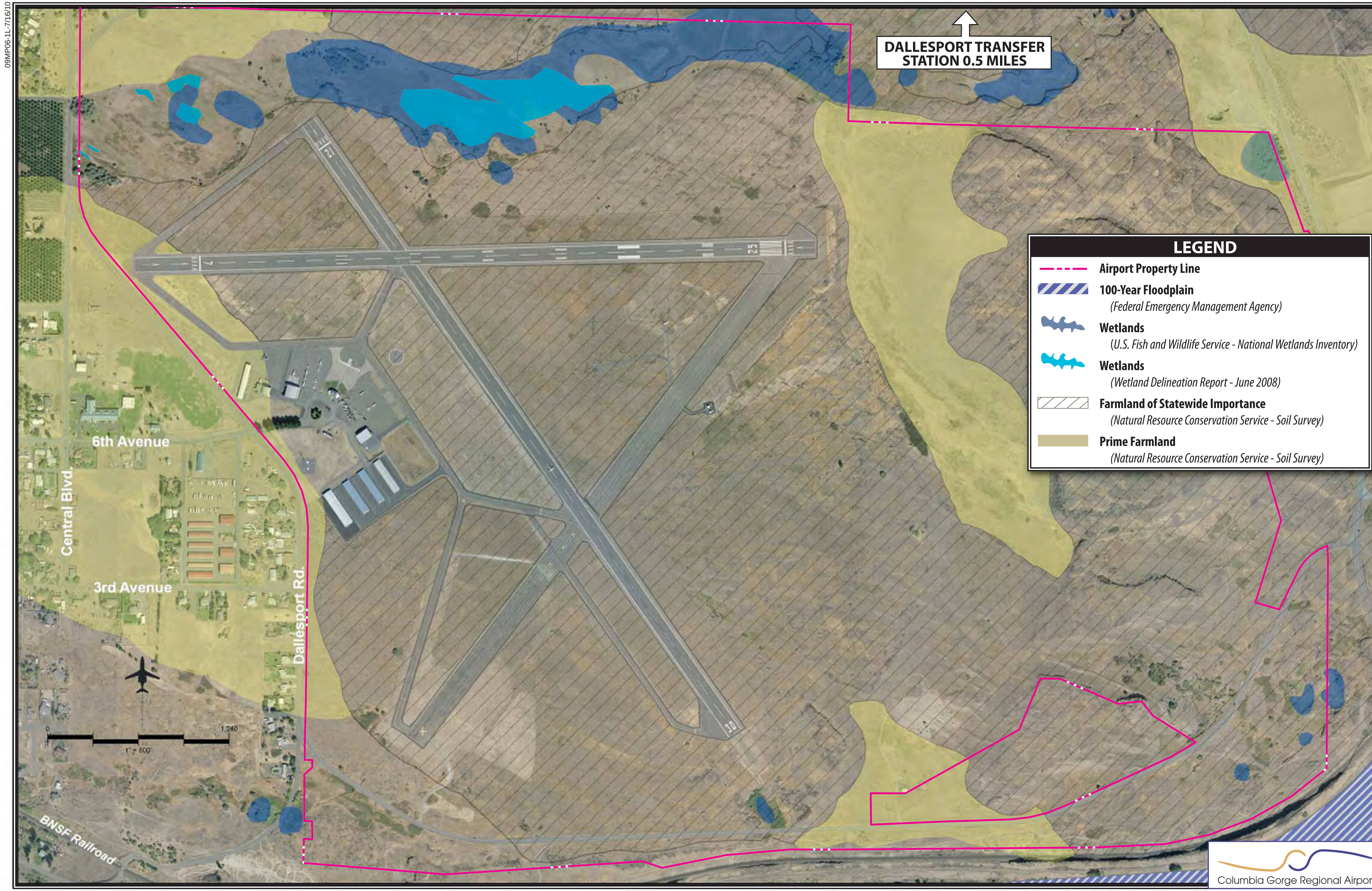


Exhibit 1L
ENVIRONMENTAL SENSITIVITIES

According to the U.S. Fish and Wildlife Service Upper Columbia Fish and Wildlife Office website, there are three species that are federally listed as threatened or endangered in Klickitat County. In addition, the Washington Department of Fish and Wildlife lists an additional 41 species that are either threatened or endangered for the entire state. These are listed in **Table 1L**.

TABLE 1L
State and Federally Listed Threatened or Endangered Species in Klickitat County, Washington

Common Name	Species	Federal Status	State Status
Ferruginous hawk	*Buteo regalis*	-	Threatened
Marbled murrelet	*Brachyramphus marmoratus*	-	Threatened
Sage grouse	*Centrocercus urophasianus*	-	Threatened
Sharp-tailed grouse	*Tympanuchus phasianellus*	-	Threatened
Lynx	*Lynx Canadensis*	-	Threatened
Mazama (Western) pocket gopher	*Thomomys mazama*	-	Threatened
Steller sea lion	*Eumetopias jubatus*	-	Threatened
Western gray squirrel	*Sciurus griseus*	-	Threatened
Green sea turtle	*Chelonia mydas*	-	Threatened
Loggerhead sea turtle	*Caretta caretta*	-	Threatened
Ferruginous hawk	*Buteo regalis*	-	Threatened
Marbled murrelet	*Brachyramphus marmoratus*	-	Threatened
Sage grouse	*Centrocercus urophasianus*	-	Threatened
Sharp-tailed grouse	*Tympanuchus phasianellus*	-	Threatened
Northern leopard frog	*Rana pipiens*	-	Endangered
Oregon spotted frog	*Rana pretiosa*	-	Endangered
American white pelican	*Pelecanus erythrorhynchos*	-	Endangered
Brown pelican	*Pelecanus occidentalis*	-	Endangered
Sandhill crane	*Grus Canadensis*	-	Endangered
Oregon spotted frog	*Rana pretiosa*	-	Endangered
American white pelican	*Pelecanus erythrorhynchos*	-	Endangered
Brown pelican	*Pelecanus occidentalis*	-	Endangered
Sandhill crane	*Grus Canadensis*	-	Endangered
Oregon spotted frog	*Rana pretiosa*	-	Endangered
American white pelican	*Pelecanus erythrorhynchos*	-	Endangered
Brown pelican	*Pelecanus occidentalis*	-	Endangered
Sandhill crane	*Grus Canadensis*	-	Endangered
Oregon spotted frog	*Rana pretiosa*	-	Endangered
American white pelican	*Pelecanus erythrorhynchos*	-	Endangered
Fin whale	*Baleonoptera physalus*	-	Endangered
Fisher	*Martes pennant*	-	Endangered
Gray wolf	*Canis lupus*	Endangered	Endangered
Grizzly bear	*Ursus arctos*	-	Endangered
Humpback whale	*Megaptera novaeangliae*	-	Endangered
Killer whale	*Orcinus orca*	-	Endangered
Pygmy rabbit	*Brachylagus idahoensis*	-	Endangered
Sea otter	*Enhydra lutris*	-	Endangered
Sei whale	*Baleonoptera borealis*	-	Endangered
Sperm whale	*Physeter macrocephalus*	-	Endangered
Woodland caribou	*Rangifer tarandus*	-	Endangered
Leatherback sea turtle	*Dermochelys coriacea*	-	Endangered
Western pond turtle	*Actinemys marmorata*	-	Endangered
Bull trout	*Salvelinus confluentus*	Threatened	-
Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened	-

Source: USFWS online listed species database, http://www.fws.gov/easternwashington/species/countySppLists.html, accessed November 2009
Washington Department of Fish and Wildlife, http://wdfw.wa.gov/wildlife/management/endangered.html

Several of the listed species are unlikely to be present at the airport due to absence of suitable habitat. Species unlikely to be present at the airport include the sea lion, sea turtle, sea otter, and whale species which require aquatic habitat. Field surveys of the airport would be necessary to determine the potential presence of the remaining listed species.

Floodplains

Executive Order 11988 directs federal agencies to take action to reduce the risk of flood loss, minimize the impact of floods on human safety, health, and welfare, and restore and preserve the natural and beneficial values served by the floodplains.

A review of Federal Emergency Management Agency (FEMA) floodplain information indicates the airport is located outside of the 100-year floodplain. Immediately south of the airport, the area along the Columbia River is designated as 100-year floodplain, as indicated on **Exhibit 1L**.

Hazardous Materials, Pollution Prevention, and Solid Waste

Federal, state, and local laws regulate hazardous materials use, storage, transport, and disposal. These laws may extend to past and future landowners of properties containing these materials. In addition, disrupting sites containing hazardous materials or contaminates may cause significant impacts to soil, surface water, groundwater, air quality, and the organisms using these resources.

The EPA's *Enviromapper for Envirofacts* was consulted regarding the presence of impaired waters or regulated hazardous sites. According to the EPA *Enviromapper*, there are no known impaired waters or hazardous sites at the airport. The website indicates that the Dallesport Transfer Station, a solid waste management facility, located immediately northeast of the airport, is subject to EPA regulation. The location of the transfer station is depicted on **Exhibit 1L**.

Historical, Architectural, and Cultural Resources

Determination of a project's environmental impact to historic and cultural resources is made under guidance in the *National Historic Preservation Act* (NHPA) *of 1966*, as amended, the *Archaeological and Historic Preservation Act* (AHPA) *of 1974*, the *Archaeological Resources Protection Act* (ARPA), and the *Native American Graves Protection and Repatriation Act* (NAGPRA) *of 1990*. In addition, the *Antiquities Act of 1906*, the *Historic Sites Act of 1935*, and the *American Indian Religious Freedom Act of 1978* also protect historical, architectural, archaeological, and cultural resources. Impacts may occur when the proposed project causes an adverse effect on a property which has been identified (or is unearthed during construction) as having historical, architectural, archaeological, or cultural significance. In Washington, the Department of

Archaeology and Historic Preservation has oversight over laws and regulations regarding historical, architectural, archeological and cultural resources.

A review of the Washington Department of Archaeology and Historic Preservation indicates that there are no known or previously recorded significant archaeological sites on airport property[2].

Light Emissions and Visual Impacts

Airport lighting is characterized as either airfield lighting (i.e., runway, taxiway, approach and landing lights) or landside lighting (i.e., security lights, building interior lighting, parking lights, and signage). Generally, airport lighting does not result in significant impacts unless a high intensity strobe light, such as a Runway End Identifier Lighting (REIL), would produce glare on any adjoining site, particularly residential uses.

The existing light features of the airport are described in detail previously in this chapter.

Environmental Justice Areas

Environmental justice can be defined as ensuring that an action does not unfairly impact a minority race or families living under the poverty level. The EPA's *Environmental Justice Geographic Assessment Tool* was consulted regarding the presence of environmental justice areas within the airport environs. According to this resource, areas surrounding the airport do not include high percentages of low income or minority populations.

Water Quality

The *Clean Water Act* provides the authority to establish water quality standards, control discharges, develop waste treatment management plans and practices, prevent or minimize the loss of wetlands, and regulate other issues concerning water quality. Water quality concerns related to airport development most often relate to the potential for surface runoff and soil erosion, as well as the storage and handling of fuel, petroleum products, solvents, etc.

The Columbia River is located immediately south of the airport. This river is not considered impaired, and is not in violation of established water quality standards.

Congress mandates (under the *Clean Water Act*) implementation of the National Pollutant Discharge Elimination System (NPDES). This program addresses non-agricultural storm water discharges. Through the use of NPDES permits, certain procedures are required to prevent contamination of water bodies from storm water runoff. The EPA can delegate this permit authority to individual states. In Washington, the Washington Depart-

[2] Washington Department of Archaeology and Historic Preservation, http://www.dahp.wa.gov/pages/wisaardIntro.htm, accessed November 2009

ment of Ecology administers the NPDES program.

Wetlands

The U.S. Army Corps of Engineers regulates the discharge of dredged and/or fill material into waters of the United States, including adjacent wetlands, under Section 404 of the *Clean Water Act*. Wetlands are defined in Executive Order 11990, *Protection of Wetlands*, as "those areas that are inundated by surface or groundwater with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetation or aquatic life that requires saturated or seasonably saturated soil conditions for growth and reproduction." Wetlands can include swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflows, mud flats, natural ponds, estuarine areas, tidal overflows, and shallow lakes and ponds with emergent vegetation. Wetlands exhibit three characteristics: the soil is inundated or saturated to the surface at some time during the growing season (hydrology), has a population of plants able to tolerate various degrees of flooding or frequent saturation (hydrophytes), and soils that are saturated enough to develop anaerobic conditions during the growing season (hydric).

The National Wetlands Inventory, managed by the U.S. Fish and Wildlife Service, indicates presence of several wetland features north of Runway 7-25. In 2008, 120 acres of the airport, including the area north of Runway 7-25, was surveyed for wetlands. The survey report, prepared by Mark Yinger Associates, confirms the presence of features meeting the U.S. Army Corps of Engineers' definition of wetlands. Additionally, the National Wetlands Inventory indicates the presence of a wetland feature located southwest of Runway 12-30 along the extended runway centerline. The location of wetlands is depicted on **Exhibit 1L**.

SUMMARY

The information discussed in this inventory chapter provides a foundation upon which the remaining elements of the planning process will be constructed. Information on current airport facilities and utilization will serve as a basis, with additional analysis and data collection, for the development of forecasts of aviation activity and facility requirement determinations.

DOCUMENT SOURCES

As mentioned earlier, a variety of different sources were utilized in the inventory process. The following listing reflects a partial compilation of these sources. This does not include data provided by airport management as part of their records, nor does it include airport drawings and photographs which were referenced for information. On-site inventory and interviews with staff and tenants contributed to the inventory effort.

Airport/Facility Directory, Northwest U.S., U.S. Department of Transportation, Federal Aviation Administration, National Aeronautical Charting Office, expires 22 October, 2009.

Seattle Sectional Aeronautical Chart, U.S. Department of Transportation, Federal Aviation Administration, National Aeronautical Charting Office, expires 19 December 2009.

National Plan of Integrated Airport Systems (NPIAS), U.S. Department of Transportation, Federal Aviation Administration, 2009-2013.

U.S. Terminal Procedures, Northwest, U.S. Department of Transportation, Federal Aviation Administration, National Aeronautical Charting Office, expires 22 October 2009.

Columbia Gorge Regional Airport Layout Plan Report (2004-2024). Century West Engineering, et.al.

2010 Complete Economic and Demographic Data Source (CEDDS). Woods & Poole Economics, Washington, D.C.

The Dalles Comprehensive Land Use Plan. May 2007 Draft. Prepared by Winterbrook Planning.

Population Forecasts For The Dalles, Memo Dated May 2006. Prepared by ECONorthwest.

City of The Dalles: Economic Opportunities Analysis, prepared by ECONorthwest, April 2007.

Oregon Aviation Plan 2007. Oregon Department of Aviation. Accessed on September 9, 2009:
http://www.aviation.state.or.us/Aviation/index.shtml

Klickitat County Zoning Ordinance No. 62678, as amended. Accessed on September 9, 2009:
http://www.klickitatcounty.org/planning/

GorgeTransLink. Accessed on September 9, 2009:
http://www.gorgetranslink.com/

Wasco County Planning Department Accessed on September 9, 2009:
http://co.wasco.or.us/planning/planhome.html

Columbia Gorge Economic Development Association. Accessed on September 9, 2009:
http://www.cgeda.com/default.shtml

Mid-Columbia Economic Development District. Accessed on September 9, 2009:
http://www.mcedd.org/index.htm

Mid-Columbia Council of Governments. Accessed on September 9, 2009: http://www.mccog.com/

A number of websites were also used to collect information for the inventory chapter. These include the following:

FAA 5010 Airport Master Record Data:
www.airnav.com

U.S. Census Bureau:
www.census.gov

The City of The Dalles. Accessed on September 9, 2009:
http://www.ci.the-dalles.or.us/

Bureau of Economic Analysis, U.S. Department of Commerce: http://www.bea.gov/bea/regional/data.htm

GCR and Associates. Accessed on September 3, 2009: http://www.airportiq.com/default.htm

Columbia Gorge Regional Airport

Chapter Two

FORECASTS

FORECASTS

Columbia Gorge Regional Airport

An important factor when planning the future needs of an airport involves a definition of aviation demand that may reasonably be expected to occur in both the near term (five years) and long term (20 years). For a general aviation airport such as Columbia Gorge Regional Airport (DLS), forecasts of based aircraft and operations (takeoffs and landings) serve as the basis for facility planning.

The Federal Aviation Administration (FAA) has oversight responsibility to review and approve aviation forecasts developed in conjunction with airport planning studies. The FAA reviews such forecasts with the objective of comparing them to the FAA *Terminal Area Forecasts* (TAF) and the *National Plan of Integrated Airport Systems* (NPIAS). In addition, aviation activity forecasts are an important input to the benefit-cost analyses associated with some airport development projects.

FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems*, dated December 4, 2004, says forecasts should be:

- Realistic
- Based on the latest available data
- Reflective of current conditions at the airport
- Supported by information in the study
- Able to provide adequate justification for airport planning and development

The forecast process for an airport master plan consists of a series of basic steps that can vary depending upon the issues to be addressed and the level of effort required to develop

the forecast. The steps include a review of previous forecasts, determination of data needs, identification of data sources, collection of data, selection of forecast methods, preparation of the forecasts, and evaluation and documentation of the results.

FAA Advisory Circular (AC) 150/5070-6B, *Airport Master Plans*, outlines six standard steps involved in the forecast process, including:

1) Obtain existing FAA and other related forecasts for the area served by the airport.

2) Determine if there have been significant local conditions or changes in the forecast factors.

3) Make and document any adjustments to the aviation activity forecasts.

4) Where applicable, consider the effects of changes in uncertain factors affecting demand for airport services.

5) Evaluate the potential for peak loads within the overall forecasts of aviation activity.

6) Monitor actual activity levels over time to determine if adjustments are necessary in the forecasts.

Aviation activity can be affected by many influences on the local, regional, and national levels, making it virtually impossible to predict year-to-year fluctuations of activity over 20 years with any certainty. Therefore, it is important to remember that forecasts are to serve only as guidelines, and planning must remain flexible enough to respond to a range of unforeseen developments.

The following forecast analysis for Columbia Gorge Regional Airport was produced following these basic guidelines. Existing forecasts, including the *2004 Airport Layout Plan Report*, are examined and compared against current and historic activity. The historical aviation activity is then examined along with other factors and trends that can affect demand. The intent is to provide an updated set of aviation-demand projections for Columbia Gorge Regional Airport that will permit the airport to make planning adjustments as necessary to maintain a viable, efficient, and cost-effective facility.

SOCIOECONOMIC CHARACTERISTICS

A variety of historical and forecast socioeconomic data has been collected for use in various elements of this master plan. This information provides essential background information for use in determining aviation service level requirements. Aviation forecasts are related to the population base and the economic strength of the region; therefore, it is necessary to have an understanding of socioeconomic outlook for the airport service area. As discussed in the previous chapter, the primary service area for the airport includes all of Klickitat and Wasco counties.

This section will present baseline statistical information related to socioeconomic indicators such as population, employment, and income. With this information, analysis will be undertaken to develop forecasts of future aviation that can be reasonably expected at Columbia Gorge Regional Airport.

Population is one of the most important elements to consider when planning for the future needs of the airport. Several sources were examined for population data including the U.S. Census Bureau, demographics produced by the respective states, and Woods & Poole Economics.

It is preferable to utilize local or regional data when it is available. For the City of The Dalles, several studies have been produced in conjunction with an update to the Comprehensive Plan. These studies include *City of The Dalles: Economic Opportunities Analysis*, prepared by ECONorthwest, April 2007, and *Population Forecasts for The Dalles*, dated May 2006, prepared by ECONorthwest. The Comprehensive Plan, utilizing the findings by ECONorthwest, was prepared by Winterbrook Planning.

ECONOMIC BASELINE

The economy of the Mid-Columbia Region is primarily rural in nature, and land use is predominantly agricultural. Wasco County's principal industries are agriculture (cereal grains, sweet cherries, apples, and livestock), lumber, manufacturing, electric power generation, transportation, and aluminum manufacturing. Wheat is the dominant field crop on the 190,000 acres of non-irrigated cropland. Of the 38,000 acres of irrigated land in the county, most are devoted to cherry orchards.

Wasco County, founded in 1854, covers an area of 2,396 square miles or 1,523,840 acres and contains six incorporated communities. It was named for the Wasco (or Wascopam) Indian tribe. Wasco County, Oregon had an estimated 2006 population of 23,712, down from 23,791 in 2000. The county seat is the City of The Dalles, with a population in 2000 of 12,156 making up 51.1% of the county's total population. Per capita personal income for Wasco County in 2004 was $24,958, under statewide and national figures of $30,561 and $33,050.

The major agricultural product of the City is sweet cherries. The Dalles is a producer for both domestic and overseas markets. There are in excess of 6,000 acres of sweet cherry trees around the City. Wheat is another important agricultural product with 50,000 acres currently in cultivation in The Dalles area. Additional agricultural products include cattle, hay, and fruits.

The City is a strategic home base for year-round recreation. Water sport enthusiasts will find boating, excellent fishing, and one of the finest wind surfing areas in the United States on the Columbia River. To the east are substantial opportunities to camp, fish, hike, and sightsee. To the west, ski enthusiasts have the opportunity to challenge the ski slopes of Mt. Hood where there are numerous resorts.

Klickitat County, Washington shares a similar economy to that of Wasco County, Oregon with the economy being dominated by agricultural industries. The leading agricultural products are wheat, alfalfa, barley, potatoes, and carrots. The county is a leading producer of fruit bearing trees and vines such apples, pears, cherries, grapes, peaches, and apricots. Livestock production is also common including beef and milk cows, sheep, and lambs.

Klickitat County was founded in 1859, with the county seat ultimately established in the City of Goldendale, approximately 25 miles to the northeast of the Columbia Gorge Regional Airport. The population of Klickitat County in 2000 was 19,161 and by 2008 it was estimated at 20,377. The population is spread over 1,872 square miles (about the size of Delaware) of mountain, range-land, canyon, and river in the South-Central part of Washington. The Columbia Gorge Regional Airport is physically located in Klickitat County.

THE DALLES ECONOMIC OPPORTUNITIES (ECONorthwest)

ECONorthwest developed a study titled "The City of the Dalles: Economic Opportunities Analysis" in 2007. The findings of the study are summarized as follows:

The mix of productive factors present in The Dalles, relative to other communities in the Columbia River Gorge, form The Dalles' comparative advantage. A primary comparative advantage in The Dalles is its access to transportation and its location within the Columbia River Gorge. This makes The Dalles attractive to residents and businesses that want to live and work in a community that has small-town character and scenic beauty but still needs to have access to any of several modes of transportation. Comparatively low housing costs are another important comparative advantage in The Dalles. The Dalles offers a lower-cost housing alternative to Hood River.

The following characteristics of The Dalles will affect the types of businesses most likely to locate in The Dalles:

- The presence and expected growth of the Columbia Gorge Regional Airport could help The Dalles attract businesses engaged in the manufacture and service of aircraft, avionics, and related equipment.

- The Dalles' semi-rural setting, access to I-84 and other modes of transportation, and workforce availability make The Dalles attractive to businesses in manufacturing. Examples include high-tech electronics, food processing, industrial equipment, recreational equipment, and other specialty manufacturing.

- Access to transportation, including the access to I-84, the railroad, barges, and the airport, makes The Dalles attractive to businesses in the warehousing and transportation sector. Large warehouse facilities that serve large areas appear to favor more central settings, such as the Willamette Valley. The Dalles is more likely to attract more modest facilities that serve a smaller geographic region or that specialize in fewer goods.

- The Dalles' attractive semi-rural setting and quality of life could make it a location for professional, scientific, and technical services, which are attracted to areas with high quality of life. Examples include software design, engineering, and research.

- The Dalles' setting within the Columbia River Gorge, access to a variety of outdoor recreation, and the growing presence of viniculture make The Dalles attractive to tourists. Industries that serve tourists, such as food services and accommodations, are likely to grow if tourism increases.

- The comparatively low cost and high availability of electricity, water, and high speed internet connection (via the Q-life fiber optic loop) could make The Dalles attractive to businesses engaged in specialty manufacturing or technology related businesses.

Cities exist in an economic hierarchy in which larger cities offer a wider range of goods and services than smaller cities. The location of a community relative to larger cities, as well as its absolute size, affects the mix of goods and services that can be supported by a small city. The Dalles' small size has implications for the types of retail and service firms most likely to locate in The Dalles:

- The Dalles is the largest city in the Gorge, and it will continue to serve as a regional center for retail, services, and government.

- As a regional center for retail shopping, The Dalles will experience demand for development of big-box and mid-sized retail stores, primarily for grocery, general merchandise, and home improvement stores. Because of its small population base, The Dalles is unlikely to have demand for large "category killer" retailers such as Petsmart or Borders Books.

- The Dalles will continue to be the location for regional institutions such as the Mid-Columbia Medical Center, the Columbia Gorge Community College, Wasco County Courthouse, and other government offices.

- Population growth in The Dalles will drive demand for more small and specialty retail shops and offices for business, professional, and health care services.

GROWTH INDUSTRIES IN THE DALLES (ECONorthwest)

Retail and Services. The state's forecast for nonfarm employment forecast for 2004 to 2014 projects that more than half of employment growth in Region 9, which includes Wasco County, will be in retail and services. As a regional center for retail and services, The Dalles may attract the following industries:

- The Dalles may be attractive to big-box and mid-sized retail stores but is unlikely to have the demand for large "category killer" retailers such as Petsmart or Borders Books.

- The Dalles may have growth in small and specialty retail shops and offices for business, professional, and health care services as population increases.

- The Dalles' setting within the Columbia River Gorge, access to a variety of outdoor recreation, and the growing presence of viniculture make The Dalles attractive to tourists. Industries that serve tourists, such as food services and accommodations, are likely to grow if tourism increases.

- The Dalles' may be attractive for firms engaged in professional, scientific and technical services, such as software design, engineering, and research.

Government. The state's forecast for nonfarm employment forecast for 2004 to 2014 projects that growth in government will account for about one-third of employment growth in Region 9, including Wasco County. The Dalles may see employment growth in government for the following reasons:

- The Dalles will continue to be the location for regional institutions such as the Columbia Gorge Community College, Wasco County Courthouse, and other government offices.

- The Dalles will have growth in local government as population increases. Assuming that families with young children locate in The Dalles, growth in local government is likely to be dominated by education.

Industrial. The state's forecast for nonfarm employment forecast for 2004 to 2014 projects that growth in industrial sectors will account for the smallest portion of employment growth in Region 9, which includes Wasco County. The Dalles has comparative advantages, such as location and access to transportation, that may contribute to the growth in employment in the following industries:

- The Dalles should be attractive for firms engaged in a range of specialty manufacturing, including aircraft, high-tech electronics, food processing, industrial equipment, and recreational equipment.

- The Dalles should also be attractive for firms engaged in warehousing and distribution. The Dalles is more likely to attract more modest facilities that serve a smaller geographic region or that specialize in fewer goods.

The Dalles may be attractive to industries that need large amounts of electricity from stable sources.

MAJOR EMPLOYERS (ECONorthwest)

As part of the study, ECONorthwest interviewed 10 major employers in The Dalles' Urban Growth Boundary (UGB). Of the 10 firms interviewed, three firms have expansion plans and expect to add between 80 and 90 jobs in the next few years. The Mid-Columbia Medical Center and Oregon Cherry Growers plan to continue to add between 40-60 employees per year for the next several years. The following is a list of major employers interviewed, and their responses regarding firm expansion plans.

- **Mid-Columbia Medical Center (735+ employees).** The Mid-Columbia Medical Center anticipates hiring about 30 employees per year as their facility expands. They are planning to build a new hospital in five or ten years. They own less than ten acres surrounding their current site. Their plans are uncertain at this point, but they may choose to purchase land to relocate the hospital to a new site. If they do so, they will select a site closer to Interstate 84.

- **Oregon Cherry Growers, Inc. (250+ employees in standard processing, 1,000+ during fresh harvesting).** The Oregon Cherry Growers do not plan to expand their facilities, but plan to hire 10-20 standard processing employees every year for the next several years.

- **Safeway Stores, Incorporated (180+ employees).** Safeway Stores recently expanded their facility and do not plan any additional expansions in the near future. They are constantly hiring because of heavy employee turnover, but this hiring should not add substantially to their current employment level.

- **Wasco County (175+ employees).** The County is keeping employment levels stable and has no plans to expand any facilities. The County owns a variety of sites in The Dalles' UGB, most of which they want to eventually sell to put the land back on the tax rolls.

- **Fred Meyer (160+ employees).** The Fred Meyer store at The Dalles is scheduled for a 26,000 square-foot expansion between 2006 and 2007. The expanded store will occupy the current site, and they expect to add about 40 employees after the expansion.

- **Northwest Aluminum Company (120+ employees).** Northwest Aluminum does not anticipate any job growth and does not plan to relocate or expand facilities. They own 440 acres of land in The Dalles; 220 of those acres are currently occupied by their facilities and the remaining 220 are for sale.

- **Columbia Basin Nursing Home (70+ employees).** Columbia Basin is a non-profit corporation that operates the Nursing Home on land owned by Wasco County. The facility currently does not plan for significant employee growth or expansion of their building, but if any of the existing nursing homes in the area go out of business Columbia Basin may expand to meet demand.

- **Kmart (65+ employees).** Kmart has no plans for expansion of employment or its facilities.

- **Region 9 Educational Service District (57+ employees).** The Region 9 ESD has no plans for expansion of employment or its facilities.

- **Precision Lumber Company (28+ employees).** Precision Lumber recently laid off a number of employees. They do not expect to increase employment but may expand their facility relatively soon on land they own or lease.

In addition to what was learned from employer interviews, information available on the Oregon Labor Market Information System (OLMIS) web site and through other interviews indicates that other firms plan to expand or add jobs in The Dalles:

- Google has purchased about 30 acres of land from the Port of The Dalles and expects to build a data warehousing facility on the property. They expect to eventually employ about 120 people in The Dalles (this project has been completed).

- Homeshield, a maker of components for windows and doors, has purchased land at the Port of the Dalles and expects to build a 65,000 square-foot manufacturing plant to fabricate window parts. Homeshield expects to expand this facility and add employees within three years.

- Home Depot opened a store in The Dalles in 2004 and has about 110 employees.

- The Columbia Gorge Regional Airport expects to grow over the next five years. According to airport staff, they have approximately 700 undeveloped acres. They hope to develop 200 acres for use by aviation related companies, including services and specialty manufacturing. They hope to develop the remaining 500 acres as a golf course and hotel complex. A developer is interested in this land and has a tentative agreement with the City to develop the hotel and golf course.

- Insitu is a company currently headquartered in Bingen, WA. Their primary business is the engineering and manufacture of an unmanned aircraft system. Interviews with community leaders have given insight to plans by the company to locate a new headquarters complex in the Columbia Gorge region. A search has been initiated for a location that could accommodate a 100,000 square-foot building complex. Property at the airport has been considered for this project.

DEMOGRAPHICS

A variety of historical and forecast socioeconomic data has been collected for use in various elements of this master plan. This information provides essential background information for use in determining aviation service level requirements. Aviation forecasts are related to the population base and the economic strength of the region; therefore, it is necessary to have an understanding of socioeconomic outlook for the airport service area.

This section will present baseline statistical information related to socioeconomic indicators such as population, employment, and income. With this information, analysis will be undertaken to develop forecasts of future aviation demand that can be reasonably expected at Columbia Gorge Regional Airport.

Population

In 2006-07, The Dalles made substantial revisions to the economic and residential elements of the Comprehensive Plan based on revised population and employment projections. Cities and counties are required to formally adopt population projections as part of their comprehensive plans. **Table 2A** presents historic population data for The Dalles and area counties.

TABLE 2A
Historic Population Trends

				Average Annual Growth Rate		
Area	**1980**	**1990**	**2000**	**80-90**	**90-00**	**80-00**
Oregon	2,633,156	2,842,321	3,421,399	0.77%	1.87%	1.32%
Wasco County	21,732	21,683	23,791	-0.02%	0.93%	0.45%
Hood River County	15,835	16,903	20,411	0.65%	1.90%	1.28%
Skamania County, WA	7,919	8,289	9,872	0.46%	1.76%	1.11%
The Dalles	10,820	11,060	12,156	0.22%	0.95%	0.58%

Source: Population Forecast for The Dalles, May 22, 2006 (ECONorthwest)

The *Population Forecast for The Dalles* (ECONorthwest, 2006) presents the population forecast for the City of The Dalles for the period 2006-2056. The forecast reaches a population of 23,740 by 2030. A 1.9 percent annual growth rate is assumed from 2006-2026, 1.3 percent from 2026-2046, and 0.9 percent from 2047-2056. For purposes of this master plan, population forecasts to 2030 will be considered. This rate is based on The Dalles' growth between 1980 and 2005, and the projection method is a deterministic method rather then a flat line projection.

The Dalles is currently the largest City in Wasco County, and will account for an increasingly large percentage of the county's population. The forecast results in The Dalles Urban Growth Boundary accounting for more than 65 percent of the Office Economic Analysis' (OEA) forecast population for Wasco County in 2040. Many of the factors that will influence growth in The Dalles will also affect Wasco County. Thus, it is reasonable to adjust the OEA figures to account for a higher rate of growth in The Dalles. **Table 2B** presents forecast population data for The Dalles and Wasco County.

TABLE 2B
Adjusted Population Forecast for The Dalles

Year	Wasco County*	Adjusted Wasco County	Wasco Adjusted AAGR 5-Year Intervals	The Dalles	The Dalles AAGR 05-30 5-Year Intervals
2005	23,420	23,420	NA	15,184	NA
2010	23,753	25,582	1.78%	16,682	1.90%
2015	24,297	27,944	1.78%	18,329	1.90%
2020	24,896	30,525	1.78%	20,137	1.90%
2025	25,670	33,346	1.78%	22,124	1.90%
2030	26,563	35,578	1.30%	23,740	1.42%
2035	27,522	37,737	1.19%	25,324	1.30%
2040	28,653	40,029	1.19%	27,013	1.30%

*Oregon Office of Economic Analysis
Source: Based on the OEA forecasts for Wasco County and projections for the Dalles' population by ECONorthwest

Employment

Analysis of a community's employment base can be valuable in determining the overall economic well-being of that community. In most cases, the community make-up and health are significantly impacted by the availability of jobs, the variety of employment opportunities, and the types of wages provided by local employers.

In addition to the trends in the local economy presented in the previous section, some qualitative judgments about future conditions can be made:

- Employment in Wasco County has grown faster than population since 1980. Demographic and employment data shows that Wasco County has a higher ratio of residents per job than in Oregon as a whole, in part because Wasco County has a larger share of older residents who are not part of the labor force. (ECONorthwest: *Economic Opportunities Analysis 2007*)

- The Dalles has been, and will continue to be, the employment center of Wasco County. The Dalles currently has almost 73 percent of the County's employment, but only 52 percent of its population. This pattern of employment growth will probably change somewhat - population growth in The Dalles is likely to outpace employment growth, reducing the gap between its share of employment and population. (ECONorthwest: *Economic Opportunities Analysis 2007*)

Based on these judgments, historic employment growth in Wasco County, and the population growth rates forecast for Wasco County and The Dalles, it appears that an appropriate assumption for the average annual rate of total employment growth is 1.6 percent for the next 20 years. **Table 2C** shows the results of applying this growth rate to the total employment base in The Dalles. The average annual growth rate in employment over the next 20 years is 1.6 percent.

TABLE 2C
Total Employment
The Dalles Urban Growth Boundary

	Historic		Forecast			AAGR
	2004	**2006**	**2011***	**2016***	**2026**	**2006-2026**
Retail and Services	6,398	6,604	7,150	7,740	8,800	1.45%
Industrial	1,703	1,758	1,903	2,060	2,708	2.18%
Government	1,447	1,490	1,617	1,751	2,031	1.56%
Total Employment	9,548	9,852	10,670	11,551	13,539	1.60%

*Interpolated
AAGR: Average annual growth rate

Source: The City of The Dalles: Economic Opportunities Analysis - April 2007 (Prepared by ECO-Northwest)

Income

Table 2D presents historical per capita personal income (PCPI) for the two counties and states. As indicated in the table, the PCPI growth trends have been in line with national trends. Income trends can often be an indicator of the growth potential of an airport. Between 2005 and 2009, income grew significantly in both counties, each exceeding the growth rates of their respective states. Income growth is forecast to continue to exceed that of the state through the 2030 planning period.

TABLE 2D
Income Trend and Projection

Year	Klickitat County	AAGR	Wasco County	AAGR	State of Washington	AAGR	State of Oregon	AAGR
Historic Trend								
2000	$24,444	NA	$25,643	NA	$34,447	NA	$30,457	NA
2005	$25,488	0.84%	$25,561	-0.06%	$35,192	0.43%	$30,677	0.14%
2009 *	$28,438	2.78%	$28,249	2.53%	$37,387	1.52%	$31,664	0.79%
Projection								
2015	$29,397	0.55%	$29,970	0.99%	$39,831	1.06%	$34,306	1.34%
2020	$31,307	1.27%	$32,137	1.41%	$42,174	1.15%	$36,749	1.39%
2030	$36,015	1.41%	$37,230	1.48%	$47,766	1.25%	$42,491	1.46%

*Estimate

Source: Woods & Poole - CEDDS; Per Capita Personal Income (2004)

AVIATION TRENDS

The forecasts developed for the airport must also consider national, regional, and local aviation trends. The following section describes the trends in aviation. This information is utilized both in statistical analysis and to aid the forecast preparer in making any manual adjustments to the forecasts.

NATIONAL TRENDS

Each year, the FAA publishes its national aviation forecast. Included in this publication are forecasts for large air carriers, regional air carriers, general aviation, and FAA workload measures. The forecasts are prepared to meet budgeting and planning needs of the constituent units of the FAA and to provide information that can be used by state and local authorities, the aviation industry, and the general public. The current edition, FAA *Aerospace Forecasts - Fiscal Years 2009-2025*, has been utilized in the generation of the aviation demand forecasts to follow.

Historically, aviation activity has closely followed the national economic outlook. With each passing month of 2008, "consumer confidence dipped as energy prices spiked, housing foreclosures climbed, credit tightened, and unemployment surged." This chain of events resulted in lower than expected demand for air travel. Nonetheless, the FAA continues to forecast long term aviation growth.

Since 2001, U.S. airlines have adjusted to the impacts of 9/11, concerns about international pandemics, airline bankruptcies, record high fuel prices, and the most significant economic downturn since the Great Depression (December 2007 – present). Yet, the number of passengers travelling is forecast to continue to grow over the long term, demonstrating the value of air transportation. The 2009 forecast calls for a sharp decline in activity in the near term, with a return to growth over the long term.

Measures of aviation demand such as available seat miles (ASMs) and revenue passenger miles (RPMs) are expected to drop 6.7 percent and 8.9 percent, respectively, in 2009. Both are anticipated to begin a growth trend in 2010, averaging 3.8 percent and 3.4 percent growth through 2025. Passenger enplanements are forecast to decline 7.8 percent in 2009 and then begin growing at 2.7 percent annually through 2025.

The economic downturn has also dampened the near-term prospects for the general aviation industry. After several consecutive years of growth, general aviation activity fell 5.6 percent in 2008. Worldwide shipments of new general aviation aircraft declined in 2008 for the first time since 2002 (down 6.7 percent). Piston aircraft shipments fell 20.7 percent, but turbine aircraft shipments increased by 16.7 percent. Total billings for general aviation aircraft were up 14.4 percent in 2008, demonstrating the sharp difference in demand between piston and turbine aircraft.

Economic Outlook

The FAA uses the most recent Administration forecasts to project domestic aviation demand. The National Bureau of Economic Research indicated that the U.S. officially entered a recession in December 2007. The Bureau of Economic Analysis reported that real gross domestic product (GDP) fell at an annual rate of 3.8 percent in the fourth quarter of 2008. The question for forecasters is how long the recession will continue. The combination of structural changes, particularly in the banking and housing sectors, monetary policy, and passage of the *American Recovery and Reinvestment Act* (Stimulus Package), are projected to lead the economy out of recession in the second half of 2009 at the earliest. Initially, the recovery is expected to be modest over the second half of 2009 with positive growth occurring through 2010 and beyond.

Between 2010 and 2013, U.S. GDP is projected to be above trend (3.8 percent) with rates ranging from 2.4 percent to 4.5 percent. Beyond 2013, U.S. GPD is forecast to balance around 2.6 percent.

General Aviation Industry Trends

In the years since the passage of the *General Aviation Revitalization Act of 1994* (federal legislation which limits the liability on general aviation aircraft to 18 years from the date of manufacture), it is clear that the Act has successfully infused new life into the general aviation industry. This legislation sparked an interest to renew the manufacturing of general aviation aircraft due to the reduction in product liability, as well as renewed optimism for the industry. After the passage of this legislation, annual shipments of new aircraft rose every year between 1994 and 2000. According to the General Aviation Manufacturers Association (GAMA), between 1994 and 2000 general aviation aircraft shipments increased at an average annual rate of more than 18 percent, increasing from 1,132 shipments in 1994, to 3,147 shipments in 2000.

According to figures published by GAMA, worldwide manufacturers of general aviation aircraft delivered 3,969 aircraft in 2008. This represented the first year-over-last decline in shipments since 2001. **Table 2E** presents historical data related to aircraft shipments. After years of sustained growth, piston aircraft shipments declined in 2008, while turbine aircraft continued to grow.

The trend in general aviation manufacturing and billing over the previous eight years is clear. After a drop in total aircraft manufactured from 2001 through 2003, strong growth has occurred each year beginning in 2004. From 2003 through 2007, worldwide net billings have grown by 55 percent. In 2007, business jet manufacturing reached more than 1,000 units for the first time. Also notable is the resurgence of both turboprop and multi-engine piston aircraft.

TABLE 2E
Annual General Aviation Airplane Shipments
Manufactured Worldwide and Factory Net Billings

Year	Total	SEP	MEP	TP	J	Net Billings ($ billions)
2000	3,147	1,877	103	415	752	13,496
2001	2,998	1,645	147	422	784	13,868
2002	2,677	1,591	130	280	676	11,778
2003	2,686	1,825	71	272	518	9,998
2004	2,961	1,999	52	319	591	11,918
2005	3,590	2,326	139	375	750	15,156
2006	4,053	2,513	242	412	886	18,815
2007	4,272	2,417	258	459	1138	21,811
2008	3,969	1,943	176	535	1315	24,837

SEP - Single Engine Piston; MEP - Multi-Engine Piston; TP - Turboprop; J - Turbofan/Turbojet
Source: General Aviation Manufacturers Association 2008 Stat Book

Many capable general aviation and reliever airports have seen an upward trend in activity by business jets. There are numerous factors that have led to this trend including the growth of fractional aircraft ownership and a desire by frequent travelers to save time by avoiding commercial service airports. **Table 2F** presents growth trends in fractional aircraft ownership.

TABLE 2F
Fractional Aircraft and Share Owners

Year	Number of Aircraft	Number of Shares
2000	574	2,810
2001	689	3,601
2002	780	4,244
2003	286	4,516
2004	870	4,765
2005	945	4,828
2006	984	4,863
2007	1,030	5,168
2008	1,094	5,179

Source: GAMA 2008 Stat Book

Honeywell Corporation also tracks the general aviation industry. Their second quarter publication, dated August 4, 2009, shows a steep decline in aircraft production. In the first half of 2009, total general aviation shipments fell 45.8 percent, from 1,918 units in 2008 to 1,039 in 2009. Total billings were down 21.7 percent. Piston-powered shipments totaled 434 units compared to 1,034 units delivered in the first half of 2008, a 58 percent decline. Turboprops were down 13.6 percent from 221 in the first half of 2008 to 191 in 2009. Business jet shipments totaled 414 units in the first half of 2009, a 37.6 percent decrease over the 663 units delivered in the first half of 2008.

In October 2009, Honeywell published its 18th annual Aerospace Business Aviation Outlook. In the report it was noted that business jet shipments for 2009 are expected to be approximately 800, down from 1,139 in 2008. Deliveries in 2010 are expected to decline further to below 700. The report indicates that potential buyers of general aviation aircraft are delaying that purchase until the economy has clearly turned around. Honeywell anticipates that this pent-up demand will improve the outlook for order intake and new jet deliveries beyond the 2011 timeframe.

FAA General Aviation Forecasts

The FAA forecasts of general aviation activity assume that business use of general aviation aircraft will continue to expand at a more rapid pace than that for personal/sport use. Corporate use of fractional and charter aircraft continues to be practical alternatives to commercial travel due to time savings.

The active general aviation fleet is projected to increase at an average annual rate of 1.0 percent over the 17-year FAA forecast period, growing from 234,015 in 2008 to 275,230 by 2025. The more expensive and sophisticated turbine fleet is projected to grow 4.8 percent annually from 11,400 in 2008 to 25,165 in 2025. Conversely, the number of active piston-powered aircraft is projected to decrease from a total of 165,720 in 2008 to 164,550 in 2025. Multi-engine piston aircraft representing 11 percent of total piston aircraft is forecast to decline 1.0 percent annually, while single engine piston aircraft are forecast to grow 0.1 percent over the same timeframe. **Exhibit 2A** presents the FAA forecast for U.S. active general aviation aircraft.

FAA forecasts of general aviation operations (takeoffs and landings) are categorized as local and itinerant with local operations being those within the traffic pattern airspace of an airport and itinerant being those aircraft with a destination away from the airport. General aviation activity at FAA air traffic facilities (including FAA contract towers) fell 5.6 percent in 2008. This was the steepest decline since 2003. Itinerant general aviation operations have been steadily declining since 2000 from a high of 22.844 million to a current low of 17.368 million in 2008. Itinerant operations are forecast to continue to contract at 3.5 percent annually through 2010, then grow at 1.5 percent from 2010-2020.

Local operations are forecast to follow a similar trend contracting at 2.6 percent from 2008-2010, and then growing at 0.3 percent annually thereafter. Air taxi and commuter operations are forecast to follow a similar trend to itinerant general aviation activity contracting 2.9 percent from 2008-2010 followed by an average annual growth rate of 1.5 percent through 2025.

As discussed, general aviation activity typically follows the state of the national economy. As of this writing (October 2009), there are indications that some sectors of the economy are beginning to change. Monthly job losses have declined significantly from early in the year. The stock market has rebounded to reclaim nearly half the losses experienced in the winter of 2008-2009. At the same time, unemployment continues to rise and is expected to peak at above 10 percent nationally before a reversal is expected.

The conclusion to be drawn is that recession has had a severe and negative impact on general aviation activity across the country. Some economic indicators are beginning to reverse the trend as of October 2009. The FAA forecasts do take into account the economic collapse that occurred in late 2008 and they forecast the economy showing growth again in 2010.

REGIONAL AND LOCAL AVIATION

Both the states of Oregon and Washington have a vested interest in the Columbia Gorge Regional Airport. Therefore, both states engage in planning and development for the airport. In Oregon, the Columbia Gorge Regional Airport is included in the *Oregon Aviation Plan* (OAP 2007). The airport is also included in the *Washington State Long-Term Air Transportation Study* (LATS 2009).

The OAP 2007 forecast methodology was approved by the FAA. Columbia Gorge Regional Airport based aircraft were estimated at 57 in 2005, and forecast to increase to 73 by 2025. This equates to an annual growth rate of 1.27 percent. Total operations were estimated at 29,600 in 2005 and were forecast to grow to 44,750 by 2025. The annual growth rate for operations is 2.09 percent.

The LATS 2009 provides forecasts of aviation demand for the state with a base year of 2005. In 2005, approximately 8,100 general aviation aircraft based at public use airports in Washington State. This is projected to reach 9,700 in 2015 and 11,800 by 2030. From 2005 to 2030, this represents an annual growth rate of 1.49 percent. The Southwest Washington Regional Transportation Council (RTC) includes nine airports and is forecast to experience an average annual growth rate in based aircraft of 1.95 percent from 2025-2030. General aviation operations in Washington State were estimated at 3.0 million in 2005 and are forecast to reach 4.4 million in 2030, representing an average annual growth of 1.6 percent. Total operations in the Southwest Washington RTC is forecast to have an annual growth rate of 1.81 percent from 2005-2030.

AVIATION FORECAST METHODOLOGY

The development of aviation forecasts proceeds through both analytical and judgmental processes. A series of mathematical relationships is tested to establish statistical logic and rationale for projected growth. However, the judgment of the forecast analyst, based upon professional experience, knowledge of the aviation industry, and assessment of the local situation, is important in the final determination of the preferred forecast.

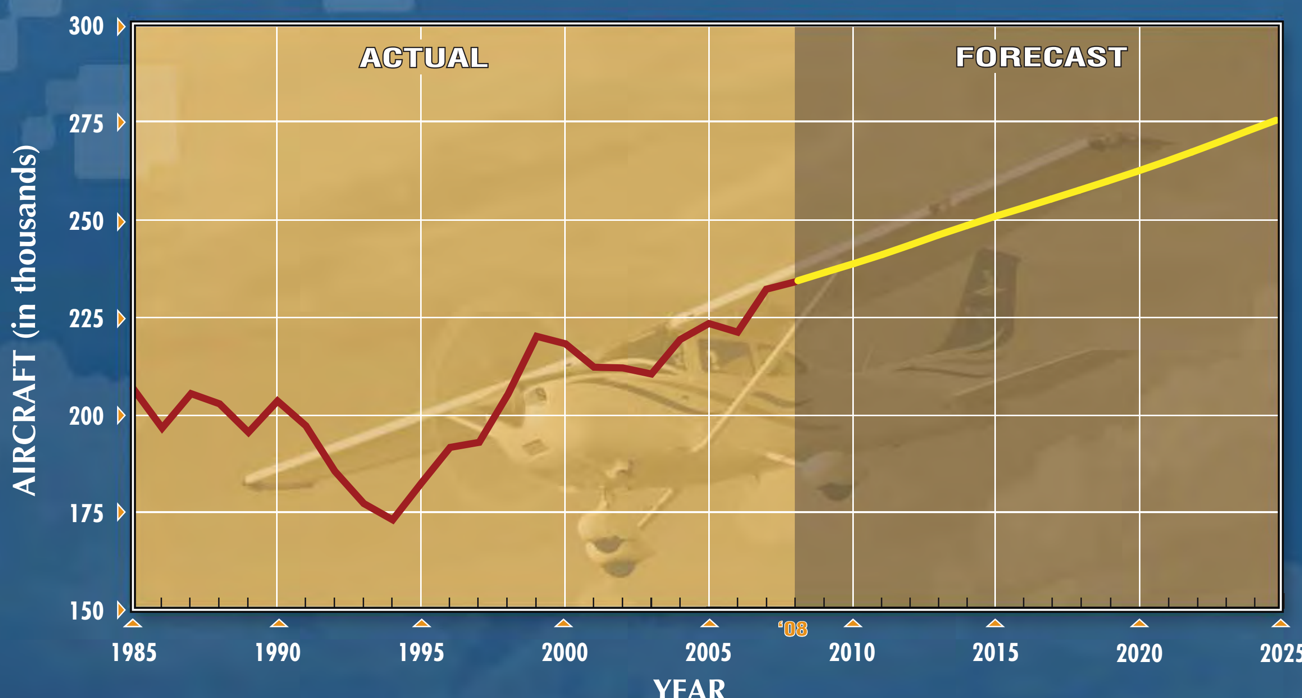
Beyond five years, the predictive reliability of the forecasts can diminish. Therefore, it is prudent for the airport to update the forecasts, reassess the assumptions originally made, and revise the forecasts based on the current airport and industry conditions. Facility and financial planning usually require at least a 10-year preview, since it often takes several years to complete a major facility development program. However, it is important to use forecasts which do not overestimate revenue-generating capabilities

08MP04-2A-7/16/10

U.S. ACTIVE GENERAL AVIATION AIRCRAFT

(in thousands)

	2008	2015	2020	2025
FIXED WING				
PISTON				
Single Engine	146.6	143.5	144.9	148.5
Multi-Engine	19.1	17.9	17.0	16.0
TURBINE				
Turboprop	9.6	10.5	11.5	12.2
Turbojet	11.4	17.1	20.9	25.2
ROTORCRAFT				
Piston	3.1	4.6	5.3	5.9
Turbine	7.1	9.0	9.9	10.9
EXPERIMENTAL	24.1	29.1	32.0	34.6
SPORT AIRCRAFT	7.0	12.7	14.4	15.9
OTHER	6.0	6.1	6.0	6.0
TOTAL	234.0	250.5	261.8	275.2



Source: FAA Aerospace Forecasts, Fiscal Years 2009-2025.

Notes: An active aircraft is one that has a current registration and was flown at least one hour during the calendar year.

Columbia Gorge Regional Airport

Exhibit 2A
U.S. ACTIVE GENERAL AVIATION AIRCRAFT FORECASTS

or understate demand for facilities needed to meet public (user) needs.

A wide range of factors are known to influence the aviation industry and can have significant impacts on the extent and nature of activity occurring in both the local and national markets. Technological advances in aviation have historically altered and will continue to change the growth rates in aviation demand over time. A recent example is the substantial growth in the production and delivery of business jet aircraft, which resulted in a growth rate that far exceeded expectations. Such changes are difficult to predict but over time reasonable growth trends can be identified. Using a broad spectrum of demographic, economic, and industry data, forecasts for Columbia Gorge Regional Airport have been developed. Several standard statistical methods have been employed to generate various projections of aviation demand.

Trend line projections are probably the simplest and most familiar of the forecasting techniques. By fitting growth curves to historical demand data, then extending them into the future, a basic trend line projection is produced. A basic assumption of this technique is that outside factors will continue to affect aviation demand in much the same manner as in the past. As broad as this assumption may be, the trend line projection does serve as a reliable benchmark for comparing other projections.

Correlation analysis provides a measure of a direct relationship between two separate sets of historic data. Should there be a reasonable correlation between the data, further evaluation using regression analysis may be employed.

Regression analysis measures the statistical relationship between dependent and independent variables yielding a "correlation coefficient." The correlation coefficient (Pearson's "r") measures association between the changes in a dependent variable and independent variable(s). If the r-squared (r^2) value (coefficient determination) is greater than 0.90, it indicates good predictive reliability. A value below 0.90 may be used with the understanding that the predictive reliability is lower.

Market share analysis involves a historical review of airport activity as a percentage, or share, of a larger regional, state, or national aviation market. A historical market share trend is determined providing an expected market share for the future. These shares are then multiplied by the forecasts of the larger geographical area to produce a market share projection. This method has the same limitations as trend line projections, but can provide a useful check on the validity of other forecasting techniques.

Utilizing these statistical methods, available existing forecasts, and analyst expertise, forecasts of aviation demand for Columbia Gorge Regional Airport have been developed. The remainder of this chapter presents the aviation demand forecasts and includes activity in two broad categories: based aircraft and annual operations.

GENERAL AVIATION FORECASTS

The number of based aircraft is the most basic indicator of general aviation demand. By developing a forecast of based aircraft, the needs of the airport can be forecast more accurately. One method of forecasting based aircraft at an airport is to examine local aircraft ownership, or aircraft registrations in the airport's service area. The primary service area for aircraft basing at Columbia Gorge Regional Airport is Klickitat and Wasco counties.

COUNTY REGISTERED AIRCRAFT

The owner of an aircraft is required to register that aircraft and receive a unique N-number to be prominently painted on the aircraft. The N-number is often referred to as the tail number since most aircraft have the number painted on the tail. This aircraft data is maintained by the FAA and is available to the public. A review of this database provides reliable historical information regarding the number and type of aircraft registered within the approximate airport service area. Utilizing this historical aircraft registration data, forecasts of future aircraft registrations can be made. With a forecast of registered aircraft, a projection of based aircraft can be made.

Aircraft registration data for Klickitat and Wasco counties was obtained going back to 1995 and is presented in **Table 2G**. In 1995, there were 141 registered aircraft in the two counties which has grown to 189 by 2009. Over this time period, there was an average of slightly more than three new aircraft registrations per year. In 2000, there were 183 registered aircraft, which steadily rose to 197 in 2008. Registrations have dropped back to 189 in 2009.

TABLE 2G
Registered Aircraft Fleet Mix in Two-County Area
Klickitat County, WA, and Wasco County, OR

Year	Single Engine Piston	Multi-Engine Piston	Turboprop	Jet	Helicopter	Other	Total
1995	128	5	0	0	6	2	141
1996	136	4	1	0	5	2	148
1997	144	4	2	0	5	2	157
1998	151	7	1	0	6	3	168
1999	152	6	1	0	6	3	168
2000	163	7	2	1	6	4	183
2001	158	6	6	1	8	4	183
2002	160	6	7	1	8	4	186
2003	152	3	13	2	7	3	180
2004	150	3	16	2	5	2	178
2005	159	3	14	2	4	2	184
2006	172	6	2	1	4	3	188
2007	172	5	3	1	5	6	192
2008	172	6	6	3	4	6	197
2009*	162	5	7	1	6	8	189

Annual Growth Rate 1995-2009:	**1.97%**
Annual Growth Rate 2000-2009:	**0.32%**

*Through October 2009
Source: FAA Aircraft Registry Database; FAA Census of U.S. Civil Aircraft

Exhibit 2B graphically depicts aircraft registrations in the two counties by location between 1995 and 2009. In 1995, 47.5 percent of the registered aircraft, or 67, were within 10 miles of the airport. By 2009, 82 registrations were within 10 miles, equating to 43.4 percent. The percentage of aircraft between 10 and 20 miles increased from 19.9 to 23.3 percent. Aircraft registrations within the 20-mile ring have remained level at approximately 67 percent between 1995 and 2009.

The historic annual growth rate in registered aircraft in the two counties shows a distinction between growth in the 1990s and growth in the 2000s. The majority of growth occurred in the years (1995-2000) immediately following reform legislation concerning liability on the manufacturer of general aviation aircraft. From 1995 through 2000, registrations grew 4.4 percent annually. From 2000 to 2009, the annual growth rate was 0.32 percent. Over the whole timeframe from 1995 to 2009, the annual growth rate is 1.97 percent annually.

Several forecasts of registered aircraft for the two-county area have been developed and are presented on **Table 2H.** The first simply considers the historical growth trend since 2000, which is 0.82 percent annually. By extending this trend out over the next 20 years, a forecast of 199 registered aircraft by 2015 and 224 registered aircraft by 2030 results.

The next forecast considers maintaining a constant number of registered aircraft per 1,000 people in The Dalles (11.54 registrations per 1,000 people). This results in 212 registrations in 2015, 232 in 2020, and 274 in 2030. This is an annual growth rate of 1.79 percent.

A third forecast compared the percent of registration with the number of U.S. active general aviation aircraft as forecast by the FAA. Utilizing a constant share of 0.08 percent, 198 registrations resulted in 2015, 208 in 2020, and 229 in 2030. This is an annual growth rate of 0.91 percent.

Several statistical trends and regressions were also considered. For this type of analysis, an r^2 value is generated. This value is a measure of the statistical reliability of the analysis. Generally, r^2 values greater than 0.9 percent indicate a strong correlation between variables and, therefore, a greater statistical reliability.

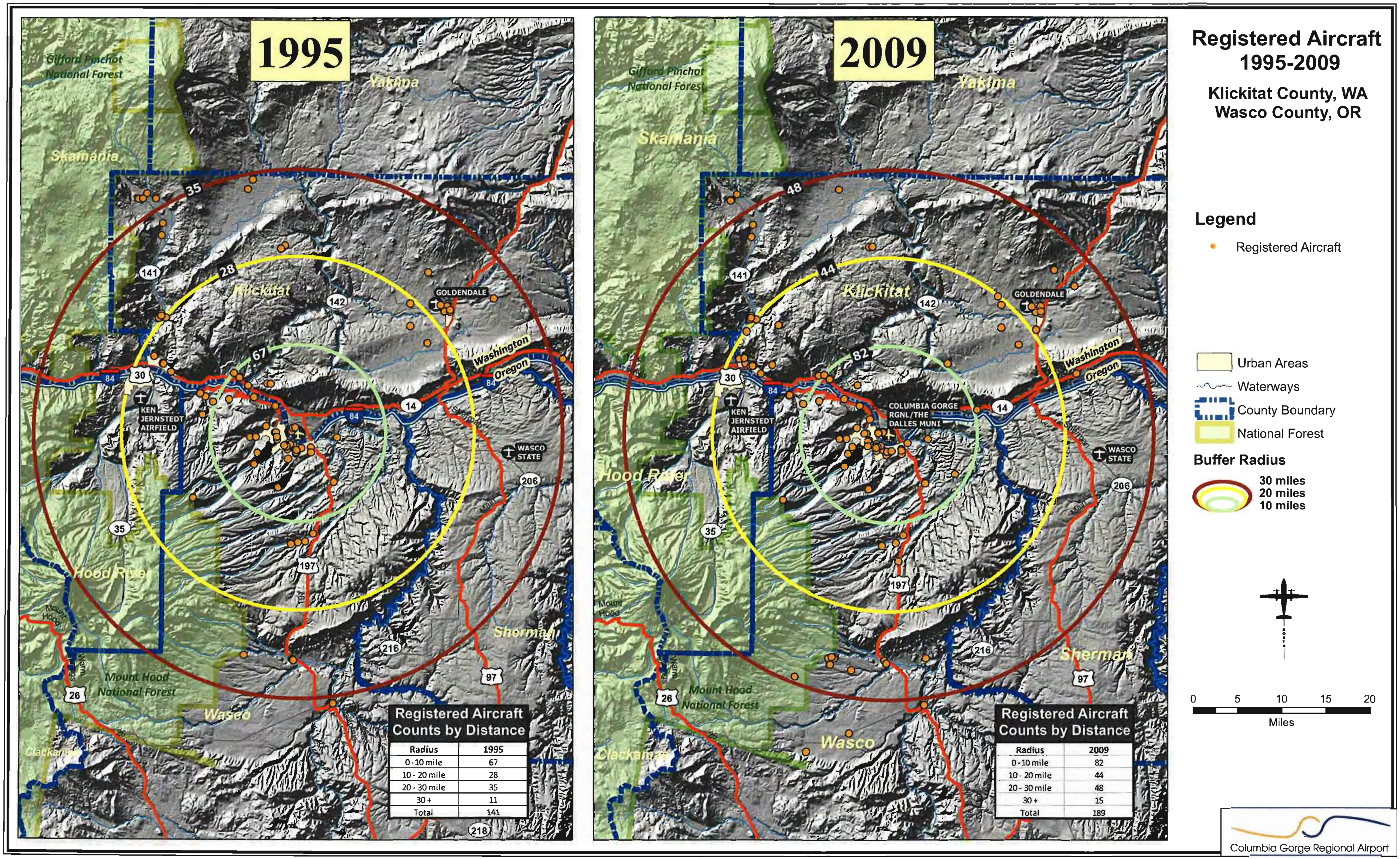
The first of these statistical analyses is a trend line in which a forecast is developed by statistically "fitting" an "average" line over the historical data and extending that line into the future. This method resulted in a poor correlation with an r^2 value of 0.60 percent. This resulted in a forecast of 204 registrations for 2015, 213 for 2020, and 231 for 2029.

The next analysis utilized socioeconomic data for population and employment as independent variables and registered aircraft as the dependant variable. When comparing The Dalles population to registered aircraft, an r^2 value of 0.52 percent resulted. When employment in the county was established as the independent variable, an r^2 value of 0.63 resulted. Both of these are below the threshold for statistical reliability; therefore, a multiple regression utilizing both population and employment was considered. This resulted in a slightly higher r^2 value of 0.73 percent. Each of these had very similar registered aircraft projections. Because these statistical measures did not return an r^2 value greater than 0.90 percent, none were utilized further.

TABLE 2H
Registered Aircraft Projections
Columbia Gorge Regional Airport

Year	Two-County Registrations[1]	U.S. Active Aircraft[2]	Percent of U.S. Active Aircraft	The Dalles Population[3]	Aircraft Per 1,000 Population
2000	183	217,533	0.084%	12,156	15.054
2001	183	211,446	0.087%	12,709	14.399
2002	186	211,244	0.088%	13,287	13.999
2003	180	209,606	0.086%	13,891	12.958
2004	178	219,319	0.081%	14,523	12.256
2005	184	224,262	0.082%	15,184	12.118
2006	188	221,942	0.085%	15,472	12.151
2007	192	231,606	0.083%	15,766	12.178
2008	197	234,015	0.084%	16,066	12.262
2009	189	236,235	0.080%	16,371	11.545
Historical Growth Scenario 0.82% (2000-2008)					
2015	199	248,105	0.080%	18,329	10.831
2020	207	259,475	0.080%	20,137	10.271
2030	224	285,941	0.079%	23,740	9.455
Annual Growth Rate 2009-2030: 0.82%					
Constant Aircraft Per 1,000 Population The Dalles					
2015	212	248,105	0.085%	18,329	11.545
2020	232	259,475	0.090%	20,137	11.545
2030	274	285,941	0.096%	23,740	11.545
Annual Growth Rate 2009-2030: 1.79%					
Constant Market Share of U.S. Fleet					
2015	198	248,105	0.080%	18,329	10.830
2020	208	259,475	0.080%	20,137	10.309
2030	229	285,941	0.080%	23,740	9.636
Annual Growth Rate 2009-2030: 0.91%					
SELECTED FORECAST					
2015	205	248,105	0.083%	18,329	11.184
2020	220	259,475	0.085%	20,137	10.925
2030	240	285,941	0.084%	23,740	10.110
Annual Growth Rate 2009-2030: 1.06%					

[1]*FAA Aircraft Registry Database; FAA Census of U.S. Civil Aircraft*
[2]*FAA Aerospace Forecast for Fiscal Years 2009-2025*
[3]*Population Forecast for The Dalles - ECONorthwest May 2006*



Radius	1995
0 - 10 mile	67
10 - 20 mile	28
20 - 30 mile	35
30 +	11
Total	141

Radius	2009
0 - 10 mile	82
10 - 20 mile	44
20 - 30 mile	48
30 +	15
Total	189

Exhibit 2B
KLICKITAT COUNTY WA AND WASCO COUNTY OREGON REGISTERED AIRCRAFT LOCATION MAP

The selected forecast is an approximate average of the three forecasts considered useful. This forecast considers 205 registrations by 2015, 220 by 2020, and 240 by 2030. The selected forecast results in an annual growth rate of 1.06 percent. **Exhibit 2C** graphically presents the registered aircraft projections and the selected forecast.

Now that registered aircraft have been forecast, a based aircraft forecast for Columbia Gorge Regional Airport can be developed.

BASED AIRCRAFT

Identifying the current number of based aircraft is critical to the master plan analysis yet it can be challenging for several reasons. First, historical records of based aircraft were not required by the FAA until 2008. Second, historical based aircraft records for the airport have not been actively maintained over the years. Since most of the hangar spaces at the airport are owned and leased by the airport, a reasonable estimate of the current based aircraft can be determined.

In consultation with airport management, a 2009 based aircraft figure of 68 has been determined. There are 51 T-hangar positions, 50 of which are filled. There are 61 tie-down positions, 12 of which are leased. The hangar to the south of the terminal building houses two Air Tractors (model AT-402). The hangar to the immediate northwest houses three aircraft and the Quonset hut hangar houses the life flight helicopter (typically on the ramp).

In 2008, the FAA contracted with a private consulting firm, GCR & Associates, to collect and catalog the number of based aircraft across the country. This information is now on-line at http://www.basedaircraft.com/bacounts.

The FAA has recently begun utilizing this data as a starting point for forecast approval consideration. Since the forecasts generated in this study will be submitted to the FAA for approval, it is imperative that the based aircraft figure be as accurate as possible. The GCR data shows a based aircraft figure of 66 in 2009.

Several other forecasts have been developed for the airport in the recent past. This includes the FAA *Terminal Area Forecast* (published December 2008), the *2004 Airport Layout Plan (ALP) Report*, the *2007 Oregon Aviation Plan (OAP)*, the *2009 Long Term Air Transportation Study (LATS)* from the Washington Department of Transportation – Aviation Division. Finally, FAA form 5010, *Airport Master Record*, identifies 65 based aircraft for 2009.

New Based Aircraft Projections

Utilizing market share ratios, two new based aircraft forecasts are presented in **Table 2J**. The first forecast maintains a constant 35.98 percent market share of the registered aircraft in the two-counties as based aircraft at Columbia Gorge Regional Airport. This results in 74 based aircraft in 2015, increasing to 86 based aircraft by 2030. An increasing projection has also been developed that continues the historical trend. This forecast increases the airports market share of registered aircraft from a base year of 37 percent to 43 percent by 2030.

TABLE 2J
Based Aircraft Forecasts as a Share of Registrations
Columbia Gorge Regional Airport

Year	Two-County Registered Aircraft	Percent Based at The Dalles	Number Based at DLS (TAF)
2000	183	23.50%	43
2001	183	22.95%	42
2002	186	25.27%	47
2003	180	26.67%	48
2004	178	23.60%	42
2005	184	30.98%	57
2006	188	30.32%	57
2007	192	29.69%	57
2008	197	29.44%	58
2009	189	35.98%	68*
Annual Growth Rate 2000-2009: 4.69%			
Constant Share Forecast			
2015	205	35.98%	74
2020	220	35.98%	79
2030	240	35.98%	86
Annual Growth Rate 2009-2030: 1.14%			
Increasing Share Forecast			
2015	205	37.00%	76
2020	220	39.00%	86
2030	240	43.00%	103
Annual Growth Rate 2009-2030: 2.01%			

*Airport Records
Source: Coffman Associates analysis

Table 2K presents the two market share forecasts along with the existing based aircraft forecasts. As can be seen, each of the comparison forecasts under-estimates the 2009 base year based aircraft figure, therefore the annual growth rates can provide guidance for determining a selected based aircraft forecast.

The lowest growth rate forecast is the 2004 ALP Report. The 2030 based aircraft forecast from this report, as extrapolated from 2022, is 74 and an annual growth rate of 0.92 percent. This represents the low end forecast, which is not surprising since it is the oldest forecast and it was completed before some of the newest hangars had been constructed.

The high end forecast is the increasing market share of registered aircraft in the two-county service area. This forecast results in an annual growth rate of 2.01 percent. This represents the addition of 35 new based aircraft over the next 20 years.

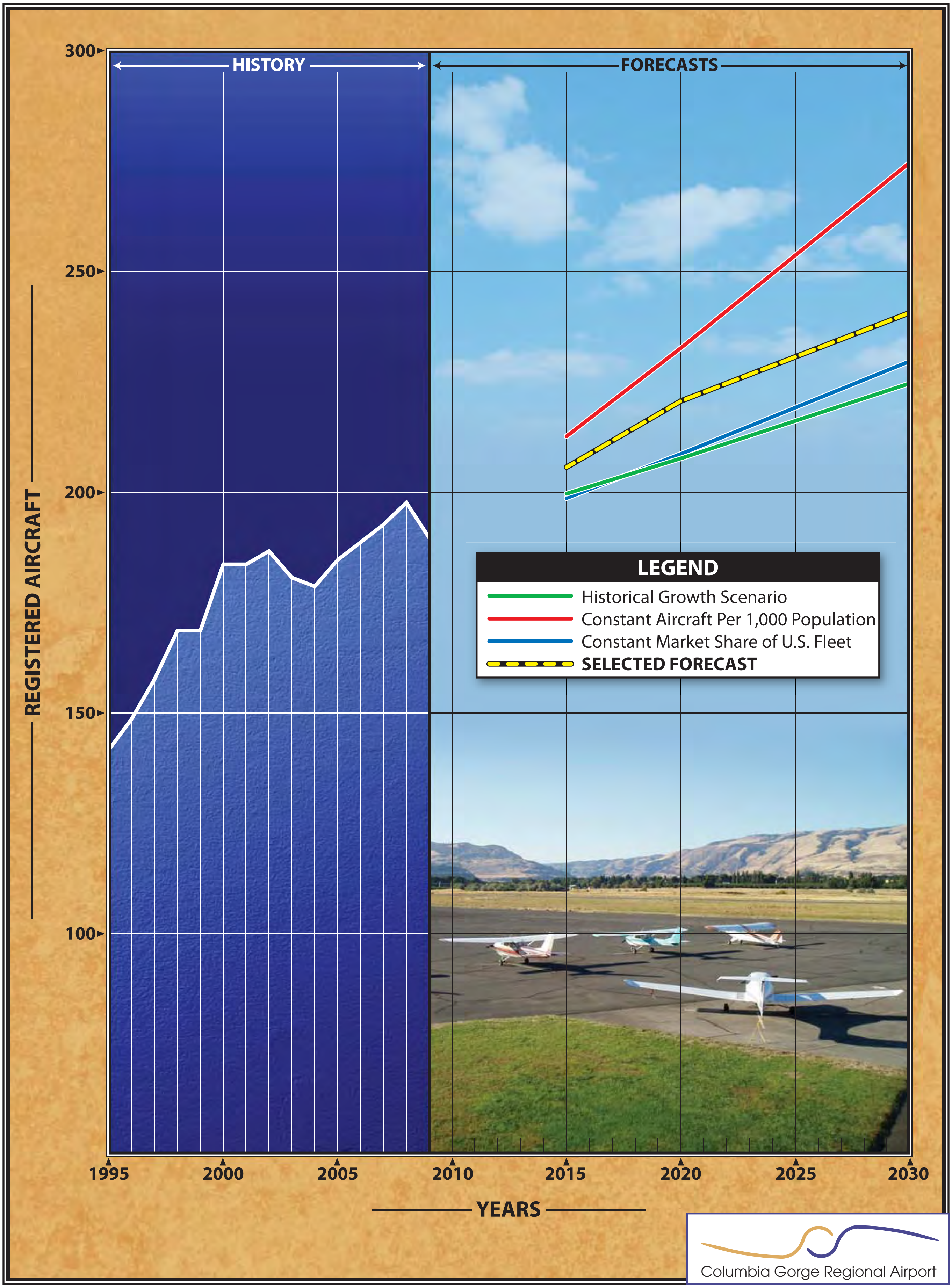


Exhibit 2C
REGISTERED AIRCRAFT FORECAST
TWO COUNTY SERVICE AREA

TABLE 2K Based Aircraft Forecast Summary Columbia Gorge Regional Airport					
	2009 (Base Year)	**2015**	**2020**	**2030**	**AAGR 2009-2030**
Market Share of County Registered Aircraft					
Constant Share (36%)	68	74	79	86	1.14%
Increasing Share (37-43%)	68	76	86	103	2.01%
Comparison Projections*					
FAA TAF	59	64	73	85	1.75%
2004 ALP Report	61	64	68	74	0.92%
2007 OAP	61	66	69	79	1.24%
2009 LATS	61	64	68	76	1.05%
SELECTED FORECAST	**68**	**75**	**82**	**95**	**1.60%**

TAF: Terminal Area Forecast
ALP: Airport Layout Plan
OAP: Oregon Aviation Plan
LATS: Long Term Air Transportation Study (Washington)
* Figures interpolated and extrapolated to plan years.

Source: Coffman Associates analysis

The selected forecast is the approximate average of the two market share forecasts and would represent the addition of 27 new airplanes to the airport over the next 20 years. This is an annual growth rate of 1.6 percent. The selected forecast has an annual growth rate lower than that of the FAA TAF but higher than the state plans and the 2004 ALP report.

There are several additional factors that support a growth scenario at Columbia Gorge Regional Airport. There is a lack of airports directly competing for aviation demand in the service area, particularly for business aviation. The economic outlook is optimistic for The Dalles as described in detail in Chapter One. The national economic recession is forecast to end by early 2010. The planned resort development could lead to an increase in aviation demand. The airport also has a recent history of filling new hangars. **Exhibit 2D** presents the based aircraft forecasts and the selected forecast.

BASED AIRCRAFT FLEET MIX PROJECTIONS

Knowing the aircraft fleet mix expected to utilize the airport is necessary to properly plan facilities that will best serve the level and type of activity occurring at the airport. As detailed previously, the growth areas in the general aviation fleet nationally is in turboprop and jet aircraft, as well as helicopters. Single engine piston-powered aircraft are forecast to grow slightly, while multi-engine piston aircraft are forecast to decrease slightly. Growth within each based aircraft category at the airport has been determined, in part, by comparison with national projections and consideration of local economic conditions.

On the local level, an examination of the registered aircraft fleet mix for the two-county service area was conducted and is presented in **Table 2L**. Over the last 15 years, single engine aircraft have represented approximately 88 percent and have shown relatively steady growth. Multi-engine piston-powered aircraft have represented approximately five percent over the same time period and have shown no growth. Turboprops showed a spike in registrations in 2003, and then fell back to previous levels by 2006. Helicopters have remained flat in terms of growth.

TABLE 2L
Two-County Registered Aircraft Fleet Mix Projections

Year	SEP	%	MEP	%	TP	%	J	%	R	%	O	%	Total
1995	128	90.78%	5	3.55%	0	0.00%	0	0.00%	6	4.26%	2	1.42%	141
1996	136	91.89%	4	2.70%	1	0.68%	0	0.00%	5	3.38%	2	1.35%	148
1997	144	91.72%	4	2.55%	2	1.27%	0	0.00%	5	3.18%	2	1.27%	157
1998	151	89.88%	7	4.17%	1	0.60%	0	0.00%	6	3.57%	3	1.79%	168
1999	152	90.48%	6	3.57%	1	0.60%	0	0.00%	6	3.57%	3	1.79%	168
2000	163	89.07%	7	3.83%	2	1.09%	1	0.55%	6	3.28%	4	2.19%	183
2001	158	86.34%	6	3.28%	6	3.28%	1	0.55%	8	4.37%	4	2.19%	183
2002	160	86.02%	6	3.23%	7	3.76%	1	0.54%	8	4.30%	4	2.15%	186
2003	152	84.44%	3	1.67%	13	7.22%	2	1.11%	7	3.89%	3	1.67%	180
2004	150	84.27%	3	1.69%	16	8.99%	2	1.12%	5	2.81%	2	1.12%	178
2005	159	86.41%	3	1.63%	14	7.61%	2	1.09%	4	2.17%	2	1.09%	184
2006	172	91.49%	6	3.19%	2	1.06%	1	0.53%	4	2.13%	3	1.60%	188
2007	172	89.58%	5	2.60%	3	1.56%	1	0.52%	5	2.60%	6	3.13%	192
2008	172	87.31%	6	3.05%	6	3.05%	3	1.52%	4	2.03%	6	3.05%	197
2009	162	85.71%	5	2.65%	7	3.70%	1	0.53%	6	3.17%	8	4.23%	189
Avg.		88.55%		2.91%		2.91%		0.54%		3.25%		1.84%	
FLEET MIX PROJECTIONS													
2015	175	85.50%	6	3.00%	8	3.75%	2	0.75%	6	3.00%	8	4.00%	205
2020	184	83.50%	7	3.00%	9	4.00%	3	1.25%	9	4.00%	9	4.25%	220
2030	193	80.50%	7	3.00%	12	5.00%	4	1.75%	12	5.00%	11	4.75%	240

SEP-Single Engine Piston; MEP-Multi-engine Piston; TP-Turboprop; J-Jet; R-Rotor (Helicopter); O-Other
Source: Coffman Associates analysis of FAA Aircraft Registry Database

A base year (2009) fleet mix has been determined from interviews with airport management. There are 57 single engine piston aircraft and two (2) multi-engine piston aircraft. There are five (5) turboprop aircraft which includes two Air Tractors (model 402), one Rockwell Aero Commander 690, a Piper Meridian, and a TBM 850. There are four (4) based helicopters. There are currently no based business jets. There are a total of 68 based aircraft.

Based in part on national and local fleet mix data, a forecast of the future based aircraft fleet mix at Columbia Gorge Regional Airport can be made. As presented in **Table 2M**, single-engine piston-powered aircraft will

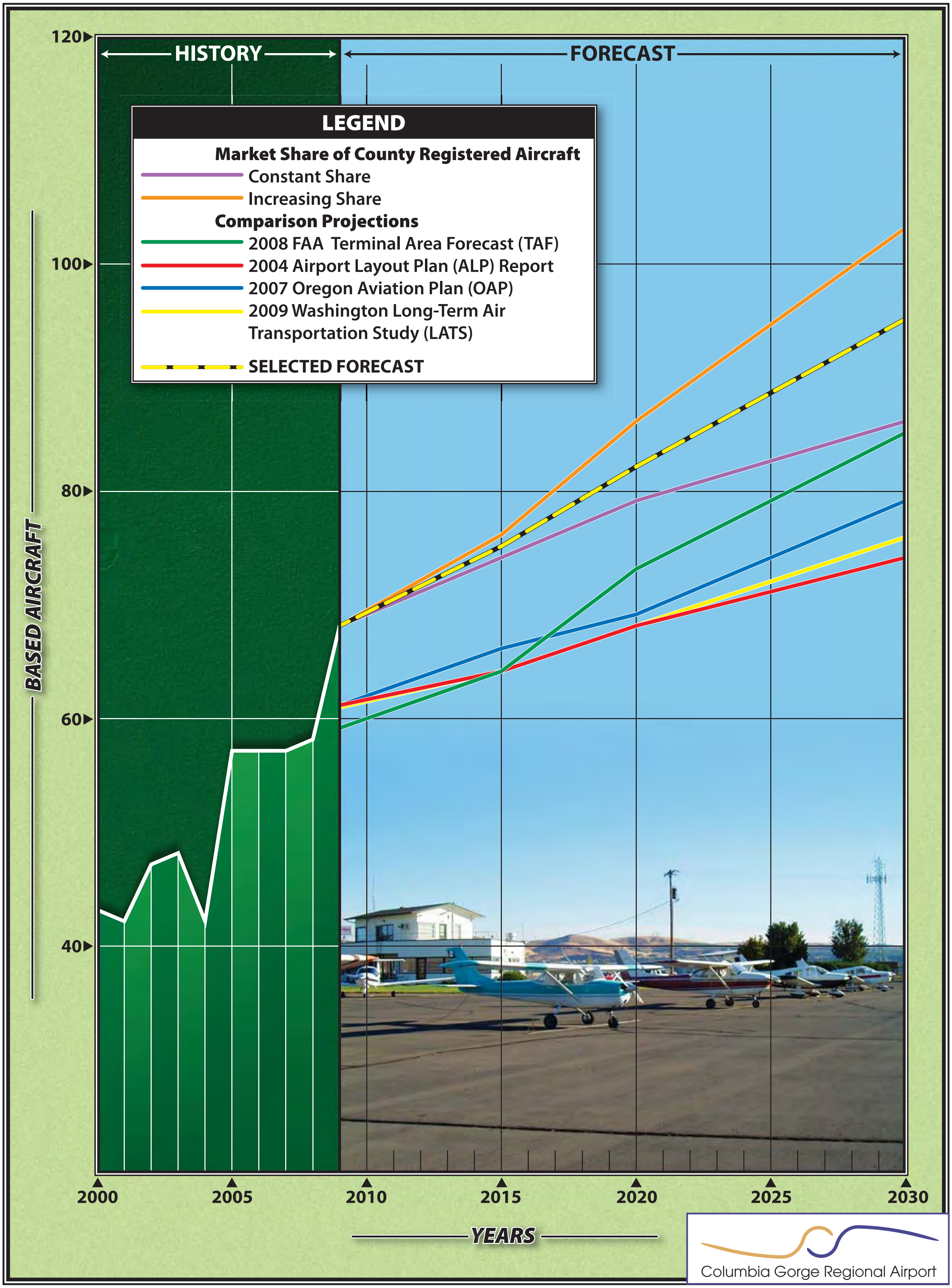


Exhibit 2D
BASED AIRCRAFT FORECAST

continue to account for the vast majority of based aircraft at the airport. Over the course of the 20-year planning period, turboprops, jets, and helicopters are forecast to grow as a percent of total based aircraft. Single and multi-engine piston-powered aircraft are forecast to drop slightly as a percent of the mix.

TABLE 2M
Based Aircraft Fleet Mix
Columbia Gorge Regional Airport

Aircraft Type	2009	Percent	2015	Percent	2020	Percent	2030	Percent
Single Engine Piston	57	83.82%	62	82.67%	66	80.49%	77	81.05%
Multi-Engine Piston	2	2.94%	2	2.67%	3	3.66%	3	3.16%
Turboprop	5	7.35%	6	8.00%	7	8.54%	7	7.37%
Jet	0	0.00%	1	1.33%	1	1.22%	2	2.11%
Helicopters	4	5.88%	4	5.33%	5	6.10%	6	6.32%
Total	**68**	**100.00%**	**75**	**100.00%**	**82**	**100.00%**	**95**	**100.00%**

Source: Coffman Associates analysis of FAA Registered Aircraft Database

ANNUAL OPERATIONS

Airport operations can be characterized as local or itinerant. A local operation is a takeoff or landing performed by an aircraft that operates within sight of the airport, or which executes simulated approaches or touch-and-go operations at the airport. Itinerant operations are those performed by aircraft with a specific origin or destination away from the airport. Generally, local operations are characterized by training operations. Historically, 70 percent of the operations at Columbia Gorge Regional Airport have been itinerant in nature, with the remaining 30 percent characterized as local.

Operations at an airport are further classified as general aviation, air taxi/other, air carrier, or military. Air taxi is generally considered on-demand service that includes charter and fractional activity. This is considered itinerant in nature. Air carrier activity is scheduled passenger operations, which is not currently available at Columbia Gorge Regional Airport. Military activity is not unusual at general aviation airports and can include both local and itinerant. There is evidence of military activity at the airport. Typically, itinerant operations increase with business and commercial use as business aircraft are used primarily to transport people from one location to another.

Columbia Gorge Regional Airport is a non-towered facility. This means that actual operations counts are not readily available. Therefore, estimates must be made based on interviews with airport operators and management and from historical documentation. **Table 2N** presents the most current forecasts of total operations for the airport. None of these previous forecasts include projections for air taxi or military activity.

TABLE 2N Existing Total Operations Forecasts Columbia Gorge Regional Airport				
Year	**2004 ALP**	**2007 OAP**	**2008 TAF**	**2009 LATS**
2009	35,791	33,337	32,043	35,792
2010	36,143	34,343	32685	36,143
2015	37,898	37,511	36,091	37,898
2020	39,997	40,970	39,855	39,997
2025	42,421	44,750	44,008	42,338
2030	44,993	48,877	48,312	44,460
AAGR 2009-2030	1.10%	1.84%	1.97%	1.04%

ALP: Airport Layout Plan Report
OAP: Oregon Aviation Plan
TAF: Terminal Area Forecast
LATS: Washington Long-Term Air Transportation Study
Note: All Figures interpolated to plan years.

Source: Coffman Associates analysis

Itinerant General Aviation Operations

Table 2P outlines the history of itinerant general aviation operations at Columbia Gorge Regional Airport in relation to the total general aviation itinerant operations at towered airports in the United States. The Columbia Gorge Regional Airport market share, as a percentage of general aviation itinerant operations at towered airports across the country, increased from a low of 0.0898 percent in 2002, to a high of 0.1388 percent in 2009. This increase in the percentage share is reflective of growing itinerant operations at the airport, while total U.S. itinerant operations were generally declining. The national decline in total general aviation itinerant operations since 2002 is forecast to begin trending upward in 2010 and continue increasing through 2025. During a period where national general aviation itinerant operations were on the decline, Columbia Gorge Regional Airport realized an increase, and an overall increase in market share.

Several statistical analyses were conducted to generate forecasts of itinerant general aviation operations. An increasing market share forecast of U.S. itinerant operations was first developed that is consistent with the historical trend. This forecast resulted in an increase from 22,429 itinerant operations in 2009 to 34,135 in 2030, an average annual increase of 2.02 percent.

A second market share of U.S. itinerant operations was developed which held the 2009 ratio constant through 2030. This resulted in 30,566 operations in 2030. This forecast is not in keeping with the general growth trend in itinerant operations at the airport and, therefore, represents a low end forecast.

TABLE 2P
General Aviation Itinerant Operations Forecast
Columbia Gorge Regional Airport

Year	DLS GA Itinerant Ops[1]	US GA Itinerant Ops*	Market Share Itinerant Ops	DLS Based Aircraft[1]	Itinerant Ops Per Based Aircraft
2002	19,270	21,450,500	0.0898%	47	410
2003	19,755	20,231,300	0.0976%	48	412
2004	20,233	20,007,200	0.1011%	42	482
2005	20,718	19,315,100	0.1073%	57	363
2006	21,133	18,741,100	0.1128%	57	371
2007	21,556	18,577,200	0.1160%	57	378
2008	21,988	17,367,900	0.1266%	58	379
2009	22,429	16,160,100	0.1388%	59	380
Increasing Market Share (AGR = 2.02%)					
2015	24,257	17,326,100	0.1400%	75	323
2020	27,114	18,699,100	0.1450%	82	331
2030	34,135	22,022,486	0.1550%	95	359
Constant Market Share of 2009 Percent (AGR = 1.48%)					
2015	24,047	17,326,100	0.1388%	75	321
2020	25,953	18,699,100	0.1388%	82	316
2030	30,566	22,022,486	0.1388%	95	322
Constant Operations Per Based Aircraft (AGR = 2.29%)					
2015	28,511	17,326,100	0.1646%	75	380
2020	31,173	18,699,100	0.1667%	82	380
2030	36,114	22,022,486	0.1640%	95	380
Selected Forecast (AGR = 1.94%)					
2015	25,600	17,326,100	0.1478%	64	400
2020	28,100	18,699,100	0.1503%	73	385
2030	33,600	22,022,486	0.1526%	85	395

[1] Historical data from FAA Terminal Area Forecast (TAF)
* 2030 figure is extrapolated utilizing the 2010-2020 average annual growth rate.
AGR = Average Growth Rate from 2009 to 2030

A third forecast was developed that maintained a constant number of operations per based aircraft. In 2009, the airport has experienced 380 itinerant operations per based aircraft. When extending this ratio, the long range forecast results in 36,114 itinerant operations.

The selected forecast is an average of the three new forecasts developed for this master plan. By 2015, 25,600 annual itinerant general aviation operations are forecast. This is an average annual growth of 2.23 percent. By the long term planning period, itinerant operations are forecast to reach 33,600. The annual growth rate from 2009 to 2030 is 1.94 percent. The FAA desires that the operations forecast be within a 10 percent range of the TAF. The selected forecast meets this requirement.

Comparative Itinerant Operations Forecasts

Table 2Q presents the four most recent forecasts of aviation demand for the airport. Each of these forecasts is presented in the plan years of this master plan and has been interpolated and extrapolated as necessary. This comparison shows that there is a general consensus among the various forecasts related to the operations at the airport. The selected forecast appears to be within a reasonable range.

TABLE 2Q
Existing Comparative Itinerant Operations Forecasts
Columbia Gorge Regional Airport

Year	DLS GA Itinerant Ops[1]	US GA Itinerant Ops*	Market Share Itinerant Ops	DLS Based Aircraft	Itinerant Ops Per Based Aircraft
Oregon Aviation Plan 2007 (AGR = 1.84%)					
2009	23,336	16,160,100	0.1444%	61	383
2015	26,258	17,326,100	0.1515%	66	398
2020	28,679	18,699,100	0.1534%	69	416
2030	34,214	22,022,486	0.1554%	79	433
2004 ALP Report (AGR = 1.10%)					
2009	25,054	16,160,100	0.1550%	61	411
2015	26,529	17,326,100	0.1531%	64	415
2020	27,998	18,699,100	0.1497%	68	412
2030	31,495	22,022,486	0.1430%	74	426
FAA TAF Forecast (AGR = 1.97%)					
2009	22,429	16,160,100	0.1388%	59	380
2015	25,263	17,326,100	0.1458%	64	395
2020	27,897	18,699,100	0.1492%	73	382
2030	33,818	22,022,486	0.1536%	85	398
2009 LATS (AGR = 1.04%)					
2009	25,054	16,160,100	0.1550%	61	411
2015	26,529	17,326,100	0.1531%	64	415
2020	27,998	18,699,100	0.1497%	68	412
2030	31,122	22,022,486	0.1413%	76	410

* 2030 figure is extrapolated utilizing the 2010-2020 average annual growth rate.
AGR = Average Growth Rate from 2009 to 2030

Local General Aviation Operations

Local operations are generally considered training or touch-and-go operations. The rules governing pilot certification require a certain number of flight hours as well as landings and take-offs to maintain a pilot's license. The presence of a flight school at the airport can have a significant impact on the number of these operations. Recently, a flight school was established at the airport. There are approximately six full-time students. The new flight school is affiliated with a national flight training business and is actively marketing locally.

The airport provides many features that are attractive to pilots, especially the presence of instrument approaches, including the LDA/GS approach to Runway 25. This is a non-precision approach utilizing an offset localizer and glide slope antenna to provide vertical and horizontal positional information. This is the most sophisticated instrument approach within 60 miles of the airport.

The local general aviation operations forecast is developed with much the same methodology as the itinerant general aviation operations forecast. **Table 2R** presents the several forecasts and the selected forecast.

TABLE 2R
General Aviation Local Operations Forecast
Columbia Gorge Regional Airport

Year	DLS GA Local Ops	US GA Local Ops*	Market Share Local Ops	DLS Based Aircraft[1]	Local Ops Per Based Aircraft
2002	8,260	16,172,800	0.0511%	47	176
2003	8,467	15,292,100	0.0554%	48	176
2004	8,672	14,960,400	0.0580%	42	206
2005	8,880	14,845,900	0.0598%	57	156
2006	9,058	14,378,900	0.0630%	57	159
2007	9,240	14,557,300	0.0635%	57	162
2008	9,425	13,921,400	0.0677%	58	163
2009	9,614	13,184,900	0.0729%	59	163
Increasing Market Share (AGR = 1.43%)					
2015	10,287	13,273,200	0.0775%	75	137
2020	10,825	13,531,700	0.0800%	82	132
2030	12,953	14,392,000	0.0900%	95	136
Constant Market Share of 2009 Percent (AGR = 0.42%)					
2015	9,678	13,273,200	0.0729%	75	129
2020	9,867	13,531,700	0.0729%	82	120
2030	10,494	14,392,000	0.0729%	95	110
Constant Operations Per Based Aircraft 2009 (AGR = 1.87%)					
2015	12,221	13,273,200	0.0921%	75	163
2020	13,362	13,531,700	0.0987%	82	163
2030	15,480	14,392,000	0.1076%	95	163
Selected Forecast (AGR = 1.45%)					
2015	10,700	13,273,200	0.0806%	64	167
2020	11,400	13,531,700	0.0842%	73	156
2030	13,000	14,392,000	0.0903%	85	153

[1] Historical data from FAA Terminal Area Forecast (TAF)
* 2030 figure is extrapolated utilizing the 2010-2020 average annual growth rate.
AGR = Average Growth Rate from 2009 to 2030

The first forecast is an increasing market share of U.S. local operations. Over the previous 10 years, the airport has shown an increase in local operations even as national local operations have decreased. A reasonable planning envelope emerged considering the two other new forecasts. The low end is defined by a constant share of U.S. local operations and a high end results from maintaining a constant number of local operations per based aircraft. The several available comparative forecasts show the range to be reasonable.

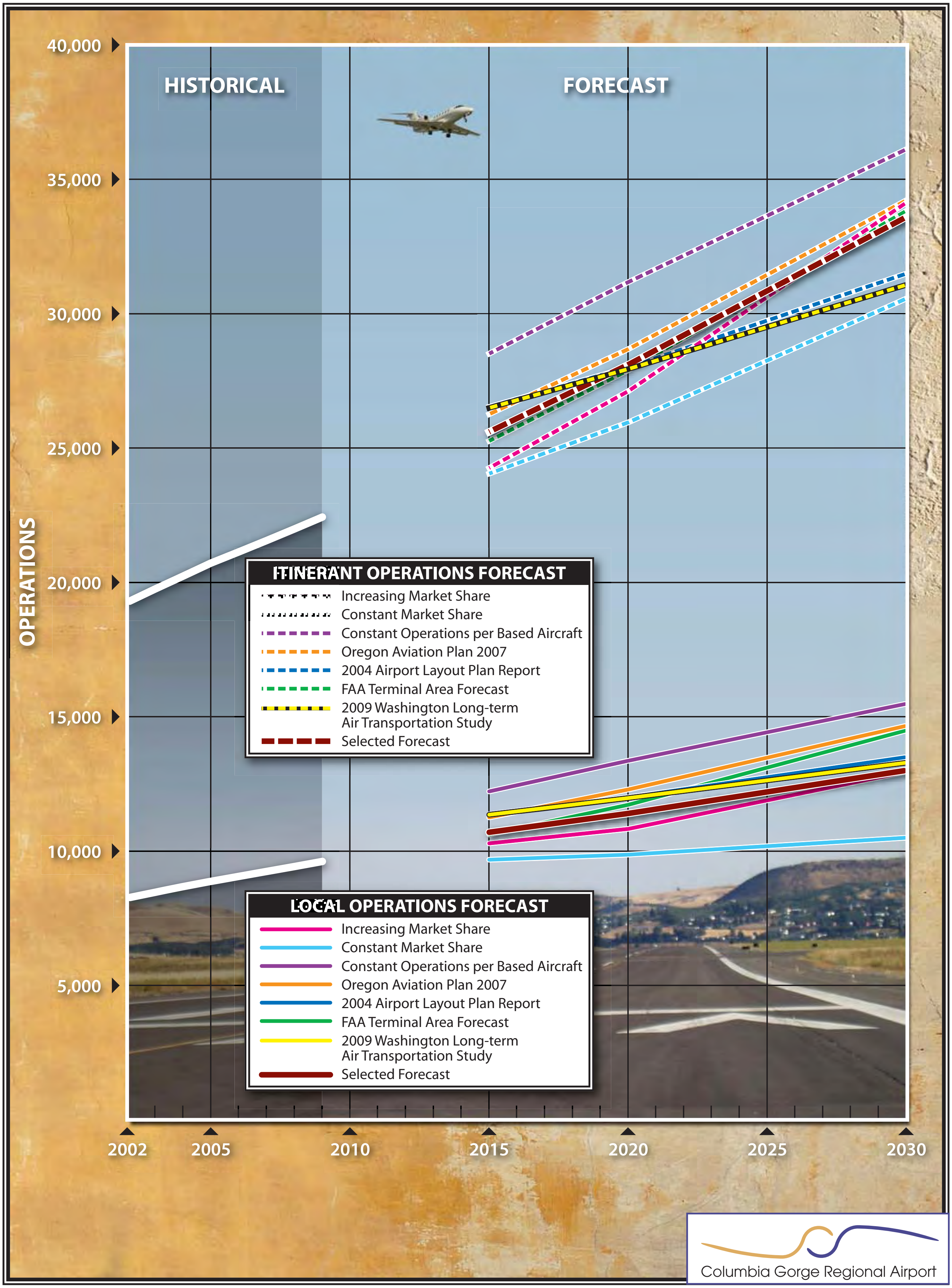
The selected forecast is an approximate average of the three new forecasts. In 2015, 10,700 local operations are forecast. This is forecast to steadily increase to 13,000 local operations in 2030. **Exhibit 2E** presents graphs of local and itinerant forecasts including the selected forecast for each.

Table 2S presents the four most recent forecasts of aviation demand for the airport. Each of these forecasts is presented in the plan years of this master plan and has been interpolated and extrapolated as necessary. This comparison shows that there is a general consensus among the various forecasts related to the operations at the airport. The selected forecast appears to be within a reasonable range.

TABLE 2S
Existing Comparative Local Operations Forecasts
Columbia Gorge Regional Airport

Year	DLS GA Local Ops	US GA Local Ops*	Market Share Local Ops	DLS Based Aircraft	Local Ops Per Based Aircraft
Oregon Aviation Plan 2007 (AGR = (1.84%)					
2009	10,001	13,184,900	0.0759%	61	164
2015	11,253	13,273,200	0.0848%	66	171
2020	12,291	13,531,700	0.0908%	69	178
2030	14,663	14,392,000	0.1019%	79	186
2004 ALP Report (AGR = 1.10%)					
2009	10,737	13,184,900	0.0814%	61	176
2015	11,369	13,273,200	0.0857%	64	178
2020	11,999	13,531,700	0.0887%	68	176
2030	13,498	14,392,000	0.0938%	74	182
FAA TAF Forecast (AGR = 1.97%)					
2009	9,614	13,184,900	0.0729%	59	163
2015	10,828	13,273,200	0.0816%	64	169
2020	11,958	13,531,700	0.0884%	73	164
2030	14,494	14,392,000	0.1007%	85	171
2009 LATS (AGR = 1.04%)					
2009	10,738	13,184,900	0.0814%	61	176
2015	11,369	13,273,200	0.0857%	64	178
2020	11,999	13,531,700	0.0887%	68	176
2030	13,338	14,392,000	0.0927%	76	176

* 2030 figure is extrapolated utilizing the 2010-2020 average annual growth rate.
AGR = Average Growth Rate from 2009 to 2030



Columbia Gorge Regional Airport

Exhibit 2E
ITINERANT AND LOCAL GENERAL AVIATION OPERATIONS FORECASTS

Air Taxi Operations

The air taxi category includes aircraft involved in on-demand passenger, small parcel transport, and air ambulance activity. This category of operations is regulated under Federal Aviation Regulations (FAR) Part 135. The *2004 Airport Layout Plan Report* and the 2007 *Oregon Aviation Plan* did not specifically forecast air taxi operations. The FAA TAF does have a category for air taxi but for Columbia Gorge Regional Airport, no forecast is provided. Therefore, a baseline estimate must be made based on interviews with airport management and businesses.

Life Flight Network operates an air ambulance helicopter and a fixed wing, twin-engine, Aero Commander from the airport. On average, they will experience one call per day throughout a year. Utilization is estimated at 50 percent between the helicopter and the fixed-wing aircraft. This translates to 365 operations per aircraft per year or 730 total annual operations.

Operators of fractional aircraft typically operate under FAR Part 135. Information related to how often these operators utilize the airport is limited. One source, www.airportiq.com, tracks flight plans that have been opened and closed on the ground. Any flight plans that are closed in the air, which is common if visual conditions exist, are not logged to a specific airport. This data was obtained for Columbia Gorge Regional Airport. The results showed that operators of fractionally owned aircraft do utilize the airport. Over the past several years, records have identified approximately 100 operations per year. This figure would represent the minimum.

The airport is located in a region of the country where energy production is extensive. Several of these companies utilize the airport as a starting point to do aerial monitoring of wind farms and other energy production infrastructure. Most of these operations are by helicopter. It is estimated that operations by these companies represent at least 1,300 annual operations. With a total count of 2,180 annual operations, air taxi represents an additional 10 percent of itinerant operations.

Table 2T presents the air taxi operations forecast. The forecast is based on 10 percent of itinerant operations being air taxi in nature. The FAA does forecast air taxi operations nationally and that figure is presented for comparative purposes. The forecast shows an annual growth rate from 2009 to 2030 of 2.14 percent. This figure is in line with the overall growth rate for itinerant operations at the airport of 1.94 percent.

TABLE 2T
Other/Air Taxi Forecasts

Year	Other/Air Taxi Operations	DLS Itinerant Operations	U.S. Air Taxi/ Commuter Operations	Percent
2009	2,180	22,429	10,270,800	0.0212%
FORECAST (AGR = 2.14%)				
2015	2,600	25,600	11,282,000	0.0230%
2020	2,800	28,100	11,985,100	0.0234%
2030*	3,400	33,600	13,788,266	0.0247%

* 2030 U.S. Air Taxi figure extrapolated at 1.5% annual growth
AGR = Annual Growth Rate
Sources: FAA TAF; FAA Aerospace Forecasts FY 2009-2025

Military Operations

At some general aviation airports, military operations can be common. Columbia Gorge Regional Airport does not experience regular military operations. The FAA TAF forecasts 1,000 itinerant military operations annually from 2001 through 2025. The previous master plan also included this figure. For planning purposes, this master plan will include 1,000 military itinerant operations for each of the plan years.

The Army National Guard 113th Aviation Regiment is based at the Eastern Oregon Regional Airport near Pendleton, Oregon, approximately 130 miles to the east of The Dalles. This unit flies CH-47 helicopters, the Chinook. They will utilize the Columbia Gorge Regional Airport on occasion, primarily to train with the instrument approaches. Gray Army Airfield is located at Fort Lewis, Washington, approximately 40 miles south of Seattle. The Columbia Gorge Regional Airport frequently sees activity from Blackhawk helicopters from the Gray Army Airfield.

Annually during the summer, the military teams up with local law enforcement and the Drug Enforcement Agency (DEA) to conduct exercises from the airport. They will base at the airport for several weeks and conduct missions to find illegal drug farms.

Overall, operations by military aircraft are estimated at 1,000 annually. Forecasts of military activity are difficult because the mission can change quickly. These forecasts will consider a constant 250 local and 750 itinerant military operations annually.

Operations Fleet Mix

Estimating the number of operations by aircraft type helps to identify necessary facility requirements and various environmental impacts. Operations by multi-engine, turboprop, and business jet aircraft are considered itinerant in nature. In an effort to generally estimate the number of operations by aircraft type, the airport staff began documenting N-numbers, aircraft type, date, and time of itinerant operations. This effort began in September 2009.

The results show that helicopters account for approximately 17 percent of total itinerant operations. Discussions with airport staff indicate that most of these operations are associated with the energy companies monitoring power lines or ferrying employees to more remote wind farms. Business jet activity represents approximately three percent of operations and turboprops represented eight percent. **Table 2U** presents the fleet mix operations forecast.

TABLE 2U
Fleet Mix Operations Forecast
Columbia Gorge Regional Airport

	2009	2015	2020	2030
Local Operations				
Piston (~92%)	9,064	10,050	10,650	12,050
Helicopter (~8%)	800	900	1,000	1,200
Total Local	9,864	10,950	11,650	13,250
Itinerant Operations[1]				
Single Piston (69%)	17,498	19,976	21,839	26,048
Multi-Piston (3%)	761	869	950	1,133
Turboprop (8%)	2,029	2,316	2,532	3,020
Jet (3%)	761	869	950	1,133
Helicopters (17%)	4,311	4,922	5,381	6,418
Total Itinerant	25,359	28,950	31,650	37,750
Total Operations	35,223	39,900	43,300	51,000

[1]Itinerant operations percent based on airport manual count.
Source: Coffman Associates analysis

Peaking Operations

Many aspects of facility planning relate to levels of peak activity. For example, the appropriate size of a terminal building can be estimated by determining the number of people that could reasonably be expected to use the facility at a given time. The following planning definitions apply to the peak periods:

- **Peak Month** -- The calendar month when peak aircraft operations occur.
- **Design Day** -- The average day in the peak month.
- **Busy Day** -- The busy day of a typical week in the peak month.
- **Design Hour** -- The peak hour within the design day.

It is important to note that only the peak month is an absolute peak within a given year. All other peak periods will be exceeded at various times during the year. The peak period forecasts represent reasonable planning standards that can be applied without overbuilding or being too restrictive.

Without the availability of records from a tower, peak periods must be estimated. The forecast of peak month operations assumes approximately 10 percent of annual operations. This is typical for a general aviation airport that does not have extreme seasonal changes to activity levels.

The design day was then calculated by dividing the peak month operations by 30. The busy day has been estimated at 40 percent higher than the average day in the peak month and was calculated by multiplying the design day by 1.4. Design hour operations were calculated at 17.5 percent of design day operations. **Table 2V** summarizes the general aviation peak activity forecasts.

TABLE 2V
Peak Operations Forecast
Columbia Gorge Regional Airport

	2008	2014	2019	2029
Annual Operations	35,223	39,900	43,300	51,000
Peak Month (10%)	3,522	3,990	4,330	5,100
Busy Day	164	186	202	238
Design Day	117	133	144	170
Design Hour (17.5%)	21	23	25	30

Source: Coffman Associates analysis

Annual Instrument Approaches

An instrument approach, as defined by the FAA, is "an approach to an airport with the intent to land by an aircraft in accordance with an Instrument Flight Rule (IFR) flight plan, when visibility is less than three miles and/or when the ceiling is at or below the minimum initial approach altitude." To qualify as an instrument approach, aircraft must land at the airport after following one of the published instrument approach procedures in less than visual conditions. Forecasts of annual instrument approaches (AIAs) provide guidance in determining an airport's requirements for navigational aid facilities such as an ILS. It should be noted that practice or training approaches do not count as annual AIAs.

During poor weather conditions, pilots are less likely to fly and rarely would perform training operations. As a result, an estimate of the total number of AIAs can be made based on a percent of itinerant operations regardless of the frequency of poor weather conditions. An estimate of two percent of itinerant operations is utilized to forecast AIAs at Columbia Gorge Regional Airport as presented in **Table 2W**.

TABLE 2W
Annual Instrument Approach (AIAs) Projections
Columbia Gorge Regional Airport

	AIAs	Itinerant Operations	Ratio
2015	579	28,950	2.00%
2020	633	31,650	2.00%
2030	755	37,750	2.00%

Source: Coffman Associates analysis

In the future, Columbia Gorge Regional Airport will be increasingly utilized by larger and more sophisticated aircraft (as is the trend nationally). Also, the increased availability of low-cost navigational equipment could allow for smaller and less-sophisticated aircraft to utilize instrument approaches. National trends indicate an increasing percentage of instrument approaches given the greater availability of approaches at airports with GPS and the availability of more cost-effective equipment.

SUMMARY

This chapter has outlined the various activity levels that might reasonably be anticipated over the planning period. **Exhibit 2F** presents a summary of forecasted data. The baseline year for forecast data is 2009. The forecasting effort extends 20 years to the year 2030.

Columbia Gorge Regional Airport is a general aviation airport experiencing approximately 35,000 operations in 2009. The airport has a two-runway system with the primary runway, Runway 12-30, measuring 5,097 feet in length and the secondary runway, Runway 7-25 measuring 4,647 feet. Runway 25 supports an unusual non-precision instrument approach with an offset localizer and glide slope antenna. This approach improves the capability of the airport in times of poor weather conditions.

General aviation activity often trends with national and local economies. The country has been in a recessionary period since December 2007, and activity at both commercial service airports and general aviation airports has been down. The Columbia Gorge Regional Airport has, to date, weathered the economic downturn fairly well. Operations have continued to trend upward, and all but one of the available hangar positions is full.

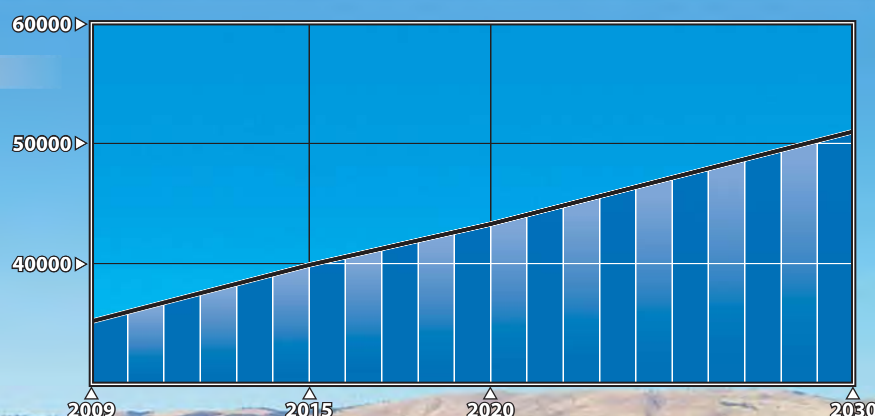
The aviation demand forecasts generally follow a historical growth trend at the airport. Based aircraft are forecast to grow from 68 in 2009 to 95 in 2030. Operations are forecast to grow from 35,000 in 2009 to 51,000 in 2030. The fleet mix at the airport is projected to continue to be dominated by smaller piston-powered aircraft. In the future, the airport is forecast to see the addition of at least one business jet, and a few more turboprops and helicopters.

The next step in the master plan process is to use the forecasts to determine development needs for the airport through 2030. Chapter Three – Facility Requirements will address airside elements, such as safety areas, runway, taxiways, lighting, and navigational aids, as well as landside requirements, including hangars, aircraft aprons, and support services. As a general observation, Columbia Gorge Regional Airport is well-positioned for growth into the future. The local economy is forecast to be strong and there are no airports that compete significantly within 60 miles. The remaining portions of the master plan will lay out how that growth can be accommodated in an orderly, efficient, and cost-effective manner.

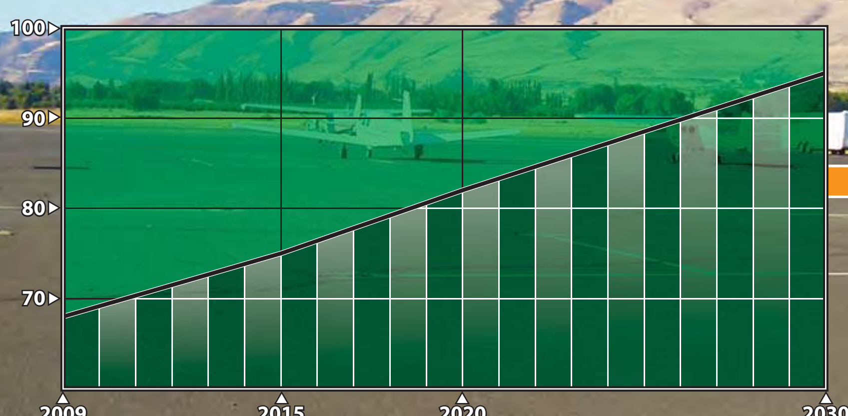
08MP04-2F-7/16/10

	ACTUAL	FORECAST		
ANNUAL OPERATIONS	**2009**	**2015**	**2020**	**2030**
General Aviation				
Itinerant	22,429	25,600	28,100	33,600
Local	9,614	10,700	11,400	13,000
Military				
Itinerant	750	750	750	750
Local	250	250	250	250
Air Taxi (Itinerant)	2,180	2,600	2,800	3,400
Total Itinerant	**25,359**	**28,950**	**31,650**	**37,750**
Total Local	**9,864**	**10,950**	**11,650**	**13,250**
TOTAL OPERATIONS	**35,223**	**39,900**	**43,300**	**51,000**
BASED AIRCRAFT	**2009**	**2015**	**2020**	**2030**
Single Engine	57	62	66	77
Multi-Engine	2	2	3	3
Turboprop	5	6	7	7
Business Jet	0	1	1	2
Helicopter	4	4	5	6
TOTAL BASED AIRCRAFT	**68**	**75**	**82**	**95**
Instrument Approaches (AIAs)	NA	579	633	755

Annual Operations



Based Aircraft



Columbia Gorge Regional Airport

Exhibit 2F
FORECAST SUMMARY

Columbia Gorge Regional Airport

Chapter Three

FACILITY REQUIREMENTS

FACILITY REQUIREMENTS

To properly plan for the future of Columbia Gorge Regional Airport, it is necessary to translate forecast aviation demand into the specific types and quantities of facilities that can adequately serve this identified demand. This chapter uses the results of the forecasts presented in Chapter Two, as well as established planning criteria, to determine the airfield (i.e., runways, taxiways, navigational aids, marking and lighting) and landside (i.e., hangars, aircraft parking apron, and automobile parking) facility requirements.

The objective of this effort is to identify, in general terms, the adequacy of the existing airport facilities, outline what new facilities may be needed, and when these may be needed to accommodate forecast demands. Having established these facility requirements, alternatives for providing these facilities will be evaluated in Chapter Four - Alternatives to determine the most cost-effective and efficient means for implementation.

PLANNING HORIZONS

An updated set of aviation demand forecasts for Columbia Gorge Regional Airport has been established. These activity forecasts include annual operations, based aircraft, fleet mix, and peaking characteristics. With this information, specific components of the airfield and landside system can be evaluated to determine their capacity to accommodate future demand.

Cost-effective, efficient, and orderly development of an airport should rely more upon actual demand at an airport than on a time-based forecast figure. In order to develop a master plan that is demand-based rather than time-based, a series of planning hori-

zon milestones have been established that take into consideration the reasonable range of aviation demand projections.

It is important to consider that the actual activity at the airport may be higher or lower than what the annualized forecast portrays. By planning according to activity milestones, the resultant plan can accommodate unexpected shifts or changes in the area's aviation demand. It is important for the plan to accommodate these changes so that airport officials can respond to unexpected changes in a timely fashion.

The most important reason for utilizing milestones is it allows airport management to make decisions and develop facilities according to need generated by actual demand levels. The demand-based schedule provides flexibility in development, as development schedules can be slowed or expedited according to demand at any given time over the planning period. The resultant plan provides airport officials with a financially responsible and needs-based program. The planning milestones essentially correlate to the five, ten, and twenty-year periods used in the previous chapter.

CRITICAL AIRCRAFT

The selection of appropriate Federal Aviation Administration (FAA) design standards for the development and location of airport facilities is based primarily upon the characteristics of the aircraft which are currently using or are expected to use the airport. The critical design aircraft is used to define the design parameters for the airport. The critical design aircraft is defined as the most demanding category of aircraft, or family of aircraft, which conducts at least 500 operations per year at the airport. Planning for future aircraft use is of particular importance since design standards are used to plan separation distances between facilities. These future standards must be considered now to ensure that short term development does not preclude the long range potential needs of the airport.

The FAA has established a coding system to relate airport design criteria to the operational and physical characteristics of aircraft expected to use the airport. This airport reference code (ARC) has two components. The first component, depicted by a letter, is the aircraft approach category and relates to aircraft approach speed (operational characteristic); the second component, depicted by a Roman numeral, is the airplane design group and relates to aircraft wingspan (physical characteristic). Generally, aircraft approach speed applies to runways and runway-related facilities, while airplane wingspan primarily relates to separation criteria involving taxiways, taxilanes, and landside facilities.

According to FAA Advisory Circular (AC) 150/5300-13, *Airport Design*, an aircraft's approach category is based upon 1.3 times its stall speed in landing configuration at that aircraft's maximum certificated weight. The airplane design group (ADG) is based upon either the aircraft's wingspan or tail height, whichever is greater. For example, an aircraft may fall in ADG II for wingspan but ADG III for tail height. This aircraft would be classified under ADG-III. **Table 3A** presents the components of the airport reference code.

TABLE 3A
Airport Reference Code

Aircraft Approach Category		
Category	*Speed*	
A	< 91 Knots	
B	91- < 121 Knots	
C	121- < 141 Knots	
D	141- <166 Knots	
E	≥ 166 Knots	
Airplane Design Group[1]		
Group	*Tail Height (ft)*	*Wingspan (ft)*
I	< 20	< 49
II	20- < 30	49- < 79
III	30- < 45	70- < 118
IV	45- < 60	118- < 171
V	60- < 66	171- < 214
VI	66- < 80	214- < 262

[1] Utilize the most demanding category.
Source: FAA AC 150/5300-13, Airport Design

Exhibit 3A summarizes representative aircraft by ARC. As shown on the exhibit, the airport does not currently, nor is it expected to, regularly serve aircraft in ARCs C-IV, D-IV, or D-V. These large transport aircraft are used by commercial carriers, which do not currently use, nor are they expected to use, the airport through the planning period. Some of the largest business jets such as the Gulfstream V fall in ARC D-III and are capable of operating at the airport under certain conditions.

In order to determine airfield design requirements, the critical aircraft and critical ARC should first be determined then appropriate airport design criteria can be applied. This begins with a review of aircraft currently using the airport and those expected to use the airport through the 20-year planning period.

CURRENT CRITICAL AIRCRAFT

The critical design aircraft is defined as the most demanding category of aircraft which conduct 500 or more itinerant operations at the airport each year. In some cases, more than one specific make and model of aircraft comprises the airport's critical design aircraft. One category of aircraft may be the most critical in terms of approach speed, while another is most critical in terms of wingspan and/or tail height, which affects runway/taxiway width and separation design standards.

General aviation aircraft using the airport include a variety of small single and multi-engine piston-powered aircraft, turboprops, and occasionally turbojet aircraft. While the airport is used by a number of helicopters, they are not included in this determination as they are not assigned an ARC.

The majority of the based aircraft are single and multi-engine piston-powered aircraft which fall within approach categories A and B and ADG I. To determine if the current ARC for the airport is larger than A/B-I, an analysis of both based and transient activity by larger turboprops and business jets was undertaken.

There are no business jets based at the airport currently. There are five turboprop aircraft based at the airport: two Air Tractor 402s, a TBM850, a Rockwell Aero Commander 690, and a Piper Meridian. Each of these aircraft falls in ARC B-I. Therefore, the based turboprops would justify, at a minimum, ARC B-I. An examination of itinerant activity, from two primary sources was also undertaken.

A subscription service from www.airportiq.com provides data on flight plans. The data available includes aircraft owner, aircraft type, N-number, origin, destination, date, and time-of-day. The database only captures those flight plans that are opened and closed on the ground. It is common for pilots to either open or close a flight plan while in the air, particularly when operating in visual conditions. Therefore, the data captured represents a minimum level of activity and actual activity is higher. Nonetheless, from this database, it can be determined what types of aircraft utilize the airport. **Table 3B** is a sampling of the types of larger aircraft that have utilized the airport over the last several years.

TABLE 3B
Business Jet and Turboprop Activity
Columbia Gorge Regional Airport

Owner	Aircraft Type	Aircraft Model	Aircraft ARC
Bank of America	Jet	Cessna 525	B-I
Cardinal Glass Industries	Jet	Cessna 560XL	B-II
Swanson Aviation	Jet	Cessna 680	C-II
Valley Jet, LLC	Jet	IAI G-200	C-II
GC Air, LLC	Jet	G-IV	D-II
Wells Fargo	Jet	Hawker 800XP	C-II
V3, LLC	Jet	Lear 60	D-I
Wilson Construction	Jet	Cessna 525	B-I
First Union Commercial Corp.	Jet	Gulfstream IV	D-II
Cardinal IG Co.	Turboprop	King Air 200	B-II
Hawker Beechcraft Corp.	Turboprop	King Air 200	B-II
PC Aviation, LLC	Turboprop	King Air 90	B-II
Summit Projects, Inc	Turboprop	Piper 46-350P	A-I
U.S. Dept. of Energy	Turboprop	King Air 300	B-II

Source: www.airportiq.com

As can be seen, a wide variety of businesses and government agencies use the airport. Aircraft as large as the Gulfstream IV (D-II) were identified in the database. More common business jet activity is seen from those in ARC C-II and below. Airport management has indicated that some of the largest business jets including the Gulfstream V (D-III) have utilized the airport.

The previous Airport Layout Plan (ALP) indicated that the ARC was B-II for both runways. This determination was based primarily on acoustical counts taken at the airport in 1999 through the State of Oregon. The acoustical counts estimated multi-engine operations (including turbine) at 2,646 and business jet operations at 75. Assuming these operations were

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A-I

- Beech Baron 55
- **Beech Bonanza**
- Cessna 150
- Cessna 172
- Cessna Citation Mustang
- Eclipse 500
- Piper Archer
- Piper Seneca

B-I *less than 12,500 lbs.*

- Beech Baron 58
- Beech King Air 100
- Cessna 402
- **Cessna 421**
- Piper Navajo
- Piper Cheyenne
- Swearingen Metroliner
- Cessna Citation I

B-II *less than 12,500 lbs.*

- **Super King Air 200**
- Cessna 441
- DHC Twin Otter

B-I, B-II *over 12,500 lbs.*

- Super King Air 350
- Beech 1900
- Jetstream 31
- Falcon 10, 20, 50
- Falcon 200, 900
- **Citation II**, III, IV, V
- Saab 340
- Embraer 120

A-III, B-III

- DHC Dash 7
- **DHC Dash 8**
- DC-3
- Convair 580
- Fairchild F-27
- ATR 72
- ATP

C-I, D-I

- Beech 400
- **Lear 25, 31, 35, 45, 55, 60**
- Israeli Westwind
- HS 125-400, 700

C-II, D-II

- Cessna Citation III, VI, VIII, X
- **Gulfstream II, III, IV**
- Canadair 600
- ERJ-135, 140, 145
- CRJ-200, 700, 900
- Embraer Regional Jet
- Lockheed JetStar

C-III, D-III

- ERJ-170, 190
- Boeing Business Jet
- B 727-200
- **B 737-300 Series**
- MD-80, DC-9
- Fokker 70, 100
- A319, A320
- Gulfstream V
- Global Express

C-IV, D-IV

- **B-757**
- B-767
- C-130
- DC-8-70
- DC-10
- MD-11
- L1011

D-V

- **B-747** Series
- B-777

Note: Aircraft pictured is identified in bold type.

Columbia Gorge Regional Airport

Exhibit 3A
AIRPORT REFERENCE CODES

largely split between B-I and B-II, it was determined that operations by aircraft in ARC B-II represented at least 1,325 operations at the airport.

A more recent sampling of activity at the airport was begun in September 2009 and continues to the present. The airport FBO is manually tracking itinerant activity. From September 17 to October 26, 2009, B-II or larger aircraft included the King Air 200, Citation X, Hawker 4000, Citation 550, Citation 560XL, Beechjet 400, and IAI Astra. Some of these aircraft are operating under weight restrictions because of the runway length.

Given the wide variety of turboprop and business jets that operate at the airport, a critical aircraft falling into ARC B-II is reasonable. By meeting this design standard, the airport can meet the needs of all turboprop aircraft and approximately 50 percent of the business jet fleet. Larger business jets can and do operate at the airport but on a less frequent basis. If an extension of the runway system were needed, it would be these aircraft that would drive the need. **Therefore, the current critical aircraft is determined to be in ARC B-II.**

FUTURE CRITICAL AIRCRAFT

The aviation demand forecasts indicate the potential for continued growth in business jet and turboprop activity at the airport. This includes the forecast addition of at least one based business jet in the short term and up to two jets by the long term. Based turboprops are also expected to increase.

The type and size of the business jet activity in the future is difficult to precisely identify. Factors such as the forecast population and employment growth in the airport service area, the proximity and level of service at other regional airports, and development at the airport can influence future activity. One of the development factors could be the construction of a golf and residential resort, as presented in Chapter One. Part of this plan is to include an apron and terminal building facility on the east side of the airport. Such a facility would potentially attract more business jets to the airport.

Increased activity by larger business jets would drive the need to meet more stringent design standards, including any expansion of the runway and taxiway system. The forecasts do not point to large business jets representing the critical aircraft within the planning period. **Therefore, this master plan will consider the long term critical aircraft to remain in ARC B-II.**

AIRFIELD REQUIREMENTS

As indicated earlier, airport facilities include both airfield and landside components. Airfield facilities include those facilities that are related to the arrival, departure, and ground movement of aircraft. These components include:

- Safety Area Design Standards
- Runways
- Taxiways
- Navigational Approach Aids
- Lighting, Marking, and Signage

SAFETY AREA DESIGN STANDARDS

The FAA has established several imaginary surfaces to protect aircraft operational areas and keep them free from obstructions that could affect their safe operation. These include the runway safety area (RSA), object free area (OFA), obstacle free zone (OFZ), precision obstacle free zone (POFZ), and runway protection zone (RPZ).

The entire RSA, OFZ, POFZ, and OFA should be under the direct ownership of the airport sponsor to ensure these areas remain free of obstacles and can be readily accessed by maintenance and emergency personnel. It is not required that the RPZ be under airport ownership, but it is strongly recommended. An alternative to outright ownership of the RPZ is the purchase of avigation easements (acquiring control of designated airspace within the RPZ) or having sufficient land use control measures in places which ensure the RPZ remains free of incompatible development. **Exhibit 3B** presents the various safety areas and highlights those areas where the safety areas are non-standard.

Dimensional standards for the various safety areas associated with the runways are a function of the type of aircraft (ARC) expected to use the runways as well as the approved instrument approach capability. Both runways should meet the design standards for frequent activity by aircraft in ARC B-II. The approach with the best minimums is the circling GPS approach which offers visibility minimums as low as 1¼-mile. Runway 25 offers a sophisticated LDA/glide slope instrument approach but the visibility minimum is 2¾-miles. The cloud ceiling for both of these instrument approaches is higher than 1,000 feet which defines visual flight conditions.

Runway Safety Area (RSA)

The RSA is defined in FAA Advisory Circular (AC) 150/5300-13, *Airport Design,* as a "surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of undershoot, overshoot, or excursion from the runway." The RSA is centered on the runway and dimensioned in accordance to the approach speed of the critical aircraft using the runway. The FAA requires the RSA to be cleared and graded, drained by grading or storm sewers, capable of accommodating the design aircraft and fire and rescue vehicles, and free of obstacles not fixed by navigational purpose.

The FAA has placed a higher significance on maintaining adequate RSA at all airports. Under Order 5200.8, effective October 1, 1999, the FAA established the *Runway Safety Area Program*. The Order states, "The objective of the Runway Safety Area Program is that all RSAs at federally-obligated airports…shall conform to the standards contained in Advisory Circular 150/5300-13, *Airport Design*,

09MP06-3C-7/16/10

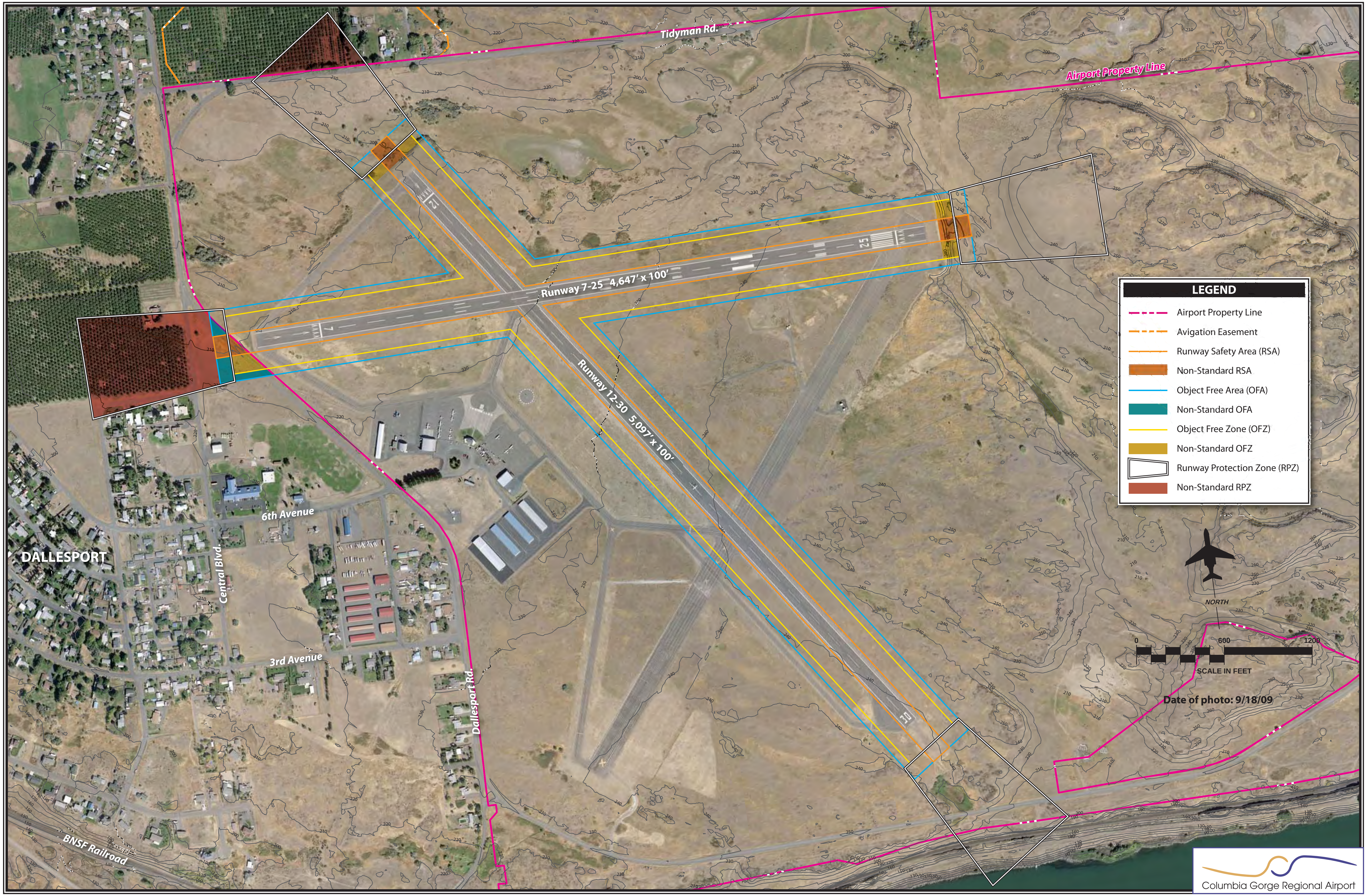

Exhibit 3B
AIRFIELD SAFETY AREAS

to the extent practicable." Each Regional Airports Division of the FAA is obligated to collect and maintain data on the RSA for each runway at the airport and perform airport inspections.

Table 3C presents the FAA design standards as they apply to Columbia Gorge Regional Airport. The airport should meet the standards associated with ARC B-II now and into the future. The table also presents the design standards for ARC C-II if the airport ever transitioned to the next level of design aircraft. This information is simply for comparative purposes as this master plan does not forecast a transition to ARC C-II within the 20-year scope.

TABLE 3C
Runway Design Standards
Columbia Gorge Regional Airport

	FAA Standards		**Current Airport Condition**
Design Standard	**B-II**	**C-II***	**B-II**
Applicable Approach	**> 1 Mile**	**> 1 Mile**	**> 1 Mile**
RUNWAYS			
Runway Width	75	100	100
Runway Shoulder Width	10	10	10
Runway Safety Area			
Width	150	500	Non-Standard
Length Beyond End	300	1,000	Non-Standard
Length Prior to Landing	300	600	300
Runway Object Free Area			
Width	500	800	Non-Standard
Length Beyond End	300	1,000	Non-Standard
Runway Obstacle Free Zone			
Width	400	400	Non-Standard
Length Beyond End	200	200	Non-Standard
Runway Centerline to:			
Holding Position	200	250	200
Parallel Taxiway	240	300	>240
Aircraft Parking Area	250	400	>250

* For comparative purposes only
Source: FAA AC 150/5300-13, Airport Design

The RSA for both runways should be 150 feet wide and extend 300 feet beyond the runway ends. The length beyond the runway ends is measured from the end of the runway, and not the location of the displaced landing thresholds. The existing RSA extends approximately 100 feet behind (to the northwest) of the Runway 12 pavement end before it is penetrated by a fence line and bushes. The RSA beyond the Runway 30 end appears to meet the design standards.

The RSA behind the Runway 25 end extends approximately 100 feet before the terrain drops significantly. The RSA grading standard is a maximum of three percent within the first 200 feet of RSA beyond the runway end and five percent over the length of the RSA beyond the runway end.

The RSA beyond the Runway 7 pavement end is penetrated by the perimeter fence approximately 50 feet from the runway end. Because of the angle of Dallesport Road compared to the runway, the width of the RSA is also penetrated in this area.

Object Free Area (OFA)

The runway OFA is "a two-dimensional ground area, surrounding runways, taxiways, and taxilanes, which is clear of objects except for objects whose location is fixed by function (i.e., airfield lighting)." The OFA does not have to be graded and level like the RSA; instead, the primary requirement for the OFA is that no object in the OFA, penetrate the lateral elevation of the RSA. The runway OFA is centered on the runway, extending out in accordance to the critical aircraft design category utilizing the runway.

For a B-II runway with visual approaches or an instrument approach with visibility minimums of not less than 1-mile, such as the runways at Columbia Gorge Regional Airport, the FAA calls for the OFA to be 500 feet wide, centered on the runway, and extend 300 feet beyond the runway ends. The length of the OFA beyond the runway ends is the same as the RSA.

The OFA behind Runway 12 is penetrated by bushes and a fence line in much the same manner as the RSA in this area. The OFA appears to be in compliance behind the Runway 30 end. The OFA behind the Runway 25 end appears to be in compliance since there is not a grading standard for the OFA as there is for the RSA. The OFA behind the Runway 7 end is penetrated by the perimeter fence and Dallesport Road. This also negatively impacts the width of the OFA.

Obstacle Free Zones (OFZ)

The OFZ is an imaginary volume of airspace which precludes object penetrations, including taxiing and parked aircraft. The only allowance for OFZ obstructions is navigational aids mounted on frangible bases which are fixed in their location by function such as airfield signs. The OFZ is established to ensure the safety of aircraft operations. If the OFZ is obstructed, the airport's approaches could be removed or approach minimums could be increased.

For all runways serving aircraft over 12,500 pounds, the OFZ is 400 feet wide, centered on the runway, and extends 200 feet beyond the runway ends. This standard applies to both runways at the airport. The OFZ is non-standard behind the Runway 7 end due to the penetration of the fence and Dallesport Road.

Precision Obstacle Free Zone (POFZ)

For runways providing a vertically guided approach, a precision obstacle free zone (POFZ) is required. The POFZ is defined as "a volume of airspace above an area beginning at the runway threshold, at the threshold elevation, and centered on the extended runway centerline, 200 feet long by 800 feet wide." The POFZ is only in effect when the following operational conditions are met:

1. Vertically guided approach

2. Reported ceiling below 250 feet and/or visibility less than three-quarters-of-a-statute-mile

3. An aircraft on final approach within two (2) miles of the runway threshold

When these conditions are met, aircraft holding for take-off must hold in such a position so that neither the fuselage nor the tail of the aircraft penetrates the POFZ. The wings of the aircraft are allowed to penetrate the surface. Runway 25 has a vertically guided approach but the visibility minimum is 2¾-mile, thus POFZ standards will not apply to Columbia Gorge Regional Airport.

Runway Protection Zones (RPZ)

The RPZ is a trapezoidal area centered on the runway, typically beginning 200 feet beyond the runway end. The RPZ has been established by the FAA to provide an area clear of obstructions and incompatible land uses, in order to enhance the protection of approaching aircraft as well as people and property on the ground. The RPZ is comprised of the central portion of the RPZ and the controlled activity area. The dimensions of the RPZ vary according to the visibility minimums serving the runway and the type of aircraft (design aircraft) operating on the runway. The dimensions of the RPZs at Columbia Gorge Regional Airport are presented in **Table 3D**.

TABLE 3D
Runway Protection Zones
Columbia Gorge Regional Airport

	All Runways	
Visibility Minimum	> 1-mile	> 1-mile
Airport Reference Code	B-II	C-II*
Inner Width	500	500
Outer Width	700	1,010
Length	1,000	1,700

* For comparative purposes only
Source: FAA AC 150/5300-13, Airport Design

The central portion of the RPZ extends from the beginning to the end of the RPZ, is centered on the runway centerline, and is the width of the OFA. Only objects necessary to aid air navigation, such as approach lights, are allowed in this portion of the RPZ. Wildlife attractants, fuel farms, places of public assembly, and residences are prohibited from the RPZs. The remaining portions of the RPZ, the controlled activity areas, have strict land use limitations. FAA AC 150/5300-13, *Airport Design*, specifically allows surface parking facilities but they are discouraged. All other uses are prohibited.

As previously discussed, where possible, the airport should have positive control over all safety areas including the RPZs. Currently, portions of the RPZs serving Runways 12, 30, and 7 extend beyond the airport property line.

Runway/Taxiway Separation

The design standards for the separation between runways and parallel taxiways are determined by the critical aircraft and the instrument approach visibility minimum. The current critical aircraft is represented by those aircraft in ARC B-II. The separation standard is 240 feet from the runway centerline to the parallel taxiway centerline. All parallel taxiways meet or exceed this standard.

AIRFIELD CAPACITY

A demand/capacity analysis measures the capacity of the airfield facilities (i.e., runways and taxiways) in order to identify and plan for additional development needs. Columbia Gorge Regional Airport's multi-runway system can provide up to 230,000 annual operations under ideal conditions. Due to times when the airport is closed, typically due to weather, a more reasonable capacity is identified as approximately 210,000 annual operations.

FAA Order 5090.3B, *Field Formulation of the National Plan of Integrated Airport Systems* (NPIAS), indicates that improvements to capacity should be considered when operations reach 60 percent of the airfield's annual service volume (ASV). If the projected long range planning horizon level of 51,000 operations comes to fruition, the airfield's ASV will reach 24 percent. As a result, there is not a need for additional runways or other capacity improvements.

RUNWAYS

The adequacy of the existing runway system at Columbia Gorge Regional Airport has been analyzed from a number of perspectives, including runway orientation, runway length, pavement strength, width, and adherence to safety area standards. From this information, requirements for runway improvements were determined for the airport.

Runway Orientation

The airport is served by two intersecting runways. A third runway was closed and converted into a taxiway in 2005. Runway 12-30 is orientated in a northwest to southeast manner, intersecting Runway 7-25 approximately 1,800 feet from the Runway 7 pavement end. Runway 7-25 is oriented in an east to west manner, and intersects Runway 12-30 approximately 1,100 feet from the Runway 12 pavement end.

For the operational safety and efficiency of an airport, it is desirable for the primary runway to be oriented as close as possible to the direction of the prevailing wind. This reduces the impact of wind components perpendicular to the direction of travel of an aircraft that is landing or taking off.

FAA Advisory Circular 150/5300-13, *Airport Design,* recommends that a crosswind runway should be made available when the primary runway orientation provides for less than 95 percent wind coverage for specific crosswind components. The 95 percent wind coverage is computed on the basis of the crosswind component not exceeding 10.5 knots (12 mph) for ARCs A-I and B-I; 13 knots (15 mph) for ARCs A-II and B-II; and 16 knots (18 mph) for ARC C-I through D-II.

Weather data specific to the airport was obtained from the NOAA National Climatic Data Center. This data was collected from the on-field automated surface observation system (ASOS) over a continuous 10-year period from 1998 to 2009. A total of 87,558 observations of wind direction and other data points were made.

Runway 12-30 provides 95.08 percent wind coverage for 10.5 knot crosswinds, 97.77 percent coverage at 13 knots, and 99.34 percent at 16 knots. Runway 7-25 provides for 90.66 percent wind coverage at 10.5 knots, 95.88 percent at 13 knots, and 98.78 percent at 16 knots. **Exhibit 3C** presents a wind rose of the data developed following FAA guidance.

At a minimum, the airport should maintain the two runway system. Runway 12-30 provides the greatest length, which is necessary when considering the increasing usage of the airport by larger aircraft needing more runway length. Runway 7-25 provides the only instrument approach with vertical and horizontal guidance. If the approach could be relocated to the Runway 30 end the airport could remain viable with a single runway, but mountainous terrain prevents this possibility. Therefore, Runway 12-30 and 7-25 should be maintained and should both be capable of accommodating operations by the critical aircraft group to the greatest extent practicable.

Runway Length

Runway 12-30 is the primary runway and is 5,097 feet in length. Runway 7-25 is the crosswind runway measuring 4,647 feet in length. The determination of runway length requirements for the airport is based on five primary factors:

- Mean maximum temperature of the hottest month
- Airport elevation
- Runway gradient
- Critical aircraft type expected to use the airport
- Stage length of the longest nonstop destination (specific to larger aircraft)

The mean maximum daily temperature of the hottest month for Columbia Gorge Regional Airport is 89 degrees Fahrenheit (F). The airport elevation is 247 feet above mean sea level (MSL). The runway end elevation difference is 32 feet for Runway 7-25 and 28.5 feet for Runway 12-30. Runway 12-30 has a longitudinal gradient of 0.7 percent, while Runway 7-25 has a 0.6 percent longitudinal gradient, both of which conform to FAA design standards. For aircraft in approach categories A and B, the runway longitudinal gradient cannot exceed two percent. For aircraft in approach categories C and D, the maximum allowable longitudinal runway gradient is 1.5 percent.

The first step in evaluating runway length requirements is to determine general runway length requirements for the majority of aircraft operating at the airport. The majority of operations at Columbia Gorge Regional Airport consist of small aircraft weighing less than 12,500 pounds. According to runway length charts in AC 150/5325-4B, *Runway Length Requirements for Airport Design*, 100 percent of small aircraft with fewer than 10 passenger seats can operate on a 3,800-foot long runway. Small aircraft with 10 or more passenger seats require a runway length of 4,100 feet. Both runways provide adequate length to meet the needs of the predominant airport operators.

Runway length requirements for business jets weighing less than 60,000 pounds have also been calculated. These calculations take into consideration the runway gradient and landing length requirements for contaminated runways (wet). AC 150/5325-4B stipulates that runway length determination for business jets consider a grouping of airplanes with similar operating characteristics. The AC provides two separate "family groupings of airplanes" each based upon their representative percentage of aircraft in the national fleet. The first grouping is those business jets that make up 75 percent of the national fleet and the second group is those making up 100 percent of the national fleet. **Table 3E** presents a partial list of aircraft in each aircraft grouping. A third group considers business jets weighing more than 60,000 pounds. Runway length determination for these aircraft must be based on the performance characteristics of the individual aircraft.

TABLE 3E
Business Jet Categories for Runway Length Determination

75 percent of the national fleet	MTOW	75-100 percent of the national fleet	MTOW	Greater than 60,000 pounds	MTOW
Lear 35	20,350	Lear 55	21,500	Gulfstream II	65,500
Lear 45	20,500	Lear 60	23,500	Gulfstream IV	73,200
Cessna 550	14,100	Hawker 800XP	28,000	Gulfstream V	90,500
Cessna 560XL	20,000	Hawker 1000	31,000	Global Express	98,000
Cessna 650 (VII)	22,000	Cessna 650 (III/IV)	22,000		
IAI Westwind	23,500	Cessna 750 (X)	36,100		
Beechjet 400	15,800	Challenger 604	47,600		
Falcon 50	18,500	IAI Astra	23,500		

MTOW: Maximum Take Off Weight
Source: FAA AC 150/5325-4B, Runway Length Requirements for Airport Design

Table 3F presents the results of the runway length analysis developed following the guidance provided in FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*. To accommodate 75 percent of the business jet fleet, a runway length of 5,500 feet is recommended. This length is de-

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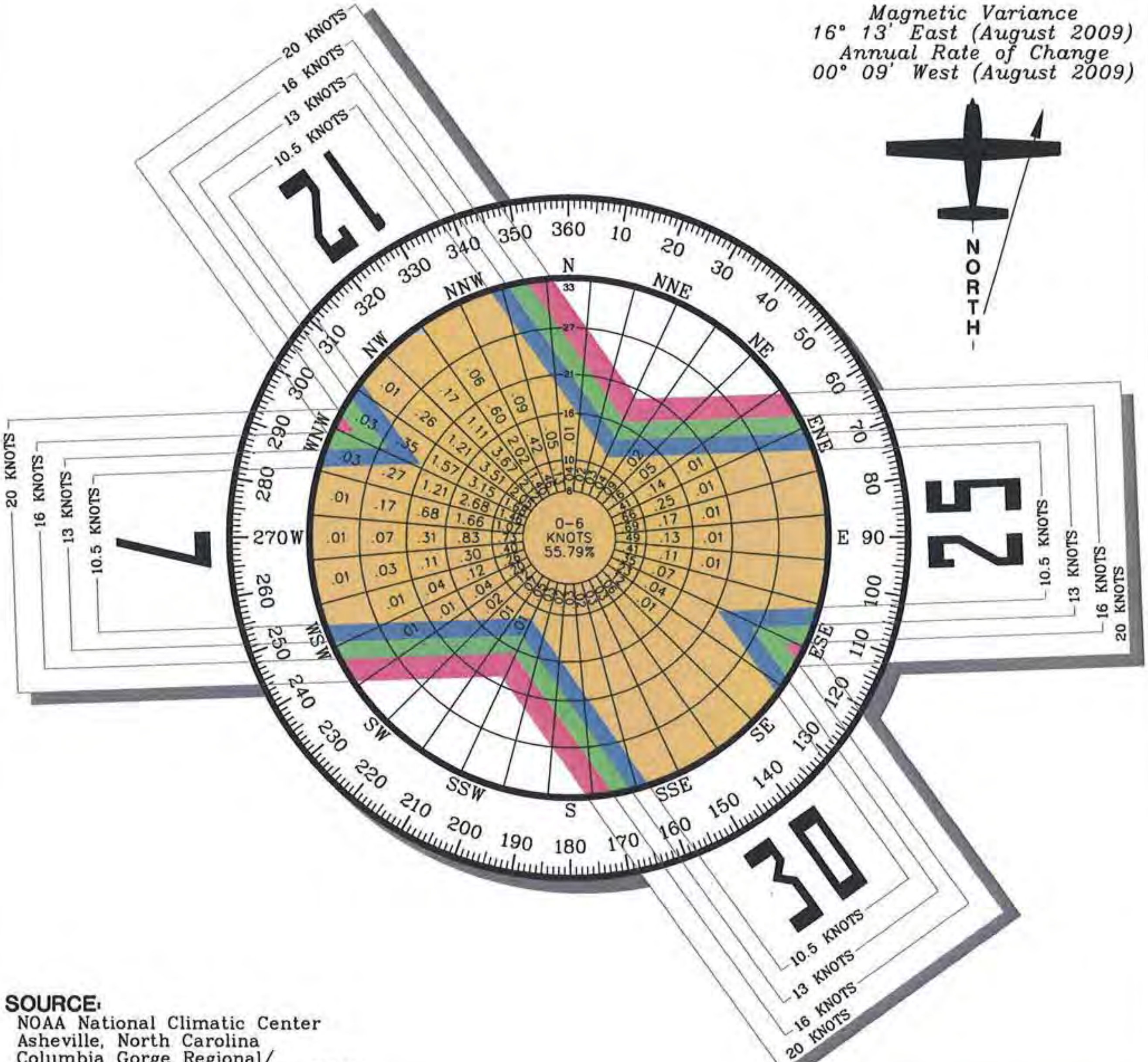
ALL WEATHER WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 7-25	*90.66%*	*95.88%*	*98.78%*	*99.86%*
Runway 12-30	*95.08%*	*97.77%*	*99.34%*	*99.87%*
Combined	*99.70%*	*99.96%*	*100.00%*	*100.00%*

Magnetic Variance
16° 13' East (August 2009)
Annual Rate of Change
00° 09' West (August 2009)



SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Columbia Gorge Regional/
The Dalles Municipal Airport (DLS)
Dalles Port, Washington

OBSERVATIONS:
87,558 All Weather Observations
10/1998-08/2009

Columbia Gorge Regional Airport

Exhibit 3C
WIND ROSE

rived from a raw length of 4,800 feet that is adjusted, as recommended, for runway gradient, and consideration of landing length needs on a contaminated runway (wet and slippery). Dry runways would require approximately 5,100 feet of runway length to accommodate 75 percent of the business jets. Utilization of the 90 percent useful load characteristics is not allowed unless specific justification exists.

TABLE 3F
Recommended Runway Lengths
Columbia Gorge Regional Airport

Airport and Runway Data	
Airport Elevation	247 feet above mean sea level
Average high monthly temperature	89 degrees (August)
Runway gradient*	31.6' Runway 7-25
Runway Length Recommended for Airport Design	
Category of Aircraft	**Runway Length**
Small airplanes with less than 10 passenger seats	
95 percent of these small airplanes	3,200’
100 percent of these small airplanes	3,800’
Small airplanes with 10 or more passenger seats	4,100’
Business jets of 60,000 pounds or less	
75% of fleet at 60% useful load	**5,500'**
100% of fleet at 60% useful load	6,000'
75% of fleet at 90% useful load	7,000'
100% of fleet at 90% useful load	9,000'
Business jets of more than 60,000 pounds	6,100’

* Difference in feet between runway end elevations.
Note: Runway lengths above 30 feet are rounded up to the nearest 100 feet.
Source: FAA AC 150/5325-4B, Runway Length Requirements for Airport Design.

To accommodate business jets in the 75 to 100 percent category, a runway length of 6,000 feet is recommended. The recommended runway length to accommodate business jets weighing greater than 60,000 pounds is 6,100 feet. Without specific justification of an operations need, these runway length requirements cannot be utilized.

Columbia Gorge Regional Airport will continue to experience operations by business jets. According to the forecast presented in Chapter Two, at least one business jet could base at the airport in the short term and two are forecast by the long term. The operations fleet mix estimated current business jet operations at 761 annually with growth to 1,133 by the long term. Without actual evidence of the type of business jets, it is assumed that the majority of these operations will be by those falling in the 75 percent category. Therefore, to accommodate landing length requirements of business jets in the 75 percent category on a wet runway, a minimum runway length of 5,500 feet is recommended. Alternatives to be developed in Chapter Four will consider the possibilities of extending one runway to this length.

Runway Width

Both runways are 100 feet wide having been reduced in recent years from 150 feet. According to the design criteria for ARC B-II airports, the runways need to be at least 75 feet wide. The runways have been maintained at 100 feet in width due to ever increasing activity by larger turboprop and business jet aircraft. Maintaining the runways at a 100-foot width preserved the growth potential for the airport; therefore, this width should be maintained.

Runway Strength

An important feature of airfield pavement is its ability to withstand repeated use by aircraft. The FAA Airport/Facility Directory places the pavement strength for both runways at 30,000 pounds single wheel loading (SWL), and 30,000 pounds dual wheel loading (DWL). These strength ratings refer to the configuration of the aircraft landing gear. For example, SWL indicates an aircraft with a single wheel on each landing gear.

In 2008, the airport engineer was contracted to conduct a pavement evaluation to determine the actual pavement condition. Utilizing deflection testing and runway core sampling, it was determined that the runways consist of approximately 2.5 inches of asphalt concrete over approximately 6.5 inches of sandy gravel.

Based on the results of the core sampling and deflection testing, the single wheel load bearing capacity for Runway 7-25 is estimated at 4,000 pounds. For Runway 12-30, the load bearing capacity is estimated at 18,000 pounds. These strength ratings do not preclude operations by aircraft with greater weight but it does indicate that the life of the pavement will be significantly reduced. The airport does require prior permission for aircraft weighing more than the published 30,000 pounds.

The airport should consider capital projects that increase the strength rating of both runways to at least 30,000 pounds SWL and 60,000 pounds DWL.

The report says an approximate overlay of between 4.5 and 5.0 inches of asphalt for both runways would be needed to accommodate operations by aircraft weighing up to 50,000 pounds.

TAXIWAYS

As is common with many former military airfields, the taxiway layout and design is not uniform. Guidance from the FAA of taxiway layouts is presented in AC 150/5300-13, *Airport Design* and *Engineering Brief No. 75: Incorporation of Runway Incursion Prevention into Taxiway and Apron Design*. The engineering brief recommends taxiways to intersect the runway at a 90-degree angle in order to improve pilot situational awareness by increasing visibility to both ends of the runway. The brief also discourages multiple taxiways and/or runway intersections.

At Columbia Gorge Regional Airport, there are several locations where taxiways angle to intersect with the runway. There are also several locations where multiple taxiways intersect in one location. The airfield design plan will reduce these conflict points and improve safety.

The taxiway width standard for a critical aircraft in ADG II is 35 feet. The critical design aircraft currently and into the future is anticipated to remain in ADG II; therefore, taxiways should be at least 35 feet wide. The taxiways vary in width at Columbia Gorge Regional Airport. Historically, the FAA has supported continued maintenance of taxiways that exceed design standards because the cost to remove a portion of the width and relocate lighting can exceed the cost of long term maintenance. The alternatives discussion will address the taxiway layout and provide alternate layouts to improve safety.

INSTRUMENT NAVIGATIONAL AIDS

Runway 25 has an LDA/DME instrument approach that provides vertical and horizontal guidance from an offset localizer antenna and a glide slope antenna. This approach provides for visibility minimums as low 2¾-miles and cloud ceilings of 1,200 feet for A and B aircraft only. This approach was implemented in 2005 by the FAA following an Environmental Assessment that included analysis of the area airspace. This approach is likely the best instrument approach the airport is going to be able to obtain primarily due to the mountainous terrain.

The airport also has a circling GPS approach that provides for visibility minimums not lower than 1¼-miles for small aircraft in approach category A and 1½-miles in approach category B. The approach is also authorized for use by pilots operating aircraft in approach categories C and D but the visibility minimum is 3 miles.

The airport is located in the Columbia River Gorge which results in a loss of direct communication with air traffic control when aircraft are below approximately 500 feet. Several solutions may be available to alleviate this problem.

The FAA has begun a rollout of the Surveillance and Broadcast Services (SBS) program. Approximately 800 SBS ground-based radio stations are planned to be installed by 2013. The system automatically transmits the equivalent of ground-based radar coverage and real time local and regional weather information.

Another element related to the SBS system is the Wide Area Multilateration (WAM) system. Utilizing several ground-based remote sensors to determine aircraft position, this information is provided to the pilots and air traffic control to help pilots navigate in mountainous terrain. This system is new in 2009 and is initially being rolled out in Juneau, Alaska and in portions of Colorado.

VISUAL NAVIGATION AIDS

The airport beacon, located just west of the terminal building, provides for rapid identification of the airport. The beacon should be maintained through the planning period.

Runway end identification lights (REIL) are strobe lights set to either side of the runway. These lights provide rapid identification of the runway threshold. REILs should be installed at runway ends not currently providing an approach lighting system but supporting instrument operations. REILs are located on the end of Runway 30 and should be maintained. REILS should also be considered for Runway 25.

Precision approach path indicator (PAPI) lights provide pilots with visual descent information to the runway touchdown zone. There are no visual approach path aids at the airport currently. Analysis in the alternatives chapter will utilize the new airport mapping to determine if PAPIs are feasible for approaches to Runways 25 and 30.

A summary of the airside needs at Columbia Gorge Regional Airport is presented on **Exhibit 3D**.

LANDSIDE REQUIREMENTS

Landside facilities are those necessary for the handling of aircraft and passengers while on the ground. These facilities provide the essential interface between the air and ground transportation modes. The capacity of the various components of each element was examined in relation to projected demand to identify future landside facility needs. This includes components for general aviation needs such as:

- Aircraft Hangars
- Aircraft Parking Aprons
- General Aviation Terminal
- Auto Parking and Access
- Airport Support Facilities

HANGARS

Utilization of hangar space varies as a function of local climate, security, and owner preferences. The trend in general aviation aircraft, whether single or multi-engine, is toward more sophisticated aircraft (and consequently, more expensive aircraft); therefore, many aircraft owners prefer enclosed hangar space to outside tie-downs.

The demand for aircraft storage hangars is dependent upon the number and type of aircraft expected to be based at the airport in the future. For planning purposes, it is necessary to estimate hangar requirements based upon forecast operational activity. However, hangar development should be based upon actual demand trends and financial investment conditions.

While a majority of aircraft owners prefer enclosed aircraft storage, a number of based aircraft owners will still tie-down outside (due to the lack of hangar availability, hangar rental rates, and/or operational needs). Therefore, enclosed hangar facilities do not necessarily need to be planned for each based aircraft. At Columbia Gorge Regional Airport, it is estimated that 83 percent of the based aircraft are currently stored in hangars (12 tie-down aircraft). If facilities are available, it is estimated that 91 percent will be stored in a hangar in the short term (7 tie-down aircraft), 92 percent in the intermediate term (7 tie-down aircraft), and 95 percent in the long term (5 tie-down aircraft).

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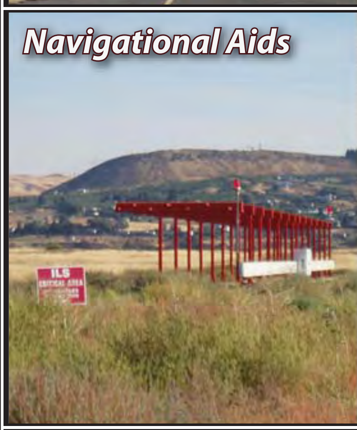
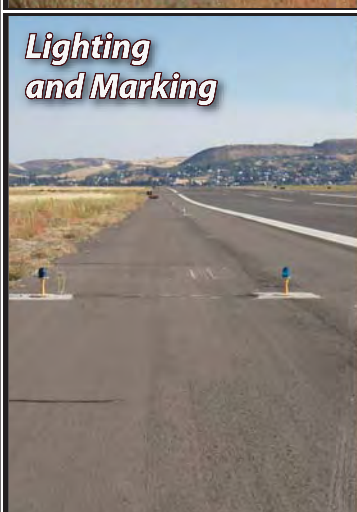
CATEGORY	AVAILABLE	SHORT TERM	LONG TERM
Runways 	**Runway 12-30** ARC B-II 5,097' x 100' 18,000# SWL 18,000# DWL Non-standard safety areas **Runway 7-25** ARC B-II 4,647' x 100' 4,000# SWL 4,000# DWL Non-standard safety areas	**Runway 12-30** ARC B-II Same 30,000# SWL 60,000# DWL Standard safety areas **Runway 7-25** Same Same 30,000# SWL 60,000#DWL Standard safety areas	**Runway 12-30** ARC B-II 5,500' x 100' Same Same Same **Runway 7-25** Same Same Same Same Same
Taxiways 	Vary from 30' to 50' wide Angled Threshold Taxiways	Uniform 50' width Evaluate Right-angle Threshold Taxiways	Same Same
Navigational Aids 	RCO, ASOS, Segmented Circle **Runway 12-30** GPS-A (Circling) **Runway 7-25** GPS-A (Circling) LDA/DME Rwy 25	Same **Runway 12-30** Same **Runway 7-25** Same Same	SBS Radio Station **Runway 12-30** GPS Straight-In (Rwy 30), if feasible **Runway 7-25** GPS Straight-In (Rwy 25), if feasible ILS Straight-In (Rwy 25), if feasible
Lighting and Marking 	Rotating beacon Three lighted windcones MITL Throat Lighting MIRL **Runway 12-30** Basic marking REIL (30) **Runway 7-25** Precision marking	Same Same Full MITL Same **Runway 12-30** Same Same Add PAPI (Rwy 30), if feasible **Runway 7-25** Same Add PAPI (Rwy 25), if feasible	Same Same Same Same **Runway 12-30** Same Same Same **Runway 7-25** Same Same

KEY

PAPI - Precision Approach Path Indicator
GPS - Global Positioning System
DME - Direction Measuring Equipment
REIL - Runway End Identification Lights
MIRL - Medium Intensity Runway Lighting
MITL - Medium Intensity Taxiway Lighting
ASOS - Automated Surface Observation System
RCO - Remote Communications Outlet

Columbia Gorge Regional Airport

Exhibit 3D
AIRSIDE REQUIREMENTS

There are three general types of aircraft storage hangars: T-hangars, box-hangars, and conventional hangars. T-hangars are similar in size and will typically house one single engine piston powered aircraft. Some multi-engine aircraft owners may elect to utilize these facilities as well. There are typically many T-hangar units "nested" within a single structure. There are 51 T-hangar units at the airport. For determining future aircraft storage needs, a planning standard of 1,200 square feet per based aircraft is utilized for T-hangars.

Box hangars are open-space facilities with no interfering supporting structure. Box hangars can very in size and can either be attached to others or be standalone hangars. Typically, box hangars will house larger multi-engine, turboprop, or jet aircraft. For planning purposes, the Quonset hut is considered a box hangar with the capability of housing two aircraft. For future planning, a standard of 2,500 square feet per aircraft is utilized for box hangars.

Conventional hangars are the familiar large hangars with open floor plans that can store several aircraft. At Columbia Gorge Regional Airport, there are two conventional hangars, one to the immediate north of the terminal building and one to the south. For planning purposes, the northern conventional hangar has the capability to house up to five aircraft but currently houses three. The conventional hangar to the south can house up to three but currently houses the two Air Tractor spray aircraft. For future planning needs, 2,500 square feet per aircraft is utilized for conventional hangars.

There is a total of 61 possible enclosed aircraft storage spaces with 57 of those spaces currently occupied. Three of the four remaining spaces are located within the conventional hangars that are leased to a single entity whose businesses are not aircraft storage. Therefore, the theoretical space available in the conventional hangars is not available to the general public.

Table 3G presents the need for aircraft storage based on the demand forecasts. Assumptions have been made on owner preferences for a storage type based on trends at general aviation airports. More sophisticated aircraft such as multi-engine, turboprop, and jets are assumed to be in a hangar. Half of the helicopters are also assumed to be in hangars. Tie-down aircraft are assumed to be single engine piston and the remaining half of the helicopters.

A portion of executive and conventional hangars often are utilized for maintenance activities or for office space. A planning standard of 175 square feet per based aircraft is considered for these purposes and is considered in addition to the aircraft storage needs.

It is estimated that there is 78,600 square feet of hangar space available currently. In the short term, there is a forecast need for 11 additional aircraft storage positions and 43,400 square feet of hangar space. The results of the forecasts show that this hangar space is needed in the form of box and conventional hangars. By the intermediate term, an additional 16,000 square feet of storage space is needed to accommodate an additional seven based aircraft. By the long term, a total of 163,000 square feet of storage space is needed from a mix of T-hangars, box hangars, and conventional hangars, to accommodate a total of 90 based aircraft to be stored.

It should be noted that these hangar requirements are general in nature based on the aviation demand forecasts. The actual need for hangar space will further depend on the actual usage within hangars. For example, some hangars may be utilized entirely for non-aircraft storage; yet from a planning standpoint, they have an aircraft storage capacity. Therefore, the needs of an individual user may differ from the calculated space necessary.

TABLE 3G
Hangar Needs
Columbia Gorge Regional Airport

	Available	Forecast Need		
	Base Year	Short Term	Intermediate Term	Long Term
Total Based Aircraft	68	75	82	95
Aircraft In Hangars	56	68	75	90
T-Hangars (1,200 s.f.)				
Single Engine		46	49	60
Multi-Engine		0	1	1
Turbo/Jet		0	0	0
Helicopter		0	0	0
Total T-hangar Positions	51	46	50	61
Total T-hangar Area	59,600	55,000	60,000	73,000
Total Square Feet Needed		0	400	13,400
Conventional Hangars (2,500 s.f.)				
Single Engine		5	6	7
Multi-Engine		1	1	1
Turbo/Jet		4	4	5
Helicopter		1	1	1
Total Conventional Hangar Positions	8	11	12	14
Total Conventional Hangar Area	13,000	26,000	31,000	35,000
Total Square Feet Needed		13,000	18,000	22,000
Box Hangars (2,500 s.f.)				
Single Engine		6	6	8
Multi-Engine		1	1	1
Turbo/Jet		3	4	4
Helicopter		1	2	2
Total Box Hangar Positions	2	11	13	15
Total Box Hangar Area	3,000	28,000	33,000	38,000
Total Square Feet Needed		25,000	30,000	35,000
Maintenance Hangars and Area	3,000	13,000	14,000	17,000
Total Hangar Positions	**61/57***	**68**	**75**	**90**
Total Hangar Area (s.f.)	**78,600**	**122,000**	**138,000**	**163,000**
Total Hangar Area Need (s.f.)		**43,400**	**16,000**	**25,000**

* Theoretical positions available are 61 based on area calculations. Actual usage is 57 positions.

AIRCRAFT PARKING APRON

The aircraft parking apron is an expanse of paved area intended for aircraft parking and circulation. Typically, a main apron is centrally located near the airside entry point, such as a terminal building. Ideally, the main apron is large enough to accommodate transient airport users as well as a portion of locally based aircraft. Often smaller aprons are available adjacent to FBO hangars and at other locations around the airport. The apron layout at Columbia Gorge Regional Airport follows this typical pattern.

The apron to the south of the terminal building is designated for transient aircraft. There are 24 tie-down positions sized for small aircraft on this 7,900 square yard apron. The central apron is approximately 7,000 square yards and is utilized for circulation and for fueling. There are no designated parking positions in this area. There are two aprons to the northwest of the terminal building with 37 local tie-down positions sized for small aircraft. These two aprons total approximately 13,450 square yards. There are no designated large aircraft parking positions designated at the airport currently. Excluding the central circulation apron, there is a total of 21,350 square yards of apron parking available.

FAA Advisory Circular 150/5300-13, *Airport Design*, suggests a methodology by which transient apron requirements can be determined from knowledge of busy-day operations. At Columbia Gorge Regional Airport, the number of itinerant spaces required was determined to be approximately 13 percent of the busy-day itinerant operations. This results in a current need for 15 itinerant aircraft parking spaces. By the long term planning period, 23 spaces are estimated to be needed.

A planning criterion of 800 square yards per aircraft was applied to determine future transient apron area requirements for single and multi-engine aircraft. For turboprops and business jets (which can be much larger), a planning criterion of 1,600 square yards per aircraft position was used. The current need for transient apron area is 14,100 square yards. By the long term planning period, approximately 22,000 square yards is necessary.

For planning purposes, 85 percent of transient spaces are estimated to be needed for non-jet aircraft, which is in line with airport activity levels. This results in a current need for two designated large aircraft spaces. By the long term planning period, there is a need for a total of four large aircraft spaces.

An aircraft parking apron should provide space for the number of locally based aircraft that are not stored in hangars, transient aircraft, and for maintenance activity. For local tie-down needs, an additional ten spaces are identified for maintenance activity. Maintenance activity would include the movement of aircraft into and out of hangar facilities and temporary storage of aircraft on the ramp. Currently, a total of 22 local positions are needed (12 based plus 10 additional).

Total apron parking requirements are presented in **Table 3H**. Currently, there are 24 transient positions available for single and multi-engine aircraft and none designated for larger business aircraft. The calculated need for transient parking is 14,100 square yards, and there is 7,900 square yards currently available. The need for transient position and apron area are both forecast to increase through the planning period.

TABLE 3H
Aircraft Apron Requirements
Columbia Gorge Regional Airport

			FORECAST		
	Currently Available (2009)	**Calculated Need (2009)**	**Short Term**	**Intermediate Term**	**Long Term**
Local Apron Positions	37	22	17	17	15
Local Apron Area (s.y.)	13,450	14,000	11,000	11,000	10,000
Transient Apron Positions	24	15	18	19	23
Piston Transient Positions	24	13	15	16	19
Turbine Transient Positions	0	2	3	3	4
Transient Apron Area (s.y.)	7,900	14,100	16,100	17,700	22,000
Central Circulation Apron	7,000	7,000	7,000	7,000	7,000
Total Apron Area (s.y.)	28,350	35,100	34,100	35,700	39,000

The apron area designated for local tie-downs and maintenance activity appears adequate through the long term planning period. This is primarily due to the assumption that as more hangars are constructed, a greater percentage of those who currently tie-down will transition to an enclosed hangar. The transient apron provides an adequate number of positions for small aircraft but there are no designated positions for larger aircraft. In addition, more transient apron area may be needed to allow for greater clearances between aircraft. It should be noted that while it is preferred to designate between itinerant and local apron areas, on busier days, apron area can be cross-utilized to accommodate the mix experienced on that day.

GENERAL AVIATION TERMINAL FACILITIES

General aviation terminal facilities have several functions. Space is required for a pilots' lounge, flight planning, concessions, management, and storage. More advanced airports will have leasable space in the terminal building for such features as a restaurant, FBO line services, and other needs. This space is not necessarily limited to a single, separate terminal building, but can include space offered by FBOs in their hangars for these functions and services.

The methodology used in estimating general aviation terminal facility needs is based on the number of airport users expected to utilize general aviation facilities during the design hour. General aviation space requirements were then based upon providing 120 square feet per design hour itinerant passenger. Design hour itinerant passengers are determined by multiplying design hour itinerant operations by the number of passengers on the aircraft (multiplier). An increasing passenger count (from 1.9 to 2.3) is used to account for the likely increase in the number of passengers utilizing general aviation services. **Table 3J** outlines the general aviation terminal facility space requirements for Columbia Gorge Regional Airport.

TABLE 3J
General Aviation Terminal Area Facilities
Columbia Gorge Regional Airport

	Existing	Short Term	Intermediate Term	Long Term
Design Hour Operations	21	23	25	30
Design Hour Itinerant Operations	15	17	18	22
Multiplier	1.9	2.0	2.1	2.3
Total Design Hour Itinerant Passengers	29	33	38	51
General Aviation Building Space (s.f.)	2,500	4,000	5,000	6,000

The terminal building at Columbia Gorge Regional Airport, constructed in 1943, provides approximately 2,500 square feet of space. This includes space leased for a small restaurant operation. Interviews with airport management have indicated that the current size of the building is constraining. The forecasts confirm this by indicating that, at a minimum, 4,000 square feet may be needed in the short term and 6,000 feet in the long term. The feasibility of either expanding the existing building or construction of a new building will be explored in the alternatives chapter.

In addition, the airport terminal building is the entrance to the community for most air passengers utilizing the airport. It should be assumed that these passengers include decision-makers who may be considering investment in the community. Therefore, it is recommended that the airport sponsor be cognizant of the appearance of the airport and the terminal building in particular.

SUPPORT REQUIREMENTS

Various facilities that do not logically fall within classifications of airside or landside facilities have also been identified. These other areas provide certain functions related to the overall operation of the airport.

AUTOMOBILE PARKING

Planning for adequate automobile parking is a necessary element for any airport. Parking needs can effectively be divided between transient airport users and locally based users. Transient users include those employed at the airport and visitors, while locally based users primarily include those attending to their based aircraft. A planning standard of 1.9 times the design hour passenger count provides the minimum number of vehicle spaces needed for transient users. Locally based parking spaces are calculated as one-half the number of based aircraft.

At Columbia Gorge Regional Airport, there are approximately 45 vehicle parking spaces available near the terminal building. Each of the airport business hangars has vehicle parking available. A planning standard of 400 square feet is utilized to determine total vehicle parking space necessary. This includes area needed for circulation and handicap clearances. Parking requirements for the airport are summarized in **Table 3K**.

TABLE 3K
GA Vehicle Parking Requirements
Columbia Gorge Regional Airport

	Existing	Short Term	Intermediate Term	Long Term
Design Hour Itinerant Passengers	29	33	38	51
GA Itinerant Spaces		60	69	92
GA Based Spaces		38	41	48
Itinerant Parking Area (s.f.)		24,000	28,000	37,000
GA Based Parking Area (s.f.)		15,000	16,000	19,000
Total GA Parking Area (s.f.)	18,000	39,000	44,000	56,000
Total Parking Spaces	45	98	110	139

There appears to be a need in the short term for additional vehicle parking spaces. Parking should be made available in close proximity to the terminal building and airport businesses. In an effort to limit the level of vehicle traffic on the aircraft movement areas, many general aviation airports are providing separate parking in support of facilities with multiple aircraft parking positions, such as T-hangars. Vehicle parking spaces will be considered in conjunction with additional facility needs in the alternatives chapter.

AIRCRAFT RESCUE AND FIREFIGHTING (ARFF) FACILITIES

Only those airports that are certificated under Title 14 Code of Federal Regulations, Part 139, are required to have on-site firefighting capabilities. Columbia Gorge Regional Airport is not a Part 139 airport and, therefore, is not required to have on-site firefighting capabilities. Instead, local fire departments respond to airport emergencies.

The closest fire station is Volunteer Fire District No. 6 located less than a minute from the airport in Dallesport. There is an operations Oshkosh ARFF crash vehicle at the fire station. This vehicle has storage capacity for water, dry chemical, and aqueous firefighting foam (AFFF). Other traditional firefighting equipment is also available.

A location on airport property to the west of the terminal building has been identified for a future fire station. The alternatives chapter will analyze if this is the best location for this facility.

FUEL STORAGE

Columbia Gorge Regional Airport has underground fuel storage tanks located under the central apron in proximity to the self-serve fuel island. There is a 10,000-gallon Avgas tank and a 12,000-gallon tank for Jet A fuel. These tanks are owned by the airport and fuel management is undertaken by the airport FBO.

In recent years, underground fuel tanks have caused environmental concerns. A tank that develops a crack or leak can go unnoticed and the ground soil and environment can be damaged. While relocation of the tanks to an aboveground position is not legally required at this time, at the first opportunity the airport should take this step.

Additional fuel storage capacity should be planned when the airport is unable to maintain an adequate supply and reserve. While each airport determines their own desired reserve, a 14-day reserve is common for general aviation airports. When additional capacity is needed, it should be planned in 10,000 to 12,000 gallon increments. Common fuel tanker trucks have an 8,000-gallon capacity. While the current capacity appears to be adequate to meet the needs of the airport, future operational activity levels could necessitate additional capacity needs. The alternatives chapter will examine the relocation of the underground tanks with a doubling of capacity.

A summary of landside and support needs is presented on **Exhibit 3E**.

SUMMARY

The intent of this chapter has been to outline the facilities required to meet potential aviation demand projected for Columbia Gorge Regional Airport for the next 20 years. In an effort to provide a more flexible master plan, the yearly forecasts from Chapter Two have been converted to planning horizon levels. The short term roughly corresponds to a five-year time frame, the intermediate term is approximately 10 years, and the long term is 20 years. By utilizing planning horizons, airport management can focus on demand indicators for initiating projects and grant requests rather than on specific dates in the future.

The current and future critical design aircraft (500 or more annual operations), fall in airport reference code B-II. Representative aircraft include many turboprops such as the King Air 300 and some smaller business jets such as the Cessna Citation models 500, 550, and 560. The forecasts indicate that operations at the airport will continue to grow with an increase in activity by all aircraft types including turboprops and business jets.

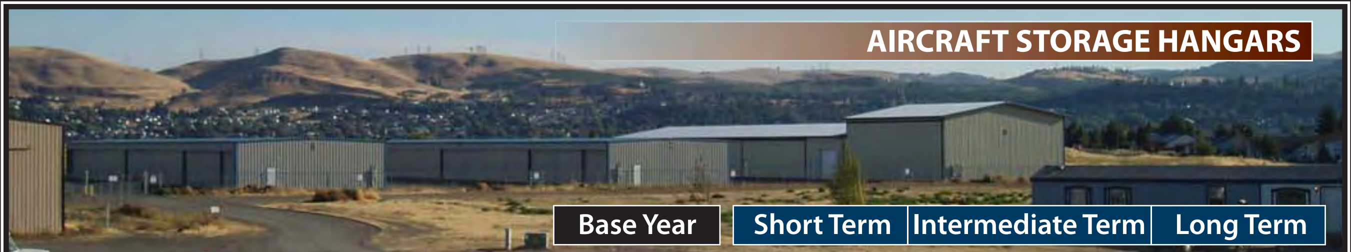
The airfield system, including the current maximum runway length of 5,097 feet, meets the needs of the critical aircraft. To accommodate a greater percentage of business jets, a runway extension to 5,500 feet should be considered. This would likely be an intermediate or long term need unless one or several business jets base at the airport in the short term.

On the landside, the airport has been very proactive in recent years. Over 40 new T-hangar positions have been constructed in the last 10 years and all of them are full. Additional hangar space is needed to accommodate forecast growth. It is recommended that the airport diversify its hangar offerings by focusing on medium-sized box hangars or an additional conventional hangar.

The next chapter, Alternatives, will examine potential improvements to the airfield system. Most of the alternatives discussion will focus on those capital improvements that would require federal grant funds. Other projects of local concern will also be presented. On the land side, several facility layouts that meet the forecast demands over the next 20 years will be presented. Ultimately, an overall airport layout vision that is well beyond the 20-year scope of the master plan will be developed.

09MP063E-7/16/10

AIRCRAFT STORAGE HANGARS

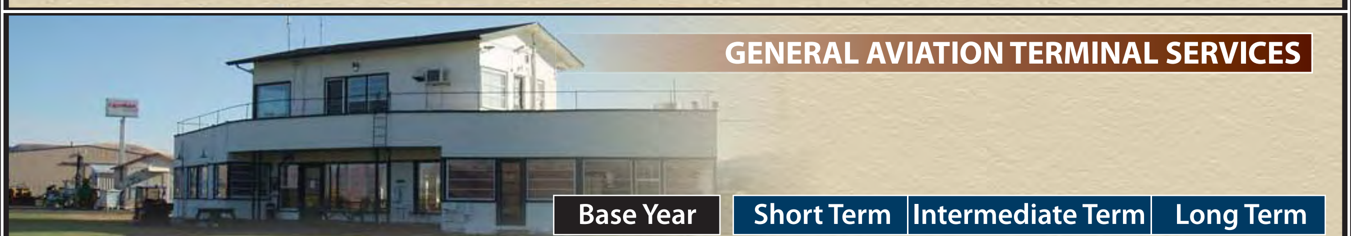


	Base Year	Short Term	Intermediate Term	Long Term
Based Aircraft	**68**	**75**	**82**	**95**
Aircraft to be tied down	12	7	7	5
Aircraft to be Hangared				
Single Engine	47	57	62	75
Multi-Engine	2	2	3	3
Turbo/Jet	5	7	8	9
Rotor	2	2	3	3
Total to be Hangared	**56**	**68**	**75**	**90**
Hangar Positions				
T-Hangar Positions	51	46	50	61
Box Hangar Positions	2	11	13	15
Conventional Hangar Positions	8	11	12	14
Hangar Area				
T-Hangars (s.f.)	59,600	55,000	60,000	73,000
Conventional Hangar (s.f.)	13,000	26,000	31,000	35,000
Box Hangar (s.f.)	3,000	28,000	33,000	38,000
Maintenance Area (s.f.)	3,000	13,000	14,000	17,000
Total Hangar Area	***78,600***	***122,000***	***138,000***	***163,000***

AIRCRAFT PARKING APRON AREA

	Base Year	Short Term	Intermediate Term	Long Term
Local Apron Positions	37	17	17	15
Local Apron Area (s.y.)	*13,450*	*11,000*	*11,000*	*10,000*
Transient Apron Positions	24	18	19	23
Piston Transient Positions	24	15	16	19
Turbine Transient Positions	0	3	3	4
Transient Apron Area (s.y.)	*7,900*	*16,100*	*17,700*	*22,000*
Circulation Apron (s.y.)	*7,000*	*7,000*	*7,000*	*7,000*
Total Apron Area (s.y)	***28,350***	***34,100***	***35,700***	***39,000***

GENERAL AVIATION TERMINAL SERVICES



	Base Year	Short Term	Intermediate Term	Long Term
Auto Parking				
Spaces	45	98	110	139
Area (s.f.)	18,000	39,000	44,000	56,000
Terminal Building				
Area (s.f.)	2,500	4,000	5,000	6,000

Source: Coffman Associates Analysis

Columbia Gorge Regional Airport

Exhibit 3E
LANDSIDE FACILITY REQUIREMENTS

Columbia Gorge Regional Airport

Chapter Four

ALTERNATIVES

ALTERNATIVES

Columbia Gorge Regional Airport

In the previous chapter, airside and landside facilities required to satisfy the demand through the long range planning period were identified. The next step in the planning process is to evaluate reasonable ways these facilities can be provided. There can be countless combinations of design alternatives, but the alternatives presented here have been limited by the negotiated scope of services and are those with the perceived greatest potential for implementation.

Any development proposed for a master plan is evolved from an analysis of projected needs for a set period of time. Though the needs were determined by utilizing industry accepted statistical methodologies, unforeseen future events could impact the timing of the needs identified. The master planning process attempts to develop a viable concept for meeting the needs caused by projected demands for the next 20 years. However, no plan of action should be developed which may be inconsistent with the future goals and objectives of Klickitat County and the City of The Dalles and its citizens, who have a vested interest in the development and operation of the airport.

The development alternatives for Columbia Gorge Regional Airport can be categorized into two functional areas: the **airside** (runways, navigational aids, taxiways, etc.) and **landside** (hangars, apron, and terminal area). Within each of these areas, specific capabilities and facilities are required or desired. In addition, the utilization of airport property to provide revenue support for the airport and to benefit the economic development and well-

being of the regional area must be considered.

Each functional area interrelates and affects the development potential of the others. Therefore, all areas are examined individually and then coordinated as a whole to ensure the final plan is functional, efficient, and cost-effective. The total impact of all these factors on the existing airport must be evaluated to determine if the investment in Columbia Gorge Regional Airport will meet the needs of the community, both during and beyond the 20-year planning period.

The alternatives considered are compared using environmental, economic, and aviation factors to determine which of the alternatives will best fulfill the local aviation needs. With this information, as well as the input from various airport stakeholders, a final airport concept can evolve into a realistic development plan.

AIRPORT DEVELOPMENT OBJECTIVES

Prior to identifying objectives specifically associated with development of Columbia Gorge Regional Airport, non-development alternatives are briefly considered. Non-development alternatives include a "no-build" or "do-nothing" alternative, the transfer of services to another existing airport or the development a new airport at a new location.

The Columbia Gorge Regional Airport plays a critical role in the economic development of the region and plays an important role in the continuity of the national aviation network. There is significant public and private investment at the airport. Pursuit of a non-development alternative would slowly devalue these investments, lead to infrastructure deterioration, and potentially the loss of significant levels of federal funding for airport improvements. Ultimately, the safety of aircraft, pilots, and persons on the ground could be jeopardized. Therefore, the non-development alternatives are not further considered.

It is the goal of this effort to produce a balanced airside and an appropriate landside aircraft storage mix to best serve forecast aviation demands. However, before defining and evaluating specific alternatives, airport development objectives should be considered. As owner and operator, Klickitat County and The City of The Dalles provide the overall guidance for the operation and development of the airport. It is of primary concern that the airport is marketed, developed, and operated for the betterment of the community and its users. With this in mind, the following development objectives have been defined for this planning effort:

- To preserve and protect public and private investments in existing airport facilities.
- To develop a safe, attractive, and efficient aviation facility in accordance with applicable federal, state, and local regulations.
- To develop a balanced facility that is responsive to the current

and long term needs of all general aviation users.

- To be reflective and supportive of the long term planning efforts currently applicable to the region.
- To develop a facility with a focus on self-sufficiency in both operational and developmental cost recovery.
- To ensure that future development is environmentally compatible.

AIRSIDE PLANNING ISSUES

Generally, airside issues relate to those airport elements that contribute to the safe and efficient transition of aircraft and passengers from air transportation to the landside facilities at the airport. This includes the established design standard for the airport, the instrument approach capability, the capacity of the airfield, the length and strength of the runways, and the layout of the taxiways. Each of these elements was introduced in the previous chapters. This chapter will examine airside issues specific to Columbia Gorge Regional Airport. These will then be applied to several airside development alternatives. **Exhibit 4A** presents a summary of the airside and landside elements.

VISUAL APPROACH AIDS

Certain approach aids provide information to pilots to indicate if they are on the correct glide path to the runway for landing. A common visual approach aid is a precision approach path indicator (PAPI) light system. The system consists of two, three, or four boxes of lights in a single row, set perpendicular to the runway, that provide a visual indication of an aircraft's position on the glide path for the associated runway. The PAPI is positioned to the side of the runway usually about 1,000 feet from the runway threshold. The PAPI system lights can be seen up to five miles during the day and twenty miles at night.

Each box of lights is equipped with an optical apparatus that splits light output into two segments, red and white. Depending on the angle of approach, the lights will appear either red or white to the pilot. Ideally, the total of lights will change from white to half red, moving in succession from the runway side to the outer side. The pilot will have reached the normal glide path (usually three degrees) when there is an even split in red and white lights. If an aircraft is beneath the glide path, red lights will outnumber white; if an aircraft is above the glide path, more white lights are visible.

Columbia Gorge Regional Airport does not currently have any visual approach aids. Because of the variety of aircraft that operate at the airport, up to and including the largest business jets, a PAPI is recommended. A limiting factor of installing a PAPI at Columbia Gorge Regional Airport is the elevation of the surrounding terrain. As part of this master plan, an examination of the general parameters for a PAPI installed to serve each runway end was examined.

The technical specifications for PAPI installation are available in Federal Aviation Administration (FAA) Order 6850.2A, *Visual Guidance Lighting Systems*. According to the order, the PAPI obstacle clearance surface has been established to provide the pilot with a minimum clearance over obstacles during approach and must remain clear of obstructions. The surface itself begins on the runway centerline, approximately 300 feet in front of the PAPI system (closer to the threshold), and proceeds outward to a distance of four statute miles. The glide path rises at a three degree slope and encompasses a 20 degree fan (10 degrees to either side of centerline). If a site survey determines that there is an obstacle penetration that cannot be moved or lowered, then the glide path angle must be changed either by moving the PAPI system farther away from the runway threshold or by increasing the glide path angle.

Exhibit 4B presents the results of the PAPI analysis for Columbia Gorge Regional Airport. As can be seen, a three degree glide path to Runways 25, 30, and 7 is penetrated by the surrounding terrain. The three degree glide path to Runway 12 is clear of terrain obstruction. The exhibit shows that the glide path angle necessary to clear the highest point within the PAPI fan would exceed four degrees. While there is no specific FAA guidance to prevent the installation of a PAPI with a greater than four degree glide path, a full area airspace study would need to be undertaken to determine if a PAPI to any of these three runway ends would be feasible.

As indicated, the traditional three degree glide path for Runway 12 is clear of terrain penetrations. A PAPI would be feasible for this runway end. The benefit of installing a PAPI to Runway 12 would need to be weighed against the cost and maintenance of the system, especially since Runway 12 is the least utilized runway for approaches.

RUNWAY LINE-OF-SIGHT

In FAA Advisory Circular (AC) 150/5300-13, *Airport Design,* the FAA has developed line-of-sight standards for runways. Along individual runways, any two points located five feet above the runway centerline must be mutually visible for the entire runway length. However, if a full-length parallel taxiway is available, then the line-of-sight between any two points (five feet above the runway) need only be half the runway length. **Exhibit 4C** presents a preliminary line-of-sight analysis of the runways.

Runways are rarely flat and many are not a straight plane surface. It is common for runways to have moderate undulations. Such is the case at Columbia Gorge Regional Airport where the runway profiles are closer to a bell curve than to a flat plane. The new airport mapping produced in conjunction with this master plan shows that the high point of Runway 12-30 is located near the intersection with Tax-

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AIRSIDE PLANNING ISSUES

- Consideration of PAPIs
- Runway Line of Sight
- Runway Length
- Safety Area Design Standards
- Landing Thresholds and Declared Distances
- Critical Aircraft
- Taxiway Layout
- Instrument Approach Capability

LANDSIDE PLANNING ISSUES

- Airport Land Use
- Separation of Activity Levels
- Location and Types of Future Hangars
- East Side Development
- Fuel Storage Alternatives
- On-Airport Fire Station

Columbia Gorge Regional Airport

Exhibit 4A
AIRPORT PLANNING ISSUES

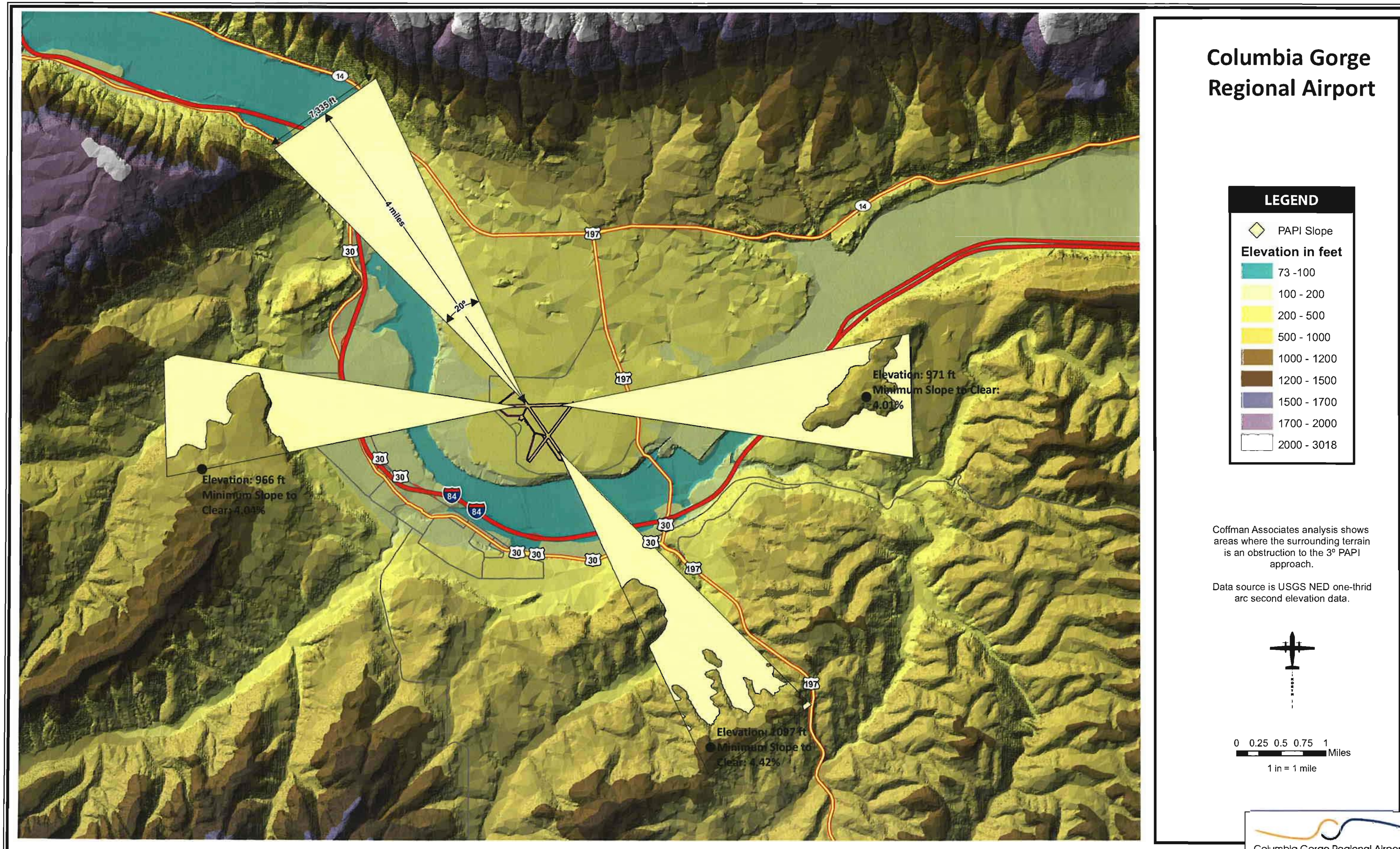
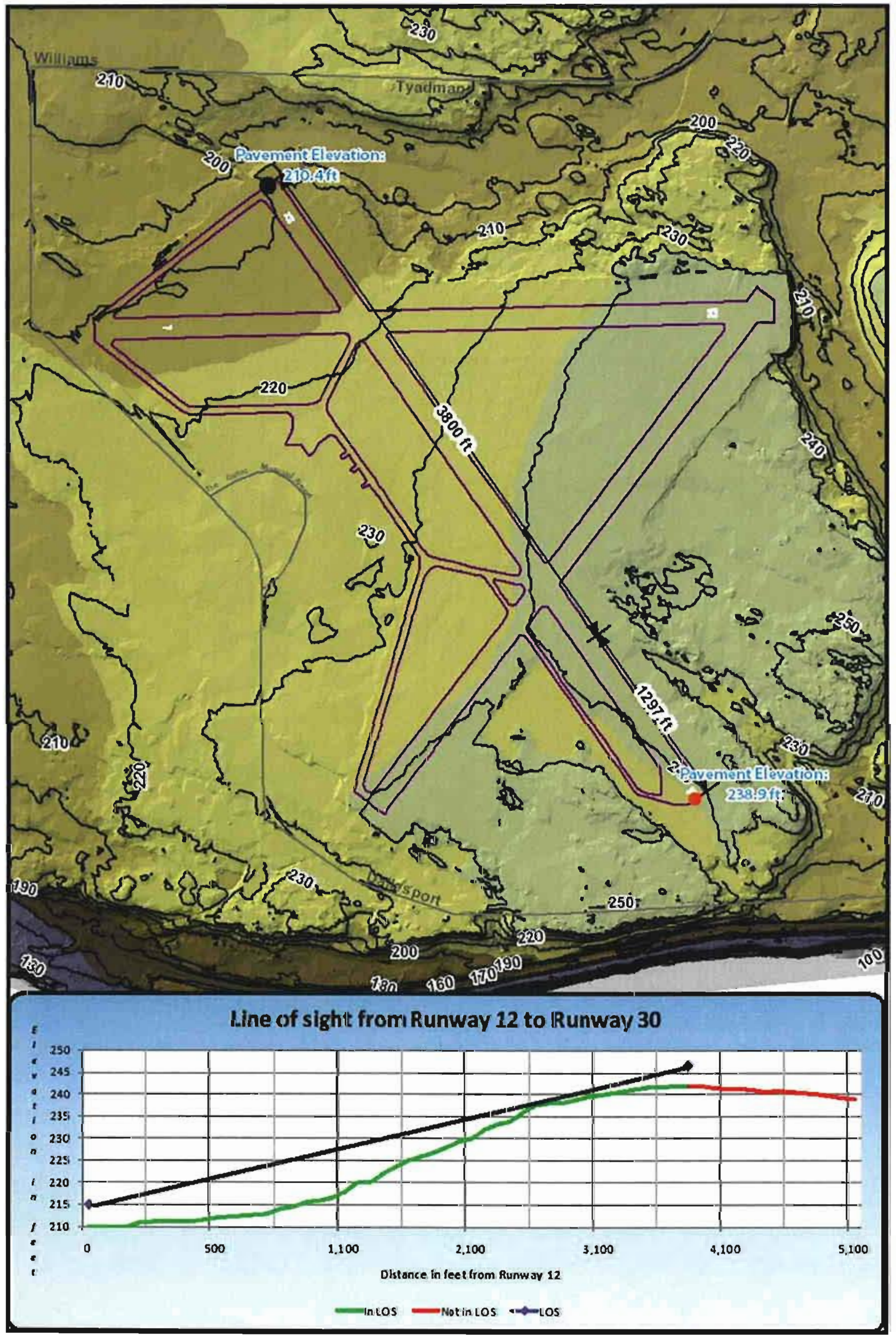
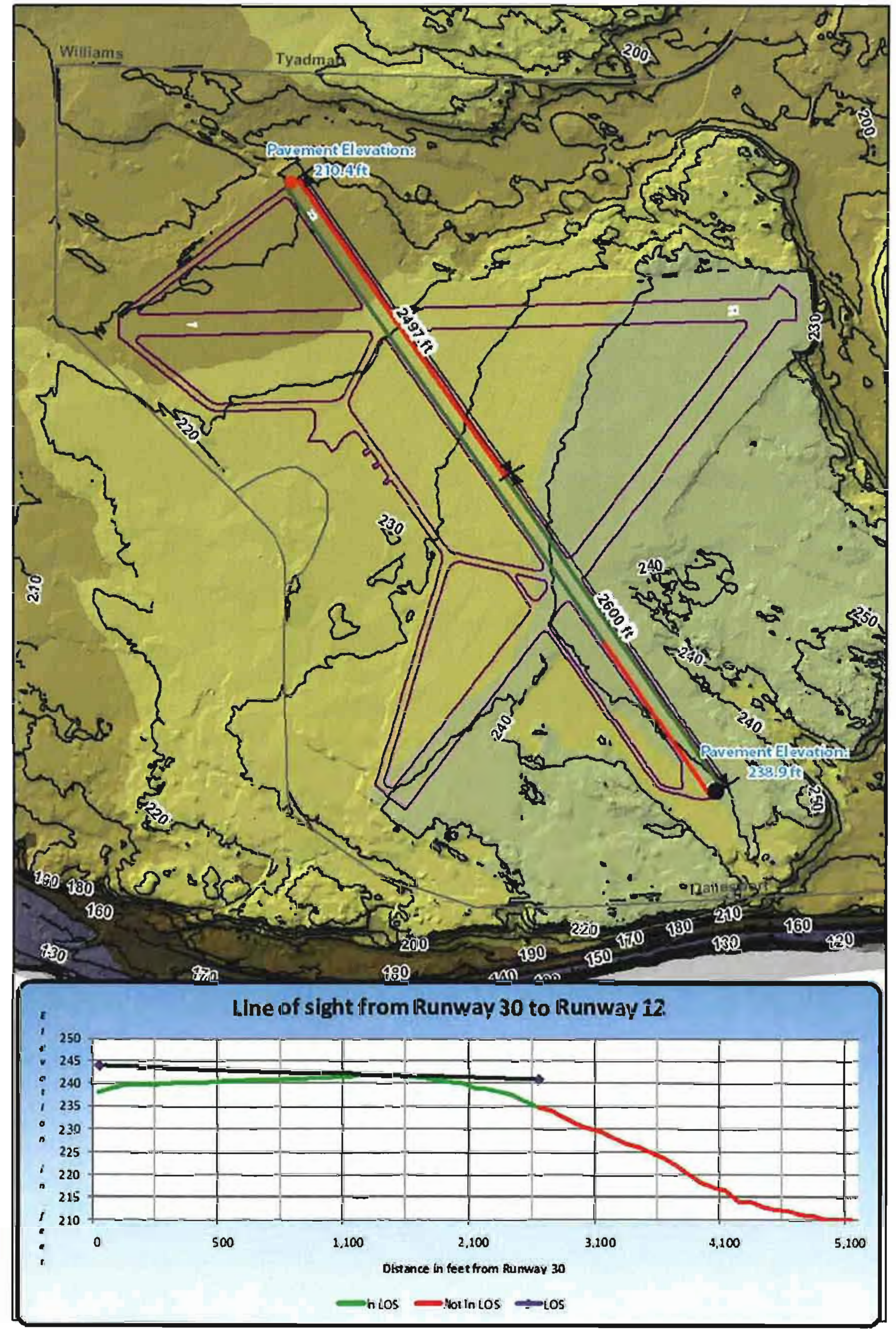


Exhibit 4B
PAPI SLOPE TERRAIN IMPACTS





Columbia Gorge Regional Airport

LEGEND

- Does not have line of sight*
- Has line of sight*
- Observer Location
- Target Location

Elevation dataset created from survey prepared on 11/03/09 by David C. Smith and Associates INC.

* *Line of sight analysis by Coffman Associates according to standard set forth in AC 150-5300-13 (Airport Design).*

Maps set to uniform scale of:

1 inch = 1,000 feet

0 500 1,000 1,500 2,000
Feet

Columbia Gorge Regional Airport

Exhibit 4C
LINE OF SIGHT

iway A3, and that both runway ends are lower in elevation than this point.

From an observation point five feet above the Runway 12 threshold, the line-of-sight extends approximately 3,800 feet down the runway. The remaining runway length does not meet the line-of-sight standard due to the hump in the runway. An observer located five feet above the Runway 30 threshold has a line-of-sight of approximately 2,600 feet.

Runway 7-25 also has a line-of-sight issue. An observer standing on the Runway 7 end has visibility for 4,475 feet then the Runway 25 end dips below the acceptable visibility line. An observer standing on the Runway 25 end is able to only see approximately 1,875 feet.

The runway line-of-sight issue is complex. A full evaluation of alternatives should be conducted to determine a viable solution. The inclusion of a full-length parallel taxiway does reduce the magnitude of the line-of-sight penetration for Runway 12-30, but it is still not standard. The airport capital improvement program, to be presented in Chapter Six will include an evaluation study of the line-of-sight issue.

A second line-of-sight consideration, called the runway visibility zone, is necessary for intersecting runways. The runway visibility zone is created from imaginary lines connecting the four runways' visibility points. The location of the runway visibility points on each runway are a factor of the distance from the threshold to the intersection. The runway visibility zone is recommended to be clear of object penetrations so that any two observers (five feet above the ground) are mutually visible anywhere within the zone. The runway visibility zone is depicted on each of the airside alternatives.

RUNWAY LENGTH ISSUES

Columbia Gorge Regional Airport provides a two runway system. The primary runway, Runway 12-30, is 5,097 feet long. The crosswind runway, Runway 7-25, is 4,647 feet. The runway length has been shown to be adequate to accommodate all small aircraft weighing less than 12,500 pounds. These types of aircraft represent the vast majority of activity at the airport. The airport also receives activity from large turboprops and business jets weighing more than 12,500 pounds.

The critical design aircraft is that group of similar aircraft types that will account for 500 annual operations. It was determined in Chapter Three – Facility Requirements that the current critical design aircraft is in airport reference code (ARC) B-II. The forecasts of aviation activity suggest the critical design aircraft will remain in ARC B-II through the 20-year scope of this master plan.

The operational fleet mix indicates that the airport currently experiences more than 500 annual business jet operations; therefore, business jet activity is critical to determine runway length requirements. To accommodate 75 percent of business jets at 60 percent useful load, the FAA recommends a runway length of 5,100 feet for dry runways and 5,500 feet for wet runways. The need for additional runway length (beyond 5,500 feet) can be justified when the critical design aircraft shifts to a large business jet (ARC C-II and larger). In this case, the airport would need to accommodate 100 percent of the business jets at 60 percent load. This results in a minimum runway length of 5,800 feet in both wet and dry conditions.

Table 4A shows the FAA classification of business jets. Of the business jet operations at Columbia Gorge Regional Airport, the majority are by those in the 75 percent category. All business jets are capable of operating on the runway length available, but the larger business jets may be weight restricted.

TABLE 4A
Business Jets Planning Statistics

Aircraft Make	Aircraft Model	ARC	MTOW#	Aircraft Make	Aircraft Model	ARC	MTOW#
Airplanes that Make Up 75 Percent of the Fleet				**Airplanes that Make Up 75 Percent of the Fleet**			
Aerospatiale	SN-601 Corvette	B-I	14,550	Hawker	600	C-II	25,000
BAe	125-700	C-II	24,200	Sabreliner	40	B-I	18,650
Beech Jet	400A	C-I	16,100	Sabreliner	60	C-I	20,200
Beech Jet	Premier I	C-I	12,500	Sabreliner	75a/80	C-II	23,300
Cessna	500 Citation/501 Citation S	B-I	11,850	Sabreliner	T-39	B-I	17,760
Cessna	Citation I/II/III	B-I	10,600				
Cessna	525A II (CJ-2)/525B	B-II	12,500	**Airplanes that Make Up 100 Percent of the Fleet**			
Cessna	550 Citation Bravo	B-II	14,800	BAe	Corporate 800/1000		
Cessna	550 Citation II	B-II	15,100	Bombardier	Challenger 600	C-II	41,250
Cessna	551 Citation II/Special	B-II	15,100	Bombardier	Challenger 604	C-II	47,600
Cessna	552 Citation	B-II	15,100	Bombardier	Challenger 300	C-II	38,850
Cessna	560 Citation Encore	B-II	16,830	Cessna	S550 Citation S/II	B-II	12,500
Cessna	560/560 XL Citation Excel	B-II	20,000	Cessna	650 Citation III/IV	C-II	21,000
Cessna	560 Citation V Ultra	B-II	16,300	Cessna	750 Citation X	C-II	36,100
Cessna	650 Citation VII	B-II	22,000	Dassault	Falcon 900C/900EX	C-II	45,500
Cessna	680 Citation Sovereign	C-II	30,300	Dassault	Falcon 2000/2000EX	C-II	41,000
Dassault	Falcon 10	B-I	18,740	IAI	Astra 1125 (G-150)	C-II	23,500
Dassault	Falcon 20	B-II	28,660	IAI	Galaxy 1126 (G-200)	C-II	34,850
Dassault	Falcon 50/50 EX	B-II	37,480	Learjet	45XR	C-I	20,200
Dassault	Falcon 900/900B	B-II	45,500	Learjet	55/55B/55C	C-I	21,500
Eclipse	Eclipse 500	A-I	5,950	Learjet	60	D-I	23,500
IAI	Jet Commander 1121	C-I	23,500	Hawker	125-1000 Horizon	C-II	36,000
IAI	Westwind 1123/1124	C-I	23,500	Hawker	800/800XP	C-II	28,000
Learjet	20 Series	C-I	15,000	Sabreliner	65/75	C-II	24,000
Learjet	31/31A/31A ER	C-I	16,500	**Airplanes over 60,000 pounds**			
Learjet	35/35A/36/36A	C-I	18,300	Bombardier	CL-700 Global Express	C-III	96,000
Learjet	40/45	C-I	20,200	Gulfstream	II	D-II	65,300
Mitsubishi	Mu-300 Diamond	B-I	14,630	Gulfstream	III	C-II	68,700
Raytheon	390 Premier	B-I	12,500	Gulfstream	IV (G-350, G-450)	D-II	71,780
Hawker	400/400XP	C-II	23,300	Gulfstream	V (G-500, G-550)	D-III	89,000

ARC: Airport Reference Code; MTOW: Maximum Certified Takeoff Weight (pounds)
Source: AC 150/5325-4B, Runway Length Requirements for Airport Design

The airfield alternatives analysis will consider the most feasible runway to extend to a length of 5,500 feet in order to accommodate 75 percent of business jets at 60 percent useful load under wet conditions. Since the current length of Runway 12-30 meets the runway length requirement (5,100 feet) under dry conditions, an extension of either runway to 5,500 feet would need to be justified by 500 actual operations by business jets under wet conditions. Since rainy conditions are not prevalent in the region, any runway extension would be an intermediate to long term project.

A runway extension project could also be justified by a transition in the critical aircraft from ARC B-II to ARC C-II. A transition such as this most commonly occurs if one or several large business jets base at the airport. Depending on the type of large business jets to base at the airport, a total runway length of up to 6,100 feet could be justified. This scenario would have a significant impact on the applicable design standards. For example, the runway safety area beyond the runways would increase from 300 feet to 1,000 feet. Future updates to this master plan should monitor and assess the potential transition of the applicable critical design aircraft.

RUNWAY SAFETY AREA (RSA) CONSIDERATIONS

The runway safety area (RSA) is a designated area surrounding the runways. According to the FAA, the RSA is to be:

(1) cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations;

(2) drained by grading or storm sewers to prevent water accumulation;

(3) capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft, and;

(4) free of objects, except for objects that need to be located in the RSA because of their function (in aiding air navigation).

The dimension of the RSA surrounding the runway is a function of the critical aircraft. The current and future critical aircraft is in ARC B-II. The existing B-II RSA should be 150 feet wide (centered on the runway) and extend 300 feet beyond each end of the runway.

FAA Order 5300.1F, *Modification of Agency Airport Design, Construction, and Equipment Standards*, indicates in Paragraph 6.d the following:

". . . Runway safety areas at both certificated and non-certificated airports that do not meet dimensional standards are subject to FAA Order 5200.8, *Runway Safety Area Program*. Modification of Standards is not issued for nonstandard runway safety areas."

The FAA placed a greater emphasis on meeting RSA standards with the publication of FAA Order 5200.8, *Runway Safety Area Program,* in 1999, following congressional direction. The Order states in Paragraph 5, "The object of the Runway Safety Area Program is that all RSAs at federally obligated airports and all RSAs at airports certified under 14 Code of Federal Regulations (CFR) Part 139 shall conform to the standards contained in AC 150/5300-13, *Airport Design*, to the extent practicable."

The Order goes on to state in Paragraph 8.b:

"The Regional Airports Division Manager shall review all data collected for each RSA in Paragraph 7, along with the supporting documentation prepared by the region for that RSA, and make one of the following determinations:

(1) The existing RSA meets the current standards contained in AC 150/5300-13, *Airport Design*.

(2) The existing RSA does not meet the current standards, but it is practicable to improve the RSA so that it will meet current standards.

(3) The existing RSA can be improved to enhance safety, but the RSA will still not meet current standards.

(4) The existing RSA does not meet current RSA standards, and it is not practicable to improve the RSA."

The findings of this master plan will aid the Regional Airports Division Manager for the FAA's Northwest Mountain Region in making a determination on the existing condition of RSAs at Columbia Gorge Regional Airport.

Appendix 2 of FAA Order 5200.8 provides direction for an RSA determination. This includes the alternatives that must be evaluated. Paragraph 3 of Appendix 2 states:

"The first alternative that must be considered in every case is constructing the traditional graded runway safety area surrounding the runway. Where it is not practicable to obtain the entire safety area in this manner, as much as possible should be obtained. Then the following alternatives shall be addressed in the supporting documentation:

- Construct the traditional graded runway safety area surrounding the runway.
- Relocation, shifting, or realignment of the runway.
- Reduction in runway length where the existing runway length exceeds that which is required for the existing or projected design aircraft.
- A combination of runway relocation, shifting, grading, realignment, or reduction.
- Implementation of declared distances.

- Installation of Engineered Materials Arresting Systems (EMAS)."

As discussed previously in Chapter Three – Facility Requirements and visually presented on Exhibit 3B, the RSA behind Runways 25, 12, and 7 do not meet the FAA standard. The alternatives evaluation will provide the most viable solutions to rectify the non-standard RSA conditions.

DECLARED DISTANCES

Declared distances are the effective runway distances that the airport operator declares available for take-off run, take-off distance, accelerate stop distance, and landing distance requirements. Declared distances are defined as the following:

Take-off run available (TORA) - The length of the runway declared available and suitable to accelerate from brake release to lift-off, plus safety factors.

Take-off distance available (TODA) - The TODA plus the length of any remaining runway or clearway beyond the far end of the TORA available to accelerate from brake release past lift-off, to start of take-off climb, plus safety factors.

Accelerate-stop distance available (ASDA) - The length of the runway plus stopway declared available and suitable to accelerate from break release to take-off decision speed, and then decelerate to a stop, plus safety factors.

Landing distance available (LDA) - The distance from the threshold to complete the approach, touchdown, and decelerate to a stop, plus safety factors.

The TORA and TODA are generally equal to the actual runway length as a clearway is not provided at the airport. The ASDA and the LDA are the primary considerations in determining the runway length available for use by aircraft, as these calculations must consider providing the RSA to standard in operational calculations. The ASDA and LDA can be figured as the usable portions of the runway length less the distance required to maintain adequate RSA beyond the ends of the runway or prior to the landing threshold. By regulation, 300 feet of RSA is required beyond both runway ends for ASDA and LDA calculations.

The purpose of declared distances is to provide an equivalent runway safety area (RSA), object free area (OFA), and runway protection zone (RPZ) in accordance with design standards at existing constrained airports where it is otherwise impracticable to meet standards. Declared distances are also employed where there are obstructions in the runway approaches and/or departure surfaces that the airport is unable to remove. When a landing threshold is displaced, it is the airport's responsibility to publish the declared distances in the Airport/Facility Directory.

Table 4B presents two sets of declared distances for Columbia Gorge Regional Airport. The first set relates to the existing runway markings. The second set is what the declared distances should be based on providing 300 feet of RSA beyond each runway end. It should be noted that neither of these are currently published. **Exhibit 4D** shows a visual depiction of the declared distances.

When considering the actual declared distances, the ASDA for Runway 12 is the entire runway length of 5,097 feet because pilots can begin their takeoff run at the end of the runway and the full 300 feet of RSA is available beyond the Runway 30 threshold. The LDA for Runway 12 is the runway length less the landing threshold displacement. The ASDA and LDA for Runway 30 is 4,897 feet. This is because only 100 feet of RSA is available beyond the Runway 12 end.

TABLE 4B
Declared Distances (in feet)
Columbia Gorge Regional Airport

Runways	Declared Distances as Marked		Actual Declared Distances	
	ASDA	LDA	ASDA	LDA
Runway 12	5,097	4,897	5,097	4,897
Runway 30	5,097	5,097	4,897	4,897
Runway 7	4,647	4,207	4,451	4,011
Runway 25	4,647	4,451	4,347	4,151

ASDA: Accelerate-stop distance available
LDA: Landing distance available
Source: FAA AC 150/5300-13, Airport Design, Change 15

When taking off on Runway 7, the ASDA is 4,451 feet, which is calculated by taking the runway length and subtracting the area beyond the Runway 25 threshold needed for RSA. The LDA to Runway 7 is 4,011 feet, as the landing threshold is displaced 440 feet.

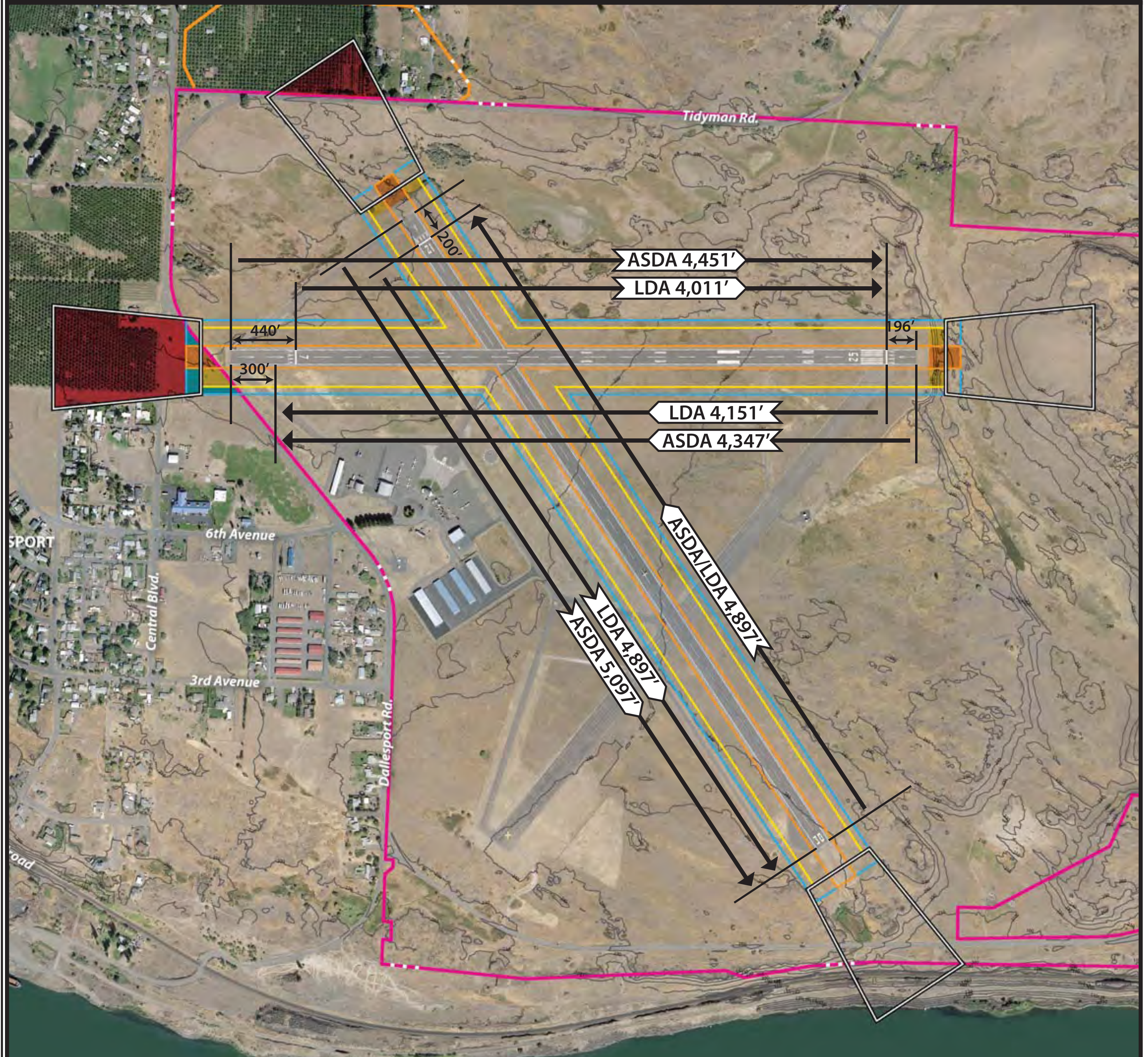
When utilizing Runway 25 for takeoff, 4,347 feet is available since 300 feet of RSA is needed beyond the Runway 7 end. Since the end of Runway 7 is the beginning of the RSA penetration (fence line), there is effectively no RSA available. When landing to Runway 25, the LDA available is further reduced to 4,151 feet due to the displaced landing threshold.

Prior FAA approval for implementation of declared distances is always required and will not be approved in conjunction with a runway extension. Basically, airports cannot build into a situation where declared distances are necessary. A primary goal of the alternatives analysis is to position the runway system so that declared distances are not necessary. The FAA supports removing the need for declared distances as long as there is not a negative impact to operations.

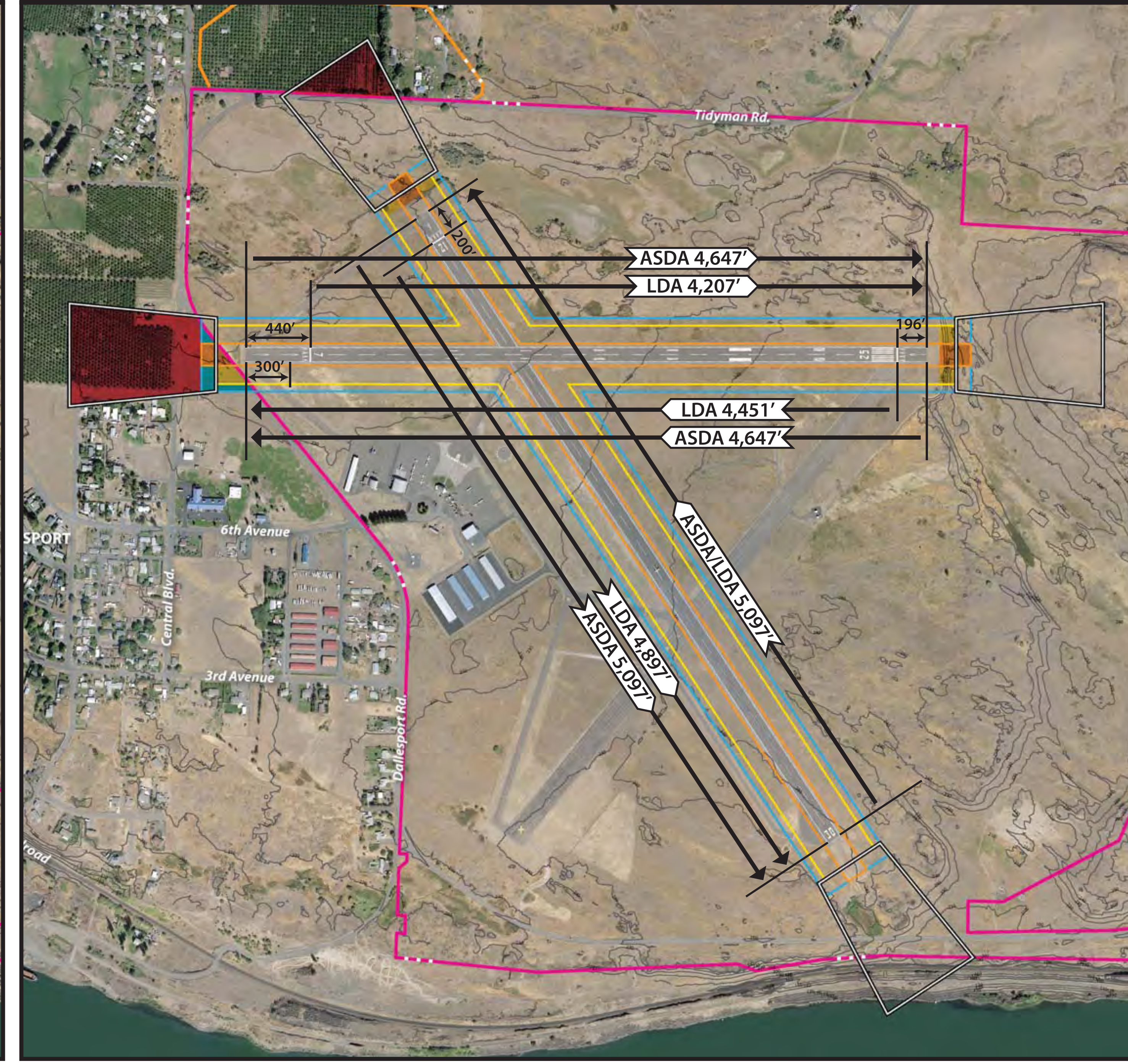
AIRSIDE DEVELOPMENT ALTERNATIVES

The alternatives to be presented next consider meeting airport design stan-

ACTUAL DECLARED DISTANCES



DECLARED DISTANCES AS MARKED



LEGEND

- Airport Property Line
- Avigation Easement
- Runway Safety Area (RSA)
- Non-Standard RSA
- Object Free Area (OFA)
- Non-Standard OFA
- Object Free Zone (OFZ)
- Non-Standard OFZ
- Runway Protection Zone (RPZ)
- Non-Standard RPZ

DECLARED DISTANCES (in feet)

Runways	Declared Distances as Marked		Actual Declared Distances	
	ASDA	LDA	ASDA	LDA
Runway 12	5,097	4,897	5,097	4,897
Runway 30	5,097	5,097	4,897	4,897
Runway 7	4,647	4,207	4,451	4,011
Runway 25	4,647	4,451	4,347	4,151

ASDA: Accelerate-stop distance available
LDA: Landing distance available

Source: FAA AC 150/5300-13, Airport Design, Change 15

NORTH

0 1000 2000
SCALE IN FEET

Date of photo: 9/18/09

Columbia Gorge Regional Airport

Exhibit 4D
DECLARED DISTANCES

dards, particularly as they relate to the RSA, OFA, RPZ, and obstacle free zone (OFZ). The current operational activity level indicates that Columbia Gorge Regional Airport is an ARC B-II airport. The forecast growth over the next 20 years indicates that the airport will remain in this design category.

The possible alternatives are limitless, but the airside alternatives presented are believed to be those that best consider all factors specific to the airport, while being financially reasonable and within FAA standards. The recommended development plan, which will be presented in Chapter Five, will likely be a combination of critical elements from several of these alternatives.

Each of the alternatives identifies the airport property along the flight line as areas that should be exclusively reserved for aviation-related activity. The landside alternatives discussion will provide more detail related to land uses on airport property. The landside alternatives will show potential building and hangar layouts needed to meet long term aviation demand at the airport.

AIRSIDE ALTERNATIVE 1

The first alternative is presented on **Exhibit 4E**. This alternative considers the impact of extending Runway 12-30 to the north an additional 403 feet in order to bring the total runway length to 5,500 feet. This is the preferred runway to extend based on the predominant winds, but it does not have a straight-in instrument approach.

Threshold Siting Surface Impact

There are several imaginary surfaces that extend from the runway end that must be considered with analyzing potential impact of a runway extension. Of particular concern is the threshold siting surface (TSS). The TSS for Runway 12 begins 200 feet from the runway end, is 400 feet wide on its inner portion and extends outward and upward at a 20:1 slope. The surface extends to a distance of 10,000 feet. This surface must be clear of obstructions.

Tidyman Road presents an object penetration to the TSS when the runway is extended 403 feet to the north. In order for the TSS to be clear, a portion of the road would need to be relocated, of lowered, as shown on **Exhibit 4E**.

Exhibit 4F shows the technical analysis associated with the TSS to the extended runway end. When considering clearances over Tidyman Road, an additional 15 feet is added to the road elevation to account for vehicular traffic.

The TSS leading to Runway 7 is currently and would remain penetrated by Dallesport Road by approximately 10 feet. FAA AC 150/5300-13, *Airport Design*, provides mitigating alternatives for existing TSS penetrations. The alternatives are:

- The object is removed or lowered to preclude penetration of applicable threshold siting surface;

- The threshold is displaced to preclude penetration of the applicable threshold siting surfaces, with a resulting shorter landing distance; or

- The glidepath angle (GPA) and/or threshold crossing height (TCH) is/are modified, or a combination of threshold displacement and GPA/TCH increase is accomplished.

- Visibility minimums are raised.

- Night operations are prohibited unless the obstruction is lighted or an approved visual glidepath indicator is used.

Since the TSS penetration of Dallesport Road is an existing condition and the location of the landing threshold is not planned to change in this alternative, there would be no additional impact to the TSS leading to Runway 7. For Runway 7, this alternative fixes the non-standard RSA and OFA. The TSS remains penetrated by Dallesport Road. Because of the TSS penetration, a straight-in instrument approach to Runway 7 would not be possible under this alternative.

Runway Safety Area Impact

The existing RSA behind Runway 12 does not meet standard. Currently, it extends approximately 100 feet behind the runway end before the grade becomes non-standard and it is penetrated by a fence line. When planning this extension, the RSA would be improved to meet standard.

On the Runway 7 end the RSA is penetrated by Dallesport Road. In this alternative, the RSA is brought up to standard by relocating the runway end to the existing displaced landing threshold. This would require the removal of approximately 440 feet of runway length. A new threshold access taxiway would then need to be constructed. Relocating the runway end in this manner would allow both the RSA and OFA to remain on airport property.

The RSA for Runway 25 does not meet standard due to the significant terrain change approximately 100 feet from the runway end. This airfield alternative assumes that the standard graded RSA would be supplied. The Runway 30 RSA meets standard.

Taxiway Layout

As discussed in Chapter Three - Facility Requirements, improvements to the taxiway system can be made. There are several options available depending on the overall airfield alternatives. A new threshold taxiway is planned to connect to Runway 12. Parallel Taxiway A is planned to be extended from the intersection with Taxiway A3 to the Runway 12 threshold taxiway. Development of this taxiway would eliminate several non-standard elements on the airfield.

Taxiway A1 is an angled taxiway extending from the Runway 7 end to the

Exhibit 4E
AIRFIELD ALTERNATIVE 1

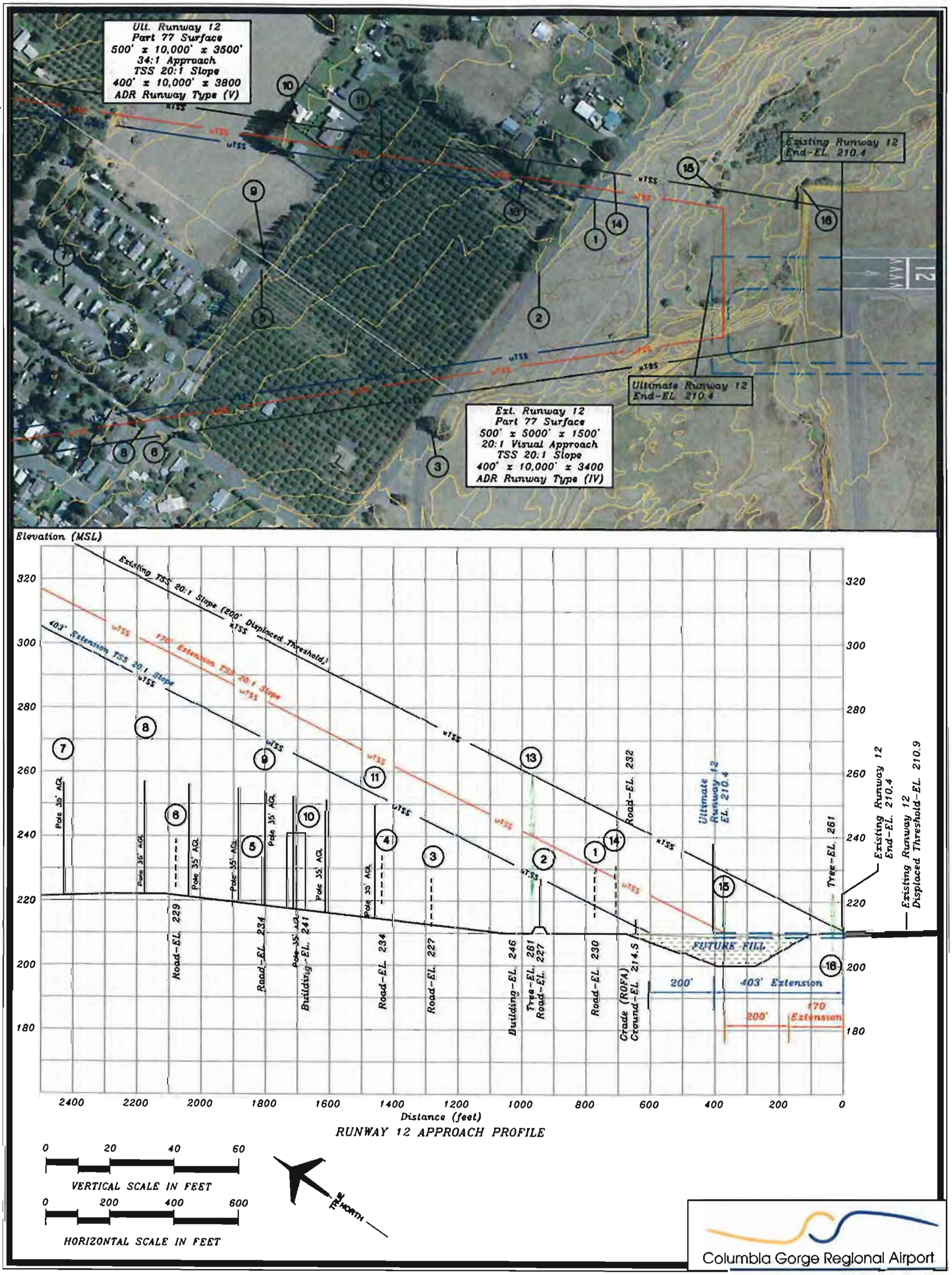


Exhibit 4F
RUNWAY 12 EXTENSION IMPACTS

Runway 12 end. The angled nature of this taxiway can be eliminated with the construction of the parallel taxiway. Taxiway A2 currently meets at the intersection of the two runways. Design standards discourage this layout. The extension of parallel Taxiway A would allow for a portion of Taxiway A2 (at the runway intersection) to be removed. A new taxiway exit from Runway 12-30 would then connect to the remaining portion of Taxiway A2.

With the relocation of the Runway 7 end to the current landing threshold, approximately 440 feet of runway is unusable. The FAA encourages unusable pavements to be removed. To this end, this pavement is planned to be removed along with a portion of Taxiway B. This portion of Taxiway B is angled and should be re-designed to provide a right-angle entrance to Runway 7.

The threshold taxiways to both Runways 25 and 30 are also angled taxiways. New right-angled threshold taxiways with aircraft hold aprons are planned.

Property Acquisition

Planning includes the identification of property adjacent to the airport that is recommended for acquisition by the airport. Some property acquisition would be necessary to allow for the various airfield improvements (e.g., runway extension). Other property recommended for acquisition includes the RPZ. As discussed in Chapter Three – Facility Requirements, the RPZs should be under the control of the airport where possible. In lieu of fee simple ownership of the RPZs, avigation easements are acceptable. Nonetheless, this master plan recommends fee simple ownership of the RPZ, even if an easement already exists.

In the first alternative, the RPZ for Runway 7 extends to the west of Dallesport Road. This encompasses approximately 11.3 acres. The RPZ for Runway 12 extends beyond Tidyman Road. With the potential 403-foot extension of Runway 12 and the relocation of Tidyman Road, approximately 13.1 acres would need to be acquired. The RPZ for Runway 30 extends south across airport property and over the bluffs of the Columbia River. This area is undevelopable due to the bluffs, so a recommendation for acquisition is not made. The RPZ for Runway 25 remains on airport property.

It should be noted that the minimum property acquisition necessary for each alternative has been identified. Where splitting of a parcel would obviously negatively impact the remaining portion of the parcel, it is assumed that the entire parcel would be acquired.

Alternative Summary

This first alternative has some notable advantages and disadvantages. An advantage is that the primary runway can be extended to 5,500 feet. The taxiway layout can be improved to increase the level of safety and efficiency of the airfield. This alternative allows for Dallesport Road, west of Runway 7, to be maintained in its current location while the Runway 7 RSA is brought up to standard.

The primary disadvantage is that Runway 7-25 would be reduced in length from 4,647 feet to 4,207 feet. The airport would need to acquire property to the north of Tidyman Road and a portion of the road would need to be relocated in order to allow for approach clearances.

AIRSIDE ALTERNATIVE 2

The second airside alternative, presented on **Exhibit 4G**, considers extending Runway 7-25 to 5,500 feet. Runway 7-25 has the only straight-in (with offset localizer) instrument approach. Therefore, it makes sense to extend the runway with the most sophisticated instrument approach in order to better accommodate operators of aircraft that would typically utilize the approach and may need additional landing length.

In this alternative, consideration of the maximum extension to the east without negatively impacting the localizer and glideslope critical areas was given. A maximum extension of 531 feet is planned on the Runway 25 end with the remaining 322 feet being applied to the Runway 7 end. It should be noted that the instrument approach would need to be recalibrated and possibly relocated to accommodate the longer runway. This could mean the approach would need to be decommissioned for as much as 18 months.

To accommodate the additional runway length on the Runway 7 end, Dallesport Road would need to be relocated, as shown in the exhibit. The relocation of Dallesport Road would require some property acquisition, including at least seven homes on the south side of 7th Avenue and one home associated with the orchard to the west of Dallesport Road. The property to be acquired is approximately 30.6 acres.

The Runway 12 RPZ currently extends beyond Tidyman Road. While the airport owns an avigation easement over this property, it is still recommended that the 3.7 acres within the RPZ be acquired. Relocation of Tidyman Road is not necessary in this alternative.

The RSA for each runway end is planned to be prepared in a manner that meets FAA standard. In addition to the extension of both ends of Runway 7-25, 300 feet beyond the ends would be graded to standard. The RSA beyond Runway 12 would also be improved. The RSA beyond Runway 30 already meets standard.

Taxiway and Apron Layout

The taxiway layout presented shows a full-length parallel taxiway associated with each runway. The taxiways are situated 300 feet from the runways. This distance exceeds the separation requirement of 240 feet for a B-II airport with instrument approaches with greater than ¾-mile visibility minimums. Setting taxiways at this dis-

09MP06-4G-07/16/10

Exhibit 4G
AIRFIELD ALTERNATIVE 2

tance allows for future airport growth including either a transition to a critical aircraft in ARC C-II, or the introduction of an instrument approach with ¾-mile visibility or lower. While neither of these conditions is anticipated, it is appropriate to plan beyond the 20-year scope of the master plan for some elements.

The planning standard for taxiway width at a B-II airport is 35 feet. All future taxiways are planned to this standard. Portions of Taxiways A and B are currently 50 feet wide. It is reasonable to maintain these taxiways at this width.

The taxiway layout will allow the removal of the existing angled taxiways. Several new entrance/exit taxiways are planned at appropriate intervals along each runway. The taxiways providing access from the parallel taxiway to the terminal area apron are off-set from those connecting to the runway. This is an FAA recommended layout that reduced the potential for runway incursion by forcing pilots to make a turn prior to entering the runway. Hold aprons are also planned at each runway threshold.

Portions of Taxiways A and B are separated from the runway by 560 and 580 feet respectively. Planning for full-length parallel taxiways allows the airport to reclaim unused area in the terminal area to a depth of approximately 150 feet. This area would allow for an expansion of the terminal area apron.

Alternative Summary

Airfield Alternative 2 provides a vision for the airfield that meets many of the goals of this alternatives exercise. It is shown that Runway 7-25 can be extended to a length of 5,500 feet, which would allow the airport to meet the needs of most small and medium sized business jets. The longer runway will also extend the capability of large business jets that are typically weight restricted.

The RSAs for both runways are planned to be graded and extended to meet FAA design standards. This effort, along with obstruction removal where applicable, eliminates the need for displaced landing thresholds or declared distances.

A new taxiway layout is presented that includes full-length parallel taxiways for both runways. Under this design, all angled taxiways may be eliminated, thus meeting FAA goals. Aircraft holding aprons are also planned at the runway thresholds.

AIRSIDE ALTERNATIVE 3

Airside Alternative 3 is a variation on the first alternative and is presented on **Exhibit 4H**. This alternative considers a runway extension to Runway 12-30 that does not necessitate the relocation of Tidyman Road. To accomplish this, the runway is extended to the north 170 feet and the remaining 233 feet is added to the south. With the extension to Runway 12, the RPZ would expand slightly to encompass a total of 6.4 acres to the north of Tidyman Road. Currently this RPZ encompasses 3.7 acres.

Extension of Runway 30, 233 feet to the south, would have a terrain impact to the TSS. This area would need to be graded to meet TSS standards. **Exhibit 4J** shows the TSS clearances for this alternative.

New threshold taxiways are planned to both ends, thus eliminating the current angled taxiways. Taxiway A is planned to connect from the Runway 12 threshold to the intersection with Taxiway A2, completing the parallel taxiways. A new runway exit taxiway is also planned which will allow for the closure of that portion of Taxiway A2 that currently connects at the intersection of the two runways. The only remaining angled taxiway is A3. This taxiway is preserved in order to provide a cost effective alternative to maintaining access to the Runway 25 threshold.

Runway 7-25 currently has displaced landing thresholds on both ends. This effectively reduces operational runway length. As the only runway with a straight-in instrument approach it is valuable to maintain as much runway length as possible, but it should be noted that this approach is approved for category A and B aircraft and not larger C and D aircraft.

An analysis was undertaken to determine if the landing thresholds could be relocated back to the pavement ends. On the Runway 25 end, the RSA would need to be brought up to grade standards. A new right-angled threshold taxiway is then planned.

On the Runway 7 end, it is not possible to relocate the threshold to the pavement end without impacting Dallesport Road. In this alternative, consideration was given to shifting a portion of Dallesport Road and utilizing the Central Boulevard alignment to carry vehicular traffic. This shift would be the least impactful to the airports neighbors as no homes or business would need to be acquired for the road relocation. A total of 22.6 acres to the west of Dallesport Road would need to be acquired. Most of this is encompassed by the Runway 7 RPZ.

The analysis of the threshold siting surface indicates that Dallesport Road would still be a penetration if the landing threshold were relocated to the pavement end. Therefore, to clear the TSS the landing threshold is shifted approximately 38 feet to the east. In this alternative, the excess pavement is removed, thus reducing the runway length from 4,609 feet to 4,467 feet. This alternative would eliminate the need for a displaced landing threshold and declared distances.

Two other options are available when considering the Runway 7 end that would avoid the need to shorten the runway. The first would be to relocate a portion of Dallesport Road at least 38 feet to the west. Another option would be to implement declared distances and relocate the Runway 7 landing threshold 38 feet to the east.

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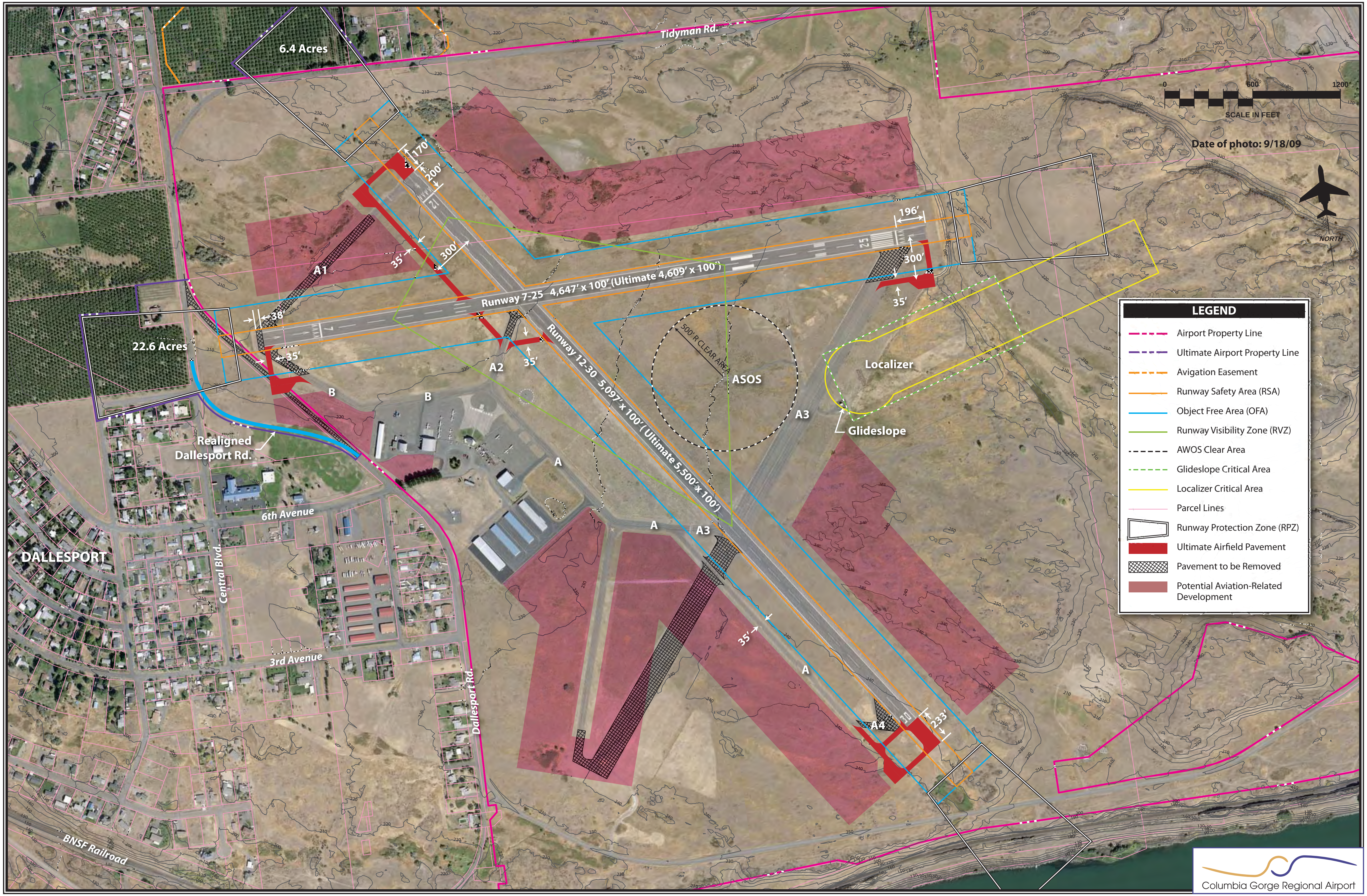

Exhibit 4H
AIRFIELD ALTERNATIVE 3

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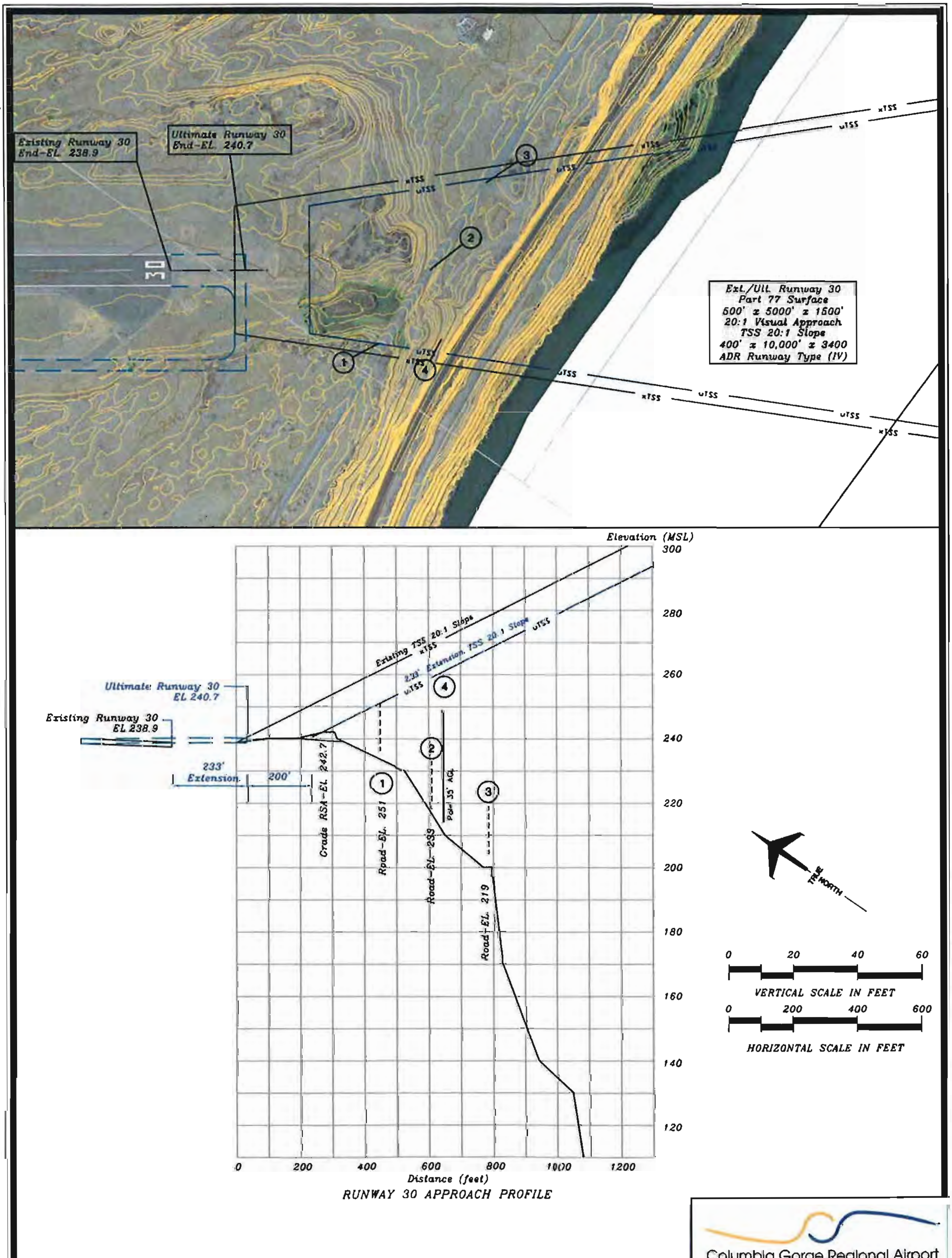

Exhibit 4J
RUNWAY 30 EXTENSION IMPACTS

This option is not ideal as a central goal of the alternatives analysis is to eliminate the need for displaced landing thresholds and declared distances.

Alternative Summary

Airfield Alternative 3 is a variation on the first alternative. In this alternative, the extension of Runway 12-30 to 5,500 feet in length is accomplished by extending both ends. The benefit of this is that Tidyman Road would remain clear of the TSS and would not have to be relocated.

In an effort to eliminate the need for displaced landing thresholds or declared distances, Dallesport Road is realigned and the runway is shortened by 38 feet. This option would have the least impact to the neighboring community.

All angled taxiways except A3 are removed. Taxiway A3 is maintained in order to provide access to the Runway 25 threshold.

AIRSIDE ALTERNATIVE 4

Airside Alternative 4, presented on **Exhibit 4K**, considers the impact of extending the Runway 7 end to a total runway length of 5,500 feet. Extending Runway 7 would preserve the current instrument approach to Runway 25, an approach that is complex in design and was difficult to obtain. Extending to the west would also take advantage of the relatively flat terrain.

The extension of Runway 7 by 853 feet would necessitate a significant rerouting of Dallesport Road, as shown on the exhibit. Approximately 44.8 acres, which encompasses 13 homes, the orchard business, and the fire department building, would need to be acquired. It should be noted that the FAA prefers that roads not be in the RPZs. Existing roads within the RPZ (but not the OFA or RSA) are generally acceptable to the FAA, but when extending a runway, the FAA would likely look to relocate the road entirely outside the RPZ.

The taxiway layout is similar to that of Alternative 2, in that two full length parallel taxiways are provided. All angled taxiways are removed, thus removing line-of-sight issues. Each of the RSAs are planned to be graded to meet standard. The main apron is expanded to take advantage of the additional space created by the parallel taxiways.

Alternative Summary

This alternative provides for the extension of Runway 7-25 to the west in order to take advantage of the relative flat terrain to the west. The challenge is that the community of Dallesport is impacted the most in this alternative. This impact should be weighed against the operational benefit.

CUT AND FILL COMPARISON

As part of this master planning effort, new aerial mapping of the airport was undertaken. With this data, estimates of the volume of cut and fill related to the ends of the runway for each alternative have been made. As might be expected, Alternative 2 that includes extension of Runway 25 to the east would require the most amount of earthwork. Approximately 390,000 cubic yards of fill would be required for this alternative, while approximately 100,000 cubic yards would be necessary for each of the other three alternatives. The cost difference is estimated to be approximately $1.3 million. **Table 4C** presents the cut and fill volume comparison.

TABLE 4C
Cut and Fill Estimates
Columbia Gorge Regional Airport Alternatives

	Alt. 1	**Cost Estimate**	**Alt. 2**	**Cost Estimate**	**Alt. 3**	**Cost Estimate**	**Alt. 4**	**Cost Estimate**
Runway 12								
Cut	2,218	$13,306			0	$0	0	$0
Fill	101,886	$611,314			72,187	$433,122	36,305	$217,832
Subtotal	104,104	$624,620			72,187	$433,122	36,305	$217,832
Runway 30								
Cut					14,631	$87,787		
Fill					8,440	$50,639		
Subtotal					23,071	$138,426		
Runway 7								
Cut			36,431	$218,583			89,997	$539,979
Fill			18,916	$113,495			20,759	$124,556
Subtotal			55,347	$332,078			110,756	$664,535
Runway 25								
Cut	14,661	$87,968	6,136	$36,817	13,860	$83,162	101,782	$610,691
Fill	107,522	$645,133	381,409	$2,288,452	108,054	$648,322	704	$4,224
Subtotal	122,183	$733,101	387,545	$2,325,269	121,914	$731,484	102,486	$614,915
TOTAL	**226,287**	**$1,357,721**	**442,892**	**$2,657,347**	**217,172**	**$1,303,032**	**249,547**	**$1,497,282**

Note: Cut and fill totals are in cubic yards. Cost estimates are based on $6 per cubic yard.
Source: Coffman Associates analysis utilizing GIS.

AIRSIDE SUMMARY

The primary goal of the alternatives analysis has been to meet FAA design standards and analyze the capability of the airport to support an ultimate runway length of 5,500 feet. Each of the alternatives accomplishes these goals. Therefore, it is prudent to consider the potential impacts that each alternative will have. **Table 4D** presents a summary matrix of the physical and environmental impacts that the airside alternatives may have.

Any extension of Runway 7-25 to the west will have the greatest impact. Alternatives 2 and 4 both require the relocation of Tidyman Road, impacting homes in Dallesport. The relocation of Dallesport Road, as shown on these two alternatives, would likely require further analysis.

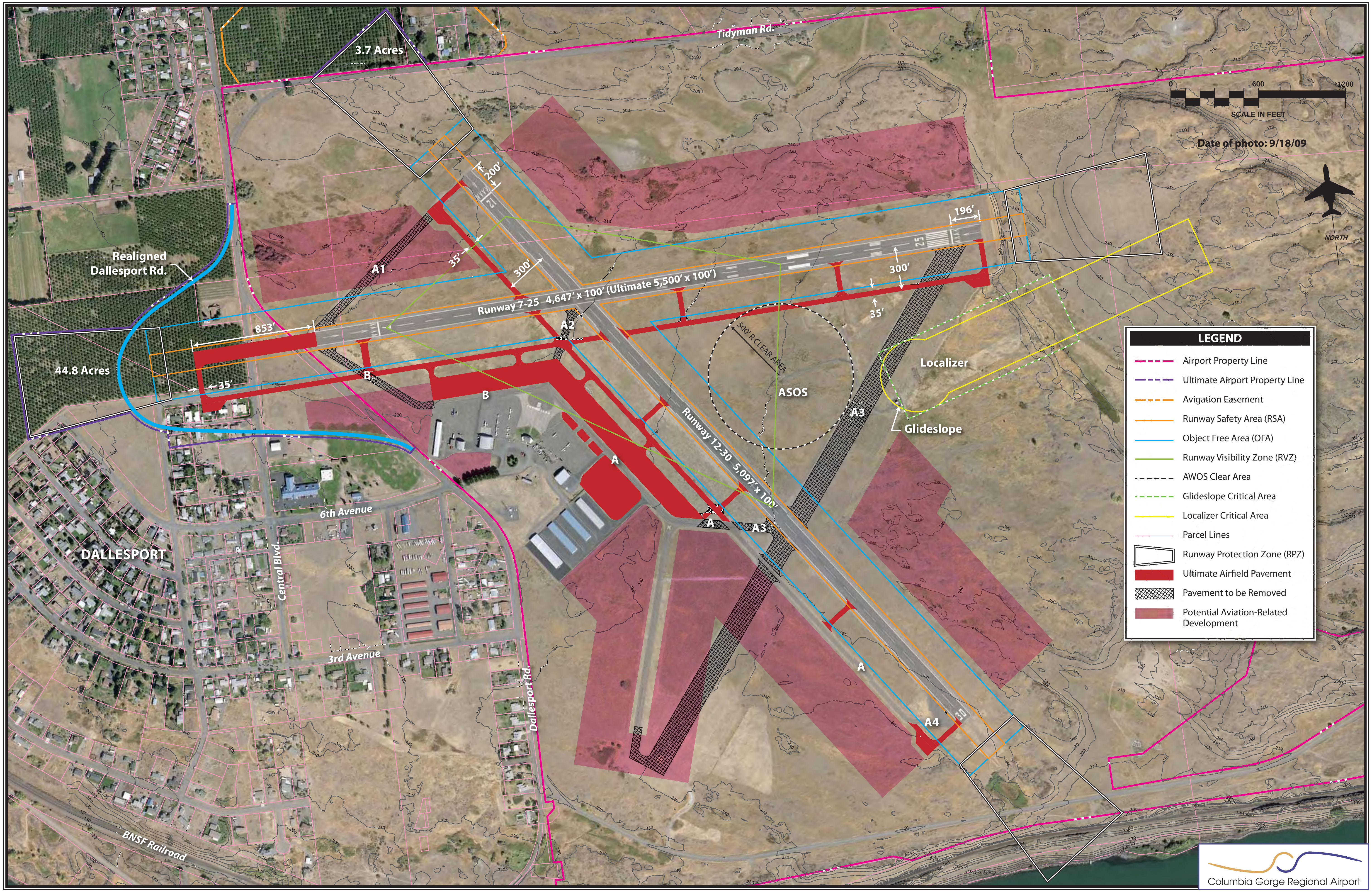

Exhibit 4K
AIRFIELD ALTERNATIVE 4

TABLE 4D
Summary Matrix of Airside Alternatives
Columbia Gorge Regional Airport

	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
RUNWAY 12				
Extension	Extend 403'	NA	Extend 170'	NA
Physical Impacts	Relocate Tidyman Road; Acquire 2 homes and orchard.	NA	None	NA
Environmental Impacts	Potential Wetland impact.	NA	Potential Wetland impact.	NA
RUNWAY 30				
Extension	NA	NA	233'	NA
Physical Impacts	NA	NA	None	NA
Environmental Impacts	NA	NA	NA	NA
RUNWAY 7				
Extension	Shorten by 440'	Extend 322'	Shorten Runway by 38'	Extend 853'
Physical Impacts	Negatively impact operations, potentially making Runway 25 less useful.	Relocate Dallesport Road; Acquire 4 homes and an orchard.	Modestly impact operations; Relocate Dallesport Road to Central Blvd. alignment.	Relocate Dallesport Road; Acquire 10 homes and fire station.
Environmental Impacts	None	Potential Dallesport overflights increase; Acquire 4 homes. Road closer to school.	Limited impacts; Road closer to school.	Significant impact to Dallesport; Increase overflights; Road closer to school.
RUNWAY 25				
Extension	NA	Extend 531'	NA	NA
Physical Impacts	NA	Recalibrate LDA/GS approach; Extensive fill.	NA	NA
Environmental Impacts	None	None	None	None
EARTHWORK				
Cut and Fill Volume (cubic yards)	226,287	442,891	217,172	249,547

Alternative 3 presented an option to extend primary Runway 12-30 with limited impact to the surrounding neighborhood. The only impact outside airport property is that the Runway 12 RPZ extends to encompass approximately 2.5 additional acres north of Tidyman Road. This area is currently within an avigation easement owned by the airport. It appears that this option would not have significant environmental impacts.

Extension of Runway 25 to the east presents significant challenges. The LDA/GS instrument approach is very valuable to the airport. Any extension of Runway 25 may impact this approach. The approach would need to be recalibrated and redesigned. This could result in the loss of the approach for up to 18 months. The worst case scenario would be the loss of the approach. Negatively impacting this instrument approach should be avoided.

Extension of the Runway 25 end requires significant earthwork. There is a significant drop in elevation from the runway end that requires more than 440,000 cubic yards of cut and fill. This is more than twice as much as any of the other alternatives.

LANDSIDE PLANNING ISSUES

Generally, landside issues relate to those airport facilities necessary, or desired, for the safe and efficient parking and storage of aircraft, movement of passengers and pilots to and from aircraft, airport land use, and overall revenue support functions. In addition, elements such as fueling capability, availability of services, and emergency response are also considered in the landside functions.

Landside planning issues, summarized on **Exhibit 4A**, will focus on facility locating strategies following a philosophy of separating activity levels. The number of structures and the storage capacity available is limited. Therefore, it is important to plan for an appropriate mix of smaller T-hangars, box hangars, and larger conventional hangars.

The orderly development of the airport terminal area (those areas parallel to the runway and along the flight line) can be the most critical, and probably the most difficult, development to control on the airport. A development approach of "taking the path of least resistance" can have a significant effect on the long term viability of an airport. Allowing development without regard to a functional plan can result in a haphazard array of buildings and small ramp areas, which will eventually preclude the most efficient use of valuable space along the flight line.

Activity in the terminal area should be divided into three categories at an airport. The high-activity area should be planned and developed as the area providing aviation services on the airport. An example of a high-activity area is the aircraft parking apron, which provides outside storage and circulation of aircraft. In addition, large conventional hangars housing fixed base operators (FBOs), other airport businesses, or used for aircraft storage would be considered high-activity uses. A conventional hangar structure in the high-activity area should be a minimum of 6,400 square feet (80 feet by 80 feet). If space is available, it is more common to plan these hangars for up to 200 feet by 200 feet. The best location for high-activity areas is along the flight line near midfield, for ease of access to all areas of the airfield.

The medium-activity category defines the next level of airport use and primarily includes corporate aircraft operators that may desire their own executive or conventional hangar storage on the airport. A hangar in the medium-activity use area should be at least 50 feet by 50 feet, or a minimum of 2,500 square feet. The best location for medium-activity use is off the immediate flight line, but still with ready access to the runway/taxiway system. Typically, these areas will be adjacent to the high-activity areas. Parking and utilities such as water and sewer should also be provided in this area.

The low-activity use category defines the area for storage of smaller single and twin-engine aircraft. Low-activity users are personal or small business aircraft owners who prefer individual space in T-hangars or small executive hangars. Low-activity areas should be located in less-conspicuous areas or to the ends of the flight line. This use category will require electricity, but may not require water or sewer utilities.

In addition to the functional compatibility of the terminal area, the proposed development concept should provide a first-class appearance for Columbia Gorge Regional Airport. Consideration to aesthetics should be given high priority in all public areas, as the airport can many times serve as the first impression a visitor may have of the community.

The existing terminal area at Columbia Gorge Regional Airport has, for the most part, followed the separation of activity levels philosophy. The terminal building faces a central ramp area with hangar areas located to the sides. Larger, high-activity hangars are immediately adjacent the main apron and lower-activity box and T-hangars are set farther to the sides.

Ideally, terminal area facilities at general aviation airports should follow a linear configuration parallel to the primary runway. The linear configuration allows for maximizing available space, while providing ease of access to terminal facilities from the airfield. Each landside alternative will address development issues, such as the separation of activity levels and efficiency of layout. Each of the landside alternatives will address the forecast needs from the previous chapter of this plan.

AIRPORT LAND USE

The Columbia Gorge Regional Airport currently encompasses approximately 945 acres. As the airport has accepted grants for capital improvements from the FAA, the airport sponsor has agreed to certain "grant assurances." Grant assurances related to land use assure that airport property will be reserved for aeronautical purposes. If the airport sponsors wish to sell (release) airport land or lease airport land for a non-aeronautical purpose (land-use change), they must petition the FAA for approval. The Airport Layout Plan and the Airport Property Map must then be updated to reflect the sale or land-use change of the identified property.

Land Use Change

A land-use change permits land to be leased for non-aeronautical purposes. A land-use change does not authorize the sale of airport land. Leasing airport land to produce revenue from non-aeronautical uses allows the land to earn revenue for the airport as well as serve the interests of civil aviation by making the airport as selfsustaining as possible. Airport sponsors may petition for a land use change for the following purposes:

- So that land that is not needed for aeronautical purposes can be leased to earn revenue from non-aviation uses. This is land that is clearly surplus to the airport's aviation needs.

- So that land that cannot be used for aeronautical purposes can be leased to earn revenue from non-aviation uses. This is land that cannot be used by aircraft or where there are barriers or topography that prevents an aviation use.

- So that land that is not presently needed for aeronautical purposes can be rented on a temporary basis to earn revenue from non-aviation uses.

A land-use change shall not be approved by the FAA if the land has a present or future airport or aviation purpose, meaning the land has a clear aeronautical use. If land is needed for aeronautical purposes, a land-use change is not justified. Ordinarily, land on or in proximity to the flight line and airport operations area is needed for aeronautical purposes and should not be used for non-aviation purposes.

The proceeds derived from the land-use change must be used exclusively for the benefit of the airport. The proceeds derived from the land-use change may not be used for a non-airport purpose. The proceeds cannot be diverted to the airport sponsor's general fund or for general economic development unrelated to the airport.

At a minimum, Columbia Gorge Regional Airport should reserve the flight line adjacent to all runways for future aeronautical purposes. The alternatives have generally identified those areas that should be reserved for aviation uses.

Release of Airport Property

A release of airport property would entail the sale of land that is not needed for aeronautical purposes currently or into the future. The following documentation is required to be submitted to the FAA for consideration of a land release:

1. What is requested?
2. What agreement(s) with the United States are involved?
3. Why the release, modification, reformation or amendment is requested?
4. What facts and circumstances justify the request?
5. What requirements of state or local law or ordinance should be provided for in the language of an FAA issued document if the request is consented to or granted?
6. What property or facilities are involved?
7. How the property was acquired or obtained by the airport owner.
8. What is the present condition and what present use is made of any property or facilities involved?
9. What use or disposition will be made of the property or facilities?
10. What is the appraised fair market value of the property or facilities?

Appraisals or other evidence required to establish fair market value.

11. What proceeds are expected from the use or disposition of the property and what will be done with any net revenues derived?
12. A comparison of the relative advantage or benefit to the airport from sale or other disposition as opposed to retention for rental income?

Each request should have a scaled drawing attached showing all airport property and airport facilities which are currently obligated for airport purposes by agreements with the United States. Other exhibits supporting or justifying the request, such as maps, photographs, plans and appraisal reports, should be attached, as appropriate.

As presented in Chapter One – Inventory, there are plans for the development of a golf course/resort on a portion of undeveloped airport property. The airport is currently working with the FAA to release two tracts totaling 38.8 acres to allow for development of a time-share community associated with the resort. Neither of these tracts is necessary to accommodate future aviation demand at the airport. The remaining airport property intended for the golf course/resort is planned to be leased and not sold. The airport land use map that will be included as part of the airport layout plan set, will include those areas of airport property that should be reserved for aeronautical purposes and those areas available for non-aviation leases or excess to aviation needs.

VEHICULAR ACCESS AND PARKING

A planning consideration for any airport master plan is the segregation of vehicles and aircraft operational areas. This is both a safety and security consideration for the airport. Aircraft safety is reduced and accident potential increased when vehicles and aircraft share the same pavement surfaces. Vehicles contribute to the accumulation of debris on aircraft operational surfaces, which increases the potential for Foreign Object Damage (FOD), especially for turbine-powered aircraft. The potential for runway incursions is increased, as vehicles may inadvertently access active runway or taxiway areas if they become disoriented once on the aircraft operational area (AOA). Airfield security may be compromised as there is loss of control over the vehicles as they enter the secure AOA. The greatest concern is for public vehicles, such as delivery vehicles and visitors, which may not fully understand the operational characteristics of aircraft and the markings in place to control vehicle access. The best solution is to provide dedicated vehicle access roads to each landside facility that is separated from the aircraft operational areas with security fencing.

The segregation of vehicle and aircraft operational areas is supported by FAA guidance established in June 2002. FAA AC 150/5210-20, *Ground Vehicle Operations on Airports*, states, "The control of vehicular activity on the airside of an airport is of the highest importance." The AC further states, "An airport operator should limit vehicle operations on the movement areas of the airport to only those vehicles necessary to support the operational activity of the airport."

The landside alternatives for Columbia Gorge Regional Airport have been developed to reduce the need for vehicles to cross an apron or taxiway area. Dedicated vehicle parking areas, which are outside the airport fence line, are considered for all potential hangars.

FUEL FACILITIES

The existing fuel storage is located in underground tanks below the fuel island on the main apron. The airport FBO operators have indicated a desire to have the fuel storage facilities relocated to an aboveground facility. Aboveground fuel tanks can be easier to maintain, in some cases. A leak can be identified more quickly with aboveground tanks. As a revenue generating item, fuel facilities are not eligible for federal grant funding. Appropriate locations for a replacement fuel farm will be identified in the alternatives to be presented.

AIRPORT INDUSTRIAL PARK

As discussed in Chapter One – Inventory, a binding site plan for an airport business/industrial park has been submitted to Klickitat County for review. Those parcels that are planned to have frontage to the taxiway/taxilane system must be reserved for aviation use exclusively to conform to FAA grant assurances.

Exhibit 4L shows the parcel layout of the binding site plan for the industrial/business park as revised in March 2010. This site plan takes into consideration various master plan recommendations and airport design standards. The parcels allow for the taxiway object free area (OFA) associated with Taxiway A (65.5 feet from the taxiway centerline), to remain clear of objects. A taxilane is planned to be extended into the industrial/business park. The taxilane OFA is 57.5 feet from the taxilane centerline.

It should be noted that the extension of the taxilane into the business park is not necessary to provide aviation-related parcels to meet forecast demand. The parcels along Taxiway A as well as parcels 2, 3, and 4 meet and exceed the long term forecast need for aviation parcels.

BUILDING RESTRICTION LINE

The building restriction line (BRL) identifies suitable building area locations on the airport. The BRL encompasses the RPZs, the OFA, the runway visibility zone, NAVAID critical areas, areas required for terminal instrument procedures, and other areas necessary for meeting airport line-of-sight.

Two primary factors contribute to the determination of the BRL: type of runway (utility or other-than-utility) and the capability of the instrument approaches. As a regional airport supporting business jet operations, Columbia Gorge Regional Airport is an

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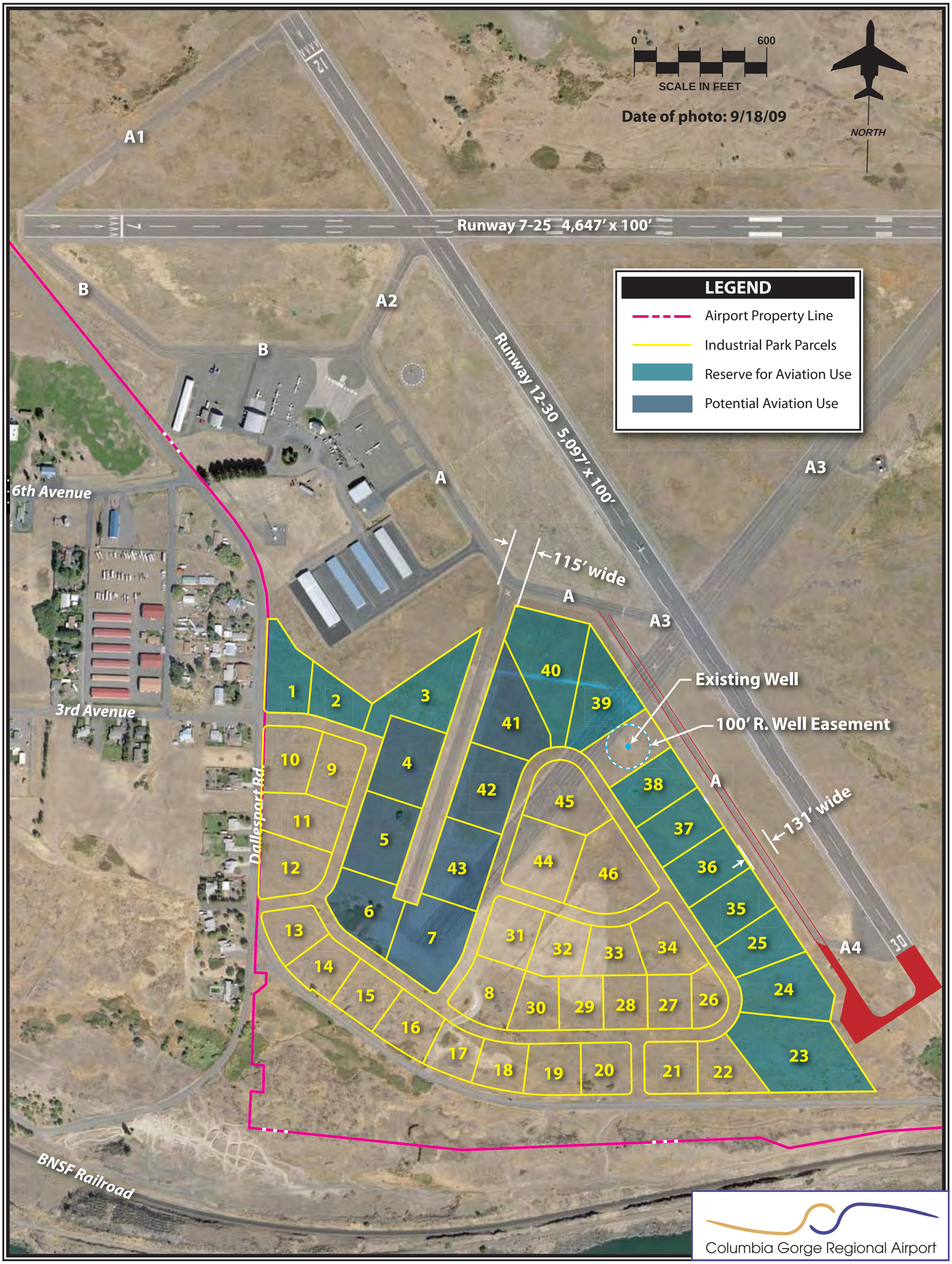

Exhibit 4L
INDUSTRIAL PARK

"other-than-utility" airport. The instrument approach provides for visibility minimums greater than ¾-mile.

The BRL is also set by the allowable height of airport buildings. At Columbia Gorge Regional Airport, the BRL is 495 feet from the runway centerlines for buildings no taller than 35 feet.

LANDSIDE ALTERNATIVES

As presented in Chapter Three – Facility Requirements, the airport has approximately 79,000 square feet of hangar space currently available. In the short term, an additional 43,000 square feet of space is forecast to be needed. Through the long term, a total of 84,000 square feet is forecast to be needed. In terms of aircraft storage mix, box hangar and conventional hangar space is the highest priority, while a need for more T-hangars is realized in the intermediate and long term.

LANDSIDE ALTERNATIVE A

Landside Alternative A, presented on **Exhibit 4M**, presents a building layout that utilizes the existing pavements and access points to the greatest extent possible. The T-hangar complex to the south of the terminal building is replicated on the southeast side of the access taxiway. By replicating this layout, the airport is able to build off of the existing taxiway, thereby minimizing expenses associated with new taxiways. The first three structures are T-hangars encompassing 12,500 square feet each. The fourth structure is a connected box hangar encompassing approximately 15,000 square feet.

To the east of the T-hangar complex is an open space that could accommodate larger conventional hangars as shown. These hangars are approximately 10,000 square feet each. This location is ideal for high activity airport businesses. A total of 102,500 square feet of new hangar space is proposed.

The location of a new fire station is shown in the north terminal area. This fire station is intended to serve the surrounding community as well as airport needs. An aboveground fuel farm is also identified. This location would allow refueling tankers to make delivery without traversing the main aircraft ramp.

LANDSIDE ALTERNATIVE B

Landside Alternative B considers a longer range vision for the terminal area. A new terminal building is envisioned to the south of the existing building. This location would allow the current terminal building to remain open to the public while the new building is being constructed. The building depicted is approximately 9,000 square feet. This size building would allow for some leasable space, including a restaurant. **Exhibit 4N** presents the second landside alternative.

Ideally, hangars are arranged in a linear fashion facing the nearest runway. The hangars north of the terminal building are slightly askew and are not perpendicular to either runway. This alternative considers maintaining the existing hangars and filling in with new hangars.

A large conventional hangar is situated between the old terminal building and the large conventional hangar to the north. This hangar is approximately 8,800 square feet. Further to the north is a location identified for individual box hangars. As depicted, there are four hangars that each encompasses 3,500 square feet, and a smaller hangar that is approximately 2,500 feet. These hangar types are popular with owners, particularly those that utilize a multi-engine, turboprop, or small business jet.

The T-hangar/box hangar complex is enhanced in this alternative by extending the taxilane to make room for nine box hangars and two conventional hangars. This layout is once again maximizing use of the existing taxilanes. A total of 52,800 square feet is made available in addition to the 37,500 square feet from the three T-hangar buildings.

A new idea presented here is to extend the taxilane and apron that currently provides access to the hangar fronting the transient apron. This would allow for the introduction of three new hangars and a total of 14,400 square feet of storage space. A total of 144,400 square feet is shown in this alternative.

LANDSIDE ALTERNATIVE C

Landside Alternative C, presented on **Exhibit 4P**, considers a facility layout that takes advantage of the additional apron space that can be gained through the development of parallel taxiways that are 300 feet from the runway centerline. A replacement terminal building is shown that is constructed in front of the current terminal building. This would allow the existing terminal building to remain in place until the new building is completed.

Two new conventional hangars, each encompassing 10,000 square feet, are then located to the sides of the new terminal building. These conventional hangars would be high activity airport business hangars. The current conventional hangar to the north is shown as remaining in place; ultimately this hangar too could be replaced.

The Quonset hut and the T-hangar building to the north are planned for redevelopment; in this case being replaced by two more large conventional hangars. In total, this alternative provides for 77,500 square feet of hangar space, which includes redeveloping approximately 15,000 square feet.

LANDSIDE SUMMARY

Some portions of the existing hangar layout at Columbia Gorge Regional

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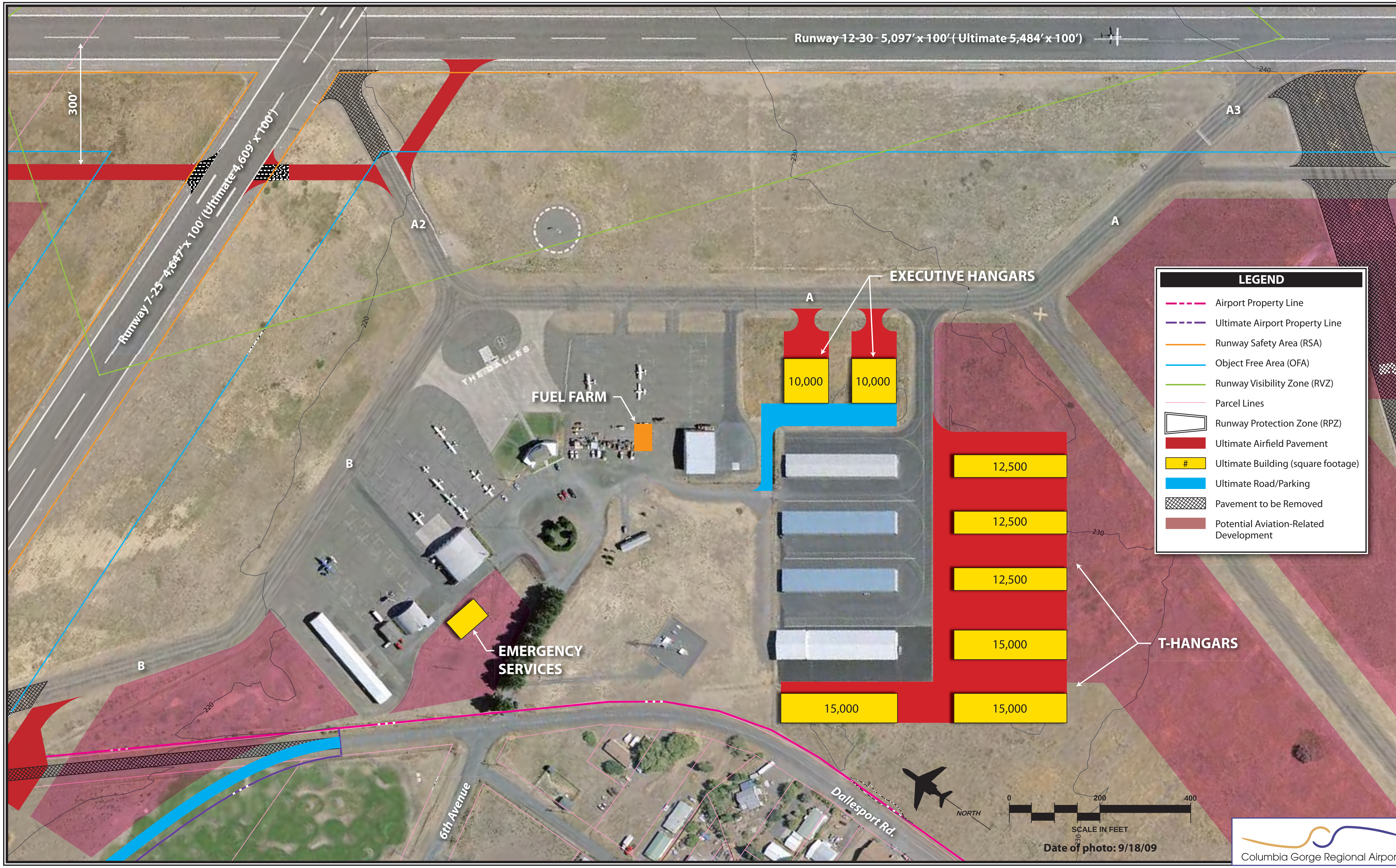

Exhibit 4M
LANDSIDE ALTERNATIVE A

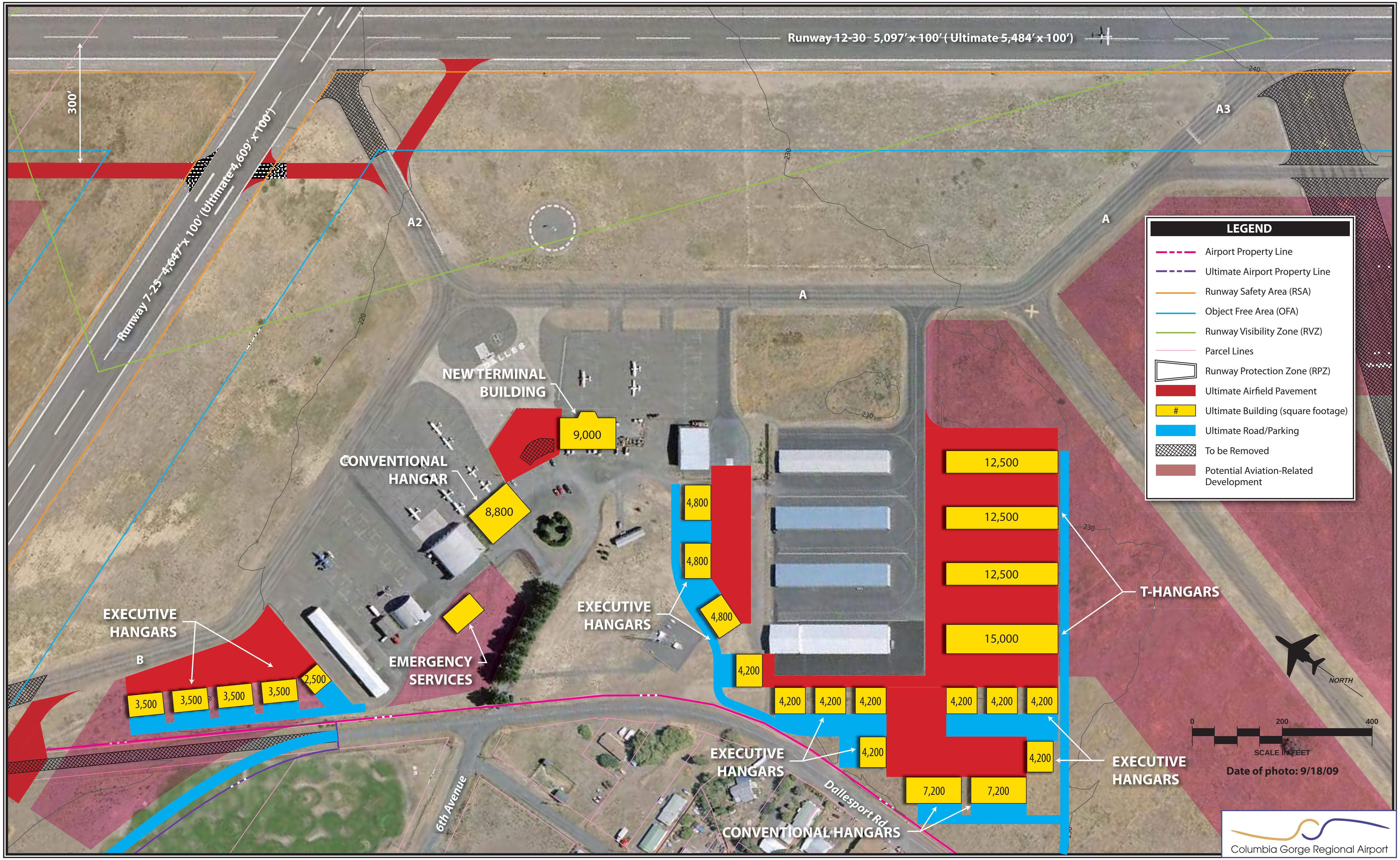

Exhibit 4N
LANDSIDE ALTERNATIVE B

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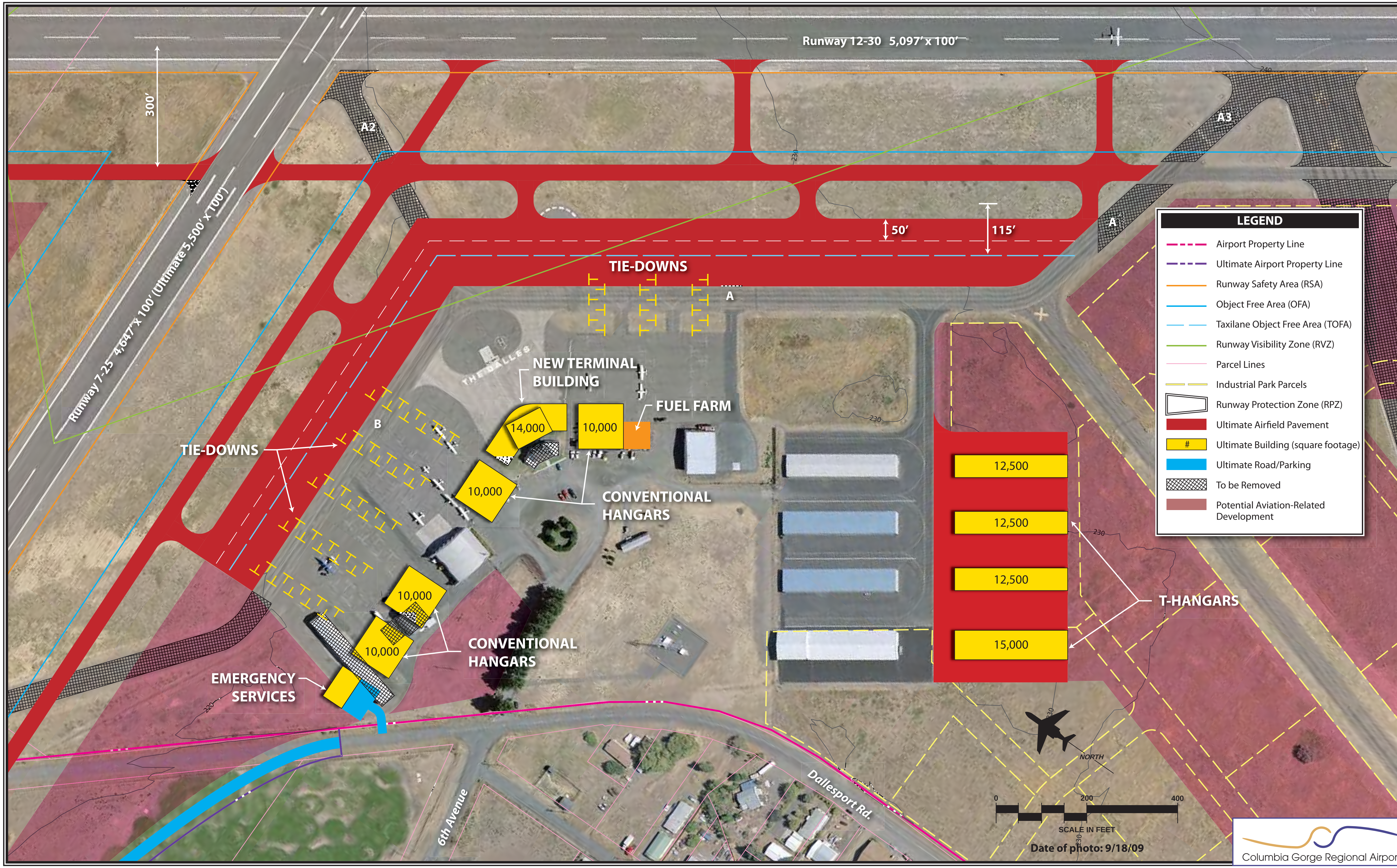

Exhibit 4P
LANDSIDE ALTERNATIVE C

Airport follow normal convention for efficiency of layout, while other areas do not. The T-hangar complex on the south maximizes the available space and provides a central location for these types of hangars. Each of the alternatives replicates this layout by providing a mirror image development across the taxilane.

The existing hangar development surrounding the terminal building does not provide the same level of efficiency. The hangars on the north are not perpendicular to the runway and there is not a clear building restriction line. Nonetheless, the terminal building location is ideal as it is the central focal point of the airport.

As discussed in Chapter Three – Facility Requirements, the airport is forecast to need approximately 43,000 square feet of new hangar space in the next five years and 84,000 over the next 20 years. **Table 4E** presents a summary of the total hangar area proposed for each alternative.

TABLE 4E
Landside Hangar Summary
Columbia Gorge Regional Airport

	Alternative A	Alternative B	Alternative C
T-Hangar	37,500	37,500	37,500
Box Hangar	45,000	83,700	15,000
Conventional Hangar	20,000	23,200	40,000
Redevelopment	0	0	(15,000)
Total	102,500	144,400	77,500

The landside alternatives are intended to help guide airport development decisions. Several areas of the airport terminal area have been identified for specific use types. Large conventional hangars intended to support aviation businesses should be located on the main central apron. Medium activity private box hangars should be set to the side of the high activity areas. T-Hangars or connected box hangars are low activity centers and should be comingled to the greatest extent possible.

ALTERNATIVES SUMMARY

Several development alternatives related to both the airside and the landside have been presented. Some of the alternatives have been developed for the purpose of determining viability, such as the extension of Runway 7. While an extension of Runway 7 can be done, it would likely be the most expensive and have the greatest negative impact to the citizens on Dallesport. Therefore, Airside Alternative 3 presents the most viable alternative for a runway extension, by adding 170 feet to the north end of Runway 12-30 and 233 feet to the south end.

The extension of Runway 12-30 in this manner does not require the airport to relocate any roads or purchase additional property. This is also the primary runway and the runway with the greatest percentage of wind coverage. The primary draw-back to extending this runway is the lack of straight-in instrument approaches. It should be noted that this runway is available for circling approaches. The circling approach, in fact, provides better visibility and cloud ceiling minimums than the LDA/GS approach to Runway 25.

Two alternatives were presented related to the disposition of Runway 7-25 if Runway 12-30 is the designated extended runway. The first option shortened the runway by 440 feet in order to provide adequate RSA and approach clearance over Dallesport Road. The second option would relocate a portion of Dallesport Road to the Central Blvd. alignment in order to provide for RSA. The runway would still need to be shortened by 38 feet to allow for approach clearances. A third option would relocate Dallesport Road slightly farther to the west of the Central Blvd alignment, in order to allow for approach clearances.

The taxiway system at Columbia Gorge Regional Airport should be improved to increase safety and efficiency. The angled threshold taxiways should be replaced with right-angled taxiways. A new taxiway leading from Taxiway A2 to the Runway 12 threshold should be constructed, thereby making a full-length parallel Taxiway A to the primary runway. Ultimately, a parallel taxiway to Runway 7-25 could be needed as well.

The landside alternatives identify specific areas of the terminal area and provide recommendation for how they should be planned for development. As a general rule, facilities serving a similar activity level should be grouped together. New T-hangars should be located to the south of the terminal area adjacent to the current T-hangar complex. Conventional hangars should be utilized as high activity airport businesses and should be centrally located. Box hangars should occupy those medium activity areas.

Now that several alternatives for both the airside and landside have been presented, it is possible to combine these elements into a preliminary concept, as shown on **Exhibit 4Q.** This exhibit represents a starting point for final concept discussions.

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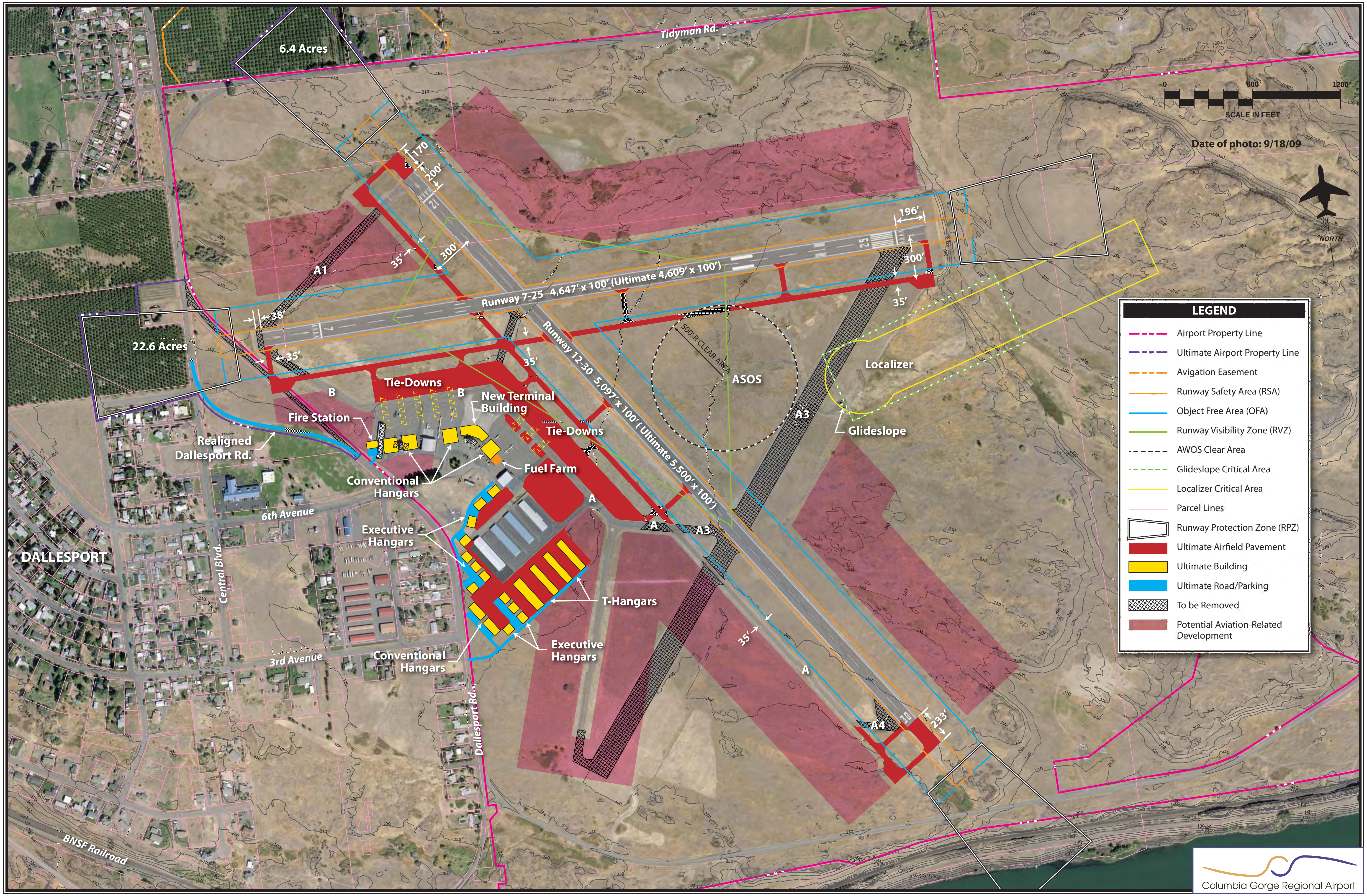

Exhibit 4Q
PRELIMINARY MASTER PLAN CONCEPT

Columbia Gorge Regional Airport

Chapter Five

RECOMMENDED MASTER PLAN CONCEPT

Columbia Gorge Regional Airport

RECOMMENDED MASTER PLAN CONCEPT

The airport master planning process for Columbia Gorge Regional Airport (DLS) has evolved through the development of forecasts of future demand, an assessment of future facility needs, and an evaluation of airport development alternatives to meet those future facility needs. The planning process has included the development of draft working papers which were presented to the Planning Advisory Committee (PAC) and discussed at several coordination meetings and a public information workshop.

The PAC is comprised of several constituencies with an investment or interest in Columbia Gorge Regional Airport. These groups included representatives from the Federal Aviation Administration (FAA), City of The Dalles, Klickitat County, state aviation representatives from Washington and Oregon, airport businesses, and local and national aviation associations. This diverse group has provided extremely valuable input into the recommended plan.

In the previous chapter, several development alternatives were analyzed to explore options for the future growth and development of Columbia Gorge Regional Airport. The development alternatives have been refined into a single recommended concept for the master plan. This chapter describes, in narrative and graphic form, the recommended direction for the future use and development of Columbia Gorge Regional Airport.

RECOMMENDED MASTER PLAN CONCEPT

The recommended master plan concept incorporates elements from each of the airside and landside alternatives presented in the previous chapter. This concept provides the airport with the ability to meet the increasing demands on the airport by larger corporate aircraft while also providing adequate space for smaller piston aircraft operators. The recommended master plan concept, as shown on **Exhibit 5A**, presents the ultimate configuration for the airport that preserves and enhances the role of the airport while meeting FAA design standards. A phased program to implement the recommended development concept will be presented in Chapter Six - Capital Improvement Program. The following sub-sections will describe the recommended master plan concept in detail.

AIRSIDE CONCEPT

The FAA has established design criteria to define the physical dimensions of runways and taxiways, as well as the imaginary surfaces surrounding them which protect the safe operation of aircraft at the airport. These design standards also define the separation criteria for the placement of landside facilities.

As discussed previously, the design criteria primarily center on the airport's critical design aircraft. The critical aircraft is the most demanding aircraft or family of aircraft which currently, or are projected to, conduct 500 or more itinerant operations (take-offs and landings) per year at the airport. Factors included in airport design are an aircraft's wingspan, approach speed, tail height and, in some cases, the instrument approach visibility minimums for each runway. The FAA has established the Airport Reference Code (ARC) to relate these critical aircraft factors to airfield design standards.

Analysis conducted in Chapter Three - Facility Requirements concluded that the current critical aircraft is defined by aircraft falling in ARC B-II. These aircraft are represented by turboprops and many small business jets. The future critical aircraft is projected to remain within ARC B-II, but be defined primarily by small and medium sized business jets.

While airfield elements, such as runway length and safety areas, must meet design standards associated ARC B-II, landside elements can be designed to accommodate specific categories of aircraft. For example, a taxilane into a T-hangar area only needs to meet the object free area (OFA) width standard for smaller single and multi-engine piston aircraft (ARC A-I and B-I) expected to utilize the taxilane, not those for the larger business jets representing the overall critical aircraft for the airport.

Table 5A presents the design standards to be applied to the runways at Columbia Gorge Regional Airport. It also highlights those areas where the runway does not currently meet FAA design standards. The following discussion will describe the recommended master plan concept in detail and the proposed solutions to meeting design standards.

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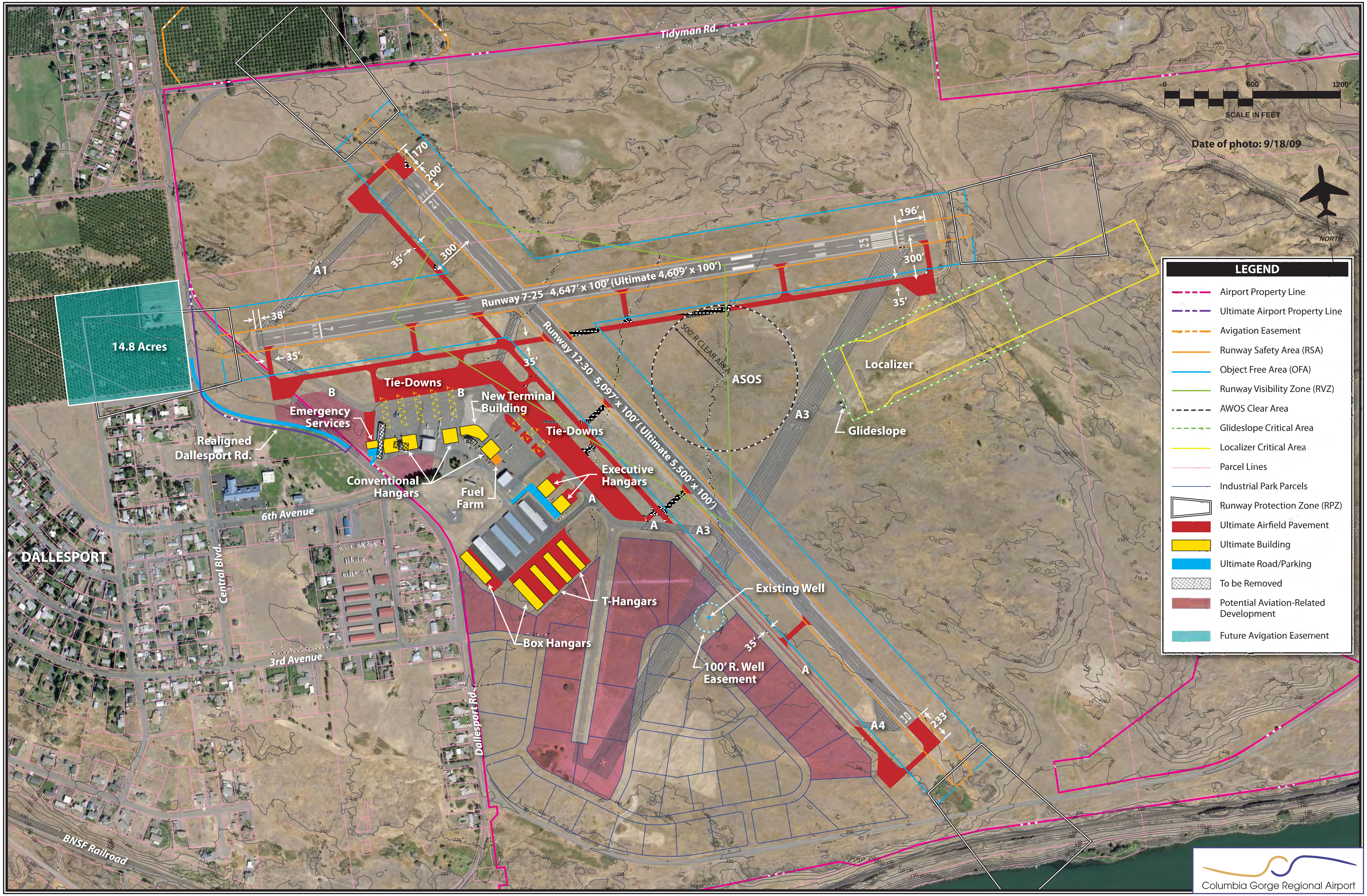

Exhibit 5A
MASTER PLAN CONCEPT

TABLE 5A
Airfield Planning Design Standards (Ultimate)
Columbia Gorge Regional Airport

	FAA Standards	Current Condition
Design Standard	**B-II**	**B-II**
Applicable Approach	**> 1 Mile**	**> 1 Mile**
RUNWAYS		
Runway Width	75	100
Runway Shoulder Width	10	10
Runway Safety Area		
Width	150	Non-Standard
Length Beyond End	300	Non-Standard
Length Prior to Landing	300	300
Runway Object Free Area		
Width	500	Non-Standard
Length Beyond End	300	Non-Standard
Runway Obstacle Free Zone		
Width	400	Non-Standard
Length Beyond End	200	Non-Standard
Runway Centerline to:		
Holding Position	200	200
Parallel Taxiway	240	>240
Aircraft Parking Area	250	>250
TAXIWAYS		
Width	35	30-50
Shoulder Width	10	10
Safety Area Width	79	79
Object Free Area Width	131	131
Edge Safety Margin	7.5	7.5
Taxilane Object Free Area	115	115
Taxiway Centerline to:		
Fixed or Movable Object	65.5	65.5
Parallel Taxiway/Taxilane (Centerline)	105	105
RUNWAY PROTECTION ZONES		
Inner Width	500	500
Outer Width	700	700
Length	1,000	1,000

All measurements in feet
Source: FAA AC 150/5300-13, Airport Design

Instrument Approaches

The location of the airport within the valley created by the Columbia River presents difficulties when trying to improve the instrument approaches. In 2006, the airport installed a localizer and a glide slope antenna. Due to the surrounding terrain, these instruments are offset from the runway and the resulting instrument approach is offset. As a result, the lowest visibility minimum is 2¾-miles and the cloud ceiling minimums are 1,200 feet. This approach is also only available to aircraft in approach categories A and B. A circling Area Navigation (RNAV) Global Positioning System (GPS) instrument approach is available that offers visibility minimums as low as 1¼-miles for approach category A aircraft, 1½-miles for approach category B, and three miles for approach category C aircraft.

While these instrument approaches may be the best the airport can currently obtain, future technological advances may allow for straight-in instrument capability. For planning purposes, straight-in instrument non-precision approaches are planned for Runways 12, 30, and 7. Runway 25 is also planned to remain a non-precision approach, although the minimums may be improved in the future. It should be noted that the FAA undertook extensive research when installing the localizer and glide slope antenna and determined that the above-referenced minimums for Runway 25 were the best that could be implemented.

In the future, as technology advances, particularly GPS technology, there may be some opportunity for improved approaches. The airport should monitor these advances and maintain discussions with the FAA. Future planning studies should also reassess the possibility of improved instrument approaches.

Visual Approach Aids

Visual approach aids are those ground based facilities that help pilots identify the airport and the runway ends. Visual approach aids include Runway End Identifier Lights (REILs), Precision Approach Path Indicators (PAPIs), and various styles of approach lighting systems. The *Oregon Aviation Plan* (2007) identifies Columbia Gorge Regional Airport as deficient in this area.

Analysis in the alternatives chapter indicated that the airport could support a traditional PAPI on the approach to Runway 12 with a three degree glide path. A PAPI is also considered for the approach to Runway 30, but the glide path will have to be non-traditional. Nonetheless, PAPIs are considered for both ends of Runway 12-30.

Where an approach lighting system is not considered, REILs should be installed to help pilots rapidly identify the runway ends. REILs are available on the Runway 30 end. Since Runway 25 supports the offset instrument, it too should have REILs.

Runway Length

As discussed in Chapter Three – Facility Requirements, Runway 12-30 is currently 5,097 long, and this length meets the needs of most operators, including 75 percent of the business jet fleet at 60 percent useful load. Under some circumstances, a runway length of 5,500 feet would be beneficial. These conditions would include very hot days or rainy days where additional length may be needed for turbine landing operations.

As presented on the recommended concept, an extension of primary Runway 12-30 to a length of 5,500 feet is planned. To accomplish this with minimal impact to existing roads and residences, approximately 170 feet is added to the Runway 12 end and the remaining 233 feet is added to the Runway 30 end.

The length of Runway 7-25 is reduced slightly in order to allow for approach clearance over Dallesport Road. Currently, the landing threshold to Runway 7 is displaced by 440 feet. Once Dallesport Road is relocated, this threshold can be relocated to the west approximately 402 feet. This action would allow for the runway to meet runway safety area (RSA), OFA, and obstacle free zone (OFZ) standards and to provide approach clearance.

Runway Strength

Recent runway strength testing indicated that Runway 12-30 has a single-wheel load bearing strength (SWL) of 18,000 pounds. The SWL for Runway 7-25 was estimated at 4,000 pounds SWL. The runways should be capable of withstanding repeated activity by the heaviest aircraft in ARC B-II. Many business jets with a single wheel on each landing strut are in ARC B-II and exceed 25,000 pounds. The minimum runway strength recommended is 30,000 pounds. The airport also sees activity by business jets with two wheels on each landing gear strut. Therefore, the dual-wheel load bearing strength should be 60,000 pounds.

Some of the largest and heaviest business jets, including the Gulfstream IV and V, Challenger 600s, and Falcon 2000s occasionally operate at the airport. When the runway strengthening project is in the design phase consideration may be given to extending the strength of the runway to 60,000 pounds SWL and 90,000 pounds DWL.

Safety Areas

The Facility Requirements chapter discussed the requirements for the RSA, OFA, OFZ, and the runway protection zones (RPZ). Of particular concern is the RSA, which must meet FAA design standard to the greatest extent possible. The RSA at Columbia Gorge Regional Airport is centered on the runway and should be 150 feet wide and extend 300 feet off each runway end.

The analysis presented in the alternatives chapter showed that the most reasonable method to meeting RSA standards is to simply fill and grade the RSA to standard. At the time of this safety improvement, the OFA and OFZ should also be considered.

The RPZ is a trapezoidal area beginning 200 feet from the runway end and extending out in accordance with the operational activity at the airport and the instrument approach visibility minimums. The function of the RPZ is to enhance the protection of people and property on the ground. The FAA recommends the airport have positive control of the RPZ through fee-simple ownership if possible. Portions of the RPZs serving Runways 12, 7, and 30 extend off airport property. An avigation easement for the Runway 7 RPZ is recommended. The RPZ extending off airport property south of Runway 30 is undevelopable and does not pose an incompatibility to the airport. Therefore, the Runway 30 RPZ is not recommended for acquisition.

Taxiways

The taxiway layout at Columbia Gorge Regional Airport is not uniform and presents some safety concerns. The primary safety concern is the angled nature of the intersections with the runway thresholds. This reduces pilot visibility. Therefore, a primary feature of the taxiway layout in the recommended plan is that all angled taxiways are removed and are replaced by 90-degree angled intersections.

The width of the taxiways should also be uniform. The portion of Taxiway A leading to the Runway 30 threshold is only 30 feet wide. The plan recommends widening this to 35 feet. All new taxiways are planned at a width of 35 feet. Some portions of Taxiway A near the terminal area are currently 50 feet wide. These are planned to remain at this width.

The runway/taxiway separation standard for an ARC B-II airport is 240 feet. The parallel taxiways currently meet or exceed this standard. The southern portion of Taxiway A is situated 300 feet from the runway. This separation distance meets the standard for ARC C-II airports. While a transition to this ARC is not forecast in the master plan, the airport does receive some activity from business jets in this category. Future parallel taxiways are planned at 300 feet of separation.

Full length parallel taxiways are planned to both runways. These taxiways will improve the efficiency of aircraft movements and make additional terminal area space available.

Entrance and exit taxiways to the runways are staggered from those taxiways that lead to aircraft parking areas. This design layout is intended to reduce the possibility of runway incursions by forcing pilots to maneuver their aircraft onto the parallel taxiway before entering the runway environment. FAA Engineering Brief No. 75 (EB-75) recommends improving taxiway and apron layouts for enhanced safety, and the *FAA Northwest Mountain Region Plan – 2010* reflects this as a stated goal.

Taxiway Edge Lighting

The Oregon Aviation Plan indicates that regional airports should have full taxiway lighting. Currently, Columbia Gorge Regional Airport only has "throat" taxiway lighting at two intersections with the runway. This lighting should be expanded to all taxiways.

Declared Distances

FAA Advisory Circular (AC) 150/5300-13, *Airport Design*, Change 15, makes it clear that any airport with a displaced landing threshold has to implement declared distances. Columbia Gorge Regional Airport has displaced landing thresholds on Runways 7, 25, and 12. The reasons for displacing a landing threshold are not always documented, but can include inadequate RSA, OFA, OFZ, and obstruction to the approach.

The process for implementing declared distances is to write a letter to the FAA planner or engineer with responsibility for the airport, requesting that declared distances be published in the official Airport/Facility Directory. Exhibit 4D showed the applicable declared distances for the airport. A primary goal of the master plan concept is to position the runway system so that declared distances are not necessary. This is accomplished by removing any obstruction to the runway and upgrading the RSA, OFA, and OFZ to standard.

Airside Conclusion

Significant improvements are planned for Columbia Gorge Regional Airport that will enhance safety and position the airport for growth. The activity levels currently and within the 20-year planning horizon indicate that the airport should meet design standards associated with ARC B-II.

At times, a runway length of 5,500 feet could be necessary to accommodate the largest business jets included in the ARC B-II critical aircraft group. This is the length determined to fully accommodate 75 percent of business jets at 60 percent useful load, which is FAA's criteria for accommodating business jet activity. Runway 12-30 is planned to be extended from 5,097 feet to 5,500 feet by adding 170 feet to the north end and 233 feet to the south end. By splitting the extension between the two ends, there is no additional impact to the existing roads beyond Runway 12-30.

Another goal is to meet design standards for the RSA, OFA, and OFZ. These standards are not met to varying degrees beyond Runways 7, 25, and 12. Providing fill and grading the area 300 feet beyond the runway ends is the recommended solution to meeting safety area standards.

The existing landing threshold displacements limit the operational length for both runways. The extension and grading of the area beyond the ends of Runway 12, 30, and 25 will allow the threshold to be placed at the pavement ends. On the Runway 7 end, Dallesport Road is planned to be shifted to the west to meet safety area standards. The Runway 7 landing threshold can then be relocated back approximately 362 feet. The operational length available for Runway 7 will increase, but the physical length of the runway will be reduced by 38 feet. This is necessary to provide for a clear threshold siting surface leading to Runway 7.

Another goal of the airside plan is the removal of angled taxiways leading to the runway thresholds. Threshold taxiways that are at 90-degrees to the Runway provide greater visibility for pilots. In addition, both runways are planned for full length parallel taxiways situated at 300 feet from the runway centerlines.

The airside concept as planned would bring the airport into compliance with FAA design standards. It will also provide the maximum capability for the airport while maintaining standards associated with ARC B-II.

LANDSIDE CONCEPT

The primary goal of landside facility planning is to provide adequate aircraft storage space to meet forecast needs while also maximizing operational efficiencies and land uses. Achieving this goal yields a development scheme which segregates aircraft activity levels while maximizing the airport's revenue potential. **Exhibit 5A** also depicts the recommended landside development plan for the airport.

Hangars

The recommended concept shows the location for certain hangar types. Following the philosophy of separation of activity levels, larger high-activity conventional hangars are located facing the main apron. Lower activity T-hangars and box/executive hangars are set farther from the main apron and grouped together. **Table 5B** presents the total hangar positions and area provided in the master plan concept.

TABLE 5B
Hangar Space Planned
Columbia Gorge Regional Airport

	Current Supply Estimate	20-Year Supply Forecast	Total 20-year Need	Provided in Master Plan
Based Aircraft	68	75	82	95
Positions				
T-Hangar Positions	51	61	10	21
Box Hangar Positions	2	15	13	11
Conventional Hangar Positions	8	14	6	18
Hangar Area Requirements (s.f.)				
T-Hangar Hangar Area	59,600	73,000	13,400	28,700
Box Hangar Area	3,000	38,000	35,000	28,500
Conventional Hangar Area	13,000	35,000	22,000	44,000
Maintenance Area Reserve	3,000	17,000	14,000	16,000
Total Hangar Storage Area (s.f.)	78,600	163,000	84,400	117,200

Source: Coffman Associates analysis

As can be seen from the table, the master plan concept provides approximately 117,200 square feet of hangar space. The need over the course of the next 20 years is estimated at 84,600 square feet. Therefore, the hangar layout presented represents a vision for the airport that extends beyond the scope of this master plan. The reason for this is to provide airport decision makers with dedicated areas on the airport that should be reserved for certain hangar types. For example, the T-hangar area should remain reserved for T-hangars even beyond the scope of the master plan.

The hangar layout shown on the exhibit meets the separation of activity levels philosophy. On the main central ramp are located larger conventional hangars intended to accommodate fixed base operator (FBO) type activities. Hangar development space that is located on the main ramp and in close proximity to the terminal building should be reserved for high-activity uses such as an FBO or bulk aircraft storage. T-hangars and box hangars should be located farther away from the main terminal area.

The overall plan for the terminal apron area is to redevelop aging facilities, as feasible. When undertaking redevelopment, the opportunity exists to orient replacement facilities toward the runway. The Otis T-hangars (aged wooden frame 8-unit T-hangar facility) and the Quonset hut hangar could be replaced by conventional hangars as shown. The main conventional hangar just north of the existing terminal building is in good shape and is planned to remain. Between this conventional hangar and the terminal building is an undeveloped open space. This space is planned to accommodate another conventional hangar. Immediately south of the terminal building is another undeveloped area planned for another conventional hangar.

A replacement terminal building is planned in the location of the existing terminal building. As discussed previously, the existing terminal building is nearly 70 years old and does not meet facility codes for modern public buildings. A replacement terminal building will also serve as a "front door" to the region and as such it should be of a quality that reflects well upon the region. The building footprint shown is approximately 14,000 square feet, but an initial construction is planned to approximately 8,000 square feet to accommodate growth over the next 10-15 years.

Moving farther south there is an undeveloped parcel in front of the T-hangars that is planned for two medium sized box hangars. These would be ideal for use as corporate hangars. The location is somewhat removed from the terminal area apron, yet still provides ready access to the runway system.

The existing T-hangar and box hangar area is planned for expansion. This is a great location for these lower activity uses. As shown, three of the facilities are T-hangars and two are connected box hangar facilities.

As stated, the layout presented exceeds the forecast need for hangar storage space during the 20-year scope of the master plan. Nonetheless, by depicting a long term vision, airport management and potential developers can make informed decisions on what type of hangar to use and where to locate. For example, based on the concept, a private hangar builder should be directed to a location planned to accommodate their planned hangar type.

Property Acquisition

Planning for growth of the airport includes the consideration of strategic property acquisition of adjacent lands in order to allow for facility expansion or for the protection of the function and role of the airport. The FAA supports and provides reimbursement for necessary property acquisition. The reimbursements are provided when the land is necessary for airport development or protection. Basically, the FAA supports and funds immediate land acquisition needs but does not support "land-banking" of land that may or may not be needed in the future.

The RPZ serving Runway 12 extends off airport property to the north. The airport currently owns an avigation easement in this area. This easement should provide the protection the airport needs to prevent obstructions. With the easement, the airport is able to top trees or prevent other structures from being constructed in the approach. While the FAA recommends ownership of RPZ lands, this property is utilized as an active orchard. In the future, if the land use has the potential to change, or if the property becomes available for sale, the airport may want to consider purchasing the property in fee simple.

Property to the west of Dallesport Road falls within the RPZ for Runway 7. This property is also used as an orchard. In the short term, the airport should acquire avigation easement rights in order to protect the RPZ from any approach penetrations. Approximately 15 acres is recommended for the easement. If the land use has the potential to change, the airport may want to consider fee simple acquisition.

Business Park Plans

Based on the earlier findings of this master plan and the recommended concept, the airport has revised the binding site plan for the airport business park located in the southwest corner of airport property. The revised site plan is shown on **Exhibit 5A**. The new site plan provides for adequate taxiway object free area, including around the extension of Taxiway A, the planned hold apron adjacent to Runway 30, and the taxiway extending into the business park. The new plan also excludes areas reserved for future T-hangars/box hangars.

Those parcels that are adjacent to the taxiway system must be reserved for aviation-related businesses. Parcels that do not have taxiway access can accommodate any compatible business and does not have to be in the aviation industry. These parcels would bring land lease revenue to the airport.

Resort and Golf Course Plans

The planned use of excess airport property for a golf course and resort is a unique opportunity for the Columbia Gorge Regional Airport. As discussed previously, the airport has more land than is needed for aviation purposes. The proposed resort and golf course has been overlaid onto the recommended concept and is presented on **Exhibit 5B**.

The resort layout, as proposed, includes leasing airport property that should remain under the direct positive control of the airport. Of particular concern are the Runway 25 RSA and RPZ, and the critical areas associates with the localizer and glideslope antenna. Each of these areas should remain exclusively under airport control.

Support Facilities

The existing fuel farm is located below ground on the main apron. This location provides a central location and self-serve capabilities, but it also presents its own set of challenges. One challenge is monitoring for potential leaks, which can be difficult. When replacement is needed, it is recommended that the fuel farm be moved to above ground. As shown on the exhibit, the future fuel farm is situated in such a fashion that could maintain the self-serve function while eliminating the need for fuel trucks to enter the aircraft movement areas.

In the northwest terminal area, space is reserved for a new dual purpose emergency services facility that can serve community needs as well as airport

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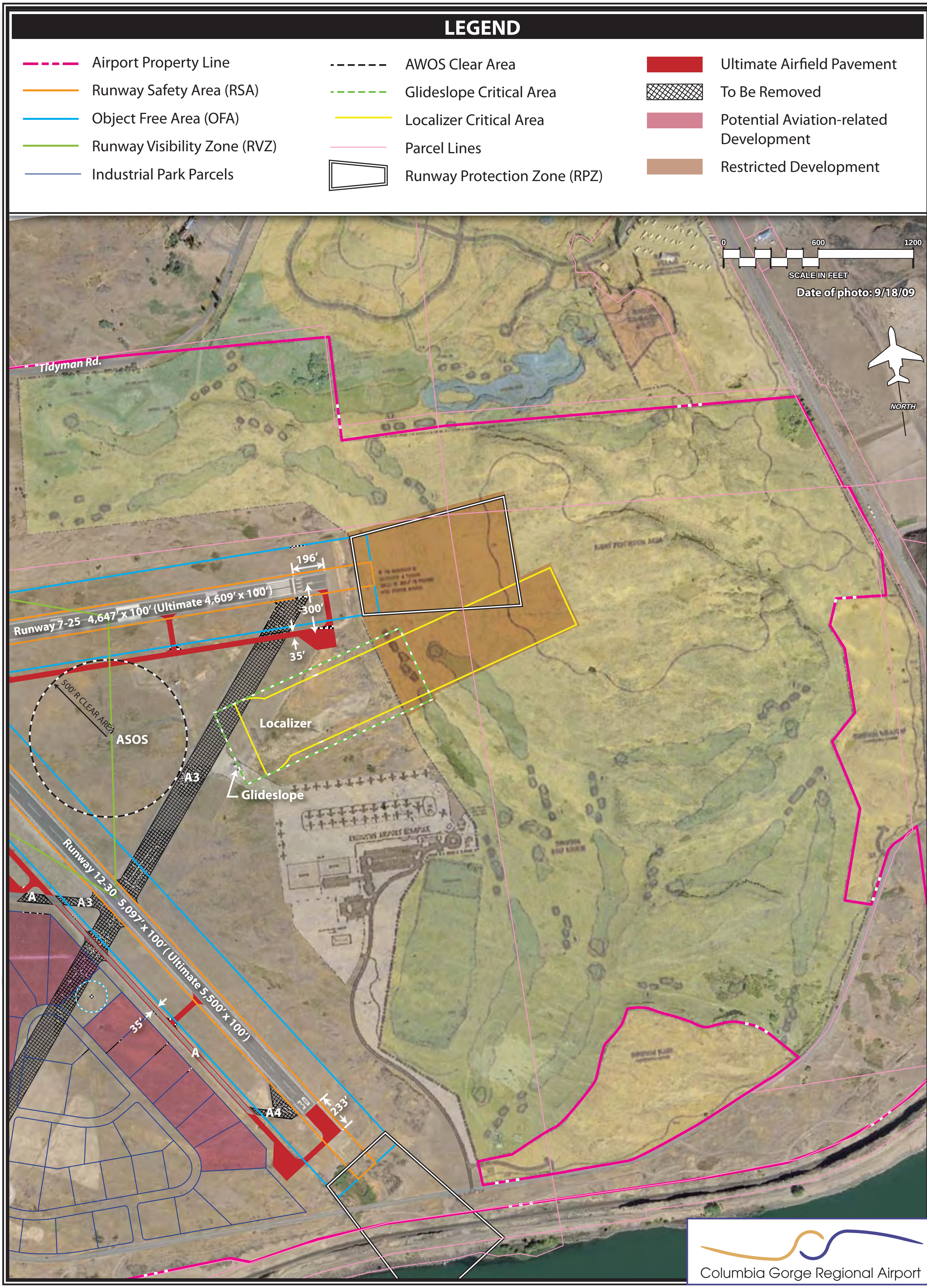


Exhibit 5B
RESORT AND GOLF COURSE DETAIL

needs. The location identified would provide ready access to Dallesport Road as well as the airfield.

SUMMARY

The recommended master plan concept has been developed with significant input from the PAC. The PAC included representation from the FAA, state aviation agencies, airport management, airport businesses, and various economic development agencies, The Dalles, and Klickitat County. This plan provides the necessary development to accommodate and satisfy the anticipated growth over the next 20 years and beyond.

The recommended concept provides for projects that address both airside (runways and taxiways) and landside (hangars) needs. On the airside, the top priority is meeting safety design standards. Currently, the RSA beyond Runways 25, 7, and 12 are nonstandard. The master plan identifies methods to bring these safety areas up to standard while minimizing the impact to the existing runway system. The RSA behind Runways 12 and 25 are planned to be filled and brought up to grading standards. The RSA behind Runway 7 traverses Dallesport Road. It is recommended that Dallesport Road be rerouted to provide the required safety area.

Runway 12-30 is 5,098 feet long, which meets the needs of the critical aircraft (that grouping of general aviation aircraft that represent 500 or more annual itinerant operations), now and into the future. To fully meet the needs of 75 percent of the business jet fleet at 60 percent useful load, a runway length of 5,500 feet is recommended. The master plan reflects this need by planning for the extension of Runway 12-30 in both directions. The purpose of extending both ends is to eliminate the need for further road relocations to accommodate airport needs.

The taxiway system includes several intersections that do not provide optimal peripheral views for pilots. The FAA recommends that 90-degree taxiway intersections be planned to provide pilots better visibility. The improvements to the taxiway system remove angled entrance/exit to the runway. Other taxiway improvements include the ultimate development of full length parallel taxiways to both runways.

On the landside, a variety of hangar types are planned, including T-hangars, box/executive hangars, and conventional hangars. These planned hangars are strategically located to provide for maximum separation of activity levels. As such, planned conventional hangars are located on the main apron area, while lower activity box and T-hangars are located farther from the main apron.

A new terminal building is planned in approximately the same location as the existing terminal building. The existing terminal building does not meet the standards of current building codes or the standards of general aviation functions. In addition, a terminal building should be an aesthetically pleasing entrance to the region.

The next chapter of this master plan will consider strategies for funding the recommended improvements and will provide a reasonable schedule for undertaking the projects based on demand over the course of the next 20 years.

Columbia Gorge Regional Airport

Chapter Six

CAPITAL IMPROVEMENT PROGRAM

CAPITAL IMPROVEMENT PROGRAM

The analyses completed in previous chapters evaluated development needs at the airport over the next 20 years and beyond, based on forecast activity and operational efficiency. Next, basic economic, financial, and management rationale is applied to each development item so that the feasibility of each item contained in the plan can be assessed.

The presentation of the capital improvement program (CIP) has been organized into two sections. First, the airport development schedule and CIP cost estimate is presented in narrative and graphic form. Second, capital improvement funding sources on the federal, state, and local levels are identified and discussed.

AIRPORT DEVELOPMENT SCHEDULES AND COST SUMMARIES

Now that the recommended concept has been developed and specific needs and improvements for the airport have been established, the next step is to determine a realistic schedule (implementation timeline) and the associated costs for the plan. This section will examine the overall cost of each item in the development plan and present a development schedule. The recommended improvements are grouped by planning horizon: short term, intermediate term, and long term. The short term planning horizon is further subdivided into yearly increments. **Table 6A** summarizes

key milestones for each of the three planning horizons.

A key aspect of this planning document is the use of demand-based planning milestones. Projects should be considered based on actual demand levels within the next five years. As short term horizon activity levels are reached, it will then be time to program for the intermediate term based upon the next activity milestones. Similarly, when the intermediate term milestones are reached, it will be time to program for the long term activity milestones.

TABLE 6A
Planning Horizon Summary
Columbia Gorge Regional Airport

	Base Year	Short Term	Intermediate Term	Long Term
General Aviation Activity				
Based Aircraft	68	75	82	95
Annual Operations				
Itinerant	22,429	25,600	28,100	33,600
Local	9,614	10,700	11,400	13,000
Total General Aviation Operations				
Air Taxi Activity				
Itinerant	2,180	2,600	2,800	3,400
Military Activity				
Itinerant	750	750	750	750
local	250	250	250	250
Total Operations	35,223	39,900	43,300	51,000

Source: Coffman Associates analysis

Many development items included in the recommended concept will need to follow demand indicators. For example, the plan includes construction of new hangar aprons and taxilanes. Based aircraft will be the indicator for additional hangar needs. If based aircraft growth occurs as projected, additional hangars should be constructed to meet the demand. Often this potential growth is tracked with a hangar waiting list.

If growth slows or does not occur as forecast, some projects may be delayed. As a result, capital expenditures will be undertaken as needed, which leads to a responsible use of capital assets.

Some development items do not depend on demand, such as meeting design standards for runway safety area (RSA). Safety related projects should be programmed in a timely manner regardless of the forecast growth in activity. Other items, such as pavement maintenance, should be addressed in a scheduled manner and are not dependant on reaching aviation demand milestones. These types of projects typically are more associated with day-to-day operations.

As a master plan is a conceptual document, implementation of the capital projects should only be undertaken after further refinement of their design and costs through architectural and engineering analyses. Moreover, some projects may require extensive infrastructure improvements (i.e., drainage improvements, extension of utilities, etc.), that may take more than one year to complete.

Once the list of necessary projects was identified and refined, project specific cost estimates were developed. The cost estimates include design, engineering, construction administration, and contingencies that may arise on the project. Capital costs presented here should be viewed only as estimates subject to further refinement during design. Nevertheless, these estimates are considered sufficient for planning purposes. Cost estimates for each of the development projects in the capital improvement plan are in current (2010) dollars. **Exhibit 6A** presents the proposed CIP for Columbia Gorge Regional Airport. **Exhibit 6B** presents the CIP overlaid onto the airport aerial photograph and broken out into planning horizons.

SHORT TERM IMPROVEMENTS

2011 Projects

As with all capital projects funded in whole or part by federal funds, environmental considerations must be undertaken. The level of documentation necessary for each project must be determined in consultation with the Federal Aviation Administration (FAA). There are three major levels of environmental review to be considered under the *National Environmental Policy Act* (NEPA): categorical exclusion (CATEX), environmental assessment (EA), or environmental impact statement (EIS). Each level requires more time to complete and more detailed information. Guidance on what level of documentation is required for a specific project is provided in FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures*. Projects such as property acquisition and runway extensions require, at a minimum, an EA.

The first line item in the CIP provides an amount for environmental documentation associated with short term projects. It should be noted that environmental documents typically have a shelf life of three years before they need to be updated if an associated project has not yet been undertaken. Therefore, this line item may be spread over several years depending on the project considered.

On larger and more time consuming projects, preliminary engineering can be undertaken prior to the planned year of construction. A line item for preliminary engineering of the planned 2012 projects is identified in the 2011 plan year. This preliminary engineering should cover the Runway 12-30 reconstruction and extension, the extension of Taxiway A to the

Runway 12 threshold, the Runway 12 RSA improvement, and the Taxiway A widening.

The next project planned for 2011 is related to bringing the Runway 7 RSA up to standard. As shown in the master plan concept, relocating Dallesport Road slightly to the west will accomplish this goal. To this end, a portion of the property to the west of the existing Dallesport Road alignment will need to be transferred to the airport.

In 1980, approximately 19.5 acres of property to the west of Dallesport Road was transferred from the airport (by the City of The Dalles acting as airport sponsor) to Klickitat County for development of a public park. Approximately 6.6 acres of the northern portion of this property was to remain undeveloped in order to maintain approach protection to Runway 7.

Since this time, FAA design standards have changed and it is now necessary for a portion of this property to be transferred back to the airport in order to meet the FAA design standards and to preserve the current runway length. It is recommended that nine acres be transferred back to the airport. This area encompasses the property that would be located on the east side of the relocated Dallesport Road. A modest line item has been included in order to cover any legal fees necessary to formerly transfer the recommended portion of property from Klickitat County to the airport. Through this action, the RSA standard can be met and the Runway 7-25 pavement can be maintained, and the operational length can be enhanced.

The next project is the construction of a new set of T-hangars to accommodate forecast growth in based aircraft at the airport. As presented, a 12,500 square foot facility is planned with 11 units. The estimated cost of the facility includes surrounding access pavement. While the CIP identifies the cost for T-hangar construction as being the responsibility of the airport sponsor, this can also be accomplished through private development.

Ongoing maintenance of airport surfaces is considered throughout the plan. It is required by the FAA that airports that accept public funds, such as Columbia Gorge Regional Airport, maintain the useful life of their pavements. Because of the nature of pavement wear, some years may require a larger investment in rehabilitation; therefore, the CIP simply allocates an average yearly estimate of $25,000 for ongoing pavement maintenance.

2012 Projects

Fiscal Year 2012 is planned for major construction activity at the airport. The CIP identifies several projects but they are all inter-related. Each of the projects identified for 2012 could be lumped into one single large project. In an effort to clearly identify what is recommended, the projects have been divided into segments. This approach could also benefit funding availability

	PROJECT DESCRIPTION	PROJECT COST	FAA ELIGIBLE	LOCAL SHARE
SHORT TERM PROGRAM (0-5 YEARS)				
2011				
1	Environmental Documentation	$250,000	$237,500	$12,500
2	Preliminary Design Runway 12-30 Reconstruct	$350,000	$332,500	$17,500
3	Transfer Property West of Airport Back to Airport	$10,000	$0	$10,000
4	Construct T-Hangar	$799,000	$0	$799,000
5	Pavement Maintenance	$25,000	$22,500	$1,250
2011	**TOTAL**	**$1,434,000**	**$592,500**	**$840,250**
2012				
6	Reconstruct/Strengthen/Lengthen Runway 12-30 (Fix LOS)	$6,625,000	$6,293,750	$331,250
7	Taxiway A Extension to Rwy 12/Threshold Reconstruct	$1,081,000	$1,026,950	$64,860
8	Widen/Strengthen Taxiway A	$1,379,000	$1,310,050	$82,740
9	Taxiway A Rwy 30 Threshold	$589,000	$559,550	$35,340
10	Runway 12 RSA Improvement	$675,000	$641,250	$33,750
11	Pavement Maintenance	$25,000	$23,750	$1,250
2012	**TOTAL**	**$10,374,000**	**$9,855,300**	**$549,190**
2013				
12	Replacement Emergency Generator	$150,000	$142,500	$7,500
13	Relocate Dallesport Road	$731,000	$694,450	$36,550
14	Rehabilitate Taxilane into Business Park	$118,000	$112,100	$5,900
15	Perimeter Fencing	$420,000	$399,000	$21,000
16	Pavement Maintenance	$25,000	$23,750	$1,250
2013	**TOTAL**	**$1,444,000**	**$1,371,800**	**$72,200**
2014				
17	Runway 7-25 Right-Angled Threshold Taxiways	$2,886,000	$2,741,700	$173,160
18	Runway 25 RSA Improvement	$1,078,000	$1,024,100	$53,900
19	REIL Runway 25	$42,000	$37,800	$2,100
20	Pavement Maintenance	$25,000	$23,750	$1,500
2014	**TOTAL**	**$4,031,000**	**$3,827,350**	**$230,660**
2015				
21	PAPIs Runway 12-30	$112,000	$106,400	$5,600
22	RPZ Property Easement Acquisition (15 acres)	$28,000	$25,200	$2,800
23	Pavement Maintenance	$25,000	$22,500	$2,500
2015	**TOTAL**	**$165,000**	**$154,100**	**$10,900**
TOTAL SHORT TERM PROGRAM		**$17,448,000**	**$15,801,050**	**$1,703,200**
INTERMEDIATE TERM PROGRAM (6-10 YEARS)				
1	Construct T-Hangar	$799,000	$0	$799,000
2	Add Fuel Farm	$300,000	$0	$300,000
3	Construct Terminal Building	$1,512,000	$0	$1,512,000
4	Pavement Maintenance	$125,000	$118,750	$6,250
TOTAL INTERMEDIATE TERM PROGRAM		**$2,736,000**	**$118,750**	**$2,617,250**
LONG TERM PROGRAM (11-20 YEARS)				
1	Reconstruct/Strengthen Runway 7-25 (Fix LOS)	$4,890,000	$4,645,500	$244,500
2	Parallel Taxiway Runway 7-25	$2,310,000	$2,194,500	$115,500
3	Expand Apron	$3,473,000	$3,299,350	$173,650
4	Construct T-Hangar	$799,000	$0	$799,000
5	Extend Taxiway A (Apron Area)	$1,181,000	$1,121,950	$59,050
6	Remove Taxiway A3	$303,000	$287,850	$15,150
7	Pavement Maintenance	$250,000	$237,500	$12,500
TOTAL LONG TERM PROGRAM		**$13,206,000**	**$11,786,650**	**$1,419,350**
TOTAL PROGRAM COSTS		**$33,390,000**	**$27,706,000**	**$5,740,000**

Note: Totals may not equal due to rounding

Columbia Gorge Regional Airport

Exhibit 6A
CAPITAL IMPROVEMENT PROGRAM

09MP06-5A-07/16/10

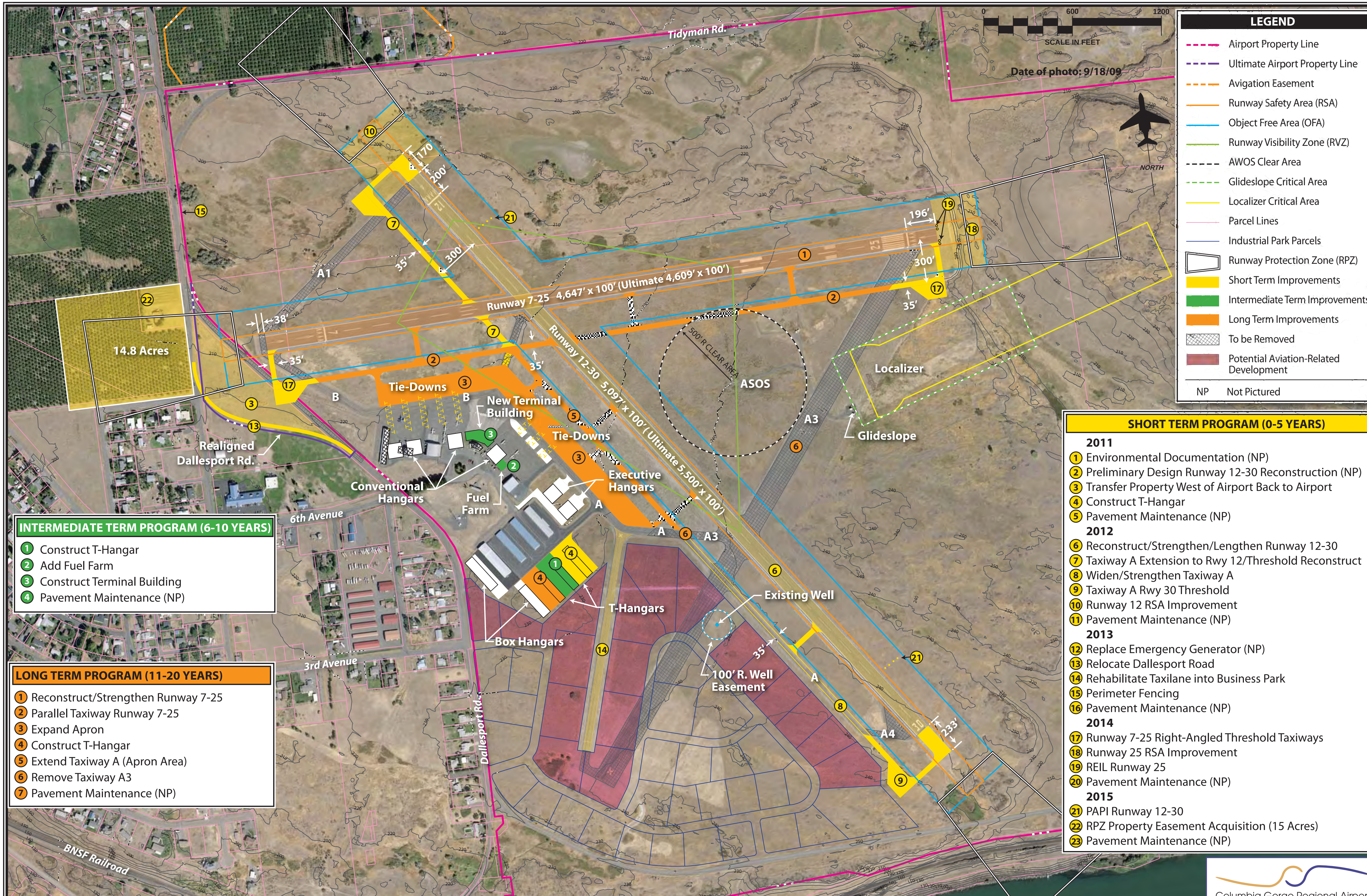


Exhibit 6B
DEVELOPMENT STAGING

since several grants may be needed to undertake the planned improvements.

The major project considered for 2012 is the reconstruction of Runway 12-30. As documented, this runway has a strength rating of only 18,000 pounds single wheel loading. The critical aircraft for the airport includes many business jets that exceed this weight. The runway also has a line of sight issue, meaning visibility from one end to the other does not meet standard. The runway currently does not have a crown along the runway centerline. Having a crown on the runway centerline is the current design standard to allow water runoff to be more evenly disbursed. (Note: The FAA and the airport engineer are currently [2010] working to determine if a runway crown is necessary for Runway 12-30) This project considers reconstruction, lengthening, and strengthening of the runway.

The next project is closely associated with the previous runway project. A new taxiway is planned from the intersection with Taxiway A2, near the terminal area ramp extending to the new Runway 12 threshold. By constructing this new taxiway segment, angled Taxiway A1 and a portion of angled Taxiway A2 can be removed, thereby improving pilot visibility and meeting current taxiway design standards.

The next project is the construction of the south end of Taxiway A leading to the new Runway 30 threshold. Currently this taxiway does not meet the width standard of 35 feet and the taxiway is not strength rated to meet the demands of the critical design aircraft. This project includes an aircraft hold apron.

A high priority project for the airport is the improvement of the Runway 12 RSA. As part of the project to extend Runway 12, the RSA should be improved to meet standard. Compacted fill material needs to be brought in to build up the 300-foot RSA to standard behind the runway end.

2013 Projects

The airport has, on occasion, experienced power failures which have effectively closed the airport at night. Airport management has indicated that a new backup generator is necessary to maintain operational safety and capacity in the event of future power failures. Therefore, a line item is reserved for a new generator.

Provided the airport has been able to successfully re-acquire the property located to the west of the Runway 7 end, the airport can now improve the Runway 7 RSA by relocating Dallesport Road. This project plans to shift Dallesport Road to the west utilizing the Central Avenue alignment. The RSA can then be cleared and graded to standard. The existing baseball field is planned to be preserved.

The airport is well along in designing a business park on airport property. Those parcels that are located adjacent to taxiways and the apron should be reserved for aviation-related businesses. To this end, a taxiway is planned to be extended into the business park to increase the number of parcels available for hangar development.

The last project considered is the need for perimeter fencing around the airport. Currently, only a portion of the terminal area has adequate fencing. Much of the airport has only three strand barbed wire or no fencing at all. In order to provide greater airport security and prevent wildlife intrusion, a six-foot high chain-link fence with three strand barbed-wire is planned.

2014 Projects

The 2014 projects focus on safety related projects and improvements intended to meet design standards for Runway 7-25. In the previous year, the RSA for Runway 7 was improved. The projects in this year include RSA improvement on the Runway 25 end and construction of standard right-angled threshold taxiways. The right-angled taxiways include the cost hold aprons, taxiway lighting, and marking.

Runway 25 provides a localizer/glideslope non-precision instrument approach for approach category A and B aircraft. This approach is offset by six degrees due to the surrounding terrain. In order to help pilots readily identify the runway end, Runway End Identification Lights (REILs) are planned. These strobe lights are positioned to the side of the runway and pilots can see them at a distance of up to 20 miles. These lights can be shielded to eliminate light impacts to nearby residents.

2015 Projects

The first project of the 2015 CIP is the installation of Precision Approach Path Indicator (PAPI) lights on both ends of Runway 12-30. Previous analysis demonstrated that a traditional three-degree glidepath can be implemented on the approach to Runway 12. A traditional glide-path to Runway 30 would penetrate the surrounding terrain. Therefore, a higher glidepath angle would be necessary for the PAPI on Runway 30. Further engineering will be required to determine exactly what the glidepath will need to be.

The next project considered is the acquisition of easement rights on the approach to Runway 7. An avigation easement will allow the airport to proactively prevent any approach obstructions leading to Runway 7. Ultimately, the airport may want to purchase this property if it comes up for sale, but the existing land use (orchard) is currently compatible with airport operations.

Short Term Summary

The list of short term projects includes those of highest priority for the airport. Of particular concern is the nonstandard RSA beyond the ends of Runways 7, 12, and 25. These need to be filled in with embankment and graded to meet design standard. These projects are also associated with other improvements including taxiway construction and runway lengthening. By improving the RSA's, the displaced landing thresholds can be relocated back to the runway ends, thereby gaining additional operational runway length.

Several projects identified for the short term planning period address safety issues related to Runway 12-30. This runway is planned to be lengthened by 403 feet to provide adequate length for the critical design aircraft (B-II business jets). The runway itself is planned to be reconstructed to a strength rating of at least 30,000 pounds single wheel loading (SWL) (currently 18,000 pounds SWL). The angled taxiways leading to the runway thresholds are planned to be replaced with 90-degree threshold taxiways. Other taxiway improvements are planned, including removing a portion of Taxiway A2 so that the five-point intersection at the runway intersection can be eliminated.

Final planned improvements in the short term include enhancements to the approaches to the runway ends. REILs are planned for the Runway 25 end to provide quick runway end identification for pilots. This is particularly important for this runway end as it currently supports an instrument approach. The addition of PAPIs to both ends of primary Runway 12-30 is also planned. Ultimately, this runway may support instrument approaches as well.

The short term projects total approximately \$17.5 million. Approximately \$15.8 million is eligible for FAA grant funding. The remaining \$1.7 million would be the responsibility of the airport sponsor.

INTERMEDIATE TERM IMPROVEMENTS

Planning new projects beyond a five year timeframe can be challenging. Project need is heavily dependant upon local demand and the economic outlook of the aviation industry. Therefore, intermediate term projects are grouped together to represent years 6-10. The use of planning horizons to group potential airport projects provides the airport flexibility to accelerate those projects that are needed immediately and delay those projects that no longer have a high priority. The projects are prioritized based on the aviation forecasts, but these priorities may change.

Several intermediate term projects are necessary based on demand and need for the airport. The first is the construction of a new set of T-hangars. Most revenue generating facilities at airports are not eligible for federal funding. If all other airfield improvements have been completed, then some funding could be available for hangar construction, but it is a low priority for the FAA. Therefore, hangar construction is assumed to be the responsibility of the airport sponsor.

A replacement fuel farm is considered that would have Jet A and Avgas tanks as well as a self-serve capability. This fuel farm would replace the existing underground facility located on the main terminal area ramp. Proper containment would be necessary for the new fuel farm.

The largest and most significant project planned for the intermediate planning horizon is the construction of a replacement terminal building. There is a great need to replace the existing facility that is nearly 70 years old, does not meet current design standards, and is too small to meet current demand. In addition, a prominent terminal building acts as an entrance to the community for potential investors.

Intermediate term projects total approximately $2.7 million. Since most of the projects identified are not eligible for FAA funding, approximately $2.6 million would be the responsibility of the airport sponsor.

LONG TERM IMPROVEMENTS

The first project considered in the long term planning horizon is the reconstruction of Runway 7-25. This runway faces similar strength and line-of-site issues to that of Runway 12-30. The reconstruction project is planned to increase the strength rating from 4,000 pounds SWL to at least 30,000 pounds SWL. The line-of site issues would also be corrected.

The next project is the completion of a full length parallel taxiway. It should be noted that, by design standard, once a parallel taxiway is constructed for Runway 7-25, the runway would meet the line-of-site standard, but it would be improved significantly.

The parallel taxiway would also serve the purpose of improving the efficiency of ground movements to and from the runway. Once the parallel taxiway is constructed, there would no longer be a need for Taxiway A3 to access the Runway 25 threshold. Taxiway A3 could then be removed or utilized for access to future east side airport development.

At this stage in the development plan, the central portion of Taxiway A is planned to be shifted to a distance of 300 feet from Runway 12-30. This project completes the full parallel taxiway system. Once this taxiway shift is complete then the main terminal area apron can be expanded as needed. Because of the distance from the existing Taxiway A to the Runway 12-30 centerline (nearly 600 feet), there is an opportunity to expand the usable apron toward the runway.

Remaining projects in the long term planning horizon include the construction of additional hangars. Once again, hangars should only be undertaken if there is existing demand on a waiting list. While T-hangar construction is shown as the responsibility of the airport sponsor, there are opportunities for private developers to undertake the project.

The long term projects total approximately $13.2 million, of which approximately $11.8 million is eligible for FAA funding. Approximately $1.4 million would then be the responsibility of the airport sponsor.

CAPITAL IMPROVEMENT SUMMARY

The CIP is intended as a road map to airport improvements to help guide the airport sponsor, the FAA, and the state aviation departments on needed projects. The plan as presented will meet the forecast demand over the next 20-years and, in many respects, beyond.

The total 20-year CIP proposes approximately $33.4 million in airport development. Of this total, approximately $27.7 would be eligible for FAA grant funding, and the remaining $5.7 would be the responsibility of the airport sponsor.

CAPITAL IMPROVEMENT FUNDING SOURCES

Financing capital improvements at the airport will not rely solely on the financial resources of the airport or the co-sponsors. Capital improvement funding is available through various grant-in-aid programs on both the state and federal levels. Historically, Columbia Gorge Regional Airport has received federal and state grants. While some years more funds could be available, the CIP was developed with project phasing in order to remain realistic and within the range of anticipated grant assistance. The following discussion outlines key sources of funding potentially available for capital improvements at Columbia Gorge Regional Airport.

FEDERAL GRANTS

Through federal legislation over the years, various grant-in-aid programs have been established to develop and maintain a system of public airports across the United States. The purpose of this system and its federally based funding is to maintain national defense and to promote interstate commerce. The most recent legislation affecting federal funding was enacted in late 2003 and is titled *Century of Flight Authorization Act of 2003,* or Vision 100.

The four-year bill covered FAA fiscal years 2004, 2005, 2006, and 2007. Airport Improvement Program (AIP) funding was authorized at $3.4 billion in 2004, $3.5 billion in 2005, $3.6 billion in 2006, and $3.7 billion in 2007. This bill provided the FAA the opportunity to plan for longer term projects versus one-year reauthorizations. As of spring 2010, a new multi-year bill has not been passed, but several continuing resolutions have maintained funding for priority airport projects.

The source for AIP funds is the Aviation Trust Fund. The Aviation Trust Fund was established in 1970 to provide funding for aviation capital investment programs (aviation development, facilities and equipment, and research and development). The Aviation Trust Fund also finances the operation of the FAA. It is funded by user fees, including taxes on airline tickets, aviation fuel, and various aircraft parts. The Aviation Trust Fund is also up for reauthorization.

Funding for AIP eligible projects is undertaken through a cost sharing arrangement in which FAA provides up to 95 percent of the cost and the airport sponsor invests the remaining five percent. In exchange for this level of funding, the airport sponsor is required to meet various grant assurances, including maintaining the improvement for its useful life, usually 20 years.

Entitlement Funds

Federal funds are distributed each year by the FAA from appropriations by Congress. A portion of the annual distribution is to commercial service airports based upon minimum enplanement levels of at least 10,000 passengers annually.

General aviation airports can receive up to $150,000 each year in Non-Primary Entitlement (NPE) funds (National Plan of Integrated Airport Systems [NPIAS] inclusion is required for general aviation entitlement funding). It should be noted that some versions of the current bills moving through Congress do not include future NPE funds. In the past, Columbia Gorge Regional Airport has received NPE funding. The sponsor can spend the given year, plus up to three accumulated years for a maximum of $600,000.

Discretionary Funds

The remaining AIP funds are distributed by the FAA based on the priority of the projects for which they have requested federal assistance through discretionary apportionments. A national priority ranking system is used to evaluate and rank each airport project. Those projects with the highest priority from airports across the country are given preference in funding. High priority projects include those related to meeting design standards, capacity improvements, and other safety enhancements.

Under the AIP program, examples of eligible development projects include the airfield, public aprons, and access roads. Additional buildings and structures may be eligible if the function of the structure is to serve airport operations in a non-revenue generating capacity, such as maintenance facilities. Some revenue enhancing structures, such as T-hangars, may be eligible if all airfield improvements have been made but the priority ranking of these facilities is very low.

Whereas entitlement monies are guaranteed on an annual basis, discretionary funds are not assured. If the combination of entitlement, discretionary, and airport sponsor match does not provide enough capital for planned development, projects may be delayed.

Other supplemental funding sources are described in the following subsections.

FAA Facilities and Equipment (F&E) Program

The Airway Facilities Division of the FAA administers the Facilities and Equipment (F&E) Program. This program provides funding for the installation and maintenance of various navigational aids and equipment of the national airspace system. Under the F&E program, funding is provided for FAA airport traffic control towers (ATCTs), enroute navigational aids, on-airport navigational aids, and approach lighting systems.

While F&E still installs and maintains some navigation aids, on-airport facilities at general aviation airports has not been a priority. Therefore, airports are often requesting funding assistance for navigational aids through AIP and then maintaining the equipment on their own. This is likely the avenue that Columbia Gorge Regional Airport will have to take to install the REILs and PAPIs recommended in the plan.

STATE AID TO AIRPORTS

Both Oregon and Washington make direct investment in airports within their respective states. Columbia Gorge Regional Airport is in the unique position of being sponsored by the City of the Dalles in Oregon, and Klickitat County in Washington. Therefore, the airport is eligible for various funding programs in each state.

State of Oregon

*Connect*Oregon

*Connect*Oregon is an initiative first introduced in 2005 by the Oregon Legislature to invest in air, rail, marine, and transit infrastructure. The program is focused on improving the connections between the highway system and other modes of transportation to better integrate the multi-modal system, improve the flow of commerce, and remove delays. The first installment of this program provided $100 million for 43 projects. The program was renewed at similar funding levels in both 2007 and 2009. The most recent installment of the program includes a commitment to set aside at least five percent of the total for rural airports in the state and no less than 10 percent to each of five regions. This insures that funding is distributed throughout the state, and that airports in different regions don't have to compete for funding with all Oregon airports.

Funding for the program is from lottery-based bonds, sold by the Oregon Department of Administrative Services, deposited into Oregon's Multimodal Transportation Fund, and administered by the Oregon Department of Transportation Local Government Section. Projects eligible for Oregon's Highway Fund are not eligible for *Connect*Oregon, which gives aviation projects less competition for funding (Oregon Department of Aviation).

Of the 43 projects funded under *ConnectOregon* I (as the 2005 bill is known), 10 were aviation projects. Projects included runway relocation, runway extension, air cargo facilities, maintenance facilities, terminal improvements, and aircraft services and fueling. Funding also went to a multi-region project of installing Automatic Dependent Surveillance – Broadcast (ADS-B) transceivers at various airports in the state. Similar aviation projects were funded with *Connect*Oregon II (2007) and III (2009).

Financial Aid to Municipalities (FAM)

The Oregon Department of Aviation's *FAM Grant Program* is designed to fund planning, development, and capital improvements at airports across the state. Oregon municipalities meeting certain criteria are eligible to apply for these grants. These grants are capped at $25,000 and can be used for matching FAA grants or other projects not generally eligible for FAA funding.

Pavement Maintenance Program (PMP)

The PMP program is a state-funded aid program intended to assist airports in undertaking preventative maintenance. A local match is required depending on the category of the airport as defined in the *Oregon Aviation Plan*. The most recent recommended match for a Regional airport, such as Columbia Gorge Regional Airport, was 10 percent. In addition, the Oregon Department of Aviation (through a subcontractor) inspects 66 Oregon airports, including Columbia Gorge Regional Airport, for pavement condition. This database of information helps airports meet FAA grant assurances for maintaining airport pavements.

State of Washington

Airport Aid Grant Program

The Washington State Department of Transportation (WSDOT) – Division of Aviation provides grants for capital improvements to many of the state's 138 public airports. The Airport Aid Grant Program has two categories of funding. The first provides half of the local match, or 2.5 percent, for FAA funded projects. The second category allows for WSDOT to fund airport projects directly. Direct funding is only available for those projects that the FAA is unable to fund in the current cycle and some FAA ineligible items, such as fuel farms. In 2009, through the *Airport Aid Grant Program*, WSDOT Aviation awarded approximately $900,000, which helped leverage more than $11.2 million in federal funding.

The maximum amount WSDOT Aviation can award to an individual airport sponsor is $250,000, which requires a local match of five percent. Eligible projects are divided into three major categories: 1) pavement; 2) safety; 3) maintenance, operations, and planning (MO&P). Typical pavement projects include crack sealing, slurry sealing, fog sealing, overlays, reconstructions, extensions, widening or other alterations to the aircraft movement surface. Repairs or reconstructions to turf surfaces are considered eligible under this category. Typical safety projects include airspace obstruction clearing, runway safety area or object free area clearing, installation of wind indicators, marking, lighting, signing, reflectors, RPZ/approach surface land acquisition, NAVAIDs, approach aids, weather reporting, and fencing or drainage improvements. Typical MO&P projects include weed control, grounds maintenance, vehicles and equipment (e.g., snow removal, tractors, mowers, etc.) fuel system installations, fire suppression systems, airport master planning, airport layout planning, and environmental reviews or documentation. The MO&P category also includes grant funding for security improvements such as flood lights, access control gates, surveillance cameras, and pay phones.

This funding source cannot be used for construction of private hangars or other private revenue producing structures. Other projects such as terminal buildings, utility infrastructure, and access roads are typically not eligible to receive state funding.

Other Washington Funding Sources

In 2005, the Washington Legislature directed the Joint Legislative Audit & Review Committee (JLARC) to assemble an inventory of state grant and loan programs that assist local governments and others in developing their infrastructure. The inventory includes 75 separate programs. These programs provided more than $1 billion in grants and loans for infrastructure projects in 2005. The inventory is organized into three volumes. Potential sources for transportation infrastructure grants and loans are identified in volume two. More information on these programs can be found at the following web site:
http://www.leg.wa.gov/JLARC/AuditAndStudyReports/2006/Pages/06-11.aspx

The Washington Department of Commerce also provides guidance and grant assistance in several areas that could be beneficial to airports. This includes land use planning, infrastructure planning, and assistance with public financing of public projects. Further information can be obtained at the following web site:
http://www.commerce.wa.gov/site/657/default.aspx

LOCAL FUNDING

The balance of project costs, after consideration has been given to grants, must be funded through local resources. The goal of the airport is to generate enough revenue to cover all operating and capital expenditures. As with many general aviation airports, this is not always possible and other financial methods will be needed.

There are several alternatives for local financing options for future development at the airport, including airport revenues, direct funding from the airport sponsors, issuing bonds, and leasehold financing. These strategies could be used to fund the local matching share, or complete the project if grant funding cannot be arranged. The capital improvement program has assumed that some landside facility development would be privately developed.

There are several municipal bonding options available, including general obligation bonds, limited obligation bonds, and revenue bonds. General obligation bonds are a common form of municipal bond which is issued by voter approval, is secured by the full faith and credit of the county, and future tax revenues are pledged to retire the debt. As instruments of credit and because the community secures the bonds, general obligation bonds reduce the available debt level of the community. Due to the community pledge to secure and pay general obligation bonds, they are the most secure type of municipal bond and are generally issued at lower interest rates and carry lower costs of issuance. The primary disadvantage of general obligation bonds is that they require voter approval and are subject to statutory debt limits. This requires that they be used for projects that have broad support among the voters, and that they are reserved for projects that have the highest public priorities.

In contrast to general obligation bonds, limited obligation bonds (sometimes referred to as self-liquidating bonds) are secured by revenues from a local source. While neither general fund revenues nor the taxing power of the local community is pledged to pay the debt service, these sources may be required to retire the debt if pledged revenues are insufficient to make interest and principal payments on the bonds. These bonds still carry the full faith and credit pledge of the local community and are considered, for the purpose of financial analysis, as part of the debt burden of the local community. The overall debt burden of the local community is a factor in determining interest rates on municipal bonds.

There are several types of revenue bonds, but in general, they are a form of municipal bond which is payable solely from the revenue derived from the operation of a facility that was constructed or acquired with the proceeds of the bonds. For example, a lease revenue bond is secured with the income from a lease assigned to the repayment of the bonds. Revenue bonds have become a common form of financing airport improvements. Revenue bonds present the opportunity to provide those improvements without direct burden to the taxpayer. Revenue bonds normally carry a higher interest rate because they lack the guarantees of general and limited obligation bonds.

Leasehold financing refers to a developer or tenant financing improvements under a long term ground lease. The obvious advantage of such an arrangement is that it relieves the community of all responsibility for raising the capital funds for improvements. However, the private development of facilities on a ground lease, particularly on property owned by a government agency, produces a unique set of concerns.

In particular, it is more difficult to obtain private financing as only the improvements and the right to continue the lease can be claimed in the event of a default. Ground leases normally provide for the reversion of improvements to the airport at the end of the lease term, which reduces their potential value to a lender taking possession. Also, companies that want to own their property as a matter of financial policy may not locate where land is only available for lease.

Airport Revenue

Airports are capable of generating revenue since they can be operated as a business and not just a public amenity. Columbia Gorge Regional Airport generates revenue from several sources, including hangar rental, ground leases, and fuel flowage fees. An examination of the fee structure for airport revenue sources was undertaken.

The airport owns most of the hangars on the airport and leases space to airport users. The rates charged for the hangars are within the expected norm for an airport like Columbia Gorge Regional Airport. The Otis hangars (north apron eight-unit T-hangar facility) generate approximately $165 per month per unit. Newer T-hangars to the south generate $265 per unit per month. Box and conventional hangar lease rates range from $0.20 to $0.30 per square foot per month. Ground lease rates are currently $0.23 per square foot per year. The aircraft storage lease rates are reasonable and should be maintained. Over time, lease agreements should provide for adjustment based on common indices such as the Consumer Price Index (CPI).

The airport has revenue sources other than hangar or ground leases. The airport receives revenue for leasing space to the cellular companies to allow their equipment on the beacon tower. The fixed base operator (FBO) pays a monthly fee for counter/office space in the terminal building. The FBO also pays a fuel flowage fee.

FINANCING CONCLUSION

The CIP previously presented indicated a need for approximately $16.7 million in airport improvements in the next five years. The only revenue source that is currently guaranteed is the federal non-primary entitlement funding of up to $150,000 annually. Clearly, other revenue sources will need to be identified in order to accomplish the projects identified in the CIP. Airport management should work with the FAA to pursue discretionary grants. They should also work with both state aviation agencies to fund priority projects.

SUMMARY

The best means to begin implementation of the recommendations in this master plan is to first recognize that planning is a continuous process that does not end with completion and approval of this document. Rather, the ability to continuously monitor the existing and forecast status of airport activity must be provided and maintained. The issues upon which this master plan is based will remain valid for a number of years. The primary goal is for the airport to best serve the air transportation needs of the region, while continuing to be economically self-sufficient.

The actual need for facilities is most appropriately established by airport activity levels rather than a specified date. For example, projections have been made as to when additional hangars may be needed at the airport. In reality, however, the time frame in which the development is needed may be substantially different. Actual demand may be slower to develop than expected. On the other hand, high levels of demand may establish the need to accelerate the development. Although every effort has been made in this master planning process to conservatively estimate when facility development may be needed, aviation demand will dictate when facility improvements need to be delayed or accelerated.

The real value of a usable master plan is in keeping the issues and objectives in the minds of the managers and decision-makers so that they are better able to recognize change and its effect. In addition to adjustments in aviation demand, decisions made as to when to undertake the improvements recommended in this master plan will impact the period that the plan remains valid. The format used in this plan is intended to reduce the need for formal and costly updates by simply adjusting the timing. Updating can be done by the manager, thereby improving the plan's effectiveness.

In summary, the planning process requires the airport management to consistently monitor the progress of the airport in terms of aircraft operations and based aircraft. Analysis of aircraft demand is critical to the timing and need for new airport facilities. The information obtained from continually monitoring airport activity will provide the data necessary to determine if the development schedule should be accelerated or decelerated.

Columbia Gorge Regional Airport

Appendix A

GLOSSARY OF TERMS

A

ABOVE GROUND LEVEL: The elevation of a point or surface above the ground.

ACCELERATE-STOP DISTANCE AVAILABLE (ASDA): See declared distances.

ADVISORY CIRCULAR: External publications issued by the FAA consisting of nonregulatory material providing for the recommendations relative to a policy, guidance and information relative to a specific aviation subject.

AIR CARRIER: An operator which: (1) performs at least five round trips per week between two or more points and publishes flight schedules which specify the times, days of the week, and places between which such flights are performed; or (2) transports mail by air pursuant to a current contract with the U.S. Postal Service. Certified in accordance with Federal Aviation Regulation (FAR) Parts 121 and 127.

AIRCRAFT: A transportation vehicle that is used or intended for use for flight.

AIRCRAFT APPROACH CATEGORY: A grouping of aircraft based on 1.3 times the stall speed in their landing configuration at their maximum certificated landing weight. The categories are as follows:

- Category A: Speed less than 91 knots.
- Category B: Speed 91 knots or more, but less than 121 knots.
- Category C: Speed 121 knots or more, but less than 141 knots.
- Category D: Speed 141 knots or more, but less than 166 knots.
- Category E: Speed greater than 166 knots.

AIRCRAFT OPERATION: The landing, takeoff, or touch-and-go procedure by an aircraft on a runway at an airport.

AIRCRAFT OPERATIONS AREA (AOA): A restricted and secure area on the airport property designed to protect all aspects related to aircraft operations.

AIRCRAFT OWNERS AND PILOTS ASSOCIATION: A private organization serving the interests and needs of general aviation pilots and aircraft owners.

AIRCRAFT RESCUE AND FIRE FIGHTING: A facility located at an airport that provides emergency vehicles, extinguishing agents, and personnel responsible for minimizing the impacts of an aircraft accident or incident.

AIRFIELD: The portion of an airport which contains the facilities necessary for the operation of aircraft.

AIRLINE HUB: An airport at which an airline concentrates a significant portion of its activity and which often has a significant amount of connecting traffic.

AIRPLANE DESIGN GROUP (ADG): A grouping of aircraft based upon wingspan. The groups are as follows:

- Group I: Up to but not including 49 feet.
- Group II: 49 feet up to but not including 79 feet.
- Group III: 79 feet up to but not including 118 feet.
- Group IV: 118 feet up to but not including 171 feet.
- Group V: 171 feet up to but not including 214 feet.
- Group VI: 214 feet or greater.

AIRPORT AUTHORITY: A quasi-governmental public organization responsible for setting the policies governing the management and operation of an airport or system of airports under its jurisdiction.

AIRPORT BEACON: A navigational aid located at an airport which displays a rotating light beam to identify whether an airport is lighted.

AIRPORT CAPITAL IMPROVEMENT PLAN: The planning program used by the Federal Aviation Administration to identify, prioritize, and distribute funds for airport development and the needs of the National Airspace System to meet specified national goals and objectives.

AIRPORT ELEVATION: The highest point on the runway system at an airport expressed in feet above mean sea level (MSL).

AIRPORT IMPROVEMENT PROGRAM: A program authorized by the Airport and Airway

Improvement Act of 1982 that provides funding for airport planning and development.

AIRPORT LAYOUT DRAWING (ALD): The drawing of the airport showing the layout of existing and proposed airport facilities.

AIRPORT LAYOUT PLAN (ALP): A scaled drawing of the existing and planned land and facilities necessary for the operation and development of the airport.

AIRPORT LAYOUT PLAN DRAWING SET: A set of technical drawings depicting the current and future airport conditions. The individual sheets comprising the set can vary with the complexities of the airport, but the FAA-required drawings include the Airport Layout Plan (sometimes referred to as the Airport Layout Drawing (ALD), the Airport Airspace Drawing, and the Inner Portion of the Approach Surface Drawing, On-Airport Land Use Drawing, and Property Map.

AIRPORT MASTER PLAN: The planner's concept of the long-term development of an airport.

AIRPORT MOVEMENT AREA SAFETY SYSTEM: A system that provides automated alerts and warnings of potential runway incursions or other hazardous aircraft movement events.

AIRPORT OBSTRUCTION CHART: A scaled drawing depicting the Federal Aviation Regulation (FAR) Part 77 surfaces, a representation of objects that penetrate these surfaces, runway, taxiway, and ramp areas, navigational aids, buildings, roads and other detail in the vicinity of an airport.

AIRPORT REFERENCE CODE (ARC): A coding system used to relate airport design criteria to the operational (Aircraft Approach Category) to the physical characteristics (Airplane Design Group) of the airplanes intended to operate at the airport.

AIRPORT REFERENCE POINT (ARP): The latitude and longitude of the approximate center of the airport.

AIRPORT SPONSOR: The entity that is legally responsible for the management and operation of an airport, including the fulfillment of the requirements of laws and regulations related thereto.

AIRPORT SURFACE DETECTION EQUIPMENT: A radar system that provides air traffic controllers with a visual representation of the movement of aircraft and other vehicles on the ground on the airfield at an airport.

AIRPORT SURVEILLANCE RADAR: The primary radar located at an airport or in an air traffic control terminal area that receives a signal at an antenna and transmits the signal to air traffic control display equipment defining the location of aircraft in the air. The signal provides only the azimuth and range of aircraft from the location of the antenna.

AIRPORT TRAFFIC CONTROL TOWER (ATCT): A central operations facility in the terminal air traffic control system, consisting of a tower, including an associated instrument flight rule (IFR) room if radar equipped, using air/ground communications and/or radar, visual signaling and other devices to provide safe and expeditious movement of terminal air traffic.

AIR ROUTE TRAFFIC CONTROL CENTER: A facility which provides en route air traffic control service to aircraft operating on an IFR flight plan within controlled airspace over a large, multi-state region.

AIRSIDE: The portion of an airport that contains the facilities necessary for the operation of aircraft.

AIRSPACE: The volume of space above the surface of the ground that is provided for the operation of aircraft.

AIR TAXI: An air carrier certificated in accordance with FAR Part 121 and FAR Part 135 and authorized to provide, on demand, public transportation of persons and property by aircraft. Generally operates small aircraft "for hire" for specific trips.

AIR TRAFFIC CONTROL: A service operated by an appropriate organization for the purpose of providing for the safe, orderly, and expeditious flow of air traffic.

AIR ROUTE TRAFFIC CONTROL CENTER (ARTCC): A facility established to provide air traffic control service to aircraft operating on an IFR flight plan within controlled airspace and principally during the en route phase of flight.

AIR TRAFFIC CONTROL SYSTEM COMMAND CENTER: A facility operated by the FAA which is responsible for the central flow control, the central altitude reservation system, the airport reservation position system, and the air traffic service contingency command for the air traffic control system.

AIR TRAFFIC HUB: A categorization of commercial service airports or group of commercial service airports in a metropolitan or urban area based upon the proportion of annual national enplanements existing at the airport or airports. The categories are large hub, medium hub, small hub, or non-hub. It forms the basis for the apportionment of entitlement funds.

AIR TRANSPORT ASSOCIATION OF AMERICA: An organization consisting of the principal U.S. airlines that represents the interests of the airline industry on major aviation issues before federal, state, and local government bodies. It promotes air transportation safety by coordinating industry and governmental safety programs and it serves as a focal point for industry efforts to standardize practices and enhance the efficiency of the air transportation system.

ALERT AREA: See special-use airspace.

ALTITUDE: The vertical distance measured in feet above mean sea level.

ANNUAL INSTRUMENT APPROACH (AIA): An approach to an airport with the intent to land by an aircraft in accordance with an IFR flight plan when visibility is less than three miles and/or when the ceiling is at or below the minimum initial approach altitude.

APPROACH LIGHTING SYSTEM (ALS): An airport lighting facility which provides visual guidance to landing aircraft by radiating light beams by which the pilot aligns the aircraft with the extended centerline of the runway on his final approach and landing.

APPROACH MINIMUMS: The altitude below which an aircraft may not descend while on an IFR approach unless the pilot has the runway in sight.

APPROACH SURFACE: An imaginary obstruction limiting surface defined in FAR Part 77 which is longitudinally centered on an extended runway centerline and extends outward and upward from the primary surface at each end of a runway at a designated slope and distance based upon the type of available or planned approach by aircraft to a runway.

APRON: A specified portion of the airfield used for passenger, cargo or freight loading and unloading, aircraft parking, and the refueling, maintenance and servicing of aircraft.

AREA NAVIGATION: The air navigation procedure that provides the capability to establish and maintain a flight path on an arbitrary course that remains within the coverage area of navigational sources being used.

AUTOMATED TERMINAL INFORMATION SERVICE (ATIS): The continuous broadcast of recorded non-control information at towered airports. Information typically includes wind speed, direction, and runway in use.

AUTOMATED SURFACE OBSERVATION SYSTEM (ASOS): A reporting system that provides frequent airport ground surface weather observation data through digitized voice broadcasts and printed reports.

AUTOMATED WEATHER OBSERVATION STATION (AWOS): Equipment used to automatically record weather conditions (i.e. cloud height, visibility, wind speed and direction, temperature, dew point, etc.)

AUTOMATIC DIRECTION FINDER (ADF): An aircraft radio navigation system which senses and indicates the direction to a non-directional radio beacon (NDB) ground transmitter.

AVIGATION EASEMENT: A contractual right or a property interest in land over which a right of unobstructed flight in the airspace is established.

AZIMUTH: Horizontal direction expressed as the angular distance between true north and the direction of a fixed point (as the observer's heading).

B

BASE LEG: A flight path at right angles to the landing runway off its approach end. The base leg normally extends from the downwind leg to the intersection of the extended runway centerline. See "traffic pattern."

BASED AIRCRAFT: The general aviation aircraft that use a specific airport as a home base.

BEARING: The horizontal direction to or from any point, usually measured clockwise from true north or magnetic north.

BLAST FENCE: A barrier used to divert or dissipate jet blast or propeller wash.

BLAST PAD: A prepared surface adjacent to the end of a runway for the purpose of eliminating the erosion of the ground surface by the wind forces produced by airplanes at the initiation of takeoff operations.

BUILDING RESTRICTION LINE (BRL): A line which identifies suitable building area locations on the airport.

C

CAPITAL IMPROVEMENT PLAN: The planning program used by the Federal Aviation Administration to identify, prioritize, and distribute Airport Improvement Program funds for airport development and the needs of the National Airspace System to meet specified national goals and objectives.

CARGO SERVICE AIRPORT: An airport served by aircraft providing air transportation of property only, including mail, with an annual aggregate landed weight of at least 100,000,000 pounds.

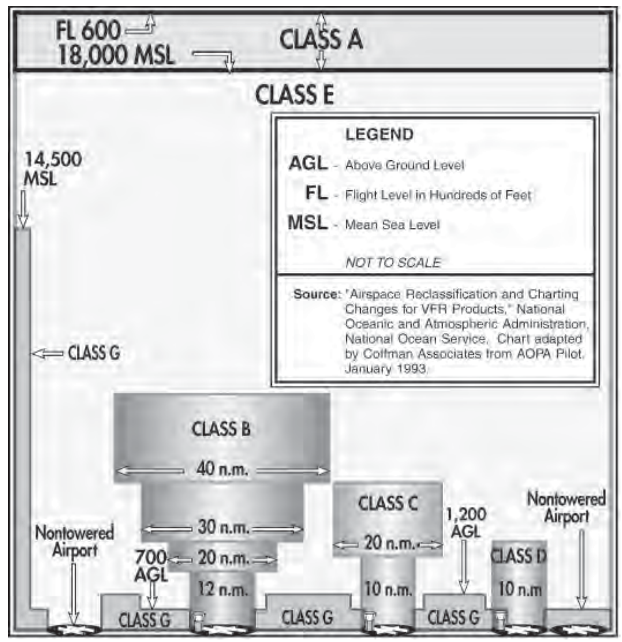
CATEGORY I: An Instrument Landing System (ILS) that provides acceptable guidance information to an aircraft from the coverage limits of the ILS to the point at which the localizer course line intersects the glide path at a decision height of 100 feet above the horizontal plane containing the runway threshold.

CATEGORY II: An ILS that provides acceptable guidance information to an aircraft from the coverage limits of the ILS to the point at which the localizer course line intersects the glide path at a decision height of 50 feet above the horizontal plane containing the runway threshold.

CATEGORY III: An ILS that provides acceptable guidance information to a pilot from the coverage limits of the ILS with no decision height specified above the horizontal plane containing the runway threshold.

CEILING: The height above the ground surface to the location of the lowest layer of clouds which is reported as either broken or overcast.

CIRCLING APPROACH: A maneuver initiated by the pilot to align the aircraft with the runway for landing when flying a predetermined circling instrument approach under IFR.



CLASS A AIRSPACE: See Controlled Airspace.

CLASS B AIRSPACE: See Controlled Airspace.

CLASS C AIRSPACE: See Controlled Airspace.

CLASS D AIRSPACE: See Controlled Airspace.

CLASS E AIRSPACE: See Controlled Airspace.

CLASS G AIRSPACE: See Controlled Airspace.

CLEAR ZONE: See Runway Protection Zone.

COMMERCIAL SERVICE AIRPORT: A public airport providing scheduled passenger service that enplanes at least 2,500 annual passengers.

COMMON TRAFFIC ADVISORY FREQUENCY: A radio frequency identified in the appropriate aeronautical chart which is designated for the purpose of transmitting airport advisory information and procedures while operating to or from an uncontrolled airport.

COMPASS LOCATOR (LOM): A low power, low/medium frequency radio-beacon installed in conjunction with the instrument landing system at one or two of the marker sites.

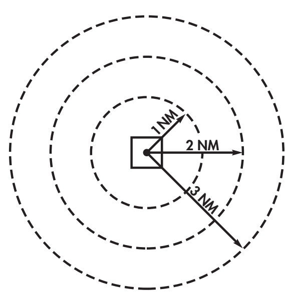
CONICAL SURFACE: An imaginary obstruction-limiting surface defined in FAR Part 77 that extends from the edge of the horizontal surface outward and upward at a slope of 20 to 1 for a horizontal distance of 4,000 feet.

CONTROLLED AIRPORT: An airport that has an operating airport traffic control tower.

CONTROLLED AIRSPACE: Airspace of defined dimensions within which air traffic control services are provided to instrument flight rules (IFR) and visual flight rules (VFR) flights in accordance with the airspace classification. Controlled airspace in the United States is designated as follows:

- **CLASS A**: Generally, the airspace from 18,000 feet mean sea level (MSL) up to but not including flight level FL600. All persons must operate their aircraft under IFR.

- **CLASS B**: Generally, the airspace from the surface to 10,000 feet MSL surrounding the nation's busiest airports. The configuration of Class B airspace is unique to each airport, but typically consists of two or more layers of air space and is designed to contain all published instrument approach procedures to the airport. An air traffic control clearance is required for all aircraft to operate in the area.



- **CLASS C**: Generally, the airspace from the surface to 4,000 feet above the airport elevation (charted as MSL) surrounding those airports that have an operational control tower and radar approach control and are served by a qualifying number of IFR operations or passenger enplanements. Although individually tailored for each airport, Class C airspace typically consists of a surface area with a five nautical mile (nm) radius and an outer area with a 10 nautical mile radius that extends from 1,200 feet to 4,000 feet above the airport elevation. Two-way radio communication is required for all aircraft.

- **CLASS D**: Generally, that airspace from the surface to 2,500 feet above the air port elevation (charted as MSL) surrounding those airports that have an operational control tower. Class D airspace is individually tailored and configured to encompass published instrument approach procedure . Unless otherwise authorized, all persons must establish two-way radio communication.

- **CLASS E**: Generally, controlled airspace that is not classified as Class A, B, C, or D. Class E airspace extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace. When designated as a surface area, the airspace will be configured to contain all instrument procedures. Class E airspace encompasses all Victor Airways. Only aircraft following instrument flight rules are required to establish two-way radio communication with air traffic control.

- **CLASS G**: Generally, that airspace not classified as Class A, B, C, D, or E. Class G airspace is uncontrolled for all aircraft. Class G airspace extends from the surface to the overlying Class E airspace.

CONTROLLED FIRING AREA: See special-use airspace.

CROSSWIND: A wind that is not parallel to a runway centerline or to the intended flight path of an aircraft.

CROSSWIND COMPONENT: The component of wind that is at a right angle to the runway centerline or the intended flight path of an aircraft.

CROSSWIND LEG: A flight path at right angles to the landing runway off its upwind end. See "traffic pattern."

D

DECIBEL: A unit of noise representing a level relative to a reference of a sound pressure 20 micro newtons per square meter.

DECISION HEIGHT: The height above the end of the runway surface at which a decision must be made by a pilot during the ILS or Precision Approach Radar approach to either continue the approach or to execute a missed approach.

DECLARED DISTANCES: The distances declared available for the airplane's takeoff runway, takeoff distance, accelerate-stop distance, and landing distance requirements. The distances are:

- **TAKEOFF RUNWAY AVAILABLE (TORA)**: The runway length declared available and suitable for the ground run of an airplane taking off.

- **TAKEOFF DISTANCE AVAILABLE (TODA)**: The TORA plus the length of any remaining runway and/or clear way beyond the far end of the TORA.

- **ACCELERATE-STOP DISTANCE AVAILABLE (ASDA)**: The runway plus stopway length declared available for the acceleration and deceleration of an aircraft aborting a takeoff.

- **LANDING DISTANCE AVAILABLE (LDA)**: The runway length declared available and suitable for landing.

DEPARTMENT OF TRANSPORTATION: The cabinet level federal government organization consisting of modal operating agencies, such as the Federal Aviation Administration, which was established to promote the coordination of federal transportation programs and to act as a focal point for research and development efforts in transportation.

DISCRETIONARY FUNDS: Federal grant funds that may be appropriated to an airport based upon designation by the Secretary of Transportation or Congress to meet a specified national priority such as enhancing capacity, safety, and security, or mitigating noise.

DISPLACED THRESHOLD: A threshold that is located at a point on the runway other than the designated beginning of the runway.

DISTANCE MEASURING EQUIPMENT (DME): Equipment (airborne and ground) used to measure, in nautical miles, the slant range distance of an aircraft from the DME navigational aid.

DNL: The 24-hour average sound level, in Aweighted decibels, obtained after the addition of ten decibels to sound levels for the periods between 10 p.m. and 7 a.m. as averaged over a span of one year. It is the FAA standard metric for determining the cumulative exposure of individuals to noise.

DOWNWIND LEG: A flight path parallel to the landing runway in the direction opposite to landing. The downwind leg normally extends between the crosswind leg and the base leg. Also see "traffic pattern."

E

EASEMENT: The legal right of one party to use a portion of the total rights in real estate owned by another party. This may include the right of passage over, on, or below the property; certain air rights above the property, including view rights; and the rights to any specified form of development or activity, as well as any other legal rights in the property that may be specified in the easement document.

ELEVATION: The vertical distance measured in feet above mean sea level.

ENPLANED PASSENGERS: The total number of revenue passengers boarding aircraft, including originating, stop-over, and transfer passengers, in scheduled and nonscheduled services.

ENPLANEMENT: The boarding of a passenger, cargo, freight, or mail on an aircraft at an airport.

ENTITLEMENT: Federal funds for which a commercial service airport may be eligible based upon its annual passenger enplanements.

ENVIRONMENTAL ASSESSMENT (EA): An environmental analysis performed pursuant to the National Environmental Policy Act to determine whether an action would significantly affect the environment and thus require a more detailed environmental impact statement.

ENVIRONMENTAL AUDIT: An assessment of the current status of a party's compliance with applicable environmental requirements of a party's environmental compliance policies, practices, and controls.

ENVIRONMENTAL IMPACT STATEMENT (EIS): A document required of federal agencies by the National Environmental Policy Act for major projects are legislative proposals affecting the environment. It is a tool for decision-making describing the positive and negative effects of a proposed action and citing alternative actions.

ESSENTIAL AIR SERVICE: A federal program which guarantees air carrier service to selected small cities by providing subsidies as needed to prevent these cities from such service.

F

FEDERAL AVIATION REGULATIONS: The general and permanent rules established by the executive departments and agencies of the Federal Government for aviation, which are published in the Federal Register. These are the aviation subset of the Code of Federal Regulations.

FEDERAL INSPECTION SERVICES: The provision of customs and immigration services including passport inspection, inspection of baggage, the collection of duties on certain imported items, and the inspections for agricultural products, illegal drugs, or other restricted items.

FINAL APPROACH: A flight path in the direction of landing along the extended runway centerline. The final approach normally extends from the base leg to the runway. See "traffic pattern."

FINAL APPROACH AND TAKEOFF AREA (FATO). A defined area over which the final phase of the helicopter approach to a hover, or a landing is completed and from which the takeoff is initiated.

FINAL APPROACH FIX: The designated point at which the final approach segment for an aircraft landing on a runway begins for a non-precision approach.

FINDING OF NO SIGNIFICANT IMPACT (FONSI): A public document prepared by a Federal agency that presents the rationale why a proposed action will not have a significant effect on the environment and for which an environmental impact statement will not be prepared.

FIXED BASE OPERATOR (FBO): A provider of services to users of an airport. Such services include, but are not limited to, hangaring, fueling, flight training, repair, and maintenance.

FLIGHT LEVEL: A designation for altitude within controlled airspace.

FLIGHT SERVICE STATION: An operations facility in the national flight advisory system which utilizes data interchange facilities for the collection and dissemination of Notices to Airmen, weather, and administrative data and which provides pre-flight and in-flight advisory services to pilots through air and ground based communication facilities.

FRANGIBLE NAVAID: A navigational aid which retains its structural integrity and stiffness up to a designated maximum load, but on impact from a greater load, breaks, distorts, or yields in such a manner as to present the minimum hazard to aircraft.

G

GENERAL AVIATION: That portion of civil aviation which encompasses all facets of aviation except air carriers holding a certificate of convenience and necessity, and large aircraft commercial operators.

GENERAL AVIATION AIRPORT: An airport that provides air service to only general aviation.

GLIDESLOPE (GS): Provides vertical guidance for aircraft during approach and landing. The glideslope consists of the following:

1. Electronic components emitting signals which provide vertical guidance by reference to airborne instruments during instrument approaches such as ILS; or

2. Visual ground aids, such as VASI, which provide vertical guidance for VFR approach or for the visual portion of an instrument approach and landing.

GLOBAL POSITIONING SYSTEM (GPS): A system of 24 satellites used as reference points to enable navigators equipped with GPS receivers to determine their latitude, longitude, and altitude.

GROUND ACCESS: The transportation system on and around the airport that provides access to and from the airport by ground transportation vehicles for passengers, employees, cargo, freight, and airport services.

H

HELIPAD: A designated area for the takeoff, landing, and parking of helicopters.

HIGH INTENSITY RUNWAY LIGHTS: The highest classification in terms of intensity or brightness for lights designated for use in delineating the sides of a runway.

HIGH-SPEED EXIT TAXIWAY: A long radius taxiway designed to expedite aircraft turning off the runway after landing (at speeds to 60 knots), thus reducing runway occupancy time.

HORIZONTAL SURFACE: An imaginary obstruction- limiting surface defined in FAR Part 77 that is specified as a portion of a horizontal plane surrounding a runway located 150 feet above the established airport elevation. The specific horizontal dimensions of this surface are a function of the types of approaches existing or planned for the runway.

I

INITIAL APPROACH FIX: The designated point at which the initial approach segment begins for an instrument approach to a runway.

INSTRUMENT APPROACH PROCEDURE: A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing, or to a point from which a landing may be made visually.

INSTRUMENT FLIGHT RULES (IFR): Procedures for the conduct of flight in weather conditions below Visual Flight Rules weather minimums. The term IFR is often also used to define weather conditions and the type of flight plan under which an aircraft is operating.

INSTRUMENT LANDING SYSTEM (ILS): A precision instrument approach system which normally consists of the following electronic components and visual aids:

1. Localizer.
2. Glide Slope.
3. Outer Marker.
4. Middle Marker.
5. Approach Lights.

INSTRUMENT METEOROLOGICAL CONDITIONS: Meteorological conditions expressed in terms of specific visibility and ceiling conditions that are less than the minimums specified for visual meteorological conditions.

ITINERANT OPERATIONS: Operations by aircraft that are not based at a specified airport.

K

KNOTS: A unit of speed length used in navigation that is equivalent to the number of nautical miles traveled in one hour.

L

LANDSIDE: The portion of an airport that provides the facilities necessary for the processing of passengers, cargo, freight, and ground transportation vehicles.

LANDING DISTANCE AVAILABLE (LDA): See declared distances.

LARGE AIRPLANE: An airplane that has a maximum certified takeoff weight in excess of 12,500 pounds.

LOCAL AREA AUGMENTATION SYSTEM: A differential GPS system that provides localized measurement correction signals to the basic GPS signals to improve navigational accuracy integrity, continuity, and availability.

LOCAL OPERATIONS: Aircraft operations performed by aircraft that are based at the airport and that operate in the local traffic pattern or within sight of the airport, that are known to be departing for or arriving from flights in local practice areas within a prescribed distance from the airport, or that execute simulated instrument approaches at the airport.

LOCAL TRAFFIC: Aircraft operating in the traffic pattern or within sight of the tower, or aircraft known to be departing or arriving from the local practice areas, or aircraft executing practice instrument approach procedures. Typically, this includes touch and-go training operations.

LOCALIZER: The component of an ILS which provides course guidance to the runway.

LOCALIZER TYPE DIRECTIONAL AID (LDA): A facility of comparable utility and accuracy to a localizer, but is not part of a complete ILS and is not aligned with the runway.

LONG RANGE NAVIGATION SYSTEM (LORAN): Long range navigation is an electronic navigational aid which determines aircraft position and speed by measuring the difference in the time of reception of synchronized pulse signals from two fixed transmitters. Loran is used for en route navigation.

LOW INTENSITY RUNWAY LIGHTS: The lowest clas- sification in terms of intensity or brightness for lights designated for use in delineating the sides of a runway.

M

MEDIUM INTENSITY RUNWAY LIGHTS: The middle classification in terms of intensity or brightness for lights designated for use in delineating the sides of a runway.

MICROWAVE LANDING SYSTEM (MLS): An instrument approach and landing system that provides precision guidance in azimuth, elevation, and distance measurement.

MILITARY OPERATIONS: Aircraft operations that are performed in military aircraft.

MILITARY OPERATIONS AREA (MOA): See special-use airspace

MILITARY TRAINING ROUTE: An air route depicted on aeronautical charts for the conduct of military flight training at speeds above 250 knots.

MISSED APPROACH COURSE (MAC): The flight route to be followed if, after an instrument approach, a landing is not affected, and occurring normally:

1. When the aircraft has descended to the decision height and has not established visual contact; or

2. When directed by air traffic control to pull up or to go around again.

MOVEMENT AREA: The runways, taxiways, and other areas of an airport which are utilized for taxiing/hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and parking areas. At those airports with a tower, air traffic control clearance is required for entry onto the movement area.

N

NATIONAL AIRSPACE SYSTEM: The network of air traffic control facilities, air traffic control areas, and navigational facilities through the U.S.

NATIONAL PLAN OF INTEGRATED AIRPORT SYSTEMS: The national airport system plan developed by the Secretary of Transportation on a biannual basis for the development of public use airports to meet national air transportation needs.

NATIONAL TRANSPORTATION SAFETY BOARD: A federal government organization established to investigate and determine the probable cause of transportation accidents, to recommend equipment and procedures to enhance transportation safety, and to review on appeal the suspension or revocation of any certificates or licenses issued by the Secretary of Transportation.

NAUTICAL MILE: A unit of length used in navigation which is equivalent to the distance spanned by one minute of arc in latitude, that is, 1,852 meters or 6,076 feet. It is equivalent to approximately 1.15 statute mile.

NAVAID: A term used to describe any electrical or visual air navigational aids, lights, signs, and associated supporting equipment (i.e. PAPI, VASI, ILS, etc.)

NAVIGATIONAL AID: A facility used as, available for use as, or designed for use as an aid to air navigation.

NOISE CONTOUR: A continuous line on a map of the airport vicinity connecting all points of the same noise exposure level.

NON-DIRECTIONAL BEACON (NDB): A beacon transmitting nondirectional signals whereby the pilot of an aircraft equipped with direction finding equipment can determine his or her bearing to and from the radio beacon and home on, or track to, the station. When the radio beacon is installed in conjunction with the Instrument Landing System marker, it is normally called a Compass Locator.

NON-PRECISION APPROACH PROCEDURE: A standard instrument approach procedure in which no electronic glide slope is provided, such as VOR, TACAN, NDB, or LOC.

NOTICE TO AIRMEN: A notice containing information concerning the establishment, condition, or change in any component of or hazard in the National Airspace System, the timely knowledge of which is considered essential to personnel concerned with flight operations.

O

OBJECT FREE AREA (OFA): An area on the ground centered on a runway, taxiway, or taxilane centerline provided to enhance the safety of aircraft operations by having the area free of objects, except for objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes.

OBSTACLE FREE ZONE (OFZ): The airspace below 150 feet above the established airport elevation and along the runway and extended runway centerline that is required to be kept clear of all objects, except for frangible visual NAVAIDs that need to be located in the OFZ because of their function, in order to provide clearance for aircraft landing or taking off from the runway, and for missed approaches.

ONE-ENGINE INOPERABLE SURFACE: A surface emanating from the runway end at a slope ratio of 62.5:1. Air carrier airports are required to maintain a technical drawing of this surface depicting any object penetrations by January 1, 2010.

OPERATION: The take-off, landing, or touch-and-go procedure by an aircraft on a runway at an airport.

OUTER MARKER (OM): An ILS navigation facility in the terminal area navigation system located four to seven miles from the runway edge on the extended centerline, indicating to the pilot that he/she is passing over the facility and can begin final approach.

P

PILOT CONTROLLED LIGHTING: Runway lighting systems at an airport that are controlled by activating the microphone of a pilot on a specified radio frequency.

PRECISION APPROACH: A standard instrument approach procedure which provides runway alignment and glide slope (descent) information. It is categorized as follows:

- **CATEGORY I (CAT I)**: A precision approach which provides for approaches with a decision height of not less than 200 feet and visibility not less than 1/2 mile or Runway Visual Range (RVR) 2400 (RVR 1800) with operative touchdown zone and runway centerline lights.

- **CATEGORY II (CAT II)**: A precision approach which provides for approaches with a decision height of not less than 100 feet and visibility not less than 1200 feet RVR.

- **CATEGORY III (CAT III)**: A precision approach which provides for approaches with minima less than Category II.

PRECISION APPROACH PATH INDICATOR (PAPI): A lighting system providing visual approach slope guidance to aircraft during a landing approach. It is similar to a VASI but provides a sharper transition between the colored indicator lights.

PRECISION APPROACH RADAR: A radar facility in the terminal air traffic control system used to detect and display with a high degree of accuracy the direction, range, and elevation of an aircraft on the final approach to a runway.

PRECISION OBJECT FREE AREA (POFA): An area centered on the extended runway centerline, beginning at the runway threshold and extending behind the runway threshold that is 200 feet long by 800 feet wide. The POFA is a clearing standard which requires the POFA to be kept clear of above ground objects protruding above the runway safety area edge elevation (except for frangible NAVAIDS). The POFA applies to all new authorized instrument approach procedures with less than 3/4 mile visibility.

PRIMARY AIRPORT: A commercial service airport that enplanes at least 10,000 annual passengers.

PRIMARY SURFACE: An imaginary obstruction limiting surface defined in FAR Part 77 that is specified as a rectangular surface longitudinally centered about a runway. The specific dimensions of this surface are a function of the types of approaches existing or planned for the runway.

PROHIBITED AREA: See special-use airspace.

PVC: Poor visibility and ceiling. Used in determining Annual Service Volume. PVC conditions exist when the cloud ceiling is less than 500 feet and visibility is less than one mile.

R

RADIAL: A navigational signal generated by a Very High Frequency Omni-directional Range or VORTAC station that is measured as an azimuth from the station.

REGRESSION ANALYSIS: A statistical technique that seeks to identify and quantify the relationships between factors associated with a forecast.

REMOTE COMMUNICATIONS OUTLET (RCO): An unstaffed transmitter receiver/facility remotely controlled by air traffic personnel. RCOs serve flight service stations (FSSs). RCOs were established to provide ground-to-ground communications between air traffic control specialists and pilots at satellite airports for delivering en route clearances, issuing departure authorizations, and acknowledging instrument flight rules cancellations or departure/landing times.

REMOTE TRANSMITTER/RECEIVER (RTR): See remote communications outlet. RTRs serve ARTCCs.

RELIEVER AIRPORT: An airport to serve general aviation aircraft which might otherwise use a congested air-carrier served airport.

RESTRICTED AREA: See special-use airspace.

RNAV: Area navigation - airborne equipment which permits flights over determined tracks within prescribed accuracy tolerances without the need to overfly ground-based navigation facilities. Used en route and for approaches to an airport.

RUNWAY: A defined rectangular area on an airport prepared for aircraft landing and takeoff. Runways are normally numbered in relation to their magnetic direction, rounded off to the nearest 10 degrees. For example, a runway with a magnetic heading of 180 would be designated Runway 18. The runway heading on the opposite end of the runway is 180 degrees from that runway end. For example, the opposite runway heading for Runway 18 would be Runway 36 (magnetic heading of 360). Aircraft can takeoff or land from either end of a runway, depending upon wind direction.

RUNWAY ALIGNMENT INDICATOR LIGHT: A series of high intensity sequentially flashing lights installed on the extended centerline of the runway usually in conjunction with an approach lighting system.

RUNWAY END IDENTIFIER LIGHTS (REIL): Two synchronized flashing lights, one on each side of the runway threshold, which provide rapid and positive identification of the approach end of a particular runway.

RUNWAY GRADIENT: The average slope, measured in percent, between the two ends of a runway.

RUNWAY PROTECTION ZONE (RPZ): An area off the runway end to enhance the protection of people and property on the ground. The RPZ is trapezoidal in shape. Its dimensions are determined by the aircraft approach speed and runway approach type and minima.

RUNWAY SAFETY AREA (RSA): A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway.

RUNWAY VISIBILITY ZONE (RVZ): An area on the airport to be kept clear of permanent objects so that there is an unobstructed line of- site from any point five feet above the runway centerline to any point five feet above an intersecting runway centerline.

RUNWAY VISUAL RANGE (RVR): An instrumentally derived value, in feet, representing the horizontal distance a pilot can see down the runway from the runway end.

S

SCOPE: The document that identifies and defines the tasks, emphasis, and level of effort associated with a project or study.

SEGMENTED CIRCLE: A system of visual indicators designed to provide traffic pattern information at airports without operating control towers.

SHOULDER: An area adjacent to the edge of paved runways, taxiways, or aprons providing a transition between the pavement and the adjacent surface; support for aircraft running off the pavement; enhanced drainage; and blast protection. The shoulder does not necessarily need to be paved.

SLANT-RANGE DISTANCE: The straight line distance between an aircraft and a point on the ground.

SMALL AIRPLANE: An airplane that has a maximum certified takeoff weight of up to 12,500 pounds.

SPECIAL-USE AIRSPACE: Airspace of defined dimensions identified by a surface area wherein activities must be confined because of their nature and/or wherein limitations may be imposed upon aircraft operations that are not a part of those activities. Special-use airspace classifications include:

- **ALERT AREA**: Airspace which may contain a high volume of pilot training activities or an unusual type of aerial activity, neither of which is hazardous to aircraft.

- **CONTROLLED FIRING AREA**: Airspace wherein activities are conducted under conditions so controlled as to eliminate hazards to nonparticipating aircraft and to ensure the safety of persons or property on the ground.

- **MILITARY OPERATIONS AREA (MOA)**: Designated airspace with defined vertical and lateral dimensions established outside Class A airspace to separate/segregate certain military activities from instrument flight rule (IFR) traffic and to identify for visual flight rule (VFR) traffic where these activities are conducted.

- **PROHIBITED AREA**: Designated airspace within which the flight of aircraft is prohibited.

- **RESTRICTED AREA**: Airspace designated under Federal Aviation Regulation (FAR) 73, within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Most restricted areas are designated joint use. When not in use by the using agency, IFR/VFR operations can be authorized by the controlling air traffic control facility.

- **WARNING AREA**: Airspace which may contain hazards to nonparticipating aircraft.

STANDARD INSTRUMENT DEPARTURE (SID): A preplanned coded air traffic control IFR departure routing, preprinted for pilot use in graphic and textual form only.

STANDARD INSTRUMENT DEPARTURE PROCEDURES: A published standard flight procedure to be utilized following takeoff to provide a transition between the airport and the terminal area or en route airspace.

STANDARD TERMINAL ARRIVAL ROUTE (STAR): A preplanned coded air traffic control IFR arrival routing, preprinted for pilot use in graphic and textual or textual form only.

STOP-AND-GO: A procedure wherein an aircraft will land, make a complete stop on the runway, and then commence a takeoff from that point. A stop-and-go is recorded as two operations: one operation for the landing and one operation for the takeoff.

STOPWAY: An area beyond the end of a takeoff runway that is designed to support an aircraft during an aborted takeoff without causing structural damage to the aircraft. It is not to be used for takeoff, landing, or taxiing by aircraft.

STRAIGHT-IN LANDING/APPROACH: A landing made on a runway aligned within 30 degrees of the final approach course following completion of an instrument approach.

T

TACTICAL AIR NAVIGATION (TACAN): An ultrahigh frequency electronic air navigation system which provides suitably-equipped aircraft a continuous indication of bearing and distance to the TACAN station.

TAKEOFF RUNWAY AVAILABLE (TORA): See declared distances.

TAKEOFF DISTANCE AVAILABLE (TODA): See declared distances.

TAXILANE: The portion of the aircraft parking area used for access between taxiways and aircraft parking positions.

TAXIWAY: A defined path established for the taxiing of aircraft from one part of an airport to another.

TAXIWAY SAFETY AREA (TSA): A defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway.

TERMINAL INSTRUMENT PROCEDURES: Published flight procedures for conducting instrument approaches to runways under instrument meteorological conditions.

TERMINAL RADAR APPROACH CONTROL: An element of the air traffic control system responsible for monitoring the en-route and terminal segment of air traffic in the airspace surrounding airports with moderate to high levels of air traffic.

TETRAHEDRON: A device used as a landing direction indicator. The small end of the tetrahedron points in the direction of landing.

THRESHOLD: The beginning of that portion of the runway available for landing. In some instances the landing threshold may be displaced.

TOUCH-AND-GO: An operation by an aircraft that lands and departs on a runway without stopping or exiting the runway. A touch-and go is recorded as two operations: one operation for the landing and one operation for the takeoff.

TOUCHDOWN: The point at which a landing aircraft makes contact with the runway surface.

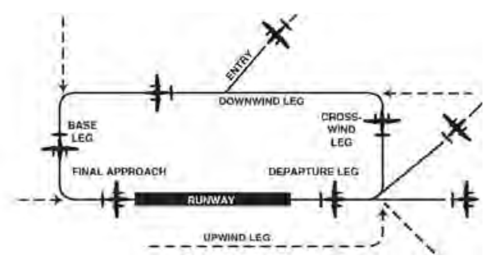
TOUCHDOWN AND LIFT-OFF AREA (TLOF): A load bearing, generally paved area, normally centered in the FATO, on which the helicopter lands or takes off.

TOUCHDOWN ZONE (TDZ): The first 3,000 feet of the runway beginning at the threshold.

TOUCHDOWN ZONE ELEVATION (TDZE): The highest elevation in the touchdown zone.

TOUCHDOWN ZONE (TDZ) LIGHTING: Two rows of transverse light bars located symmetrically about the runway centerline normally at 100- foot intervals. The basic system extends 3,000 feet along the runway.

TRAFFIC PATTERN: The traffic flow that is prescribed for aircraft landing at or taking off from an airport. The components of a typical traffic pattern are the upwind leg, crosswind leg, downwind leg, base leg, and final approach.



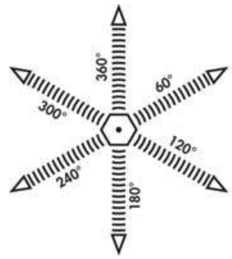
U

UNCONTROLLED AIRPORT: An airport without an air traffic control tower at which the control of Visual Flight Rules traffic is not exercised.

UNCONTROLLED AIRSPACE: Airspace within which aircraft are not subject to air traffic control.

UNIVERSAL COMMUNICATION (UNICOM): A nongovernment communication facility which may provide airport information at certain airports. Locations and frequencies of UNICOM's are shown on aeronautical charts and publications.

UPWIND LEG: A flight path parallel to the landing runway in the direction of landing. See "traffic pattern."



V

VECTOR: A heading issued to an aircraft to provide navigational guidance by radar.

VERY HIGH FREQUENCY/ OMNIDIRECTIONAL RANGE (VOR): A ground-based electronic navigation aid transmitting very high frequency navigation signals, 360 degrees in azimuth, oriented from magnetic north. Used as the basis for navigation in the national airspace system. The VOR periodically identifies itself by Morse Code and may have an additional voice identification feature.

VERY HIGH FREQUENCY OMNI-DIRECTIONAL RANGE/ TACTICAL AIR NAVIGATION (VORTAC): A navigation aid providing VOR azimuth, TACAN azimuth, and TACAN distance-measuring equipment (DME) at one site.

VICTOR AIRWAY: A control area or portion thereof established in the form of a corridor, the centerline of which is defined by radio navigational aids.

VISUAL APPROACH: An approach wherein an aircraft on an IFR flight plan, operating in VFR conditions under the control of an air traffic control facility and having an air traffic control authorization, may proceed to the airport of destination in VFR conditions.

VISUAL APPROACH SLOPE INDICATOR (VASI): An airport lighting facility providing vertical visual approach slope guidance to aircraft during approach to landing by radiating a directional pattern of high intensity red and white focused light beams which indicate to the pilot that he is on path if he sees red/white, above path if white/white, and below path if red/red. Some airports serving large aircraft have three-bar VASI's which provide two visual guide paths to the same runway.

VISUAL FLIGHT RULES (VFR): Rules that govern the procedures for conducting flight under visual conditions. The term VFR is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of flight plan.

VISUAL METEOROLOGICAL CONDITIONS: Meteorological conditions expressed in terms of specific visibility and ceiling conditions which are equal to or greater than the threshold values for instrument meteorological conditions.

VOR: See "Very High Frequency Omnidirectional Range Station."

VORTAC: See "Very High Frequency Omnidirectional Range Station/Tactical Air Navigation."

W

WARNING AREA: See special-use airspace.

WIDE AREA AUGMENTATION SYSTEM: An enhancement of the Global Positioning System that includes integrity broadcasts, differential corrections, and additional ranging signals for the purpose of providing the accuracy, integrity, availability, and continuity required to support all phases of flight.

AC: advisory circular

ADF: automatic direction finder

ADG: airplane design group

AFSS: automated flight service station

AGL: above ground level

AIA: annual instrument approach

AIP: Airport Improvement Program

AIR-21: Wendell H. Ford Aviation Investment and Reform Act for the 21st Century

ALS: approach lighting system

ALSF-1: standard 2,400-foot high intensity approach lighting system with sequenced flashers (CAT I configuration)

ALSF-2: standard 2,400-foot high intensity approach lighting system with sequenced flashers (CAT II configuration)

AOA: Aircraft Operation Area

APV: instrument approach procedure with vertical guidance

ARC: airport reference code

ARFF: aircraft rescue and fire fighting

ARP: airport reference point

ARTCC: air route traffic control center

ASDA: accelerate-stop distance available

ASR: airport surveillance radar

ASOS: automated surface observation station

ATCT: airport traffic control tower

ATIS: automated terminal information service

AVGAS: aviation gasoline - typically 100 low lead (100L)

AWOS: automated weather observation station

BRL: building restriction line

CFR: Code of Federal Regulation

CIP: capital improvement program

DME: distance measuring equipment

DNL: day-night noise level

DWL: runway weight bearing capacity of aircraft with dual-wheel type landing gear

DTWL: runway weight bearing capacity of aircraft with dual-tandem type landing gear

FAA: Federal Aviation Administration

FAR: Federal Aviation Regulation

FBO: fixed base operator

FY: fiscal year

GPS: global positioning system

GS: glide slope

HIRL: high intensity runway edge lighting

IFR: instrument flight rules (FAR Part 91)

ILS: instrument landing system

IM: inner marker

LDA: localizer type directional aid

LDA: landing distance available

LIRL: low intensity runway edge lighting

LMM: compass locator at ILS outer marker

LORAN: long range navigation

MALS: midium intensity approach lighting system with indicator lights

MIRL: medium intensity runway edge lighting

MITL: medium intensity taxiway edge lighting

MLS: microwave landing system

MM: middle marker

MOA: military operations area

MSL: mean sea level

NAVAID: navigational aid

NDB: nondirectional radio beacon

NM: nautical mile (6,076.1 feet)

NPES: National Pollutant Discharge Elimination System

NPIAS: National Plan of Integrated Airport Systems

NPRM: notice of proposed rule making

ODALS: omnidirectional approach lighting system

OFA: object free area

OFZ: obstacle free zone

OM: outer marker

PAC: planning advisory committee

PAPI: precision approach path indicator

PFC: porous friction course

PFC: passenger facility charge

PCL: pilot-controlled lighting

PIW public information workshop

PLASI: pulsating visual approach slope indicator

POFA: precision object free area

PVASI: pulsating/steady visual approach slope indicator

PVC: poor visibility and ceiling

RCO: remote communications outlet

REIL: runway end identifier lighting

RNAV: area navigation

RPZ: runway protection zone

RSA: runway safety area

RTR: remote transmitter/receiver

RVR: runway visibility range

RVZ: runway visibility zone

SALS: short approach lighting system

SASP: state aviation system plan

SEL: sound exposure level

SID: standard instrument departure

SM: statute mile (5,280 feet)

SRE: snow removal equipment

SSALF: simplified short approach lighting system with runway alignment indicator lights

STAR: standard terminal arrival route

SWL: runway weight bearing capacity for aircraft with single-wheel tandem type landing gear

TACAN: tactical air navigational aid

TAF: Federal Aviation Administration (FAA) Terminal Area Forecast

TLOF: Touchdown and lift-off

TDZ: touchdown zone

TDZE: touchdown zone elevation

TODA: takeoff distance available

TORA: takeoff runway available

TRACON: terminal radar approach control

VASI: visual approach slope indicator

VFR: visual flight rules (FAR Part 91)

VHF: very high frequency

VOR: very high frequency omni-directional range

VORTAC: VOR and TACAN collocated

Columbia Gorge Regional Airport

Appendix B

FORECAST APPROVAL

U.S. Department
of Transportation

Federal Aviation Administration

Seattle Airports District Office
1601 Lind Avenue, S. W., Ste 250
Renton, Washington 98055-4056

27 November, 2009

Mr. Jim Lehman
Airport Manager
Columbia Gorge Regional/
The Dalles Municipal Airport
PO Box 285
Dallesport, WA 98617

Dear Mr. Lehman:

Airport Improvement Program (AIP) Project Number 3-41-0059-006
Approval of Activity Forecasts – Columbia Gorge Regional Airport Master Plan Update

I have reviewed the Inventory, Forecasts, and Facility Requirements chapters for The Dalles Municipal Airport Master Plan Update submitted by Mr. Patrick Taylor of Coffman, Associates.

I find adequate justification exists for the figures cited in the Forecasts of Aviation Activity and hereby approve the Forecast Summary. The aforementioned chapters appear to be both well-researched and well-written, and I believe that you and your Consultant are off to a good start.

The following changes are recommended to the text in order of presentation:

1. Pg 1-15 – Nav Aids: The Transponder Landing System (TLS) is to be decommissioned and removed and should not be identified as a navigational aid to be used by the public.
2. Pg 1-25 – Service Area: "Brazoria County Airport" is mentioned twice. Please replace.
3. Pg 2-28 – Table 2Q: Should read, "related 'to' the operations…"
4. Pg 2-29 – The LDA/GS is a non-precision approach procedure.
5. Pg 2-33 – I believe that the ANG UH-60 helicopters are based at Gray Army Airfield and not McCord AFB as is noted.
6. Pg 2-36 – LDA/GS should read "non-precision" vice precision.
7. Exhibit 3-A, Aircraft category A-I: Aircraft pictured is a Beechcraft Bonanza (not a Baron 55 as appears in bold type).
8. Pgs 3-11 and 3-15: Change precision to read: non-precision.

If you have any questions, please feel free to contact me at: 425.227.2649 or by e-mail at: bruce.fisher@faa.gov.

Sincerely,

Bruce C. Fisher
Airport Planner, Oregon / Idaho

cc: Mr. Patrick Taylor, Coffman Assoc.

Columbia Gorge Regional Airport

Appendix C

AIR CARRIER ANALYSIS
14 CFR PART 139

Appendix C
AIR CARRIER ANALYSIS
14 CFR PART 139

Columbia Gorge Regional Airport

Prior to June 9, 2004, Title 14 of the Code of Federal Regulations (CFR) Part 139 applied to airports that had scheduled or unscheduled air carrier operations in aircraft with a seating capacity of more than 30 passenger seats. Under the 2004 amendments, 14 CFR Part 139 also now applies to airports with scheduled air carrier operations in aircraft with a seating capacity of more than nine passenger seats. If an airport has only unscheduled air carrier operations in aircraft with a seating capacity of less than 31 passenger seats, Part 139 does not apply.

Previously, airports were issued an Airport Operating Certificate (AOC) or a Limited Airport Operating Certificate (LOAC) corresponding to either scheduled or unscheduled air carrier operations. These certificates have now been replaced with a single AOC that covers operation of a Class I, II, III, or IV airport. The class of airport is determined by the seating capacity of the air carrier aircraft and the schedule of service. The class of airport will be discussed in detail later in this document.

The purpose of this report is to analyze potential compliance with these new regulations as they apply to the Columbia Gorge Regional Airport. This report summarizes each section of the 14 CFR Part 139 regulations and what would need to be done at Columbia Gorge Regional Airport to comply with this regulation.

CLASSIFICATION

In order to apply for an AOC, the airport must provide written documentation to the Federal Aviation Administration (FAA) Northwest Mountain Region Airports Division that there is currently air carrier service or that air carrier service will begin on a certain date. Without air carrier service, this regulation does not apply. During periods when there is no air carrier service, the airport's AOC becomes inactive.

As mentioned above, the 14 CFR Part 139 certification requirements applicable to Columbia Gorge Regional Airport will relate to the type of aircraft serving the airport. In helping to define the airport's class, it is important to understand the distinction between the definition of large and small air carrier aircraft.

- A large air carrier aircraft is designed for 31 passenger seats or more.
- A small air carrier aircraft is designed for 10 to 30 passenger seats.

Note: 14 CFR Part 139 does not apply to airports served by scheduled air carrier aircraft with nine seats or less and/or unscheduled air carrier aircraft with 30 seats or less.

14 CFR Part 139 defines four airport classifications as follows:

- **Class I** - an airport certificated to serve scheduled operations of large air carrier aircraft that also can serve unscheduled passenger operations of large air carrier aircraft and/or scheduled operations of small air carrier aircraft. A Class I airport may serve any class of air carrier operations.
- **Class II** - an airport certificated to serve scheduled operations of small air carrier aircraft and the unscheduled passenger operations of large air carrier aircraft. A Class II airport cannot serve scheduled large air carrier aircraft.
- **Class III** - an airport certificated to serve scheduled operations of small air carrier aircraft. A Class III airport cannot serve scheduled or unscheduled large air carrier aircraft. **(This would be the most likely classification for Columbia Gorge Regional Airport).**
- **Class IV** - an airport certificated to serve unscheduled passenger operations of large air carrier aircraft. A Class IV airport cannot serve scheduled large or small air carrier aircraft.

Note: The FAA will only allow an airport to be certificated for the type of operations currently occurring at the airport.

14 CFR PART 139 CERTIFICATION OF AIRPORTS

The following sections of this report will examine each section of 14 CFR Part 139. A summary of the regulation is provided, as well as an explanation of what Columbia Gorge Regional Airport would need to do to be in compliance with these regulations. Deadlines for compliance are noted. Worksheets to help with record keeping are provided where applicable.

SUBPART A – GENERAL

139.1 Applicability

This regulation applies to airports serving scheduled air carrier operations in aircraft designed for more than nine passenger seats or airports serving unscheduled air carrier operations in aircraft designed for more than 30 passenger seats, and are located in any state of the United States, the District of Columbia, or any territory or possession of the United States.

139.3 Delegation of authority.

The FAA Administrator has the authority to issue, deny, and revoke the AOC to specific levels of management within the Office of Airports. In most cases, this will be the Regional Airports Division Manager.

139.5 Definitions.

AFFF means aqueous film forming foam agent.

Air carrier aircraft means an aircraft that is being operated by an air carrier and is categorized as either a large air carrier aircraft if designed for at least 31 passenger seats or a small air carrier aircraft if designed for more than nine passenger seats but less than 31 passenger seats, as determined by the aircraft type certificate issued by a competent civil aviation authority.

Air carrier operation means the takeoff or landing of an air carrier aircraft and includes the period of time from 15 minutes before until 15 minutes after the takeoff or landing.

Airport means an area of land or other hard surface (excluding water) that is used or intended to be used for the landing and takeoff of aircraft, including any buildings and facilities.

Airport Operating Certificate means a certificate, issued under this part, for operation of a Class I, II, III, or IV airport.

Average daily departures means the average number of scheduled departures per day of air carrier aircraft computed on the basis of the busiest three consecutive calendar months of the immediately preceding 12 consecutive calendar months. However, if the average daily departures are expected to increase, then "average daily departures" may be determined by planned rather than current activity in a manner authorized by the Administrator.

Certificate holder means the holder of an Airport Operating Certificate issued under this part.

Class I airport means an airport certificated to serve scheduled operations of large air carrier aircraft that can also serve unscheduled passenger operations of large air carrier aircraft and/or scheduled operations of small air carrier aircraft.

Class II airport means an airport certificated to serve scheduled operations of small air carrier aircraft and the unscheduled passenger operations of large air carrier aircraft. A Class II airport cannot serve scheduled large air carrier aircraft.

Class III airport means an airport certificated to serve scheduled operations of small air carrier aircraft. A Class III airport cannot serve scheduled or unscheduled large air carrier aircraft.

Class IV airport means an airport certificated to serve unscheduled passenger operations of large air carrier aircraft. A Class IV airport cannot serve scheduled large or small air carrier aircraft.

Clean agent means an electrically nonconducting volatile or gaseous fire extinguishing agent that does not leave a residue upon evaporation and has been shown to provide extinguishing action equivalent to halon 1211 under test protocols of FAA Technical Report DOT/FAA/AR-95/87.

Heliport means an airport, or an area of an airport, used or intended to be used for the landing and takeoff of helicopters.

Index means the type of aircraft rescue and firefighting equipment and quantity of fire extinguishing agent that the certificate holder must provide in accordance with Sec. 139.315.

Joint-use airport means an airport owned by the United States that leases a portion of the airport to a person operating an airport specified under Sec. 139.1(a).

Movement area means the runways, taxiways, and other areas of an airport that are used for taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and aircraft parking areas.

Regional Airports Division Manager means the airport's division manager for the FAA region in which the airport is located.

Safety area means a defined area comprised of either a runway or taxiway and the surrounding surfaces that is prepared or suitable for reducing the risk of damage to aircraft in the event of an undershoot, overshoot, or excursion from a runway or the unintentional departure from a taxiway.

Scheduled operation means any common carriage passenger-carrying operation for compensation or hire conducted by an air carrier for which the air carrier or its representatives offers in advance the departure location, departure time, and arrival location. It does not include any operation that is conducted as a supplemental operation under 14 CFR Part 121 or public charter operations under 14 CFR Part 380.

Shared-use airport means a U.S. Government-owned airport that is co-located with an airport specified under Sec. 139.1(a) and at which portions of the movement areas and safety areas are shared by both parties.

Unscheduled operation means any common carriage passenger-carrying operation for compensation or hire, using aircraft designed for at least 31 passenger seats, conducted by an air carrier for which the departure time, departure location, and arrival location are specifically negotiated with the customer or the customer's representative. It includes any passenger-carrying supplemental operation conducted under 14 CFR Part 121 and any passenger-carrying public charter operation conducted under 14 CFR Part 380.

Wildlife hazard means a potential for a damaging aircraft collision with wildlife on or near an airport. As used in this part, "wildlife" includes feral animals and domestic animals out of the control of their owners.

139.7 Methods and procedures for compliance.

An airport that receives an AOC must comply with the requirements of subparts C and D of Part 139. FAA Advisory Circulars (AC) present acceptable methods and procedures, but not the only means, for demonstrating compliance with the applicable regulations. The FAA will consider other methods of demonstrating compliance. The method or procedure must be approved by the Airport Certification Safety Inspector (ACSI) and included in your Airport Certification Manual (ACM).

SUBPART B – CERTIFICATION

139.101 General requirements.

Based upon the most likely class determination discussed in previous paragraphs (Class III), the airport must comply with 14 CFR Part 139 to establish scheduled airline service. This requires obtaining an AOC and getting an approved ACM.

139.103 Application for certificate.

Two signed copies of the ACM and one signed copy of Form 5280-1.

139.105 Inspection authority.

The ACSI is allowed to inspect the airport at any time to ensure compliance with this regulation and the airport's approved ACM. These inspections may be unannounced and may include tests to determine compliance with the applicable parts. Failure to allow these inspections or tests may result in civil penalties or certificate action.

139.107 Issuance of certificate.

Columbia Gorge Regional Airport is entitled to a certificate if there is air carrier service, the airport has submitted all the documentation as outlined under section 139.103, and the airport is equipped and able to provide a safe airport operating environment in accordance with the approved ACM and any other provisions imposed by the FAA to ensure safety in air transportation. Once approved, the certificate will be mailed to the operating entity with the effective date.

139.109 Duration of certificate.

Once issued, the AOC is good indefinitely unless it is surrendered or it is suspended or revoked by the FAA.

139.111 Exemptions.

An airport may petition the FAA for an exemption from any requirement of Part 139 including Airport Rescue and Firefighting (ARFF). These requests for exemption must be in writing and submitted at least 120 days before the proposed effective date of the exemption. An exact detail of what must be included in the request and the necessary procedures are outlined under 139.111(b) and (c) and 14 CFR Part 11.

Exemptions, if approved, will be time limited and normally not exceed one year. An exemption is not a permanent fix. Airports should work towards full compliance and the termination of the exemption.

Also, an exemption is not a “Modification of Standards” which is covered in FAA Order 5300.1, “Approval Level for Modification of Agency Airport Design and Construction Standards.” Questions about “Exemptions” and “Modification of Standards” should be addressed to the ACSI.

139.113 Deviations.

Without prior approval, an airport may deviate from any of the requirements of subpart D of this regulation or the ACM to the extent necessary to deal with an emergency that is required to protect life or property.

Within 14 days after the emergency that caused a deviation, the airport must provide a written description of the deviation to the Regional Airports Division Manager.

SUBPART C – AIRPORT CERTIFICATION MANUAL

139.201 General Requirements.

An airport must have and comply with an approved ACM. The ACM must contain all the elements contained in 139.203. AC 150/5210-21 provides a format for the ACM that is acceptable to the FAA. The airport must maintain a complete and current copy at all times. The airport will also need to provide a copy to the ACSI. Therefore, the original and all changes must be submitted in duplicate.

In addition, the airport must provide the ACM to all airport personnel responsible for its implementation. This includes air carriers, fixed base operator (FBO) personnel, and emergency response personnel. Personnel should be trained on the contents of the ACM and expected to comply with its provisions.

139.203 Contents of Airport Certification Manual.

The ACM is a description of the operating procedures, facilities and equipment, responsibility assignments, and any other information needed by personnel concerned with operating the airport on how they need to comply with the provisions of subpart D of Part 139.

As evident from the chart below, the ACM elements are the same for Class I, II, and III airports. The primary differences between a Class I and Class III AOC are as follows:

- Class I airports are required to conduct a full scale emergency exercise every three years. Class III airports are not required to conduct a full-scale emergency exercise.
- Class III airports can pursue exemptions from Airport Rescue and Fire Fighting (ARFF) requirements. Class I airports cannot.

REQUIRED AIRPORT CERTIFICATION MANUAL ELEMENTS				
Manual elements	**Class I**	**Class II**	**Class III**	**Class IV**
1. Lines of succession of airport operational responsibility	X	X	X	X
2. Each current exemption issued to the airport from the requirements of this part	X	X	X	X
3. Any limitations imposed by the Administrator	X	X	X	X
4. A grid map or other means of identifying locations and terrain features on and around the airport that are significant to emergency operations	X	X	X	X
5. The location of each obstruction required to be lighted or marked within the airport's area of authority	X	X	X	X
6. A description of each movement area available for air carriers and its safety areas, and each road described in § 139.319(k) that serves it	X	X	X	X
7. Procedures for avoidance of interruption or failure during construction work of utilities serving facilities or NAVAIDS that support air carrier operations	X	X	X	
8. A description of the system for maintaining records, as required under § 139.301	X	X	X	X
9. A description of personnel training, as required under § 139.303	X	X	X	X
10. Procedures for maintaining the paved areas, as required under § 139.305	X	X	X	X
11. Procedures for maintaining the unpaved areas, as required under § 139.307	X	X	X	X
12. Procedures for maintaining the safety areas, as required under §139.309	X	X	X	X
13. A plan showing the runway and taxiway identification system, including the location and inscription of signs, runway markings, and holding position markings, as required under §139.311	X	X	X	X
14. A description of, and procedures for maintaining, the marking, signs, and lighting systems, as required under § 139.311	X	X	X	X
15. A snow and ice control plan, as required under § 139.313	X	X	X	

REQUIRED AIRPORT CERTIFICATION MANUAL ELEMENTS				
Manual elements	**Class I**	**Class II**	**Class III**	**Class IV**
16. A description of the facilities, equipment, personnel, and procedures for meeting the aircraft rescue and firefighting requirements, in accordance with §§ 139.315, 139.317 and 139.319	X	X	X	X
17. A description of any approved exemption to aircraft rescue and firefighting requirements, as authorized under § 139.111	X	X	X	X
18. Procedures for protecting persons and property during the storing, dispensing, and handling of fuel and other hazardous substances and materials, as required under § 139.321	X	X	X	X
19. A description of, and procedures for maintaining, the traffic and wind direction indicators, as required under § 139.323	X	X	X	X
20. An emergency plan as required under § 139.325	X	X	X	X
21. Procedures for conducting the self-inspection program, as required under § 139.327	X	X	X	X
22. Procedures for controlling pedestrians and ground vehicles in movement areas and safety areas, as required under § 139.329	X	X	X	
23. Procedures for obstruction removal, marking, or lighting, as required under § 139.331	X	X	X	X
24. Procedures for protection of NAVAIDS, as required under § 139.333	X	X	X	
25. A description of public protection, as required under § 139.335	X	X	X	
26. Procedures for wildlife hazard management, as required under § 139.337	X	X	X	
27. Procedures for airport condition reporting, as required under § 139.339	X	X	X	X
28. Procedures for identifying, marking, and lighting construction and other unserviceable areas, as required under § 139.341	X	X	X	
29. Any other item that the Administrator finds is necessary to ensure safety in air transportation	X	X	X	X

It is imperative that the ACM describe the actual conditions and operations at the airport. If changes occur, the manual must be updated in accordance with 139.205. As part of the ACSI inspection, a pre-inspection review of the ACM will always be accomplished. Remember that the ACM must be kept current at all times.

139.205 Amendment of Airport Certification Manual.

An "amendment" to the ACM is a significant change in the method of compliance to Part 139 by the airport operator. Simple changes to names, phone numbers, and minor wording corrections constitute a "revision." These revisions must still be submitted to the ACSI for approval in a timely manner, but do not constitute an actual amendment.

The ACM is formally amended either at the discretion of the certificate holder or at the request of the FAA. Examples of what constitutes an amendment are major changes to the Emergency or Wildlife Hazard Management Plans, change in ARFF index, or an addition of a new runway. All proposed amendments by the certificate holder must be submitted in writing to the ACSI at least 30 days prior to the effective date of the amendment unless a shorter time period is allowed by the FAA.

If the FAA initiates the amendment, the proposed amendment will be provided to the airport operator in writing. There will be at least seven days to respond. After review of the airport operators' response, the FAA will issue a final amendment that becomes effective not less than 30 days after the certificate holder receives it. The FAA can issue an immediate amendment if there is an emergency situation requiring such action. The airport can petition the FAA within 30 days of such an emergency amendment to reconsider the emergency situation or the amendment itself.

SUBPART D – OPERATIONS

139.301 Records.

An airport is required to maintain certain records for specified periods of time. These records must be in a manner prescribed in the applicable section of Part 139 and as authorized by the ACSI. These records must be made available during inspection. The period of time these records must be maintained is as follows (in consecutive calendar months):

Personnel training (24 Months)
Emergency personnel training (24 Months)
Airport tenant fueling inspection (12 Months)
Airport tenant fueling agent training (12 Months)
Self-inspection (6 Months)
Movement areas and safety areas training (24 Months)
Accident and incident (12 months)
Airport Condition (6 Months)
Any additional records deemed necessary by the ACSI

What constitutes acceptable records will be covered under the appropriate section.

139.303 Personnel.

An airport must provide sufficient and qualified personnel to comply with the requirements of Part 139 and the ACM. The important point here is that there must be a balance between the number of personnel an airport employs and the training/experience level these personnel possess. Personnel who access movement areas and safety areas to perform their duties must be properly trained and equipped to their job. This training must be accomplished prior to commencement of their duties and at least once every 12 consecutive calendar months.

Neither the ACSI nor other FAA offices will dictate to an airport what constitutes sufficient qualified personnel. The number of personnel an airport operator needs is that which is required to meet, maintain, and operate the airport at the minimum safety standards set forth in Part 139. The conditions found on the airport are what an ACSI must base their determination on as to whether there are sufficient qualified personnel. An ACSI can observe personnel while performing their duties and, if necessary, even test personnel on their knowledge of a subject appropriate to their responsibilities.

Also, having numerous employees may meet the test of sufficiency, but inadequate training may leave an individual less than qualified. A training program is a mandatory requirement and must include the requirements of Part 139 and the ACM. Records of this training must be kept for 24 consecutive calendar months. The curriculum for the initial and recurrent training must include the areas specified in this part and a description must be included in the ACM. The FAA may require additional subject areas for training as appropriate.

An airport may use an independent organization or designee to comply with the requirements of this part and the ACM, but this arrangement would have to be approved by the ACSI and this organization or designee would still have to meet the same requirements.

139.305 Paved areas.

All pavements available for air carrier use, including runways, taxiways, loading ramps, and parking areas must be maintained to meet the required specifications of this part. Although there is a specific criterion, any pavement cracks or variations that could impair an air carrier aircraft's directional control is a violation of this part and needs to be immediately addressed. A good self-inspection program is important to identifying potential problem areas before they exceed standards. These inspections should be conducted in varying weather conditions, such as heavy rain, to determine if the pavement is draining properly and to identify areas where ponding is occurring so that these areas can be repaired.

The airport should have a regular maintenance program in place to remove mud, dirt, sand, loose aggregate, debris, foreign objects, rubber deposits and other contaminates as well as repair cracks, holes, and deterioration. Any crack or surface variation that produces loose aggregate or other contaminants shall be immediately repaired. The airport should work with the FAA Airport District Office (ADO) to procure funding for major repairs and reconstructions, but this does not relieve the airport of its responsibility to make immediate repairs or restrict air carrier use if necessary.

AC 150/5380-6, *Guidelines and Procedures for Maintenance of Airport Pavements*, provides an introduction to airport pavement maintenance and is a good starting point for airport personnel. Also, AC 150/5380-7, *Pavement Management System*, describes the components of a Pavement Management System.

Runways 12-30 and 7-25 are available for small air carrier use. However, these runways do not currently meet FAA design standards for line-of-sight along the length of the runway. The Master Plan has recommended capital projects to bring both runways into compliance with this design standard. Taxiways A and B serve the two runways, and capital projects in the Master Plan have been recommended to make each taxiway parallel to their respective runways for the entire runway length.

139.307 Unpaved areas.

There are no unpaved areas for potential air carrier operations.

139.309 Safety areas.

A safety area is an area comprised of either a runway or taxiway and the surrounding surfaces that is prepared or suitable for reducing the risk of damage to aircraft in the event of an undershoot, overshoot, or excursion from a runway or the unintentional departure from a taxiway. Safety area design and dimensional standards shall be provided and maintained for each runway and taxiway that is available for air carrier use.

Safety areas must be cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations. They should also allow for water to adequately drain, preventing accumulation. The safety area is there to support an aircraft without causing major damage. Safety areas should also be able to support ARFF equipment under dry conditions.

No objects may be located in the safety area unless they are located there specifically for their function. Usually, items located in the safety areas are limited to signs, lighting, and navigational aids. Items that are approved to remain in the safety areas shall be on frangible structures with the frangible point no higher then three inches above the grade.

Currently, safety areas beyond three runway ends (7, 25, and 12) do not meet design standards on the airport. The Master Plan has recommended capital projects in the short-term planning period to eliminate the non-standard conditions.

AC 150/5300-13, *Airport Design*, paragraph 305 and Appendix 8 discuss Runway Safety Areas (RSA) and paragraph 403 discusses Taxiway Safety Areas (TSA).

139.311 Marking, signs, and lighting.

Airports must provide and maintain a marking system for air carrier operations. This includes marking runways for the approach with the lowest authorized minimums, taxiway centerlines and edge markings as appropriate, holding position markings and marking instrument landing system (ILS) critical areas. Markings must be provided and maintained so that pilots can easily see them. Maintaining markings means to have a scheduled maintenance program to repaint faded, chipped, or worn markings. This includes the addition of glass beads on all required markings and the outlining of markings with a black border on light colored pavements. Markings should also be kept clean and free of rubber deposits. AC 150/5340-1, *Standards for Airport Markings*, contains the acceptable standards for airport markings at airports with air carrier operations.

Columbia Gorge Regional Airport is equipped with an LDA/DME approach to Runway 25. Runway 25 has precision markings, while Runways 7, 12, and 30 have basic markings. Edge markings and holding position markings are consistent with standards.

Airports must provide and maintain a sign system for air carrier operations. This sign system must include signs identifying taxiing routes, holding position signs, and ILS critical area signs. For Class III airports, only holding position signs, and instrument landing system (ILS) critical area signs must be internally illuminated. Other signs must be lighted if they are installed on a lighted runway or taxiway. Signs must be properly positioned appropriate to their size and must be maintained so that pilots can easily read them. Maintaining signs includes replacing worn or faded panels and keeping them clear of snow and vegetation. An airport sign plan must be submitted to the ACSI for approval and included in the ACM. AC 150/5340-18, *Standards for Airport Sign Systems*, provides guidance for the type of airport signs.

Current holding position marking and signage is located at a distance of 200 feet from runway centerlines, consistent with standards.

Airports must provide and maintain a lighting system for air carrier operations when the airport is open at night or during periods of reduced visibility. This system must include runway lights that meet the specifications for the takeoff and landing minimums of the runway and one taxiway lighting system. In addition to runway and taxiway lighting, an airport is required to have an airport beacon, approach lighting that meets the specifications for takeoff and landing minimums unless this lighting is provided and maintained by the FAA, and obstruction marking and lighting as appropriate. AC 150/5340-24, *Runway and Taxiway Edge Lighting System*, describes acceptable standards for the design, installation, and maintenance of runway and taxiway edge lighting systems.

Runways 7-25 and 12-30 have medium intensity runway lighting (MIRL), and medium intensity taxiway lighting (MITL) is available at taxiway throats. The airport has a rotating beacon.

The airport is responsible for maintaining its marking, lighting, and signs. This means that that they should be clean, unobscured, and clearly visible at all times. Any faded, missing, or nonfunctional items should be repaired or replaced. Marking, lighting, and signs are used by pilots and need to be easily seen and able to provide an accurate reference to the user.

FAA Advisory Circulars that provide assistance with compliance with this section are listed below.

AC 150/5340-21, *Airport Miscellaneous Lighting Visual Aids*, describes the standards for the system design, installation, inspection, testing, and maintenance of airport miscellaneous visual aids (i.e., airport beacons, beacon towers, wind cones, wind tees, and obstruction lights).

AC 150/5340-26, *Maintenance of Airport Visual Aid Facilities*, provides recommended guidelines for maintenance of airport visual aid facilities.

AC 150/5340-27A, *Air-to-Ground Radio Control of Airport Lighting Systems*, contains the FAA standard operating configurations for air-to-ground radio control of airport lighting systems.

AC 150/5345-44F, *Specification for Taxiway and Runway Signs*, contains a specification for lighted and unlighted signs to be used on taxiways and runways.

139.313 Snow and ice control.

A snow and ice control plan is needed in an area where measurable snow and icing conditions occur at least once a year. This plan must be approved by the ACSI and becomes an enforceable part of the ACM. When snow and/or icing conditions occur, the airport must execute the approved plan.

139.315 Aircraft Rescue and Firefighting (ARFF): Index determination:

The length of air carrier aircraft and the average scheduled daily departures of air carrier aircraft determine ARFF index. The minimum ARFF index will always be Index A.

Below is the length of air carrier aircraft that make up a particular index:

(1) Index A includes aircraft less than 90 feet in length.
(2) Index B includes aircraft at least 90 feet but less than 126 feet in length.
(3) Index C includes aircraft at least 126 feet but less than 159 feet in length.
(4) Index D includes aircraft at least 159 feet but less than 200 feet in length.
(5) Index E includes aircraft at least 200 feet in length.

Small turboprops such as the Embraer 120 and Bombardier Q200 fall within Index A, as do small regional jets such as the Bombardier CRJ 200 and Embraer 135.

Paragraph (e) of this section allows for a Class III airport to comply with this section if they can provide a level of safety comparable to Index A, the procedure is approved by the ACSI, and if it is documented in the ACM. The alternate compliance must include the criteria listed in paragraph 139.315(e)(i-iv).

Note: Determination of ARFF index is used to determine the minimum ARFF equipment and agents that must be available for air carrier operations to occur on an airport.

139.317 Aircraft rescue and firefighting: Equipment and agents.

Once the ARFF index has been determined, a determination of the minimum type and number of ARFF vehicles, the type and number of pounds of dry chemical, the amount of Halon 1211 or clean agent (referred to as agent/s) that must be on the truck(s), and the amount of aqueous film forming foam (AFFF) and water that must be available on the truck(s) is determined. Refer to 139.317(a-e) for applicable index requirements.

All trucks used to comply with index B and above must be equipped with a turret. This section also specifies the foam discharge rate and the agent discharge rate for each vehicle (139.317(f-g)). Other extinguishing agents may be used only if they are approved by the ACSI and in amounts that provide the same level of firefighting capability.

Vehicles must be able to carry enough AFFF to mix with twice the amount of water the vehicle is required to carry.

FAA Advisory Circulars that may assist with compliance with this section are listed below.

AC 150/5210-6C, *Aircraft Fire and Rescue Facilities and Extinguishing Agents* outlines scales of protection considered as the recommended level compared with the minimum level in Federal Aviation Regulation (F.A.R.) Part 139.49 and tells how these levels were established from test and experience data.

AC 150/5220-4, *Water Supply Systems for Aircraft Fire and Rescue Protection* provides guidance for the selection of a water source and standards for the design of a distribution system to support ARFF service operations on airports.

AC 150/5220-10C *Guide Specification for Water/Foam Aircraft Rescue and Firefighting Vehicles* contains performance standards, specifications, and recommendations for the design, construction, and testing of a family of ARFF vehicles.

AC 150/5220-19, *Guide Specification for Small Agent Aircraft Rescue and Fire Fighting Vehicles* contains performance standards, specifications, and recommendations for the design, construction, and testing of a family of small, dual agent ARFF vehicles.

AC 150/5220-10C, *Guide Specification for Water/Foam Aircraft Rescue and Firefighting Vehicles* contains performance standards, specifications, and recommendations for the design, construction, and testing of a family of ARFF vehicles.

AC 150/5210-13A, *Water Rescue Plans, Facilities, and Equipment* provides guidance to assist airport operators in preparing for water rescue operations.

AC 150/5210-15, *Airport Rescue and Firefighting Station Building Design* provides standards and guidance for planning, designing, and constructing an airport rescue and firefighting station.

AC 150/5210-19, *Driver's Enhanced Vision System (DEVS)* contains performance standards, specifications, and recommendations for DEVS.

AC 150/5220-4B, *Water Supply Systems for Aircraft Fire and Rescue Protection* provides guidance for the selection of a water source and standards for the design of a distribution system to support ARFF service operations on airports.

139.319 Aircraft Rescue and Firefighting: Operational requirements.

It is required that an airport, during air carrier operations (defined as the period of time 15 minutes before until 15 minutes after the takeoff or landing) provide the ARFF capability for their required index. If the average daily departures or the length of aircraft changes such that the index increases, the airport is required to meet the ARFF required by the increased ARFF index. If there is reduction in average daily departures or the length of aircraft, the airport may reduce its index by following the procedures under section 139.319(d)(1-3).

ARFF vehicles are required to be ready and capable to meet their intended requirements as required by 139.319(g)(1-3) and the response requirements of 139.319(h)(1-2). The ACSI will initiate a timed response drill during inspections. Vehicles must also be equipped with the necessary radios to communicate with all required parties as outlined in 139.319(e)(1-4), and they must be appropriately marked and lighted in accordance with 139.319(f)(1-2).

ARFF personnel must be trained and equipped to perform their duties. Personnel training includes initial and recurrent training with a curriculum that is approved by the ACSI and includes all the elements of 139.319(i)(2)(i-xi) and (3).

Initial Training. Prior to any person assuming ARFF duties, they must have completed initial training as outlined above. It is not acceptable to simply take a structural firefighter and assign them to ARFF duties without additional training. Initial training may be accomplished during an initial ARFF training course offered by an approved facility or internally using an approved curriculum. The internal curriculum must be approved by the ACSI. Initial training is not complete until the individual has participated in at least one live-fire drill. Initial ARFF training records are kept as long as the person is employed and will be made available during each inspection.

Recurrent Training. Once an ARFF person has completed initial training, they must receive recurrent instruction every 12 consecutive calendar months using an approved curriculum. The Aircraft Rescue and Fire Fighting (ARFF) Computer-Based Training (CBT) CD is an excellent supplement to the curriculum but should not be considered all-inclusive. Practical application with the airport's equipment, airport familiarization, driving on the airport, and duties under the airport emergency plan are just a few areas that cannot be fully taught using the CD. ARFF personnel must also participate in at least one live-fire drill every 12 consecutive calendar months. The live-fire drill must be accomplished at an approved training facility or in a manner acceptable to the ACSI.

An airport is required to maintain a record of all recurrent training given to each individual for 24 consecutive calendar months and these records will be made available during each inspection.

Medical Services. The airport is required to have at least one individual available during air carrier operations that has been trained and is current in basic emergency medical services as outlined in 139.319(i)(4). The individual must have received at least 40 hours of training in the required topics and a record of this training must be maintained for 24 consecutive calendar months and made available for inspection. The emergency medical person does not have to be an ARFF person and they do not need to meet the timed response requirements. Off-airport personnel, such as an ambulance service, may be used if a reasonable response time is assured. How the airport will meet this requirement must be approved by the ACSI and documented in the ACM.

The airport must also meet the requirements of 139.319(i)(5 & 6) with regards to hazardous materials guidance and maintaining emergency access roads.

FAA Advisory Circulars that may assist with compliance with this section are listed below.

AC 150/5210-17, *Programs for Training of Aircraft Rescue and Firefighting Personnel* provides information on courses and reference materials for training of ARFF personnel and Change 1, AC 150/5210-17. Change 1 changed the AC to reflect a new source for the FAA Standard Basic Aircraft Rescue and Firefighting Curriculum and to update other sources of training programs.

Note: An Aircraft Rescue and Fire Fighting (ARFF) Computer-Based Training (CBT) CD is available from the ACSI.

AC 150/5210-18, *Systems for Interactive Training of Airport Personnel* provides guidance in the design of systems for interactive training of airport personnel.

AC 150/5210-7C, *Aircraft Rescue and Firefighting Communications* provides guidance for planning and implementing the airport ARFF Communications systems.

AC 150/5210-14A, *Airport Fire and Rescue Personnel Protective Clothing* was developed to assist airport management in the development of local procurement specifications for an acceptable, cost-effective proximity suit for use in aircraft rescue and firefighting operations.

139.321 Handling and storing of hazardous substances and materials.

The airport is required to establish and maintain acceptable fire safety standards for handling fuel servicing on the airport. This includes storing and dispensing fuel. These standards must be approved by the ACSI and included in the ACM. It is recommended that the airport adopt NFPA 407, Standard for Aircraft Fuel Servicing (current edition) as the standard for the airport. 139.321(b)(1-7) lists the minimum standards that must be addressed if NFPA 407 is not adopted.

Once the standards are approved and adopted, the airport, as a fueling agent, if applicable, and all other fueling agents on the airport including Part 121 and Part 135 certificated air carriers, must comply with the standards. To ensure compliance, the airport must inspect the trucks and storage and dispensing facilities every three consecutive calendar months. The inspection records must be maintained for 12 consecutive calendar months. The inspection results should show the discrepancies found and the corrective action taken. Regardless of the inspections, the airport must require fueling agents to immediately correct any noncompliance with a standard. If the fueling agent cannot correct the deficiency in a reasonable period of time, the airport will notify the ACSI.

All fueling agents shall have at least one supervisor that has completed an approved fuel-training course in fire safety. A list of nationally approved courses is attached. The individual must complete the training prior to initial performance of duties or be enrolled in a course that will be completed within 90 days of starting work. They must also receive recurrent training every 24 consecutive calendar months. Any training courses other than the nationally approved courses must be reviewed and approved by the ACSI as acceptable. The inspector will want to see documentation of the training.

The supervisor must provide initial on-the-job training and recurrent instruction every 24 consecutive calendar months to all other employees that are responsible for handling fuel in any manner. Once every 12 consecutive calendar months, the fueling agent must provide the airport written confirmation that all training has been accomplished. The written confirmation must be maintained for 12 consecutive calendar months and should include the name of the person receiving the training and the date the training occurred.

The attached forms can also be used to track and record the quarterly inspections required by this part. These inspections can be performed by someone other than airport staff, such as the Fire Marshall. The ACM must state who will be responsible for these inspections.

AC 150/5230-4 *Aircraft Fuel Storage, Handling, and Dispensing On Airports* provides guidance in this area.

139.323 Traffic and wind direction indicators.

An airport must have a wind cone that provides surface wind direction information to pilots and supplemental wind cones at each end of all air carrier runways or at a point visible to a pilot during final approach and prior to takeoff. If the airport is open at night, it must be lighted.

There is no control tower at Columbia Gorge Regional Airport. A segmented circle with lighted wind cone is located between the ramp and Runway 12-30. Supplemental lighted and unlighted wind cones are located near each runway end. Each of the two runways are lighted and REILs are installed on Runway 30.

FAA Advisory Circulars that may assist with compliance with this section are listed below.

AC 150/5340-5B, *Segmented Circle Airport Marker System* sets forth standards for a system of airport marking consisting of certain pilot aids and traffic control devices.

AC 150/5340-23B, *Supplemental Wind Cones* describes criteria for the location and performance of supplemental wind cones.

139.325 Airport Emergency Plan.

The airport is required to write and maintain an Airport Emergency Plan (AEP). The plan is designed to minimize personal injury and damage to property in the event of an emergency situation. All parties that have a role in the plan should participate in the development of the plan. AC 150/5200-31A, *Airport Emergency Plan* provides guidance for the preparation and implementation of emergency plans at civil airports. The AEP may be written using the guidance provided in the AC and must include all applicable parts of 139.325(b-f).

The plan will be submitted in two copies to the ACSI for approval. The AEP Review Checklist must be completed and included with the submission of the AEP. The ACSI will review the plan and, once approved, it will become part of the ACM.

Once completed, the AEP must be coordinated with all parties that have responsibilities under the plan. All airport personnel having duties and responsibilities under the plan must be trained on their assignments under the plan. Once every 12 consecutive calendar months, the plan must be reviewed with all parties that have responsibilities under the plan. This is the opportunity to get everyone together and go through the plan page by page to ensure everyone is familiar with their duties and that the information in the plan is accurate. The airport should keep a participant list as well as minutes of the meeting. Any changes to the plan should be immediately submitted to the ACSI for approval.

Every 36 consecutive calendar months, all Class I airports must hold a full-scale emergency plan exercise. Class II, III and IV airports do not need to complete this requirement; however, it is recommended. The AEP Exercise Evaluation Checklist should be used to prepare and evaluate the exercise. The purpose of the full-scale exercise is to test the effectiveness of the AEP through a response of the airport and its mutual aid for a disaster at the airport. All planning, execution, and evaluation documentation should be maintained for inspection purposes.

FAA Advisory Circulars that may assist with compliance with this section are listed below.

AC 150/5200-12B, *Fire Department Responsibility in Protecting Evidence at the Scene of an Aircraft Accident* furnishes general guidance for the airport, employees, airport management, and other personnel responsible for firefighting and rescue operations on the proper presentation of evidence at the scene of an aircraft accident.

AC 150/5210-2A, *Airport Emergency Medical Facilities and Services* provides information and advice so that airports may take specific voluntary preplanning actions to assure at least minimum first-aid and medical readiness appropriate to the size of the airport in terms of permanent and transient personnel.

139.327 Self-inspection program.

The self-inspection program is considered the cornerstone of compliance with many of the sections of Part 139. The airport must perform an inspection daily unless otherwise authorized by the ACSI and approved in the ACM. If there is air carrier service on any given day, including weekends and holidays, an inspection must be performed. The inspection schedule is required to be included in the ACM. Inspections will also be completed when required by unusual conditions or an aircraft accident/incident. Usually the inspections are recorded on an inspection checklist that is an approved part of the ACM. The inspection record must include the conditions found and the corrective action that was taken to fix the discrepancy. Each daily-recorded inspection must be maintained for 12 consecutive calendar months.

Personnel trained to identify noncompliance with all the areas that are being inspected must complete self-inspections. These personnel must be trained in accordance with 139.303 and receive initial and recurrent instruction. This initial instruction must be documented and maintained for the duration of the employee's employment. Recurrent training must be completed every 12 consecutive calendar months. Training records shall be maintained for 24 consecutive calendar months. Instruction must include the following:

1) Airport familiarization, including airport signs, marking and lighting
2) Airport emergency plan
3) Notice to Airmen (NOTAM) notification procedures
4) Procedures for pedestrians and ground vehicles in movement areas and safety areas
5) Discrepancy reporting procedures
6) A reporting system to ensure prompt correction of unsafe airport conditions noted during the inspection.

Note: A person sent to inspect the airport that is not thoroughly familiar with the requirements of Part 139 and all applicable ACs may provide an inaccurate report and potentially provide airport management with a false sense of well-being. If, during an annual certification inspection, discrepancies are discovered that should have been identified under the self-inspection program, the airport should reevaluate the self-inspection process, training, and/or personnel conducting the inspections.

All personnel responsible for self-inspections should be thoroughly familiar with the contents of AC 150/5200-18B, *Airport Safety Self-Inspection* and AC 150/5200-29, *Announcement of Availability: Airport Self-Inspection Videotape* (which may be obtained through the ACSI).

It is critical that the self-inspection program is tied to the airport condition reporting system. The use of the NOTAM system is acceptable, but an additional system to immediately notify air carriers directly may be necessary. In some cases, the information or NOTAM may have to be hand delivered, faxed or e-mailed directly to the air carrier in order to ensure prompt notification. The air carriers should also be notified as soon as the discrepancy is corrected.

139.329 Pedestrians and Ground Vehicles.

The only pedestrians or ground vehicles that should be allowed to be in the movement areas (runway and taxiways) and safety areas are those that are absolutely necessary for airport operations. The airport is responsible for limiting access to the movement areas to authorized personnel and vehicles only. Normally, this limits the access to rescue, maintenance, and inspection activities. Construction would be considered maintenance, but the airport must ensure that the construction safety plan is in compliance with this section. Wherever possible, service roads should be constructed to alleviate vehicles such as fuel trucks from entering the movement areas.

The airport must establish and implement procedures for access to the operational movement and safety areas. This means that the airport must establish a driver's training program that includes provisions for all personnel that may have to drive or walk in the movement/safety areas. The training program must be approved and included in the ACM. It must also include the consequences that the airport will enforce if an individual does not follow the rules. This training must be documented and the documentation must be maintained for 24 consecutive calendar months.

The Columbia Gorge Regional Airport air carrier movement area would be defined as Runways 12-30 and 7-25, and Taxiways A, A1, A2, A3, A4, and B. The driver of any vehicle which might cross any of these areas would require ground vehicle training.

It should be noted that not all tenants gaining access through the fence would require ground vehicle training. Tenants accessing T-hangars or other buildings on the airport would not require training.

FAA Advisory Circulars that may assist with compliance with this section are listed below.

AC 150/5210-20, *Ground Vehicle Operations on Airports* contains guidance to airport operators developing ground vehicle operation training programs.

AC 150/5210-5B, *Painting, Marking, and lighting of Vehicles Used on an Airport* provides guidance, specifications, and standards in the interest of airport personnel safety and operational efficiency for painting, marking, and lighting of vehicles operating in the airport operations areas.

139.331 Obstructions.

Any objects that are within the airport's authority that have been determined by the FAA to be an obstruction must be removed, marked, or lighted unless an FAA aeronautical study has determined that it is not necessary. If the object has not had an FAA aeronautical study, the airport is required to initiate the study. The airport must have procedures in place for the identification of obstructions to the applicable Part 77 imaginary surfaces. Applicability of airport authorities will be determined on a case-by-case basis.

FAA Advisory Circulars that may assist with compliance with this section are listed below.

AC 150/5340-21, *Airport Miscellaneous Lighting Visual Aids* describes the standards for the system design, installation, inspection, testing, and maintenance of airport obstruction lights.

AC 150/5345-43E, *Specification for Obstruction Lighting Equipment* contains the FAA specification for obstruction lighting equipment.

139.333 Protection of NAVAIDS.

The airport must prevent the construction of facilities near NAVAIDS and air traffic control facilities that would derogate the signal or operation of the facility. This includes electronic and visual facilities.

This is usually accomplished with signage and restricting access to the airport to those authorized to use the airport and through defining safety measures during construction.

139.335 Public protection.

The airport must have safeguards to prevent inadvertent entry to the movement areas by unauthorized person or vehicles. Fencing that meets Transportation Security Administration (TSA) regulations are acceptable to meet the requirements of this section. The airport must also provide reasonable protection of persons and property from jet blast. The airport perimeter fencing would need to be upgraded.

139.337 Wildlife hazard management.

Wildlife hazard management at airports is a critical issue that, if taken lightly, poses a serious threat to life and property. For this reason, airports are required to take immediate action to alleviate wildlife hazards any time they are detected.

If an airport has any of the occurrences listed in 139.337(b)(1-4), they are required to have a wildlife hazard assessment. The wildlife hazard assessment usually starts with an initial consultation and possibly a site visit. The consultation and/or site visit will determine the need for a complete wildlife hazard assessment. If it is required, the wildlife hazard assessment must be completed by an individual as specified under 139.337(c) and include the items listed under 139.337(c)(1-5). Wildlife hazard assessments and plans are eligible for Airport Improvement Plan (AIP) funding and need to be coordinated with the ADO.

The wildlife hazard assessment is submitted to the ACSI, who will determine if there is a need for a wildlife hazard management plan. If it is determined that a plan is required, the certificate holder must write a plan using the assessment as a guide. The plan is submitted to the ACSI for approval and is implemented by the airport. Section 139.337(e) and (f) will be followed in the development, writing and implementation of the plan.

All airport personnel that may be required to execute the plan must be trained on its implementation, and the airport must evaluate the effectiveness of the plan at least every 12 consecutive calendar months or whenever additional occurrences that triggered the assessment occur.

If an airport has an advisory for wildlife in the Airport Facility Directory (AFD), they will be required to have an initial consultation and site visit. If it is determined that a wildlife hazard assessment is required, then one must be performed.

FAA Advisory Circulars that may assist with compliance with this section are listed below.

AC 150/5200-33, *Hazardous Wildlife Attractants on or Near Airports* provides guidance on locating certain land uses having the potential to attract hazardous wildlife to or in the vicinity of public-use airports.

AC150/5200-32, *Announcement of Availability: Bird Strike Incident/Ingestion Report* explains the nature of the revision of FAA Form 5200-7, Bird Strike Incident/Ingestion Report and how it can be obtained.

AC 150/5200-34, *Construction or Establishment of Landfills near Public Airports* contains guidance on complying with new Federal statutory requirements regarding the construction or establishment of landfills near public airports.

139.339 Airport condition reporting.

The airport is required to collect and disseminate the airport condition to all air carriers. They can use the NOTAM system or another system approved by your ACSI to accomplish this requirement. Airport conditions that may affect the safe operations of air carriers are listed under section 139.339(c)(1-9). The airport must keep a record of each dissemination of airport condition to air carriers for 12 consecutive calendar months.

FAA Advisory Circulars that may assist with compliance with this section are listed below.

AC 150/5200-28B, *Notices to Airmen (NOTAMS) for Airport Operators* provides guidance for use of the NOTAM system in airport condition reporting.

139.341 Identifying, marking, and lighting construction and other unserviceable areas.

The airport is responsible for the marking and lighting of construction and unserviceable areas, construction equipment and roadways, and areas adjacent to a NAVAID that may cause the derogation of the signal or failure of the NAVAID. They must also include procedures for avoiding damage to existing utilities and other underground facilities.

The best way to comply with this section is to have a thorough construction safety plan. The safety plan must include all the items required by this section.

FAA Advisory Circulars that may assist with compliance with this section are listed below.

AC 150/5345-55, *Lighted Visual Aid to Indicate Temporary Runway Closure* provides guidance in the design of a lighted visual aid to indicate temporary runway closure.

139.343 Noncomplying conditions.

An airport must limit air carrier operations to only those parts of the airport that are safe for air carrier operations. If any of the requirements of subpart D cannot be met to the extent that unsafe conditions exist on the airport, it is the responsibility of the airport to close those areas to air carrier use until they are brought back into compliance.

Example: Disabled aircraft or vehicles on a runway or taxiway, taxi routes with inadequate wing tip clearance, or parking aprons that will not support the weight or turning radius due to design or condition.

SUMMARY

Several projects (as recommended in the Master Plan) need to be undertaken to ensure that the airfield system complies with FAA design standards. In addition, the following steps would need to be taken for 14 CFR Part 139 compliance at Columbia Gorge Regional Airport:

1. Prepare and submit a Class III ACM to the FAA (139.203).
2. Prepare ground vehicle operating rules and regulations and a ground vehicle training program (139.329).
3. Prepare a training program for airport personnel involved with Part 139 implementation (139.303/327).
4. Ensure that FBOs comply with the fuel training requirements (139.321).
5. Develop a record-keeping system (139.301/303) for the following:
    a. Personnel training (24 Months)
    b. Emergency personnel training (24 Months)
    c. Airport tenant fueling inspection (12 Months)
    d. Airport tenant fueling agent training (12 Months)
    e. Self-inspection (6 Months)
    f. Movement areas and safety areas training (24 Months)
    g. Accident and incident (12 months)
    h. Airport Condition (6 Months)
6. Prepare and submit an Airport Emergency Plan (AEP) to the FAA (139.325).
7. Acquire an ARFF vehicle and comply with ARFF training and operational requirements (139.315/317/319).

Columbia Gorge Regional Airport

Appendix D

ENVIRONMENTAL OVERVIEW

Appendix D
ENVIRONMENTAL OVERVIEW

A review of the potential environmental impacts associated with proposed airport projects is an essential consideration in the Airport Master Plan process. The primary purpose of this section is to review the proposed improvement program at Columbia Gorge Regional Airport to determine whether the proposed developments identified in the master plan could, individually or collectively, have the potential to significantly affect the quality of the environment. The information contained in this section was obtained from previous studies, various internet websites, and analysis by the consultant.

Construction of any and all improvements depicted on the Airport Layout Plan (ALP) will require compliance with the *National Environmental Policy Act* (NEPA) *of 1969*, as amended. This includes privately funded projects in addition to those projects receiving federal funding. For projects not "categorically excluded" under Federal Aviation Administration (FAA) Order 1050.1E, *Environmental Impacts: Policies and Procedures*, compliance with NEPA is generally satisfied through the preparation of an Environmental Assessment (EA). In instances where significant environmental impacts are expected, an Environmental Impact Statement (EIS) may be required.

An environmental inventory is included in Chapter One to provide baseline information about the airport environs. This appendix provides an overview of the potential impacts to the existing resources resulting from implementation of the planned improvements outlined in the master plan. While this portion of the master plan is not designed to satisfy the NEPA requirements, it is intended to supply a preliminary review of environmental issues that would need to be analyzed in more detail within the environmental review processes. This evaluation considers all environmental categories required as outlined within FAA Order 1050.1E, *Environmental Impacts, Policies and Procedures* and FAA Order 5050.4B, *National Environmental Policy Act* (NEPA) *Implementation Instructions for Airport Actions.*

The following sections provide a description of the environmental resources which could be impacted by the proposed ultimate airport development depicted on Exhibit 5A. Through a review of previous environmental studies and resource agency websites, it was determined that the following resources are not present within the airport environs or cannot be inventoried:

- Coastal Barriers
- Coastal Zone Management Areas
- Construction Impacts
- Energy Supply, Natural Resources, and Sustainable Design
- Secondary (Induced) Impacts
- Wild and Scenic Rivers

AIR QUALITY

Air quality in a given location is described by the concentrations of various pollutants in the atmosphere. The significance of a pollution concentration is determined by comparing it to the state and federal air quality standards. In 1971, the U.S. Environmental Protection Agency (EPA) established standards that specify the maximum permissible short-term and long-term concentrations of various air contaminants. The National Ambient Air Quality Standards (NAAQS) consist of primary and secondary standards for six criteria pollutants which include: Ozone (O_3), Carbon Monoxide (CO), Sulfur Dioxide (SO_2), Nitrogen Oxide (NO), Particulate matter (PM_{10} and $PM_{2.5}$), and Lead (Pb).

Based on both federal and state air quality standards, a specific geographic area can be classified as either an "attainment," "maintenance," or "non-attainment" area for each pollutant. The threshold for non-attainment designation varies by pollutant. According to the EPA's Greenbook, Klickitat County is classified as an attainment area for all criteria pollutants.

A number of planned projects at the airport could result in temporary impacts to air quality during construction. Temporary impacts would result during the construction of improvements including: relocation of Dallesport Road, terminal building construction, Taxiway A improvements, fuel farm construction, Runway 7-

25 reconstruction and parallel taxiway construction, and the reconstruction of Runway 12-30. Emissions from the operation of construction vehicles and fugitive dust from pavement removal are common air pollutants during construction. During evaluation of these specific projects, an emissions inventory, prepared with the use of the FAA's Emission and Dispersion Modeling System or the Environmental Protection Agency's NONROAD or Mobile6 emission models may be required. The results of the inventory would be compared to established thresholds to determine if implementation of the proposed projects would result in an air quality impact. More permanent air quality impacts will result from the forecasted increase in operations at the airport. As the number of operations increase, these potential impacts may need to be evaluated as part of any required environmental documentation for planned projects.

DEPARTMENT OF TRANSPORTATION SECTION 4(f) RESOURCES

Section 4(f) properties include publicly owned land from a public park, recreational area, or wildlife and waterfowl refuge of national, state, or local significance, or any land from a historic site of national, state, or local significance.

Based on a review of local mapping, none of the proposed airport improvements will result in direct impacts to Section 4(f) resources. The parcels of land west of the airport identified for fee simple or avigation easement acquisition are privately owned and are not identified as a public park, recreational area, or wildlife and waterfowl refuge of national, state, or local significance, or land from a historic site of national, state, or local significance. Additionally, indirect impacts to Section 4(f) resources are not anticipated due to the distance between the airport and area parks and recreational facilities.

FISH, WILDLIFE, AND PLANTS

Biotic resources include the various types of plants and animals that are present in a particular area. The term also applies to rivers, lakes, wetlands, forests, and other habitat types that support plants, birds, and/or fish. Typically, development in areas such as previously disturbed airport property, populated places, or farmland would result in minimal impacts to biotic resources.

The U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) are charged with overseeing the requirements contained within Section 7 of the *Endangered Species Act*. This Act was put into place to protect animal or plant species whose populations are threatened by human activities. Along with the FAA, the FWS and the NMFS review projects to determine if a significant impact to these protected species will result with implementation of a proposed project. Significant impacts occur when the proposed action could jeopardize the continued existence of a protected species or would result in the destruction or adverse modification of federally designated critical habitat in the area.

The *Sikes Act* and various amendments authorize states to prepare statewide wildlife conservation plans, and the Department of Defense (DOD) to prepare similar plans, for resources under their jurisdiction. Airport improvement projects should be checked for consistency with the State or DOD Wildlife Conservation Plans where such plans exist.

Table D1 depicts federally and state listed threatened and endangered species for Klickitat County. According to the U.S. FWS Upper Columbia Fish and Wildlife Office website, there are three species that are federally listed as threatened or endangered in Klickitat County. In addition, the Washington Department of Fish and Wildlife lists an additional 41 species as threatened or endangered.

TABLE D1
State and Federally Listed Threatened or Endangered Species in Klickitat County, Washington

Common Name	Species	Federal Status	State Status
Ferruginous hawk	*Buteo regalis*	-	Threatened
Marbled murrelet	*Brachyramphus marmoratus*	-	Threatened
Sage grouse	*Centrocercus urophasianus*	-	Threatened
Sharp-tailed grouse	*Tympanuchus phasianellus*	-	Threatened
Lynx	*Lynx canadensis*	-	Threatened
Mazama (Western) pocket gopher	*Thomomys mazama*	-	Threatened
Steller sea lion	*Eumetopias jubatus*	-	Threatened
Western gray squirrel	*Sciurus griseus*	-	Threatened
Green sea turtle	*Chelonia mydas*	-	Threatened
Loggerhead sea turtle	*Caretta caretta*	-	Threatened
Ferruginous hawk	*Buteo regalis*	-	Threatened
Marbled murrelet	*Brachyramphus marmoratus*	-	Threatened
Sage grouse	*Centrocercus urophasianus*	-	Threatened
Sharp-tailed grouse	*Tympanuchus phasianellus*	-	Threatened
Northern leopard frog	*Rana pipiens*	-	Endangered
Oregon spotted frog	*Rana pretiosa*	-	Endangered
American white pelican	*Pelecanus erythrorhynchos*	-	Endangered
Fin whale	*Baleonoptera physalus*	-	Endangered
Fisher	*Martes pennanti*	-	Endangered
Gray wolf	*Canis lupus*	Endangered	Endangered
Grizzly bear	*Ursus arctos*	-	Endangered
Humpback whale	*Megaptera novaeangliae*	-	Endangered
Killer whale	*Orcinus orca*	-	Endangered
Pygmy rabbit	*Brachylagus idahoensis*	-	Endangered
Sea otter	*Enhydra lutris*	-	Endangered
Sei whale	*Baleonoptera borealis*	-	Endangered
Sperm whale	*Physeter macrocephalus*	-	Endangered
Woodland caribou	*Rangifer tarandus*	-	Endangered
Leatherback sea turtle	*Dermochelys coriacea*	-	Endangered
Western pond turtle	*Actinemys marmorata*	-	Endangered
Bull trout	*Salvelinus confluentus*	Threatened	-
Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened	-

Source: FWS online listed species database, http://www.fws.gov/easternwashington/species/countySppLists.html, accessed November 2009
Washington Department of Fish and Wildlife, http://wdfw.wa.gov/wildlife/management/endangered.html

Several of the listed species are unlikely to be present at the airport due to absence of suitable habitat. Species unlikely to be present at the airport include the bull trout, sea lion, sea turtle, sea otter, and whale species which require aquatic habitat. Additionally, the habitat range of the gray wolf does not include Washington or Oregon and therefore it is unlikely to be present within the project area.

Planned airport development projects that would require the development of relatively undisturbed land include: relocation of Dallesport Road, portions of the Runway 7-25 threshold taxiways, the extension of the Runway 12-30 parallel taxiway, and expansion of the terminal apron. Field surveys may be required to determine the potential for the presence of protected species for these projects. Additionally, coordination with the U.S. FWS and/or the Washington Department of Fish and Wildlife may be necessary to determine the extent, if any, of field investigations prior to undertaking any of the planned improvements.

FARMLAND

The *Farmland Protection Policy Act* (FPPA) was enacted to preserve farmland. FPPA guidelines apply to farmland classified as prime or unique, or of state or local importance as determined by the appropriate government agency, with concurrence by the Secretary of Agriculture.

According to information obtained from the United States Department of Agriculture's National Resource Conservation Service (NRCS) website, soils of statewide importance are located throughout the airport property, except for the western portions near the terminal area. The northern portion of the terminal area is classified as prime farmland, if irrigated, and the southern portion is classified as not prime farmland. The areas designated as prime farmland if irrigated would be exempt from FPPA as no irrigation system exists for this area. Additionally, those areas classified as soils of statewide importance are identified as urban on the Klickitat County NRCS soil map, and therefore could be exempt from FPPA requirements. Portions of the property identified for acquisition on the east side of the airport are classified as prime farmland. Further coordination with the NRCS may be required prior to the land acquisition project to determine if it is subject to FPPA requirements.

FLOODPLAINS

As defined in FAA Order 1050.1E, floodplains consist of "lowland and relatively flat areas adjoining inland and coastal water including flood prone areas of offshore islands, including at a minimum, that area subject to one percent or greater chance of flooding in any given year." Federal agencies are directed to take action to reduce the risk of flood loss, minimize the impact of floods on human safety, health and welfare, and restore and preserve the natural and beneficial values served by floodplains. Floodplains have natural and beneficial values, such as providing ground water recharge, water quality maintenance, fish, wildlife, plants, open space, natural beauty, outdoor recreation, agriculture, and forestry. FAA Order 1050.1E (12) (c) indicates that "if the proposed action and reasonable alternatives are not within the limits of a base floodplain (100-year flood area)," that it may be assumed that there are no floodplain impacts. The limits of base floodplains are determined by Flood Insurance Rate Maps (FIRM) prepared by the Federal Emergency Management Agency (FEMA).

A review of FEMA floodplain information indicates that the airport is located outside of the 100-year floodplain. None of the proposed airport improvements will occur within the 100-year floodplain for the Columbia River.

HAZARDOUS MATERIALS, POLLUTION PREVENTION, AND SOLID WASTE

Federal, state, and local laws regulate hazardous materials use, storage, transport, and disposal. These laws may extend to past and future landowners of properties containing these materials. In addition, disrupting sites containing hazardous materials or contaminates may cause significant impacts to soil, surface water, groundwater, air quality, and the organisms using these resources.

The EPA's *Enviromapper for Envirofacts*[1] was consulted regarding the presence of impaired waters or regulated hazardous sites. No impaired waters are located on or in the vicinity of the airport. According to the site, there are no SUPERFUND hazardous waste sites located within the vicinity of the airport.

An environmental due diligence audit (EDDA) may be required for the area identified for acquisition to determine the presence of any recognized environmental conditions (RECs). An REC is defined by the American Society for Testing and Materials as the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances, or petroleum products into the ground, groundwater, or surface water of a property.

A construction-related National Pollutant Discharge Elimination System (NPDES) permit may be required prior to on-airport construction projects. The permit requires a Notice of Intent for all construction activities disturbing one or more acre of land. In conjunction with the NPDES, a Storm Water Pollution Prevention Plan (SWPPP) may be required to outline the best management practices to be used to minimize impacts to storm water conveyance systems.

[1] http://www.epa.gov/enviro/emef/, Accessed March 2010.

HISTORICAL AND CULTURAL RESOURCES

Determination of a project's impact to historical and cultural resources is made in compliance with the *National Historic Preservation Act* (NHPA) *of 1966*, as amended for federal undertakings. A historic property is defined as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP). Properties or sites having traditional religions or cultural importance to Native American Tribes may also qualify.

Planned airport development projects that would require the development of relatively undisturbed land include: relocation of Dallesport Road and portions of the Runway 7-25 threshold taxiways, the extension of the Runway 12-30 parallel taxiway, and expansion of the terminal apron. Field surveys may be required to determine the potential for historic properties in the airport environs. Additionally, coordination with the Washington Department of Archaeology and Historic Preservation may be necessary to determine the extent, if any, of field investigations prior to undertaking any of the planned improvements. Projects such as the fuel farm, terminal building, and emergency services building are planned for areas that are relatively disturbed and regularly maintained; therefore, it is not anticipated that impacts to historical sites would occur with these projects.

NOISE

Per federal regulation, the Yearly Day-Night Average Sound Level (DNL) is used in this study to assess aircraft noise. DNL is the metric currently accepted by the FAA, EPA, and Department of Housing and Urban Development (HUD) as an appropriate measure of cumulative noise exposure. These three agencies have each identified the 65 DNL noise contour as the threshold of incompatibility. Noise exposure contours are overlaid on maps of existing and planned land uses to determine areas that may be affected by aircraft noise at or above 65 DNL. The noise exposure contours are developed using the FAA-approved Integrated Noise Model (INM) which accepts inputs for several airport characteristics including: aircraft type, operations, flight tracks, time of day, and topography.

Exhibit D1 depicts the existing condition noise exposure contours for Columbia Gorge Regional Airport. As shown on the exhibit, the 65 DNL noise contour remains entirely on airport property. The existing 65 DNL noise contour does not encompass any noise-sensitive land uses based on a review of aerial photography for the area. **Exhibit D2** depicts the forecast 2015 condition noise contours. As with the existing condition, the 65 DNL noise contour remains on airport property does not affect any noise-sensitive land uses. **Exhibit D3** depicts the forecast 2030 condition noise contours. As with the existing condition and 2015 conditions, the 65

DNL noise contour remains on airport property and does not affect any noise-sensitive land uses.

COMPATIBLE LAND USE

The compatibility of existing and planned land uses in the vicinity of an airport is typically associated with the extent of the airport's noise impacts. Noise impacts are generally evaluated by comparing the extent and airport's noise exposure contours to the land uses within the immediate vicinity of the airport. As previously discussed, the existing and future noise contours for Columbia Gorge Regional Airport do not affect any noise-sensitive land uses.

LIGHT EMISSIONS AND VISUAL IMPACTS

Airport lighting is characterized as either airfield lighting (i.e., runway, taxiway, approach and landing lights) or landside lighting (i.e., security lights, building interior lighting, parking lights, and signage). Generally, airport lighting does not result in significant impacts unless a high intensity strobe light, such as a Runway End Identifier Light (REIL), would produce glare on any adjoining site, particularly residential uses.

Visual impacts relate to the extent that the proposed development contrasts with the existing environment and whether a jurisdictional agency considers this contrast objectionable. The visual sight of aircraft, aircraft contrails, or aircraft lights at night, particularly at a distance that is not normally intrusive, should not be assumed to constitute an adverse impact.

Additional security lighting may be constructed as part of the planned apron and hangar developments. These lights would be shielded and focused on the aprons and hangars to minimize increases in off-airport illumination.

The planned runway end identifier lights for Runway 25 will change lighting in areas east of the airport. Presently, there are no light-sensitive land uses, such as residences, located within the area immediately south of the airport; therefore, no impacts are anticipated with implementation of this project.

Additionally, the Runway 12 precision approach path indicator light system (PAPI) will alter lighting north of the airport. Residences located on the north side of Tidyman Road are approximately 1,200 feet north of the proposed PAPI. However, due to the distance between the light source and the residences, no impacts are anticipated with implementation of this project.

09MP06-D1-07/16/10

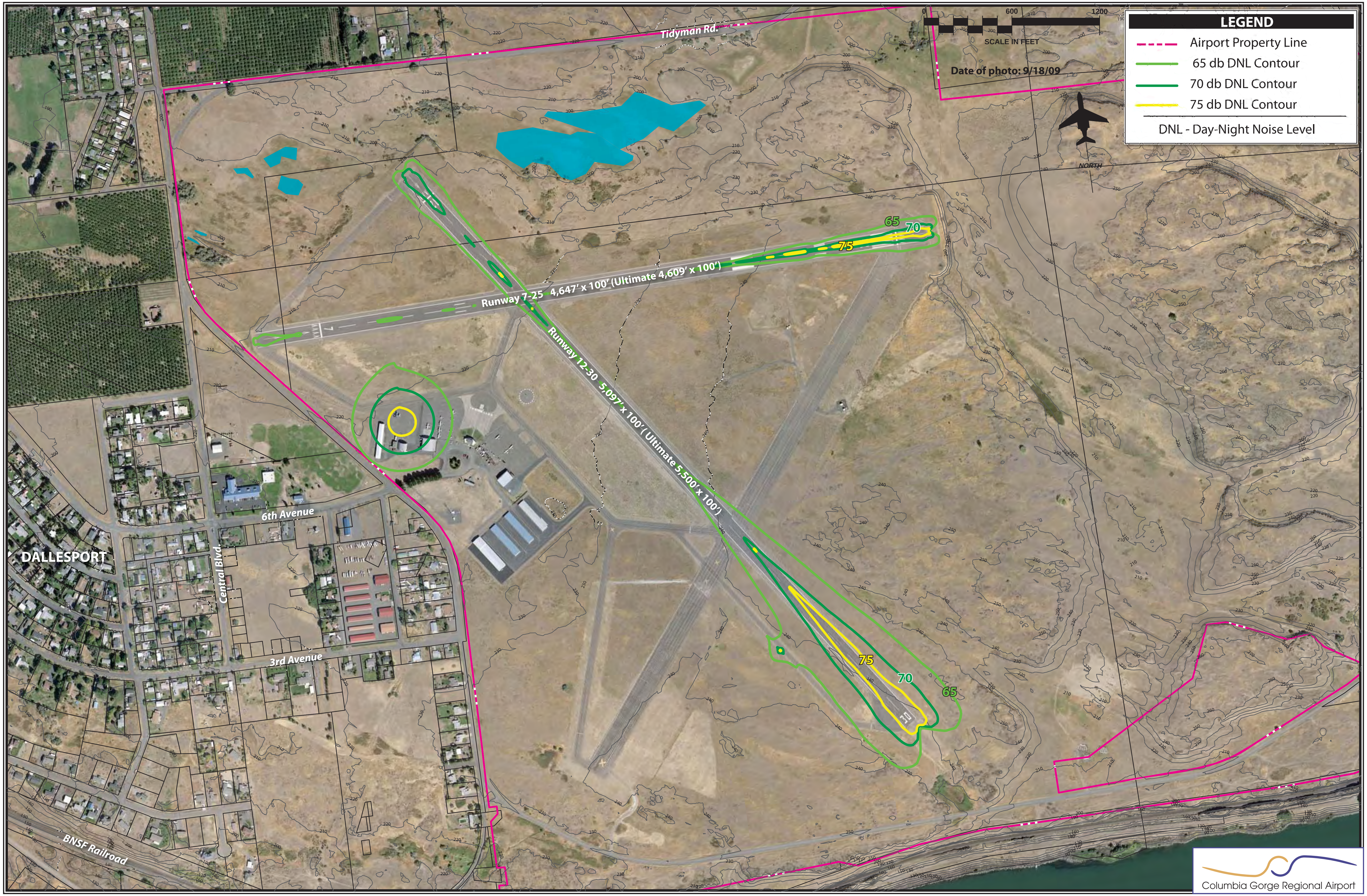


Exhibit D1
2010 NOISE CONTOURS

09MP06-D2-07/16/10

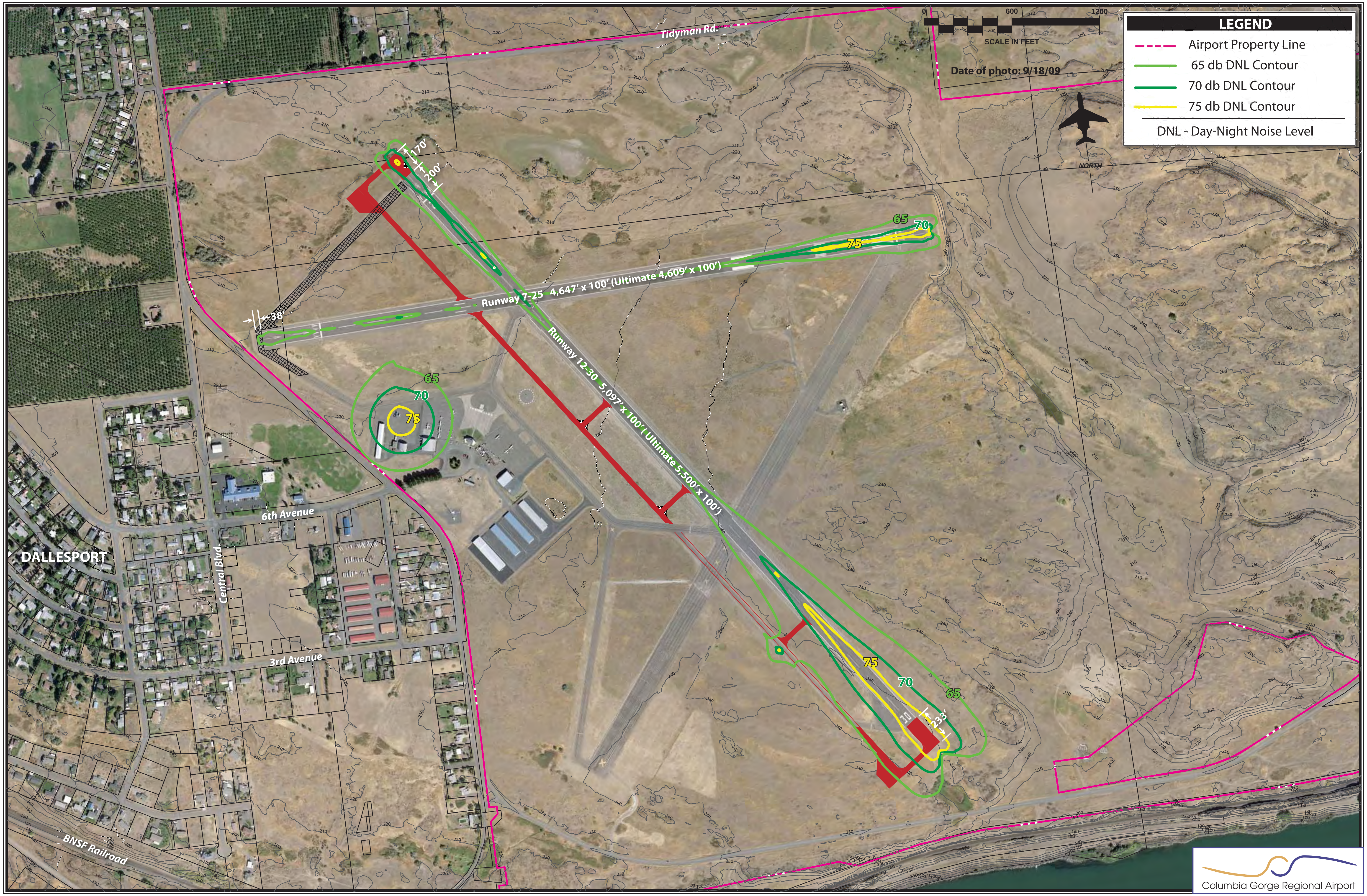


Exhibit D2
2015 NOISE CONTOURS

09MP06-D3-07/16/10

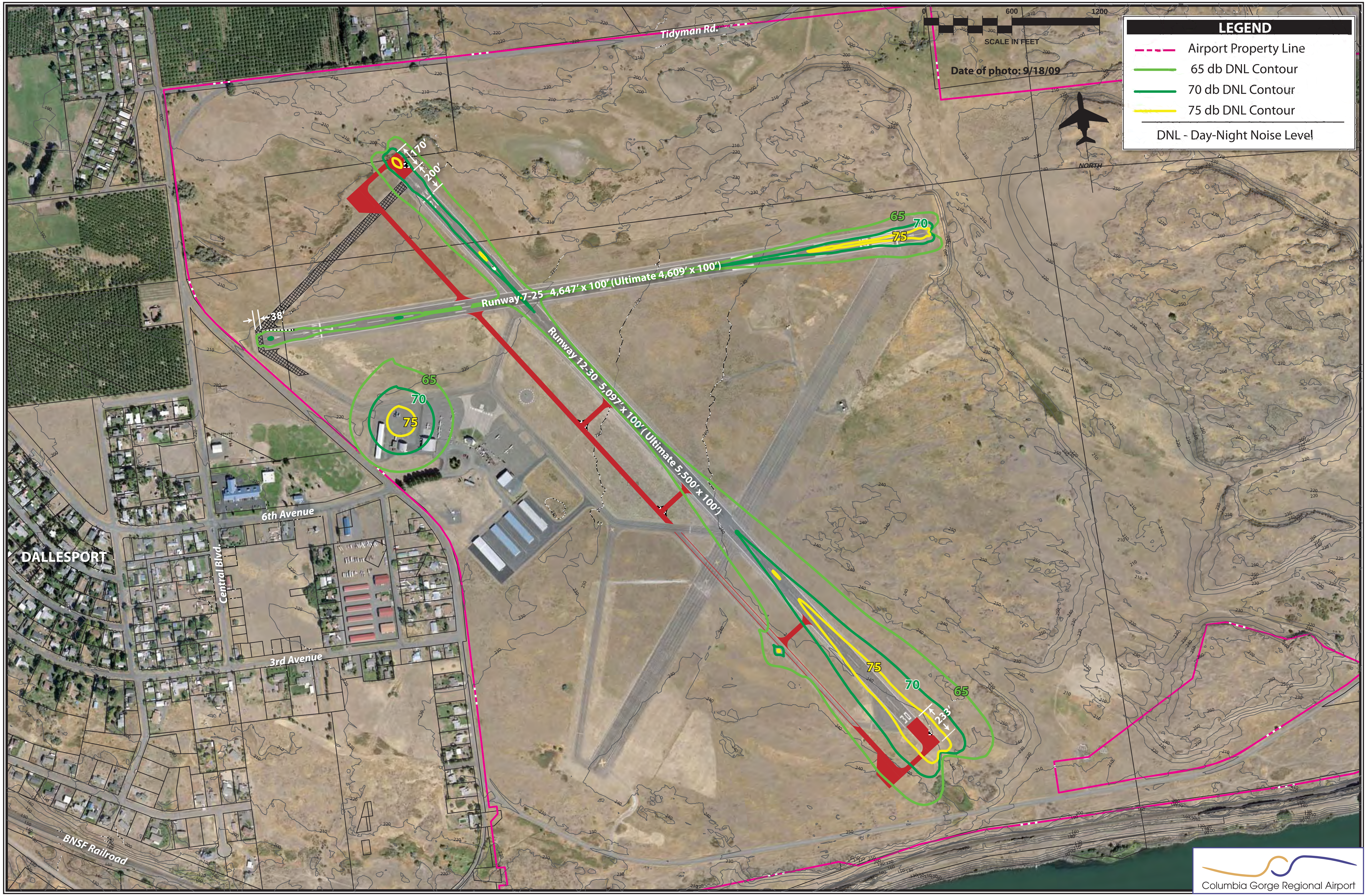


Exhibit D3
2030 NOISE CONTOURS

SOCIOECONOMIC IMPACTS, ENVIRONMENTAL JUSTICE, AND CHILDREN'S ENVIRONMENTAL HEALTH AND SAFETY RISKS

Socioeconomic impacts known to result from airport improvements are often associated with relocation activities or other community disruptions, including alterations to surface transportation patterns, division or disruption of existing communities, interferences with orderly planned development, or an appreciable change in employment related to the project.

The acquisition of real property or displacing people or businesses is required to conform to the *Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970* (URARPAPA). These regulations mandate that certain relocation assistance services be made available to owners/tenants of the properties. As indicated on Exhibit 5A, one seven-acre area is identified for acquisition to accommodate hangar development and development parcels. The planned acquisition area does not include any residences or businesses. Acquisition of these parcels will require conformance with the regulations outlined in URARPAPA.

Executive Order 12898, *Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations,* and the accompanying Presidential Memorandum, and Order DOT 5610.2, *Environmental Justice*, require FAA to provide for meaningful public involvement by minority and low-income populations, as well as analysis that identifies and addresses potential impacts on these populations that may be disproportionately high and adverse.

According to the U.S. Census Bureau, the block group[2] that includes the airport, the airport environs do not contain high percentages (above 50 percent) of minority populations or high percentages of residents below the poverty level.

Pursuant to Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks,* federal agencies are directed to identify and assess environmental health and safety risks that may disproportionately affect children. These risks include those that are attributable to products or substances that a child is likely to come in contact with or ingest, such as air, food, drinking water, recreational waters, soil, or products to which they may be exposed.

During construction of the projects outlined within the master plan, appropriate measures should be taken to prevent access by unauthorized persons to construction project areas. Additionally, best management practices should be implemented to decrease environmental health risks to children.

[2] U.S. Census Bureau, http://www.census.gov/, accessed March 2010

WETLANDS AND WATERS OF THE U.S.

The U.S. Army Corps of Engineers (USACE) regulates the discharge of dredge and/or fill material into waters of the United States, including adjacent wetlands, under Section 404 of the *Clean Water Act*.

Wetlands are defined by Executive Order 11990, *Protection of Wetlands*, as "those areas that are inundated by surface or groundwater with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction." Categories of wetlands include swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflows, mud flats, natural ponds, estuarine area, tidal overflows, and shallow lakes and ponds with emergent vegetation. Wetlands exhibit three characteristics: hydrology, hydrophytes (plants able to tolerate various degrees of flooding or frequent saturation), and poorly drained soils.

A Wetland Delineation Report was prepared for the northwestern portion of Columbia Gorge Regional Airport in June 2008. The location of wetlands identified during field surveys of this area are identified on **Exhibit D4**. Seven wetlands are present in the survey area totaling 9.8 acres. As shown on **Exhibit D4**, airport improvements included in the master plan will not disturb the identified wetlands in the northwest portion of the airport. Additionally, according to the National Wetlands Inventory maintained by the FWS, a wetland area is located at the southern end of Runway 12-30. The location of the wetland area is identified on **Exhibit D4**. This area may be affected as part of the Runway Safety Area grading associated with the proposed southerly extension of Runway 12-30. Field surveys and coordination with the USACE may be necessary during the environmental documentation process for development in areas that have not been surveyed to determine the presence of jurisdictional wetlands within those areas.

WATER QUALITY

The *Clean Water Act* provides the authority to establish water quality standards, control discharges, develop waste treatment management plans and practices, prevent or minimize the loss of wetlands, and regulate other issues concerning water quality. Water quality concerns related to airport development most often relate to the potential for surface runoff and soil erosion, as well as the storage and handling of fuel, petroleum products, solvents, etc.

The EPA's Enviromapper website indicates that there are no impaired streams within the vicinity of the airport.

09MP06-04-07/16/10

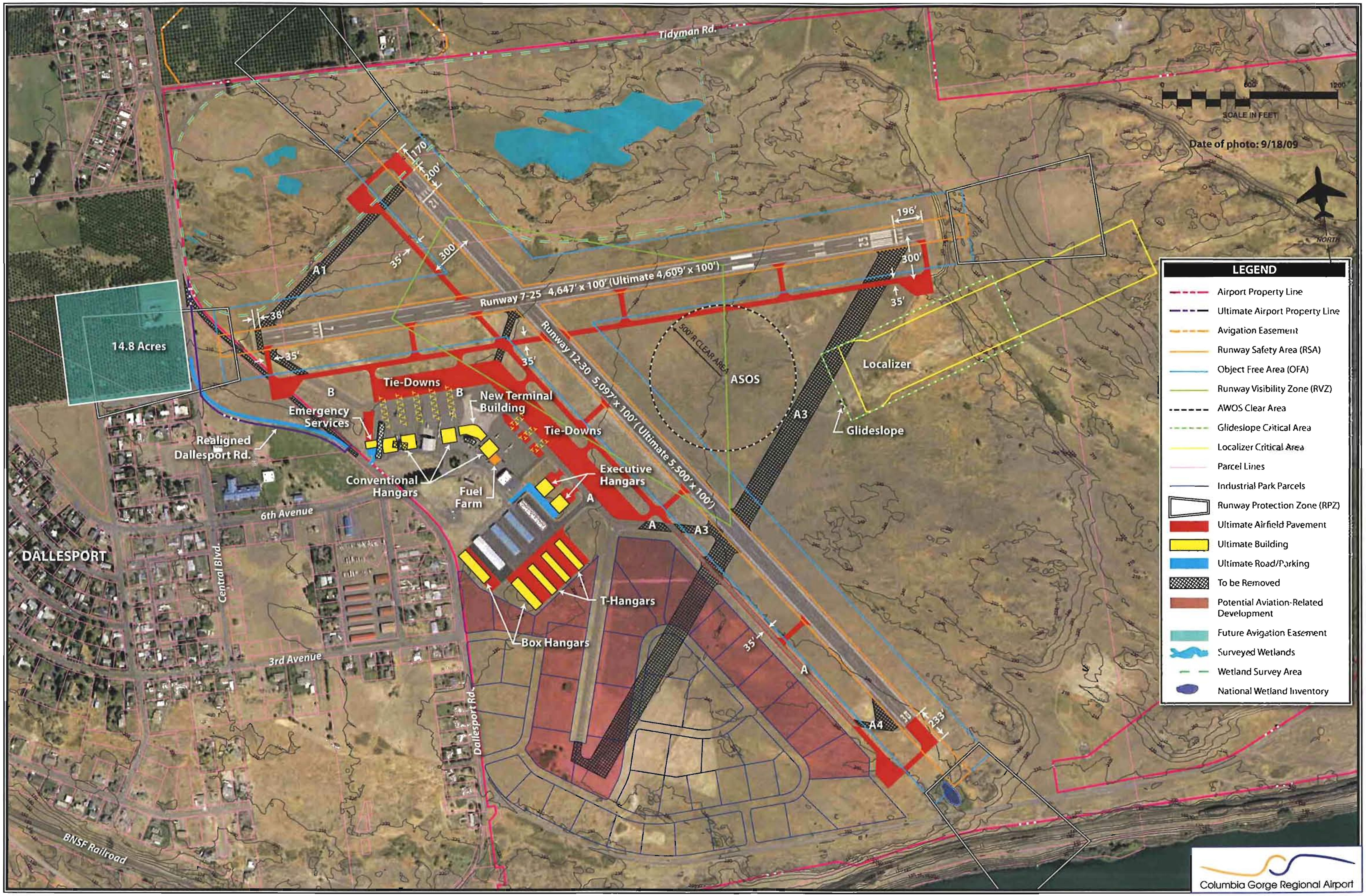


Exhibit D4
MASTER PLAN CONCEPT WITH WETLANDS

During construction of any of the planned improvements at the airport, it is suggested that mitigation measures from FAA Advisory Circular 150/5370-10A, *Standards for Specifying Construction of Airports, Item P-156, Temporary Air and Water Pollution, Soil Erosion and Siltation Control*, be incorporated into project design specifications to further mitigate potential water quality impacts. These standards include temporary measures to control water pollution, soil erosion, and siltation through the use of berms, fiber mats, gravels, mulches, slope drains, and other erosion control methods.

DRINKING WATER

The quality of the drinking water available to the airport and the adjacent Town of Dallesport is an important environmental consideration. In 1974, Congress enacted the *Safe Drinking Water Act* (SDWA) with the goal of ensuring safe drinking water for all users of public supplies. The EPA has the regulatory authority to enforce the Act and has directed states to develop a Wellhead Protection Program (WHP) in order to maximize the safety of the water supply at the local level. The Dallesport Water District has developed a WHP for their service area which includes the airport.

The WHP includes the following elements:

- A susceptibility assessment.
- Identification of the WHP Time-of-Travel (TOT) zones.
- An inventory of potential contaminant sources and land use activities.
- A discussion of the management strategy.
- Contingency and emergency response planning.
- Supporting information and documentation.

There are two Dallesport Water District wellheads that are in close proximity to the airport. The first, identified as Well No. 3, is on the west of Dallesport Road near the intersection with 6th Avenue. This wellhead is approximately 700 feet from the airport terminal building. The second, Well No. 2, is located approximately 500 feet further to the west along 6th Avenue. The airport also has a new well located in the planned business park that may ultimately be connected to the Dallesport Water District distribution network.

Exhibit D5 is a map contained within the WHP narrative report that identifies the one, five, and ten year TOT zones. Time of travel refers to the amount of time it takes a particle of groundwater entering the aquifer at the boundary of the WHP zone to reach the well after one, five, or ten years of pumping.

Two items at the airport were identified as items of concern. The first is an external heating oil tank located outside the Life Flight Services hangar. This tank does not have secondary containment and sits on a gravel base. The second is a long strip trench that drains storm water runoff from the main apron to a catch basin. The strip trench is adjacent to the airport fuel station as well as heavy equipment and aircraft parking areas. While not specifically identified in the WHP narrative report, the existing underground fuel farm and fueling island is within a few feet of the ten-year TOT.

09MP06-D5-7/16/10

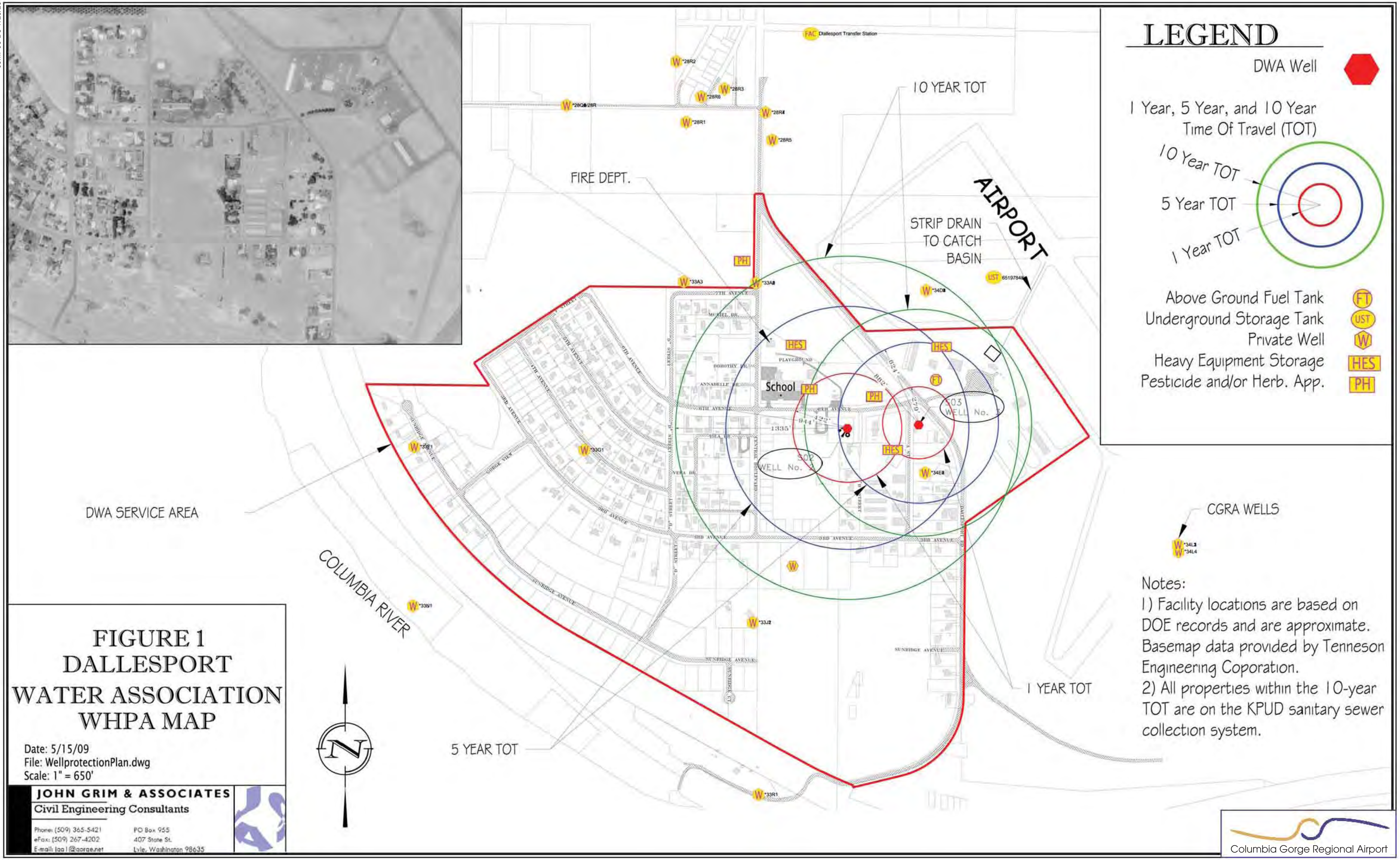


Exhibit D5
WELLHEAD PROTECTION
PROGRAM MAP

Columbia Gorge Regional Airport

Appendix E

AIRPORT PLANS

Appendix E
AIRPORT PLANS

As part of this master plan, the Federal Aviation Administration (FAA) requires the development of several computer drawings detailing specific parts of the airport and its environs. These drawings were created on a computer-aided drafting system (CAD) and serve as the official depiction of the current and planned condition of the airport. These drawings will be delivered to the FAA for their review and inspection. The FAA will critique the drawings from a technical perspective to be sure all applicable federal regulations are met. The FAA will use the CAD drawings as the basis and justification for funding decisions.

It should be noted that the FAA requires that any changes to the airfield (i.e., runway and taxiway system, etc.) be represented on the drawings. The landside configuration developed during this master planning process is also depicted on the drawings, but the FAA recognized that landside development is much more fluid and dependent upon developer needs. Thus, an updated drawing set is not typically necessary for future landside alterations.

The following is a description of the CAD drawings included with this master plan.

AIRPORT LAYOUT PLAN

An official Airport Layout Plan (ALP) drawing has been developed for Columbia Gorge Regional Airport, a draft of which is included in this appendix. The ALP drawing graphically presents the existing and ultimate airport layout plan. The ALP drawing will include such elements as the physical airport features, wind data tabulation, location of airfield facilities (i.e., runways, taxiways, navigational aids), and existing general aviation development (and commercial development for air carrier airports). Also presented on the ALP are the runway safety areas, airport property boundary, and revenue support areas. The ALP is used by the FAA to determine funding eligibility for future capital projects.

The computerized plan provides detailed information on existing and future facility layouts on multiple layers that permit the user to focus on any section of the airport at a desired scale. The plan can be used as base information for design and can be easily updated in the future to reflect new development and more detail concerning existing conditions as made available through design surveys.

FAR PART 77 AIRSPACE DRAWING

Federal Aviation Regulation (F.A.R.) Part 77, *Objects Affecting Navigable Airspace*, was established for use by local authorities to control the height of objects near airports. The FAR Part 77 Airspace Drawing included in this master plan is a graphic depiction of this regulatory criterion. The FAR Part 77 Airspace Drawing is a tool to aid local authorities in determining if proposed development could present a hazard to aircraft using the airport. The FAR Part 77 Airspace Drawing can be a critical tool for the airport sponsor's use in reviewing proposed development in the vicinity of the airport.

The airport sponsors should do all in their power to ensure development stays below the FAR Part 77 surfaces to protect the role of the airport. The following discussion will describe those surfaces that make up the recommended FAR Part 77 surfaces at Columbia Gorge Regional Airport.

The FAR Part 77 Airspace Drawing assigns three-dimensional imaginary surfaces associated with the airport. These imaginary surfaces emanate from the runway centerline(s) and are dimensioned according to the visibility minimums associated with the approach to the runway end and size of aircraft to operate on the runway. The FAR Part 77 imaginary surfaces include the primary surface, approach surface, transitional surface, horizontal surface, and conical surface. Each surface is described as follows:

Primary Surface

The primary surface is an imaginary surface longitudinally centered on the runway. The primary surface extends 200 feet beyond each runway end. The elevation of any point on the primary surface is the same as the elevation along the nearest associated point on the runway centerline. Under FAR Part 77 regulations, the primary surface for both runways is 500 feet wide.

Approach Surface

An approach surface is also established for each runway end. The approach surface begins at the same width as the primary surface, extends upward and outward from the primary surface end, and is centered along an extended runway centerline. The approach surface leading to each runway is based upon the type of approach available (instrument or visual) or planned.

In an effort to protect the airport from future adjacent incompatible land uses, approach surfaces with instrument approach procedures are planned to each runway end. The approach slope dimensions are based on a non-precision instrument approach with greater than ¾-miles visibility. The approach surface extends from the primary surface at a 34:1 slope to a distance of 10,000 feet and a width of 3,500 feet.

Transitional Surface

Each runway has a transitional surface that begins at the outside edge of the primary surface at the same elevation as the runway. The transitional surface also connects with the approach surfaces of each runway. The surface rises at a slope of 7 to 1, up to a height 150 feet above the highest runway elevation. At that point, the transitional surface is replaced by the horizontal surface.

Horizontal Surface

The horizontal surface is established at 150 feet above the highest elevation of the runway surface. Having no slope, the horizontal surface connects the transitional and approach surfaces to the conical surface at a distance of 10,000 feet from the end of the primary surfaces of each runway.

Conical Surface

The conical surface begins at the outer edge of the horizontal surface. The conical surface then continues for an additional 4,000 feet horizontally at a slope of 20 to 1. Therefore, at 4,000 feet from the horizontal surface, the elevation of the conical surface is 350 feet above the highest airport elevation.

APPROACH SURFACE PROFILE DRAWINGS

The runway profile drawing presents the entirety of the FAR Part 77 approach surface to the runway ends. It also depicts the runway centerline profile with elevations. This drawing provides profile detail that the Airspace Drawing does not. The profile drawings also depict the existing and future Threshold Siting Surface.

INNER APPROACH SURFACE DRAWINGS

The Inner Portion of the Approach Surface Drawing contains the plan and profile view of the inner portion of the approach surface to the runway and a tabular listing of all surface violations. The drawing also contains other approach surfaces, such as the threshold siting surface. Detailed obstruction and facility data is provided to identify planned improvements and the disposition of obstructions. A drawing of each runway end is provided.

TERMINAL AREA DRAWING

The terminal area drawing is a larger scale plan view drawing of existing and planned aprons, buildings, hangars, parking lots, and other landside facilities. It is prepared in accordance with FAA AC 150/5300-13, *Airport Design*.

AIRPORT LAND USE DRAWING

The objective of the Airport Land Use Drawing is to coordinate uses of the airport property in a manner compatible with the functional design of the airport facility. Airport land use planning is important for orderly development and efficient use of available space. There are two primary considerations for airport land use planning. These are to secure those areas essential to the safe and efficient operation of the airport and to determine compatible land uses for the balance of the property which would be most advantageous to the airport and community.

In the development of an airport land use plan for Columbia Gorge Regional Airport, the airport property was broken into several large general tracts. Each tract was analyzed for specific site characteristics, such as tract size and shape, land characteristics, and existing land uses. The availability of utilities and the accessibility to various transportation modes were also considered. Limitations and constraints to development such as height and noise restrictions, runway visibility zones, and contiguous land uses were analyzed next. Finally, the compatibility of various land uses in each tract was analyzed.

The depiction of on-airport land uses on this drawing becomes the official FAA acceptance of current and future land uses. For Columbia Gorge Regional Airport, all airport property adjacent to the taxiways and runways is planned for aviation purposes.

AIRPORT PROPERTY MAP

The Airport Property Map provides information on property under airport control and is therefore subject to FAA grant assurances. The various recorded deeds that make up the airport property are listed in tabular format. The primary purpose of the drawing is to provide information for analyzing the current and future aeronautical use of land acquired with federal funds.

DEPARTURE SURFACE DRAWING

For runways supporting instrument operations, such as Runway 25, a separate drawing depicting the departure surface is required. The departure service, also called the one engine inoperable (OEI) obstacle identification surface (OIS) is a surface emanating from the departure end of the runway to a distance of 10,200 feet. The inner width is 1,000 feet and the outer width is 6,466 feet. On January 1, 2009, the FAA required that the airport have this drawing completed. The departure surface information should be made available to any commercial operator at the airport.

There are three recommended methods to mitigate penetrations to this surface:

1. The object is removed or lowered.
2. The Takeoff Distance Available (TODA) is decreased (i.e., pilots are instructed to lift off prior to the runway end in order to avoid the obstruction.
3. Instrument departure minimums are raised.

Existing obstacles of 35 feet or less would not require mitigation; instead, new departure procedures may be introduced or existing departure procedures may be altered or no action may be taken.

DRAFT ALP DISCLAIMER

The ALP set has been developed in accordance with accepted FAA standards. The ALP set has not yet been approved by the FAA and is subject to FAA airspace review. Land use and other changes may result.

AIRPORT LAYOUT PLANS

Prepared For The City Of The Dalles, Oregon and Klickitat County, Washington

Columbia Gorge Regional Airport Dallesport, Washington

Date of Photo:9/18/2009

INDEX OF DRAWINGS

1. AIRPORT DATA SHEET
2. AIRPORT LAYOUT PLAN
3. TERMINAL AREA DRAWING
4. AIRPORT AIRSPACE DRAWING
5. RUNWAYS 7-25 & 12-30 APPROACH SURFACE PROFILES
6. INNER PORTION OF RUNWAY 7-25 APPROACH SURFACE DRAWING
7. INNER PORTION OF RUNWAY 12-30 APPROACH SURFACE DRAWING
8. AIRPORT LAND USE DRAWING
9. EXHIBIT A - PROPERTY MAP
10. RUNWAY 7-25 DEPARTURE SURFACE DRAWING
11. RUNWAY 12-30 DEPARTURE SURFACE DRAWING

PRELIMINARY

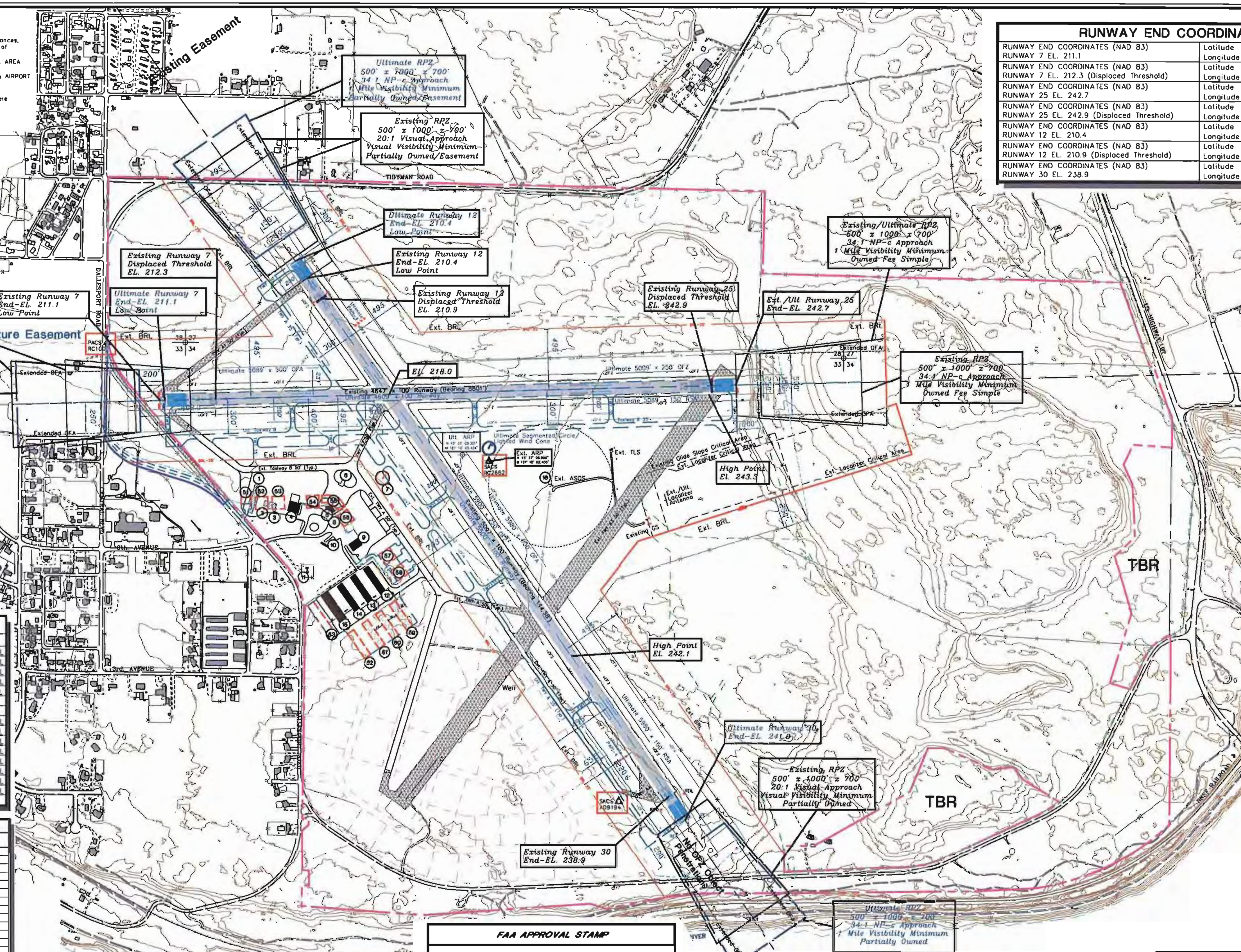
July 2010

PRECISION APPROACH ENGINEERING

Coffman Associates Airport Consultants www.coffmanassociates.com

GENERAL NOTES:

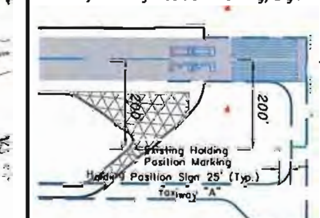
1. Depiction of features and objects, including related elevations and clearances, Within the runway approach surfaces are depicted on the Inner Portion of Runway Approach Surface Drawings.
2. Details concerning terminal improvements are depicted on the TERMINAL AREA DRAWING.
3. Recommended land uses within the airport environs are depicted on the AIRPORT LAND USE DRAWING.
4. Photography Dated September 18, 2009.
5. Existing/ultimate fence along existing/ultimate Property Line except where shown.
6. TBR: To be released.



RUNWAY END COORDINATES (NAD 83)

RUNWAY END COORDINATES (NAD 83) RUNWAY 7 EL. 211.1	Latitude Longitude	N 45° 37' 14.890" W 121° 10' 40.860"	N 45° 37, 14.903" W 121° 10' 40.326"
RUNWAY END COORDINATES (NAD 83) RUNWAY 7 EL. 212.3 (Displaced Threshold)	Latitude Longitude	N 45° 37' 15.050" W 121° 10' 34.680"	Remove
RUNWAY END COORDINATES (NAD 83) RUNWAY 25 EL. 242.7	Latitude Longitude	N 45° 37' 16.490" W 121° 09' 35.530"	SAME
RUNWAY END COORDINATES (NAD 83) RUNWAY 25 EL. 242.9 (Displaced Threshold)	Latitude Longitude	N 45° 37' 16.420" W 121° 09' 38.280"	Remove
RUNWAY END COORDINATES (NAD 83) RUNWAY 12 EL. 210.4	Latitude Longitude	N 45° 37' 24.700" W 121° 10' 24.380"	N 45° 37' 26.068" W 121° 10' 25.766"
RUNWAY END COORDINATES (NAD 83) RUNWAY 12 EL. 210.9 (Displaced Threshold)	Latitude Longitude	N 45° 37' 23.090" W 121° 10' 22.750"	Remove
RUNWAY END COORDINATES (NAD 83) RUNWAY 30 EL. 238.9	Latitude Longitude	N 45° 36' 43.690" W 121° 09' 42.820"	N 45° 36' 41.817" W 121° 09 40.922"

Taxiway Holding Position Marking/Sign



Ultimate Buildings/Facilities

NO.	Description/Elevation (MSL)	
50	Hangar	25' AGL
51	Hangar	25' AGL
52	Hangar	25' AGL
53	Hangar	25' AGL
54	Hangar	25' AGL
55	Hangar	25' AGL
56	Hangar	25' AGL
57	Hangar	25' AGL
58	Hangar	25' AGL
59	T-Hangar (10 units)	22' AGL
60	T-Hangar (10 units)	22' AGL
61	T-Hangar (10 units)	22' AGL
62	Box Hangar	22' AGL
63	Box Hangar	22' AGL

Existing Buildings/Facilities

NO.	Description/Elevation (MSL)	
1	T-Hangar (10 units) (Otis)	239 MSL
2	Quonset Hut Hangar	236 MSL
3	Quonset Hut Hangar	246 MSL
4	Hangar (AAE)	248 MSL
5	Terminal Building	251 MSL
6	Fuel Island	N/A
7	Segmented Circle	–
8	Equipment Storage	239 MSL
9	Hangar (Shearer Sprayers)	251 MSL
10	Resident Security	239 MSL
11	Airport Beacon	332 MSL
12	T-Hangar (10 units)	245 MSL
13	T-Hangar (10 units)	247 MSL
14	T-Hangar (10 units)	247 MSL
15	T-Hangar (10 units)	259 MSL
16	ASOS	–

LEGEND

EXISTING	ULTIMATE	DESCRIPTION
None		ULTIMATE ROAD
None		ABANDONED PAVEMENT (To Be Removed)
		AIRPORT REFERENCE POINT (ARP)
	Same	AIRPORT ROTATING BEACON
		BUILDING
	Same	DRAINAGE
		FACILITY CONSTRUCTION
None	PAPI-4	NAVIGATIONAL AID INSTALLATION (PAPI-4)
REIL	REIL	RUNWAY END IDENTIFICATION LIGHTS
		RUNWAY THRESHOLD LIGHTS
	Same	SECTION CORNER
		SEGMENTED CIRCLE/WIND INDICATOR
	Same	TOPOGRAPHY (2009)
	Same	ASOS
		HOLDING POSITION MARKING
	Same	DIRT ROAD
		FENCING
		AIRPORT PROPERTY LINE/with FENCE
BRL		BUILDING RESTRICTION LINE (BRL)
EXTENDED OFA		EXTENDED OBJECT FREE AREA
		PARCELS
uRVZ		ULTIMATE RUNWAY VISIBILITY ZONE
uOFZ		ULTIMATE OBSTACLE FREE ZONE
uRSA		ULTIMATE RUNWAY SAFETY AREA
uOFZ		ULTIMATE OBSTACLE FREE ZONE
		EXISTING/ULTIMATE TREES
		SURVEY MONUMENT (PACS/SACS)
		RUNWAY SHADE
	Same	TIE-DOWNS
		RUNWAY PROTECTION ZONE (RPZ)

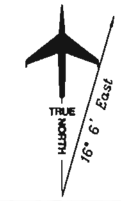
OBSTACLE FREE ZONE (OFZ) OBJECT PENETRATIONS

OBJECT	PENETRATION	DISPOSITION
Road & Fence at Runway 7 end	Yes	Relocate
Fence at Runway 12 end	Yes	Relocate
Fence at Runway 25 end	Yes	Relocate

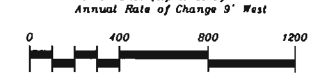
THRESHOLD SITING SURFACE OBJECT PENETRATIONS

OBJECT	PENETRATION	DISPOSITION
Road at Runway 7 end	Yes	Relocate
Trees at Runway 12 end	Yes	Remove Trees
Bluff at Runway 30	Yes	No Action

FAA APPROVAL STAMP



Magnetic Declination
16° 6' East (April 2010)
Annual Rate of Change 9' West



SURVEY CONTROL STATIONS

DESIGNATION/PID	LATITUDE	LONGITUDE
DLS A SACS AD9194	45° 37' 17.135" N	121° 10' 41.027" W
DLS ARP SACS RC2662	45° 37' 6.651" N	121° 10' 2.500" W
K 425 PACS RC1007	45° 36' 36.499" N	121° 09' 48.937" W

No.	REVISIONS	DATE	BY	APP'D.
3	-	-	-	-
2	-	-	-	-
1	Airport Layout Plan Updated	11/04	CWEC	-

"THE PREPARATION OF THESE DOCUMENTS WAS FINANCED IN PART THROUGH A PLANNING GRANT FROM THE FEDERAL AVIATION ADMINISTRATION AS PROVIDED UNDER SECTION 505 OF THE AIRPORT AND AIRWAY IMPROVEMENT ACT OF 1982, AS AMENDED. THE CONTENTS DO NOT NECESSARILY REFLECT THE OFFICIAL VIEWS OR POLICY OF THE FAA. ACCEPTANCE OF THESE DOCUMENTS BY THE FAA DOES NOT IN ANY WAY CONSTITUTE A COMMITMENT ON THE PART OF THE UNITED STATES TO PARTICIPATE IN ANY DEVELOPMENT DEPICTED HEREIN, NOR DOES IT INDICATE THAT THE PROPOSED DEVELOPMENT IS ENVIRONMENTALLY ACCEPTABLE IN ACCORDANCE WITH APPROPRIATE PUBLIC LAWS."

FOR APPROVAL BY:

City of The Dalles ____ DATE: ____

Klickitat County ____ DATE: ____

Columbia Gorge Regional Airport

AIRPORT LAYOUT PLAN

PRELIMINARY

The Dalles, Oregon & Klickitat County, Washington

PLANNED BY: Patrick C. Taylor | DETAILED BY: Larry D. Johnson

APPROVED BY: Stephen C. Wagner | July 19, 2010 | SHEET 2 OF 11

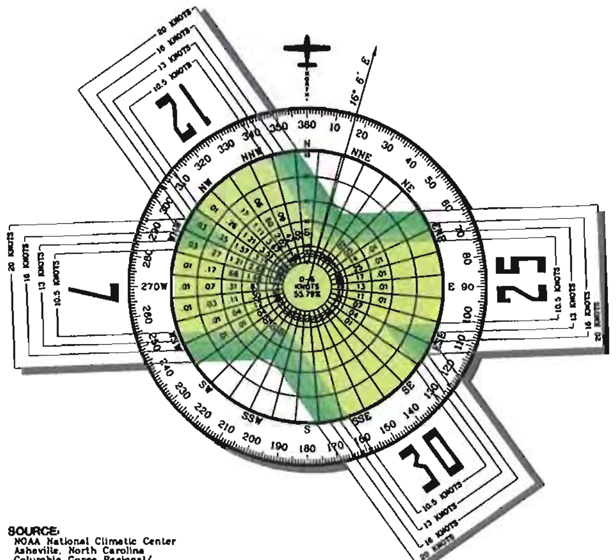
PRECISION APPROACH ENGINEERING

Coffman Associates Airport Consultants www.coffmanassociates.com

Coffman Associates-LDJ dls_alp.dwg Monday August 2 2010 4:04pm

ALL WEATHER WIND COVERAGE

RUNWAYS	10.5 Knots 12 MPH	13 Knots 15 MPH	16 Knots 18 MPH	20 Knots 23 MPH
Runway 7-25	90.66%	95.88%	98.78%	99.86%
Runway 12-30	96.08%	97.77%	99.34%	99.87%
Combined	99.70%	99.96%	100.00%	100.00%

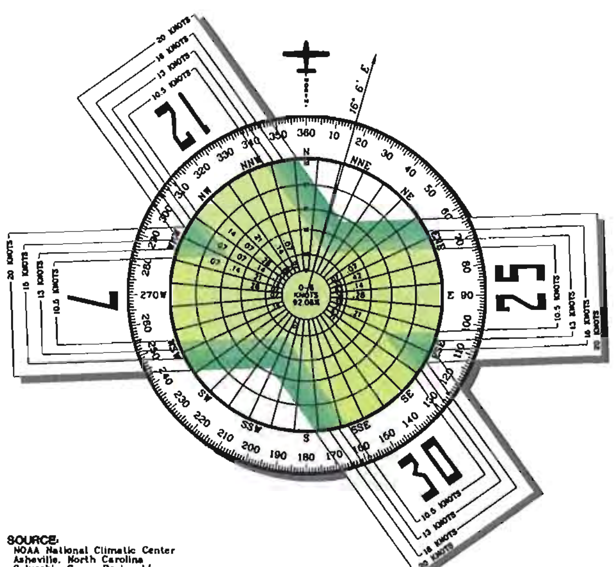


SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Columbia Gorge Regional/
The Dalles Municipal Airport (DLS)
Dalles Port, Washington

OBSERVATIONS:
87,558 All Weather Observations
10/1998-08/2009

IFR WEATHER WIND COVERAGE

RUNWAYS	10.5 Knots 12 MPH	13 Knots 15 MPH	16 Knots 18 MPH	20 Knots 23 MPH
Runway 7-25	99.25%	99.51%	99.86%	100.00%
Runway 12-30	98.97%	99.56%	99.96%	100.00%
Combined	99.96%	100.00%	100.00%	100.00%



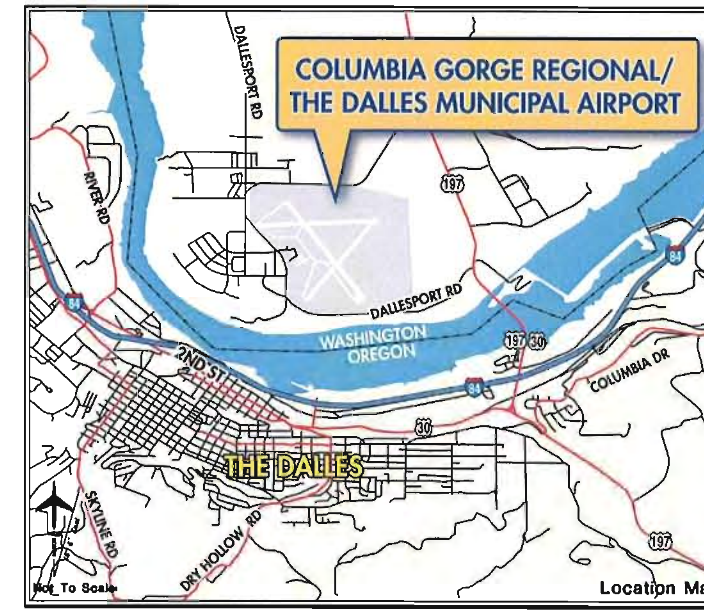
SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Columbia Gorge Regional/
The Dalles Municipal Airport (DLS)
Dalles Port, Washington

OBSERVATIONS:
1,427 IFR CAT-I Observations
10/1998-08/2009

AIRPORT DATA

OWNER: The Dalles, Oregon, USA		AIRPORT NPIAS CODE: GA	
CITY: The Dalles, Oregon, USA		COUNTY: KLICKITAT	
RANGE: R13E TOWNSHIP: T2N			

Columbia Gorge Regional/The Dalles Municipal Airport (DLS)		EXISTING	ULTIMATE
AIRPORT SERVICE LEVEL		General Aviation	SAME
AIRPORT REFERENCE CODE		B-II	B-II
DESIGN AIRCRAFT		King Air 200	King Air 200
AIRPORT ELEVATION (Vert. Datum: NAVD88)		243.3 MSL	243.3 MSL
MEAN MAXIMUM TEMPERATURE OF HOTTEST MONTH		89° (July)	89° (July)
AIRPORT REFERENCE POINT (ARP) COORDINATES (Horz. Datum: NAD83)	Latitude	N 45° 37' 06.800"	N 45° 37' 09.301"
	Longitude	W 121° 10' 02.400"	W 121° 10' 05.434"
AIRPORT INSTRUMENT APPROACH GPS APPROACH		RNAV (GPS)-A LDA/DME (Rwy 25) COPTER LDA/DME LOC/GS	RNAV (GPS)-A LDA/DME (Rwy 25) COPTER LDA/DME LOC/GS (Rwy 25) RNAV (GPS) Rwy 7 RNAV (GPS) Rwy 12 RNAV (GPS) Rwy 30
AIRPORT and TERMINAL NAVIGATIONAL AIDS		Airport Beacon	Airport Beacon
GPS AT AIRPORT		Yes	SAME



RUNWAY DATA

RUNWAY DATA	Runway 7-25 EXISTING	Runway 7-25 ULTIMATE	Runway 12-30 EXISTING	Runway 12-30 ULTIMATE
AIRCRAFT APPROACH CATEGORY-DESIGN GROUP	B-II	B-II	B-II	B-II
CRITICAL AIRCRAFT	King Air 200	King Air 200	King Air 200	King Air 200
WINGSPAN OF CRITICAL AIRCRAFT	54.5'	54.5'	54.5'	54.5'
UNDERCARRIAGE WIDTH OF CRITICAL AIRCRAFT	17.2'	17.2'	17.2'	17.2'
APPROACH SPEED (KNOTS) OF CRITICAL AIRCRAFT	200 knots	200 knots	200 knots	200 knots
MAX. CERTIFIED TAKEOFF WEIGHT (LBS.) OF CRITICAL AIRCRAFT	12,500 lbs	12,500 lbs	12,500 lbs	12,500 lbs
RUNWAY EFFECTIVE GRADIENT	0.7%	0.7%	0.6%	0.6%
RUNWAY MAXIMUM GRADIENT	0.7%	0.7%	0.6%	0.6%
RUNWAY CENTERLINE TO PARALLEL RUNWAY CENTERLINE	N/A	N/A	N/A	N/A
TAXIWAY CENTERLINE TO FIXED OR MOVABLE OBJECT	65.5'	65.5'	65.5'	65.5'
TAXIWAY WINGTIP CLEARANCE	26'	26'	26'	26'
RUNWAY CENTERLINE TO PARALLEL TAXIWAY CENTERLINE	240'	240'	240'	240'
RUNWAY DIMENSIONS (L X W)	4647' x 100'	4609' x 100'	5097' x 100'	5500' x 100'
RUNWAY TRUE BEARING (SURVEYED)	88.01°/ 268.01°	88.01°/ 268.01°	144.58°/ 324.59°	144.58°/ 324.59°
RUNWAY WIND COVERAGE (16 KNOTS/18 MPH)	98.78%	98.78%	99.34%	99.34%
RUNWAY MAXIMUM ELEVATION/HIGH POINT OF RUNWAY	243.9' MSL	243.9' MSL	242.1 MSL	242.1 MSL
ELEVATION OF RUNWAY LOW POINT	210.8 MSL	210.8 MSL	210.4 MSL	210.4 MSL
RUNWAY LIGHTING	MIRL	MIRL	MIRL	MIRL
RUNWAY SURFACE TYPE	Asphalt	Asphalt	Asphalt	Asphalt
RUNWAY PAVEMENT STRENGTH (IN THOUSAND LBS.)[1]	4(S)	30(S), 60(DW)	18(S)	30(S), 60(DW)
LINE OF SIGHT REQUIREMENT MET	No	Yes	No	Yes
TAXIWAY WIDTH	35'	35'	35'	35'
TAXIWAY LIGHTING	Reflectors	MITL	Reflectors/Throat Lights	MITL
TAXIWAY MARKING	Centerline	Centerline	Centerline	Centerline
TAXIWAY SURFACE MATERIAL	Asphalt	Asphalt	Asphalt	Asphalt
TAXIWAY SAFETY AREA WIDTH	79'	79'	79'	79'
TAXIWAY OBJECT FREE AREA WIDTH	131'	131'	131'	131'
TAXIWAY HOLDING POSITION MARKING/HOLDSIGN	200'	200'	200'	200'

	RUNWAY 7	RUNWAY 25	RUNWAY 7	RUNWAY 25	RUNWAY 12	RUNWAY 30	RUNWAY 12	RUNWAY 30
PART 77 CATEGORY	BV	NP-C	NP-C	NP-C	BV	BV	NP-C	NP-C
PART 77 APPROACH SLOPE	20:1	34:1	34:1	34:1	20:1	20:1	34:1	34:1
RUNWAY INSTRUMENTATION	Visual	Nonprecision	Nonprecision	Nonprecision	Visual	Visual	Nonprecision	Nonprecision
RUNWAY END MARKING	Visual	Precision	Visual	Nonprecision	Visual	Visual	Nonprecision	Nonprecision
RUNWAY BLAST PAD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RUNWAY APPROACH VISIBILITY MINIMUMS (LOWEST)	Visual	1 mile	1 mile	1 mile	Visual	Visual	1 mile	1 mile
RUNWAY APPROACH LIGHTING	None	None	None	None	None	None	None	None
PRECISION OBJECT FREE ZONE (800' X 200')	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
THRESHOLD SITING REQUIREMENTS (APPENDIX 2)	Rwy Type 4	Rwy Type 5	Rwy Type 5	Rwy Type 5	Rwy Type 4	Rwy Type 4	Rwy Type 5	Rwy Type 5
THRESHOLD SITING SURFACE OBJECT PENETRATIONS	YES	Yes	NO	NO	Yes	Yes	NO	Yes
ELEVATION (NAVD88) OF RUNWAY ENDS	211.1 MSL	242.7 MSL	211.1 MSL	242.7 MSL	210.4 MSL	238.9 MSL	210.4 MSL	241.0
RUNWAY THRESHOLD DISPLACEMENT	440' (Dspld)	196' (Dspld)	N/A	N/A	200' (Dspld)	None	N/A	N/A
RUNWAY DISPLACED THRESHOLD ELEVATION (NAVD 88)	212.3 MSL	242.9 MSL	N/A	N/A	210.9 MSL	N/A	N/A	N/A
ELEVATION (NAVD88) OF RUNWAY TOUCHDOWN ZONE	239.5 (TDZE)	243.3 (TDZE)	234.0 (TDZE)	243.3 (TDZE)	240.3 (TDZE)	242.1 (TDZE)	240.3 (TDZE)	242.1 (TDZE)
RUNWAY SAFETY AREA (RSA BEYOND STOP END)	300'	300'	300'	300'	300'	300'	300'	300'
RUNWAY SAFETY AREA WIDTH	150'	150'	150'	150'	150'	150'	150'	150'
RUNWAY OBJECT FREE AREA (OFA BEYOND STOP END)	300'	300'	300'	300'	300'	300'	300'	300'
RUNWAY OBJECT FREE AREA WIDTH	500'	500'	500'	500'	500'	500'	500'	500'
RUNWAY OBSTACLE FREE ZONE (BEYOND STOP END)	200'	200'	200'	200'	200'	200'	200'	200'
RUNWAY OBSTACLE FREE ZONE WIDTH	250'	250'	250'	250'	250'	250'	250'	250'
TAKEOFF RUN AVAILABLE (TORA)	4647'	4647'	4609'	4609'	5097'	5097'	5500'	5500'
TAKEOFF DISTANCE AVAILABLE (TODA)	4647'	4647'	4609'	4609'	5097'	5097'	5500'	5500'
ACCELERATE-STOP DISTANCE AVAILABLE (ASDA)	4207'	4451'	4609'	4609'	4897'	5097'	5500'	5500'
LANDING DISTANCE AVAILABLE (LDA)	4207'	4451'	4609'	4609'	4897'	5097'	5500'	5500'
ELECTRONIC NAVIGATIONAL AIDS	Visual	LDA/DME LOC/GS	RNAV (GPS)	LDA/DME LOC/GS	Visual	Visual	RNAV (GPS)	RNAV (GPS)
RUNWAY VISUAL NAVIGATIONAL AIDS	None	None	None	REIL	None	REIL	PAPI-4	PAPI-4 REIL

1 PAVEMENT STRENGTHS ARE EXPRESSED IN SINGLE (S), DUAL (D), DUAL TANDEM (DT), AND/OR DOUBLE DUAL TANDEM (DDT) WHEEL LOAD CAPACITIES.
2 (Third Party SURVEY 8/18/2005)

No.	REVISIONS	DATE	BY	APP'D.
3	-	-	-	-
2	-	-	-	-
1	Airport Layout Plan Updated	11/04	CWEC	-

"THE PREPARATION OF THESE DOCUMENTS WAS FINANCED IN PART THROUGH A PLANNING GRANT FROM THE FEDERAL AVIATION ADMINISTRATION AS PROVIDED UNDER SECTION 505 OF THE AIRPORT AND AIRWAY IMPROVEMENT ACT OF 1982, AS AMENDED. THE CONTENTS DO NOT NECESSARILY REFLECT THE OFFICIAL VIEWS OR POLICY OF THE FAA. ACCEPTANCE OF THESE DOCUMENTS BY THE FAA DOES NOT IN ANY WAY CONSTITUTE A COMMITMENT ON THE PART OF THE UNITED STATES TO PARTICIPATE IN ANY DEVELOPMENT DEPICTED HEREIN, NOR DOES IT INDICATE THAT THE PROPOSED DEVELOPMENT IS ENVIRONMENTALLY ACCEPTABLE IN ACCORDANCE WITH APPROPRIATE PUBLIC LAWS."

Columbia Gorge Regional Airport

AIRPORT DATA SHEET

PRELIMINARY

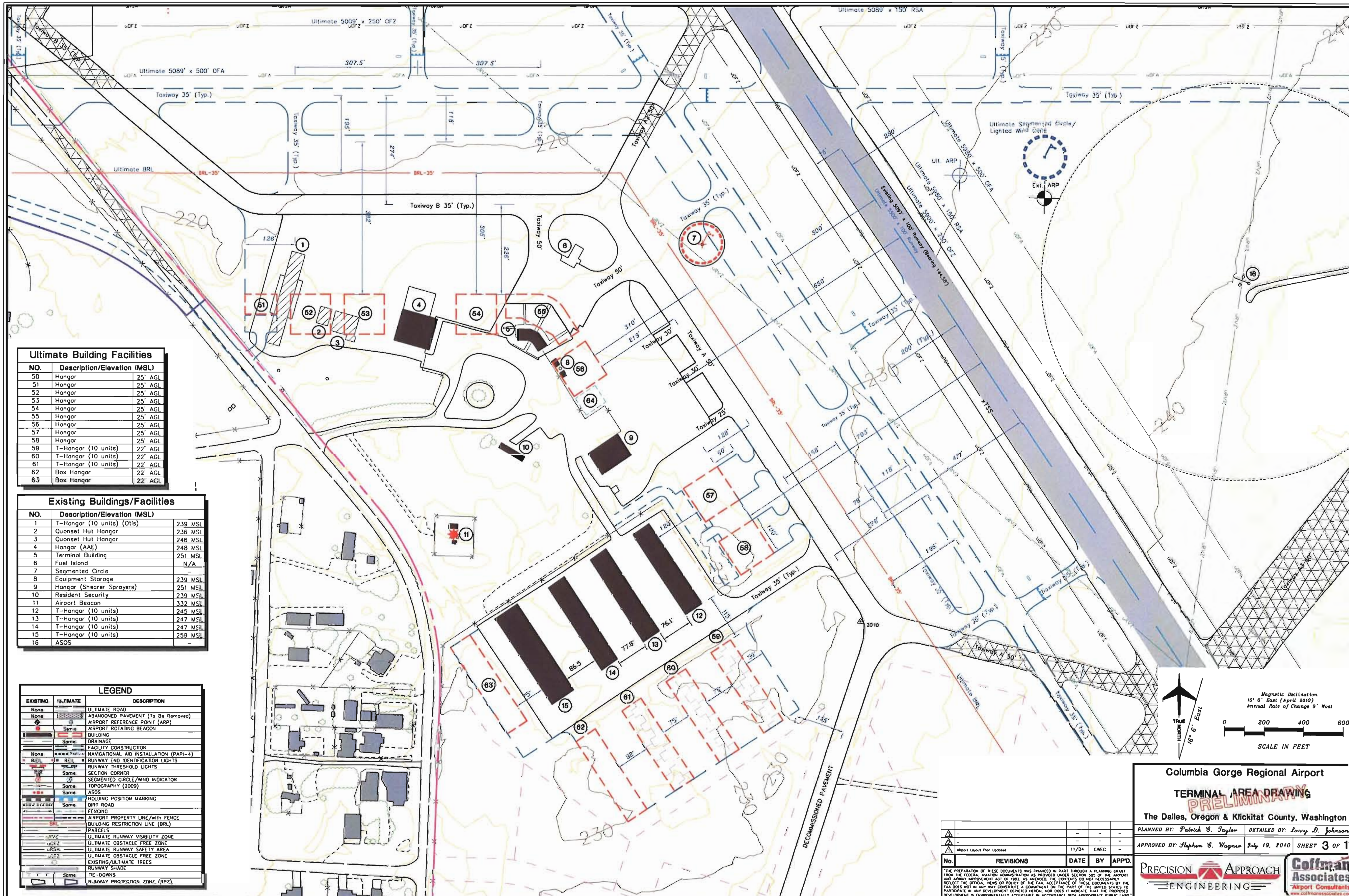
The Dalles, Oregon & Klickitat County, Washington

PLANNED BY: Patrick E. Taylor | DETAILED BY: Larry D. Johnson

APPROVED BY: Stephen E. Wagner | July 19, 2010 | SHEET 1 OF 11

PRECISION APPROACH ENGINEERING

Coffman Associates Airport Consultants www.coffmanassociates.com



Ultimate Building Facilities

NO.	Description/Elevation (MSL)	
50	Hangar	25' AGL
51	Hangar	25' AGL
52	Hangar	25' AGL
53	Hangar	25' AGL
54	Hangar	25' AGL
55	Hangar	25' AGL
56	Hangar	25' AGL
57	Hangar	25' AGL
58	Hangar	25' AGL
59	T-Hangar (10 units)	22' AGL
60	T-Hangar (10 units)	22' AGL
61	T-Hangar (10 units)	22' AGL
62	Box Hangar	22' AGL
63	Box Hangar	22' AGL

Existing Buildings/Facilities

NO.	Description/Elevation (MSL)	
1	T-Hangar (10 units) (Otis)	239 MSL
2	Quonset Hut Hangar	236 MSL
3	Quonset Hut Hangar	246 MSL
4	Hangar (AAE)	248 MSL
5	Terminal Building	251 MSL
6	Fuel Island	N/A
7	Segmented Circle	–
8	Equipment Storage	239 MSL
9	Hangar (Shearer Sprayers)	251 MSL
10	Resident Security	239 MSL
11	Airport Beacon	332 MSL
12	T-Hangar (10 units)	245 MSL
13	T-Hangar (10 units)	247 MSL
14	T-Hangar (10 units)	247 MSL
15	T-Hangar (10 units)	259 MSL
16	ASOS	–

LEGEND

EXISTING	ULTIMATE	DESCRIPTION
None		ULTIMATE ROAD
None		ABANDONED PAVEMENT (To Be Removed)
		AIRPORT REFERENCE POINT (ARP)
	Same	AIRPORT ROTATING BEACON
		BUILDING
	Same	DRAINAGE
		FACILITY CONSTRUCTION
None	PAPI-4	NAVIGATIONAL AID INSTALLATION (PAPI-4)
REIL	REIL	RUNWAY END IDENTIFICATION LIGHTS
		RUNWAY THRESHOLD LIGHTS
	Same	SECTION CORNER
		SEGMENTED CIRCLE/WIND INDICATOR
	Same	TOPOGRAPHY (2009)
	Same	ASOS
		HOLDING POSITION MARKING
	Same	DIRT ROAD
		FENCING
		AIRPORT PROPERTY LINE/with FENCE
BRL		BUILDING RESTRICTION LINE (BRL)
		PARCELS
uRVZ		ULTIMATE RUNWAY VISIBILITY ZONE
uOFZ		ULTIMATE OBSTACLE FREE ZONE
uRSA		ULTIMATE RUNWAY SAFETY AREA
uOFZ		ULTIMATE OBSTACLE FREE ZONE
		EXISTING/ULTIMATE TREES
		RUNWAY SHADE
	Same	TIE-DOWNS
		RUNWAY PROTECTION ZONE (RPZ)

No.	REVISIONS	DATE	BY	APP'D.
3	-	-	-	-
2	-	-	-	-
1	Airport Layout Plan Updated	11/04	CWEC	-

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Columbia Gorge Regional Airport

TERMINAL AREA DRAWING

PRELIMINARY

The Dalles, Oregon & Klickitat County, Washington

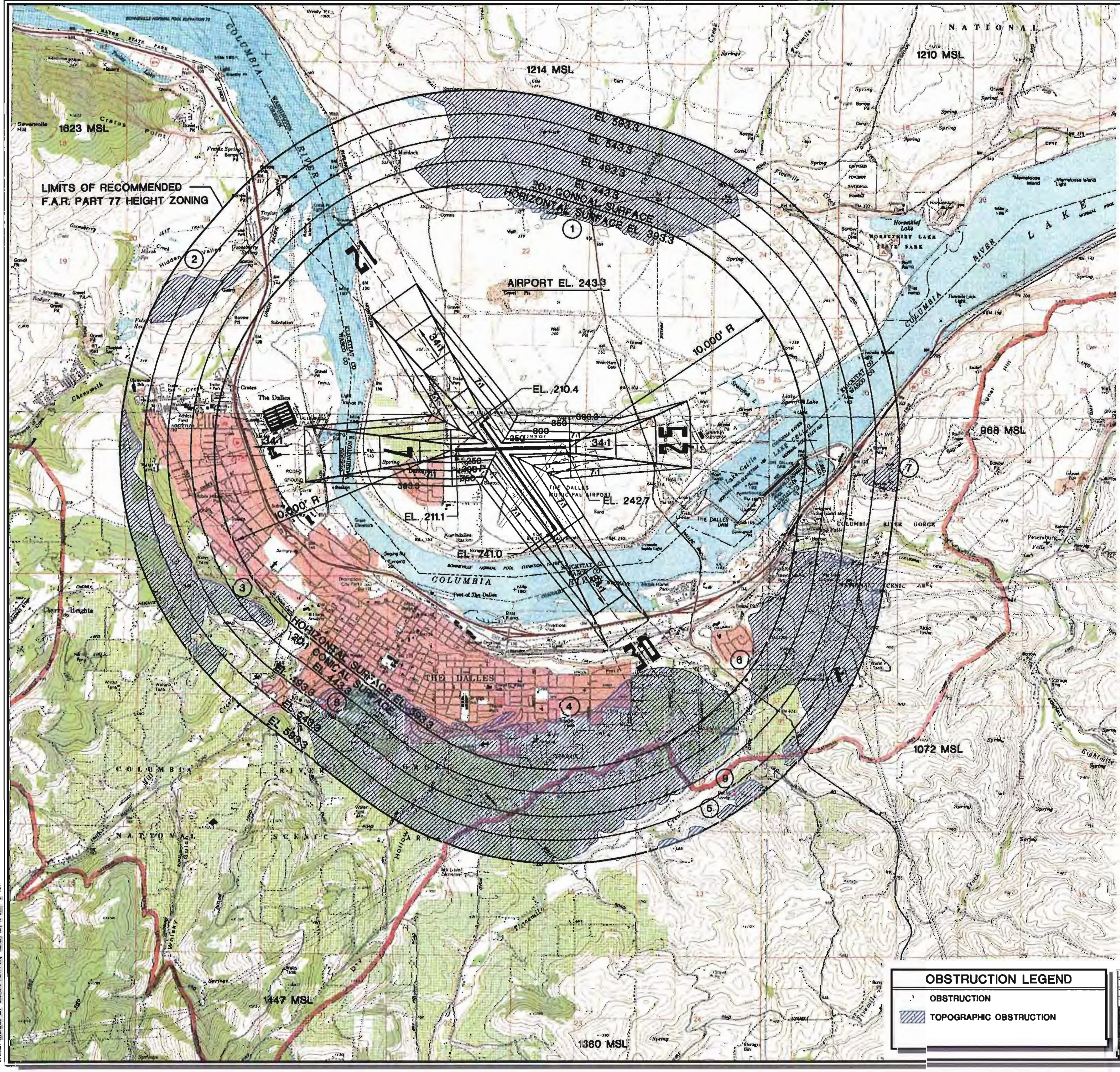
PLANNED BY: Patrick C. Taylor | DETAILED BY: Larry D. Johnson

APPROVED BY: Stephen C. Wagner | July 19, 2010 | SHEET 3 OF 11

PRECISION APPROACH ENGINEERING

Coffman Associates Airport Consultants www.coffmanassociates.com

Coffman Associates-LDJ dls_tap.dwg Monday July 19 2010 9:47am

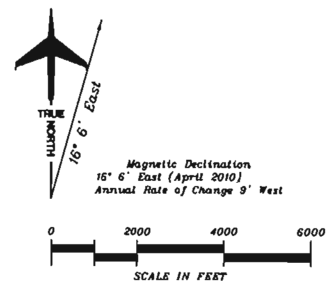


OBSTRUCTION TABLE

Description/Elevation	Obstructed Part 77 Surface	Surface Elevation	Object Penetration	Proposed Object Disposition
1. TERRAIN EL 440 (UP TO 1040 MSL)	Horizontal Surface Conical Surface	393.3 MSL 593.3 MSL	46.7' 446.7'	NO ACTION
2. TERRAIN EL 640	Conical Surface	511.0 MSL	129'	NO ACTION
3. TERRAIN EL 530	Conical Surface	437.0 MSL	93'	NO ACTION
4. TERRAIN EL 940	Horizontal Surface Conical Surface	393.3 MSL 438.0 MSL	546.7' 502'	NO ACTION
5. TERRAIN EL 720	Conical Surface	593.3 MSL	126.7'	NO ACTION
6. TERRAIN EL 480 (UP TO 680 MSL)	Horizontal Surface Conical Surface	393.3 MSL 593.3 MSL	86.7' 286.7	NO ACTION
7 TERRAIN EL 750	Conical Surface	585 MSL	165'	NO ACTION
8. RADIO TOWERS EL 709	Conical Surface	490 MSL	219'	NO ACTION
9. RADIO TOWERS EL 830	Conical Surface	560 MSL	270'	NO ACTION

GENERAL NOTES:

1. Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surfaces, unless otherwise noted. Road obstructions reflect a safety clearance of 10' for dirt Roads or private Roads, 15' for noninterstate Roads, 17' for interstate Roads, and 23' for railroad.
2. Depiction of features and objects within the primary, transitional, and horizontal Part 77 surfaces, is illustrated on the AIRPORT AIRSPACE DRAWINGS.
3. Depiction of features and objects within the outer portion of the approach surfaces, is illustrated on the APPROACH SURFACE PROFILES.
4. Depiction of features and objects within the inner portion of the approach surfaces, is illustrated on the INNER PORTION OF THE RUNWAY APPROACH SURFACE DRAWINGS.



OBSTRUCTION LEGEND

- OBSTRUCTION
- TOPOGRAPHIC OBSTRUCTION

No.	REVISIONS	DATE	BY	APP'D.
3	-	-	-	-
2	-	-	-	-
1	Airport Layout Plan Updated	11/04	CWEC	-

THE PREPARATION OF THESE DOCUMENTS WAS FINANCED IN PART THROUGH A PLANNING GRANT FROM THE FEDERAL AVIATION ADMINISTRATION AS PROVIDED UNDER SECTION 505 OF THE AIRPORT AND AIRWAY IMPROVEMENT ACT OF 1982, AS AMENDED. THE CONTENTS DO NOT NECESSARILY REFLECT THE OFFICIAL VIEWS OR POLICY OF THE FAA. ACCEPTANCE OF THESE DOCUMENTS BY THE FAA DOES NOT IN ANY WAY CONSTITUTE A COMMITMENT ON THE PART OF THE UNITED STATES TO [illegible] DEVELOPMENT AS ENVIRONMENTALLY ACCEPTABLE IN ACCORDANCE WITH APPROPRIATE PUBLIC LAWS.

Columbia Gorge Regional Airport

AIRPORT AIRSPACE DRAWING

PRELIMINARY

The Dalles, Oregon & Klickitat County, Washington

PLANNED BY: Patrick C. Taylor | DETAILED BY: Larry D. Johnson

APPROVED BY: Stephen C. Wagner | July 19, 2010 | SHEET 4 OF 11

PRECISION APPROACH ENGINEERING

Coffman Associates
Airport Consultants
www.coffmanassociates.com

GENERAL NOTES:

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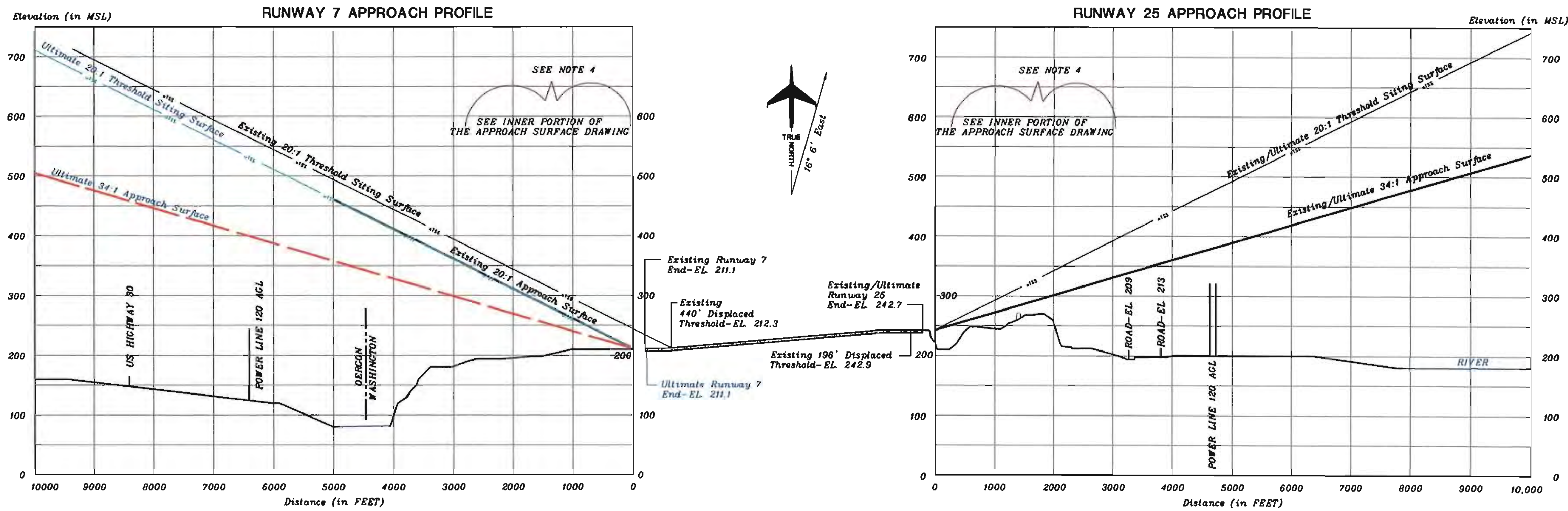

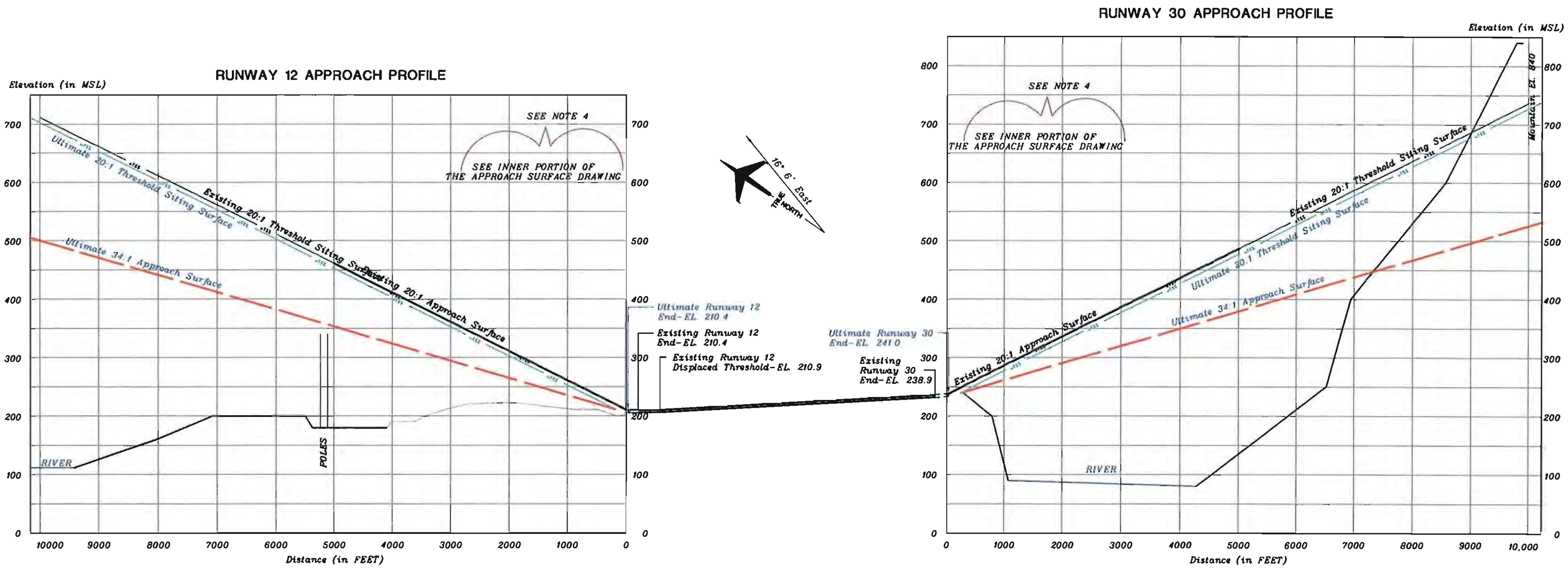

OBSTRUCTION TABLE

Runway 7 Object Description/Elevation	Ult. 34:1 Approach	Ext. 20:1 Approach	Ult. 20:1 TSS Penetration	Proposed Object Disposition
None				

OBSTRUCTION TABLE

Runway 25 Object Description/Elevation	Ult. 34:1 Approach	Ext. 20:1 Approach	Ult. 20:1 TSS Penetration	Proposed Object Disposition
None				

OBSTRUCTION TABLE

Runway 12 Object Description/Elevation	Ult. 34:1 Approach	Ext. 20:1 Approach	Ult. 20:1 TSS Penetration	Proposed Object Disposition
None				

OBSTRUCTION TABLE

Runway 30 Object Description/Elevation	Ult. 34:1 Approach	Ext. 20:1 Approach	Ult. 20:1 TSS Penetration	Proposed Object Disposition
1. Bluff El. 840	390'	N/A	176'	Request Aeronautical Study

Magnetic Declination
16° 6' East (April 2010)
Annual Rate of Change 9' West

0 100 200 300
VERTICAL SCALE IN FEET

0 1000 2000 3000
HORIZONTAL SCALE IN FEET

No.	REVISIONS	DATE	BY	APP'D.
3	-	-	-	-
2	-	-	-	-
1	Airport Layout Plan Updated	11/04	CWEC	-

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Columbia Gorge Regional Airport

RUNWAY 7-25 & RUNWAY 12-30 APPROACH SURFACE PROFILE

PRELIMINARY

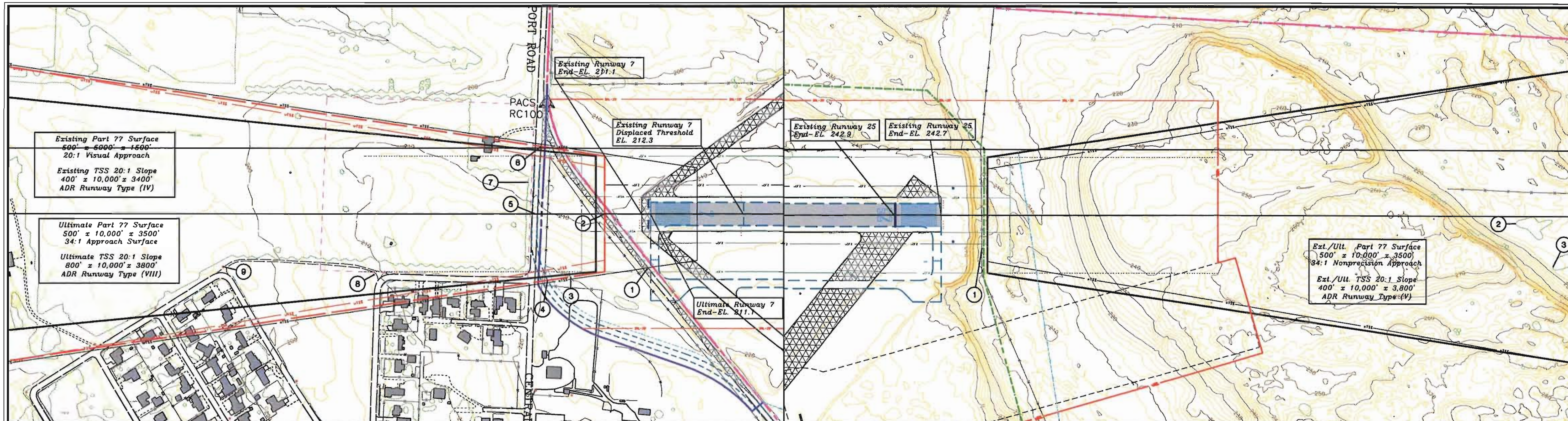
The Dalles, Oregon & Klickitat County, Washington

PLANNED BY: Patrick C. Taylor | DETAILED BY: Larry D. Johnson

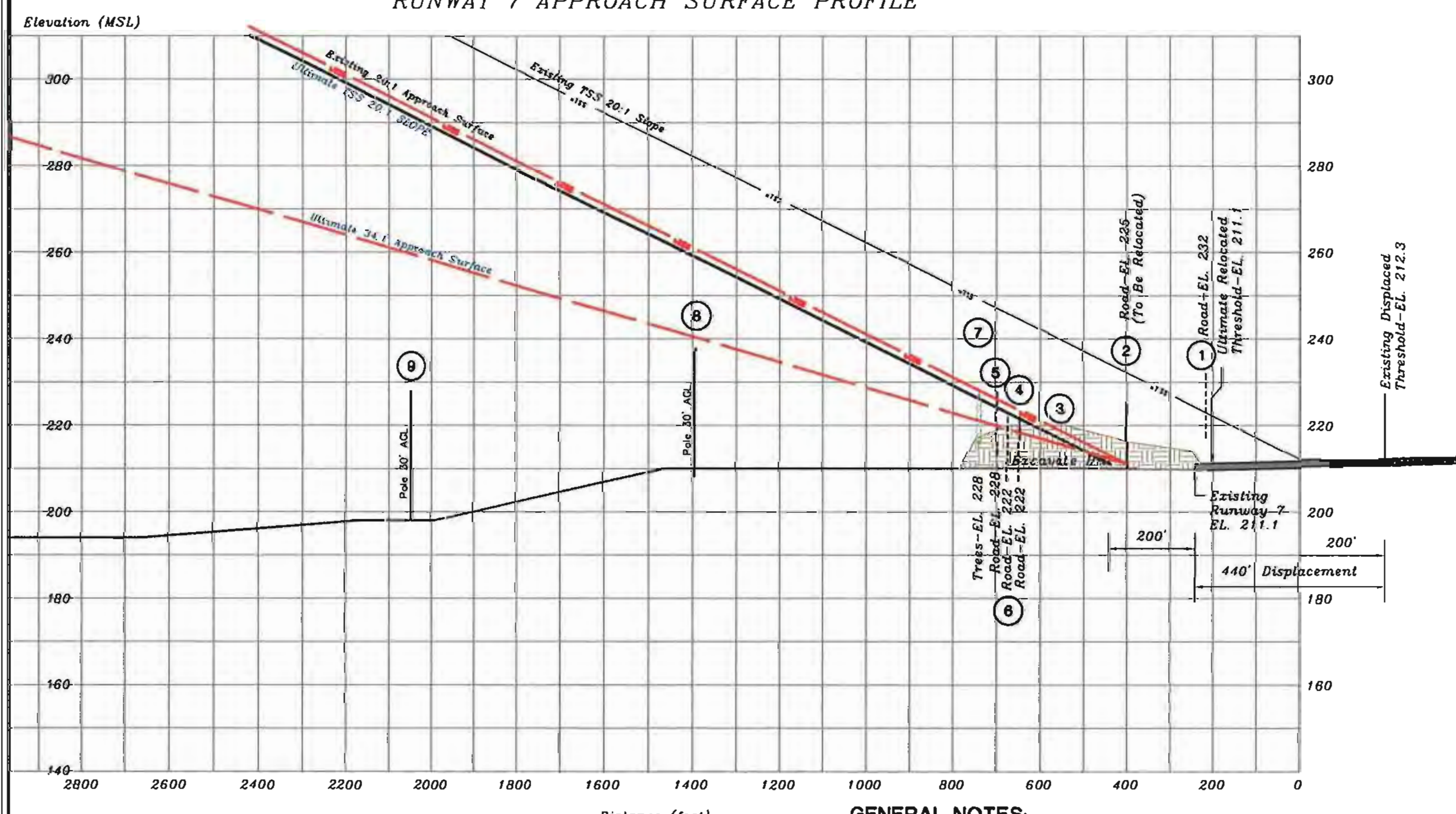
APPROVED BY: Stephen C. Wagner | July 19, 2010 | SHEET 5 OF 11

PRECISION APPROACH ENGINEERING

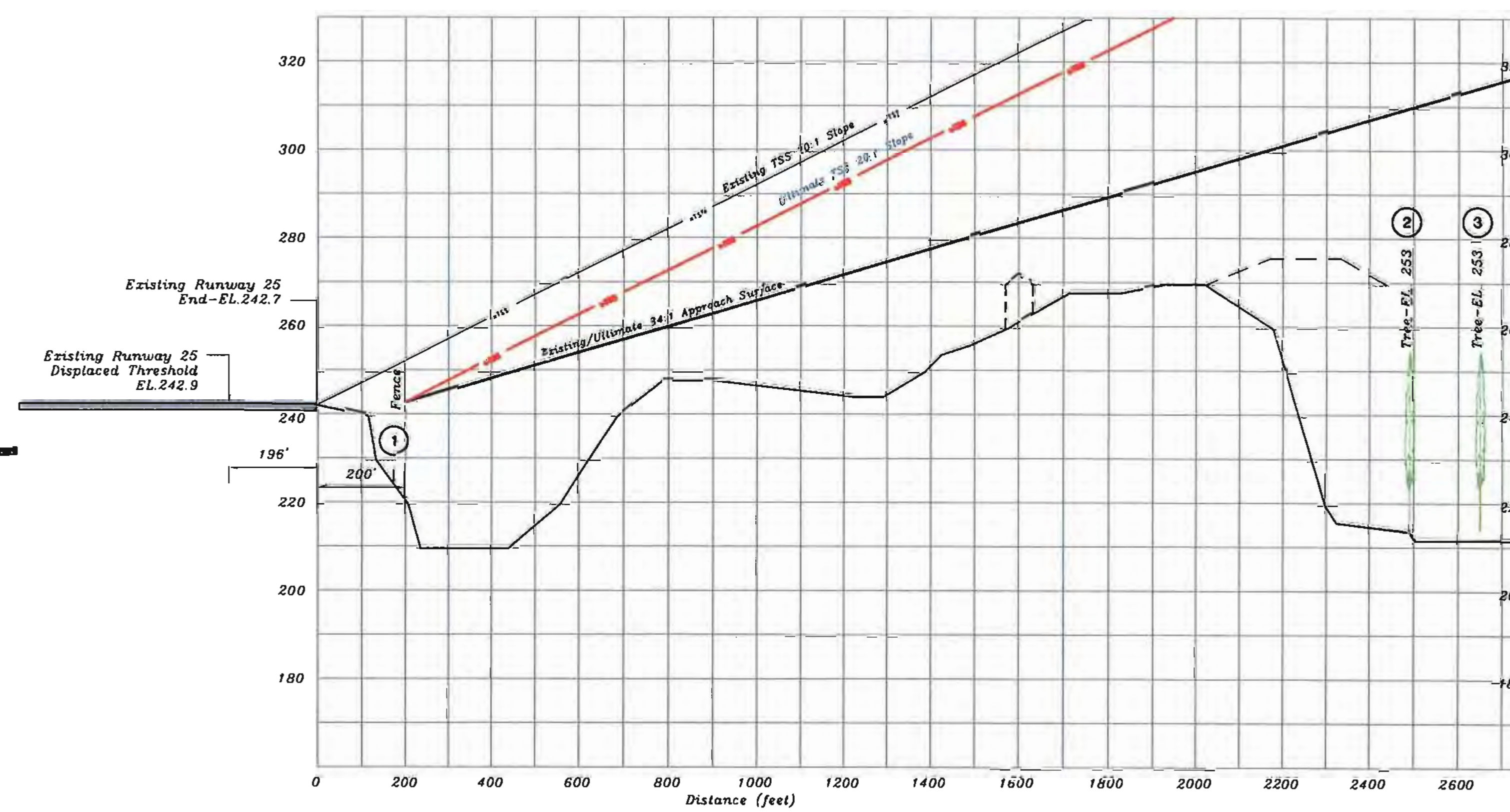
Coffman Associates Airport Consultants www.coffmanassociates.com



RUNWAY 7 APPROACH SURFACE PROFILE



RUNWAY 25 APPROACH SURFACE PROFILE



GENERAL NOTES:

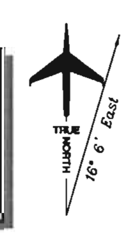
Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surfaces, unless otherwise noted. Road obstructions reflect a safety clearance of 10' for dirt Roads or private Roads, 15' for noninterstate Roads, 17' for interstate Roads, and 23' for railroad.

OBSTRUCTION TABLE

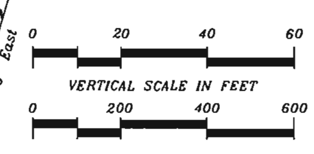
Runway 7 Object Description/Elevation	Obstructed Part 77 Surface	Object Penetration	TSS 20:1 Penetration	Proposed Object Disposition
1. Road EL. 232	34:1 Approach	N/A	9'	Relocate
2. Road EL. 225	34:1 Approach	14'	14'	Relocate
3. Hill EL. 220	34:1 Approach	10'	10'	Excavate 13'
4. Road EL. 222	34:1 Approach	2.6'	No	Lower Road
5. Road EL. 228	34:1 Approach	8'	2'	Lower Road
6. Road EL. 222	34:1 Approach	3.6'	No	Lower Road
7. Tree EL. 229	34:1 Approach	7'	No	Remove Trees

OBSTRUCTION TABLE

Runway 25 Object Description/Elevation	Obstructed Part 77 Surface	Object Penetration	TSS 20:1 Penetration	Proposed Object Disposition
– None	–	–	–	–



Magnetic Declination
16° 6' East (April 2010)
Annual Rate of Change 9' West



No.	REVISIONS	DATE	BY	APP'D.
3	-	-	-	-
2	-	-	-	-
1	Airport Layout Plan Updated	11/04	CWEC	-

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Columbia Gorge Regional Airport

INNER PORTION OF RUNWAY 7-25 APPROACH SURFACE DRAWING

PRELIMINARY

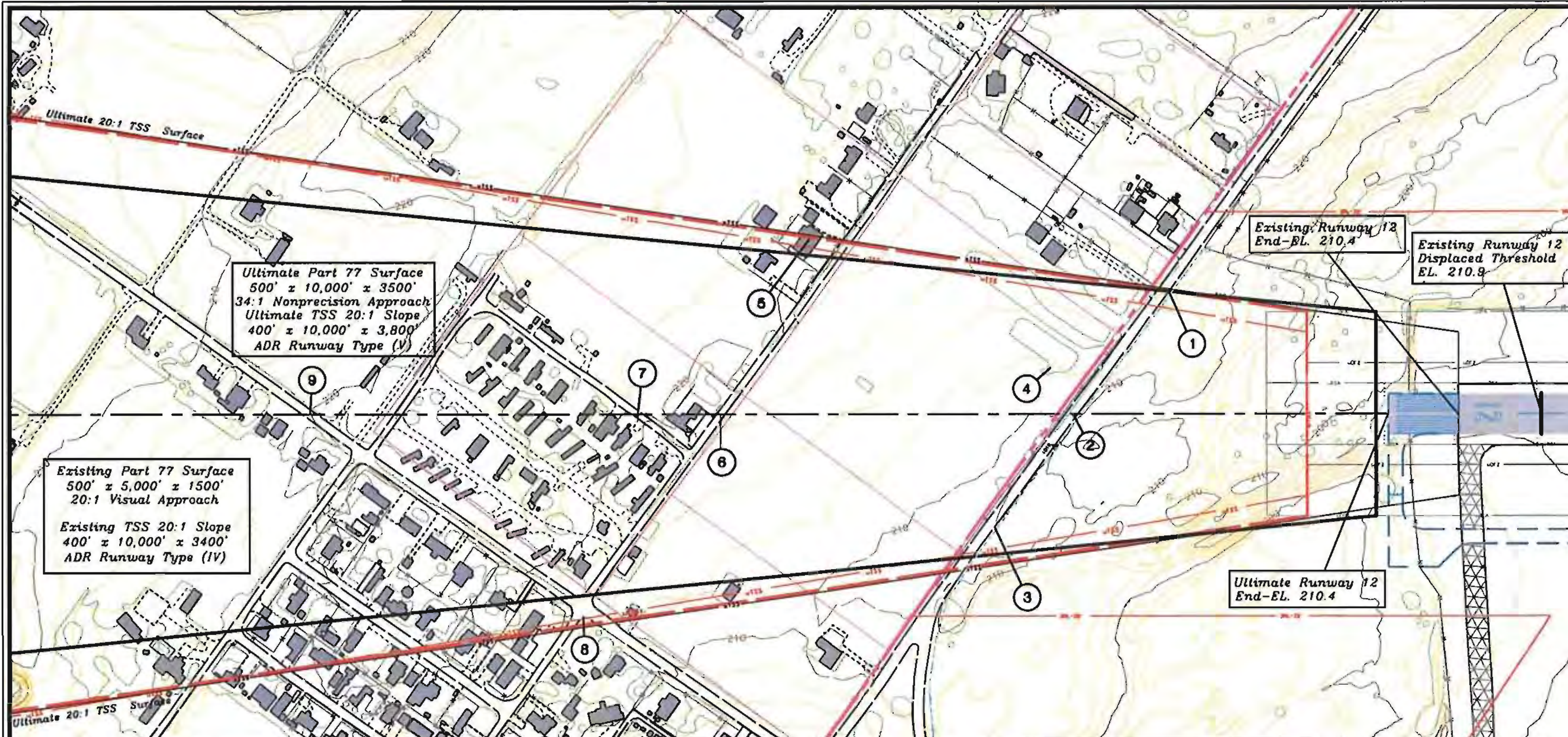
The Dalles, Oregon & Klickitat County, Washington

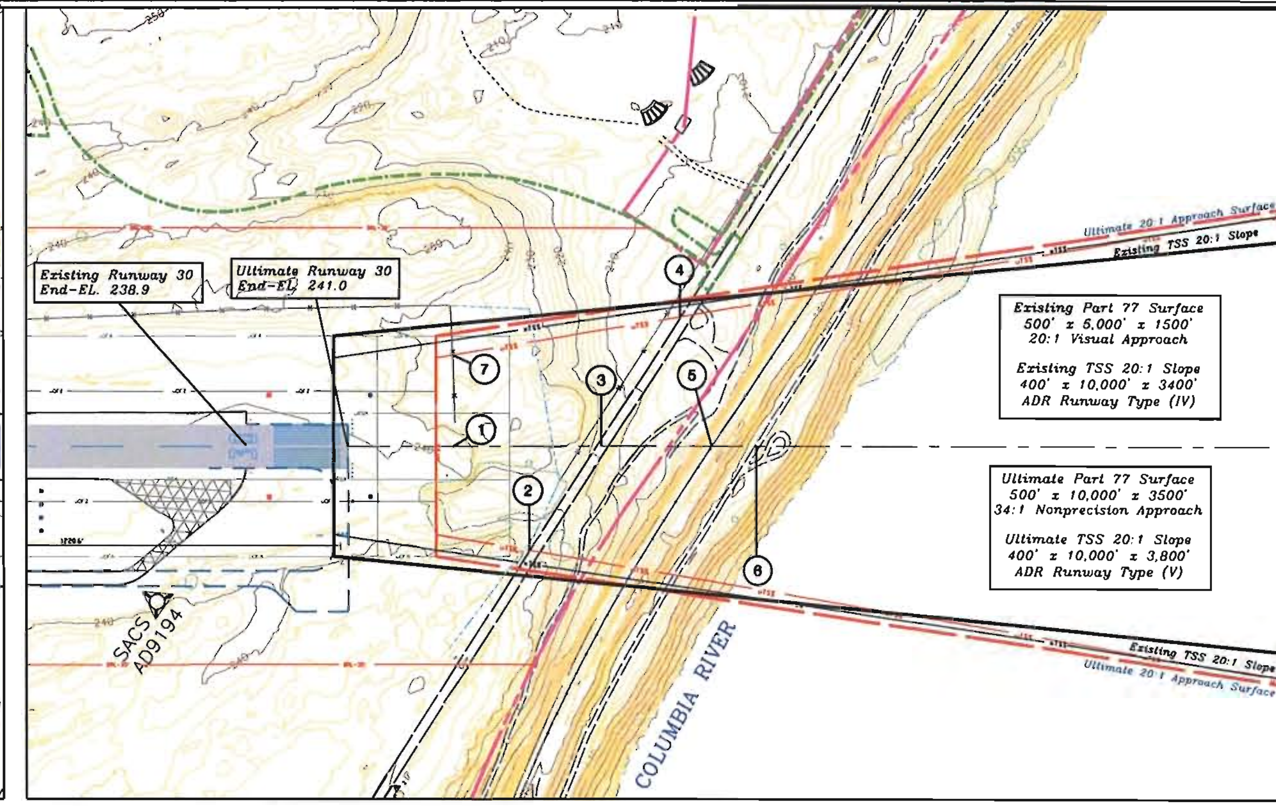
PLANNED BY: Patrick C. Taylor | DETAILED BY: Larry D. Johnson

APPROVED BY: Stephen C. Wagner | July 19, 2010 | SHEET 6 OF 11

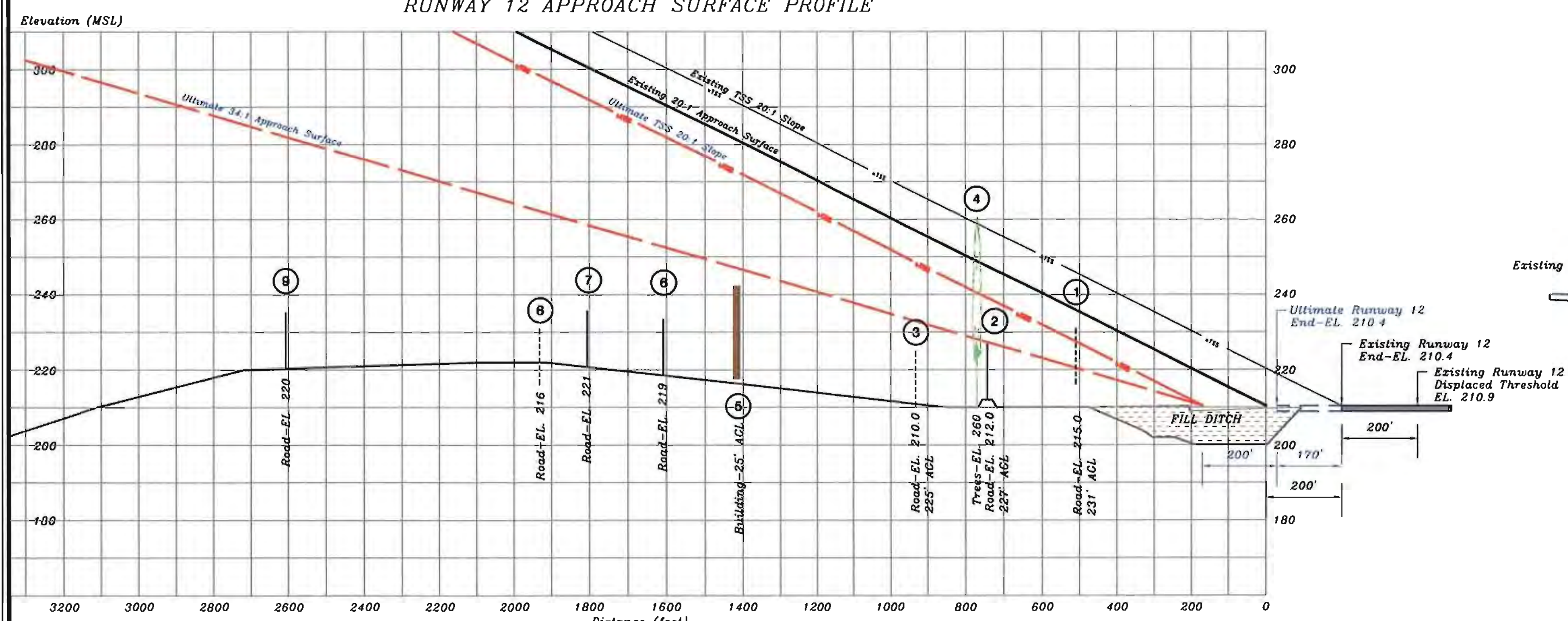
PRECISION APPROACH ENGINEERING

Coffman Associates Airport Consultants www.coffmanassociates.com

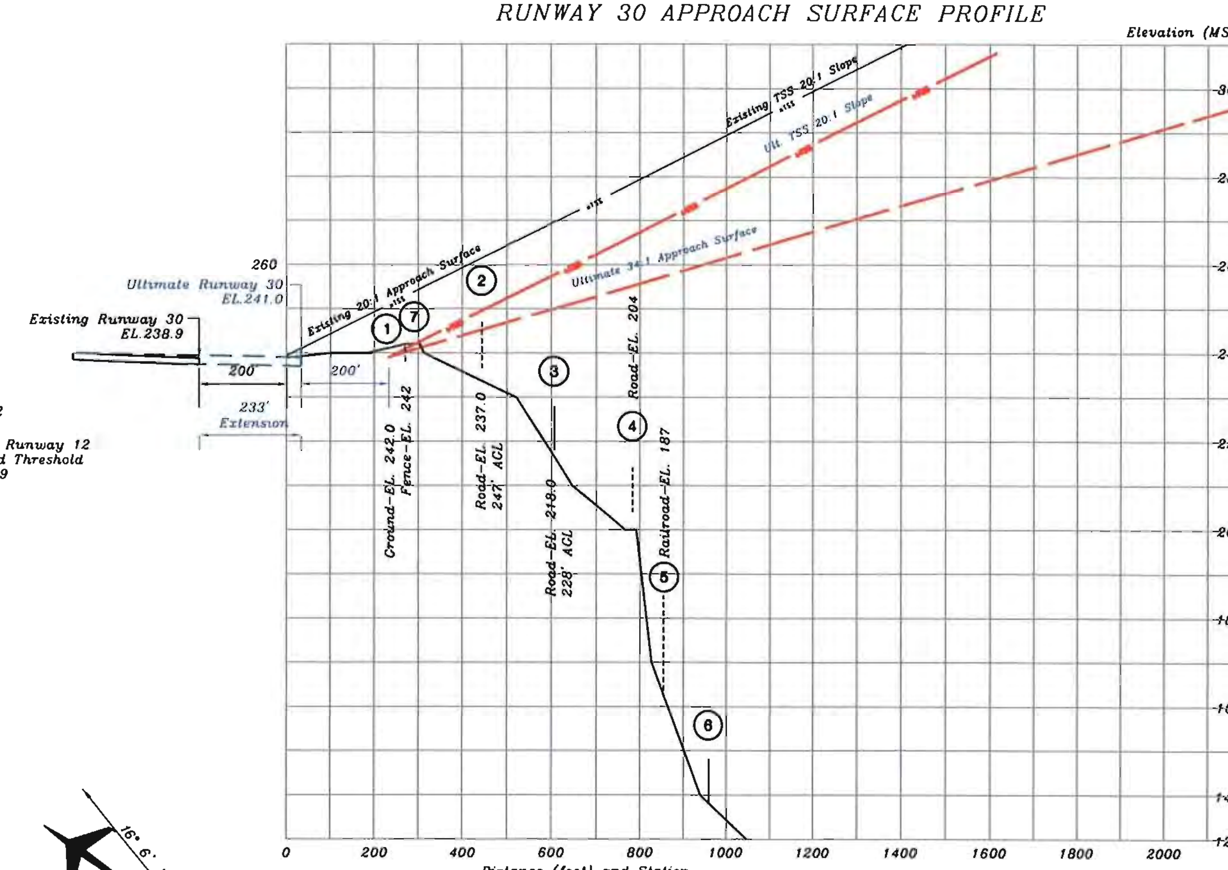




RUNWAY 12 APPROACH SURFACE PROFILE



RUNWAY 30 APPROACH SURFACE PROFILE



GENERAL NOTES:

1. Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surfaces, unless otherwise noted. Road obstructions reflect a safety clearance of 10' for dirt Roads or private Roads, 15' for noninterstate Roads, 17' for interstate Roads, and 23' for railroad.

OBSTRUCTION TABLE

Runway 12 Object Description/Elevation	Obstructed Part 77 Surface	Object Penetration	TSS 20:1 Penetration	Proposed Object Disposition
1. Road EL. 231	34:1 Approach	10.6	2.4	Request Aeronautical Study
4. Trees EL. 261	34:1 Approach	33'	21'	Remove Trees

OBSTRUCTION TABLE

Runway 30 Object Description/Elevation	Obstructed Part 77 Surface	Object Penetration	TSS 20:1 Penetration	Proposed Object Disposition
1. Ground-EL. 244	34:1 Approach	3'	No	Excavate
2. Road-EL. 247	34:1 Approach	2'	No	No Action (Private Rd.)
7. Fence-EL. 242	34:1 Approach	1'	1'	Relocate

15° 6' East
TRUE NORTH

Magnetic Declination
15° 6' East (April 2010)
Annual Rate of Change 9' West

0 20 40 60
VERTICAL SCALE IN FEET

0 200 400 600
HORIZONTAL SCALE IN FEET

No.	REVISIONS	DATE	BY	APP'D.
3	-	-	-	-
2	-	-	-	-
1	Airport Layout Plan Updated	11/04	CWEC	-

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Columbia Gorge Regional Airport

INNER PORTION OF RUNWAY 12-30 APPROACH SURFACE DRAWING

PRELIMINARY

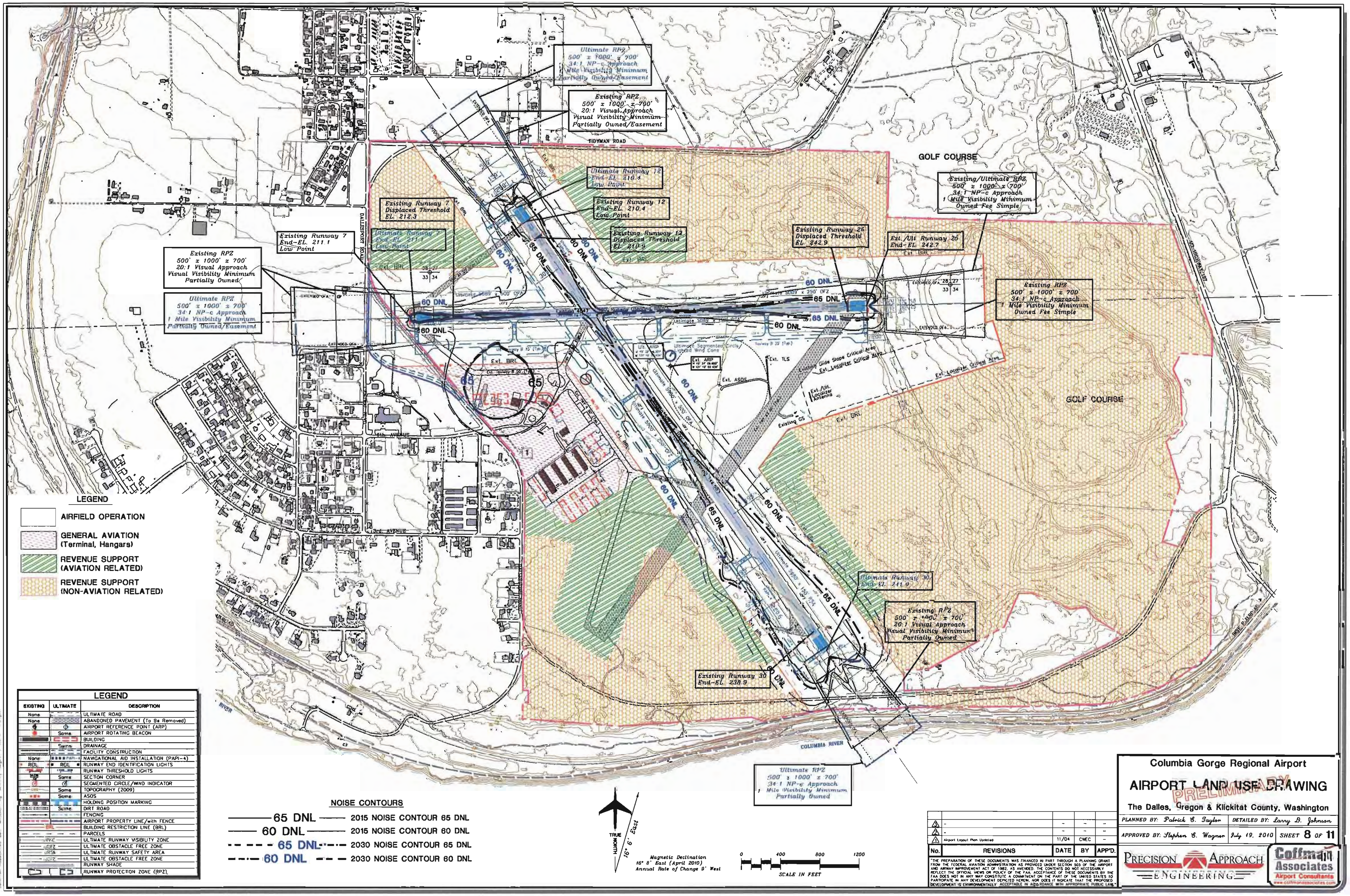
The Dalles, Oregon & Klickitat County, Washington

PLANNED BY: Patrick C. Taylor | DETAILED BY: Larry D. Johnson

APPROVED BY: Stephen C. Wagner | July 19, 2010 | SHEET 7 OF 11

PRECISION APPROACH ENGINEERING

Coffman Associates Airport Consultants www.coffmanassociates.com


Ultimate RPZ
500' x 1000' x 700'
34:1 NP-c Approach
1 Mile Visibility Minimum
Partially Owned/Easement
Existing RPZ
500' x 1000' x 700'
20:1 Visual Approach
Visual Visibility Minimum
Partially Owned/Easement
TIDYMAN ROAD
GOLF COURSE
Ultimate Runway 12
End-EL. 210.4
Low Point
Existing Runway 12
End-EL. 210.4
Low Point
Existing Runway 12
Displaced Threshold
EL. 210.9
Existing Runway 7
Displaced Threshold
EL. 212.3
Existing Runway 7
End-EL. 211.1
Low Point
Existing RPZ
500' x 1000' x 700'
20:1 Visual Approach
Visual Visibility Minimum
Partially Owned
Ultimate RPZ
500' x 1000' x 700'
34:1 NP-c Approach
1 Mile Visibility Minimum
Partially Owned/Easement
Existing Runway 25
Displaced Threshold
EL. 242.9
Ext./Ult Runway 25
End-EL. 242.7
Existing/Ultimate RPZ
500' x 1000' x 700'
34:1 NP-c Approach
1 Mile Visibility Minimum
Owned Fee Simple
Existing RPZ
500' x 1000' x 700'
34:1 NP-c Approach
1 Mile Visibility Minimum
Owned Fee Simple
65 DNL
60 DNL
Ext. ARP
Ext. ASOS
Ext. TLS
Ext. BRL
GOLF COURSE
Ultimate Runway 30
End-EL. 241.9
Existing RPZ
500' x 1000' x 700'
20:1 Visual Approach
Visual Visibility Minimum
Partially Owned
Existing Runway 30
End-EL. 238.9
COLUMBIA RIVER
Ultimate RPZ
500' x 1000' x 700'
34:1 NP-c Approach
1 Mile Visibility Minimum
Partially Owned
3rd AVENUE
LEGEND
AIRFIELD OPERATION
GENERAL AVIATION (Terminal, Hangars)
REVENUE SUPPORT (AVIATION RELATED)
REVENUE SUPPORT (NON-AVIATION RELATED)
LEGEND
EXISTING | ULTIMATE | DESCRIPTION
None | | ULTIMATE ROAD
None | | ABANDONED PAVEMENT (To Be Removed)
AIRPORT REFERENCE POINT (ARP)
Same | AIRPORT ROTATING BEACON
BUILDING
Same | DRAINAGE
FACILITY CONSTRUCTION
None | PAPI-4 | NAVIGATIONAL AID INSTALLATION (PAPI-4)
REIL | REIL | RUNWAY END IDENTIFICATION LIGHTS
RUNWAY THRESHOLD LIGHTS
Same | SECTION CORNER
SEGMENTED CIRCLE/WIND INDICATOR
Same | TOPOGRAPHY (2009)
Same | ASOS
HOLDING POSITION MARKING
Same | DIRT ROAD
FENCING
AIRPORT PROPERTY LINE/with FENCE
BRL | BUILDING RESTRICTION LINE (BRL)
PARCELS
uRVZ | ULTIMATE RUNWAY VISIBILITY ZONE
uOFZ | ULTIMATE OBSTACLE FREE ZONE
uRSA | ULTIMATE RUNWAY SAFETY AREA
uOFZ | ULTIMATE OBSTACLE FREE ZONE
RUNWAY SHADE
RUNWAY PROTECTION ZONE (RPZ)
NOISE CONTOURS
65 DNL — 2015 NOISE CONTOUR 65 DNL
60 DNL — 2015 NOISE CONTOUR 60 DNL
65 DNL — 2030 NOISE CONTOUR 65 DNL
60 DNL — 2030 NOISE CONTOUR 60 DNL
TRUE NORTH
16° 6' East
Magnetic Declination
16° 6' East (April 2010)
Annual Rate of Change 8' West
0 400 800 1200
SCALE IN FEET
Columbia Gorge Regional Airport
AIRPORT LAND USE DRAWING
PRELIMINARY
The Dalles, Oregon & Klickitat County, Washington
PLANNED BY: Patrick C. Taylor
DETAILED BY: Larry D. Johnson
APPROVED BY: Stephen C. Wagner
July 19, 2010
SHEET 8 OF 11
No. | REVISIONS | DATE | BY | APP'D.
3 | - | - | - | -
2 | - | - | - | -
1 | Airport Layout Plan Updated | 11/04 | CWEC | -
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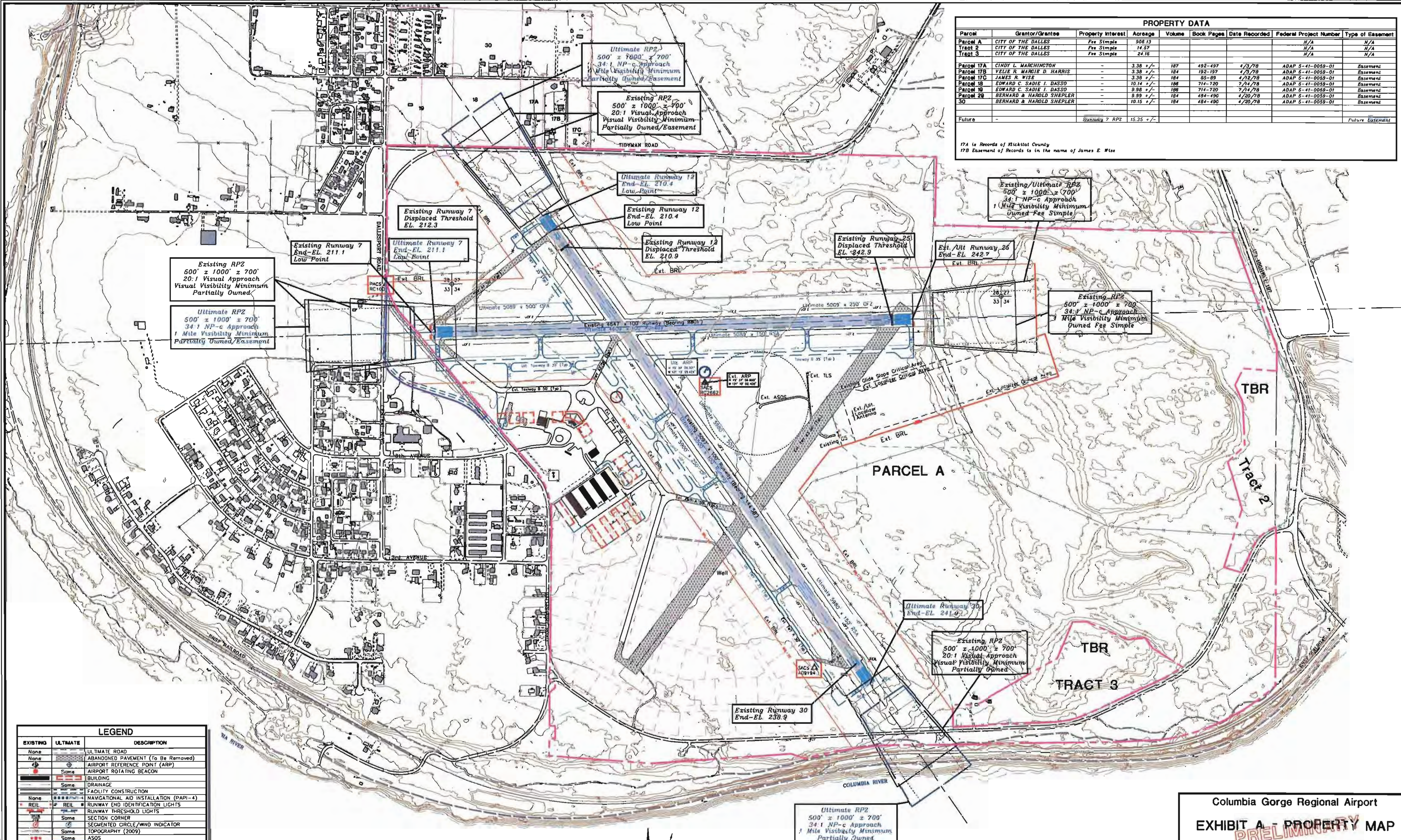

PROPERTY DATA

Parcel	Grantor/Grantee	Property Interest	Acreage	Volume	Book Pages	Date Recorded	Federal Project Number	Type of Easement
Parcel A	CITY OF THE DALLES	Fee Simple	908.13				N/A	N/A
Tract 2	CITY OF THE DALLES	Fee Simple	14.57				N/A	N/A
Tract 3	CITY OF THE DALLES	Fee Simple	24.16				N/A	N/A
Parcel 17A	CINDY L. MARCHINGTON	-	3.38 +/-	187	492-497	4/3/78	ADAP 5-41-0059-01	Easement
Parcel 17B	VELIE R. MARGIE D. HARRIS	-	3.38 +/-	184	192-197	4/3/78	ADAP 5-41-0059-01	Easement
Parcel 17C	JAMES R. WISE	-	3.38 +/-	184	85-89	4/12/78	ADAP 5-41-0059-01	Easement
Parcel 18	EDWARD C. SADIE I. DASSO	-	10.14 +/-	186	714-720	7/14/78	ADAP 5-41-0059-01	Easement
Parcel 19	EDWARD C. SADIE I. DASSO	-	9.98 +/-	186	714-720	7/14/78	ADAP 5-41-0059-01	Easement
Parcel 29	BERNARD & HAROLD SHEPLER	-	9.99 +/-	184	484-490	4/20/78	ADAP 5-41-0059-01	Easement
30	BERNARD & HAROLD SHEPLER	-	10.15 +/-	184	484-490	4/20/78	ADAP 5-41-0059-01	Easement
Future	-	Runway 7 RPZ	15.35 +/-					Future Easement

17A is Records of Klickitat County
17B Easement of Records is in the name of James E. Wise

LEGEND

EXISTING	ULTIMATE	DESCRIPTION
None		ULTIMATE ROAD
None		ABANDONED PAVEMENT (To Be Removed)
		AIRPORT REFERENCE POINT (ARP)
	Same	AIRPORT ROTATING BEACON
		BUILDING
	Same	DRAINAGE
		FACILITY CONSTRUCTION
None	PAPI-4	NAVIGATIONAL AID INSTALLATION (PAPI-4)
REIL	REIL	RUNWAY END IDENTIFICATION LIGHTS
		RUNWAY THRESHOLD LIGHTS
	Same	SECTION CORNER
		SEGMENTED CIRCLE/WIND INDICATOR
	Same	TOPOGRAPHY (2009)
	Same	ASOS
		HOLDING POSITION MARKING
	Same	DIRT ROAD
		FENCING
		AIRPORT PROPERTY LINE/with FENCE
BRL		BUILDING RESTRICTION LINE (BRL)
		PARCELS
uRVZ		ULTIMATE RUNWAY VISIBILITY ZONE
uOFZ		ULTIMATE OBSTACLE FREE ZONE
uRSA		ULTIMATE RUNWAY SAFETY AREA
uOFZ		ULTIMATE OBSTACLE FREE ZONE
		RUNWAY SHADE
		RUNWAY PROTECTION ZONE (RPZ)

Coffman Associates-LDJ dls_alp.dwg Monday August 2 2010 4:04pm

GENERAL NOTES:

1. Depiction of features and objects, including related elevations and clearances, Within the runway approach surfaces are depicted on the Inner Portion of Runway Approach Surface Drawings.
2. Details concerning terminal improvements are depicted on the TERMINAL AREA DRAWING.
3. Recommended land uses within the airport environs are depicted on the AIRPORT LAND USE DRAWING.
4. Photography Dated September 18, 2009.
5. Existing/ultimate fence along existing/ultimate Property Line except where shown.
6. TBR: To be released.

No.	REVISIONS	DATE	BY	APP'D.
3	-	-	-	-
2	-	-	-	-
1	Airport Layout Plan Updated	11/04	CWEC	-

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Columbia Gorge Regional Airport

EXHIBIT A - PROPERTY MAP

PRELIMINARY

The Dalles, Oregon & Klickitat County, Washington

PLANNED BY: Patrick C. Taylor | DETAILED BY: Larry D. Johnson
APPROVED BY: Stephen C. Wagner | July 19, 2010 | SHEET 9 OF 11

PRECISION APPROACH ENGINEERING

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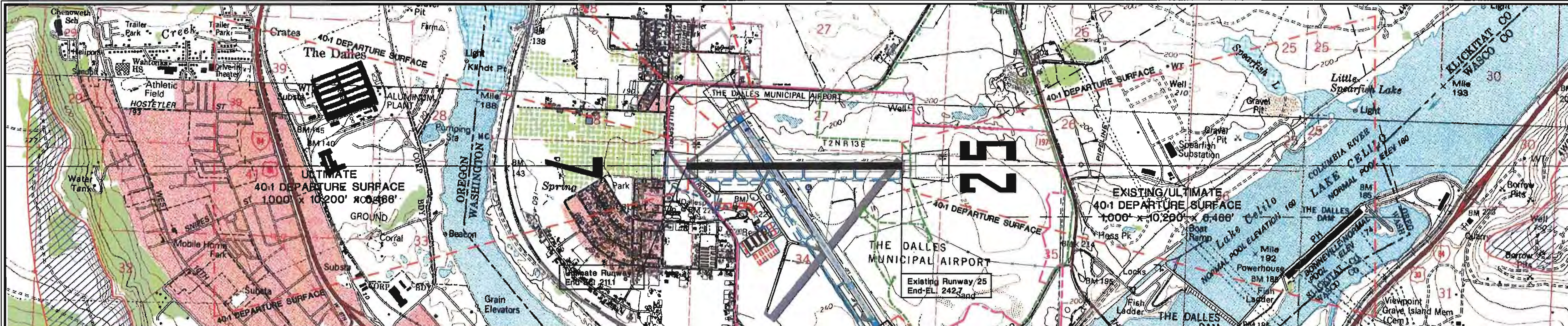
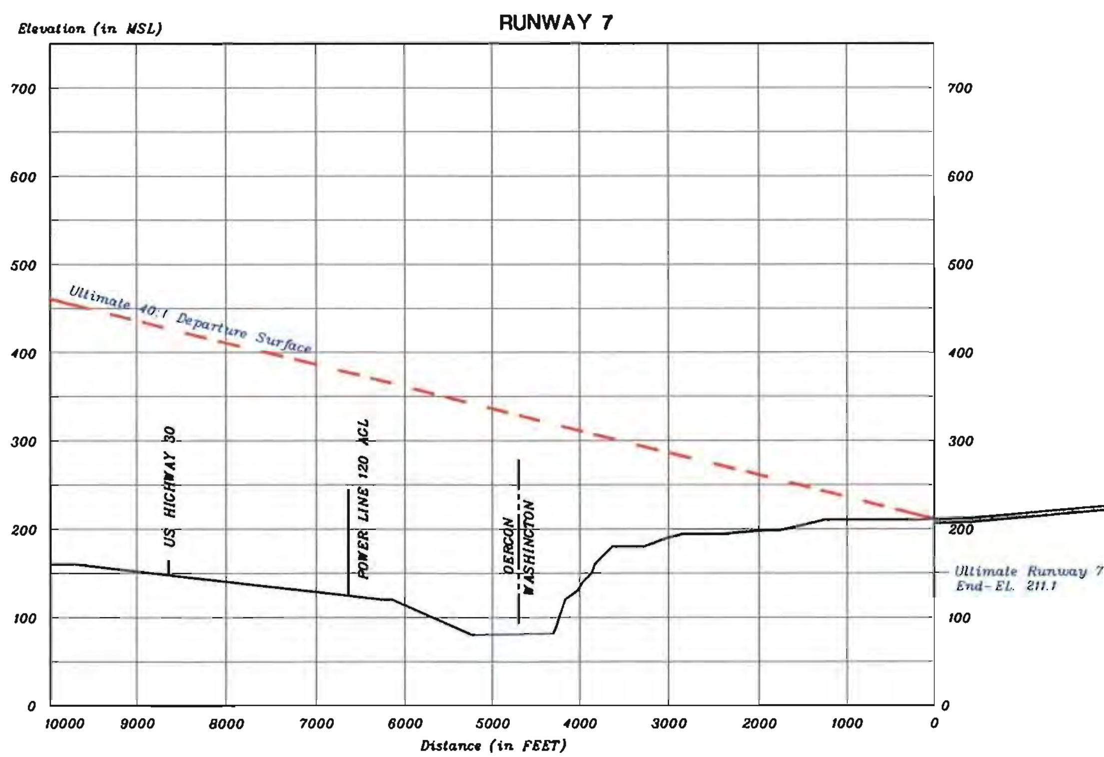
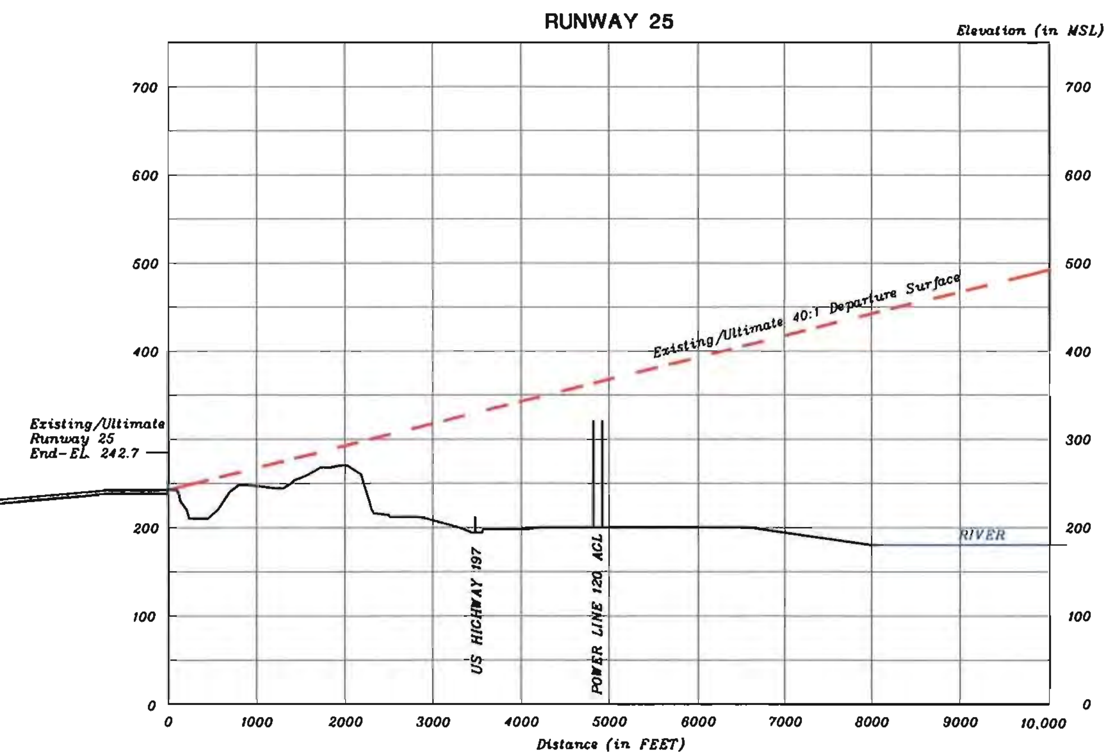






GENERAL NOTES:

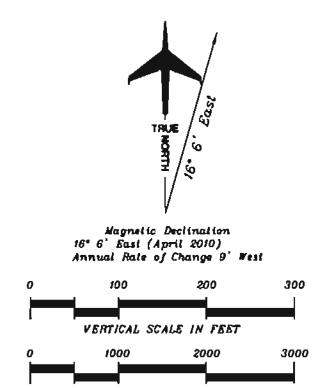
1. Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surfaces, unless otherwise noted. Road obstructions reflect a safety clearance of 10' for dirt Roads or private Roads, 15' for noninterstate Roads, 17' for interstate Roads, and 23' for railroad.
2. Depiction of features and objects within the primary, transitional, and horizontal Part 77 surfaces, is illustrated on the AIRPORT AIRSPACE DRAWINGS.
3. Depiction of features and objects within the outer portion of the approach surfaces, is illustrated on the APPROACH SURFACE PROFILES.
4. Depiction of features and objects within the inner portion of the approach surfaces, is illustrated on the INNER PORTION OF THE RUNWAY APPROACH SURFACE DRAWINGS.

OBSTRUCTION TABLE

Runway 7 Object Description/Elevation	Obstructed TERP Surface	Ultimate Penetration	Existing Penetration	Proposed Object Disposition
None				

OBSTRUCTION TABLE

Runway 25 Object Description/Elevation	Obstructed TERP Surface	Ultimate Penetration	Existing Penetration	Proposed Object Disposition
None				



No.	REVISIONS	DATE	BY	APP'D.
3	-	-	-	-
2	-	-	-	-
1	Airport Layout Plan Updated	11/04	CWEC	-

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Columbia Gorge Regional Airport

RUNWAY 7-25
40:1 DEPARTURE SURFACE PROFILE

PRELIMINARY

The Dalles, Oregon & Klickitat County, Washington

PLANNED BY: Patrick C. Taylor | DETAILED BY: Larry D. Johnson

APPROVED BY: Stephen C. Wagner | July 19, 2010 | SHEET 10 OF 11

PRECISION APPROACH ENGINEERING

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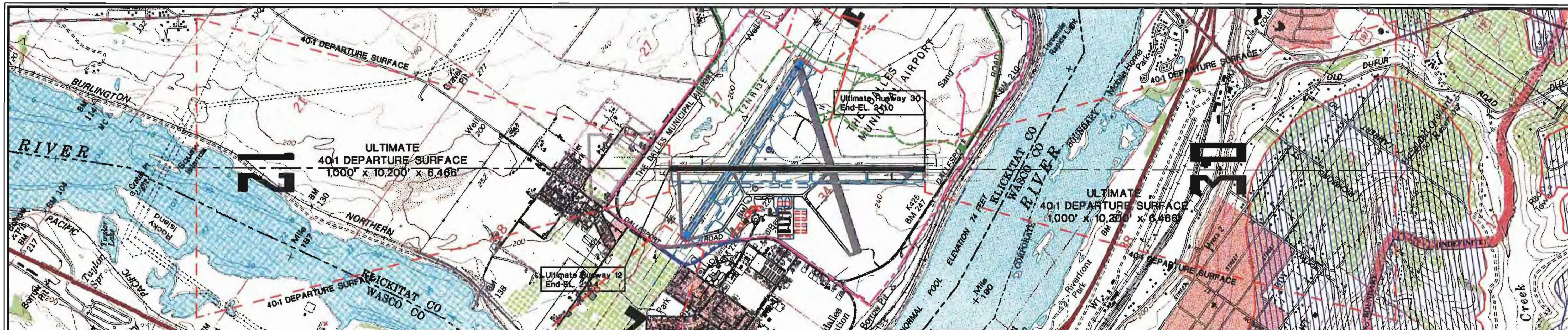
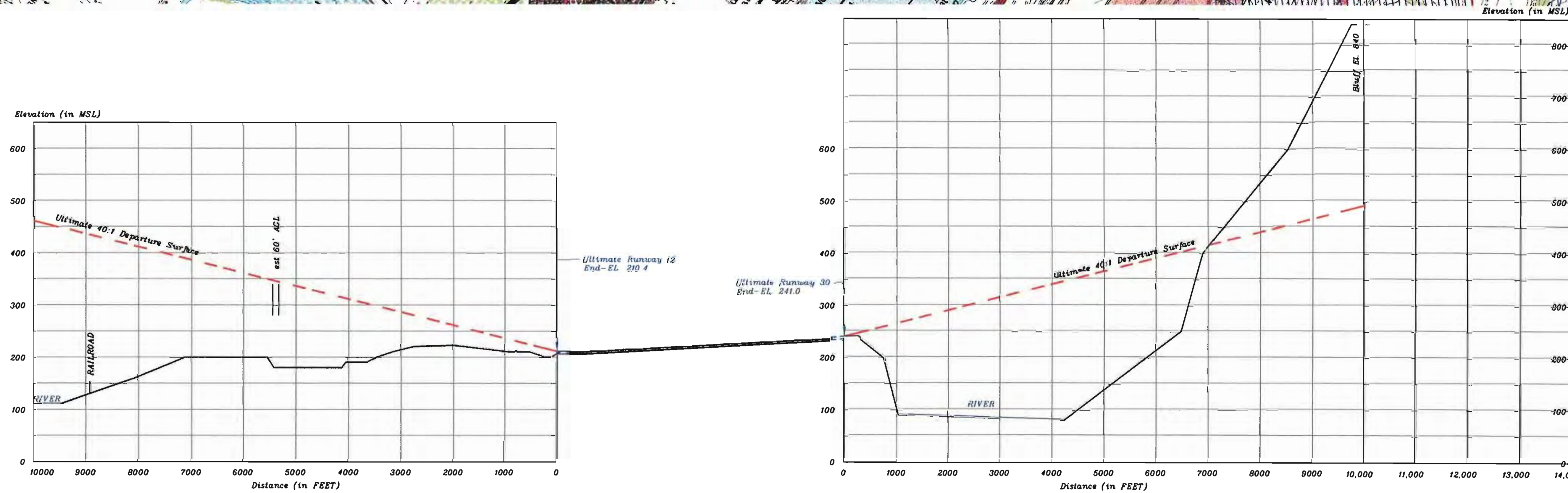




GENERAL NOTES:

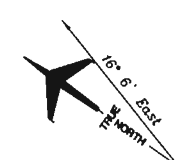
1. Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surfaces, unless otherwise noted. Road obstructions reflect a safety clearance of 10' for dirt Roads or private Roads, 15' for noninterstate Roads, 17' for interstate Roads, and 23' for railroad.
2. Depiction of features and objects within the primary, transitional, and horizontal Part 77 surfaces, is illustrated on the AIRPORT AIRSPACE DRAWINGS.
3. Depiction of features and objects within the outer portion of the approach surfaces, is illustrated on the APPROACH SURFACE PROFILES.
4. Depiction of features and objects within the inner portion of the approach surfaces, is illustrated on the INNER PORTION OF THE RUNWAY APPROACH SURFACE DRAWINGS.

OBSTRUCTION TABLE

Runway 12 Object Description/Elevation	Obstructed TERP Surface	Ultimate Penetration	Existing Penetration	Proposed Object Disposition
None				

OBSTRUCTION TABLE

Runway 30 Object Description/Elevation	Obstructed TERP Surface	Ultimate Penetration	Existing Penetration	Proposed Object Disposition
1. Bluff EL 840	40:1	426'	No	Request Aeronautical Study



Magnetic Declination
16° 6' East (April 2010)
Annual Rate of Change 9' West

0 100 200 300
VERTICAL SCALE IN FEET

0 1000 2000 3000
HORIZONTAL SCALE IN FEET

No.	REVISIONS	DATE	BY	APP'D.
3	-	-	-	-
2	-	-	-	-
1	Airport Layout Plan Updated	11/04	CWEC	-

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Columbia Gorge Regional Airport

RUNWAY 12-30
40:1 DEPARTURE SURFACE PROFILE

PRELIMINARY

The Dalles, Oregon & Klickitat County, Washington

PLANNED BY: Patrick C. Taylor | DETAILED BY: Larry D. Johnson

APPROVED BY: Stephen C. Wagner | July 19, 2010 | SHEET 11 OF 11

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Suite 100
Lee's Summit, MO 64063

PHOENIX
(602) 993-6999

4835 E. Cactus Road
Suite 235
Scottsdale, AZ 85254

APPENDIX F. TRANSIT FEASIBILITY ANALYSIS

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING / PLANNING
610 SW Alder Street, Suite 700, Portland, OR 97205 P 503.228.5230 F 503.273.8169

TRANSIT FEASIBILITY MEMORANDUM #1

Date:	January 12, 2017	Project #: 18495.8
To:	Transit Plan Advisory Committee	
From:	Susan Wright, PE and Krista Purser, Kittelson & Associates, Inc.	
Project:	The Dalles Transportation System Plan	
Subject:	Transit Alternatives Analysis and Feasibility Assessment Background Memo	

The City of The Dalles is nearly complete with an update to their Transportation System Plan (TSP). Prior to adopting the TSP in early 2017, the City of The Dalles and the Oregon Department of Transportation (ODOT) are partnering to assess the potential for enhancing transit service within both the local community and the region. This assessment will be incorporated into the TSP prior to adoption. This memorandum is the first in a series of documents that will assess available transit services, current and projected future transit needs, partnering and funding opportunities, and other considerations to inform the new Transit chapter of The Dalles TSP.

1.0 Introduction

The Dalles is currently served by three principle transit providers including Columbia Area Transit (CAT), the Mid-Columbia Council of Government's Transportation Network (LINK), and Greyhound. The transit services provided are generally increasing in frequency and coverage as additional services and amenities are added. Some recent trends impacting transit service within and beyond The Dalles include:

- Transit service availability is increasing in the Columbia Gorge area as a whole. The enhanced service is in turn increasing the number of places accessible by transit to residents of The Dalles through CAT’s services.
- The Dalles currently has many people that utilize the existing LINK dial-a-ride service which is also experiencing growth in ridership.
- There is a recognized need to explore the opportunity and feasibility of providing fixed-route transit service in The Dalles to help people move around the City as well as access inter-city transit that serves The Dalles.

- A new transit center opened this year on West 7th Street near the Chenoweth interchange. The transit center serves as a location for future local fixed-route service to connect with CAT, LINK dial-a-ride, and inter-city services.

The remainder of this memorandum summarizes background information that will be used to inform the development and evaluation of alternatives for providing fixed-route transit within the City of The Dalles. The following sections include an overview of changes between existing and projected future population and job densities in The Dalles, a summary of the Wasco County Coordinated Transportation Plan findings, a summary of existing transit service and ridership in The Dalles, CAT on-board survey findings, and LINK trip data findings.

1.1 POPULATION AND JOBS

Land use and density plays an important role in developing an effective transit system as the type, density, and mix of land use affect travel patterns. Existing and future job and household densities from the travel demand model used to develop the City's Transportation System Plan are summarized below along with an overview of areas with transit-supportive densities.

1.1.1 Existing and Future Job Densities

Figure 1 shows the projected change in employment density in The Dalles based on the travel demand model prepared by ODOT for the City's Transportation System Plan. Existing dense employment areas are Downtown as well as at Columbia Gorge Community College (CGCC) and the Mid-Columbia Medical Center. Growth is expected along 6th Street and Downtown. Job growth is also anticipated along River Road and the Lone Pine region; however, the densities are anticipated to be very low due to the large area. There may be future employers along River Road whose employees would benefit from transit. Existing and projected densities are included in Attachment A.

1.1.2 Existing and Future Household Densities

In 2010, the population of The Dalles was 13,620. The five-year population growth rate is currently at 8% for Wasco County, about 1.6% annual growth, and is expected to continue steadily. Figure 2 shows the projected change in household densities in The Dalles also based on the travel demand model prepared for the City's Transportation System Plan. Existing households are concentrated in the northwestern region and central areas of the City. Increases are expected in the central and eastern area of the City. Existing and projected household densities are also included in Attachment A.

1.1.3 Transit-Supportive Densities

When planning transit in an urban area, it is important to identify areas where the existing and future land use is supportive of transit. An area is generally considered transit supportive if one of the following thresholds is met:

- population density of 3 households/gross acre or more; or,
- job density of 4 employees/gross acre.

Figures 3 and 4 identify areas with transit supportive population or job densities under existing and projected future conditions, respectively. As shown, most areas of The Dalles currently have transit supportive densities with the exception of the River Road areas and far eastern portion of the city. These areas will need to be carefully considered to assess whether there are (or will be) specific key destinations, low income housing, or major employers that should be considered for regular transit service.

1.2 WASCO COUNTY CTP FINDINGS

The Mid-Columbia Economic Development District (MCEDD) prepared the 2016-2019 Wasco County Coordinated Transportation Plan (CTP) to meet state and federal requirements for Special Transportation Fund (STF) agencies. The CTP looks for service needs and prioritizes improvements to provide a strategy for financial resource investment, to improve transportation services for certain populations, and to guide acquisition of funds and grants. While the CTP analyzed countywide CTP transportation services, it offers useful insights to the needs of The Dalles. This section summarizes interview results, needs and proposed strategies, and key destinations in The Dalles.

1.2.1 LINK Rider Interview Summary

As part of the Wasco County CTP, LINK riders were surveyed regarding their current trip patterns and desired outcomes of a fixed-route transit system. Identified origins and the percentage of surveyors who resided in these areas are listed below. Interview results for desired fixed-route destinations are discussed in section 1.2.3.

- Chenoweth Area (42%)
- Other – including east side of city, Downtown, Mill Creek/Mt. Hood St., Foley Lakes Mobile Park, Pinewood Manor Mobile Park, and Lone Pine Village (22%)
- Dry Hollow Area (10%)
- Colonel Wright Area and The Dalles High School Area (26% total)

Per the survey, 94% of LINK riders and 61% of the participating general public said they were very or somewhat likely to use a fixed-route service.

1.2.2 Needs and Proposed Strategies

The CTP identified transit needs and proposed strategies to address these needs for target populations including seniors, persons with disabilities, low income individuals, and limited English proficiency individuals. The complete needs and strategies assessment can be found in Attachment B. Key needs that can be addressed with fixed-route service or should be considered in planning for fixed-route service include the following:

- Access to shopping – Serving shopping destinations with fixed-route service would address this need and increase likelihood of ridership.
- Address employment transportation – Ensure fixed-route service connects to areas of dense populations and jobs.
- Provide access to affordable public transportation during early morning and evening peaks, as well as weekends – Assess service hours for fixed-route service.
- Address scheduling difficulties presented by need for LINK's 24-hour notice and 30-minute pick-up window – Plan stops near major LINK origins to provide regular, predictable service.
- Other considerations
    - Collaborate with Human Services providers – Ensure Human Services Agency is involved in fixed-route development.
    - Funding – Leverage state and Federal grants in establishing fixed-route service, as local funding is limited.
    - Affordable fares – Maintain low fares for fixed-route service.
    - Address cash/exact change only system – Explore new fare payment system and monthly pass options.
    - Improve bilingual marketing – Provide information, materials, and outreach in several languages to ensure limited English proficiency populations' needs are addressed.
    - Address safety and security concerns – Extend Travel Ambassador program to fixed-route service. The Travel Ambassador program provides one-on-one assistance to travelers in determining services and routing information; allowing bus drivers to focus on operating the bus and providing extra attention to onboard safety concerns.

1.2.3 Key Destinations

An overview of existing activity centers in The Dalles plus additional potential key destinations for transit service identified in the Wasco County CTP are shown in Figure 5. The key destinations identified in the CTP include:

- Medical care: medical clinics, One Community Health, Northern Wasco County Public Health District, Mid-Columbia Medical Center (MCMC), Water's Edge
- Work – unspecified locations
- Shopping: Safeway, Fred Meyer/Grocery Outlet/Cascade Square; BiMart, Kmart, Downtown
- Recreation – especially high among The LINK onboard respondents
- School – elementary schools, middle & high schools, Columbia Gorge Community College

Listed in order of frequency of response, those surveyed as part of the CTP provided the following preferred destinations:

- Shopping
- Medical/Pharmacy
- School
- Downtown
- Human Services Agencies
- Government Offices
- Library
- Pool
- Post Office

The Columbia Gorge Community College (CGCC) campus in The Dalles is already a destination of the CAT service between The Dalles and Hood River. CGCC plans to shift additional classes from its Hood River Campus to The Dalles campus, and thus transit demand and preference for service to this destination may increase.

The Dalles Marina and the Columbia River Commercial dock should also be considered potential key destinations. Two cruise ships regularly dock at the Columbia River Commercial Dock. On days where both ships service The Dalles simultaneously, the smaller ship docks at The Dalles Marina while the larger ship docks at the Columbia River Commercial Dock. The larger ship provides its own bus for passengers between the dock, Downtown, Gorge Discovery Center, and other destinations. The smaller ship provides options for the Gorge Discovery Center and Maryhill Museum, but passengers are otherwise left to walk from the Marina to downtown, which is one mile away along an unlit trail.

1.3 EXISTING TRANSIT SYSTEM

The Dalles is currently served by several transit services providing inter-city service. There is also currently demand-responsive service available in The Dalles, but there is no fixed-route transit service within The Dalles. The following transit services are available in The Dalles or nearby communities:

- CAT: Hood River/The Dalles Fixed-Route Service
- CAT/LINK: Hood River/The Dalles/Portland Fixed-Route Service
- LINK Dial-A-Ride & Shopping Bus
- Greyhound
- Amtrak

The following provides an overview of each of the available transit services. Figure 6 provides a schematic overview of the existing connections and schedules of the fixed-route inter-city transit service options.

1.3.1 Route Descriptions and Service Overview

Columbia Area Transit – Hood River/The Dalles

The Hood River County Transportation District operates CAT, the fixed-route service connecting Hood River and The Dalles. The bus runs three trips daily, Monday through Friday, in each direction. Buses serve the Columbia Gorge Community College and the transit center in The Dalles. In Hood River, buses serve Rosauer's Market, Providence Hood River Memorial Hospital, Wal-Mart, and the Hood River Hotel. Fares are currently $3.00 each way, with discounted rates for seniors and persons with disabilities and free rides for children aged 0-6 years old.

It should be noted that the feasibility of "Upper Valley" transit service between Hood River, Odell, and Parkdale is being assessed and may increase demand for travel from The Dalles to Hood River as it would provide access to additional destinations. Federal Lands Access Program (FLAP) grant applications are also pending for a Portland-Hood River-Timberline connection. This service would also serve Mount Hood Meadows and connect with the Mount Hood Express transit service that operates between Timberline and Portland four times per day, seven days per week. The availability of this service is also likely to greatly increase demand between The Dalles and Hood River.

Columbia Area Transit & LINK – Hood River/The Dalles/Portland

CAT and LINK provide fixed-route service connecting Hood River, The Dalles, and Portland on Tuesday and Thursday each week. The feasibility of a third day of service is being assessed. The bus departs the transit center in The Dalles in the morning and returns from TriMet's Gateway MAX light rail/bus transit station in Portland during the afternoon, with a stop in Hood River each way. Fares are $8.00 each way, with discounted rates for seniors and persons with disabilities and free rides for children aged 0-6 years old.

LINK Dial-a-Ride

The Mid-Columbia Council of Governments (MCCOG) provides door-to-door transportation services throughout Wasco County. The trips are scheduled in advance and may serve several passengers with different destinations at once. LINK offers lift-equipped buses. LINK service operating hours are 8:00 AM to 5:00 PM, Monday through Friday, closed on federal holidays. Fares range from $1.50 (within the City of The Dalles) up to $5.00 (originating or ending outside of The Dalles) per trip.

LINK also provides a "Shopper Shuttle" bus on Mondays and Wednesdays, 10 AM to 12 PM. The $3.00 fare provides unlimited stops to access Bi-Mart, K-Mart, Grocery Outlet, St. Vincent Thrift Store, Downtown, Safeway, and Fred Meyer. LINK drivers are available to help load and unload bags. Reservations are required.

A new transit center operated by the MCCOG opened this year on West 7th Street, near the Chenoweth interchange. The transit center serves as a stop location for CAT's service to Hood River and Portland, LINK resources, and Greyhound operations.

Greyhound

Greyhound service provides three trips daily between The Dalles, Hood River, and Portland. However, a day trip to Portland would require a trip from The Dalles to depart at 3:30 AM, 2:40 PM, or 4:25 PM, and depart Portland at 10:00 AM, 12:10 PM, or 11:00 PM. Roundtrip fare prices range from $48 to $75, posing a barrier for low-income populations.

Amtrak

The nearest Amtrak station is in Wishram, Washington. This station is served by Amtrak's Empire Builder route, connecting Seattle and Portland to cities across the northern United States and ending in Chicago. The Portland-bound train departs at 7:30 AM daily and arrives in Portland at 10:10 AM, with lowest amenity roundtrip fares near $46. The Spokane-bound train departs at 6:55 PM daily and arrives in Spokane at 12:13 AM, with lowest amenity roundtrip fares near $82. The Wishram station is located approximately 16 miles from The Dalles. Currently, there are no fixed-route transit connections nor does LINK dial-a-ride provide service between the station and The Dalles.

1.3.2 LINK and CAT Ridership

Monthly ridership data for LINK dial-a-ride and CAT's service to Portland from The Dalles was provided by MCCOG for financial year 2015-2016. LINK dial-a-ride service includes Medicaid and Shopper Shuttle riders. The data shows 697 annual rides to/from The Dalles on CAT's service to Portland, 2,998 annual rides to/from The Dalles on CAT's service ending in Hood River, and 18,999 annual rides on the LINK dial-a-ride service. Figure 7 shows ridership data by month for each of these services. Ridership was highest between July and October for service to Portland, January and February for service to Hood River, and January and June for LINK service. The increase in LINK ridership could be partially the result of an increase in service hours in Quarter 1 and 2 of 2016 as compared with 2015.

Figure 7 – Monthly Ridership (FY 2015-16)

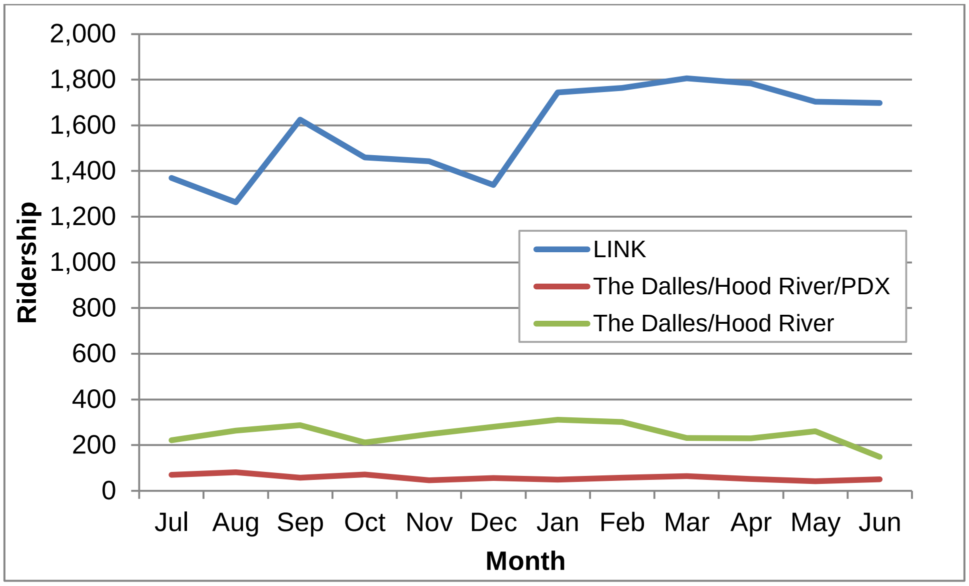
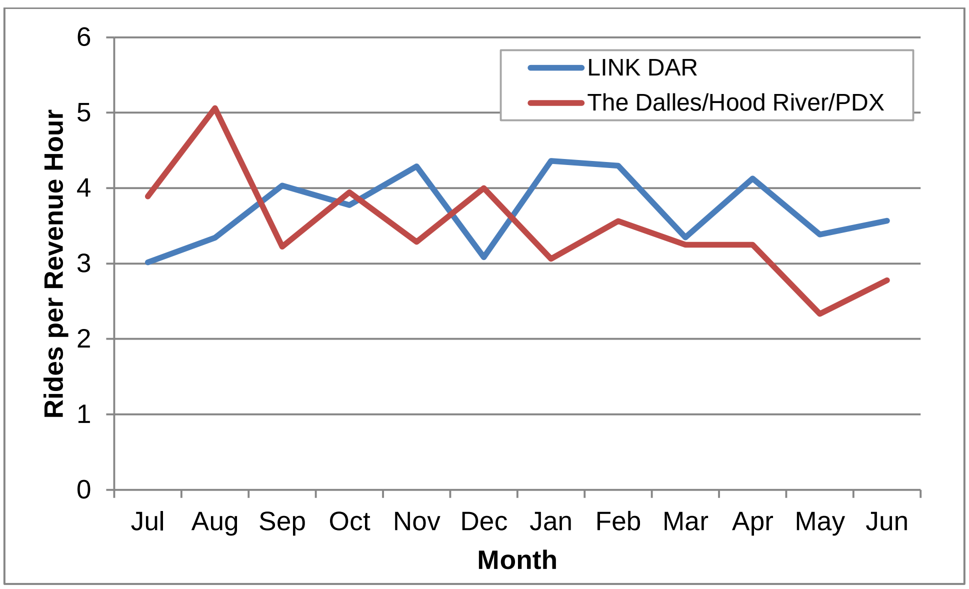


Figure 8 shows rides per revenue hour for CAT's service to Portland and LINK dial-a-ride service. Both services have annual average rides per service hour of approximately 3.5. This is a very productive rate for dial-a-ride service with most small transit agencies striving to reach 2.0 rides per hour. The LINK's high rate could be attributable to the lack of fixed-route service, the relatively compact size of The Dalles, and very efficient trip scheduling and routing.

Figure 8 – Riders per Revenue Hour by Month (FY 2015-16)



1.3.3 CAT The Dalles-Hood River On-Off Analysis

CAT operates three buses per day between The Dalles and Hood River. This route currently serves two stops in The Dalles: the Columbia Gorge Community College (CGCC) and the new transit center.

However, the data summarized below does not include this stop; data is from the prior downtown Transportation Center stop. Boarding and alighting information providing the annual number of passengers entering and exiting the bus at each of the existing stops in The Dalles is summarized by time-of-day in Figures 9 and 10.

Figure 9 – The Dalles Annual Boardings by Time-of-Day

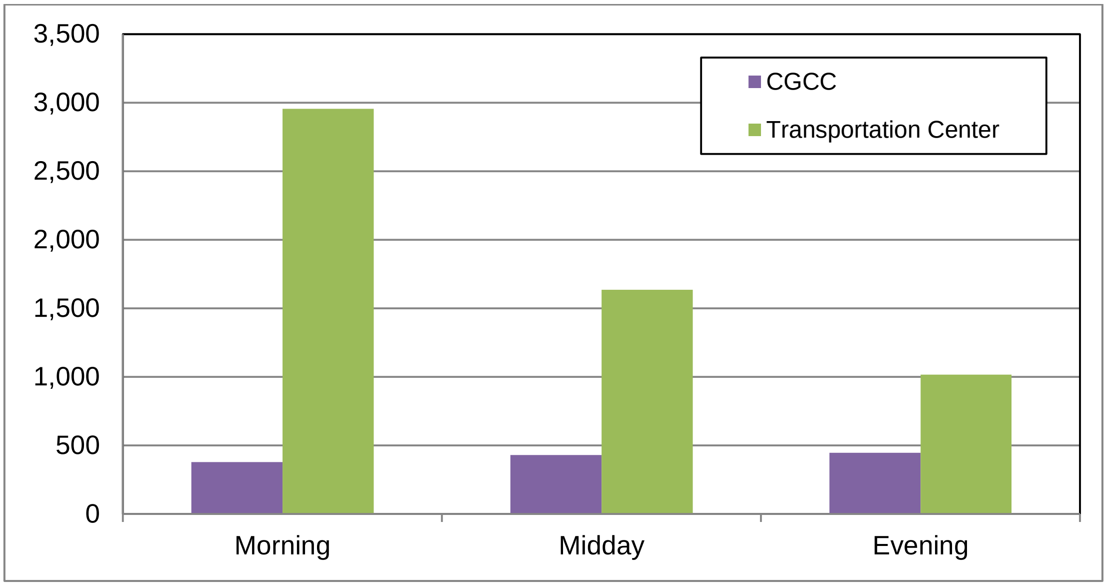
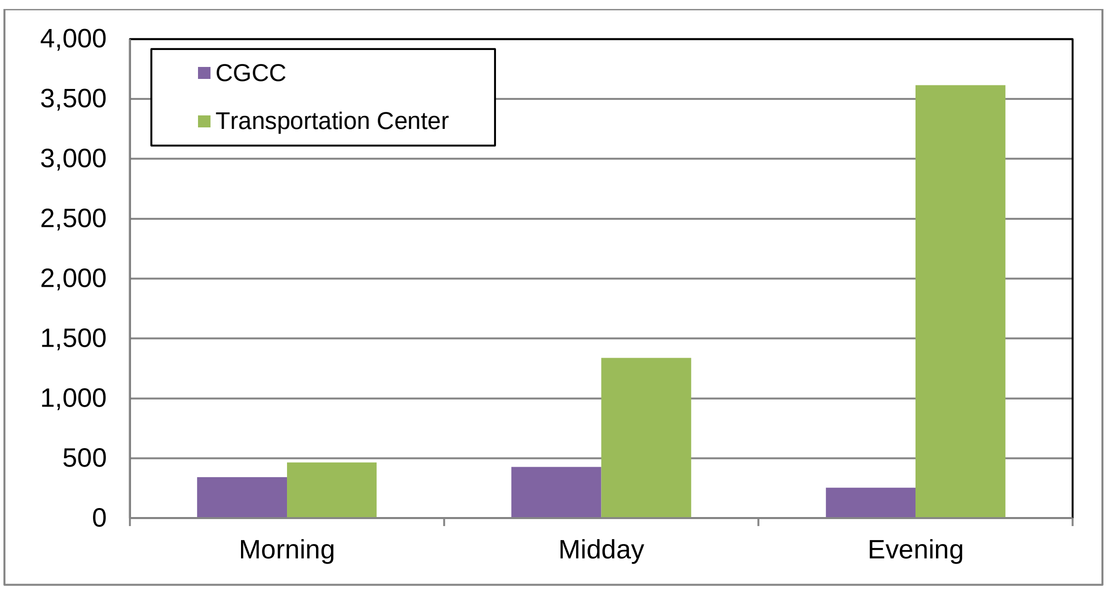


Figure 10 – The Dalles Annual Alightings by Time-of-Day



The boarding and alighting data show high boardings at the downtown Transportation Center in the morning, fewer during midday, and even less during the evening. Alightings at the downtown Transportation Center increase throughout the day. This pattern suggests that ridership on this route is predominantly people commuting from The Dalles to Hood River. Boardings and alightings at the CGCC are relatively balanced throughout the day indicating that this stop is serving students commuting to

The Dalles from Hood River. The reported boardings and alightings also suggest commuters from The Dalles to Hood River may find this stop more convenient than the current downtown Transportation Center.

1.4 CAT ON-BOARD SURVEY

Columbia Area Transit (CAT) conducted a rider survey as part of their Transit Development Plan process. This survey includes origin-destination questions for riders to/from The Dalles. Of the 34 survey respondents, 8 riders identified either their origin or destination in The Dalles. The findings of the survey are as follows:

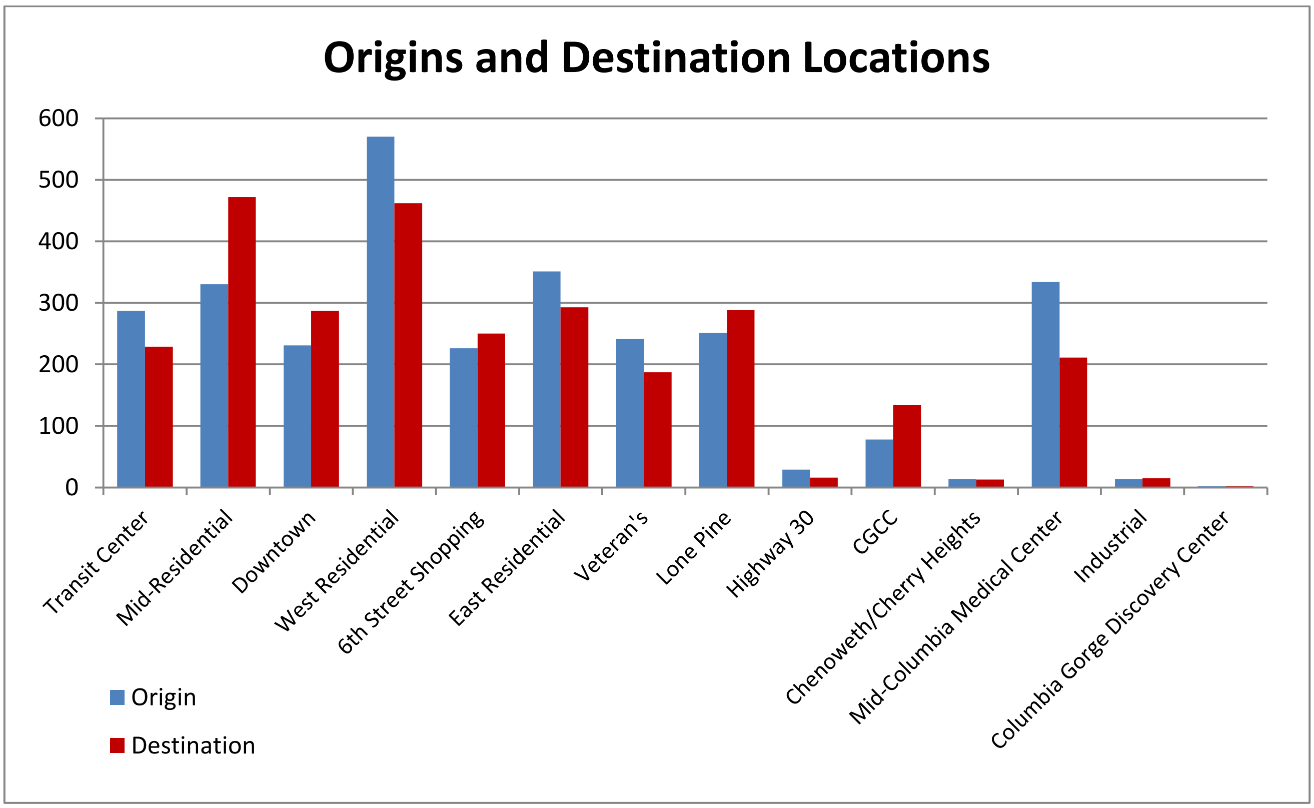
- **Origins** of riders include home (4), work (1), school/college (1), shopping (1), and other (2).
- **Destinations** of riders include home (4), work (1), school/college (1), recreation (1), and other (1).
- Riders **got to the bus station by** walking (5), transferring from another transit service (1), getting dropped off by car (1), and transferring from another service after being dropped off by car (1).
- Riders planned to **get to their destination** by being picked up by car (3) and other (1).
- When asked if their trip **started and ended in Hood River**, 1 rider indicated yes and 4 riders indicated no.
- For **round trips** on the bus that day, 4 riders indicated yes and 4 riders indicated no.
- CAT **ridership frequency** was at 5 days per week (1), 2 to 4 days per week (4), 1 day per week (1), and 1 to 4 days per month (2).
- If there was no bus available, riders' **alternatives to the bus** included walk or bike (1), drive alone (1), be driven by someone else or take a taxi (5), or Greyhound (1).
- 3 riders had **access to a car** for that particular trip and 3 riders did not have access to a car.
- Riders' **ages** were under 16 years (1), 23-34 years (1), 35-49 years (2), 50-62 years (2), and 62 years or more (2).
- Riders' **ethnicities** were white/Caucasian (6), Asian (1), and other (1).
- Riders' **incomes** were under $14,999 (3), $30,000-$49,999 (1), and $50,000-$74,999 (3).
- Riders' **employment** and student status were not currently employed (1), employed part-time (1), employed full-time (2), retired (3), and other (1).
- For potential **improvements to CAT service**, riders indicated a desire for early morning service (2), evening bus service (1), Hood River local bus service (1), and more service to Portland (2).

Survey responses indicate riders have a wide range of trip purpose, age, income, and employment status. Half of the riders indicated they had access to a car for that particular trip and had higher income; meaning up to 50% of riders may use the service by choice. Rather than walk, several riders were dropped off by car or intending to be picked up by car on the initial or final legs of their trip. This may indicate the walk to or from their stop is too long or physically straining. Fixed-route service could address initial and final connections to origins and destinations.

1.5 LINK TRIP DATA

LINK provided street origin, street destination, and trip purpose information for their dial-a-ride trips from third quarter of 2016. The origin and destination streets were categorized by area of town, as shown in Figure 11.

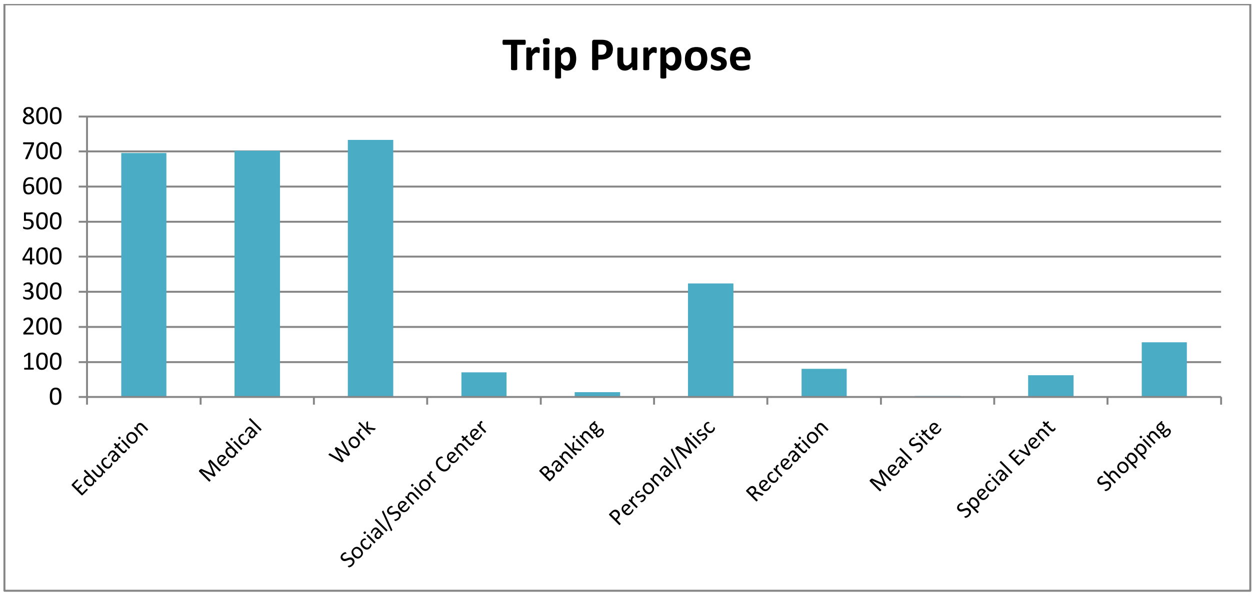
Figure 11 – Origin and Destination Locations



The Veteran's area includes Columbia View Drive, Veteran's Drive, and any connecting residential streets. The East Residential area includes residential streets from Old Dufur Road to Dry Hollow Road. The Mid-Residential area includes residential streets from Dry Hollow Road to Wright Street. The West Residential area includes residential streets from Wright Street to Pomona Street. Transit Center includes residential and commercial streets from Pomona Street to Irvine Street. Several streets are ambiguous, such as W 10th Street, which extends from the Mid-Residential area to the Transit Center. These streets were assumed to be in the West Residential area.

Trip purpose is shown in Figure 12. As shown, the purpose for approximately 25% of trips was for education, 25% for medical purposes, 26% for work, and the remaining 24% for social/senior center, banking, personal/miscellaneous, recreation, meal site, special events, or shopping.

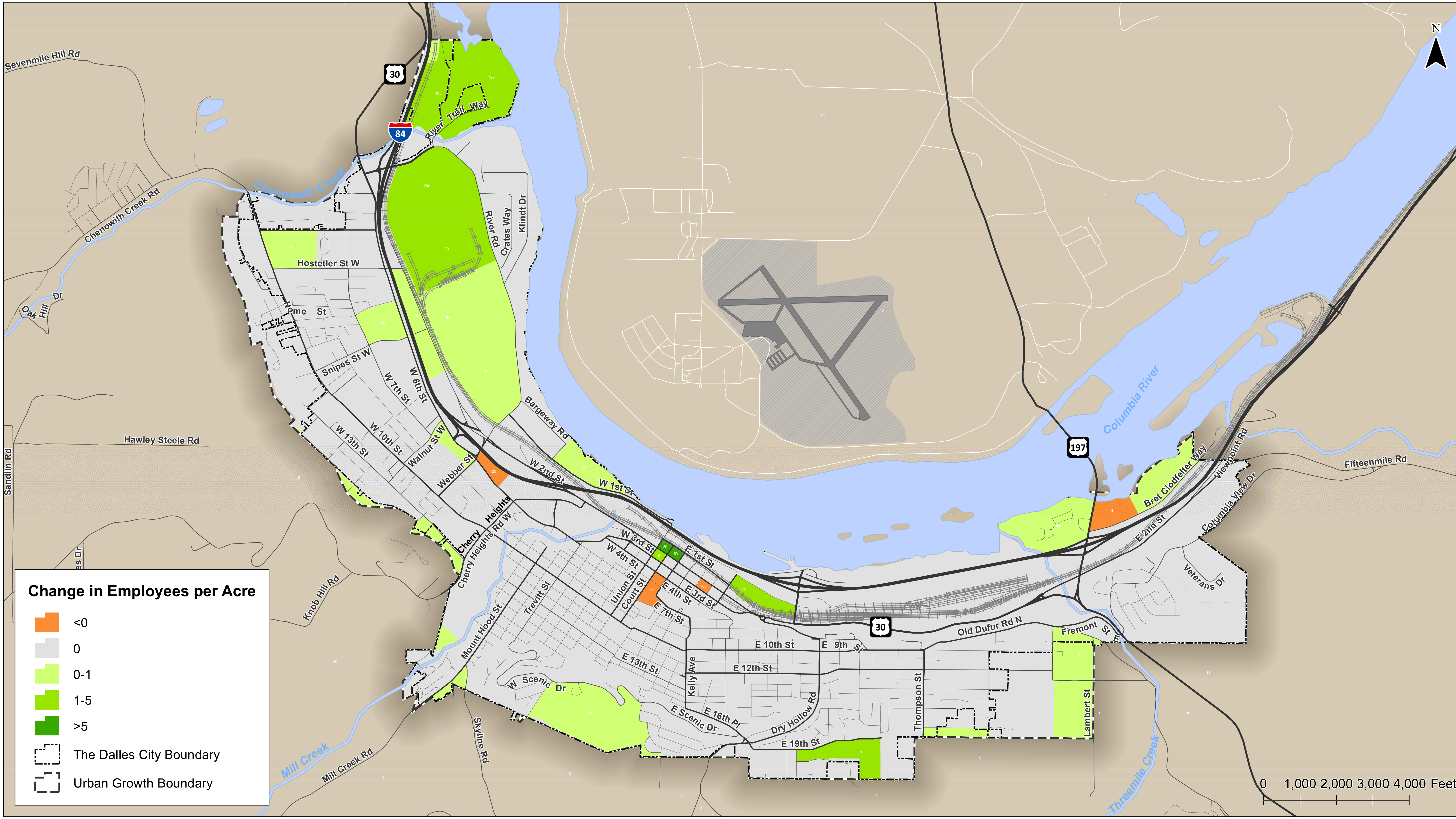
Figure 12 – Trip Purpose



1.6 NEXT STEPS

The information in this memorandum was discussed with the Transit Plan Advisory Committee (TPAC) which includes representatives from the City, Wasco County, ODOT, MCCOG, CAT, and the MCEDD.

We will then prepare an alternatives analysis memo assessing potential fixed-route transit service models including suggested stop locations and costs, an estimate of potential transit demand, and potential costs and funding options available for different service models. This analysis will be discussed with the TPAC to determine what elements should be incorporated into the City's Transportation System Plan.



Change in Employment from 2010 to 2036
The Dalles, Oregon

Figure 1

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County

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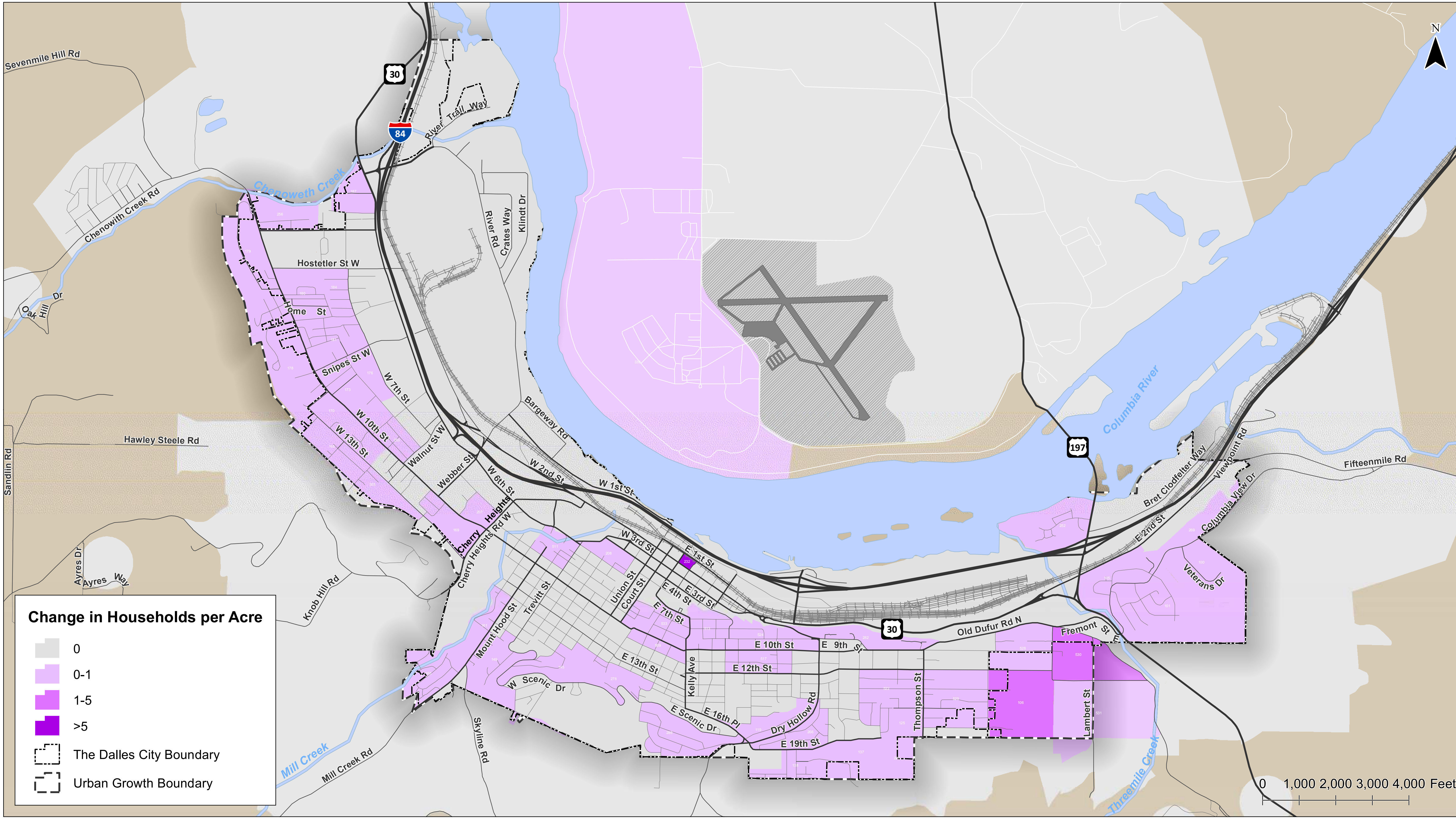

Change in Households from 2010 to 2036
The Dalles, Oregon

Figure
2

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County

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2010 Transit Supportive Areas
The Dalles, Oregon

Figure
3

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Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County

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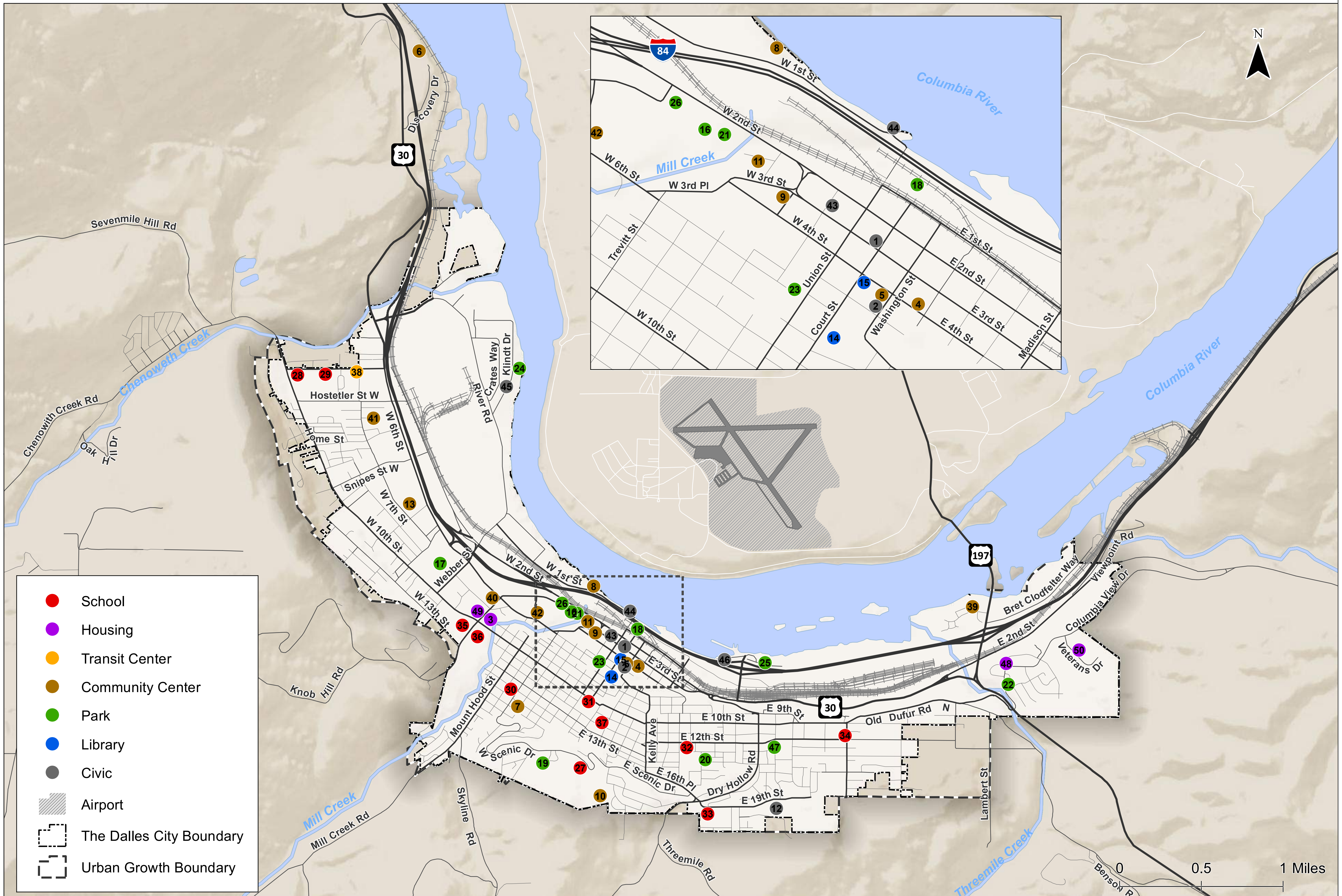
2036 Transit Supportive Areas
The Dalles, Oregon

Figure
4

Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County



1 The Dalles City Hall
2 Wasco County Court House
3 Mid-Columbia Senior Center
4 The Dalles Civic Auditorium
5 The Dalles Art Center
6 Columbia Gorge Discovery Center
7 Fort Dalles Museum
8 Rock Fort
9 Old St. Peter's Landmark
10 Fort Dalles Readiness Center
11 Wasco County Courthouse Muesum
12 Mid Columbia Medical Center
13 The Gorge Youth Center (future)
14 The Dalles - Wasco County Library
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17 Kramer Field
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41 Bi-Mart
42 Safeway
43 The Dalles Post Office
44 Columbia River Commercial Dock
45 Port of The Dalles
46 The Dalles Marina
47 Bob Williams Field
48 Flagstone Senior Living
49 Cherry Heights Senior Living
50 Oregon Veterans Home

Activity Centers
The Dalles, Oregon

Figure
5

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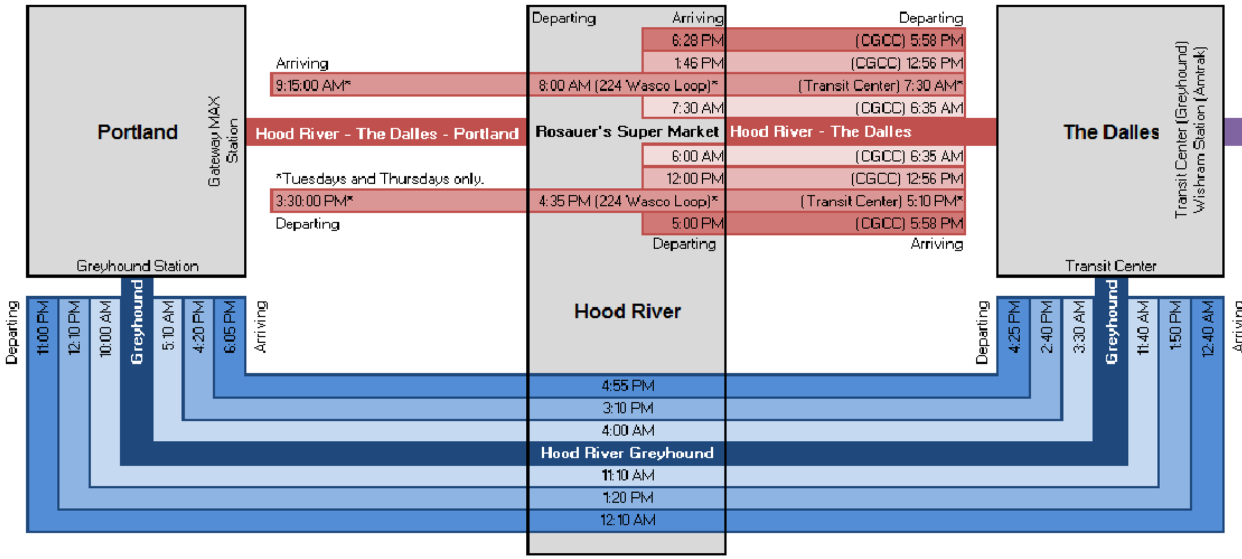
Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning
APG

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA



Arriving

Time Range	Pendleton (Greyhound)	Spokane (Greyhound)	Empire Builder (Amtrak, Wishram Station): Portland	Empire Builder (Amtrak, Wishram Station): Spokane
6 PM - 6 AM	3:30 AM			6:55 PM
12 PM - 6 PM	2:45 PM	4:20 PM		
6 AM - 12 PM			7:30 AM	
Amtrak & Additional Greyhound Routes				
6 AM - 12 PM		11:45 AM		7:30 AM
12 PM - 6 PM	1:50 PM	2:40 PM		
6 PM - 6 AM	12:45 AM		6:55 PM	

Departing

Existing Weekday Transit Routes
The Dalles, Oregon

Figure
6

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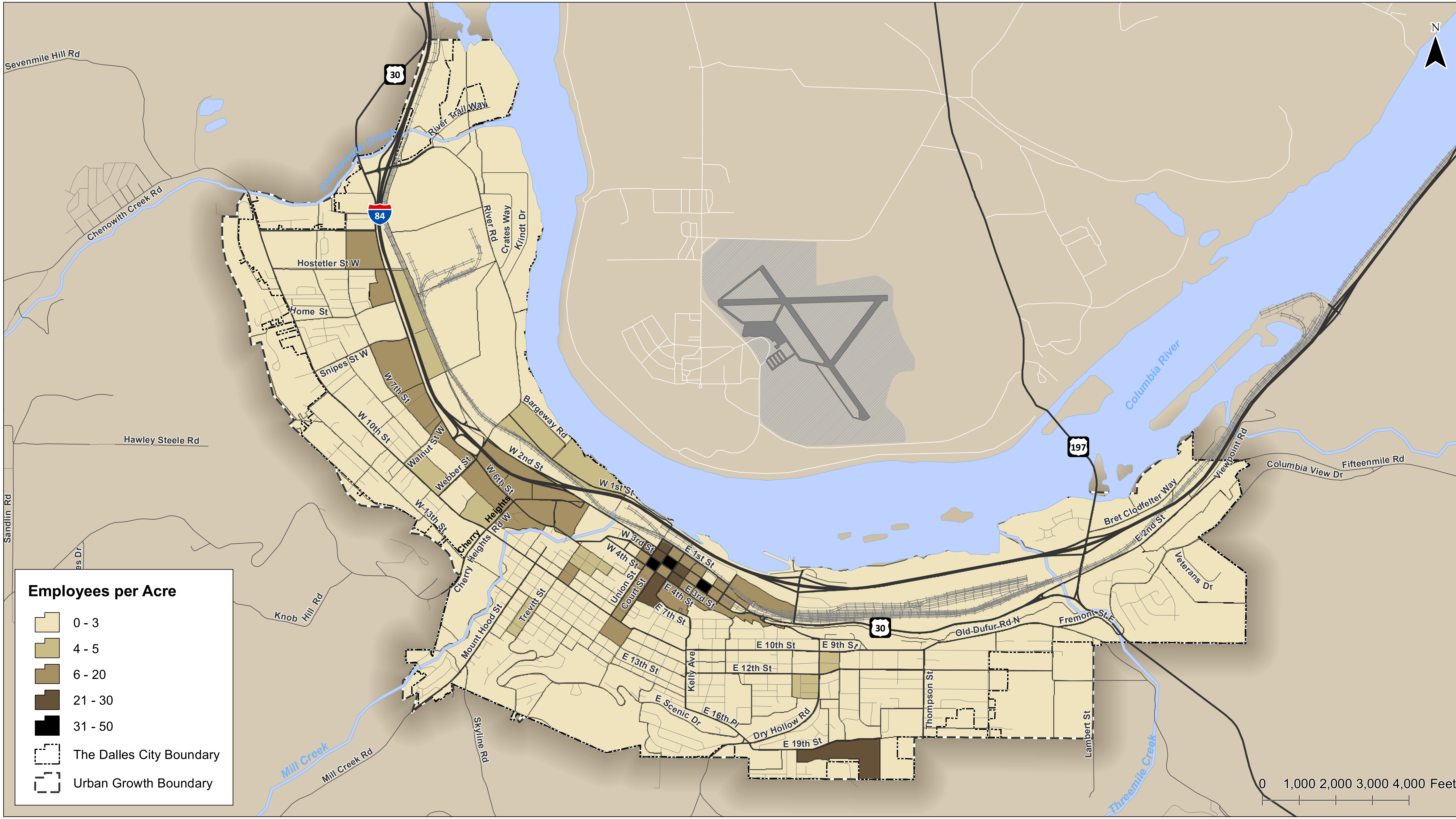
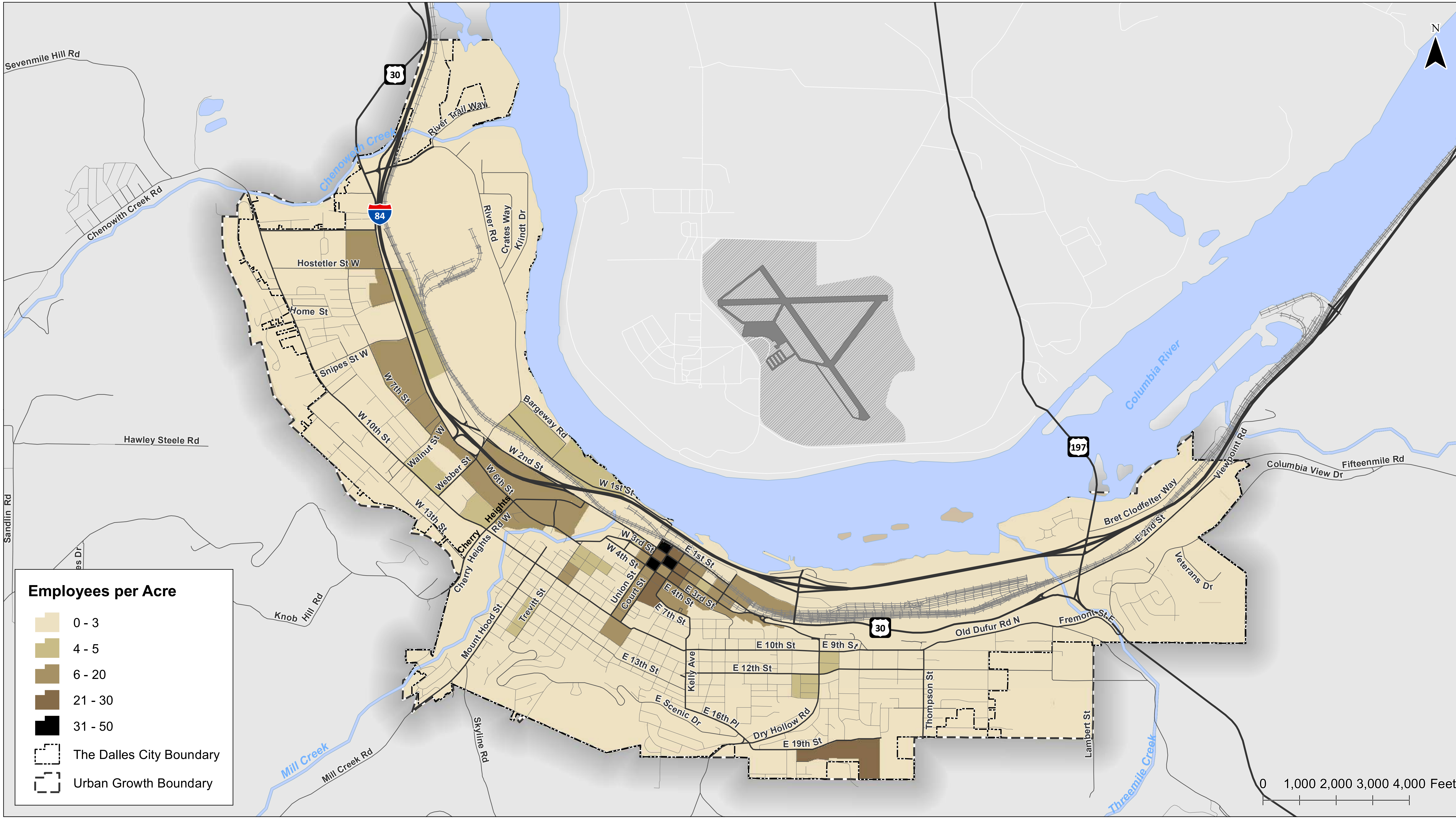
Attachment A Jobs and Housing Densities



2010 Employment Density
The Dalles, Oregon

Figure 1

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County



2036 Employment Density
The Dalles, Oregon

Figure
2

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County

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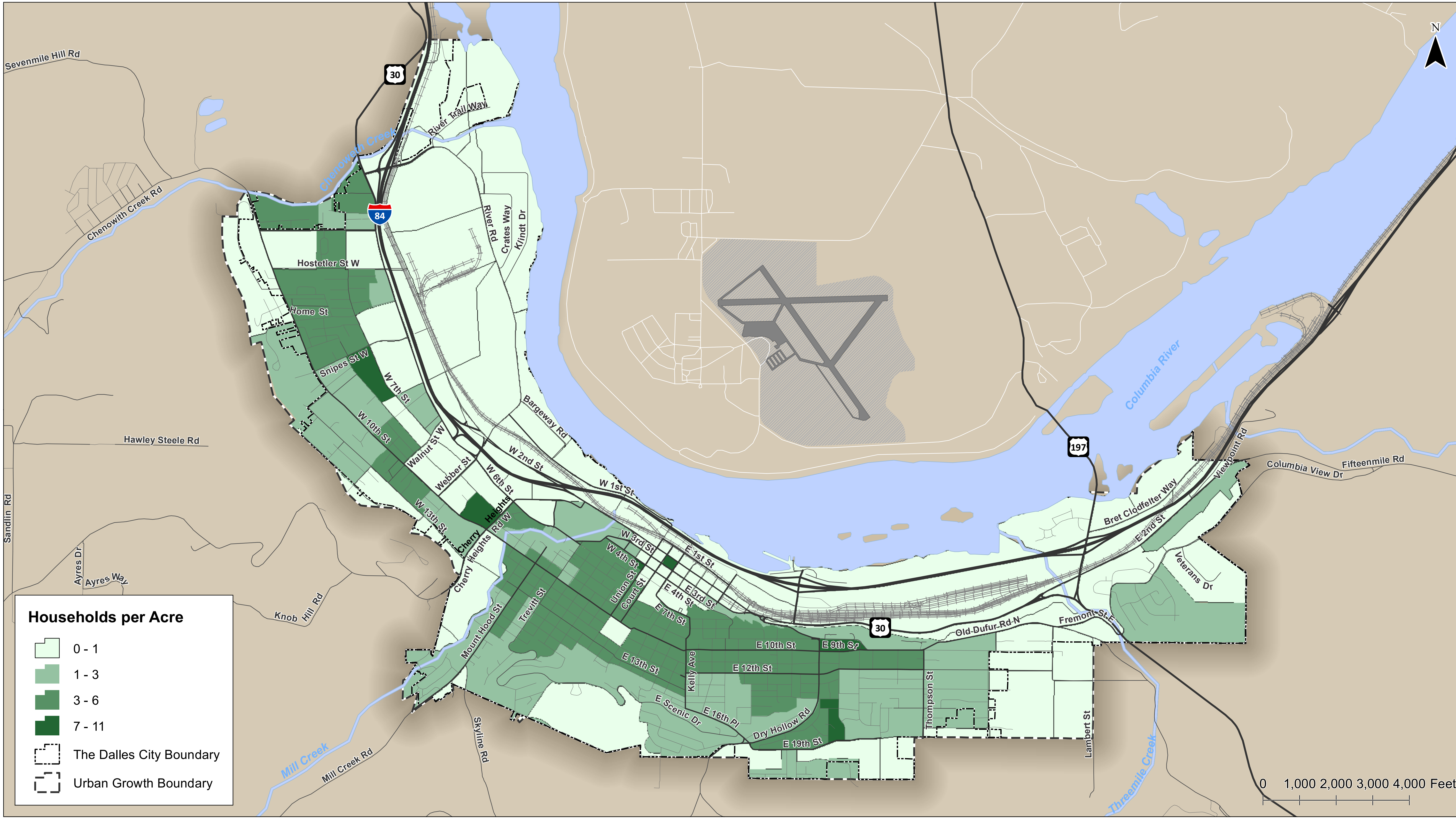

2010 Household Density
The Dalles, Oregon

Figure
3

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County

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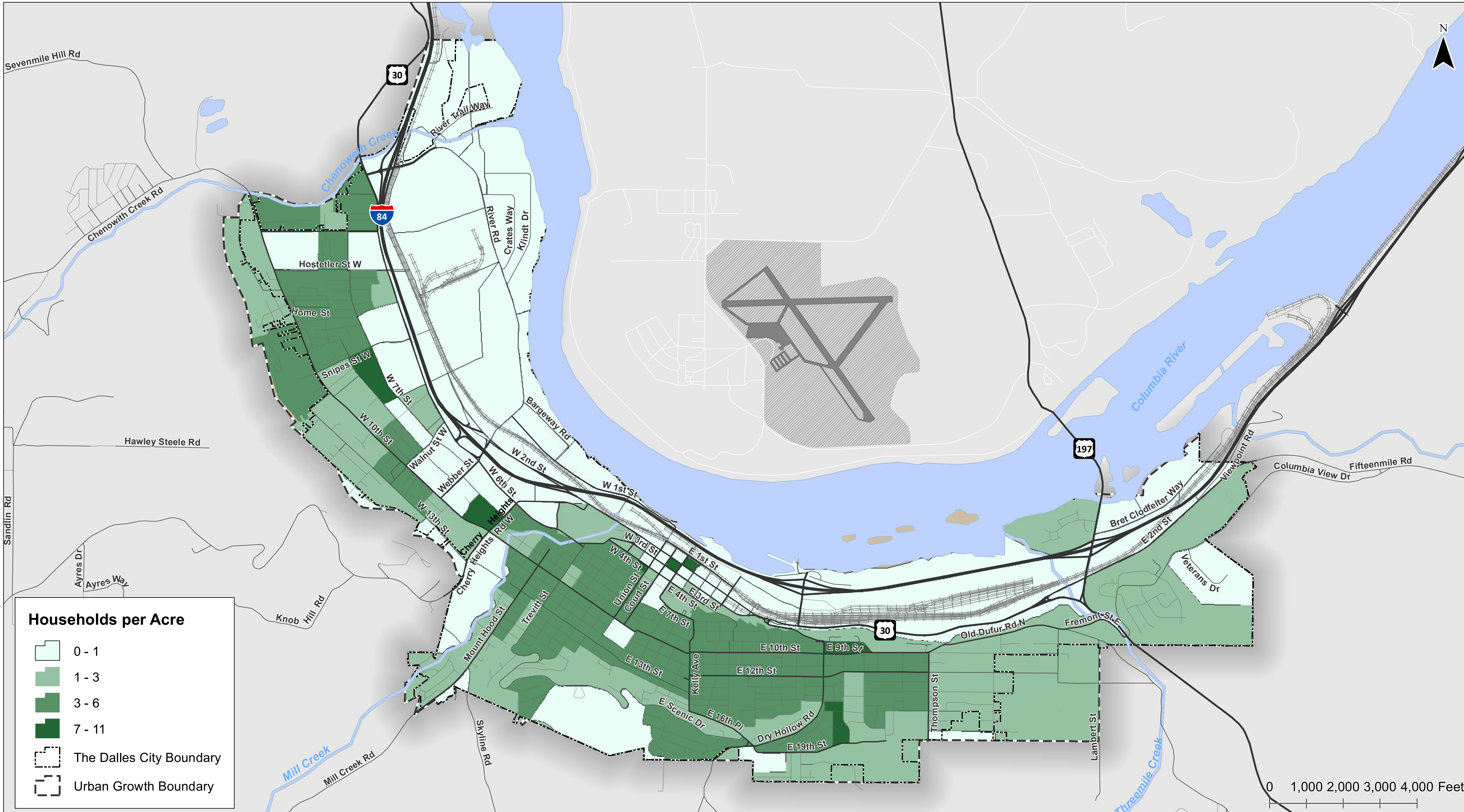

The Hub of the Pacific Northwest — City of The Dalles, Oregon

2036 Household Density
The Dalles, Oregon

Figure
4

Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning
APG

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County

Attachment B Needs and Strategies Assessment

Strategies to Address Needs, Barriers and Gaps

Based upon information gathered from public meetings, surveys, and stakeholder interviews the following are strategies to address Wasco County's transportation needs, barriers and gaps. Strategies affecting seniors are marked by an S, those affecting individuals with disabilities are marked by a D, those affecting low-income individuals are marked by an LI and those affecting Limited English Proficiency individuals are marked by and LEP. The Special Transportation Fund Committee was tasked with determining the Priority rankings for each of the strategies corresponding to an identified transportation need, barrier or service gap. In the chart below, green denotes high priority and yellow denotes medium priority. There were no low priorities listed. Please see Appendix K for the Criteria and Methodology used in determining strategic priorities and Appendix L for a List of the Prioritized Strategies.

Category: Sustain Existing Transportation Services

Identified Transportation Needs/Barriers and Service Gaps	Strategies to Address	Priority	Population Affected(S/D/LI, LEP)	Resource Capacity
Continue to provide the current dial-a-ride transportation service which is vital to special needs populations.	Maintain dial-a-ride transportation operations.	High	S,D,LI, LEP	Administration capacity exists. Financial resources likely available through STF funding for operations.
Continue to provide current shopping buses which are very popular and highly utilized.	Maintain shopping bus service. Conduct regularly scheduled review of service to ensure target populations needs are being met.	High	S,D,LI, LEP	Administration capacity exists. Financial resources likely available through STF to fund operations.
Maintain intercity service to Hood River to connect with CAT's intercity Portland bus service	Maintain intercity service to Hood River to connect with CAT's intercity Portland bus service. Conduct regularly scheduled review of service to ensure target populations needs are being met.	High	S,D,LI, LEP	Administration capacity exists. Financial resources likely available through STF & 5310 to fund operations.

Category: Operations

Identified Transportation Needs/Barriers and Service Gaps	Strategies to Address	Priority	Population Affected(S/D/LI, LEP)	Resource Capacity
Fleet Management	• Provide for replacement of vehicles that have exceeded their useful life. • Provide funding for ongoing and timely preventative vehicle maintenance to ensure the safety and reliability of the transportation services.	High	S,D,LI, LEP	Administration capacity exists. Financial resources likely available through STF funding for operations as well as through other state transportation grants, e.g. 5310.
Completion of Transit Center infrastructure	Seek funding for construction of: • a bus shelter to protect the vehicles from the elements and to secure them after hours (intended to be completed with already available funds); • a maintenance shop for routine vehicle service to optimize vehicle safety and longevity; • Park and Ride infrastructure to complete Transit Center.	Medium	S,D,LI, LEP	Administrative capacity exists. Financial resources likely available through capital equipment grants or funding resources.
Maintain affordable fares as cost is an issue for the target populations.	• Continue to secure state, Federal and local funding to keep fares minimal. • Explore other fare options.	High	S,D,LI, LEP	Administration capacity exists and there is a will of The LINK administrators to keep public transportation as affordable as possible.

Address scheduling difficulties presented by the need for 24-hour advance notice for dial-a-ride services. Resolve frustration over the 30 minute pick-up window/wait-time for dial-a-ride service.	• Explore the possibility of creating some type of fixed route or deviated transportation service within the City of The Dalles as outlined in the Transportation Development Plan. • Better educate target populations about how the transportation system operates.	Medium	S,D,LI, LEP	Administration capacity exists. The Transportation Development Plan will explore the feasibility and sustainability of additional fixed route or deviated service within the City of The Dalles and will address implementation. Costs may be off-set by reduced staff time needed to schedule the dial-a-ride public transportation and by efficiencies gained through consolidated and consistent routes.
Address antiquated cash/exact change only or ticket payment system.	Monitor and explore new fare payment systems in order to identify one to replace MCCOG's current cash only/exact change and paper tickets' fare system. Explore options for Monthly Passes Review locations and distribution options for purchase of tickets.	Medium	S, D,LI,LEP	Administrative capacity exists. Special foundation or local/regional grant money may be available for start-up costs when a viable option is identified.

Address staff language and cultural training skills to meet the needs of those with Limited English Proficiency.	The LINK is participating in the Association of Oregon counties LEP Implementation of Recommendations grant which will address staff language and cultural understanding through an education session co-created with members of the Latino community. A one page resource with key Spanish transportation phrases will be shared and the use of Google Translate App in the field may be tested. Staff language and cultural training will be continued after the grant period ends.	High	S,D,LI, LEP	The LINK Administration is in support of the LEP Implementation grant. Funding was secured through the Association of Oregon Counties/ODOT.
Implement the Transportation Development Plan to enhance service delivery and better serve the transportation needs of the City of The Dalles.	Use the Transportation Development Plan's recommendations as a guide to next steps.	Medium	S,D,LI, LEP	Administration capacity exists. May require additional financial and staff resources. Some financial resources are likely available through STF & 5310 funding as well as through other state and Federal transportation grants, e.g. discretionary funds; local funds will be necessary as will be fares; private partners may be interested in supporting.

Category: Service Expansion

Identified Transportation Needs/Barriers and Service Gaps	Strategies to Address	Priority	Population Affected(S/D/LI, LEP)	Resource Capacity

Expand dial-a-ride service area coverage inclusive of the entire county.	• Analyze operations to see if efficiencies would provide greater ability to offer more reliable service to outlying areas of the county. • Consider public/private partnership to expand services throughout the county. • Continue to seek state/federal and private grant funding to support expanded service. • Consider paid display ads on buses to help fund expanded	Medium	S,D,LI, LEP	Administration capacity exists. Would require additional financial and staff resources. Financial resources are likely available through STF funding as well as through other state and Federal transportation grants, e.g. discretionary funds; local funds would be needed; private partners may be interested in supporting.

Employment transportation: address the very real need some individuals in the target populations have in accessing regular public transportation to/from work.	• Seek state/federal/local and private grant funding to support service expansion to meet workers' needs.
	• Consider cooperative partnership with employers to help fund service expansion.
	    • Conduct a survey of employers to clarify needs, identify partners and define potential contributions
	    • Explore incentives for employers to participate
	• Consider paid display ads on buses to help fund expanded service hours.
		High	D,LI,LEP	Administration capacity exists. Would require additional financial and staff resources. Financial resources may be available through STF or 5310 funds or state/federal transportation discretionary funding; Local funding would be needed; private partners may be interested in supporting.
				Foundation funds for needs assessment

Address the capacity of the sole, existing transportation provider by assuring stable funding. There is a high demand for transportation services yet public transportation dollars remain flat. Stable Federal, state and local funding is imperative in order to continue to acquire and maintain the number of vehicles as well as the staffing level necessary to meet demand. Address limited local funding that can be used to leverage state and federal funding sources.	• Continue to seek all Federal and state transportation grants that The LINK is eligible for. • Leverage all match against Federal and state grants. • Utilize local groups to advocate for public transportation funds. • Identify, secure and utilize potential additional sources/partners to support local operational funding or local match, such as support from the Chamber, the City, Community College etc. • Identify, secure and utilize nontraditional sources of local funding, such as support from the business community. • Develop a strategy to discuss the feasibility of establishing a taxing authority through referral to voters to establish a Public Transit District.	High	S,D,LI, LEP	MCCOG currently seeks out and applies for eligible grants. Working with local groups to develop advocates for public transportation requires additional administrative capacity. This work might best be done by a Board member. Working to identify and build collaborative operational support from potential additional sources/partners is an idea which has merit and while it will take skill and time, may be worth the effort. Taxing authority discussion would be challenging and take a great deal of time.

Category: Marketing/Education/Outreach

Identified Transportation Needs/Barriers and Service Gaps	Strategies to Address	Priority	Population Affected(S/D/LI, LEP)	Resource Capacity
Improve bilingual marketing and public awareness of the County's transportation services and how to access them. Across the target population groups, many did not know about the public transportation options available to them.	• The LEP Implementation of Recommendations grant is designed to address bicultural marketing and public awareness of the County's transportation services and how to access them. • The grant also incorporates additional outreach to Human Services Agency staff to reach the target populations with meaningful transportation information. • Support the Travel Ambassadors program. The Travel Ambassadors are community health workers who will provide one-on-one education on how to understand and access the County's transportation services. • Include materials in Spanish on the buses and in fare detail. • Develop and conduct ongoing Wasco County marketing campaign using traditional and nontraditional approaches to reach the target market.	High	S,D,LI.LEP	Resource capacity is high as the LEP Implementation grant is funded for implementation FY 2016/17. For ongoing marketing, the administrative capacity may be limited. MCEDD's Mobility Manager can assist with outreach efforts.

Address stigma and negative perceptions of the transportation system. Stakeholders shared there is a negative perception associated with using the Dial-a-Ride transportation service that precludes them from using it. Survey respondents indicated they do not associate The LINK with public transportation.	• Consider additional outreach and education on benefits of using public transportation: eco-friendly; relaxing – can read or text while riding; • Consider an "everybody rides" campaign by asking a series of local celebrities to ride and publicizing their trips in social and print media. • Modernize the look of buses and equipment, which may include "wrapping" the bus and adding bike/board racks	High	S,D,LI.LEP	Administrative capacity may be limited to provide the time required to perform additional outreach and/or conduct an "everybody rides" campaign. The STF committee can assist with connections to support these activities
Address safety and security concerns voiced particularly by Limited English Proficiency stakeholders due to language and cultural barriers and those voiced by seniors and other target populations. Address the ease of using the system for target populations with better connections to the natural communication points, such as Community Health Workers and Medical schedulers.	• Support the Travel Ambassadors program to be developed through the LEP grant. The Travel Ambassadors are community health workers who will provide one-on-one education on how to understand and access the County's transportation services. • Extend the Travel Ambassador program to reach additional populations • Increase connections to Community Health Workers (CHW) and medical schedulers with marketing materials and information; provide education including at CHW training events	High	LEP	The Travel Ambassadors program development is funded for implementation FY 2016/17. Partner with the CCO. Work with Community Health Workers

Market and promote the system to ensure target populations are aware of the services available.	• Distribute material about the transportation system at key sites. • Maintain existing promotion activities, including website, radio and print. • Increase targeted outreach to individuals with disabilities, aging persons in the County and persons with lower incomes • Explore effective opportunities to better promote the services offered.	High		The STF committee can assist with connections to key distribution sites

Category: Planning and Coordination

Identified Transportation Needs/Barriers and Service Gaps	Strategies to Address	Priority	Population Affected(S/D/LI,	Resource Capacity
Increase options for regional travel in the Mid-Columbia area.	Continue participation in the Gorge TransLink Alliance to network and collaborate with the Mid-Columbia transportation service providers. Gorge TransLink Alliance members continue to identify and bring to fruition funding opportunities to support regional transportation connections.	Medium	S,D,LI.LEP	Capacity currently exists through the Administrators' regular participation in the Gorge TransLink Alliance.
Continued collaboration with Human Services providers in essential to meet the needs of the target population.	As able, attend public Human Service Agency meetings to maintain strong working relationships and bolster the ability to respond collaboratively to emerging needs or changing conditions.	Medium	S,D,LI.LEP	Capacity exists within the current Administration.

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TRANSIT FEASIBILITY MEMORANDUM #2

Date:	January 12, 2017	Project #: 18495.8
To:	Transit Plan Advisory Committee	
From:	Susan Wright, PE and Krista Purser, Kittelson & Associates, Inc.	
Project:	The Dalles Transportation System Plan	
Subject:	Transit Alternatives and Feasibility Assessment	

The City of The Dalles is nearly complete with an update to their Transportation System Plan (TSP). Prior to adopting the TSP in early 2017, the City of The Dalles and the Oregon Department of Transportation (ODOT) are partnering to assess the potential for enhancing transit service within both the local community and the region. Transit Feasibility Memorandum #1 provided background information related to existing services, ridership, needs, and key destinations used to complete the alternatives analysis in this memorandum. This memorandum identifies potential fixed-route service alternatives, estimates the potential ridership, estimates costs, and identifies potential funding opportunities. These memorandums will inform the Transit chapter of The Dalles TSP.

1.1 TRANSIT SERVICE ALTERNATIVES

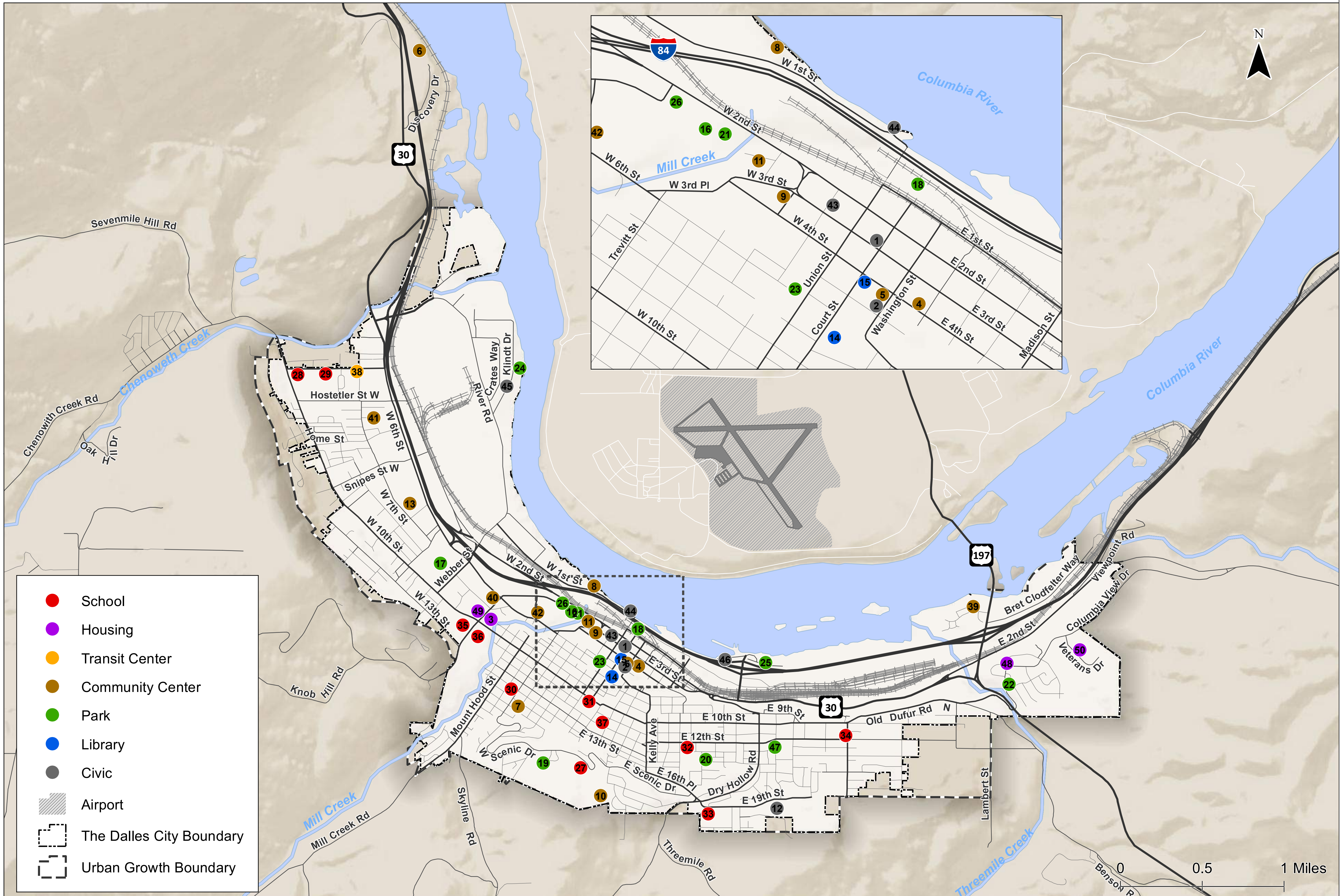
The following provides details and assumptions for several transit service alternatives, including key stop locations, routing and frequency, operating costs, and capital costs.

1.1.1 Key Stop Locations

Key destinations in The Dalles were identified based on findings from the Wasco County CTP and discussion with the Transit Plan Advisory Committee (TPAC). Figure 1 shows these destinations.

High priority stops for service in the near-term include:

- Transit Center
- 6th Street Shopping (Cascade Square, Safeway, Fred Meyer, etc.)
- Downtown
- Lone Pine Shopping, Residential, Medical Area, and nearby hotels
- Mid-Columbia Medical Center
- Columbia Gorge Community College – The Dalles (CGCC)



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49 Cherry Heights Senior Living
50 Oregon Veterans Home

Activity Centers
The Dalles, Oregon

Figure
1

Oregon Department of Transportation

Kittelson & Associates, Inc. Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

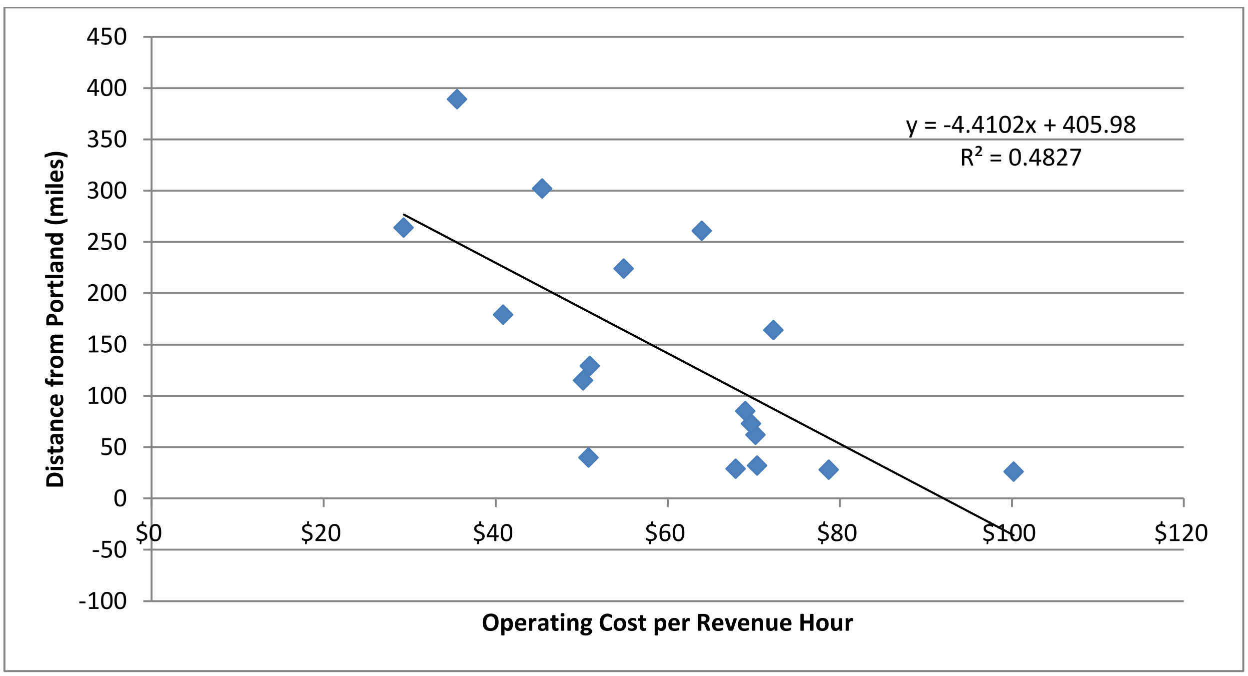
Routing alternatives, discussed in section 1.2, prioritize these destinations and aim to serve additional destinations identified in Figure 1 along the route.

Although an important destination for dial-a-ride, the Veterans Clinic is not identified as a high-priority stop for fixed-route transit due the difficulty to serve it and the high portion of riders in that area that will still require a door-to-door ride. However, two alternatives are provided that serve this area.

1.1.2 Operations and Capital Cost Assumptions

The Federal Transit Administration requires recipients of Urbanized Area Formula Program (5307) or Rural Formula Program (5311) to report operating cost, revenue hour, and revenue mile data to the National Transit Database (NTD). This data, which includes fixed-route and demand-responsive, was used to estimate operational costs of a fixed-route system in The Dalles. In Oregon, operational costs tend to increase as distance to Portland decreases, as shown in Figure 2.

Figure 2 – Operating Costs per Revenue Hour vs. Distance from Portland (FY 2013)



The Dalles is approximately 85 miles from Portland, similar to Hood River County Transportation District (65 miles, $70.20/hour), Mid-Columbia Council of Governments Link (85 miles, $69.03/hour), and Tillamook County Transportation District (75 miles, $69.70/hour). Based on this assessment, planning level operational costs for a fixed-route transit system in The Dalles are assumed to be approximately $70/hour.

Capital costs are expected to be $500,000 per 40-foot bus, based on the American Public Transportation Association (APTA)'s *2016 Public Transportation Vehicle Database*. The *2015-2018 STIP* shows the average STIP funding for bus purchases to be near $350,000 which typically does not include local match.

1.2 TRANSIT DEMAND FORECAST

Potential transit demand was estimated using TCRP Report 161. The following sections provide an overview of the methodology and the results of five service level scenarios.

1.2.1 TCRP Report 161 Overview

In 2012, the Transportation Research Board (TRB) published a methodology to estimate small-city fixed-route transit demand through Transit Cooperative Research Program (TCRP) Reports 58 and 161. TCRP Report 161 is a workbook providing step-by-step procedures for quantifying the need for passenger transportation services and quantifies the demand that is likely to be generated given the service hours provided.

The purpose of this evaluation is to understand expected demand for a fixed-route system. It is important to note that the demand reported by this analysis is only a rough estimate based on the demographic makeup of The Dalles. It is a very broad brush analysis based on typical demographics factors that would indicate a propensity to use transit. It doesn't contain any specific land use variables and is generic for all small cities.

As shown in Table 1, the ridership estimates for one fixed route bus in The Dalles that operates 7 days per week, 10-13 hours per day, is 41,600 annual trips. The demand forecast increases non-linearly up to 92,400 annual trips if there were three buses operating 7 days per week with the same service hours. By comparison, as documented in Memorandum #1, there are 697 annual rides to/from The Dalles on CAT's service to Portland, 2,998 annual rides to/from The Dalles on CAT's service ending in Hood River, and 18,999 annual rides on the LINK dial-a-ride service. One fixed route bus has the potential to serve roughly double the amount of rides that LINK provides operating approximately three buses per day. *Attachment "A" includes the detailed analysis per TCRP Report 161 methodology.*

Table 1: Transit Demand Forecast

Number of Buses	Annual Revenue-Hours per Route[1]	TCRP 161 Estimated Ridership	Rides/Service Hour	Annual Operating Cost
1	4,415	41,600	9.4	$309,100
2	8,830	67,100	7.6	$618,100
3	13,220	92,400	7.0	$891,500

1 All buses assumed to operate from 6:00 a.m. to 7:00 p.m. on weekdays and 8:00 a.m. to 6:00 p.m. on weekends, a total of 4,415 annual service hours per route operated.

1.3 ROUTE AND SERVICE LEVEL ALTERNATIVES

Running buses on one hour headways would allow for ease of scheduling and predictability. In order to run routes on one hour headways, a maximum of 50 minutes per hour of operating time should be used to account for bus driver breaks, bus driver changes, and late bus catch-ups. Buses operate on an average speed of 10-15 mph. Given these assumptions, proposed route alternatives are roughly 10 miles long. Routes longer than 10 miles would result in headways greater than one hour or the need for additional buses to maintain 60 minute headways. Some alternatives assume operation of two or three buses which can be used to add additional routes and increase the service coverage area, or they can be used to reduce headways from 60 minutes to 30 minutes by running on the same route as another bus.

Most of the alternatives include a loop route. Loops provide the benefit of increasing the service area compared to a line route that travels both directions on the same route. The disadvantages of loops are the increased travel time associated with out of direction travel on a one-way loop as well as the ease of understanding of where the bus will take you and how to ride the bus. Most of the proposed loops are designed to be less than 30 minutes and to operate on parallel streets so as riders could walk for example between 1st Avenue and 10th Street to avoid out of direction travel on the bus. Opportunities to transfer between routes vary by alternative but are mostly provided downtown, at the transit center, or at CGCC.

Routing and scheduling should keep future CAT schedules in mind in order to allow for easy transfers between routes. For example, the Hood River – The Dalles schedule lists bus arrivals at the Transportation Center at 6:46 AM, 12:44 PM, and 5:48 PM. With one hour headways, a fixed-route service could operate for 50 minutes, arrive at the new transit center on the 0:40 of the hour and then depart at the 0:50 of the hour. This would allow transfer to and from the fixed-route service.

Remix, a transit planning software, was used to develop seven routing alternatives. Remix provides estimated run times, population and employment within ¼ mile of the route, and annual operating cost based on the input cost per revenue hour ($70) and hours of service for alternative routes. All routes were assumed to operate from 6:00 a.m. to 7:00 p.m. on weekdays and 8:00 a.m. to 6:00 p.m. on weekends, a total of 4,415 annual service hours per route operated. The seven routing alternatives and their results are described below.

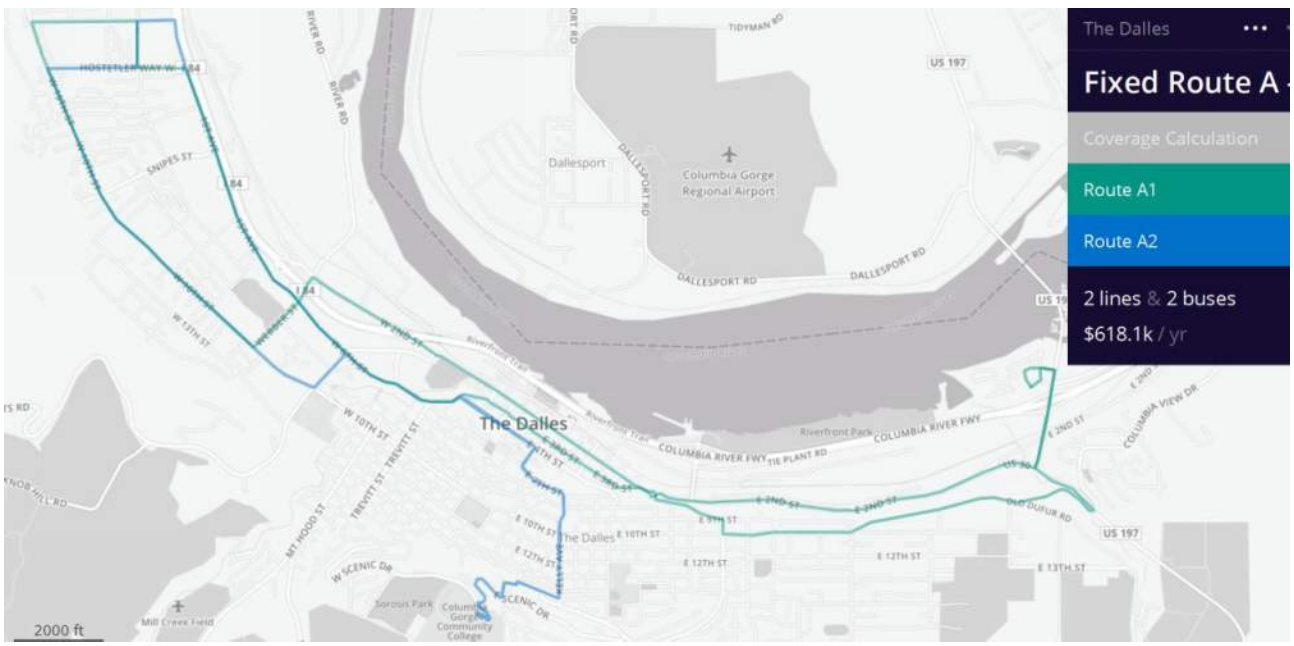
Alternative A

Alternative A covers all high priority destinations between two separate routes except for the Mid-Columbia Medical Center. Two buses run on 1 hour headways. A west loop services the transit center, 6th Street shopping center, Downtown, and CGCC. An east loop services the 6th Street shopping center, Downtown, and Lone Pine. Riders would need to transfer at either a Downtown stop or 6th Street shopping center stop to transfer between the north bus and south bus. This alternative does not serve the Mid-Columbia Medical Center. Alternative A is shown in Figure 3.

Statistics for this alternative include:

- Buses Required – 2
- Revenue Hours – 8,830
- Estimated demand - 67,100 annual rides
- Cost - $618,100 per year to operate, $1,000,000 capital cost
- ¼ Mile Capture area - 6,800 people, 5,300 jobs

Figure 3 – Alternative A



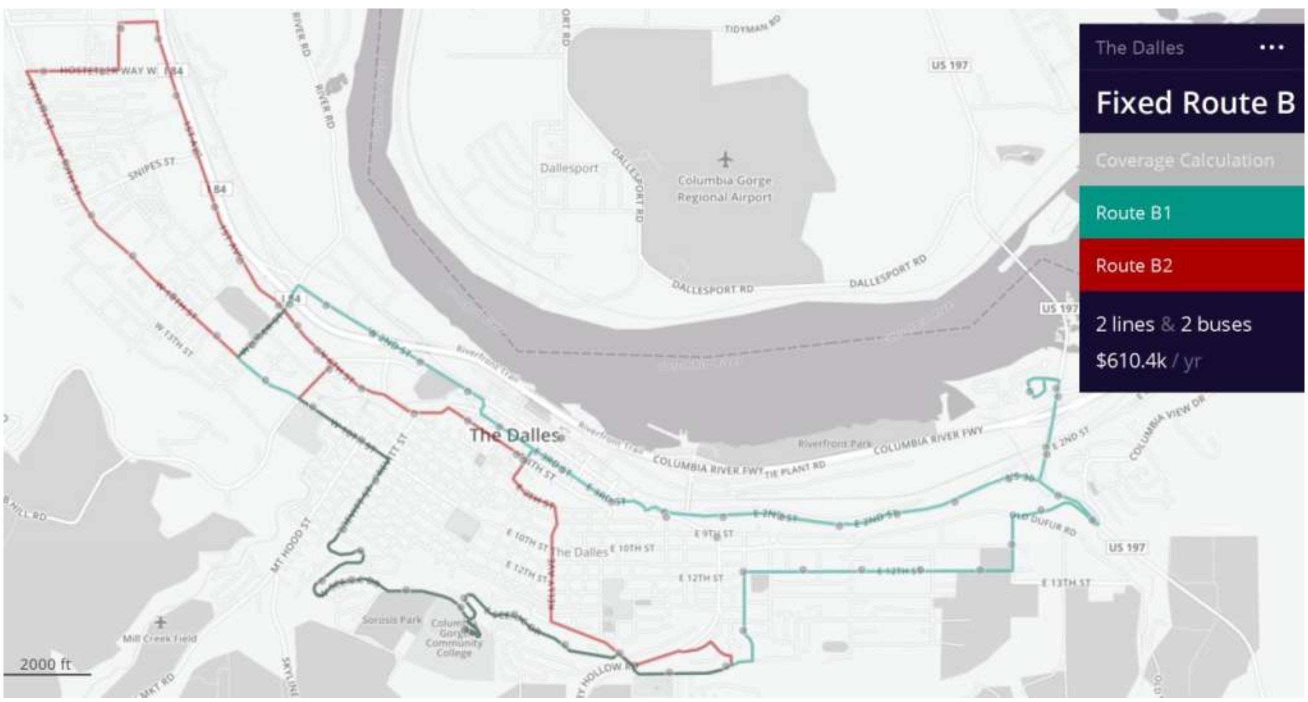
Alternative B

Alternative B covers all priority destinations between two different routes. Two buses run on 1 hour headways. A west loop services the transit center, 6th Street shopping center, Downtown, CGCC, and Mid-Columbia Medical Center. An east loop services the 6th Street shopping center, Downtown, CGCC, Mid-Columbia Medical Center, and Lone Pine. Riders would need to transfer at 6th Street shopping center, Downtown, CGCC, or Mid-Columbia Medical Center stops. Alternative B is shown in Figure 4.

Statistics for this alternative include:

- Buses Required – 2
- Revenue Hours – 8,830
- Estimated demand - 67,100 annual rides
- Cost - $610,400 per year to operate, $1,000,000 capital cost
- ¼ Mile Capture area - 9,300 people, 5,800 jobs

Figure 4 – Alternative B



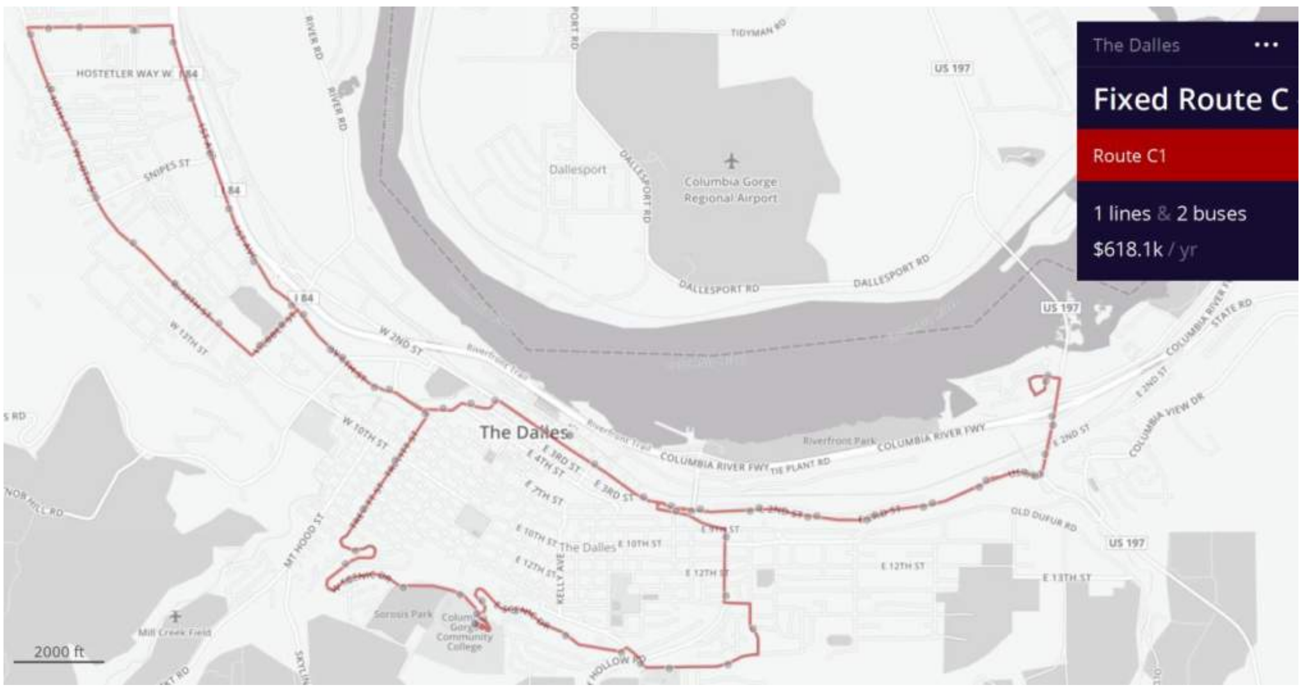
Alternative C

Alternative C covers all priority destinations with one route. Two buses run on half hour headways. One route services the transit center, 6th Street shopping center, Downtown, CGCC, Mid-Columbia Medical Center, and Lone Pine area. Alternative C is shown in Figure 5.

Statistics for this alternative include:

- Buses Required – 2
- Revenue Hours – 8,830
- Estimated demand - 67,100 annual rides
- Cost - $618,100 per year to operate, $1,000,000 capital cost
- ¼ Mile Capture area – 8,400 people, 5,400 jobs

Figure 5 – Alternative C



Alternative D

Alternative D covers all priority destinations except for the Lone Pine area with one route. One bus runs on 1 hour headways, servicing the transit center, 6th Street shopping center, Downtown, CGCC, and the Mid-Columbia Medical Center. The Lone Pine area is not serviced. This alternative does not serve the Lone Pine area. Alternative D is shown in Figure 6.

Statistics for this alternative include:

- Buses Required – 1
- Revenue Hours – 4,415
- Estimated demand - 41,600 annual rides
- Cost - $309,100 per year to operate, $500,000 capital cost
- ¼ Mile Capture area – 7,600 people, 5,200 jobs

Figure 6 – Alternative D

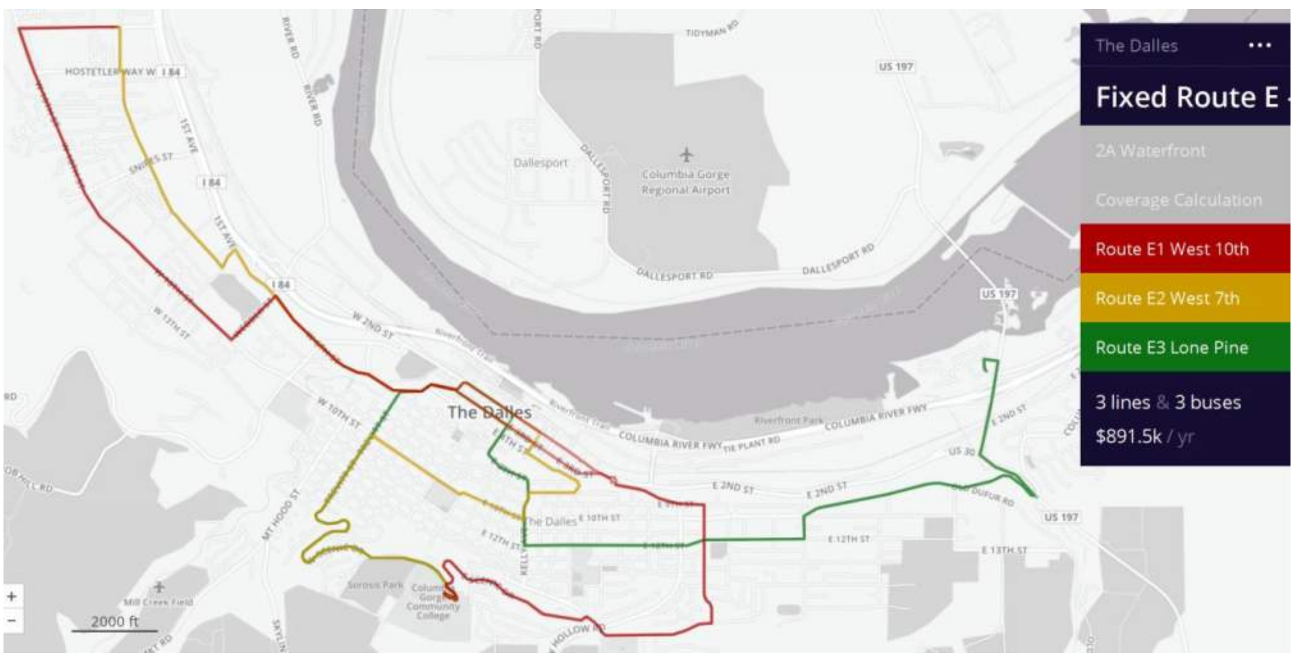
Alternative E

Alternative E covers all priority destinations between three different out-and-back routes. Three buses run on 1 hour headways. One route operates along West 10th Street, servicing the transit center, 6th Street shopping center, Downtown, CGCC, and Mid-Columbia Medical Center. Another route operates along West 7th Street, servicing the transit center, 6th Street shopping center, Downtown, and CGCC. One route serves the east side of town, serving the Lone Pine area, Downtown, and CGCC. Alternative E is shown in Figure 7.

Statistics for this alternative include:

- Buses Required – 3
- Revenue Hours – 13,220
- Estimated demand – 92,400 annual rides
- Cost - $891,500 per year to operate, $1,500,000 capital cost
- ¼ Mile Capture area – 9,400 people, 5,700 jobs

Figure 7 – Alternative E



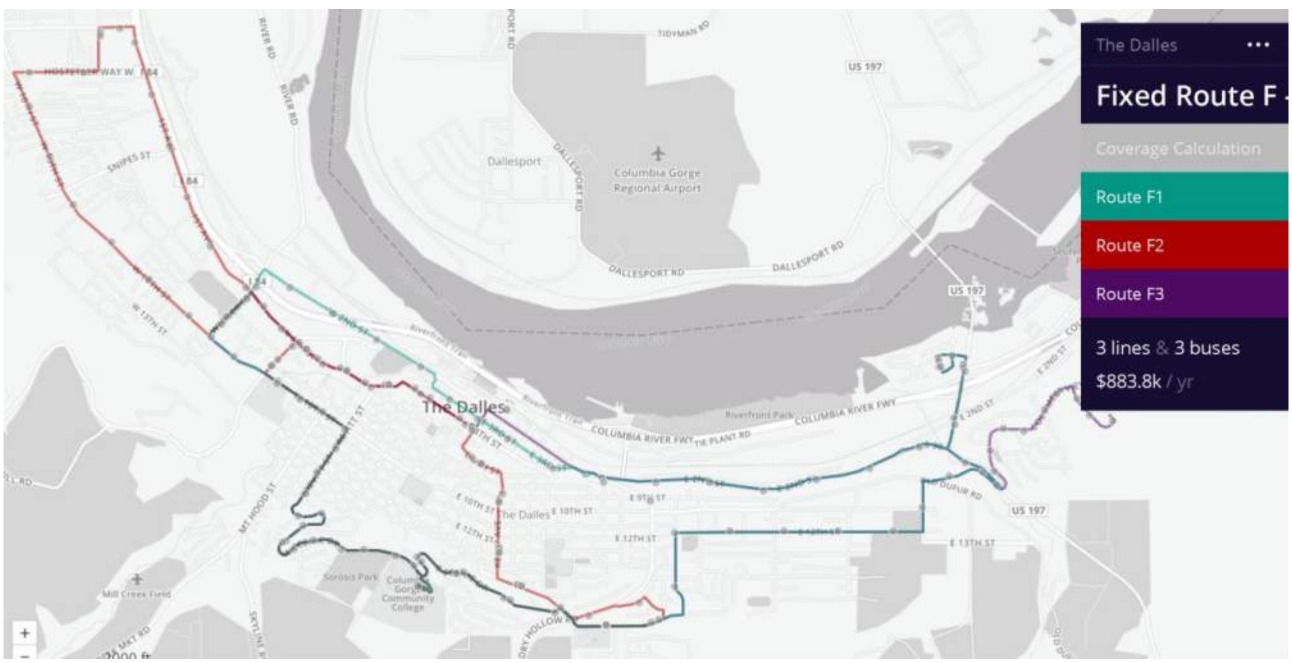
Alternative F

Alternative F covers all priority destinations between three different routes. Three buses run on 1 hour headways. A west loop services the transit center, 6th Street shopping center, Downtown, CGCC, and Mid-Columbia Medical Center. An east loop services the 6th Street shopping center, Downtown, CGCC, Mid-Columbia Medical Center, and Lone Pine. A second east loop services the 6th Street shopping center, Downtown, CGCC, Mid-Columbia Medical Center, Lone Pine area, and the Veteran's Affairs area. Riders would need to transfer at 6th Street shopping center, Downtown, CGCC, or Mid-Columbia Medical Center stops. Alternative F is shown in Figure 8.

Statistics for this alternative include:

- Buses Required – 3
- Revenue Hours – 13,220
- Estimated demand – 92,400 annual rides
- Cost - $883,800 per year to operate, $1,500,000 capital cost
- ¼ Mile Capture area – 9,600 people, 6,000 jobs

Figure 8 – Alternative F



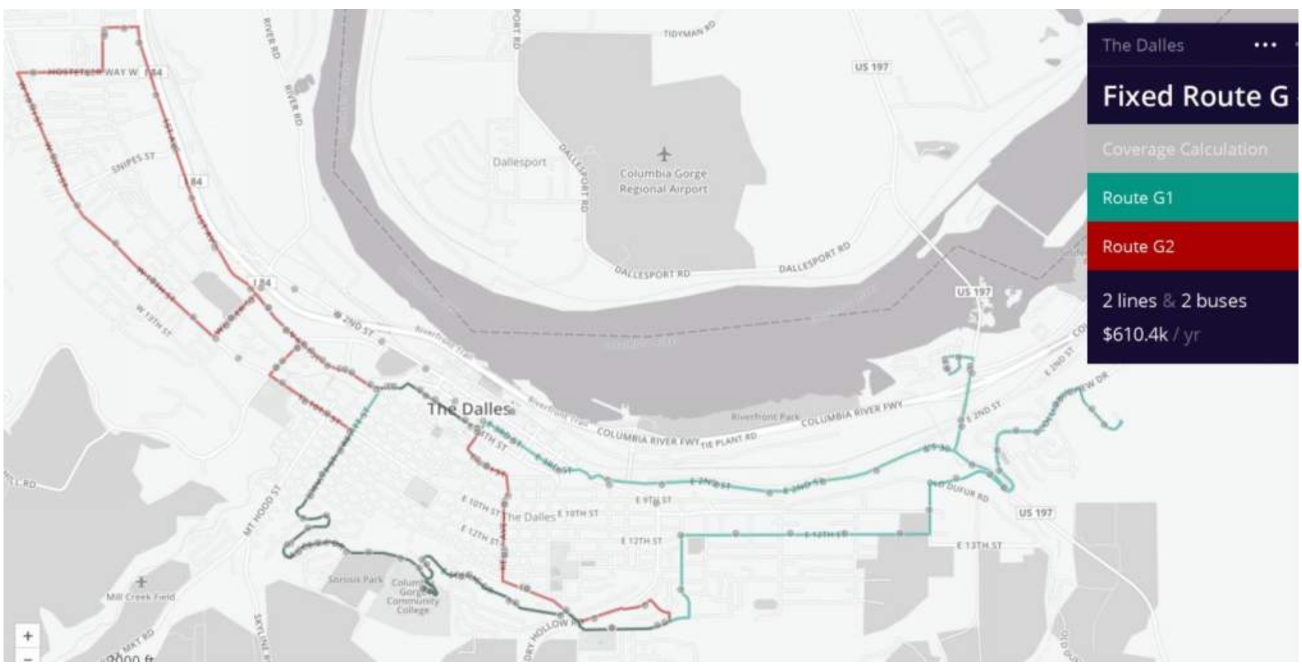
Alternative G

Alternative G covers all priority destinations between two different routes. Two buses run on 1 hour headways. A west loop services the transit center, 6th Street shopping center, Downtown, CGCC, and Mid-Columbia Medical Center. An east loop services Downtown, CGCC, Mid-Columbia Medical Center, Lone Pine, and the Veteran's Affairs area. Riders would need to transfer at stops Downtown, at CGCC, or Mid-Columbia Medical Center. Alternative G is shown in Figure 9.

Statistics for this alternative include:

- Buses Required – 2
- Revenue Hours – 8,830
- Estimated demand - 41,600 annual rides
- Cost - $610,400 per year to operate, $1,000,000 capital cost
- ¼ Mile Capture area – 9,400 people, 5,700 jobs

Figure 9 – Alternative G



1.3.1 Alternatives Summary

The seven alternatives are summarized in Table 2. While TCRP 161 provides a rough estimate for ridership, the methodology doesn't take population or job densities into account, though those factors may vastly influence ridership. For example, Alternatives A and C have the same estimated ridership, yet Alternative C captures approximately 1,600 more people within ¼ mile of its stops. The increased amount of capture would make higher ridership on Alternative C more likely.

Table 2: Alternatives Summary

Alternative	Annual Revenue-Hours per Route	Number of Routes	Headways (minutes)	Number of Buses	TCRP 161 Estimated Ridership	Capital Cost	Annual Operating Cost	# of Priority Stops Served	Pop/Job Coverage[1]
A	8,830	2	60	2	67,100	$1,000,000	$618,100	5 of6 (No Medical Center)	6.8k/5.3k
B	8,830	2	60	2	67,100	$1,000,000	$610,400	6 of 6	9.3k/5.8k
C	8,830	1	30	2	67,100	$1,000,000	$618,100	6 of 6	8.4k/5.4k
D	4,415	1	60	1	41,600	$500,000	$309,100	5 of 6 (No Lone Pine)	7.6k/5.2k
E	13,220	3	60	3	92,400	$1,500,000	$891,500	6 of 6	9.4k/5.7k
F	13,220	3	60	3	92,400	$1,500,000	$883,800	6 of6 + VA	9.6k/6.0k
G	8,830	2	60	2	67,100	$1,000,000	$610,400	6 of6 + VA	9.4k/5.7k

1.3.2 Effect on CAT and LINK Ridership

The LINK dial-a-ride service currently serves 18,999 rides annually and approximately 3.5 rides per service hour. Fixed-route demand is forecasted to be near 7.0-9.4 riders per hour, depending on annual revenue hours. Each service hour of fixed-route service is expected to be near 2-2.5 times more productive than dial-a-ride service. As fixed-route service is expected to capture many LINK riders, the LINK may be able to decrease the number of buses running simultaneously while maintaining service for its riders. In addition, ridership on a fixed-route service may increase ridership on the CAT Hood River-The Dalles route and the CAT/LINK Hood River-The Dalles-Portland route.

1.4 POTENTIAL FUNDING OPTIONS

To fund a fixed-route system in The Dalles, potential funding sources must be identified. The list below identifies the state and federal grant programs that could be applied for. That is followed by a list of sources that could be generated locally to fund transit. The list includes a variety of sources used by other transit providers.

[1] Remix calculates populations and jobs within ¼ mile of bus stops.

State and Federal Transit Grant Programs

A number of state and federal transit grant programs are available that provide funding sources to local transit agencies. Transit agencies in Wasco County receive funds from some of these sources, namely STF, 5310, and 5311. Many of these funds are fixed amounts based on a formula for Wasco County, so utilizing them for fixed-route transit service in The Dalles would require they be used in lieu of other services. Federal grant programs regularly are added and removed with each renewal of the federal transportation bill. A sampling of current known grant programs is included below[2]:

- State Special Transportation Funds (STF)
- Federal Transit Administration (FTA)
    - Section 5310 - Special Needs for Elderly Individuals and Individuals with Disabilities
    - Section 5311 - Small Cities and Rural Areas programs
    - Section 5314 – Technical Assistance and Workforce Development
    - Section 5339 – Buses and Bus Facilities

The grant programs are described in more detail below.

STF Program

The STF was created in 1985 by the Oregon Legislature. STF is allocated (based on population) by the Oregon Legislature every two years to 42 jurisdictions around the state including TCTD. It is funded by cigarette tax revenue, excess revenue earned from sales of photo ID Cards, and other funds from the Oregon Department of Transportation. The STF Program provides a flexible, coordinated, reliable and continuing source of revenue in support of transportation services for seniors and people with disabilities of any age. The Oregon Legislature intended that STF funds be used to provide transportation services needed to access health, education, work, and social/recreational opportunities so that seniors and people with disabilities may live as independently and productively as possible. The funds may be used for any purpose directly related to transportation services, including transit operations, capital equipment, planning, travel training and other transit-related purposes.

Section 5310 Funds

The 49 U.S.C 5310 program (§5310) provides formula funding to states and metropolitan regions for the purpose of meeting the transportation needs of seniors and people with disabilities. Funds are

[2] The level of funding available from these federal programs and the eligibility of projects to receive continued support vary by program. In general, however, these grant programs are not considered stable sources of annual funding. Rather, these programs can help fund the purchase of vehicles, capital investments, or fund temporary operations of a new services or special programs.

apportioned based on each state's share of the population for these two groups. The purpose of the program is to improve mobility for seniors and people with disabilities by removing barriers to transportation service and expanding transportation mobility options. Eligible projects include both "traditional" capital investment and "nontraditional" investment beyond the Americans with Disabilities Act (ADA) complementary paratransit services.

Traditional Section 5310 project examples include:

- Purchasing buses and vans for providing service to seniors and/or people with disabilities
- Preventative Maintenance
- Wheelchair lifts, ramps, and securement devices for such vehicles
- Transit-related information technology systems, including scheduling/routing/one-call systems
- Acquisition of transportation services for seniors and/or people with disabilities under a contract, lease, or other arrangement

Section 5311 Funds

The 49 U.S.C 5311 program (§5311) provides funding for transit capital, planning, and operations in rural areas (population less than 50,000), including job access and reverse commute projects.

Section 5314 Funds

The 49 U.S.C 5314 program (§5314) supports technical assistance activities that enable more effective and efficient delivery of transportation services, foster compliance with federal laws (including the ADA), meet the transportation needs of the elderly, and more.

Section 5339 Funds

The 49 U.S.C 5339 program (§5339) provides funding through a competitive allocation process to states and transit agencies to replace, rehabilitate and purchase buses and related equipment and to construct bus-related facilities. The competitive allocation provides funding for major improvements to bus transit systems that would not be achievable through formula allocations.

Local Funding Options

The following is a list of potential local funding sources that could be implemented to fund transit. The list includes a variety of sources used by other transit providers; however they have varying levels of feasibility in The Dalles.

- **Property Taxes** could provide consistent revenue to support a fixed-route system in The Dalles. Most municipalities collect property taxes, tax assessed on the value of an owned property, a portion of which can be used to fund transit.
- **Business Taxes** could also provide consistent revenue, taxing the net income of nearby businesses. Businesses benefit from their employees receiving consistent and reliable transportation and their customers receiving viable means to travel to the establishment.
- **Tax Increment Financing** can be used to capture additional property taxes generated in the vicinity of transit specific improvements or areas. This type of funding can also be used to capture a portion of property value caused by a particular investment.
- **Tax Incentive Zones** provide an indirect avenue for transit funding by potentially increasing fare revenue, sponsorship revenue, etc. by providing tax incentives for businesses and residents residing near transit oriented or transit friendly developments.
- **Multimodal Impact Fees** are similar to Transportation Impact Fees (TIFs) but focused on improvements to multimodal transportation options. In the event that a TIF is established, the fixed-route service could work to allocate a portion of the funds towards transit enhancing improvements.
- **Advertising/Sponsorship** opportunities could provide small amounts of consistent revenue. Some transit providers sell sponsorship for facility names, individual transit vehicles, within brochures, transit corridor guide books, etc.
- **Parking Fees/Fines** have the ability to provide incentives for users to use transit to reach desirable areas of the city, such as downtown The Dalles. The implementation of a parking strategy could increase transit ridership and thus fare box recovery as well as increase parking revenue.

1.5 NEXT STEPS

The information in this memorandum will be discussed with the Transit Plan Advisory Committee (TPAC) to confirm elements for inclusion in the TSP. The TSP will then be updated to include the background information, transit alternatives, and prioritized recommendations.

Attachment A TCRP Report 161 Results

Report 58 is a methodology report describing how the research team developed the need and demand estimation methods, findings of the analysis, and the recommendation for function to be used in estimating need and demand.

The methods for estimating demand address four specific markets – general public rural passenger transportation, passenger transportation specifically related to social service or other programs, travel on fixed-route services in micropolitan areas, and travel on commuter services from rural counties to urban centers. The methods were developed using data from the Rural National Transit Database (2006, 2009, and 2010), the National Household Transportation Survey (2001 and 2009), the American Community Survey (various years) and the Longitudinal Employment-Household Dynamics dataset as well as data on services operated and ridership on those services provided by over 200 individuals who participated in workshops held in a dozen states in 2010 and 2011. Since this study was completed recently, it has not been widely applied or validated.

Note that TCRP 161 states the following with regard to its estimates:

> *The estimates of need made using the mobility gap method are typically far greater than the number of trips actually observed on rural passenger transportation systems and are likely greater than the demand that would be generated for any practical level of service. Much of the remaining trip-based mobility gap is likely filled by friends and relatives driving residents of non-car-owning households. Therefore, agencies choosing to use the mobility gap may wish to establish a target or goal for the proportion of the gap to be satisfied by publicly provided services. In the testing of these suggested methodologies with a number of rural transit agencies, it was found that, at best, only about 20% of the mobility gap trip-based need was met.*

Our analysis focused on the existing socioeconomic conditions in The Dalles. Inputs used to estimate transit need include:

- City population
- Four-year college enrollment
- Annual revenue hours

This is used to generate an expected number of transit trip demand. The Dalles population is 15,068 and college enrollment[3] is 0. The annual revenue hours input is dependent on the provided hours and number of routes running.

[3] The methodology doesn't count community college

SERVICE AREA CHARACTERISTICS INPUT TABLE -- Fill In All Unshaded Boxes

Service Area:	The Dalles
Analysis Description:	Fixed-route demand analysis
Additional Description:	The Dalles TSP

Transit Need Inputs

Number of persons residing in households with income below the poverty level:

Number of households residing in households owning no vehicles:

	Households	Persons
1-Person households:		
2-Person households:		
3-Person households:		
4-or-more-Person households:		

Mobility Gap:

Enter State (from drop-down list):

General Public Rural Non-Program

		American Community Survey Table Number
Population Age 60+		B01001
Population Age 18 - 64 with a Mobility Limitation		S1810
Persons Living in Households with No Vehicle Available		B08201

General Public Rural Passenger Transportation

Need:		
Annual Vehicle-miles of Service:		Annual Revenue-Miles

Small City Fixed Route Inputs

Population of City:	15,068	Persons
College and University Enrollment (Total):	0	Students
Annual Revenue-Hours of Service:	4,415	Annual Revenue-Hours

Demand - Commuter by Transit to an Urban Center

Workers Commuting from Rural County to Urban Center		
Distance from Rural County to Urban Center		Miles
Is the Urban Center a State Capital?	☐	Check Box for Yes

Program Demand Inputs

Program Name	Program Type	Number of Program Participants:	Number of Events per Week:	Percentage of Participants who attend on an **AVERAGE** day:	Percentage of Participants who are Transit Depdendent or Likely to Use Transit:	Number of Weeks Program is Offered (Annually):

The prefered source of demographic data is the American Community Survey, available at:
http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml
At that website enter the referenced ***Table Number*** *in the appropriate box. Some table numbers may not be available for communities under*

RURAL TRANSIT NEED/DEMAND ESTIMATION - OUTPUT TABLE

Service Area:	The Dalles
Analysis Description:	Fixed-route demand analysis
Additional Description:	The Dalles TSP

Estimation of Transit Need

Total need for passenger transportation service:		Persons
Total households without access to a vehicle:		Households
State Mobility Gap:		Daily 1-Way Psgr.-Trips per Household
Total need based on mobility gap:		Daily 1-Way Passenger-Trips
		Annual 1-Way Passenger-Trips

General Public Rural Non-Program Demand

Estimate of demand for general public rural transportation

Rural transit trips:		Annual 1-Way Passenger-Trips

General Public Rural Passenger Transportation

Estimate of demand for rural transportation

Total Rural Non-Program Demand		Annual 1-Way Passenger-Trips

Small City Fixed Route

Annual Ridership:	41,600	Annual 1-Way Passenger-Trips

Demand - Commuter by Transit to an Urban Center

Proportion of Commuters using Transit:		
Commuter trips by transit between counties:		Daily 1-Way Passenger Trips
		Annual 1-Way Passenger-Trips

Rural Program Demand

Annual Program Trip Estimation

		Annual 1-Way Passenger-Trips
		Annual 1-Way Passenger-Trips
		Annual 1-Way Passenger-Trips
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		Annual 1-Way Passenger-Trips
		Annual 1-Way Passenger-Trips
		Annual 1-Way Passenger-Trips
Total Rural Program Demand		Annual 1-Way Passenger-Trips

SERVICE AREA CHARACTERISTICS INPUT TABLE -- Fill In All Unshaded Boxes

Service Area:	The Dalles
Analysis Description:	Fixed-route demand analysis
Additional Description:	The Dalles TSP

Transit Need Inputs

	Households	Persons
Number of persons residing in households with income below the poverty level:		
Number of households residing in households owning no vehicles:		
1-Person households:		
2-Person households:		
3-Person households:		
4-or-more-Person households:		

Mobility Gap:
Enter State (from drop-down list):

General Public Rural Non-Program

		American Community Survey Table Number
Population Age 60+		B01001
Population Age 18 - 64 with a Mobility Limitation		S1810
Persons Living in Households with No Vehicle Available		B08201

General Public Rural Passenger Transportation

Need:		
Annual Vehicle-miles of Service:		Annual Revenue-Miles

Small City Fixed Route Inputs

Population of City:	15,068	Persons
College and University Enrollment (Total):	0	Students
Annual Revenue-Hours of Service:	8,830	Annual Revenue-Hours

Demand - Commuter by Transit to an Urban Center

Workers Commuting from Rural County to Urban Center		
Distance from Rural County to Urban Center		Miles
Is the Urban Center a State Capital?	☐	Check Box for Yes

Program Demand Inputs

Program Name	Program Type	Number of Program Participants:	Number of Events per Week:	Percentage of Participants who attend on an **AVERAGE** day:	Percentage of Participants who are Transit Depdendent or Likely to Use Transit:	Number of Weeks Program is Offered (Annually):

The prefered source of demographic data is the American Community Survey, available at:
http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml
*At that website enter the referenced **Table Number** in the appropriate box. Some table numbers may not be available for communities under*

RURAL TRANSIT NEED/DEMAND ESTIMATION - OUTPUT TABLE

Service Area:	The Dalles
Analysis Description:	Fixed-route demand analysis
Additional Description:	The Dalles TSP

Estimation of Transit Need		
Total need for passenger transportation service:		Persons
Total households without access to a vehicle:		Households
State Mobility Gap:		Daily 1-Way Psgr.-Trips per Household
Total need based on mobility gap:		Daily 1-Way Passenger-Trips
		Annual 1-Way Passenger-Trips

General Public Rural Non-Program Demand		
Estimate of demand for general public rural transportation		
Rural transit trips:		Annual 1-Way Passenger-Trips

General Public Rural Passenger Transportation		
Estimate of demand for rural transportation		
Total Rural Non-Program Demand		Annual 1-Way Passenger-Trips

Small City Fixed Route		
Annual Ridership:	67,100	Annual 1-Way Passenger-Trips

Demand - Commuter by Transit to an Urban Center		
Proportion of Commuters using Transit:		
Commuter trips by transit between counties:		Daily 1-Way Passenger Trips
		Annual 1-Way Passenger-Trips

Rural Program Demand		
Annual Program Trip Estimation		
		Annual 1-Way Passenger-Trips
		Annual 1-Way Passenger-Trips
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		Annual 1-Way Passenger-Trips
Total Rural Program Demand		Annual 1-Way Passenger-Trips

SERVICE AREA CHARACTERISTICS INPUT TABLE -- Fill In All Unshaded Boxes

Service Area:	The Dalles
Analysis Description:	Fixed-route demand analysis
Additional Description:	The Dalles TSP

Transit Need Inputs

	Households	Persons
Number of persons residing in households with income below the poverty level:		
Number of households residing in households owning no vehicles:		
1-Person households:		
2-Person households:		
3-Person households:		
4-or-more-Person households:		

Mobility Gap:

Enter State (from drop-down list):

General Public Rural Non-Program

		American Community Survey Table Number
Population Age 60+		B01001
Population Age 18 - 64 with a Mobility Limitation		S1810
Persons Living in Households with No Vehicle Available		B08201

General Public Rural Passenger Transportation

Need:		
Annual Vehicle-miles of Service:		Annual Revenue-Miles

Small City Fixed Route Inputs

Population of City:	15,068	Persons
College and University Enrollment (Total):	0	Students
Annual Revenue-Hours of Service:	13,220	Annual Revenue-Hours

Demand - Commuter by Transit to an Urban Center

Workers Commuting from Rural County to Urban Center		
Distance from Rural County to Urban Center		Miles
Is the Urban Center a State Capital?	☐	Check Box for Yes

Program Demand Inputs

Program Name	Program Type	Number of Program Participants:	Number of Events per Week:	Percentage of Participants who attend on an **AVERAGE** day:	Percentage of Participants who are Transit Depdendent or Likely to Use Transit:	Number of Weeks Program is Offered (Annually):

The prefered source of demographic data is the American Community Survey, available at:
http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml
At that website enter the referenced ***Table Number*** *in the appropriate box. Some table numbers may not be available for communities under*

RURAL TRANSIT NEED/DEMAND ESTIMATION - OUTPUT TABLE

Service Area:	The Dalles
Analysis Description:	Fixed-route demand analysis
Additional Description:	The Dalles TSP

Estimation of Transit Need		
Total need for passenger transportation service:		Persons
Total households without access to a vehicle:		Households
State Mobility Gap:		Daily 1-Way Psgr.-Trips per Household
Total need based on mobility gap:		Daily 1-Way Passenger-Trips
		Annual 1-Way Passenger-Trips

General Public Rural Non-Program Demand		
Estimate of demand for general public rural transportation		
Rural transit trips:		Annual 1-Way Passenger-Trips

General Public Rural Passenger Transportation		
Estimate of demand for rural transportation		
Total Rural Non-Program Demand		Annual 1-Way Passenger-Trips

Small City Fixed Route		
Annual Ridership:	92,400	Annual 1-Way Passenger-Trips

Demand - Commuter by Transit to an Urban Center		
Proportion of Commuters using Transit:		
Commuter trips by transit between counties:		Daily 1-Way Passenger Trips
		Annual 1-Way Passenger-Trips

Rural Program Demand		
Annual Program Trip Estimation		
		Annual 1-Way Passenger-Trips
		Annual 1-Way Passenger-Trips
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		Annual 1-Way Passenger-Trips
Total Rural Program Demand		Annual 1-Way Passenger-Trips

APPENDIX G. TECHNICAL MEMORANDUM 6: PREFERRED PLAN

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TECHNICAL MEMORANDUM

The Dalles Transportation System Plan

Technical Memorandum #6: Preferred Alternative

Date:	June 30, 2016	Project #: 18495.0
To:	Project Management Team	
From:	Susan Wright, PE; Chris Brehmer, PE; and Ashleigh Griffin, AICP	

This memorandum presents the preferred, cost-constrained transportation system alternatives for The Dalles Transportation System Plan (TSP). Previous technical memorandums documented existing and future conditions and recommended alternatives to the existing and anticipated system deficiencies. This memorandum identifies priorities using a prioritization process based on project evaluation criteria, input from the Project Management Team (PMT), input from the Technical Advisory Committee (TAC), Public Advisory Committee (PAC), and Public Workshops.

This memorandum is divided into four sections, consistent with the four modal elements of the TSP update. The sections include:

- **Roadway Element** – This element presents the City's updated functional classification plan, the updated Roadway Design Standards, and the preferred alternatives for Roadway, Freight, Bridge and Culvert, Intersection, Interchange, Corridor, and Safety Improvements.
- **Bicycle and Pedestrian Element** – This element presents the City's proposed Pedestrian and Bicycle Plans and the preferred alternatives to accomplish the plans.
- **Public Transportation Element** – This element presents the preferred alternatives for Public Transportation Improvements.
- **Air, Water, Rail, and Pipeline Element** – This element presents the preferred alternatives for Air, Water, Rail, and Pipeline Improvements.

The project tables included in each section provide a basic description of the preferred alternatives. They also identify the source of the preferred alternatives (New Project, Interchange Area Management Plan, Existing TSP, etc.).

PROJECT EVALUATION CRITERIA AND PRIORITIZATION

The preferred transportation system alternatives were prioritized as high, medium, and low priority projects to address the City's goals for the transportation system. The goals are documented in *Technical Memorandum #2*.

Evaluation criteria were developed to evaluate progress toward the goals. These evaluation criteria are also documented in *Technical Memorandum #2*. The evaluation criteria were used to prioritize projects by identifying how well a project advances the TSP goals.

The project evaluations were used to identify the projects within each section of the plan as high, medium, or low priority relative to each other. *The evaluation criteria matrix provides a summary of each project and is included in Appendix 1.*

ROADWAY ELEMENT

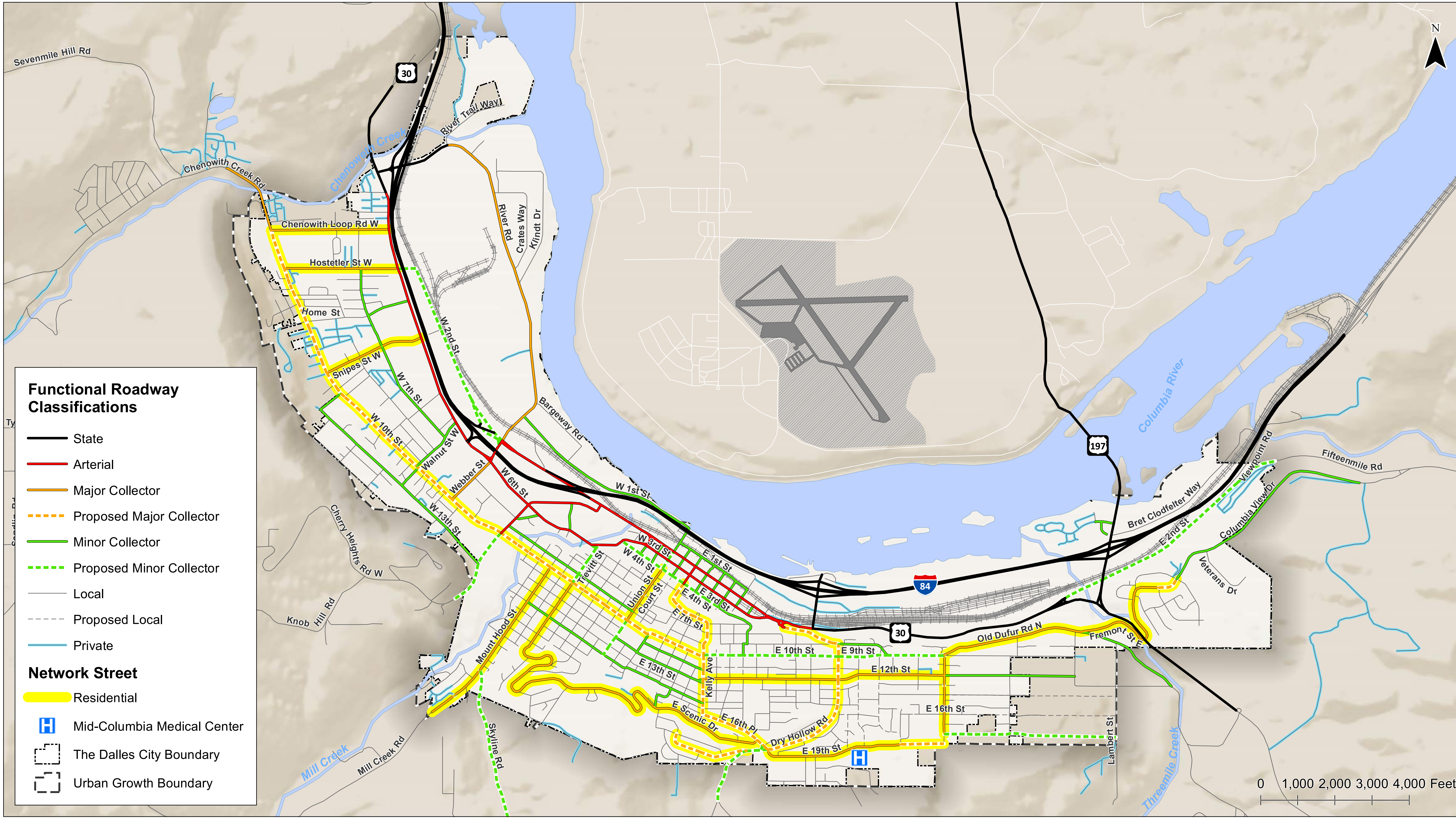
This section presents the City's updated functional classification plan and roadway design standards as well as the preferred alternatives for Roadway, Freight, Bridge and Culvert, Intersection, Interchange, Corridor, and Safety Improvements.

The roadway element of the updated TSP will include a detailed description of the City's updated functional classification plan, roadway design standards, and access management standards as presented within this memorandum. It will also include a prioritized list of transportation system improvement projects.

Functional Classification Plan

The proposed functional classification plan is shown in Figure 6-1. This plan includes several updates to the existing plan that reflect changes in traffic volumes and travel patterns throughout the City, recommendations from local planning documents, and improvements to the existing functional classification plan.

The key changes in the functional classification map include classifying "Residential Network Streets" as either Major or Minor Collectors, providing new east-west routes to improve access and circulation for new residential areas as well as the Mid-Columbia Medical Center (MCMC), and downgrading some streets to local streets where the new east-west connection provides a new primary route to the MCMC. These updates impact the design of the roadway, including the types of bicycle and pedestrian facilities. A more detailed description of these changes is provided in *Technical Memorandum #5: Alternatives Analysis*.



Proposed Functional Classifications
The Dalles, Oregon

Figure
6-1

\\kittelson.com\fs\H_Portland\projfile\18495 - The Dalles TSP\gis\TM #6\6-1 Proposed Existing Functional Classifications.mxd - agriffin - 6:33 PM 4/19/2016

Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

Roadway Design Standards

The City's roadway design standards are summarized in Table 6-1. The cross-sections include additional information on right-of-way width, number of travel lanes, bicycle and pedestrian facilities, and other amenities such as landscape strips and on-street parking. These cross-sections are intended for planning and designing new roadways, as well as for improving existing roadways where it is physically and economically feasible. In some locations within the City, constraints such as steep grades and limited right-of-way may prevent the full cross-section from being constructed. The landscape buffer may be waived if justification is provided.

Table 6-1. Roadway Design Standards for City Streets

	Arterial/State	Major Collector	Minor Collector	Local Street
Number of Vehicle Lanes	3	2	2	2
Lane Width	12' *Note: On freight routes, lanes should be 14' wide or include a 2' striped buffer between the travel lane and the bicycle lane.*	12'	12'	8'
Center Turn Lane Width	14'	N/A	N/A	N/A
Landscape Buffer Width	5'	5'	5'	4'
Shoulder, Bike Lane, and/or On-Street Parking Width	6' Bike Lane *Note: Provide a buffer between the travel lane and bike lane whenever possible.*	6' Bike Lane *Note: Replace the bicycle lane with 8' parking lane when adjacent to residential properties with primary access to the Major Collector. Consider curb bulb-outs at intersection corners with on-street parking areas to improve pedestrian visibility, and reduce roadway crossing widths.*	6' Bike Lane *Note: Exceptions are allowed to replace the bicycle lane with 8' on-street parking lane when adjacent to residential properties with primary access to Minor Collector.*	8' On-Street Parking *Note: The removal of the on-street parking lanes is allowed in industrial areas to accommodate two 16-foot travel lanes for heavy vehicles.*
Shoulder Surface	Paved	Paved	Paved	Paved
Pavement Width	50'	36'	36'	32'
Minimum Sidewalk Width	5' *Note: 6' on State highways*	5'	5' *Note: Consider curb bulb-outs at intersection corners where on-street parking to improve pedestrian visibility, and reduce roadway crossing widths.*	5' *Note: Consider curb bulb-outs at intersection corners to define parking areas, improve pedestrian visibility, and reduce roadway crossing widths, except in industrial areas.*
Surface Type	Paved	Paved	Paved	Paved
Minimum ROW Width	90'	60'	60'	50'
Additional Notes:	*Provide on-street parking on the West side of 6th Street.* *Roadways that may require deviation from this standard are limited to US 30 and 2nd and 3rd Streets within the downtown couplet.*	*All major collectors, except for Webber Street and River Road are identified as Residential Network Streets and have specified cross-sectional standards.* *Widening for turn lanes at major intersections with other collector and arterial facilities should have a minimum of 12' lane width.*		

Note: These cross-sections apply to all roadways except streets designated by The Dalles as "Residential Network Streets." Each Residential Network Street is shown in Figure 6-1 and the adopted cross-sections are provided in Appendix 2.

Access Management

Access management is a set of measures regulating vehicular access to streets, roads, and highways from public roads and private driveways. Access management is a policy tool which seeks to balance mobility, the need to provide efficient, safe, and timely travel with access to individual properties. Proper implementation of access management techniques should contribute to reduced congestion, reduced accident rates, less need for roadway widening, energy conservation, and reduced air pollution. Measures may include, but are not limited to, restrictions on the type and amount of access to roadways, and use of physical controls, such as signals and channelization including raised medians, to reduce impacts of approach road traffic on the main facility.

The City's access management policy maintains and enhances the integrity (capacity, safety, and level of service) of city streets. Numerous driveways or street intersections increase the number of conflicts and potential for collisions and decrease mobility and traffic flow. The city of The Dalles, as with every city, seeks a balance of streets that provide access with streets that serve mobility. The following access management strategies would improve local access and mobility in the city of The Dalles:

- Maintain city-wide access spacing standards according to a roadway's jurisdiction and functional classification.
- Establish an approach for access consolidation over time to move in the direction of the standards at each opportunity.
- Work with land use development applications to consolidate driveways where feasible.
- Identify potential transportation improvement projects that provide left turn lanes where warranted for access onto cross streets.
- Construct raised medians to provide for right-in/right-out driveways as appropriate.

Access Spacing Standards

The following describes ODOT and city of The Dalles access spacing standards.

ODOT Standards

Oregon Administrative Rule 734, Division 51 establishes procedures, standards, and approval criteria used by ODOT to govern highway approach permitting and access management consistent with Oregon Revised Statutes (ORS), Oregon Administrative Rules (OAR), statewide planning goals, acknowledged comprehensive plans, and the Oregon Highway Plan (OHP). The OHP serves as the policy basis for implementing Division 51 and guides access management rules and administration, including mitigation and public investment, when required, to ensure highway safety and operations pursuant to this division.

Access management standards for approaches to state highways vary based on the classification of the highway and highway designation, type of area, and posted speed.

The OHP classifies Highway 004 (US 197) as a Regional Highway through The Dalles and Highway 292 (US 30) as a District Highway through The Dalles. Future development along these highways (new development, redevelopment, zone changes, and/or comprehensive plan amendments) will be required to meet the OHP access management policies and standards. Table 6-2 summarizes ODOT's current access management standards for private driveways on these highways.

Table 6-2. ODOT Highway Access Spacing Standards

Location	Highway Classification	Posted Speed (MPH)	Spacing Standards (Feet) [1]
US 197 (Hwy 004), north of Fremont Street	Regional	45 mph	500'
US 197 (Hwy 004), south of Fremont Street	Regional	65 mph	990'
US 30 (Hwy 292)	District	40 mph	360'

[1] These access management spacing standards do not apply to approaches in existence prior to April 1, 2000 except as provided in OAR 734-051-5120(9).

City Standards

Access management standards for approaches to city streets are also based on roadway functional classification. Table 6-3 identifies the City's standards as they relate to new development and redevelopment. In addition to the spacing standards below, access should be taken from lower classification streets whenever possible.

Table 6-3. Access Spacing Standards for City Roadways

Functional Classification	Minimum Posted Speed	Minimum Spacing between Driveways and/or Streets
Arterial Street (2-Way)	25 – 40 mph	300 – 400 feet
Arterial Street (1-Way)	25 – 35 mph	150 – 300 feet
Major Collector Street	25 – 35 mph	150 – 300 feet
Minor Collector Street	25 – 35 mph	75 – 150 feet
Major/Minor Collector Street in Industrial Area	25 – 35 mph	150 – 300 feet

Driveway Access Spacing Adjustments

Driveway access spacing adjustments may be provided to parcels whose highway/street frontage, topography, natural resources or physical barriers would otherwise preclude access that meets access spacing standards. Approval of an adjustment could impose conditions that: 1) the access may be closed at such time that reasonable access becomes available to a local public street and 2) the establishment of joint/cross access easements. The review authority may also require a given land owner to work in cooperation with adjacent land owners to provide either joint access points, front and rear cross-over easements, or a rear access upon future redevelopment to the extent allowed by City code and the Oregon Administrate Rules.

The requirements for obtaining an adjustment from ODOT's minimum spacing standards are documented in OAR 734-051-3050. The City Engineer may adjust the access spacing standards for streets under the City's jurisdiction where the physical site characteristics or layout of abutting properties precludes access that would meet access spacing standards. The City's approval criteria can be found in the Land Use Development Ordinance (LUDO).

Access Consolidation through Management

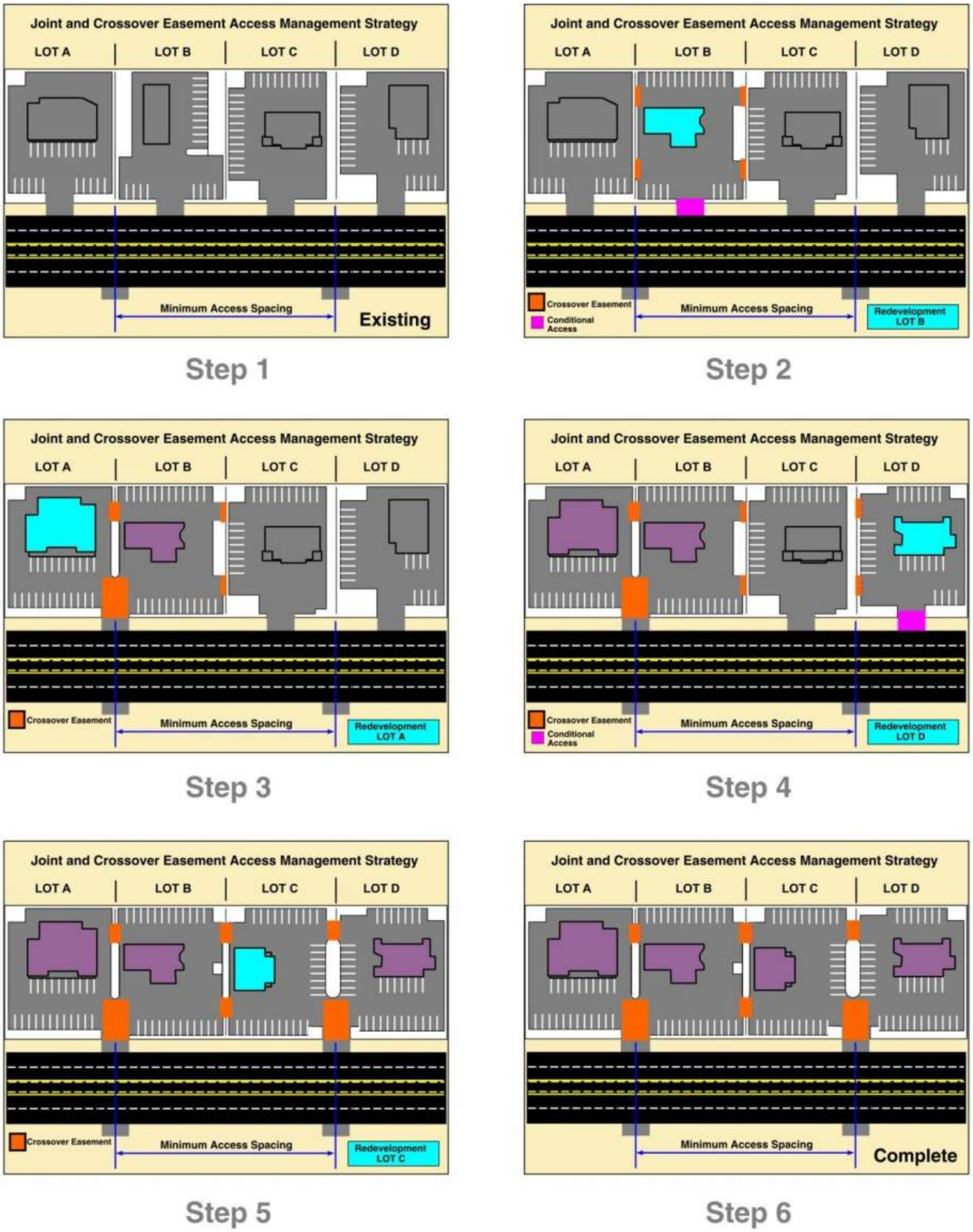
From an operational perspective, access management measures seek to limit the number of redundant access points along roadways. This enhances roadway capacity, improves safety, and benefits circulation. The City should complement access spacing enforcement with provision of alternative access points where appropriate. Purchasing right-of-way and closing driveways without a parallel road system and/or other local access could seriously affect the viability of the impacted properties. Thus, if the City takes an access management approach, alternative access could be developed to avoid "land-locking" a given property.

As part of every land use action, the City should evaluate the potential need for conditioning a given development proposal with the following guidelines in order to maintain and/or improve traffic operations and safety along the arterial and collector roadways.

- Developments with frontage on two roadways should locate their driveways on the lower functional classified roadway.
- Access driveways should align with opposing driveways.
- The City may permit multiple driveways so long as they meet the driveway access spacing standards.
- If spacing standards cannot be met, the City should try to consolidate access points with neighboring properties.
- Where standards cannot be met and joint access is not feasible, the City should grant temporary conditional access by providing crossover easements on compatible parcels (considering topography, access, and land use) to facilitate future access between adjoining parcels.

Exhibit 1 illustrates the potential application of cross-over easements and access consolidation over time to achieve access management objectives. As illustrated in the exhibit, by using these guidelines, all driveways can eventually move in the overall direction of meeting driveway access spacing standards as development and redevelopment occur along a given street.

Exhibit 1: Application of an Example of Potential Driveway Consolidation

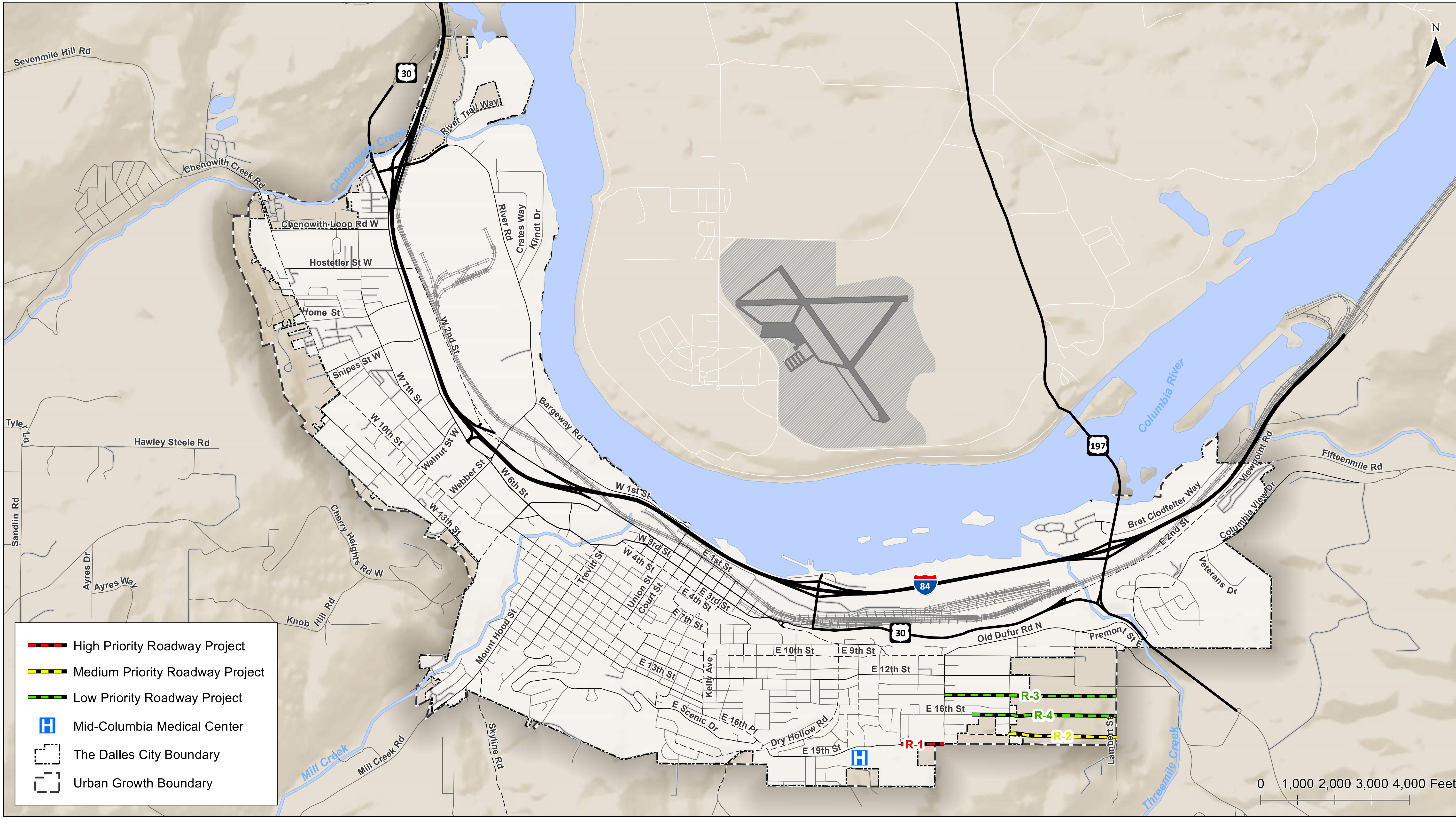


New Roadways

The preferred alternative for new roadways is summarized in Table 6-4 and shown in Figure 6-2 and is consistent with the new roadways shown on the functional classification map.

Table 6-4. New Roadways

Map ID	Location	Project Type	Project Description	Cost Estimate	Recommended Priority	Potential Funding Source		
						ODOT	City	Private
R-1	E 19th Street Extension	New Connection	Construct new Major Collector between Thompson Street and Oakwood Drive	$900,000	High		✓	
R-2	E 18th Street Connection	New Connection	Construct new Minor Collector between Lambert Street and Morton Street, as development occurs	$1.9 million	Medium		✓	✓
R-3	E 14th Street Connection	New Connection	Construct new local street between Morton Street and Lambert Street	$2.0 million	Low/Development Driven		✓	✓
R-4	E 16th Street Connection	New Connection	Construct new local street between Morton Street and Lambert Street	$1.3 million	Low/Development Driven		✓	✓
Total Cost of High Priority New Roadway Projects				**$900,000**				
Total Cost of Medium Priority New Roadway Projects				**$1,900,000**				
Total Cost of Low Priority/ Development-Driven New Roadway Projects				**$3,300,000**				
Total Cost of New Roadway Projects				***$6,100,000***				



New Roadways
The Dalles, Oregon

Figure
6-2

Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

Freight Route Designations

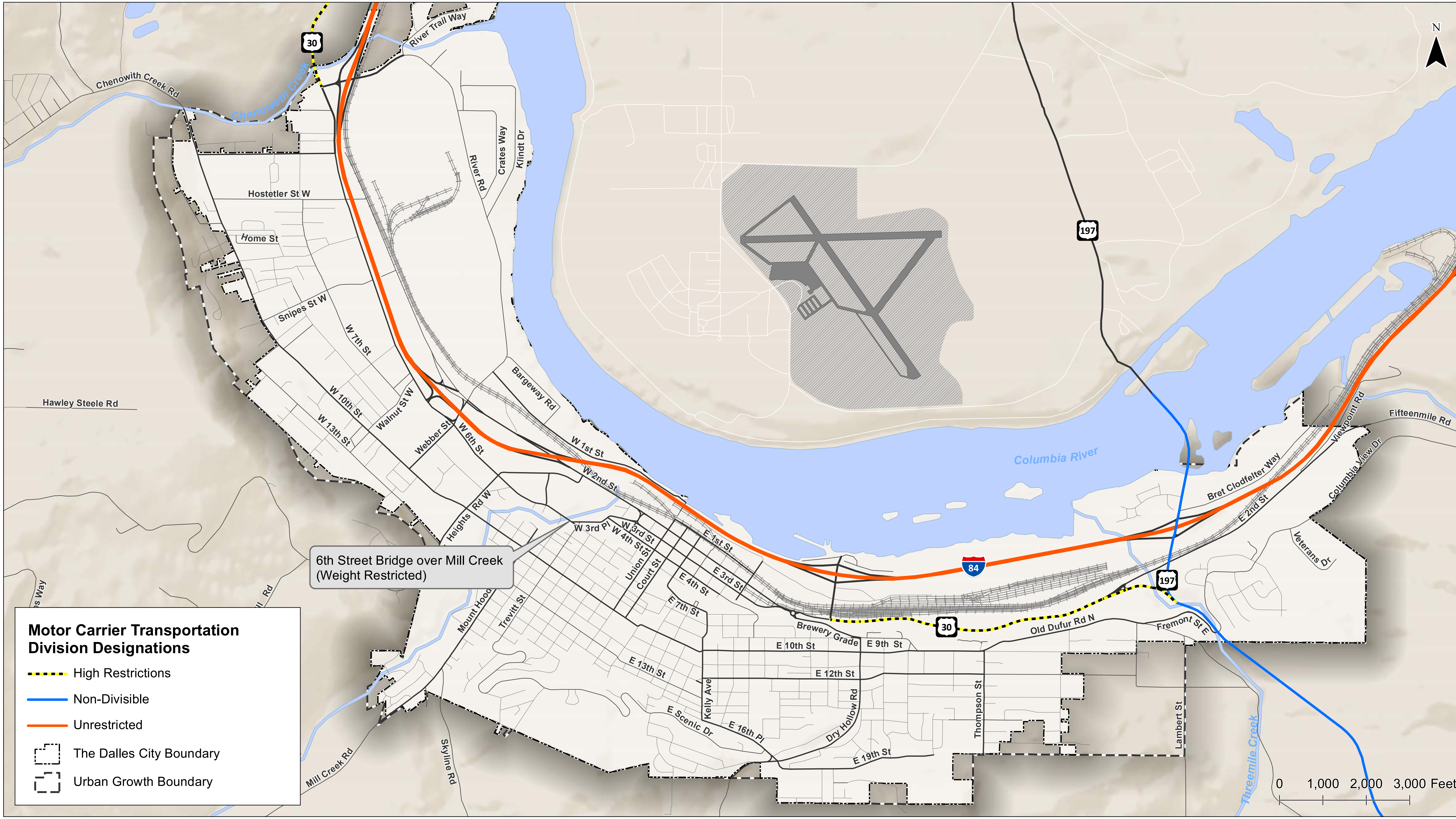
The City's designated freight routes are shown in Figure 6-3 along with ODOT's Motor Carrier Transportation Division (MCTD) freight routes. Access to the major freight areas within The Dalles is generally provided via River Road and connects to I-84 at the Chenoweth Interchange and the Webber Street Interchange. Additional freight generators between I-84 and the railroad near Brewery Overpass Road have convenient access to I-84 via Brewery Overpass interchange terminals.

The MCTD-designated freight routes shown in Figure 6-3 are assigned a description ranging from most restrictive to the most accessible routes for the movement of freight. These descriptions are provided below.

- Routes colored black and yellow are highly restricted to truck and oversize load traffic. These routes may be important for local freight access by permit but not for general use. These routes should not be considered for use as a viable detour route for trucks.
- Routes colored blue are unrestricted to standard freight truck traffic but are either weight or width restricted for non-divisible and/or heavy haul loads. These routes are viable detour routes for general freight trucks only but will not accommodate certain oversize and overweight loads.
- Routes colored orange are generally available for use by unrestricted freight and oversize/overweight routes. These are typically the most heavily used truck routes in the state and also usually offer the most viable unrestricted detour route.

The existing W 6th Street bridge over Mill Creek is currently posted with weight restrictions (refer to Figure 6-3). However, comments indicated the road is a popular truck route. Signage should be placed throughout the City informing trucks of alternative routes in advance of the bridge to provide opportunity for them to avoid the bridge. Project BR-4 in the Bridge and Culvert Plan addresses this issue.

No additional improvements were identified to serve freight. However, several of the intersection improvements are located on freight routes. The design of these improvements must consider the impacts to freight traffic.



MCTD Freight Mobility Map
The Dalles, Oregon

Figure
6-3

Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

\\kittelson.com\fs\H_Portland\projfile\18495 - The Dalles TSP\gis\TM #6\6-3 MCTD Freight Mobility Map.mxd - agriffin - 3:14 PM 4/20/2016

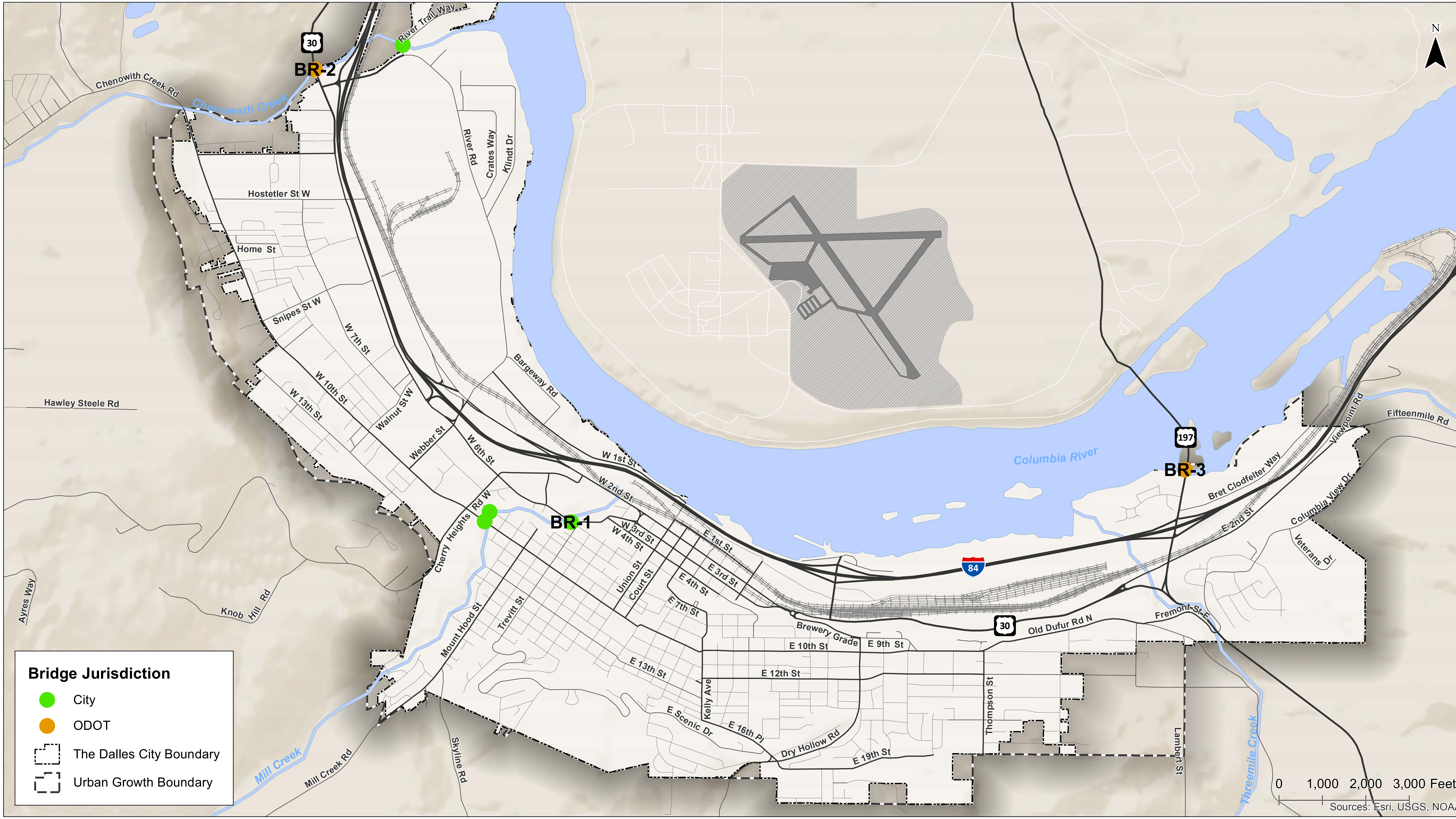
Bridge and Culvert Improvements

The preferred alternatives for Bridge and Culvert improvements are summarized in Table 6-5 and shown in Figure 6-4. The alternatives developed as part of the TSP update were combined with other alternatives identified in the City's current TSP. The alternatives for bridge and culvert improvements include replacing existing bridge structures and widening existing bridge structures.

Table 6-5 summarizes the bridge and culvert improvements proposed to be included in the updated TSP.

Table 6-5. Bridge and Culvert Projects

Map ID	Location	Project Type	Project Description	Cost Estimate	Recommended Priority	Potential Funding Source		
						ODOT	City	Private
BR-1	W 6th Street at Mill Creek	Bridge	Conduct feasibility study to determine the cost of repairing this historic bridge	$20,000	Medium		✓	
BR-2	Structure 00506 – US 30 (Hwy 100) bridge over Chenoweth Creek	Bridge	Replace bridge	TBD	High	✓		
BR-3	Structure 06635Q – US 197 Bridge over the Columbia River	Bridge	Widen bridge	TBD	Medium	✓		
BR-4	Signage to Redirect Trucks around 6th Street Bridge	Bridge	Install signage to provide advance warning to trucks to allow them to redirect and avoid the 6th Street, weight restricted, bridge over Mill Creek	$5,000	High		✓	



Bridge and Culvert Plan
The Dalles, Oregon

Figure
6-4

Oregon Department of Transportation
KITTELSON & ASSOCIATES, INC. TRANSPORTATION ENGINEERING/PLANNING

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

Intersection Improvements

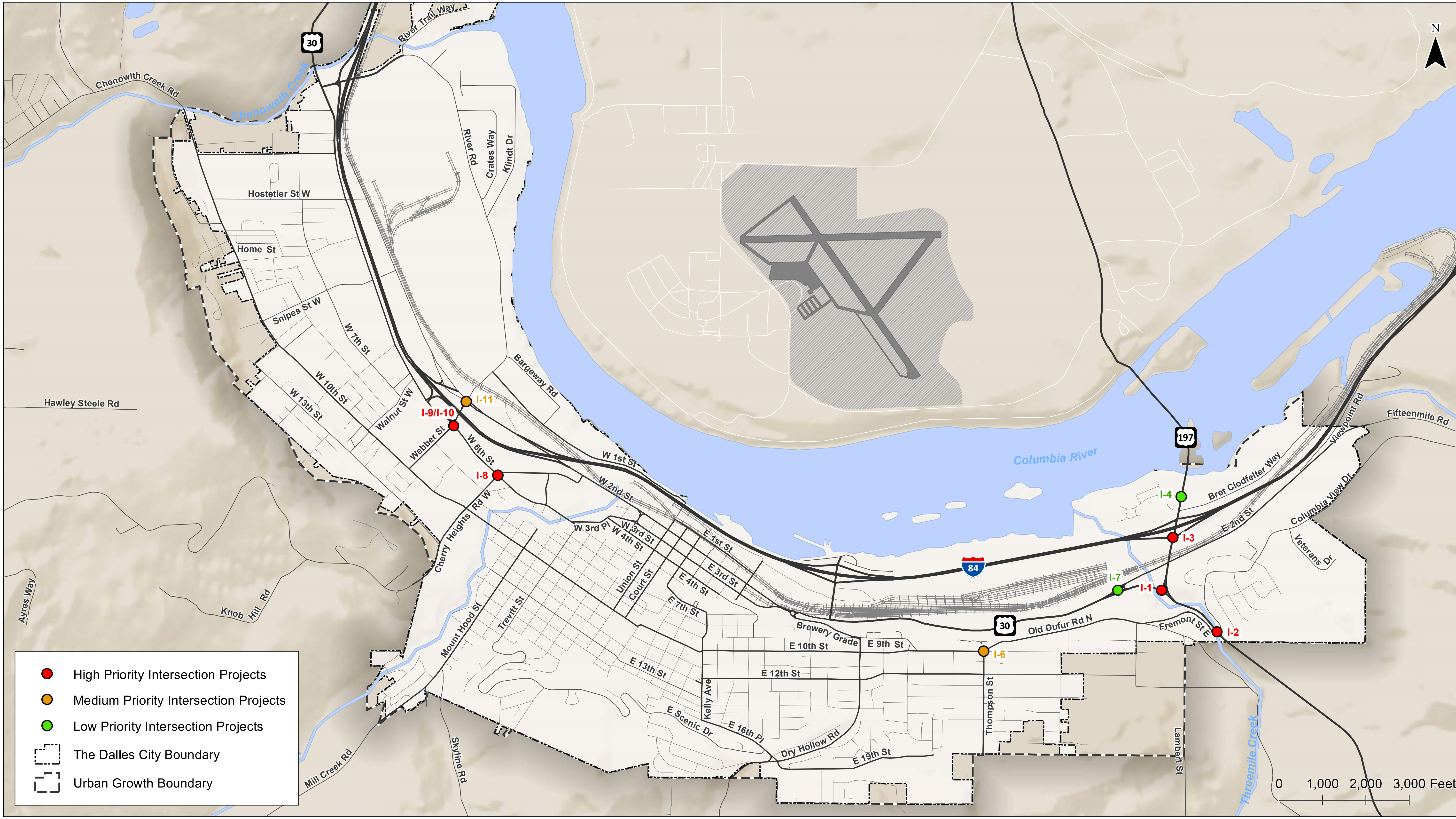
The preferred alternatives for intersection improvements are summarized in Table 6-6 and shown in Figure 6-5. The alternatives for improvements include:

- Reconfigure the intersection to improve operations with treatments such as roundabouts;
- Optimize the signal timing/phasing;
- Reconfigure or add additional left- and/or right-lanes; and
- Conduct corridor studies to further evaluate perceived issues to determine if deficiencies are present that may be mitigated by improvements.

Note that the improvements in Table 6-6 are capacity or queuing-based. Additional improvements related to safety are presented later in this memorandum.

Table 6-6. Intersection Improvements

Map ID	Location	Project Type	Project Description	Cost Estimate	Recommended Priority	Potential Funding Source			
						ODOT	City	Private	County
I-1	US 197/US 30	Intersection, Operations	Install a roundabout to address both safety and operational issues. The selection and design of the roundabout should consider the truck traffic that currently uses this route to gain momentum when traveling uphill on US 197 towards the landfill. A right-turn bypass lane from the west to south leg may assist trucks in maintaining momentum. *(This project is also shown on the Safety map as project S-1.)*	$2.0 to $2.5 million	High	✓		✓	
I-2	US 197/Fremont Street/ Columbia View Drive	Intersection, Operations	Install sign upgrades, rumble strips, and dynamic message signage to provide advance warning of the intersection.	$20,000	High	✓	✓		
			Restrict left-turns from minor-street approaches with raised median and construct median U-turn to south on US 197 (install a J-turn) to improve safety.	$350,000	High	✓	✓		
			In the longer term, install an overpass while converting existing intersections to right-in, right-out or maintaining the J-turn. *(This project is also shown on the Safety map as project S-2.)*	>$1.3 million	Vision	✓	✓		
I-3	US 197/ I-84 EB Ramps	Intersection, Operations	Install a traffic signal to increase capacity. *(This project is also related to projects on the Safety map: S-8 and S-9.)*	$1.25 to $1.5 million	High	✓		✓	
I-4	US 197/ Lone Pine Boulevard	Intersection, Operations	Construct single-lane roundabout.	$1.5 to $2.0 million	Low/Development Driven	✓		✓	
I-6	Thompson St/E 10th St/ Old Dufur Road	Intersection, Realignment	Convert the existing intersection to an off-set "T" and a mini-roundabout.	$130,000	Medium		✓		
I-7	E 2nd St/US 30	Intersection, Realignment	Realign this intersection into a more traditional T-intersection.	$100,000	Low	✓			✓
I-8	Cherry Heights Rd/W 6th Street	Intersection, Realignment	Convert the southbound approach to a shared left-through lane and an exclusive right-turn lane and modify the signal to provide permitted left-turn phasing. Extend the northbound left-turn lane on Cherry Heights Rd to accommodate future queue lengths.	$20,000	High		✓		
I-9 & I-10	W 2nd St/ Webber Road and W 6th St/Webber Road	Intersection, Realignment	Extend the northbound right-turn lane at the Webber and 2nd Street intersection and the southbound right-turn lane at the Webber and 6th Street intersection.	$100,000	High		✓		
I-11	W 2nd Street and W 6th Street	Intersection, Realignment	Add an exclusive northbound and southbound left-turn lane at the 2nd and 6th Street intersections, respectively, by realigning the approaches. Alter the signal timings to accommodate the new lane configurations. Coordinate the signals.	$500,000	Medium		✓		
			Total Cost of High Priority Intersection Projects	**$4,120,000**					
			Total Cost of Medium Priority Intersection Projects	**$630,000**					
			Total Cost of Low/Vision Priority Intersection Projects	**$1,400,000**					
			Total Cost of Development-Driven Intersection Projects	**$1,300,000**					
			Total Cost of Intersection Projects	***$6,580,000***					



Intersection Alternatives
The Dalles, Oregon

Figure
6-5

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

Oregon Department of Transportation
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Interchange Improvements

ODOT completed an Interchange Area Management Plan (IAMP) at the I-84 Chenoweth Interchange in 2006. Table 6-7 and Figure 6-6 include projects from the IAMP that are proposed to be included in the TSP update. Additional information on land use, system, travel demand, and access management strategies is documented in the IAMP.

The IAMP identified four roadway improvement phases (near-term, mid-term, long-term, and vision beyond planning horizon). These were developed to estimate the amount of new development that could occur within the study area before implementation of various components of the local access and circulation plan are required. These phases were developed as planning milestones, since improvements will likely be needed incrementally as development occurs. The phases are intended to show the increments of development that can occur before major improvements are needed. The Vision projects and many of the long-term projects are not expected to be needed due to the revisions in growth estimates for the area. The presence of wetlands and development of low trip-generating uses have resulted in lower impacts than expected during the IAMP development. Project W1 (providing a 5-lane section on W 6th Street) is an example of a project that is not likely to be needed in the future. Table 6-7 identifies the proposed phasing of projects in the IAMP.

Table 6-7. IAMP Projects and Phasing Plan

Map Reference	Improvement Type	Description	Cost Estimate*
Phase 1 – Near-Term Improvements			
I1	Restripe Bridge Lanes	Restripe lanes on bridge to accommodate four lanes (two in each direction, including side-by-side left-turn lanes)	Funded by Development
W4	Intersection Improvement (Signal)	Intersection control at West 6th Street/Hostetler Street to accommodate future traffic	Funded by Development
Phase 2 – Mid-Term Improvements and Actions			
E10	Intersection Improvement (Roundabout)	Intersection control to accommodate future traffic at reconstructed River Trail Way/River Road	$710,000
I2	Signalize Intersection	Accommodate weekday a.m. and p.m. peak hour travel demand at Westbound I-84 Ramp Terminal	$760,000
I3	Signalize Intersection	Accommodate weekday a.m. and p.m. peak hour travel demand at Eastbound I-84 Ramp Terminal	
W2	Intersection Improvement (Roundabout or Signal)	Intersection control at West 6th Street (US 30)/River Road to accommodate future traffic and provide for u-turns created by the median	Funded by Development
W3	Intersection Improvement (Roundabout or Signal)	Intersection control at W 6th Street/Chenoweth Loop to accommodate future traffic and provide for u-turns created by the median	Funded by Development
Phase 3 – Long-Term Improvements			
E2B	UP Railroad At-Grade Crossing and	Provides Hostetler Street connection to River Road and intersection control to accommodate traffic at Hostetler Street	Funded by Development

Map Reference	Improvement Type	Description	Cost Estimate*
	Signal (Short-term)	and 2nd Street (requires approval by ODOT Rail and UPRR)	
E3	New Collector Roadway	Extend Hostetler Street from West 2nd Street to River Road	$4,210,000
E1	New Collector Roadway	Extend River Trail Way from River Road to Hostetler Street Extension	$12,430,000
W2	Provide Left-Turns	Provide dual westbound left-turns at River Road/West 6th Street (US 30) roundabout or signal	Funded by Development
W1	W 6th Street Median	Construct raised median and provide 5-lane section on W 6th Street from River Road to Chenoweth Loop	Funded by Development
W5	Widen West 6th Street to 5 Lanes	Widen West 6th Street from River Road to south of Hostetler Street to accommodate weekday a.m. and p.m. peak hour travel demand	Funded by Development
W4	Dual Westbound Left-Turns	Provide dual westbound left-turns at W 6th Street/Hostetler Street intersection	Funded by Development
E2	Traffic Signal	Traffic signal installed at 2nd Street/Hostetler Street	$13,410,000
E11	Intersection Improvement (Signals)	Intersection control to accommodate future traffic at connection of River Road/Crates Way (North)/Columbia Road	$300,000
E9	Intersection Improvement (Roundabout)	Intersection control to accommodate future traffic at Hostetler Street/River Way Trail Extension	$830,000
E12	Intersection Improvement (Roundabout or Signal)	Intersection control to accommodate traffic at future connection of River Road and Hostetler Street	$500,000
Phase 4 – Long-Term Vision			
I4	Widen Bridge to 6 Lanes (Long-term)	Accommodate weekday peak hour travel demand beyond the 85-percent development threshold (NOT PART OF 20-YEAR PLAN)	Funded by Development
Ongoing Phase – Improvements Implemented in any Phase			
E1	New Local Roadway	Extend River Trail Way from River Road to the Hostetler Street Extension	Funded by Development
E4	New Local Roadway (Long-term)	Provides local business access	Funded by Development
E4B	New Local Roadway (Short-term)	Provides temporary local business access until environmental concerns can be mitigated and project E4 can be constructed	Funded by Development
E5	New Local Roadway	Provides local business access	Funded by Development
E6	New Local Roadway	Provides local business access. Alignment is variable depending on parcel access and circulation.	Funded by Development
N1	New Local Roadways	Provide a network of local streets	Funded by Development
W7	New Local Roadway	Provides local connection between Division Street and Irvine Street	Funded by Development
W8	New Local Roadway	Provides paved local connection between 6th Street and 7th Street	Funded by Development
W9	Cul-de-sac	Supports consolidation of accesses on West 6th Street	Funded by Development

Map Reference	Improvement Type	Description	Cost Estimate*
W4 & W5	Left-turn Lanes	Construct exclusive left-turn lanes on northbound, eastbound, and southbound approaches and an exclusive right-turn lane on the northbound approach to the West 6th Street/Hostetler Street intersection (elements of projects W4 and W5)	Funded by Development
N2^	ROW Preservation	Preserve ROW for a potential future overpass of I-84	Funded by Development
N3	ROW Preservation	Preserve ROW for a potential future overpass of I-84	Funded by Development
W6	Relocate Driveway/New Local Roadway	Relocated driveway further from interchange and River Road/West 6th Street intersection to meet access spacing standards	Funded by Development
E13	Intersection Improvement (Signal)	Intersection control to accommodate future traffic at River Road/Klindt Drive	$500,000
Summary of Total Cost for Non-Development Funded IAMP Projects			
		Phase 1 Projects	**--**
		Phase 2 Projects	**$1,470,000**
		Phase 3 Projects	**$31,680,000**
		Phase 4 Projects	**--**
		Ongoing Projects	**$500,000**
		Total IAMP Projects	***$33,650,000***

*Cost estimates were developed during IAMP project and are only shown for the projects that are not intended to be funded by development.

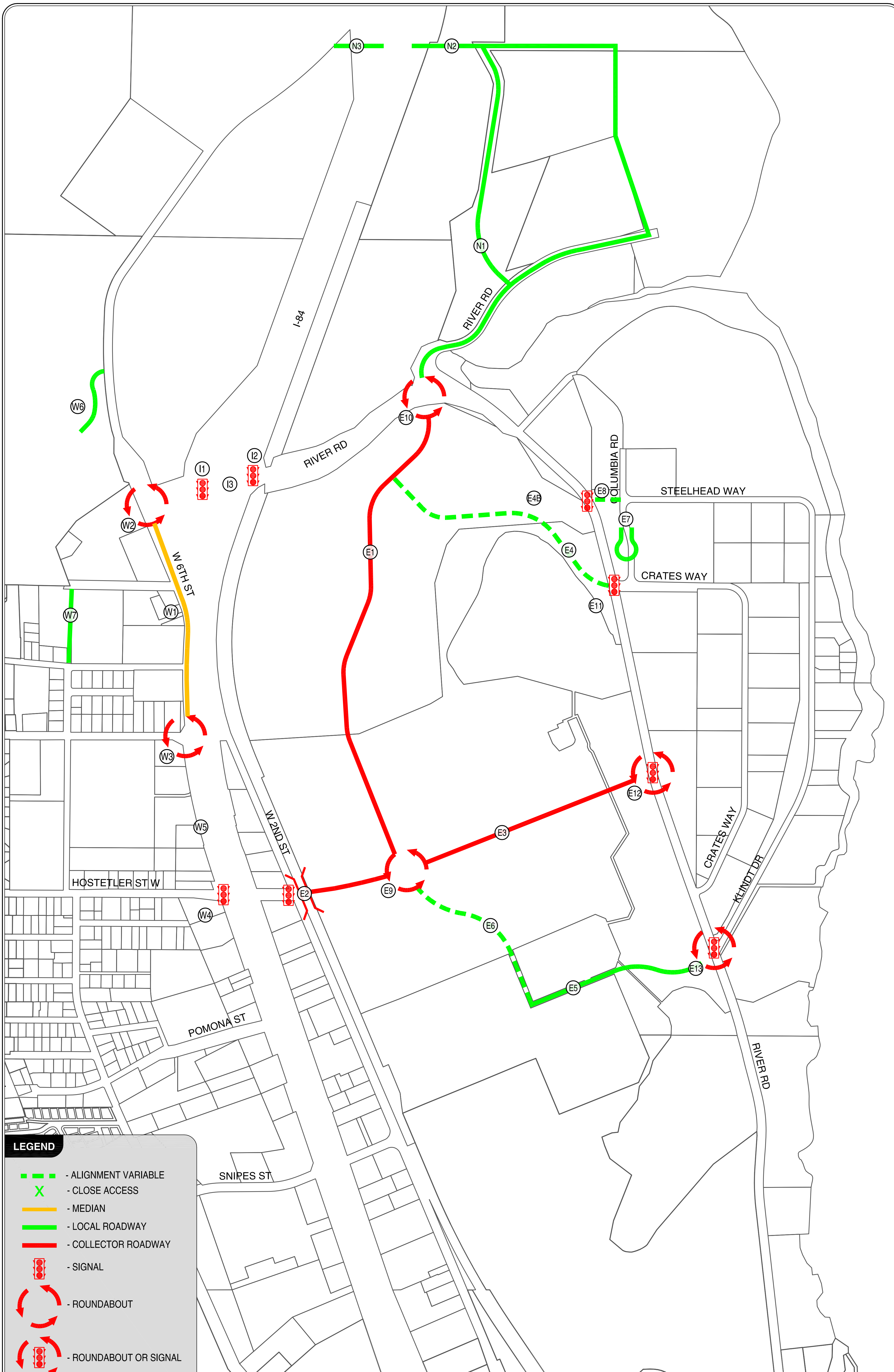
^The alignment for N2 bisects land that is now owned by a developer. If future construction of this connection is pursued, realignment may be needed.

The IAMP further identified the percent of development that is expected to be accommodated under each improvement phase, as summarized in Table 6-8. For example, if all improvements identified in Phase 2 are in operation, between 11 and 55 percent of full build-out under the land use scenario could occur before queuing and intersection operations exceed capacity.

As shown in Table 6-8, the Long-Term Improvements are expected to provide capacity for up to 75-percent of full build-out of all vacant and redevelopable land within the study area. However, the amount of reasonable development that may occur in this area needs to be reevaluated based on the most current information related to developable areas. The potential for development is anticipated to be lower than previously estimated due to wetlands and other issues. It is likely that only the near-term and mid-term improvements may be needed in this area.

Table 6-8. Transportation Improvement Thresholds

Improvement Phase	Development Threshold (Percent of Full Build-Out)
0 – No-Build	--
1 – Near-Term Improvements	<10%
2 – Mid-Term Improvements	11-55%
3 – Long-Term Improvements	56-75%
4 – Long-Term Vision Improvements	76-85%



IAMP PROJECTS
THE DALLES, OREGON

FIGURE
6-6

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TRANSPORTATION ENGINEERING / PLANNING

Safety Improvements

The preferred alternatives for safety improvements are summarized in Table 6-9 and shown in Figure 6-7. It should be noted that many of the roadway, pedestrian, and bicycle improvement projects identified in other sections of this memorandum will improve safety along City roads.

The alternatives for safety improvements include:

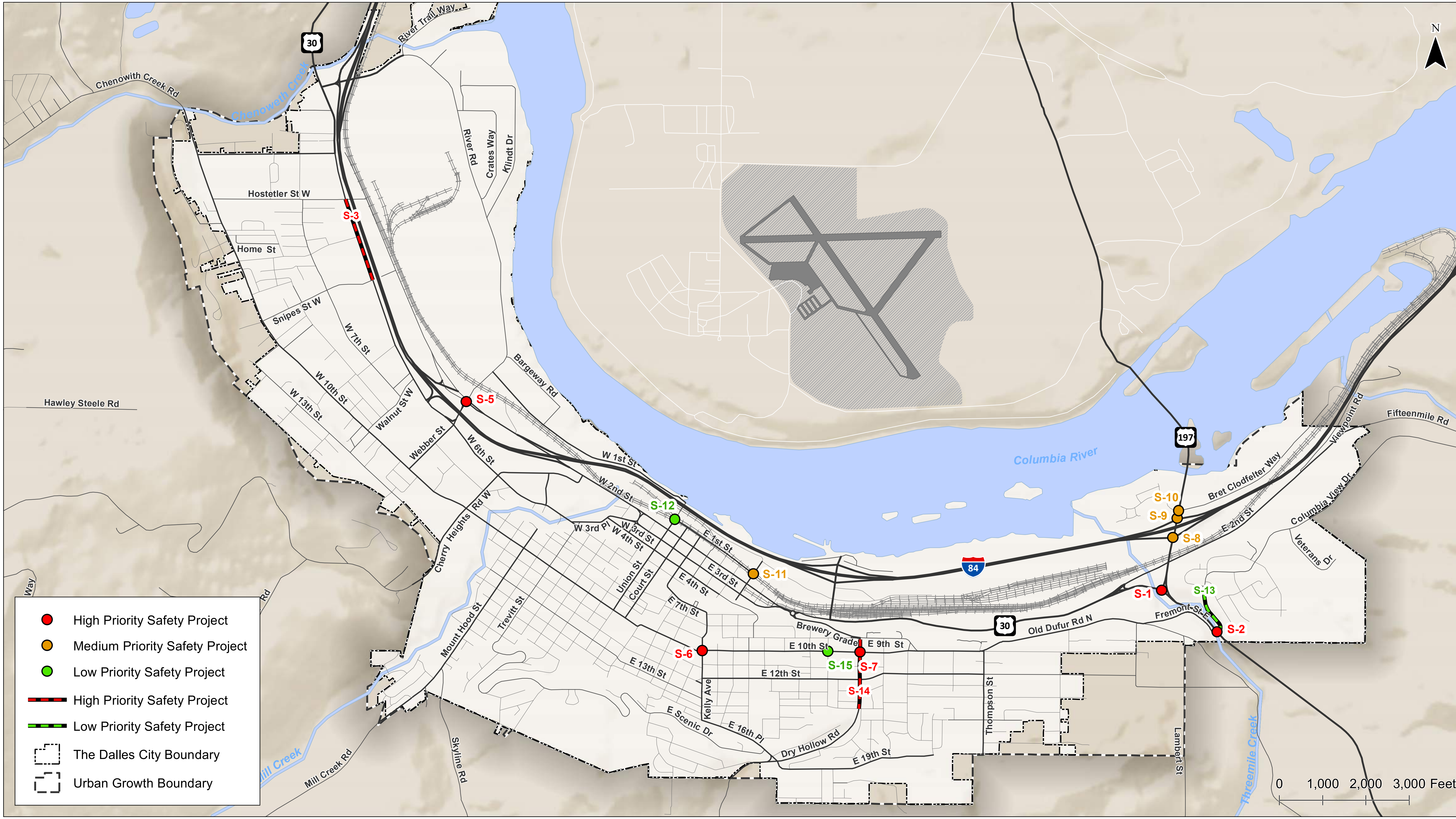
- Realigning intersection approaches;
- Installing signage and pavement markings;
- Reconfiguring turn lanes at intersections;
- Installing a J-turn intersection treatment; and
- Installing guardrail.

Table 6-9 summarizes the safety improvements proposed to be included in the updated TSP.

Table 6-9. Safety Improvements

Map ID	Location	Project Type	Project Description	Cost Estimate	Recommended Priority	Potential Funding Source		
						ODOT	City	Private
S-1	US 197/US 30	Safety	Install systemic safety improvements (signing and markings), and install a roundabout to address both safety and operational issues. The design of the roundabout should consider that trucks currently use this route to gain momentum when traveling uphill on US 197 towards the landfill. *(This project is also shown on the Safety map as project I-1.)*	$2,000 for Systemic Safety Improvements; See Project S-1 for total cost estimate.	High	✓		
S-2	US 197/Fremont Street/Columbia View Drive	Safety	Safety improvements including sign upgrades, rumble strips, and dynamic message signage.	$20,000	High	✓	✓	
			Install a J-turn intersection treatment.	$350,000	High	✓	✓	
			Install an overpass or roundabout in the long-term.	>$1.3 million	Vision	✓	✓	
S-3	West 6th Street from Snipes Street to Hostetler Street	Safety	Restripe roadway and widen, as necessary, to provide a consistent 3-lane section with center two-way, left-turn lane. Further study is needed to determine the preferred solution. Note: this project should be completed in conjunction with P-14.	$250,000	High		✓	
S-5	Webber Street at W 2nd Street and W 6th Street	Safety	Realign approaches to provide protected left-turn phasing to reduce left-turn crashes on the Webber Street approaches.	See Project I-11	High		✓	
S-6	Kelly Avenue/East 10th Street	Safety	Potential safety improvements include installing Stop Ahead signage (W3-1) on the East 10th Street approaches, use of a larger stop sign size, use of retroreflective tape on the sign post, and/or addition of Light Emitting Diode (LED) lights on the STOP sign border.	$2,000	High		✓	
S-7	Dry Hollow Road/East 10th Street	Safety	Potential safety improvements include the use of a larger stop sign size, use of retroreflective tape on the sign post, or addition of LED lights on the STOP sign border.	$2,000	High		✓	
S-8	US 197/I-84 EB Ramps	Safety	Systemic sign upgrades as potential candidates for the ODOT All Roads Transportation Safety (ARTS) Program. *(Project I-3 identifies a project to install a traffic signal to increase capacity here.)*	$1,000	Medium	✓		
S-9	US 197/I-84 WB Ramps	Safety	Systematic sign upgrades as potential candidates for the ODOT ARTS program.	$1,000	Medium	✓		
S-10	US 197/Bret Clodfelter Way	Safety	Illumination and systemic sign upgrades as potential candidates for the ODOT ARTS program.	$14,000	Medium	✓		
S-11	1st St/Madison Street	Safety	Install part time restriction sign (sign that illuminates with railroad crossing activation) restricting eastbound left-turns during the approach and passage of trains (subject to ODOT Rail and Union Pacific Railroad approval).	$20,000	Medium		✓	
S-12	1st St/Union Street	Safety	Install signage prohibiting drivers from stopping on the railroad tracks similar to Do Not Block Intersection signage. (subject to ODOT Rail and Union Pacific Railroad approval).	$1,000	Low		✓	

S-13	Columbia View Drive Guardrail	Safety	Install guardrail along Columbia View Drive as it ascends the hill east of Highway 197.	$60,000	Low		✓	
S-14	Dry Hollow Road Corridor Study	Safety	Conduct a corridor study of Dry Hollow Road between E 9th Street and E 14th Street to evaluate speeds and determine whether corridor and/or intersection treatments such as mini-roundabouts or low-cost treatments such as signing and striping enhancements are needed.	$10,000	High		✓	
S-15	Lewis Street/10th Street Intersection Enhancements	Safety	Stripe stop bars on Lewis Street at the approaches to 10th Street; Install advanced warning signage for the Lewis Street approaches.	$5,000	Low		✓	
			Total Cost of High Priority Safety Projects	**$266,000**				
			Total Cost of Medium Priority Safety Projects	**$36,000**				
			Total Cost of Low Priority Safety Projects	**$66,000**				
			Total Cost of Safety Projects	***$368,000***				
Note: The cost for projects S-2 and S-5 are excluded from the total because they are included in the cost for intersection projects.								



The Hub of the Pacific Northwest · City of The Dalles · Oregon

Safety Plan
The Dalles, Oregon

Figure
6-7

Oregon Department of Transportation

Kittelson & Associates, Inc. Transportation Engineering/Planning

APG

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

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BICYCLE AND PEDESTRIAN ELEMENT

The pedestrian and bicycle plan identifies the complete network of facilities for pedestrians and bicyclists. These networks include sidewalks and bike lanes or alternative treatments to provide connectivity on the major roads in the City. Sidewalk improvements have also been identified on some local streets and neighborhood streets that are located along routes near schools, provide access to local attractions, and in other high priority locations identified by the Public.

Projects within these plans were prioritized based on several factors:

- Inclusion in the Pedestrian and Bicycle Advisory Committee's Priority Network;
- Increasing north-south connectivity between downtown and areas south of downtown;
- Increasing east-west connectivity connecting to downtown;
- Providing connectivity to key destinations; and
- Providing parallel routes to high-volume roadways.

Bicycle Plan

The Bicycle Plan is shown in Figure 6-8. The map illustrates the planned bicycle routes throughout the City and indicates whether an on-street bicycle lane or a shared-roadway is recommended.

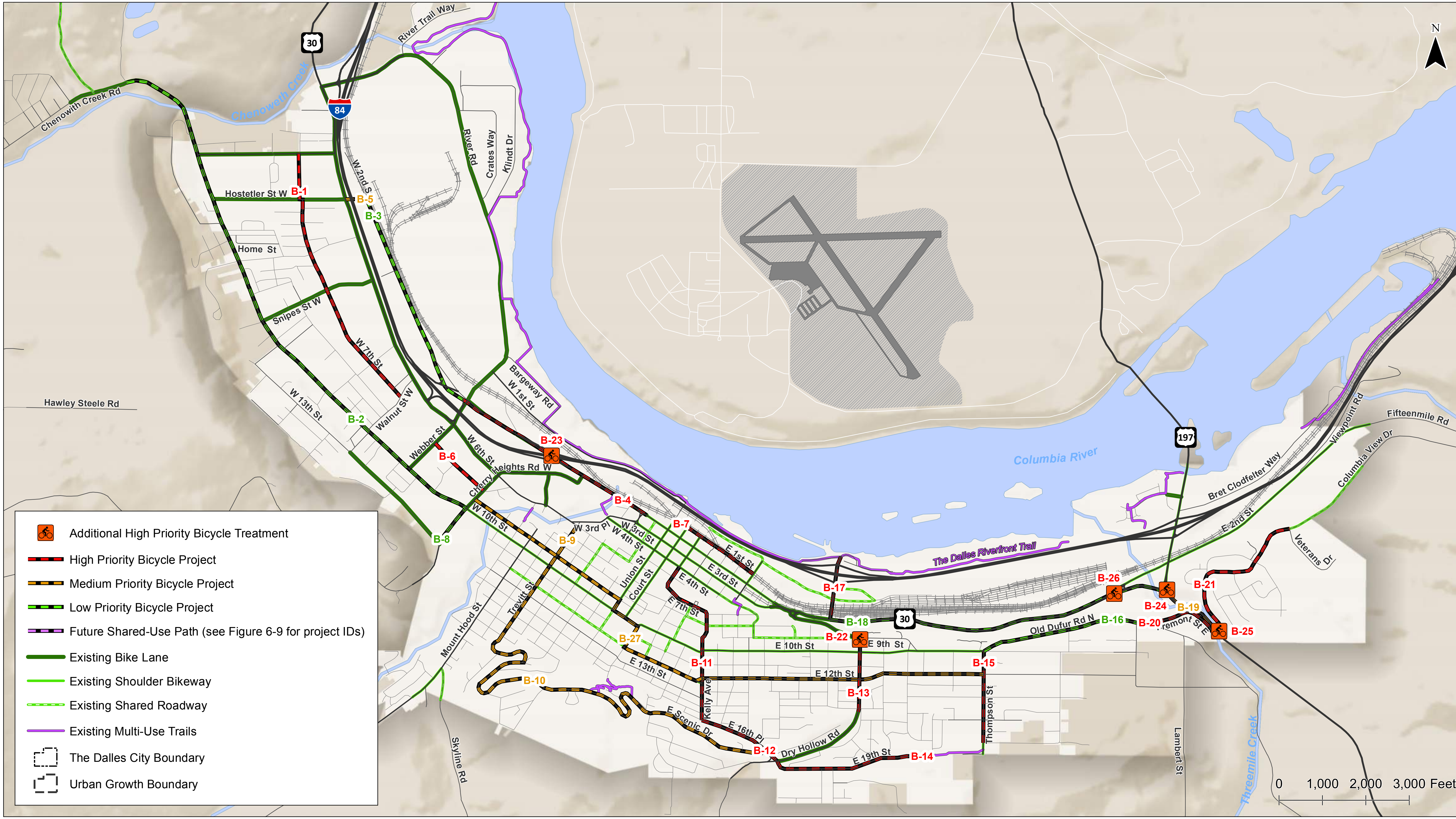
In some cases, buffered bike lanes or shared-use trails are recommended. Buffered bike lanes are on-street bike lanes that include a physical separation ("buffer") between the bike lane and the vehicle traffic lane and/or the vehicle parking lane. Buffered bike lanes can be particularly helpful on streets with comparatively high vehicle speeds, high vehicle volumes, or relatively frequent parking turnover. Shared-use paths are separated from the roadway by an open space or barrier. Shared-use paths are typically used by pedestrians and bicyclists as two-way facilities. Such paths can also be constructed on alignments separate from roadways to create more direct routes between destinations and also serve as elements of a recreational trail system.

Projects to complete the bicycle Plan in The Dalles are identified in Table 6-10.

Table 6-10. Bicycle Projects

Map ID	Location	Project Description	Project Type	Cost Estimate	Recommended Priority	Potential Funding Source		
						ODOT	City	Private
B-1	West 7th Street from the new Transit center to Walnut Street	Add a bicycle lane(s) along West 7th Street from Chenowith Loop Road to Hostetler Street	Bicycle Lane without Pavement Widening	$2,000	High		✓	
		Install sharrow markings along West 7th Street from Hostetler Street to Pomona Street	Shared Roadway	$1,000				
		Add a bicycle lane(s) along West 7th Street from Pomona Street to Walnut Street	Bicycle Lane without Pavement Widening	$10,000				
B-2	West 10th Street from Foley Lakes to Cherry Heights Road	Widen the existing bicycle lane to a 7-ft buffered bicycle lane from Foley Lakes to Cherry Heights Road	Bicycle Lane without Pavement Widening	$7,000	Low		✓	
B-3	West 2nd Street from Hostetler Street to Webber Street	Add a bicycle lane(s) along West 2nd Street from Hostetler Street to Webber Street	Bicycle Lane with Pavement Widening	$800,000	Low		✓	
B-4	West 2nd Street from Webber Street to Lincoln Street	Conduct a refinement plan for West 2nd Street from Webber Street to Lincoln Street that develops the preferred streetscape for this gateway section of the corridor and considers treatments at the key intersections, including Cherry Heights Road and W 2nd Street. Add a bicycle lane(s) along West 2nd Street from Webber Street to Lincoln Street	Bicycle Lane with Pavement Widening	$1,275,000	High		✓	
B-5	Hostetler Street from West 2nd Street to West 6th Street	Add a bicycle lane(s) along Hostetler Street from West 2nd Street to West 6th Street	Bicycle Lane with Pavement Widening	$1,000	Medium		✓	
B-6	West 8th Street from Webber Street to Cherry Height Road	Install sharrow markings and signage along West 8th Street from Webber Street to Cherry Height Road	Shared Roadway	$2,000	High		✓	
B-7	East 1st Street from Union Street to Madison Street	Add a bicycle lane(s) along East 1st Street from Union Street to Madison Street. Consider a 2-way bike lane along this route.	Bicycle Lane without Pavement Widening	$5,000	High		✓	
B-8	Cherry Heights Road from West 13th Street to West 10th Street	Add a bicycle route Cherry Heights Road from West 13th Street to 525ft north	Bicycle Lane with Pavement Widening	$111,000	Low		✓	
		Add a bicycle route Cherry Heights Road from 525ft north of West 13th Street to W 10th Street	Bicycle Lane without Pavement Widening	$1,000				
B-9	Trevitt Street from West 6th Street to West 17th Street	Install sharrow markings and signage along Trevitt Street from West 6th Street to W 17th Street	Shared Roadway	$3,000	Medium		✓	
B-10	Scenic Drive from West 17th Street to E16th Street	Add a bicycle route on Scenic Drive from West 17th Street to E 19th Street	Bicycle Lane without Pavement Widening	$14,000	Medium		✓	
B-11	Kelly Avenue from East 5th Street to E 16th Place	Add a bicycle route along Kelly Avenue from East 5th Street to E 7th Street	Shared Roadway	$4,000	High		✓	
		Add a bicycle route along Kelly Avenue from East 7th Street to E 10th Street	Shared Roadway	$1,000				
		Add a bicycle route along Kelly Avenue from E 10th Street to East 14th St	Shared Roadway	$4,000				
		Add a bicycle route along Kelly Avenue from East 16th Street to East 14th St	Shared Roadway	$1,000				
B-12	E 16th Place from Kelly Avenue to Dry Hollow Road	Add a bicycle route uphill along East 16th Street from Kelly Avenue to East 17 Street. This project would impact the existing on-street parking and may require a shared-lane treatment or widening the sidewalks to create a shared-use path for a portion of it to minimize impacts to on-street parking.	Uphill Bicycle Lane with Pavement Widening	$39,000	High		✓	
		Add a bicycle route along East 16th Street from East 17 Street to Dry Hollow Road	Bicycle Lane without Pavement Widening	$3,000				
B-13	Dry Hollow Road from East 16th Street to Brewery Grade	Add a bicycle route along Dry Hollow Road from East 14th Street to Brewery Grade	Shared Roadway	$1,000	High		✓	
B-14	East 19th Street from Dry Hollow Road to Oakwood Drive	Install sharrow markings and signage along East 19th Street from Dry Hollow Road to Oakwood Drive	Shared Roadway	$3,000	High		✓	
B-15	Thompson Street from East 18th Street to East 10th Street	Add a bicycle route along Thompson Street from East 18th Street to East 10th Street	Bicycle Lane with Pavement Widening	$144,000	High		✓	
B-16	Old Dufur Road from Fremont Street to East 10th Street	Add a bicycle route along Old Dufur Road from Fremont Street to East 10th Street	Bicycle Lane with Pavement Widening	$400,000	Low		✓	
B-17	Brewery Overpass	Add a bicycle route along Brewery Overpass	Shared Roadway	$1,000	High		✓	
B-18	US 30 from US 197 to Brewery Overpass	Add a bicycle route along East 2nd Street from US 197 to Brewery Overpass	Bicycle Lane with Pavement Widening	$979,000	Low	✓		
B-19	US 197 from Fremont Street/Columbia View Drive to Lone Pine Boulevard	Add a bicycle route along US 197 from Fremont Street/Columbia View Drive to US30	Bicycle Lane without Pavement Widening	$5,000	Medium	✓		

B-20	Fremont Street	Add a bicycle route along Fremont Street	Shared Roadway	$1,000	High		✓	
B-21	Columbia View Drive	Install sharrow markings and signage along Columbia View Drive from US197 to Veterans Drive	Shared Roadway	$3,000	High		✓	
B-22	Dry Hollow at Brewery Grade	Additional bike treatment to improve bicycle safety	Bicycle	$3,000	High		✓	
B-23	I-84 and 2nd Street	Additional bike treatment to improve bicycle safety	Bicycle	$3,000	High	✓		
B-24	US 197 at US 30	Additional bike treatment to improve bicycle safety	Bicycle	$2,000	High	✓		
B-25	US 197 at Fremont Street/Columbia View Drive	Additional bike treatment to improve bicycle safety	Bicycle	$3,000	High	✓		
B-26	US 30 and E 2nd Street	Additional bike treatment to improve bicycle safety	Bicycle	$2,000	High	✓		
B-27	W 9th Street Bike Lanes	Install bike lanes on W 9th Street from Cherry Heights to Court Street to E 10th Street to Washington Street to E 12th Street to Old Dufur Road to create a complete east-west connection. This project should include treatment at the intersections of Dry Hollow Road/E 8th Street and Dry Hollow Road/E 9th Street to guide bicyclists in appropriate crossings. Colored pavement markings and signage may be used to direct left-turning bicyclists to use two-stage left-turns with the crosswalks.	Bicycle Lane without Pavement Widening	$30,000	Medium		✓	
			Total Cost of High Priority Bicycle Projects	**$1,515,000**				
			Total Cost of Medium Priority Bicycle Projects	**$53,000**				
			Total Cost of Low Priority Bicycle Projects	**$2,298,000**				
			Total Cost of Bicycle Projects	***$3,866,000***				



Bicycle Plan
The Dalles, Oregon

Figure
6-8

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The Hub of the Pacific Northwest — City of The Dalles — Oregon

Oregon Department of Transportation
Kittelson & Associates, Inc. — Transportation Engineering/Planning
APG

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

Pedestrian Plan

The Pedestrian Plan is shown in Figure 6-9. The map illustrates the key pedestrian routes throughout the City and identifies where improvements are needed to complete sidewalk gaps or improve crossings on these networks. Pedestrian needs within The Dalles are primarily addressed through sidewalks or multi-use paths.

Projects to complete the Pedestrian Plan in The Dalles are identified in Table 6-11.

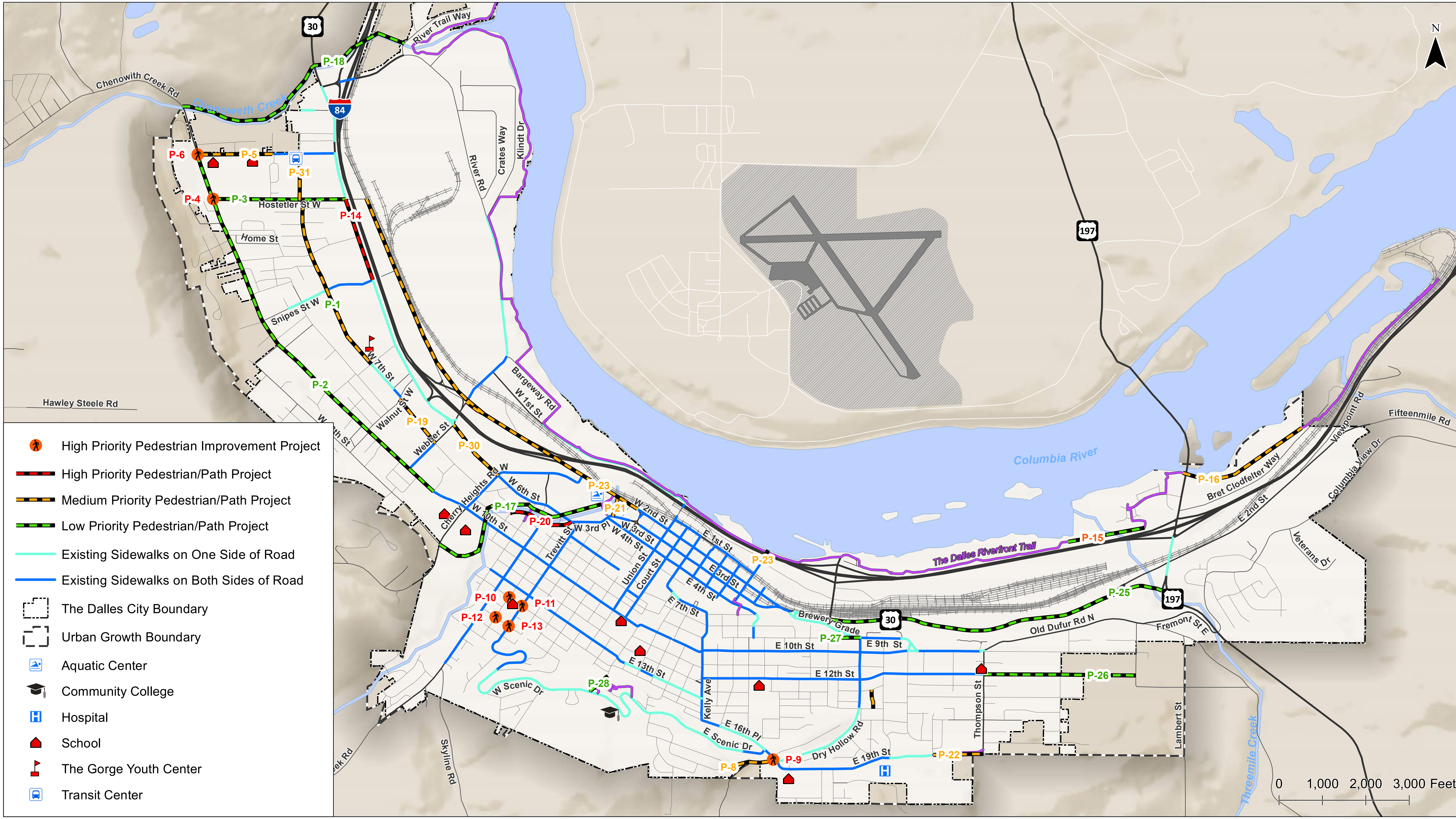
Table 6-11. Pedestrian Projects

Map ID	Location	Project Description	Project Type	Cost Estimate	Recommended Priority	Potential Funding Source		
						ODOT	City	Private
P-1	W 7th Street Sidewalk	Add a sidewalk on both sides of the street to fill sidewalk gaps from Chenowith Loop Road to Walnut Street. (Note: Sidewalk is only desired for the west side of W 7th Street between Chenoweth Loop Road and Hostetler.)	Sidewalk	$ 560,000	Low		✓	
P-2	W 10th Street Sidewalk	Add a sidewalk on both sides of the street to fill sidewalk gaps from Chenowith Loop Road to Vey Way	Sidewalk	$ 611,000	Low		✓	
P-3	Hostetler Street Sidewalk	Add a sidewalk on both sides of the street from West 10th Street to West 6th Street	Sidewalk	$ 200,000	Low		✓	
P-4	W 10th Street/Hostetler Street intersection	Stripe high emphasis crosswalk markings and install appropriate school crossing signal	Crossing	$ 2,000	High		✓	
P-5	Chenowith Loop Road Sidewalk	Add sidewalk on the south side of the street from Chenowith Elementary School to W 10th Street	Sidewalk	$ 46,000	Medium		✓	
P-6	W 10th Street/Chenowith Loop Road Crosswalk	Stripe crosswalk markings and install appropriate school crossing signage	Crossing	$ 2,400	High		✓	
P-8	E 19th Street Sidewalk	Add sidewalk on the north side of the street from East 18th Street to Dry Hollow Road	Sidewalk	$ 30,000	Medium		✓	
P-9	E 16th Place/E 19th Street/Dry Hollow Road Crosswalk	Stripe crosswalk markings and install upgraded school crossing signage	Crossing	$ 2,500	High		✓	
P-10	W 14th Street/Bridge Street Crosswalk	Stripe crosswalk markings and install upgraded school crossing signage	Crossing	$ 2,200	High		✓	
P-11	W 14th Street/Trevitt Street Crosswalk	Stripe crosswalk markings and install upgraded school crossing signage	Crossing	$ 2,200	High		✓	
P-12	W 16th Street/Bridge Street Crosswalk	Stripe crosswalk markings and install upgraded school crossing signage	Crossing	$ 2,200	High		✓	
P-13	W 16th Street/Trevitt Street Crosswalk	Stripe crosswalk markings and install upgraded school crossing signage	Crossing	$ 2,200	High		✓	
P-14	W 6th Street Sidewalk	Fill gaps between Snipes Street and Hostetler Street. Note: this should be conducted in conjunction with project S-3.	Sidewalk	$34,000	High		✓	
P-15*	The Dalles Riverfront Trail	Fill gap in Riverfront Trail from Lone Pine to existing trail. *Note that this project has been opposed by one of the tribes and is unlikely to be developed.*	Shared-Use Path	Unknown	Vision		✓	
P-16*	The Dalles Riverfront Trail	Complete Riverfront Trail from US 197 to The Dalles Dam	Shared-Use Path	Unknown	Medium		✓	
P-17	Mill Creek Trail^	Construct path on the west bank of Mill Creek from Cherry Heights Road/13th Street intersection to The Dalles Riverfront Trail	Shared-Use Path	Unknown	Low		✓	
P-18	Chenoweth Creek Trail^	Construct trail along the creek from W 10th Street to the Riverfront Trail, including an at-grade crossing of US 30 (Historic Columbia River Highway) and an undercrossing of I-84.	Shared-Use Path	Unknown	Low		✓	
P-19	Shared Use Path between West 7th Street and West 8th Street	Construct a shared-use path between West 7th Street and West 8th Street (from Walnut to Webber)	Shared-Use Path	$30,000	Medium		✓	
P-20	Shared-Use Path along between W 8th Place and West 6th Street	Construct a shared-use path between Wright Street and West 6th Street. Pre-engineering for part of this trail has begun. Further plans should be coordinated with The Dalles Watershed Council and the Riverfront Trail Committee.	Shared-Use Path	$37,000	High		✓	
P-21	Shared-Use Path to the Aquatic Center	Construct a shared-use path between the intersection of West 3rd Place and West 4th Street to connect to the Aquatic Center and the Thompson City Park. This path should use the existing bridge. Much of this path will be constructed on private property.	Shared-Use Path	$7,000	Medium		✓	
P-22	Sidewalks and Bicycle Lanes on East 19th Street and Thompson Street	Install sidewalks and bicycle lanes on the future East 19th Street connection to Thompson Street. This will be accomplished through roadway project R-1 and is included in the cost estimate for that project.	Sidewalk	--	High		✓	
P-23	W 2nd Street: Lincoln Street to Webber Street	Add a sidewalk on both sides of the street from Lincoln Street to Webber Street, based on result of streetscape study.	Sidewalk	$250,000	Medium		✓	
P-24	Bike Hub	Install bike hub.	Bike Hub	$70,000	High	✓	✓	✓

Map ID	Location	Project Description	Project Type	Cost Estimate	Recommended Priority	Potential Funding Source		
						ODOT	City	Private
P-25	E 2nd Street Sidewalks	Construct sidewalks on one side of East Second Street between Brewery Overpass Road and Highway 197	Sidewalk	$380,000	Low	✓	✓	
P-26	E 12th Street Sidewalks	Construct sidewalks on E 12th Street between Thompson and Richmond	Sidewalk	$170,000	Low		✓	
P-27	E 9th Street Sidewalk Infill	Construct sidewalks on E 9th Street from Lewis Street to Brewery Grade to provide a complete connection.	Sidewalk	$13,000	Low		✓	
P-28	Sorosis Park Trail Connection Study	Study the feasibility of improving the trail connections between Sorosis Park and Washington Street.	Study	$20,000	Low		✓	
P-29	Pedestrian Access Study	Evaluate the best locations for pedestrian/bicycle connections across the interstate and railroad to access the river, Riverfront trail, and Lone pine.	Study	$20,000	High	✓	✓	
P-30	6th Street/Cherry Heights Road Pedestrian Access Study	Complete a study to examine pedestrian access in the area and determine the appropriate location and design for a mid-block crossing(s) of 6th Street between Cherry Heights Road and Webber Street.	Study	$5,000	Medium	✓	✓	
P-31	W 2nd Street Sidewalks from Webber to Hostetler	Install sidewalks on the west side of W 2nd Street.	Sidewalk	$510,000	Medium		✓	
			Total Cost of High Priority Pedestrian Projects	**$176,700**				
			Total Cost of Medium Priority Pedestrian Projects	**$878,000**				
			Total Cost of Low Priority Pedestrian Projects	**$1,954,000**				
			Total Cost of Pedestrian Projects	***$3,008,700***				

^Indicates project was identified from current TSP.

*The alignment of these path projects is uncertain at this point and may change prior to implementation.



Pedestrian Plan
The Dalles, Oregon

Figure
6-9

K:\H_Portland\projfile\18495 - The Dalles TSP\gis\TM #6\6-9 Pedestrian Plan.mxd - openbnd - 9:50 PM 4/20/2016

Oregon Department of Transportation
Kittelson & Associates, Inc. Transportation Engineering/Planning

Coordinate System: NAD 1983 StatePlane Oregon North FIPS 3601 Feet Intl
Data Source: Wasco County
Sources: Esri, USGS, NOAA

PUBLIC TRANSPORTATION ELEMENT

Public transportation service within The Dalles includes a dial-a-ride, door-to-door service operated by the Mid-Columbia Council of Government's Transportation Network (The Link). In addition, ODOT provides public utility commission (PUC) licenses to private companies and charter service providers. Intercity transit service is provided by Greyhound, Columbia Area Transit, the Hood River County Transportation District and by Amtrak Thruway bus service.

A new transit center, operated by the Mid-Columbia Council of Governments (MCCOG), is currently under construction on West 7th Street, near the Chenoweth interchange. The transit center is expected to be complete in 2016, with park-and-ride space and bus service provided by Columbia Area Transit, MCCOG's Link, and Greyhound.

To enhance transit service within The Dalles, the City should evaluate the feasibility of implementing a fixed-route service. The service should prioritize routes between residential areas and key destinations (e.g., MCMC, Columbia Gorge Community College, downtown, Aquatic Center, etc.). Additional evaluation of fixed-route services will be conducted in summer 2016 and specific recommendations will be included in the final TSP.

AIR, WATER, RAIL, AND PIPELINE ELEMENTS

The following describes identified needs and planned improvements related to the air, water, rail, and pipeline modes.

Air System

The Dalles is served by the Columbia Gorge Regional Airport, also known as The Dalles Airport. The *Oregon Aviation Plan* assigns the Columbia Gorge Regional Airport as a Category 3 (Regional General Aviation) airport. It has two runways and serves 45 operations per day on average.

The Columbia Gorge Regional Airport – Airport Master Plan, completed in August 2010, includes plans to construct new hangars, replace the existing terminal building, expand the runway ramps, install a new fuel farm, and utilize excess airport property for revenue generation. A plan to generate revenue includes a planned business park area located in the southwest corner of the airport property. The Master Plan also identified a unique opportunity to utilize the excess airport property for a golf course and resort.

Thirty-five acres in the business park have been developed into 17 lots that are shovel-ready for construction with the completed roadway infrastructure and utilities (water, sewer, electricity, cable, and high speed internet). Development is expected to continue at the business park.

Water System

The Columbia River serves as the northern boundary of The Dalles and provides a valuable resource to the City and the surrounding area. The river provides recreational opportunities and economic development opportunities such as the four private cruise lines that port at The Dalles Marine Terminal near the intersection of W 1st Street and Union Street. Cruises run from March to November each year and result in many passengers connecting to the pedestrian facilities in The Dalles or transferring to buses to visit local tourist destinations. This further emphasizes the need for improved pedestrian connections between the river and the areas near downtown and the transit center.

The Port of The Dalles Marina is located on the Columbia River at River Mile Post 190. The Marina provides space for 62 boathouses and approximately 30 open moorage positions that are leased on a monthly, 6-month or annual basis. A boat launch is located adjacent to the Marina to accommodate boat haul outs with trailers.

Rail System

The Union Pacific Railroad (UP) provides freight service along the I-84 corridor, known as the east-west transcontinental route linking Oregon with the mid-west and beyond. Locally, the transcontinental route operates between Portland and Hinkle Rail Yard (near Hermiston, Oregon) along the southern bank of the Columbia River. Hinkle Rail Yard is a junction point, and the location of UP’s primary carload classification yard in the Pacific Northwest. The route continues southeast from Hinkle to Granger, Wyoming and Ogden, Utah, connecting to UP’s historic Central Corridor that links the San Francisco Bay Area of California with Salt Lake City, Utah; Omaha, Nebraska; and Chicago, Illinois.

UP’s network in Oregon is predominantly single track with passing sidings. Top inbound commodities include mixed freight handled in containers and trailers, recyclables/waste, fertilizers, soda ash and coal. Top outbound commodities were dominated by mixed freight handled in intermodal service, and lumber/building materials.

According to the *Oregon Rail Plan*, the Federal Railroad Administration (FRA) has established nine track classes, which set maximum speeds for freight and passenger trains, based on the track condition. UP track is maintained to FRA Class 1 conditions with no weight or dimensional restriction through The Dalles. In Oregon, Class 1 railroads have freight train speeds up to 60 mph and passenger speeds up to 79 mph. Within The Dalles, trains are restricted to 40 mph.

There are three at-grade crossings on major roads within the City, including: Webber Street, Union Street, and Madison Street. At-grade crossings result in interaction between fixed-rail and other transportation system users. ODOT Rail regulates all public at-grade highway-railroad grade crossings in Oregon.

All three crossings feature "Active Control" crossings that communicate the presence or approach of a train using measures such as flashing lights, bells, and/or a gate system. However, due to geometry and limited spacing between the railroad tracks and 1st Street, the City and ODOT have noted a few potential conflicts. At the rail crossing on Madison Street, eastbound left-turn traffic from 1st Street does not have a physical crossing barrier in place. This is due to the fact that 1st Street parallels the railroad tracks and 1st Street intersects with Madison Street at the crossing. Additional warning or other devices may be needed to enforce the crossing warning system.

At the Union Street rail crossing, southbound traffic turning left onto 1st Street may create a queue across the railroad tracks during peak periods of vehicular traffic. Signage should be installed to encourage queued vehicles to stop in advance of the railroad crossing. Safety projects S-11 and S-12 are intended to address rail crossing issues.

Pipeline and Transmission System

Northwest Natural Gas operates a major natural gas distribution line serving The Dalles. This distribution line extends southward from the main transmission line, which runs along the Washington side of the Columbia River Gorge. Northwest Pipeline Corporation operates the main transmission line.

TRANSPORTATION FINANCE ELEMENT

Funding for transportation projects is increasingly in short supply as existing infrastructure ages and transportation demands increase. This section provides a means for evaluating the likelihood that projects can be funded within the timelines identified in the TSP and defines priorities based on available funding opportunities.

Funding for the implementation of the projects identified in the Transportation System Plan will be shared between the City of The Dalles, ODOT, and private development. The proportional contributions to be made by private development are to be determined at the time that development occurs or some land use change triggers the need for implementation in conformance with the development review process. Contributions of each agency, if any, should reflect facility usage by local, regional, or statewide trips.

Transportation Funding

The City of The Dalles has three primary sources for funding transportation projects: a three-cent fuel tax, the State Motor Vehicle Fund, and the FAU Exchange Funds. The Transportation System Development Charge (SDC) Fund accounts for the receipt and expenditures of revenues to construct collector and arterial street improvements and is funded by SDC fees assessed on new development.

The primary sources of revenue for the Transportation Fund have been the State of Oregon gas tax and, to a lesser extent, state revenue sharing and the FAU fund exchange program. Recognizing the impact that the installation of public utilities have on the need for street repairs, the City of The Dalles recently began receiving some funding from franchise fees. The Transportation Fund covers the City's street, bike lane, and right-of-way.

Technical Memorandum #5: Alternatives Analysis provided a summary of the transportation-related funding and expenditures for the past five fiscal years. Based on records of expenditures in the current budget, the City anticipates spending 13 percent of the annual Street Fund budget on capital projects. If this level of funding is maintained for capital projects over the 20-year planning horizon, the City could fund approximately $6 million in capital projects.

Planned Transportation System Cost Summary

Table 6-12 provides a summary of the capital cost associated with construction of the transportation system needs identified in this memorandum. As shown, the full cost of the planned system is approximately $53 million over the 20 year period, including approximately $6.9 million in high priority projects, $4.1 million in medium priority projects, $42 million in low priority and development driven projects. Note that this cost does not include the financial commitments required for on-going maintenance and rehabilitation of the existing transportation system. Based on the anticipated $6 million in funds available for capital improvement projects over the next 20 years, **the draft financially constrained plan includes the high priority projects**.

Table 6-12. Planned Transportation System Cost Summary

Project Type	High Priority (Cost Constrained Projects)	Medium Priority	Low Priority/ Development Driven	*Total*
Roadway	$900,000	$1,900,000	$3,300,000	*$6,100,000*
Intersection	$4,120,000	$630,000	$3,150,000	*$7,900,000*
IAMP	--	$1,470,000	$32,180,000	*$33,650,000*
Safety	$266,000	$36,000	$66,000	*$368,000*
Pedestrian/Trail	$176,700	$878,000	$1,954,000	*$3,008,700*
Bicycle	$1,515,000	$53,000	$2,298,000	*$3,866,000*
Bridge	$5,000	$20,000	--	*$25,000*
Total	**$6,982,700**	**$4,987,000**	**$42,948,000**	***$54,917,700***

Table 6-12 shows the full cost of all of the identified project needs presented in this memorandum and does not account for the amount of these projects that will be funded by ODOT or private funds. Therefore, the City's portion of the total cost is likely to be lower than shown here. In some projects on ODOT facilities, the City may act as a partner and provide a match in funds, which may vary in percentage of the overall project cost.

Additional grants and funding opportunities that may be used to help fill the gap in funding projects were documented in *Technical Memorandum #5: Alternatives Analysis* and will be included in the final TSP.

NEXT STEPS

The draft Plan Elements presented in this memorandum were discussed by the Technical Advisory Committee (TAC), Public Advisory Committee (PAC), and public at meetings on April 26, 2016. Based on input received from these groups, Plan Elements and priorities were revised and will be used to create the draft Transportation System Plan.

Several issues have identified for further discussion at the meeting. These are discussed below.

Downtown Two-Way Conversion

Technical Memorandum #5 provided discussion on the option of converting the downtown couplet to a two-way system. This issue was not resolved at that time and was therefore carried forward for discussion again.

Within The Dalles downtown, the roadway system operates as a one-way couplet with westbound traffic on 2nd Street and eastbound traffic on 3rd Street. While there are few issues with the couplet today, the City is making efforts to revitalize downtown and attract new businesses that could be supported by a conversion.

Successful one-way to two-way conversions have been documented in several Oregon cities, one of the most notable being downtown Oregon City. Oregon City's conversion resulted in a complete street project that filled gaps in transportation infrastructure by linking transit, pedestrian, and bicycle networks. The project has been credited as "bolstering Oregon City's downtown, with 37 new downtown businesses opening in…32 months."

The advantages and disadvantages of a one-way to two-way conversion in The Dalles have been qualitatively evaluated relative to economic development, and motorized and non-motorized travel. Table 6-13 provides a general summary of the factors to be considered by the City and its stakeholders. If the consensus is that the conversion warrants further review after reviewing this qualitative comparison, additional quantitative evaluations of projects and costs could be completed to further inform decisions. An operational analysis of a two-way street couplet would require a new model run by ODOT's Transportation Planning Analysis Unit (TPAU) to understand how changes in traffic patterns would influence operations.

Table 6-13. Qualitative Evaluation of a One-Way to Two-Way Street Conversion in Downtown The Dalles

Evaluation Category	Advantages of Conversion	Disadvantages of Conversion
Motor Vehicles	• Easy-to-navigate network	• Impacts to existing local circulation downtown, potentially reducing traffic on 3rd Street while increasing through traffic on 2nd Street. • Increases congestion by introducing more conflicting movements at every intersection • Upgrades required to existing signals and intersections, including: ○ Westbound left-turn lane at 2nd Street/Lincoln Street ($100,000) ○ Signal modifications at 4 existing signals ($30,000), assuming permissive only left-turn phasing • New signals may be required to accommodate increased left-turn demand on 2nd Street at Taylor Street and Lincoln Street ($400,000)
Economic Development	• Supports other ongoing economic development efforts • Increases the visibility and accessibility of retail offerings • Slower speeds and congestion may make downtown appear busy, which could attract more retail customers	• Not a stand-alone catalyst for economic development.
Pedestrian/Bicycle	• Reduced speeds due to congestion may encourage more bicyclists to share the road with motor vehicles • Reduced potential for multi-threat crossing conflicts	• Additional delay at intersections.

Economic Development

Economic development is often cited as a primary benefit of a conversion and is associated with making the streets more "customer friendly" and "easier to navigate" – especially for tourist and infrequent customers. The level of these benefits is difficult to estimate, but given that The Dalles downtown is only 10 blocks long within the couplet, these benefits to potential customers appear minimal.

The conversion of one-way to two-way streets should not be considered a catalyst for economic development, but it could support other downtown revitalization efforts currently underway by The Dalles Main Street organization. According to the National Trust for Historic Preservation (www.preservationnation.org) the retail area affected by the conversion should be "experiencing a comeback" before a conversion can be effective.

Pedestrian and Bicycles

Experts from the Pedestrian and Bicycle Information Center within the University of North Carolina Highway Safety Research Center (www.pedbikeinfo.org) suggest one-way to two-way street conversions can "also help reduce motor vehicle speeds and vehicle miles traveled and provide improved conditions and access for bicyclists."

For pedestrians the potential for a multiple-threat crossing conflict is reduced by providing two-way traffic. This conflict occurs when a pedestrian is crossing a two-lane roadway and the vehicle in the lane nearest to the pedestrian stops for the pedestrian and a vehicle in the second lane does not stop. A two-way traffic flow eliminates this conflict since both drivers theoretically have an unobstructed view of the crosswalk on the approach.

Other pedestrian and bicycle enhancements, such as bulb-outs at intersections to reduce crossing distance, can be implemented without a conversion to two-way traffic.

Public Input

The Downtown Couplet conversion was not discussed with the PAC/TAC members during Meeting #2 due to time constraints; however, this was discussed as part of the public open house. The feelings were mixed with some people for the conversion and some against it. Both sides agreed that a comprehensive economic impact assessment needs to be completed before any decisions are made. Many of the supporters of the conversion stated that if the study did not indicate an economic benefit they would change their views on the conversion.

The TAC/PAC decided not to move this project forward. If the City decides to carry it forward in the future, a study will be needed before making a decision on the potential conversion.

US 197 Corridor

Several projects are identified along the US 197 corridor. Because the implementation of these projects may impact other intersections along the corridor, these projects should be considered holistically to develop a phased implementation approach. In addition, this corridor is an important truck corridor. The impacts of improvements to truck traffic should be considered. Two key project locations along this corridor include:

- US 197/Fremont Street/Columbia View Drive (I-2): Several intersection improvements are proposed at this location to address safety issues. Low-cost treatments such as signage and rumble strips are proposed in the near-term. A J-turn treatment is also proposed in the near-term. However, the implementation of the J-turn should be coordinated with the implementation of the roundabout (project I-1) at US 197/US 20. The roundabout would facilitate the southbound u-turn movement while the J-turn intersection would facilitate the northbound u-turn movement. In the longer-term, an overpass or roundabout may be implemented at this location.

- US 197/US 30 (Project I-1): A roundabout or signal is proposed at the intersection of US 197/US 30 to address both safety and operational issues. This improvement also supports the function of the J-turn at US 197/Fremont Street/Columbia View Drive. However, comments from ODOT staff have indicated that trucks traveling from the west leg of the intersection to the south gain momentum through this area to travel up the grade to the south. The selection and design of a preferred alternative at this location should consider these impacts.

E 19th Street Extension

The E 19th Street extension project is proposed to improve east-west connectivity in the eastern side of the City. If constructed, the E 19th Street extension would alleviate several existing local roads that are not intended to serve high traffic volumes, including E 14th Street, E 12th Street, and Dry Hollow Road. Residents on the east side of the City will be able to utilize the E 19th Street connection for direct access to the school, parks, residences, medical center, and other attractions on the south side of the City. In addition, once the E 19th Street extension is constructed, the E 16th Street connection may be opened, further improving east-west connectivity. The completion of the E 19th Street connection would work towards a grid system in the east side of the City, consistent with street spacing and patterns in the rest of the City.

APPENDICES

Appendix 1 Evaluation and Prioritization Matrix

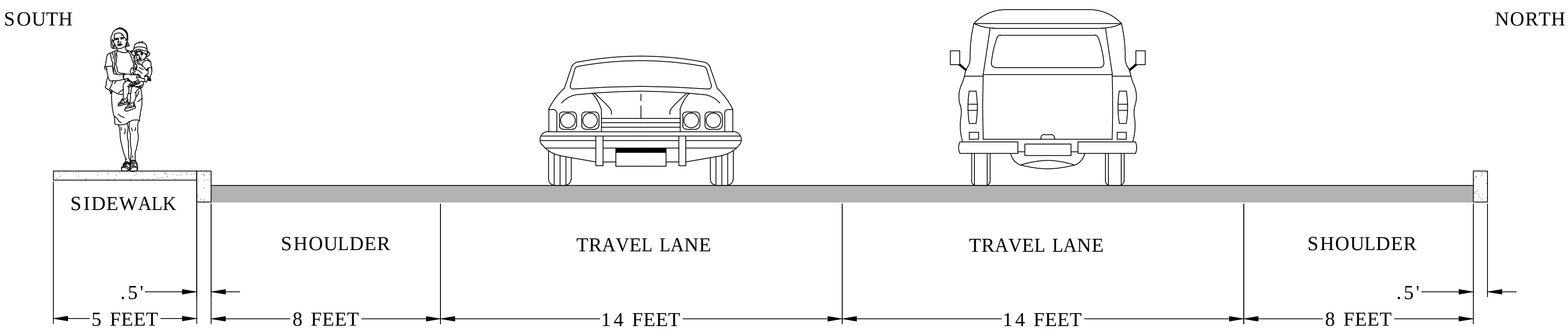
Appendix 2 Roadway Cross-Sections

Appendix 1 Evaluation and Prioritization Matrix

Criteria Number	Evaluation Criteria	Evaluation Measures	I-1 US 197/US 30	I-2 US 197/Fremont Street	1-3 US 197/I-84 EB	1-4 US 197/Lone Pine Boulevard	1-6 Thompson St/E 10th St/Old Dufur Road	I-7 East 2nd Street/US 30	I-8 Cherry Heights Rd/W 6th St	I-9 W 2nd St/Webber Rd, W 6th St/Webber Rd	I-10 W 2nd St/Webber Rd, W 6th St/Webber Rd	1-11 W 2nd St/Webber St	R-1 E 19th Street Extension	R-2 E 18th Street Connection	R-3 E 14th Street Connection	R-4 E 16th Street Connection	S-1 US 197/US 30	S-2 US 197/Fremont Street/Columbia View Drive	S-3 West 6th Street from Snipes Street to Hostetler Street	S-5 Webber Street at W 2nd Street and W 6th Street	S-6 Kelly Avenue/East 10th Street	S-7 Dry Hollow Road/East 10th Street	S-8 US 197/I-84 EB Ramps	S-9 US 197/I-84 WB Ramps	S-10 US 197/Bret Clodfelter Way	S-11 1st St/Madison Street	S-12 1st St/Union Street	S-13 Columbia View Drive Guardrail	S-14 Dry Hollow Road Corridor Study	S-15 Lewis Street/10th Street Intersection Enhancements
Goal 1: Safety and Mobility - Ensure a safe and efficient transportation system for all users in a state of good repair.			12	7	8	8	8	5	3	2	2	2	5	2	2	2	10	10	6	5	5	6	6	5	5	4	3	3	7	4
1A1	Estimated number of fatal or serious injury crashes.	To what extent does the alternative reduce the estimated frequency of fatal and serious injury crashes? Whenever possible, estimate the change in predicted crash frequency using Safety Performance Functions from the Highway Safety Manual calibrated for Oregon and/or crash modification factors (CMFs) approved by ODOT for use in the All Roads Transportation Safety (ARTS) program	2	2	2	2	1	1	1	1	1	1	0	0	0	0	1	2	2	2	2	2	2	2	2	1	1	1	2	1
1A2	Estimated number of bicycle and pedestrian related crashes.	To what extent does the alternative reduce the estimated frequency of pedestrian and bicycle related crashes? Whenever possible, measure using reliable crash modification factors (CMFs) for estimating relative change in predicted crash frequency.	2	0	2	1	2	1	0	0	0	0	1	0	0	0	1	2	1	1	0	1	1	0	0	0	0	0	2	0
1B1	Number of conflict points between all modes of travel including crossing points for pedestrians and bicyclists along major arterials and vehicular at-grade rail crossings.	To what extent does the alternative increase safety by reducing vehicle to vehicle, vehicle to rail, vehicle to pedestrian/bicycle, or pedestrian/bicycle to pedestrian/bicycle conflict points? Measured as relative impact between alternatives in regards to reducing the number of conflict between modes and speed differential. For example, installing raised medians to provide a physical barrier between modes at intersections.	2	0	0	1	1	1	0	0	0	0	0	0	0	0	2	2	1	0	0	0	0	0	0	0	0	0	1	0
1B2	Intersection visibility and sight distances available to motorists, pedestrians, and bicyclists at intersections and key decision points.	To what extent does the alternative improve sight distance for all system users, increasing available time to identify and react to potential conflicts? Measured as relative impact between alternatives for providing adequate sight distance based on desired operating speeds.	2	2	0	1	2	1	0	0	0	0	1	0	0	0	2	1	0	0	1	1	1	1	1	1	0	0	0	1
1C1	Percent of study intersections meeting applicable operational performance measures.	To what extent does the alternative mitigate or improve operational performance relative to applicable targets and standards? Measured by the degree to which an alternative mitigates a failing condition or improves operations.	2	2	2	1	0	0	1	1	1	1	1	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0
1D1	Percentage of acceptable pavement conditions based on roadway classification or extended lifespan of pavement.	To what extent will the project preserve or extend the life of the existing pavement condition? Measured by whether or not the project improves the pavement condition index.	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	-1	0	0	0	0	0	0	0	0	0	0	0	0
1E1	Compliance with agency standards or implementation of industry best practices.	To what extent does the alternative improve the transportation facility to meet or comply with agency design standards or implement an industry best practice? Measured by whether or not an alternative improves the transportation facility to meet or comply with agency design standards or implements an industry best practice.	2	1	2	2	2	1	1	0	0	0	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Goal 2: Expand affordable, accessible and multimodal options to improve connections for all users of the transportation system to jobs, services and activity centers			1	1	2	2	4	0	0	0	0	0	6	6	1	1	1	-1	10	0	0	0	0	0	0	0	0	0	5	0
2A1	Potential impact on bicycle and pedestrian volumes.	To what degree may the alternative increase pedestrian and bicyclist travel on appropriately-designed facilities? Measured by potential increase in pedestrian and bicyclist volume relative to baseline conditions.	0	0	1	1	1	0	0	0	0	0	1	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0
2A2	Compliance with "Complete Streets" concept within urban areas, and appropriate locations within the urban fringe.	To what extent does the alternative provide a "Complete Street" within urban areas, and appropriate locations within the urban fringe? Measured by whether or not an alternative adopts a "Complete Street" approach or incorporates "Complete Street" components within urban areas, and appropriate locations within the urban fringe?	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	2	0	0	0	0	0	0	0	0	0	1	0
2B1	Impact on system-wide connectivity and availability of more direct routes for each mode of transportation.	To what extent does the alternative improve the connectivity of the existing transportation system or provide a more direct route? Measured by the extent each alternative increases connectivity and provides facilities for each mode. Connectivity includes filling a gap in an existing route and designing new facilities that provide continuous routes between key destinations.	0	1	1	1	2	0	0	0	0	0	2	2	1	1	0	-1	2	0	0	0	0	0	0	0	0	0	1	0
2B1	Miles of designated facilities for bicyclists and pedestrians provided.	To what extent does the alternative increase the number of miles of pedestrian and bicycle facilities (on-street and off-street)? Measured by potential expansions of the pedestrian and bicycle systems.	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
2C1	Impact on transit ridership.	To what degree does the alternative promote transit ridership or make transit a more viable option for all users? Measured by whether or not an alternative is able to increase transit ridership.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2D1	Impact of transportation project on low income and minority populations.	To what extent does the alternative affect low income and minority populations? Measured as relative ability of each alternative to spread the impacts and benefits of transportation improvements equitably to all populations.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2D2	Viability of non-auto travel.	To what degree are transportation facilities (transit service, sidewalks, bicycle lanes, separated mixed-use paths, parks) for non-auto travelers integrated into the alternative? Measured relative to facilities and integration present in baseline conditions.	1	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0
Goal 3: Integration - Integrate land use, financial, and environmental planning to prioritize strategic transportation investments and preserve The Dalles' identity.			2	1	1	3	1	2	1	1	1	1	0	-1	-1	-1	-1	0	2	1	2	2	2	2	2	3	2	1	1	2
3A1	Compliance with local land use plans, comprehensive plans, and regional transportation plans.	To what extent does the alternative comply with local or regional land use, comprehensive, and transportation plans? Measured by whether or not an alternative is identified or compatible with an adopted plan.	1	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3B1	Incorporation of Transportation Demand Management (TDM) Strategies.	To what extent are TDM strategies being implemented to improve the transportation system? Measured by the use of TDM strategies incorporated into the alternative.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
3C1	Cost/benefit analysis and potential impact on forecasted expenditures.	To what degree does the alternative leverage a positive return on investment? Measured by the calculated cost/benefit analysis and alignment with current funding projections.	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	1	1	1	2	2	2	2	2	1	2	1	1	2
3D1	Impacts on air quality, environmentally sensitive areas, and water and soil quality.	To what degree does the alternative impact environmentally sensitive areas? Measured by the potential adverse impacts of the alternative to the environment.	0	0	0	0	0	0	0	0	0	0	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	-1	0
3E1	Incorporation of ITS technology.	To what extent is ITS technology being implemented for system improvements? Measured by the use of ITS devices relative to Baseline.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Goal 4: Economic Development - Build and maintain the transportation system to support economic vitality in the City.			7	5	7	5	1	1	1	2	2	2	4	3	3	3	4	3	1	0	0	0	2	2	2	2	1	1	2	0
4A1	Roadway geometry accommodates freight movement where it is warranted.	To what extent does the alternative accommodate the design vehicle for designated freight routes? Measured by whether or not an alternative is able to accommodate the design vehicle without potential adverse impacts to other modes.	1	1	2	1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	1	0	0	0	0	0
4B1	Traffic operations performance on designated freight routes.	To what extent does the alternative provide acceptable performance along designated freight routes? Measured by operational performance along freight routes.	2	2	2	2	0	0	0	1	1	1	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0
4B2	System-wide congestion and travel time.	To what extent does the alternative relieve congestion or reduce travel times on the transportation system? Measured by whether or not an alternative relieves congestion or reduces travel time.	2	1	2	1	1	0	1	1	1	1	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0
4C1	Impact on intermodal connectivity and availability of air, rail, barge and freight facilities.	To what extent does the alternative improve the intermodal connectivity of the existing transportation system or provide better access to air, rail, barge or freight facilities? Measured by the extent to which each alternative increases intermodal connectivity and provides better connections to air, rail, barge and freight facilities.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4D1	External funding opportunities leveraged and financially responsible development proposals.	To what extent does the alternative leverage other private funding sources or include transportation improvements as part of a development proposal? Measured by whether or not an alternative leverages additional funding sources or is included as part of a development proposal.	1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	0	0	0	1	1	1	2	1	1	1	0
4E1	Potential increased attraction to desired businesses and developers.	To what extent does the alternative eliminate roadblocks to development caused by the transportation system? Measured by the critical transportation improvements funded relative to Baseline.	1	1	1	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Score			22	14	18	18	14	8	5	5	5	5	15	10	5	5	14	12	19	6	7	8	10	9	9	9	6	5	15	6

Appendix 2 Roadway Cross-Sections

BREWERY GRADE CROSS SECTION



CITY OF THE DALLES

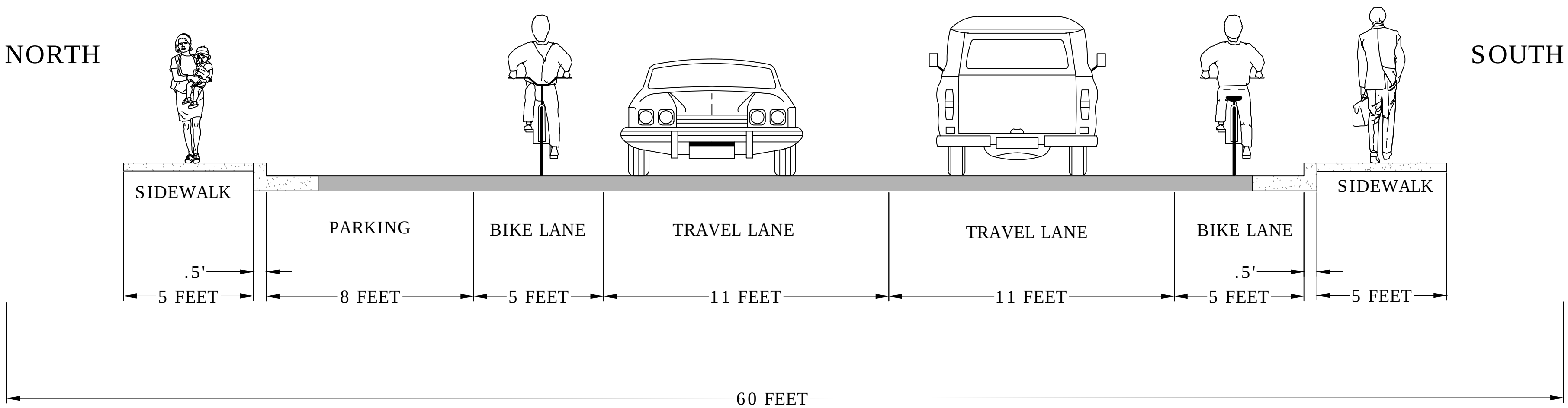
GRID STREET CROSS SECTION

DATE: 10/17/2014

STREET: BREWERY GRADE

CHENOWITH LOOP ROAD CROSS SECTION

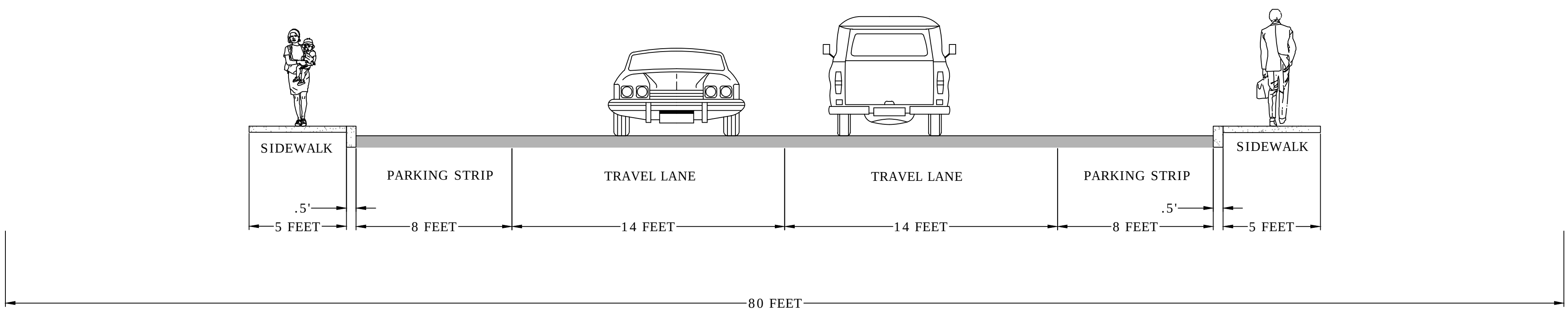
CHENOWITH LOOP ROAD RIGHT-OF-WAY = 60 FEET



CITY OF THE DALLES	
The Hub of the Pacific Northwest · CITY of THE DALLES · OREGON	GRID STREET CROSS SECTION
	DATE: 10/17/2014
STREET: CHENOWITH LOOP ROAD	

COLUMBIA VIEW DRIVE CROSS SECTION

RIGHT-OF-WAY = 80 FEET



CITY OF THE DALLES

The Hub of the Pacific Northwest CITY of THE DALLES OREGON

GRID STREET CROSS SECTION

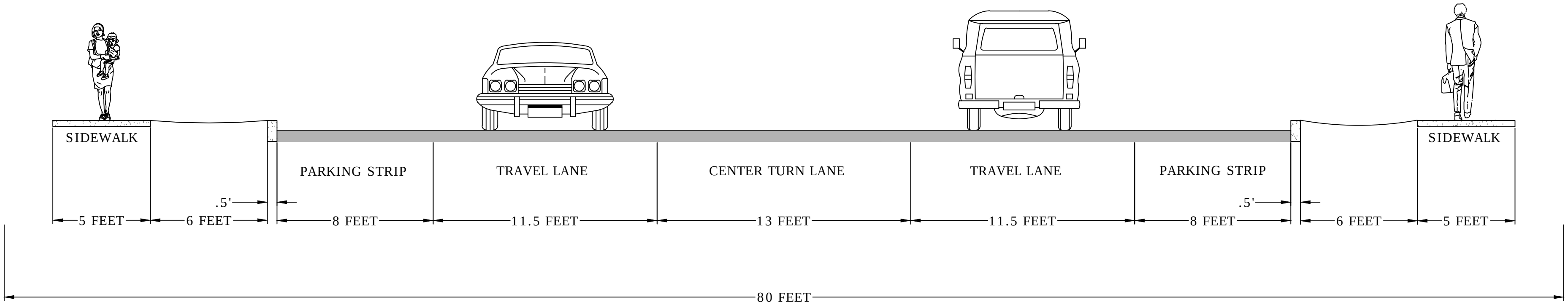
DATE: 10/17/2014

STREET: COLUMBIA VIEW DRIVE

DRY HOLLOW ROAD CROSS SECTION

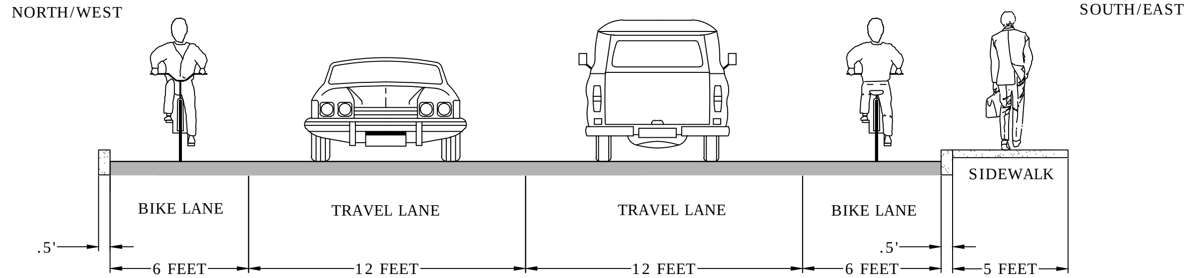
RIGHT-OF-WAY = 80 FEET

14TH TO 9TH STREET



DRY HOLLOW ROAD CROSS SECTION

19TH TO 14TH STREET



CITY OF THE DALLES

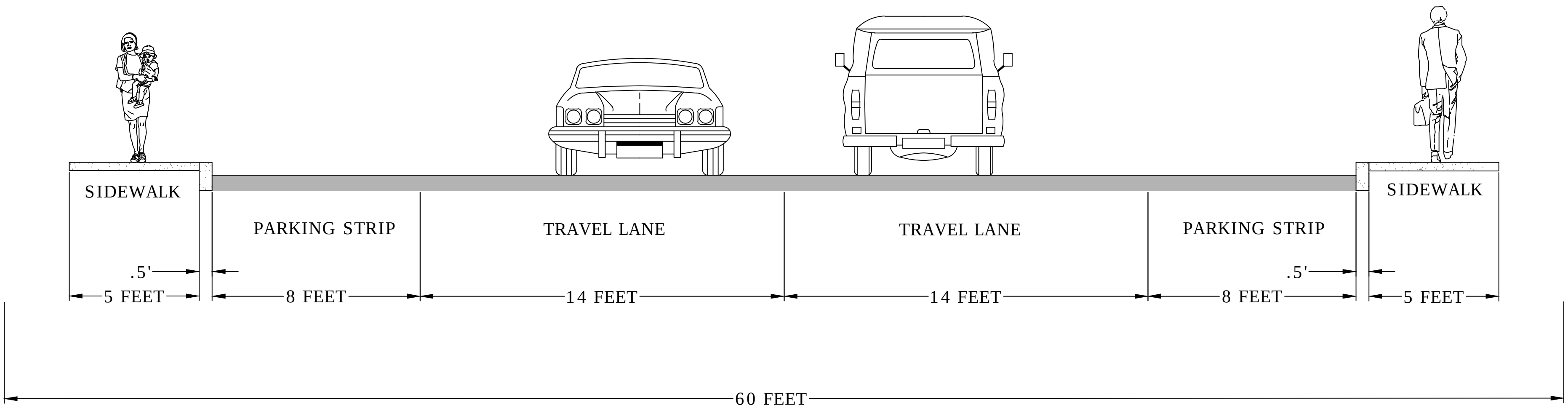
GRID STREET CROSS SECTION

DATE: 10/17/2014

STREET: DRY HOLLOW ROAD

EAST 19TH STREET CROSS SECTION

RIGHT-OF-WAY = 60 FEET
EAST OF DRY HOLLOW ROAD



CITY OF THE DALLES

GRID STREET CROSS SECTION

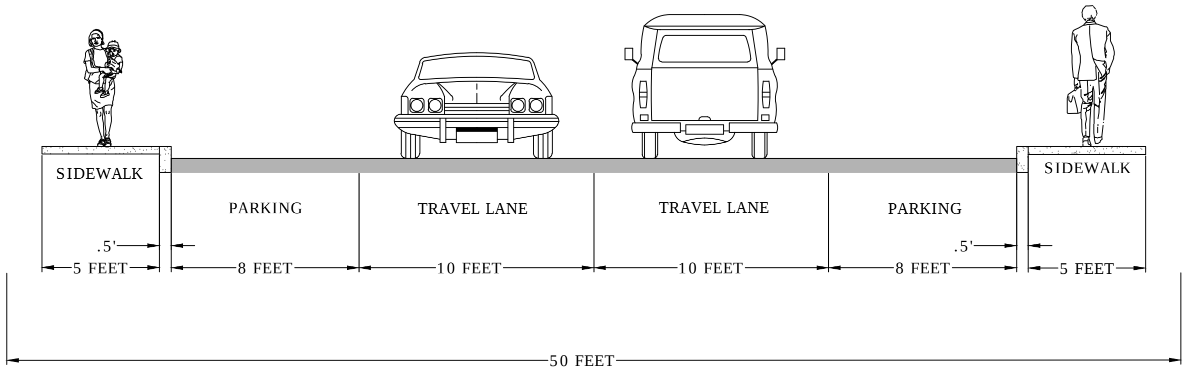
DATE: 10/17/2014

STREET: EAST 19TH STREET - EAST

EAST 19TH STREET CROSS SECTION

RIGHT-OF-WAY = 50 FEET

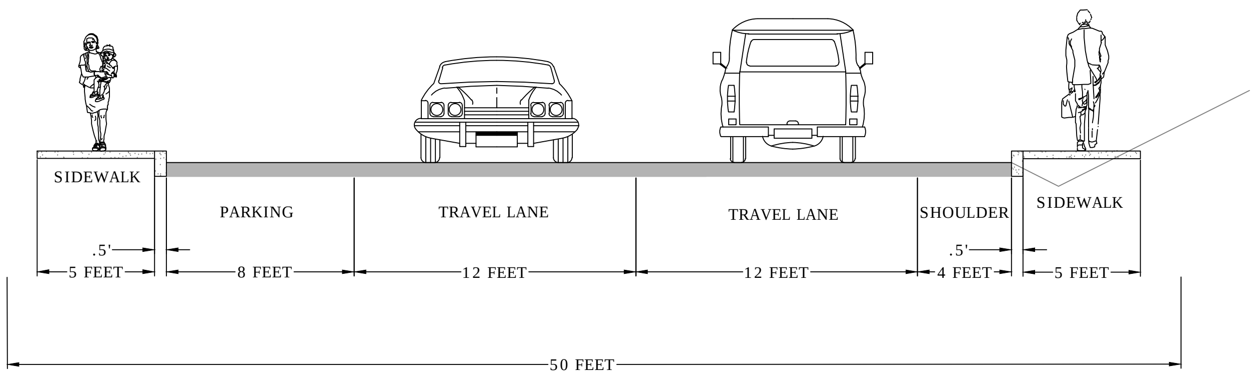
18TH TO 18TH STREET (WEST OF DRY HOLLOW ROAD)



EAST 19TH STREET CROSS SECTION

RIGHT-OF-WAY = 50 FEET

EAST 18TH TO DRY HOLLOW ROAD



CITY OF THE DALLES

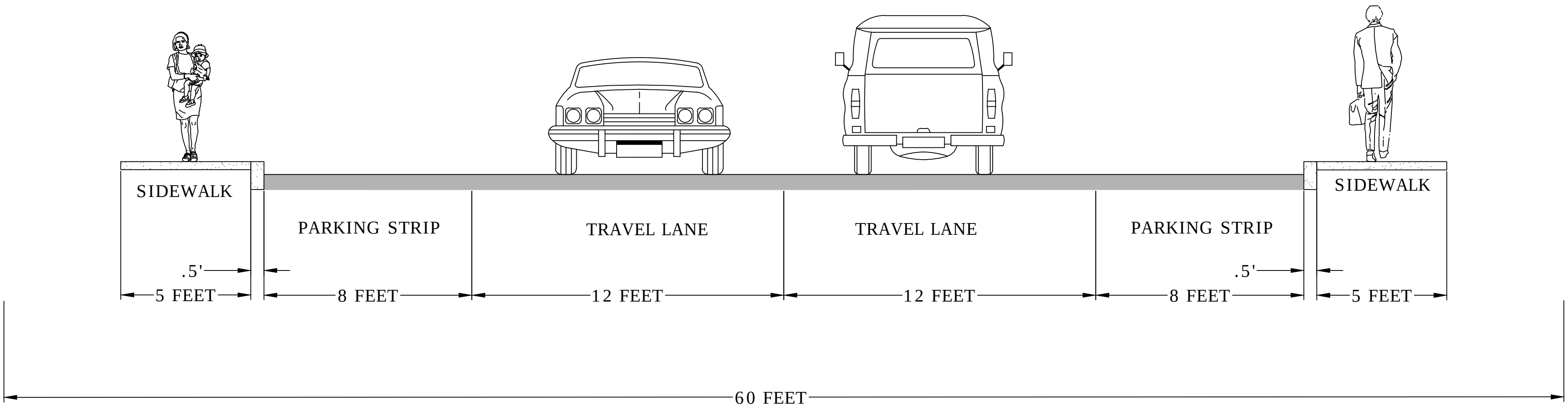
GRID STREET CROSS SECTION

DATE: 10/17/2014

STREET: SNIPES STREET

EAST 7TH PLACE CROSS SECTION

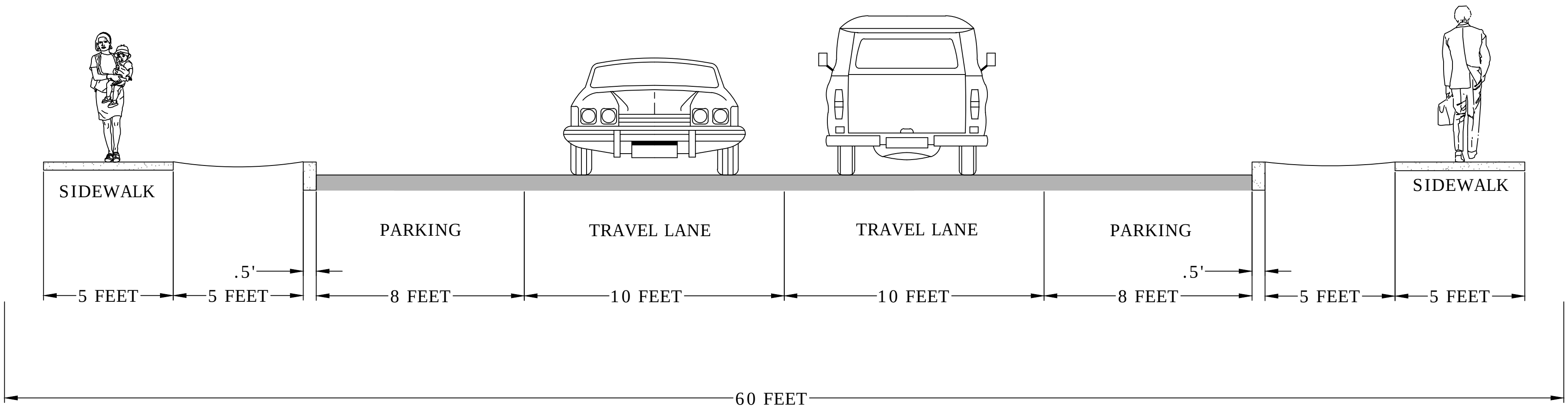
RIGHT-OF-WAY = 60 FEET



CITY OF THE DALLES	
	GRID STREET CROSS SECTION
	DATE: 10/17/2014
STREET: EAST 7TH PLACE	

EAST 12TH STREET CROSS SECTION

RIGHT-OF-WAY = 60 FEET



CITY OF THE DALLES

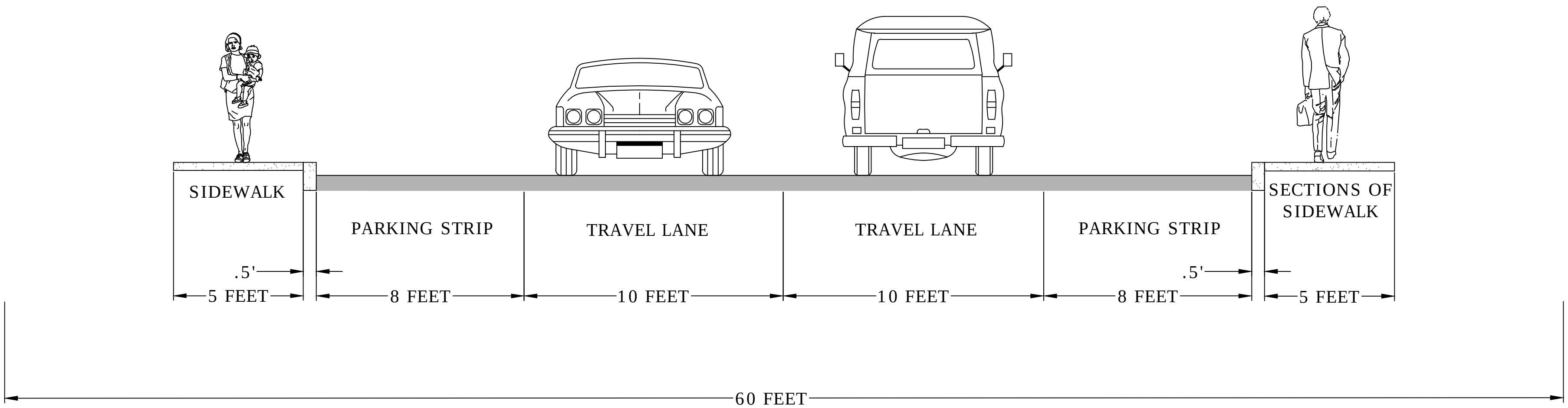
GRID STREET CROSS SECTION

DATE: 10/17/2014

STREET: EAST 12TH STREET

EAST 16TH PLACE CROSS SECTION

RIGHT-OF-WAY = 60 FEET



CITY OF THE DALLES

GRID STREET CROSS SECTION

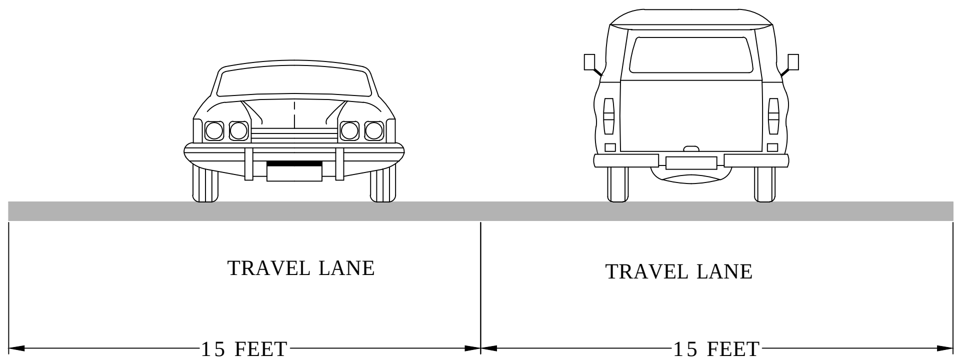
DATE: 10/17/2014

STREET: EAST 16TH PLACE

FREMONT STREET E CROSS SECTION

FREMONT STREET RIGHT-OF-WAY = VARIES

CURRENT CROSS SECTION



CITY OF THE DALLES

The Hub of the Pacific Northwest CITY of THE DALLES OREGON

GRID STREET CROSS SECTION

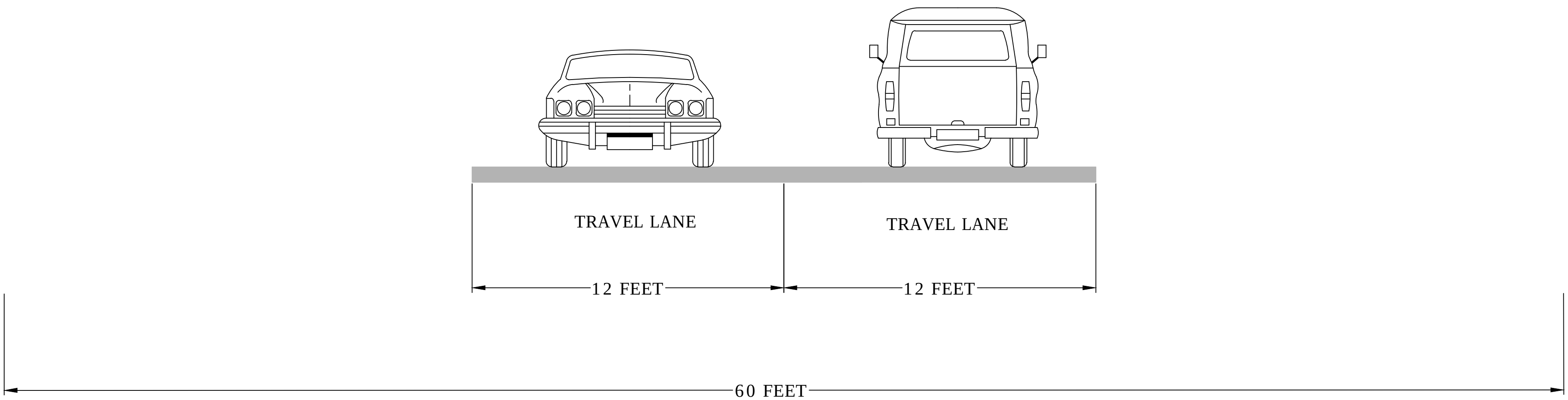
DATE: 10/17/2014

STREET: FREMONT STREET - EAST

FREMONT STREET W CROSS SECTION

FREMONT STREET RIGHT-OF-WAY = 60 FEET

CURRENT CROSS SECTION



CITY OF THE DALLES

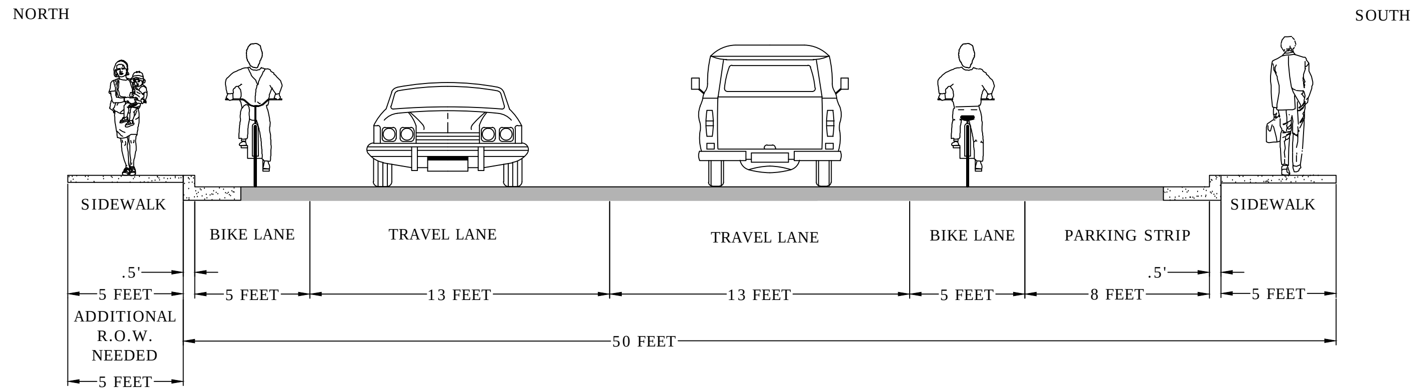
GRID STREET CROSS SECTION

DATE: 10/17/2014

STREET: FREMONT STREET - WEST

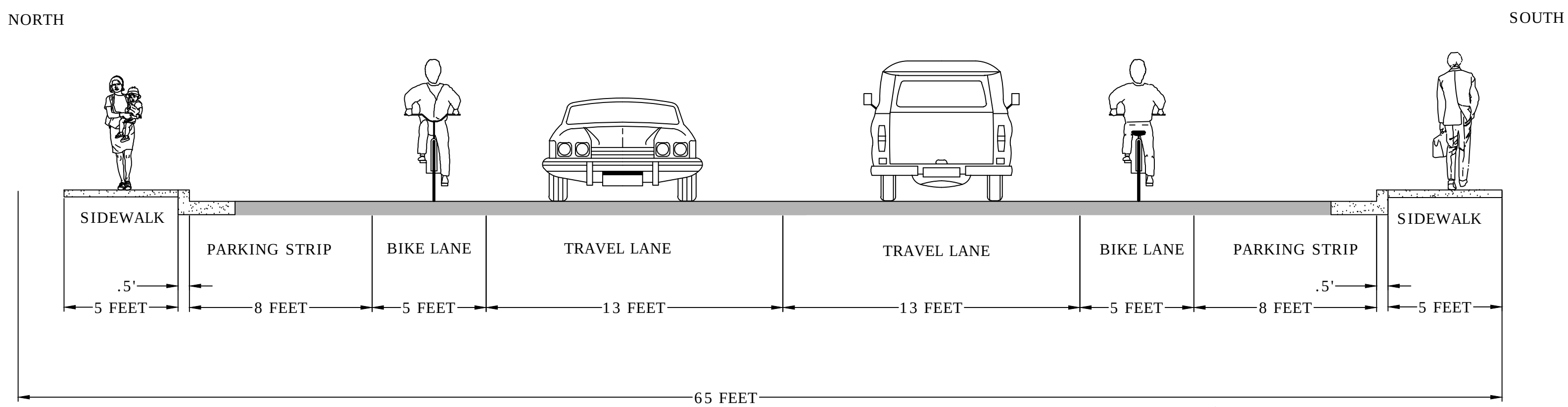
HOSTETLER STREET CROSS SECTION

PROPOSED STREET SECTION WITHIN 50 FT RIGHT OF WAY



HOSTETLER STREET CROSS SECTION

PROPOSED STREET SECTION WITH 65 FT RIGHT OF WAY



CITY OF THE DALLES

The Hub of the Pacific Northwest
CITY of THE DALLES
OREGON

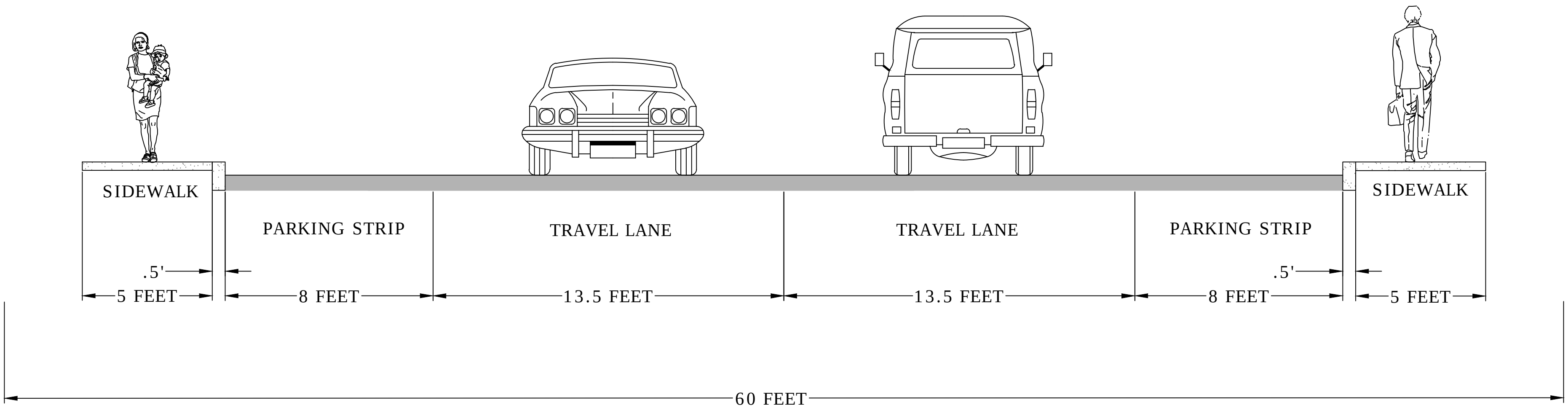
GRID STREET CROSS SECTION

DATE: 10/17/2014

STREET: HOSTETLER STREET

KELLY AVENUE CROSS SECTION

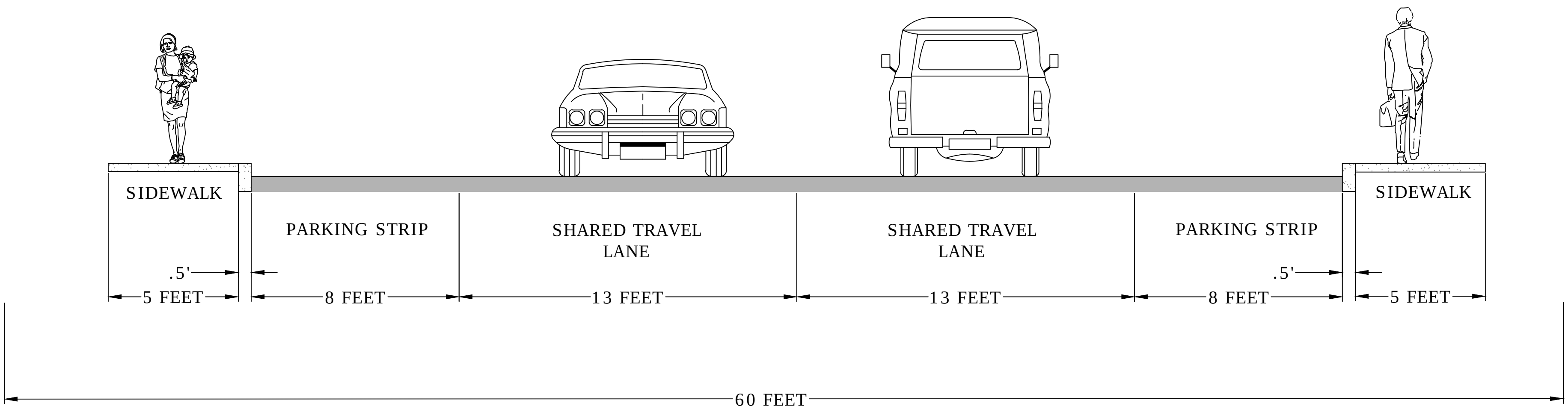
RIGHT-OF-WAY = 60 FEET



CITY OF THE DALLES	
	GRID STREET CROSS SECTION
	DATE: 10/17/2014
STREET: KELLY AVENUE	

MT. HOOD STREET CROSS SECTION

MT HOOD STREET ROAD RIGHT-OF-WAY = 60 FEET



CITY OF THE DALLES

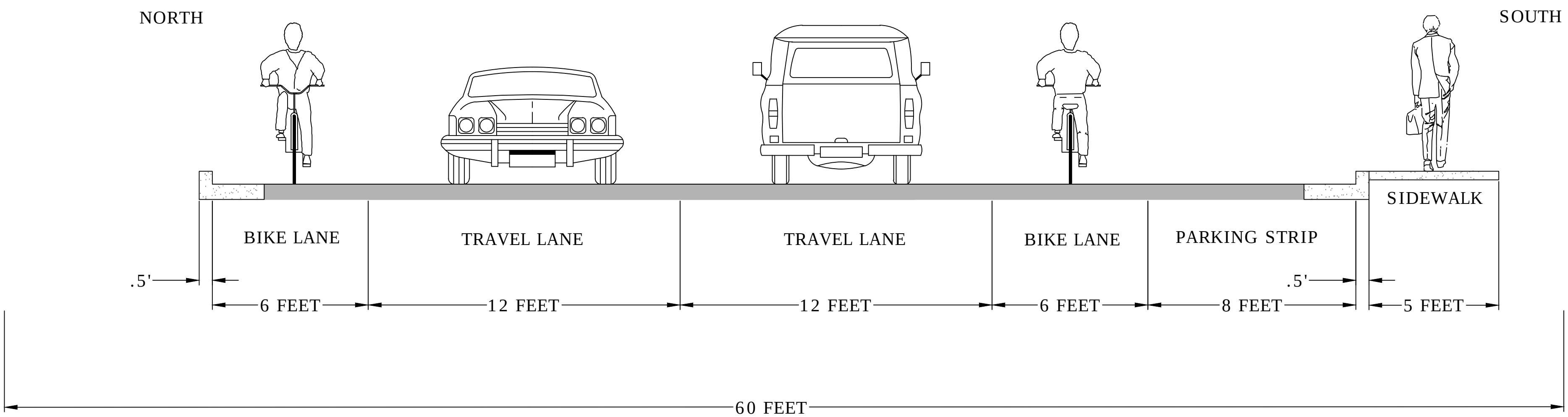
GRID STREET CROSS SECTION

DATE: 10/17/2014

STREET: MT. HOOD STREET

OLD DUFUR ROAD CROSS SECTION

RIGHT-OF-WAY = 60 FEET



CITY OF THE DALLES

GRID STREET CROSS SECTION

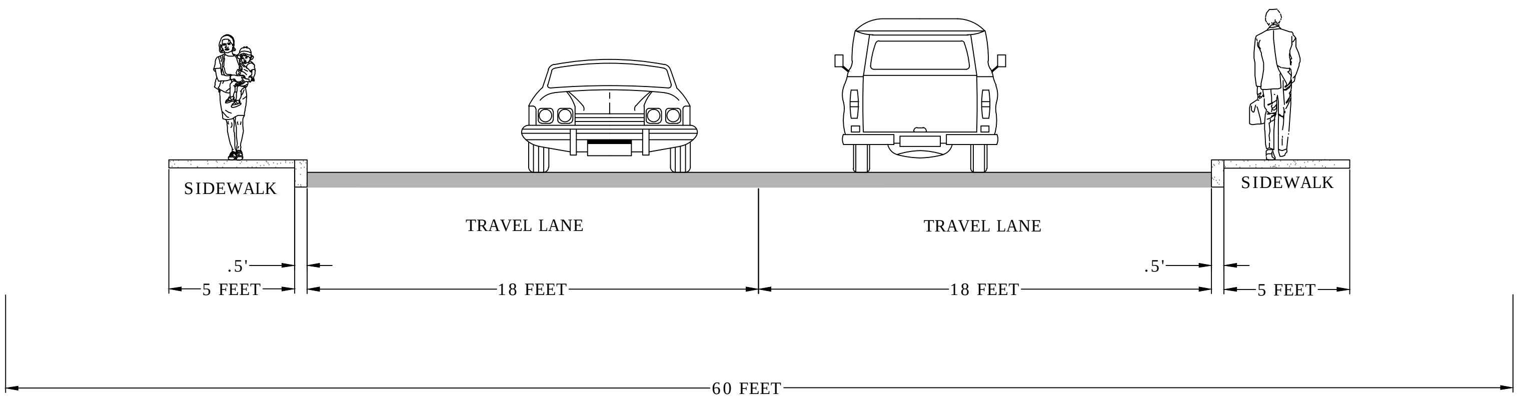
DATE: 10/17/2014

STREET: OLD DUFUR ROAD

SCENIC DRIVE CROSS SECTION

RIGHT-OF-WAY = 60 FEET

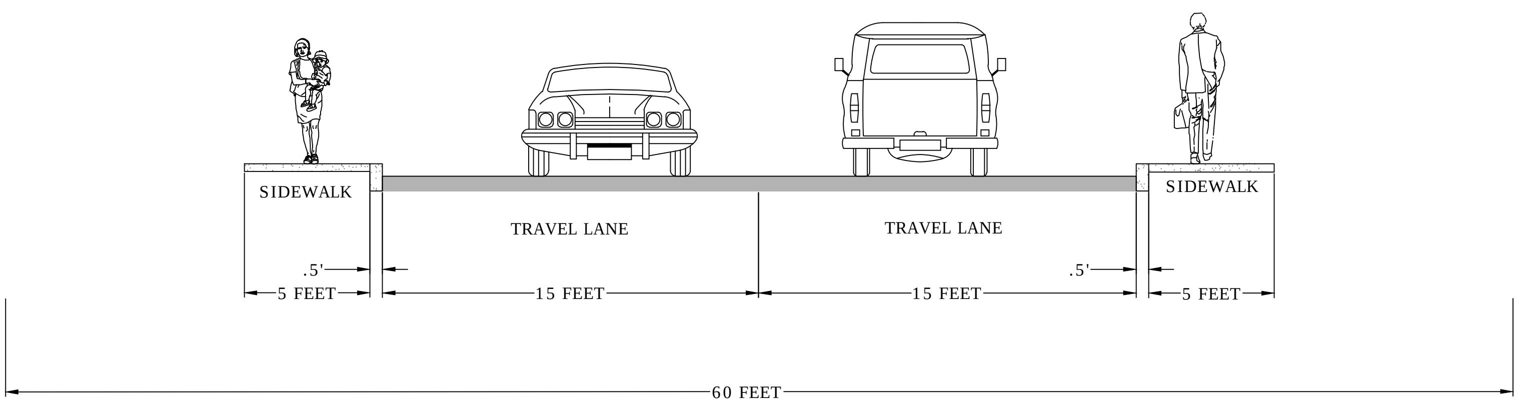
36 FT ROAD SECTION



SCENIC DRIVE CROSS SECTION

SCENIC DRIVE RIGHT-OF-WAY = 60 FEET

30 FT ROAD SECTION



CITY OF THE DALLES

The Hub of the Pacific Northwest CITY of THE DALLES OREGON

GRID STREET CROSS SECTION

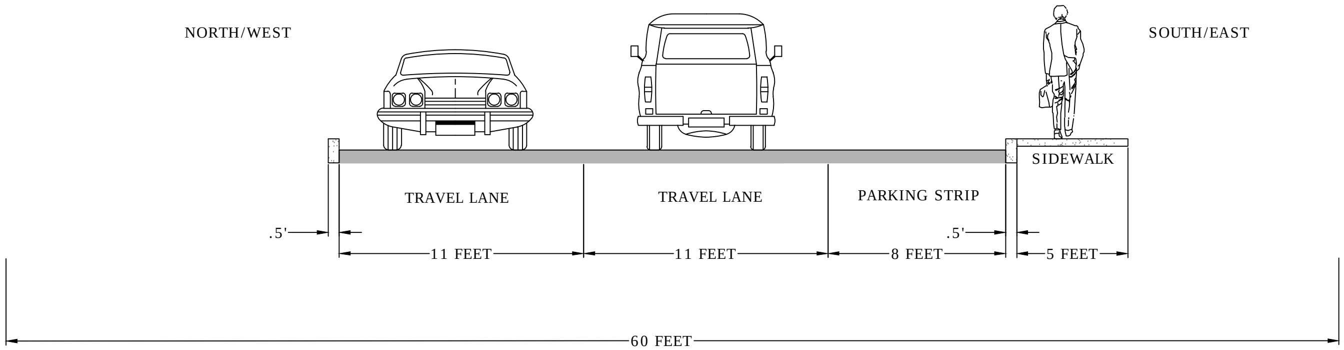
DATE: 10/17/2014

STREET: SCENIC DRIVE

SCENIC DRIVE CROSS SECTION

RIGHT-OF-WAY = 60 FEET

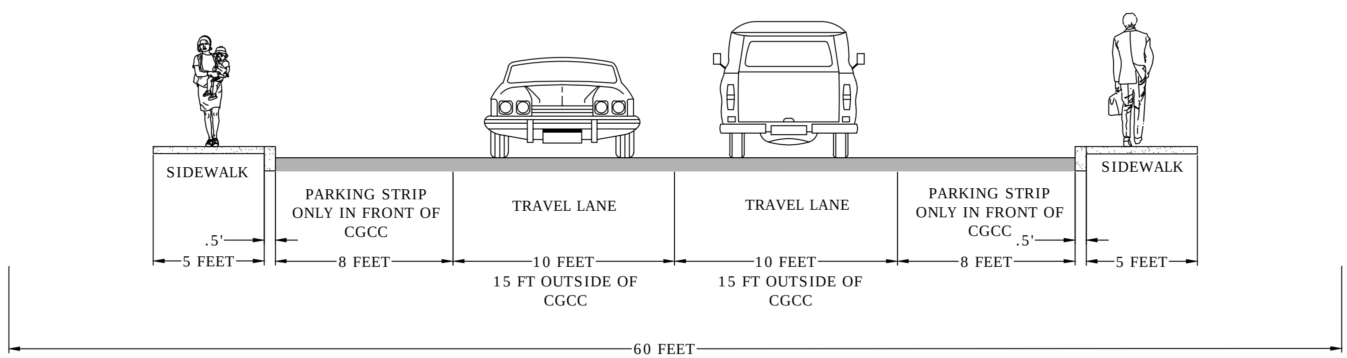
20TH STREET TO VIEW POINT



SCENIC DRIVE CROSS SECTION

RIGHT-OF-WAY = 60 FEET

VIEW POINT TO JEFFERSON STREET



CITY OF THE DALLES

GRID STREET CROSS SECTION

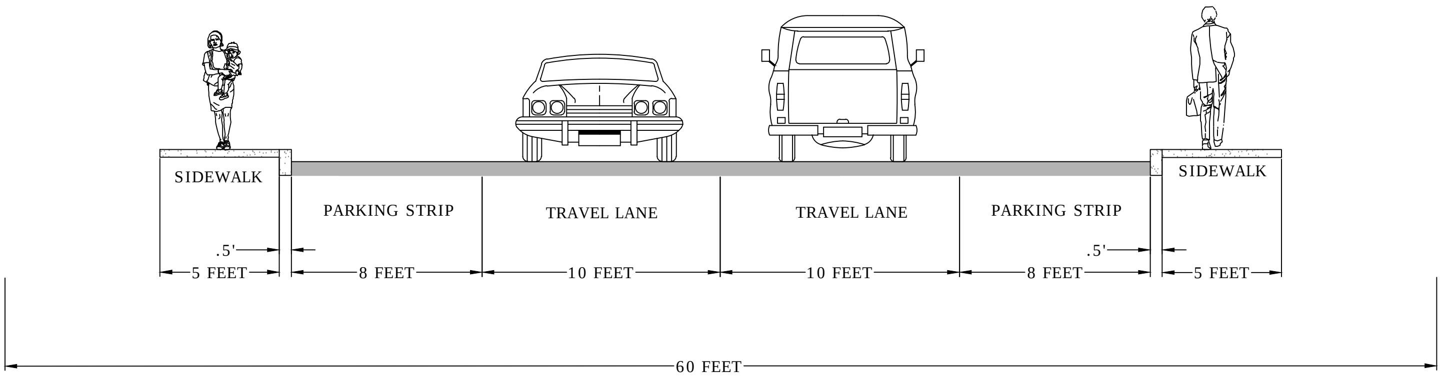
DATE: 10/17/2014

STREET: SCENIC DRIVE - EAST

SCENIC DRIVE CROSS SECTION

RIGHT-OF-WAY = 60 FEET

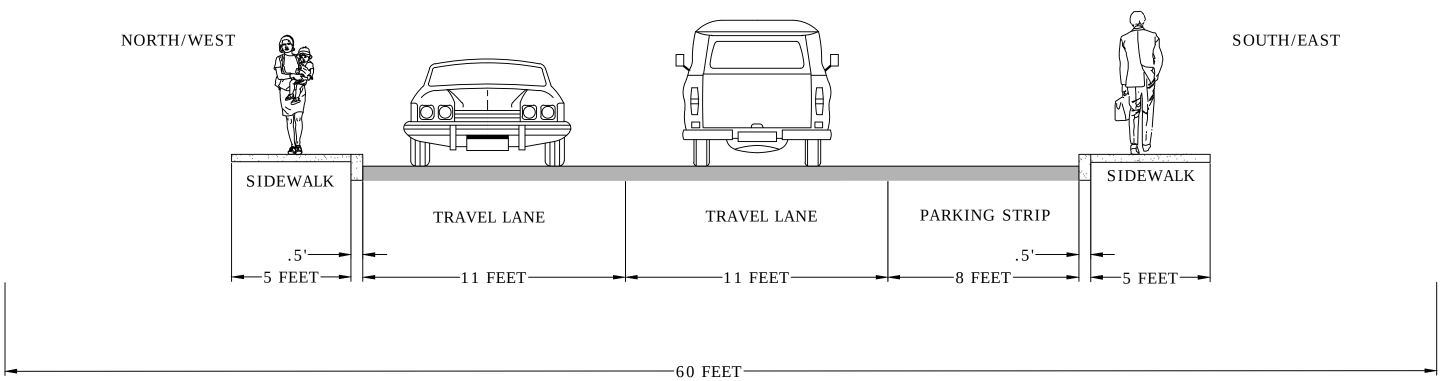
17TH STREET TO LIBERTY WAY



SCENIC DRIVE CROSS SECTION

RIGHT-OF-WAY = 60 FEET

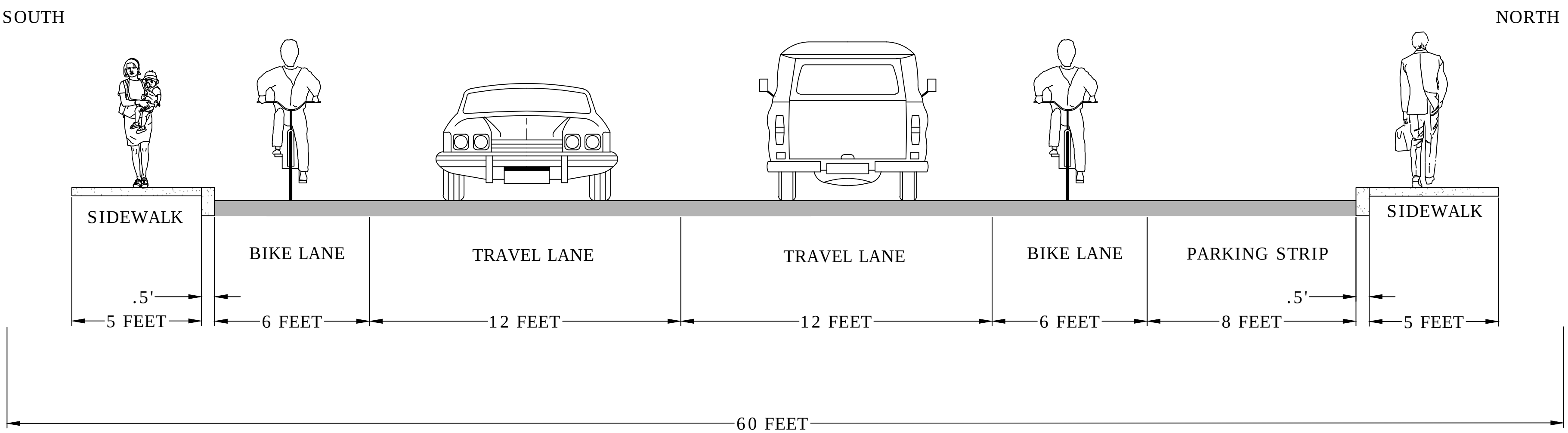
LIBERTY WAY TO 20TH STREET



CITY OF THE DALLES	
The Hub of the Pacific Northwest · CITY of THE DALLES · OREGON	GRID STREET CROSS SECTION
	DATE: 10/17/2014
STREET: SCENIC DRIVE - WEST	

SNIPES STREET CROSS SECTION

RIGHT-OF-WAY = 60 FEET



CITY OF THE DALLES

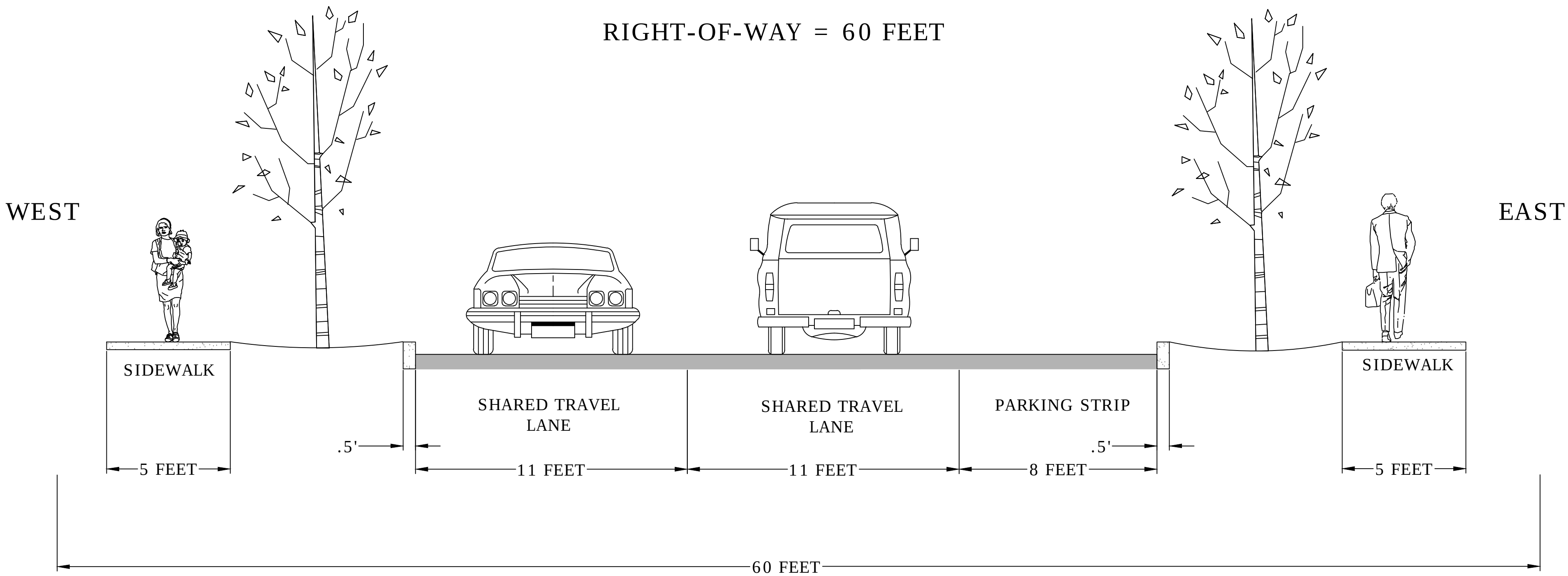
GRID STREET CROSS SECTION

DATE: 10/17/2014

STREET: SNIPES STREET

TREVITT STREET CROSS SECTION

RIGHT-OF-WAY = 60 FEET



CITY OF THE DALLES

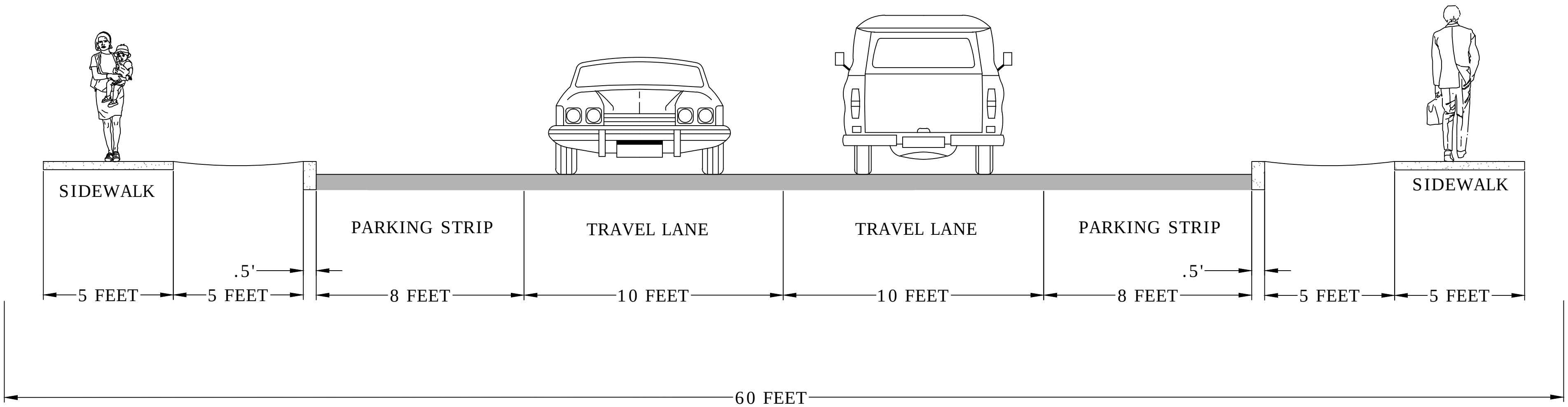
GRID STREET CROSS SECTION

DATE: 10/17/2014

STREET: TREVITT STREET

UNION STREET CROSS SECTION

RIGHT-OF-WAY = 60 FEET



CITY OF THE DALLES

GRID STREET CROSS SECTION

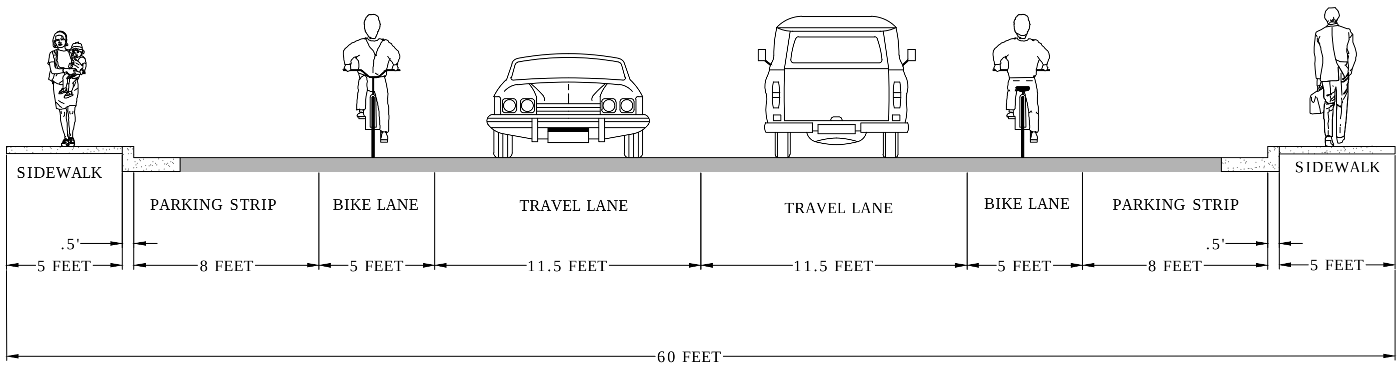
DATE: 10/17/2014

STREET: EAST 7TH PLACE

WEST 10TH STREET CROSS SECTION

WEST 10TH STREET ROAD RIGHT-OF-WAY = 60 FEET

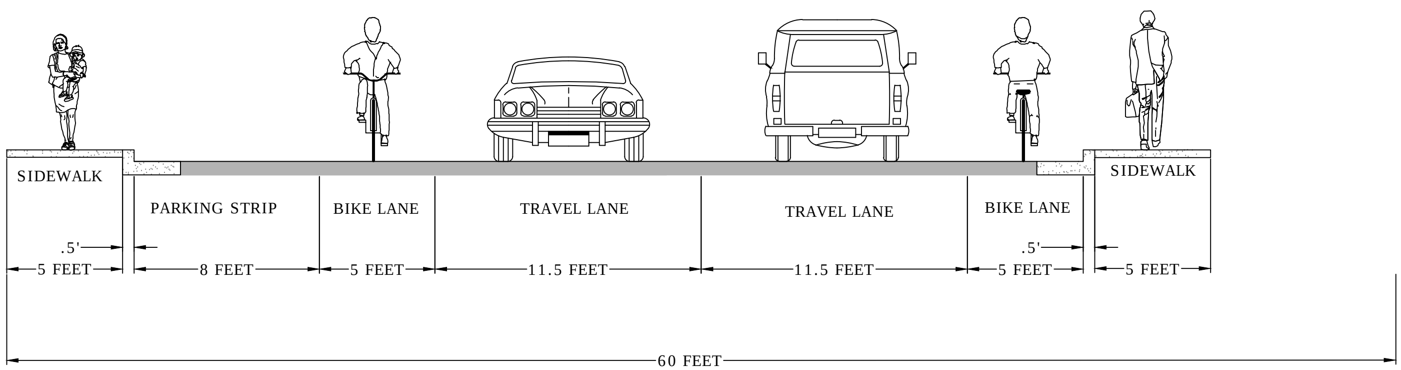
PROPOSED SECTION - PARKING BOTH SIDES



WEST 10TH STREET CROSS SECTION

WEST 10TH STREET ROAD RIGHT-OF-WAY = 60 FEET

PROPOSED SECTION - PARKING ONE SIDE



CITY OF THE DALLES

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GRID STREET CROSS SECTION

DATE: 10/17/2014

STREET: WEST 10TH STREET

APPENDIX H. LAND USE DEVELOPMENT ORDINANCE AMENDMENTS

Memorandum

Date: June 14, 2016, REVISED December 16, 2016

To: The Dalles Technical and Community Advisory Committees

From: Darci Rudzinski and Clinton "CJ" Doxsee, Angelo Planning Group

CC: Susan Wright and Ashleigh Griffin, Kittelson & Associates, Inc.

Re: The Dalles Comprehensive Plan Amendments

Overview

An update to The Dalles Transportation System Plan (TSP) is intended to be adopted in 2016 as the transportation element of the City's Comprehensive Plan, replacing the 2007 TSP. Transportation policies currently reside in the Comprehensive Plan document under Goal 12: Transportation. The Comprehensive Plan policies have been reviewed to ensure that they reflect the goals and objectives of the TSP update, as well as address transportation-related issues that have been raised over the course of the project to date. The following pages include proposed amendments to Goal 12 of the Comprehensive Plan. Modifications are shown in underline/~~strikeout~~ formatting to signify new or deleted text.

GOAL # 12: TRANSPORTATION

To provide and encourage a safe, convenient, and economical transportation system.

A transportation plan shall (1) consider all modes of transportation including mass transit, air, water, pipeline, rail, highway, bicycle and pedestrian; (2) be based upon an inventory of local, regional and state transportation needs; (3) consider the differences in social consequences that would result from utilizing differing combinations of transportation modes; (4) avoid principal reliance upon any one mode of transportation; (5) minimize adverse social, economic and environmental impacts and costs; (6) conserve energy; (7) meet the needs of the transportation-disadvantaged by improving transportation services, (8) facilitate the flow of goods and services so as to strengthen the local and regional economy; and (9) conform with local and regional comprehensive land use plans. Each plan shall include a provision for transportation as a key facility.

Background

The Dalles 1982 Comprehensive Plan included a description of highways and streets in The Dalles urban area, including street classification and standards, mass transit, water, rail and air transportation, and bicycle and pedestrian circulation including bike trail and bike lane standards. Also included ~~is~~ was a detailed inventory of existing street capacity and future traffic levels. This data and findings are incorporated into this Plan by reference.

As part of the City of The Dalles periodic review of the 1982 Comprehensive Plan, a Public Facilities Plan was prepared and subsequently adopted as a plan element of The Dalles Comprehensive Plan (Ordinance 93-1163). The Dalles 1991 Public Facilities Plan includes a transportation element, and is incorporated into this Plan by reference.

The City of The Dalles along with Klickitat County, Washington owns The Columbia Gorge Regional Airport, located north of The Dalles in Washington State. While the airport is not located within The Dalles urban growth boundary, it is an important public facility for The Dalles, Klickitat County, and the mid-Columbia Gorge region. ~~A master plan for the airport was prepared in 2004 - Columbia Gorge Regional Airport Layout Plan (Century West Engineering, 2004) - which outlines on-airport and off-airport improvements and plans.~~ The Columbia Gorge Regional Airport – Airport Master Plan, completed in 2010, includes plans for new on-airport and off-airport improvements.

In 1993, The Dalles began a multi-phased update of The Dalles Transportation Plan in the context of preparing a Transportation System Plan (TSP) for the City. This first phase was completed, providing updated traffic counts and a detailed inventory of existing street and transportation improvements. The City's 1993 Bicycle Master Plan was incorporated into this Plan by reference. The Dalles TSP was completed and adopted in 2007.~~, and is incorporated by reference into this Transportation Element.~~

In 2016, The Dalles completed a comprehensive update of the 2007 TSP to ensure the transportation system supports the economic and community goals of the City. The updated TSP, the transportation element of the Comprehensive Plan, plans for a multi-modal transportation system that will support the planned residential, commercial, and industrial growth in the City. The ~~following~~ goal~~s~~ and policies ~~are reprinted from the acknowledged transportation element of The Dalles 1982 Comprehensive Plan along with amendments based on the TSP~~ have been updated to reflect the objectives and recommendations of the 2016 TSP.

Transportation Goal

To provide a transportation system that supports the safety and mobility needs of local residents, business and industry, affords choice between transportation modes, is convenient and affordable to use, and supports planned land uses.

Goal 12 Policies

1. Mass transit and supporting transportation improvements for The Dalles Urban Area shall be encouraged.

2. Pedestrian~~,~~ and bicycle routes ~~and horse trails~~ in the Urban Area shall be encouraged.

3. Develop and maintain a transportation system that supports connections to air, rail, marine, or freight transportation, including services provided by the Columbia Gorge Regional Airport, the Port of The Dalles, and The Dalles Marine Terminal.

4. The Columbia Gorge Regional Airport is a transportation facility of regional importance which shall be properly maintained to meet the needs of the Mid-Columbia Area. ~~Adopt the Columbia Gorge Regional Airport Layout Plan.~~ The City shall regulate uses within the Airport Overlay Zone to ensure that physical hazards to air traffic at the Airport are avoided.

5. Encourage the provision of adequate barge handling facilities to meet present and future barge traffic on the Columbia River.

6. Encourage commercial and recreational use of the Commercial Dock Facility, while respecting tribal fishing rights and access to the river.

7. Develop a safe and efficient arterial and collector street system that provides additional north-south and east-west local access routes, thereby relieving traffic congestion on the street system.

8. Provide an ~~adequate~~ integrated system of arterial and collector streets throughout the city to accommodate future growth needs for all users in ~~of the~~ residential, commercial, and industrial areas of the community.

9. Street standards shall be flexible as to street trees, sidewalks, planting strips, and widths.

10. Commercial and industrial developments shall provide adequate ingress and egress, off-street parking, and adequate landscaping.

11. Develop a street system that improves vehicular access to the downtown area and maintains The Dalles as the hub by providing access for development in outlying areas.

12. Provide adequate transit services to make shopping, health and social services accessible to transportation disadvantaged residents as funds are available.

13. ~~Identify recommended truck routes and~~ Prioritize efficient freight movement on identified freight routes and, in particular, ~~required~~ street improvements to safely accommodate the north-south truck movement from the hillside orchards to the downtown processing plants, and access to the commercial and industrial areas.

14. ~~Support the development of alternatives to the automobile including mass transit, and facilities for bicycles and pedestrians.~~ Plan for and maintain a multi-modal transportation system that incorporates safety and operational improvements for bicyclists and pedestrians.

15. Preserve and maintain the existing transportation system in a good state of repair and prioritize transportation projects that provide the most benefit for the cost, consistent with existing standards and policies.

16. Develop and maintain an environmentally sensitive transportation system.

17. Improve safety and operational components of existing transportation facilities not meeting City standards or industry best practices.

18. Incorporate Transportation Demand Management (TDM) strategies to reduce the number of single occupancy vehicles, maximize the use of existing infrastructure, and reduce parking demands.

19. Incorporate new technologies to enhance the transportation system and extend the useful life of existing facilities.

20. Improve the movement of goods and delivery of services throughout the City while balancing the needs of all users with a variety of travel modes.

21. Support planning for a fixed-route, inner-city public transit system, as described in the Transit Element of the adopted Transportation System Plan.

Goal 12 Implementing Measures

- ~~Identify measures to enhance safety along streets and at street intersections in The Dalles urban area.~~ Implement access spacing standards and access management measures, consistent with the strategies in the adopted TSP, through the development process in order to maintain and/or improve traffic operations and safety along the arterial and collector roadways.
- Develop and implement a system for prioritizing pavement maintenance and rehabilitation.
- Street standards, including street trees, sidewalks, planting strips, and widths, shall be made flexible in the Land Use and Development Ordinance based upon local topographic conditions, traffic demands, and citizen input.
- ~~The~~ Improvements at the Columbia Gorge Regional Airport ~~Layout Plan~~ shall be consistent with the adopted Airport Master Plan and implemented as funds are available.
- Maintain sufficient roadway width and turning radii to ensure safe passage of the

motoring public while integrating with pedestrian and bicycle movement.

- The City shall maintain on-street parking, specifically in the downtown area, and review all landscaping and off-street parking site plans to ensure conformance with the ~~Zoning~~ Land Use Development Ordinance and the Comprehensive Plan.
- Provide pedestrian and bicycle access~~, especially when direct motor vehicle access is not possible.~~ consistent with the roadway design standards for City streets in the Transportation System Plan.
- A convenient and economic system of transportation shall be encouraged to be provided for ~~needy,~~ senior citizens and the ~~handicapped~~ disabled and other transportation disadvantaged.
- Work with Mid-Columbia Council of Governments to determine optimal transit routes within The Dalles and work collaboratively with the agency to explore and pursue funding sources to pay for a fixed-route transit system. Coordinate with Columbia Area Transit (CAT) to ensure that intercity bus service routes and schedules and the City's planned transit system are mutually supportive.
- Implement the standards and recommendations in ~~Chapter 6~~ of The Dalles Transportation System Plan.~~, including:~~
  - ~~Figure 11 - Proposed Street Classification and Traffic Signals;~~
  - ~~Figure 12 - Street Design Standards (Arterial and Major/Minor Collectors);~~
  - ~~Figure 13 - Street Design Standards (Industrial and Commercial Collector and Local Streets, and Local Residential Streets and Alleys);~~
  - ~~Table 5 - Street Design Standards;~~
  - ~~Table 6 - General Access Management Guidelines;~~
  - ~~Figure 14 - Street Improvement Projects;~~
  - ~~Figure 15 - Proposed Bikeway Plan; and~~
  - ~~Figure 16 -Truck Route Plan.~~
- ~~Evaluate the need for additional signals in the city, including at the I 84 interchanges.~~
- Improve intersection operations through the downtown by measures including, but not limited to, coordinating traffic signals.
- Identify improvements to existing policies and standards that address street connectivity and spacing.
- Prioritize transportation projects that provide the most benefit for their cost, consistent with existing standards and policies.
- Implementing ordinances shall consider the following community desires:
  - Integrating new arterial and collector routes into the existing city grid system.
  - Pedestrian and bicycle needs should be considered in all public and private development and redevelopment.
  - Intermodal access to neighborhood parks and neighborhood centers is needed.
  - Additional commercial access to the east side of town is needed, either through the creation of business opportunities or by street improvements.
  - Mixed use areas should be promoted to allow employment and shopping opportunities in residential areas, thereby reducing vehicular trips.
  - The public streets in commercial areas should be developed and redeveloped with aesthetics and people in mind, providing street furniture and shade trees wherever feasible.

Angelo planning group — LAND USE PLANNING • TRANSPORTATION PLANNING • PROJECT MANAGEMENT

Memorandum

Date: June 14, 2016, REVISED December 16, 2016

To: The Dalles Technical and Community Advisory Committees

From: Darci Rudzinski and Clinton "CJ" Doxsee, Angelo Planning Group

CC: Susan Wright and Ashleigh Griffin, Kittelson & Associates, Inc.

Re: Development Code Amendments

Land Use Development Ordinance Amendments

Elements of The Dalles' Transportation System Plan (TSP) are implemented in the requirements of the Land Use Development Ordinance (LUDO). The LUDO regulates development within City limits and implements the long-range land use vision embodied in The Dalles' Comprehensive Plan, of which the TSP is a part.

The LUDO has been audited to ensure that City requirements reflect the goals and objectives of the TSP update, as well as address transportation-related issues that have been raised over the course of the project to date. The intent of this exercise is to identify potential consistency issues between local code requirements and the TSP goals and objectives, as well as note any possible Oregon Transportation Planning Rule (TPR) compliance concerns, early in the planning process. Table 1 contains a list of recommendations resulting from this audit. Provided information includes an overview of existing requirements and how these provisions are proposed be modified in order to better implement the City's new TSP. Specific "adoption-ready" amendments to the LUDO follow the table, under numbered headings that correspond with the recommendations in the table.

Table 1: Land Use Development Code Recommendations

	Recommendation	LUDO Section	Relevant TSP Goal/Objective
1.	**Permit outright transportation improvements that are consistent with the adopted TSP.** Specific transportation facilities, services, and improvements are commonly not subject to land use regulation due to the minimal impact on land use.[1] These should be listed as permitted outright in individual zones, or made exempt through a provision added to land use regulations in LUDO Chapter 3 (Application Review Procedures) or Chapter 10 (Improvements Required with Development).	Applications Review Procedures 3.020 (Review Procedures) Or General Regulations 10.060 (Street Requirements)	Goal #3: Integration OAR 660-012-0045(1)
2.	**Require ordinance amendments to be consistent with the TSP.** Review criteria for ordinance amendments can be strengthened by directly referencing the TSP as part of required conformance with the Comprehensive Plan. In addition, the City should consider adopting language requiring proposals that "significantly affect" an existing or planned transportation facility (pursuant to the TPR, Section -0060) demonstrate consistency with the identified function, capacity, and performance standards of the facility.	Ordinance Amendments 3.110.030 (Review Criteria)	TSP Goal #3: Integration OAR 660-012-0045(2)(g) OAR 660-012-0060
3.	**Modify site plan review and conditional use permit evaluation criterial to include multi-modal transportation and safety considerations.** Both conditional use review and site plan review (which is a condition of approval for a CUP) approval require consistency with the transportation system. Requirements in both Sections can be improved to include bike and pedestrian access and circulation improvements, as well as reference to TSP access management and spacing standards.	Site Plan Review 3.030.040.B (Public Facilities Capacity) Conditional Use Permits 3.050.040.C (Impact)	TSP Goal #3: Integration Goal #4: Economic Development OAR 660-012-0045(2)(e)

[1] Operation, maintenance, and repair of existing transportation facilities identified in the TSP, such as road, bicycle, pedestrian, port, airport and rail facilities, and major regional pipelines and terminals. Dedication of right-of-way, authorization of construction and the construction of facilities and improvements, where the improvements are consistent with clear and objective dimensional standards. Changes in in the frequency of transit, rail, and airport services.

	Recommendation	LUDO Section	Relevant TSP Goal/Objective
4.	**Develop clear and objective standards for the Airport Approach Zone.** Provisions are in place in LUDO 5.120 and 6.090(B) to prevent development that would negatively impact the airport. However, clear and objective standards are not currently included, and the LUDO states that regulations should be developed.	Zone District Regulations 5.120 (Airport Approach Zones)	TSP Goal #4: Economic Development OAR 660-012-0045(2)(c)
5.	**Ensure access management requirements are consistent with the updated TSP.** Where new or modified access management and spacing standards are proposed in the updated TSP, the LUDO will need to be updated to be consistent with the standards	General Regulations 6.050 (Access Management)	Goal #2: Accessibility and Connectivity OAR 660-012-0045(2)(a)
6.	**Allow for the redevelopment of existing parking areas for transit-oriented uses.** The City currently allows existing developments to replace up to 10% of existing parking spaces with landscaping, pedestrian amenities, or bicycle parking. This provision should be expanded to allow for transit amenities, such as bus stops and pullouts, bus shelters, and park and ride stations.	Parking Standards 7.020.040(C) (Reductions for Existing Uses)	Goal #2: Accessibility and Connectivity OAR 660-012-0045(4)(e)
7.	**Review traffic study requirements and modify to be consistent with the recommendations of the updated TSP.** Thresholds for requiring a traffic impact study to be submitted as part of development proposal, as well as the requirements of the analysis, should be evaluated for consistency with TSP findings. Improvements to existing code language could include clarifying the thresholds and requirements of the "limited traffic study" vs. "full traffic study." Site Plan Review Traffic System Impact requirements (Section 3.030.020 Review Procedures) may also need to be revised for consistency, or to include a cross-reference to Section 10.060.	General Regulations 10.060.A (Traffic Studies)	Goal #1 Safety and Mobility OAR 660-012-0045(2)(b)

<table>
<tr><th></th><th>Recommendation</th><th>LUDO Section</th><th>Relevant TSP Goal/Objective</th></tr>
<tr><td>8.</td><td>Update local street standards to be consistent with the updated TSP. In updating the City's street requirements, consider the following:
Removing street standards from the LUDO and referencing the (updated) table in the TSP. Adopting the TSP standards into the LUDO by reference would eliminate the need to modify standards in both documents in the future. If design standards are to be retained in both the TSP and the LUDO, the LUDO should also include local street standards (not just arterial and collector).
Incorporating the "network streets" from the Residential Street Public Improvement Guidelines in the TSP street classifications. If these streets are addressed in the TSP, the list can be removed from the LUDO. In addition, the City should distinguish "guidelines" from development requirements, eliminating or modifying the resolution language so that the LUDO retains only relevant applicability provisions and development requirements.
The Residential Street Public Improvement Guidelines will be retained in the LUDO. The guidelines were recently adopted by City Council and city staff advised that these should be retained in Chapter 10. However, staff raised concerns that the application of these guidelines, which exempt street and sidewalk improvements for lots not abutting a network street, partition, and "serial" partitioning could result in de facto subdivisions that are underserved by city roads and sidewalks. APG has drafted alternative code language in Chapter 9, under Partition Application Review, in response to staff's concerns.</td><td>Improvements Required with Development 10.060 (Street Requirements)</td><td>Goal #1: Safety and Mobility

OAR 660-012-0045(7)</td></tr>
</table>

	Recommendation	LUDO Section	Relevant TSP Goal/Objective
9.	**Consider incorporating transit-supportive development requirements.** The Dalles' currently has fixed-route transit within City limits, with a new transit center planned on Chenoweth Loop near W 6th Street. Transit stops are permitted outright as accessory uses; however, there are no additional transit supportive provisions in the LUDO. Amendments to increase transit supportive language should be discussed and considered given the current transit improvements underway in the City and the enhanced emphasis on multi-modal transportation in the TSP update project.	Chapter 10 Improvements Required with Development (new Section)	Goal #2: Accessibility and Connectivity OAR 660-012-0045(4)(a)

Recommendation 1

10.060 Street Requirements

[…]

K. Transportation Improvements Permitted Outright. Except where otherwise specifically regulated by this ordinance, the following improvements are permitted outright:

1. Normal operation, maintenance, repair, and preservation activities of existing transportation facilities.
2. Installation of culverts, pathways, medians, fencing, guardrails, lighting, and similar types of improvements within the existing right-of-way.
3. Projects that are consistent with projects identified and planned for in the Transportation System Plan.
4. Landscaping as part of a transportation facility.
5. Emergency measure necessary for the safety and protection of property.
6. Acquisition of right-of-way for public roads, highways, and other transportation improvements designated in the Transportation System Plan.
7. Construction of a street or road as part of an approved subdivision or land partition consistent with the applicable land division ordinance.

Recommendation 2

3.110 Zone Changes

3.100.030 Review Criteria

A Zone Change shall be granted if the following criteria are met:

[…]

A. Conformance. The proposed Zone Change conforms to the Comprehensive Plan, including the Transportation System Plan, and all other provisions of this Ordinance.

[…]

C. Streets and Traffic. The site is, or will be, adequately served by streets for the type and volume of traffic generated by uses that may be permitted in the new zone and the planned function, capacity, and performance standards as adopted in the Transportation System Plan. Requirements of the State of the impacted transportation facility or facilities. Requirements of the State Transportation Planning Rule shall apply to those land use actions that significantly affect the transportation system, as defined by OAR 660-012-0060.

3.110 Ordinance Amendments

3.110.030 Review Criteria

Proposed text amendments shall be consistent with the Comprehensive Plan, and State Laws and Administrative Rules, including the State Transportation Planning Rule OAR 660-012-0060. Proposed text amendments shall be consistent with the adopted Transportation System Plan and the planned function, capacity, and performance standards of the impacted facility or facilities. Requirements of the State Transportation Planning Rule shall apply to those land use actions that significantly affect the transportation system, as defined by OAR 660-012-0060.

Recommendation 3

3.030 Site Plan Review

3.030.040 Review Criteria

The following criteria shall be used to approve, approve with conditions, or deny the site plan:

A. City Ordinance Provisions. All the provisions from the applicable City ordinances have been met or will be met by the proposed development.

B. Public Facilities Capacity. Adequate capacity of City facilities for water, sanitary sewer, storm sewer, and streets and sidewalks can and will be provided to, and where applicable, through the subject property in order to: 1) meet connectivity standards per the Transportation System Plan and other documents, and ; 2) provide for future development of surrounding property.

C. Improvements Required of Development. The Proposal complies with all of the applicable LUDO Chapter 10 standards, including, but not limited to:

1. *Section 10.040 Bicycle Requirements*

2. *Section 10.050 Pedestrian Requirements*

3. *Section 10.060 Street Requirements*

3.050 Conditional Use Permits

3.050.040 Review Criteria

A conditional use permit shall be granted if the Commission finds that the proposed use conforms with, or can be made to conform with through added conditions, any related requirements of this and other City Ordinances and all of the following criteria:

[…]

B. Standards. The proposed use conforms to all applicable standards of the zone district where the use is proposed to be located. The proposed use will also be consistent with the purposes of this ordinance, and any other statutes, ordinances, or policies that may be applicable.

C. Impact. The proposed structure(s) and use(s) shall be designed and operated in such a way as to meet the standards of this section. Impacts caused by the construction of the conditional use shall not be considered regarding a decision on the validation of the application.

[…]

6. The transportation system is capable, or can be made capable, of supporting the additional transportation impacts generated by the use. Evaluation factors shall include, but are not limited:

    a. Street designations and capacities; ~~and~~

    b. On-street parking impacts~~.~~;

    c. Bicycle safety and connectivity;

    d. Pedestrian safety and connectivity; and

    e. Transit capacity and efficiency.

Recommendation 4

5.120 Airport Approach Overlay Zone

5.120.010 Purpose

The City of The Dalles is a part owner of the Columbia Gorge Regional Airport, located in Klickitat County, Washington. The airport is a valuable asset to the City and the citizens and businesses of Wasco and Klickitat Counties. The topography of the region restricts approaches to the airport and the City desires to protect those approaches as much as possible. When the approaches use airspace over the areas within the zoning jurisdiction of the City of The Dalles, the City will protect that airspace. No development or operational characteristic will be allowed that would hinder the use of the airspace. ~~The city will develop regulations that will delineate the approaches and what will be allowed to develop under those approaches. Until those retailed regulations are in effect, the City has adopted a general regulation set out in~~

Section 5.120 is adopted to implement Oregon Revised Statutes (ORS) 836.600 through 836.630 and policies of the Comprehensive Plan as they relate to private use airports. When applied, it provides for the continued operation and vitality of the Columbia Gorge Regional Airport consistent with state law. It also provides for safety standards to reduce the potential for safety hazards for property and for persons living, working or recreating on lands near the airport. The Airport Approach Overlay Zone shall be applied to the underlying zone.

5.120.020 ~~Protection of Approach Zones~~ Definitions

~~No development or operation shall in any way negatively affect the approach zones to the airport or the safe use of the approach zones by aircraft landing or taking off from the airport.~~

Airport. The strip of land used for taking off and landing aircraft, together with all adjacent land used in connection with the aircraft landing or taking off from the strip of land, including but not limited to land used for existing airport uses.

Airport Direct Impact Area. The area located within 5,000 feet of an airport runway, excluding lands within the runway protection zone and approach surface.

Airport Elevation. The highest point of an airport's usable runway, measured in feet above mean sea level.

Airport Imaginary Surfaces. Imaginary areas in space and on the ground that are established in relation to the airport and its runways. Imaginary areas are defined by the primary surface, runway protection zone, approach surface, horizontal surface, conical surface and transitional surface.

Airport Secondary Impact Area. The area located between 5,000 and 10,000 feet from an airport runway.

Airport Sponsor. The owner, manager, or other person or entity designated to represent the interests of an airport.

Approach Surface. A surface longitudinally centered on the extended runway centerline and extending outward and upward from each end of the primary surface.

A. The inner edge of the approach surface is the same width as the primary surface and it expands uniformly to a width of:

   1. 2,000 feet for a utility runway having a non-precision instrument approach;

   2. 3,500 feet for a non-precision instrument runway, other than utility, having visibility minimums greater than three-fourths statute mile;

   3. 4,000 feet for a non-precision instrument runway, other than utility, having visibility minimums at or below three-fourths statute mile; and

   4. 16,000 feet for precision instrument runways.

B. The approach surface extends for a horizontal distance of:

1. 5,000 feet at a slope of 20 feet outward for each foot upward for all utility runways;
2. 10,000 feet at a slope of 34 feet outward for each foot upward for all non-precision instrument runways, other than utility; and
3. 10,000 feet at a slope of 50 feet outward for each one foot upward, with an additional 40,000 feet at slope of 40 feet outward for each one foot upward, for precision instrument runways.

C. The outer width of an approach surface will be that width prescribed in this subsection for the most precise approach existing or planned for that runway end.

Department of Aviation. The Oregon Department of Aviation, the State agency chiefly responsible for matters relating to the continuing development of aviation as part of the state's transportation system, and the safety of its airways.

FAA. The Federal Aviation Administration.

Height. The highest point of a structure or tree, plant or other object of natural growth, measured from mean sea level.

Horizontal Surface. A horizontal plane 150 feet above the established airport elevation, the perimeter of which is constructed by swinging arcs of specified radii from the center of each end of the primary surface of each runway of each airport and connecting the adjacent arcs by lines tangent to those arcs. The radius of each arc is:

A. 5,000 feet for all runways designated as utility.

B. 10,000 feet for all other runways.

C. The radius of the arc specified for each end of a runway will have the same arithmetical value. That value will be the highest determined for either end of the runway. When a 5,000 foot arc is encompassed by tangents connecting two adjacent 10,000 foot arcs, the 5,000 foot arc shall be disregarded on the construction of the perimeter of the horizontal surface.

Non-precision Instrument Runway. A runway having an existing instrument approach procedure utilizing air navigation facilities with only horizontal guidance, or area type navigation equipment, for which a straight-in non- precision instrument approach has been approved, or planned, and for which no precision approach facilities are planned or indicated on an FAA- approved airport layout plan or other FAA planning document.

Obstruction. Any structure or tree, plant or other object of natural growth that penetrates an imaginary surface.

Other than Utility Runway. A runway that is constructed for and intended to be used by turbine driven aircraft or by propeller-driven aircraft exceeding 12,500 pounds gross weight.

Precision Instrument Runway. A runway having an existing instrument approach procedure utilizing air navigation facilities that provide both horizontal and vertical guidance, such as an Instrument Landing

System (ILS) or Precision Approach Radar (PAR). It also means a runway for which a precision approach system is planned and is so indicated by an FAA-approved airport layout plan or other FAA planning document.

Public Assembly Facility. A permanent or temporary structure or facility, place or activity where concentrations of people gather in reasonably close quarters for purposes such as deliberation, education, worship, shopping, employment, entertainment, recreation, sporting events, or similar activities. Public assembly facilities include, but are not limited to, schools, churches, conference or convention facilities, employment and shopping centers, arenas, athletic fields, stadiums, clubhouses, museums, and similar facilities and places, but do not include parks, golf courses or similar facilities unless used in a manner where people are concentrated in reasonably close quarters. Public assembly facilities also do not include air shows, structures or uses approved by the FAA in an adopted airport master plan, or places where people congregate for short periods of time such as parking lots or bus stops.

Runway. A defined area on an airport prepared for landing and takeoff of aircraft along its length.

Significant. As it relates to bird strike hazards, "significant" means a level of increased flight activity by birds across an approach surface or runway that is more than incidental or occasional, considering the existing ambient level of flight activity by birds in the vicinity.

Structure. Any constructed or erected object which requires location on the ground or is attached to something located on the ground. Structures include but are not limited to buildings, decks, fences, signs, towers, cranes, flagpoles, antennas, smokestacks, earth formations and overhead transmission lines. Structures do not include paved areas.

Transitional Surface. Those surfaces that extend upward and outward at 90 degree angles to the runway centerline and the runway centerline extended at a slope of seven (7) feet horizontally for each foot vertically from the sides of the primary and approach surfaces to the point of intersection with the horizontal and conical surfaces. Transitional surfaces for those portions of the precision approach surfaces which project through and beyond the limits of the conical surface, extend a distance of 5,000 feet measured horizontally from the edge of the approach surface and at a 90 degree angle to the extended runway centerline.

Utility Runway. A runway that is constructed for and intended to be used by propeller driven aircraft of 12,500 pounds maximum gross weight or less.

Visual Runway. A runway intended solely for the operation of aircraft using visual approach procedures, where no straight-in instrument approach procedures or instrument designations have been approved or planned, or are indicated on an FAA-approved airport layout plan or any other FAA planning document.

Water Impoundment. Includes wastewater treatment settling ponds, surface mining ponds, detention and retention ponds, artificial lakes and ponds, and similar water features. A new water impoundment includes an expansion of an existing water impoundment except where such expansion was previously authorized by land use action approved prior to the effective date of this ordinance.

5.120.030 Notice of Land Use and Permit Applications within Overlay Zone Area.

Except as otherwise provided herein, written notice of applications for land use or limited land use decisions, including comprehensive plan or zoning amendments, in an area within this overlay zone, shall be provided to the airport sponsor and the Department of Aviation in the same manner as notice is provided to property owners entitled by law to written notice of land use or limited land use applications in accordance with Section 3.020.

A. Notice shall be provided to the airport sponsor and the Department of Aviation when the property, or a portion thereof, that is subject to the land use or limited land use application is located within 10,000 feet of the sides or ends of a runway:

B. Notice of land use and limited land use applications shall be provided within the following timelines.

   1. Notice of land use or limited land use applications involving public hearings shall be provided prior to the public hearing at the same time that written notice of such applications is provided to property owners entitled to such notice.

   2. Notice of land use or limited land use applications not involving public hearings shall be provided at least 20 days prior to entry of the initial decision on the land use or limited land use application.

C. Notice of the decision on a land use or limited land use application shall be provided to the airport sponsor and the Department of Aviation within the same timelines that such notice is provided to parties to a land use or limited land use proceeding.

D. Notices required under Paragraphs A-C of this section need not be provided to the airport sponsor or the Department of Aviation where the land use or limited land use application meets all of the following criteria:

   1. Would only allow structures of less than 35 feet in height;

   2. Involves property located entirely outside the approach surface;

   3. Does not involve industrial, mining or similar uses that emit smoke, dust or steam; sanitary landfills or water impoundments; or radio, radiotelephone, television or similar transmission facilities or electrical transmission lines; and

   4. Does not involve wetland mitigation, enhancement, restoration or creation.

5.120.040 Height Limitations on Allowed Uses in Underlying Zones.

All uses permitted by the underlying zone shall comply with the height limitations in this Section. When height limitations of the underlying zone are more restrictive than those of this overlay zone, the underlying zone height limitations shall control.

A. Except as provided in subsections B and C of this Section, no structure or tree, plant or other object of natural growth shall penetrate an airport imaginary surface.

B. For areas within airport imaginary surfaces but outside the approach and transition surfaces, where the terrain is at higher elevations than the airport runway surfaces such that existing structures and permitted development penetrate or would penetrate the airport imaginary surfaces, a local government may authorize structures up to 35 feet in height.

C. Other height exceptions or variances may be permitted when supported in writing by the airport sponsor, the Department of Aviation and the FAA. Applications for height variances shall follow the procedures for other variances and shall be subject to such conditions and terms as recommended by the Department of Aviation and the FAA.

5.120.050 Procedures.

An applicant seeking a land use or limited land use approval in an area within this overlay zone shall provide the following information in addition to any other information required in the permit application:

A. A map or drawing showing the location of the property in relation to the airport imaginary surfaces. The Planning Department shall provide the applicant with Departure Surface Profile maps in the Columbia Gorge Regional Airport Master Plan upon which to locate the property.

B. Elevation profiles and a site plan, both drawn to scale, including the location and height of all existing and proposed structures, measured in feet above mean sea level.

C. If a height variance is requested, letters of support from the airport sponsor, the Department of Aviation and the FAA.

5.120.060 Land Use Compatibility Requirements.

Applications for land use or building permits for properties within the boundaries of this overlay zone shall comply with the requirements of this chapter as provided herein.

A. Outdoor Lighting. No new or expanded industrial, commercial or recreational use shall project lighting directly onto an existing runway or taxiway or into existing airport approach surfaces except where necessary for safe and convenient air travel. Lighting for these uses shall incorporate shielding in their designs to reflect light away from airport approach surfaces. No use shall imitate airport lighting or impede the ability of pilots to distinguish between airport lighting and other lighting.

B. Glare. No glare producing material, including but not limited to unpainted metal or reflective glass, shall be used on the exterior of structures located within an approach surface or on nearby lands where glare could impede a pilot's vision.

C. Industrial Emissions. No new industrial, mining or similar use, or expansion of an existing industrial, mining or similar use, shall, as part of its regular operations, cause emissions of smoke, dust or steam that could obscure visibility within airport approach surfaces, except upon demonstration, supported by substantial evidence, that mitigation measures imposed as approval conditions will reduce the potential for safety risk or incompatibility with airport operations to an insignificant level. The review authority shall impose such conditions as necessary to ensure that the use does not obscure visibility.

D. Communications Facilities and Electrical Interference. Proposals for the location of new or expanded radio, radiotelephone, and television transmission facilities and electrical transmission lines within this overlay zone shall be coordinated with the Department of Aviation and the FAA prior to approval.

E. Landfills. No new sanitary landfills shall be permitted within 10,000 feet of any airport runway. Expansions of existing landfill facilities within these distances shall be permitted only upon demonstration that the landfills are designed and will operate so as not to increase the likelihood of bird/aircraft collisions. Timely notice of any proposed expansion shall be provided to the airport sponsor, the Department of Aviation and the FAA, and any approval shall be accompanied by such conditions as are necessary to ensure that an increase in bird/aircraft collisions is not likely to result.

5.120.070 Water Impoundments within Approach Surfaces and Airport Direct and Secondary Impact Boundaries.

Any use or activity that would result in the establishment or expansion of a water impoundment shall comply with the requirements of ORS 836.623.

5.120.080 Nonconforming Uses

Section 5.120 shall not be construed to require the removal, lowering, or alteration of any existing structure or vegetation not conforming to Section 5.120. Section 5.120 shall not require any change in the construction, or alteration of the intended use of any structure, the construction or alteration of which was begun or completed prior to the effective date of this safety overlay zone.

Recommendation 5

6.050 Access Management

6.050.030 General Requirements

[…]

I. In addition to the spacing standards in 6.050.040, access shall be taken from lower classification streets whenever possible.

6.050.040 Access Standards

~~(NOTE~~: Access to lots of record existing at time of adoption of this Ordinance shall not be denied. Table 1 identifies the City's access spacing standards as they relate to new development and redevelopment. Separation requirements between street intersections are listed in *Section 9.020.020(B)(2): Size*. ~~The following regulations are for non-residential zones.~~

A. Separation Standards. Separation between access points shall conform to the access ~~is based on the City's preferred~~ spacing standards as specified below in Table 1; however, access separation may be reduced to accommodate characteristics specific to a proposed site and/or use. In cases where separation is reduced below the preferred spacing standard, the reduction shall not be less than the appropriate stopping sight distance standard listed below in Table 2 for arterial and collector streets, unless the approving authority finds that all of the provisions of Section 6.050.050 below have been met. In no case shall the residential spacing standards for local residential streets listed in Table 3 be reduced.

[…]

Table 1: ~~Preferred Spacing Standards, All Streets~~ Access Spacing Standards for City Roadways

[Table 1 to be replaced with TSP Table 6-3.]

Table 2: Stopping Sight Distance, Arterials and Collectors

[…]

Table 3: Residential Minimum Spacing Standards

[…]

6.050.050 Exceptions to Standards

A. The City may allow a reduction in the required minimum separation distance between access points on arterial and collector streets where such separation is impractical due to existing street frontage, topography, natural resources or physical barriers, provided a minimum separation based on safety is maintained and all of the following requirements are met:

~~A.~~ 1. Public Safety. A licensed professional engineer specializing in traffic submits proof that a reasonable standard of public safety applies.

~~B.~~ 2. Elimination of Replaced Access Points. The property owner enters into an agreement with the City to close and eliminate pre-existing connections on site which are being replaced by the new access point.

~~C.~~ 3. Legal Lot(s) of Record. The lot(s) is a legal lot(s) of record.

B. The City may require one or more of the following as a condition of approval of an exception to the minimum access spacing standards:

1. The non-conforming access be closed at such time that reasonable access becomes available to a local public street.
2. The proposal includes agreement(s) with adjacent land owners to provide either joint access points, front and rear cross-over easements, or a rear access upon future redevelopment.

Recommendation 6

7.020 General Provisions

7.020.040 Allowed Motor Vehicle Parking Reductions, Waivers, and Exemptions.

[…]

C. Reductions for Existing Uses. Property owners of existing nonresidential development may take advantage of incentives to reduce vehicle parking below the minimum off-street vehicular parking standards established in Section 7.060: Minimum and Maximum Off- Street Parking Requirements as provided below:

[…]

3. Even when no expansion or redevelopment of the site is proposed, the property owner may replace up to 10% of existing parking spaces with the following:

    a) Additional landscaping equal to the square footage of the parking space reduction.

    b) On-site, publicly accessible pedestrian plazas, seating areas, shelters and/or walkways (in addition to required walkways).

    c) Bicycle parking in addition to the number of bicycle parking spaces required in Section 7.060: Minimum and Maximum Off-Street Parking Requirements. New bicycle parking shall conform to the design standards contained in Section 7.040: Bicycle Parking Design Standards.

    d) Bus shelters and other pedestrian and transit amenities located adjacent to streets with existing or planned transit routes.

Recommendation 7

Section 3.030 Site Plan Review

3.030.020 Review Procedures

H. Traffic System Impacts. For developments that are likely to generate more than 400 average daily motor vehicle trips (ADTs), the applicant shall provide a traffic impact study ~~or traffic counts~~ pursuant to the requirements of Section 10.060 to demonstrate the level of impact of the proposed development on the surrounding street system. The determination of impact or effect, and the scope of the impact study, shall be coordinated with the provider of the affected transportation facility. The developer shall be required to mitigate impacts attributable to the project.

10.060 Street Requirements

A. Traffic Impact Studies.

1. Traffic Impact Studies (TIS) ~~studies~~ shall be required of all development proposals that meet one or more of the following:

    a. Development of 16 or more dwelling units,~~;~~

b. and any Any other development proposal that is likely to generate more than 400 average daily motor trips. In addition, a traffic study may be required if the

c. Any development proposal that is near within [500] feet of an intersection that is already at or below level of service "D".

2. Limited Traffic Impact Studies (LTIS).

a. Notwithstanding 10.060.A.1 above the previous language, the City may require an initial, limited traffic study for development proposals to determine the level of service at nearby intersections within [500] feet of the proposed development.

b. If the limited traffic study finds the level of service to be at or below "D", the City may require a TIS full traffic study.

3. The TIS traffic study shall be conducted in accordance with the following:

1a. A proposal establishing the scope of the traffic study shall be submitted for review to the Director. The study requirements shall reflect the magnitude of the project in accordance with accepted traffic engineering practices. Large p Projects should assess all nearby key intersections. b. Once the scope of the traffic study has been approved, the applicant shall present the results with an overall site development proposal. The study shall be sealed and signed by a Licensed Professional Engineer specializing in traffic.

4. Approval Criteria

a. Location of new arterial streets shall conform to the Transportation System Plan, and traffic signals should generally not be spaced closer than 1,500 feet for reasonable traffic progression.

b. The TIS demonstrates that adequate transportation facilities exist to serve the proposed development or identifies mitigation measures that resolve identified traffic safety problems in a manner that is satisfactory to the City and, when state highway facilities are affected, to ODOT

c. For affected non-highway facilities, the TIS establishes that level-of-service standards adopted by the City have been met.

5. Conditions of Approval

a. The City may deny, approve, or approve a proposal with conditions necessary to meet operational and safety standards; provide the necessary right-of-way for improvements; and to require construction of improvements to ensure consistency with the future planned transportation system.

b. Construction of off-site improvements may be required to mitigate impacts resulting from development that relate to capacity deficiencies and public safety; and/or to upgrade or construct public facilities to city standards.

c. Improvements required as a condition of development approval, when not voluntarily provided by the applicant, shall be roughly proportional to the impact of the development on transportation facilities. Findings in the development approval shall indicate how the required improvements directly relate to and are roughly proportional to the impact of development.

~~2. If the traffic study identifies level-of-service conditions less than the minimum standard established in The Dalles Transportation Master Plan, improvements and funding strategies mitigating the problem shall be considered concurrent with a development proposal.~~

~~3. Location of new arterial streets shall conform to The Dalles Transportation Master Plan, and traffic signals should generally not be spaced closer than 1500 feet for reasonable traffic progression.~~

Recommendation 8

9.030 Partitions, Minor Replats, and Lot Line Adjustments

9.030.040 Partition Application Review

A. Review Procedure. Partition applications shall be processed as administrative actions, per the provisions of *Section 3.020.040: Administrative Actions*. Where the Director determines that continuous partitioning of a tract of land may occur in subsequent years, potentially resulting in the need for new road(s), utilities, or stormwater drainage facilities to be constructed and unmitigated impacts to City services and surrounding property, the application shall be referred to the Planning Commission, pursuant to *Section 3.020.050 Quasi-Judicial Actions* for a determination as to the applicability of the LUDO subdivision requirements.

10.060 Street Requirements

[…]

J. Location, Grades, Alignment and Widths. […]

[…]

5. ~~Except for streets designated in the Transportation System Plan as local and located in residential zones,~~ Street right-of-way and improvement shall conform to the widths and standards in Table 6-1 of the Transportation System Plan ~~shall be as specified in the chart below~~, or as modified in subsection 6. Streets designated in the Transportation System Plan as local and located in residential zones shall meet development standards as established by City Council resolution. A copy of the latest resolution can be obtained from the ~~Community Development Department~~ Planning Department.

Recommendation 9

Chapter 10: Improvements Required with Development

[…]

10.130 Transit Requirements

Improvements at transit stops. A proposed development that is adjacent to or includes an existing or planned transit stop will be required to plan for access to the transit stop and, where determined necessary in consultation with the transit agency, provide for transit improvements. Requirements apply where the subject parcel(s) or portions thereof are within 200 feet of a transit stop. Development requirements and improvements may include the following:

A) Intersection or mid-block traffic management improvements, as needed and practicable, to allow for pedestrian crossings at transit stops.

B) Building placement within 20 feet of the transit stop, a transit street or an intersection street, or a pedestrian plaza at the stop or a street intersection.

C) Transit passenger landing pads accessible to disabled persons to transit agency standards.

D) An easement or dedication for a passenger shelter and an underground utility connection to a transit stop if requested by the transit agency.

APPENDIX I. TRANSPORTATION PLANNING RULE (TPR) FINDINGS

LAND USE PLANNING
TRANSPORTATION PLANNING
PROJECT MANAGEMENT

MEMORANDUM

Findings of Compliance for The Dalles Transportation System Plan Update

The Dalles Transportation System Plan Update

DATE	February 28, 2017
TO	Project Management Team
FROM	Darci Rudzinski and Clinton "CJ" Doxsee, Angelo Planning Group
CC	Steven Harris, City of The Dalles Planning Director

OVERVIEW

A Planning Commission hearing is scheduled on March 16, 2017 to review the updated The Dalles Transportation System Plan (TSP) and related amendments to Comprehensive Plan Transportation Policies and Land Use and Development Ordinance (LUDO). Upon the Planning Commission's recommendation, The Dalles' City Council will hold a hearing to adopt the updated TSP as an element of the City's Comprehensive Plan and related amendments. Updates to the TSP and Comprehensive Plan are required to be in compliance with state policies and planning documents.

This memorandum includes findings that show the updated TSP and related amendments are in compliance with the following:

- Land Use Goals
- Oregon Transportation Plan (2006)
- Oregon Highway Plan
- OAR 660 Division 12 Transportation Planning Rule (TPR)
- OAR 734 Division 51 Highway Approaches, Access Control, Spacing Standards, and Medians.

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FINDINGS OF COMPLIANCE

Statewide Land Use Goals

The City is proposing to adopt an update of the The Dalles Transportation System Plan (TSP), thereby amending the state-acknowledged The Dalles Comprehensive Plan. The following findings demonstrate that the adoption of the updated TSP is consistent with relevant Statewide Land Use Planning Goals.

Goal 1: Citizen Involvement
Goal 1 requires the development of a citizen involvement program that is widespread, allows two-way communication, provides for citizen involvement through all planning phases, and is understandable, responsive, and funded.

Response: The progress of The Dalles TSP update was guided by the Technical Advisory Committee (TAC) and Public Advisory Committee (PAC). The TAC consisted of 13 members and represented multiple jurisdictions and agencies. The PAC consisted of 15 members, representing a variety of community, business, and advocacy interests.

The TAC and PAC were responsible for reviewing technical aspects, including all the technical memoranda, of the TSP and providing input to represent various organizations and community groups. These groups met jointly five times during the course of the project. In addition to the established advisory committees, two public meetings were held at key junctures in the process. At these meetings, the public was asked to share transportation concerns and comment on future transportation improvement projects, programs, pilot projects, policies, and future studies, and respective priorities of these plan elements. Finally, the draft TSP was presented and discussed with the City Planning Commission, and upon their recommendation, will be reviewed, discussed, and adopted by the City Council.

Goal 2: Land Use Planning
This goal requires that a land use planning process and policy framework be established as a basis for all decisions and actions relating to the use of land. All local governments and state agencies involved in the land use action must coordinate with each other. City, county, state and federal agency and special districts plans and actions related to land use must be consistent with the comprehensive plans of cities and counties and regional plans adopted under Oregon Revised Statues (ORS) Chapter 268.

Response: Existing state, regional, and local plans, policies, standards, and laws relevant to the TSP were reviewed and evaluated to guide the development of the TSP (Table 1-1 Summary of Documents Reviewed, Ch. 1). Coordination between the state, regional, and local agencies was accomplished through both the Project Management Team (PMT), which included key city staff members, and the TAC. Members of the TAC that provided guidance on the development of the TSP included representatives from multiple agencies, which are listed below.

- Bicycle Advisory Committee
- City of The Dalles Planning
- City of The Dalles Police
- Department of Land Conservation and Development (DLCD)
- Oregon Department of Transportation (ODOT)

- Mid-Columbia Council of Governments
- Mid-Columbia Economic Development District
- Mid-Columbia Fire & Rescue
- Port of The Dalles
- Wasco County Planning Department
- Wasco County Public Works Department

Goal 9: Economic Development

This goal requires that local comprehensive plans and policies contribute to a stable and healthy economy in all regions of the state.

Response: Goal 2 of The Dalles' TSP is Accessibility and Connectivity, which focuses on providing a transportation system available to all users regardless of the economic status.

Goal 4 of the TSP is Economic Development, which seeks to leverage the transportation system as a catalyst for economic vitality.

Evaluation criteria were developed to provide a process to evaluate project alternatives relative to TSP goals and objectives in Chapter 2. There are several key projects in the TSP that will further the city's economic development goals.

As shown in Table 6-4, New Roadways and Figure 6-2, Roadway Plan, four projects are planned that would create new roadways in the southeast of The Dalles. These new roadways will provide access to support new development and redevelopment for areas within the UGB.

Projects to improve and realign intersections near I-84 and Weber Street are proposed that will improve capacity or intersection queuing (see project I-9 through I-11 in Table 6-6, Intersection Improvements and Figure 6-5, Intersection Alternatives). These intersections provide connections between I-84, an unrestricted freight route, and the commercial areas W 6th Street and the Chenoweth industrial area along River Road.

ODOT completed an Interchange Area Management Plan (IAMP) at the I-84 Chenoweth Interchange since the previous TSP was adopted. Projects from the IAMP are included in the adopted TSP and will improve capacity in the short and long-term for vacant and re-developable industrial land in the nearby area (Table 6-7, IAMP Projects and Phasing Plan and Figure 6-6, IAMP Projects).

Goal 10: Housing

This goal requires the City plans provide for the appropriate type, location and phasing of public facilities and services sufficient to support housing development in areas presently developed or undergoing development or redevelopment.

Response: The TSP estimated future travel demand is based on population and employment forecasts in the year 2035, existing travel patterns, and existing and planned/funded transportation improvements. ODOT's Transportation Planning Analysis Unit (TPAU), in coordination with City staff, modeled travel demand patterns for the year 2036 to determine areas anticipated to experience the most development or redevelopment (see Table 4-1, The Dalles Land Use Summary and Figure 4-1, Change in Households from 2010 to 2036).

As noted in the findings to Goal 9, and as shown in Table 6-4, New Roadways, and Figure 6-2, Roadway Plan, four projects are planned that would create new roadways in the southeast area of The Dalles. These new roadways will provide access to support new housing development and re-development for areas within the UGB.

Several bicycle and pedestrian facility improvement projects are proposed in residentially zoned areas of the City. In particular, bicycle and pedestrian facility improvements providing important cross-city connections are proposed along W 7th Street (B-1 in Table 6-10, Bicycle Projects and Figure 6-8, Bicycle Plan; P-1, P-30, P-31 in Table 6-11, Pedestrian Projects and Figure 6-9, Pedestrian Plan) and W 10th Street west of Mill Creek (B-2 in Table 6-10, Bicycle Projects and Figure 6-8, Bicycle Plan; P-2, P-4, and P-6 in Table 6-11, Pedestrian Projects and Figure 6-9, Pedestrian Plan). In addition, bicycle facility improvement projects are proposed along W 10th Street, east of Mill Creek, and E 12th St (B-27 in Table 6-10, Bicycle Projects and Figure 6-8, Bicycle Plan).

Goal 11: Public Facilities and Services

Goal 11 requires cities and counties to plan and develop a timely, orderly and efficient arrangement of public facilities and services to serve as a framework for urban and rural development. The goal requires that urban and rural development be "guided and supported by types and levels of urban and rural public facilities and services appropriate for, but limited to, the needs and requirements of the urban, urbanizable and rural areas to be served."

Response: Transportation facilities, including roadways, bikeways, and sidewalks are a primary type of public facility and managed by public agencies such as The Dalles, Wasco County, and ODOT.

The TSP documents existing conditions and future needs for The Dalles' transportation system (see Chapter 3, Existing Conditions and Chapter 4, Future Travel Demand). Proposed improvements and implementation measures have been tailored as the means to meet identified future needs while also conforming to City policies and project goals and objectives.

The TSP was guided by and developed to be consistent with current transportation goals and policies found in the Comprehensive Plan and other relevant regional and state goals and policies (see Table 1-1, Summary of Documents Reviewed). In addition, City policies in the Comprehensive Plan are proposed to be modified to incorporate project goals and objectives (see Draft Policy Amendments). City Staff: This reference is to The Dalles Comprehensive Plan Amendments memorandum dated 5/14, revised 12/16. Please update reference, as appropriate and consistent with the rest of the staff report and hearing packet.

Goal 12: Transportation

Goal 12 requires cities, counties, metropolitan planning organizations, and ODOT to provide and encourage a "safe, convenient and economic transportation system." This is accomplished through development of Transportation System Plans based on inventories of local, regional and state transportation needs. Goal 12 is implemented through OAR 660, Division 12, also known as the Transportation Planning Rule ("TPR"). The TPR contains numerous requirements governing transportation planning and project development. (See the "OAR 660, Division 12" section of this document for findings of compliance with the TPR.)

Response: The Draft TSP was guided by project goals and objectives that addressed mobility, safety, economic development, accessibility, and connectivity. Existing conditions and future transportation needs were analyzed with respect to these goals and objectives. The inventory and analysis of existing and future conditions identified opportunities to improve the transportation system (see Figure 4-6, Future Needs). These needs were identified in the inventory, by advisory committee members and the public, and through capacity analysis based on projected future traffic volumes. Evaluation criteria, relative to the TSP goals and objectives, were used to evaluate improvement alternatives that would address identified needs. Alternatives were then presented to and refined during discussions with PAC/TAC members.

A major purpose of the Transportation Planning Rule (TPR), OAR 660 Division 12 that implements Goal 12, is to promote coordination of land use and transportation planning. The updated TSP will be adopted as the Transportation Element of the City's Comprehensive Plan. TSP adoption, along with the adoption of associated Comprehensive Plan transportation policies, will be accomplished through a legislative amendment. In addition, the City is proposed to adopt minor Land Use and Development Ordinance (LUDO) amendments to ensure consistency between adopted development requirements and the goals, objectives, and recommendations of the TSP (see TSP Volume II: Technical Appendices, 8. Land Use Development Ordinance Amendments and Draft Policy Amendments). City Staff: This reference is to The Dalles Comprehensive Plan Amendments memorandum dated 5/14, revised 12/16. Please update reference, as appropriate and consistent with the rest of the staff report and hearing packet.

Oregon Transportation Plan (2006)

The Oregon Transportation Plan (OTP) is the state's long-range, multimodal transportation plan. The OTP is the overarching policy document for a series of modal and topic plans that together form the state transportation system plan (TSP). A local TSP must be consistent with applicable OTP goals and policies. Findings of compatibility will be part of the basis for TSP approval. The following demonstrates how the Draft TSP complies with State transportation policy:

POLICY 1.2 – Equity, Efficiency and Travel Choices
It is the policy of the State of Oregon to promote a transportation system with multiple travel choices that are easy to use, reliable, cost-effective and accessible to all potential users, including the transportation disadvantaged.

Response: Provisions for street design can be found in TSP Table 6-1, Roadway Design Standards for City Streets. The functional classification of the street determines design standards. Design for each classification provides accommodation for all users with provisions for bike lanes, sidewalks, and landscaping.

The bicycle and pedestrian plan identifies a complete network of facilities for pedestrians and bicyclists. These networks include sidewalks and bike lanes or alternative treatments to provide bicycle and pedestrian connectivity on major roads in the City. More than 25 bicycle improvement projects are identified in Table 6-10 and shown in Figure 6-8. More than 30 pedestrian improvement projects are identified in Table 6-11 and shown in Figure 6-9.

The public transportation plan in Chapter 6 evaluated the feasibility of implementing fixed-route service in the City. The plan evaluated implementation and phasing strategies and potential funding options, including state and federal transit grant programs as well as local funding options. Alternatives are provided in Chapter 5 and identify high priority transit stop locations, cost assumptions, and routing alternatives. In addition, the chapter evaluates the effect of a fixed-route system on similar transit services provided in the area, such as CAT and LINK.

In addition to these TSP elements that promote equity and travel choices, proposed amendments to the LUDO are designed to support the development of complete bicycle, pedestrian, and transit networks. Proposed amendments include modifications to site plan review and conditional use permit evaluation criteria to include multi-modal transportation safety considerations (Recommendation 3 of the TSP Volume II: Technical Appendices, 8. Land Use Development Ordinance Amendments) Further, proposed amendments will support the development of transit by allowing or requiring transit amenities when specific criteria are met (Recommendation 6 and 8 of TSP Volume II: Technical Appendices, 8. Land Use Development Ordinance Amendments).

POLICY 2.1 - Capacity and Operational Efficiency
It is the policy of the State of Oregon to manage the transportation system to improve its capacity and operational efficiency for the long term benefit of people and goods movement.

POLICY 2.2 – Management of Assets
It is the policy of the State of Oregon to manage transportation assets to extend their life and reduce maintenance costs.

Response: The type, condition, and performance of facilities that provide transportation for people, goods, and services is documented in Chapter 3, Existing Conditions of the Draft TSP. Findings based on existing conditions identify existing needs and opportunities to improve the system based on project goals and objectives. Similarly, Chapter 4, Future Travel Demand, builds on existing conditions findings by anticipating future transportation system needs within the City through the year 2035.

Regulations and standards that are proposed to implement the TSP are designed to preserve and maintain the transportation network include access management measures and traffic impact study requirements (see Chapter 6 of the Draft TSP). Access management measures regulate vehicular access to streets, roads, and highways, and seeks to balance mobility with access for auto-users. Access management standards for approaches to state highways rely on ODOT highway access spacing standards (Table 6-2, ODOT Highway Access Spacing Standards). Access management standards for city streets are based on functional classification and posted speed and shown in Table 6-3, Access Spacing Standards for City Roadways. Additional access management measures found in Chapter 6 include driveway access spacing adjustments and access consolidation management. These measures are intended to maintain and improve safety and mobility on the City's existing and future roadway system.

Standards for traffic impact studies currently exist in the LUDO, which ensures that proposed amendments to City plans or ordinances are evaluated for consistency with the TSP. Proposed amendments to the LUDO include clarify thresholds for when traffic impact studies are required as part of proposed development. The refined LUDO requirements clarify requirements and ensure that future development and the planned transportation system remain in balance. (Recommendation 7 in TSP Volume II: Technical Appendices, 8. Land Use Development Ordinance

Amendments).

POLICY 3.1 – An Integrated and Efficient Freight System
It is the policy of the State of Oregon to promote an integrated, efficient and reliable freight system involving air, barges, pipelines, rail, ships and trucks to provide Oregon a competitive advantage by moving goods faster and more reliably to regional, national and international markets.

POLICY 3.2 – Moving People to Support Economic Vitality
It is the policy of the State of Oregon to develop an integrated system of transportation facilities, services and information so that intrastate, interstate and international travelers can travel easily for business and recreation.

Response: Figure 6-3, MCTD Freight Mobility Map shows designated freight routes, along with ODOT's Motor Carrier Transportation freight routes, within City limits. Critical interchanges between freight routes and freight generators include the Chenoweth and Webber Street interchange. Several projects listed in Table 6-6, Intersection Improvements, and shown in Figure 6-5, Intersection Alternatives, will improve the performance of these intersections, allowing for increased efficiency of freight traffic.

In addition, recommended project improvements from the completed Chenoweth IAMP have been incorporated to the Draft TSP and can be found in Table 6-7, IAMP Projects and Phasing Plan and are shown in Figure 6-6, IAMP Projects. The IAMP identifies four roadway improvement phases to encourage new development in areas zoned for commercial and industrial uses.

Union Pacific Railroad (UP) provides freight service along the I-84 corridor. Project S-11 found in Table 6-9, Safety Improvements, and shown in Figure 6-7, Safety Plan, will improve efficiency of UP trains during passage by restricting vehicle approaches.

POLICY 4.1 - Environmentally Responsible Transportation System
It is the policy of the State of Oregon to provide a transportation system that is environmentally responsible and encourages conservation and protection of natural resources.

Response: Improving the pedestrian and bicycle networks is generally considered to provide the greatest benefit for encouraging non-auto trips, thereby minimizing energy consumption and air quality impacts. The Dalles Draft TSP has developed bicycle and pedestrian plan that identify projects for creating complete networks (see Tables 6-10 and 6-11 and Figures 6-8 and 6-9).

Similarly, transit provides an alternative to automobile trips for trips longer than those normally taken on foot or by bicycle. As described in the response to Policy 1.2, the public transportation plan evaluates the feasibility of implementing fixed-route service within the City to provide alternatives to using automobiles for key destinations within City limits.

POLICY 5.1 – Safety
It is the policy of the State of Oregon to continually improve the safety and security of all modes and transportation facilities for system users including operators, passengers, pedestrians, recipients of goods and services, and property owners.

Response: Transportation alternatives for The Dalles were developed and evaluated to address transportation needs based on current and future forecast conditions, which included a review and analysis of 5-year crash history reports for all study intersections (see Figures 3-12 and 3-13 and Tables 3-6 and 3-7). The TSP also evaluated transportation facilities using the Bicycle Level of Traffic Stress to determine which bicycle facility improvements would have the greatest increase in safety. In addition, the TPS used ODOT's Statewide Priority Index System, as well as discussions with City staff, to help identify additional areas where safety improvements were necessary.

The Dalles Draft TSP identifies transportation improvement projects specific to safety and can be found in Table 6-9, Safety Improvements, and shown in Figure 6-7, Safety Plan. Safety projects include signage, guard rails, and intersection realignments or improvements. In addition, many of the roadway, pedestrian, and bicycle improvement projects identified in other parts of the Draft TSP will improve safety along City roads.

POLICY 7.1 – A Coordinated Transportation System
It is the policy of the State of Oregon to work collaboratively with other jurisdictions and agencies with the objective of removing barriers so the transportation system can function as one system.

Response: The City needs to coordinate with multiple agencies, including ODOT, Wasco County, and Mid-Columbia Council of Governments, regarding transportation system planning within the City's UGB. As a grant and project manager, ODOT staff has been involved in project management meetings as well as the public meetings addressed under Statewide Goal 1 in this report.

POLICY 7.3 – Public Involvement and Consultation
It is the policy of the State of Oregon to involve Oregonians to the fullest practical extent in transportation planning and implementation in order to deliver a transportation system that meets the diverse needs of the state.

POLICY 7.4 - Environmental Justice
It is the policy of the State of Oregon to provide all Oregonians, regardless of race, culture or income, equal access to transportation decision-making so all Oregonians may fairly share in benefits and burdens and enjoy the same degree of protection from disproportionate adverse impacts.

Response: The Dalles Draft TSP planning process included several opportunities for public involvement and input as described in detail in Chapter 1, Introduction and Policy Context, of the TSP and the findings for Statewide Goal 1 of this report. Information regarding the planning process was made available through the project's website as well as the City's website. Two public meetings were conducted at major milestones during the development of the TSP. An online interactive map where residents and stakeholders could provide comments on specific transportation facilities and areas of concern was provided on the project website was included to allow for additional feedback.

Oregon Highway Plan

The 1999 Oregon Highway Plan (OHP) establishes policies and investment strategies for Oregon's state highway system over a 20-year period and refines the goals and policies found in the OTP. Policies in the OHP emphasize the efficient management of the highway system to increase safety and to extend highway capacity, partnerships with other agencies and local governments, and the use of new techniques to improve road safety and capacity. These policies also link land use and transportation, set standards for highway performance and access management, and emphasize the relationship between state highways and local road, bicycle, pedestrian, transit, rail, and air systems. The Draft TSP meets the

State policies as follows:

***Policy 1A** (Highway Classification) defines the function of state highways to serve different types of traffic that should be incorporated into and specified through IAMPs.*

***Policy 1C** (State Highway Freight System) states the need to balance the movement of goods and services with other uses.*

Response: The state facilities within The Dalles provide district, statewide, and regional connectivity. Each facility is currently regulated according to a functional classification that established their primary function (moving people across regions or providing access to local destinations) and their access management regulations (standards to minimize the number of access points onto highways to preserve capacity). Functional classifications for The Dalles include freeways/state, arterials, collectors, and local streets.

The TSP includes ODOT and City of The Dalles access spacing standards to regulate vehicle access to streets, roads, and highways in order to maintain a balance between providing mobility for through traffic and access to these roadways. ODOT access spacing standards are based on OAR 734, Division 51 and provides standards for approaches to highways based on classification. US 197 is classified by ODOT as a Regional Highway through The Dalles, and Highway 292 (US 30) is classified as a District Highway. Future development along these highways will be required to meet ODOT's highway access spacing standards found in Table 6-2, ODOT Highway Access Spacing Standards.

***Policy 1B** (Land Use and Transportation) recognizes the need for coordination between state and local jurisdictions.*

Response: As has been described previously in this report, and particularly in response to Statewide Goals 1 and 2, and OTP Policy 7.1, development of the TSP has involved close coordination between the City, ODOT and other affected stakeholders. In addition, proposed amendments regarding traffic impact studies and mitigation provides a connection between land use development decisions and managing and protecting the City's transportation system (see TSP Volume II: Technical Appendices, 8. Land Use Development Ordinance Amendments).

***Policy 1F** (Highway Mobility Standards) sets mobility standards for ensuring a reliable and acceptable level of mobility on the highway system by identifying necessary improvements that would allow the interchange to function in a manner consistent with OHP mobility standards.*

Response: The Draft TSP analyzed traffic operations at signalized and un-signalized intersections for existing conditions and forecasted travel demand. The analyses were compared to The Dalles and ODOT performance standards to identify potential needs for improvement (see Tables 3-4, Existing Intersection Operations – Weekday PM Peak Hour and 4-2, Forecast 2035 Intersection Operations – Weekday PM Peak Hour, and Figures 3-11, Existing Traffic Conditions PM Peak Hour and 4-4, 2035 Traffic Conditions Weekday PM Peak Hour). Most intersections within The Dalles currently operate or are project to operate at acceptable levels. The TSP identifies transportation projects to improve intersection performance for intersections near US 30, US 197 and I-84 that were identified as exceeding applicable performance targets (see I-1 through I-3 in Table 6-6, Intersection Improvements and Figure 6-5, Intersection Alternatives).

***Policy 1G** (Major Improvements) requires maintaining performance and improving safety by improving efficiency and management before adding capacity. ODOT works with regional and local governments to address highway performance and safety.*

Response: As summarized in Chapters 3 and 4 of the TSP, the greatest transportation needs within The Dalles relate to traffic operations, safety, and multimodal facilities; these needs are not addressed through capacity projects. Chapter 5 of the TSP describes how projects were identified to address existing and future needs and identifies alternatives to address those needs. In addition, access management standards for access, spacing, driveway access, and access consolidation are included in Chapter 6 of the TSP to improve the efficiency of the transportation system and mitigate the need for adding capacity.

***Policy 2B** (Off-System Improvements) helps local jurisdictions adopt land use and access management policies.*

Response: As noted in the response to Policy 1G, the TSP includes access management standards to manage access to the City's road system to preserve capacity and maintain safety. The access management standards include standards for driveway spacing based in the functional classification of the street (see Table 6-3, Access Spacing Standards for City Roadways), as well as guidelines for consolidation of existing access points (see Figure 6-1, Application of an Example of Potential Driveway Consolidation).

The City currently includes access management standards in LUDO 6.050 – Access Management. Proposed amendments refer to, and make consistent with, the updated TSP (see TSP Volume II: Technical Appendices, 8. Land Use Development Ordinance Amendments).

***Policy 2F** (Traffic Safety) improves the safety of the highway system.*

Response: As described in the response to OTP Policy 5.1, a detailed crash analysis was performed during the TSP update process for all study intersections (see Figures 3-12, and 3-13 and Tables 3-6 and 3-7). The update process evaluated transportation facilities using the Bicycle Level of Traffic Stress to identify safety needs. Specific safety projects are identified by the Draft TSP and can be found in Table 6-9, Safety Improvements and shown in Figure 6-7, Safety Plan. In addition, many of the roadway, pedestrian, and bicycle improvement projects identified in other parts of the TSP will improve safety along City roads.

***Policy 3A** (Classification and Spacing Standards) sets access spacing standards for driveways and approaches to the state highway system.*

***Policy 3D** (Deviations) establishes general policies and procedures for deviations from adopted access management standards and policies.*

Response: As described in the response to Policy 2B of the OHP, the TSP includes access management standards that maintain and enhance the integrity (i.e., capacity, safety, and level of service) of The Dalles' roadways. Standards included in the 2016 TSP refer to state access management standards for state facilities (Table 7-2 in the TSP, Exhibit A). These standards apply to new development or redevelopment; existing accesses are allowed to remain if the land use does not change. The desired access spacing will gradually be obtained over time, increasing efficiency and safety, as redevelopment occurs.

The City currently includes access management standards in LUDO 6.050 – Access Management. Proposed amendments refer to, and make consistent with, the updated TSP (see TSP Volume II: Technical Appendices, 8. Land Use Development Ordinance Amendments). In addition, proposed amendments to the LUDO will allow for exceptions to access spacing standards when certain conditions are met and through specific conditions of approval.

***Policy 4A** (Efficiency of Freight Movement) It is the policy of the State of Oregon to maintain and improve the efficiency of freight movement on the state highway system and access to intermodal connections. The State shall seek to balance the needs of long distance and through freight movements with local transportation needs on highway facilities in both urban areas and rural communities.*

Response: Project BR-4 in the bridge and culvert plan identifies a project to improve signage throughout the City to inform truck traffic of alternate routes in order to avoid weight restricted transportation facilities (see Table 6-5, Bridge and Culvert Projects and Figure 6-4, Bridge and Culvert Plan). In addition, several intersection projects identified in the TSP are located on designated freight routes and will improve the movement of freight traffic when improved (see Table 6-6, Intersection Improvements and Figure 6-5, Intersection Alternatives).

***Policy 4B** (Alternative Passenger Modes) It is the policy of the State of Oregon to advance and support alternative passenger transportation systems where travel demand, land use, and other factors indicate the potential for successful and effective development of alternative passenger modes.*

Response: The TSP includes a Bicycle and Pedestrian Plan element that identifies the complete network of facilities for pedestrians and bicyclists. The network includes sidewalks and bike lanes or alternative treatments to provide connectivity on the major roads in the City. Sidewalk improvements have also been identified on some local streets and neighborhood streets that are located along routes near schools, provide access to local attractions, and in other high priority locations identified by the public. Table 6-10, Bicycle Projects, and Figure 6-8, Bicycle Plan, identify over 25 transportation improvements to complete the bicycle network on major roads. Table 6-11, Pedestrian Projects, and Figure 6-9, Pedestrian Plan, identify over 30 transportation improvements to form a complete network on major roads.

The Draft TSP also evaluated the feasibility of implementing a fixed-route transit service providing service within the City. Routing alternatives were analyzed in Chapter 5, and the implementation and phasing plan and potential funding options for a fixed-route transit system are provided in Chapter 6 of the TSP.

Other Modal Plans

The State has a number of modal and topic plans that together form the State TSP. In addition to the OHP, which is the modal plan for the State's roadways, the following govern aspects of statewide planning for the transportation system: Oregon Transportation Safety Action Plan; Oregon Bicycle and Pedestrian Plan/ Bicycle and Pedestrian Design Guide; Oregon Public Transportation Plan; Oregon Freight Plan; Oregon State Rail Plan; and Oregon Aviation Plan.

<u>Response:</u> Draft TSP Chapter 6: Transportation System Plan describes the modal plans that make up The Dalles TSP. In addition to the Roadway Plan, the City's Draft TSP includes a Safety Plan, Bicycle and Pedestrian Plan, Public Transit Plan, and Air, Water, Rail, and Pipeline Plans. The City's modal plans were developed to be consistent with State modal plans and to ensure that the relevant State policies and requirements are implemented through the planned local transportation system.

<u>OAR 660 Division 12 Transportation Planning Rule (TPR)</u>

The purpose of the Transportation Planning Rule (TPR) is "to implement Statewide Planning Goal 12 (Transportation) and promote the development of safe, convenient and economic transportation systems that are designed to reduce reliance on the automobile so that the air pollution, traffic and other livability problems faced by urban areas in other parts of the country might be avoided." A major purpose of the TPR is to promote more careful coordination of land use and transportation planning, to ensure that planned land uses are supported by and consistent with planned transportation facilities and improvements.

OAR 660 Division 12 Transportation Planning Rule (TPR)
The TPR contain policies for preparing and implementing a transportation system plan.

<u>Response:</u> The Draft TSP includes chapters on existing conditions, future conditions, a roadway classification system and corresponding standards, recommended improvements by mode, and a general funding plan as required by Section -0020 of the TPR. The previously adopted TSP was acknowledged by the Department of Land Conservation and Development and found to be in compliance with the TPR. The 2016 TSP is an update of the acknowledged TSP.

Section -0045 of the TPR requires that local jurisdictions amend their land use regulations to implement the TSP. Elements of the Draft TSP are implemented in the requirements of The Dalles' LUDO. The LUDO regulates land uses and development within the City and implements the long-range vision of the Comprehensive Plan, of which the TSP is part. Proposed amendments to the LUDO are intended to protect the design and function of the transportation network by including or referencing access management and street design standards found in the updated TSP. Proposed amendments also include additional standards for allowing conditions to be applied when warranted by a traffic impact study. In addition, future amendments to the LUDO would be required to be consistent with the planned function, capacity, and performance standards for land use actions that significantly affect the transportation system, consistent with TPR -0060. See TSP Volume II: Technical Appendices, 8. Land Use Development Ordinance Amendments.

<u>OAR 734, Division 51. Highway Approaches, Access Control, Spacing Standards, and Medians</u>

OAR 734-051 governs the permitting, management, and standards of approaches to state highways to ensure safe and efficient operation of the state highways. OAR 734-051 policies address the following:

- How to bring existing and future approaches into compliance with access spacing standards, and ensure the safe and efficient operation of the highway;
- The purpose and components of an access management plan; and
- Requirements regarding mitigation, modification, and closure of existing approaches as part of project development.

<ins>Response:</ins> As described in the response to OHP Policies 3A and 3B, access management standards for state highways will be consistent with state access standards.