

126th South - Bangerter Hwy to 4570 West

Riverton City, Utah

Storm Drain Report



December 2004

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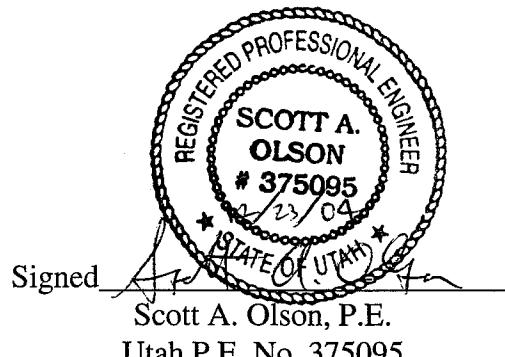
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Riverton City, Utah

Storm Drain Report



December 2004



Signed
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Utah P.E. No. 375095

Prepared by:



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 Hydraulic Calculations
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Introduction

This report is for the design of the 126th South storm drain mainline and laterals between Bangerter Hwy and 4570 West, in conjunction with the design and re-construction of the roadway. It is anticipated that 126th South will be built as the land on the north and south sides of the road are developed. This report will serve to inform the future developments what flow they may discharge to the storm drain main line and at what locations. This report is prepared for use and implementation by Riverton City.

Existing Features

The terrain along 126th South is a gentle ridge line that drops in elevation to the north and south and from west to east. Most of the adjacent properties along the corridor are unimproved. All surface runoff water flows overland or into existing irrigation ditches. Two sections of 126th South have curb and gutter with inlets which discharge into the Welby-Jacob canal and into an irrigation ditch. All 126th South surface runoff water from the west of 4570 West flows into the Whispering Springs retention pond. At the east end of the corridor, a 30" pipe at Bangerter Hwy is designed to accept 20 cfs from the 126th South storm drain system. The outlet for all other 126th South storm water will be an existing 42" pipe at Swensen Farm Dr. and 40th West. This 42" pipe discharges into Midas Creek at about 120th South and 40th West.

The grade along 126th South is roughly two percent from west to east. The ground also drops off to the north and the south, at about 0.5%. The service area for the roadway drainage includes property on each side of the road. It is anticipated that future land developments within this area will contribute storm water runoff to the 126th South system. Figure 1 shows the drainage basins for the service area.

The Western Springs retention pond receives all 126th South runoff water that comes from the west of 4570 West. As part of the city storm drain master plan, this retention pond is to become a detention pond by out-letting a minimum of 5 cfs into the 126th South storm drain system.

The 30" storm drain pipe at Bangerter Hwy was installed and is owned by UDOT. From Riverton's 126th South storm drain system, UDOT will accept a total flow of 20 cfs to be discharged into its system, of which 10 cfs will be pass-through runoff from UDOT's future construction of Legacy Hwy at about 4800 West. UDOT has agreed with Riverton City to accept a 10 cfs discharge of Riverton's runoff as part of the betterment agreements for the 12300/12600 South road widening. 126th South storm water runoff in excess of 10 cfs must be routed to the Midas Creek outfall on 40th West.

Hydrology

Figure 1 shows the drainage service area and sub-basins for the 126th South system. The design storm is the 10-year event with a 5-minute duration. The IDF curve, shown in Figure 2, was derived from the Salt Lake County and Draper City precipitation maps. Future developments will be limited to a maximum 0.2 cfs per acre storm water discharge into the 126th South system regardless of storm intensity or duration. The sub-basins shown in Figure 1 are listed with their areas and corresponding maximum discharges into the 126th South system.

Hydraulics

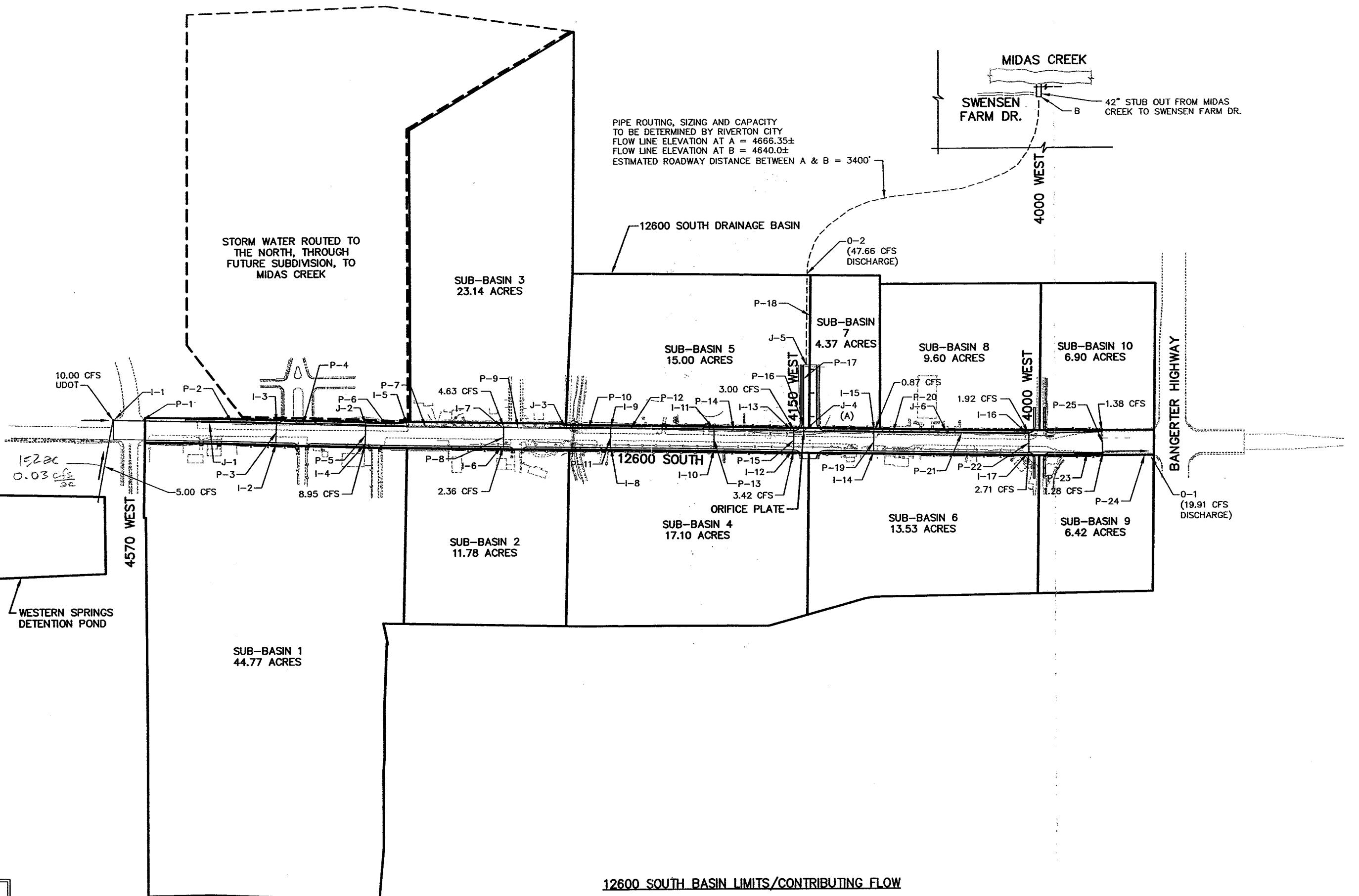
The design inflow into the 126th South storm drain system at 4570 West is 15 cfs; 10 cfs from the future Legacy Hwy and 5 cfs from the Western Springs detention pond. As the system extends to the east, additional flow is received from the sub-basins and the roadway. The storm drain system elevation has been designed to accept piped inflow from each sub-basin at the following locations and rate:

Flow from sub-basin 1:	8.95 cfs at Sta. 29+76 Rt.
Flow from sub-basin 2:	2.36 cfs at Sta. 35+58 Rt.
Flow from sub-basin 3:	4.63 cfs at Sta. 35+56 Lt.
Flow from sub-basin 4:	3.42 cfs at Sta. 47+80 Rt.
Flow from sub-basin 5:	3.00 cfs at Sta. 47+80 Lt.
Flow from sub-basin 6:	2.71 cfs at Sta. 57+68 Rt.
Flow from sub-basin 7:	0.87 cfs at Sta. 51+15 Lt.
Flow from sub-basin 8:	1.92 cfs at Sta. 57+68 Lt.
Flow from sub-basin 9:	1.28 cfs at Sta. 60+83 Rt.
Flow from sub-basin 10:	1.38 cfs at Sta. 60+78 Lt.

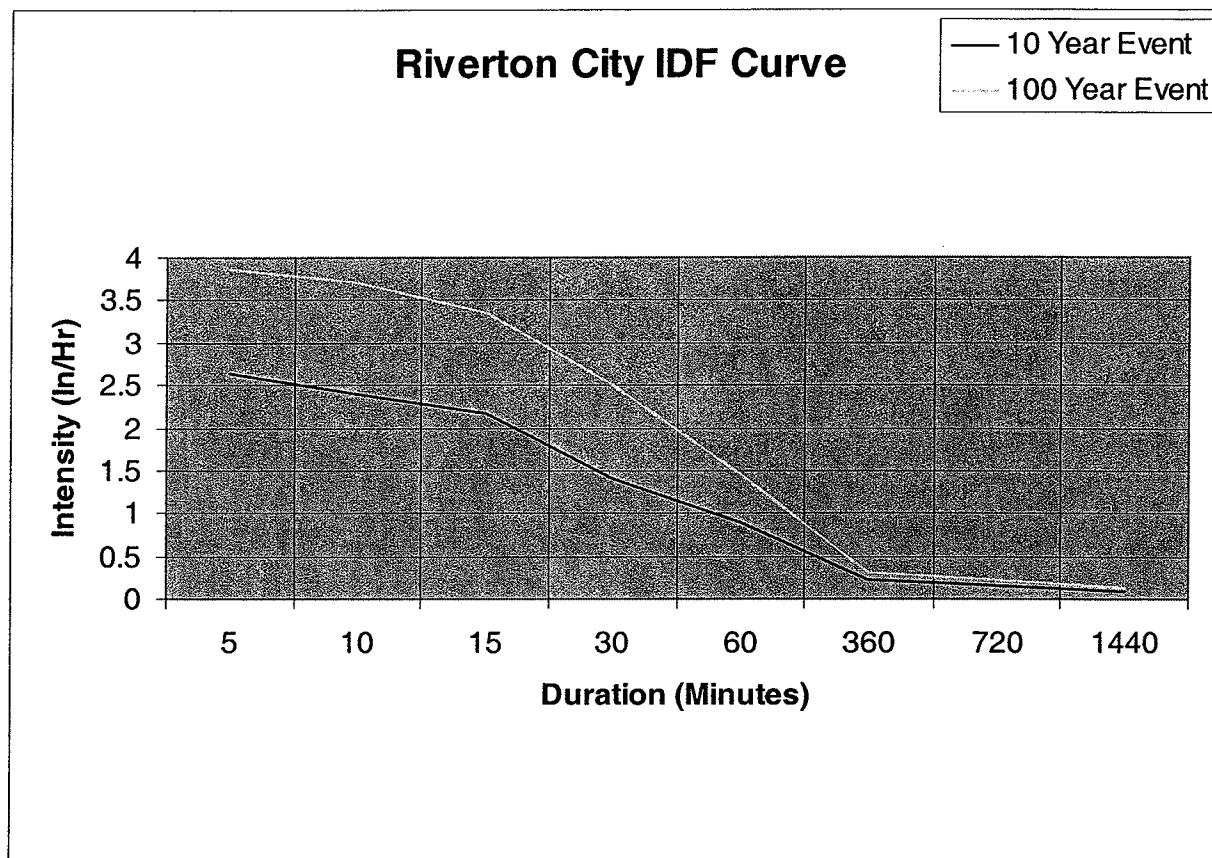
For the design storm event, the system was modeled using StormCAD v4.1 by Haestad Methods, Inc. Appendix B shows the detailed analysis of the Riverton and UDOT Flow model. At station 48+22, 126th South system flow in excess of 4.27 cfs is diverted to the north at 4150 West by a 1.0' by 0.68' orifice plate. This remaining storm water will be piped to the Midas Creek outfall at Swensen Farm Dr. and 40th West by a system that will be designed at a later date. That system should be designed for the 126th South flow (48.50 cfs) and the drainage from other areas as the city may determine. Appendix A shows the design calculations and sizes needed if UDOT discharge is not included.

System Capacity

Riverton City anticipates that Herriman City may want to discharge water into the 126th South system. The storm drain piping size required to carry the Riverton and UDOT 15 cfs inflow at 4570 West and the design storm water runoff along the corridor has a reserve capacity. This reserve capacity will allow Riverton City to either increase the initial flow into the 126th South system from the Western Springs detention pond or accept some storm water discharge from Herriman City. Appendix C shows that an additional 3 cfs may be added into the system at 4570 West. Any more than this and flooding will occur without up-sizing the piping. Any additional flow will need to be accounted for in the design of the pipe system from 126th South to the Midas Creek outfall at Swensen Farm Dr. and 40th West.



DESIGNED SO	CHECKED SJ	DRAWN BCS	DATE 06/04
APPROVED X	DATE X	PROJECT NO. 0311-103	SCALE 1"=150'
REVISIONS X	DWG. NO. X	SHCET NO. 1	1 OF 1



IDF Curve generated from interpolation of the Herriman Fire Station data, Draper City data and the storm precipitation amounts for the Salt Lake Valley by TRC North American Weather Consultants Meteorological Solutions, Inc., August, 1999.

Figure 2

Appendix A

Riverton Only Flows:

Hydraulic Calculations,
Inlet Report &
Pipe Report

Riverton Only Flows

12600 South Storm Drain Report - Riverton Only Flows

This scenario assumes a flow of 5 cfs coming from the Western Springs detention pond into the inlet box I-1. No additional flow from UDOT or Herriman City is added.

The drainage basin is shown in Figure 1 with delineated sub-basins. The location where runoff from the sub-basins enters the storm drain system are indicated in Figure 1, as well as the inlet locations.

4.25 cfs is diverted at juction box J4 to continue down 126th South while the remaining 37.89 cfs flows toward Midas Creek.

Gravity subnetwork discharging at: O-2

```
>>> Info: Loading and hydraulic computations completed
      successfully.
>>> Warning: P-5 Pipe discharge is above full flow capacity.
>>> Warning: P-1 Pipe fails maximum cover constraint.
>>> Warning: P-10 Pipe discharge is above full flow capacity.
>>> Warning: P-12 Pipe discharge is above full flow capacity.
>>> Warning: P-16 Pipe discharge is above full flow capacity.
>>> Warning: P-13 Pipe fails minimum velocity constraint.
>>> Warning: P-11 Pipe fails minimum velocity constraint.
>>> Warning: P-17 Pipe discharge is above full flow capacity.
>>> Warning: P-18 Pipe discharge is above full flow capacity.
```

```
>>> Info: Subsurface Analysis iterations: 2
```

```
>>> Info: Convergence was achieved.
```

Gravity subnetwork discharging at: O-1

```
>>> Info: Loading and hydraulic computations completed
      successfully.
```

CALCULATION SUMMARY FOR SURFACE NETWORKS

Label	Inlet Type	Inlet	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Capture Efficiency (%)	Gutter Spread (ft)	Gutter Depth (ft)
I-12	Combination Inlet	Combination APWA Design Combo	1.06	0.00	100.0	1.26	0.01
I-10	Combination Inlet	Combination APWA Design Combo	1.27	0.06	95.7	4.47	0.21
I-8	Combination Inlet	Combination APWA Design Combo	1.38	0.04	97.0	4.09	0.20
I-6	Combination Inlet	Combination APWA Design Combo	1.53	0.14	91.6	5.23	0.22
I-4	Combination Inlet	Combination APWA Design Combo	1.13	0.03	97.7	3.99	0.20
I-2	Combination Inlet	Combination APWA Design Combo	1.51	0.13	92.0	5.17	0.22
I-13	Combination Inlet	Combination APWA Design Combo	1.06	0.00	100.0	1.26	0.01
I-11	Combination Inlet	Combination APWA Design Combo	1.26	0.05	95.9	4.43	0.21
I-9	Combination Inlet	Combination APWA Design Combo	1.30	0.03	97.8	3.87	0.20
I-7	Combination Inlet	Combination APWA Design Combo	1.25	0.05	96.2	4.37	0.20
I-5	Combination Inlet	Combination APWA Design Combo	1.53	0.14	91.6	5.24	0.22
I-3	Combination Inlet	Combination APWA Design Combo	1.51	0.13	92.0	5.17	0.22
I-1	Combination Inlet	Combination APWA Design Combo	0.00	0.00	100.0	0.00	0.00
I-19	Combination Inlet	Combination APWA Design Combo	1.11	0.03	97.1	4.20	0.20
I-18	Combination Inlet	Combination APWA Design Combo	1.11	0.03	97.1	4.20	0.20
I-17	Combination Inlet	Combination APWA Design Combo	1.70	0.22	88.7	5.73	0.23
I-14	Combination Inlet	Combination APWA Design Combo	0.99	0.01	99.1	3.53	0.19
I-16	Combination Inlet	Combination APWA Design Combo	1.70	0.22	88.7	5.73	0.23
I-15	Combination Inlet	Combination APWA Design Combo	0.99	0.01	99.1	3.53	0.19

CALCULATION SUMMARY FOR SUBSURFACE NETWORK WITH ROOT: O-2

Label	Number of Sections	Section Size	Section Shape	Length (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Upstream (ft)	Hydraulic Grade Downstream (ft)
P-18	1	30 inch	Circular	428.00	37.60	7.66	4,668.86	4,665.26
P-17	1	30 inch	Circular	287.00	37.89	7.72	4,671.31	4,668.86
P-16	1	30 inch	Circular	42.00	42.14	8.58	4,671.75	4,671.31
P-14	1	30 inch	Circular	335.00	34.02	9.37	4,674.03	4,671.75
P-15	1	18 inch	Circular	81.00	4.48	2.53	4,671.90	4,671.75
P-13	1	18 inch	Circular	81.00	1.27	1.31	4,674.03	4,674.03
P-12	1	24 inch	Circular	438.00	31.87	10.18	4,683.75	4,675.05
P-10	1	24 inch	Circular	187.00	29.29	9.32	4,686.88	4,683.75
P-11	1	18 inch	Circular	82.00	1.38	0.79	4,683.76	4,683.75
P-9	1	24 inch	Circular	260.00	29.30	11.28	4,692.73	4,686.88
P-7	1	24 inch	Circular	408.00	19.58	9.40	4,699.39	4,692.73
P-8	1	18 inch	Circular	81.00	3.89	3.90	4,692.83	4,692.73
P-6	1	24 inch	Circular	176.00	18.06	7.29	4,701.07	4,699.66
P-4	1	24 inch	Circular	371.00	8.00	6.04	4,708.66	4,701.07
P-5	1	18 inch	Circular	76.00	10.08	5.72	4,701.77	4,701.07
P-2	1	24 inch	Circular	280.00	5.00	5.68	4,711.50	4,708.66
P-3	1	18 inch	Circular	79.00	1.51	3.53	4,709.64	4,708.66
P-1	1	24 inch	Circular	398.00	5.00	4.51	4,713.63	4,711.63

Riverton only Flows

Label	Total System Flow (cfs)	Ground Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
O-2	37.16	4,670.26	4,665.26	4,665.26
J-5	37.60	4,672.40	4,668.86	4,668.86
J-4	37.89	4,673.84	4,671.31	4,671.31
I-13	42.14	4,674.75	4,671.75	4,671.75
I-11	34.02	4,680.80	4,674.03	4,674.03
I-12	4.48	4,674.75	4,671.90	4,671.90
I-10	1.27	4,680.80	4,674.03	4,674.03
I-9	31.87	4,690.11	4,683.75	4,683.75
J-3	29.29	4,694.21	4,686.88	4,686.88
I-8	1.38	4,690.11	4,683.76	4,683.76
I-7	29.30	4,697.88	4,692.73	4,692.73
I-5	19.58	4,705.00	4,699.39	4,699.39
I-6	3.89	4,697.90	4,692.83	4,692.83
J-2	18.06	4,708.61	4,701.07	4,701.07
I-3	8.00	4,715.31	4,708.66	4,708.66
I-4	10.08	4,708.63	4,701.77	4,701.77
J-1	5.00	4,721.28	4,711.50	4,711.50
I-2	1.51	4,715.33	4,709.64	4,709.64
I-1	5.00	4,730.78	4,713.63	4,713.63

CALCULATION SUMMARY FOR SUBSURFACE NETWORK WITH ROOT: O-1

Label	Number of Sections	Section Size	Section Shape	Length (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Upstream (ft)	Hydraulic Grade Downstream (ft)
P-24	1	24 inch	Circular	191.00	19.98	13.29	4,647.67	4,640.97
P-23	1	24 inch	Circular	314.00	15.14	5.79	4,649.82	4,648.25
P-25	1	18 inch	Circular	87.00	2.49	3.50	4,648.09	4,647.67
P-22	1	24 inch	Circular	79.00	10.75	5.64	4,650.04	4,649.82
P-21	1	24 inch	Circular	343.00	7.16	6.80	4,658.08	4,650.04
P-20	1	24 inch	Circular	310.00	7.17	6.43	4,661.39	4,658.24
P-19	1	18 inch	Circular	81.00	0.99	2.41	4,661.74	4,661.39

Label	Total System Flow (cfs)	Ground Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
O-1	19.97	4,645.00	4,640.97	4,640.97
I-18	19.98	4,651.47	4,647.67	4,647.67
I-17	15.14	4,657.11	4,649.82	4,649.82
I-19	2.49	4,651.62	4,648.09	4,648.09
I-16	10.75	4,657.13	4,650.04	4,650.04
J-6	7.16	4,662.99	4,658.08	4,658.08
I-15	7.17	4,668.81	4,661.39	4,661.39
I-14	0.99	4,668.81	4,661.74	4,661.74

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Scenario: 12600 South
Inlet Report - Riverton Only Flows

Project Engineer: Horrocks Engineers
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 12/22/04 2:13

Horrocks Engineers StormCAD v4.1.1 [4.2014]
 © Haestad Methods, Inc. 37 Brookside Road Waterbury, CT 06708 USA

Label	Calculated Station (ft)	Ground Elevation (ft)	Set Rim Equal to Ground Elevation?	Rim Elevation (ft)	Sump Elevation (ft)	Area (acres)	Inlet C	Inlet CA (acres)	Time of Concentration (min)	External CA (acres)	External Time of Concentration (min)	Additional Flow (cfs)	Additional Carryover (cfs)	Known Flow (cfs)	Inlet	Inlet Location	Description
I-1	36+10	4,730.78	true	4,730.78	4,712.86	0.00	0.00	0.00	5.00	0.00	0.00	5.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-2	30+11	4,715.33	true	4,715.33	4,709.30	0.71	0.88	0.62	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-4	26+37	4,708.63	true	4,708.63	4,700.00	0.44	0.88	0.39	5.00	0.00	0.00	8.95	0.00	0.00	Combination APWA Design Combo	On Grade	
I-3	29+32	4,715.31	true	4,715.31	4,708.00	0.71	0.88	0.62	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-6	20+58	4,697.90	true	4,697.90	4,692.19	0.71	0.87	0.62	5.00	0.00	0.00	2.36	0.00	0.00	Combination APWA Design Combo	On Grade	
I-5	23+85	4,705.00	true	4,705.00	4,698.19	0.66	0.87	0.58	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-7	19+77	4,697.88	true	4,697.88	4,691.40	0.50	0.87	0.43	5.00	0.00	0.00	4.63	0.00	0.00	Combination APWA Design Combo	On Grade	
I-8	16+12	4,690.11	true	4,690.11	4,682.31	0.55	0.88	0.48	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-9	15+30	4,690.11	true	4,690.11	4,681.50	0.55	0.88	0.48	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-10	11+73	4,680.80	true	4,680.80	4,673.42	0.55	0.88	0.48	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-12	8+38	4,674.75	true	4,674.75	4,667.37	0.43	0.88	0.38	5.00	0.00	0.00	3.42	0.00	0.00	Combination APWA Design Combo	In Sag	
I-11	10+92	4,680.80	true	4,680.80	4,672.61	0.55	0.88	0.48	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-13	7+57	4,674.75	true	4,674.75	4,666.56	0.43	0.88	0.38	5.00	0.00	0.00	3.00	0.00	0.00	Combination APWA Design Combo	In Sag	
I-14	13+18	4,668.81	true	4,668.81	4,661.43	0.43	0.88	0.38	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-15	12+37	4,668.81	true	4,668.81	4,660.62	0.43	0.88	0.38	5.00	0.00	0.00	0.87	0.00	0.00	Combination APWA Design Combo	On Grade	
I-16	5+84	4,657.13	true	4,657.13	4,649.08	0.82	0.87	0.72	5.00	0.00	0.00	1.92	0.00	0.00	Combination APWA Design Combo	On Grade	
I-19	2+78	4,651.62	true	4,651.62	4,647.60	0.40	0.87	0.35	5.00	0.00	0.00	1.38	0.00	0.00	Combination APWA Design Combo	On Grade	
I-17	5+05	4,657.11	true	4,657.11	4,648.27	0.82	0.87	0.72	5.00	0.00	0.00	2.71	0.00	0.00	Combination APWA Design Combo	On Grade	
I-18	1+91	4,651.47	true	4,651.47	4,646.70	0.40	0.87	0.35	5.00	0.00	0.00	1.28	0.00	0.00	Combination APWA Design Combo	On Grade	

These calculations are based upon the drainage basin shown in Figure 1 with 5 cfs coming from the Western Springs detention pond. Inlet areas were calculated for asphalt ("C" value of 0.95), concrete ("C" value of 0.95) and park strip/planter areas ("C" value of 0.15). Flow from water landing on the concrete sidewalk is assumed to travel directly to the inlet without passing over the planter area; this is a conservative analysis.

Scenario: 12600 South
Pipe Report - Riverton Only Flows

Project Engineer: Horrocks Engineers
o:\...\cad\work\riverton only flows.stm
12/22/04 2:10

Horrocks Engineers StormCAD v4.1.1 [4.2014]
© Haestad Methods, Inc. 37 Brookside Road Waterbury, CT 06708 USA

Label	Upstream Node	Downstream Node	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Mannings n	Full Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Cover (ft)	Downstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Description
P-1	I-1	J-1	0.00	0.00	0.00	0.00	5.00	398.00	0.005025	24 inch	0.013	16.04	4,712.86	4,710.86	4,730.78	4,721.28	15.92	8.42	4,713.63	4,711.63		
P-3	I-2	I-3	0.71	0.88	0.62	0.57	2.64	1.51	79.00	0.016456	18 inch	0.013	13.47	4,709.30	4,708.00	4,715.33	4,715.31	4.53	5.81	4,709.64	4,708.66	
P-2	J-1	I-3	N/A	N/A	N/A	0.00	0.00	5.00	280.00	0.010214	24 inch	0.013	22.86	4,710.86	4,708.00	4,721.28	4,715.31	8.42	5.31	4,711.50	4,708.66	
P-5	I-4	J-2	0.44	0.88	0.39	0.43	2.64	10.08	76.00	0.005263	18 inch	0.013	7.62	4,700.00	4,699.60	4,708.63	4,708.61	7.13	7.51	4,701.77	4,701.07	
P-4	I-3	J-2	0.71	0.88	0.62	1.14	2.62	8.00	371.00	0.022642	24 inch	0.013	34.04	4,708.00	4,699.60	4,715.31	4,708.61	5.31	7.01	4,708.66	4,701.07	
P-6	J-2	I-5	N/A	N/A	N/A	1.56	2.61	18.06	176.00	0.008011	24 inch	0.013	20.25	4,699.60	4,698.19	4,708.61	4,705.00	7.01	4.81	4,701.07	4,699.66	
P-8	I-6	I-7	0.71	0.87	0.62	0.58	2.64	3.89	81.00	0.009753	18 inch	0.013	10.37	4,692.19	4,691.40	4,697.90	4,697.88	4.21	4.98	4,692.83	4,692.73	
P-7	I-5	I-7	0.66	0.87	0.58	2.14	2.61	19.58	408.00	0.016642	24 inch	0.013	29.18	4,698.19	4,691.40	4,705.00	4,697.88	4.81	4.48	4,699.39	4,692.73	
P-9	I-7	J-3	0.50	0.87	0.43	3.18	2.60	29.30	260.00	0.027692	24 inch	0.013	37.64	4,691.40	4,684.20	4,697.88	4,694.21	4.48	8.01	4,692.73	4,686.88	
P-11	I-8	I-9	0.55	0.88	0.48	0.52	2.64	1.38	82.00	0.009878	18 inch	0.013	10.44	4,682.31	4,681.50	4,690.11	4,690.11	6.30	7.11	4,683.76	4,683.75	
P-10	J-3	I-9	N/A	N/A	N/A	3.18	2.60	29.29	187.00	0.014439	24 inch	0.013	27.18	4,684.20	4,681.50	4,694.21	4,690.11	8.01	6.61	4,686.88	4,683.75	
P-12	I-9	I-11	0.55	0.88	0.48	4.19	2.59	31.87	438.00	0.019155	24 inch	0.013	31.31	4,681.50	4,673.11	4,690.11	4,680.80	6.61	5.69	4,683.75	4,675.05	
P-13	I-10	I-11	0.55	0.88	0.48	0.48	2.64	1.27	81.00	0.010000	18 inch	0.013	10.50	4,673.42	4,672.61	4,680.80	4,680.80	5.88	6.69	4,674.03	4,674.03	
P-15	I-12	I-13	0.43	0.88	0.38	0.40	2.64	4.48	81.00	0.010000	18 inch	0.013	10.50	4,667.37	4,666.56	4,674.75	4,674.75	5.88	6.69	4,671.90	4,671.75	
P-14	I-11	I-13	0.55	0.88	0.48	5.14	2.52	34.02	335.00	0.018060	30 inch	0.013	55.12	4,672.61	4,666.56	4,680.80	4,674.75	5.69	5.69	4,674.03	4,671.75	
P-16	I-13	J-4	0.43	0.88	0.38	5.94	2.47	42.14	42.00	0.005000	30 inch	0.013	29.00	4,666.56	4,666.35	4,674.75	4,673.84	5.69	4.99	4,671.75	4,671.31	
P-17	J-4	J-5	N/A	N/A	N/A	5.34	2.46	37.89	287.00	0.005052	30 inch	0.013	29.15	4,666.35	4,664.90	4,673.84	4,672.40	4.99	5.00	4,671.31	4,668.86	
P-18	J-5	O-2	N/A	N/A	N/A	5.34	2.41	37.60	428.00	0.005000	30 inch	0.013	29.00	4,664.90	4,662.76	4,672.40	4,670.26	5.00	5.00	4,668.86	4,665.26	
P-19	I-14	I-15	0.43	0.88	0.38	0.37	2.64	0.99	81.00	0.010000	18 inch	0.013	10.50	4,661.43	4,660.62	4,668.81	4,668.81	5.88	6.69	4,661.74	4,661.39	
P-20	I-15	J-6	0.43	0.88	0.38	1.34	2.64	7.17	310.00	0.010161	24 inch	0.013	22.80	4,660.62	4,657.47	4,668.81	4,662.99	6.19	3.52	4,661.39	4,658.24	
P-21	J-6	I-16	N/A	N/A	N/A	1.34	2.63	7.16	343.00	0.024461	24 inch	0.013	35.38	4,657.47	4,649.08	4,662.99	4,657.13	3.52	6.05	4,658.08	4,650.04	
P-22	I-16	I-17	0.82	0.87	0.72	1.98	2.62	10.75	79.00	0.010253	24 inch	0.013	22.91	4,649.08	4,648.27	4,657.13	4,657.11	6.05	6.84	4,650.04	4,649.82	
P-25	I-19	I-18	0.40	0.87	0.35	0.42	2.64	2.49	87.00	0.010345	18 inch	0.013	10.68	4,647.60	4,646.70	4,651.62	4,651.47	2.52	3.27	4,648.09	4,647.67	
P-23	I-17	I-18	0.82	0.87	0.72	2.61	2.62	15.14	314.00	0.005000	24 inch	0.013	16.00	4,648.27	4,646.70	4,657.11	4,651.47	6.84	2.77	4,649.82	4,648.25	
P-24	I-18	O-1	0.40	0.87	0.35	3.45	2.61	19.98	191.00	0.035079	24 inch	0.013	42.37	4,646.70	4,640.00	4,651.47	4,645.00	2.77	3.00	4,647.67	4,640.97	

These sizes and calculations are based upon the drainage basin shown in Figure 1 with 5 cfs coming from the Western Springs detention pond.

Appendix B

Riverton and UDOT Flows:

Hydraulic Analysis,
Inlet Report &
Pipe Report

Riverton and Udot Flows

12600 South Storm Drain Report - Riverton and Udot Flows

This scenario assumes a flow of 5 cfs coming from the Western Springs detentin pond and 10 cfs coming from the future Legacy Highway (UDOT) into the inlet box I-1. No additional flow from Herriman City is added.

The drainage basin is shown in Figure 1 with delineated sub-basins. The location where runoff from the sub-basins enters the storm drain system are indicated in Figure 1, as well as the inlet locations.

4.27 cfs is diverted at juction box J4 to continue down 126th South while the remaining 48.50 cfs flows toward Midas Creek.

Several pipes were upsized in order to handle the additional UDOT flow. See the Pipe Report - Riverton and UDOT Flows for a list.

Gravity subnetwork discharging at: 0-2

```
>>> Info: Loading and hydraulic computations completed
      successfully.
>>> Warning: P-6 Pipe discharge is above full flow capacity.
>>> Warning: P-7 Pipe discharge is above full flow capacity.
>>> Warning: P-5 Pipe discharge is above full flow capacity.
>>> Warning: P-1 Pipe fails maximum cover constraint.
>>> Warning: P-9 Pipe discharge is above full flow capacity.
>>> Warning: P-16 Pipe discharge is above full flow capacity.
>>> Warning: P-13 Pipe fails minimum velocity constraint.
>>> Warning: P-11 Pipe fails minimum velocity constraint.
>>> Warning: P-17 Pipe discharge is above full flow capacity.
>>> Warning: P-18 Pipe discharge is above full flow capacity.
```

```
>>> Info: Subsurface Analysis iterations: 2
```

```
>>> Info: Convergence was achieved.
```

Gravity subnetwork discharging at: 0-1

```
>>> Info: Loading and hydraulic computations completed
      successfully.
```

CALCULATION SUMMARY FOR SURFACE NETWORKS

Label	Inlet Type	Inlet	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Capture Efficiency (%)	Gutter Spread (ft)	Gutter Depth (ft)
I-12	Combination Inlet	Combination APWA Design Combo	1.06	0.00	100.0	1.26	0.01
I-10	Combination Inlet	Combination APWA Design Combo	1.27	0.06	95.7	4.47	0.21
I-8	Combination Inlet	Combination APWA Design Combo	1.38	0.04	97.0	4.09	0.20
I-6	Combination Inlet	Combination APWA Design Combo	1.53	0.14	91.6	5.23	0.22
I-4	Combination Inlet	Combination APWA Design Combo	1.13	0.03	97.7	3.99	0.20
I-2	Combination Inlet	Combination APWA Design Combo	1.51	0.13	92.0	5.17	0.22
I-13	Combination Inlet	Combination APWA Design Combo	1.06	0.00	100.0	1.26	0.01
I-11	Combination Inlet	Combination APWA Design Combo	1.26	0.05	95.9	4.43	0.21
I-9	Combination Inlet	Combination APWA Design Combo	1.30	0.03	97.8	3.87	0.20
I-7	Combination Inlet	Combination APWA Design Combo	1.25	0.05	96.2	4.37	0.20
I-5	Combination Inlet	Combination APWA Design Combo	1.53	0.14	91.6	5.24	0.22
I-3	Combination Inlet	Combination APWA Design Combo	1.51	0.13	92.0	5.17	0.22
I-1	Combination Inlet	Combination APWA Design Combo	0.00	0.00	100.0	0.00	0.00
I-19	Combination Inlet	Combination APWA Design Combo	1.11	0.03	97.1	4.20	0.20
I-18	Combination Inlet	Combination APWA Design Combo	1.11	0.03	97.1	4.20	0.20
I-17	Combination Inlet	Combination APWA Design Combo	1.70	0.22	88.7	5.73	0.23
I-14	Combination Inlet	Combination APWA Design Combo	0.99	0.01	99.1	3.53	0.19
I-16	Combination Inlet	Combination APWA Design Combo	1.70	0.22	88.7	5.73	0.23
I-15	Combination Inlet	Combination APWA Design Combo	0.99	0.01	99.1	3.53	0.19

CALCULATION SUMMARY FOR SUBSURFACE NETWORK WITH ROOT: 0-2

Label	Number of Sections	Section Size	Section Shape	Length (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Upstream (ft)	Hydraulic Grade Downstream (ft)
P-18	1	36 inch	Circular	428.00	48.16	6.81	4,667.99	4,665.76
P-17	1	36 inch	Circular	287.00	48.50	6.86	4,669.51	4,667.99
P-16	1	36 inch	Circular	42.00	52.77	7.47	4,669.77	4,669.51
P-14	1	30 inch	Circular	335.00	44.43	10.55	4,674.37	4,669.77
P-15	1	18 inch	Circular	81.00	4.48	2.53	4,669.92	4,669.77
P-13	1	18 inch	Circular	81.00	1.27	0.90	4,674.37	4,674.37
P-12	1	30 inch	Circular	438.00	41.95	12.17	4,683.07	4,674.37
P-10	1	30 inch	Circular	187.00	39.31	11.15	4,685.89	4,683.19
P-11	1	18 inch	Circular	82.00	1.38	1.16	4,683.07	4,683.07
P-9	1	24 inch	Circular	260.00	39.32	12.53	4,694.53	4,686.67
P-7	1	24 inch	Circular	408.00	29.59	9.42	4,701.51	4,694.53
P-8	1	18 inch	Circular	81.00	3.89	2.20	4,694.64	4,694.53
P-6	1	24 inch	Circular	176.00	28.08	8.94	4,704.22	4,701.51
P-4	1	24 inch	Circular	371.00	18.01	8.36	4,709.03	4,704.22
P-5	1	18 inch	Circular	76.00	10.08	5.71	4,704.92	4,704.22
P-2	1	24 inch	Circular	280.00	15.00	7.76	4,712.04	4,709.18
P-3	1	18 inch	Circular	79.00	1.51	3.10	4,709.64	4,709.03
P-1	1	24 inch	Circular	398.00	15.00	5.80	4,714.39	4,712.39

Riverton and Udot Flows

Label	Total System Flow (cfs)	Ground Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
O-2	47.66	4,670.26	4,665.76	4,665.76
J-5	48.16	4,672.40	4,667.99	4,667.99
J-4	48.50	4,673.84	4,669.51	4,669.51
I-13	52.77	4,674.75	4,669.77	4,669.77
I-11	44.43	4,680.80	4,674.37	4,674.37
I-12	4.48	4,674.75	4,669.92	4,669.92
I-10	1.27	4,680.80	4,674.37	4,674.37
I-9	41.95	4,690.11	4,683.07	4,683.07
J-3	39.31	4,694.21	4,685.89	4,685.89
I-8	1.38	4,690.11	4,683.07	4,683.07
I-7	39.32	4,697.88	4,694.53	4,694.53
I-5	29.59	4,705.00	4,701.51	4,701.51
I-6	3.89	4,697.90	4,694.64	4,694.64
J-2	28.08	4,708.61	4,704.22	4,704.22
I-3	18.01	4,715.31	4,709.03	4,709.03
I-4	10.08	4,708.63	4,704.92	4,704.92
J-1	15.00	4,721.28	4,712.04	4,712.04
I-2	1.51	4,715.33	4,709.64	4,709.64
I-1	15.00	4,730.78	4,714.39	4,714.39

CALCULATION SUMMARY FOR SUBSURFACE NETWORK WITH ROOT: O-1

Label	Number of Sections	Section Size	Section Shape	Length (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Upstream (ft)	Hydraulic Grade Downstream (ft)
P-24	1	24 inch	Circular	191.00	19.92	13.28	4,647.66	4,640.96
P-23	1	24 inch	Circular	314.00	15.08	5.79	4,649.82	4,648.25
P-25	1	18 inch	Circular	87.00	2.49	3.50	4,648.09	4,647.66
P-22	1	24 inch	Circular	79.00	10.69	5.64	4,650.04	4,649.82
P-21	1	24 inch	Circular	343.00	7.09	6.78	4,658.08	4,650.04
P-20	1	24 inch	Circular	310.00	7.10	6.41	4,661.39	4,658.24
P-19	1	18 inch	Circular	81.00	0.99	2.42	4,661.74	4,661.39

Label	Total System Flow (cfs)	Ground Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
O-1	19.91	4,645.00	4,640.96	4,640.96
I-18	19.92	4,651.47	4,647.66	4,647.66
I-17	15.08	4,657.11	4,649.82	4,649.82
I-19	2.49	4,651.62	4,648.09	4,648.09
I-16	10.69	4,657.13	4,650.04	4,650.04
J-6	7.09	4,662.99	4,658.08	4,658.08
I-15	7.10	4,668.81	4,661.39	4,661.39
I-14	0.99	4,668.81	4,661.74	4,661.74

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Scenario: 12600 South
Inlet Report - Riverton and UDOT Flows

Project Engineer: Horrocks Engineers
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Horrocks Engineers StormCAD v4.1.1 [4.2014]
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Label	Calculated Station (ft)	Ground Elevation (ft)	Set Rim Equal to Ground Elevation?	Rim Elevation (ft)	Sump Elevation (ft)	Area (acres)	Inlet C	Inlet CA (acres)	Time of Concentration (min)	External CA (acres)	External Time of Concentration (min)	Additional Flow (cfs)	Additional Carryover (cfs)	Known Flow (cfs)	Inlet	Inlet Location	Description
I-1	36+10	4,730.78	true	4,730.78	4,712.86	0.00	0.00	0.00	5.00	0.00	0.00	15.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-2	30+11	4,715.33	true	4,715.33	4,709.30	0.71	0.88	0.62	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-4	26+37	4,708.63	true	4,708.63	4,700.00	0.44	0.88	0.39	5.00	0.00	0.00	8.95	0.00	0.00	Combination APWA Design Combo	On Grade	
I-3	29+32	4,715.31	true	4,715.31	4,708.00	0.71	0.88	0.62	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-6	20+58	4,697.90	true	4,697.90	4,692.19	0.71	0.87	0.62	5.00	0.00	0.00	2.36	0.00	0.00	Combination APWA Design Combo	On Grade	
I-5	23+85	4,705.00	true	4,705.00	4,698.19	0.66	0.87	0.58	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-7	19+77	4,697.88	true	4,697.88	4,691.40	0.50	0.87	0.43	5.00	0.00	0.00	4.63	0.00	0.00	Combination APWA Design Combo	On Grade	
I-8	16+12	4,690.11	true	4,690.11	4,682.31	0.55	0.88	0.48	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-9	15+30	4,690.11	true	4,690.11	4,681.50	0.55	0.88	0.48	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-10	11+73	4,680.80	true	4,680.80	4,673.42	0.55	0.88	0.48	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-12	8+38	4,674.75	true	4,674.75	4,667.37	0.43	0.88	0.38	5.00	0.00	0.00	3.42	0.00	0.00	Combination APWA Design Combo	In Sag	
I-11	10+92	4,680.80	true	4,680.80	4,672.61	0.55	0.88	0.48	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-13	7+57	4,674.75	true	4,674.75	4,666.56	0.43	0.88	0.38	5.00	0.00	0.00	3.00	0.00	0.00	Combination APWA Design Combo	In Sag	
I-14	13+18	4,668.81	true	4,668.81	4,661.43	0.43	0.88	0.38	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-15	12+37	4,668.81	true	4,668.81	4,660.62	0.43	0.88	0.38	5.00	0.00	0.00	0.87	0.00	0.00	Combination APWA Design Combo	On Grade	
I-16	5+84	4,657.13	true	4,657.13	4,649.08	0.82	0.87	0.72	5.00	0.00	0.00	1.92	0.00	0.00	Combination APWA Design Combo	On Grade	
I-19	2+78	4,651.62	true	4,651.62	4,647.60	0.40	0.87	0.35	5.00	0.00	0.00	1.38	0.00	0.00	Combination APWA Design Combo	On Grade	
I-17	5+05	4,657.11	true	4,657.11	4,648.27	0.82	0.87	0.72	5.00	0.00	0.00	2.71	0.00	0.00	Combination APWA Design Combo	On Grade	
I-18	1+91	4,651.47	true	4,651.47	4,646.70	0.40	0.87	0.35	5.00	0.00	0.00	1.28	0.00	0.00	Combination APWA Design Combo	On Grade	

These calculations are based upon the drainage basin shown in Figure 1 with 5 cfs coming from the Western Springs detention pond and 10 cfs from the future UDOT Legacy Highway. Inlet areas were calculated for asphalt ("C" value of 0.95), concrete ("C" value of 0.95), and park strip/planter areas ("C" value of 0.15). Flow from water landing on the concrete sidewalk is assumed to travel directly to the inlet without passing over the planter area; this is a conservative analysis.

Scenario: 12600 South
Pipe Report - Riverton and UDOT Flows

Project Engineer: Horrocks Engineers
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Horrocks Engineers StormCAD v4.1.1 [4.2014]
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Label	Upstream Node	Downstream Node	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Mannings n	Full Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Cover (ft)	Downstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Description	
P-1	I-1	J-1	0.00		0.00	0.00	0.00	15.00	398.00	0.005025	24 inch	0.013	16.04	4,712.86	4,710.86	4,730.78	4,721.28	15.92	8.42	4,714.39	4,712.39		
P-3	I-2	I-3	0.71		0.88	0.62	0.57	2.64	1.51	79.00	0.016456	18 inch	0.013	13.47	4,709.30	4,708.00	4,715.33	4,715.31	4.53	5.81	4,709.64	4,709.03	
P-2	J-1	I-3	N/A		N/A	N/A	0.00	0.00	15.00	280.00	0.010214	24 inch	0.013	22.86	4,710.86	4,708.00	4,721.28	4,715.31	8.42	5.31	4,712.04	4,709.18	
P-5	I-4	J-2	0.44		0.88	0.39	0.43	2.64	10.08	76.00	0.005263	18 inch	0.013	7.62	4,700.00	4,699.60	4,708.63	4,708.61	7.13	7.51	4,704.92	4,704.22	
P-4	I-3	J-2	0.71		0.88	0.62	1.14	2.63	18.01	371.00	0.022642	24 inch	0.013	34.04	4,708.00	4,699.60	4,715.31	4,708.61	5.31	7.01	4,709.03	4,704.22	
P-6	J-2	I-5	N/A		N/A	N/A	1.56	2.62	28.08	176.00	0.008011	24 inch	0.013	20.25	4,699.60	4,698.19	4,708.61	4,705.00	7.01	4.81	4,704.22	4,701.51	
P-8	I-6	I-7	0.71		0.87	0.62	0.58	2.64	3.89	81.00	0.009753	18 inch	0.013	10.37	4,692.19	4,691.40	4,697.90	4,697.88	4.21	4.98	4,694.64	4,694.53	
P-7	I-5	I-7	0.66		0.87	0.58	2.14	2.62	29.59	408.00	0.016642	24 inch	0.013	29.18	4,698.19	4,691.40	4,705.00	4,697.88	4.81	4.48	4,701.51	4,694.53	
P-9	I-7	J-3	0.50		0.87	0.43	3.18	2.61	39.32	260.00	0.025769	24 inch	0.013	36.31	4,691.40	4,684.70	4,697.88	4,694.21	4.48	7.51	4,694.53	4,686.67	
P-11	I-8	I-9	0.55		0.88	0.48	0.52	2.64	1.38	82.00	0.009878	18 inch	0.013	10.44	4,682.31	4,681.50	4,690.11	4,690.11	6.30	7.11	4,683.07	4,683.07	
P-10	J-3	I-9	N/A		N/A	N/A	3.18	2.61	39.31	187.00	0.014439	30 inch	0.013	49.28	4,684.20	4,681.50	4,694.21	4,690.11	7.51	6.11	4,685.89	4,683.19	
P-12	I-9	I-11	0.55		0.88	0.48	4.19	2.61	41.95	438.00	0.020297	30 inch	0.013	58.43	4,681.50	4,672.61	4,690.11	4,680.80	6.11	5.69	4,683.07	4,674.37	
P-13	I-10	I-11	0.55		0.88	0.48	0.48	2.64	1.27	81.00	0.010000	18 inch	0.013	10.50	4,673.42	4,672.61	4,680.80	4,680.80	5.88	6.69	4,674.37	4,674.37	
P-15	I-12	I-13	0.43		0.88	0.38	0.40	2.64	4.48	81.00	0.010000	18 inch	0.013	10.50	4,667.37	4,666.56	4,674.75	4,674.75	5.88	6.69	4,669.92	4,669.77	
P-14	I-11	I-13	0.55		0.88	0.48	5.14	2.60	44.43	335.00	0.016567	30 inch	0.013	52.79	4,672.61	4,667.06	4,680.80	4,674.75	5.69	5.19	4,674.37	4,669.77	
P-16	I-13	J-4	0.43		0.88	0.38	5.94	2.57	52.77	42.00	0.005000	36 inch	0.013	47.16	4,666.56	4,666.35	4,674.75	4,673.84	5.19	4.49	4,669.77	4,669.51	
P-17	J-4	J-5	N/A		N/A	N/A	5.46	2.57	48.50	287.00	0.005052	36 inch	0.013	47.41	4,666.35	4,664.90	4,673.84	4,672.40	4.49	4.50	4,669.51	4,667.99	
P-18	J-5	O-2	N/A		N/A	N/A	5.46	2.50	48.16	428.00	0.005000	36 inch	0.013	47.16	4,664.90	4,662.76	4,672.40	4,670.26	4.50	4.50	4,667.99	4,665.76	
P-19	I-14	I-15	0.43		0.88	0.38	0.37	2.64	0.99	81.00	0.010000	18 inch	0.013	10.50	4,661.43	4,660.62	4,668.81	4,668.81	5.88	6.69	4,661.74	4,661.39	
P-20	I-15	J-6	0.43		0.88	0.38	1.22	2.64	7.10	310.00	0.010161	24 inch	0.013	22.80	4,660.62	4,657.47	4,668.81	4,662.99	6.19	3.52	4,661.39	4,658.24	
P-21	J-6	I-16	N/A		N/A	N/A	1.22	2.63	7.09	343.00	0.024461	24 inch	0.013	35.38	4,657.47	4,649.08	4,662.99	4,657.13	3.52	6.05	4,658.08	4,650.04	
P-22	I-16	I-17	0.82		0.87	0.72	1.86	2.62	10.69	79.00	0.010253	24 inch	0.013	22.91	4,649.08	4,648.27	4,657.13	4,657.11	6.05	6.84	4,650.04	4,649.82	
P-25	I-19	I-18	0.40		0.87	0.35	0.42	2.64	2.49	87.00	0.010345	18 inch	0.013	10.68	4,647.60	4,646.70	4,651.62	4,651.47	2.52	3.27	4,648.09	4,647.66	
P-23	I-17	I-18	0.82		0.87	0.72	2.49	2.62	15.08	314.00	0.005000	24 inch	0.013	16.00	4,648.27	4,646.70	4,657.11	4,651.47	6.84	2.77	4,649.82	4,648.25	
P-24	I-18	O-1	0.40		0.87	0.35	3.33	2.61	19.92	191.00	0.035079	24 inch	0.013	42.37	4,646.70	4,640.00	4,651.47	4,645.00	2.77	3.00	4,647.66	4,640.96	

These sizes and calculations are based upon the drainage basin shown in Figure 1 with 5 cfs coming from the Western Springs detention pond and 10 cfs coming from the future UDOT Legacy Highway. The addition of the 10 cfs from UDOT in relation to the Riverton Only Flows (see Appendix A) required pipe P-10 to increase from 24" to 30", pipe P-12 to increase from 24" to 30", pipe P-16 to increase from 30" to 36", and pipe P-17 to increase from 30" to 36". Pipe P-18 will need to be up-sized, but it is not part of the construction of 126th South. It will be built as part of the 4150 West Roadway.

Appendix C

Riverton and UDOT Full Capacity:

**Hydraulic Analysis,
Inlet Report &
Pipe Report**

Riverton and Udot Full Capacity

12600 South Storm Drain Report - Riverton and Udot Full Capacity

This scenario shows the capacity of the Riverton and Udot Flows storm drain system. A total of 18 cfs can be discharged into Inlet I-1 without flooding occurring. It should be noted that Inlet I-4 is 4" from flooding out the top and Inlet I-5 is 9" from flooding out the top. If more than 18 cfs is discharged into the system, the piping must be upsized or flooding will occur at these locations.

The drainage basin is shown in Figure 1 with delineated sub-basins. The location where runoff from the sub-basins enters the storm drain system are indicated in Figure 1, as well as the inlet locations.

3.94 cfs is diverted at junction box J4 to continue down 126th South while the remaining 51.78 cfs flows toward Midas Creek.

=====
Gravity subnetwork discharging at: 0-2

```
>>> Info: Loading and hydraulic computations completed
    successfully.
>>> Warning: P-6 Pipe discharge is above full flow capacity.
>>> Warning: P-7 Pipe discharge is above full flow capacity.
>>> Warning: P-3 Pipe fails minimum velocity constraint.
>>> Warning: P-5 Pipe discharge is above full flow capacity.
>>> Warning: P-1 Pipe fails maximum cover constraint.
>>> Warning: P-1 Pipe discharge is above full flow capacity.
>>> Warning: P-9 Pipe discharge is above full flow capacity.
>>> Warning: P-16 Pipe discharge is above full flow capacity.
>>> Warning: P-13 Pipe fails minimum velocity constraint.
>>> Warning: P-11 Pipe fails minimum velocity constraint.
>>> Warning: P-17 Pipe discharge is above full flow capacity.
>>> Warning: P-18 Pipe discharge is above full flow capacity.
```

```
>>> Info: Subsurface Analysis iterations: 2
>>> Info: Convergence was achieved.
```

=====
Gravity subnetwork discharging at: 0-1

```
>>> Info: Loading and hydraulic computations completed
    successfully.
```

CALCULATION SUMMARY FOR SURFACE NETWORKS

Label	Inlet Type	Inlet	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Capture Efficiency (%)	Gutter Spread (ft)	Gutter Depth (ft)
I-12	Combination Inlet	Combination APWA Design Combo	1.06	0.00	100.0	1.26	0.01
I-10	Combination Inlet	Combination APWA Design Combo	1.27	0.06	95.7	4.47	0.21
I-8	Combination Inlet	Combination APWA Design Combo	1.38	0.04	97.0	4.09	0.20
I-6	Combination Inlet	Combination APWA Design Combo	1.53	0.14	91.6	5.23	0.22
I-4	Combination Inlet	Combination APWA Design Combo	1.13	0.03	97.7	3.99	0.20
I-2	Combination Inlet	Combination APWA Design Combo	1.51	0.13	92.0	5.17	0.22
I-13	Combination Inlet	Combination APWA Design Combo	1.06	0.00	100.0	1.26	0.01
I-11	Combination Inlet	Combination APWA Design Combo	1.26	0.05	95.9	4.43	0.21
I-9	Combination Inlet	Combination APWA Design Combo	1.30	0.03	97.8	3.87	0.20
I-7	Combination Inlet	Combination APWA Design Combo	1.25	0.05	96.2	4.37	0.20
I-5	Combination Inlet	Combination APWA Design Combo	1.53	0.14	91.6	5.24	0.22
I-3	Combination Inlet	Combination APWA Design Combo	1.51	0.13	92.0	5.17	0.22
I-1	Combination Inlet	Combination APWA Design Combo	0.00	0.00	100.0	0.00	0.00
I-19	Combination Inlet	Combination APWA Design Combo	1.11	0.03	97.1	4.20	0.20
I-18	Combination Inlet	Combination APWA Design Combo	1.11	0.03	97.1	4.20	0.20
I-17	Combination Inlet	Combination APWA Design Combo	1.70	0.22	88.7	5.73	0.23
I-14	Combination Inlet	Combination APWA Design Combo	0.99	0.01	99.1	3.53	0.19
I-16	Combination Inlet	Combination APWA Design Combo	1.70	0.22	88.7	5.73	0.23
I-15	Combination Inlet	Combination APWA Design Combo	0.99	0.01	99.1	3.53	0.19

CALCULATION SUMMARY FOR SUBSURFACE NETWORK WITH ROOT: 0-2

Label	Number of Sections	Section Size	Section Shape	Length (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Upstream (ft)	Hydraulic Grade Downstream (ft)
P-18	1	36 inch	Circular	428.00	51.46	7.28	4,668.31	4,665.76
P-17	1	36 inch	Circular	287.00	51.78	7.32	4,670.04	4,668.31
P-16	1	36 inch	Circular	42.00	55.72	7.88	4,670.33	4,670.04
P-14	1	30 inch	Circular	335.00	47.42	10.91	4,674.46	4,670.33
P-15	1	18 inch	Circular	81.00	4.48	< 0.52	4,670.48	4,670.33
P-13	1	18 inch	Circular	81.00	1.27	< 0.84	4,674.47	4,674.46
P-12	1	30 inch	Circular	438.00	44.95	12.33	4,683.14	4,674.46
P-10	1	30 inch	Circular	187.00	42.31	11.29	4,685.98	4,683.28
P-11	1	18 inch	Circular	82.00	1.38	(1.07)	4,683.15	4,683.14
P-9	1	24 inch	Circular	260.00	42.32	13.48	4,695.78	4,686.68
P-7	1	24 inch	Circular	408.00	32.59	10.32	4,704.25	4,695.78
P-8	1	18 inch	Circular	81.00	3.89	2.20	4,695.89	4,695.78
P-6	1	24 inch	Circular	176.00	31.07	9.89	4,707.57	4,704.25
P-4	1	24 inch	Circular	371.00	21.01	6.69	4,710.77	4,707.57
P-5	1	18 inch	Circular	76.00	10.08	5.71	4,708.27	4,707.57
P-2	1	24 inch	Circular	280.00	18.00	6.90	4,712.20	4,710.77
P-3	1	18 inch	Circular	79.00	1.51	0.86	4,710.78	4,710.77
P-1	1	24 inch	Circular	398.00	18.00	5.93	4,715.14	4,712.62

Riverton and Udot Full Capacity

Label	Total System Flow (cfs)	Ground Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
O-2	50.98	4,670.26	4,665.76	4,665.76
J-5	51.46	4,672.40	4,668.31	4,668.31
J-4	51.78	4,673.84	4,670.04	4,670.04
I-13	55.72	4,674.75	4,670.33	4,670.33
I-11	47.42	4,680.80	4,674.46	4,674.46
I-12	4.48	4,674.75	4,670.48	4,670.48
I-10	1.27	4,680.80	4,674.47	4,674.47
I-9	44.95	4,690.11	4,683.14	4,683.14
J-3	42.31	4,694.21	4,685.98	4,685.98
I-8	1.38	4,690.11	4,683.15	4,683.15
I-7	42.32	4,697.88	4,695.78	4,695.78
I-5	32.59	4,705.00	4,704.25	4,704.25
I-6	3.89	4,697.90	4,695.89	4,695.89
J-2	31.07	4,708.61	4,707.57	4,707.57
I-3	21.01	4,715.31	4,710.77	4,710.77
I-4	10.08	4,708.63	4,708.27	4,708.27
J-1	18.00	4,721.28	4,712.20	4,712.20
I-2	1.51	4,715.33	4,710.78	4,710.78
I-1	18.00	4,730.78	4,715.14	4,715.14

CALCULATION SUMMARY FOR SUBSURFACE NETWORK WITH ROOT: O-1

Label	Number of Sections	Section Size	Section Shape	Length (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Upstream (ft)	Hydraulic Grade Downstream (ft)
P-24	1	24 inch	Circular	191.00	19.60	13.22	4,647.66	4,640.96
P-23	1	24 inch	Circular	314.00	14.76	5.78	4,649.79	4,648.22
P-25	1	18 inch	Circular	87.00	2.49	3.51	4,648.09	4,647.66
P-22	1	24 inch	Circular	79.00	10.37	5.58	4,650.02	4,649.79
P-21	1	24 inch	Circular	343.00	6.77	6.66	4,658.06	4,650.02
P-20	1	24 inch	Circular	310.00	6.78	6.33	4,661.37	4,658.22
P-19	1	18 inch	Circular	81.00	0.99	2.43	4,661.74	4,661.37

Label	Total System Flow (cfs)	Ground Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
O-1	19.59	4,645.00	4,640.96	4,640.96
I-18	19.60	4,651.47	4,647.66	4,647.66
I-17	14.76	4,657.11	4,649.79	4,649.79
I-19	2.49	4,651.62	4,648.09	4,648.09
I-16	10.37	4,657.13	4,650.02	4,650.02
J-6	6.77	4,662.99	4,658.06	4,658.06
I-15	6.78	4,668.81	4,661.37	4,661.37
I-14	0.99	4,668.81	4,661.74	4,661.74

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Scenario: 12600 South
Inlet Report - Riverton and UDOT Full Capacity

Project Engineer: Horrocks Engineers
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Label	Calculated Station (ft)	Ground Elevation (ft)	Set Rim Equal to Ground Elevation?	Rim Elevation (ft)	Sump Elevation (ft)	Area (acres)	Inlet C	Inlet CA (acres)	Time of Concentration (min)	External CA (acres)	External Time of Concentration (min)	Additional Flow (cfs)	Additional Carryover (cfs)	Known Flow (cfs)	Inlet	Inlet Location	Description
I-1	36+10	4,730.78	true	4,730.78	4,712.86	0.00	0.00	0.00	5.00	0.00	0.00	18.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-2	30+11	4,715.33	true	4,715.33	4,709.30	0.71	0.88	0.62	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-4	26+37	4,708.63	true	4,708.63	4,700.00	0.44	0.88	0.39	5.00	0.00	0.00	8.95	0.00	0.00	Combination APWA Design Combo	On Grade	
I-3	29+32	4,715.31	true	4,715.31	4,708.00	0.71	0.88	0.62	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-6	20+58	4,697.90	true	4,697.90	4,692.19	0.71	0.87	0.62	5.00	0.00	0.00	2.36	0.00	0.00	Combination APWA Design Combo	On Grade	
I-5	23+85	4,705.00	true	4,705.00	4,698.19	0.66	0.87	0.58	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-7	19+77	4,697.88	true	4,697.88	4,691.40	0.50	0.87	0.43	5.00	0.00	0.00	4.63	0.00	0.00	Combination APWA Design Combo	On Grade	
I-8	16+12	4,690.11	true	4,690.11	4,682.31	0.55	0.88	0.48	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-9	15+30	4,690.11	true	4,690.11	4,681.50	0.55	0.88	0.48	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-10	11+73	4,680.80	true	4,680.80	4,673.42	0.55	0.88	0.48	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-12	8+38	4,674.75	true	4,674.75	4,667.37	0.43	0.88	0.38	5.00	0.00	0.00	3.42	0.00	0.00	Combination APWA Design Combo	In Sag	
I-11	10+92	4,680.80	true	4,680.80	4,672.61	0.55	0.88	0.48	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-13	7+57	4,674.75	true	4,674.75	4,666.56	0.43	0.88	0.38	5.00	0.00	0.00	3.00	0.00	0.00	Combination APWA Design Combo	In Sag	
I-14	13+18	4,668.81	true	4,668.81	4,661.43	0.43	0.88	0.38	5.00	0.00	0.00	0.00	0.00	0.00	Combination APWA Design Combo	On Grade	
I-15	12+37	4,668.81	true	4,668.81	4,660.62	0.43	0.88	0.38	5.00	0.00	0.00	0.87	0.00	0.00	Combination APWA Design Combo	On Grade	
I-16	5+84	4,657.13	true	4,657.13	4,649.08	0.82	0.87	0.72	5.00	0.00	0.00	1.92	0.00	0.00	Combination APWA Design Combo	On Grade	
I-19	2+78	4,651.62	true	4,651.62	4,647.60	0.40	0.87	0.35	5.00	0.00	0.00	1.38	0.00	0.00	Combination APWA Design Combo	On Grade	
I-17	5+05	4,657.11	true	4,657.11	4,648.27	0.82	0.87	0.72	5.00	0.00	0.00	2.71	0.00	0.00	Combination APWA Design Combo	On Grade	
I-18	1+91	4,651.47	true	4,651.47	4,646.70	0.40	0.87	0.35	5.00	0.00	0.00	1.28	0.00	0.00	Combination APWA Design Combo	On Grade	

These calculations are based upon the drainage basin shown in Figure 1 with an analysis of the full capacity of the Riverton and UDOT Flows piping system (See Appendix B). The sizes and areas are the same as those listed in Appendix B: Riverton and UDOT Flows.

Scenario: 12600 South
Pipe Report - Riverton and UDOT Full Capacity

Project Engineer: Horrocks Engineers
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Label	Upstream Node	Downstream Node	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Mannings n	Full Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Cover (ft)	Downstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Description
P-1	I-1	J-1	0.00	0.00	0.00	0.00	18.00	398.00	0.005025	24 inch	0.013	16.04	4,712.86	4,710.86	4,730.78	4,721.28	15.92	8.42	4,715.14	4,712.62		
P-3	I-2	I-3	0.71	0.88	0.62	0.57	2.64	1.51	79.00	0.016456	18 inch	0.013	13.47	4,709.30	4,708.00	4,715.33	4,715.31	4.53	5.81	4,710.78	4,710.77	
P-2	J-1	I-3	N/A	N/A	N/A	0.00	0.00	18.00	280.00	0.010214	24 inch	0.013	22.86	4,710.86	4,708.00	4,721.28	4,715.31	8.42	5.31	4,712.20	4,710.77	
P-5	I-4	J-2	0.44	0.88	0.39	0.43	2.64	10.08	76.00	0.005263	18 inch	0.013	7.62	4,700.00	4,699.60	4,708.63	4,708.61	7.13	7.51	4,708.27	4,707.57	
P-4	I-3	J-2	0.71	0.88	0.62	1.14	2.63	21.01	371.00	0.022642	24 inch	0.013	34.04	4,708.00	4,699.60	4,715.31	4,708.61	5.31	7.01	4,710.77	4,707.57	
P-6	J-2	I-5	N/A	N/A	N/A	1.56	2.62	31.07	176.00	0.008011	24 inch	0.013	20.25	4,699.60	4,698.19	4,708.61	4,705.00	7.01	4.81	4,707.57	4,704.25	
P-8	I-6	I-7	0.71	0.87	0.62	0.58	2.64	3.89	81.00	0.009753	18 inch	0.013	10.37	4,692.19	4,691.40	4,697.90	4,697.88	4.21	4.98	4,695.89	4,695.78	
P-7	I-5	I-7	0.66	0.87	0.58	2.14	2.62	32.59	408.00	0.016642	24 inch	0.013	29.18	4,698.19	4,691.40	4,705.00	4,697.88	4.81	4.48	4,704.25	4,695.78	
P-9	I-7	J-3	0.50	0.87	0.43	3.18	2.61	42.32	260.00	0.025769	24 inch	0.013	36.31	4,691.40	4,684.70	4,697.88	4,694.21	4.48	7.51	4,695.78	4,686.68	
P-11	I-8	I-9	0.55	0.88	0.48	0.52	2.64	1.38	82.00	0.009878	18 inch	0.013	10.44	4,682.31	4,681.50	4,690.11	4,690.11	6.30	7.11	4,683.15	4,683.14	
P-10	J-3	I-9	N/A	N/A	N/A	3.18	2.61	42.31	187.00	0.014439	30 inch	0.013	49.28	4,684.20	4,681.50	4,694.21	4,690.11	7.51	6.11	4,685.98	4,683.28	
P-12	I-9	I-11	0.55	0.88	0.48	4.19	2.61	44.95	438.00	0.020297	30 inch	0.013	58.43	4,681.50	4,672.61	4,690.11	4,680.80	6.11	5.69	4,683.14	4,674.46	
P-13	I-10	I-11	0.55	0.88	0.48	0.48	2.64	1.27	81.00	0.010000	18 inch	0.013	10.50	4,673.42	4,672.61	4,680.80	4,680.80	5.88	6.69	4,674.47	4,674.46	
P-15	I-12	I-13	0.43	0.88	0.38	0.40	2.64	4.48	81.00	0.010000	18 inch	0.013	10.50	4,667.37	4,666.56	4,674.75	4,674.75	5.88	6.69	4,670.48	4,670.33	
P-14	I-11	I-13	0.55	0.88	0.48	5.14	2.60	47.42	335.00	0.016567	30 inch	0.013	52.79	4,672.61	4,667.06	4,680.80	4,674.75	5.69	5.19	4,674.46	4,670.33	
P-16	I-13	J-4	0.43	0.88	0.38	5.94	2.57	55.72	42.00	0.005000	36 inch	0.013	47.16	4,666.56	4,666.35	4,674.75	4,673.84	5.19	4.49	4,670.33	4,670.04	
P-17	J-4	J-5	N/A	N/A	N/A	5.52	2.56	51.78	287.00	0.005052	36 inch	0.013	47.41	4,666.35	4,664.90	4,673.84	4,672.40	4.49	4.50	4,670.04	4,668.31	
P-18	J-5	O-2	N/A	N/A	N/A	5.52	2.50	51.46	428.00	0.005000	36 inch	0.013	47.16	4,664.90	4,662.76	4,672.40	4,670.26	4.50	4.50	4,668.31	4,665.76	
P-19	I-14	I-15	0.43	0.88	0.38	0.37	2.64	0.99	81.00	0.010000	18 inch	0.013	10.50	4,661.43	4,660.62	4,668.81	4,668.81	5.88	6.69	4,661.74	4,661.37	
P-20	I-15	J-6	0.43	0.88	0.38	1.16	2.64	6.78	310.00	0.010161	24 inch	0.013	22.80	4,660.62	4,657.47	4,668.81	4,662.99	6.19	3.52	4,661.37	4,658.22	
P-21	J-6	I-16	N/A	N/A	N/A	1.16	2.63	6.77	343.00	0.024461	24 inch	0.013	35.38	4,657.47	4,649.08	4,662.99	4,657.13	3.52	6.05	4,658.06	4,650.02	
P-22	I-16	I-17	0.82	0.87	0.72	1.80	2.62	10.37	79.00	0.010253	24 inch	0.013	22.91	4,649.08	4,648.27	4,657.13	4,657.11	6.05	6.84	4,650.02	4,649.79	
P-25	I-19	I-18	0.40	0.87	0.35	0.42	2.64	2.49	87.00	0.010345	18 inch	0.013	10.68	4,647.60	4,646.70	4,651.62	4,651.47	2.52	3.27	4,648.09	4,647.66	
P-23	I-17	I-18	0.82	0.87	0.72	2.44	2.62	14.76	314.00	0.005000	24 inch	0.013	16.00	4,648.27	4,646.70	4,657.11	4,651.47	6.84	2.77	4,649.79	4,648.22	
P-24	I-18	O-1	0.40	0.87	0.35	3.27	2.61	19.60	191.00	0.035079	24 inch	0.013	42.37	4,646.70	4,640.00	4,651.47	4,645.00	2.77	3.00	4,647.66	4,640.96	

These sizes are the same as the Riverton and UDOT Flows (see Appendix B). Calculations are based upon the full capacity of the drainage system before flooding occurs; 18 cfs inflow at inlet I-1.

Appendix D

Orifice Plate Design

126th South Orifice Design Worksheet for Rectangular Orifice

Project Engineer: Scott Olson

c:\...\utilities\storm drain\orifice plate.fm2
12/22/04 2:59

Horrocks Engineers

© Haestad Methods, Inc. 37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

FlowMaster v6.0 [614b]

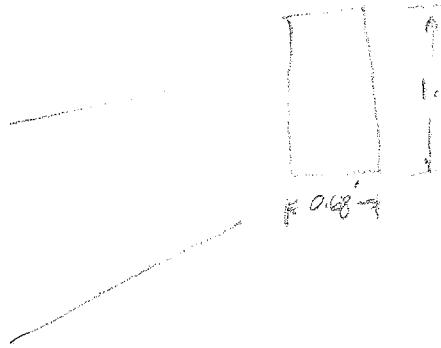
Page 1

Project Description

Worksheet 12600 South Orifice
Type Rectangular Orifice
Solve For Opening Width

Input Data

Discharge	4.27	cfs
Headwater Elevation	4,669.51	ft
Centroid Elevation	4,667.93	ft
Tailwater Elevation	4,666.35	ft
Discharge Coefficient	0.62	
Opening Height	1.00	ft



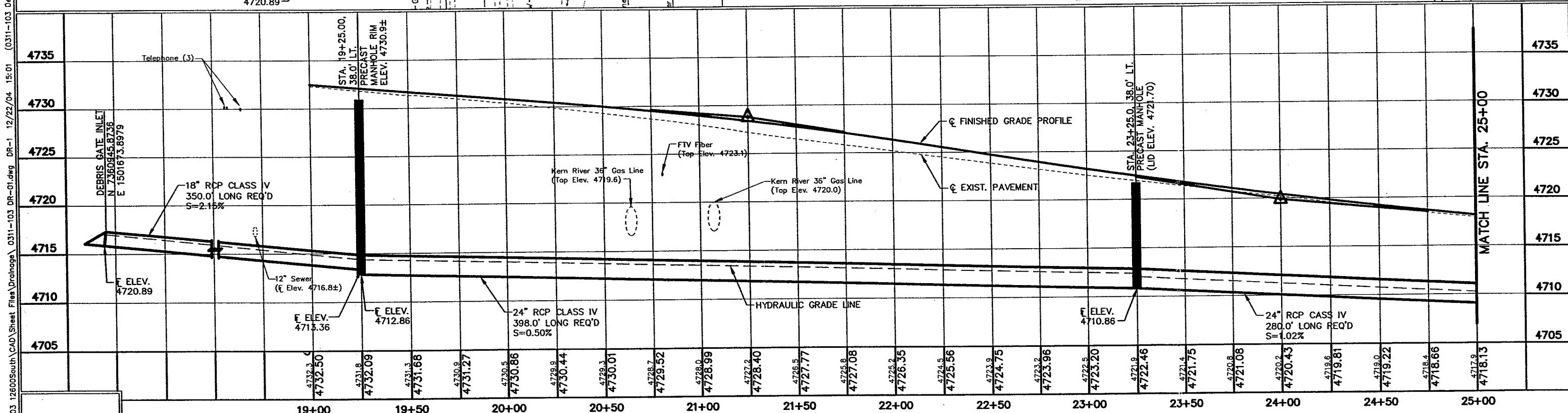
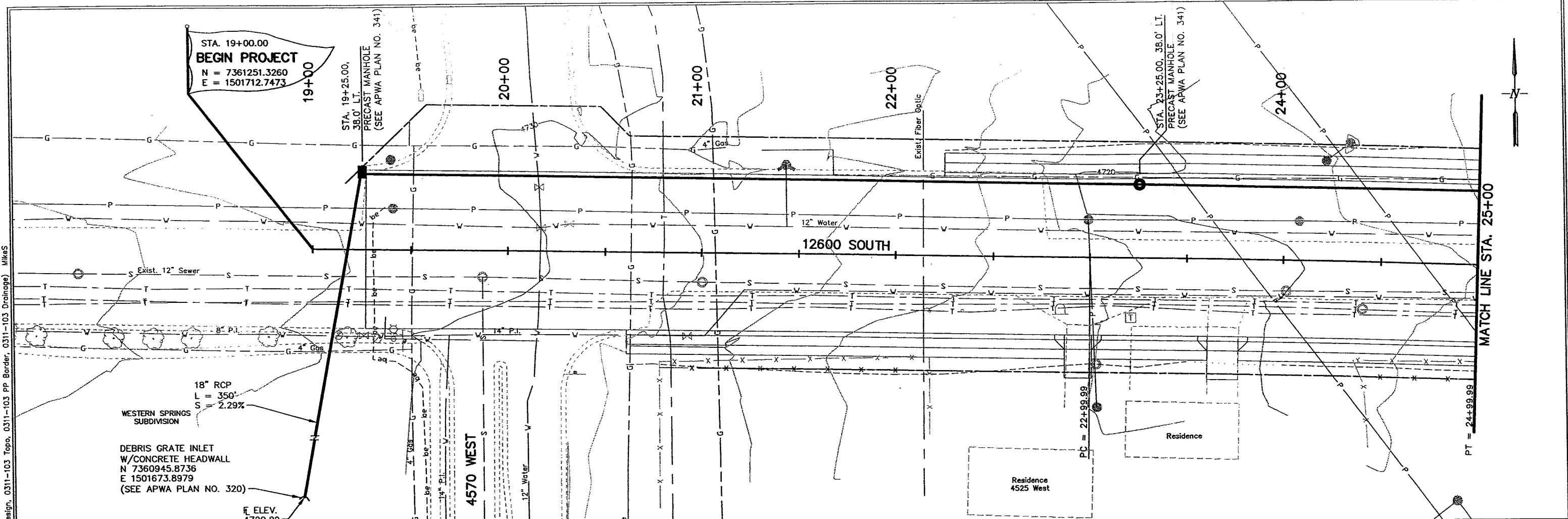
Results

Opening Width	0.68	ft
Headwater Height Above Centroid	1.58	ft
Tailwater Height Above Centroid	-1.58	ft
Flow Area	0.7	ft ²
Velocity	6.25	ft/s

Appendix E

Drainage Plan Sheets

(Hydraulic grade line shows the Riverton and UDOT Flows scenario)



A graphic scale bar with markings at 0, 12.5, 25, and 50. The scale is labeled "GRAPHIC SCALE" above it and "(IN FEET)" below it.

**HORROCK
ENGINEER**

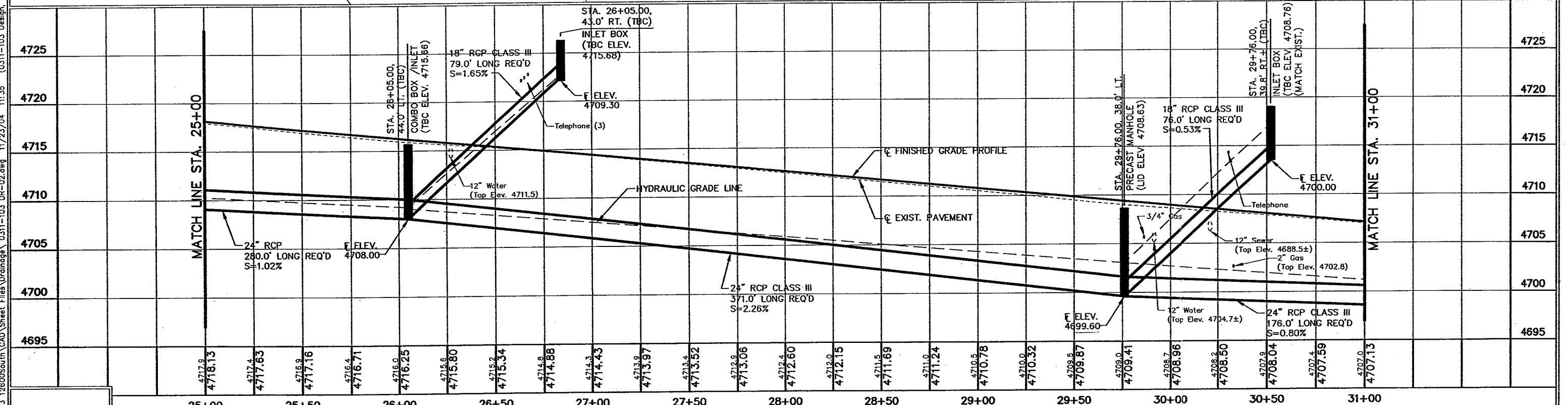
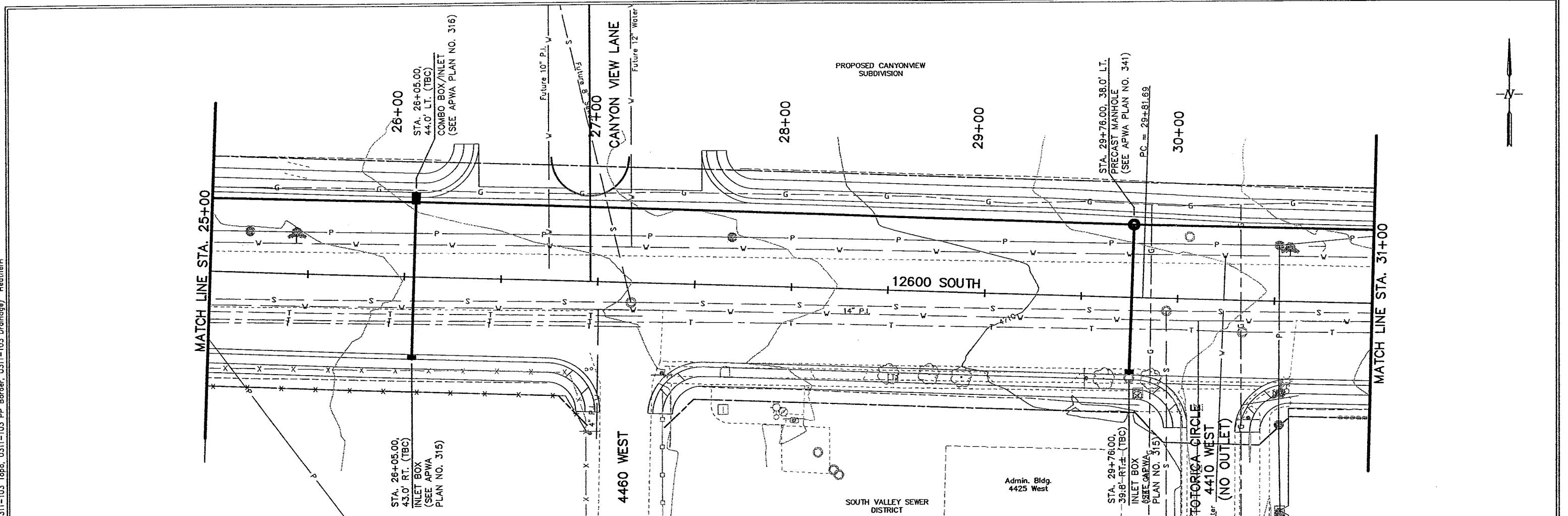
ONE WEST
P.O. BOX
AMERICAN
(801) 763-

RIVERTON 12600 SOUT

DRAINAGE PLAN

STA. 19+00 TO STA. 25+00

DESIGNED SO	CHECKED X	DRAWN BCS	DATE 04/04
APPROVED X	DATE X	PROJECT NO. 0311-103	SCALE 1"=50'
REVISIONS X	DWG. NO. X	SHEET NO. 32	OF 49



A graphic scale diagram consisting of a horizontal line with tick marks. The labels above the line are 25, 0, 12.5, 25, and 50. Below the line, the text '(IN FEET)' is centered.



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P.O.
AMERI
(801)

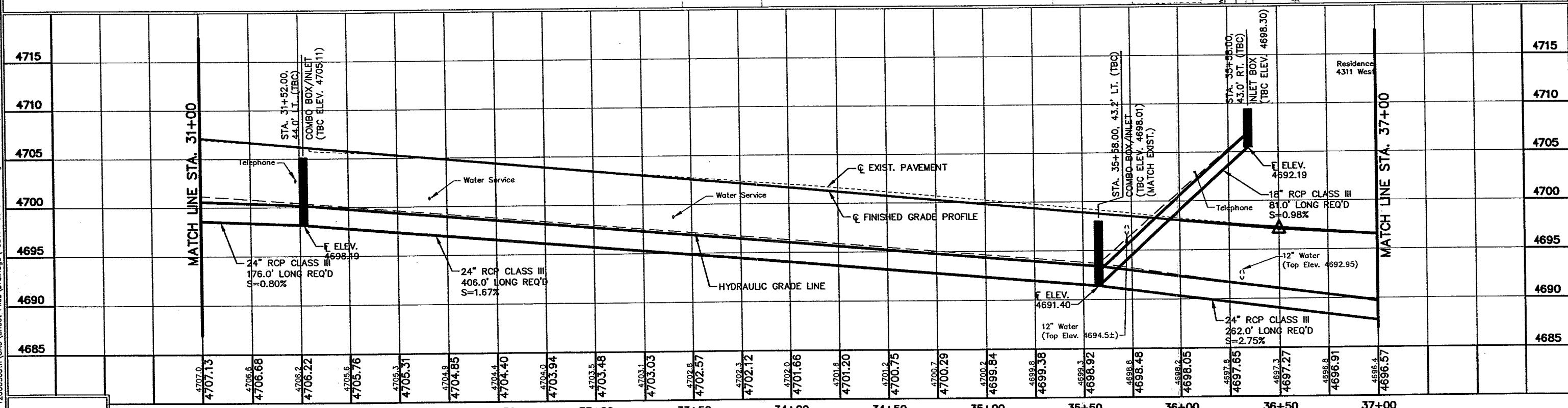
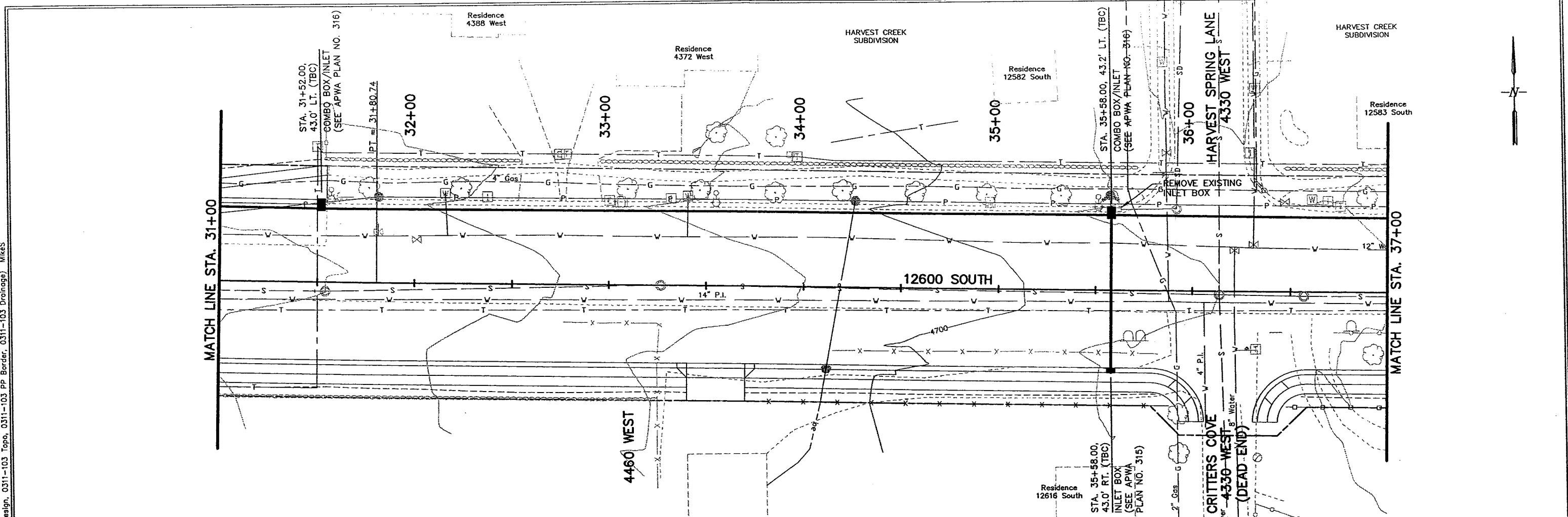
WEST MAIN
BOX 377
CAN FORK
763-5100

RIVERTON 12600 SOUTH

DRAINAGE PLAN

STA. 25+00 TO STA. 31+00

	DESIGNED SO	CHECKED X	DRAWN BCS	DATE 04/04
	APPROVED X	DATE X	PROJECT. NO. 0311-103	SCALE 1"=50'
	REVISIONS X	DRWG. NO. X	SHEET NO. 33	OF 49



A graphic scale consisting of a horizontal line with tick marks and numerical labels. The labels are 25, 0, 12.5, 25, and 50. Below the line is a black and white checkerboard pattern. At the bottom center, the text '(IN FEET)' is written in parentheses.



ONE WEST MAIN
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(801) 763-5100

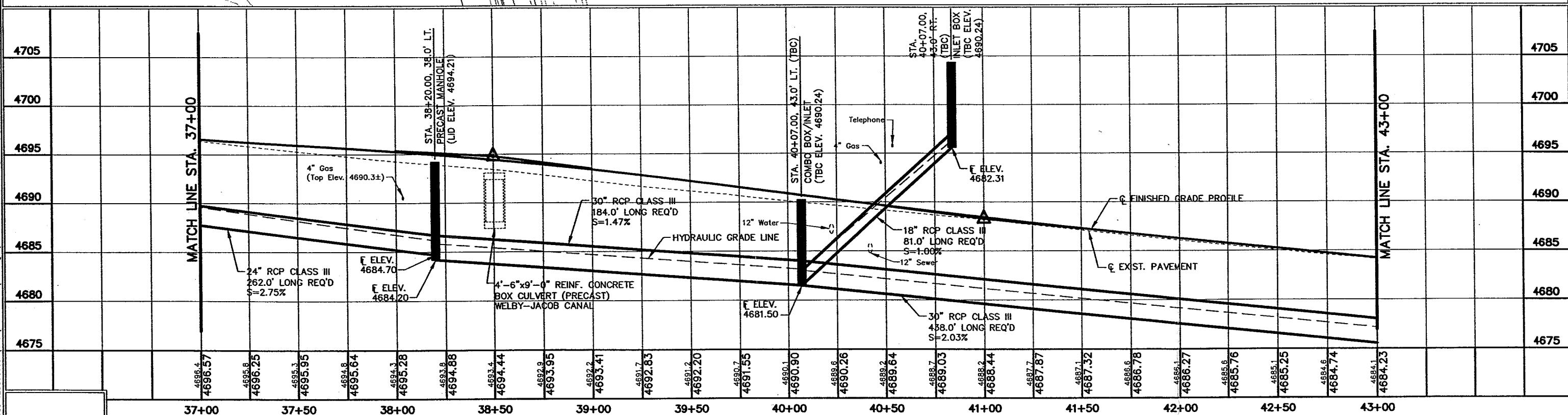
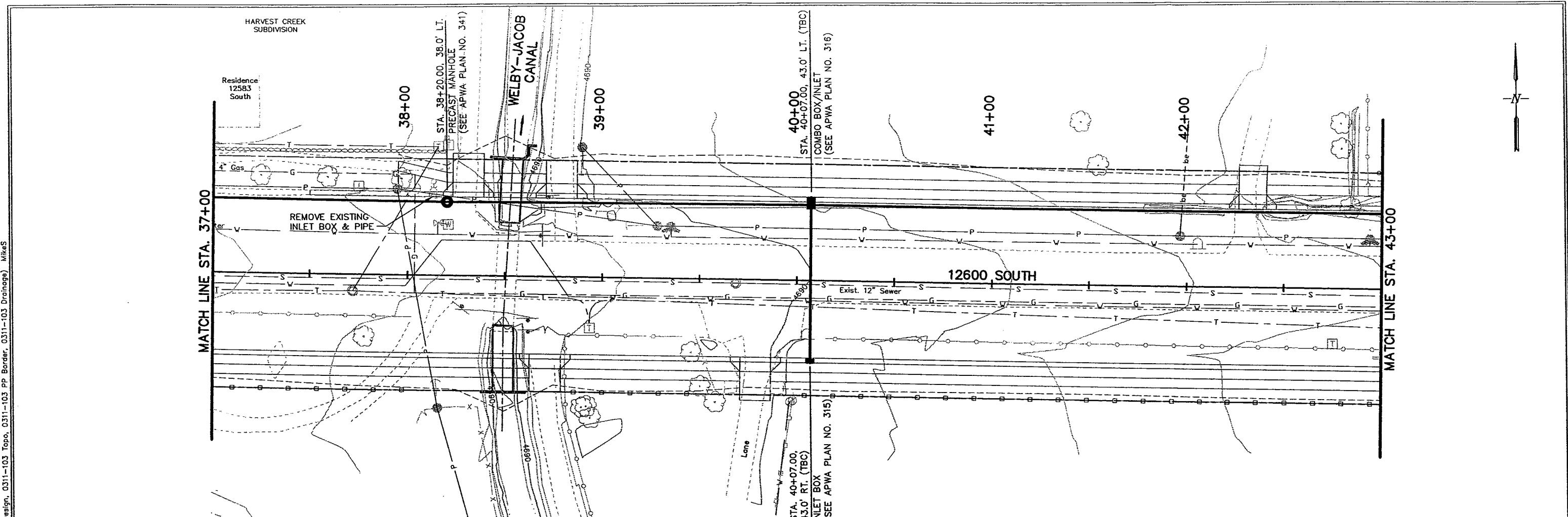
RIVERTON 12600 SOUTH

RIVERTON CITY

DRAINAGE PLAN

STA. 31+00 TO STA. 37+00

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SO	X	BCS	04/04
APPROVED	DATE	PROJECT. NO.	SCALE
X	X	0311-103	1"=50'
REVISIONS	DWG. NO.	SHEET NO.	
X	X	34 OF 49	



A graphic scale with markings at 0, 12.5, 25, and 50 feet.



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AMERICAN FORUM
(801) 763-5111

RIVERTON 12600 SOUTH

RIVERTON CITY

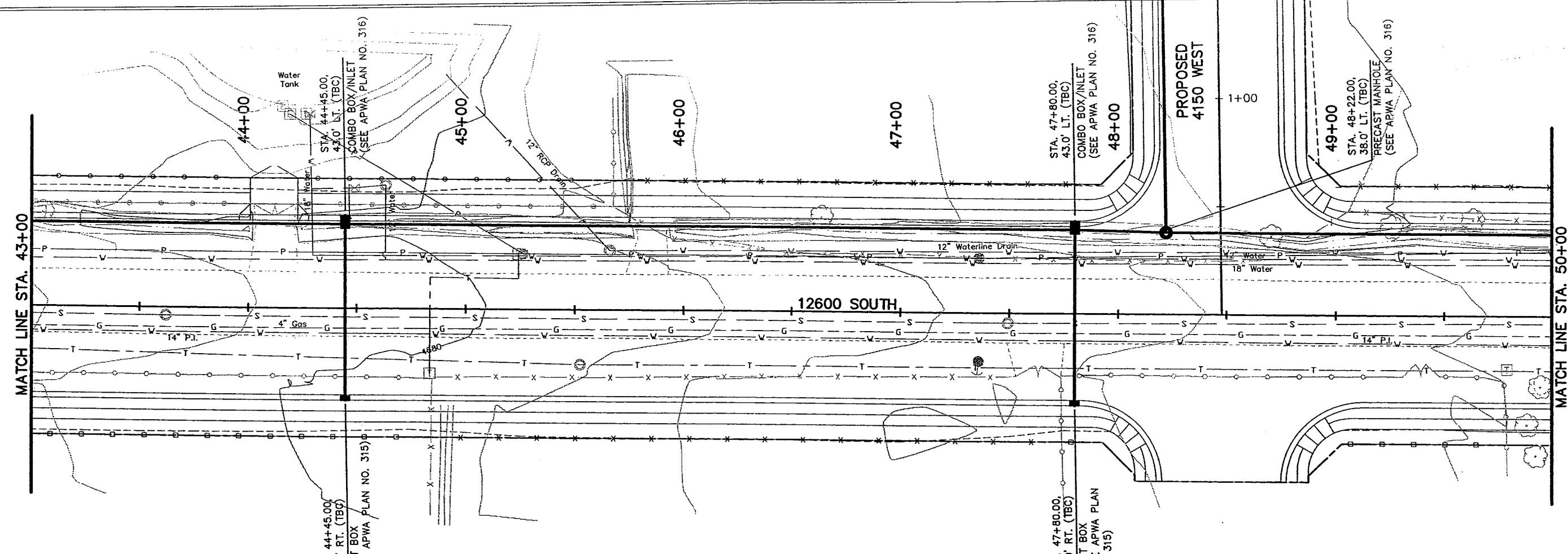
DRAINAGE PLAN

STA. 37+00 TO STA. 43+00

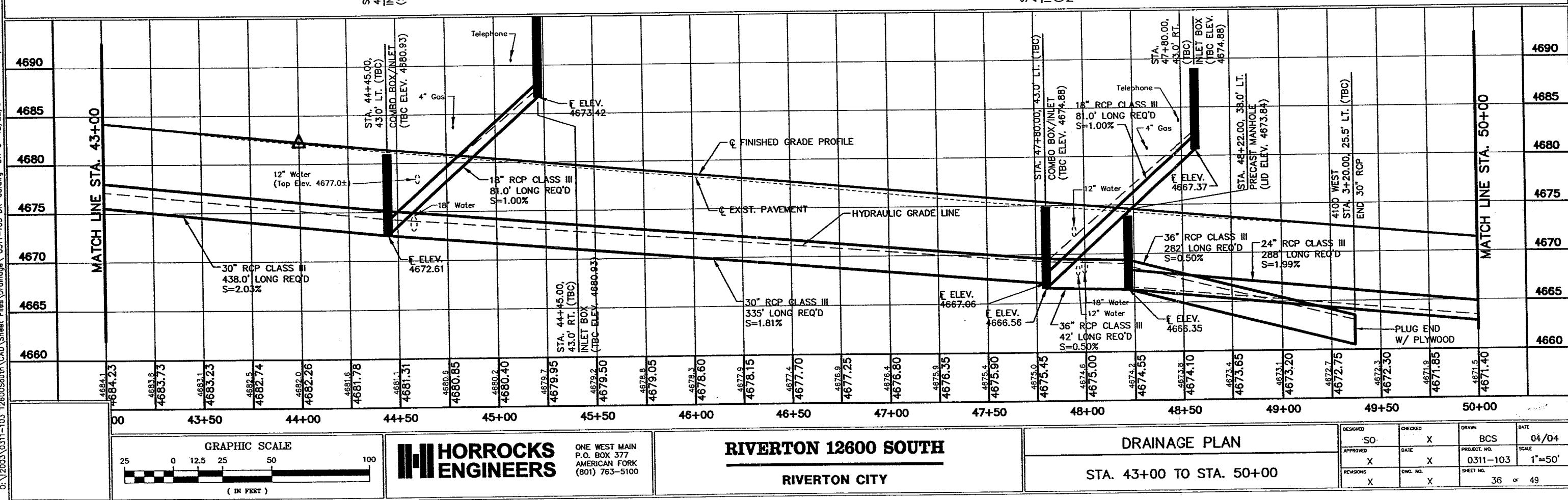
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APPROVED	DATE	PROJECT NO.	SCALE
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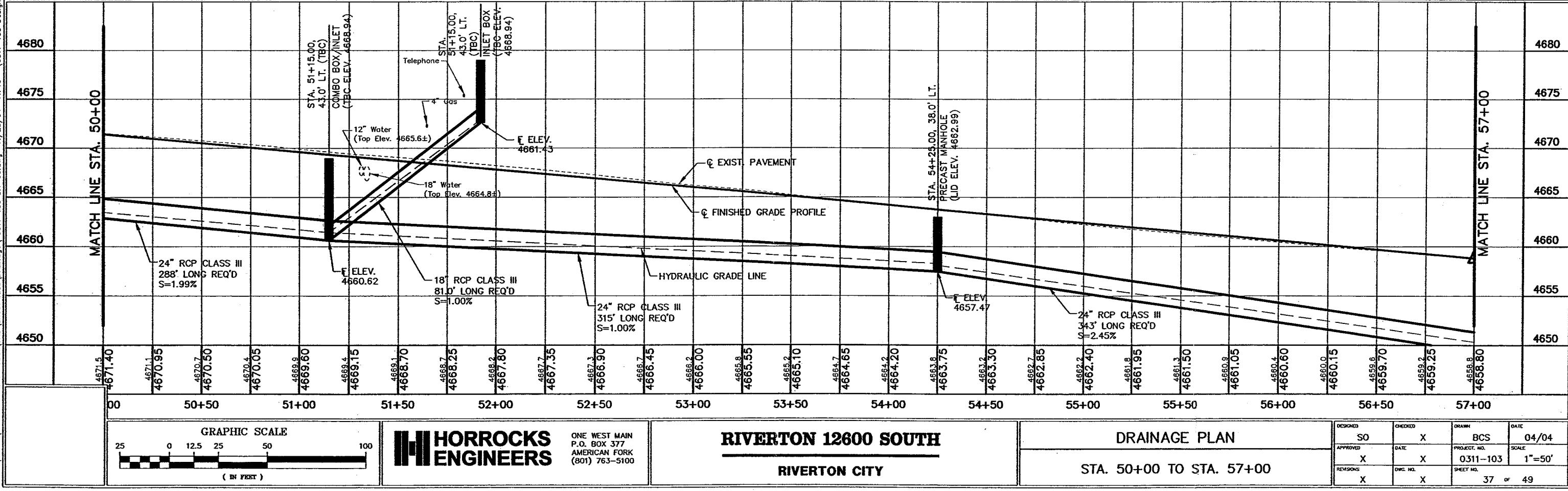
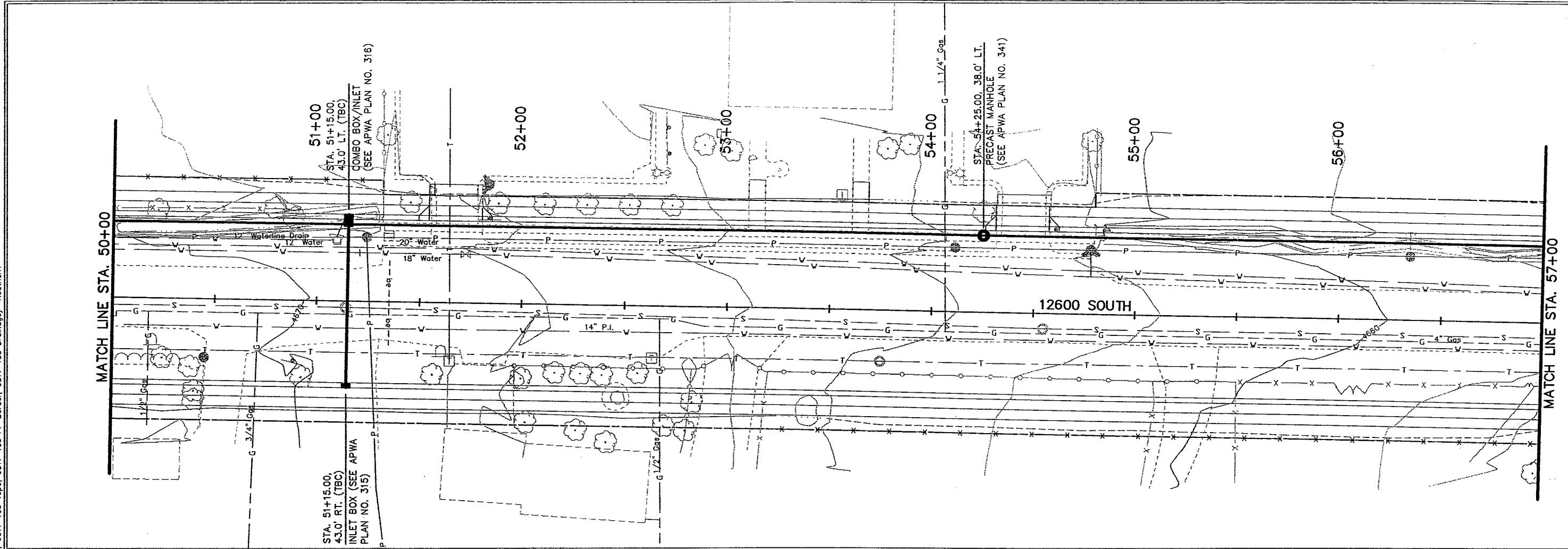
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X	X	35	of 49

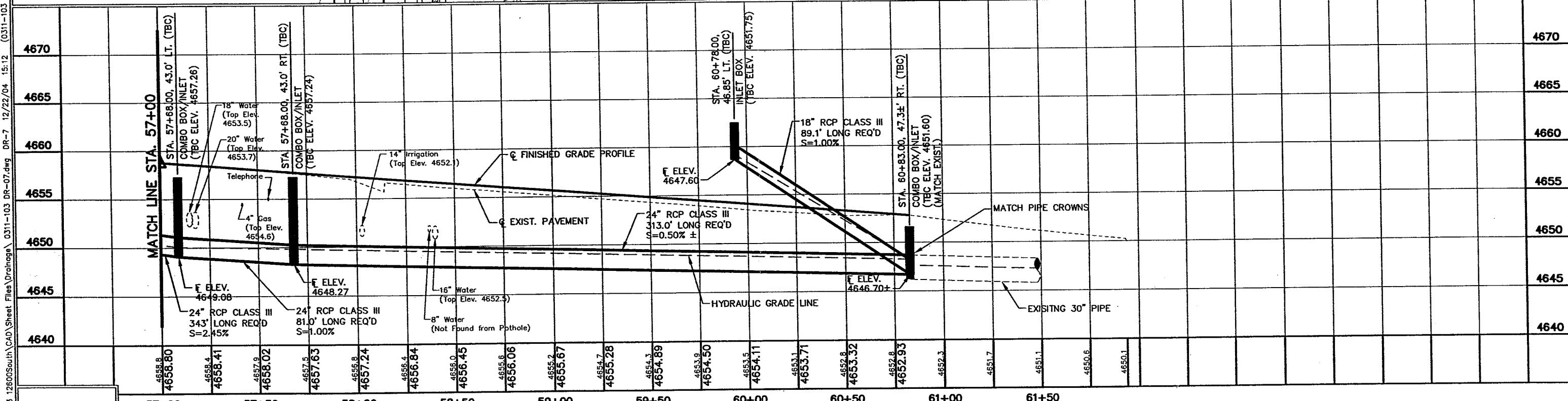
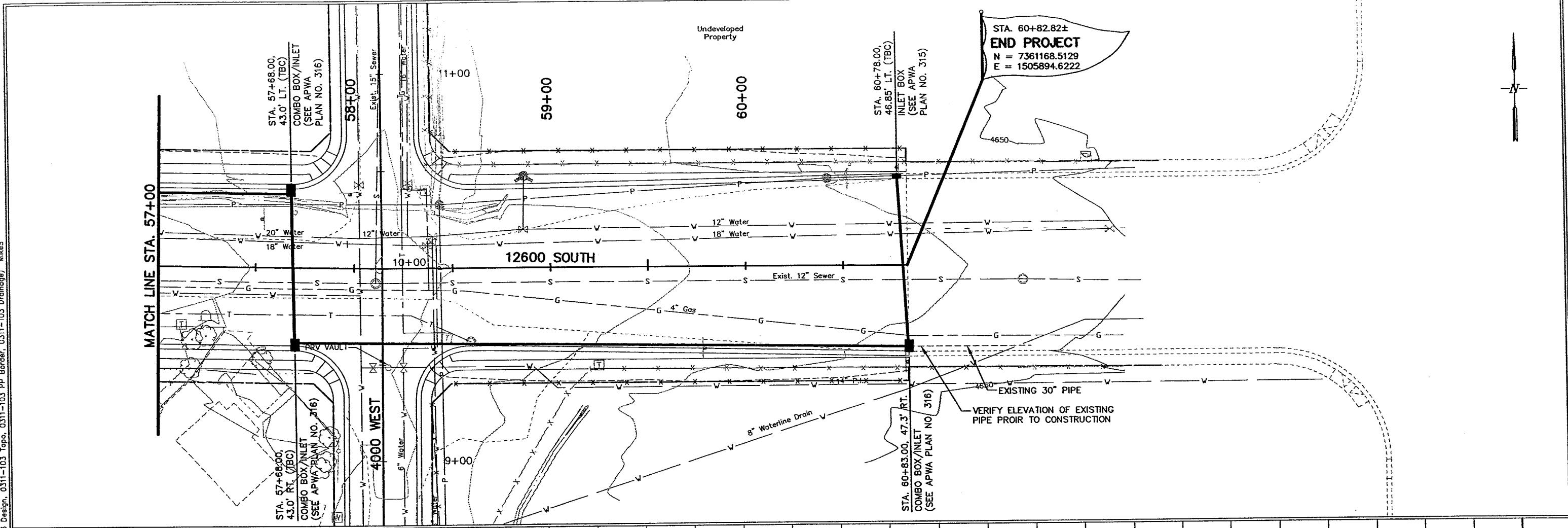
MATCH LINE STA. 43+00



MATCH LINE STA. 50+00







GRAPHIC SCALE
25 0 12.5 25 50 100
(IN FEET)

**HORROCKS
ENGINEERS**

ONE WEST MAIN
P.O. BOX 377
AMERICAN FORK
(801) 763-5100

RIVERTON 12600 SOUTH
RIVERTON CITY

DRAINAGE PLAN
STA. 57+00 TO STA. 60+82.82

DESIGNED BY	CHECKED BY	DRAWN BY	DATE
SO	X	BCS	04/04
APPROVED BY	DATE	PROJECT NO.	SCALE
X		0311-103	1"=50'
REVISIONS	DWG. NO.	SHEET NO.	
X	X	38	of 49

To: Mr. Frederick Lutze, P.E
City of Riverton
From: E.Bramwell
Date: November 23, 2004



Subject: 12600 south - Bangerter to 4570 west
Submittal of Current status Products

Transmittal

The following items are:

- Requested
- Enclosed
- Sent Separately

via Hand Delivery

- Report
- Test Result
- Specifications
- Calculations
- Cost Estimate
- Check Print
- Progress Estimate
- Other

No. of copies	Description
2	Storm Drain Report
2	Preliminary Plans (sheets 1-49)
2	Welby - Jacob Canal Memorandum of understanding 7/15/04

These data are submitted:

- At your request
- For your approval
- For your review
- For your action
- For your files
- For your information

General Remarks: [GENERAL REMARKS]

Encls.



Copies: file
1



To: Mr. Jack McKee, President Welby-Jacob Canal Co.
Mr. Daro Hamilton, Bluffdale Director
Mr. Brian Andrew, P.E. Consulting Engineer for Welby-Jacob

From: Ernest T. Bramwell, P.E. *ETB*

Date: Thursday, July 15, 2004

Subject: Memorandum of Understanding for Welby-Jacob Canal Structure
Extensions Associated with the Future Widening of 12600 South and
13400 South in Riverton

MEMORANDUM

Gentlemen:

This memorandum records the observations and understandings from our 2 p.m. July 2, 2004, on-site meeting at the Welby-Jacob Canal crossings of 12600 South and 13400 South in Riverton. It was understood that Riverton City is preparing the concept design for 12600 South widening from 4570 West to Bangerter Highway. Actual street widening will likely occur segmentally in a somewhat piecemeal fashion as adjacent land develops. The Welby-Jacob Canal passes under 12600 South in a 4'-6" by 9'-0" precast concrete box culvert constructed within the last 15 years. The existing box culvert is in excellent condition and passes the normal canal flow with about 2.25 feet of freeboard. Canal Company regulations state that "culverts and bridges shall be minimum 6 ft in height unless otherwise approved." If a new 6-foot deep box culvert were required for the Welby-Jacob Canal crossing, the 12600 South roadway design would be severely impacted.

Mr. McKee and Mr. Hamilton stated that the existing structure is functioning well, that it has ample freeboard to pass floating debris, and that disturbing the canal channel to construct a deeper box culvert cross-section would be more costly, undesirable, and unnecessary. They agreed that headwalls and wing walls should be provided when the box culvert is extended for 12600 South widening. It was agreed that Horrocks would submit sketches showing:

1. Extension of existing box culvert x-section,
2. Concrete headwalls with 6-inch bevel at the top of the opening and a 2.5-foot deep concrete cut-off wall,
3. Concrete wingwalls extended perpendicularly into the canal banks,
4. A check dam at the outlet end to maintain a suitable canal water surface elevation for the irrigation turnout at the northeast corner, and
5. Relocation of the existing turnout gate and irrigation ditch at the northeast corner.

Horrocks will develop concept sketches and submit them to Welby-Jacob for review. The approved concept sketches will be incorporated into the 12600 South roadway plans to guide the final design when the existing canal is actually extended during

development of adjacent properties. Formal canal company permitting and canal company fees will be the responsibility of the City/developer at an undetermined future time.

13400 South Welby-Jacob Crossing

The 13400 South crossing was visited and reviewed during the same meeting. It is a reinforced concrete structure with concrete wingwalls and was operating with about 18 inches of freeboard on July 2, 2004. Mr. McKee said there have been no operating problems at 13400 South.

The agreed approach to this crossing was the same as for 12600 South as follows:

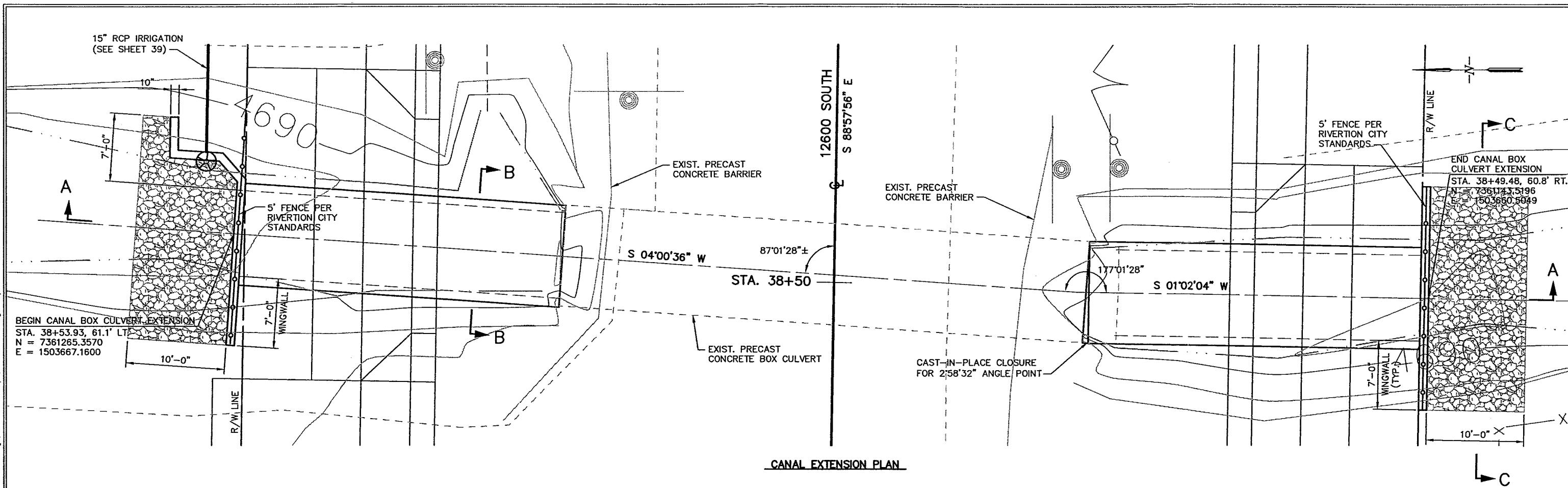
1. Retain the existing opening size (4' x 10'),
2. Perform a professional structural assessment of the existing 13400 South Culvert. Investigate the concrete cracking which is visible in the roof slab at the culvert entrance,
3. Extend the existing structure if a professional structural assessment shows it to be structurally sound and cost effective to retain, and
4. Provide headwalls and wingwalls as for 12600 South.

There are several significant utility features at the 13400 South canal crossing which should be thoroughly evaluated. They include visible 14-inch gas and 18-inch water pipelines over the canal, a buried Jordan Valley Water Conservancy District aqueduct (30" or 48" diameter), buried primary and secondary water pipelines, and a private irrigation well and pumphouse at the northeast corner of the crossing. Messrs. McKee and Hamilton agreed to the same arrangements as for the 12600 South crossing regarding the canal company's review of the design concepts with formal permitting and fees being deferred until development occurs.

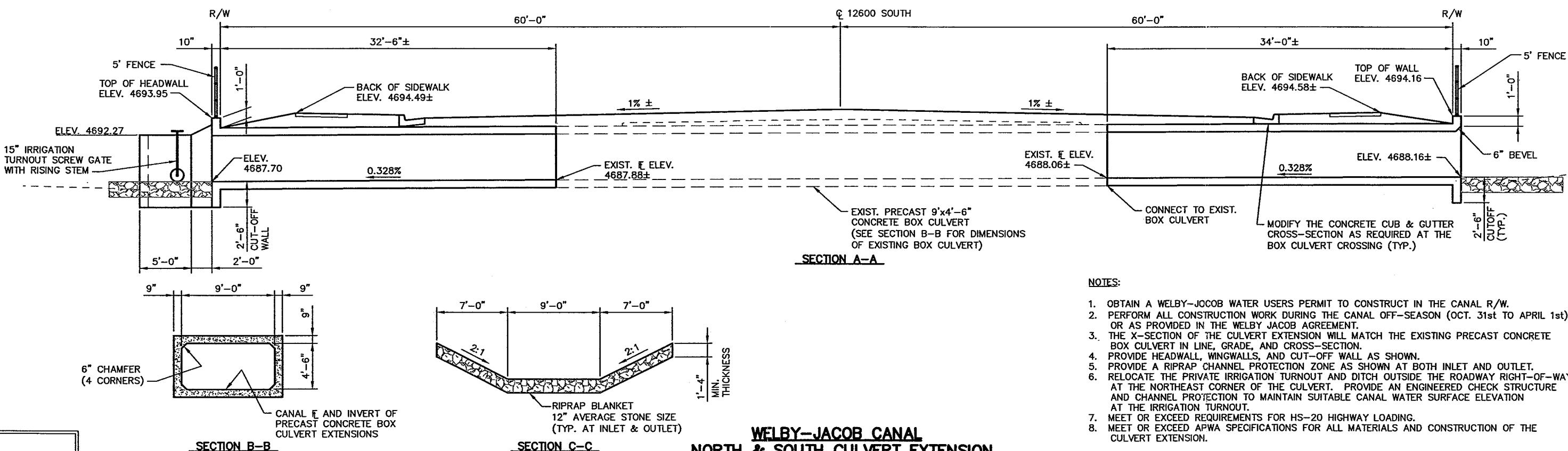
Please contact me ASAP with any corrections or clarifications which you believe are necessary to this outline of observations and understandings from the July 2 meeting.

Thank you

cc: Mr. Tom Beesley, Riverton City Engineering w/ enclosures



CANAL EXTENSION PLAN



**WELBY-JACOB CANAL
NORTH & SOUTH CULVERT EXTENSION**



**HORROCKS
ENGINEERS**

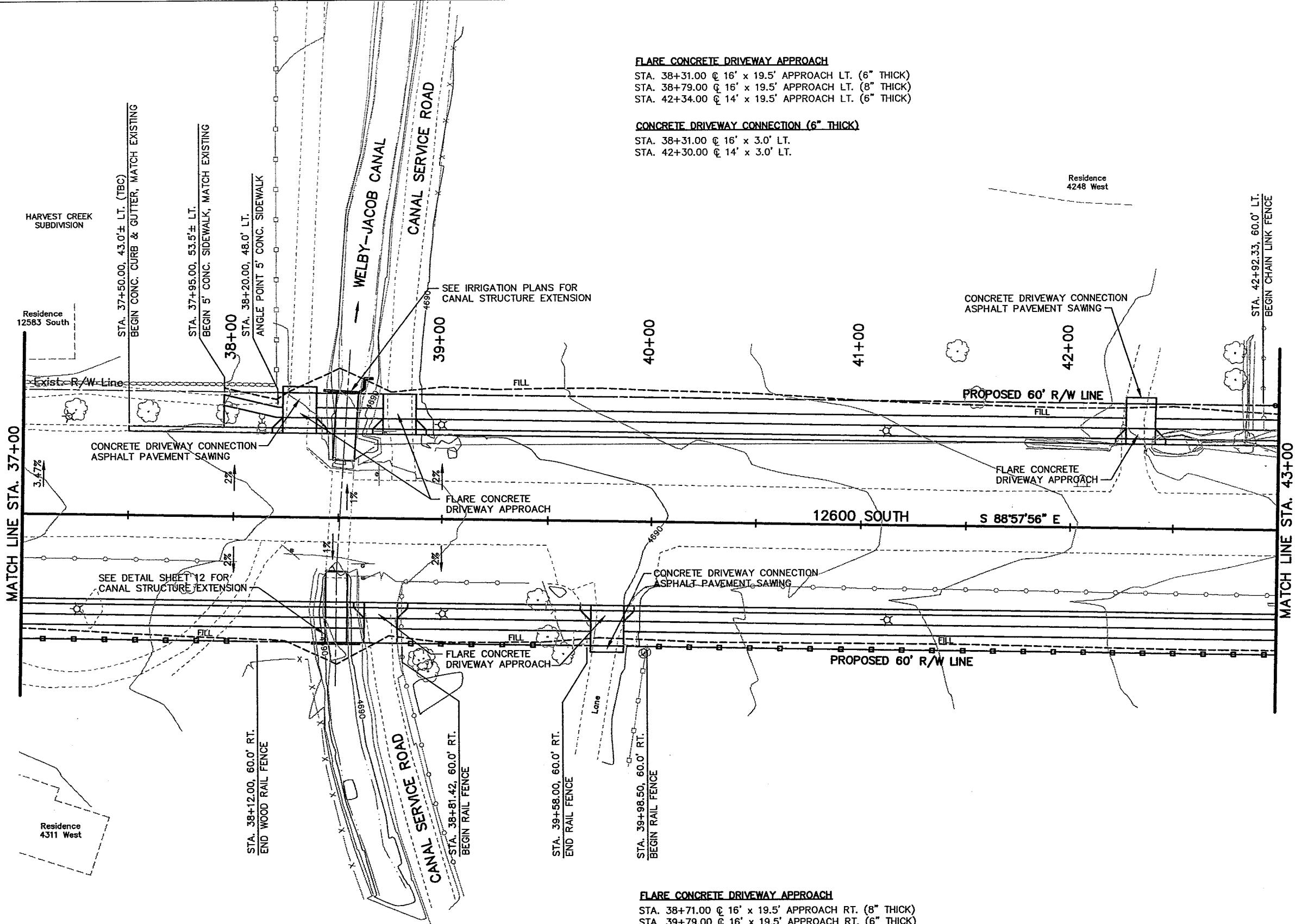
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(801) 763-5100

RIVERTON 12600 SOUTH
RIVERTON CITY

DETAILS

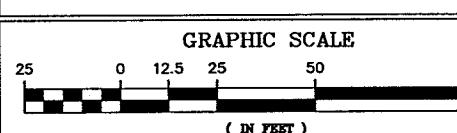
IRRIGATION

DESIGNED ETB	CHECKED X	DRAWN HAH	DATE 7/04
APPROVED X	DATE X	PROJECT. NO. X	SCALE X
REVISIONS X	DWG. NO. X	SHEET NO. 12	OF 49



LEGEND

DECORATIVE LIGHT POLE LOCATIONS



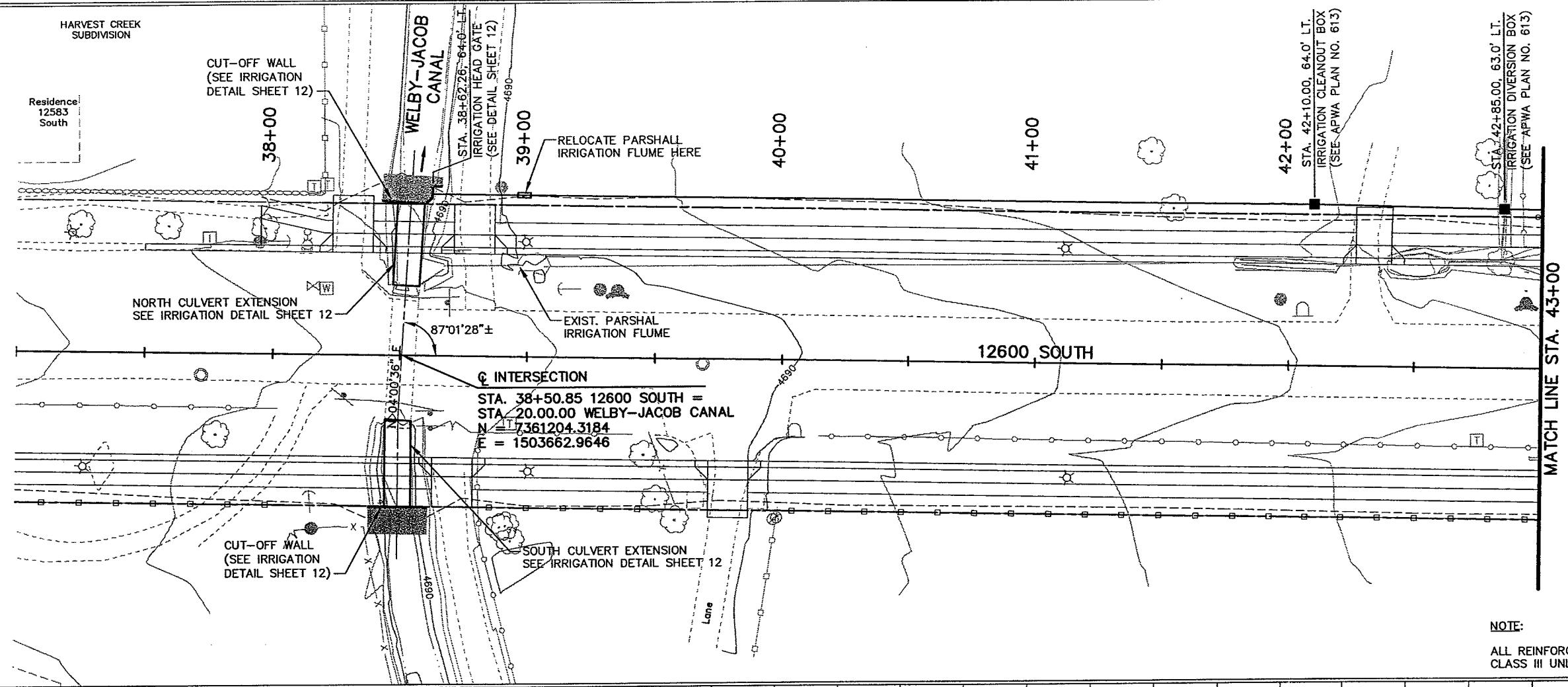
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(801) 763-5101

RIVERTON 12600 SOUTH

ROADWAY PLAN

STA. 37+00 TO STA. 43+00

DESIGNED SO	CHECKED ETB	DRAWN BCS	DATE 04/04
APPROVED X	DATE X	PROJECT. NO. 0311-103	SCALE 1"=50'
REVISIONS X	DWG. NO. X	SHEET NO. 24	OF 49

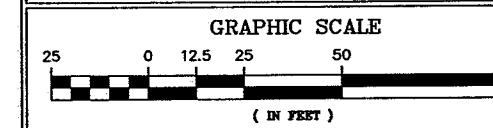


NOTE:
ALL REINFORCED CONCRETE PIPE SHALL BE
CLASS III UNLESS NOTED OTHERWISE.

0600South CAD\Street Files\Irrigation\0311-103 IR-01.dwg 07/16/04 10:40 (0311-103 Design)

The diagram illustrates a cross-section of a water main line. Key features include:

- Water Main:** A large-diameter pipe running horizontally.
- Turnout Pipe:** An irrigation turnout pipe labeled "15' ~ 32' LONG".
- Flume:** A "RELOCATED PARSHALL IRRIGATION FLUME HERE" indicated by a dashed line.
- Culvert:** A "4'-6"x9'-0" REINF. CONCRETE BOX CULVERT (PRECAST) WELBY-JACOB CANAL" located at STA. 38+62.26, ELEV. 4687.70.
- Gas Line:** A "4" Gas" line shown branching off the main.
- Telephone Line:** A "Telephone" line shown branching off the main.
- Valves:** Various valves and fittings along the main line, including a valve at STA. 42+10.00, ELEV. 4681.50.
- Outlets:** An "18" RCP 306.0' LONG REQ'D S=1.78%" outlet and an "18" RCP 75.0' LONG REQ'D S=2.67%" outlet.
- Diversion Box:** An "IRRIGATION DIVERSION BOX RIM ELEV. 4683.00" located at STA. 42+85.00, ELEV. 4679.50.
- Match Line:** A "MATCH LINE STA. 43+00" section.
- Notes:** Includes "STA. 38+62.26 64.0' LT. IRRIGATION HEAD GATE (SEE DETAIL SHEET 12)" and "STA. 42+10.00 64.0' LT. IRRIGATION CLEANOUT BOX RIM ELEV. 4684.60".



S ONE WEST MAIL
P.O. BOX 377
AMERICAN FOR
S (801) 763-51

RIVERTON 12600 SOUTH

RIVERTON CITY

IRRIGATION PLAN

STA. 37+00 TO STA. 43+00

DESIGNED SO	CHECKED <input checked="" type="checkbox"/>	DRAWN BCS	DATE 04/04
APPROVED <input checked="" type="checkbox"/>	DATE <input checked="" type="checkbox"/>	PROJECT. NO. 0311-103	SCALE 1"=50'
REVISIONS	DWG. NO. <input checked="" type="checkbox"/>	SHEET NO. 39	OF 49