Final PS&E Submittal
Drainage Report
for
Kolb Road
(Sabino Canyon Road to Sunrise Drive)

Pima County Project No. 4KSCSD

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1.0 Introduction

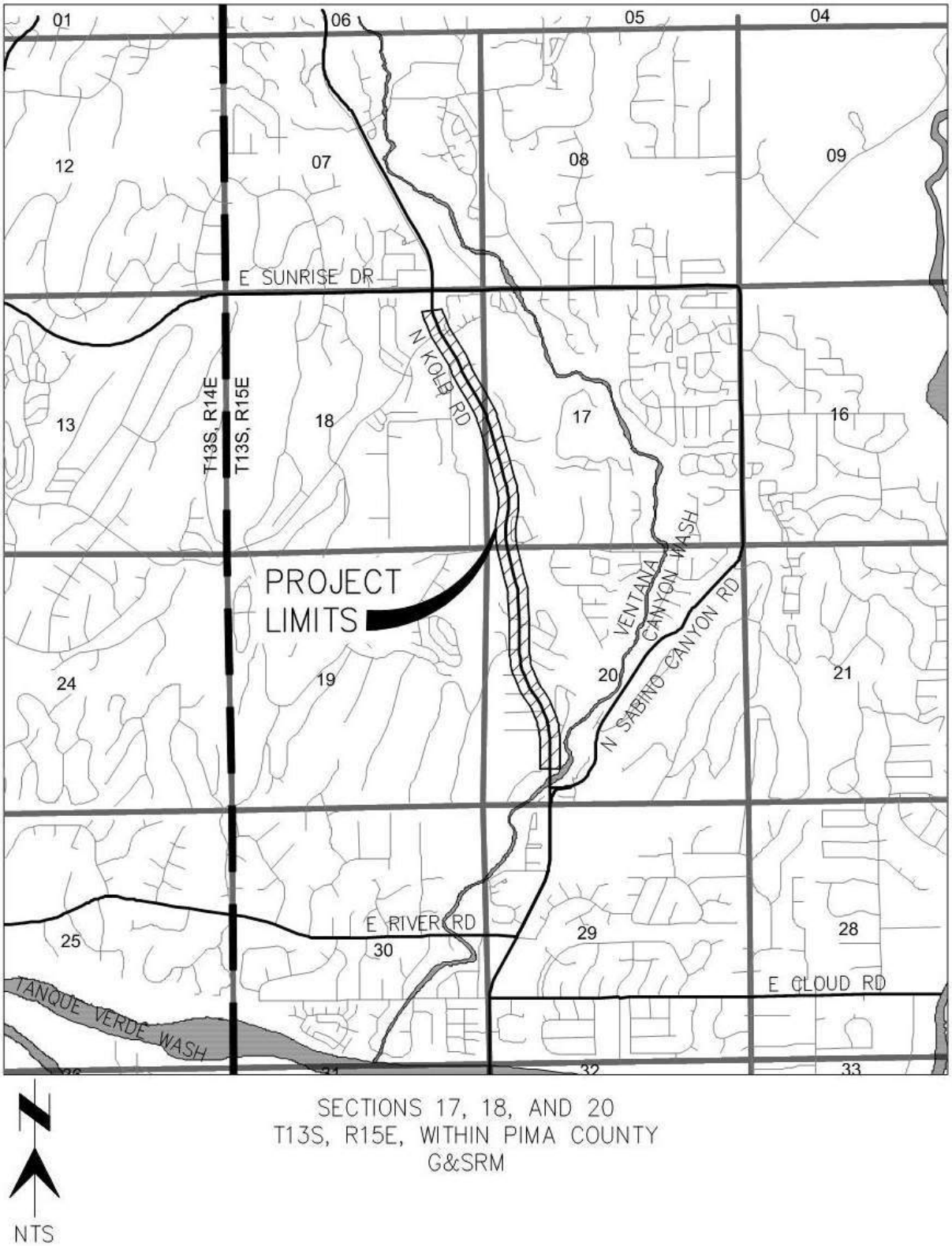
1.1 Project Description

The proposed project is located along Kolb Road, beginning approximately 200' south of Sunrise Drive and extending south to 500' north of Sabino Canyon Road. This project is located in portions of Sections 17, 18 and 20 of Township 13 South, Range 15 East, within Pima County, Arizona, as shown on the location map in Figure 1. Kolb Road is currently an un-curbed two-lane roadway and will be widened to a three-lane roadway, with two-way left-turn lanes, multi-use lanes, sidewalk, stormdrain system, cross drainage structures, retaining walls, traffic signal, native re-vegetation landscaping, signing, and pavement. Curb will be constructed on both sides of the roadway for a majority of the project.

Within this segment of the project, several unnamed washes cross the roadway from west to east, flowing through private property and subdivisions en- route to the Ventana Canyon Wash. Corrugated metal pipe (CMP) exists at the majority of wash crossings, with few crossings occurring at grade over the roadway. The capacity of the existing CMP varies, but in general, is not adequate to convey the 100-year storm event peak discharges under the roadway. When capacity is exceeded, flows will overtop the roadway and spill to the east, or along the roadway. Kolb Road crosses Ventana Canyon Wash at the southern project limits and north of Sabino Canyon Road. The culvert crossing at the Ventana Canyon Wash was improved previously as part of the Sabino Canyon Road Intersection improvements (Project No. 4TSCKR). Existing CMP will be replaced with reinforced concrete pipe (RCP) to meet current design standards and fully convey the 100-year storm event design discharge under the roadway.

Few roadside ditches exist, which convey flow parallel to the road, directing runoff towards the existing culverts. Runoff that is not being conveyed in the existing culverts currently sheet flows onto the roadway and its shoulder, depositing sediment within the paved roadway. These flows generally concentrate and flow parallel to the roadway and cause erosion in the shoulder. Existing roadside ditches will be relocated where roadway improvements encroach, and new ditches will be constructed where none exist to minimize impacts to existing drainage patterns and adjacent private property.

Figure 1
Location Map



2.0 Hydrologic Analysis

2.1 Existing Drainage Features

Stormwater runoff impacting Kolb Road generally originates west of the roadway and flows in an easterly direction. Watersheds have slopes ranging between 1.0% and 29.0%. Sheet flow is the prevailing drainage pattern upstream of Kolb Road. As flows reach Kolb Road, channelization begins to occur. Channels generally flow to culvert crossings that outlet across private property and ultimately flow into natural drainageways. Driveway culverts also exist in areas where roadside ditches exist. The majority of culvert crossings are not adequately sized to convey the 100-year storm event peak discharge under the roadway.

2.1.1 Proposed Improvements

Proposed improvements include widening the roadway, new curb and sidewalk, replacing and upsizing cross drainage structures, constructing roadside ditches and stormdrain, and erosion protection. Adjustments to the roadway profile and cross slopes will be made as necessary to accommodate the proposed drainage structures.

In addition to replacing and upsizing the existing cross culverts, new culverts will be constructed in areas where flows currently discharge over the roadway or driveways. Proposed improvements are displayed in Appendix 5.

2.1.2 Design Criteria

Hydrologic analyses for offsite watersheds impacting the project were performed using the procedures outlined in the *Pima County Roadway Design Manual* (PCRDM)*, Fourth Ed. 2014.* PC-Hydro 6.0 was utilized to perform the peak discharge calculations.

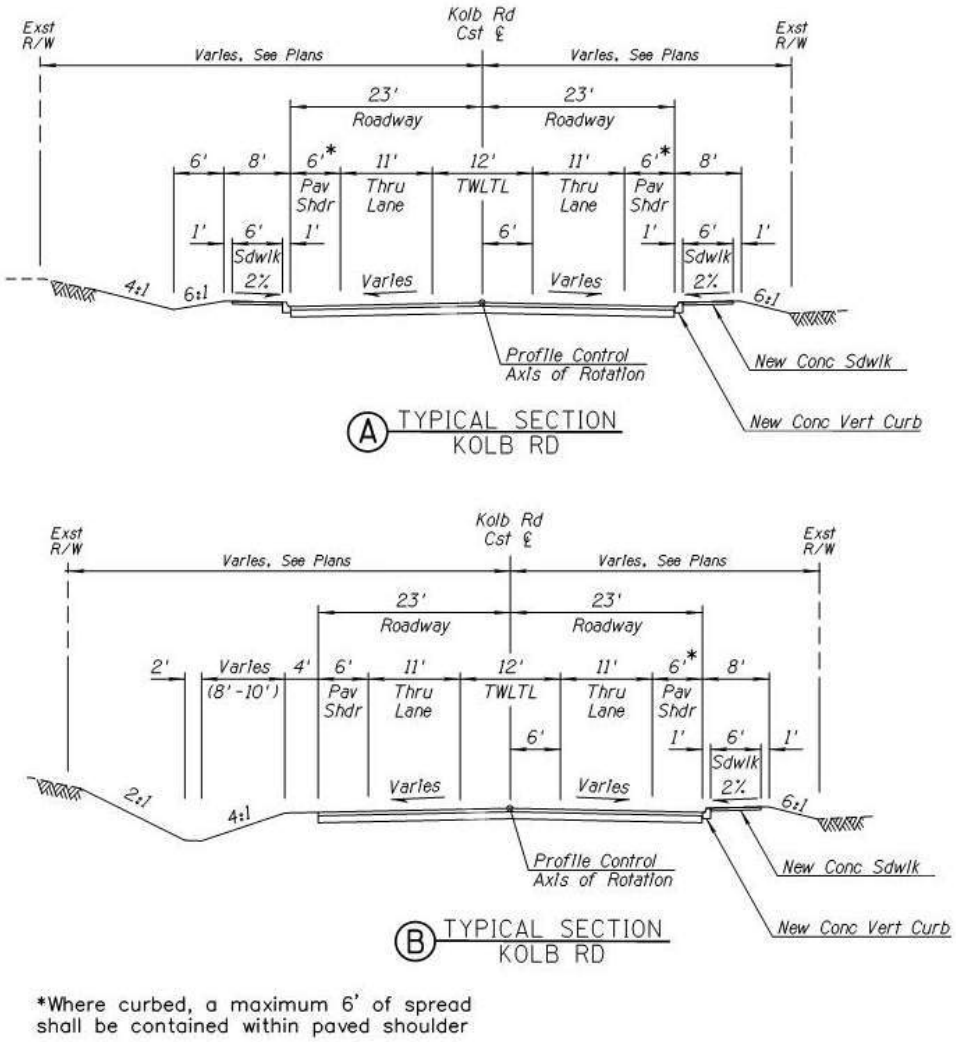
The approved drainage design criteria to be followed, and as presented in the Preliminary Drainage Report is summarized below:

- Cross drainage structures shall be sized to covey the 100-year, one-hour design storm to provide all-weather access per Section 2.10.
- The design storm for pavement drainage analyses is the 10-year, one-hour storm to meet spread criteria and the 100-year, one-hour storm to ensure less than one foot of ponding within the roadway.
- Pavement Drainage related to spread and catch basin sizing along Kolb Road shall be designed for the 10-year storm event. Per the Table 2-8 Spread Criteria in the PCRDM, on 2-5 lane roadways, one lane of pavement must remain free from flow. Spread within Kolb Road is confined to the paved shoulder/multi-use lane and one

foot into the travel lane for the majority of the project limits, which is a maximum of 7 feet with curb (See Figure 2 -Typical Sections). Ponding above the top of curb elevation is not allowed.

- Along Kolb Road, the project will make every effort to keep the proposed 100-year water surface elevations below the existing WSEs. If proposed water surface elevations increase on private property, drainage easements will be required. Flows within the roadway shall not exceed a ponded depth of one foot. Discharges shall be calculated using the Pima County Modified Rational Method.
- Stormdrain systems within the project shall be designed for the 100-year storm event for area drains outside the roadway and 10-year storm event for pavement inlets with a hydraulic grade line at least 12" below the inlet elevation.

Figure 2
Typical Sections



3.0 Existing Conditions

3.1 Overview

Stormwater runoff concentrating at Kolb Road is generated to the west from generally undeveloped land and flows to the east. Offsite watersheds were delineated using topography generated from the Pima Association of Governments 2015 Lidar Data. Sheet flow is the prevailing drainage pattern upstream of Kolb Road and becomes more channelized as flow reaches Kolb Road. The majority of Kolb Road is uncurbed, allowing drainage from the roadway to sheet flow off the pavement and flow along the shoulder or within roadside ditches to cross culverts. A number of the homes on the east side of Kolb Road are lower than the existing roadway and receive concentrated flows overtopping the roadway, which has resulted in erosion, causing property owners to install rock riprap as erosion protection or berms to direct flows away from homes.

The majority of the parcels adjacent to the Kolb Road Right-of-Way are privately owned, with a few exceptions of properties owned by Pima County or a homeowners' association.

No regulatory Federal Emergency Management Agency (FEMA) floodplains exist within the project limits per FIRM Panel 04019C1715L, Effective Date June 16, 2011. The project is located entirely within Zone X (unshaded), which denotes areas outside of the 500-year floodplain. Ventana Canyon Wash, located immediately south of the project limits, is denoted as Special Flood Hazard Area which is subject to inundation by the 1% annual chance flood. Project limits and floodplain limits are depicted in Appendix 2 FEMA FIRM Panel.

3.2 Existing Conditions Hydrology

Hydrologic calculations for offsite watersheds were performed using PC-Hydro 6.0, which utilized the Modified Rational Method, as outlined in the Pima County Roadway Design Manual. Watersheds were delineated based on PAG topographic data. Watershed characteristics were estimated from the topographic data, recent aerial photography, and field visits. The Existing Conditions Watershed Maps are shown in Appendix 3. Table 1 summarizes the offsite discharges utilized in the drainage analysis. Calculation sheets are provided in Appendix 1.

Table 1
Existing Conditions Offsite Hydrologic Analysis Summary

Offsite Watershed ID	Area (ac)	Length (ft)	Δ H (ft)	Slope (%)	Soil Type C/D	Impervious (%)	Basin Factor	Q100 (cfs)
1*	28.06	Discharge per Kolb Road/Sunrise Drive Intersection Plan 4BKLSR						20.0
1a	0.41	358	6	1.68	100/0	90	0.035	2.6**
1b	0.51	406	3	0.74	100/0	90	0.035	3.2**
2a*	15.86	Discharge per Ventana Canyon Village Plan						43.0
2b*	4.02	Discharge per Ventana Canyon Village Plan						86.0
3	19.41	1580	72	4.56	100/0	25	0.035	151.2
4	36.06	Discharge per Ventana Plaza Grading and Paving Plan						166.0
4a	7.45	Discharge per Ventana Plaza Grading and Paving Plan						60.0
5	0.62	356	16	4.49	100/0	35	0.035	5.0
6	1.79	404	44	10.89	100/0	15	0.035	13.4
6a	10.66	1282	26	15.60	100/0	15	0.035	85.0
7	2.99	495	78	15.76	100/0	15	0.035	22.4
8	2.08	557	100	17.95	100/0	25	0.035	16.2
9	2.47	749	120	16.02	100/0	10	0.035	17.5
10	2.24	577	116	20.10	100/0	10	0.035	16.4
11	0.65	449	80	17.82	100/0	35	0.035	5.4
12	3.78	638	142	22.26	100/0	10	0.035	28.5
13a	1.92	718	148	20.61	100/0	10	0.035	14.9
13b	5.21	795	158	19.87	100/0	90	0.035	40.4
13c	0.65	433	16	3.70	100/0	40	0.035	5.6
14	7.30	1113	220	19.77	100/0	15	0.035	54.6
15	2.20	736	224	30.43	100/0	5	0.035	15.8
16	3.61	787	230	29.22	100/0	15	0.035	27.0
17a	6.19	1175	218	18.55	100/0	5	0.035	44.4
17b	6.83	1241	213	17.16	100/0	5	0.035	49.0
18	9.24	1310	132	10.08	100/0	5	0.035	69.8
19	0.16	110	14	12.73	100/0	5	0.035	1.2
20	2.51	583	82	14.07	100/0	35	0.035	20.7
21	1.89	965	126	13.06	100/0	50	0.032	17.3
22	40.50	2808	266	9.47	100/0	30	0.035	304.0
22a	6.31	1544	68	4.40	100/0	30	0.035	48.2
22b	3.38	861	134	15.56	100/0	30	0.035	25.8
23	27.87	2028	268	13.21	100/0	25	0.035	217.1
24	5.70	979	148	15.12	100/0	40	0.035	47.0
24a	5.58	1095	34	3.11	100/0	60	0.032	52.8
25	3.85	1044	168	16.09	100/0	60	0.032	34.4
26	30.46	1864	272	14.59	100/0	40	0.035	255.6
27	2.77	1362	56	4.11	100/0	35	0.035	23.9
28a	0.41	520	28	5.38	100/0	80	0.032	10.9
28b	1.13	464	26	5.50	100/0	75	0.032	14.6

*Existing discharges compiled from Development Plans.

**Q10 for Pavement Drainage

3.3 Existing Conditions Hydraulics

3.3.1 Existing Culverts

Fifteen cross culverts and six driveway culverts convey flows east and south. Eleven of these structures are undersized for the 100-year storm event which causes flows to overtop the roadway, which are indicated in the table below. These culverts will be replaced with RCP and upsized as necessary to accommodate the 100-year peak flow and provide all-weather access. Table 2 summarizes the locations, sizes, material, and peak discharges at each of the existing culverts. Analysis of the existing cross culverts and driveway culverts were performed utilizing HY-8©, which utilizes the FHWA methodology presented in HDS-5, Design of Highway Culverts. Results of the HY-8 analysis can be found in Appendix 4. Locations of the existing culverts and headwater ponding limits are provided on Figure 4 – Existing Conditions Watershed Map in Appendix 3.

Table 2
Existing Conditions Culvert Analysis Summary

Offsite Watershed ID	Station	Existing Culvert	Q100 (cfs)	Culvert Discharge (cfs)	HW Elev. (ft)	100-yr Storm Event Overtoping Issue
2a	Sta 151+00	2-30" RCP	43.0	43.0	2752.58	Flows Overtop Headwall
2	Sta 150+00	3-36" CMP	86.0	86.0	2748.63	
4	Sta 147+50	2-42" RCP	166.0	166.0	2754.96	Flows Overtop Headwall
4a	Sta 144+30	2-30" CMP	60.0	60.0	2763.59	
6a	Sta 135+00	1-24" CMP	79.8	30.6	2763.39	East on Priv. Property
5 & 6	Sta 133+50	1-24" CMP	18.4	10.7	2758.37	East across Kolb Rd
7	Sta 131+20	2-24" CMP	22.4	13.5	2751.89	East across Kolb Rd
8	Sta 129+50	2-24" CMP	16.2	5.0	2743.75	East across Kolb Rd
9	Sta 127+00	1-24" CMP	17.5	17.5	2736.19	
12	Sta 123+00	1-35"x24" ARCH	28.5	28.3	2730.35	East across Kolb Rd
13b	Sta 118+00	1-36" CMP	40.4	29.6	2715.44	East across Kolb Rd
13c	Sta 117+50	1-36" CMP	60.9	40.2	2711.38	South across Rainbow Cyn
14	Sta 114+00	1-36" CMP	54.6	28.2	2703.7	
16 & 17a	Sta 111+00	1-36" CMP	71.4	43.6	2700.51	East across Kolb Rd
17b	Sta 100+50	1-36" CMP	49.0	49.0	2705.4	Southeast across Kolb Rd
18	Sta 90+00	2-24" CMP	69.8	38.3	2661.01	East across Kolb Rd
20	Sta 87+00	1-24" CMP	20.7	20.1	2656.19	South across Quail Run Dr
22	Sta 80+00	3-48" CMP	304.0	304.0	2638.43	
24	Sta 70+00	2-36" CMP	264.1	198.4	2599.45	
27	Sta 59+00	1-24" RCP	23.9	23.4	2561.7	South across Priv. Driveway
27	Sta 58+00	1-24" RCP	23.9	23.9	2556.12	South across Priv. Driveway

The concentration point for offsite watershed 1 (OS1) is located just west of the Ventana Canyon Village along Kolb Road. Flows are collected into an existing stormdrain system and flow east under Kolb Rd, which outlets west of the Kolb/Sunrise Commercial Center. Flows within this watershed originate in undeveloped land on the western portion of the watershed and sheetflow into the neighborhood to the east. A majority of the flows are routed through numerous detention/retention basins and ultimately end up in the southern portion of the watershed. Overflow from the southernmost basin is discharged across Territory Drive via 3-36" RCPs into a channel in OS4. The remaining flows that reach Kolb Road are conveyed to the existing culvert, which is north of the project limits. The existing stormdrain system shall remain and will not be impacted by this project; therefore, no hydrologic or hydraulic analyses were performed for OS1 and 100-year discharges are based on historical development plans noted on Figure 4.

A portion of the offsite pavement drainage bypasses the existing stormdrain catchbasin on the on the west median on Sunrise Drive, discharging south onto Kolb Road. Flows from OS1a are conveyed along the east edge of the existing roadway, which is curbed from the intersection to the existing driveway. Under existing conditions, a portion of the flow is conveyed into the Kolb/Sunrise Commercial Center parking lot via the existing driveway and eventually into a private basin maintained by Pinnacle Canyon Condominiums. The remaining flow from OS1a continues south along the edge of the roadway until it enters the same private basin.

Offsite watersheds OS2a and OS2b are part of the Ventana Canyon Village Development Plan. The watershed was delineated in two parts to identify the areas contributing to the two existing culverts. OS2a is the northern half of the commercial development, which flows east through the parking lot toward Kolb Road. Flows are combined with pavement runoff from Kolb Road in a roadside channel and are then conveyed south under the existing driveway by 2-30" RCPs. Flows from OS2b also sheet flow east towards Kolb Road, where they combine with OS2a and are conveyed across Kolb via 3-36" CMPs to a private basin.

West of Kolb Road along the northern side of Territory Drive, discharge from OS3 sheet flows east, concentrating in the northeast corner of the watershed. Flow crosses Via Arancio via an unknown sized culvert into the detention/retention basin in the eastern portion of the watershed. Overflow from the basin is discharged across Territory Drive via 3-36" RCPs into OS4. The offsite culverts will not be impacted by this project and will remain; therefore, no hydrologic or hydraulic analyses were performed for OS3. Culvert discharges from OS3 to OS4 are based on previous report/plans noted on Figure 4.

Offsite flows from OS4 and OS4a originate southwest of the Kolb Road and Territory Drive intersection. Peak discharges from the Ventana Plaza Plans were used for the analysis of the existing 2-42" CMPs. The peak discharge included the commercial development, several housing developments upstream along with discharge from OS3. The existing 2-42" CMPs located at the proposed roundabout will remain in place. The additional flows from pavement drainage are minor in comparison and do not necessitate upsizing of these pipes, which is discussed in further detail in Section 4.3.

Runoff from OS5 sheet flows across Kolb Road, just south of Gate Ridge Road, and combines with OS6a. Flows from OS5 and OS6a are conveyed south under a private driveway along the east side of Kolb Road. Under existing conditions, the culvert conveys 30.6cfs while the remaining 49.2cfs overtops the driveway due to undersized pipes and flows both onto private property and onto Kolb Road.

OS6 sheet flows east to the edge of the roadway then south along the Kolb Road shoulder to the existing 1-24" CMP. The existing culvert conveys 10.7cfs while the remaining 7.7cfs overtop and flow south along or overtop of Kolb Road. Flows discharged through the culvert are conveyed via natural channels and eventually end up in the Ventana Canyon Wash. Runoff from OS7, OS8 and OS9 follow similar drainage patterns, with each watershed converging at the existing culverts and conveyed east under Kolb Road.

Watersheds OS10 and OS11 do not have existing cross drainage structures and currently sheet flow across Kolb Road onto private property. A portion of the flows from OS10 discharge directly down a private driveway, which was built at a lower elevation than Kolb Road, and deposits large amounts of sediment at the bottom of the driveway next to the private dwelling.

Discharge from OS11 overtops Kolb Road and splits, flowing into a natural swale to the east and flowing to the south along the east edge of the roadway. The flows along Kolb Road combine at the outlet of the existing 35"x24" arch pipe from OS12 and cross private property. The homeowner has constructed riprap both upstream and downstream of the concrete swale across the driveway. Evidence of sediment deposits in the private driveway can be seen in aerial photos. Flows then continue across Rocky Ridge Drive into a natural channel.

Runoff from OS13a and OS13b sheet flows across the majority of the watershed until it channelizes west of Kolb Road, in locations where homes were built. The more

concentrated flows are conveyed south along the west side of Kolb Road to an existing 1-36" CMP. Discharge from the culvert combines with pavement and offsite drainage at OS13c and is conveyed south under Rainbow Canyon Drive via 1-36"CMP. Flows continue south in a channel adjacent to the west side of a private wall and eventually discharge into natural channels within the Quail Canyon Master Homeowners Association common area.

Sheet flows from OS14 begin to channelize near the base of the watershed, where grading was done to build homes. Flows are conveyed along the west side of Kolb Road to the existing 1-36" CMP. While the pipe is adequately sized, the new culvert will need to be extended and slightly skewed to accommodate the roadway widening, which is discussed in more detail in Section 4.3.

No existing structures exist to convey overland flows from OS15 and OS17a. Both of the watershed discharges overtop Kolb Road onto private property, flowing between homes into natural drainage swales.

Overland flows from OS16 channelize towards the base of the slope and are conveyed to the east side of Kolb Road via 1-36" CPM. The existing culvert is adequately sized but will need to be relocated and extended to accommodate the roadway widening. Just north of Snyder Road, watershed OS17b is undeveloped with steep slopes up to 29%. An existing 1-36" CMP is located at the northwest corner of Kolb Road and Snyder Road. The existing culvert inlet does not provide the necessary depth to contain the headwater at the culvert and flows overtop the intersection and continue south along Kolb Road.

The existing culvert inlet for OS18 was completely covered by sediment. Runoff which was intended to flow into the culvert appears to sheet flow across the roadway, ponding against the retaining wall with weep holes and discharges into the parking lot of The Arboretum apartment complex.

Flows from watershed OS19 partially flow east across Kolb Road and south along the west side of the roadway to combine with OS20. Combined runoff at OS20 is conveyed across Kolb Road via 1-24" CMP and discharges onto private property, flowing between the driveways of two homes.

Offsite and pavement drainage from OS21 generally flows east along the shoulders of Quail Run Drive, until sheet flowing across Kolb Road onto private property and continuing along Rocky Creek Drive.

Just north of Painted Quail Place, existing 3-48" CMPs convey the concentrated flows discharging from watershed OS22a. Flows are discharged east of Kolb Road within a natural channel into the Quail Canyon Master Homeowners Association common area.

Overland flow from OS23 channelizes as it approaches Kolb Road and is conveyed south along the edge of the roadway. Flows cross Pintail Drive at grade, flowing southeast into an existing swale and are combined with discharge from OS24. The combined peak discharges are conveyed to 2-36" CMPs, which do not provide adequate conveyance capacity. Due to undersized culverts, headwater ponds approximately 8 ft on private property before overtopping Gambel Circle. Discharge from the culvert and from OS25 continue south in an existing natural channel.

Watershed OS27 is a combination of offsite flows and pavement drainage. Flows are conveyed along the west side of Kolb Road, through a series of existing 24" CMPs at driveways. The discharge from OS27 combines with OS26, just past the project limits, and is conveyed to existing 4-42" CMPs under Little Savannah Lane. Hydraulic analysis of the existing culverts using HEC-RAS determined the existing culvert headwater overtops the 4-42" CMPs. This culvert is south of the project limits and will remain in place.

Pavement drainage and offsite run-on east of Kolb Road, from OS28b, is conveyed south along the edge of the roadway in a paved swale. Flows along the pavement cross private driveways and an existing driveway for a Rural Metro Fire Station #73. Just past the Fire Station, flows are discharged onto the unpaved shoulder and continue south, with visible signs of erosion and headcutting near the edge of pavement. Discharge from OS28b combines with OS28a, flowing south along the east side of Kolb Road. Flows are conveyed under a private driveway via and existing culvert before discharging into the Ventana Canyon Wash, south of the project limits.

3.3.2 Channels

With a few exceptions, constructed roadside channels do not exist within the project limits. The exceptions include a riprap lined channel located southwest of Territory Drive and a channel along the west side of Kolb Road, beginning south of Pintail Drive and outlets at the Ventana Canyon Wash. Many roadside channels have formed as a result of pavement runoff and are labeled on the Existing Conditions Map in Appendix 3. Capacities for the existing channels, both constructed and natural, were not analyzed as part of this report

because they will either be replaced under proposed conditions or will not be impacted by the improvements. Construction of new channels is proposed and will be designed for 100-year conveyance for contributing areas outside the roadway and 10-year conveyance capacity for pavement drainage.

3.3.3 Stormdrain

No stormdrain systems exist within the proposed project limits. North of the project limits, a stormdrain system was constructed under project number 4SRSCA to collect stormwater along Sunrise Drive thru catch basins and discharge via existing pipes. The stormdrain system conveys flow east of Kolb Road, where it outlets into a channel.

South of the project limits, on the east curb of the northbound lane, is a catch basin just north of the Ventana Canyon Wash, approximately 470 feet to the north of Sabino Canyon Road. These existing stormdrain networks shall remain as-is.

3.3.4 Bridges

No bridges exist within the proposed project limits. Just south of the project limits and north of Sabino Canyon Road, Kolb Road crosses the Ventana Canyon Wash via an existing multi-barrel box culvert.

3.4 Summary of Existing Conditions

Under existing conditions, runoff impacting Kolb Road is generated from the west and sheet flows towards the uncurbed roadway to the east and begins to channelize just west of Kolb Road. Pavement drainage sheet flows off the majority of the uncurbed roadway, except in a few curbed locations. Flows begin to concentrate in shallow ditches along the sides of the roadway and are conveyed to nearby cross-culverts. Larger flows occasionally break out of roadside channels and cross Kolb Road, resulting in significant sediment deposition. Downstream of cross-culverts, flows typically return to sheet flow conditions or remain channelized within natural swales. Flows ultimately discharge to the Ventana Canyon Wash.

4.0 Proposed Cross-Drainage Improvements

4.1 Offsite Drainage Approach

Offsite drainage will be conveyed in a similar fashion as existing conditions; collecting and conveying runoff from the west side of Kolb Road to the east, under the roadway via a series of cross-drainage structures. Drainage structure sizes will be increased, where necessary, to convey 100-year peak discharge under the road. New culverts were added in

areas where flows previously crossed overtop the roadway. With the addition of curb along a majority of the project, offsite flows will no longer be allowed to flow across the roadway. Where culverts are not feasible, area inlets have been added to collect and convey flows to culverts or channels via stormdrain. Additional details of the offsite watersheds is discussed in the Proposed Conditions Hydraulics, Section 4.3.

4.2 Proposed Conditions Hydrology

Hydrologic calculations were performed in the same manner as existing conditions, utilizing the PC-Hydro methodology. Watersheds were delineated based upon the proposed design in order to quantify peak discharges for use in sizing necessary drainage structures. Offsite watersheds remained generally the same as existing conditions but were subdivided where necessary. Under existing conditions, the majority of Kolb Road was uncurbed, resulting in pavement drainage sheet flowing off the roadway. Sidewalk or a decomposed granite pedestrian path and curb are proposed for most of the project resulting in the need to analyze pavement spread to ensure compliance with current County standards. Onsite watersheds were delineated for the curbed sections, sidewalks and roadside channels. The proposed roadway design and pavement watersheds are provided in on Figure 5 – Proposed Conditions Pavement Drainage Watershed Map in Appendix 5. Appendix 6 summarizes the offsite proposed conditions hydrologic analysis.

Pavement watershed Q_{10} discharges have been determined using the Q_{10}/Q_{100}=0.5 ratio. Values for the weighted curve number (Cw) and the rainfall intensity(i) were based on data acquired from PC Hydro for the area of this project

Q_{100} = CiA
Cw = 0.92
i (with Tc=5min) = 10.8 in/hr

CiA = 0.92 * 10.8 in/hr * 1 ac = 9.94 cfs

Q_{10}/Q_{100}=0.5 * 9.94 cfs=> Q_{10}=4.97 cfs/acre

Pavement discharges were calculated by multiplying the acreage of each watershed by 5cfs, slightly more conservative than if calculated using 4.97cfs. The pavement discharges were used for roadway inlet and stormdrain sizing.

To determine the inlet sizing, the total discharge for each inlet was input into FlowMaster, which included the Q_{10} for each pavement watershed plus bypass from upstream inlets.

Based on the Pima County Roadway Design Manual Table 2-9 – Capture Ratios for Inlets, from the, the appropriate ratio was applied for required efficiency and used to solve for opening lengths. Opening lengths were then upsized to the nearest standard wing length. A summary of the pavement discharges and inlet sizing for stormdrain have been summarized in Table 3 – Pavement Drainage Hydrologic Analysis Summary Table.

The existing conditions offsite watersheds were subdivided to reflect the changes in conveyance due to the construction of the roadway and drainage improvements. The subdivided offsite watersheds are shown on Figure 6 and a summary of parameters and peak discharge results can be found in Table 4 – Proposed Offsite Hydrologic Analysis Summary Table.

Table 3
Pavement Drainage Hydrologic Analysis Summary Table

WSHD ID	INLET ID	Area	Q10	Q Total	Q Capture	Q bypass	Wing Length	Spread	Flow Depth	Inlet Type
		(ac)	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	
1a	SC17	0.55	2.73	2.73	1.77	0.96	12	10.39	0.21	SC
1b	SC16	0.08	0.42	1.38	1.35	0.03	12	8.93	0.18	SC
2a	CB71	0.20	1.00	1.00	0.84	0.16	12	8.31	0.11	CB
2b	CB69	0.04	0.20	0.36	0.31	0.05	4	5.41	0.07	CB
2c	CB68	0.06	0.28	0.33	0.25	0.08	4	6.47	0.08	CB
3a	CO1	0.03	0.15	0.23	0.18	0.05	4	5.24	0.08	CO
3b	CO2	0.04	0.18	0.22	0.17	0.05	4	5.15	0.08	CO
3c	CO3	0.04	0.20	0.26	0.19	0.07	4	5.48	0.08	CO
3d	CO4	0.03	0.17	0.24	0.18	0.06	4	5.32	0.08	CO
3e	CO5	0.03	0.15	0.20	0.16	0.04	4	4.97	0.07	CO
3f	CO6	0.03	0.15	0.19	0.15	0.04	4	4.33	0.07	CO
3g	CB65	0.10	0.90**	1.92	1.92	--	--	--	--	AG
4a	CO7	0.03	0.15	0.15	0.12	0.03	4	3.94	0.06	CO
4b	CO8	0.02	0.12	0.15	0.13	0.02	4	3.85	0.07	CO
4c	CO9	0.02	0.08	0.09	0.09	0.00	4	3.84	0.06	CO
4d	CO11	0.01	0.07	0.08	0.08	0.00	4	3.88	0.06	CO
4e	CO12	0.03	0.14	0.13	0.13	0.00	4	4.65	0.07	CO
4f	CB63*	0.08	0.39	0.39						
4i	CB62	0.09	0.80**	1.40	1.40	--	--	--	--	AG
5a	CB63*	0.09	0.47	0.94		0.94				
5b	CB63*	0.04	0.19	1.13	0.27	0.87		4.29	0.09	
6a	CB74	0.27	1.34	1.41	1.41	0.00	8	5.98	0.15	CB

WSHD ID	INLET ID	Area	Q10	Q Total	Q Capture	Q bypass	Wing Length	Spread	Flow Depth	Inlet Type
		(ac)	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	
6b	CB77	0.04	0.20	0.20	0.20	0.00		2.77	0.06	
7a	CB61	0.03	0.15	0.15	0.10	0.05	3	3.22	0.06	CB
7b	CB63	0.04	0.19	1.37	1.37	0.00	8	6.61	0.13	CBw/ DblG
7c	PE-3	0.30	2.7**	4.23	4.23	--		--	--	
8a	CO17	0.01	0.07	0.11	0.11	0.00	4	2.49	0.06	SC T1
8b	CO18	0.01	0.04	0.15	0.13	0.02	4	4.06	0.06	CO
8c	CO19	0.05	0.23	0.25	0.18	0.07	4	4.15	0.08	CO
8d	CO20	0.08	0.38	0.45	0.45	0.00	4	6.93	0.14	
8e	CB60	0.05	0.27	1.45	1.35	--	--	--	--	AG
9a	CO15	0.04	0.22	0.23	0.15	0.08	4	3.58	0.06	CO
9b	CO16	0.01	0.07	0.15	0.11	0.04	4	3.19	0.05	CO
9c	CB59	0.05	0.5**	0.88	0.88	--	--	--	--	AG
10	CB57	0.09	0.44	0.44	0.44	0.00	8	3.24	0.11	CB
11a	CB58	0.05	0.26	0.30	0.23	0.07	4	7.61	0.08	CB
11b	CB56	0.15	0.73	0.94	0.91	0.03	16	5.07	0.10	CB
12a	CB53	0.17	0.87	0.99	0.69	0.30	8	5.17	0.10	CB
12b	CB55	0.09	0.46	0.76	0.75	0.01	16	4.62	0.09	CB
13	SC15	0.17	0.84	0.88	0.67	0.21	8	5.03	0.10	SC
14	SC18	0.12	0.58	0.58	0.46	0.12	4	5.04	0.10	CB
15	SC14	0.13	0.64	0.64	0.60	0.04	8	5.23	0.10	SC
16	CB50	0.18	1.28	3.78	2.56	1.22	12	8.81	0.19	CB
17A	CB49	0.04	0.22	1.44	0.92	0.52	12	6.42	0.13	CB
17B	CB48	0.06	0.32	0.84	0.67	0.17	8	5.33	0.11	CB
18	SC13	0.19	0.97	1.09	1.09	0.00	12	5.74	0.11	SC
19	--	0.31	1.56	1.56	N/A - Not Curbed					
20	CB47	0.12	0.58	0.58	0.34	0.24	16	6.25	0.08	SD
				0.24	0.22	0.02		6.29	0.08	CBw/G
21	--	0.13	0.67	0.67	N/A - Not Curbed					
22	--	0.23	1.17	1.19	N/A - Not Curbed					
23	--	0.31	1.53	1.53	N/A - Not Curbed					
24	--	0.32	1.59	1.59	N/A - Not Curbed					
25	CB45*	0.16	0.80	0.80	0.00	0.80				
26	CB45	0.09	0.44	1.24	1.09	0.15	12	6.32	0.13	CB
27	CB44	0.20	1.01	1.16	0.98	0.18	8	5.74	0.11	CB
28	CB42	0.09	0.43	0.60	0.60	0.00	12	4.48	0.09	CB
29	CB41	0.17	0.86	0.86	0.79	0.07	12	5.13	0.10	CB

WSHD ID	INLET ID	Area	Q10	Q Total	Q Capture	Q bypass	Wing Length	Spread	Flow Depth	Inlet Type
		(ac)	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	
30	CB38	0.22	1.10	1.17	1.14	0.03	16	5.76	0.12	CB
31	SC12	0.20	1.00	1.02	0.75	0.27	8	5.49	0.11	SC
32	SC11	0.15	0.77	1.04	0.97	0.07	12	5.51	0.11	SC
33	CB35	0.16	0.80	0.87	0.79	0.08	12	6.35	0.10	CB
34	--	0.97	4.83	4.96	N/A - Not Curbed					
35	SC10	0.20	0.98	0.98	0.93	0.05	12	5.39	0.11	SC
36	CB34	0.15	0.74	0.74	0.69	0.05	6	3.83	0.19	CBw/G
37	CB33	0.16	0.79	0.83	0.78	0.05	6	4.01	0.20	CBw/G
38	CB32	0.19	0.94	0.99	0.95	0.04	9	4.28	0.21	CBw/G
39	CB31	0.10	0.48	0.52	0.52	0.00	6	2.60	0.13	CBw/G
40	CB72	0.19	0.97	0.98	0.81	0.17	16	3.97	0.08	CB
41	--	0.13	0.67	0.84	N/A - Not Curbed					
42	CB73	0.17	0.84	0.84	0.72	0.12	16	3.86	0.08	CB
43	--	0.15	0.75	0.75	N/A - Not Curbed					
44	CB30	0.22	1.11	1.11	0.77	0.34		5.01	0.10	DblGI
				0.34	0.23	0.11	16	3.24	0.06	SD
45	CB29	0.28	1.42	1.53	0.70	0.83	16	6.20	0.12	SD
				0.83	0.55	0.28		4.94	0.10	GI
46	CB26	0.10	0.52	0.80	0.52	0.28	32	8.60	0.07	SD
46	CB26	0.10	0.52	0.28	0.28	0.00		1.39	0.11	GI
47A	CB28	0.21	1.04	1.04	0.72	0.32	8	5.35	0.11	CB
47B	CB27	0.10	0.50	0.81	0.79	0.02	12	5.44	0.11	CB
48	CB25	0.24	1.20	1.22	0.90	0.32	12	4.44	0.12	CB
49	SC9*	0.24	1.22	1.54	0.00	1.54				
50	SC9	0.18	0.91	2.44	1.95	0.49	12	6.94	0.18	SC
51	SC8	0.14	0.71	1.20	1.03	0.17	8	7.61	0.15	SC
52	SC7	0.12	0.62	0.79	0.51	0.28	4	6.72	0.13	SC
53	CB23	0.08	0.40	0.40	0.18	0.22	6	4.73	0.09	SD
53	CB23	0.08	0.40	0.22	0.18	0.04		3.78	0.08	GI
54	CB21	0.07	0.37	0.65	0.68	-0.03	8	6.46	0.13	CB
55	CB22	0.06	0.30	0.34	0.33	0.01	4	5.07	0.10	CB
56	CB19	0.10	0.50	0.51	0.41	0.10	4	5.18	0.10	CB
57	CB18A	0.15	0.76	0.74	0.71	0.03	8	6.02	0.12	CB
58	CB17B	0.19	0.94	1.04	0.88	0.16	12	5.28	0.11	CB
59	CB16	0.16	0.81	0.84	0.77	0.07	12	4.81	0.10	CB
60	CB15	0.17	0.87	1.03	0.95	0.08	16	5.04	0.10	CB
61	CB14	0.18	0.88	0.95	0.91	0.04	16	4.88	0.10	CB

WSHD ID	INLET ID	Area	Q10	Q Total	Q Capture	Q bypass	Wing Length	Spread	Flow Depth	Inlet Type
		(ac)	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	
62	CB12A	0.30	1.48	1.60	1.35	0.25	6	4.79	0.13	CBw/G
63	CB11A	0.27	1.37	1.63	1.26	0.37	12	4.76	0.13	CB
64	CB10	0.16	0.78	1.15	1.05	0.10	12	4.47	0.13	CB
65	CB8*	0.26	1.30	1.40						
66	CB8	0.18	0.88	2.28	1.48	0.80	8	6.55	0.18	CB
67	CB7	0.18	0.89	1.68	1.35	0.33	8	6.41	0.18	CB
68	CB6A*	0.11	0.55	0.88	0.00	0.88				
69	CB6A	0.17	0.87	2.08	2.08	0.00	42	7.30	0.20	SD
70a	CB5	0.08	0.39	0.39	0.38	0.01	4	5.17	0.11	CB
70b	CB4	0.07	0.37	0.38	0.37	0.01	4	3.97	0.11	CB
71	CB3	0.16	0.78	0.78	0.68	0.10	8	4.17	0.12	CB
72	CB2	0.11	0.53	0.63	0.63	0.00	12	3.70	0.10	CB
73	SC6	0.27	1.37	1.37	0.90	0.47	8	4.50	0.13	SC
74	SC5	0.27	1.34	1.81	1.40	0.41	12	4.86	0.13	SC
75	CB1F	0.16	0.81	1.22	0.99	0.23	12	4.19	0.12	CB
76A	CB1C*	0.12	0.60	0.60						
76B	CB1C	0.20	0.98	1.21	0.83	0.38	8	4.38	0.12	CB
77	CB1B	0.18	0.92	1.30	1.06	0.24	12	5.99	0.12	CB
78	SC3	0.24	1.21	1.45	1.33	0.12	12	5.51	0.15	SC
79	--	0.11	0.55	0.67		0.67		4.65	0.13	
80	SC2	0.39	1.96	1.96	1.55	0.41	12	7.34	0.15	SC

*Flows downstream to next inlet

**Q100 calculated and used for analysis

Table 4
Proposed Offsite Hydrologic Analysis Summary Table

Offsite Watershed ID (OS)	Outfalls at Drainage Structure	Drainage Area (ac)	Length (ft)	ΔH (ft)	Slope	Q100 (cfs)
4B		1.30	722	88	0.12	9.6
4C		0.49	368	56.5	0.15	3.7
4D	CB-54	0.08	115	33	0.29	0.6
5		0.60	356	14	0.04	5
6A	P14	10.05	1282	200	0.16	76.6
6B	CB-50	0.43	313	40	0.13	3.5
6C	P13	1.78	404	36	0.09	13.3
7	P12	3.10	495	78	0.16	23.1
8	P11	1.68	556	99	0.18	13.4
9	P10	2.51	725	120	0.17	18.1
10	P6	2.19	577	116	0.20	16.5
11	P7 to P9	0.52	405	78	0.19	4.1
12	P9	3.71	638	142	0.22	26.5
13A	CB-43	0.29	177	17	0.10	2.3
13B	CB-43	1.52	671	168	0.25	11
13C	CB-40	0.17	116	13	0.11	1.3
13D	CB-37	4.82	885	182	0.21	33.9
13E	CB-39	0.13	75	8	0.11	0.9
14A	CB-36	3.52	810	198	0.24	24.7
14B	P5-P4	0.46	243	42	0.17	3.7
14C	P4	3.03	721	214	0.30	21.9
15	Ditch	2.12	750	230	0.31	15.3
16	P-3	3.49	757	226	0.30	25.2
17A	P-3	5.94	1064	225	0.21	42.9
17B	Ditch	1.86	716	206	0.29	13.4
17C	CB-X	0.33	239	35	0.15	2.3
17D	Ex. Cul.	0.44	274	17	0.06	3.1
17E	P2	4.77	894	184	0.21	33.5
18	PE-2	8.03	1310	120	0.09	60.7
20	CB-20	2.56	667	83	0.12	21.1
21A	CB-20	0.69	960	128	0.13	6.3
21B	CB-18B	1.06	987	125	0.13	9.7
22A	P-1	39.79	2808	266	0.09	323.2
22B	CB-17B	0.11	190	9	0.05	0.9
23A	CB-13	1.04	344	17	0.05	8.4
23B	BC-1	25.72	2004	269	0.13	195
23C	CB-76	0.79	486	58	0.12	4.7**
23D	CB-75	0.29	486	55	0.11	1.7**
24A	CB-12B	0.45	116	9	0.08	4
24B	CB-11B	0.30	174	14	0.08	2.7
24C	CB-9	0.33	216	22	0.10	2.9

Offsite Watershed ID (OS)	Outfalls at Drainage Structure	Drainage Area (ac)	Length (ft)	ΔH (ft)	Slope	Q100 (cfs)
24D	CB-6B	2.47	642	32	0.05	21.9
24E	CB-70A	0.45	230	6	0.03	4.2
24F	BC1	5.20	914	149	0.16	42.8
25		3.79	958	168	0.18	31.2
26	Exst RCBC	30.73	2338	219	0.09	253
26A	CB-1H	0.06	162	2	0.01	0.5
27A	CB-1G	0.61	270	17	0.06	5
27B	CB-1D	0.45	205	16	0.08	3.7
27C	CB-1A	0.17	121	17	0.14	1.4
27D	Exst RCBC	0.39	412	19	0.05	3.2
28E	CB-70B	0.20	81	10	0.12	1.8
28D	CB-71	0.09	123	8	0.07	0.8
28C	CB-1E	1.13	552	33	0.06	11
28B		0.09	203	9	0.04	0.9
28A		0.33	525	18	0.03	3.2

**Q10 for Pavement Drainage

4.3 Proposed Conditions Hydraulics

4.3.1 Culverts and Outlet Protection

The hydraulic performance of the culverts was analyzed using computer program HEC-RAS and HY8 to determine the headwater elevations and outlet velocities. HEC-RAS utilizes the methodologies found in the Federal Highway Administration's (FHWA) Hydraulic Design Series 5 (HDS-5) publication. Results of the culvert analyses are provided in Table 5. Calculation sheets are provided in Appendix E and HEC-RAS results in Appendix D, respectively.

Headwater elevations of proposed culverts were compared to those under existing conditions, and drainage easements provided for the locations where the increase of water surface is more than 0.10 feet outside of the right-of-way (ROW). Changes in water surface elevations are summarized in Table 5. A decrease in water surface generally occurred at the inlet of each culvert due to the grading and/or drop inlets provided.

Proposed improvements include the design of eighteen culverts across or along Kolb Road and one culvert along Snyder Road. Improvements will incorporate construction of new culverts and culvert extensions to account for roadway widening and upsizing to adequately convey the 100-year storm with the purpose of preventing flow from overtopping the roadway. Culvert hydraulics were analyzed using the computer program

HY-8©, which utilizes the FHWA methodology presented in HDS-5, Design of Highway Culverts.

Flows from offsite watershed 1 (OS1), located just west of the Ventana Canyon Village along Kolb Road, are collected into an existing stormdrain system and are conveyed east under Kolb Rd, which outlets west of the Kolb/Sunrise Commercial Center. The existing stormdrain system will not be impacted by this project; therefore, no hydrologic or hydraulic analyses were performed for OS1 and 100-year discharges are based on historical development plans.

Offsite pavement drainage from Sunrise Drive discharges within the project limits into onsite watersheds (WS) 1a and 1b. Construction of curb and scuppers is proposed, which will convey and collect flows in water harvesting basins. A small amount of bypass will continue south to a new curb inlet within WS7b, which will discharge directly into the private basin. The addition of the water harvesting basin will reduce flows from pavement drainage which previously discharged into the private drainage basin.

Existing offsite peak discharges from OS2a and OS2b were not altered by this project; however, the pavement drainage from Kolb Rd previously flowing into OS2a and OS2b is now contained within the curb. The flows from pavement are minor compared to the overall watershed discharges and were not removed for proposed conditions analysis.

The existing culvert under the driveway for OS2a needed to be relocated outside of the roadway fill slope. Flows from OS2a will be conveyed via new 2-30" RCPs (Pipe 15), where it combines with discharges from OS2b. The combined flows are conveyed to the east into the existing private drainage basin via a pipe extension of the existing 3-36" CMPs (PE-3). Pavement drainage from WS2a-c and WS3a-f is collected via curb opening and flows into cascading water harvesting basins within the Kolb Road median. Overflow from the water harvesting basins is collected in a new area grate within WS3g and conveyed via stormdrain to the extended 3-36" CMPs (PE-3).

The next median south collects pavement flows from WS4a-e in a similar fashion, via curb openings into water harvesting basins. Overflow from the basin is collected in the area grate in WS4i, combined with the collect flows in WS7b and also discharged into the extended 3-36" CMPs (PE-3) via stormdrain. While the increased pavement area contributes additional discharge, the water harvesting basins both in the median and on the east side of the road retain a portion of the flows. The overall discharge results to the private drainage basin are reduced from existing conditions, which collected the pavement

flows from the same general watershed areas. Excluding discharges from the existing 2-42" RCP's (WS4), the existing overall discharges to the private basin total 134.8cfs under existing conditions and 128.26cfs under proposed.

West of Kolb Road along the northern side of Territory Drive, discharge from OS3 remains unchanged from existing conditions. Existing offsite culverts will not be impacted by this project; therefore, no hydrologic or hydraulic analyses were performed for OS3.

The existing 2-42" CMPs located at the proposed roundabout will remain in place. These pipes convey flows from the commercial development and from housing developments upstream. The additional flows from pavement drainage are minor in comparison and do not necessitate upsizing of these pipes. The pavement discharge from WS10 was included in the original analysis and will not be considered adding flows. Two stormdrain systems discharge at the concentration point of OS4, adding 6.25cfs to the 166cfs existing discharge. Two scuppers convey pavement drainage from WS13 and WS15 into the existing channel upstream of OS4a, which combines with the OS4 discharge. The additional flows to OS4a are 1.27cfs in addition to the 66cfs, which is negligible in comparison. It should be noted that under existing conditions, the roadway was crowned and not curbed, so a portion of the pavement drainage from the roadway was already included in the existing peak discharge calculation.

The majority of existing watersheds OS4B-D will remain unchanged until reaching the roadway. A new retaining wall with a small swale at the top of the wall is proposed at the base of watersheds OS4C and OS4D, conveying flows north to the proposed area inlet at the concentration point for OS4C. Flows are combined in the stormdrain system that outlets to OS4, mentioned previously.

Drainage patterns for OS4B will remain unchanged and will continue to flow in a natural drainage swale and discharge through openings in the existing wall for the Pinnacle Canyon Condominiums. Under existing conditions, the driveway to the north of the swale was uncurbed and flows that overtopped the existing drainage swale would flow across the private driveway. A new water harvesting basin and area grate at WS9c are proposed to intercept overflow from OS4B as well as the pavement drainage from WS9a and WS9b. The stormdrain system and area inlet at WS9c have been sized to convey the full discharge from OS4B to account for the possibility that the weep holes in the wall on private property are not maintained and become clogged.

Flows from OS6a are conveyed south under a private driveway along the east side of Kolb Road. Under existing conditions, the culvert discharged 30.6cfs while the remaining 49.2cfs would overtop the driveway due to undersized pipes. The proposed 2-53"x34" HERCPs (P-14) were upsized to the extent practicable in order to still provide adequate cover at the driveway. While 3.2cfs still overtops the driveway under proposed conditions, the new culvert will convey 77.5cfs and the headwater elevation was reduced.

A large section of Kolb Road, from Gate Ridge Road to Snyder Road, is uncurbed along the west side. The roadway is crowned from Gate Ridge Road to approximately 900 feet south. Pavement drainage from the west half of the roadway is allowed to sheet flow off the roadway into a proposed channel. Runoff from OS5 and OS6C sheet flows east, to the west edge of Kolb Road, and is collected in the new channels and conveyed south to the proposed 1-24" RCP. Flows are discharged east of Kolb Road into an existing natural channel within the Quail Canyon Homeowners Master Association common area.

Flows draining to the east side of the curbed roadway are either discharged directly east via sidewalk scuppers or are collected via inlets and conveyed south in proposed stormdrain systems, which discharge to the east side of Kolb Road.

Runoff from OS7, OS8 and OS9 follows similar drainage patterns, with runoff from each watershed collecting at the channel then discharging to proposed culverts. While the existing culverts for OS7-9 had sufficient capacity, the proposed widening and roadway vertical increase will bury the inlets and outlets. The proposed 2-24" RCPs for OS7 (P-12) and OS8 (P-11) were not upsized; however, the inlets were realigned to maximize capture of the flows. The outlets were proposed in the same locations as to match existing drainage patterns downstream. To achieve positive drainage while keeping minimum cover, the existing 24" CMP at OS9 was replaced by 1-38"x24" HERCP (P-10). With the roadway profile raising and fill limits extending further up existing slopes, drop inlets are required for a number of culverts to reduce the headwater elevations and to avoid overtopping of the road. Drop inlet locations are shown on the Cross Culvert Plan and Profile sheets in Appendix 14.

Under existing conditions, OS10 discharged over the roadway and flowed down a private driveway. A new 1-38"x24" HERCP (P-6) is proposed at the concentration point for OS10 to alleviate the flows and sedimentation next to the private dwelling. The proposed culvert will outlet north of the property line into a swale with a riprap berm directing flows past the driveway and dwelling. Flows daylight to match existing conditions just past the end

of the existing driveway. FlowMaster calculations to compare the existing and proposed conditions for the culvert outlet and swale are located in Appendix 7.

Flows from OS11 and WS24 are collected in a new riprap lined channel on the west side of Kolb Road and conveyed south, under an existing driveway, to a new 1-18" RCP (P-7). Discharges from the driveway culvert combine with runoff from OS12 and flow south to the new 1-38"x24" HERCP (P-9). The outlet of the proposed culvert is located in the same location as existing. While the discharge from the proposed culvert is higher than the existing culvert discharge, the overall flows across the private driveway have been reduced. Under existing conditions, partial flows from OS10 and full flows from OS11 were conveyed between the eastside roadway shoulder and an existing vegetated berm. Approximately 13.5cfs from the roadside flow was added to the culvert discharge of 28.3cfs, totaling nearly 42cfs flowing across the private driveway on the northeast corner of Kolb Rd and Rocky Ridge Dr. The proposed culvert at OS10 reduces the discharge across the private driveway to 33.9cfs. Flows then continue southeast along Rocky Ridge Drive until discharging into the same natural channel as existing.

To alleviate flows across private driveways on the west side of Kolb Road, lined channels and area drains are proposed to collect runoff from OS13A-D and OS14A. Flows are conveyed via stormdrains to a location south of the existing culvert location. Existing flows were conveyed east across Kolb Rd and then south across Rainbow Canyon Road; however, the culverts were undersized. Reconstructing a new culvert with sufficient capacity was not feasible in the same location as the current flows already discharge along the base of a wall on private property. Flows from OS13E are collected by a new area inlet and conveyed south in the new stormdrain system. The stormdrain outlets into a lined swale approximately 115' feet south of the existing culvert, where it daylights to match existing conditions. Two scuppers were added to discharge pavement drainage at WS31 (SC12) and WS32 (SC11). The roadway was previously uncurbed and pavement drainage would sheet flow off Kolb Road onto private property, combining with flows from the existing culvert under Rainbow Canyon Rd. The discharge location of SC12 is south of the outlet of the existing culvert, just north of the previously mentioned stormdrain outlet, and discharges 0.76cfs into the natural channel. While the outlet is proposed to discharge into the channel along the base of an existing wall, the discharge is a fraction of what the channel previously contained.

Runoff from OS14B is collected in a new channel and conveyed under the private driveway via a new 1-30"x19" HERCP (P-5). Discharge from the culvert combines with OS14C before crossing under Kolb Road via 1-36" RCP (P-4). The proposed outlet for the culvert

is in the same general location as the existing outlet to keep drainage patterns similar to existing conditions.

Sheet flows from OS15 no longer overtop the roadway due to the addition of a rock lined channel along the west side of the roadway and a change in the vertical profile. The west side of Kolb Road is uncurbed and superelevated, allowing pavement drainage from WS34 to flow into the roadside channel. Watersheds OS17A and OS17B have similar proposed drainage patterns, with a channel along the west side of Kolb to convey runoff from offsite and pavement drainage north. The channels from OS15, OS17A and SO17B converge at the center of OS16, where a new 3-30" RCP (P-3) conveys flows east, under Kolb Road. The culvert outlet discharges to the same location as existing conditions to maintain exiting drainage patterns.

The west side of Kolb Road remains uncurbed until just north of Snyder Road but is superelevated towards the east. Flows from OS17E are collected in a channel on the west side of Kolb Road and conveyed south toward Snyder Road. To provide adequate depth for ponding, an area grate and catch basin are proposed on the north west corner of the intersection to convey flows to the proposed 1-36" RCP (P-2). Due to large grade change between the west and east side of the roadway, a steep slope of over 15% was required within the culvert. A grade break is proposed for the last 50' of the culvert to reduce velocities and will outlet into a wire tied riprap lined channel along the north side of Snyder Road. Flows continue east to the existing driveway for the Villas at Sabino Canyon Condominiums. In order to keep ponded headwater within the proposed channel, another grate inlet was proposed to connect to the new 1-30"x19" (P-16) HERCP under the driveway. Runoff is allowed to return to existing drainage patterns once it outlets east of the driveway.

The existing culvert inlet for OS18 was completely covered by sediment. Runoff appears to sheet flow across the roadway, ponding against the retaining wall with weep holes and discharges into the parking lot of The Arboretum apartment complex. A pipe extension with 2-24" RCPs (PE-2) is proposed to connect to the existing pipes, which will reduce the flows along the existing retaining wall and reduce the sediment washed into the parking lot via the scour at the weep holes.

Roadway improvements will necessitate a 1-24" RCP pipe extension at OS20, connecting to the existing 1-24" CMP (PE-1). The existing culvert outlets into a natural swale with rock riprap on a berm, which diverts flows away from the driveway. The only change

proposed for the existing outlet is the addition of riprap on the channel bottom to prevent scour.

Part of the flows from OS20 bypass the culvert and continue south in a channel to an area inlet just north of Quail Run Drive. Grading west of the intersection directs flows from OS21A, which flow along the north side of Quail Run Drive, into the new area inlet. Flows along the south side of Quail Run Drive, which previously overtopped Kolb Road, are now collected in an area grate on the southwest corner and conveyed into the new stormdrain system.

Just north of Painted Quail Drive, the existing 3-48" CMPs will be replaced with 3-60"x38" HERCPs (P-1) to convey the concentrated flows discharging from watershed OS22a. Flows continue east within a natural channel which matches the existing drainage pattern. Under existing conditions, offsite watershed OS22B flowed along the east edge of Kolb Road and discharged at the culvert outlet. With the addition of curb and driveway improvements, OS22B flows will now be collected in an area inlet north of the private driveways and conveyed to the proposed culvert via stormdrain.

Under existing conditions, flows from OS23 overtop and flow across Kolb Road or are conveyed south and cross Pintail Drive at grade. The existing watershed was subdivided to account for the various drainage improvements. A small channel along the west side of Kolb Road collects flows from OS23A via an area inlet and discharges to the east, through the headwall at the outlet of P-1.

A new riprap lined channel will be constructed to collect discharge from OS23B and convey flows south, along the west side of Kolb Road. To provide all weather access for Pintail Drive, a new 2-6'x3' RCBC (BC-2) will be constructed to convey flows under the roadway. Roadway drainage from Pintail Drive watersheds OS23C and OS23D, which originally discharged across Kolb Road, will now be collected via two area inlets and discharged into the RCBC. Additional area inlets on the east side of Kolb Road will collect discharge from offsite watersheds OS24A-C, which previously flowed along the uncurbed roadway, and convey flows to the box culvert at Pintail Drive.

Discharge from the Pintail Drive box culvert flows south in a rock lined channel, collecting additional flows from OS24F. The existing 2-36" CMPs at Gambel Circle were undersized and will be replaced by 1-10'x4' RCBC (BC-1). Additional flows from OS24D and pavement drainage, which are collected via inlets and conveyed by stormdrain, will discharge into the new box culvert at Gambel Circle. A plunge basin is proposed at the

outlet of the culvert to reduce velocities to match the existing conditions drainage pattern. The existing channel continues flowing south and diverges from the project limits. With the exception of the plunge basin, no changes for the existing channel within OS26 are proposed. Flows from OS26 eventually migrate west towards Kolb Road but are conveyed south under Little Savannah Lane via existing 4-42" CMPs, which is south of the project limits and will remain.

Offsite flows east of Kolb Road are conveyed south to an area inlet at the concentration point for OS28C and flow west under Kolb Road in the new stormdrain system. South of Cripple Creek Drive, the roadway is superelevated and drains to the west curbline. Scuppers are proposed to discharge flows off the roadway and into a riprap lined channel, which also collects offsite flows from OS27A. Flows are conveyed south to an area inlet just north of Clayridge Drive and then south via the proposed stormdrain system. Drainage patterns for OS27B and OS27C are similar to OS27A, with a proposed channel and area inlet at the southern concentration points of the watersheds. The proposed stormdrain system outlets within the northern portion of OS27D and flows south along the edge of roadway fill. Flows from OS27D combine with OS26 just south of the project limits.

Under existing conditions, peak discharges conveyed to the existing 4-42" CMPs totaled 279.5cfs. With the additional pavement drainage and the conveyance of a portion of the flows from the east side of Kolb Road, the peak discharge increased to 287.81cfs. Hydrologic analysis of the existing culvert was performed using HEC-RAS. The change in roadway profile and increase in peak discharge resulted in a headwater increase of only 0.05' at the existing culvert and no change in water surface elevation downstream of the culvert.

Offsite watershed OS28A continues to flow south along the east edge of Kolb Road and discharges into the Ventana Canyon Wash. A proposed scupper discharges pavement drainage into the right of way at the end of the project limits. A small amount of flow bypasses the scupper but is captured within the existing catchbasin south of the project limits.

Erosion protection at culvert outlets were sized using the methodology outlined in the FHWA HEC-14 manual. HEC-14 does not provide methodology for rectangular culverts, so an equivalent pipe diameter was calculated based on the opening area of the culvert. This yields conservative lengths, depths and rock sizes since the calculations are primarily based on culvert opening height and equivalent diameters are larger than box heights. Results of the culvert and erosion protection analyses are provided in Table 5, with detailed

calculations in Appendix 8. Slope mattresses are used in locations with high velocities and excessive rock sizes. Additional information for the slope mattresses can be found on Detail D13 in Appendix 8. Culvert calculation sheets are provided in Appendix 7.

4.3.2 Sedimentation

Sedimentation is a concern within the project limits, since it is a frequent occurrence for sedimentation on the existing roadway after storm events. An equation provided in the City of Tucson Standards Manual for Drainage Design and Floodplain Management was used to estimate the potential for sedimentation within a proposed culvert. Input variables include the flow rates, slopes, and manning's values at the approaching sections and culvert. A calculated result of less than one indicates that a culvert is unlikely to clog due to sediment deposition. Values greater than one indicate the opposite, with likelihood of sediment deposition within the culvert increasing as the calculated value increases. The sedimentation potential was calculated for each proposed culvert crossing within the project limits and is summarized in Appendix 13. Culverts have been designed to result in a value of less than one.

Table 5
Proposed Conditions Culvert Analysis Summary

Culvert Ref No.	Station	Proposed Culvert	Contributing Watersheds	Design Q_{100}	Q_{CUL} Thru Culvert	Q_{BYP} Bypass	Vel	HW	Outlet Protection**				
									D_{50}	T	L	W @ Outlet	W @ End
				(cfs)	(cfs)	(cfs)	(ft/sec)	(ft)	(in)	(ft)	(ft)	(ft)	(ft)
BC-1*	69+83	1-10'x4' RCBC	OS24 & 23 P66, 67, 68 & 69	264.1			17.07	2594.54	Plunge Basin (See Detail D13 in Appendix 8)				
BC-2*	73+40	2-6'x3' RCBC	OS23, P62, 63 & 64	220.5			18.11	2610.92	*	1.5		10.0	10.0
P-1	80+51	3-60"x38" RCP	OS21 & 22, P54, 55, 56, 57, 58 & 59	369.92	362.12	7.8	17.78	2642.55	Plunge Basin (See Detail D13 in Appendix 8)				
PE-1	86+52	1-24" Pipe ext.	OS18 (PE-2) Bypass, OS20, P50, 51 & 52	49.4	23.34	26.04	12.96	2655.62	12	1.50	10.0	2.0	8.6
PE-2	89+99	2-24" Pipe ext.	OS18, P44, 45, 46, 47A, 47B, 48 & 49	65.9	41.14	24.79	7.98	2660.89	Existing Pipe Outlet to Remain				
P-2*	100+61	1-36" RCP	OS17E, P36, 37, 38 & 39	36.4			14.88	2709.67	*	1.0	21.0	18.0	18.0
P-3	110+95	3-30" RCP	OS15, 16, 17a & 17b	96.8			13.69	2697.38	12	2.0	12.8	12.2	15.9
P-4*	114+06	1-36" RCP	OS14B & 14C	54.6			14.16	2704.12	*	1.0	21.0	12.0	17.0
P-6	126+28	1-23"x14" HERCP	OS10	16.4	13.73	2.67	6.36	2735.39	12	2.0	36.0	22.1	10.1
P-7*	125+00	1-18" RCP	OS11	8.1			5.84	2733.87	*	1.0	9.0	11.0	11.0
P-9*	123+14	1-38"x24" HERCP	OS11,12 & P24	36.6			12.98	2730.54	*	1.0	15.0	5.4	12.6
P-10	127+09	1-38"x24" HERCP	OS9 & P23	19.6			11.12	2735.69	12	1.5	12.0	6.2	10.8
P-11	129+34	2-24" RCP	8A	13.9			10.87	2747.22	6	1.0	12.0	9.0	9.0
P-12	131+25	2-24" RCP	OS6C Bypass & OS7	22.4			10.87	2751.69	6	1.5	8.0	5.8	5.8
P-13	133+58	1-24" RCP	OS5, OS6C, P19	20.0			14.05	2758.21	12	2.0	12.0	7.0	7.0
PE-3	149+99	3-36" Pipe ext.	OS2a&b, P3g, P4i, P7b	123.5			16.44	2752.2	Existing Pipe Outlet within Parking Lot to Remain				
DRIVEWAY CULVERTS													
Exst WS4a	144+30	2-30" CMP	OS4a (To remain)	60.0					Existing Pipe Outlet within Parking Lot to Remain				
P-5	115+61	1-30"x19" HERCP	OS14B	4.4			7.54	2708.85	6	1.0	8.0	4.6	7.4
P-14*	134+72	1-53"x34" HERCP	OS6A, P17A & 17B	80.7			11.26	2762.33	*	1.5	16.0	6.4	15.0

Culvert Ref No.	Station	Proposed Culvert	Contributing Watersheds	Design Q_{100}	Q_{CUL} Thru Culvert	Q_{BYP} Bypass	Vel	HW	Outlet Protection**				
									D_{50}	T	L	W @ Outlet	W @ End
				(cfs)	(cfs)	(cfs)	(ft/sec)	(ft)	(in)	(ft)	(ft)	(ft)	(ft)
P-15	150+55	2-30" RCP	OS2a	43.0			14.03	2753.59	Outlets to new Drop Inlet Structure for PE-3				
P-16*	9+62	1-38"x24" HERCP	OS17b, P40 & 42	40.3			15.75	2669.21	22	1.0	20.0	11.6	7.9

* Slope Mattresses used for high outlet velocities or excessive rock sizes. D_{50} per Section 913 of the Standard Specifications.

√alues shown as designed. Calculated values in Appendix 8 show minimum value required. Minimum D_{50} = 6”. Wire tied D_{50}=6” or 12” can be substituted for excessive rock sizes.

4.3.3 Channels

Roadside channels are necessary in order to convey roadway runoff as well as offsite flows to nearby cross culverts, maintaining flow within the right of way and off the roadway surface. Normal depth calculations were used to size roadside channels and are summarized in Table 6 and more detailed normal depth calculations from FlowMaster are in Appendix 9. Channel details are included in the Final PS&E construction plans.

There are both triangular and trapezoidal channels located along the west side of Kolb Road throughout the project. The longitudinal slopes of the channels vary from 1% to 7%, with foreslopes and backslopes ranging from 10:1 to 2:1. All channels have been sized to convey 100-year peak discharge from the corresponding watersheds. Erosion control treatments for the channels were analyzed and results are documented within the Table 6 - Channel Summary Table with supporting documentation in Appendix 9.

Table 6
Proposed Channel Summary

Channel #	Station Start	Station End	Channel Shape	Contrib. OS#	Q10 (Pvmt) (cfs)	Q100 (Offsite) (cfs)	Total Q (cfs)	Normal Depth (ft)	Free-board (ft)	Channel Depth (ft)	Riprap Lined*	Vel (fps)
1a	58+01	58+75	Triangular	27	0	1.4	1.4	0.4	0.09	0.49	No	2.95
1b	59+60	60+75	Triangular	27		3.7	3.7	0.61	0.13	0.74	Yes	3.32
2	61+66	64+80	Trapezoidal	27	2.3	5.0	7.3	0.54	0.13	0.67	Yes	4.05
3	65+85	67+60	Triangular	27	0	0.5	0.5	0.27	0.06	0.33	No	1.99
4a	70+14	72+38	Trapezoidal	23B	0	264.1	264.1	2.11	0.53	2.64	Yes	8.21
4b	74+35	77+60	Trapezoidal	23B	0	220.5	220.5	2.04	0.54	2.58	Yes	8.90
4c	77+60	78+55	Trapezoidal	24F	0	195.0	195.0	2.2	0.54	2.74	Yes	8.22
5	79+50	80+65	Triangular	23	0	8.4	8.4	0.79	0.17	0.96	Yes	3.89
7a	85+70	92+50	Trapezoidal	20	3.5	21.1	24.6	1.08	0.24	1.32	Yes	4.84

Channel #	Station Start	Station End	Channel Shape	Contrib. OS#	Q10 (Pvmt) (cfs)	Q100 (Offsite) (cfs)	Total Q (cfs)	Normal Depth (ft)	Free-board (ft)	Channel Depth (ft)	Riprap Lined*	Vel (fps)
7b	92+50	99+05	Trapezoidal	18	0	60.7	60.7	1.63	0.37	2.00	Yes	6.11
8a	100+90	104+00	Trapezoidal	17E	0	33.5	33.5	1.47	0.28	1.75	No	3.54
8b	104+50	105+50	Triangular	17B	0	13.4	13.4	1.28	0.23	1.51	Yes	2.71
8c	105+50	110+45	Triangular	17a/b	0	56.3	56.3	1.81	0.39	2.20	Yes	5.7
9a	109+00	112+00	Trapezoidal	17a/b	0	56.3	56.3	1.91	0.36	2.27	Yes	3.81
9b	112+00	113+70	Triangular	15	0	15.3	15.3	1.16	0.23	1.39	Yes	3.79
10a	114+25	117+40	Trapezoidal	14B+C	0	25.6	25.6	1.11	0.23	1.34	Yes	4.36
10b	117+00	117+40	Trapezoidal	14A	0	24.7	24.7	1.09	0.23	1.32	Yes	4.32
11a	119+75	120+25	Trapezoidal	13C	0	1.3	1.3	0.2	0.05	0.25	Yes	2.51
11b	120+95	122+20	Trapezoidal	13A	0	2.3	2.3	0.27	0.07	0.34	No	2.99
12a	123+25	125+75	Trapezoidal	12, 11	1.6	30.6	32.2	1.45	0.27	1.72	Yes	3.48
12b	126+00	126+65	Trapezoidal	10	0	16.5	16.5	0.7	0.15	0.85	Yes	3.57
13	127+25	129+90	Trapezoidal	9A	1.5	18.1	19.6	0.91	0.20	1.11	Yes	4.53
14a	130+70	131+50	Trapezoidal	7	0.7	23.1	23.8	1.15	0.23	1.38	Yes	3.8
14b	132+00	133+85	Triangular	7	0.7	23.1	23.8	1.4	0.28	1.68	Yes	4.06
15a	135+41	136+15	Triangular	6C	1.6	13.3	14.9	1.08	0.23	1.31	Yes	4.27
16	141+00	143+80	Triangular	4A	1.3	1.2	2.5	0.48	0.10	0.58	No	3.1
17**	143+41	144+75	Triangular	6a	1.2	6.4	7.6	0.84	0.17	1.01	Yes	3.53
18	151+03	152+92	Trapezoidal	2a		43.0	43.0	1.32	0.26	1.58	Yes	3.77

*Riprap lining height required to the Channel Depth indicated (Normal Depth + Freeboard)
**Located on the east side of Kolb Road

4.3.4 Stormdrain

Networks of stormdrain pipe are required throughout the project to provide connection from catch basin inlets to culvert outlets, or to be provided as outfalls to the catch basin inlets. These networks use 18” to 36” diameter pipes to connect to a variety of catch basins (including off-pavement), scuppers, and manholes. In some cases, these networks outlet to cross-drainage structures directly.

Pavement drainage, inlet sizing and stormdrain capacity was analyzed for the 10-year design storm. A check storm evaluation of the pavement drainage and stormdrain system was not performed for the 100-year design discharge; however, 100-year design discharges were analyzed at inlets in sag locations. Under existing conditions, a majority of the roadway was uncurbed which allowed 100-year flows to overtop the roadway and flow outside of right-of-way. With proposed curb throughout a majority of the project, flows within the roadway would only pond 6” before overtopping the curb. Flows that overtopped the curb would either be conveyed to drainage structures in the new channels along the west side or would flow outside the right-of-way on the east side. Overtopping

flows on the east side would match the existing conditions drainage patterns but would be reduced significantly due to the addition of curb and drainage improvements.

Stormdrain inlets were analyzed using FlowMaster and included the capture ratios as required in Table 2-9 of the Pima County RDM. As previously discussed, Table 4 summarizes the wing/opening lengths for inlets. The stormdrain system hydraulics were analyzed using AutoCAD Storm and Sanitary Analysis. Detailed inlet calculations from FlowMaster are in Appendix 10. See the attached stormdrain plan and profile sheets in Appendix 14 for additional information.

4.4 Right-of-Way Requirements

Erosion protection will be provided within the existing right of way limits or the new drainage easements, where required. Drainage easements will also be required where ponding upstream of proposed culverts will result in increases greater than 0.10 feet.

5.0 Summary and Conclusions

The proposed design will convey flows safely and efficiently under Kolb Road in a manner consistent with existing conditions. Existing drainage crossings will be upsized to convey the 100-year peak discharge without overtopping the roadway. Ponding at culvert inlets will be maintained within the right of way, or additional easements as required. Pavement drainage will be provided via scuppers, catchbasin inlets and stormdrain pipe, discharging either to the nearest roadside channel, culvert or to existing outfall locations. Due to the overall size of the watersheds impacting this site, the additional impervious area will not provide a significant change to overall peak discharges within the washes downstream.

APPENDIX 1

EXISTING CONDITIONS OFFSITE HYDROLOGIC CALCULATIONS

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	06/28/2018
Concentration Point:	1a	Job #	7PIM160201
Watershed Area:	0.41 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	6	358	0.0168	0.035

Length of Watercourse (Lc):	358	feet	Mean Slope:	0.0168
Length to Cen. of Gravity (Lca):	179	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 10-years NOAA Data Obtained: 2018-06-28 10:35:07 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2944 Longitude: -110.8396

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.59	0.89	1.11	1.49	1.84	2.05	2.13	2.36	2.63	2.81

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88.2	88.8	0.481
D	-	-	-	-
Imp.	90	99	99	0.937

Weighted Runoff Coef. (Cw):	0.89	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	7.08	in/hr
Runoff Supply Rate (q) @ Tc:	6.31	in/hr
PEAK DISCHARGE:	2.6	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	06/28/2018
Concentration Point:	1b	Job #	7PIM160201
Watershed Area:	0.51 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	3	406	0.0074	0.035

Length of Watercourse (Lc):	406	feet	Mean Slope:	0.0074
Length to Cen. of Gravity (Lca):	203	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 10-years NOAA Data Obtained: 2018-06-28 10:35:07 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2944 Longitude: -110.8396

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.59	0.89	1.11	1.49	1.84	2.05	2.13	2.36	2.63	2.81

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88.2	88.8	0.481
D	-	-	-	-
Imp.	90	99	99	0.937

Weighted Runoff Coef. (Cw):	0.89	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	7.08	in/hr
Runoff Supply Rate (q) @ Tc:	6.31	in/hr
PEAK DISCHARGE:	3.2	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	3	Job #	7PIM160201
Watershed Area:	19.41 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	72	1580	0.0456	0.035

Length of Watercourse (Lc):	1580	feet	Mean Slope:	0.0456
Length to Cen. of Gravity (Lca):	790	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.301 Longitude: -110.8402

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88	91	0.668
D	-	-	-	-
Imp.	25	99	99	0.957

Weighted Runoff Coef. (Cw):	0.74	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	7.73	in/hr
PEAK DISCHARGE:	151.2	cfs

Lesser Return Periods

Return Period	Ratio	Qpeak
2-year	.10	15.1
5-year	.23	34.8
10-year	.35	52.9
25-year	.55	83.1
50-year	.75	113.4

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	5	Job #	7PIM160201
Watershed Area:	0.62 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	14	356	0.0393	0.035

Length of Watercourse (Lc):	356	feet	Mean Slope:	0.0393
Length to Cen. of Gravity (Lca):	178	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	15

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.301 Longitude: -110.8402

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88	91	0.668
D	-	-	-	-
Imp.	35	99	99	0.957

Weighted Runoff Coef. (Cw):	0.769	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	8.03	in/hr
PEAK DISCHARGE:	5	cfs

Lesser Return Periods

Return Period	Ratio	Qpeak
2-year	.10	0.5
5-year	.23	1.2
10-year	.35	1.8
25-year	.55	2.8
50-year	.75	3.8

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	6	Job #	7PIM160201
Watershed Area:	1.79 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	36	404	0.0891	0.035

Length of Watercourse (Lc):	404	feet	Mean Slope:	0.0891
Length to Cen. of Gravity (Lca):	202	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.301 Longitude: -110.8402

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88	91	0.668
D	-	-	-	-
Imp.	15	99	99	0.957

Weighted Runoff Coef. (Cw):	0.711	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	7.42	in/hr
PEAK DISCHARGE:	13.4	cfs

Lesser Return Periods

Return Period	Ratio	Qpeak
2-year	.10	1.3
5-year	.23	3.1
10-year	.35	4.7
25-year	.55	7.4
50-year	.75	10

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	07/27/2017
Concentration Point:	6a	Job #	7PIM160201
Watershed Area:	10.66 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	200	1282	0.156	0.035

Length of Watercourse (Lc):	1282	feet	Mean Slope:	0.156
Length to Cen. of Gravity (Lca):	641	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-08-13 03:49:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.301 Longitude: -110.8402

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88	91.18	0.683
D	-	-	-	-
Imp.	15	99	99	0.959

Weighted Runoff Coef. (Cw):	0.72	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	7.91	in/hr
PEAK DISCHARGE:	85	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	7	Job #	7PIM160201
Watershed Area:	2.99 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	78	495	0.1576	0.035

Length of Watercourse (Lc):	495	feet	Mean Slope:	0.1576
Length to Cen. of Gravity (Lca):	248	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	15

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.301 Longitude: -110.8402

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88	91	0.668
D	-	-	-	-
Imp.	15	99	99	0.957

Weighted Runoff Coef. (Cw):	0.711	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	7.42	in/hr
PEAK DISCHARGE:	22.4	cfs

Lesser Return Periods

Return Period	Ratio	Qpeak
2-year	.10	2.2
5-year	.23	5.1
10-year	.35	7.8
25-year	.55	12.3
50-year	.75	16.8

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	8	Job #	7PIM160201
Watershed Area:	2.08 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	100	557	0.1795	0.035

Length of Watercourse (Lc):	557	feet	Mean Slope:	0.1795
Length to Cen. of Gravity (Lca):	279	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	15

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.301 Longitude: -110.8402

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88	91	0.668
D	-	-	-	-
Imp.	25	99	99	0.957

Weighted Runoff Coef. (Cw):	0.74	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	7.73	in/hr
PEAK DISCHARGE:	16.2	cfs

Lesser Return Periods

Return Period	Ratio	Qpeak
2-year	.10	1.6
5-year	.23	3.7
10-year	.35	5.7
25-year	.55	8.9
50-year	.75	12.1

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	9	Job #	7PIM160201
Watershed Area:	2.47 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	120	749	0.1602	0.035

Length of Watercourse (Lc):	749	feet	Mean Slope:	0.1602
Length to Cen. of Gravity (Lca):	375	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	25

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.301 Longitude: -110.8402

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	87	90.18	0.643
D	-	-	-	-
Imp.	10	99	99	0.957

Weighted Runoff Coef. (Cw):	0.674	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	7.04	in/hr
PEAK DISCHARGE:	17.5	cfs

Lesser Return Periods

Return Period	Ratio	Qpeak
2-year	.10	1.8
5-year	.23	4
10-year	.35	6.1
25-year	.55	9.6
50-year	.75	13.1

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	10	Job #	7PIM160201
Watershed Area:	2.24 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	116	557	0.2083	0.035

Length of Watercourse (Lc):	557	feet	Mean Slope:	0.2083
Length to Cen. of Gravity (Lca):	279	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	15

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88	91	0.668
D	-	-	-	-
Imp.	10	99	99	0.957

Weighted Runoff Coef. (Cw):	0.697	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	7.27	in/hr
PEAK DISCHARGE:	16.4	cfs

Lesser Return Periods

Return Period	Ratio	Qpeak
2-year	.10	1.6
5-year	.23	3.8
10-year	.35	5.7
25-year	.55	9
50-year	.75	12.3

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	11	Job #	7PIM160201
Watershed Area:	0.65 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	80	449	0.1782	0.035

Length of Watercourse (Lc):	449	feet	Mean Slope:	0.1782
Length to Cen. of Gravity (Lca):	225	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89	91.66	0.689
D	-	-	-	-
Imp.	35	99	99	0.957

Weighted Runoff Coef. (Cw):	0.783	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	8.17	in/hr
PEAK DISCHARGE:	5.4	cfs

Lesser Return Periods

Return Period	Ratio	Qpeak
2-year	.10	0.5
5-year	.23	1.2
10-year	.35	1.9
25-year	.55	2.9
50-year	.75	4

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	12	Job #	7PIM160201
Watershed Area:	3.78 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	142	638	0.2226	0.035

Length of Watercourse (Lc):	638	feet	Mean Slope:	0.2226
Length to Cen. of Gravity (Lca):	319	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89	91.66	0.689
D	-	-	-	-
Imp.	10	99	99	0.957

Weighted Runoff Coef. (Cw):	0.716	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	7.47	in/hr
PEAK DISCHARGE:	28.5	cfs

Lesser Return Periods

Return Period	Ratio	Qpeak
2-year	.10	2.8
5-year	.23	6.5
10-year	.35	10
25-year	.55	15.7
50-year	.75	21.3

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	06/22/2018
Concentration Point:	13a	Job #	7PIM160201
Watershed Area:	1.92 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	148	718	0.2061	0.035

Length of Watercourse (Lc):	718	feet	Mean Slope:	0.2061
Length to Cen. of Gravity (Lca):	359	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30

RETURN PERIOD: 100-years NOAA Data Obtained: 2017-12-14 04:42:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2997 Longitude: -110.8408

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	87.3	90.37	0.659
D	-	-	-	-
Imp.	15	99	99	0.959

Weighted Runoff Coef. (Cw):	0.7	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	7.68	in/hr
PEAK DISCHARGE:	14.9	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	06/22/2018
Concentration Point:	13b	Job #	7PIM160201
Watershed Area:	5.21 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	150	795	0.1887	0.035

Length of Watercourse (Lc):	795	feet	Mean Slope:	0.1887
Length to Cen. of Gravity (Lca):	397.5	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30

RETURN PERIOD: 100-years NOAA Data Obtained: 2017-12-14 04:42:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2997 Longitude: -110.8408

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	87.3	90.37	0.659
D	-	-	-	-
Imp.	15	99	99	0.959

Weighted Runoff Coef. (Cw):	0.7	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	7.68	in/hr
PEAK DISCHARGE:	40.4	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	06/22/2018
Concentration Point:	13c	Job #	7PIM160201
Watershed Area:	0.65 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	16	433	0.037	0.035

Length of Watercourse (Lc):	433	feet	Mean Slope:	0.037
Length to Cen. of Gravity (Lca):	216.5	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30

RETURN PERIOD: 100-years NOAA Data Obtained: 2017-12-14 04:42:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2997 Longitude: -110.8408

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	87.3	90.37	0.659
D	-	-	-	-
Imp.	40	99	99	0.959

Weighted Runoff Coef. (Cw):	0.78	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	8.5	in/hr
PEAK DISCHARGE:	5.6	cfs

Calculation performed 2018-08-14 11:53:48 AM by PC-Hydro V6.1

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	14	Job #	7PIM160201
Watershed Area:	7.3 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	208	1113	0.1869	0.035

Length of Watercourse (Lc):	1113	feet	Mean Slope:	0.1869
Length to Cen. of Gravity (Lca):	557	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88	91	0.668
D	-	-	-	-
Imp.	15	99	99	0.957

Weighted Runoff Coef. (Cw):	0.711	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	7.42	in/hr
PEAK DISCHARGE:	54.6	cfs

Lesser Return Periods

Return Period	Ratio	Qpeak
2-year	.10	5.5
5-year	.23	12.6
10-year	.35	19.1
25-year	.55	30
50-year	.75	41

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	15	Job #	7PIM160201
Watershed Area:	2.2 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	224	736	0.3043	0.035

Length of Watercourse (Lc):	736	feet	Mean Slope:	0.3043
Length to Cen. of Gravity (Lca):	368	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	15

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88	91	0.668
D	-	-	-	-
Imp.	5	99	99	0.957

Weighted Runoff Coef. (Cw):	0.683	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	7.12	in/hr
PEAK DISCHARGE:	15.8	cfs

Lesser Return Periods

Return Period	Ratio	Qpeak
2-year	.10	1.6
5-year	.23	3.6
10-year	.35	5.5
25-year	.55	8.7
50-year	.75	11.8

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	16	Job #	7PIM160201
Watershed Area:	3.61 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	230	787	0.2922	0.035

Length of Watercourse (Lc):	787	feet	Mean Slope:	0.2922
Length to Cen. of Gravity (Lca):	394	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	15

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88	91	0.668
D	-	-	-	-
Imp.	15	99	99	0.957

Weighted Runoff Coef. (Cw):	0.711	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	7.42	in/hr
PEAK DISCHARGE:	27	cfs

Lesser Return Periods

Return Period	Ratio	Qpeak
2-year	.10	2.7
5-year	.23	6.2
10-year	.35	9.5
25-year	.55	14.9
50-year	.75	20.3

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	cr
Project Name:	Kolb Road	Date:	02/08/2017
Concentration Point:	17a	Job #	7PIM160201
Watershed Area:	6.19 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	218	1175	0.1855	0.035

Length of Watercourse (Lc):	1175	feet	Mean Slope:	0.1855
Length to Cen. of Gravity (Lca):	587.5	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	15

RETURN PERIOD: 100-years NOAA data user generated

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: _____ Longitude: _____

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88	91	0.668
D	-	-	-	-
Imp.	5	99	99	0.957

Weighted Runoff Coef. (Cw):	0.683	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	7.12	in/hr
PEAK DISCHARGE:	44.4	cfs

Lesser Return Periods

Return Period	Ratio	Qpeak
2-year	.10	4.4
5-year	.23	10.2
10-year	.35	15.6
25-year	.55	24.4
50-year	.75	33.3

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	cr
Project Name:	Kolb Road	Date:	02/08/2017
Concentration Point:	17	Job #	7PIM160201
Watershed Area:	6.83 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	213	1241	0.1716	0.035

Length of Watercourse (Lc):	1241	feet	Mean Slope:	0.1716
Length to Cen. of Gravity (Lca):	620.5	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	15

RETURN PERIOD: 100-years NOAA data user generated

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88	91	0.668
D	-	-	-	-
Imp.	5	99	99	0.957

Weighted Runoff Coef. (Cw):	0.683	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	7.12	in/hr
PEAK DISCHARGE:	49	cfs

Lesser Return Periods

Return Period	Ratio	Qpeak
2-year	.10	4.9
5-year	.23	11.3
10-year	.35	17.2
25-year	.55	27
50-year	.75	36.8

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	18	Job #	7PIM160201
Watershed Area:	9.24 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	130	1310	0.0992	0.035

Length of Watercourse (Lc):	1310	feet	Mean Slope:	0.0992
Length to Cen. of Gravity (Lca):	655	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2906 Longitude: -110.839

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.9	1.37	1.7	2.29	2.83	3.16	3.31	3.62	3.96	4.29

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88	91.15	0.681
D	-	-	-	-
Imp.	5	99	99	0.958

Weighted Runoff Coef. (Cw):	0.694	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.8	in/hr
Runoff Supply Rate (q) @ Tc:	7.5	in/hr
PEAK DISCHARGE:	69.8	cfs

Lesser Return Periods

Return Period	Ratio	Qpeak
2-year	.10	7
5-year	.23	16.1
10-year	.35	24.4
25-year	.55	38.4
50-year	.75	52.4

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	19	Job #	7PIM160201
Watershed Area:	0.16 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	14	110	0.1273	0.035

Length of Watercourse (Lc):	110	feet	Mean Slope:	0.1273
Length to Cen. of Gravity (Lca):	55	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89	91.66	0.689
D	-	-	-	-
Imp.	5	99	99	0.957

Weighted Runoff Coef. (Cw):	0.702	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	7.33	in/hr
PEAK DISCHARGE:	1.2	cfs

Lesser Return Periods

Return Period	Ratio	Qpeak
2-year	.10	0.1
5-year	.23	0.3
10-year	.35	0.4
25-year	.55	0.7
50-year	.75	0.9

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	20	Job #	7PIM160201
Watershed Area:	2.51 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	82	583	0.1407	0.035

Length of Watercourse (Lc):	583	feet	Mean Slope:	0.1407
Length to Cen. of Gravity (Lca):	292	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89	91.66	0.689
D	-	-	-	-
Imp.	35	99	99	0.957

Weighted Runoff Coef. (Cw):	0.783	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	8.17	in/hr
PEAK DISCHARGE:	20.7	cfs

Lesser Return Periods

Return Period	Ratio	Qpeak
2-year	.10	2.1
5-year	.23	4.8
10-year	.35	7.2
25-year	.55	11.4
50-year	.75	15.5

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	07/05/2018
Concentration Point:	21	Job #	7PIM160201
Watershed Area:	1.89 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	126	965	0.1306	0.032

Length of Watercourse (Lc):	965	feet	Mean Slope:	0.1306
Length to Cen. of Gravity (Lca):	483	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-07-05 02:32:55 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89	91.83	0.703
D	-	-	-	-
Imp.	50	99	99	0.959

Weighted Runoff Coef. (Cw):	0.83	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	9.07	in/hr
PEAK DISCHARGE:	17.3	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	cr
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	22	Job #	7PIM160201
Watershed Area:	39.82 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	266	2808	0.0947	0.035

Length of Watercourse (Lc):	2808	feet	Mean Slope:	0.0947
Length to Cen. of Gravity (Lca):	1404	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 100-years NOAA data user generated

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88	91	0.668
D	-	-	-	-
Imp.	20	99	99	0.957

Weighted Runoff Coef. (Cw):	0.73	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	7.57	in/hr
PEAK DISCHARGE:	304	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	cr
Project Name:	Kolb Road	Date:	05/10/2017
Concentration Point:	22a	Job #	7PIM160201
Watershed Area:	6.31 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	68	1544	0.044	0.035

Length of Watercourse (Lc):	1544	feet	Mean Slope:	0.044
Length to Cen. of Gravity (Lca):	772	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 100-years NOAA data user generated

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88	91	0.668
D	-	-	-	-
Imp.	20	99	99	0.957

Weighted Runoff Coef. (Cw):	0.73	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	7.57	in/hr
PEAK DISCHARGE:	48.2	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	cr
Project Name:	Kolb Road	Date:	05/10/2017
Concentration Point:	22b	Job #	7PIM160201
Watershed Area:	3.38 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	134	861	0.1556	0.035

Length of Watercourse (Lc):	861	feet	Mean Slope:	0.1556
Length to Cen. of Gravity (Lca):	431	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 100-years NOAA data user generated

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88	91	0.668
D	-	-	-	-
Imp.	20	99	99	0.957

Weighted Runoff Coef. (Cw):	0.73	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	7.58	in/hr
PEAK DISCHARGE:	25.8	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	23	Job #	7PIM160201
Watershed Area:	27.87 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	268	2028	0.1321	0.035

Length of Watercourse (Lc):	2028	feet	Mean Slope:	0.1321
Length to Cen. of Gravity (Lca):	1014	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	15

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88	91	0.668
D	-	-	-	-
Imp.	25	99	99	0.957

Weighted Runoff Coef. (Cw):	0.74	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	7.73	in/hr
PEAK DISCHARGE:	217.1	cfs

Lesser Return Periods

Return Period	Ratio	Qpeak
2-year	.10	21.7
5-year	.23	49.9
10-year	.35	76
25-year	.55	119.4
50-year	.75	162.8

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	24	Job #	7PIM160201
Watershed Area:	5.7 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	148	979	0.1512	0.035

Length of Watercourse (Lc):	979	feet	Mean Slope:	0.1512
Length to Cen. of Gravity (Lca):	490	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88	91	0.668
D	-	-	-	-
Imp.	40	99	99	0.957

Weighted Runoff Coef. (Cw):	0.784	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	8.18	in/hr
PEAK DISCHARGE:	47	cfs

Lesser Return Periods

Return Period	Ratio	Qpeak
2-year	.10	4.7
5-year	.23	10.8
10-year	.35	16.4
25-year	.55	25.8
50-year	.75	35.2

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	04/06/2017
Concentration Point:	24a	Job #	7PIM160201
Watershed Area:	5.6 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	34	1095	0.0311	0.032

Length of Watercourse (Lc):	1095	feet	Mean Slope:	0.0311
Length to Cen. of Gravity (Lca):	522	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-05-16 07:58:07 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89	91.83	0.703
D	-	-	-	-
Imp.	60	99	99	0.959

Weighted Runoff Coef. (Cw):	0.86	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	9.35	in/hr
PEAK DISCHARGE:	52.8	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	25	Job #	7PIM160201
Watershed Area:	3.85 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	168	1044	0.1609	0.032

Length of Watercourse (Lc):	1044	feet	Mean Slope:	0.1609
Length to Cen. of Gravity (Lca):	522	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89	91.66	0.689
D	-	-	-	-
Imp.	60	99	99	0.957

Weighted Runoff Coef. (Cw):	0.85	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	8.87	in/hr
PEAK DISCHARGE:	34.4	cfs

Lesser Return Periods

Return Period	Ratio	Qpeak
2-year	.10	3.4
5-year	.23	7.9
10-year	.35	12
25-year	.55	18.9
50-year	.75	25.8

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	04/12/2018
Concentration Point:	26	Job #	7PIM160201
Watershed Area:	31 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	272	1864	0.1459	0.035

Length of Watercourse (Lc):	1864	feet	Mean Slope:	0.1459
Length to Cen. of Gravity (Lca):	932	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	15

RETURN PERIOD: 100-years NOAA data user generated

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88	91	0.668
D	-	-	-	-
Imp.	40	99	99	0.957

Weighted Runoff Coef. (Cw):	0.78	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	8.18	in/hr
PEAK DISCHARGE:	255.6	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	04/12/2018
Concentration Point:	27	Job #	7PIM160201
Watershed Area:	2.9 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	56	1362	0.0411	0.035

Length of Watercourse (Lc):	1362	feet	Mean Slope:	0.0411
Length to Cen. of Gravity (Lca):	681	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA data user generated

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89	91.66	0.689
D	-	-	-	-
Imp.	35	99	99	0.957

Weighted Runoff Coef. (Cw):	0.78	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	8.17	in/hr
PEAK DISCHARGE:	23.9	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	04/12/2018
Concentration Point:	28A	Job #	7PIM160201
Watershed Area:	1.1 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	27	773	0.0349	0.032

Length of Watercourse (Lc):	773	feet	Mean Slope:	0.0349
Length to Cen. of Gravity (Lca):	386.5	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-07-24 02:49:36 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2833 Longitude: -110.8367

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.9	1.37	1.69	2.28	2.82	3.15	3.29	3.6	3.93	4.24

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.79	0.7
D	-	-	-	-
Imp.	80	99	99	0.958

Weighted Runoff Coef. (Cw):	0.91	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.8	in/hr
Runoff Supply Rate (q) @ Tc:	9.79	in/hr
PEAK DISCHARGE:	10.9	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	04/12/2018
Concentration Point:	28B	Job #	7PIM160201
Watershed Area:	1.5 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	37	631	0.0586	0.032

Length of Watercourse (Lc):	631	feet	Mean Slope:	0.0586
Length to Cen. of Gravity (Lca):	315.5	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-07-24 02:49:36 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2833 Longitude: -110.8367

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.9	1.37	1.69	2.28	2.82	3.15	3.29	3.6	3.93	4.24

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.79	0.7
D	-	-	-	-
Imp.	75	99	99	0.958

Weighted Runoff Coef. (Cw):	0.89	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.8	in/hr
Runoff Supply Rate (q) @ Tc:	9.65	in/hr
PEAK DISCHARGE:	14.6	cfs

APPENDIX 2

FEMA FIRM PANEL

Figure 3 - FEMA FIRM Panel

LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

Limit of Moderate Wave Action

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

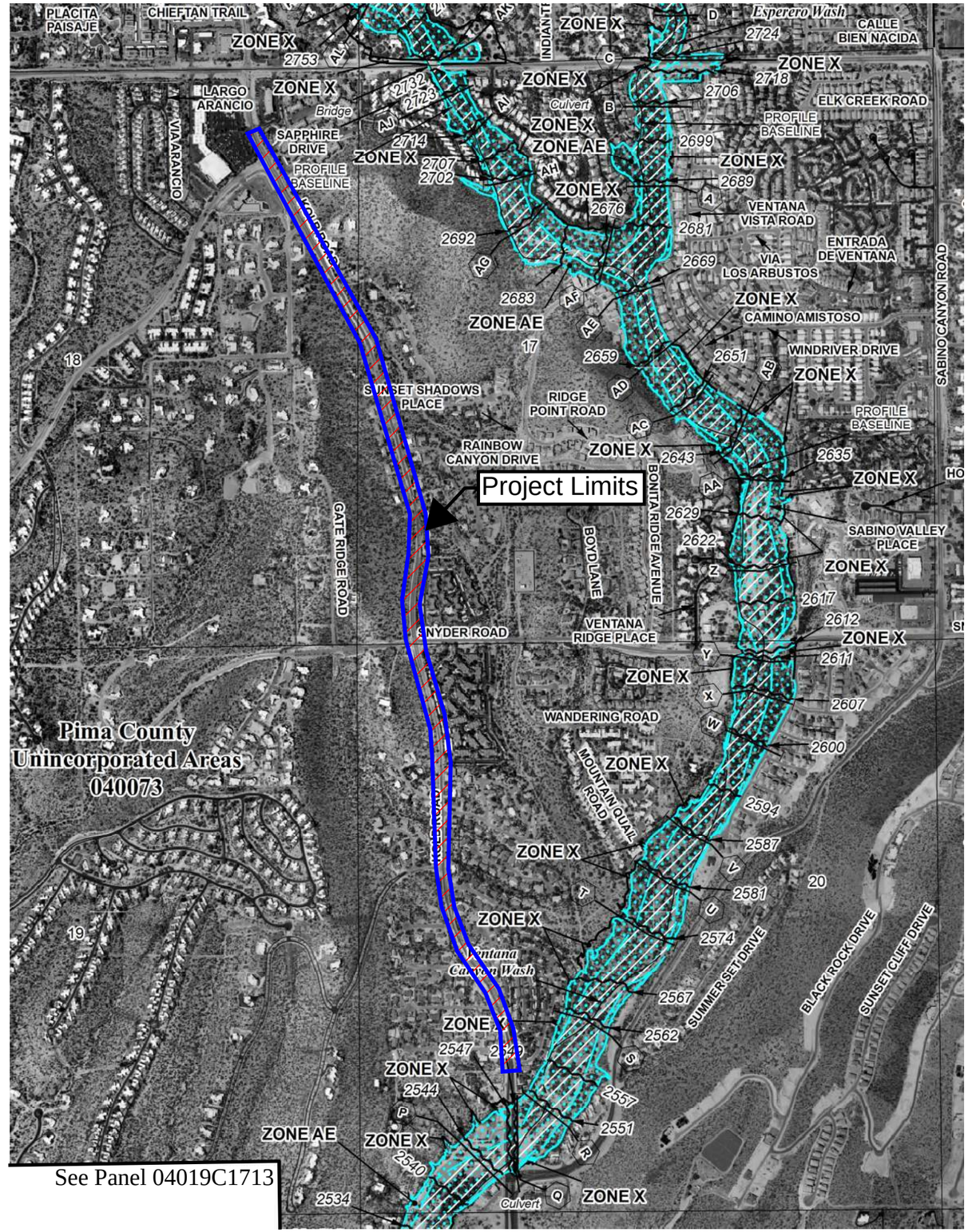
* Referenced to the North American Vertical Datum of 1988

(A)———(A)	Cross section line
(23)- - - -(23)	Transect line
87°07'45", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
24 76 000m N	1000-meter Universal Transverse Mercator grid values, zone 12
600000 FT	5000-foot grid values: Arizona State Plane coordinate system, Central zone (FIPSZONE 0202), Transverse Mercator projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5	River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
February 8, 1999

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
June 16, 2011 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.



NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1715L

FIRM
FLOOD INSURANCE RATE MAP

PIMA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 1715 OF 4750

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
PIMA COUNTY	040073	1715	L
TUCSON, CITY OF	040076	1715	L

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04019C1715L

MAP REVISED
JUNE 16, 2011

Federal Emergency Management Agency

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
February 8, 1999

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
June 16, 2011 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

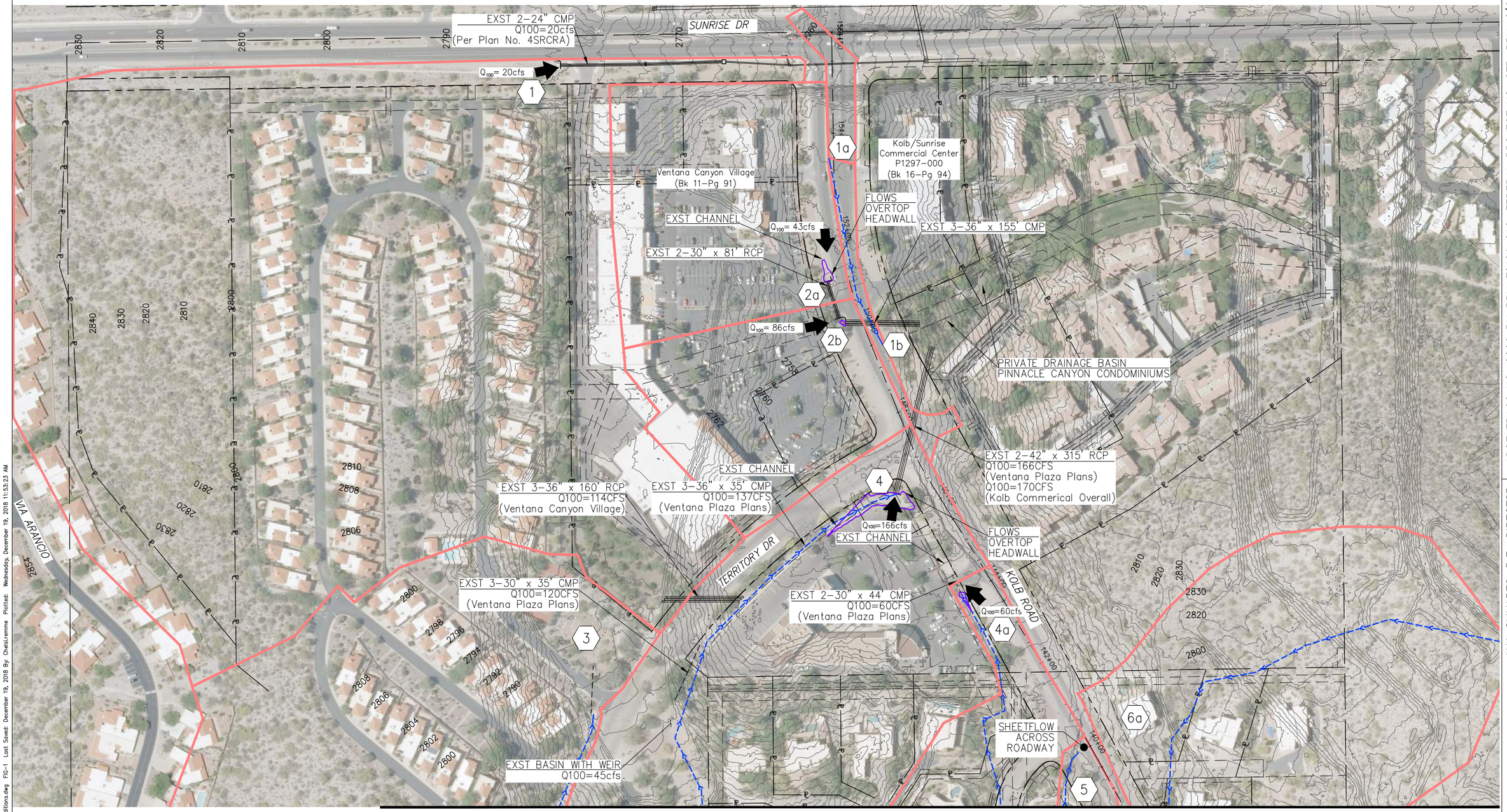
For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

500 0 1000 2000 FEET
MAP SCALE

APPENDIX 3

EXISTING CONDITIONS WATERSHED MAP



MATCHLINE SEE SHEET 2

LEGEND

- WATERSHED BOUNDARY
- (2) WATERSHED ID
- LONGEST FLOW PATH
- PONDING LIMITS

100 0 50 100 150 200

SCALES: HORIZ. 1"=100' VERT.

SHEET 1 OF 6

PIMA COUNTY DEPARTMENT OF TRANSPORTATION

ANA OLIVARES, P.E., DIRECTOR

FIG 4-EXISTING CONDITIONS WATERSHED MAP
FOR
KOLB ROAD
SABINO CANYON TO SUNRISE DR

PSOMAS
333 E. Wetmore Road, Suite 450
Tucson, AZ 85705
(520) 292-2300 (520) 292-1290 fax
www.psomas.com

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 65879 CHELSI REMME DATE SIGNED 12/19/2018 ARIZONA U.S.A. EXPIRES 6/5/2021

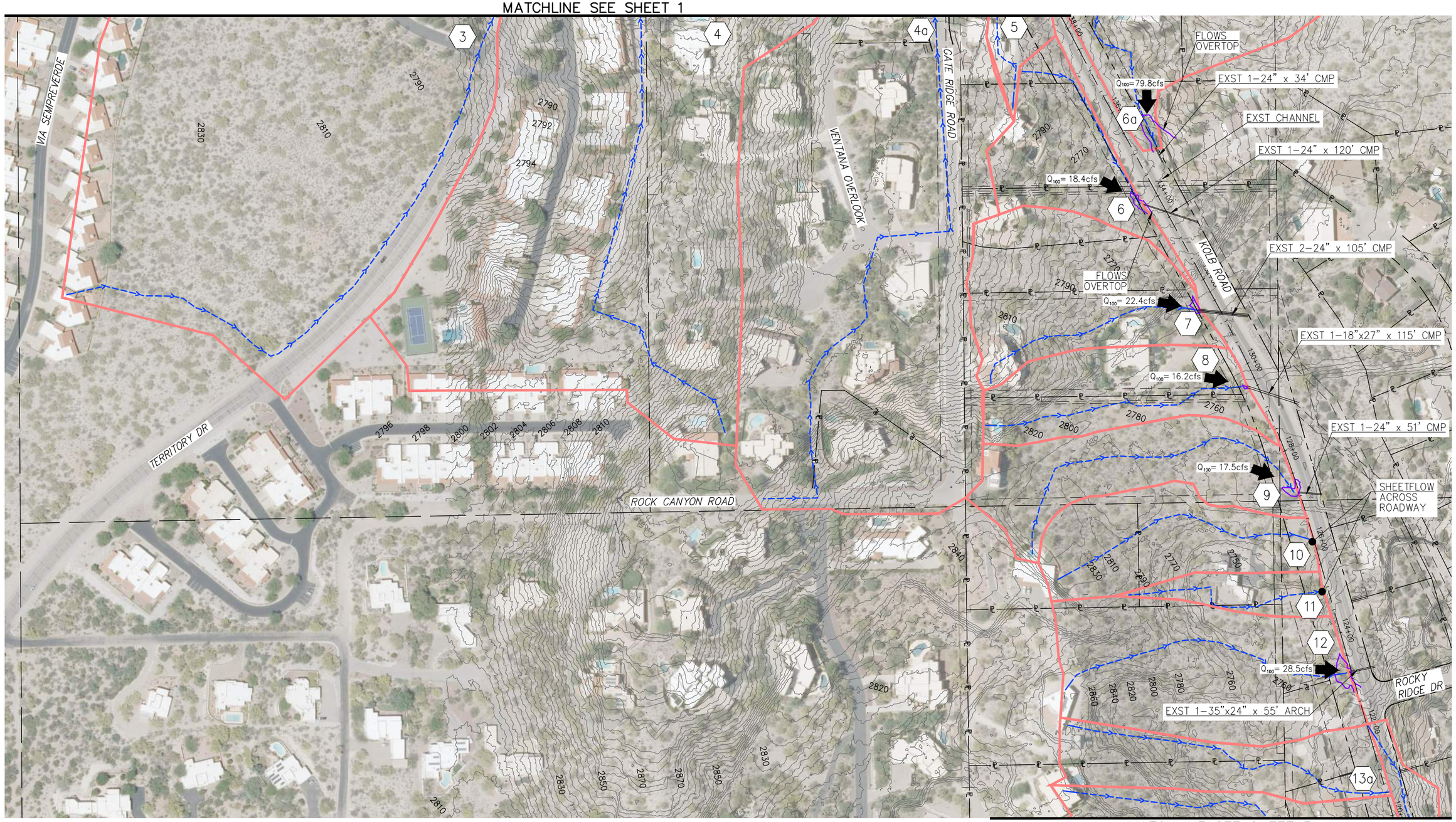
ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

NO.	REVISION DESCRIPTION	DIV. ENGINEER	DATE

		DATE
DESIGNED:	CR	12/2018
DRAWN:	CR	12/2018
CHECKED:	KT	12/2018
PROJ. ENG.:	KT	12/2018

T:\7PM160201\WATRES\GLOBAL\EXHIB\Figure 4 - Existing Conditions.dwg FIG-1 Last Saved: December 19, 2018 By: Chelsi.remme Plotted: Wednesday, December 19, 2018 11:53:23 AM

MATCHLINE SEE SHEET 1



MATCHLINE SEE SHEET 3

LEGEND

- WATERSHED BOUNDARY
- (2) WATERSHED ID
- LONGEST FLOW PATH
- PONDING LIMITS

100 0 50 100 150 200

SCALES: HORIZ. 1"=100' VERT.

SHEET 2 OF 6

PIMA COUNTY DEPARTMENT OF TRANSPORTATION

ANA OLIVARES, P.E., DIRECTOR

FIG 4–EXISTING CONDITIONS WATERSHED MAP FOR KOLB ROAD SABINO CANYON TO SUNRISE DR

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REGISTERED PROFESSIONAL ENGINEER (CIVIL) CHELSI REAME 65879 DATE SIGNED 01/11/2021 ARIZONA U.S.A. EXPIRES 6/30/2021

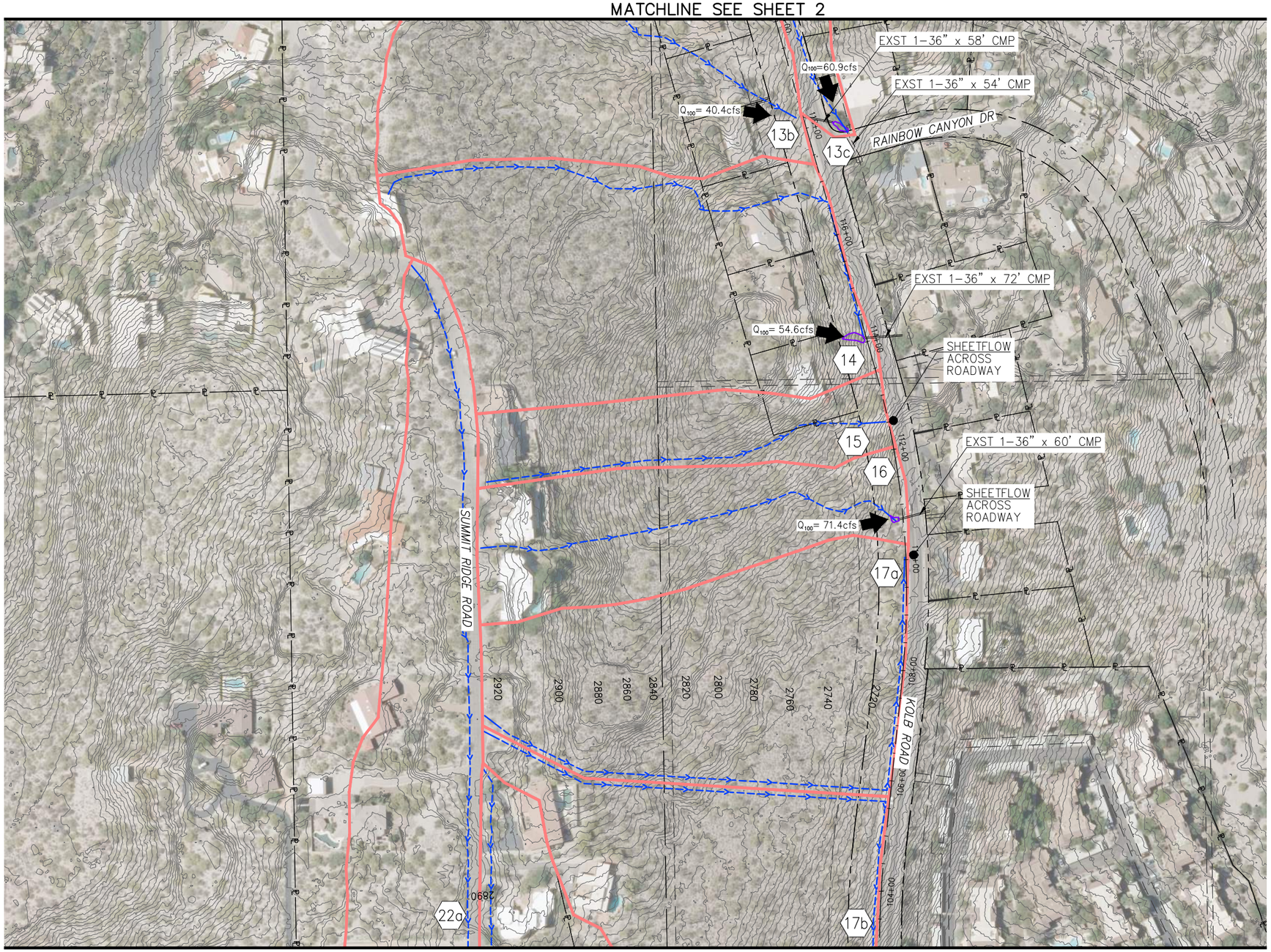
NO.	REVISION DESCRIPTION	DIV. ENGINEER	DATE

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

		DATE
DESIGNED:	CR	12/2018
DRAWN:	CR	12/2018
CHECKED:	KT	12/2018
PROJ. ENG.:	KT	12/2018

T:\PPM160201\WATRES\GLOBAL\EXHIB\Figure 4 - Existing Conditions.dwg FIG-2 Last Saved: December 19, 2018 By: Chelsi.remme Plotted: Wednesday, December 19, 2018 11:53:42 AM

MATCHLINE SEE SHEET 2



MATCHLINE SEE SHEET 4

LEGEND

- WATERSHED BOUNDARY
- 2 WATERSHED ID
- LONGEST FLOW PATH
- PONDING LIMITS

100 0 50 100 150 200

SCALES: HORIZ. 1"=100' VERT.

SHEET 3 OF 6

PIMA COUNTY DEPARTMENT OF TRANSPORTATION ANA OLIVARES, P.E., DIRECTOR

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

NO.	REVISION DESCRIPTION	DIV. ENGINEER	DATE

		DATE
DESIGNED:	CR	12/2018
DRAWN:	CR	12/2018
CHECKED:	KT	12/2018
PROJ. ENG.:	KT	12/2018

FIG 4-EXISTING CONDITIONS WATERSHED MAP FOR KOLB ROAD SABINO CANYON TO SUNRISE DR

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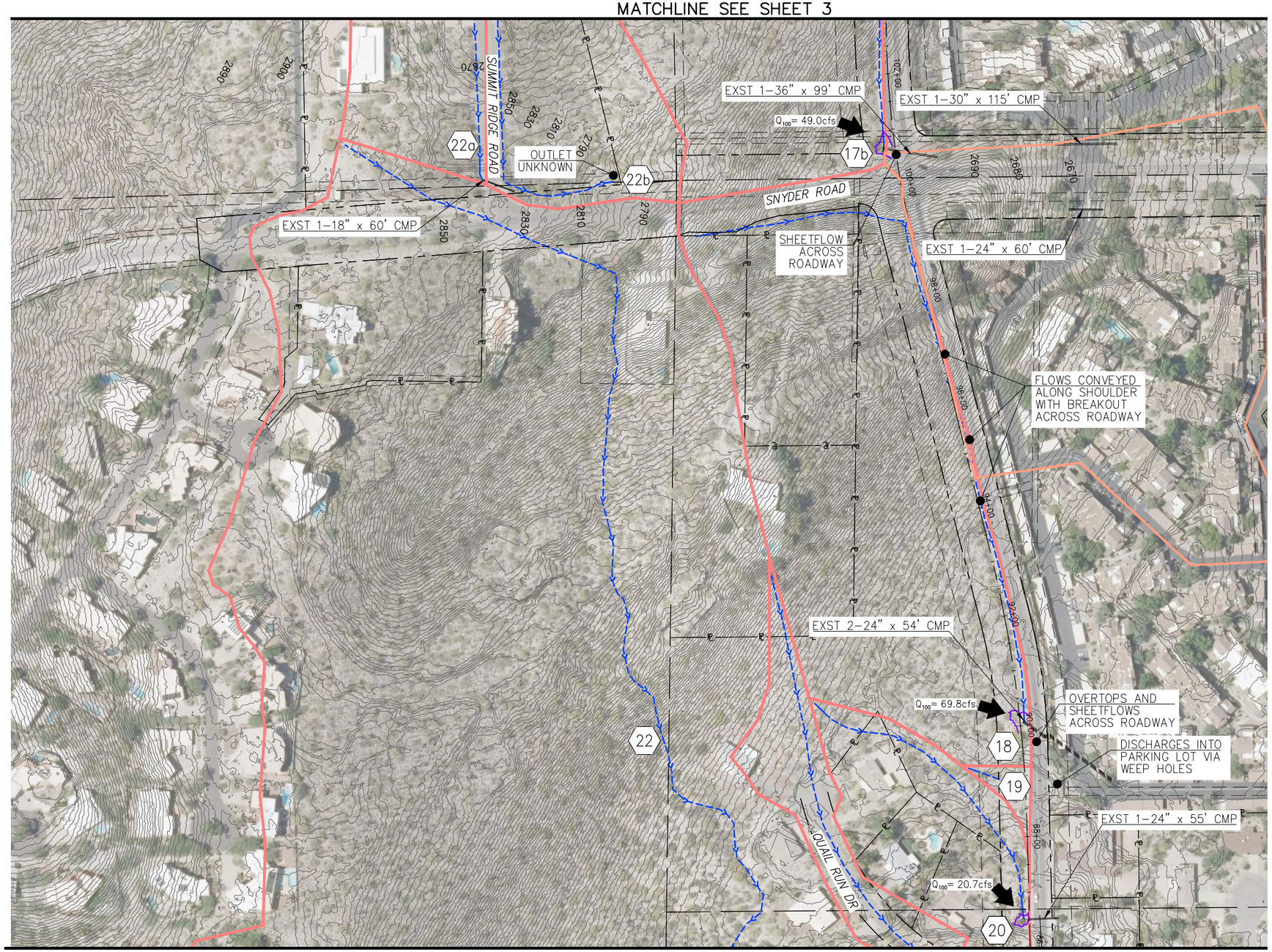
www.psomas.com

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 635879 CHELSI RENAE BATES STONEBURG ARIZONA 5/31/2021 EXPIRES

T:\79416\0201\WATRES\GLOBAL\EXHIBY\Figure 4 - Existing Conditions.dwg FIG-3 Last Saved: December 19, 2018 By: Chelsi.renae Plotted: Wednesday, December 19, 2018 11:54:02 AM

MATCHLINE SEE SHEET 3



MATCHLINE SEE SHEET 5

LEGEND

- WATERSHED BOUNDARY
- (2) WATERSHED ID
- LONGEST FLOW PATH
- PONDING LIMITS

100 0 50 100 150 200

SCALES: HORIZ. 1"=100' VERT.

SHEET 4 OF 6

PIMA COUNTY DEPARTMENT OF TRANSPORTATION

ANA OLIVARES, P.E., DIRECTOR

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

NO.	REVISION DESCRIPTION	DIV. ENGINEER	DATE

		DATE
DESIGNED:	CR	12/2018
DRAWN:	CR	12/2018
CHECKED:	KT	12/2018
PROJ. ENG.:	KT	12/2018

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(520) 292-2300 (520) 292-1290 fax
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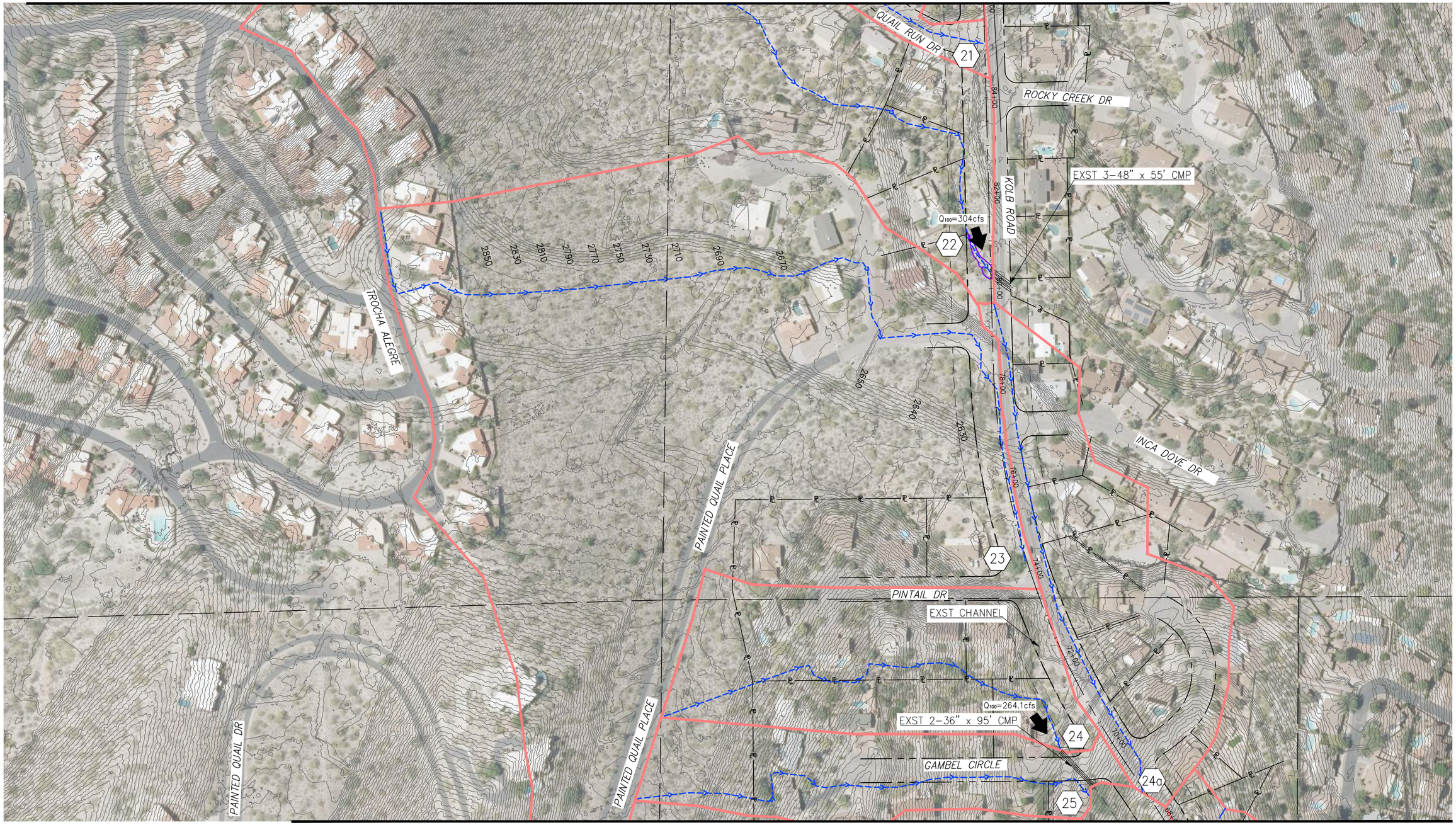
Registered Professional Engineer (Civil) CERTIFICATE NO. 65879 CHELSI REMME DATE SIGNED 5/19/2018 ARIZONA U.S.A. EXPIRES 5/31/2021

FIG 4-EXISTING CONDITIONS WATERSHED MAP FOR KOLB ROAD

SABINO CANYON TO SUNRISE DR

T:\7PM160201\WATRES\GLOBAL\EXHIB\Figure 4 - Existing Conditions.dwg FIG-4 Last Saved: December 19, 2018 By: Chelsi.remme Plotted: Wednesday, December 19, 2018 11:54:22 AM

MATCHLINE SEE SHEET 4



MATCHLINE SEE SHEET 6

LEGEND

- WATERSHED BOUNDARY
- 2 WATERSHED ID
- LONGEST FLOW PATH
- PONDING LIMITS

100 0 50 100 150 200

SCALES: HORIZ. 1"=100' VERT.

SHEET 5 OF 6

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

NO.	REVISION DESCRIPTION	DIV. ENGINEER	DATE

		DATE
DESIGNED:	CR	12/2018
DRAWN:	CR	12/2018
CHECKED:	KT	12/2018
PROJ. ENG.:	KT	12/2018

PIMA COUNTY DEPARTMENT OF TRANSPORTATION

ANA OLIVARES, P.E., DIRECTOR

FIG 4-EXISTING CONDITIONS WATERSHED MAP FOR KOLB ROAD SABINO CANYON TO SUNRISE DR

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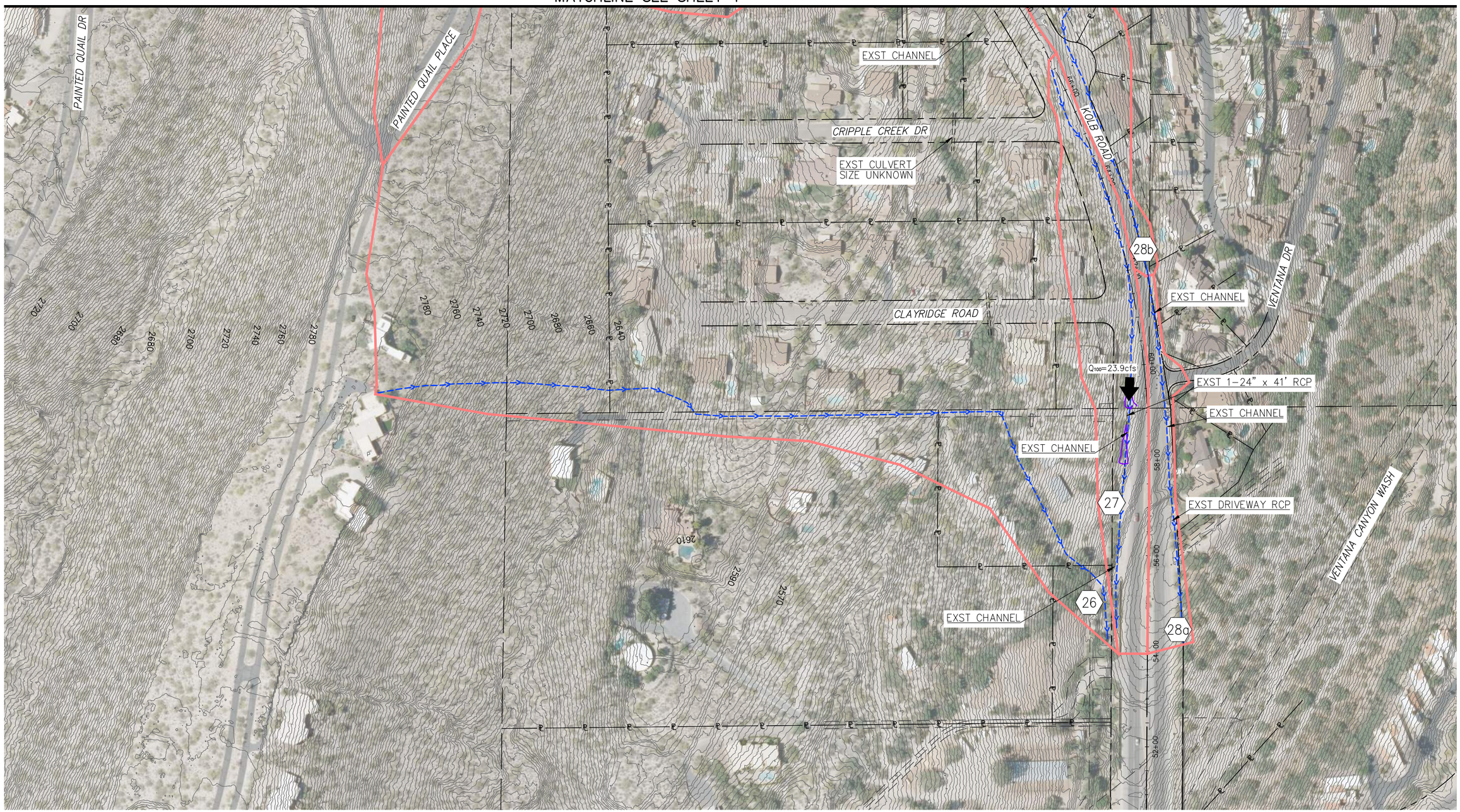
Tucson, AZ 85705
(520) 292-2300 (520) 292-1290 fax
www.psomas.com

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 65879 CHELSI REAME DATE SIGNED 01/17/2019 ARIZONA U.S.A. EXPIRES 6/30/2021

T:\PPM160201\WATRES\GLOBAL\EXHIB\Figure 4 - Existing Conditions.dwg FIG-5 Last Saved: December 19, 2018 By: Chelsi.remme Plotted: Wednesday, December 19, 2018 11:54:42 AM

MATCHLINE SEE SHEET 4



LEGEND

- WATERSHED BOUNDARY
- (2) WATERSHED ID
- LONGEST FLOW PATH
- PONDING LIMITS

N

100 0 50 100 150 200

SCALES: HORIZ. 1"=100' VERT.

SHEET 6 OF 6

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

NO.	REVISION DESCRIPTION	DIV. ENGINEER	DATE

		DATE
DESIGNED:	CR	12/2018
DRAWN:	CR	12/2018
CHECKED:	KT	12/2018
PROJ. ENG.:	KT	12/2018

PIMA COUNTY DEPARTMENT OF TRANSPORTATION ANA OLIVARES, P.E., DIRECTOR

FIG 4-EXISTING CONDITIONS WATERSHED MAP FOR KOLB ROAD SABINO CANYON TO SUNRISE DR

PSOMAS
333 E. Wetmore Road, Suite 450
Tucson, AZ 85705
(520) 292-2300 (520) 292-1290 fax
www.psomas.com

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 65879 CHELSI REAME DATE SIGNED 12/17/2018 ARIZONA U.S.A. EXPIRES 6/30/2021

T:\PPM160201\WATRES\GLOBAL\EXHIB\Figure 4 - Existing Conditions.dwg FIG-6 Last Saved: December 19, 2018 By: Chelsi.reame Plotted: Wednesday, December 19, 2018 11:56:02 AM

APPENDIX 4

EXISTING CONDITIONS
CULVERT CALCULATIONS (HY8)

Table 1a - Summary of Culvert Flows at Crossing: Sta 151+00

Headwater Elevation (ft)	Total Discharge (cfs)	2-30inRCP(CP2a) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2751.71	21.20	21.20	0.00	1
2752.13	31.17	31.17	0.00	1
2752.51	41.14	41.14	0.00	1
2752.58	43.00	43.00	0.00	1
2753.36	61.08	61.08	0.00	1
2753.71	71.05	67.90	3.09	10
2753.85	81.02	70.40	10.54	7
2753.96	90.99	72.29	18.64	6
2754.05	100.96	73.87	27.01	5
2754.14	110.93	75.25	35.52	4
2754.21	120.90	76.51	44.30	4
2753.57	65.23	65.23	0.00	Overtopping

Table 1b - Culvert Summary Table: 2-30inRCP(CP2a)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
21.20	21.20	2751.71	1.561	0.265	1-S2n	0.925	1.088	0.925	0.845	6.198	2.993
31.17	31.17	2752.13	1.979	1.102	1-S2n	1.147	1.330	1.183	1.027	6.591	3.331
41.14	41.14	2752.51	2.361	1.572	1-S2n	1.353	1.538	1.353	1.179	7.346	3.592
43.00	43.00	2752.58	2.433	1.664	1-S2n	1.391	1.573	1.434	1.205	7.153	3.635
61.08	61.08	2753.36	3.211	2.964	5-S2n	1.779	1.881	1.831	1.428	7.710	3.992
71.05	67.90	2753.71	3.561	3.332	5-S2n	1.959	1.979	1.959	1.535	8.018	4.155
81.02	70.40	2753.85	3.700	3.592	7-M2c	2.500	2.012	2.012	1.633	8.313	4.302
90.99	72.29	2753.96	3.809	3.658	7-M2c	2.500	2.037	2.037	1.725	8.441	4.435
100.96	73.87	2754.05	3.901	3.718	7-M2c	2.500	2.056	2.056	1.810	8.549	4.557
110.93	75.25	2754.14	3.985	3.775	7-M2c	2.500	2.073	2.073	1.891	8.645	4.670
120.90	76.51	2754.21	4.062	3.830	7-M2c	2.500	2.088	2.088	1.967	8.733	4.775

****

Straight Culvert

Inlet Elevation (invert): 2750.15 ft, Outlet Elevation (invert): 2749.57 ft

Culvert Length: 82.00 ft, Culvert Slope: 0.0071

****

Site Data - 2-30inRCP(CP2a)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2750.15 ft

Outlet Station: 82.00 ft

Outlet Elevation: 2749.57 ft

Number of Barrels: 2

Culvert Data Summary - 2-30inRCP(CP2a)

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 1c - Downstream Channel Rating Curve (Crossing: Sta 151+00)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
21.20	2750.42	0.85	2.99	0.53	0.68
31.17	2750.60	1.03	3.33	0.64	0.70
41.14	2750.75	1.18	3.59	0.74	0.71
43.00	2750.77	1.20	3.63	0.75	0.71
61.08	2751.00	1.43	3.99	0.89	0.73
71.05	2751.10	1.53	4.16	0.96	0.74
81.02	2751.20	1.63	4.30	1.02	0.74
90.99	2751.29	1.72	4.43	1.08	0.75
100.96	2751.38	1.81	4.56	1.13	0.75
110.93	2751.46	1.89	4.67	1.18	0.76
120.90	2751.54	1.97	4.78	1.23	0.76

Tailwater Channel Data - Sta 151+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2749.57 ft

Roadway Data for Crossing: Sta 151+00

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2756.42
1	25.00	2755.50
2	50.00	2754.72
3	75.00	2753.57
4	100.00	2753.62

Roadway Surface: Paved

Roadway Top Width: 12.00 ft

Table 2a - Summary of Culvert Flows at Crossing: Sta 150+00

Headwater Elevation (ft)	Total Discharge (cfs)	3-36inCMP(CP2) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2747.61	42.30	42.30	0.00	1
2748.08	62.07	62.07	0.00	1
2748.53	81.84	81.84	0.00	1
2748.63	86.00	86.00	0.00	1
2749.68	121.38	121.38	0.00	1
2750.13	141.15	141.15	0.00	1
2750.81	160.92	160.92	0.00	1
2752.30	180.69	180.69	0.00	1
2753.66	200.46	197.96	2.29	24
2753.81	220.23	199.81	20.16	7
2753.90	240.00	200.92	38.84	5
2753.62	197.43	197.43	0.00	Overtopping

Table 2b - Culvert Summary Table: 3-36inCMP(CP2)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
42.30	42.30	2747.61	1.785	0.0*	1-S2n	1.091	1.193	1.091	0.936	5.859	3.411
62.07	62.07	2748.08	2.252	0.0*	1-S2n	1.349	1.461	1.349	1.151	6.490	3.824
81.84	81.84	2748.53	2.705	0.348	1-S2n	1.589	1.686	1.589	1.332	6.951	4.144
86.00	86.00	2748.63	2.802	0.528	1-S2n	1.638	1.729	1.638	1.367	7.032	4.203
121.38	121.38	2749.68	3.702	3.852	7-M2c	2.074	2.069	2.069	1.634	7.781	4.634
141.15	141.15	2750.13	4.298	4.191	7-M2c	2.372	2.231	2.231	1.764	8.345	4.833
160.92	160.92	2750.81	4.985	4.910	7-M2c	3.000	2.376	2.376	1.885	8.932	5.011
180.69	180.69	2752.30	5.776	6.465	7-M2c	3.000	2.504	2.504	1.997	9.556	5.173
200.46	197.96	2753.66	6.559	7.831	7-M2c	3.000	2.600	2.600	2.103	10.140	5.322
220.23	199.81	2753.81	6.648	7.981	7-M2c	3.000	2.609	2.609	2.203	10.205	5.460
240.00	200.92	2753.90	6.702	8.072	7-M2c	3.000	2.615	2.615	2.298	10.244	5.588

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2745.83 ft, Outlet Elevation (invert): 2743.18 ft

Culvert Length: 154.02 ft, Culvert Slope: 0.0172

****

Site Data - 3-36inCMP(CP2)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2745.83 ft

Outlet Station: 154.00 ft

Outlet Elevation: 2743.18 ft

Number of Barrels: 3

Culvert Data Summary - 3-36inCMP(CP2)

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: None

Table 2c - Downstream Channel Rating Curve (Crossing: Sta 150+00)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
42.30	2744.12	0.94	3.41	0.58	0.70
62.07	2744.33	1.15	3.82	0.72	0.72
81.84	2744.51	1.33	4.14	0.83	0.74
86.00	2744.55	1.37	4.20	0.85	0.74
121.38	2744.81	1.63	4.63	1.02	0.76
141.15	2744.94	1.76	4.83	1.10	0.77
160.92	2745.06	1.88	5.01	1.18	0.77
180.69	2745.18	2.00	5.17	1.25	0.78
200.46	2745.28	2.10	5.32	1.31	0.78
220.23	2745.38	2.20	5.46	1.37	0.79
240.00	2745.48	2.30	5.59	1.43	0.79

Tailwater Channel Data - Sta 150+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 9.50 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2743.18 ft

Roadway Data for Crossing: Sta 150+00

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2753.58
1	50.00	2753.62
2	100.00	2753.77

Roadway Surface: Paved

Roadway Top Width: 50.00 ft

Table 3a - Summary of Culvert Flows at Crossing: Sta 147+50

Headwater Elevation (ft)	Total Discharge (cfs)	2-42inRCP(CP4) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2753.39	112.00	112.00	0.00	1
2754.32	145.80	145.80	0.00	1
2754.96	166.00	166.00	0.00	1
2757.46	213.40	196.38	16.87	12
2757.70	247.20	198.00	49.00	8
2757.86	281.00	199.08	81.60	6
2757.98	314.80	199.93	114.53	5
2758.09	348.60	200.66	147.52	4
2758.18	382.40	201.21	180.95	4
2758.27	416.20	201.79	214.32	4
2758.35	450.00	202.38	247.18	3
2757.25	194.95	194.95	0.00	Overtopping

Table 3b - Culvert Summary Table: 2-42inRCP(CP4)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
112.00	112.00	2753.39	3.632	0.0*	5-S2n	1.988	2.341	1.988	1.737	9.621	4.623
145.80	145.80	2754.32	4.558	1.999	5-S2n	2.385	2.671	2.385	1.973	10.144	4.961
166.00	166.00	2754.96	5.202	4.141	5-S2n	2.659	2.839	2.659	2.100	10.312	5.134
213.40	196.38	2757.46	6.328	7.703	7-M2c	3.500	3.047	3.047	2.364	11.044	5.485
247.20	198.00	2757.70	6.393	7.942	7-M2c	3.500	3.057	3.057	2.532	11.107	5.700
281.00	199.08	2757.86	6.437	8.098	7-M2c	3.500	3.063	3.063	2.687	11.149	5.893
314.80	199.93	2757.98	6.472	8.222	7-M2c	3.500	3.068	3.068	2.831	11.183	6.070
348.60	200.66	2758.09	6.502	8.326	7-M2c	3.500	3.072	3.072	2.966	11.212	6.232
382.40	201.21	2758.18	6.525	8.412	7-M2t	3.500	3.075	3.093	3.093	11.183	6.382
416.20	201.79	2758.27	6.549	8.521	7-M2t	3.500	3.078	3.214	3.214	10.910	6.523
450.00	202.38	2758.35	6.574	8.673	7-M2t	3.500	3.082	3.328	3.328	10.712	6.656

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2749.76 ft, Outlet Elevation (invert): 2741.73 ft

Culvert Length: 315.10 ft, Culvert Slope: 0.0255

****

Site Data - 2-42inRCP(CP4)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2749.76 ft

Outlet Station: 315.00 ft

Outlet Elevation: 2741.73 ft

Number of Barrels: 2

Culvert Data Summary - 2-42inRCP(CP4)

Barrel Shape: Circular

Barrel Diameter: 3.50 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 3c - Downstream Channel Rating Curve (Crossing: Sta 147+50)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
112.00	2743.47	1.74	4.62	1.08	0.76
145.80	2743.70	1.97	4.96	1.23	0.77
166.00	2743.83	2.10	5.13	1.31	0.78
213.40	2744.09	2.36	5.48	1.48	0.79
247.20	2744.26	2.53	5.70	1.58	0.80
281.00	2744.42	2.69	5.89	1.68	0.80
314.80	2744.56	2.83	6.07	1.77	0.81
348.60	2744.70	2.97	6.23	1.85	0.81
382.40	2744.82	3.09	6.38	1.93	0.82
416.20	2744.94	3.21	6.52	2.01	0.82
450.00	2745.06	3.33	6.66	2.08	0.83

Tailwater Channel Data - Sta 147+50

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 7.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2741.73 ft

Roadway Data for Crossing: Sta 147+50

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2757.00
1	25.00	2757.25
2	50.00	2757.50
3	75.00	2757.75
4	100.00	2758.00

Roadway Surface: Paved

Roadway Top Width: 109.00 ft

Table 4a - Summary of Culvert Flows at Crossing: Sta 144+30

Headwater Elevation (ft)	Total Discharge (cfs)	2-30inCMP(CP4a) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2762.86	45.00	45.00	0.00	1
2763.08	50.50	50.50	0.00	1
2763.46	56.00	56.00	0.00	1
2763.59	60.00	60.00	0.00	1
2763.86	67.00	67.00	0.00	1
2764.17	72.50	72.50	0.00	1
2764.64	78.00	78.00	0.00	1
2765.11	83.50	83.50	0.00	1
2765.58	89.00	89.00	0.00	1
2766.08	94.50	94.50	0.00	1
2766.16	100.00	95.44	4.49	7
2766.29	96.80	96.80	0.00	Overtopping

Table 4b - Culvert Summary Table: 2-30inCMP(CP4a)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
45.00	45.00	2762.86	2.466	0.382	1-S2n	1.541	1.610	1.541	1.232	6.875	3.679
50.50	50.50	2763.08	2.695	2.039	5-S2n	1.673	1.708	1.673	1.303	7.027	3.795
56.00	56.00	2763.46	2.937	3.069	7-M2c	1.815	1.802	1.802	1.370	7.391	3.901
60.00	60.00	2763.59	3.123	3.198	7-M2c	1.933	1.865	1.865	1.416	7.640	3.974
67.00	67.00	2763.86	3.475	3.456	7-M2c	2.500	1.967	1.967	1.493	8.088	4.092
72.50	72.50	2764.17	3.776	3.775	7-M2c	2.500	2.039	2.039	1.550	8.455	4.178
78.00	78.00	2764.64	4.100	4.245	7-M2c	2.500	2.105	2.105	1.604	8.840	4.259
83.50	83.50	2765.11	4.449	4.716	7-M2c	2.500	2.165	2.165	1.657	9.244	4.336
89.00	89.00	2765.58	4.824	5.185	7-M2c	2.500	2.217	2.217	1.707	9.670	4.409
94.50	94.50	2766.08	5.225	5.686	7-M2c	2.500	2.262	2.262	1.755	10.116	4.479
100.00	95.44	2766.16	5.296	5.767	7-M2c	2.500	2.269	2.269	1.802	10.194	4.545

****

Straight Culvert

Inlet Elevation (invert): 2760.39 ft, Outlet Elevation (invert): 2759.54 ft

Culvert Length: 44.01 ft, Culvert Slope: 0.0193

****

Site Data - 2-30inCMP(CP4a)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2760.39 ft

Outlet Station: 44.00 ft

Outlet Elevation: 2759.54 ft

Number of Barrels: 2

Culvert Data Summary - 2-30inCMP(CP4a)

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 4c - Downstream Channel Rating Curve (Crossing: Sta 144+30)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
45.00	2760.77	1.23	3.68	0.77	0.71
50.50	2760.84	1.30	3.80	0.81	0.72
56.00	2760.91	1.37	3.90	0.85	0.72
60.00	2760.96	1.42	3.97	0.88	0.73
67.00	2761.03	1.49	4.09	0.93	0.73
72.50	2761.09	1.55	4.18	0.97	0.74
78.00	2761.14	1.60	4.26	1.00	0.74
83.50	2761.20	1.66	4.34	1.03	0.74
89.00	2761.25	1.71	4.41	1.06	0.75
94.50	2761.30	1.76	4.48	1.10	0.75
100.00	2761.34	1.80	4.55	1.12	0.75

Tailwater Channel Data - Sta 144+30

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2759.54 ft

Roadway Data for Crossing: Sta 144+30

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2765.78
1	25.00	2766.29
2	50.00	2767.45
3	75.00	2768.66
4	100.00	2769.63

Roadway Surface: Paved

Roadway Top Width: 30.00 ft

Table 5a - Summary of Culvert Flows at Crossing: Sta 135+00

Headwater Elevation (ft)	Total Discharge (cfs)	1-24inCMP(CP6a) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2762.33	27.90	26.69	1.19	15
2762.80	40.11	28.45	11.62	7
2763.03	52.32	29.30	22.96	7
2763.21	64.53	29.95	34.49	6
2763.35	76.74	30.46	46.23	6
2763.39	79.80	30.57	49.13	4
2763.59	101.16	31.23	69.87	5
2763.69	113.37	31.53	81.79	4
2763.78	125.58	31.79	93.63	3
2763.86	137.79	32.04	105.66	3
2763.94	150.00	32.27	117.69	3
2762.00	25.40	25.40	0.00	Overtopping

Table 5b - Culvert Summary Table: 1-24inCMP(CP6a)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
27.90	26.69	2762.33	4.891	4.616	7-M2c	2.000	1.802	1.802	1.218	8.955	3.332
40.11	28.45	2762.80	5.362	5.118	7-M2c	2.000	1.837	1.837	1.425	9.421	3.654
52.32	29.30	2763.03	5.594	5.371	7-M2c	2.000	1.850	1.850	1.597	9.656	3.907
64.53	29.95	2763.21	5.771	5.563	7-M2c	2.000	1.859	1.859	1.745	9.838	4.120
76.74	30.46	2763.35	5.914	5.717	7-M2t	2.000	1.871	1.876	1.876	9.951	4.304
79.80	30.57	2763.39	5.946	5.756	7-M2t	2.000	1.873	1.907	1.907	9.898	4.347
101.16	31.23	2763.59	6.150	6.111	4-FFf	2.000	1.878	2.000	2.105	9.942	4.614
113.37	31.53	2763.69	6.248	6.304	4-FFf	2.000	1.881	2.000	2.206	10.036	4.748
125.58	31.79	2763.78	6.337	6.481	4-FFf	2.000	1.889	2.000	2.301	10.120	4.871
137.79	32.04	2763.86	6.420	6.648	4-FFf	2.000	1.893	2.000	2.390	10.199	4.986
150.00	32.27	2763.94	6.500	6.807	4-FFf	2.000	1.890	2.000	2.475	10.273	5.094

****

Straight Culvert

Inlet Elevation (invert): 2757.44 ft, Outlet Elevation (invert): 2756.64 ft

Culvert Length: 34.01 ft, Culvert Slope: 0.0235

****

Site Data - 1-24inCMP(CP6a)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2757.44 ft

Outlet Station: 34.00 ft

Outlet Elevation: 2756.64 ft

Number of Barrels: 1

Culvert Data Summary - 1-24inCMP(CP6a)

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope

Inlet Depression: None

Table 5c - Downstream Channel Rating Curve (Crossing: Sta 135+00)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
27.90	2757.86	1.22	3.33	0.76	0.70
40.11	2758.07	1.43	3.65	0.89	0.71
52.32	2758.24	1.60	3.91	1.00	0.72
64.53	2758.38	1.74	4.12	1.09	0.73
76.74	2758.52	1.88	4.30	1.17	0.74
79.80	2758.55	1.91	4.35	1.19	0.74
101.16	2758.74	2.10	4.61	1.31	0.75
113.37	2758.85	2.21	4.75	1.38	0.76
125.58	2758.94	2.30	4.87	1.44	0.76
137.79	2759.03	2.39	4.99	1.49	0.77
150.00	2759.11	2.47	5.09	1.54	0.77

Tailwater Channel Data - Sta 135+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 2.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2756.64 ft

Roadway Data for Crossing: Sta 135+00

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2763.64
1	6.00	2763.56
2	13.00	2763.19
3	22.00	2762.72
4	35.00	2762.00

Roadway Surface: Paved

Roadway Top Width: 18.00 ft

Table 6a - Summary of Culvert Flows at Crossing: Sta 133+50

Headwater Elevation (ft)	Total Discharge (cfs)	1-24inCMP(CP5-6) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2757.90	6.50	6.50	0.00	1
2758.08	8.85	8.15	0.65	12
2758.18	11.20	9.06	2.08	8
2758.26	13.55	9.73	3.78	7
2758.32	15.90	10.25	5.61	6
2758.37	18.25	10.68	7.51	5
2758.37	18.40	10.71	7.65	3
2758.44	22.95	11.34	11.57	4
2758.48	25.30	11.60	13.63	3
2758.51	27.65	11.85	15.75	3
2758.54	30.00	12.09	17.88	3
2757.91	6.59	6.59	0.00	Overtopping

Table 6b - Culvert Summary Table: 1-24inCMP(CP5-6)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
6.50	6.50	2757.90	1.390	0.0*	1-S2n	0.653	0.903	0.653	0.629	7.057	2.287
8.85	8.15	2758.08	1.573	0.0*	1-S2n	0.736	1.016	0.736	0.727	7.501	2.480
11.20	9.06	2758.18	1.673	0.0*	1-S2n	0.780	1.072	0.780	0.810	7.717	2.636
13.55	9.73	2758.26	1.747	0.0*	1-S2n	0.811	1.111	0.811	0.884	7.870	2.769
15.90	10.25	2758.32	1.806	0.0*	1-S2n	0.835	1.144	0.835	0.950	7.976	2.886
18.25	10.68	2758.37	1.856	0.0*	1-S2n	0.854	1.168	0.854	1.010	8.066	2.990
18.40	10.71	2758.37	1.859	0.0*	1-S2n	0.856	1.170	0.856	1.014	8.071	2.996
22.95	11.34	2758.44	1.933	0.0*	1-S2n	0.884	1.204	0.884	1.118	8.189	3.170
25.30	11.60	2758.48	1.965	0.0*	1-S2n	0.895	1.218	0.895	1.167	8.239	3.250
27.65	11.85	2758.51	1.996	0.0*	1-S2n	0.906	1.231	0.906	1.214	8.285	3.324
30.00	12.09	2758.54	2.025	0.0*	5-S2n	0.916	1.244	0.916	1.257	8.327	3.394

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2756.51 ft, Outlet Elevation (invert): 2750.77 ft

Culvert Length: 120.14 ft, Culvert Slope: 0.0478

****

Site Data - 1-24inCMP(CP5-6)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2756.51 ft

Outlet Station: 120.00 ft

Outlet Elevation: 2750.77 ft

Number of Barrels: 1

Culvert Data Summary - 1-24inCMP(CP5-6)

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope

Inlet Depression: None

Table 6c - Downstream Channel Rating Curve (Crossing: Sta 133+50)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
6.50	2751.23	0.63	2.29	0.39	0.63
8.85	2751.33	0.73	2.48	0.45	0.65
11.20	2751.41	0.81	2.64	0.51	0.66
13.55	2751.48	0.88	2.77	0.55	0.66
15.90	2751.55	0.95	2.89	0.59	0.67
18.25	2751.61	1.01	2.99	0.63	0.68
18.40	2751.61	1.01	3.00	0.63	0.68
22.95	2751.72	1.12	3.17	0.70	0.69
25.30	2751.77	1.17	3.25	0.73	0.69
27.65	2751.81	1.21	3.32	0.76	0.70
30.00	2751.86	1.26	3.39	0.78	0.70

Tailwater Channel Data - Sta 133+50

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 2.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2750.60 ft

Roadway Data for Crossing: Sta 133+50

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2760.72
1	25.00	2759.81
2	50.00	2759.09
3	75.00	2758.40
4	100.00	2757.91

Roadway Surface: Paved

Roadway Top Width: 35.00 ft

Table 7a - Summary of Culvert Flows at Crossing: Sta 131+20

Headwater Elevation (ft)	Total Discharge (cfs)	2-24inCMP(CP7) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2751.37	7.80	7.80	0.00	1
2751.55	11.02	10.57	0.39	12
2751.68	14.24	12.52	1.67	9
2751.78	17.46	14.05	3.35	7
2751.85	20.68	15.34	5.28	6
2751.89	22.40	15.97	6.38	5
2751.97	27.12	17.51	9.53	5
2752.03	30.34	18.47	11.83	5
2752.07	33.56	19.34	14.14	4
2752.12	36.78	20.14	16.60	4
2752.15	40.00	20.80	19.14	3
2751.39	8.10	8.10	0.00	Overtopping

Table 7b - Culvert Summary Table: 2-24inCMP(CP7)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
7.80	7.80	2751.37	0.920	0.0*	1-S2n	0.355	0.688	0.355	0.548	10.100	2.299
11.02	10.57	2751.55	1.104	0.0*	1-S2n	0.412	0.807	0.433	0.656	10.195	2.537
14.24	12.52	2751.68	1.232	0.0*	1-S2n	0.448	0.885	0.448	0.748	11.525	2.725
17.46	14.05	2751.78	1.326	0.0*	1-S2n	0.475	0.941	0.475	0.828	11.870	2.882
20.68	15.34	2751.85	1.402	0.0*	1-S2n	0.496	0.985	0.496	0.901	12.202	3.018
22.40	15.97	2751.89	1.437	0.0*	1-S2n	0.507	1.005	0.543	0.937	11.178	3.085
27.12	17.51	2751.97	1.523	0.0*	1-S2n	0.531	1.054	0.531	1.029	12.646	3.248
30.34	18.47	2752.03	1.576	0.0*	1-S2n	0.546	1.083	0.546	1.086	12.856	3.346
33.56	19.34	2752.07	1.623	0.0*	1-S2n	0.559	1.108	0.600	1.140	11.791	3.437
36.78	20.14	2752.12	1.666	0.0*	1-S2n	0.571	1.130	0.605	1.191	12.146	3.522
40.00	20.80	2752.15	1.701	0.0*	1-S2n	0.580	1.152	0.580	1.240	13.274	3.600

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2750.45 ft, Outlet Elevation (invert): 2745.40 ft

Culvert Length: 105.12 ft, Culvert Slope: 0.0481

****

Site Data - 2-24inCMP(CP7)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2750.45 ft

Outlet Station: 105.00 ft

Outlet Elevation: 2745.40 ft

Number of Barrels: 2

Culvert Data Summary - 2-24inCMP(CP7)

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 7c - Downstream Channel Rating Curve (Crossing: Sta 131+20)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
7.80	2745.95	0.55	2.30	0.34	0.64
11.02	2746.06	0.66	2.54	0.41	0.65
14.24	2746.15	0.75	2.72	0.47	0.66
17.46	2746.23	0.83	2.88	0.52	0.67
20.68	2746.30	0.90	3.02	0.56	0.68
22.40	2746.34	0.94	3.08	0.58	0.68
27.12	2746.43	1.03	3.25	0.64	0.69
30.34	2746.49	1.09	3.35	0.68	0.70
33.56	2746.54	1.14	3.44	0.71	0.70
36.78	2746.59	1.19	3.52	0.74	0.71
40.00	2746.64	1.24	3.60	0.77	0.71

Tailwater Channel Data - Sta 131+20

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2745.40 ft

Roadway Data for Crossing: Sta 131+20

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2754.59
1	25.00	2753.76
2	50.00	2753.03
3	75.00	2752.11
4	100.00	2751.39

Roadway Surface: Paved

Roadway Top Width: 35.00 ft

Table 8a - Summary of Culvert Flows at Crossing: Sta 129+50

Headwater Elevation (ft)	Total Discharge (cfs)	2-24inCMP(CP8) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2743.44	5.70	2.84	2.88	6
2743.53	8.13	3.45	4.63	6
2743.61	10.56	3.99	6.54	6
2743.67	12.99	4.45	8.50	5
2743.73	15.42	4.87	10.53	5
2743.75	16.20	5.00	11.18	4
2743.83	20.28	5.61	14.62	4
2743.88	22.71	5.95	16.74	4
2743.92	25.14	6.26	18.86	4
2743.96	27.57	6.56	21.00	4
2743.99	30.00	6.84	23.08	3
2743.01	0.69	0.69	0.00	Overtopping

Table 8b - Culvert Summary Table: 2-24inCMP(CP8)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.70	2.84	2743.44	0.834	0.0*	1-S2n	0.424	0.585	0.424	0.464	5.644	2.098
8.13	3.45	2743.53	0.924	0.0*	1-S2n	0.467	0.647	0.467	0.560	5.955	2.326
10.56	3.99	2743.61	1.000	0.0*	1-S2n	0.503	0.696	0.503	0.642	6.236	2.506
12.99	4.45	2743.67	1.065	0.0*	1-S2n	0.531	0.738	0.531	0.713	6.418	2.656
15.42	4.87	2743.73	1.124	0.0*	1-S2n	0.557	0.771	0.557	0.778	6.594	2.786
16.20	5.00	2743.75	1.141	0.0*	1-S2n	0.564	0.783	0.564	0.798	6.619	2.823
20.28	5.61	2743.83	1.223	0.0*	1-S2n	0.599	0.834	0.599	0.892	6.856	3.002
22.71	5.95	2743.88	1.268	0.0*	1-S2n	0.618	0.861	0.618	0.944	6.954	3.096
25.14	6.26	2743.92	1.309	0.0*	1-S2n	0.634	0.885	0.634	0.992	7.062	3.182
27.57	6.56	2743.96	1.348	0.0*	1-S2n	0.650	0.907	0.650	1.037	7.161	3.262
30.00	6.84	2743.99	1.384	0.0*	1-S2n	0.665	0.927	0.665	1.081	7.246	3.336

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2742.61 ft, Outlet Elevation (invert): 2736.92 ft

Culvert Length: 115.14 ft, Culvert Slope: 0.0495

****

Site Data - 2-24inCMP(CP8)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2742.61 ft

Outlet Station: 115.00 ft

Outlet Elevation: 2736.92 ft

Number of Barrels: 1

Culvert Data Summary - 2-24inCMP(CP8)

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: None

Table 8c - Downstream Channel Rating Curve (Crossing: Sta 129+50)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.70	2737.38	0.46	2.10	0.29	0.62
8.13	2737.48	0.56	2.33	0.35	0.64
10.56	2737.56	0.64	2.51	0.40	0.65
12.99	2737.63	0.71	2.66	0.45	0.66
15.42	2737.70	0.78	2.79	0.49	0.67
16.20	2737.72	0.80	2.82	0.50	0.67
20.28	2737.81	0.89	3.00	0.56	0.68
22.71	2737.86	0.94	3.10	0.59	0.68
25.14	2737.91	0.99	3.18	0.62	0.69
27.57	2737.96	1.04	3.26	0.65	0.69
30.00	2738.00	1.08	3.34	0.67	0.70

Tailwater Channel Data - Sta 129+50

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2736.92 ft

Roadway Data for Crossing: Sta 129+50

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2747.37
1	25.00	2746.13
2	50.00	2745.14
3	75.00	2744.00
4	100.00	2743.01

Roadway Surface: Gravel

Roadway Top Width: 35.00 ft

Table 9a - Summary of Culvert Flows at Crossing: Sta 123+00

Headwater Elevation (ft)	Total Discharge (cfs)	1-35inx24inCMP(CP12) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2728.56	10.00	10.00	0.00	1
2728.81	13.00	13.00	0.00	1
2729.05	16.00	16.00	0.00	1
2729.31	19.00	19.00	0.00	1
2729.60	22.00	22.00	0.00	1
2729.93	25.00	25.00	0.00	1
2730.31	28.00	27.93	0.02	20
2730.35	28.50	28.29	0.15	13
2730.60	34.00	30.05	3.89	10
2730.68	37.00	30.55	6.41	7
2730.73	40.00	30.93	9.01	5
2730.26	27.60	27.60	0.00	Overtopping

Table 9b - Culvert Summary Table: 1-35inx24inCMP(CP12)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
10.00	10.00	2728.56	1.319	0.0*	1-S2n	0.599	0.824	0.599	0.407	6.748	4.363
13.00	13.00	2728.81	1.566	0.0*	1-S2n	0.698	0.955	0.698	0.469	7.331	4.718
16.00	16.00	2729.05	1.811	0.0*	1-S2n	0.790	1.068	0.790	0.524	7.795	5.013
19.00	19.00	2729.31	2.071	0.015	5-S2n	0.880	1.177	0.904	0.573	7.945	5.268
22.00	22.00	2729.60	2.363	0.467	5-S2n	0.969	1.281	0.998	0.619	8.253	5.493
25.00	25.00	2729.93	2.694	0.963	5-S2n	1.059	1.379	1.089	0.661	8.557	5.695
28.00	27.93	2730.31	3.065	1.486	5-S2n	1.149	1.465	1.149	0.700	9.042	5.878
28.50	28.29	2730.35	3.114	1.554	5-S2n	1.161	1.475	1.199	0.707	8.776	5.908
34.00	30.05	2730.60	3.362	2.128	5-S2n	1.217	1.523	1.217	0.773	9.184	6.204
37.00	30.55	2730.68	3.437	2.221	5-S2n	1.233	1.536	1.233	0.806	9.221	6.351
40.00	30.93	2730.73	3.495	2.292	5-S2n	1.246	1.546	1.246	0.838	9.241	6.488

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2727.24 ft, Outlet Elevation (invert): 2725.06 ft

Culvert Length: 55.04 ft, Culvert Slope: 0.0396

****

Site Data - 1-35inx24inCMP(CP12)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2727.24 ft

Outlet Station: 55.00 ft

Outlet Elevation: 2725.06 ft

Number of Barrels: 1

Culvert Data Summary - 1-35inx24inCMP(CP12)

Barrel Shape: Pipe Arch

Barrel Span: 35.00 in

Barrel Rise: 24.00 in

Barrel Material: Steel or Aluminum

Embedment: 0.00 in

Barrel Manning's n: 0.0250

Culvert Type: Straight

Inlet Configuration: Projecting

Inlet Depression: None

Table 9c - Downstream Channel Rating Curve (Crossing: Sta 123+00)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
10.00	2725.47	0.41	4.36	1.27	1.37
13.00	2725.53	0.47	4.72	1.46	1.39
16.00	2725.58	0.52	5.01	1.63	1.42
19.00	2725.63	0.57	5.27	1.79	1.43
22.00	2725.68	0.62	5.49	1.93	1.45
25.00	2725.72	0.66	5.69	2.06	1.46
28.00	2725.76	0.70	5.88	2.19	1.47
28.50	2725.77	0.71	5.91	2.20	1.47
34.00	2725.83	0.77	6.20	2.41	1.49
37.00	2725.87	0.81	6.35	2.52	1.50
40.00	2725.90	0.84	6.49	2.62	1.51

Tailwater Channel Data - Sta 123+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0500

Channel Manning's n: 0.0350

Channel Invert Elevation: 2725.06 ft

Roadway Data for Crossing: Sta 123+00

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2731.22
1	25.00	2730.72
2	50.00	2730.26

Roadway Surface: Paved

Roadway Top Width: 25.00 ft

Table 10a - Summary of Culvert Flows at Crossing: Sta 118+00

Headwater Elevation (ft)	Total Discharge (cfs)	1-36inCMP(CP13b) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2714.66	18.30	18.30	0.00	1
2715.10	26.47	24.76	1.67	9
2715.33	34.64	27.96	6.61	9
2715.44	40.40	29.56	10.77	8
2715.60	50.98	31.82	19.09	7
2715.69	59.15	33.04	26.04	5
2715.77	67.32	34.13	33.15	5
2715.85	75.49	35.10	40.30	4
2715.91	83.66	35.99	47.62	4
2715.98	91.83	36.80	55.00	4
2716.04	100.00	37.55	62.33	3
2714.80	20.32	20.32	0.00	Overtopping

Table 10b - Culvert Summary Table: 1-36inCMP(CP13b)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
18.30	18.30	2714.66	2.060	0.0*	1-S2n	1.039	1.370	1.072	0.923	7.787	2.960
26.47	24.76	2715.10	2.505	0.215	1-S2n	1.224	1.602	1.224	1.098	8.820	3.262
34.64	27.96	2715.33	2.726	0.494	1-S2n	1.311	1.707	1.356	1.243	8.714	3.498
40.40	29.56	2715.44	2.838	0.638	1-S2n	1.352	1.756	1.400	1.333	8.839	3.639
50.98	31.82	2715.60	3.000	0.852	5-S2n	1.411	1.827	1.457	1.480	9.041	3.864
59.15	33.04	2715.69	3.090	0.970	5-S2n	1.443	1.863	1.491	1.581	9.114	4.014
67.32	34.13	2715.77	3.172	1.077	5-S2n	1.470	1.894	1.520	1.674	9.186	4.148
75.49	35.10	2715.85	3.245	1.174	5-S2n	1.495	1.922	1.545	1.760	9.255	4.272
83.66	35.99	2715.91	3.314	1.264	5-S2n	1.518	1.946	1.518	1.841	9.710	4.385
91.83	36.80	2715.98	3.377	1.347	5-S2n	1.538	1.969	1.538	1.917	9.762	4.490
100.00	37.55	2716.04	3.436	1.425	5-S2n	1.557	1.989	1.557	1.989	9.810	4.588

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2712.60 ft, Outlet Elevation (invert): 2710.58 ft

Culvert Length: 58.04 ft, Culvert Slope: 0.0348

****

Site Data - 1-36inCMP(CP13b)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2712.60 ft

Outlet Station: 58.00 ft

Outlet Elevation: 2710.58 ft

Number of Barrels: 1

Culvert Data Summary - 1-36inCMP(CP13b)

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: None

Table 10c - Downstream Channel Rating Curve (Crossing: Sta 118+00)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
18.30	2711.50	0.92	2.96	0.58	0.68
26.47	2711.68	1.10	3.26	0.69	0.69
34.64	2711.82	1.24	3.50	0.78	0.70
40.40	2711.91	1.33	3.64	0.83	0.71
50.98	2712.06	1.48	3.86	0.92	0.72
59.15	2712.16	1.58	4.01	0.99	0.73
67.32	2712.25	1.67	4.15	1.04	0.73
75.49	2712.34	1.76	4.27	1.10	0.74
83.66	2712.42	1.84	4.38	1.15	0.74
91.83	2712.50	1.92	4.49	1.20	0.75
100.00	2712.57	1.99	4.59	1.24	0.75

Tailwater Channel Data - Sta 118+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 3.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2710.58 ft

Roadway Data for Crossing: Sta 118+00

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2717.74
1	25.00	2717.12
2	50.00	2716.36
3	75.00	2715.60
4	100.00	2714.80

Roadway Surface: Paved

Roadway Top Width: 30.00 ft

Table 11a - Summary of Culvert Flows at Crossing: Sta 117+50

Headwater Elevation (ft)	Total Discharge (cfs)	1-36inCMP(CP13c) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2709.91	20.00	20.00	0.00	1
2710.46	28.00	28.00	0.00	1
2710.95	36.00	34.77	1.19	12
2711.16	44.00	37.40	6.50	9
2711.28	52.00	38.88	13.02	6
2711.37	60.00	40.03	19.86	5
2711.38	60.90	40.15	20.63	3
2711.53	76.00	41.92	34.03	5
2711.60	84.00	42.72	41.22	4
2711.67	92.00	43.45	48.51	4
2711.73	100.00	44.11	55.86	4
2710.74	31.93	31.93	0.00	Overtopping

Table 11b - Culvert Summary Table: 1-36inCMP(CP13c)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
20.00	20.00	2709.91	2.169	0.0*	1-S2n	1.046	1.436	1.077	0.963	8.461	3.031
28.00	28.00	2710.46	2.720	0.270	1-S2n	1.257	1.708	1.257	1.127	9.639	3.309
36.00	34.77	2710.95	3.212	0.903	5-S2n	1.422	1.912	1.468	1.265	9.783	3.532
44.00	37.40	2711.16	3.416	1.167	5-S2n	1.484	1.985	1.484	1.385	10.380	3.720
52.00	38.88	2711.28	3.535	1.321	5-S2n	1.519	2.024	1.519	1.493	10.480	3.883
60.00	40.03	2711.37	3.631	1.446	5-S2n	1.546	2.058	1.546	1.591	10.554	4.028
60.90	40.15	2711.38	3.641	1.459	5-S2n	1.548	2.061	1.548	1.601	10.561	4.044
76.00	41.92	2711.53	3.792	1.651	5-S2n	1.590	2.107	1.590	1.765	10.672	4.279
84.00	42.72	2711.60	3.862	1.739	5-S2n	1.608	2.127	1.608	1.844	10.719	4.389
92.00	43.45	2711.67	3.927	1.821	5-S2n	1.625	2.145	1.625	1.919	10.762	4.492
100.00	44.11	2711.73	3.987	1.896	5-S2n	1.641	2.161	1.641	1.989	10.800	4.588

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2707.74 ft, Outlet Elevation (invert): 2705.51 ft

Culvert Length: 55.05 ft, Culvert Slope: 0.0405

****

Site Data - 1-36inCMP(CP13c)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2707.74 ft

Outlet Station: 55.00 ft

Outlet Elevation: 2705.51 ft

Number of Barrels: 1

Culvert Data Summary - 1-36inCMP(CP13c)

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: None

Table 11c - Downstream Channel Rating Curve (Crossing: Sta 117+50)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
20.00	2706.47	0.96	3.03	0.60	0.68
28.00	2706.64	1.13	3.31	0.70	0.70
36.00	2706.77	1.26	3.53	0.79	0.71
44.00	2706.90	1.39	3.72	0.86	0.72
52.00	2707.00	1.49	3.88	0.93	0.72
60.00	2707.10	1.59	4.03	0.99	0.73
60.90	2707.11	1.60	4.04	1.00	0.73
76.00	2707.28	1.77	4.28	1.10	0.74
84.00	2707.35	1.84	4.39	1.15	0.74
92.00	2707.43	1.92	4.49	1.20	0.75
100.00	2707.50	1.99	4.59	1.24	0.75

Tailwater Channel Data - Sta 117+50

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 3.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2705.51 ft

Roadway Data for Crossing: Sta 117+50

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2714.34
1	25.00	2713.35
2	50.00	2712.23
3	75.00	2711.19
4	100.00	2710.74

Roadway Surface: Paved

Roadway Top Width: 25.00 ft

Table 12a - Summary of Culvert Flows at Crossing: Sta 114+00

Headwater Elevation (ft)	Total Discharge (cfs)	1-36inCMP(CP14) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2703.02	19.10	18.38	0.67	11
2703.28	27.19	22.10	5.01	9
2703.44	35.28	24.48	10.69	8
2703.57	43.37	26.33	16.96	7
2703.67	51.46	27.71	23.65	5
2703.70	54.60	28.18	26.32	4
2703.82	67.64	29.94	37.66	5
2703.89	75.73	30.89	44.77	4
2703.95	83.82	31.77	52.01	4
2704.01	91.91	32.57	59.18	3
2704.07	100.00	33.33	66.56	3
2702.81	15.40	15.40	0.00	Overtopping

Table 12b - Culvert Summary Table: 1-36inCMP(CP14)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
19.10	18.38	2703.02	2.052	0.0*	1-S2n	0.983	1.373	0.983	0.942	8.804	2.994
27.19	22.10	2703.28	2.309	0.0*	1-S2n	1.084	1.512	1.084	1.112	9.263	3.285
35.28	24.48	2703.44	2.473	0.0*	1-S2n	1.146	1.593	1.146	1.253	9.525	3.514
43.37	26.33	2703.57	2.600	0.0*	1-S2n	1.192	1.652	1.252	1.376	9.112	3.706
51.46	27.71	2703.67	2.695	0.0*	1-S2n	1.227	1.699	1.264	1.486	9.464	3.873
54.60	28.18	2703.70	2.728	0.0*	1-S2n	1.238	1.714	1.270	1.526	9.565	3.932
67.64	29.94	2703.82	2.853	0.0*	1-S2n	1.281	1.768	1.281	1.677	10.056	4.154
75.73	30.89	2703.89	2.921	0.0*	1-S2n	1.304	1.796	1.304	1.763	10.133	4.275
83.82	31.77	2703.95	2.985	0.0*	1-S2n	1.324	1.826	1.324	1.843	10.209	4.387
91.91	32.57	2704.01	3.043	0.007	5-S2n	1.343	1.849	1.343	1.918	10.277	4.491
100.00	33.33	2704.07	3.099	0.135	5-S2n	1.361	1.871	1.361	1.989	10.336	4.588

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2700.97 ft, Outlet Elevation (invert): 2697.85 ft

Culvert Length: 72.07 ft, Culvert Slope: 0.0433

****

Site Data - 1-36inCMP(CP14)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2700.97 ft

Outlet Station: 72.00 ft

Outlet Elevation: 2697.85 ft

Number of Barrels: 1

Culvert Data Summary - 1-36inCMP(CP14)

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: None

Table 12c - Downstream Channel Rating Curve (Crossing: Sta 114+00)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
19.10	2698.79	0.94	2.99	0.59	0.68
27.19	2698.96	1.11	3.28	0.69	0.69
35.28	2699.10	1.25	3.51	0.78	0.71
43.37	2699.23	1.38	3.71	0.86	0.71
51.46	2699.34	1.49	3.87	0.93	0.72
54.60	2699.38	1.53	3.93	0.95	0.73
67.64	2699.53	1.68	4.15	1.05	0.73
75.73	2699.61	1.76	4.27	1.10	0.74
83.82	2699.69	1.84	4.39	1.15	0.74
91.91	2699.77	1.92	4.49	1.20	0.75
100.00	2699.84	1.99	4.59	1.24	0.75

Tailwater Channel Data - Sta 114+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 3.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2697.85 ft

Roadway Data for Crossing: Sta 114+00

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2705.88
1	25.00	2705.06
2	50.00	2704.30
3	75.00	2703.60
4	100.00	2702.81

Roadway Surface: Paved

Roadway Top Width: 30.00 ft

Table 13a - Summary of Culvert Flows at Crossing: Sta 111+00

Headwater Elevation (ft)	Total Discharge (cfs)	1-36inCMP(CP16&17a) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2699.09	25.10	25.10	0.00	1
2700.00	37.59	37.59	0.00	1
2700.35	50.08	41.84	8.08	13
2700.45	62.57	42.96	19.48	7
2700.51	71.40	43.56	27.64	5
2700.59	87.55	44.47	42.96	5
2700.64	100.04	45.06	54.82	4
2700.69	112.53	45.59	66.88	4
2700.74	125.02	46.05	78.76	3
2700.78	137.51	46.50	90.89	3
2700.82	150.00	46.91	103.02	3
2700.20	40.04	40.04	0.00	Overtopping

Table 13b - Culvert Summary Table: 1-36inCMP(CP16&17a)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
25.10	25.10	2699.09	2.448	0.0*	1-S2n	0.960	1.613	0.960	1.071	12.432	3.216
37.59	37.59	2700.00	3.360	0.0*	5-S2n	1.192	1.990	1.192	1.290	13.877	3.572
50.08	41.84	2700.35	3.713	0.0*	5-S2n	1.265	2.104	1.323	1.468	13.462	3.846
62.57	42.96	2700.45	3.811	0.0*	5-S2n	1.284	2.133	1.337	1.621	13.628	4.072
71.40	43.56	2700.51	3.865	0.0*	5-S2n	1.294	2.148	1.294	1.718	14.421	4.211
87.55	44.47	2700.59	3.948	0.0*	5-S2n	1.310	2.170	1.310	1.878	14.498	4.435
100.04	45.06	2700.64	4.002	0.0*	5-S2n	1.319	2.184	1.383	1.990	13.682	4.588
112.53	45.59	2700.69	4.052	0.0*	5-S2n	1.328	2.197	1.394	2.093	13.705	4.728
125.02	46.05	2700.74	4.096	0.0*	5-S2n	1.336	2.208	1.403	2.190	13.731	4.855
137.51	46.50	2700.78	4.138	0.0*	5-S2n	1.343	2.218	1.411	2.281	13.759	4.974
150.00	46.91	2700.82	4.178	0.0*	5-S2n	1.350	2.228	1.419	2.367	13.789	5.084

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2696.64 ft, Outlet Elevation (invert): 2691.34 ft

Culvert Length: 60.23 ft, Culvert Slope: 0.0883

****

Site Data - 1-36inCMP(CP16&17a)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2696.64 ft

Outlet Station: 60.00 ft

Outlet Elevation: 2691.34 ft

Number of Barrels: 1

Culvert Data Summary - 1-36inCMP(CP16&17a)

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: None

Table 13c - Downstream Channel Rating Curve (Crossing: Sta 111+00)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
25.10	2692.41	1.07	3.22	0.67	0.69
37.59	2692.63	1.29	3.57	0.80	0.71
50.08	2692.81	1.47	3.85	0.92	0.72
62.57	2692.96	1.62	4.07	1.01	0.73
71.40	2693.06	1.72	4.21	1.07	0.74
87.55	2693.22	1.88	4.44	1.17	0.75
100.04	2693.33	1.99	4.59	1.24	0.75
112.53	2693.43	2.09	4.73	1.31	0.76
125.02	2693.53	2.19	4.86	1.37	0.76
137.51	2693.62	2.28	4.97	1.42	0.77
150.00	2693.71	2.37	5.08	1.48	0.77

Tailwater Channel Data - Sta 111+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 3.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2691.34 ft

Roadway Data for Crossing: Sta 111+00

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2700.26
1	25.00	2700.20
2	50.00	2700.21
3	75.00	2700.49
4	100.00	2700.68

Roadway Surface: Paved

Roadway Top Width: 25.00 ft

Table 14a - Summary of Culvert Flows at Crossing: Sta 100+50

Headwater Elevation (ft)	Total Discharge (cfs)	1-36inCMP(CP17b) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2703.41	17.20	17.20	0.00	1
2703.92	25.48	25.48	0.00	1
2704.41	33.76	33.76	0.00	1
2704.93	42.04	42.04	0.00	1
2705.43	49.00	49.00	0.00	1
2705.73	58.60	52.84	5.65	13
2705.82	66.88	54.03	12.72	7
2705.90	75.16	54.93	20.13	6
2705.96	83.44	55.66	27.69	5
2706.01	91.72	56.26	35.31	4
2706.05	100.00	56.80	43.11	4
2705.46	49.43	49.43	0.00	Overtopping

Table 14b - Culvert Summary Table: 1-36inCMP(CP17b)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
17.20	17.20	2703.41	1.749	0.0*	1-S2n	0.788	1.325	0.788	0.897	11.203	2.912
25.48	25.48	2703.92	2.256	0.0*	1-S2n	0.965	1.625	1.000	1.079	11.916	3.230
33.76	33.76	2704.41	2.749	0.0*	1-S2n	1.122	1.884	1.170	1.228	12.774	3.474
42.04	42.04	2704.93	3.275	0.0*	5-S2n	1.266	2.110	1.266	1.357	14.338	3.677
49.00	49.00	2705.43	3.767	0.0*	5-S2n	1.381	2.276	1.381	1.454	14.914	3.825
58.60	52.84	2705.73	4.065	0.0*	5-S2n	1.442	2.360	1.507	1.574	14.376	4.004
66.88	54.03	2705.82	4.161	0.0*	5-S2n	1.462	2.384	1.523	1.669	14.510	4.142
75.16	54.93	2705.90	4.235	0.0*	5-S2n	1.476	2.403	1.535	1.757	14.613	4.266
83.44	55.66	2705.96	4.296	0.0*	5-S2n	1.487	2.417	1.544	1.839	14.695	4.382
91.72	56.26	2706.01	4.347	0.0*	5-S2n	1.497	2.429	1.552	1.916	14.761	4.488
100.00	56.80	2706.05	4.393	0.0*	5-S2n	1.505	2.440	1.559	1.989	14.819	4.588

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2701.66 ft, Outlet Elevation (invert): 2692.84 ft

Culvert Length: 99.39 ft, Culvert Slope: 0.0891

****

Site Data - 1-36inCMP(CP17b)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2701.66 ft

Outlet Station: 99.00 ft

Outlet Elevation: 2692.84 ft

Number of Barrels: 1

Culvert Data Summary - 1-36inCMP(CP17b)

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 14c - Downstream Channel Rating Curve (Crossing: Sta 100+50)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
17.20	2693.74	0.90	2.91	0.56	0.67
25.48	2693.92	1.08	3.23	0.67	0.69
33.76	2694.07	1.23	3.47	0.77	0.70
42.04	2694.20	1.36	3.68	0.85	0.71
49.00	2694.29	1.45	3.82	0.91	0.72
58.60	2694.41	1.57	4.00	0.98	0.73
66.88	2694.51	1.67	4.14	1.04	0.73
75.16	2694.60	1.76	4.27	1.10	0.74
83.44	2694.68	1.84	4.38	1.15	0.74
91.72	2694.76	1.92	4.49	1.20	0.75
100.00	2694.83	1.99	4.59	1.24	0.75

Tailwater Channel Data - Sta 100+50

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 3.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2692.84 ft

Roadway Data for Crossing: Sta 100+50

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2706.35
1	25.00	2705.94
2	50.00	2705.46
3	75.00	2705.72
4	100.00	2706.24

Roadway Surface: Paved

Roadway Top Width: 40.00 ft

Table 15a - Summary of Culvert Flows at Crossing: Sta 87+00

Headwater Elevation (ft)	Total Discharge (cfs)	1-24inCMP(CP20) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2654.18	7.20	7.20	0.00	1
2654.73	11.48	11.48	0.00	1
2655.36	15.76	15.76	0.00	1
2656.15	20.04	19.97	0.00	39
2656.19	20.70	20.14	0.43	12
2656.30	28.60	20.69	7.83	7
2656.34	32.88	20.85	11.86	4
2656.37	37.16	20.99	16.08	4
2656.40	41.44	21.12	20.28	4
2656.43	45.72	21.23	24.36	3
2656.45	50.00	21.34	28.57	3
2656.15	19.97	19.97	0.00	Overtopping

Table 15b - Culvert Summary Table: 1-24inCMP(CP20)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
7.20	7.20	2654.18	1.423	0.0*	1-S2n	0.660	0.953	0.660	0.660	7.704	2.350
11.48	11.48	2654.73	1.970	0.0*	1-S2n	0.849	1.212	0.849	0.820	8.731	2.653
15.76	15.76	2655.36	2.601	0.0*	5-S2n	1.021	1.426	1.050	0.946	9.135	2.879
20.04	19.97	2656.15	3.389	1.348	5-S2n	1.184	1.603	1.184	1.053	9.993	3.062
20.70	20.14	2656.19	3.426	1.398	5-S2n	1.191	1.610	1.191	1.069	10.011	3.088
28.60	20.69	2656.30	3.544	1.555	5-S2n	1.212	1.629	1.212	1.232	10.065	3.353
32.88	20.85	2656.34	3.581	1.603	5-S2n	1.219	1.635	1.262	1.308	9.686	3.474
37.16	20.99	2656.37	3.613	1.646	5-S2n	1.225	1.640	1.267	1.379	9.704	3.583
41.44	21.12	2656.40	3.641	1.683	5-S2n	1.230	1.644	1.272	1.446	9.721	3.684
45.72	21.23	2656.43	3.666	1.716	5-S2n	1.234	1.648	1.276	1.508	9.738	3.776
50.00	21.34	2656.45	3.691	1.748	5-S2n	1.238	1.652	1.279	1.566	9.755	3.863

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2652.76 ft, Outlet Elevation (invert): 2649.66 ft

Culvert Length: 55.09 ft, Culvert Slope: 0.0564

****

Site Data - 1-24inCMP(CP20)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2652.76 ft

Outlet Station: 55.00 ft

Outlet Elevation: 2649.66 ft

Number of Barrels: 1

Culvert Data Summary - 1-24inCMP(CP20)

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: None

Table 15c - Downstream Channel Rating Curve (Crossing: Sta 87+00)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
7.20	2650.32	0.66	2.35	0.41	0.64
11.48	2650.48	0.82	2.65	0.51	0.66
15.76	2650.61	0.95	2.88	0.59	0.67
20.04	2650.71	1.05	3.06	0.66	0.68
20.70	2650.73	1.07	3.09	0.67	0.68
28.60	2650.89	1.23	3.35	0.77	0.70
32.88	2650.97	1.31	3.47	0.82	0.70
37.16	2651.04	1.38	3.58	0.86	0.71
41.44	2651.11	1.45	3.68	0.90	0.71
45.72	2651.17	1.51	3.78	0.94	0.72
50.00	2651.23	1.57	3.86	0.98	0.72

Tailwater Channel Data - Sta 87+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 2.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2649.66 ft

Roadway Data for Crossing: Sta 87+00

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2656.55
1	25.00	2656.33
2	50.00	2656.21
3	75.00	2656.15
4	100.00	2656.17

Roadway Surface: Paved

Roadway Top Width: 24.00 ft

Table 16a - Summary of Culvert Flows at Crossing: Sta 80+00

Headwater Elevation (ft)	Total Discharge (cfs)	3-48inCMP(CP22) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2635.78	111.80	111.80	0.00	1
2636.29	150.62	150.62	0.00	1
2636.79	189.44	189.44	0.00	1
2637.30	228.26	228.26	0.00	1
2637.85	267.08	267.08	0.00	1
2638.43	304.00	304.00	0.00	1
2639.09	344.72	342.58	2.07	6
2639.42	383.54	360.22	23.13	5
2639.67	422.36	372.84	49.37	5
2639.87	461.18	383.10	77.94	5
2640.05	500.00	391.89	107.97	5
2639.00	337.53	337.53	0.00	Overtopping

Table 16b - Culvert Summary Table: 3-48inCMP(CP22)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
111.80	111.80	2635.78	2.519	0.169	1-S2n	1.334	1.819	1.383	1.427	9.340	4.423
150.62	150.62	2636.29	3.033	0.742	1-S2n	1.565	2.122	1.623	1.671	10.141	4.824
189.44	189.44	2636.79	3.531	1.363	1-S2n	1.778	2.394	1.855	1.883	10.704	5.150
228.26	228.26	2637.30	4.043	2.035	5-S2n	1.981	2.638	2.076	2.073	11.179	5.428
267.08	267.08	2637.85	4.592	2.763	5-S2n	2.180	2.857	2.285	2.245	11.627	5.671
304.00	304.00	2638.43	5.166	3.986	5-S2n	2.369	3.046	2.482	2.396	11.998	5.877
344.72	342.58	2639.09	5.831	4.733	5-S2n	2.570	3.222	2.687	2.552	12.357	6.083
383.54	360.22	2639.42	6.161	5.098	5-S2n	2.665	3.296	2.786	2.691	12.490	6.263
422.36	372.84	2639.67	6.406	5.367	5-S2n	2.736	3.346	2.852	2.822	12.611	6.428
461.18	383.10	2639.87	6.613	5.592	5-S2n	2.794	3.385	2.917	2.946	12.656	6.582
500.00	391.89	2640.05	6.794	5.788	5-S2n	2.846	3.416	2.964	3.064	12.740	6.727

****

Straight Culvert

Inlet Elevation (invert): 2633.26 ft, Outlet Elevation (invert): 2631.28 ft

Culvert Length: 55.04 ft, Culvert Slope: 0.0360

****

Site Data - 3-48inCMP(CP22)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2633.26 ft

Outlet Station: 55.00 ft

Outlet Elevation: 2631.28 ft

Number of Barrels: 3

Culvert Data Summary - 3-48inCMP(CP22)

Barrel Shape: Circular

Barrel Diameter: 4.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 16c - Downstream Channel Rating Curve (Crossing: Sta 80+00)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
111.80	2632.71	1.43	4.42	0.89	0.75
150.62	2632.95	1.67	4.82	1.04	0.77
189.44	2633.16	1.88	5.15	1.18	0.78
228.26	2633.35	2.07	5.43	1.29	0.79
267.08	2633.52	2.24	5.67	1.40	0.80
304.00	2633.68	2.40	5.88	1.50	0.80
344.72	2633.83	2.55	6.08	1.59	0.81
383.54	2633.97	2.69	6.26	1.68	0.82
422.36	2634.10	2.82	6.43	1.76	0.82
461.18	2634.23	2.95	6.58	1.84	0.83
500.00	2634.34	3.06	6.73	1.91	0.83

Tailwater Channel Data - Sta 80+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 12.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2631.28 ft

Roadway Data for Crossing: Sta 80+00

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2641.38
1	25.00	2640.18
2	50.00	2639.00
3	75.00	2639.00

Roadway Surface: Paved

Roadway Top Width: 25.00 ft

Table 17a - Summary of Culvert Flows at Crossing: Sta 70+00

Headwater Elevation (ft)	Total Discharge (cfs)	2-36inCMP(CP24) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2599.07	200.00	193.71	11.44	20
2599.12	210.00	194.29	15.48	4
2599.20	220.00	195.29	24.46	6
2599.26	230.00	196.12	33.72	6
2599.32	240.00	196.85	42.89	5
2599.38	250.00	197.51	52.30	5
2599.43	260.00	198.14	61.73	5
2599.45	264.10	198.39	65.56	4
2599.52	280.00	199.28	80.61	5
2599.56	290.00	199.80	90.02	4
2599.61	300.00	200.29	99.57	4
2598.71	177.55	177.55	0.00	Overtopping

Table 17b - Culvert Summary Table: 2-36inCMP(CP24)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
200.00	193.71	2599.07	9.211	0.000	7-M2c	3.000	2.757	2.757	2.379	14.246	5.417
210.00	194.29	2599.12	9.257	0.000	7-M2c	3.000	2.750	2.750	2.433	14.312	5.486
220.00	195.29	2599.20	9.337	0.000	7-M2c	3.000	2.739	2.739	2.486	14.425	5.552
230.00	196.12	2599.26	9.404	0.000	7-M2c	3.000	2.731	2.731	2.536	14.518	5.616
240.00	196.85	2599.32	9.463	0.000	7-M2c	3.000	2.723	2.723	2.586	14.599	5.678
250.00	197.51	2599.38	9.517	0.000	7-M2c	3.000	2.717	2.717	2.634	14.673	5.739
260.00	198.14	2599.43	9.568	0.000	7-M2c	3.000	2.711	2.711	2.682	14.742	5.797
264.10	198.39	2599.45	9.588	0.000	7-M2c	3.000	2.709	2.709	2.701	14.769	5.820
280.00	199.28	2599.52	9.661	0.000	3-M2t	3.000	2.675	2.773	2.773	14.602	5.909
290.00	199.80	2599.56	9.704	0.000	3-M2t	3.000	2.656	2.817	2.817	14.498	5.962
300.00	200.29	2599.61	9.744	11.453	7-M2t	3.000	2.643	2.860	2.860	14.411	6.014

****

Straight Culvert

Inlet Elevation (invert): 2589.86 ft, Outlet Elevation (invert): 2586.39 ft

Culvert Length: 95.06 ft, Culvert Slope: 0.0365

****

Site Data - 2-36inCMP(CP24)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2589.86 ft

Outlet Station: 95.00 ft

Outlet Elevation: 2586.39 ft

Number of Barrels: 2

Culvert Data Summary - 2-36inCMP(CP24)

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 17c - Downstream Channel Rating Curve (Crossing: Sta 70+00)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
200.00	2588.77	2.38	5.42	1.48	0.79
210.00	2588.82	2.43	5.49	1.52	0.79
220.00	2588.88	2.49	5.55	1.55	0.79
230.00	2588.93	2.54	5.62	1.58	0.79
240.00	2588.98	2.59	5.68	1.61	0.80
250.00	2589.02	2.63	5.74	1.64	0.80
260.00	2589.07	2.68	5.80	1.67	0.80
264.10	2589.09	2.70	5.82	1.69	0.80
280.00	2589.16	2.77	5.91	1.73	0.80
290.00	2589.21	2.82	5.96	1.76	0.80
300.00	2589.25	2.86	6.01	1.78	0.81

Tailwater Channel Data - Sta 70+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 6.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2586.39 ft

Roadway Data for Crossing: Sta 70+00

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2600.39
1	40.00	2599.16
2	80.00	2598.71
3	100.00	2599.01

Roadway Surface: Gravel

Roadway Top Width: 30.00 ft

Table 18a - Summary of Culvert Flows at Crossing: Sta 59+00

Headwater Elevation (ft)	Total Discharge (cfs)	1-24inRCP(CP27) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2559.67	8.00	8.00	0.00	1
2560.13	12.20	12.20	0.00	1
2560.62	16.40	16.40	0.00	1
2561.22	20.60	20.60	0.00	1
2561.70	23.90	23.36	0.47	23
2561.87	29.00	24.24	4.70	9
2561.94	33.20	24.60	8.52	5
2562.00	37.40	24.88	12.41	4
2562.05	41.60	25.13	16.41	4
2562.09	45.80	25.36	20.41	4
2562.14	50.00	25.56	24.34	3
2561.59	22.74	22.74	0.00	Overtopping

Table 18b - Culvert Summary Table: 1-24inRCP(CP27)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
8.00	8.00	2559.67	1.441	0.0*	1-S2n	0.533	1.006	0.592	0.694	9.931	2.415
12.20	12.20	2560.13	1.895	0.0*	1-S2n	0.664	1.249	0.748	0.843	10.998	2.695
16.40	16.40	2560.62	2.386	0.404	5-S2n	0.778	1.455	0.896	0.963	11.636	2.909
20.60	20.60	2561.22	2.993	1.253	5-S2n	0.884	1.626	1.028	1.066	12.249	3.084
23.90	23.36	2561.70	3.473	1.681	5-S2n	0.950	1.716	1.113	1.138	12.593	3.203
29.00	24.24	2561.87	3.641	1.826	5-S2n	0.971	1.741	1.139	1.239	12.709	3.365
33.20	24.60	2561.94	3.711	1.886	5-S2n	0.979	1.751	1.149	1.314	12.755	3.482
37.40	24.88	2562.00	3.768	1.934	5-S2n	0.986	1.758	1.158	1.383	12.792	3.589
41.60	25.13	2562.05	3.818	1.977	5-S2n	0.992	1.765	1.165	1.448	12.826	3.687
45.80	25.36	2562.09	3.864	2.016	5-S2n	0.997	1.771	1.171	1.509	12.852	3.778
50.00	25.56	2562.14	3.906	2.051	5-S2n	1.002	1.776	1.178	1.566	12.873	3.863

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2558.23 ft, Outlet Elevation (invert): 2556.33 ft

Culvert Length: 41.04 ft, Culvert Slope: 0.0463

****

Site Data - 1-24inRCP(CP27)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2558.23 ft

Outlet Station: 41.00 ft

Outlet Elevation: 2556.33 ft

Number of Barrels: 1

Culvert Data Summary - 1-24inRCP(CP27)

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 18c - Downstream Channel Rating Curve (Crossing: Sta 59+00)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
8.00	2557.02	0.69	2.41	0.43	0.64
12.20	2557.17	0.84	2.70	0.53	0.66
16.40	2557.29	0.96	2.91	0.60	0.67
20.60	2557.40	1.07	3.08	0.67	0.68
23.90	2557.47	1.14	3.20	0.71	0.69
29.00	2557.57	1.24	3.36	0.77	0.70
33.20	2557.64	1.31	3.48	0.82	0.70
37.40	2557.71	1.38	3.59	0.86	0.71
41.60	2557.78	1.45	3.69	0.90	0.71
45.80	2557.84	1.51	3.78	0.94	0.72
50.00	2557.90	1.57	3.86	0.98	0.72

Tailwater Channel Data - Sta 59+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 2.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2556.33 ft

Roadway Data for Crossing: Sta 59+00

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2569.09
1	25.00	2565.79
2	50.00	2562.63
3	75.00	2561.59
4	100.00	2561.89

Roadway Surface: Paved

Roadway Top Width: 15.00 ft

Table 19a - Summary of Culvert Flows at Crossing: Sta 58+00

Headwater Elevation (ft)	Total Discharge (cfs)	1-24inRCP(CP27) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2553.99	8.00	8.00	0.00	1
2554.33	11.20	11.20	0.00	1
2554.69	14.40	14.40	0.00	1
2555.09	17.60	17.60	0.00	1
2555.57	20.80	20.80	0.00	1
2556.12	23.90	23.90	0.00	1
2556.80	27.20	27.20	0.00	1
2557.33	30.40	29.48	0.83	26
2557.42	33.60	29.86	3.64	8
2557.47	36.80	30.08	6.67	6
2557.51	40.00	30.24	9.71	5
2557.21	28.99	28.99	0.00	Overtopping

Table 19b - Culvert Summary Table: 1-24inRCP(CP27)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
8.00	8.00	2553.99	1.446	0.0*	1-S2n	0.547	1.006	0.602	0.694	9.717	2.415
11.20	11.20	2554.33	1.792	0.0*	1-S2n	0.652	1.197	0.729	0.810	10.450	2.636
14.40	14.40	2554.69	2.146	0.190	5-S2n	0.745	1.363	0.844	0.909	11.045	2.813
17.60	17.60	2555.09	2.550	0.911	5-S2n	0.832	1.510	0.951	0.994	11.554	2.962
20.80	20.80	2555.57	3.030	1.368	5-S2n	0.915	1.633	1.055	1.071	11.978	3.091
23.90	23.90	2556.12	3.580	1.863	5-S2n	0.992	1.732	1.151	1.138	12.378	3.203
27.20	27.20	2556.80	4.260	2.445	5-S2n	1.073	1.813	1.248	1.205	12.792	3.310
30.40	29.48	2557.33	4.785	2.880	5-S2n	1.128	1.853	1.313	1.265	13.086	3.405
33.60	29.86	2557.42	4.877	2.955	5-S2n	1.138	1.858	1.324	1.321	13.125	3.493
36.80	30.08	2557.47	4.931	3.002	5-S2n	1.143	1.865	1.331	1.374	13.152	3.574
40.00	30.24	2557.51	4.972	3.035	5-S2n	1.147	1.867	1.335	1.424	13.181	3.651

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2552.54 ft, Outlet Elevation (invert): 2550.70 ft

Culvert Length: 44.04 ft, Culvert Slope: 0.0418

****

Site Data - 1-24inRCP(CP27)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2552.54 ft

Outlet Station: 44.00 ft

Outlet Elevation: 2550.70 ft

Number of Barrels: 1

Culvert Data Summary - 1-24inRCP(CP27)

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 19c - Downstream Channel Rating Curve (Crossing: Sta 58+00)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
8.00	2551.39	0.69	2.41	0.43	0.64
11.20	2551.51	0.81	2.64	0.51	0.66
14.40	2551.61	0.91	2.81	0.57	0.67
17.60	2551.69	0.99	2.96	0.62	0.68
20.80	2551.77	1.07	3.09	0.67	0.68
23.90	2551.84	1.14	3.20	0.71	0.69
27.20	2551.90	1.20	3.31	0.75	0.69
30.40	2551.96	1.26	3.41	0.79	0.70
33.60	2552.02	1.32	3.49	0.82	0.70
36.80	2552.07	1.37	3.57	0.86	0.71
40.00	2552.12	1.42	3.65	0.89	0.71

Tailwater Channel Data - Sta 58+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 2.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2550.70 ft

Roadway Data for Crossing: Sta 58+00

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2557.56
1	25.00	2558.67
2	50.00	2557.54
3	75.00	2557.21
4	100.00	2557.45

Roadway Surface: Paved

Roadway Top Width: 12.00 ft

Table 20a - Summary of Culvert Flows at Crossing: Sta 127+00

Headwater Elevation (ft)	Total Discharge (cfs)	1-24inCMP(CP9) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2734.57	6.10	6.10	0.00	1
2734.87	8.49	8.49	0.00	1
2735.18	10.88	10.88	0.00	1
2735.51	13.27	13.27	0.00	1
2735.87	15.66	15.66	0.00	1
2736.19	17.50	17.50	0.00	1
2736.50	20.44	19.11	1.28	15
2736.59	22.83	19.56	3.21	8
2736.66	25.22	19.88	5.27	6
2736.71	27.61	20.12	7.44	5
2736.75	30.00	20.31	9.64	4
2736.29	18.03	18.03	0.00	Overtopping

Table 20b - Culvert Summary Table: 1-24inCMP(CP9)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
6.10	6.10	2734.57	1.310	0.0*	1-S2n	0.730	0.873	0.750	0.357	5.474	3.864
8.49	8.49	2734.87	1.615	0.087	1-S2n	0.876	1.038	0.876	0.425	6.200	4.255
10.88	10.88	2735.18	1.919	0.523	1-S2n	1.012	1.179	1.012	0.483	6.603	4.566
13.27	13.27	2735.51	2.246	1.019	5-S2n	1.144	1.308	1.144	0.535	6.917	4.827
15.66	15.66	2735.87	2.613	1.574	5-S2n	1.279	1.422	1.279	0.582	7.159	5.054
17.50	17.50	2736.19	2.932	2.293	5-S2n	1.389	1.506	1.389	0.615	7.303	5.211
20.44	19.11	2736.50	3.240	2.700	5-S2n	1.496	1.571	1.496	0.664	7.384	5.437
22.83	19.56	2736.59	3.333	2.821	5-S2n	1.529	1.588	1.529	0.702	7.391	5.603
25.22	19.88	2736.66	3.399	2.906	5-S2n	1.553	1.600	1.553	0.737	7.401	5.755
27.61	20.12	2736.71	3.451	2.973	5-S2n	1.573	1.609	1.573	0.770	7.399	5.897
30.00	20.31	2736.75	3.490	3.024	5-S2n	1.588	1.616	1.588	0.802	7.398	6.029

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2733.26 ft, Outlet Elevation (invert): 2731.85 ft

Culvert Length: 51.02 ft, Culvert Slope: 0.0276

****

Site Data - 1-24inCMP(CP9)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2733.26 ft

Outlet Station: 51.00 ft

Outlet Elevation: 2731.85 ft

Number of Barrels: 1

Culvert Data Summary - 1-24inCMP(CP9)

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: None

Table 20c - Downstream Channel Rating Curve (Crossing: Sta 127+00)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
6.10	2732.14	0.36	3.86	1.08	1.31
8.49	2732.20	0.42	4.25	1.29	1.34
10.88	2732.26	0.48	4.57	1.46	1.37
13.27	2732.31	0.53	4.83	1.62	1.38
15.66	2732.36	0.58	5.05	1.76	1.40
17.50	2732.40	0.62	5.21	1.86	1.41
20.44	2732.44	0.66	5.44	2.01	1.42
22.83	2732.48	0.70	5.60	2.12	1.44
25.22	2732.52	0.74	5.76	2.23	1.44
27.61	2732.55	0.77	5.90	2.33	1.45
30.00	2732.58	0.80	6.03	2.43	1.46

Tailwater Channel Data - Sta 127+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 3.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0485

Channel Manning's n: 0.0350

Channel Invert Elevation: 2731.78 ft

Roadway Data for Crossing: Sta 127+00

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2738.01
1	25.00	2737.48
2	50.00	2737.11
3	75.00	2736.70
4	100.00	2736.29

Roadway Surface: Paved

Roadway Top Width: 22.00 ft

Table 21a - Summary of Culvert Flows at Crossing: Sta 90+00

Headwater Elevation (ft)	Total Discharge (cfs)	2-24in CMP(CP-18) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2659.11	24.40	24.40	0.00	1
2660.13	36.96	36.96	0.00	1
2660.77	49.52	42.99	6.49	8
2661.01	62.08	44.96	17.06	8
2661.10	69.80	45.71	23.99	6
2661.28	87.20	47.09	40.03	6
2661.38	99.76	47.91	51.77	5
2661.48	112.32	48.63	63.52	4
2661.56	124.88	49.27	75.51	4
2661.65	137.44	49.85	87.53	4
2661.72	150.00	50.39	99.58	4
2660.27	38.34	38.34	0.00	Overtopping

Table 21b - Culvert Summary Table: 2-24in CMP(CP-18)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
24.40	24.40	2659.11	2.053	0.0*	5-S2n	0.000	0.000	1.249	0.977	5.910	3.157
36.96	36.96	2660.13	3.073	0.978	5-S2n	0.000	0.000	1.546	1.194	7.093	3.526
49.52	42.99	2660.77	3.713	2.013	5-S2n	0.000	0.000	1.720	1.371	7.481	3.809
62.08	44.96	2661.01	3.947	3.500	7-M2c	0.000	0.000	1.738	1.523	7.755	4.040
69.80	45.71	2661.10	4.039	3.559	7-M2c	0.000	0.000	1.746	1.607	7.855	4.164
87.20	47.09	2661.28	4.215	3.625	7-M2c	0.000	0.000	1.779	1.779	7.977	4.411
99.76	47.91	2661.38	4.322	3.717	7-M2c	0.000	0.000	1.890	1.890	7.793	4.566
112.32	48.63	2661.48	4.417	3.768	7-M2c	0.000	0.000	1.993	1.993	7.742	4.708
124.88	49.27	2661.56	4.505	3.816	7-M2c	0.000	0.000	2.000	2.089	7.842	4.838
137.44	49.85	2661.65	4.585	3.859	7-M2c	0.000	0.000	2.000	2.180	7.934	4.958
150.00	50.39	2661.72	4.660	3.899	7-M2c	0.000	0.000	2.000	2.265	8.020	5.069

* Full Flow Headwater elevation is below inlet invert.

****

Double Broken-back Culvert

Inlet Elevation (invert): 2657.06 ft,

Upper Break Elevation (invert): 2654.41 ft,

Lower Break Elevation (invert): 2645.36 ft,

Culvert Length: 185.46 ft,

Upper Culvert Section Slope: 0.0491

Steep Culvert Section Slope: 9.0500

Runout Culvert Section Slope: 0.0105

****

Site Data - 2-24in CMP(CP-18)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2657.06 ft

Upper Break Station: 54.00 ft

Upper Break Elevation: 2654.41 ft

Lower Break Station: 55.00 ft

Lower Break Elevation: 2645.36 ft

Outlet Station: 185.00 ft

Outlet Elevation: 2644.00 ft

Number of Barrels: 2

Culvert Data Summary - 2-24in CMP(CP-18)

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Upper & Middle Section Material: Corrugated Aluminum

Lower Section Material:

Embedment: 0.00 in

Upper & Middle Section Manning's n: 0.0300

Lower Section Manning's n: 0.0300

Culvert Type: Double Broken-back

Inlet Configuration: Thin Edge Projecting

Inlet Depression: None

Table 21c - Downstream Channel Rating Curve (Crossing: Sta 90+00)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
24.40	2644.98	0.98	3.16	0.61	0.69
36.96	2645.19	1.19	3.53	0.75	0.71
49.52	2645.37	1.37	3.81	0.86	0.72
62.08	2645.52	1.52	4.04	0.95	0.73
69.80	2645.61	1.61	4.16	1.00	0.74
87.20	2645.78	1.78	4.41	1.11	0.75
99.76	2645.89	1.89	4.57	1.18	0.75
112.32	2645.99	1.99	4.71	1.24	0.76
124.88	2646.09	2.09	4.84	1.30	0.76
137.44	2646.18	2.18	4.96	1.36	0.77
150.00	2646.27	2.27	5.07	1.41	0.77

Tailwater Channel Data - Sta 90+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2644.00 ft

Roadway Data for Crossing: Sta 90+00

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2662.73
1	25.00	2661.84
2	50.00	2661.00
3	75.00	2660.27

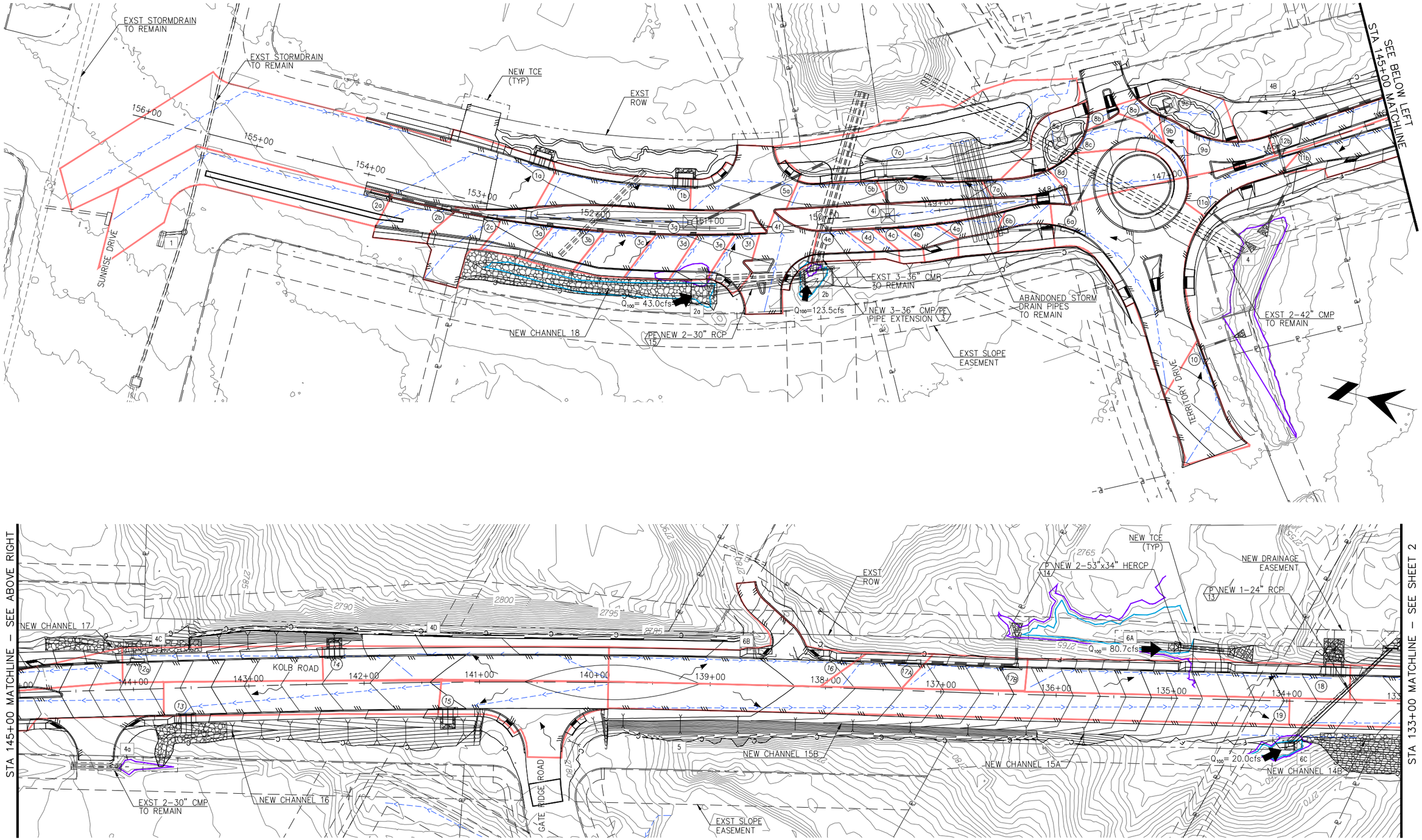
Roadway Surface: Paved

Roadway Top Width: 24.00 ft

APPENDIX 5

PROPOSED CONDITIONS PAVEMENT DRAINAGE AND OFFSITE WATERSHED MAPS

ONSITE PAVEMENT DRAINAGE



LEGEND

- WATERSHED BOUNDARY
- OFFSITE WATERSHED BOUNDARY
- (3) PAVEMENT DRAINAGE CONCENTRATION POINT
- 4p OFFSITE WATERSHED ID
- FLOW PATH
- SURFACE FLOW ARROW
- EXISTING CONDITIONS FLOODPLAIN
- PROPOSED CONDITIONS FLOODPLAIN
- EXISTING HEADWATER PONDING LIMITS
- PROPOSED HEADWATER PONDING LIMITS
- 8+40 HEC-RAS CROSS SECTION AND ID

40 0 20 40 60 80

SCALES: HORIZ. 1"=40' VERT.

SHEET 1 OF 5

Call at least two full working days before you begin excavation.
ARIZONA 811
Arizona Blue Stake, Inc.
Dial 8-1-1 or 1-800-STAKE-IT (782-5348)
In Maricopa County: (602) 263-1100

PIMA COUNTY DEPARTMENT OF TRANSPORTATION — ANA OLIVARES, P.E., DIRECTOR

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

NO.	REVISION DESCRIPTION	DIV. ENGINEER	DATE

		DATE
DESIGNED:	CR/EB	12/2018
DRAWN:	CR	12/2018
CHECKED:	KT	12/2018
PROJ. ENG.:	KT	12/2018

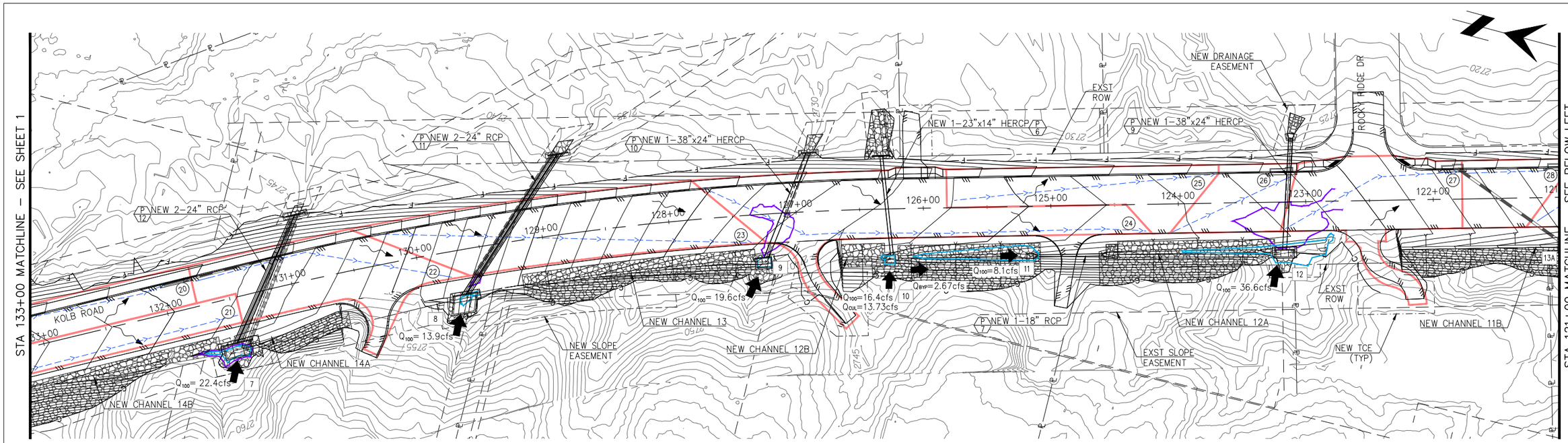
REGISTERED PROFESSIONAL ENGINEER (CIVIL) 63879 CHELSI RENAE STONEBRAKER ARIZONA U.S.A. EXPIRES 6/30/2021

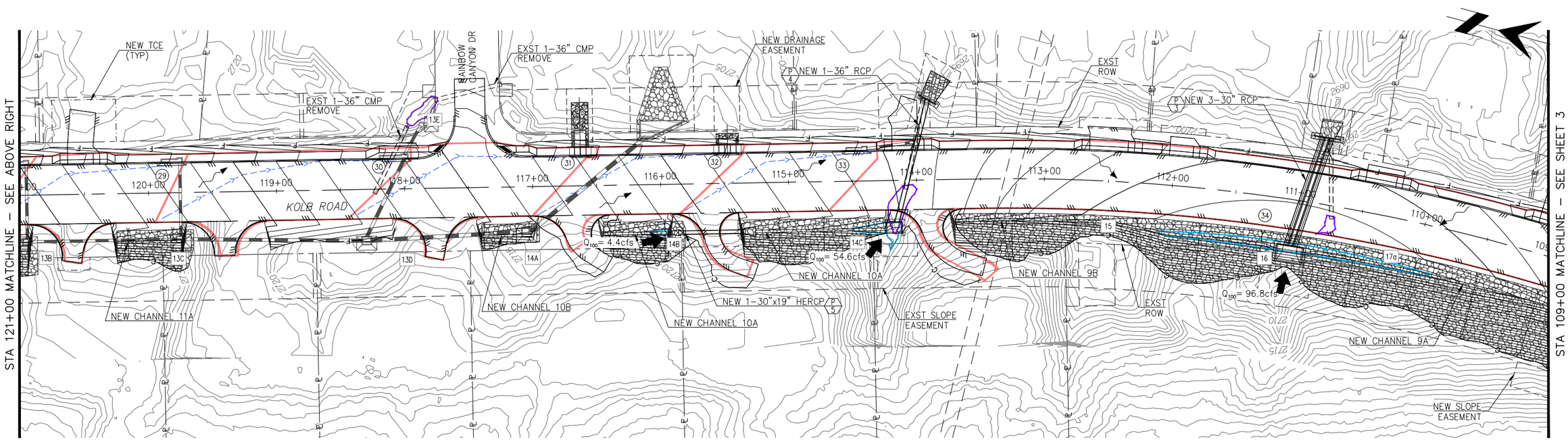
PSOMAS
333 E. Wetmore Road, Suite 450
Tucson, AZ 85705
(520) 292-2300 (520) 292-1290 fax
www.psomas.com

FIG 5 – PAVEMENT DRAINAGE FOR KOLB ROAD

SABINO CANYON TO SUNRISE DR

T:_7PM16020\WATRES\GLOBAL\EXHIB\Figure 5 – Pavement Drainage.dwg FIG-1 Last Saved: December 19, 2018 By: Chelsi.remme Plotted: Wednesday, December 19, 2018 11:31:24 AM





LEGEND

- WATERSHED BOUNDARY
- OFFSITE WATERSHED BOUNDARY
- (3) PAVEMENT DRAINAGE CONCENTRATION POINT
- 4p OFFSITE WATERSHED ID
- FLOW PATH
- SURFACE FLOW ARROW
- EXISTING CONDITIONS FLOODPLAIN
- PROPOSED CONDITIONS FLOODPLAIN
- EXISTING HEADWATER PONDING LIMITS
- PROPOSED HEADWATER PONDING LIMITS
- 8+40 HEC-RAS CROSS SECTION AND ID

Call at least two full working days before you begin excavation.
ARIZONA 811
Arizona Blue Stake, Inc.
Dial 8-1-1 or 1-800-STAKE-IT (782-5348)
In Maricopa County: (602) 263-1100

40 0 20 40 60 80

SCALES: HORIZ. 1"=40' VERT.

SHEET 2 OF 5

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

DESIGNED:	CR/EB	DATE
DRAWN:	CR	12/2018
CHECKED:	KT	12/2018
PROJ. ENG.:	KT	12/2018

NO.	REVISION DESCRIPTION	DIV. ENGINEER	DATE

ANA OLIVARES, P.E., DIRECTOR

PSOMAS
333 E. Wetmore Road, Suite 450
Tucson, AZ 85705
(520) 292-2300 (520) 292-1290 fax
www.psomas.com

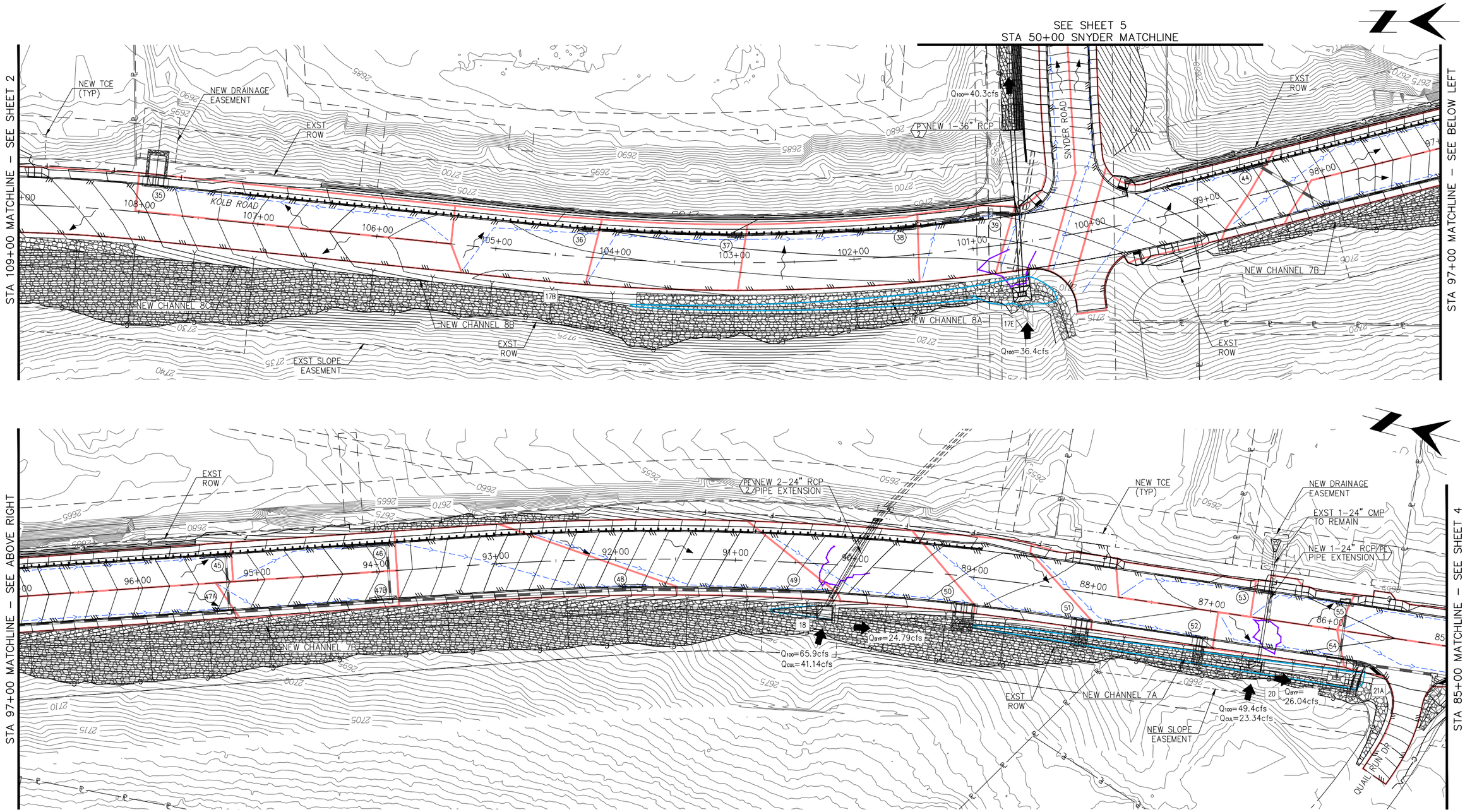
REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 65979 CHELS RENAE DATE SIGNED 01/17/19 ARIZONA U.S.A. EXPIRES 6/30/2021

PIMA COUNTY DEPARTMENT OF TRANSPORTATION

FIG 5 – PAVEMENT DRAINAGE FOR KOLB ROAD

SABINO CANYON TO SUNRISE DR

T:\PPM160201\WATRES\GLOBAL\EXHIB\Figure 5 – Pavement Drainage.dwg FIG-2 Last Saved: December 19, 2018 By: ChelsLremme Plotted: Wednesday, December 19, 2018 11:35:59 AM



LEGEND

- WATERSHED BOUNDARY
- OFFSITE WATERSHED BOUNDARY
- (3) PAVEMENT DRAINAGE CONCENTRATION POINT
- 4p OFFSITE WATERSHED ID
- FLOW PATH
- SURFACE FLOW ARROW
- EXISTING CONDITIONS FLOODPLAIN
- PROPOSED CONDITIONS FLOODPLAIN
- EXISTING HEADWATER PONDING LIMITS
- PROPOSED HEADWATER PONDING LIMITS
- 8+40 HEC-RAS CROSS SECTION AND ID

Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

40 0 20 40 60 80

SCALES: HORIZ. 1"=40' VERT.

SHEET 3 OF 5

PIMA COUNTY DEPARTMENT OF TRANSPORTATION

ANA OLIVARES, P.E., DIRECTOR

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

NO.	REVISION DESCRIPTION	DIV. ENGINEER	DATE

		DATE
DESIGNED:	CR/EB	12/2018
DRAWN:	CR	12/2018
CHECKED:	KT	12/2018
PROJ. ENG.:	KT	12/2018

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 65979 CHELS REMME DATE SIGNED 8/17/21 ARIZONA U.S.A. EXPIRES 3/31/2021

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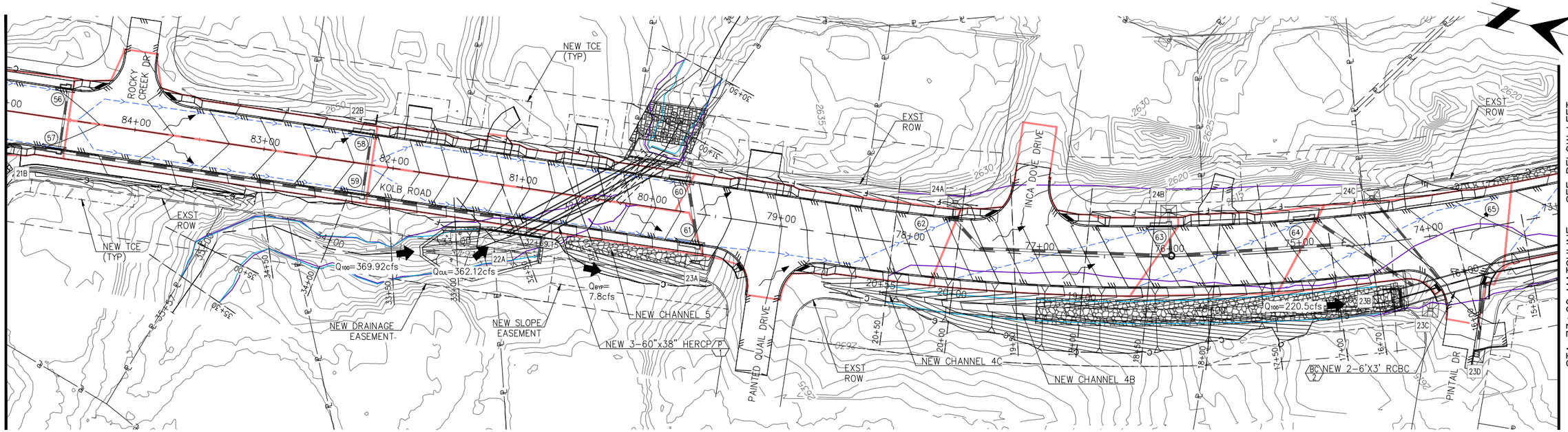
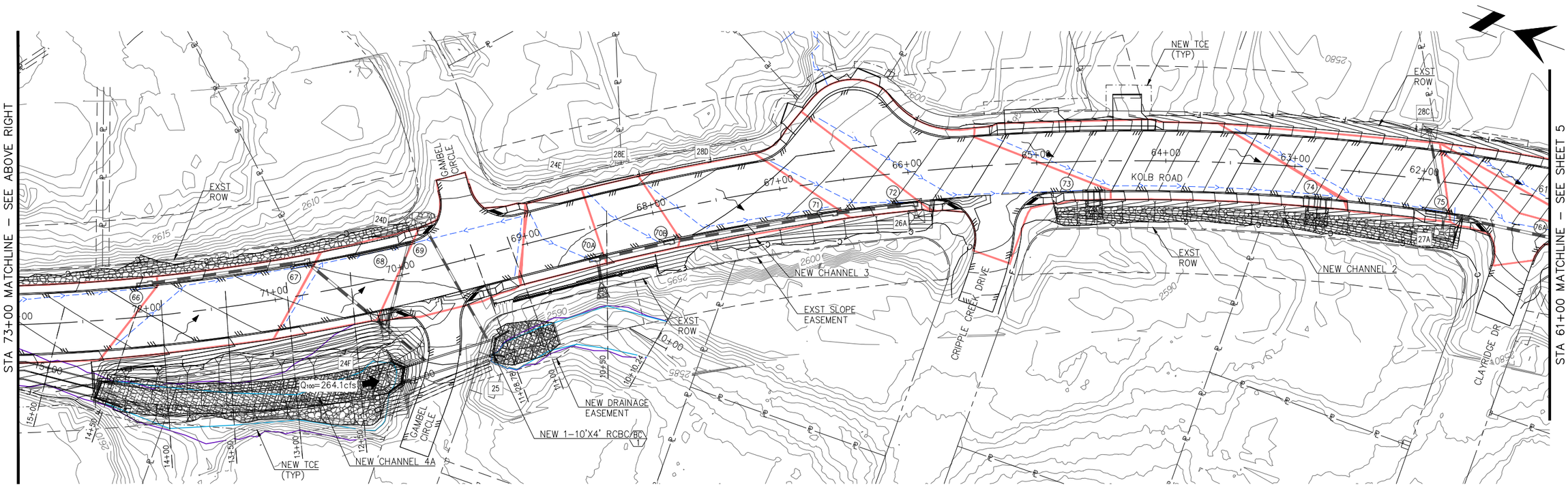
FIG 5 – PAVEMENT DRAINAGE FOR KOLB ROAD

SABINO CANYON TO SUNRISE DR

T:\7PM160201\WATRES\GLOBAL\EXHIB\Figure 5 – Pavement Drainage.dwg FIG-3 Last Saved: December 19, 2018 By: ChelsLremme Plotted: Wednesday, December 19, 2018 11:40:34 AM





LEGEND

- WATERSHED BOUNDARY
- OFFSITE WATERSHED BOUNDARY
- (3) PAVEMENT DRAINAGE CONCENTRATION POINT
- 4p OFFSITE WATERSHED ID
- FLOW PATH
- SURFACE FLOW ARROW
- EXISTING CONDITIONS FLOODPLAIN
- PROPOSED CONDITIONS FLOODPLAIN
- EXISTING HEADWATER PONDING LIMITS
- PROPOSED HEADWATER PONDING LIMITS
- 8+40 HEC-RAS CROSS SECTION AND ID

Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

40 0 20 40 60 80

SCALES: HORIZ. 1"=40' VERT.

SHEET 4 OF 5

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

NO.	REVISION DESCRIPTION	DIV. ENGINEER	DATE

		DATE
DESIGNED:	CR/EB	12/2018
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CHECKED:	KT	12/2018
PROJ. ENG.:	KT	12/2018

PIMA COUNTY DEPARTMENT OF TRANSPORTATION

ANA OLIVARES, P.E., DIRECTOR

REGISTERED CIVIL ENGINEER 65979 CHELSI RENAE DATE SIGNED 8/17/18 ARIZONA U.S.A. EXPIRES 3/31/2021

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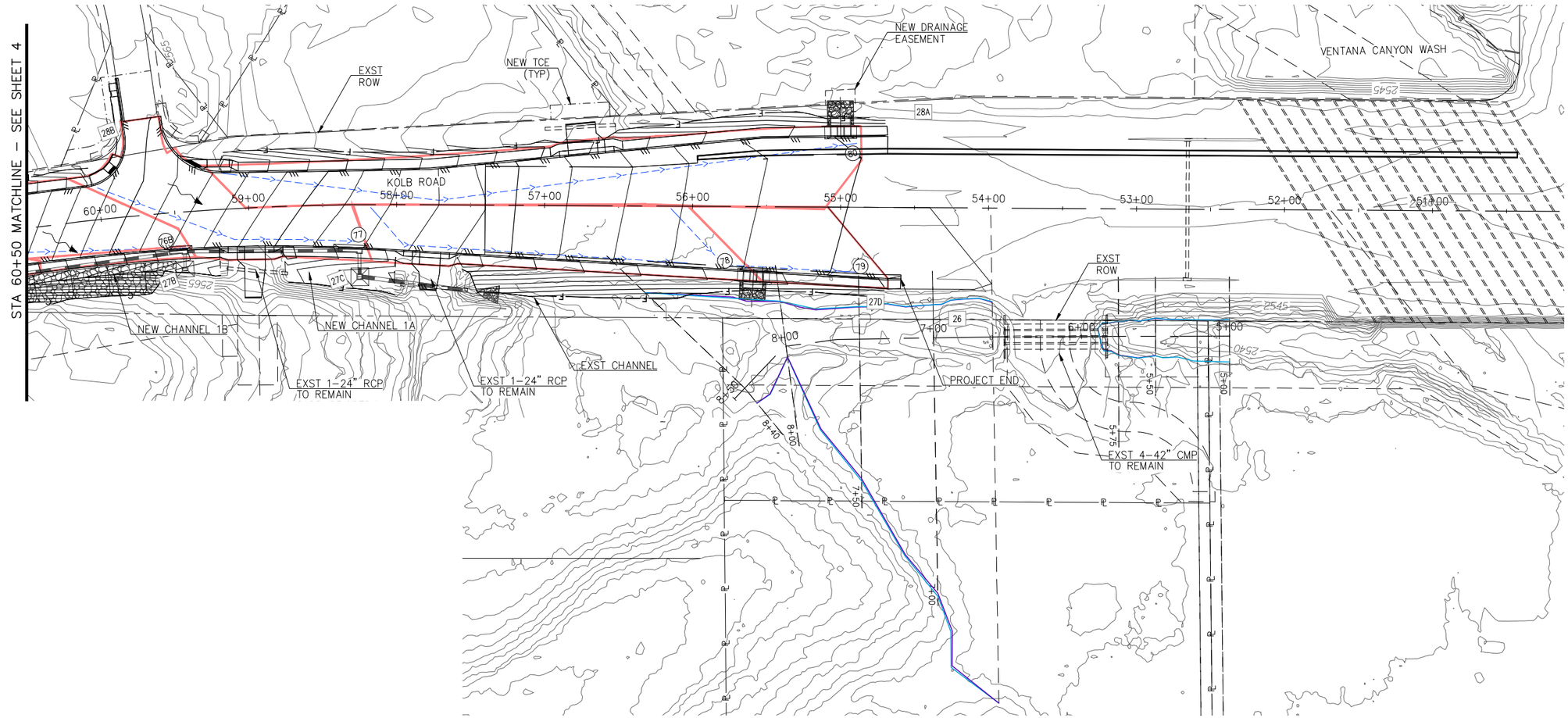
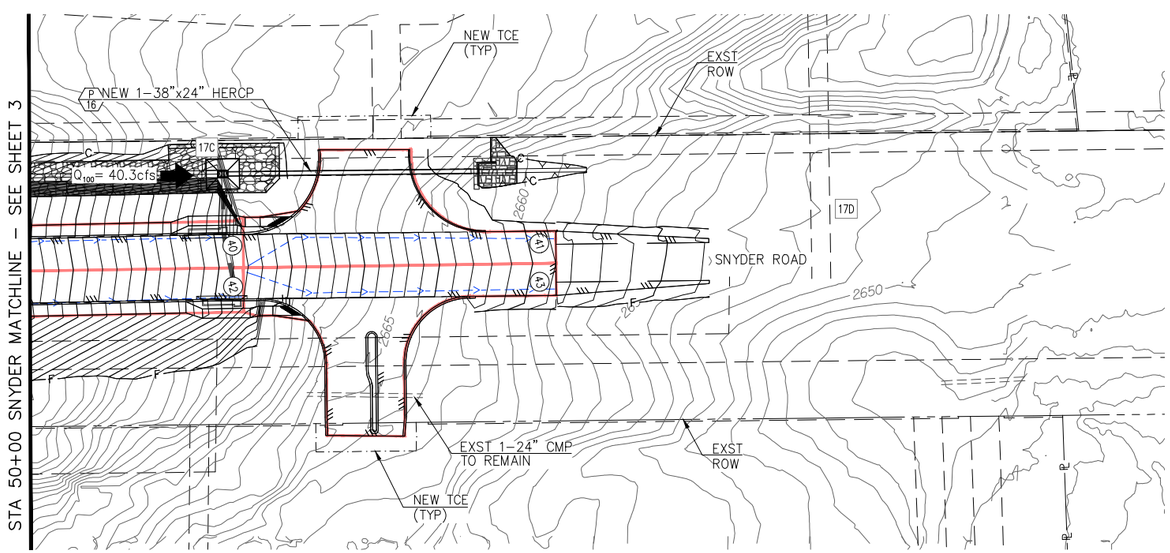
FIG 5 – PAVEMENT DRAINAGE FOR KOLB ROAD

SABINO CANYON TO SUNRISE DR

T:\PPM160201\WATRES\GLOBAL\EXHIB\Figure 5 – Pavement Drainage.dwg FIG-4 Last Saved: December 19, 2018 By: ChelsiRenne Plotted: Wednesday, December 19, 2018 11:45:10 AM





LEGEND

WATERSHED BOUNDARY	SURFACE FLOW ARROW
OFFSITE WATERSHED BOUNDARY	EXISTING CONDITIONS FLOODPLAIN
PAVEMENT DRAINAGE CONCENTRATION POINT	PROPOSED CONDITIONS FLOODPLAIN
OFFSITE WATERSHED ID	EXISTING HEADWATER PONDING LIMITS
FLOW PATH	PROPOSED HEADWATER PONDING LIMITS
	HEC-RAS CROSS SECTION AND ID

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40 0 20 40 60 80

SCALES: HORIZ. 1"=40' VERT.

SHEET 5 OF 5

PIMA COUNTY DEPARTMENT OF TRANSPORTATION ANA OLIVARES, P.E., DIRECTOR

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

FIG 5 – PAVEMENT DRAINAGE FOR KOLB ROAD SABINO CANYON TO SUNRISE DR

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Registered Professional Engineer (Civil) CERTIFICATE NO. 65879 CHELSI RENAE WEBB DATE SIGNED 5/31/18 ARIZONA U.S.A. EXPIRES 6/30/2021

NO.	REVISION DESCRIPTION	DIV. ENGINEER	DATE

		DATE
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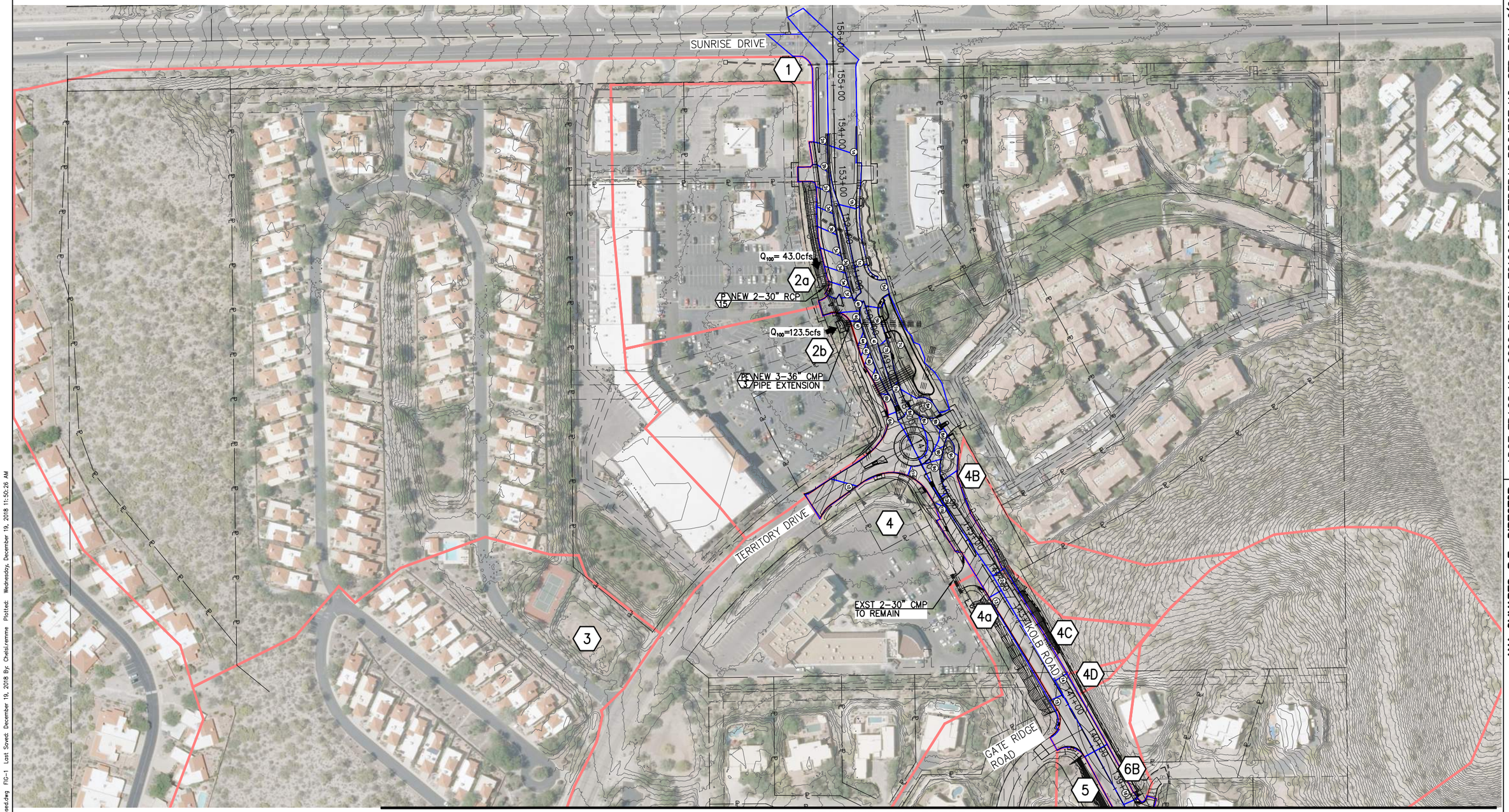
CHECKED:	KT	12/2018
PROJ. ENG.:	KT	12/2018

T:\7PM160201\WATRES\GLOBAL\EXHIB\Figure 5 - Pavement Drainage.dwg FIG-5 Last Saved: December 19, 2018 By: Chelsi remme Plotted: Wednesday, December 19, 2018 11:49:46 AM

OFFSITE WATERSHED MAPS



MATCHLINE SEE SHEET 2

LEGEND

- ONSITE PAVEMENT DRAINAGE WATERSHED
- OFFSITE WATERSHED
- ③ PAVEMENT DRAINAGE CONCENTRATION POINT
- 4D OFFSITE WATERSHED ID

100 0 50 100 150 200

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SCALES:	HORIZ. 1"=100'
	VERT.

SHEET 1 OF 6

PIMA COUNTY DEPARTMENT OF TRANSPORTATION — ANA OLIVARES, P.E., DIRECTOR

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

NO.	REVISION DESCRIPTION	DIV. ENGINEER	DATE

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PROJ. ENG.:	KT	12/2018

REGISTERED CERTIFICATE OF AUTHORITY NO. 0557 STATE OF ARIZONA CHRIS R. EMME REGISTERED PROFESSIONAL ENGINEER ARIZONA U.S.A. EXPIRES 3/31/2021

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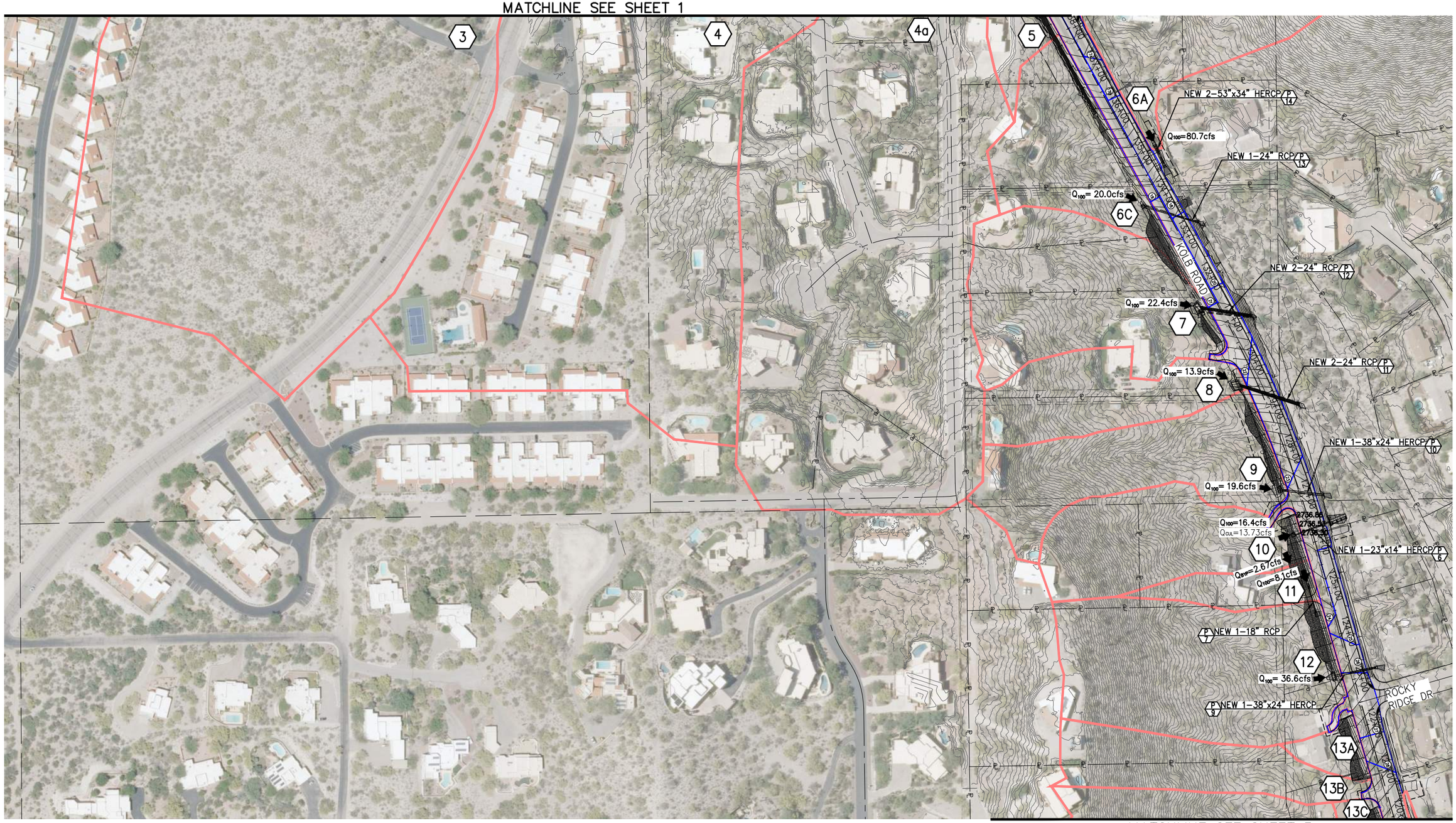
FIG 6 – PROPOSED OFFSITE WATERSHEDS
FOR
KOLB ROAD

T:\7PM160201\WATRES\GLOBAL\EXHIB\Figure 6 – Offsite Proposed.dwg FIG-1 Last Saved: December 19, 2018 By: Chelsi.remme Plotted: Wednesday, December 19, 2018 11:50:26 AM

MATCHLINE SEE SHEET 1



MATCHLINE SEE SHEET 3

LEGEND

- ONSITE PAVEMENT DRAINAGE WATERSHED
- OFFSITE WATERSHED
- ③ PAVEMENT DRAINAGE CONCENTRATION POINT
- 4D OFFSITE WATERSHED ID

N

100 0 50 100 150 200

SCALES: HORIZ. 1"=100' VERT.

SHEET 2 OF 6

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PIMA COUNTY DEPARTMENT OF TRANSPORTATION ANA OLIVARES, P.E., DIRECTOR

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

NO.	REVISION DESCRIPTION	DIV. ENGINEER	DATE

		DATE
DESIGNED:	CR/EB	12/2018
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PROJ. ENG.:	KT	12/2018

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 23879 CHELS RENAE DATE SIGNED 12/19/2018 ARIZONA, U.S.A. EXPIRES 6/30/2021

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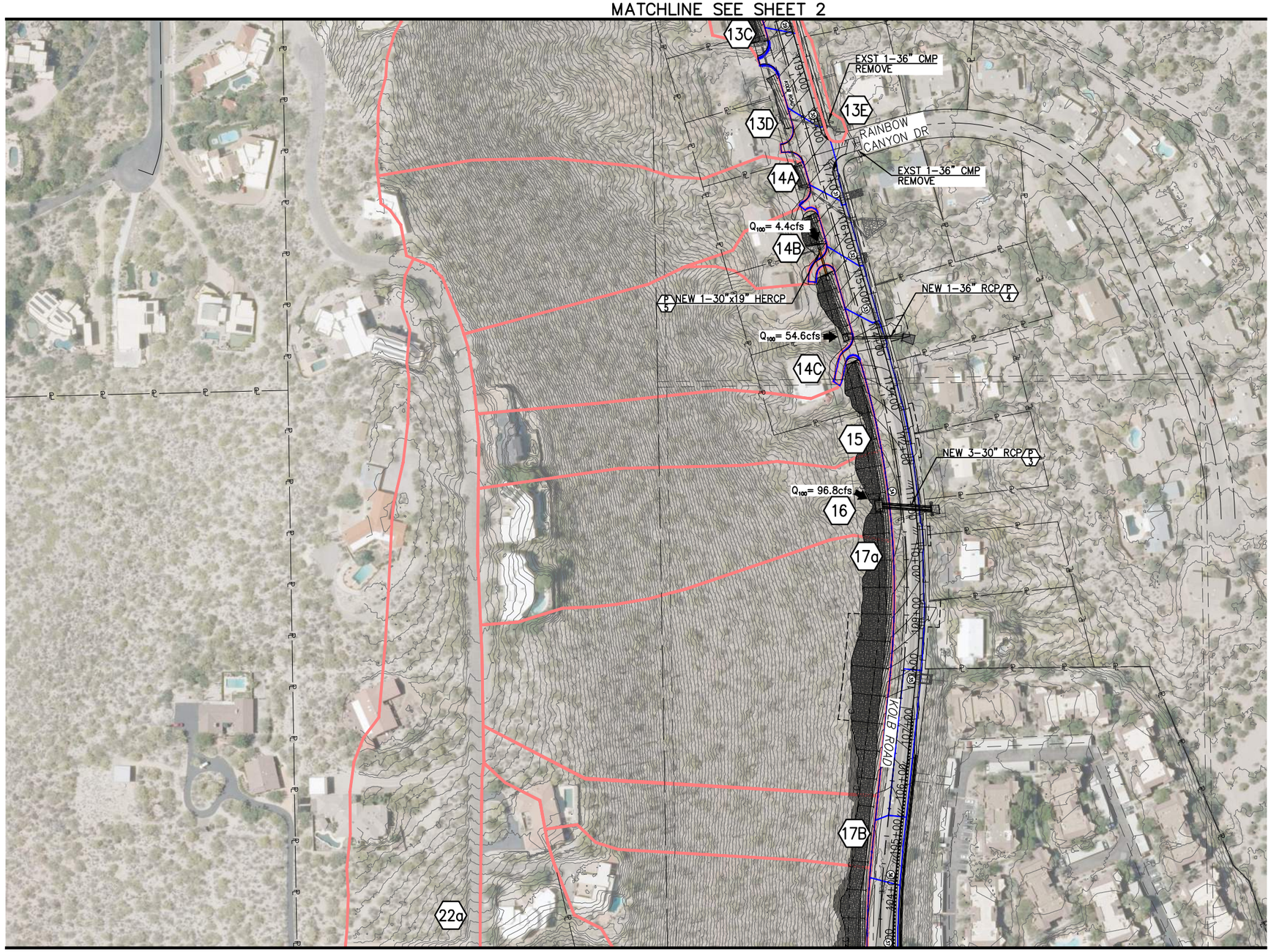
FIG 6 – PROPOSED OFFSITE WATERSHEDS FOR KOLB ROAD

T:\17PM16\0201\WATRES\GLOBAL\EXHIB\Figure 6 – Offsite Proposed.dwg FIG-2 Last Saved: December 19, 2018 By: Chels.remme Plotted: Wednesday, December 19, 2018 11:50:56 AM

MATCHLINE SEE SHEET 2



MATCHLINE SEE SHEET 4

LEGEND

- ONSITE PAVEMENT DRAINAGE WATERSHED
- OFFSITE WATERSHED
- ③ PAVEMENT DRAINAGE CONCENTRATION POINT
- 4D OFFSITE WATERSHED ID

100 0 50 100 150 200

Call at least two full working days before you begin excavation.
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SCALES: HORIZ. 1"=100' VERT.

SHEET 3 OF 6

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

NO.	REVISION DESCRIPTION	DIV. ENGINEER	DATE

		DATE
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CHECKED:	KT	12/2018
PROJ. ENG.:	KT	12/2018

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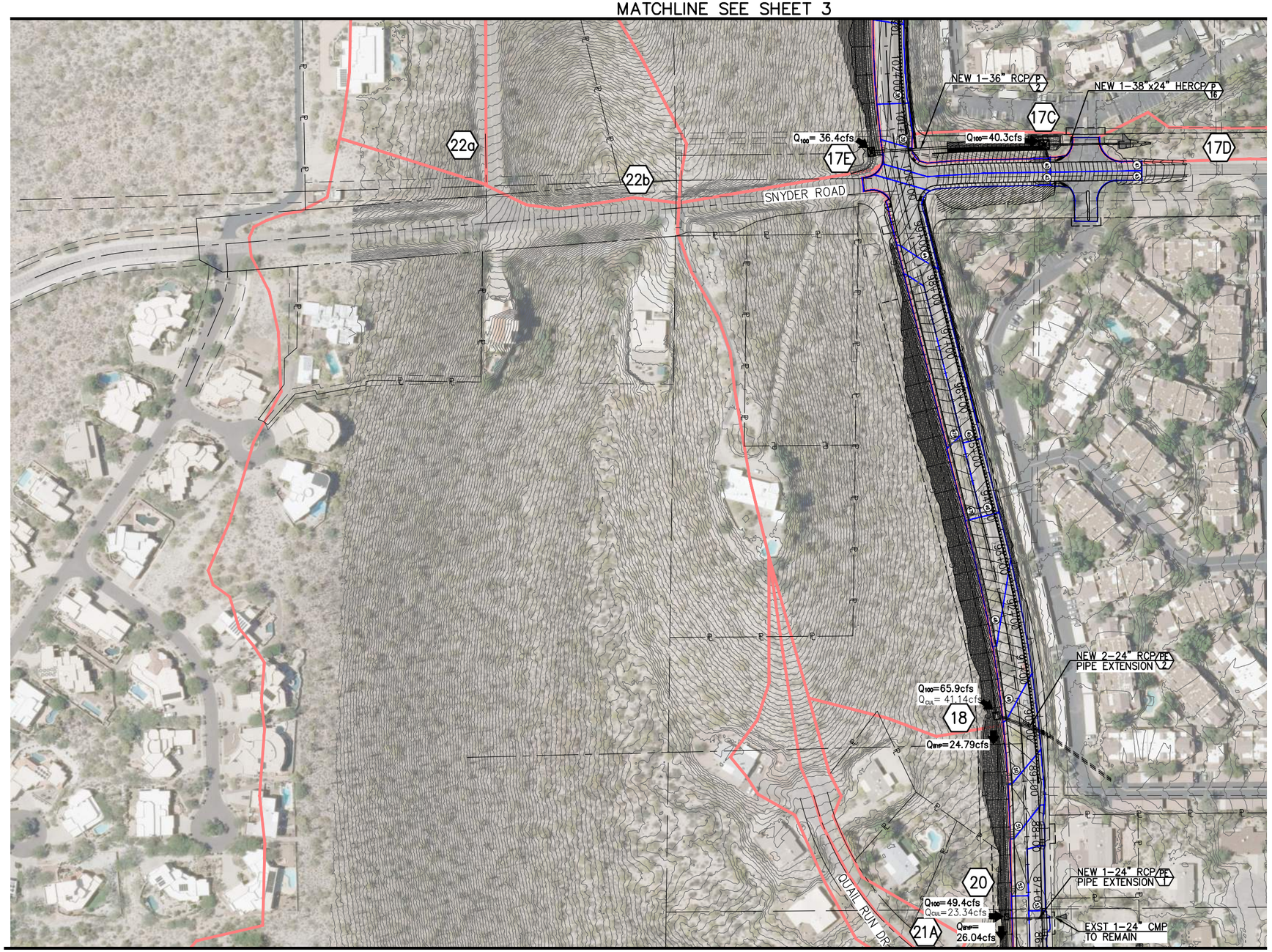
FIG 6 – PROPOSED OFFSITE WATERSHEDS
FOR
KOLB ROAD

T:\7PM160201\MATRES\GLOBAL\EXHIB\Figure 6 – Offsite Proposed.dwg FIG-3 Last Saved: December 19, 2018 By: Chelsi.remme Plotted: Wednesday, December 19, 2018 11:51:26 AM

MATCHLINE SEE SHEET 3



MATCHLINE SEE SHEET 5

LEGEND

- ONSITE PAVEMENT DRAINAGE WATERSHED
- OFFSITE WATERSHED
- ⑤ PAVEMENT DRAINAGE CONCENTRATION POINT
- 4D OFFSITE WATERSHED ID

100 0 50 100 150 200

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In Maricopa County: (602) 263-1100

SCALES: HORIZ. 1"=100' VERT.

SHEET 4 OF 6

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

NO.	REVISION DESCRIPTION	DIV. ENGINEER	DATE

		DATE
DESIGNED:	CR/EB	12/2018
DRAWN:	CR	12/2018
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PROJ. ENG.:	KT	12/2018

PIMA COUNTY DEPARTMENT OF TRANSPORTATION ANA OLIVARES, P.E., DIRECTOR

FIG 6 – PROPOSED OFFSITE WATERSHEDS FOR KOLB ROAD

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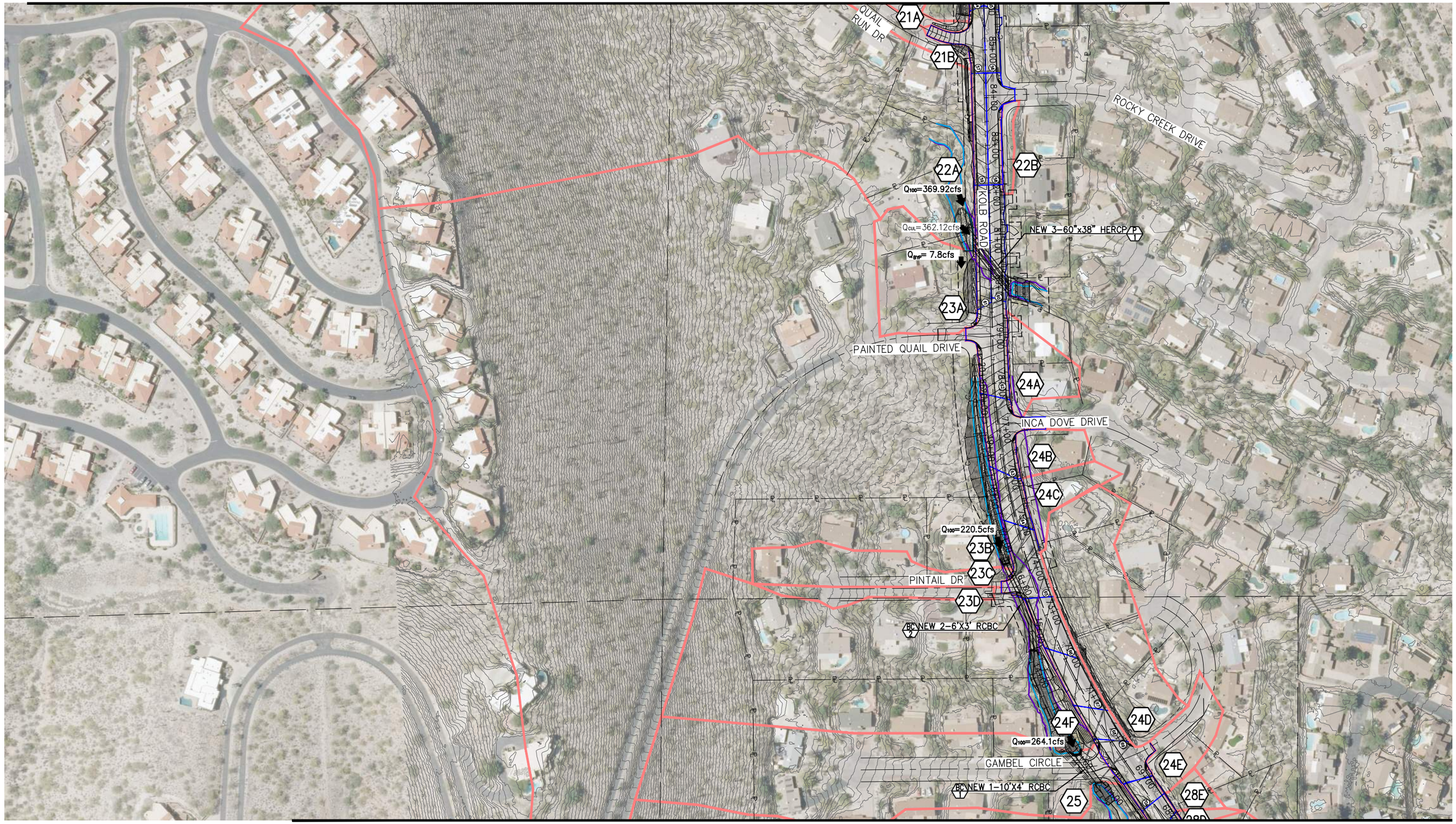
REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 05/079 CHELS REMME DATE SIGNED 12/19/18 ARIZONA U.S.A. EXPIRES 3/31/2021

T:\7PM160201\WATRES\GLOBAL\EXHIB\Figure 6 - Offsite Proposed.dwg FIG-4 Last Saved: December 19, 2018 By: Chelsi remme Plotted: Wednesday, December 19, 2018 11:51:52 AM

MATCHLINE SEE SHEET 4



MATCHLINE SEE SHEET 6

LEGEND

- ONSITE PAVEMENT DRAINAGE WATERSHED
- OFFSITE WATERSHED
- ③ PAVEMENT DRAINAGE CONCENTRATION POINT
- 4D OFFSITE WATERSHED ID

100 0 50 100 150 200

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SCALES: HORIZ. 1"=100' VERT.

SHEET 5 OF 6

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

NO.	REVISION DESCRIPTION	DIV. ENGINEER	DATE

		DATE
DESIGNED:	CR/EB	12/2018
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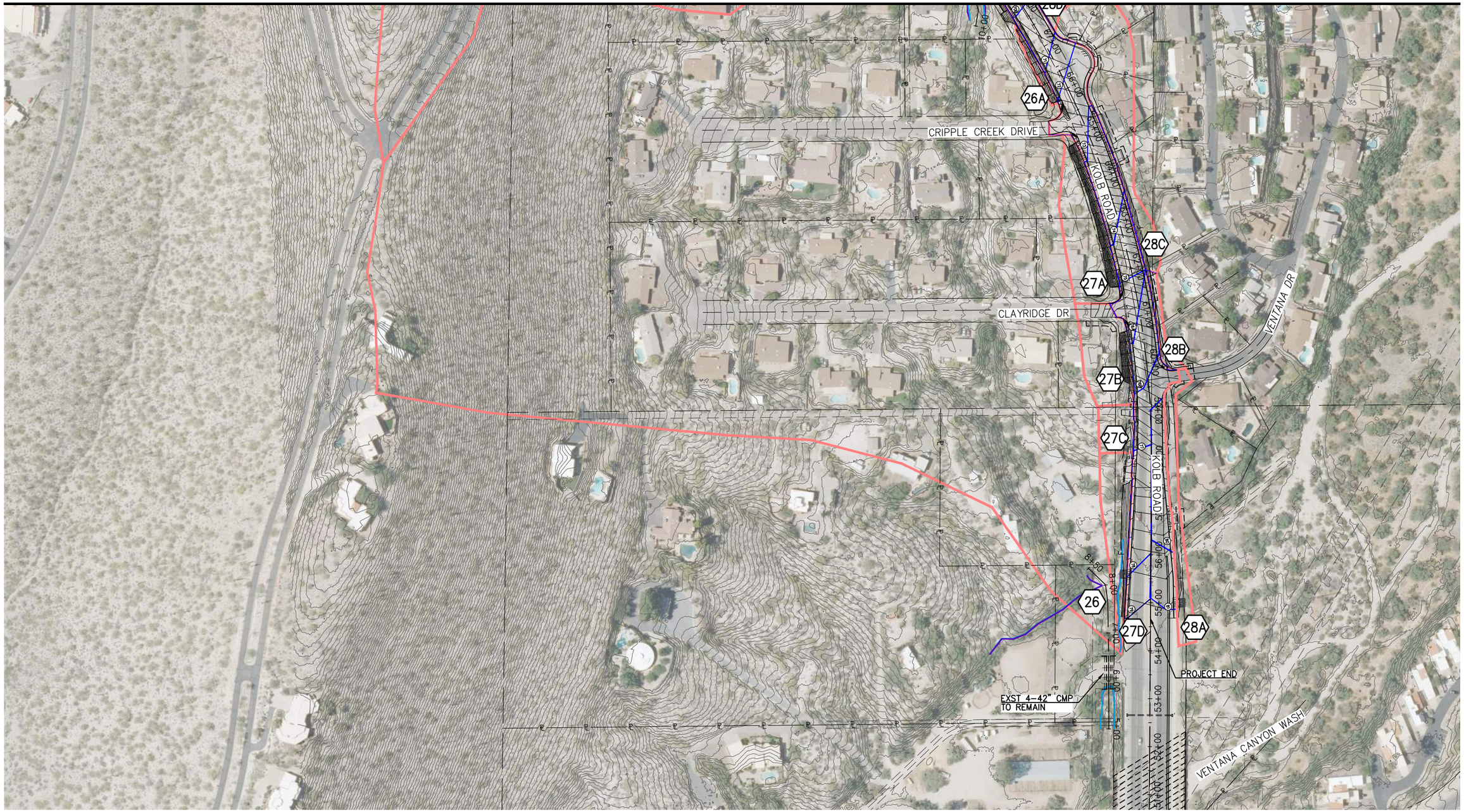
FIG 6 – PROPOSED OFFSITE WATERSHEDS FOR KOLB ROAD

T:\TPM160201\WATRES\GLOBAL\EXHIB\Figure 6 – Offsite Proposed.dwg FIG-5 Last Saved: December 19, 2018 By: Chelsi remme Plotted: Wednesday, December 19, 2018 11:52:22 AM

MATCHLINE SEE SHEET 4



LEGEND

ONSITE PAVEMENT DRAINAGE WATERSHED

OFFSITE WATERSHED

③ PAVEMENT DRAINAGE CONCENTRATION POINT

4D OFFSITE WATERSHED ID

100 0 50 100 150 200

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SCALES: HORIZ. 1"=100' VERT.

SHEET 6 OF 6

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

NO.	REVISION DESCRIPTION	DIV. ENGINEER	DATE

		DATE
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DRAWN:	CR	12/2018
CHECKED:	KT	12/2018
PROJ. ENG.:	KT	12/2018

PIMA COUNTY DEPARTMENT OF TRANSPORTATION ANA OLIVARES, P.E., DIRECTOR

FIG 6 – PROPOSED OFFSITE WATERSHEDS FOR KOLB ROAD

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T:\PM160201\WATRES\GLOBAL\EXHIB\Figure 6 - Offsite Proposed.dwg FIG-6 Last Saved: December 19, 2018 By: Chelsi.remme Plotted: Wednesday, December 19, 2018 11:52:51 AM

APPENDIX 6

PROPOSED CONDITIONS OFFSITE HYDROLOGIC CALCULATIONS

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	06/28/2018
Concentration Point:	1a	Job #	7PIM160201
Watershed Area:	0.41 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	6	358	0.0168	0.032

Length of Watercourse (Lc):	358	feet	Mean Slope:	0.0168
Length to Cen. of Gravity (Lca):	179	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 10-years NOAA Data Obtained: 2018-08-28 08:25:25 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3005 Longitude: -110.8405

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.59	0.9	1.12	1.5	1.86	2.07	2.15	2.38	2.66	2.85

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88.2	88.88	0.487
D	-	-	-	-
Imp.	90	99	99	0.938

Weighted Runoff Coef. (Cw):	0.89	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	7.08	in/hr
Runoff Supply Rate (q) @ Tc:	6.32	in/hr
PEAK DISCHARGE:	2.6	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	3g_Area Inlet	Job #	7PIM160201
Watershed Area:	0.1 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	1.2	171	0.007	0.032

Length of Watercourse (Lc):	171	feet	Mean Slope:	0.007
Length to Cen. of Gravity (Lca):	85.5	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-05-06 06:07:39 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2943 Longitude: -110.8396

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.9	1.37	1.7	2.29	2.83	3.16	3.31	3.62	3.96	4.29

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.8	0.701
D	-	-	-	-
Imp.	50	99	99	0.958

Weighted Runoff Coef. (Cw):	0.83	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.8	in/hr
Runoff Supply Rate (q) @ Tc:	8.96	in/hr
PEAK DISCHARGE:	0.9	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	JS
Project Name:	Kolb Road	Date:	04/23/2017
Concentration Point:	4B	Job #	7PIM160201
Watershed Area:	1.3 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	88	722	0.1219	0.035

Length of Watercourse (Lc):	722	feet	Mean Slope:	0.1219
Length to Cen. of Gravity (Lca):	361	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-08-23 05:35:57 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3058 Longitude: -110.8424

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.92	1.39	1.73	2.32	2.88	3.21	3.36	3.7	4.07	4.42

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	82.6	86.85	0.564
C	41	88.2	91.22	0.687
D	18	91.2	93.49	0.759
Imp.	5	99	99	0.959

Weighted Runoff Coef. (Cw):	0.66	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	11.04	in/hr
Runoff Supply Rate (q) @ Tc:	7.34	in/hr
PEAK DISCHARGE:	9.6	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	JS
Project Name:	Kolb Road	Date:	04/23/2017
Concentration Point:	4C	Job #	7PIM160201
Watershed Area:	0.49 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	56.5	368	0.1535	0.035

Length of Watercourse (Lc):	368	feet	Mean Slope:	0.1535
Length to Cen. of Gravity (Lca):	184	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-08-23 05:35:57 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3052 Longitude: -110.8426

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.92	1.39	1.73	2.32	2.88	3.21	3.36	3.7	4.07	4.42

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	82.6	86.85	0.564
C	41	88.2	91.22	0.687
D	18	91.2	93.49	0.759
Imp.	10	99	99	0.959

Weighted Runoff Coef. (Cw):	0.68	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	11.04	in/hr
Runoff Supply Rate (q) @ Tc:	7.51	in/hr
PEAK DISCHARGE:	3.7	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	JS
Project Name:	Kolb Road	Date:	04/23/2017
Concentration Point:	4D	Job #	7PIM160201
Watershed Area:	0.08 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	33	115	0.287	0.035

Length of Watercourse (Lc):	115	feet	Mean Slope:	0.287
Length to Cen. of Gravity (Lca):	57.5	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-08-23 05:35:57 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.305 Longitude: -110.8423

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.92	1.39	1.73	2.32	2.88	3.21	3.36	3.7	4.07	4.42

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	82.6	86.85	0.564
C	41	88.2	91.22	0.687
D	18	91.2	93.49	0.759
Imp.	5	99	99	0.959

Weighted Runoff Coef. (Cw):	0.66	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	11.04	in/hr
Runoff Supply Rate (q) @ Tc:	7.34	in/hr
PEAK DISCHARGE:	0.6	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	4i_Area Inlet	Job #	7PIM160201
Watershed Area:	0.09 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	2.9	128	0.0227	0.032

Length of Watercourse (Lc):	128	feet	Mean Slope:	0.0227
Length to Cen. of Gravity (Lca):	64	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-05-06 06:07:39 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2943 Longitude: -110.8396

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.9	1.37	1.7	2.29	2.83	3.16	3.31	3.62	3.96	4.29

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.8	0.701
D	-	-	-	-
Imp.	50	99	99	0.958

Weighted Runoff Coef. (Cw):	0.83	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.8	in/hr
Runoff Supply Rate (q) @ Tc:	8.96	in/hr
PEAK DISCHARGE:	0.8	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	04/10/2018
Concentration Point:	4T	Job #	7PIM160201
Watershed Area:	14.41 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	78	1835	0.0425	0.032

Length of Watercourse (Lc):	1835	feet	Mean Slope:	0.0425
Length to Cen. of Gravity (Lca):	917.5	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 10-years NOAA Data Obtained: 2018-04-10 01:30:23 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.301 Longitude: -110.8402

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.59	0.9	1.12	1.5	1.86	2.07	2.15	2.38	2.66	2.85

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89	89.61	0.511
D	-	-	-	-
Imp.	60	99	99	0.938

Weighted Runoff Coef. (Cw):	0.77	
Time of Concentration:	5.1	min
Rainfall Intensity (i) @ Tc:	7	in/hr
Runoff Supply Rate (q) @ Tc:	5.37	in/hr
PEAK DISCHARGE:	78	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	04/10/2018
Concentration Point:	4T	Job #	7PIM160201
Watershed Area:	14.41 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	78	1835	0.0425	0.032

Length of Watercourse (Lc):	1835	feet	Mean Slope:	0.0425
Length to Cen. of Gravity (Lca):	917.5	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-04-10 01:30:23 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.301 Longitude: -110.8402

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89	91.83	0.703
D	-	-	-	-
Imp.	60	99	99	0.959

Weighted Runoff Coef. (Cw):	0.86	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	9.35	in/hr
PEAK DISCHARGE:	135.8	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	4U	Job #	7PIM160201
Watershed Area:	21.5 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	72	1533	0.047	0.032

Length of Watercourse (Lc):	1533	feet	Mean Slope:	0.047
Length to Cen. of Gravity (Lca):	766.5	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 10-years NOAA Data Obtained: 2018-04-10 01:28:17 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.301 Longitude: -110.8402

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.59	0.9	1.12	1.5	1.86	2.07	2.15	2.38	2.66	2.85

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89	89.61	0.511
D	-	-	-	-
Imp.	60	99	99	0.938

Weighted Runoff Coef. (Cw):	0.77	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	7.08	in/hr
Runoff Supply Rate (q) @ Tc:	5.43	in/hr
PEAK DISCHARGE:	117.7	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	4U	Job #	7PIM160201
Watershed Area:	21.5 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	72	1533	0.047	0.032

Length of Watercourse (Lc):	1533	feet	Mean Slope:	0.047
Length to Cen. of Gravity (Lca):	766.5	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-04-10 01:28:17 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.301 Longitude: -110.8402

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89	91.83	0.703
D	-	-	-	-
Imp.	60	99	99	0.959

Weighted Runoff Coef. (Cw):	0.86	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	9.35	in/hr
PEAK DISCHARGE:	202.6	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	07/27/2017
Concentration Point:	6A	Job #	7PIM160201
Watershed Area:	10.05 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	200	1282	0.156	0.035

Length of Watercourse (Lc):	1282	feet	Mean Slope:	0.156
Length to Cen. of Gravity (Lca):	641	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-08-13 03:49:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.301 Longitude: -110.8402

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	82.6	86.79	0.559
C	41	88.2	91.18	0.683
D	18	91.2	93.45	0.755
Imp.	15	99	99	0.959

Weighted Runoff Coef. (Cw):	0.69	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	7.56	in/hr
PEAK DISCHARGE:	76.6	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	07/27/2017
Concentration Point:	6B	Job #	7PIM160201
Watershed Area:	0.43 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	200	1282	0.156	0.035

Length of Watercourse (Lc):	1282	feet	Mean Slope:	0.156
Length to Cen. of Gravity (Lca):	641	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-08-13 03:49:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3037 Longitude: -110.8418

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	82.6	86.79	0.559
C	41	88.2	91.18	0.683
D	18	91.2	93.45	0.755
Imp.	30	99	99	0.959

Weighted Runoff Coef. (Cw):	0.74	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	8.07	in/hr
PEAK DISCHARGE:	3.5	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	07/27/2017
Concentration Point:	6C	Job #	7PIM160201
Watershed Area:	1.79 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	36	404	0.0891	0.035

Length of Watercourse (Lc):	404	feet	Mean Slope:	0.0891
Length to Cen. of Gravity (Lca):	202	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-08-13 03:49:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3031 Longitude: -110.842

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	82.6	86.79	0.559
C	41	88.2	91.18	0.683
D	18	91.2	93.45	0.755
Imp.	10	99	99	0.959

Weighted Runoff Coef. (Cw):	0.68	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	7.39	in/hr
PEAK DISCHARGE:	13.3	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	07/27/2017
Concentration Point:	7	Job #	7PIM160201
Watershed Area:	3.1 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	78	495	0.1576	0.035

Length of Watercourse (Lc):	495	feet	Mean Slope:	0.1576
Length to Cen. of Gravity (Lca):	247.5	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-08-13 03:49:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3026 Longitude: -110.8418

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	82.6	86.79	0.559
C	41	88.2	91.18	0.683
D	18	91.2	93.45	0.755
Imp.	10	99	99	0.959

Weighted Runoff Coef. (Cw):	0.68	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	7.39	in/hr
PEAK DISCHARGE:	23.1	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	7c_Area Inlet	Job #	7PIM160201
Watershed Area:	0.3 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	3.2	185	0.0173	0.032

Length of Watercourse (Lc):	185	feet	Mean Slope:	0.0173
Length to Cen. of Gravity (Lca):	92.5	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-05-06 06:07:39 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2943 Longitude: -110.8396

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.9	1.37	1.7	2.29	2.83	3.16	3.31	3.62	3.96	4.29

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.8	0.701
D	-	-	-	-
Imp.	50	99	99	0.958

Weighted Runoff Coef. (Cw):	0.83	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.8	in/hr
Runoff Supply Rate (q) @ Tc:	8.96	in/hr
PEAK DISCHARGE:	2.7	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	JS
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	8A	Job #	7PIM160201
Watershed Area:	1.68 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	99	556	0.1781	0.035

Length of Watercourse (Lc):	556	feet	Mean Slope:	0.1781
Length to Cen. of Gravity (Lca):	279	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	15

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-08-24 11:44:50 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.302 Longitude: -110.8414

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	42	83	87.44	0.576
C	45	88.7	91.18	0.683
D	13	91.7	93.45	0.755
Imp.	25	99	99	0.959

Weighted Runoff Coef. (Cw):	0.73	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	7.92	in/hr
PEAK DISCHARGE:	13.4	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	8e_Area Inlet	Job #	7PIM160201
Watershed Area:	0.05 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	0.6	25	0.024	0.032

Length of Watercourse (Lc):	25	feet	Mean Slope:	0.024
Length to Cen. of Gravity (Lca):	12.5	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-05-06 06:07:39 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2943 Longitude: -110.8396

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.9	1.37	1.7	2.29	2.83	3.16	3.31	3.62	3.96	4.29

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.8	0.701
D	-	-	-	-
Imp.	50	99	99	0.958

Weighted Runoff Coef. (Cw):	0.83	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.8	in/hr
Runoff Supply Rate (q) @ Tc:	8.96	in/hr
PEAK DISCHARGE:	0.5	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	JS
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	9A	Job #	7PIM160201
Watershed Area:	2.51 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	120	725	0.1655	0.035

Length of Watercourse (Lc):	725	feet	Mean Slope:	0.1655
Length to Cen. of Gravity (Lca):	362.5	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-08-24 11:44:50 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.302 Longitude: -110.8414

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	42	82.6	86.79	0.559
C	45	88.2	91.18	0.683
D	13	91.2	93.45	0.755
Imp.	5	99	99	0.959

Weighted Runoff Coef. (Cw):	0.66	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	7.16	in/hr
PEAK DISCHARGE:	18.1	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	9c_Area Inlet	Job #	7PIM160201
Watershed Area:	0.05 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	1.4	47	0.0298	0.032

Length of Watercourse (Lc):	47	feet	Mean Slope:	0.0298
Length to Cen. of Gravity (Lca):	23.5	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-05-06 06:07:39 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2943 Longitude: -110.8396

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.9	1.37	1.7	2.29	2.83	3.16	3.31	3.62	3.96	4.29

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.8	0.701
D	-	-	-	-
Imp.	50	99	99	0.958

Weighted Runoff Coef. (Cw):	0.83	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.8	in/hr
Runoff Supply Rate (q) @ Tc:	8.96	in/hr
PEAK DISCHARGE:	0.5	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	10	Job #	7PIM160201
Watershed Area:	2.19 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	116	577	0.201	0.035

Length of Watercourse (Lc):	577	feet	Mean Slope:	0.201
Length to Cen. of Gravity (Lca):	288	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	15

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-08-27 08:47:45 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3016 Longitude: -110.8412

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	83	87.44	0.576
C	41	88.7	91.18	0.683
D	18	91.7	93.45	0.755
Imp.	10	99	99	0.959

Weighted Runoff Coef. (Cw):	0.68	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	7.46	in/hr
PEAK DISCHARGE:	16.5	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	11	Job #	7PIM160201
Watershed Area:	0.52 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	78	405	0.1926	0.035

Length of Watercourse (Lc):	405	feet	Mean Slope:	0.1926
Length to Cen. of Gravity (Lca):	202	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA data user generated

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3005 Longitude: -110.841

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	83.3	87.22	0.559
C	41	89.1	91.66	0.689
D	18	92.1	93.97	0.765
Imp.	35	99	99	0.957

Weighted Runoff Coef. (Cw):	0.76	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	7.9	in/hr
PEAK DISCHARGE:	4.1	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	12	Job #	7PIM160201
Watershed Area:	3.71 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	142	638	0.2226	0.035

Length of Watercourse (Lc):	638	feet	Mean Slope:	0.2226
Length to Cen. of Gravity (Lca):	319	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA data user generated

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3 Longitude: -110.8407

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	83.3	87.22	0.559
C	41	89.1	91.66	0.689
D	18	92.1	93.97	0.765
Imp.	10	99	99	0.957

Weighted Runoff Coef. (Cw):	0.68	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	7.1	in/hr
PEAK DISCHARGE:	26.5	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	13A	Job #	7PIM160201
Watershed Area:	0.29 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	17	177	0.096	0.035

Length of Watercourse (Lc):	177	feet	Mean Slope:	0.096
Length to Cen. of Gravity (Lca):	92.5	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30

RETURN PERIOD: 100-years NOAA Data Obtained: 2017-12-14 04:42:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2977 Longitude: -110.8403

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	81.9	85.98	0.538
C	41	87.3	90.37	0.659
D	18	90.3	92.64	0.729
Imp.	30	99	99	0.959

Weighted Runoff Coef. (Cw):	0.72	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	7.89	in/hr
PEAK DISCHARGE:	2.3	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	13B	Job #	7PIM160201
Watershed Area:	1.52 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	168	671	0.2504	0.035

Length of Watercourse (Lc):	671	feet	Mean Slope:	0.2504
Length to Cen. of Gravity (Lca):	335	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30

RETURN PERIOD: 100-years NOAA Data Obtained: 2017-12-14 04:42:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2997 Longitude: -110.8408

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	81.9	85.98	0.538
C	41	87.3	90.37	0.659
D	18	90.3	92.64	0.729
Imp.	10	99	99	0.959

Weighted Runoff Coef. (Cw):	0.66	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	7.16	in/hr
PEAK DISCHARGE:	11	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	13C	Job #	7PIM160201
Watershed Area:	0.17 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	13	116	0.1121	0.035

Length of Watercourse (Lc):	116	feet	Mean Slope:	0.1121
Length to Cen. of Gravity (Lca):	58	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30

RETURN PERIOD: 100-years NOAA Data Obtained: 2017-12-14 04:42:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2989 Longitude: -110.8407

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	81.9	85.98	0.538
C	41	87.3	90.37	0.659
D	18	90.3	92.64	0.729
Imp.	20	99	99	0.959

Weighted Runoff Coef. (Cw):	0.69	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	7.52	in/hr
PEAK DISCHARGE:	1.3	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	13D	Job #	7PIM160201
Watershed Area:	4.82 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	182	885	0.2056	0.035

Length of Watercourse (Lc):	885	feet	Mean Slope:	0.2056
Length to Cen. of Gravity (Lca):	442	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30

RETURN PERIOD: 100-years NOAA Data Obtained: 2017-12-14 04:42:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2989 Longitude: -110.8407

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	81.9	85.98	0.538
C	41	87.3	90.37	0.659
D	18	90.3	92.64	0.729
Imp.	5	99	99	0.959

Weighted Runoff Coef. (Cw):	0.64	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	6.97	in/hr
PEAK DISCHARGE:	33.9	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	06/22/2018
Concentration Point:	13E	Job #	7PIM160201
Watershed Area:	0.13 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	8	75	0.1067	0.035

Length of Watercourse (Lc):	75	feet	Mean Slope:	0.1067
Length to Cen. of Gravity (Lca):	37.5	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30

RETURN PERIOD: 100-years NOAA Data Obtained: 2017-12-14 04:42:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2989 Longitude: -110.8407

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	81.9	85.98	0.538
C	41	87.3	90.37	0.659
D	18	90.3	92.64	0.729
Imp.	12	99	99	0.959

Weighted Runoff Coef. (Cw):	0.66	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	7.23	in/hr
PEAK DISCHARGE:	0.9	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	14A	Job #	7PIM160201
Watershed Area:	3.52 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	182	810	0.2247	0.035

Length of Watercourse (Lc):	810	feet	Mean Slope:	0.2247
Length to Cen. of Gravity (Lca):	405	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30

RETURN PERIOD: 100-years NOAA Data Obtained: 2017-12-14 04:42:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2989 Longitude: -110.8407

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	81.9	85.98	0.538
C	41	87.3	90.37	0.659
D	18	90.3	92.64	0.729
Imp.	5	99	99	0.959

Weighted Runoff Coef. (Cw):	0.64	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	6.97	in/hr
PEAK DISCHARGE:	24.7	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	14B	Job #	7PIM160201
Watershed Area:	0.46 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	42	243	0.1728	0.035

Length of Watercourse (Lc):	243	feet	Mean Slope:	0.1728
Length to Cen. of Gravity (Lca):	121	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30

RETURN PERIOD: 100-years NOAA Data Obtained: 2017-12-14 04:42:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2989 Longitude: -110.8407

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	81.9	85.98	0.538
C	41	87.3	90.37	0.659
D	18	90.3	92.64	0.729
Imp.	30	99	99	0.959

Weighted Runoff Coef. (Cw):	0.72	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	7.89	in/hr
PEAK DISCHARGE:	3.7	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	14C	Job #	7PIM160201
Watershed Area:	3.03 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	214	721	0.2968	0.035

Length of Watercourse (Lc):	721	feet	Mean Slope:	0.2968
Length to Cen. of Gravity (Lca):	360	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30

RETURN PERIOD: 100-years NOAA Data Obtained: 2017-12-14 04:42:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2989 Longitude: -110.8407

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	81.9	85.98	0.538
C	41	87.3	90.37	0.659
D	18	90.3	92.64	0.729
Imp.	10	99	99	0.959

Weighted Runoff Coef. (Cw):	0.66	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	7.16	in/hr
PEAK DISCHARGE:	21.9	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	15	Job #	7PIM160201
Watershed Area:	2.12 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	230	750	0.3067	0.035

Length of Watercourse (Lc):	750	feet	Mean Slope:	0.3067
Length to Cen. of Gravity (Lca):	375	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30

RETURN PERIOD: 100-years NOAA Data Obtained: 2017-12-14 04:42:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2989 Longitude: -110.8407

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	81.9	85.98	0.538
C	41	87.3	90.37	0.659
D	18	90.3	92.64	0.729
Imp.	10	99	99	0.959

Weighted Runoff Coef. (Cw):	0.66	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	7.16	in/hr
PEAK DISCHARGE:	15.3	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	16	Job #	7PIM160201
Watershed Area:	3.49 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	226	757	0.2985	0.035

Length of Watercourse (Lc):	757	feet	Mean Slope:	0.2985
Length to Cen. of Gravity (Lca):	378	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30

RETURN PERIOD: 100-years NOAA Data Obtained: 2017-12-14 04:42:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2989 Longitude: -110.8407

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	81.9	85.98	0.538
C	41	87.3	90.37	0.659
D	18	90.3	92.64	0.729
Imp.	10	99	99	0.959

Weighted Runoff Coef. (Cw):	0.66	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	7.16	in/hr
PEAK DISCHARGE:	25.2	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	17A	Job #	7PIM160201
Watershed Area:	5.94 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	225	1064	0.2115	0.035

Length of Watercourse (Lc):	1064	feet	Mean Slope:	0.2115
Length to Cen. of Gravity (Lca):	532	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30

RETURN PERIOD: 100-years NOAA Data Obtained: 2017-12-14 04:42:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2989 Longitude: -110.8407

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	81.9	85.98	0.538
C	41	87.3	90.37	0.659
D	18	90.3	92.64	0.729
Imp.	10	99	99	0.959

Weighted Runoff Coef. (Cw):	0.66	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	7.16	in/hr
PEAK DISCHARGE:	42.9	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	17B	Job #	7PIM160201
Watershed Area:	1.86 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	206	716	0.2877	0.035

Length of Watercourse (Lc):	716	feet	Mean Slope:	0.2877
Length to Cen. of Gravity (Lca):	358	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30

RETURN PERIOD: 100-years NOAA Data Obtained: 2017-12-14 04:42:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2989 Longitude: -110.8407

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	81.9	85.98	0.538
C	41	87.3	90.37	0.659
D	18	90.3	92.64	0.729
Imp.	10	99	99	0.959

Weighted Runoff Coef. (Cw):	0.66	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	7.16	in/hr
PEAK DISCHARGE:	13.4	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	17C	Job #	7PIM160201
Watershed Area:	0.33 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	35	239	0.1464	0.035

Length of Watercourse (Lc):	239	feet	Mean Slope:	0.1464
Length to Cen. of Gravity (Lca):	119	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30

RETURN PERIOD: 100-years NOAA Data Obtained: 2017-12-14 04:42:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2945 Longitude: -110.8391

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	47	81.9	85.98	0.538
C	53	87.3	90.37	0.659
D	-	-	-	-
Imp.	10	99	99	0.959

Weighted Runoff Coef. (Cw):	0.64	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	6.96	in/hr
PEAK DISCHARGE:	2.3	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	17D	Job #	7PIM160201
Watershed Area:	0.44 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	17	274	0.062	0.035

Length of Watercourse (Lc):	274	feet	Mean Slope:	0.062
Length to Cen. of Gravity (Lca):	137	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30

RETURN PERIOD: 100-years NOAA Data Obtained: 2017-12-14 04:42:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2945 Longitude: -110.8391

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	47	81.9	85.98	0.538
C	53	87.3	90.37	0.659
D	-	-	-	-
Imp.	10	99	99	0.959

Weighted Runoff Coef. (Cw):	0.64	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	6.96	in/hr
PEAK DISCHARGE:	3.1	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	17E	Job #	7PIM160201
Watershed Area:	4.77 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	184	894	0.2058	0.035

Length of Watercourse (Lc):	894	feet	Mean Slope:	0.2058
Length to Cen. of Gravity (Lca):	447	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30

RETURN PERIOD: 100-years NOAA Data Obtained: 2017-12-14 04:42:04 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2946 Longitude: -110.8403

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	41	81.9	85.98	0.538
C	41	87.3	90.37	0.659
D	18	90.3	92.64	0.729
Imp.	5	99	99	0.959

Weighted Runoff Coef. (Cw):	0.64	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	6.97	in/hr
PEAK DISCHARGE:	33.5	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	18	Job #	7PIM160201
Watershed Area:	8.03 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	120	1310	0.0916	0.035

Length of Watercourse (Lc):	1310	feet	Mean Slope:	0.0916
Length to Cen. of Gravity (Lca):	655	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 100-years NOAA data user generated

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2906 Longitude: -110.839

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.9	1.37	1.7	2.29	2.83	3.16	3.31	3.62	3.96	4.29

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88	91.15	0.681
D	-	-	-	-
Imp.	5	99	99	0.958

Weighted Runoff Coef. (Cw):	0.69	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.8	in/hr
Runoff Supply Rate (q) @ Tc:	7.5	in/hr
PEAK DISCHARGE:	60.7	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	oz
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	20	Job #	7PIM160201
Watershed Area:	2.56 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	83	667	0.1244	0.035

Length of Watercourse (Lc):	667	feet	Mean Slope:	0.1244
Length to Cen. of Gravity (Lca):	333.5	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 1000-years NOAA data user generated

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	1.25	1.91	2.37	3.18	3.94	4.48	4.82	5.25	5.65	6.17

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89	92.98	0.802
D	-	-	-	-
Imp.	35	99	99	0.97

Weighted Runoff Coef. (Cw):	0.86	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	15	in/hr
Runoff Supply Rate (q) @ Tc:	12.91	in/hr
PEAK DISCHARGE:	33.3	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	21A	Job #	7PIM160201
Watershed Area:	0.69 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	128	960	0.1333	0.032

Length of Watercourse (Lc):	960	feet	Mean Slope:	0.1333
Length to Cen. of Gravity (Lca):	480	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-07-05 11:32:14 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.83	0.703
D	-	-	-	-
Imp.	50	99	99	0.959

Weighted Runoff Coef. (Cw):	0.83	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	9.07	in/hr
PEAK DISCHARGE:	6.3	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	21B	Job #	7PIM160201
Watershed Area:	1.06 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	125	987	0.1266	0.032

Length of Watercourse (Lc):	987	feet	Mean Slope:	0.1266
Length to Cen. of Gravity (Lca):	493.5	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-07-05 11:32:14 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.83	0.703
D	-	-	-	-
Imp.	50	99	99	0.959

Weighted Runoff Coef. (Cw):	0.83	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	9.07	in/hr
PEAK DISCHARGE:	9.7	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	04/18/2018
Concentration Point:	22A	Job #	7PIM160201
Watershed Area:	39.79 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	266	2808	0.0947	0.035

Length of Watercourse (Lc):	2808	feet	Mean Slope:	0.0947
Length to Cen. of Gravity (Lca):	1404	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-08-19 01:07:01 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88	91.18	0.683
D	-	-	-	-
Imp.	20	99	99	0.959

Weighted Runoff Coef. (Cw):	0.74	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	8.06	in/hr
PEAK DISCHARGE:	323.2	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	04/18/2018
Concentration Point:	22B	Job #	7PIM160201
Watershed Area:	0.11 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	9	190	0.0474	0.035

Length of Watercourse (Lc):	190	feet	Mean Slope:	0.0474
Length to Cen. of Gravity (Lca):	95	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-08-19 01:07:01 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88.2	91.18	0.683
D	-	-	-	-
Imp.	20	99	99	0.959

Weighted Runoff Coef. (Cw):	0.74	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	8.06	in/hr
PEAK DISCHARGE:	0.9	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	10/27/2016
Concentration Point:	23A	Job #	7PIM160201
Watershed Area:	1.04 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	17	344	0.0494	0.035

Length of Watercourse (Lc):	344	feet	Mean Slope:	0.0494
Length to Cen. of Gravity (Lca):	172	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	20

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-04-30 05:00:20 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88.2	91.18	0.683
D	-	-	-	-
Imp.	20	99	99	0.959

Weighted Runoff Coef. (Cw):	0.74	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	8.06	in/hr
PEAK DISCHARGE:	8.4	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	05/23/2017
Concentration Point:	23B	Job #	7PIM160201
Watershed Area:	25.72 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	268	2004	0.1337	0.035

Length of Watercourse (Lc):	2004	feet	Mean Slope:	0.1337
Length to Cen. of Gravity (Lca):	1002	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	30

RETURN PERIOD: 1000-years NOAA Data Obtained: 2018-04-03 10:18:47 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3002 Longitude: -110.8399

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	1.25	1.91	2.37	3.18	3.94	4.48	4.82	5.25	5.65	6.17

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	87.3	91.65	0.768
D	-	-	-	-
Imp.	10	99	99	0.97

Weighted Runoff Coef. (Cw):	0.79	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	14.99	in/hr
Runoff Supply Rate (q) @ Tc:	11.81	in/hr
PEAK DISCHARGE:	306.3	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	05/23/2017
Concentration Point:	23D	Job #	7PIM160201
Watershed Area:	0.29 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	55	486	0.1132	0.035

Length of Watercourse (Lc):	486	feet	Mean Slope:	0.1132
Length to Cen. of Gravity (Lca):	243	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 10-years NOAA Data Obtained: 2018-04-03 10:18:47 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3002 Longitude: -110.8399

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.59	0.9	1.12	1.5	1.86	2.07	2.15	2.38	2.66	2.85

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	89.61	0.511
D	-	-	-	-
Imp.	75	99	99	0.938

Weighted Runoff Coef. (Cw):	0.83	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	7.08	in/hr
Runoff Supply Rate (q) @ Tc:	5.88	in/hr
PEAK DISCHARGE:	1.7	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	05/23/2017
Concentration Point:	24A	Job #	7PIM160201
Watershed Area:	0.45 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	9	116	0.0776	0.032

Length of Watercourse (Lc):	116	feet	Mean Slope:	0.0776
Length to Cen. of Gravity (Lca):	58	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-04-03 10:18:47 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.83	0.703
D	-	-	-	-
Imp.	40	99	99	0.959

Weighted Runoff Coef. (Cw):	0.81	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	8.79	in/hr
PEAK DISCHARGE:	4	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	05/23/2017
Concentration Point:	24B	Job #	7PIM160201
Watershed Area:	0.3 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	14	174	0.0805	0.032

Length of Watercourse (Lc):	174	feet	Mean Slope:	0.0805
Length to Cen. of Gravity (Lca):	87	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-04-03 10:18:47 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.83	0.703
D	-	-	-	-
Imp.	40	99	99	0.959

Weighted Runoff Coef. (Cw):	0.81	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	8.79	in/hr
PEAK DISCHARGE:	2.7	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	05/23/2017
Concentration Point:	24C	Job #	7PIM160201
Watershed Area:	0.33 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	8	216	0.037	0.032

Length of Watercourse (Lc):	216	feet	Mean Slope:	0.037
Length to Cen. of Gravity (Lca):	108	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-04-03 10:18:47 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.83	0.703
D	-	-	-	-
Imp.	40	99	99	0.959

Weighted Runoff Coef. (Cw):	0.81	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	8.79	in/hr
PEAK DISCHARGE:	2.9	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	cr
Project Name:	Kolb Road	Date:	05/23/2018
Concentration Point:	24D	Job #	7PIM160201
Watershed Area:	1.78 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	32	530	0.0604	0.032

Length of Watercourse (Lc):	530	feet	Mean Slope:	0.0604
Length to Cen. of Gravity (Lca):	265	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-04-03 10:18:47 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.83	0.703
D	-	-	-	-
Imp.	40	99	99	0.959

Weighted Runoff Coef. (Cw):	0.81	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	8.79	in/hr
PEAK DISCHARGE:	15.8	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	cr
Project Name:	Kolb Road	Date:	05/23/2017
Concentration Point:	24E	Job #	7PIM160201
Watershed Area:	0.45 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	6	230	0.0261	0.032

Length of Watercourse (Lc):	230	feet	Mean Slope:	0.0261
Length to Cen. of Gravity (Lca):	115	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-04-03 10:18:47 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.83	0.703
D	-	-	-	-
Imp.	60	99	99	0.959

Weighted Runoff Coef. (Cw):	0.86	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	9.35	in/hr
PEAK DISCHARGE:	4.2	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	05/23/2017
Concentration Point:	24F	Job #	7PIM160201
Watershed Area:	5.2 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	149	914	0.163	0.035

Length of Watercourse (Lc):	914	feet	Mean Slope:	0.163
Length to Cen. of Gravity (Lca):	457	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	25

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-04-03 10:18:47 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8383

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	87.8	90.37	0.659
D	-	-	-	-
Imp.	30	99	99	0.959

Weighted Runoff Coef. (Cw):	0.75	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	8.17	in/hr
PEAK DISCHARGE:	42.8	cfs

Calculation performed 2018-08-19 12:12:42 PM by PC-Hydro V6.1

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	05/23/2017
Concentration Point:	25	Job #	7PIM160201
Watershed Area:	3.79 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	168	958	0.1754	0.035

Length of Watercourse (Lc):	958	feet	Mean Slope:	0.1754
Length to Cen. of Gravity (Lca):	479	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	25

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-04-03 10:18:47 AM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3002 Longitude: -110.8399

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.91	1.38	1.71	2.3	2.85	3.18	3.33	3.65	4.01	4.35

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	87.8	90.37	0.659
D	-	-	-	-
Imp.	30	99	99	0.959

Weighted Runoff Coef. (Cw):	0.75	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.92	in/hr
Runoff Supply Rate (q) @ Tc:	8.17	in/hr
PEAK DISCHARGE:	31.2	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	04/12/2018
Concentration Point:	26	Job #	7PIM160201
Watershed Area:	30.73 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	219	2338	0.0937	0.035

Length of Watercourse (Lc):	2338	feet	Mean Slope:	0.0937
Length to Cen. of Gravity (Lca):	1169	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	15

RETURN PERIOD: 100-years NOAA data user generated

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88.7	91	0.668
D	-	-	-	-
Imp.	40	99	99	0.957

Weighted Runoff Coef. (Cw):	0.78	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	8.18	in/hr
PEAK DISCHARGE:	253.3	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	04/12/2018
Concentration Point:	26A	Job #	7PIM160201
Watershed Area:	0.06 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	2	162	0.0123	0.035

Length of Watercourse (Lc):	162	feet	Mean Slope:	0.0123
Length to Cen. of Gravity (Lca):	81	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	15

RETURN PERIOD: 100-years NOAA data user generated

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	88.7	91	0.668
D	-	-	-	-
Imp.	20	99	99	0.957

Weighted Runoff Coef. (Cw):	0.73	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	7.58	in/hr
PEAK DISCHARGE:	0.5	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	04/12/2018
Concentration Point:	27	Job #	7PIM160201
Watershed Area:	1.6 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	56	1362	0.0411	0.035

Length of Watercourse (Lc):	1362	feet	Mean Slope:	0.0411
Length to Cen. of Gravity (Lca):	681	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA data user generated

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89	91.66	0.689
D	-	-	-	-
Imp.	35	99	99	0.957

Weighted Runoff Coef. (Cw):	0.78	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	8.17	in/hr
PEAK DISCHARGE:	13.2	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	04/12/2018
Concentration Point:	27A	Job #	7PIM160201
Watershed Area:	0.61 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	16	270	0.0593	0.035

Length of Watercourse (Lc):	270	feet	Mean Slope:	0.0593
Length to Cen. of Gravity (Lca):	135	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA data user generated

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.66	0.689
D	-	-	-	-
Imp.	35	99	99	0.957

Weighted Runoff Coef. (Cw):	0.78	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	8.17	in/hr
PEAK DISCHARGE:	5	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	04/12/2018
Concentration Point:	27B	Job #	7PIM160201
Watershed Area:	0.45 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	16	205	0.078	0.035

Length of Watercourse (Lc):	205	feet	Mean Slope:	0.078
Length to Cen. of Gravity (Lca):	102.5	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA data user generated

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.66	0.689
D	-	-	-	-
Imp.	35	99	99	0.957

Weighted Runoff Coef. (Cw):	0.78	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	8.17	in/hr
PEAK DISCHARGE:	3.7	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	04/12/2018
Concentration Point:	27C	Job #	7PIM160201
Watershed Area:	0.17 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	17	121	0.1405	0.035

Length of Watercourse (Lc):	121	feet	Mean Slope:	0.1405
Length to Cen. of Gravity (Lca):	60.5	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA data user generated

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.66	0.689
D	-	-	-	-
Imp.	35	99	99	0.957

Weighted Runoff Coef. (Cw):	0.78	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	8.17	in/hr
PEAK DISCHARGE:	1.4	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	04/12/2018
Concentration Point:	27D	Job #	7PIM160201
Watershed Area:	0.39 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	19	412	0.0461	0.035

Length of Watercourse (Lc):	412	feet	Mean Slope:	0.0461
Length to Cen. of Gravity (Lca):	206	feet	Weighted Basin Fac:	0.035
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA data user generated

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.3008 Longitude: -110.8398

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.87	1.32	1.64	2.21	2.74	3.04	3.19	3.41	3.69	4.18

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.66	0.689
D	-	-	-	-
Imp.	35	99	99	0.957

Weighted Runoff Coef. (Cw):	0.78	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.44	in/hr
Runoff Supply Rate (q) @ Tc:	8.17	in/hr
PEAK DISCHARGE:	3.2	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	04/12/2018
Concentration Point:	28A	Job #	7PIM160201
Watershed Area:	0.33 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	18	525	0.0343	0.032

Length of Watercourse (Lc):	525	feet	Mean Slope:	0.0343
Length to Cen. of Gravity (Lca):	262.5	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-07-24 02:49:36 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2833 Longitude: -110.8367

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.9	1.37	1.69	2.28	2.82	3.15	3.29	3.6	3.93	4.24

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.79	0.7
D	-	-	-	-
Imp.	75	99	99	0.958

Weighted Runoff Coef. (Cw):	0.89	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.8	in/hr
Runoff Supply Rate (q) @ Tc:	9.65	in/hr
PEAK DISCHARGE:	3.2	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	04/12/2018
Concentration Point:	28B	Job #	7PIM160201
Watershed Area:	0.09 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	9	203	0.0443	0.032

Length of Watercourse (Lc):	203	feet	Mean Slope:	0.0443
Length to Cen. of Gravity (Lca):	101.5	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-07-24 02:49:36 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2833 Longitude: -110.8367

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.9	1.37	1.69	2.28	2.82	3.15	3.29	3.6	3.93	4.24

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.79	0.7
D	-	-	-	-
Imp.	75	99	99	0.958

Weighted Runoff Coef. (Cw):	0.89	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.8	in/hr
Runoff Supply Rate (q) @ Tc:	9.65	in/hr
PEAK DISCHARGE:	0.9	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	04/12/2018
Concentration Point:	28C	Job #	7PIM160201
Watershed Area:	1.13 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	33	552	0.0598	0.032

Length of Watercourse (Lc):	552	feet	Mean Slope:	0.0598
Length to Cen. of Gravity (Lca):	276	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-07-24 02:49:36 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2833 Longitude: -110.8367

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.9	1.37	1.69	2.28	2.82	3.15	3.29	3.6	3.93	4.24

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.79	0.7
D	-	-	-	-
Imp.	75	99	99	0.958

Weighted Runoff Coef. (Cw):	0.89	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.8	in/hr
Runoff Supply Rate (q) @ Tc:	9.65	in/hr
PEAK DISCHARGE:	11	cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

Generated using methonds provided by Pima County Regional Flood Control District

Client:	PC	Prepared by:	CR
Project Name:	Kolb Road	Date:	04/12/2018
Concentration Point:	28D	Job #	7PIM160201
Watershed Area:	0.09 Acres	Watershed Type	Suburban Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	8	123	0.065	0.032

Length of Watercourse (Lc):	123	feet	Mean Slope:	0.065
Length to Cen. of Gravity (Lca):	61.5	feet	Weighted Basin Fac:	0.032
Veg. Cover Type(s):	Desert Brush		Veg. Cover Density:	10

RETURN PERIOD: 100-years NOAA Data Obtained: 2018-07-24 02:49:36 PM

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.2833 Longitude: -110.8367

Duration:	5-min	10-min	15-min	30-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Point Values (in):	0.9	1.37	1.69	2.28	2.82	3.15	3.29	3.6	3.93	4.24

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	-	-	-	-
C	100	89.1	91.79	0.7
D	-	-	-	-
Imp.	50	99	99	0.958

Weighted Runoff Coef. (Cw):	0.83	
Time of Concentration:	5	min
Rainfall Intensity (i) @ Tc:	10.8	in/hr
Runoff Supply Rate (q) @ Tc:	8.95	in/hr
PEAK DISCHARGE:	0.8	cfs

APPENDIX 7

PROPOSED CONDITIONS CULVERT CALCULATIONS (HY8 AND TAILWATER CHECK)

HY8 REPORT

Table 1a - Summary of Culvert Flows at Crossing: Station 149+99.17 (PE-3)

Headwater Elevation (ft)	Total Discharge (cfs)	3-36in RCP Ext Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2750.17	27.90	27.90	0.00	1
2750.59	45.11	45.11	0.00	1
2750.97	62.32	62.32	0.00	1
2751.32	79.53	79.53	0.00	1
2751.65	96.74	96.74	0.00	1
2752.00	113.95	113.95	0.00	1
2752.20	123.53	123.53	0.00	1
2752.78	148.37	148.37	0.00	1
2753.24	165.58	165.58	0.00	1
2753.76	182.79	182.79	0.00	1
2754.07	200.00	192.14	7.60	12
2753.88	186.42	186.42	0.00	Overtopping

Table 1b - Culvert Summary Table: 3-36in RCP Ext

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
27.90	27.90	2750.17	1.288	0.734	1-S2n	0.000	0.960	0.663	0.663	11.368	2.872
45.11	45.11	2750.59	1.706	0.804	1-S2n	0.000	0.960	0.869	0.869	12.963	3.353
62.32	62.32	2750.97	2.094	0.907	1-S2n	0.000	0.960	1.040	1.040	14.077	3.710
79.53	79.53	2751.32	2.441	1.044	1-S2n	0.000	0.960	1.188	1.188	14.939	3.996
96.74	96.74	2751.65	2.774	1.213	1-S2n	0.000	0.960	1.321	1.321	15.496	4.238
113.95	113.95	2752.00	3.118	1.416	5-S2n	0.000	0.960	1.442	1.442	16.074	4.448
123.53	123.53	2752.20	3.320	1.543	5-S2n	0.000	0.960	1.505	1.505	16.443	4.554
148.37	148.37	2752.78	3.902	1.921	5-S2n	0.000	0.960	1.658	1.658	17.057	4.803
165.58	165.58	2753.24	4.365	2.223	5-S2n	0.000	0.960	1.756	1.756	17.436	4.957
182.79	182.79	2753.76	4.883	2.558	5-S2n	0.000	0.960	1.849	1.849	17.777	5.099
200.00	192.14	2754.07	5.189	2.754	5-S2n	0.000	0.960	1.937	1.937	17.964	5.230

****

Single Broken-back Culvert

Inlet Elevation (invert): 2748.88 ft,

Break Elevation (invert): 2748.47 ft,

Culvert Length: 144.11 ft,

Upper Culvert Section Slope: 0.0248

Steep Culvert Section Slope: 0.0401

****

Site Data - 3-36in RCP Ext

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2748.88 ft

Break Station: 16.50 ft

Break Elevation: 2748.47 ft

Outlet Station: 144.00 ft

Outlet Elevation: 2743.36 ft

Number of Barrels: 3

Culvert Data Summary - 3-36in RCP Ext

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Upper Section Material: Concrete

Lower Section Material:

Embedment: 0.00 in

Upper Section Manning's n: 0.0130

Lower Section Manning's n: 0.0120

Culvert Type: Single Broken-back

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 1c - Downstream Channel Rating Curve (Crossing: Station 149+99.17 (PE-3))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
27.90	2744.02	0.66	2.87	0.41	0.68
45.11	2744.23	0.87	3.35	0.54	0.70
62.32	2744.40	1.04	3.71	0.65	0.72
79.53	2744.55	1.19	4.00	0.74	0.73
96.74	2744.68	1.32	4.24	0.82	0.74
113.95	2744.80	1.44	4.45	0.90	0.75
123.53	2744.87	1.51	4.55	0.94	0.76
148.37	2745.02	1.66	4.80	1.03	0.77
165.58	2745.12	1.76	4.96	1.10	0.77
182.79	2745.21	1.85	5.10	1.15	0.78
200.00	2745.30	1.94	5.23	1.21	0.78

Tailwater Channel Data - Station 149+99.17 (PE-3)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 12.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2743.36 ft

Roadway Data for Crossing: Station 149+99.17 (PE-3)

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2754.23
1	25.00	2754.11
2	50.00	2753.99
3	100.00	2753.88

Roadway Surface: Paved

Roadway Top Width: 28.00 ft

Table 2a - Summary of Culvert Flows at Crossing: Station 133+58.00 (P13)

Headwater Elevation (ft)	Total Discharge (cfs)	1-24inRCP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2757.64	6.50	6.50	0.00	1
2757.70	8.85	8.85	0.00	1
2757.75	11.20	11.20	0.00	1
2757.80	13.55	13.55	0.00	1
2757.85	15.90	15.90	0.00	1
2757.95	18.25	18.25	0.00	1
2758.21	20.00	20.00	0.00	1
2758.62	22.95	22.42	0.48	19
2758.75	25.30	23.12	2.13	10
2758.83	27.65	23.56	4.03	7
2758.89	30.00	23.90	6.04	6
2758.46	21.51	21.51	0.00	Overtopping

Table 2b - Culvert Summary Table: 1-24inRCP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
6.50	6.50	2757.64	2.321	0.0*	5-S2n	0.471	0.903	0.471	0.412	11.111	4.325
8.85	8.85	2757.70	2.379	0.0*	5-S2n	0.551	1.060	0.564	0.480	11.741	4.705
11.20	11.20	2757.75	2.432	0.0*	5-S2n	0.622	1.197	0.622	0.538	12.964	5.011
13.55	13.55	2757.80	2.482	0.0*	5-S2n	0.688	1.322	0.688	0.590	13.679	5.272
15.90	15.90	2757.85	2.528	0.0*	5-S2n	0.749	1.433	0.749	0.636	14.293	5.499
18.25	18.25	2757.95	2.632	0.0*	5-S2n	0.808	1.537	0.848	0.679	13.910	5.701
20.00	20.00	2758.21	2.894	0.0*	5-S2n	0.850	1.604	0.902	0.709	14.056	5.839
22.95	22.42	2758.62	3.298	0.0*	5-S2n	0.907	1.687	0.962	0.755	14.506	6.054
25.30	23.12	2758.75	3.425	0.0*	5-S2n	0.924	1.709	0.978	0.790	14.644	6.209
27.65	23.56	2758.83	3.507	0.0*	5-S2n	0.934	1.722	0.988	0.823	14.727	6.353
30.00	23.90	2758.89	3.571	0.0*	5-S2n	0.941	1.732	0.996	0.854	14.787	6.488

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2755.32 ft, Outlet Elevation (invert): 2749.32 ft

Culvert Length: 120.15 ft, Culvert Slope: 0.0500

Inlet Throat Elevation: 2755.32 ft, Inlet Crest Elevation: 2757.39 ft

****

Site Data - 1-24inRCP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2756.94 ft

Outlet Station: 120.00 ft

Outlet Elevation: 2749.32 ft

Number of Barrels: 1

Culvert Data Summary - 1-24inRCP

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: Yes

Table 2c - Downstream Channel Rating Curve (Crossing: Station 133+58.00 (P13))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
6.50	2749.73	0.41	4.33	1.47	1.43
8.85	2749.80	0.48	4.70	1.71	1.46
11.20	2749.86	0.54	5.01	1.92	1.48
13.55	2749.91	0.59	5.27	2.10	1.50
15.90	2749.96	0.64	5.50	2.27	1.52
18.25	2750.00	0.68	5.70	2.42	1.53
20.00	2750.03	0.71	5.84	2.52	1.54
22.95	2750.08	0.76	6.05	2.69	1.55
25.30	2750.11	0.79	6.21	2.81	1.56
27.65	2750.14	0.82	6.35	2.93	1.57
30.00	2750.17	0.85	6.49	3.04	1.58

Tailwater Channel Data - Station 133+58.00 (P13)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 2.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0571

Channel Manning's n: 0.0350

Channel Invert Elevation: 2749.32 ft

Roadway Data for Crossing: Station 133+58.00 (P13)

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2760.72
1	25.00	2759.81
2	50.00	2759.22
3	75.00	2758.99
4	100.00	2758.46

Roadway Surface: Paved

Roadway Top Width: 35.00 ft

Table 3a - Summary of Culvert Flows at Crossing: Station 131+25 (P12)

Headwater Elevation (ft)	Total Discharge (cfs)	2-24inRCP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2751.49	7.80	7.80	0.00	1
2751.54	11.02	11.02	0.00	1
2751.58	14.24	14.24	0.00	1
2751.63	17.46	17.46	0.00	1
2751.67	20.68	20.68	0.00	1
2751.69	22.40	22.40	0.00	1
2751.74	27.12	27.12	0.00	1
2751.78	30.34	30.34	0.00	1
2751.81	33.56	33.56	0.00	1
2751.84	36.78	36.78	0.00	1
2751.87	40.00	40.00	0.00	1
2753.03	65.53	65.53	0.00	Overtopping

Table 3b - Culvert Summary Table: 2-24inRCP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
7.80	7.80	2751.49	4.088	0.0*	5-S2n	0.413	0.688	0.427	0.319	7.673	3.893
11.02	11.02	2751.54	4.138	0.0*	5-S2n	0.490	0.826	0.510	0.387	8.457	4.345
14.24	14.24	2751.58	4.184	0.0*	5-S2n	0.559	0.947	0.582	0.446	9.049	4.703
17.46	17.46	2751.63	4.227	0.0*	5-S2n	0.621	1.052	0.621	0.499	10.134	5.005
20.68	20.68	2751.67	4.266	0.0*	5-S2n	0.679	1.149	0.679	0.546	10.627	5.267
22.40	22.40	2751.69	4.287	0.0*	5-S2n	0.708	1.197	0.708	0.570	10.875	5.393
27.12	27.12	2751.74	4.340	0.0*	5-S2n	0.785	1.323	0.785	0.632	11.443	5.705
30.34	30.34	2751.78	4.375	0.0*	5-S2n	0.836	1.400	0.885	0.670	10.937	5.894
33.56	33.56	2751.81	4.409	0.0*	5-S2n	0.884	1.475	0.884	0.707	12.103	6.067
36.78	36.78	2751.84	4.441	0.0*	5-S2n	0.932	1.542	0.988	0.741	11.503	6.229
40.00	40.00	2751.87	4.473	0.209	5-S2n	0.979	1.604	1.039	0.774	11.748	6.379

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2747.40 ft, Outlet Elevation (invert): 2744.00 ft

Culvert Length: 111.05 ft, Culvert Slope: 0.0306

Inlet Throat Elevation: 2747.40 ft, Inlet Crest Elevation: 2751.29 ft

****

Site Data - 2-24inRCP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2750.55 ft

Outlet Station: 111.00 ft

Outlet Elevation: 2744.00 ft

Number of Barrels: 2

Culvert Data Summary - 2-24inRCP

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: Yes

Table 3c - Downstream Channel Rating Curve (Crossing: Station 131+25 (P12))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
7.80	2744.32	0.32	3.89	1.00	1.33
11.02	2744.39	0.39	4.34	1.21	1.37
14.24	2744.45	0.45	4.70	1.39	1.39
17.46	2744.50	0.50	5.01	1.56	1.42
20.68	2744.55	0.55	5.27	1.70	1.43
22.40	2744.57	0.57	5.39	1.78	1.44
27.12	2744.63	0.63	5.70	1.97	1.46
30.34	2744.67	0.67	5.89	2.09	1.47
33.56	2744.71	0.71	6.07	2.20	1.48
36.78	2744.74	0.74	6.23	2.31	1.49
40.00	2744.77	0.77	6.38	2.42	1.50

Tailwater Channel Data - Station 131+25 (P12)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0500

Channel Manning's n: 0.0350

Channel Invert Elevation: 2744.00 ft

Roadway Data for Crossing: Station 131+25 (P12)

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2754.59
1	50.00	2753.76
2	100.00	2753.03

Roadway Surface: Paved

Roadway Top Width: 35.00 ft

Table 4a - Summary of Culvert Flows at Crossing: Station 129+34.00 (P11)

Headwater Elevation (ft)	Total Discharge (cfs)	2-24inRCP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2747.07	5.70	5.70	0.00	1
2747.12	8.13	8.13	0.00	1
2747.16	10.56	10.56	0.00	1
2747.20	12.99	12.99	0.00	1
2747.22	13.90	13.90	0.00	1
2747.28	17.85	17.85	0.00	1
2747.31	20.28	20.28	0.00	1
2747.34	22.71	22.71	0.00	1
2747.37	25.14	25.14	0.00	1
2747.40	27.57	27.38	0.02	5
2747.43	30.00	29.30	0.54	4
2747.40	27.14	27.14	0.00	Overtopping

Table 4b - Culvert Summary Table: 2-24inRCP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.70	5.70	2747.07	4.252	0.0*	5-S2n	0.323	0.585	0.323	0.334	8.386	3.197
8.13	8.13	2747.12	4.299	0.0*	5-S2n	0.384	0.703	0.384	0.406	9.314	3.563
10.56	10.56	2747.16	4.343	0.0*	5-S2n	0.438	0.807	0.438	0.467	10.039	3.853
12.99	12.99	2747.20	4.383	0.0*	5-S2n	0.486	0.903	0.497	0.521	10.325	4.093
13.90	13.90	2747.22	4.397	0.0*	5-S2n	0.503	0.936	0.503	0.540	10.866	4.175
17.85	17.85	2747.28	4.456	0.0*	5-S2n	0.571	1.064	0.571	0.616	11.625	4.485
20.28	20.28	2747.31	4.490	0.0*	5-S2n	0.611	1.134	0.611	0.658	12.078	4.649
22.71	22.71	2747.34	4.523	0.0*	5-S2n	0.648	1.205	0.677	0.697	11.718	4.800
25.14	25.14	2747.37	4.555	0.0*	5-S2n	0.683	1.272	0.683	0.734	12.800	4.937
27.57	27.38	2747.40	4.583	0.0*	5-S2n	0.715	1.329	0.746	0.769	12.387	5.066
30.00	29.30	2747.43	4.607	0.0*	5-S2n	0.742	1.375	0.742	0.802	13.350	5.185

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2742.82 ft, Outlet Elevation (invert): 2737.00 ft

Culvert Length: 132.13 ft, Culvert Slope: 0.0441

Inlet Throat Elevation: 2742.82 ft, Inlet Crest Elevation: 2746.89 ft

****

Site Data - 2-24inRCP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2746.00 ft

Outlet Station: 132.00 ft

Outlet Elevation: 2737.00 ft

Number of Barrels: 2

Culvert Data Summary - 2-24inRCP

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: Yes

Table 4c - Downstream Channel Rating Curve (Crossing: Station 129+34.00 (P11))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.70	2737.33	0.33	3.20	0.70	1.09
8.13	2737.41	0.41	3.56	0.85	1.12
10.56	2737.47	0.47	3.85	0.98	1.14
12.99	2737.52	0.52	4.09	1.09	1.16
13.90	2737.54	0.54	4.18	1.13	1.16
17.85	2737.62	0.62	4.49	1.29	1.18
20.28	2737.66	0.66	4.65	1.38	1.19
22.71	2737.70	0.70	4.80	1.46	1.20
25.14	2737.73	0.73	4.94	1.53	1.21
27.57	2737.77	0.77	5.07	1.61	1.22
30.00	2737.80	0.80	5.19	1.68	1.23

Tailwater Channel Data - Station 129+34.00 (P11)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0335

Channel Manning's n: 0.0350

Channel Invert Elevation: 2737.00 ft

Roadway Data for Crossing: Station 129+34.00 (P11)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 2747.40 ft

Roadway Surface: Gravel

Roadway Top Width: 35.00 ft

Table 5a - Summary of Culvert Flows at Crossing: Station 123+14.23 (P9)

Headwater Elevation (ft)	Total Discharge (cfs)	1-38inx24inHERCP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2728.43	10.00	10.00	0.00	1
2728.88	16.50	16.50	0.00	1
2729.33	23.00	23.00	0.00	1
2729.85	29.50	29.50	0.00	1
2730.48	36.00	36.00	0.00	1
2730.54	36.60	36.60	0.00	1
2732.05	49.00	48.46	0.47	20
2732.20	55.50	49.53	5.87	8
2732.30	62.00	50.21	11.70	6
2732.39	68.50	50.74	17.66	5
2732.46	75.00	51.20	23.76	5
2732.00	48.15	48.15	0.00	Overtopping

Table 5b - Culvert Summary Table: 1-38inx24inHERCP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
10.00	10.00	2728.43	1.196	0.0*	1-S2n	0.476	0.864	0.501	0.407	9.306	4.363
16.50	16.50	2728.88	1.653	0.0*	1-S2n	0.613	1.130	0.663	0.532	10.541	5.057
23.00	23.00	2729.33	2.105	0.0*	5-S2n	0.729	1.350	0.795	0.633	11.569	5.562
29.50	29.50	2729.85	2.622	0.384	5-S2n	0.833	1.541	0.924	0.719	12.268	5.964
36.00	36.00	2730.48	3.247	1.015	5-S2n	0.931	1.695	1.043	0.795	12.932	6.303
36.60	36.60	2730.54	3.311	1.078	5-S2n	0.940	1.707	1.054	0.802	12.980	6.331
49.00	48.46	2732.05	4.815	2.473	5-S2n	1.110	1.869	1.261	0.927	13.904	6.856
55.50	49.53	2732.20	4.973	2.611	5-S2n	1.125	1.873	1.278	0.986	13.998	7.090
62.00	50.21	2732.30	5.074	2.704	5-S2n	1.135	1.883	1.289	1.040	14.055	7.305
68.50	50.74	2732.39	5.156	2.777	5-S2n	1.142	1.889	1.299	1.091	14.088	7.502
75.00	51.20	2732.46	5.226	2.837	5-S2n	1.149	1.885	1.307	1.140	14.109	7.684

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2727.23 ft, Outlet Elevation (invert): 2724.71 ft

Culvert Length: 88.04 ft, Culvert Slope: 0.0286

****

Site Data - 1-38inx24inHERCP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2727.23 ft

Outlet Station: 88.00 ft

Outlet Elevation: 2724.71 ft

Number of Barrels: 1

Culvert Data Summary - 1-38inx24inHERCP

Barrel Shape: Elliptical

Barrel Span: 38.00 in

Barrel Rise: 24.00 in

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 5c - Downstream Channel Rating Curve (Crossing: Station 123+14.23 (P9))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
10.00	2725.12	0.41	4.36	1.27	1.37
16.50	2725.24	0.53	5.06	1.66	1.42
23.00	2725.34	0.63	5.56	1.98	1.45
29.50	2725.43	0.72	5.96	2.24	1.48
36.00	2725.51	0.80	6.30	2.48	1.50
36.60	2725.51	0.80	6.33	2.50	1.50
49.00	2725.64	0.93	6.86	2.89	1.53
55.50	2725.70	0.99	7.09	3.07	1.54
62.00	2725.75	1.04	7.30	3.25	1.55
68.50	2725.80	1.09	7.50	3.41	1.56
75.00	2725.85	1.14	7.68	3.56	1.57

Tailwater Channel Data - Station 123+14.23 (P9)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0500

Channel Manning's n: 0.0350

Channel Invert Elevation: 2724.71 ft

Roadway Data for Crossing: Station 123+14.23 (P9)

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2732.79
1	30.00	2732.01
2	50.00	2732.00

Roadway Surface: Paved

Roadway Top Width: 55.00 ft

Table 6a - Summary of Culvert Flows at Crossing: Station 114+06.88 (P4)

Headwater Elevation (ft)	Total Discharge (cfs)	1-36inRCP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2703.42	19.10	19.10	0.00	1
2703.55	27.19	27.19	0.00	1
2703.67	35.28	35.28	0.00	1
2703.77	43.37	43.37	0.00	1
2703.87	51.46	51.46	0.00	1
2704.12	54.60	54.60	0.00	1
2705.37	67.64	67.64	0.00	1
2706.29	75.73	75.73	0.00	1
2707.04	83.82	81.62	2.06	20
2707.10	91.91	82.12	9.67	6
2707.15	100.00	82.49	17.43	5
2707.00	81.34	81.34	0.00	Overtopping

Table 6b - Culvert Summary Table: 1-36inRCP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
19.10	19.10	2703.42	3.633	0.0*	5-S2n	0.802	1.401	0.802	0.793	12.137	4.658
27.19	27.19	2703.55	3.760	0.0*	5-S2n	0.963	1.683	1.032	0.931	12.188	5.103
35.28	35.28	2703.67	3.875	0.0*	5-S2n	1.107	1.927	1.205	1.046	12.829	5.455
43.37	43.37	2703.77	3.982	0.466	5-S2n	1.239	2.143	1.361	1.146	13.449	5.750
51.46	51.46	2703.87	4.082	1.516	5-S2n	1.365	2.330	1.510	1.235	13.965	6.006
54.60	54.60	2704.12	4.327	1.778	5-S2n	1.412	2.396	1.566	1.267	14.156	6.098
67.64	67.64	2705.37	5.576	2.988	5-S2n	1.605	2.624	1.793	1.390	14.882	6.439
75.73	75.73	2706.29	6.502	3.837	5-S2n	1.724	2.728	1.926	1.459	15.326	6.626
83.82	81.62	2707.04	7.247	4.503	5-S2n	1.811	2.785	2.025	1.524	15.615	6.797
91.91	82.12	2707.10	7.313	4.561	5-S2n	1.818	2.790	2.033	1.584	15.643	6.958
100.00	82.49	2707.15	7.362	4.605	5-S2n	1.824	2.793	2.039	1.642	15.664	7.107

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2699.79 ft, Outlet Elevation (invert): 2696.82 ft

Culvert Length: 99.04 ft, Culvert Slope: 0.0300

Inlet Throat Elevation: 2699.79 ft, Inlet Crest Elevation: 2702.94 ft

****

Site Data - 1-36inRCP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2702.50 ft

Outlet Station: 99.00 ft

Outlet Elevation: 2696.82 ft

Number of Barrels: 1

Culvert Data Summary - 1-36inRCP

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: Yes

Table 6c - Downstream Channel Rating Curve (Crossing: Station 114+06.88 (P4))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
19.10	2697.61	0.79	4.66	1.58	1.17
27.19	2697.75	0.93	5.10	1.86	1.20
35.28	2697.87	1.05	5.46	2.09	1.22
43.37	2697.97	1.15	5.75	2.29	1.23
51.46	2698.05	1.23	6.01	2.47	1.25
54.60	2698.09	1.27	6.10	2.53	1.25
67.64	2698.21	1.39	6.44	2.78	1.27
75.73	2698.28	1.46	6.63	2.91	1.28
83.82	2698.34	1.52	6.80	3.04	1.28
91.91	2698.40	1.58	6.96	3.16	1.29
100.00	2698.46	1.64	7.11	3.28	1.30

Tailwater Channel Data - Station 114+06.88 (P4)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 2.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0320

Channel Manning's n: 0.0350

Channel Invert Elevation: 2696.82 ft

Roadway Data for Crossing: Station 114+06.88 (P4)

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2707.00
1	25.00	2707.00
2	50.00	2707.00
3	75.00	2707.00
4	100.00	2707.00

Roadway Surface: Paved

Roadway Top Width: 30.00 ft

Table 7a - Summary of Culvert Flows at Crossing: Station 110+95.00 (P3)

Headwater Elevation (ft)	Total Discharge (cfs)	3-30inRCP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2695.34	25.10	25.10	0.00	1
2695.72	37.59	37.59	0.00	1
2696.06	50.08	50.08	0.00	1
2696.38	62.57	62.57	0.00	1
2696.71	75.06	75.06	0.00	1
2697.07	87.55	87.55	0.00	1
2697.38	96.80	96.80	0.00	1
2697.96	112.53	112.53	0.00	1
2698.50	125.02	125.02	0.00	1
2699.10	137.51	137.51	0.00	1
2699.35	150.00	142.30	7.50	12
2699.50	145.15	145.15	0.00	Overtopping

Table 7b - Culvert Summary Table: 3-30inRCP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
25.10	25.10	2695.34	1.307	0.0*	1-S2n	0.534	0.960	0.534	0.480	10.527	5.266
37.59	37.59	2695.72	1.693	0.0*	1-S2n	0.654	1.189	0.654	0.602	11.806	5.994
50.08	50.08	2696.06	2.027	0.0*	1-S2n	0.759	1.376	0.813	0.706	11.657	6.553
62.57	62.57	2696.38	2.345	0.0*	1-S2n	0.853	1.549	0.915	0.797	12.385	7.014
75.06	75.06	2696.71	2.677	0.0*	5-S2n	0.940	1.700	1.016	0.880	12.904	7.407
87.55	87.55	2697.07	3.044	0.0*	5-S2n	1.023	1.840	1.114	0.955	13.340	7.751
96.80	96.80	2697.38	3.346	0.369	5-S2n	1.082	1.932	1.180	1.008	13.694	7.984
112.53	112.53	2697.96	3.933	0.991	5-S2n	1.179	2.070	1.298	1.091	14.110	8.339
125.02	125.02	2698.50	4.470	1.535	5-S2n	1.255	2.163	1.386	1.153	14.453	8.597
137.51	137.51	2699.10	5.071	2.124	5-S2n	1.329	2.239	1.472	1.212	14.776	8.833
150.00	142.30	2699.35	5.318	2.362	5-S2n	1.358	2.265	1.504	1.268	14.902	9.054

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2694.03 ft, Outlet Elevation (invert): 2690.61 ft

Culvert Length: 92.06 ft, Culvert Slope: 0.0372

****

Site Data - 3-30inRCP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2694.03 ft

Outlet Station: 92.00 ft

Outlet Elevation: 2690.61 ft

Number of Barrels: 3

Culvert Data Summary - 3-30inRCP

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 7c - Downstream Channel Rating Curve (Crossing: Station 110+95.00 (P3))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
25.10	2691.09	0.48	5.27	1.57	1.46
37.59	2691.21	0.60	5.99	1.97	1.51
50.08	2691.32	0.71	6.55	2.31	1.54
62.57	2691.41	0.80	7.01	2.61	1.57
75.06	2691.49	0.88	7.41	2.88	1.59
87.55	2691.57	0.96	7.75	3.13	1.61
96.80	2691.62	1.01	7.98	3.30	1.62
112.53	2691.70	1.09	8.34	3.58	1.64
125.02	2691.76	1.15	8.60	3.78	1.65
137.51	2691.82	1.21	8.83	3.97	1.66
150.00	2691.88	1.27	9.05	4.15	1.67

Tailwater Channel Data - Station 110+95.00 (P3)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 8.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0525

Channel Manning's n: 0.0350

Channel Invert Elevation: 2690.61 ft

Roadway Data for Crossing: Station 110+95.00 (P3)

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2699.00
1	25.00	2699.50
2	50.00	2700.00
3	75.00	2699.50
4	100.00	2699.00

Roadway Surface: Paved

Roadway Top Width: 25.00 ft

Table 8a - Summary of Culvert Flows at Crossing: Station 127+09.00 (P10)

Headwater Elevation (ft)	Total Discharge (cfs)	1-38inx24in HERCP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2734.72	6.10	6.10	0.00	1
2734.91	8.49	8.49	0.00	1
2735.09	10.88	10.88	0.00	1
2735.26	13.27	13.27	0.00	1
2735.42	15.66	15.66	0.00	1
2735.59	18.05	18.05	0.00	1
2735.69	19.60	19.60	0.00	1
2735.92	22.83	22.83	0.00	1
2736.10	25.22	25.22	0.00	1
2736.29	27.61	27.56	0.00	15
2736.44	30.00	29.39	0.56	12
2736.29	27.60	27.60	0.00	Overtopping

Table 8b - Culvert Summary Table: 1-38inx24in HERCP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
6.10	6.10	2734.72	0.891	0.0*	1-S2n	0.372	0.660	0.387	0.313	8.131	3.709
8.49	8.49	2734.91	1.078	0.0*	1-S2n	0.436	0.789	0.436	0.376	9.585	4.108
10.88	10.88	2735.09	1.261	0.0*	1-S2n	0.492	0.905	0.517	0.430	9.688	4.427
13.27	13.27	2735.26	1.431	0.0*	1-S2n	0.544	1.006	0.583	0.478	10.052	4.696
15.66	15.66	2735.42	1.595	0.0*	1-S2n	0.591	1.096	0.639	0.522	10.488	4.928
18.05	18.05	2735.59	1.757	0.0*	1-S2n	0.636	1.184	0.684	0.562	11.050	5.135
19.60	19.60	2735.69	1.863	0.0*	1-S2n	0.664	1.241	0.720	0.587	11.206	5.257
22.83	22.83	2735.92	2.091	0.0*	5-S2n	0.719	1.345	0.785	0.636	11.674	5.491
25.22	25.22	2736.10	2.270	0.0*	5-S2n	0.758	1.421	0.827	0.669	12.055	5.646
27.61	27.56	2736.29	2.457	0.0*	5-S2n	0.795	1.488	0.877	0.701	12.246	5.792
30.00	29.39	2736.44	2.611	0.232	5-S2n	0.824	1.538	0.911	0.731	12.445	5.927

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2733.83 ft, Outlet Elevation (invert): 2731.16 ft

Culvert Length: 90.04 ft, Culvert Slope: 0.0297

****

Site Data - 1-38inx24in HERCP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2733.83 ft

Outlet Station: 90.00 ft

Outlet Elevation: 2731.16 ft

Number of Barrels: 1

Culvert Data Summary - 1-38inx24in HERCP

Barrel Shape: Elliptical

Barrel Span: 38.00 in

Barrel Rise: 24.00 in

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 8c - Downstream Channel Rating Curve (Crossing: Station 127+09.00 (P10))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
6.10	2731.47	0.31	3.71	0.95	1.30
8.49	2731.54	0.38	4.11	1.14	1.33
10.88	2731.59	0.43	4.43	1.30	1.36
13.27	2731.64	0.48	4.70	1.45	1.38
15.66	2731.68	0.52	4.93	1.58	1.39
18.05	2731.72	0.56	5.13	1.70	1.41
19.60	2731.75	0.59	5.26	1.78	1.42
22.83	2731.80	0.64	5.49	1.92	1.43
25.22	2731.83	0.67	5.65	2.02	1.44
27.61	2731.86	0.70	5.79	2.12	1.45
30.00	2731.89	0.73	5.93	2.21	1.46

Tailwater Channel Data - Station 127+09.00 (P10)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0485

Channel Manning's n: 0.0350

Channel Invert Elevation: 2731.16 ft

Roadway Data for Crossing: Station 127+09.00 (P10)

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2738.01
1	25.00	2737.48
2	50.00	2737.11
3	75.00	2736.70
4	100.00	2736.29

Roadway Surface: Paved

Roadway Top Width: 22.00 ft

Table 9a - Summary of Culvert Flows at Crossing: Station 73+40.28 (BC-2)

Headwater Elevation (ft)	Total Discharge (cfs)	2-6'x3' RCBC Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2609.97	50.00	50.00	0.00	1
2610.21	85.00	85.00	0.00	1
2610.42	120.00	120.00	0.00	1
2610.60	155.00	155.00	0.00	1
2610.78	190.00	190.00	0.00	1
2610.92	220.47	220.47	0.00	1
2611.10	260.00	260.00	0.00	1
2611.24	295.00	295.00	0.00	1
2611.75	330.00	330.00	0.00	1
2612.07	365.00	344.93	19.88	8
2612.20	400.00	351.07	48.80	6
2611.90	337.16	337.16	0.00	Overtopping

Table 9b - Culvert Summary Table: 2-6'x3' RCBC

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
50.00	50.00	2609.97	3.881	0.0*	5-S2n	0.364	0.814	0.364	1.462	11.460	5.848
85.00	85.00	2610.21	4.119	0.0*	5-S2n	0.509	1.159	0.534	1.784	13.262	6.678
120.00	120.00	2610.42	4.326	0.0*	5-S2n	0.636	1.459	0.636	2.030	15.728	7.279
155.00	155.00	2610.60	4.513	0.0*	5-S2n	0.751	1.730	0.783	2.235	16.498	7.760
190.00	190.00	2610.78	4.687	0.0*	5-S2n	0.859	1.982	0.915	2.412	17.309	8.165
220.47	220.47	2610.92	4.830	0.0*	5-S2n	0.947	2.189	1.014	2.550	18.114	8.474
260.00	260.00	2611.10	5.005	0.0*	5-S2n	1.058	2.443	1.140	2.713	19.009	8.831
295.00	295.00	2611.24	5.153	0.0*	5-S2n	1.152	2.658	1.252	2.845	19.628	9.114
330.00	330.00	2611.75	5.661	0.0*	5-S2n	1.243	2.864	1.362	2.967	20.195	9.373
365.00	344.93	2612.07	5.975	0.0*	5-S2n	1.281	2.949	1.409	3.081	20.394	9.613
400.00	351.07	2612.20	6.109	0.0*	5-S2n	1.297	2.984	1.429	3.189	20.478	9.835

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2606.09 ft, Outlet Elevation (invert): 2598.13 ft

Culvert Length: 194.16 ft, Culvert Slope: 0.0410

Inlet Throat Elevation: 2606.09 ft, Inlet Crest Elevation: 2609.41 ft

****

Site Data - 2-6'x3' RCBC

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2608.79 ft

Outlet Station: 194.00 ft

Outlet Elevation: 2598.13 ft

Number of Barrels: 2

Culvert Data Summary - 2-6'x3' RCBC

Barrel Shape: Concrete Box

Barrel Span: 6.00 ft

Barrel Rise: 3.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge (90º) Headwall

Inlet Depression: Yes

Table 9c - Downstream Channel Rating Curve (Crossing: Station 73+40.28 (BC-2))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
50.00	2599.59	1.46	5.85	2.74	1.21
85.00	2599.91	1.78	6.68	3.34	1.25
120.00	2600.16	2.03	7.28	3.80	1.27
155.00	2600.36	2.23	7.76	4.18	1.29
190.00	2600.54	2.41	8.17	4.52	1.31
220.47	2600.68	2.55	8.47	4.77	1.32
260.00	2600.84	2.71	8.83	5.08	1.34
295.00	2600.97	2.84	9.11	5.33	1.35
330.00	2601.10	2.97	9.37	5.55	1.36
365.00	2601.21	3.08	9.61	5.77	1.36
400.00	2601.32	3.19	9.84	5.97	1.37

Tailwater Channel Data - Station 73+40.28 (BC-2)

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0300

Channel Manning's n: 0.0350

Channel Invert Elevation: 2598.13 ft

Roadway Data for Crossing: Station 73+40.28 (BC-2)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 2611.90 ft

Roadway Surface: Paved

Roadway Top Width: 24.00 ft

Table 10a - Summary of Culvert Flows at Crossing: Station 69+45.76 (BC-1)

Headwater Elevation (ft)	Total Discharge (cfs)	1-10'x4' RCBC Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2591.79	75.00	75.00	0.00	1
2592.33	107.50	107.50	0.00	1
2592.81	140.00	140.00	0.00	1
2593.27	172.50	172.50	0.00	1
2593.72	205.00	205.00	0.00	1
2594.16	237.50	237.50	0.00	1
2594.54	264.10	264.10	0.00	1
2595.13	302.50	302.50	0.00	1
2595.66	335.00	335.00	0.00	1
2596.24	367.50	367.50	0.00	1
2596.86	400.00	400.00	0.00	1
2600.00	532.19	532.19	0.00	Overtopping

Table 10b - Culvert Summary Table: 1-10'x4' RCBC

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
75.00	75.00	2591.79	1.995	0.0*	1-S2n	0.514	1.204	0.586	0.805	12.809	7.048
107.50	107.50	2592.33	2.535	0.0*	1-S2n	0.643	1.531	0.765	0.981	14.058	7.871
140.00	140.00	2592.81	3.023	0.0*	1-S2n	0.760	1.826	0.936	1.131	14.955	8.520
172.50	172.50	2593.27	3.480	0.0*	1-S2n	0.868	2.098	1.102	1.264	15.650	9.060
205.00	205.00	2593.72	3.925	0.406	1-S2n	0.970	2.354	1.265	1.385	16.211	9.525
237.50	237.50	2594.16	4.375	0.885	5-S2n	1.067	2.597	1.422	1.496	16.698	9.935
264.10	264.10	2594.54	4.755	1.295	5-S2n	1.143	2.788	1.548	1.580	17.066	10.238
302.50	302.50	2595.13	5.337	2.391	5-S2n	1.249	3.052	1.726	1.695	17.531	10.638
335.00	335.00	2595.66	5.869	2.839	5-S2n	1.335	3.266	1.872	1.785	17.897	10.946
367.50	367.50	2596.24	6.447	3.319	5-S2n	1.419	3.474	2.016	1.871	18.228	11.230
400.00	400.00	2596.86	7.074	3.830	5-S2n	1.501	3.676	2.158	1.953	18.535	11.497

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2589.79 ft, Outlet Elevation (invert): 2587.15 ft

Culvert Length: 75.05 ft, Culvert Slope: 0.0352

****

Site Data - 1-10'x4' RCBC

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2589.79 ft

Outlet Station: 75.00 ft

Outlet Elevation: 2587.15 ft

Number of Barrels: 1

Culvert Data Summary - 1-10'x4' RCBC

Barrel Shape: Concrete Box

Barrel Span: 10.00 ft

Barrel Rise: 4.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (90º) Headwall

Inlet Depression: None

Table 10c - Downstream Channel Rating Curve (Crossing: Station 69+45.76 (BC-1))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
75.00	2587.63	0.80	7.05	2.51	1.54
107.50	2587.81	0.98	7.87	3.06	1.59
140.00	2587.96	1.13	8.52	3.53	1.62
172.50	2588.09	1.26	9.06	3.95	1.64
205.00	2588.22	1.39	9.52	4.32	1.66
237.50	2588.33	1.50	9.93	4.67	1.68
264.10	2588.41	1.58	10.24	4.93	1.69
302.50	2588.52	1.69	10.64	5.29	1.71
335.00	2588.62	1.79	10.95	5.57	1.72
367.50	2588.70	1.87	11.23	5.84	1.73
400.00	2588.78	1.95	11.50	6.09	1.74

Tailwater Channel Data - Station 69+45.76 (BC-1)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 10.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0500

Channel Manning's n: 0.0350

Channel Invert Elevation: 2586.83 ft

Roadway Data for Crossing: Station 69+45.76 (BC-1)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 2600.00 ft

Roadway Surface: Paved

Roadway Top Width: 33.00 ft

Table 11a - Summary of Culvert Flows at Crossing: Station 80+50.86 (P1)

Headwater Elevation (ft)	Total Discharge (cfs)	3-60inx38in HERCP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2639.07	112.04	112.04	0.00	1
2639.62	159.90	159.90	0.00	1
2640.18	207.77	207.77	0.00	1
2640.79	255.64	255.64	0.00	1
2641.49	303.50	303.50	0.00	1
2642.31	351.37	351.37	0.00	1
2642.66	369.92	369.79	0.10	4
2643.72	447.10	420.72	26.33	6
2644.13	494.97	438.36	56.51	5
2644.43	542.84	451.29	91.45	4
2644.70	590.71	461.97	128.68	4
2642.51	362.12	362.12	0.00	Overtopping

Table 11b - Culvert Summary Table: 3-60inx38in HERCP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
112.04	112.04	2639.07	2.089	0.0*	1-S2n	0.714	1.500	0.768	1.112	14.465	4.487
159.90	159.90	2639.62	2.642	0.0*	1-S2n	0.852	1.815	0.936	1.358	15.781	5.027
207.77	207.77	2640.18	3.197	0.0*	5-S2n	0.973	2.095	1.089	1.569	16.767	5.454
255.64	255.64	2640.79	3.808	0.0*	5-S2n	1.084	2.338	1.234	1.758	17.534	5.810
303.50	303.50	2641.49	4.510	0.0*	5-S2n	1.187	2.553	1.374	1.929	18.148	6.117
351.37	351.37	2642.31	5.329	0.439	5-S2n	1.284	2.727	1.507	2.087	18.723	6.390
369.92	369.79	2642.66	5.677	0.752	5-S2n	1.321	2.784	1.561	2.145	19.014	6.487
447.10	420.72	2643.72	6.743	1.671	5-S2n	1.419	2.898	1.699	2.372	19.501	6.857
494.97	438.36	2644.13	7.147	2.012	5-S2n	1.452	2.930	1.746	2.503	19.673	7.061
542.84	451.29	2644.43	7.454	2.266	5-S2n	1.478	2.948	1.779	2.626	19.812	7.251
590.71	461.97	2644.70	7.715	2.485	5-S2n	1.501	2.967	1.805	2.744	19.931	7.428

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2636.98 ft, Outlet Elevation (invert): 2631.83 ft

Culvert Length: 120.11 ft, Culvert Slope: 0.0429

****

Site Data - 3-60inx38in HERCP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2636.98 ft

Outlet Station: 120.00 ft

Outlet Elevation: 2631.83 ft

Number of Barrels: 3

Culvert Data Summary - 3-60inx38in HERCP

Barrel Shape: Elliptical

Barrel Span: 60.00 in

Barrel Rise: 38.00 in

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 11c - Downstream Channel Rating Curve (Crossing: Station 80+50.86 (P1))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
112.04	2632.94	1.11	4.49	0.87	0.82
159.90	2633.19	1.36	5.03	1.06	0.84
207.77	2633.40	1.57	5.45	1.22	0.86
255.64	2633.59	1.76	5.81	1.37	0.87
303.50	2633.76	1.93	6.12	1.50	0.88
351.37	2633.92	2.09	6.39	1.63	0.89
369.92	2633.98	2.15	6.49	1.67	0.90
447.10	2634.20	2.37	6.86	1.85	0.91
494.97	2634.33	2.50	7.06	1.95	0.92
542.84	2634.46	2.63	7.25	2.05	0.92
590.71	2634.57	2.74	7.43	2.14	0.93

Tailwater Channel Data - Station 80+50.86 (P1)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 18.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0125

Channel Manning's n: 0.0350

Channel Invert Elevation: 2631.83 ft

Roadway Data for Crossing: Station 80+50.86 (P1)

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2644.28
1	25.00	2642.93
2	30.00	2642.51

Roadway Surface: Paved

Roadway Top Width: 60.00 ft

Table 12a - Summary of Culvert Flows at Crossing: Station 86+53.54 (PE-1)

Headwater Elevation (ft)	Total Discharge (cfs)	1-24inRCP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2652.56	7.26	7.26	0.00	1
2653.30	14.04	14.04	0.00	1
2654.23	20.81	20.81	0.00	1
2655.06	27.58	25.32	2.25	6
2655.30	34.36	26.50	7.80	10
2655.47	41.13	27.24	13.81	8
2655.59	47.91	27.81	20.02	7
2655.62	49.40	27.91	21.41	5
2655.79	61.45	28.65	32.74	6
2655.85	68.23	28.94	39.16	4
2655.91	75.00	29.19	45.77	4
2654.67	23.34	23.34	0.00	Overtopping

Table 12b - Culvert Summary Table: 1-24inRCP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
7.26	7.26	2652.56	1.386	0.0*	1-S2n	0.000	0.000	0.439	0.439	9.846	2.876
14.04	14.04	2653.30	2.130	1.061	5-S2n	0.000	0.000	0.621	0.621	11.000	3.482
20.81	20.81	2654.23	3.057	2.972	7-M2c	0.000	0.000	0.760	0.760	11.983	3.888
27.58	25.32	2655.06	3.888	3.515	7-M2c	0.000	0.000	0.875	0.875	12.600	4.202
34.36	26.50	2655.30	4.134	3.659	7-M2c	0.000	0.000	0.975	0.975	12.759	4.459
41.13	27.24	2655.47	4.296	3.753	7-M2c	0.000	0.000	1.065	1.065	12.862	4.679
47.91	27.81	2655.59	4.422	3.826	7-M2c	0.000	0.000	1.145	1.145	12.941	4.873
49.40	27.91	2655.62	4.446	3.840	7-M2c	0.000	0.000	1.163	1.163	12.957	4.913
61.45	28.65	2655.79	4.616	3.939	7-M2c	0.000	0.000	1.289	1.289	13.066	5.205
68.23	28.94	2655.85	4.684	3.978	7-M2c	0.000	0.000	1.354	1.354	13.109	5.349
75.00	29.19	2655.91	4.743	4.012	7-M2c	0.000	0.000	1.416	1.416	13.148	5.483

* Full Flow Headwater elevation is below inlet invert.

****

Single Broken-back Culvert

Inlet Elevation (invert): 2651.17 ft,

Break Elevation (invert): 2650.81 ft,

Culvert Length: 94.01 ft,

Upper Culvert Section Slope: 0.0050

Steep Culvert Section Slope: 0.0518

****

Site Data - 1-24inRCP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2651.17 ft

Break Station: 72.00 ft

Break Elevation: 2650.81 ft

Outlet Station: 94.00 ft

Outlet Elevation: 2649.67 ft

Number of Barrels: 1

Culvert Data Summary - 1-24inRCP

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Upper Section Material: Concrete

Lower Section Material:

Embedment: 0.00 in

Upper Section Manning's n: 0.0120

Lower Section Manning's n: 0.0120

Culvert Type: Single Broken-back

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 12c - Downstream Channel Rating Curve (Crossing: Station 86+53.54 (PE-1))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
7.26	2650.11	0.44	2.88	0.55	0.87
14.04	2650.29	0.62	3.48	0.78	0.92
20.81	2650.43	0.76	3.89	0.95	0.94
27.58	2650.55	0.88	4.20	1.09	0.96
34.36	2650.65	0.98	4.46	1.22	0.97
41.13	2650.73	1.06	4.68	1.33	0.98
47.91	2650.82	1.15	4.87	1.43	0.99
49.40	2650.83	1.16	4.91	1.45	1.00
61.45	2650.96	1.29	5.20	1.61	1.01
68.23	2651.02	1.35	5.35	1.69	1.02
75.00	2651.09	1.42	5.48	1.77	1.02

Tailwater Channel Data - Station 86+53.54 (PE-1)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0350

Channel Invert Elevation: 2649.67 ft

Roadway Data for Crossing: Station 86+53.54 (PE-1)

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2655.91
1	25.00	2655.76
2	50.00	2654.67

Roadway Surface: Paved

Roadway Top Width: 33.00 ft

Table 13a - Summary of Culvert Flows at Crossing: Station 115+61 (P5)

Headwater Elevation (ft)	Total Discharge (cfs)	1-30"x19" HERCP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2708.40	1.00	1.00	0.00	1
2708.61	2.40	2.40	0.00	1
2708.78	3.80	3.80	0.00	1
2708.85	4.40	4.40	0.00	1
2709.08	6.60	6.60	0.00	1
2709.22	8.00	8.00	0.00	1
2709.36	9.40	9.40	0.00	1
2709.49	10.80	10.80	0.00	1
2709.63	12.20	12.20	0.00	1
2709.78	13.60	13.60	0.00	1
2709.94	15.00	15.00	0.00	1
2710.99	22.45	22.45	0.00	Overtopping

Table 13b - Culvert Summary Table: 1-30"x19" HERCP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.00	1.00	2708.40	0.368	0.0*	1-S2n	0.168	0.276	0.168	0.204	5.384	1.284
2.40	2.40	2708.61	0.584	0.0*	1-S2n	0.252	0.434	0.264	0.330	6.279	1.682
3.80	3.80	2708.78	0.750	0.0*	1-S2n	0.314	0.550	0.331	0.422	7.272	1.924
4.40	4.40	2708.85	0.817	0.0*	1-S2n	0.337	0.599	0.357	0.455	7.542	2.006
6.60	6.60	2709.08	1.054	0.0*	1-S2n	0.413	0.749	0.446	0.560	8.359	2.248
8.00	8.00	2709.22	1.194	0.0*	1-S2n	0.455	0.830	0.495	0.617	8.796	2.371
9.40	9.40	2709.36	1.329	0.0*	1-S2n	0.494	0.905	0.544	0.669	9.104	2.477
10.80	10.80	2709.49	1.465	0.0*	1-S2n	0.531	0.973	0.591	0.716	9.398	2.572
12.20	12.20	2709.63	1.604	0.140	5-S2n	0.566	1.042	0.638	0.760	9.619	2.658
13.60	13.60	2709.78	1.751	0.310	5-S2n	0.600	1.103	0.684	0.801	9.816	2.736
15.00	15.00	2709.94	1.907	0.492	5-S2n	0.632	1.165	0.723	0.840	10.101	2.809

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2708.03 ft, Outlet Elevation (invert): 2706.68 ft

Culvert Length: 45.02 ft, Culvert Slope: 0.0300

****

Site Data - 1-30"x19" HERCP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2708.03 ft

Outlet Station: 45.00 ft

Outlet Elevation: 2706.68 ft

Number of Barrels: 1

Culvert Data Summary - 1-30"x19" HERCP

Barrel Shape: Elliptical

Barrel Span: 30.00 in

Barrel Rise: 19.00 in

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 13c - Downstream Channel Rating Curve (Crossing: Station 115+61 (P5))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
1.00	2706.88	0.20	1.28	0.13	0.55
2.40	2707.01	0.33	1.68	0.21	0.59
3.80	2707.10	0.42	1.92	0.26	0.61
4.40	2707.13	0.45	2.01	0.28	0.62
6.60	2707.24	0.56	2.25	0.35	0.63
8.00	2707.30	0.62	2.37	0.39	0.64
9.40	2707.35	0.67	2.48	0.42	0.65
10.80	2707.40	0.72	2.57	0.45	0.65
12.20	2707.44	0.76	2.66	0.47	0.66
13.60	2707.48	0.80	2.74	0.50	0.66
15.00	2707.52	0.84	2.81	0.52	0.67

Tailwater Channel Data - Station 115+61 (P5)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 3.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2706.68 ft

Roadway Data for Crossing: Station 115+61 (P5)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 2710.99 ft

Roadway Surface: Paved

Roadway Top Width: 25.00 ft

Table 14a - Summary of Culvert Flows at Crossing: Station 134+72.35 (P14)

Headwater Elevation (ft)	Total Discharge (cfs)	1-53"x34" HERCP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2759.70	20.00	20.00	0.00	1
2760.38	35.50	35.50	0.00	1
2761.02	51.00	51.00	0.00	1
2761.74	66.50	66.50	0.00	1
2762.33	80.68	77.47	3.17	6
2762.69	97.50	83.47	13.96	8
2762.89	113.00	86.55	26.34	6
2763.04	128.50	88.77	39.61	5
2763.16	144.00	90.56	53.27	4
2763.27	159.50	92.16	67.27	4
2763.37	175.00	93.62	81.34	4
2762.00	71.55	71.55	0.00	Overtopping

Table 14b - Culvert Summary Table: 1-53"x34" HERCP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
20.00	20.00	2759.70	1.550	0.533	1-S2n	0.711	1.119	0.794	0.739	8.076	3.404
35.50	35.50	2760.38	2.226	1.161	1-S2n	0.953	1.523	1.111	0.991	9.210	3.999
51.00	51.00	2761.02	2.867	1.838	5-S2n	1.156	1.852	1.382	1.186	10.049	4.413
66.50	66.50	2761.74	3.585	2.942	5-S2n	1.340	2.132	1.620	1.350	10.783	4.739
80.68	77.47	2762.33	4.181	3.437	5-S2n	1.461	2.301	1.780	1.481	11.259	4.989
97.50	83.47	2762.69	4.543	3.729	5-S2n	1.527	2.382	1.863	1.620	11.520	5.245
113.00	86.55	2762.89	4.741	3.884	5-S2n	1.561	2.420	1.905	1.736	11.659	5.451
128.50	88.77	2763.04	4.888	3.998	5-S2n	1.586	2.446	1.934	1.843	11.756	5.637
144.00	90.56	2763.16	5.010	4.092	5-S2n	1.605	2.466	1.958	1.942	11.842	5.807
159.50	92.16	2763.27	5.120	4.176	5-S2n	1.623	2.483	1.978	2.035	11.914	5.963
175.00	93.62	2763.37	5.223	4.254	5-S2n	1.639	2.497	1.997	2.123	11.982	6.107

****

Straight Culvert

Inlet Elevation (invert): 2758.15 ft, Outlet Elevation (invert): 2757.46 ft

Culvert Length: 46.01 ft, Culvert Slope: 0.0150

****

Site Data - 1-53"x34" HERCP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2758.15 ft

Outlet Station: 46.00 ft

Outlet Elevation: 2757.46 ft

Number of Barrels: 1

Culvert Data Summary - 1-53"x34" HERCP

Barrel Shape: Elliptical

Barrel Span: 53.00 in

Barrel Rise: 34.00 in

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 14c - Downstream Channel Rating Curve (Crossing: Station 134+72.35 (P14))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
20.00	2758.20	0.74	3.40	0.69	0.82
35.50	2758.45	0.99	4.00	0.93	0.85
51.00	2758.65	1.19	4.41	1.11	0.87
66.50	2758.81	1.35	4.74	1.26	0.89
80.68	2758.94	1.48	4.99	1.39	0.90
97.50	2759.08	1.62	5.24	1.52	0.91
113.00	2759.20	1.74	5.45	1.62	0.92
128.50	2759.30	1.84	5.64	1.72	0.92
144.00	2759.40	1.94	5.81	1.82	0.93
159.50	2759.50	2.04	5.96	1.91	0.94
175.00	2759.58	2.12	6.11	1.99	0.94

Tailwater Channel Data - Station 134+72.35 (P14)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0150

Channel Manning's n: 0.0350

Channel Invert Elevation: 2757.46 ft

Roadway Data for Crossing: Station 134+72.35 (P14)

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2762.53
1	7.00	2762.65
2	13.00	2763.05
3	18.00	2762.85
4	31.00	2762.01
5	35.00	2762.00

Roadway Surface: Paved

Roadway Top Width: 22.00 ft

Table 15a - Summary of Culvert Flows at Crossing: Station 150+55 (P15)

Headwater Elevation (ft)	Total Discharge (cfs)	2-30inRCP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2752.48	20.00	20.00	0.00	1
2752.83	28.00	28.00	0.00	1
2753.14	36.00	36.00	0.00	1
2753.41	43.00	43.00	0.00	1
2753.78	52.00	52.00	0.00	1
2754.14	60.00	60.00	0.00	1
2754.55	68.00	68.00	0.00	1
2755.01	76.00	76.00	0.00	1
2755.53	84.00	84.00	0.00	1
2755.77	92.00	87.40	4.44	11
2755.83	100.00	88.27	11.56	5
2755.70	86.40	86.40	0.00	Overtopping

Table 15b - Culvert Summary Table: 2-30inRCP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
20.00	20.00	2752.48	1.484	0.0*	1-S2n	0.628	1.054	0.665	0.634	9.216	3.692
28.00	28.00	2752.83	1.832	0.0*	1-S2n	0.746	1.259	0.805	0.760	9.904	4.079
36.00	36.00	2753.14	2.144	0.0*	1-S2n	0.851	1.434	0.927	0.867	10.506	4.386
43.00	43.00	2753.41	2.412	0.306	1-S2n	0.936	1.573	1.023	0.951	10.993	4.613
52.00	52.00	2753.78	2.776	0.759	5-S2n	1.039	1.733	1.148	1.048	11.423	4.867
60.00	60.00	2754.14	3.138	1.197	5-S2n	1.127	1.865	1.253	1.127	11.793	5.064
68.00	68.00	2754.55	3.546	1.923	5-S2n	1.211	1.980	1.354	1.201	12.136	5.242
76.00	76.00	2755.01	4.010	2.369	5-S2n	1.295	2.082	1.451	1.269	12.464	5.405
84.00	84.00	2755.53	4.531	2.851	5-S2n	1.377	2.170	1.547	1.334	12.776	5.554
92.00	87.40	2755.77	4.771	3.067	5-S2n	1.412	2.202	1.586	1.395	12.905	5.693
100.00	88.27	2755.83	4.834	3.123	5-S2n	1.421	2.210	1.596	1.454	12.946	5.822

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2751.00 ft, Outlet Elevation (invert): 2749.10 ft

Culvert Length: 80.02 ft, Culvert Slope: 0.0238

****

Site Data - 2-30inRCP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2751.00 ft

Outlet Station: 80.00 ft

Outlet Elevation: 2749.10 ft

Number of Barrels: 2

Culvert Data Summary - 2-30inRCP

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 15c - Downstream Channel Rating Curve (Crossing: Station 150+55 (P15))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
20.00	2749.73	0.63	3.69	0.79	0.93
28.00	2749.86	0.76	4.08	0.95	0.95
36.00	2749.97	0.87	4.39	1.08	0.97
43.00	2750.05	0.95	4.61	1.19	0.98
52.00	2750.15	1.05	4.87	1.31	1.00
60.00	2750.23	1.13	5.06	1.41	1.00
68.00	2750.30	1.20	5.24	1.50	1.01
76.00	2750.37	1.27	5.40	1.58	1.02
84.00	2750.43	1.33	5.55	1.66	1.03
92.00	2750.50	1.40	5.69	1.74	1.03
100.00	2750.55	1.45	5.82	1.81	1.04

Tailwater Channel Data - Station 150+55 (P15)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 6.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0350

Channel Invert Elevation: 2749.10 ft

Roadway Data for Crossing: Station 150+55 (P15)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 80.00 ft

Crest Elevation: 2755.70 ft

Roadway Surface: Paved

Roadway Top Width: 50.00 ft

Table 16a - Summary of Culvert Flows at Crossing: Station 126+28.24 (P6)

Headwater Elevation (ft)	Total Discharge (cfs)	1-23inx14inHERCP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2736.04	10.00	10.00	0.00	1
2736.51	16.40	14.31	2.03	18
2736.67	23.00	14.69	8.22	8
2736.76	29.50	15.47	14.00	6
2736.84	36.00	15.45	20.45	5
2736.91	42.50	15.44	26.94	4
2736.97	49.00	15.53	33.49	4
2737.02	55.50	15.54	39.86	3
2737.07	62.00	15.66	46.28	3
2737.12	68.50	15.78	52.70	3
2737.16	75.00	15.88	59.11	3
2736.29	13.73	13.73	0.00	Overtopping

Table 16b - Culvert Summary Table: 1-23inx14inHERCP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
10.00	10.00	2736.04	3.102	2.048	7-M2c	1.167	1.010	1.010	0.710	6.138	1.975
16.40	14.31	2736.51	3.233	3.572	7-M2c	1.167	1.108	1.108	0.925	8.203	2.282
23.00	14.69	2736.67	3.365	3.729	7-M2t	1.167	1.077	1.102	1.102	8.443	2.511
29.50	15.47	2736.76	3.664	4.149	4-FFf	1.167	1.078	1.167	1.252	8.698	2.691
36.00	15.45	2736.84	3.655	4.271	4-FFf	1.167	1.078	1.167	1.384	8.686	2.842
42.50	15.44	2736.91	3.651	4.387	4-FFf	1.167	1.078	1.167	1.503	8.681	2.973
49.00	15.53	2736.97	3.687	4.533	4-FFf	1.167	1.157	1.167	1.612	8.731	3.089
55.50	15.54	2737.02	3.692	4.640	4-FFf	1.167	1.123	1.167	1.714	8.738	3.194
62.00	15.66	2737.07	3.740	4.786	4-FFf	1.167	1.133	1.167	1.808	8.805	3.289
68.50	15.78	2737.12	3.786	4.924	4-FFf	1.167	1.131	1.167	1.897	8.869	3.377
75.00	15.88	2737.16	3.828	5.053	4-FFf	1.167	1.124	1.167	1.981	8.928	3.459

****

Straight Culvert

Inlet Elevation (invert): 2732.94 ft, Outlet Elevation (invert): 2732.55 ft

Culvert Length: 79.00 ft, Culvert Slope: 0.0049

Inlet Throat Elevation: 2732.94 ft, Inlet Crest Elevation: 2735.66 ft

****

Site Data - 1-23inx14inHERCP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2735.44 ft

Outlet Station: 79.00 ft

Outlet Elevation: 2732.55 ft

Number of Barrels: 1

Culvert Data Summary - 1-23inx14inHERCP

Barrel Shape: Elliptical

Barrel Span: 23.00 in

Barrel Rise: 14.00 in

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: Yes

Table 16c - Downstream Channel Rating Curve (Crossing: Station 126+28.24 (P6))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
10.00	2733.26	0.71	1.97	0.22	0.47
16.40	2733.47	0.92	2.28	0.29	0.49
23.00	2733.65	1.10	2.51	0.34	0.50
29.50	2733.80	1.25	2.69	0.39	0.51
36.00	2733.93	1.38	2.84	0.43	0.51
42.50	2734.05	1.50	2.97	0.47	0.52
49.00	2734.16	1.61	3.09	0.50	0.52
55.50	2734.26	1.71	3.19	0.53	0.53
62.00	2734.36	1.81	3.29	0.56	0.53
68.50	2734.45	1.90	3.38	0.59	0.53
75.00	2734.53	1.98	3.46	0.62	0.54

Tailwater Channel Data - Station 126+28.24 (P6)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0050

Channel Manning's n: 0.0350

Channel Invert Elevation: 2732.55 ft

Roadway Data for Crossing: Station 126+28.24 (P6)

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2736.86
1	20.00	2736.53
2	40.00	2736.29

Roadway Surface: Paved

Roadway Top Width: 55.00 ft

Table 17a - Summary of Culvert Flows at Crossing: Station 9+60.28 (P7)

Headwater Elevation (ft)	Total Discharge (cfs)	1-18inRCP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2732.73	2.00	2.00	0.00	1
2733.09	3.80	3.80	0.00	1
2733.40	5.60	5.60	0.00	1
2733.76	7.40	7.40	0.00	1
2733.87	8.10	8.10	0.00	1
2734.53	11.00	11.00	0.00	1
2735.07	12.80	12.80	0.00	1
2735.71	14.60	14.60	0.00	1
2736.03	16.40	15.43	0.92	17
2736.12	18.20	15.66	2.49	9
2736.18	20.00	15.82	4.11	7
2735.83	14.92	14.92	0.00	Overtopping

Table 17b - Culvert Summary Table: 1-18inRCP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
2.00	2.00	2732.73	0.735	0.103	1-S2n	0.496	0.530	0.496	0.353	3.793	1.663
3.80	3.80	2733.09	1.095	0.658	1-S2n	0.706	0.745	0.706	0.486	4.496	1.982
5.60	5.60	2733.40	1.396	1.014	1-S2n	0.896	0.909	0.896	0.586	4.928	2.199
7.40	7.40	2733.76	1.708	1.761	7-M2c	1.103	1.050	1.050	0.669	5.598	2.367
8.10	8.10	2733.87	1.843	1.866	7-M2c	1.500	1.099	1.099	0.698	5.840	2.423
11.00	11.00	2734.53	2.529	2.496	7-M2c	1.500	1.269	1.269	0.804	6.897	2.624
12.80	12.80	2735.07	3.073	3.035	7-M2c	1.500	1.344	1.344	0.861	7.666	2.729
14.60	14.60	2735.71	3.706	3.616	7-M2c	1.500	1.394	1.394	0.914	8.527	2.823
16.40	15.43	2736.03	4.025	3.905	7-M2c	1.500	1.412	1.412	0.963	8.942	2.909
18.20	15.66	2736.12	4.120	3.990	7-M2c	1.500	1.421	1.421	1.009	9.045	2.988
20.00	15.82	2736.18	4.184	4.049	7-M2c	1.500	1.425	1.425	1.052	9.122	3.060

****

Straight Culvert

Inlet Elevation (invert): 2732.00 ft, Outlet Elevation (invert): 2731.75 ft

Culvert Length: 50.00 ft, Culvert Slope: 0.0050

****

Site Data - 1-18inRCP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2732.00 ft

Outlet Station: 50.00 ft

Outlet Elevation: 2731.75 ft

Number of Barrels: 1

Culvert Data Summary - 1-18inRCP

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 17c - Downstream Channel Rating Curve (Crossing: Station 9+60.28 (P7))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
2.00	2732.10	0.35	1.66	0.22	0.59
3.80	2732.24	0.49	1.98	0.30	0.61
5.60	2732.34	0.59	2.20	0.37	0.63
7.40	2732.42	0.67	2.37	0.42	0.64
8.10	2732.45	0.70	2.42	0.44	0.64
11.00	2732.55	0.80	2.62	0.50	0.66
12.80	2732.61	0.86	2.73	0.54	0.66
14.60	2732.66	0.91	2.82	0.57	0.67
16.40	2732.71	0.96	2.91	0.60	0.67
18.20	2732.76	1.01	2.99	0.63	0.68
20.00	2732.80	1.05	3.06	0.66	0.68

Tailwater Channel Data - Station 9+60.28 (P7)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 2.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 2731.75 ft

Roadway Data for Crossing: Station 9+60.28 (P7)

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2736.29
1	30.00	2736.21
2	50.00	2735.83

Roadway Surface: Paved

Roadway Top Width: 35.00 ft

Table 18a - Summary of Culvert Flows at Crossing: Station 100+61.11 (P2)

Headwater Elevation (ft)	Total Discharge (cfs)	1-36inRCP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2709.36	17.20	17.20	0.00	1
2709.50	25.48	25.48	0.00	1
2709.63	33.76	33.76	0.00	1
2709.67	36.40	36.40	0.00	1
2709.87	50.32	50.32	0.00	1
2709.97	58.60	58.60	0.00	1
2710.07	66.88	66.88	0.00	1
2710.17	75.16	74.95	0.13	5
2710.25	83.44	82.13	1.24	4
2710.40	91.72	83.69	7.88	8
2710.49	100.00	84.41	15.50	6
2710.11	70.10	70.10	0.00	Overtopping

Table 18b - Culvert Summary Table: 1-36inRCP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
17.20	17.20	2709.36	6.358	0.0*	5-S2n	0.000	0.000	1.378	0.409	5.428	6.338
25.48	25.48	2709.50	6.503	0.0*	5-S2n	0.000	0.000	1.030	0.507	11.861	7.146
33.76	33.76	2709.63	6.633	0.0*	5-S2n	0.000	0.000	1.104	0.590	14.299	7.771
36.40	36.40	2709.67	6.672	0.0*	5-S2n	0.000	0.000	1.134	0.614	14.866	7.946
50.32	50.32	2709.87	6.865	0.0*	5-S2n	0.000	0.000	1.293	0.729	17.252	8.727
58.60	58.60	2709.97	6.971	0.0*	5-S2n	0.000	0.000	1.383	0.789	18.415	9.111
66.88	66.88	2710.07	7.072	0.0*	5-S2n	0.000	0.000	1.475	0.844	19.336	9.457
75.16	74.95	2710.17	7.167	0.0*	5-S2n	0.000	0.000	1.564	0.896	20.115	9.771
83.44	82.13	2710.25	7.248	0.0*	5-S2n	0.000	0.000	1.641	0.945	20.763	10.060
91.72	83.69	2710.40	7.395	0.0*	5-S2n	0.000	0.000	1.657	0.991	20.895	10.326
100.00	84.41	2710.49	7.492	0.0*	5-S2n	0.000	0.000	1.665	1.035	20.949	10.572

* Full Flow Headwater elevation is below inlet invert.

****

Single Broken-back Culvert

Inlet Elevation (invert): 2703.00 ft,

Break Elevation (invert): 2688.68 ft,

Culvert Length: 133.88 ft,

Upper Culvert Section Slope: 0.2207

Steep Culvert Section Slope: 0.0200

Inlet Throat Elevation: 2703.00 ft, Inlet Crest Elevation: 2708.87 ft

****

Site Data - 1-36inRCP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2707.00 ft

Break Station: 83.00 ft

Break Elevation: 2688.68 ft

Outlet Station: 133.00 ft

Outlet Elevation: 2687.68 ft

Number of Barrels: 1

Culvert Data Summary - 1-36inRCP

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Upper Section Material: Concrete

Lower Section Material:

Embedment: 0.00 in

Upper Section Manning's n: 0.0120

Lower Section Manning's n: 0.0120

Culvert Type: Single Broken-back

Inlet Configuration: Square Edge with Headwall

Inlet Depression: Yes

Table 18c - Downstream Channel Rating Curve (Crossing: Station 100+61.11 (P2))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
17.20	2688.09	0.41	6.34	2.55	1.95
25.48	2688.19	0.51	7.15	3.17	2.01
33.76	2688.27	0.59	7.77	3.68	2.05
36.40	2688.29	0.61	7.95	3.83	2.06
50.32	2688.41	0.73	8.73	4.55	2.11
58.60	2688.47	0.79	9.11	4.92	2.13
66.88	2688.52	0.84	9.46	5.27	2.15
75.16	2688.58	0.90	9.77	5.59	2.17
83.44	2688.62	0.94	10.06	5.90	2.18
91.72	2688.67	0.99	10.33	6.18	2.20
100.00	2688.71	1.03	10.57	6.46	2.21

Tailwater Channel Data - Station 100+61.11 (P2)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.1000

Channel Manning's n: 0.0350

Channel Invert Elevation: 2687.68 ft

Roadway Data for Crossing: Station 100+61.11 (P2)

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2710.50
1	25.00	2710.26
2	50.00	2710.11

Roadway Surface: Paved

Roadway Top Width: 40.00 ft

Table 19a - Summary of Culvert Flows at Crossing: Station 89+99.49 (PE-2)

Headwater Elevation (ft)	Total Discharge (cfs)	2-24inRCPext Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2659.14	24.40	24.40	0.00	1
2659.51	31.96	31.96	0.00	1
2660.00	39.52	39.52	0.00	1
2660.42	47.08	45.31	1.75	9
2660.66	54.64	47.85	6.73	9
2660.82	62.20	49.50	12.62	8
2660.89	65.90	50.15	15.65	6
2661.05	77.32	51.78	25.43	6
2661.14	84.88	52.56	32.28	5
2661.21	92.44	53.25	39.09	4
2661.28	100.00	53.89	46.05	4
2660.09	41.14	41.14	0.00	Overtopping

Table 19b - Culvert Summary Table: 2-24inRCPext

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
24.40	24.40	2659.14	1.884	2.050	7-M2c	0.000	0.000	0.587	0.597	15.853	5.530
31.96	31.96	2659.51	2.321	2.421	7-M2c	0.000	0.000	10.186	0.689	5.087	5.982
39.52	39.52	2660.00	2.849	2.905	7-M2c	0.000	0.000	10.288	0.770	6.290	6.357
47.08	45.31	2660.42	3.333	3.212	7-M2c	0.000	0.000	10.361	0.842	7.211	6.679
54.64	47.85	2660.66	3.569	3.352	7-M2c	0.000	0.000	10.391	0.909	7.616	6.962
62.20	49.50	2660.82	3.730	3.447	7-M2c	0.000	0.000	10.410	0.970	7.878	7.218
65.90	50.15	2660.89	3.795	3.485	7-M2c	0.000	0.000	10.418	0.999	7.981	7.333
77.32	51.78	2661.05	3.963	3.583	7-M2c	0.000	0.000	10.437	1.082	8.242	7.662
84.88	52.56	2661.14	4.045	3.631	7-M2c	0.000	0.000	10.445	1.133	8.366	7.859
92.44	53.25	2661.21	4.119	3.674	7-M2c	0.000	0.000	10.453	1.182	8.475	8.042
100.00	53.89	2661.28	4.188	3.715	7-M2c	0.000	0.000	10.460	1.228	8.577	8.215

****

Double Broken-back Culvert

Inlet Elevation (invert): 2657.09 ft,

Upper Break Elevation (invert): 2656.66 ft,

Lower Break Elevation (invert): 2653.50 ft,

Culvert Length: 227.58 ft,

Upper Culvert Section Slope: 0.0049

Steep Culvert Section Slope: 0.6320

Runout Culvert Section Slope: 0.0704

****

Site Data - 2-24inRCPext

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2657.09 ft

Upper Break Station: 87.20 ft

Upper Break Elevation: 2656.66 ft

Lower Break Station: 92.20 ft

Lower Break Elevation: 2653.50 ft

Outlet Station: 227.20 ft

Outlet Elevation: 2644.00 ft

Number of Barrels: 2

Culvert Data Summary - 2-24inRCPext

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Upper & Middle Section Material: Concrete

Lower Section Material:

Embedment: 0.00 in

Upper & Middle Section Manning's n: 0.0130

Lower Section Manning's n: 0.0120

Culvert Type: Double Broken-back

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 19c - Downstream Channel Rating Curve (Crossing: Station 89+99.49 (PE-2))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
24.40	2644.60	0.60	5.53	1.86	1.45
31.96	2644.69	0.69	5.98	2.15	1.48
39.52	2644.77	0.77	6.36	2.40	1.50
47.08	2644.84	0.84	6.68	2.63	1.52
54.64	2644.91	0.91	6.96	2.84	1.53
62.20	2644.97	0.97	7.22	3.03	1.55
65.90	2645.00	1.00	7.33	3.12	1.55
77.32	2645.08	1.08	7.66	3.38	1.57
84.88	2645.13	1.13	7.86	3.54	1.58
92.44	2645.18	1.18	8.04	3.69	1.59
100.00	2645.23	1.23	8.21	3.83	1.60

Tailwater Channel Data - Station 89+99.49 (PE-2)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0500

Channel Manning's n: 0.0350

Channel Invert Elevation: 2644.00 ft

Roadway Data for Crossing: Station 89+99.49 (PE-2)

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	2661.82
1	25.00	2661.05
2	50.00	2660.09

Roadway Surface: Paved

Roadway Top Width: 24.00 ft

Table 20a - Summary of Culvert Flows at Crossing: Station 10+49.00 (P16)

Headwater Elevation (ft)	Total Discharge (cfs)	1-24inRCP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
2667.37	20.00	20.00	0.00	1
2667.77	25.50	25.50	0.00	1
2668.24	31.00	31.00	0.00	1
2668.78	36.50	36.50	0.00	1
2669.21	40.30	40.30	0.00	1
2670.16	47.50	47.50	0.00	1
2670.99	53.00	53.00	0.00	1
2671.44	58.50	55.73	2.72	14
2671.52	64.00	56.22	7.72	6
2671.59	69.50	56.59	12.85	5
2671.65	75.00	56.92	18.00	4
2671.35	55.20	55.20	0.00	Overtopping

Table 20b - Culvert Summary Table: 1-24inRCP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
20.00	20.00	2667.37	1.873	0.0*	1-S2n	0.621	1.254	0.621	0.573	13.894	6.593
25.50	25.50	2667.77	2.275	0.0*	5-S2n	0.705	1.429	0.746	0.647	13.927	7.048
31.00	31.00	2668.24	2.737	0.0*	5-S2n	0.782	1.579	0.782	0.713	15.924	7.433
36.50	36.50	2668.78	3.282	0.0*	5-S2n	0.855	1.705	0.917	0.772	15.337	7.767
40.30	40.30	2669.21	3.713	0.0*	5-S2n	0.904	1.773	0.971	0.810	15.750	7.974
47.50	47.50	2670.16	4.658	0.0*	5-S2n	0.993	1.859	1.081	0.876	16.325	8.330
53.00	53.00	2670.99	5.491	0.689	5-S2n	1.060	1.897	1.156	0.923	16.818	8.576
58.50	55.73	2671.44	5.937	1.120	5-S2n	1.093	1.838	1.192	0.968	17.064	8.800
64.00	56.22	2671.52	6.021	1.199	5-S2n	1.099	1.824	1.202	1.009	17.043	9.012
69.50	56.59	2671.59	6.088	1.259	5-S2n	1.103	1.814	1.206	1.049	17.095	9.208
75.00	56.92	2671.65	6.146	1.312	5-S2n	1.107	1.806	1.207	1.087	17.179	9.394

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 2665.50 ft, Outlet Elevation (invert): 2659.88 ft

Culvert Length: 120.13 ft, Culvert Slope: 0.0468

****

Site Data - 1-24inRCP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 2665.50 ft

Outlet Station: 120.00 ft

Outlet Elevation: 2659.88 ft

Number of Barrels: 1

Culvert Data Summary - 1-24inRCP

Barrel Shape: Elliptical

Barrel Span: 38.00 in

Barrel Rise: 24.00 in

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 20c - Downstream Channel Rating Curve (Crossing: Station 10+49.00 (P16))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
20.00	2660.45	0.57	6.59	3.00	1.84
25.50	2660.53	0.65	7.05	3.39	1.87
31.00	2660.59	0.71	7.43	3.73	1.89
36.50	2660.65	0.77	7.77	4.04	1.91
40.30	2660.69	0.81	7.97	4.24	1.92
47.50	2660.76	0.88	8.33	4.59	1.95
53.00	2660.80	0.92	8.58	4.83	1.96
58.50	2660.85	0.97	8.80	5.07	1.97
64.00	2660.89	1.01	9.01	5.28	1.98
69.50	2660.93	1.05	9.21	5.49	1.99
75.00	2660.97	1.09	9.39	5.69	2.00

Tailwater Channel Data - Station 10+49.00 (P16)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 3.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0839

Channel Manning's n: 0.0350

Channel Invert Elevation: 2659.88 ft

Roadway Data for Crossing: Station 10+49.00 (P16)

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	29.00	2671.37
1	41.00	2671.35
2	49.00	2671.35
3	56.50	2671.35
4	67.00	2671.35

Roadway Surface: Paved

Roadway Top Width: 48.00 ft

PIPE 6
TAILWATER COMPARISON

Existing Conditions
Cross Section P-6 (Sta 126+33, 48' RT)
Cut @ Proposed Outlet Headwall Location

Cross Section for Irregular Section - 1_Ex

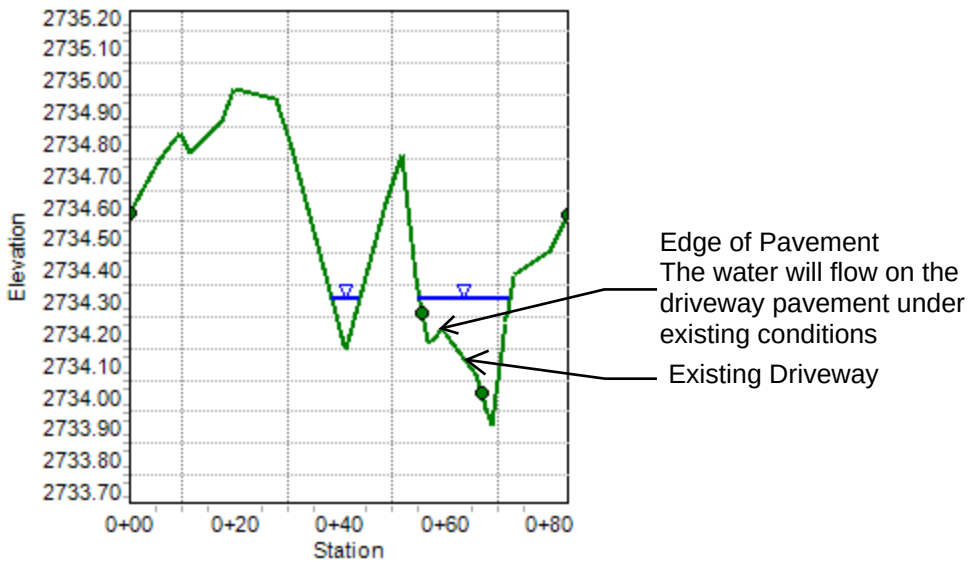
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.06000	ft/ft
Normal Depth	0.40	ft
Discharge	16.50	ft³/s

Cross Section Image



Proposed Conditions
Cross Section P-6 (Sta 126+33, 48' RT)
Cut @ Proposed Outlet Headwall Location

Cross Section for Irregular Section - 1_Pro

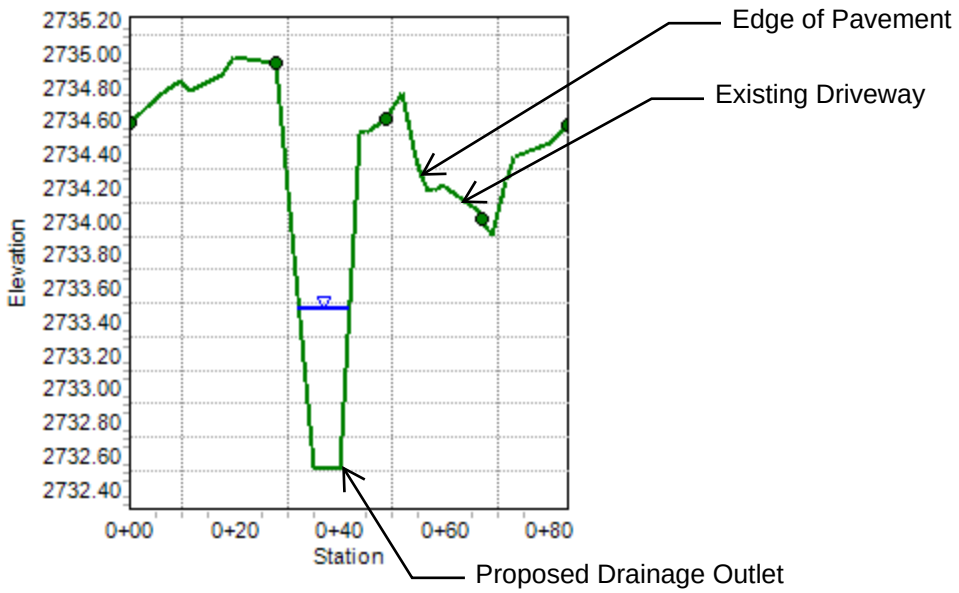
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00500	ft/ft
Normal Depth	0.95	ft
Discharge	16.50	ft³/s

Cross Section Image



Existing Conditions
Cross Section P-6 (Sta 126+34, 64' RT)
Approximate Midpoint of Proposed Outlet Protection

Cross Section for Irregular Section - 2_Ex

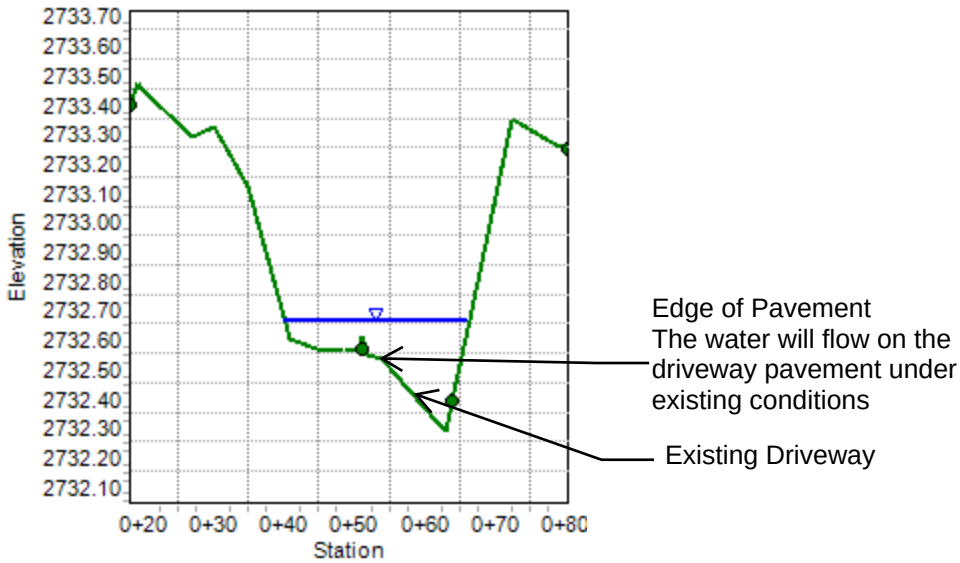
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.05000	ft/ft
Normal Depth	0.37	ft
Discharge	16.50	ft³/s

Cross Section Image



Proposed Conditions
Cross Section P-6 (Sta 126+34, 64' RT)
Approximate Midpoint of Proposed Outlet Protection

Cross Section for Irregular Section - 2_Pro

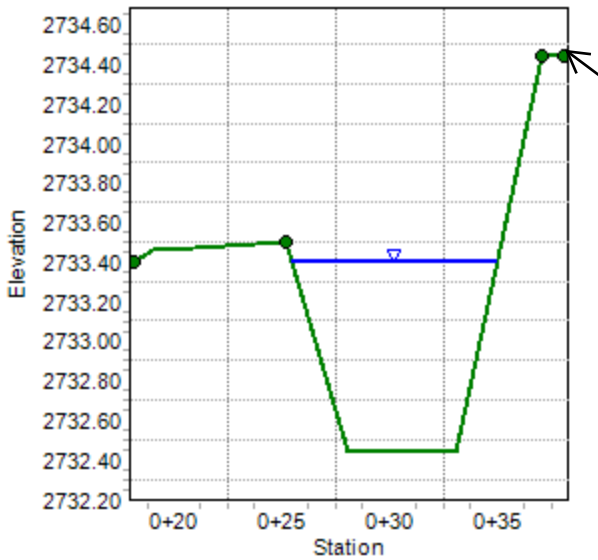
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00500	ft/ft
Normal Depth	0.96	ft
Discharge	16.50	ft³/s

Cross Section Image



A berm is constructed and the water from the culvert can not flow to the driveway under proposed conditions.

Existing driveway is left (south) of the berm.

Existing Conditions
Cross Section P-6 (Sta 126+34.8, 78' RT)
Approximate End of Proposed Outlet Protection

Cross Section for Irregular Section - 3_Ex

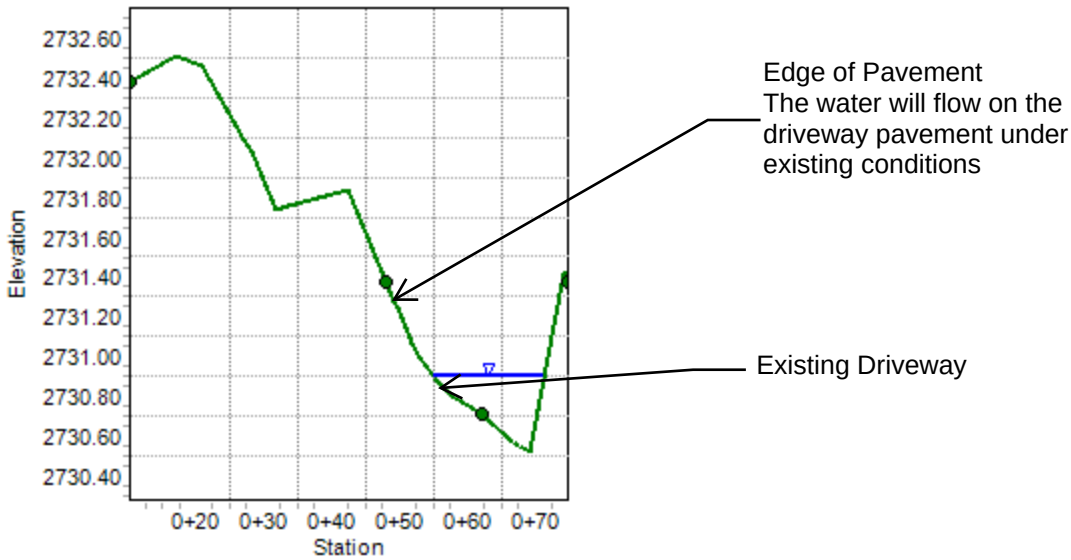
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.06000	ft/ft
Normal Depth	0.38	ft
Discharge	16.50	ft³/s

Cross Section Image



Proposed Conditions
Cross Section P-6 (Sta 126+34.8, 78' RT)
Approximate End of Proposed Outlet Protection

Cross Section for rregular Section - 3_Pro

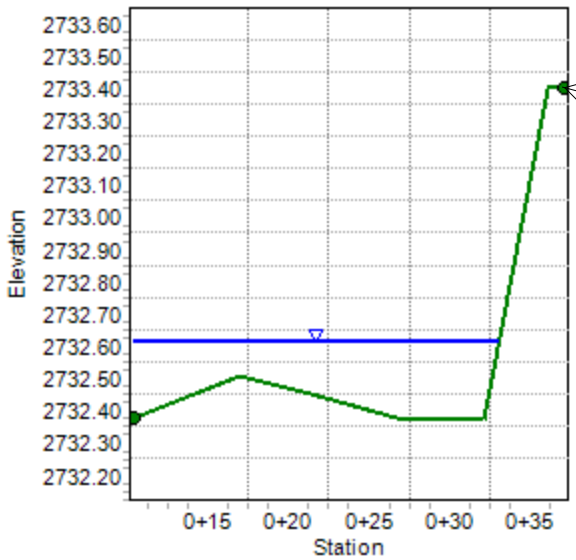
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.06000	ft/ft
Normal Depth	0.24	ft
Discharge	16.50	ft³/s

Cross Section Image



A berm is constructed and the water from the culvert will flow to the lower area of left side and no water can flow to the pavement under proposed conditions

Existing Conditions
Cross Section P-6 (Sta 126+37.8, 107' RT)
Natural Channel

Cross Section for Irregular Section - 4_Ex

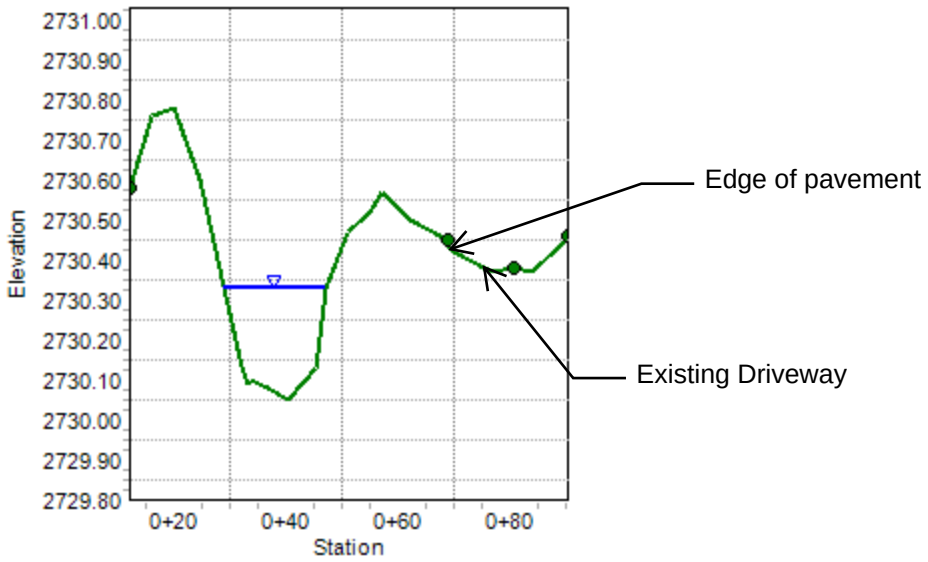
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.06000	ft/ft
Normal Depth	0.28	ft
Discharge	16.50	ft³/s

Cross Section Image



Proposed Conditions
Cross Section P-6 (Sta 126+37.8, 107' RT)
Natural Channel

Cross Section for Irregular Section - 4_Pro

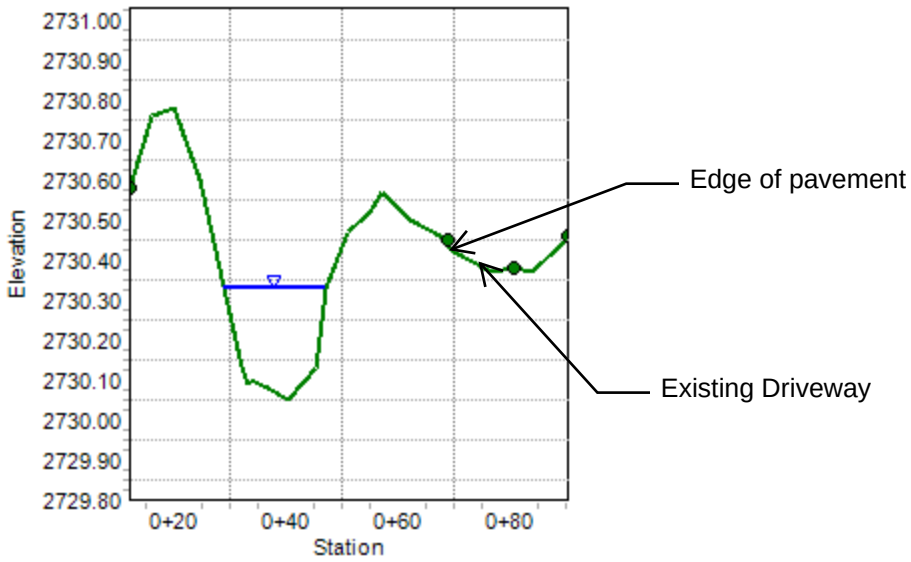
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.06000	ft/ft
Normal Depth	0.28	ft
Discharge	16.50	ft³/s

Cross Section Image



APPENDIX 8

PROPOSED CONDITIONS OUTLET PROTECTION CALCULATIONS

PSOMAS

Project Name: Kolb Road - Sabino Canyon to Sunrise Drive
Project Number: 7PIM160201 Made by: CR Date: 8/9/2018
Reference: Checked By: Date:

Calculation of Culvert Parameters

Equations taken from U.S Department of Transportation Federal Highway Administration, Hydraulic Engineering Circular No. 14, Third Edition: Hydraulic Design of Energy Dissapators for Culverts and Channels

Flare 3:1, Width at outlet is 3D

Class	D_{50}(mm)	D_{50}(in)	Apron Length[1]	Apron Depth
1	125	5	4D	$3.5D_{50}$
2	150	6	4D	$3.3D_{50}$
3	250	10	5D	$2.4D_{50}$
4	350	14	6D	$2.2D_{50}$
5	500	20	7D	$2.0D_{50}$
6	550	22	8D	$2.0D_{50}$
[1]D is the culvert rise				

General Equation:

$D_{50}=0.2D(Q/(g^{1/2}D^{2.5}))^{4/3}(D/TW)$ Eq 10.4

D_{50}=RipRap Size(m, ft)
Q=Design Discharge(m^3/s, ft^3/s)
D=Culvert Diameter(circular)(m, ft)
TW= Tailwater Depth(m, ft)
g=(Acceleration Due to Gravity, ($9.81 m/s^{2,}$ $32.2 ft/s^2$)

Whenever Flow is Supercritical in the culvert, the culvert diameter is adjusted as follows:

$D' = (D+y_n)/2$ Eq 10.5
D'= Adjusted culvert rise(m, ft)
y_n= normal (supercritical) depth in the culvert(m, ft)

PSOMAS

Project Name: Kolb Road - Sabino Canyon to Sunrise Drive
Project Number: 7PIM160201 Made by: CR Date: 8/9/2018
Reference: Pipe Culverts Checked By: Date:

Assumptions for Calculations

Gravity is a constant **g= [ft/s^2]** 32.2
Tailwater is assumed to be **0.4*D**

One value for apron length and depth calculations is used to reduce the number of classes of riprap required.
This value is based on the greatest D_{50} value obtained using Equation 10.4

Using the above assumptions the following values are used in the calculations:

Class of riprap for this project is:	6	6	5	3	5	1
Apron length multiplier for this project is:	8	8	7	5	7	4
Apron Depth multiplier for this project is:	2.0	2.0	2.0	2.4	2.0	3.5

Apron Length calculated using D
Apron Depth calculated using Supercritical D_{50}

Summary of Calculations

Culvert Pipe Reference Number	**BC-1**	**1**	**2**	**3**	**4**	**5**
Detail Location	**69+45**	**80+51**	**100+61**	**110+95**	**114+06**	**115+61**
D= [ft]	4	4	3	2.5	3	2
Q= [ft^3/s]	105.60	113.67	51.90	23.80	54.60	4.4
TW= [ft]	1.6	1.6	1.2	1	1.2	0.8
y_n	1.24	1.41	0.82	0.92	1.3	0.34
D' (from Equation 10.5)	2.62	2.71	1.91	1.71	2.15	1.17
Minimum Supercritical D_{50}= [ft]	1.71	1.80	1.35	0.66	1.23	0.14
MinimumSupercritical D_{50}= [in]	**20.48**	**21.65**	**16.14**	**7.94**	**14.75**	**1.73**

# of Pipes(or Equivalent)	2.5	3	1	3	1	1
Spacing Between Pipes [ft]	1	1	1	1	1	1
Width at Opening [ft]	11.5	14	3	9.5	3	2
Apron Length [ft]	**32**	**32**	**21**	**13**	**21**	**8**
Width at End [ft]	32.83	35.33	17.00	17.83	17.00	7.33
Apron Depth [ft]	**3.41**	**3.61**	**2.69**	**1.59**	**2.46**	**0.51**

PSOMAS

Project Name: Kolb Road - Sabino Canyon to Sunrise Drive
Project Number: 7PIM160201 Made by: CR Date: 8/9/2018
Reference: Pipe Culverts Checked By: Date:

Assumptions for Calculations

Gravity is a constant **g= [ft/s^2]** 32.2
Tailwater is assumed to be **0.4*D**

One value for apron length and depth calculations is used to reduce the number of classes of riprap required.
This value is based on the greatest D_{50} value obtained using Equation 10.4

Using the above assumptions the following values are used in the calculations:

Class of riprap for this project is:	4	1	4	4	1	1
Apron length multiplier for this project is:	6	4	6	6	4	4
Apron Depth multiplier for this project is:	2.2	3.5	2.2	2.2	3.5	3.5

Apron Length calculated using D
Apron Depth calculated using Supercritical D_{50}

Summary of Calculations

Culvert Pipe Reference Number	**6**	**7**	**9**	**10**	**11**	**12**
Detail Location	**126+28**	**123+14**	**123+14**	**127+03**	**129+34**	**131+25**
D= [ft]	1.5	1.5	2.5	2	2	2
Q= [ft^3/s]	16.40	5.40	33.90	21.63	6.95	11.20
TW= [ft]	0.6	0.6	1	0.8	0.8	0.8
y_n	1.17	0.71	0.91	0.91	0.5	0.71
D' (from Equation 10.5)	1.34	1.11	1.71	1.46	1.25	1.36
Minimum Supercritical D_{50}= [ft]	0.93	0.27	1.06	0.90	0.24	0.41
MinimumSupercritical D_{50}= [in]	**11.20**	**3.28**	**12.77**	**10.83**	**2.92**	**4.95**

# of Pipes(or Equivalent)	1	1	1	1	2	2
Spacing Between Pipes [ft]	1	1	1	1	1	1
Width at Opening [ft]	1.5	1.5	2.5	2	5	5
Apron Length [ft]	**9**	**6**	**15**	**12**	**8**	**8**
Width at End [ft]	7.50	5.50	12.50	10.00	10.33	10.33
Apron Depth [ft]	**2.05**	**0.96**	**2.34**	**1.99**	**0.85**	**1.44**

PSOMAS

Project Name: Kolb Road - Sabino Canyon to Sunrise Drive
Project Number: 7PIM160201 Made by: CR Date: 8/9/2018
Reference: Pipe Culverts Checked By: Date:

Assumptions for Calculations

Gravity is a constant **g= [ft/s^2]** 32.2
Tailwater is assumed to be **0.4*D**

One value for apron length and depth calculations is used to reduce the number of classes of riprap required.
This value is based on the greatest D_{50} value obtained using Equation 10.4

Using the above assumptions the following values are used in the calculations:

Class of riprap for this project is:	4	4	6	1	6
Apron length multiplier for this project is:	6	6	8	4	8
Apron Depth multiplier for this project is:	2.2	2.2	2.0	3.5	2.0

Apron Length calculated using D
Apron Depth calculated using Supercritical D_{50}

Summary of Calculations

Culvert Pipe Reference Number	**13**	**PE-3**	**14**	**15**	**16**
Detail Location	**133+58**	**150+08**	**134+72**	**150+55**	**9+62**
D= [ft]	2	3	2	2.5	2.5
Q= [ft^3/s]	19.96	41.18	40.34	9.93	51.9
TW= [ft]	0.8	1.2	0.8	1	1
y_n	0.81	1.27	1.22	1.1	0.97
D' (from Equation 10.5)	1.41	2.14	1.61	1.80	1.74
Minimum Supercritical D_{50}= [ft]	0.85	0.85	1.81	0.19	1.83
MinimumSupercritical D_{50}= [in]	**10.20**	**10.22**	**21.73**	**2.31**	**22.02**

# of Pipes(or Equivalent)	1	3	2	2	1
Spacing Between Pipes [ft]	1	1	1	1	1
Width at Opening [ft]	2	11	5	6	2.5
Apron Length [ft]	**12**	**18**	**16**	**10**	**20**
Width at End [ft]	10.00	23.00	15.67	12.67	15.83
Apron Depth [ft]	**1.87**	**1.87**	**3.62**	**0.67**	**3.67**

PSOMAS

Project Name: Kolb Road - Sabino Canyon to Sunrise Drive
Project Number: 7PIM160201 Made by: CR Date: 8/9/2018
Reference: Scuppers Checked By: Date:

Assumptions for Calculations

Gravity is a constant **g= [ft/s^2]** 32.2
Tailwater is assumed to be **0.4*D**

One value for apron length and depth calculations is used to reduce the number of classes of riprap required.
This value is based on the greatest D_{50} value obtained using Equation 10.4

Using the above assumptions the following values are used in the calculations:

Class of riprap for this project is:	1	1	1	1	1
Apron length multiplier for this project is:	4	4	4	4	4
Apron Depth multiplier for this project is:	3.5	3.5	3.5	3.5	3.5

Apron Length calculated using D
Apron Depth calculated using Supercritical D_{50}

Summary of Calculations

Scupper Reference Number	**SC2**	**SC3**	**SC5**	**SC6**	**SC7**
Detail Location	**55+00**	**56+00**	**63+00**	**64+50**	**87+00**
D= [ft]	1	1	1	1	1
Q= [ft^3/s]	0.96	1.33	1.65	1.37	0.62
TW= [ft]	0.4	0.4	0.4	0.4	0.4
y_n	0.26	0.17	0.34	0.31	0.21
D' (from Equation 10.5)	0.63	0.59	0.67	0.66	0.61
Minimum Supercritical D_{50}= [ft]	0.09	0.15	0.16	0.13	0.05
MinimumSupercritical D_{50}= [in]	**1.04**	**1.77**	**1.97**	**1.59**	**0.61**

# of Pipes(or Equivalent)	1	1	1	1	1
Spacing Between Pipes [ft]	1	1	1	1	1
Width at Opening [ft]	12	12	12	8	4
Apron Length [ft]	**4**	**4**	**4**	**4**	**4**
Width at End [ft]	14.67	14.67	14.67	10.67	6.67
Apron Depth [ft]	**0.30**	**0.52**	**0.58**	**0.46**	**0.18**

PSOMAS

Project Name: Kolb Road - Sabino Canyon to Sunrise Drive
Project Number: 7PIM160201 Made by: CR Date: 8/9/2018
Reference: Scuppers Checked By: Date:

Assumptions for Calculations

Gravity is a constant **g= [ft/s^2]** 32.2
Tailwater is assumed to be **0.4*D**

One value for apron length and depth calculations is used to reduce the number of classes of riprap required.
This value is based on the greatest D_{50} value obtained using Equation 10.4

Using the above assumptions the following values are used in the calculations:

Class of riprap for this project is:	1	1	1	1	1
Apron length multiplier for this project is:	4	4	4	4	4
Apron Depth multiplier for this project is:	3.5	3.5	3.5	3.5	3.5

Apron Length calculated using D
Apron Depth calculated using Supercritical D_{50}

Summary of Calculations

Scupper Reference Number	**SC8**	**SC9**	**SC10**	**SC11**	**SC12**
Detail Location	**88+00**	**89+00**	**108+00**	**115+50**	**116+50**
D= [ft]	1	1	1	1	1
Q= [ft^3/s]	0.88	1.34	0.98	1.05	1.29
TW= [ft]	0.4	0.4	0.4	0.4	0.4
y_n	0.24	0.3	0.2	0.27	0.3
D' (from Equation 10.5)	0.62	0.65	0.60	0.64	0.65
Minimum Supercritical D_{50}= [ft]	0.08	0.13	0.10	0.10	0.12
MinimumSupercritical D_{50}= [in]	**0.95**	**1.56**	**1.14**	**1.16**	**1.48**

# of Pipes(or Equivalent)	1	1	1	1	1
Spacing Between Pipes [ft]	1	1	1	1	1
Width at Opening [ft]	8	12	12	12	8
Apron Length [ft]	**4**	**4**	**4**	**4**	**4**
Width at End [ft]	10.67	14.67	14.67	14.67	10.67
Apron Depth [ft]	**0.28**	**0.45**	**0.33**	**0.34**	**0.43**

PSOMAS

Project Name: Kolb Road - Sabino Canyon to Sunrise Drive
Project Number: 7PIM160201 Made by: CR Date: 8/9/2018
Reference: Scuppers Checked By: Date:

Assumptions for Calculations

Gravity is a constant **g= [ft/s^2]** 32.2
Tailwater is assumed to be **0.4*D**

One value for apron length and depth calculations is used to reduce the number of classes of riprap required.
This value is based on the greatest D_{50} value obtained using Equation 10.4

Using the above assumptions the following values are used in the calculations:

Class of riprap for this project is:	1	1	1	1	1	1
Apron length multiplier for this project is:	4	4	4	4	4	4
Apron Depth multiplier for this project is:	3.5	3.5	3.5	3.5	3.5	3.5

Apron Length calculated using D
Apron Depth calculated using Supercritical D_{50}

Summary of Calculations

Scupper Reference Number	**SC13**	**SC14**	**SC15**	**SC16**	**SC17**	**SC18**
Detail Location	**133+50**	**114+00**	**143+50**	**151+22**	**152+53**	**142+25**
D= [ft]	1	1	1	1	1	1
Q= [ft^3/s]	0.97	0.64	0.84	1.35	1.77	0.58
TW= [ft]	0.4	0.4	0.4	0.4	0.4	0.4
y_n	0.18	0.21	0.24	0.17	0.2	0.12
D' (from Equation 10.5)	0.59	0.61	0.62	0.59	0.60	0.56
Minimum Supercritical D_{50}= [ft]	0.10	0.05	0.07	0.15	0.21	0.05
MinimumSupercritical D_{50}= [in]	**1.15**	**0.64**	**0.89**	**1.81**	**2.51**	**0.62**

# of Pipes(or Equivalent)	1	1	1	1	1	1
Spacing Between Pipes [ft]	1	1	1	1	1	1
Width at Opening [ft]	12	8	8	12	12	8
Apron Length [ft]	**4**	**4**	**4**	**4**	**4**	**4**
Width at End [ft]	14.67	10.67	10.67	14.67	14.67	10.67
Apron Depth [ft]	**0.34**	**0.19**	**0.26**	**0.53**	**0.73**	**0.18**

PSOMAS

Project Name: Kolb Road - Sabino Canyon to Sunrise Drive
Project Number: 7PIM160201 Made by: CR Date: 8/9/2018
Reference: Stormdrain Checked By: Date:
Outlet Protection

Calculation of Culvert Parameters

Equations taken from U.S Department of Transportation Federal Highway Administration, Hydraulic Engineering Circular No. 14, Third Edition: Hydraulic Design of Energy Dissapators for Culverts and Channels

Flare 3:1, Width at outlet is 3D

Class	D_{50}(mm)	D_{50}(in)	Apron Length[1]	Apron Depth
1	125	5	4D	$3.5D_{50}$
2	150	6	4D	$3.3D_{50}$
3	250	10	5D	$2.4D_{50}$
4	350	14	6D	$2.2D_{50}$
5	500	20	7D	$2.0D_{50}$
6	550	22	8D	$2.0D_{50}$
[1]D is the culvert rise				

General Equation:

$D_{50}=0.2D(Q/(g^{1/2}D^{2.5}))^{4/3}(D/TW)$ Eq 10.4

D_{50}=RipRap Size(m, ft)
Q=Design Discharge(m^3/s, ft^3/s)
D=Culvert Diameter(circular)(m, ft)
TW= Tailwater Depth(m, ft)
g=(Acceleration Due to Gravity, ($9.81 m/s^2$, $32.2 ft/s^2$)

Whenever Flow is Supercritical in the culvert, the culvert diameter is adjusted as follows:

$D' = (D+y_n)/2$ Eq 10.5
D'= Adjusted culvert rise(m, ft)
y_n= normal (supercritical) depth in the culvert(m, ft)

PSOMAS

Project Name: Kolb Road - Sabino Canyon to Sunrise Drive
Project Number: 7PIM160201 Made by: CR Date: 8/9/2018
Reference: Stormdrain Outlet Protection Checked By: Date:

Assumptions for Calculations

Gravity is a constant **g= [ft/s^2]** 32.2 32.2
Tailwater is assumed to be **0.4*D**

This value is based on the greatest D_{50} value obtained using Equation 10.4

Using the above assumptions the following values are used in the calculations:

Class of riprap for this project is:	3	3	3	3	5	3	3	3
Apron length multiplier for this project is:	5	5	5	5	7	5	5	5
Apron Depth multiplier for this project is:	2.4	2.4	2.4	2.4	2.0	2.4	2.4	2.4

Summary of Calculations

Stormdrain Reference Number	Pipe1A	Pipe5	Pipe50	Pipe 58B	Pipe 40	Pipe 60	Pipe 59	Pipe42
D= [ft]	2.5	2	2	2	3	1.5	1.5	3
Q= [ft^3/s]	11.57	2.64	5.07	6.92	90.24	0.23	0.44	0.44
TW= [ft]	1	0.8	0.8	0.8	1.2	0.6	0.6	1.2
D_{50}= [in]	**6.00**	**6.00**	**6.00**	**6.00**	**18.49**	**6.00**	**6.00**	**6.00**

# of Pipes	1	1	1	1	1	1	1	1
Spacing Between Pipes [ft]	1	1	1	1	1	1	1	1
Width at Opening [ft]	3.5	3	3	3	4	2.5	2.5	4
Apron Length [ft]	**12.5**	**10**	**10**	**10**	**21**	**7.5**	**7.5**	**15**
Width at End [ft]	11.83	9.67	9.67	9.67	18.00	7.50	7.50	14.00
Apron Depth [ft]	**1.20**	**1.20**	**1.20**	**1.20**	**3.00**	**1.20**	**1.20**	**1.20**

Project Name: Kolb Road - Sunrise Dr to Sabino Canyon
Proj.Number: 7PIM160201 Made by: CLR Date: 8/9/2018
Reference: BC1 Checked By: Date:

Calculation of Culvert Parameters

Equations taken from U.S Department of Transportation Federal Highway Administration, Hydraulic Engineering Circular No. 14, Third Edition: Hydraulic Design of Energy Dissapators for Culverts and Channels

Assumptions for Calculations

Gravity constant **g= [ft/s^2]** = 32.2
H:V = z:1, z= 2

Q (cfs)	Wo (ft)	Vo (ft/sec)	D50 (ft)	Tw (ft)	ye (ft)	Co	hs (ft)	Ls (ft)	La (ft)	Lb (ft)	Wb (ft)	yb (ft)	Vb=Q/(yc*Wb) (ft/sec)
217	12.00	18.11	0.75	1.68	0.96	2.40	0.78	7.76	3.88	11.64	19.76	1.41	3.50
							Min:	36	12.00	48.00	44		

General Equations:

Eq. 10.1

$$\frac{h_s}{y_e} = 0.86\left(\frac{D_{50}}{y_e}\right)^{-0.55}\left(\frac{V_o}{\sqrt{gy_e}}\right) - C_o$$

where:

h_s = dissipator pool depth, m (ft)
y_e = equivalent brink (outlet) depth, m (ft)
D_{50} = median rock size by weight, m (ft)
C_o = tailwater parameter

$TW/y_e < 0.75$ $C_o = 1.4$
$0.75 < TW/y_e < 1.0$ $C_o = 4.0(TW/y_e) - 1.6$
$1.0 < TW/y_e$ $C_o = 2.4$

L_s (Pool length) = $10*h_s$; L_s minimum = $3*W_0$
L_A (Apron Length) = $5*h_s$; L_A minimum = W_0

$Q^2/g = [y_c(W_B + zy_c)]^3/(W_B + 2zy_c)$

$V_c = Q/A_c$

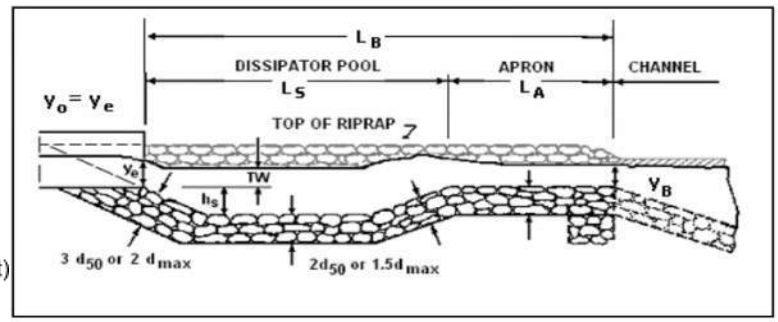


Figure 10.1. Profile of Riprap Basin

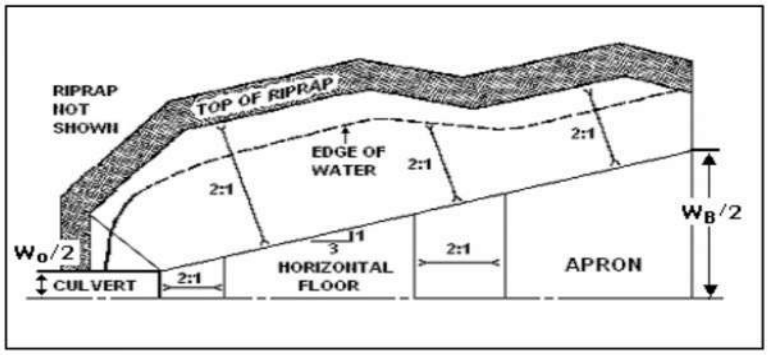


Figure 10.2. Half Plan of Riprap Basin

Project Name: Kolb Road - Sunrise Dr to Sabino Canyon
Proj.Number: 7PIM160201 Made by: CLR Date: 8/9/2018
Reference: P1 Checked By: Date:

Calculation of Culvert Parameters

Equations taken from U.S Department of Transportation Federal Highway Administration, Hydraulic Engineering Circular No. 14, Third Edition: Hydraulic Design of Energy Dissapators for Culverts and Channels

Assumptions for Calculations

Gravity constant **g= [ft/s^2]** = 32.2
H:V = z:1, z= 2

Q (cfs)	Wo (ft)	Vo (ft/sec)	D50 (ft)	Tw (ft)	ye (ft)	Co	hs (ft)	Ls (ft)	La (ft)	Lb (ft)	Wb (ft)	yb (ft)	Vb=Q/(yc*Wb) (ft/sec)
341	19.00	17.78	0.75	3	1.41	2.40	1.14	11.44	5.72	17.16	30.44	3.00	3.73

General Equations:

Eq. 10.1

$$\frac{h_s}{y_e} = 0.86\left(\frac{D_{50}}{y_e}\right)^{-0.55}\left(\frac{V_o}{\sqrt{gy_e}}\right) - C_o$$

where:

h_s = dissipator pool depth, m (ft)
y_e = equivalent brink (outlet) depth, m (ft)
D_{50} = median rock size by weight, m (ft)
C_o = tailwater parameter

$TW/y_e < 0.75$ $C_o = 1.4$
$0.75 < TW/y_e < 1.0$ $C_o = 4.0(TW/y_e) - 1.6$
$1.0 < TW/y_e$ $C_o = 2.4$

L_s (Pool length) = $10*h_s$; L_s minimum = $3*W_0$
L_A (Apron Length) = $5*h_s$; L_A minimum = W_0

$Q^2/g = [y_c(W_B + zy_c)]^3/(W_B + 2zy_c)$

$V_c = Q/A_c$

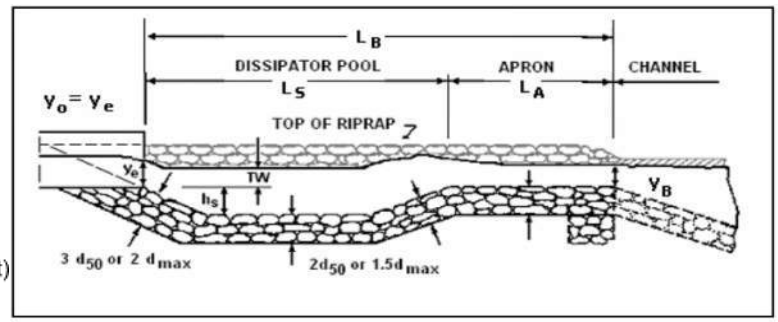


Figure 10.1. Profile of Riprap Basin

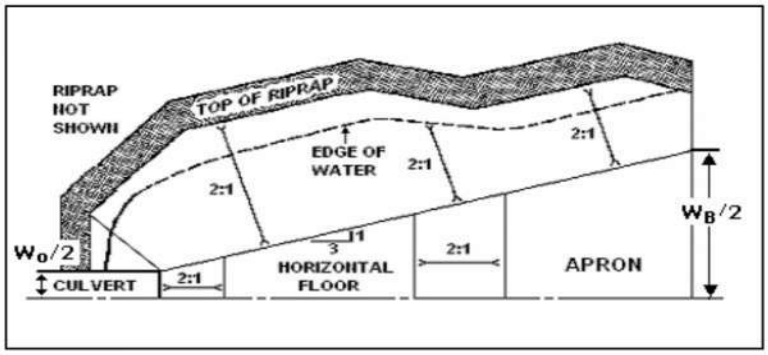


Figure 10.2. Half Plan of Riprap Basin

APPENDIX 9

PROPOSED CONDITIONS ROADSIDE CHANNEL CALCULATIONS

Worksheet for Triangular Channel - 1a

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.03300	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Discharge	1.40	ft^3/s

Results

Normal Depth	0.40	ft
Flow Area	0.47	ft^2
Wetted Perimeter	2.53	ft
Hydraulic Radius	0.19	ft
Top Width	2.39	ft
Critical Depth	0.42	ft
Critical Slope	0.02379	ft/ft
Velocity	2.95	ft/s
Velocity Head	0.14	ft
Specific Energy	0.53	ft
Froude Number	1.17	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.40	ft
Critical Depth	0.42	ft
Channel Slope	0.03300	ft/ft
Critical Slope	0.02379	ft/ft

Worksheet for Triangular Channel - 1b

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.05330	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Discharge	3.70	ft^3/s

Results

Normal Depth	0.61	ft
Flow Area	1.11	ft^2
Wetted Perimeter	3.88	ft
Hydraulic Radius	0.29	ft
Top Width	3.66	ft
Critical Depth	0.62	ft
Critical Slope	0.04701	ft/ft
Velocity	3.32	ft/s
Velocity Head	0.17	ft
Specific Energy	0.78	ft
Froude Number	1.06	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.61	ft
Critical Depth	0.62	ft
Channel Slope	0.05330	ft/ft
Critical Slope	0.04701	ft/ft

Worksheet for Trapezoidal Channel - 2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.05730	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	7.30	ft^3/s

Results

Normal Depth	0.54	ft
Flow Area	1.80	ft^2
Wetted Perimeter	4.91	ft
Hydraulic Radius	0.37	ft
Top Width	4.69	ft
Critical Depth	0.58	ft
Critical Slope	0.04226	ft/ft
Velocity	4.05	ft/s
Velocity Head	0.26	ft
Specific Energy	0.79	ft
Froude Number	1.15	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.54	ft
Critical Depth	0.58	ft
Channel Slope	0.05730	ft/ft
Critical Slope	0.04226	ft/ft

Worksheet for Triangular Channel - 3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.02480	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Discharge	0.50	ft^3/s

Results

Normal Depth	0.27	ft
Flow Area	0.25	ft^2
Wetted Perimeter	1.95	ft
Hydraulic Radius	0.13	ft
Top Width	1.88	ft
Critical Depth	0.26	ft
Critical Slope	0.02718	ft/ft
Velocity	1.99	ft/s
Velocity Head	0.06	ft
Specific Energy	0.33	ft
Froude Number	0.96	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.27	ft
Critical Depth	0.26	ft
Channel Slope	0.02480	ft/ft
Critical Slope	0.02718	ft/ft

Worksheet for Trapezoidal Channel - 4a

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.03579	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	10.00	ft
Discharge	264.10	ft^3/s

Results

Normal Depth	2.11	ft
Flow Area	32.18	ft^2
Wetted Perimeter	21.38	ft
Hydraulic Radius	1.51	ft
Top Width	20.54	ft
Critical Depth	2.29	ft
Critical Slope	0.02625	ft/ft
Velocity	8.21	ft/s
Velocity Head	1.05	ft
Specific Energy	3.15	ft
Froude Number	1.16	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.11	ft
Critical Depth	2.29	ft
Channel Slope	0.03579	ft/ft
Critical Slope	0.02625	ft/ft

Worksheet for Trapezoidal Channel - 4b

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.05070	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	6.00	ft
Discharge	220.50	ft^3/s

Results

Normal Depth	2.04	ft
Flow Area	24.78	ft^2
Wetted Perimeter	18.92	ft
Hydraulic Radius	1.31	ft
Top Width	18.26	ft
Critical Depth	2.38	ft
Critical Slope	0.02684	ft/ft
Velocity	8.90	ft/s
Velocity Head	1.23	ft
Specific Energy	3.27	ft
Froude Number	1.35	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.04	ft
Critical Depth	2.38	ft
Channel Slope	0.05070	ft/ft
Critical Slope	0.02684	ft/ft

Worksheet for Trapezoidal Channel - 4c

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.04970	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	195.00	ft^3/s

Results

Normal Depth	2.20	ft
Flow Area	23.73	ft^2
Wetted Perimeter	20.13	ft
Hydraulic Radius	1.18	ft
Top Width	19.59	ft
Critical Depth	2.48	ft
Critical Slope	0.02768	ft/ft
Velocity	8.22	ft/s
Velocity Head	1.05	ft
Specific Energy	3.25	ft
Froude Number	1.32	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.20	ft
Critical Depth	2.48	ft
Channel Slope	0.04970	ft/ft
Critical Slope	0.02768	ft/ft

Worksheet for Triangular Channel - 5

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.05090	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Discharge	8.40	ft^3/s

Results

Normal Depth	0.79	ft
Flow Area	2.16	ft^2
Wetted Perimeter	5.72	ft
Hydraulic Radius	0.38	ft
Top Width	5.50	ft
Critical Depth	0.81	ft
Critical Slope	0.04199	ft/ft
Velocity	3.89	ft/s
Velocity Head	0.24	ft
Specific Energy	1.02	ft
Froude Number	1.09	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.79	ft
Critical Depth	0.81	ft
Channel Slope	0.05090	ft/ft
Critical Slope	0.04199	ft/ft

Worksheet for Trapezoidal Channel - 7a

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.03830	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	24.59	ft^3/s

Results

Normal Depth	1.08	ft
Flow Area	5.08	ft^2
Wetted Perimeter	7.83	ft
Hydraulic Radius	0.65	ft
Top Width	7.40	ft
Critical Depth	1.10	ft
Critical Slope	0.03593	ft/ft
Velocity	4.84	ft/s
Velocity Head	0.36	ft
Specific Energy	1.44	ft
Froude Number	1.03	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.08	ft
Critical Depth	1.10	ft
Channel Slope	0.03830	ft/ft
Critical Slope	0.03593	ft/ft

Worksheet for Trapezoidal Channel - 7b

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.03830	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	60.70	ft^3/s

Results

Normal Depth	1.63	ft
Flow Area	9.94	ft^2
Wetted Perimeter	10.82	ft
Hydraulic Radius	0.92	ft
Top Width	10.17	ft
Critical Depth	1.70	ft
Critical Slope	0.03194	ft/ft
Velocity	6.11	ft/s
Velocity Head	0.58	ft
Specific Energy	2.21	ft
Froude Number	1.09	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.63	ft
Critical Depth	1.70	ft
Channel Slope	0.03830	ft/ft
Critical Slope	0.03194	ft/ft

Worksheet for Trapezoidal Channel - 8a

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00650	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	33.50	ft^3/s

Results

Normal Depth	1.47	ft
Flow Area	9.48	ft^2
Wetted Perimeter	11.38	ft
Hydraulic Radius	0.83	ft
Top Width	10.85	ft
Critical Depth	1.22	ft
Critical Slope	0.01542	ft/ft
Velocity	3.54	ft/s
Velocity Head	0.19	ft
Specific Energy	1.67	ft
Froude Number	0.67	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.47	ft
Critical Depth	1.22	ft
Channel Slope	0.00650	ft/ft
Critical Slope	0.01542	ft/ft

Worksheet for Triangular Channel - 8b

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.01320	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Discharge	13.40	ft^3/s

Results

Normal Depth	1.28	ft
Flow Area	4.94	ft^2
Wetted Perimeter	8.16	ft
Hydraulic Radius	0.61	ft
Top Width	7.70	ft
Critical Depth	1.04	ft
Critical Slope	0.03960	ft/ft
Velocity	2.71	ft/s
Velocity Head	0.11	ft
Specific Energy	1.40	ft
Froude Number	0.60	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.28	ft
Critical Depth	1.04	ft
Channel Slope	0.01320	ft/ft
Critical Slope	0.03960	ft/ft

Worksheet for Triangular Channel - 8c

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.03670	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Discharge	56.30	ft^3/s

Results

Normal Depth	1.81	ft
Flow Area	9.87	ft^2
Wetted Perimeter	11.54	ft
Hydraulic Radius	0.86	ft
Top Width	10.89	ft
Critical Depth	1.85	ft
Critical Slope	0.03270	ft/ft
Velocity	5.70	ft/s
Velocity Head	0.51	ft
Specific Energy	2.32	ft
Froude Number	1.06	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.81	ft
Critical Depth	1.85	ft
Channel Slope	0.03670	ft/ft
Critical Slope	0.03270	ft/ft

Worksheet for Trapezoidal Channel - 9a

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.01260	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	56.30	ft^3/s

Results

Normal Depth	1.91	ft
Flow Area	14.76	ft^2
Wetted Perimeter	14.15	ft
Hydraulic Radius	1.04	ft
Top Width	13.46	ft
Critical Depth	1.56	ft
Critical Slope	0.03241	ft/ft
Velocity	3.81	ft/s
Velocity Head	0.23	ft
Specific Energy	2.14	ft
Froude Number	0.64	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.91	ft
Critical Depth	1.56	ft
Channel Slope	0.01260	ft/ft
Critical Slope	0.03241	ft/ft

Worksheet for Triangular Channel - 9b

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.02940	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Discharge	15.30	ft^3/s

Results

Normal Depth	1.16	ft
Flow Area	4.04	ft^2
Wetted Perimeter	7.38	ft
Hydraulic Radius	0.55	ft
Top Width	6.96	ft
Critical Depth	1.10	ft
Critical Slope	0.03891	ft/ft
Velocity	3.79	ft/s
Velocity Head	0.22	ft
Specific Energy	1.38	ft
Froude Number	0.88	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.16	ft
Critical Depth	1.10	ft
Channel Slope	0.02940	ft/ft
Critical Slope	0.03891	ft/ft

Worksheet for Trapezoidal Channel - 10a

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.03090	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	25.60	ft^3/s

Results

Normal Depth	1.11	ft
Flow Area	5.87	ft^2
Wetted Perimeter	9.03	ft
Hydraulic Radius	0.65	ft
Top Width	8.63	ft
Critical Depth	1.07	ft
Critical Slope	0.03595	ft/ft
Velocity	4.36	ft/s
Velocity Head	0.30	ft
Specific Energy	1.40	ft
Froude Number	0.93	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.11	ft
Critical Depth	1.07	ft
Channel Slope	0.03090	ft/ft
Critical Slope	0.03595	ft/ft

Worksheet for Trapezoidal Channel - 10b

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.03090	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	24.70	ft^3/s

Results

Normal Depth	1.09	ft
Flow Area	5.72	ft^2
Wetted Perimeter	8.91	ft
Hydraulic Radius	0.64	ft
Top Width	8.52	ft
Critical Depth	1.05	ft
Critical Slope	0.03613	ft/ft
Velocity	4.32	ft/s
Velocity Head	0.29	ft
Specific Energy	1.38	ft
Froude Number	0.93	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.09	ft
Critical Depth	1.05	ft
Channel Slope	0.03090	ft/ft
Critical Slope	0.03613	ft/ft

Worksheet for Trapezoidal Channel - 11a

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.02990	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	1.30	ft^3/s

Results

Normal Depth	0.20	ft
Flow Area	0.52	ft^2
Wetted Perimeter	3.27	ft
Hydraulic Radius	0.16	ft
Top Width	3.20	ft
Critical Depth	0.21	ft
Critical Slope	0.02441	ft/ft
Velocity	2.51	ft/s
Velocity Head	0.10	ft
Specific Energy	0.30	ft
Froude Number	1.10	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.20	ft
Critical Depth	0.21	ft
Channel Slope	0.02990	ft/ft
Critical Slope	0.02441	ft/ft

Worksheet for Trapezoidal Channel - 11b

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.02990	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	2.30	ft^3/s

Results

Normal Depth	0.27	ft
Flow Area	0.77	ft^2
Wetted Perimeter	3.74	ft
Hydraulic Radius	0.21	ft
Top Width	3.64	ft
Critical Depth	0.30	ft
Critical Slope	0.02234	ft/ft
Velocity	2.99	ft/s
Velocity Head	0.14	ft
Specific Energy	0.41	ft
Froude Number	1.15	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.27	ft
Critical Depth	0.30	ft
Channel Slope	0.02990	ft/ft
Critical Slope	0.02234	ft/ft

Worksheet for Trapezoidal Channel - 12a

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.01440	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	32.19	ft^3/s

Results

Normal Depth	1.45	ft
Flow Area	9.25	ft^2
Wetted Perimeter	11.25	ft
Hydraulic Radius	0.82	ft
Top Width	10.73	ft
Critical Depth	1.19	ft
Critical Slope	0.03488	ft/ft
Velocity	3.48	ft/s
Velocity Head	0.19	ft
Specific Energy	1.64	ft
Froude Number	0.66	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.45	ft
Critical Depth	1.19	ft
Channel Slope	0.01440	ft/ft
Critical Slope	0.03488	ft/ft

Worksheet for Trapezoidal Channel - 12b

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.03840	ft/ft
Left Side Slope	10.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	16.50	ft^3/s

Results

Normal Depth	0.70	ft
Flow Area	4.62	ft^2
Wetted Perimeter	11.29	ft
Hydraulic Radius	0.41	ft
Top Width	11.14	ft
Critical Depth	0.70	ft
Critical Slope	0.04040	ft/ft
Velocity	3.57	ft/s
Velocity Head	0.20	ft
Specific Energy	0.90	ft
Froude Number	0.98	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.70	ft
Critical Depth	0.70	ft
Channel Slope	0.03840	ft/ft
Critical Slope	0.04040	ft/ft

Worksheet for Trapezoidal Channel - 13

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.04130	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	19.63	ft^3/s

Results

Normal Depth	0.91	ft
Flow Area	4.33	ft^2
Wetted Perimeter	7.81	ft
Hydraulic Radius	0.55	ft
Top Width	7.48	ft
Critical Depth	0.94	ft
Critical Slope	0.03725	ft/ft
Velocity	4.53	ft/s
Velocity Head	0.32	ft
Specific Energy	1.23	ft
Froude Number	1.05	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.91	ft
Critical Depth	0.94	ft
Channel Slope	0.04130	ft/ft
Critical Slope	0.03725	ft/ft

Worksheet for Trapezoidal Channel - 14a

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.02250	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	23.77	ft^3/s

Results

Normal Depth	1.15	ft
Flow Area	6.25	ft^2
Wetted Perimeter	9.30	ft
Hydraulic Radius	0.67	ft
Top Width	8.89	ft
Critical Depth	1.03	ft
Critical Slope	0.03631	ft/ft
Velocity	3.80	ft/s
Velocity Head	0.22	ft
Specific Energy	1.37	ft
Froude Number	0.80	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.15	ft
Critical Depth	1.03	ft
Channel Slope	0.02250	ft/ft
Critical Slope	0.03631	ft/ft

Worksheet for Triangular Channel - 14b

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.02640	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Discharge	23.77	ft^3/s

Results

Normal Depth	1.40	ft
Flow Area	5.85	ft^2
Wetted Perimeter	8.88	ft
Hydraulic Radius	0.66	ft
Top Width	8.38	ft
Critical Depth	1.31	ft
Critical Slope	0.03669	ft/ft
Velocity	4.06	ft/s
Velocity Head	0.26	ft
Specific Energy	1.65	ft
Froude Number	0.86	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.40	ft
Critical Depth	1.31	ft
Channel Slope	0.02640	ft/ft
Critical Slope	0.03669	ft/ft

Worksheet for Triangular Channel - 15a

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.04110	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Discharge	14.86	ft^3/s

Results

Normal Depth	1.08	ft
Flow Area	3.48	ft^2
Wetted Perimeter	6.85	ft
Hydraulic Radius	0.51	ft
Top Width	6.47	ft
Critical Depth	1.09	ft
Critical Slope	0.03906	ft/ft
Velocity	4.27	ft/s
Velocity Head	0.28	ft
Specific Energy	1.36	ft
Froude Number	1.02	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.08	ft
Critical Depth	1.09	ft
Channel Slope	0.04110	ft/ft
Critical Slope	0.03906	ft/ft

Worksheet for Triangular Channel - 15b

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.01790	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Discharge	3.44	ft^3/s

Results

Normal Depth	0.56	ft
Flow Area	1.24	ft^2
Wetted Perimeter	4.60	ft
Hydraulic Radius	0.27	ft
Top Width	4.46	ft
Critical Depth	0.54	ft
Critical Slope	0.02112	ft/ft
Velocity	2.77	ft/s
Velocity Head	0.12	ft
Specific Energy	0.68	ft
Froude Number	0.93	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.56	ft
Critical Depth	0.54	ft
Channel Slope	0.01790	ft/ft
Critical Slope	0.02112	ft/ft

Worksheet for Triangular Channel - 16

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.02810	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Discharge	2.46	ft^3/s

Results

Normal Depth	0.48	ft
Flow Area	0.79	ft^2
Wetted Perimeter	3.47	ft
Hydraulic Radius	0.23	ft
Top Width	3.33	ft
Critical Depth	0.50	ft
Critical Slope	0.02198	ft/ft
Velocity	3.10	ft/s
Velocity Head	0.15	ft
Specific Energy	0.63	ft
Froude Number	1.12	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.48	ft
Critical Depth	0.50	ft
Channel Slope	0.02810	ft/ft
Critical Slope	0.02198	ft/ft

Worksheet for Triangular Channel - 17

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.03890	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Discharge	7.55	ft^3/s

Results

Normal Depth	0.84	ft
Flow Area	2.14	ft^2
Wetted Perimeter	5.37	ft
Hydraulic Radius	0.40	ft
Top Width	5.07	ft
Critical Depth	0.83	ft
Critical Slope	0.04275	ft/ft
Velocity	3.53	ft/s
Velocity Head	0.19	ft
Specific Energy	1.04	ft
Froude Number	0.96	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.84	ft
Critical Depth	0.83	ft
Channel Slope	0.03890	ft/ft
Critical Slope	0.04275	ft/ft

Worksheet for Trapezoidal Channel - 18

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.01650	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	4.00	ft
Discharge	43.00	ft^3/s

Results

Normal Depth	1.32	ft
Flow Area	11.41	ft^2
Wetted Perimeter	13.64	ft
Hydraulic Radius	0.84	ft
Top Width	13.26	ft
Critical Depth	1.11	ft
Critical Slope	0.03372	ft/ft
Velocity	3.77	ft/s
Velocity Head	0.22	ft
Specific Energy	1.54	ft
Froude Number	0.72	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.32	ft
Critical Depth	1.11	ft
Channel Slope	0.01650	ft/ft
Critical Slope	0.03372	ft/ft

APPENDIX 10

PAVEMENT DRAINAGE HYDRAULIC CALCULATIONS (FLOWMASTER AND AREA INLETS)

PAVEMENT DRAINAGE INLET CALCULATIONS (FLOWMASTER)

Worksheet for CB1B - (CP77)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.30	ft^3/s
Slope	0.0300	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	12.00	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	81.58	%
Intercepted Flow	1.06	ft^3/s
Bypass Flow	0.24	ft^3/s
Spread	5.99	ft
Depth	0.12	ft
Flow Area	0.36	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	3.63	ft/s
Equivalent Cross Slope	0.04757	ft/ft
Length Factor	0.61	
Total Interception Length	19.70	ft

Worksheet for CB1C - (CP76B)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.21	ft^3/s
Slope	0.0450	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0280	ft/ft
Road Cross Slope	0.0280	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	8.80	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	68.71	%
Intercepted Flow	0.83	ft^3/s
Bypass Flow	0.38	ft^3/s
Spread	4.38	ft
Depth	0.12	ft
Flow Area	0.27	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	4.51	ft/s
Equivalent Cross Slope	0.06148	ft/ft
Length Factor	0.48	
Total Interception Length	18.50	ft

Worksheet for CB1F - (CP75)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.22	ft^3/s
Slope	0.0577	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0280	ft/ft
Road Cross Slope	0.0280	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	12.00	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	81.17	%
Intercepted Flow	0.99	ft^3/s
Bypass Flow	0.23	ft^3/s
Spread	4.19	ft
Depth	0.12	ft
Flow Area	0.25	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	4.96	ft/s
Equivalent Cross Slope	0.06228	ft/ft
Length Factor	0.60	
Total Interception Length	19.85	ft

Worksheet for CB2 - (CP72)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.63	ft^3/s
Slope	0.0300	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0280	ft/ft
Road Cross Slope	0.0280	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	12.11	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	100.00	%
Intercepted Flow	0.63	ft^3/s
Bypass Flow	0.00	ft^3/s
Spread	3.70	ft
Depth	0.10	ft
Flow Area	0.19	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	3.29	ft/s
Equivalent Cross Slope	0.06444	ft/ft
Length Factor	1.00	
Total Interception Length	12.11	ft

Worksheet for CB3 - (CP71)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.78	ft^3/s
Slope	0.0250	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0280	ft/ft
Road Cross Slope	0.0280	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	8.80	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	87.76	%
Intercepted Flow	0.68	ft^3/s
Bypass Flow	0.10	ft^3/s
Spread	4.15	ft
Depth	0.12	ft
Flow Area	0.24	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	3.24	ft/s
Equivalent Cross Slope	0.06247	ft/ft
Length Factor	0.69	
Total Interception Length	12.78	ft

Worksheet for CB4 - (CP70b)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.38	ft^3/s
Slope	0.0075	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0280	ft/ft
Road Cross Slope	0.0280	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	5.60	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	96.98	%
Intercepted Flow	0.37	ft^3/s
Bypass Flow	0.01	ft^3/s
Spread	3.97	ft
Depth	0.11	ft
Flow Area	0.22	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	1.72	ft/s
Equivalent Cross Slope	0.06325	ft/ft
Length Factor	0.86	
Total Interception Length	6.53	ft

Worksheet for CB5 - (CP70a)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.39	ft^3/s
Slope	0.0050	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0210	ft/ft
Road Cross Slope	0.0210	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	5.60	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	96.50	%
Intercepted Flow	0.38	ft^3/s
Bypass Flow	0.01	ft^3/s
Spread	5.17	ft
Depth	0.11	ft
Flow Area	0.28	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	1.39	ft/s
Equivalent Cross Slope	0.05134	ft/ft
Length Factor	0.84	
Total Interception Length	6.63	ft

Worksheet for CB6A - (CP68) - Slotted Drain

Project Description

Solve For	Slot Length

Input Data

Discharge	2.08	ft^3/s
Slope	0.0100	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0280	ft/ft
Road Cross Slope	0.0280	ft/ft
Roughness Coefficient	0.013	
Efficiency	100.00	%
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Slot Length	23.72	ft
Intercepted Flow	2.08	ft^3/s
Bypass Flow	0.00	ft^3/s
Spread	7.11	ft
Depth	0.20	ft
Flow Area	0.71	ft^2
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.94	ft/s
Equivalent Cross Slope	0.02800	ft/ft
Length Factor	1.00	
Total Interception Length	23.72	ft

Worksheet for CB07 - (CP67)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.77	ft^3/s
Slope	0.0125	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0280	ft/ft
Road Cross Slope	0.0280	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	8.80	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	76.47	%
Intercepted Flow	1.35	ft^3/s
Bypass Flow	0.42	ft^3/s
Spread	6.42	ft
Depth	0.18	ft
Flow Area	0.58	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	3.07	ft/s
Equivalent Cross Slope	0.05427	ft/ft
Length Factor	0.55	
Total Interception Length	15.93	ft

Worksheet for CB08 - (CP66)

Project Description

Solve For	Efficiency

Input Data

Discharge	2.36	ft^3/s
Slope	0.0200	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0280	ft/ft
Road Cross Slope	0.0280	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	8.80	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	62.88	%
Intercepted Flow	1.48	ft^3/s
Bypass Flow	0.88	ft^3/s
Spread	6.55	ft
Depth	0.18	ft
Flow Area	0.60	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	3.93	ft/s
Equivalent Cross Slope	0.05390	ft/ft
Length Factor	0.42	
Total Interception Length	20.78	ft

Worksheet for CB10 - (CP64)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.23	ft^3/s
Slope	0.0415	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0280	ft/ft
Road Cross Slope	0.0280	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	12.00	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	85.46	%
Intercepted Flow	1.05	ft^3/s
Bypass Flow	0.18	ft^3/s
Spread	4.47	ft
Depth	0.13	ft
Flow Area	0.28	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	4.39	ft/s
Equivalent Cross Slope	0.06109	ft/ft
Length Factor	0.66	
Total Interception Length	18.25	ft

Worksheet for CB11A - (CP63)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.71	ft^3/s
Slope	0.0525	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0280	ft/ft
Road Cross Slope	0.0280	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	12.00	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	73.87	%
Intercepted Flow	1.26	ft^3/s
Bypass Flow	0.45	ft^3/s
Spread	4.84	ft
Depth	0.14	ft
Flow Area	0.33	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	5.21	ft/s
Equivalent Cross Slope	0.05960	ft/ft
Length Factor	0.53	
Total Interception Length	22.83	ft

Worksheet for CB12A - (CP62) - Combo Inlet

Project Description

Solve For	Efficiency

Input Data

Discharge	1.60	ft³/s
Slope	0.0500	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0280	ft/ft
Road Cross Slope	0.0280	ft/ft
Roughness Coefficient	0.013	
Local Depression	1.00	in
Local Depression Width	2.00	ft
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%
Curb Opening Length	4.80	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	84.31	%
Intercepted Flow	1.35	ft³/s
Bypass Flow	0.25	ft³/s
Spread	4.77	ft
Depth	0.13	ft
Flow Area	0.32	ft²
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	5.03	ft/s
Splash Over Velocity	9.97	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.11	
Grate Flow Ratio	0.77	
Equivalent Cross Slope	0.05990	ft/ft
Active Grate Length	3.00	ft
Length Factor	0.08	
Total Interception Length	21.81	ft

Messages

Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for CB14 - (CP61)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.97	ft^3/s
Slope	0.0500	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	15.20	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	93.71	%
Intercepted Flow	0.91	ft^3/s
Bypass Flow	0.06	ft^3/s
Spread	4.88	ft
Depth	0.10	ft
Flow Area	0.24	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	4.08	ft/s
Equivalent Cross Slope	0.05147	ft/ft
Length Factor	0.79	
Total Interception Length	19.36	ft

Worksheet for CB15 - (CP60)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.03	ft^3/s
Slope	0.0500	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	15.20	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	92.43	%
Intercepted Flow	0.95	ft^3/s
Bypass Flow	0.08	ft^3/s
Spread	4.99	ft
Depth	0.10	ft
Flow Area	0.25	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	4.14	ft/s
Equivalent Cross Slope	0.05105	ft/ft
Length Factor	0.76	
Total Interception Length	19.96	ft

Worksheet for CB16 - (CP59)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.86	ft^3/s
Slope	0.0375	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	12.00	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	89.18	%
Intercepted Flow	0.77	ft^3/s
Bypass Flow	0.09	ft^3/s
Spread	4.92	ft
Depth	0.10	ft
Flow Area	0.24	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	3.56	ft/s
Equivalent Cross Slope	0.05131	ft/ft
Length Factor	0.71	
Total Interception Length	16.92	ft

Worksheet for CB17B - (CP58)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.04	ft^3/s
Slope	0.0375	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	12.00	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	84.45	%
Intercepted Flow	0.88	ft^3/s
Bypass Flow	0.16	ft^3/s
Spread	5.28	ft
Depth	0.11	ft
Flow Area	0.28	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	3.73	ft/s
Equivalent Cross Slope	0.04995	ft/ft
Length Factor	0.64	
Total Interception Length	18.62	ft

Worksheet for CB18A - (CP57)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.76	ft^3/s
Slope	0.0100	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	8.80	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	93.31	%
Intercepted Flow	0.71	ft^3/s
Bypass Flow	0.05	ft^3/s
Spread	6.02	ft
Depth	0.12	ft
Flow Area	0.36	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	2.10	ft/s
Equivalent Cross Slope	0.04748	ft/ft
Length Factor	0.78	
Total Interception Length	11.32	ft

Worksheet for CB19 - (CP56)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.51	ft^3/s
Slope	0.0100	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	5.60	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	81.28	%
Intercepted Flow	0.41	ft^3/s
Bypass Flow	0.10	ft^3/s
Spread	5.18	ft
Depth	0.10	ft
Flow Area	0.27	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	1.90	ft/s
Equivalent Cross Slope	0.05032	ft/ft
Length Factor	0.61	
Total Interception Length	9.24	ft

Worksheet for CB21 - (CP54)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.68	ft^3/s
Slope	0.0050	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	8.80	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	99.93	%
Intercepted Flow	0.68	ft^3/s
Bypass Flow	0.00	ft^3/s
Spread	6.57	ft
Depth	0.13	ft
Flow Area	0.43	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	1.57	ft/s
Equivalent Cross Slope	0.04584	ft/ft
Length Factor	0.98	
Total Interception Length	8.96	ft

Worksheet for CB22 - (CP55)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.34	ft^3/s
Slope	0.0050	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	5.60	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	98.08	%
Intercepted Flow	0.33	ft^3/s
Bypass Flow	0.01	ft^3/s
Spread	5.07	ft
Depth	0.10	ft
Flow Area	0.26	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	1.32	ft/s
Equivalent Cross Slope	0.05074	ft/ft
Length Factor	0.89	
Total Interception Length	6.30	ft

Worksheet for CB23 - (CP53) - Grate Inlet

Project Description

Solve For	Efficiency

Input Data

Discharge	0.22	ft³/s
Slope	0.0100	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Grate Width	1.62	ft
Grate Length	3.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	80.59	%
Intercepted Flow	0.18	ft³/s
Bypass Flow	0.04	ft³/s
Spread	3.78	ft
Depth	0.08	ft
Flow Area	0.14	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	1.54	ft/s
Splash Over Velocity	6.99	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.13	
Grate Flow Ratio	0.78	
Active Grate Length	1.50	ft

Worksheet for CB23 - (CP53) - Slotted Drain

Project Description

Solve For	Efficiency

Input Data

Discharge	0.40	ft^3/s
Slope	0.0100	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Slot Length	4.02	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	44.20	%
Intercepted Flow	0.18	ft^3/s
Bypass Flow	0.22	ft^3/s
Spread	4.73	ft
Depth	0.09	ft
Flow Area	0.22	ft^2
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	1.79	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.28	
Total Interception Length	14.52	ft

Worksheet for CB25 - (CP48)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.22	ft^3/s
Slope	0.0525	ft/ft
Gutter Width	1.00	ft
Gutter Cross Slope	0.0260	ft/ft
Road Cross Slope	0.0260	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	12.00	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	73.48	%
Intercepted Flow	0.90	ft^3/s
Bypass Flow	0.32	ft^3/s
Spread	4.47	ft
Depth	0.12	ft
Flow Area	0.26	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	4.70	ft/s
Equivalent Cross Slope	0.04646	ft/ft
Length Factor	0.52	
Total Interception Length	23.01	ft

Worksheet for CB26 - (CP46) - Slotted Drain

Project Description

Solve For	Efficiency

Input Data

Discharge	0.80	ft^3/s
Slope	0.0350	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0080	ft/ft
Road Cross Slope	0.0080	ft/ft
Roughness Coefficient	0.013	
Slot Length	21.44	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	64.48	%
Intercepted Flow	0.52	ft^3/s
Bypass Flow	0.28	ft^3/s
Spread	8.60	ft
Depth	0.07	ft
Flow Area	0.30	ft^2
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.71	ft/s
Equivalent Cross Slope	0.00800	ft/ft
Length Factor	0.44	
Total Interception Length	49.03	ft

Worksheet for CB26 - (CP46) - Grate Inlet

Project Description

Solve For	Efficiency

Input Data

Discharge	0.28	ft³/s
Slope	0.0350	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0800	ft/ft
Road Cross Slope	0.0800	ft/ft
Roughness Coefficient	0.013	
Grate Width	1.62	ft
Grate Length	3.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	100.00	%
Intercepted Flow	0.28	ft³/s
Bypass Flow	0.00	ft³/s
Spread	1.38	ft
Depth	0.11	ft
Flow Area	0.08	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	3.70	ft/s
Splash Over Velocity	6.99	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.11	
Grate Flow Ratio	1.00	
Active Grate Length	1.50	ft

Worksheet for CB27 - (CP47B)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.82	ft^3/s
Slope	0.0200	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	12.00	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	96.88	%
Intercepted Flow	0.79	ft^3/s
Bypass Flow	0.03	ft^3/s
Spread	5.44	ft
Depth	0.11	ft
Flow Area	0.30	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	2.78	ft/s
Equivalent Cross Slope	0.04941	ft/ft
Length Factor	0.85	
Total Interception Length	14.05	ft

Worksheet for CB28 - (CP47A)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.04	ft^3/s
Slope	0.0350	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	8.80	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	69.29	%
Intercepted Flow	0.72	ft^3/s
Bypass Flow	0.32	ft^3/s
Spread	5.35	ft
Depth	0.11	ft
Flow Area	0.29	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	3.63	ft/s
Equivalent Cross Slope	0.04971	ft/ft
Length Factor	0.48	
Total Interception Length	18.29	ft

Worksheet for CB29 - (CP45) - Slotted Drain

Project Description

Solve For	Efficiency

Input Data

Discharge	1.53	ft^3/s
Slope	0.0350	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Slot Length	10.72	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	45.82	%
Intercepted Flow	0.70	ft^3/s
Bypass Flow	0.83	ft^3/s
Spread	6.18	ft
Depth	0.12	ft
Flow Area	0.38	ft^2
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	4.00	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.29	
Total Interception Length	37.15	ft

Worksheet for CB29 - (CP45) - Grate Inlet

Project Description

Solve For	Efficiency

Input Data

Discharge	0.83	ft³/s
Slope	0.0350	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Grate Width	1.62	ft
Grate Length	3.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	66.83	%
Intercepted Flow	0.55	ft³/s
Bypass Flow	0.28	ft³/s
Spread	4.92	ft
Depth	0.10	ft
Flow Area	0.24	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	3.43	ft/s
Splash Over Velocity	6.99	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.04	
Grate Flow Ratio	0.66	
Active Grate Length	1.50	ft

Worksheet for CB30 - (CP44) - Grate Inlet

Project Description

Solve For	Efficiency

Input Data

Discharge	1.12	ft^3/s
Slope	0.0575	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Grate Width	1.62	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	68.32	%
Intercepted Flow	0.77	ft^3/s
Bypass Flow	0.35	ft^3/s
Spread	5.01	ft
Depth	0.10	ft
Flow Area	0.25	ft^2
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	4.46	ft/s
Splash Over Velocity	9.97	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.10	
Grate Flow Ratio	0.65	
Active Grate Length	3.00	ft

Messages

Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for CB30 - (CP44) - Slotted Drain

Project Description

Solve For	Efficiency

Input Data

Discharge	0.35	ft^3/s
Slope	0.0575	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Slot Length	10.42	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	65.80	%
Intercepted Flow	0.23	ft^3/s
Bypass Flow	0.12	ft^3/s
Spread	3.24	ft
Depth	0.06	ft
Flow Area	0.11	ft^2
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	3.33	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.45	
Total Interception Length	23.20	ft

Worksheet for CB31 - (CP39) - Grate Inlet

Project Description

Solve For	Efficiency

Input Data

Discharge	0.53	ft³/s
Slope	0.0200	ft/ft
Gutter Width	6.00	ft
Gutter Cross Slope	0.0500	ft/ft
Road Cross Slope	0.0500	ft/ft
Roughness Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	98.69	%
Intercepted Flow	0.52	ft³/s
Bypass Flow	0.01	ft³/s
Spread	2.60	ft
Depth	0.13	ft
Flow Area	0.17	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	3.13	ft/s
Splash Over Velocity	9.97	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.35	
Grate Flow Ratio	0.98	
Active Grate Length	3.00	ft

Messages

Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for CB32 - (CP38) - Grate Inlet

Project Description

Solve For	Efficiency

Input Data

Discharge	1.00	ft³/s
Slope	0.0050	ft/ft
Gutter Width	6.00	ft
Gutter Cross Slope	0.0500	ft/ft
Road Cross Slope	0.0500	ft/ft
Roughness Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	9.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	94.83	%
Intercepted Flow	0.95	ft³/s
Bypass Flow	0.05	ft³/s
Spread	4.28	ft
Depth	0.21	ft
Flow Area	0.46	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.18	ft/s
Splash Over Velocity	12.28	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.72	
Grate Flow Ratio	0.81	
Active Grate Length	4.50	ft

Messages

Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for CB33 - (CP37) - Grate Inlet

Project Description

Solve For	Efficiency

Input Data

Discharge	0.84	ft³/s
Slope	0.0050	ft/ft
Gutter Width	6.00	ft
Gutter Cross Slope	0.0500	ft/ft
Road Cross Slope	0.0500	ft/ft
Roughness Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	92.49	%
Intercepted Flow	0.78	ft³/s
Bypass Flow	0.06	ft³/s
Spread	4.01	ft
Depth	0.20	ft
Flow Area	0.40	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.09	ft/s
Splash Over Velocity	9.97	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.53	
Grate Flow Ratio	0.84	
Active Grate Length	3.00	ft

Messages

Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for CB34 - (CP36) - Grate Inlet

Project Description

Solve For	Efficiency

Input Data

Discharge	0.74	ft³/s
Slope	0.0050	ft/ft
Gutter Width	6.00	ft
Gutter Cross Slope	0.0500	ft/ft
Road Cross Slope	0.0500	ft/ft
Roughness Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	93.62	%
Intercepted Flow	0.69	ft³/s
Bypass Flow	0.05	ft³/s
Spread	3.83	ft
Depth	0.19	ft
Flow Area	0.37	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.02	ft/s
Splash Over Velocity	9.97	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.54	
Grate Flow Ratio	0.86	
Active Grate Length	3.00	ft

Messages

Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for CB35 - (CP33)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.85	ft^3/s
Slope	0.0300	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0210	ft/ft
Road Cross Slope	0.0210	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	12.00	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	92.89	%
Intercepted Flow	0.79	ft^3/s
Bypass Flow	0.06	ft^3/s
Spread	4.95	ft
Depth	0.10	ft
Flow Area	0.26	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	3.30	ft/s
Equivalent Cross Slope	0.05218	ft/ft
Length Factor	0.77	
Total Interception Length	15.59	ft

Worksheet for CB38 - (CP30)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.17	ft^3/s
Slope	0.0300	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	16.40	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	97.75	%
Intercepted Flow	1.14	ft^3/s
Bypass Flow	0.03	ft^3/s
Spread	5.76	ft
Depth	0.12	ft
Flow Area	0.33	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	3.53	ft/s
Equivalent Cross Slope	0.04832	ft/ft
Length Factor	0.88	
Total Interception Length	18.67	ft

Worksheet for CB41- (CP29)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.86	ft^3/s
Slope	0.0300	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	12.00	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	91.83	%
Intercepted Flow	0.79	ft^3/s
Bypass Flow	0.07	ft^3/s
Spread	5.13	ft
Depth	0.10	ft
Flow Area	0.26	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	3.27	ft/s
Equivalent Cross Slope	0.05051	ft/ft
Length Factor	0.75	
Total Interception Length	15.97	ft

Worksheet for CB42 - (CP28)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.60	ft^3/s
Slope	0.0300	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	12.00	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	98.42	%
Intercepted Flow	0.59	ft^3/s
Bypass Flow	0.01	ft^3/s
Spread	4.48	ft
Depth	0.09	ft
Flow Area	0.20	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	2.99	ft/s
Equivalent Cross Slope	0.05305	ft/ft
Length Factor	0.90	
Total Interception Length	13.33	ft

Worksheet for CB44 - (CP27)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.16	ft^3/s
Slope	0.0300	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	12.00	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	84.55	%
Intercepted Flow	0.98	ft^3/s
Bypass Flow	0.18	ft^3/s
Spread	5.74	ft
Depth	0.11	ft
Flow Area	0.33	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	3.52	ft/s
Equivalent Cross Slope	0.04838	ft/ft
Length Factor	0.65	
Total Interception Length	18.59	ft

Worksheet for CB45 - (CP26)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.24	ft^3/s
Slope	0.0204	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	12.00	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	87.76	%
Intercepted Flow	1.09	ft^3/s
Bypass Flow	0.15	ft^3/s
Spread	6.32	ft
Depth	0.13	ft
Flow Area	0.40	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	3.10	ft/s
Equivalent Cross Slope	0.04655	ft/ft
Length Factor	0.69	
Total Interception Length	17.42	ft

Worksheet for CB47 - (CP20) - Grate Inlet

Project Description

Solve For	Efficiency

Input Data

Discharge	0.59	ft^3/s
Slope	0.0200	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0130	ft/ft
Road Cross Slope	0.0130	ft/ft
Roughness Coefficient	0.013	
Grate Width	1.62	ft
Grate Length	3.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	56.98	%
Intercepted Flow	0.34	ft^3/s
Bypass Flow	0.25	ft^3/s
Spread	6.29	ft
Depth	0.08	ft
Flow Area	0.26	ft^2
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.30	ft/s
Splash Over Velocity	6.99	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.05	
Grate Flow Ratio	0.55	
Active Grate Length	1.50	ft

Worksheet for CB47 - (CP20) - Slotted Drain

Project Description

Solve For	Efficiency

Input Data

Discharge	0.25	ft^3/s
Slope	0.0200	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Slot Length	10.42	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	89.23	%
Intercepted Flow	0.22	ft^3/s
Bypass Flow	0.03	ft^3/s
Spread	3.48	ft
Depth	0.07	ft
Flow Area	0.12	ft^2
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.06	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.71	
Total Interception Length	14.68	ft

Worksheet for CB48 - (CP17b)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.84	ft^3/s
Slope	0.0250	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	8.80	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	79.41	%
Intercepted Flow	0.67	ft^3/s
Bypass Flow	0.17	ft^3/s
Spread	5.26	ft
Depth	0.11	ft
Flow Area	0.28	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	3.04	ft/s
Equivalent Cross Slope	0.05003	ft/ft
Length Factor	0.58	
Total Interception Length	15.06	ft

Worksheet for CB49 - (CP17a)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.44	ft^3/s
Slope	0.0275	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	8.80	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	64.06	%
Intercepted Flow	0.92	ft^3/s
Bypass Flow	0.52	ft^3/s
Spread	6.32	ft
Depth	0.13	ft
Flow Area	0.40	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	3.60	ft/s
Equivalent Cross Slope	0.04655	ft/ft
Length Factor	0.43	
Total Interception Length	20.29	ft

Worksheet for CB50 - (CP16)

Project Description

Solve For	Efficiency

Input Data

Discharge	3.78	ft^3/s
Slope	0.0275	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0210	ft/ft
Road Cross Slope	0.0210	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	15.20	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	67.84	%
Intercepted Flow	2.56	ft^3/s
Bypass Flow	1.22	ft^3/s
Spread	8.81	ft
Depth	0.19	ft
Flow Area	0.81	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	4.64	ft/s
Equivalent Cross Slope	0.04170	ft/ft
Length Factor	0.47	
Total Interception Length	32.51	ft

Worksheet for CB53 - (CP12a)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.99	ft^3/s
Slope	0.0380	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	8.80	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	69.49	%
Intercepted Flow	0.69	ft^3/s
Bypass Flow	0.30	ft^3/s
Spread	5.17	ft
Depth	0.10	ft
Flow Area	0.27	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	3.70	ft/s
Equivalent Cross Slope	0.05035	ft/ft
Length Factor	0.48	
Total Interception Length	18.23	ft

Worksheet for CB55 - (CP12b)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.76	ft^3/s
Slope	0.0430	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	15.20	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	99.00	%
Intercepted Flow	0.75	ft^3/s
Bypass Flow	0.01	ft^3/s
Spread	4.58	ft
Depth	0.09	ft
Flow Area	0.21	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	3.63	ft/s
Equivalent Cross Slope	0.05266	ft/ft
Length Factor	0.92	
Total Interception Length	16.48	ft

Worksheet for CB56 - (CP11b)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.94	ft^3/s
Slope	0.0380	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	15.20	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	96.95	%
Intercepted Flow	0.91	ft^3/s
Bypass Flow	0.03	ft^3/s
Spread	5.07	ft
Depth	0.10	ft
Flow Area	0.26	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	3.65	ft/s
Equivalent Cross Slope	0.05072	ft/ft
Length Factor	0.86	
Total Interception Length	17.75	ft

Worksheet for CB57 - (CP10)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.44	ft^3/s
Slope	0.0210	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0310	ft/ft
Road Cross Slope	0.0310	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	8.80	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	99.94	%
Intercepted Flow	0.44	ft^3/s
Bypass Flow	0.00	ft^3/s
Spread	3.24	ft
Depth	0.10	ft
Flow Area	0.16	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	2.70	ft/s
Equivalent Cross Slope	0.06944	ft/ft
Length Factor	0.98	
Total Interception Length	8.95	ft

Worksheet for CB58 - (CP11a)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.30	ft^3/s
Slope	0.0140	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0100	ft/ft
Road Cross Slope	0.0100	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	5.60	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	78.08	%
Intercepted Flow	0.23	ft^3/s
Bypass Flow	0.07	ft^3/s
Spread	6.15	ft
Depth	0.06	ft
Flow Area	0.19	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	1.59	ft/s
Equivalent Cross Slope	0.03708	ft/ft
Length Factor	0.57	
Total Interception Length	9.83	ft

Worksheet for CB61 - (CP7a)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.15	ft^3/s
Slope	0.0110	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	2.40	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	67.23	%
Intercepted Flow	0.10	ft^3/s
Bypass Flow	0.05	ft^3/s
Spread	3.22	ft
Depth	0.06	ft
Flow Area	0.10	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	1.45	ft/s
Equivalent Cross Slope	0.05855	ft/ft
Length Factor	0.46	
Total Interception Length	5.20	ft

Worksheet for CB63 - (CP7b) - In Sag (100-yr Check)

Project Description

Solve For	Spread

Input Data

Discharge		6.35	ft^3/s
Gutter Width		2.00	ft
Gutter Cross Slope		0.0200	ft/ft
Road Cross Slope		0.0200	ft/ft
Curb Opening Length		8.80	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		1.00	in
Local Depression Width		2.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	18.37	ft
Depth	0.37	ft
Gutter Depression	0.00	ft
Total Depression	0.08	ft

Worksheet for CB63 - (CP7b) - In Sag

Project Description

Solve For	Spread		

Input Data

Discharge		1.37	ft^3/s
Gutter Width		2.00	ft
Gutter Cross Slope		0.0200	ft/ft
Road Cross Slope		0.0200	ft/ft
Curb Opening Length		8.80	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		1.00	in
Local Depression Width		2.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	6.61	ft
Depth	0.13	ft
Gutter Depression	0.00	ft
Total Depression	0.08	ft

Worksheet for CB68 - (CP2c)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.33	ft^3/s
Slope	0.0070	ft/ft
Gutter Width	1.00	ft
Gutter Cross Slope	0.0120	ft/ft
Road Cross Slope	0.0120	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	5.60	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	76.95	%
Intercepted Flow	0.25	ft^3/s
Bypass Flow	0.08	ft^3/s
Spread	6.47	ft
Depth	0.08	ft
Flow Area	0.25	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	1.31	ft/s
Equivalent Cross Slope	0.02703	ft/ft
Length Factor	0.56	
Total Interception Length	10.05	ft

Worksheet for CB69 - (CP2b)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.36	ft^3/s
Slope	0.0080	ft/ft
Gutter Width	0.00	ft
Gutter Cross Slope	0.0130	ft/ft
Road Cross Slope	0.0130	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	5.60	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	85.07	%
Intercepted Flow	0.31	ft^3/s
Bypass Flow	0.05	ft^3/s
Spread	6.20	ft
Depth	0.08	ft
Flow Area	0.25	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	1.44	ft/s
Equivalent Cross Slope	0.03990	ft/ft
Length Factor	0.65	
Total Interception Length	8.59	ft

Worksheet for CB71 - (CP2a)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.00	ft^3/s
Slope	0.0130	ft/ft
Gutter Width	1.33	ft
Gutter Cross Slope	0.0130	ft/ft
Road Cross Slope	0.0130	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	12.00	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	84.33	%
Intercepted Flow	0.84	ft^3/s
Bypass Flow	0.16	ft^3/s
Spread	8.31	ft
Depth	0.11	ft
Flow Area	0.45	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	2.23	ft/s
Equivalent Cross Slope	0.02850	ft/ft
Length Factor	0.64	
Total Interception Length	18.67	ft

Worksheet for CB72 - (CP40)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.98	ft^3/s
Slope	0.1300	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0210	ft/ft
Road Cross Slope	0.0210	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	15.20	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	82.38	%
Intercepted Flow	0.81	ft^3/s
Bypass Flow	0.17	ft^3/s
Spread	3.97	ft
Depth	0.08	ft
Flow Area	0.17	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	5.93	ft/s
Equivalent Cross Slope	0.05624	ft/ft
Length Factor	0.62	
Total Interception Length	24.56	ft

Worksheet for CB73 - (CP42)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.84	ft^3/s
Slope	0.1300	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	15.20	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	85.39	%
Intercepted Flow	0.72	ft^3/s
Bypass Flow	0.12	ft^3/s
Spread	3.86	ft
Depth	0.08	ft
Flow Area	0.15	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	5.63	ft/s
Equivalent Cross Slope	0.05571	ft/ft
Length Factor	0.66	
Total Interception Length	23.15	ft

Worksheet for CB74 - (CP6a) - In Sag (100-yr Check)

Project Description

Solve For	Spread

Input Data

Discharge		2.80	ft^3/s
Gutter Width		2.00	ft
Gutter Cross Slope		0.0200	ft/ft
Road Cross Slope		0.0200	ft/ft
Curb Opening Length		8.80	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		1.00	in
Local Depression Width		2.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	10.64	ft
Depth	0.21	ft
Gutter Depression	0.00	ft
Total Depression	0.08	ft

Worksheet for CB74 - (CP6a)

Project Description

Solve For	Spread		

Input Data

Discharge		1.41	ft^3/s
Gutter Width		2.00	ft
Gutter Cross Slope		0.0250	ft/ft
Road Cross Slope		0.0250	ft/ft
Curb Opening Length		7.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		1.00	in
Local Depression Width		2.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	5.98	ft
Depth	0.15	ft
Gutter Depression	0.00	ft
Total Depression	0.08	ft

Worksheet for CB77 - (CP6b)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.20	ft^3/s
Slope	0.0070	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	5.60	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	100.00	%
Intercepted Flow	0.20	ft^3/s
Bypass Flow	0.00	ft^3/s
Spread	3.90	ft
Depth	0.08	ft
Flow Area	0.15	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	1.32	ft/s
Equivalent Cross Slope	0.05555	ft/ft
Length Factor	1.06	
Total Interception Length	5.28	ft

Worksheet for CO1 - (CP3a)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.23	ft^3/s
Slope	0.0050	ft/ft
Gutter Width	0.00	ft
Gutter Cross Slope	0.0150	ft/ft
Road Cross Slope	0.0150	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	3.20	ft
Local Depression	0.75	in
Local Depression Width	0.38	ft

Results

Efficiency	76.83	%
Intercepted Flow	0.18	ft^3/s
Bypass Flow	0.05	ft^3/s
Spread	5.24	ft
Depth	0.08	ft
Flow Area	0.21	ft^2
Gutter Depression	0.00	ft
Total Depression	0.06	ft
Velocity	1.12	ft/s
Equivalent Cross Slope	0.04492	ft/ft
Length Factor	0.56	
Total Interception Length	5.75	ft

Worksheet for CO2 - (CP3b)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.22	ft^3/s
Slope	0.0050	ft/ft
Gutter Width	0.00	ft
Gutter Cross Slope	0.0150	ft/ft
Road Cross Slope	0.0150	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	3.20	ft
Local Depression	0.75	in
Local Depression Width	0.38	ft

Results

Efficiency	78.13	%
Intercepted Flow	0.17	ft^3/s
Bypass Flow	0.05	ft^3/s
Spread	5.15	ft
Depth	0.08	ft
Flow Area	0.20	ft^2
Gutter Depression	0.00	ft
Total Depression	0.06	ft
Velocity	1.11	ft/s
Equivalent Cross Slope	0.04540	ft/ft
Length Factor	0.57	
Total Interception Length	5.61	ft

Worksheet for CO3 - (CP3c)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.26	ft^3/s
Slope	0.0050	ft/ft
Gutter Width	0.00	ft
Gutter Cross Slope	0.0150	ft/ft
Road Cross Slope	0.0150	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	3.20	ft
Local Depression	0.75	in
Local Depression Width	0.38	ft

Results

Efficiency	73.25	%
Intercepted Flow	0.19	ft^3/s
Bypass Flow	0.07	ft^3/s
Spread	5.48	ft
Depth	0.08	ft
Flow Area	0.23	ft^2
Gutter Depression	0.00	ft
Total Depression	0.06	ft
Velocity	1.15	ft/s
Equivalent Cross Slope	0.04366	ft/ft
Length Factor	0.52	
Total Interception Length	6.16	ft

Worksheet for CO4 - (CP3d)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.24	ft^3/s
Slope	0.0050	ft/ft
Gutter Width	0.00	ft
Gutter Cross Slope	0.0150	ft/ft
Road Cross Slope	0.0150	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	3.20	ft
Local Depression	0.75	in
Local Depression Width	0.38	ft

Results

Efficiency	75.58	%
Intercepted Flow	0.18	ft^3/s
Bypass Flow	0.06	ft^3/s
Spread	5.32	ft
Depth	0.08	ft
Flow Area	0.21	ft^2
Gutter Depression	0.00	ft
Total Depression	0.06	ft
Velocity	1.13	ft/s
Equivalent Cross Slope	0.04448	ft/ft
Length Factor	0.54	
Total Interception Length	5.89	ft

Worksheet for CO5 - (CP3e)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.20	ft^3/s
Slope	0.0050	ft/ft
Gutter Width	0.00	ft
Gutter Cross Slope	0.0150	ft/ft
Road Cross Slope	0.0150	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	3.20	ft
Local Depression	0.75	in
Local Depression Width	0.38	ft

Results

Efficiency	80.92	%
Intercepted Flow	0.16	ft^3/s
Bypass Flow	0.04	ft^3/s
Spread	4.97	ft
Depth	0.07	ft
Flow Area	0.19	ft^2
Gutter Depression	0.00	ft
Total Depression	0.06	ft
Velocity	1.08	ft/s
Equivalent Cross Slope	0.04643	ft/ft
Length Factor	0.60	
Total Interception Length	5.32	ft

Worksheet for CO6 - (CP3f)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.19	ft^3/s
Slope	0.0055	ft/ft
Gutter Width	0.00	ft
Gutter Cross Slope	0.0150	ft/ft
Road Cross Slope	0.0150	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	3.20	ft
Local Depression	0.75	in
Local Depression Width	0.38	ft

Results

Efficiency	81.22	%
Intercepted Flow	0.15	ft^3/s
Bypass Flow	0.04	ft^3/s
Spread	4.78	ft
Depth	0.07	ft
Flow Area	0.17	ft^2
Gutter Depression	0.00	ft
Total Depression	0.06	ft
Velocity	1.11	ft/s
Equivalent Cross Slope	0.04757	ft/ft
Length Factor	0.61	
Total Interception Length	5.29	ft

Worksheet for CO7 - (CP4a)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.15	ft^3/s
Slope	0.0110	ft/ft
Gutter Width	0.00	ft
Gutter Cross Slope	0.0150	ft/ft
Road Cross Slope	0.0150	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	3.20	ft
Local Depression	0.75	in
Local Depression Width	0.38	ft

Results

Efficiency	80.09	%
Intercepted Flow	0.12	ft^3/s
Bypass Flow	0.03	ft^3/s
Spread	3.85	ft
Depth	0.06	ft
Flow Area	0.11	ft^2
Gutter Depression	0.00	ft
Total Depression	0.06	ft
Velocity	1.35	ft/s
Equivalent Cross Slope	0.05482	ft/ft
Length Factor	0.59	
Total Interception Length	5.41	ft

Worksheet for CO8 - (CP4b)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.15	ft^3/s
Slope	0.0080	ft/ft
Gutter Width	0.00	ft
Gutter Cross Slope	0.0150	ft/ft
Road Cross Slope	0.0150	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	3.20	ft
Local Depression	0.75	in
Local Depression Width	0.38	ft

Results

Efficiency	83.79	%
Intercepted Flow	0.13	ft^3/s
Bypass Flow	0.02	ft^3/s
Spread	4.09	ft
Depth	0.06	ft
Flow Area	0.13	ft^2
Gutter Depression	0.00	ft
Total Depression	0.06	ft
Velocity	1.20	ft/s
Equivalent Cross Slope	0.05269	ft/ft
Length Factor	0.64	
Total Interception Length	5.03	ft

Worksheet for CO9 - (CP4c)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.09	ft^3/s
Slope	0.0040	ft/ft
Gutter Width	0.00	ft
Gutter Cross Slope	0.0150	ft/ft
Road Cross Slope	0.0150	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	3.20	ft
Local Depression	0.75	in
Local Depression Width	0.38	ft

Results

Efficiency	99.99	%
Intercepted Flow	0.09	ft^3/s
Bypass Flow	0.00	ft^3/s
Spread	3.84	ft
Depth	0.06	ft
Flow Area	0.11	ft^2
Gutter Depression	0.00	ft
Total Depression	0.06	ft
Velocity	0.81	ft/s
Equivalent Cross Slope	0.05488	ft/ft
Length Factor	0.99	
Total Interception Length	3.22	ft

Worksheet for CO11 - (CP4d)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.08	ft^3/s
Slope	0.0030	ft/ft
Gutter Width	0.00	ft
Gutter Cross Slope	0.0150	ft/ft
Road Cross Slope	0.0150	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	3.20	ft
Local Depression	0.75	in
Local Depression Width	0.38	ft

Results

Efficiency	100.00	%
Intercepted Flow	0.08	ft^3/s
Bypass Flow	0.00	ft^3/s
Spread	3.88	ft
Depth	0.06	ft
Flow Area	0.11	ft^2
Gutter Depression	0.00	ft
Total Depression	0.06	ft
Velocity	0.71	ft/s
Equivalent Cross Slope	0.05453	ft/ft
Length Factor	1.13	
Total Interception Length	2.82	ft

Worksheet for CO12 - (CP4e)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.13	ft^3/s
Slope	0.0030	ft/ft
Gutter Width	0.00	ft
Gutter Cross Slope	0.0150	ft/ft
Road Cross Slope	0.0150	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	3.20	ft
Local Depression	0.75	in
Local Depression Width	0.38	ft

Results

Efficiency	97.16	%
Intercepted Flow	0.13	ft^3/s
Bypass Flow	0.00	ft^3/s
Spread	4.65	ft
Depth	0.07	ft
Flow Area	0.16	ft^2
Gutter Depression	0.00	ft
Total Depression	0.06	ft
Velocity	0.80	ft/s
Equivalent Cross Slope	0.04842	ft/ft
Length Factor	0.86	
Total Interception Length	3.71	ft

Worksheet for CO15 - (CP9a)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.23	ft^3/s
Slope	0.0220	ft/ft
Gutter Width	0.00	ft
Gutter Cross Slope	0.0180	ft/ft
Road Cross Slope	0.0180	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	3.20	ft
Local Depression	0.75	in
Local Depression Width	0.38	ft

Results

Efficiency	63.45	%
Intercepted Flow	0.15	ft^3/s
Bypass Flow	0.08	ft^3/s
Spread	3.54	ft
Depth	0.06	ft
Flow Area	0.11	ft^2
Gutter Depression	0.00	ft
Total Depression	0.06	ft
Velocity	2.04	ft/s
Equivalent Cross Slope	0.06097	ft/ft
Length Factor	0.43	
Total Interception Length	7.47	ft

Worksheet for CO16 - (CP9b)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.15	ft^3/s
Slope	0.0270	ft/ft
Gutter Width	0.00	ft
Gutter Cross Slope	0.0160	ft/ft
Road Cross Slope	0.0160	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	3.20	ft
Local Depression	0.75	in
Local Depression Width	0.38	ft

Results

Efficiency	70.94	%
Intercepted Flow	0.11	ft^3/s
Bypass Flow	0.04	ft^3/s
Spread	3.12	ft
Depth	0.05	ft
Flow Area	0.08	ft^2
Gutter Depression	0.00	ft
Total Depression	0.06	ft
Velocity	1.92	ft/s
Equivalent Cross Slope	0.06409	ft/ft
Length Factor	0.50	
Total Interception Length	6.44	ft

Worksheet for CO17 - (CP8a)_Scupper Type 1

Project Description

Solve For	Spread

Input Data

Discharge	0.11	ft^3/s
Gutter Width	0.00	ft
Gutter Cross Slope	0.0240	ft/ft
Road Cross Slope	0.0240	ft/ft
Curb Opening Length	2.00	ft
Opening Height	0.50	ft
Curb Throat Type	Inclined	
Local Depression	0.75	in
Local Depression Width	0.38	ft
Throat Incline Angle	9.46	degrees

Results

Spread	2.85	ft
Depth	0.07	ft
Gutter Depression	0.00	ft
Total Depression	0.06	ft

Worksheet for CO18 - (CP8b)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.15	ft^3/s
Slope	0.0070	ft/ft
Gutter Width	0.00	ft
Gutter Cross Slope	0.0160	ft/ft
Road Cross Slope	0.0160	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	3.20	ft
Local Depression	0.75	in
Local Depression Width	0.38	ft

Results

Efficiency	85.93	%
Intercepted Flow	0.13	ft^3/s
Bypass Flow	0.02	ft^3/s
Spread	4.06	ft
Depth	0.07	ft
Flow Area	0.13	ft^2
Gutter Depression	0.00	ft
Total Depression	0.06	ft
Velocity	1.17	ft/s
Equivalent Cross Slope	0.05388	ft/ft
Length Factor	0.66	
Total Interception Length	4.82	ft

Worksheet for CO19 - (CP8c)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.25	ft^3/s
Slope	0.0100	ft/ft
Gutter Width	0.00	ft
Gutter Cross Slope	0.0190	ft/ft
Road Cross Slope	0.0190	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	3.20	ft
Local Depression	0.75	in
Local Depression Width	0.38	ft

Results

Efficiency	71.41	%
Intercepted Flow	0.18	ft^3/s
Bypass Flow	0.07	ft^3/s
Spread	4.09	ft
Depth	0.08	ft
Flow Area	0.16	ft^2
Gutter Depression	0.00	ft
Total Depression	0.06	ft
Velocity	1.57	ft/s
Equivalent Cross Slope	0.05663	ft/ft
Length Factor	0.50	
Total Interception Length	6.38	ft

Worksheet for CO20 - (CP8d)

Project Description

Solve For	Spread		

Input Data

Discharge		0.45	ft^3/s
Gutter Width		0.00	ft
Gutter Cross Slope		0.0200	ft/ft
Road Cross Slope		0.0200	ft/ft
Curb Opening Length		3.20	ft
Opening Height		0.50	ft
Curb Throat Type	Inclined		
Local Depression		0.75	in
Local Depression Width		0.38	ft
Throat Incline Angle		9.46	degrees

Results

Spread	6.83	ft
Depth	0.14	ft
Gutter Depression	0.00	ft
Total Depression	0.06	ft

Worksheet for Exst CB South of SC2 - In Sag

Project Description

Solve For	Spread

Input Data

Discharge	3.14	ft^3/s
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Curb Opening Length	12.00	ft
Opening Height	6.00	ft
Curb Throat Type	Horizontal	
Local Depression	0.75	in
Local Depression Width	0.38	ft
Throat Incline Angle	90.00	degrees

Results

Spread	9.86	ft
Depth	0.20	ft
Gutter Depression	0.00	ft
Total Depression	0.06	ft

Worksheet for SC2 - (CP80)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.96	ft^3/s
Slope	0.0230	ft/ft
Gutter Width	1.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	9.60	ft
Local Depression	2.00	in
Local Depression Width	1.00	ft

Results

Efficiency	78.89	%
Intercepted Flow	1.55	ft^3/s
Bypass Flow	0.41	ft^3/s
Spread	7.34	ft
Depth	0.15	ft
Flow Area	0.54	ft^2
Gutter Depression	0.00	ft
Total Depression	0.17	ft
Velocity	3.64	ft/s
Equivalent Cross Slope	0.07388	ft/ft
Length Factor	0.58	
Total Interception Length	16.59	ft

Worksheet for SC3 - (CP78)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.45	ft^3/s
Slope	0.0189	ft/ft
Gutter Width	1.00	ft
Gutter Cross Slope	0.0280	ft/ft
Road Cross Slope	0.0280	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	8.80	ft
Local Depression	2.00	in
Local Depression Width	1.00	ft

Results

Efficiency	91.84	%
Intercepted Flow	1.33	ft^3/s
Bypass Flow	0.12	ft^3/s
Spread	5.51	ft
Depth	0.15	ft
Flow Area	0.43	ft^2
Gutter Depression	0.00	ft
Total Depression	0.17	ft
Velocity	3.41	ft/s
Equivalent Cross Slope	0.09693	ft/ft
Length Factor	0.75	
Total Interception Length	11.71	ft

Worksheet for SC5 - (CP74)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.81	ft^3/s
Slope	0.0574	ft/ft
Gutter Width	1.00	ft
Gutter Cross Slope	0.0280	ft/ft
Road Cross Slope	0.0280	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	9.60	ft
Local Depression	2.00	in
Local Depression Width	1.00	ft

Results

Efficiency	77.15	%
Intercepted Flow	1.40	ft^3/s
Bypass Flow	0.41	ft^3/s
Spread	4.86	ft
Depth	0.14	ft
Flow Area	0.33	ft^2
Gutter Depression	0.00	ft
Total Depression	0.17	ft
Velocity	5.46	ft/s
Equivalent Cross Slope	0.10444	ft/ft
Length Factor	0.56	
Total Interception Length	17.15	ft

Worksheet for SC6 - (CP73)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.37	ft^3/s
Slope	0.0500	ft/ft
Gutter Width	1.00	ft
Gutter Cross Slope	0.0280	ft/ft
Road Cross Slope	0.0280	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	6.40	ft
Local Depression	2.00	in
Local Depression Width	1.00	ft

Results

Efficiency	65.86	%
Intercepted Flow	0.90	ft^3/s
Bypass Flow	0.47	ft^3/s
Spread	4.50	ft
Depth	0.13	ft
Flow Area	0.28	ft^2
Gutter Depression	0.00	ft
Total Depression	0.17	ft
Velocity	4.84	ft/s
Equivalent Cross Slope	0.10944	ft/ft
Length Factor	0.45	
Total Interception Length	14.24	ft

Worksheet for SC7 - (CP52)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.79	ft^3/s
Slope	0.0060	ft/ft
Gutter Width	1.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	3.20	ft
Local Depression	2.00	in
Local Depression Width	1.00	ft

Results

Efficiency	64.50	%
Intercepted Flow	0.51	ft^3/s
Bypass Flow	0.28	ft^3/s
Spread	6.72	ft
Depth	0.13	ft
Flow Area	0.45	ft^2
Gutter Depression	0.00	ft
Total Depression	0.17	ft
Velocity	1.75	ft/s
Equivalent Cross Slope	0.07823	ft/ft
Length Factor	0.44	
Total Interception Length	7.32	ft

Worksheet for SC8 - (CP51)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.20	ft^3/s
Slope	0.0071	ft/ft
Gutter Width	1.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	6.40	ft
Local Depression	2.00	in
Local Depression Width	1.00	ft

Results

Efficiency	86.03	%
Intercepted Flow	1.03	ft^3/s
Bypass Flow	0.17	ft^3/s
Spread	7.61	ft
Depth	0.15	ft
Flow Area	0.58	ft^2
Gutter Depression	0.00	ft
Total Depression	0.17	ft
Velocity	2.07	ft/s
Equivalent Cross Slope	0.07217	ft/ft
Length Factor	0.66	
Total Interception Length	9.62	ft

Worksheet for SC9 - (CP50)

Project Description

Solve For	Efficiency

Input Data

Discharge	2.44	ft^3/s
Slope	0.0200	ft/ft
Gutter Width	1.00	ft
Gutter Cross Slope	0.0260	ft/ft
Road Cross Slope	0.0260	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	9.60	ft
Local Depression	2.00	in
Local Depression Width	1.00	ft

Results

Efficiency	79.75	%
Intercepted Flow	1.95	ft^3/s
Bypass Flow	0.49	ft^3/s
Spread	6.94	ft
Depth	0.18	ft
Flow Area	0.63	ft^2
Gutter Depression	0.00	ft
Total Depression	0.17	ft
Velocity	3.89	ft/s
Equivalent Cross Slope	0.08257	ft/ft
Length Factor	0.59	
Total Interception Length	16.32	ft

Worksheet for SC10 - (CP35)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.98	ft^3/s
Slope	0.0300	ft/ft
Gutter Width	1.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	9.60	ft
Local Depression	2.00	in
Local Depression Width	1.00	ft

Results

Efficiency	94.78	%
Intercepted Flow	0.93	ft^3/s
Bypass Flow	0.05	ft^3/s
Spread	5.39	ft
Depth	0.11	ft
Flow Area	0.29	ft^2
Gutter Depression	0.00	ft
Total Depression	0.17	ft
Velocity	3.38	ft/s
Equivalent Cross Slope	0.09029	ft/ft
Length Factor	0.81	
Total Interception Length	11.91	ft

Worksheet for SC11 - (CP32)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.04	ft^3/s
Slope	0.0300	ft/ft
Gutter Width	1.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	9.60	ft
Local Depression	2.00	in
Local Depression Width	1.00	ft

Results

Efficiency	93.42	%
Intercepted Flow	0.97	ft^3/s
Bypass Flow	0.07	ft^3/s
Spread	5.51	ft
Depth	0.11	ft
Flow Area	0.30	ft^2
Gutter Depression	0.00	ft
Total Depression	0.17	ft
Velocity	3.43	ft/s
Equivalent Cross Slope	0.08899	ft/ft
Length Factor	0.78	
Total Interception Length	12.32	ft

Worksheet for SC12 - (CP31)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.02	ft^3/s
Slope	0.0300	ft/ft
Gutter Width	1.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	6.40	ft
Local Depression	2.00	in
Local Depression Width	1.00	ft

Results

Efficiency	73.85	%
Intercepted Flow	0.75	ft^3/s
Bypass Flow	0.27	ft^3/s
Spread	5.47	ft
Depth	0.11	ft
Flow Area	0.30	ft^2
Gutter Depression	0.00	ft
Total Depression	0.17	ft
Velocity	3.41	ft/s
Equivalent Cross Slope	0.08941	ft/ft
Length Factor	0.53	
Total Interception Length	12.18	ft

Worksheet for SC13 - (CP18)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.13	ft^3/s
Slope	0.0300	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	9.60	ft
Local Depression	2.00	in
Local Depression Width	1.00	ft

Results

Efficiency	99.74	%
Intercepted Flow	1.13	ft^3/s
Bypass Flow	0.00	ft^3/s
Spread	5.68	ft
Depth	0.11	ft
Flow Area	0.32	ft^2
Gutter Depression	0.00	ft
Total Depression	0.17	ft
Velocity	3.50	ft/s
Equivalent Cross Slope	0.13427	ft/ft
Length Factor	0.96	
Total Interception Length	9.96	ft

Worksheet for SC14 - (CP15)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.64	ft^3/s
Slope	0.0150	ft/ft
Gutter Width	1.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	6.40	ft
Local Depression	2.00	in
Local Depression Width	1.00	ft

Results

Efficiency	94.51	%
Intercepted Flow	0.60	ft^3/s
Bypass Flow	0.04	ft^3/s
Spread	5.23	ft
Depth	0.10	ft
Flow Area	0.27	ft^2
Gutter Depression	0.00	ft
Total Depression	0.17	ft
Velocity	2.34	ft/s
Equivalent Cross Slope	0.09205	ft/ft
Length Factor	0.80	
Total Interception Length	7.99	ft

Worksheet for SC15 - (CP13)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.88	ft^3/s
Slope	0.0350	ft/ft
Gutter Width	1.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	6.40	ft
Local Depression	2.00	in
Local Depression Width	1.00	ft

Results

Efficiency	76.39	%
Intercepted Flow	0.67	ft^3/s
Bypass Flow	0.21	ft^3/s
Spread	5.03	ft
Depth	0.10	ft
Flow Area	0.25	ft^2
Gutter Depression	0.00	ft
Total Depression	0.17	ft
Velocity	3.48	ft/s
Equivalent Cross Slope	0.09443	ft/ft
Length Factor	0.55	
Total Interception Length	11.60	ft

Worksheet for SC16 - (CP1b)

Project Description

Solve For	Efficiency

Input Data

Discharge	1.38	ft^3/s
Slope	0.0040	ft/ft
Gutter Width	1.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	9.60	ft
Local Depression	2.00	in
Local Depression Width	1.00	ft

Results

Efficiency	100.00	%
Intercepted Flow	1.38	ft^3/s
Bypass Flow	0.00	ft^3/s
Spread	8.93	ft
Depth	0.18	ft
Flow Area	0.80	ft^2
Gutter Depression	0.00	ft
Total Depression	0.17	ft
Velocity	1.73	ft/s
Equivalent Cross Slope	0.06522	ft/ft
Length Factor	1.05	
Total Interception Length	9.13	ft

Worksheet for SC17 - (CP1a)

Project Description

Solve For	Efficiency

Input Data

Discharge	2.73	ft^3/s
Slope	0.0070	ft/ft
Gutter Width	1.33	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	9.60	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	64.95	%
Intercepted Flow	1.77	ft^3/s
Bypass Flow	0.96	ft^3/s
Spread	10.39	ft
Depth	0.21	ft
Flow Area	1.08	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	2.53	ft/s
Equivalent Cross Slope	0.03275	ft/ft
Length Factor	0.44	
Total Interception Length	21.75	ft

Worksheet for SC18 - (CP14)

Project Description

Solve For	Efficiency

Input Data

Discharge	0.58	ft^3/s
Slope	0.0150	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0200	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.013	
Curb Opening Length	6.40	ft
Local Depression	1.00	in
Local Depression Width	2.00	ft

Results

Efficiency	79.41	%
Intercepted Flow	0.46	ft^3/s
Bypass Flow	0.12	ft^3/s
Spread	5.04	ft
Depth	0.10	ft
Flow Area	0.25	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	2.28	ft/s
Equivalent Cross Slope	0.05085	ft/ft
Length Factor	0.58	
Total Interception Length	10.95	ft

AREA INLET CALCULATIONS

PSOMAS

Project Name: Kolb Road
Project Number # : 7PIM160201 Made by CLR Date 7/12/18
Reference: COT SMDDFM Checked By Date

GRATED INLET DESIGN

General Equations

Wier

$$Q = C_s L H^{3/2}$$

where

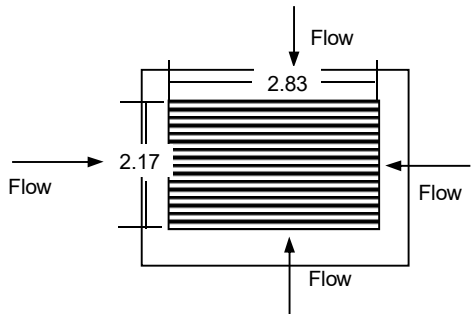
L	=	Length of Opening (ft)
C_D	=	Weir Coefficient
H	=	Height of Opening (ft)
Q	=	100-year Peak Discharge (cfs)

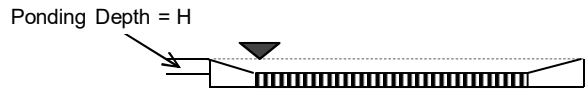
Orifice

$$Q = C_s A H^{1/2}$$

where

A	=	Effective Area
Cs	=	Orifice Coefficient
H	=	Depth of ponding
Q	=	100-year Peak Discharge (cfs)





For PC/COT EF-1 Type Grate
Effective Area = 4.66 ft^2/Grate (Per PC/COT SD-311)
Effective Horizontal Opening = 2.83 ft Perimeter = 2.83(2) + 2.17(2) = 10 feet
Clogging factor = 50%

Solution

For Catch Basin CB79 at P-2 (OS17E, P36, 37, 38 & 39)

Weir

Q_{DES}	=	36.4	cfs
C_D	=	3	
H	=	1.5	ft
L	**=**	**7**	**ft**
L_{CLOG}	**=**	**10**	

One grate provides 10-feet of opening

L_{CLOG} /10= 0.99

USE 1 GRATE

Orifice

Q_{DES}	=	36.4	cfs
C_D	=	5.35	
H	=	1.5	ft
A	**=**	5.6	ft^2
A_{CLOG}	**=**	8.3	ft^2

One grate provides 4.7 ft^2 of opening

A_{CLOG} /4.7= 1.77

USE 2 GRATES

2-grates govern

PSOMAS

Project Name: Kolb Road
Project Number # : 7PIM160201 Made by CLR Date 7/12/18
Reference: COT SMDDFM Checked By _____ Date _____

GRATED INLET DESIGN

General Equations

Wier

$$Q = C_s L H^{3/2}$$

where

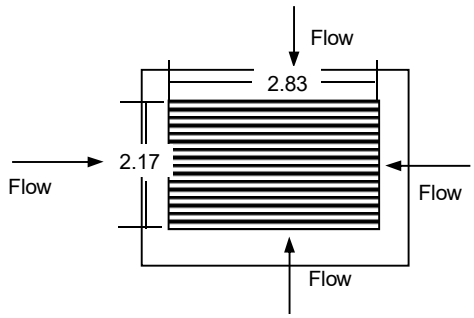
L	=	Length of Opening (ft)
C_D	=	Weir Coefficient
H	=	Height of Opening (ft)
Q	=	100-year Peak Discharge (cfs)

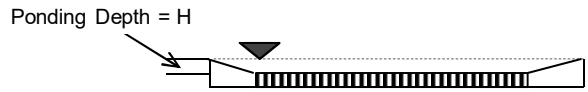
Orifice

$$Q = C_s A H^{1/2}$$

where

A	=	Effective Area
Cs	=	Orifice Coefficient
H	=	Depth of ponding
Q	=	100-year Peak Discharge (cfs)





For PC/COT EF-1 Type Grate
Effective Area = 4.66 ft^2/Grate (Per PC/COT SD-311)
Effective Horizontal Opening = 2.83 ft Perimeter = 2.83(2) + 2.17(2) = 10 feet
Clogging factor = 50%

Solution

For Catch Basin CB76 (OS23C)

Weir

Q_{DES}	=	4.7	cfs
C_D	=	3	
H	=	0.5	ft
L	**=**	**4**	**ft**
L_{CLOG}	**=**	**7**	

One grate provides 10-feet of opening

L_{CLOG} /10= 0.66

USE 1 GRATE

Orifice

Q_{DES}	=	4.7	cfs
C_D	=	5.35	
H	=	0.5	ft
A	**=**	1.2	ft^2
A_{CLOG}	=	1.9	ft^2

One grate provides 4.7 ft^2 of opening

A_{CLOG} /4.7= 0.40

USE 1 GRATE

1-grate governs

Solution

For Catch Basin CB75 (OS23D)

Weir

Q_{DES}	=	1.7	cfs
C_D	=	3	
H	=	0.5	ft
L	**=**	**2**	**ft**
L_{CLOG}	**=**	**2**	

One grate provides 10-feet of opening

L_{CLOG} /10= 0.24

USE 1 GRATE

Orifice

Q_{DES}	=	1.7	cfs
C_D	=	5.35	
H	=	0.5	ft
A	**=**	0.4	ft^2
A_{CLOG}	=	0.7	ft^2

One grate provides 4.7 ft^2 of opening

A_{CLOG} /4.7= 0.14

USE 1 GRATE

1-grate governs

PSOMAS

Project Name: Kolb Road
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Reference: COT SMDDFM Checked By _____ Date _____

GRATED INLET DESIGN

General Equations

Wier

$$Q = C_s L H^{3/2}$$

where

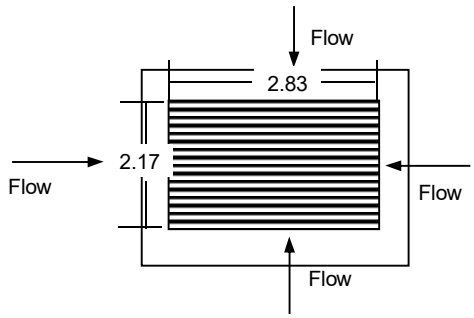
L	=	Length of Opening (ft)
C_D	=	Weir Coefficient
H	=	Height of Opening (ft)
Q	=	100-year Peak Discharge (cfs)

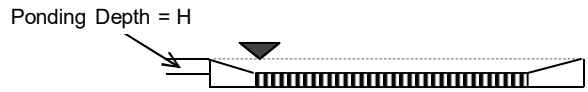
Orifice

$$Q = C_s A H^{1/2}$$

where

A	=	Effective Area
Cs	=	Orifice Coefficient
H	=	Depth of ponding
Q	=	100-year Peak Discharge (cfs)





For PC/COT EF-1 Type Grate
Effective Area = 4.66 ft^2/Grate (Per PC/COT SD-311)
Effective Horizontal Opening = 2.83 ft Perimeter = 2.83(2) + 2.17(2) = 10 feet
Clogging factor = 50%

Solution

For Catch Basin CB65 (OS3g)

Weir

Q_{DES}	=	1.92	cfs
C_D	=	3	
H	=	0.5	ft
L	**=**	**2**	**ft**
L_{CLOG}	**=**	**3**	

One grate provides 10-feet of opening

L_{CLOG} /10= 0.27

USE 1 GRATE

Orifice

Q_{DES}	=	1.92	cfs
C_D	=	5.35	
H	=	0.5	ft
A	**=**	0.5	ft^2
A_{CLOG}	**=**	0.8	ft^2

One grate provides 4.7 ft^2 of opening

A_{CLOG} /4.7= 0.16

USE 1 GRATE

1-grate governs

Solution

For Catch Basin CB62 (OS4i)

Weir

Q_{DES}	=	1.4	cfs
C_D	=	3	
H	=	0.5	ft
L	**=**	**1**	**ft**
L_{CLOG}	**=**	**2**	

One grate provides 10-feet of opening

L_{CLOG} /10= 0.20

USE 1 GRATE

Orifice

Q_{DES}	=	1.4	cfs
C_D	=	5.35	
H	=	0.5	ft
A	**=**	0.4	ft^2
A_{CLOG}	**=**	0.6	ft^2

One grate provides 4.7 ft^2 of opening

A_{CLOG} /4.7= 0.12

USE 1 GRATE

1-grate governs

PSOMAS

Project Name: Kolb Road
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GRATED INLET DESIGN

General Equations

Wier

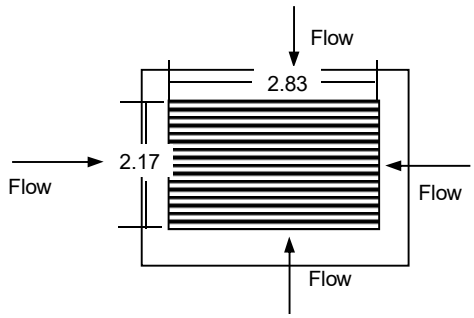
$$Q = C_s L H^{3/2}$$

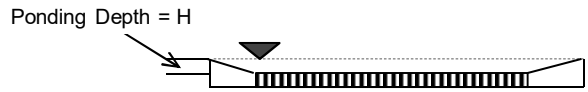
where
- L = Length of Opening (ft)
- C_D = Weir Coefficient
- H = Height of Opening (ft)
- Q = 100-year Peak Discharge (cfs)

Orifice

$$Q = C_s A H^{1/2}$$

where
- A = Effective Area
- Cs = Orifice Coefficient
- H = Depth of ponding
- Q = 100-year Peak Discharge (cfs)





For PC/COT EF-1 Type Grate
Effective Area = 4.66 ft^2/Grate (Per PC/COT SD-311)
Effective Horizontal Opening = 2.83 ft Perimeter = 2.83(2) + 2.17(2) = 10 feet
Clogging factor = 50%

Solution

For Catch Basin CB60 (CP8e)

Weir
Q_{DES} = 1.35 cfs
C_D = 3
H = 0.5 ft
L = 1 ft
L_{CLOG} = 2
One grate provides 10-feet of opening
L_{CLOG} /10= 0.19
USE 1 GRATE

Orifice
Q_{DES} = 1.35 cfs
C_D = 5.35
H = 0.5 ft
A = 0.4 ft^2
A_{CLOG} = 0.5 ft^2
One grate provides 4.7 ft^2 of opening
A_{CLOG} /4.7= 0.11
USE 1 GRATE

1-grate governs

Solution

For Catch Basin CB59 (CP9c)

Weir
Q_{DES} = 0.88 cfs
C_D = 3
H = 0.5 ft
L = 1 ft
L_{CLOG} = 1
One grate provides 10-feet of opening
L_{CLOG} /10= 0.12
USE 1 GRATE

Orifice
Q_{DES} = 0.88 cfs
C_D = 5.35
H = 0.5 ft
A = 0.2 ft^2
A_{CLOG} = 0.3 ft^2
One grate provides 4.7 ft^2 of opening
A_{CLOG} /4.7= 0.07
USE 1 GRATE

1-grate governs

PSOMAS

Project Name: Kolb Road
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GRATED INLET DESIGN

General Equations

Wier

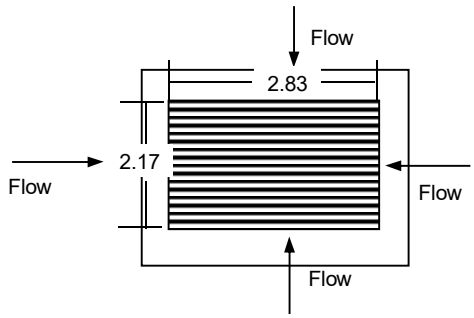
$$Q = C_s L H^{3/2}$$

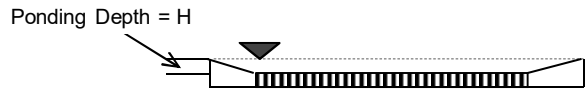
where
- L = Length of Opening (ft)
- C_D = Weir Coefficient
- H = Height of Opening (ft)
- Q = 100-year Peak Discharge (cfs)

Orifice

$$Q = C_s A H^{1/2}$$

where
- A = Effective Area
- Cs = Orifice Coefficient
- H = Depth of ponding
- Q = 100-year Peak Discharge (cfs)





For PC/COT EF-1 Type Grate
Effective Area = 4.66 ft^2/Grate (Per PC/COT SD-311)
Effective Horizontal Opening = 2.83 ft Perimeter = 2.83(2) + 2.17(2) = 10 feet
Clogging factor = 50%

Solution

For Catch Basin CB54 (OS4C&D)

Weir
Q_{DES} = 4.99 cfs
C_D = 3
H = 0.5 ft
L = 5 ft
L_{CLOG} = 7
One grate provides 10-feet of opening
L_{CLOG} /10= 0.71
USE 1 GRATE

Orifice
Q_{DES} = 4.99 cfs
C_D = 5.35
H = 0.5 ft
A = 1.3 ft^2
A_{CLOG} = 2.0 ft^2
One grate provides 4.7 ft^2 of opening
A_{CLOG} /4.7= 0.42
USE 1 GRATE

1-grate governs

Solution

For Catch Basin CB43 (OS13B)

Weir
Q_{DES} = 11 cfs
C_D = 3
H = 1 ft
L = 4 ft
L_{CLOG} = 6
One grate provides 10-feet of opening
L_{CLOG} /10= 0.55
USE 1 GRATE

Orifice
Q_{DES} = 11 cfs
C_D = 5.35
H = 1 ft
A = 2.1 ft^2
A_{CLOG} = 3.1 ft^2
One grate provides 4.7 ft^2 of opening
A_{CLOG} /4.7= 0.66
USE 1 GRATE

1-grate governs

PSOMAS

Project Name: Kolb Road
Project Number # : 7PIM160201 Made by CLR Date 7/12/18
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GRATED INLET DESIGN

General Equations

Wier

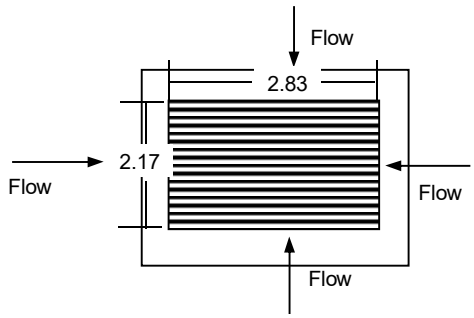
$$Q = C_s L H^{3/2}$$

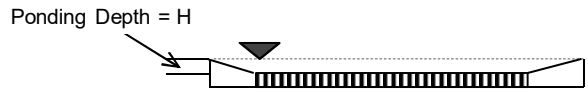
where
- L = Length of Opening (ft)
- C_D = Weir Coefficient
- H = Height of Opening (ft)
- Q = 100-year Peak Discharge (cfs)

Orifice

$$Q = C_s A H^{1/2}$$

where
- A = Effective Area
- Cs = Orifice Coefficient
- H = Depth of ponding
- Q = 100-year Peak Discharge (cfs)





For PC/COT EF-1 Type Grate
Effective Area = 4.66 ft^2/Grate (Per PC/COT SD-311)
Effective Horizontal Opening = 2.83 ft Perimeter = 2.83(2) + 2.17(2) = 10 feet
Clogging factor = 50%

Solution

For Catch Basin CB40 (OS13C)

Weir
Q_{DES} = 1.3 cfs
C_D = 3
H = 0.5 ft
L = 1 ft
L_{CLOG} = 2
One grate provides 10-feet of opening
L_{CLOG} /10= 0.18
USE 1 GRATE

Orifice
Q_{DES} = 1.3 cfs
C_D = 5.35
H = 0.5 ft
A = 0.3 ft^2
A_{CLOG} = 0.5 ft^2
One grate provides 4.7 ft^2 of opening
A_{CLOG} /4.7= 0.11
USE 1 GRATE

1-grate governs

Solution

For Catch Basin CB39 (OS13E)

Weir
Q_{DES} = 0.9 cfs
C_D = 3
H = 0.5 ft
L = 1 ft
L_{CLOG} = 1
One grate provides 10-feet of opening
L_{CLOG} /10= 0.13
USE 1 GRATE

Orifice
Q_{DES} = 0.9 cfs
C_D = 5.35
H = 0.5 ft
A = 0.2 ft^2
A_{CLOG} = 0.4 ft^2
One grate provides 4.7 ft^2 of opening
A_{CLOG} /4.7= 0.08
USE 1 GRATE

1-grate governs

PSOMAS

Project Name: Kolb Road
Project Number # : 7PIM160201 Made by CLR Date 7/12/18
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GRATED INLET DESIGN

General Equations

Wier

$$Q = C_s L H^{3/2}$$

where

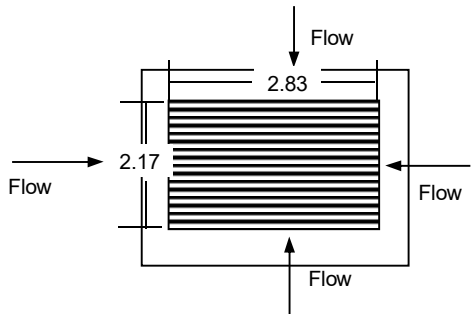
L	=	Length of Opening (ft)
C_D	=	Weir Coefficient
H	=	Height of Opening (ft)
Q	=	100-year Peak Discharge (cfs)

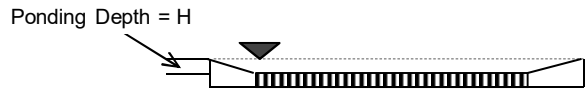
Orifice

$$Q = C_s A H^{1/2}$$

where

A	=	Effective Area
Cs	=	Orifice Coefficient
H	=	Depth of ponding
Q	=	100-year Peak Discharge (cfs)





For PC/COT EF-1 Type Grate
Effective Area = 4.66 ft^2/Grate (Per PC/COT SD-311)
Effective Horizontal Opening = 2.83 ft Perimeter = 2.83(2) + 2.17(2) = 10 feet
Clogging factor = 50%

Solution

For Catch Basin CB37 (OS13D)

Weir

Q_{DES}	=	33.9	cfs
C_D	=	3	
H	=	1.5	ft
L	**=**	**6**	**ft**
L_{CLOG}	**=**	**9**	

One grate provides 10-feet of opening

L_{CLOG} /10= 0.92

USE 1 GRATE

Orifice

Q_{DES}	=	33.9	cfs
C_D	=	5.35	
H	=	1.5	ft
A	**=**	5.2	ft^2
A_{CLOG}	**=**	7.8	ft^2

One grate provides 4.7 ft^2 of opening

A_{CLOG} /4.7= 1.65

USE 2 GRATES

2-grates govern

Solution

For Catch Basin CB36 (OS14A)

Weir

Q_{DES}	=	24.7	cfs
C_D	=	3	
H	=	1.5	ft
L	**=**	**4**	**ft**
L_{CLOG}	**=**	**7**	

One grate provides 10-feet of opening

L_{CLOG} /10= 0.67

USE 1 GRATE

Orifice

Q_{DES}	=	24.7	cfs
C_D	=	5.35	
H	=	1.5	ft
A	**=**	3.8	ft^2
A_{CLOG}	**=**	5.7	ft^2

One grate provides 4.7 ft^2 of opening

A_{CLOG} /4.7= 1.20

USE 2 GRATES

2-grates govern

PSOMAS

Project Name: Kolb Road
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GRATED INLET DESIGN

General Equations

Wier

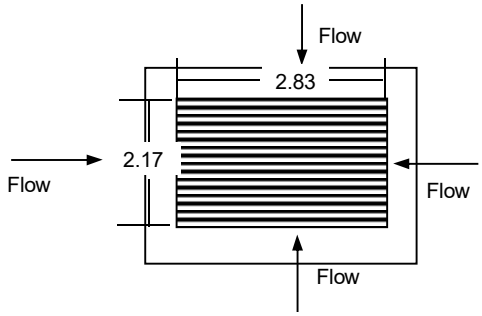
$$Q = C_s L H^{3/2}$$

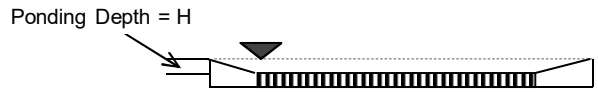
where
- L = Length of Opening (ft)
- C_D = Weir Coefficient
- H = Height of Opening (ft)
- Q = 100-year Peak Discharge (cfs)

Orifice

$$Q = C_s A H^{1/2}$$

where
- A = Effective Area
- Cs = Orifice Coefficient
- H = Depth of ponding
- Q = 100-year Peak Discharge (cfs)





For PC/COT EF-1 Type Grate
Effective Area = 4.66 ft^2/Grate (Per PC/COT SD-311)
Effective Horizontal Opening = 2.83 ft Perimeter = 2.83(2) + 2.17(2) = 10 feet
Clogging factor = 50%

Solution

For Catch Basin CB20 (Bypass from PE-1, OS21A)

Weir
Q_{DES} = 32.3 cfs
C_D = 3
H = 1.5 ft
L = 6 ft
L_{CLOG} = 9
One grate provides 10-feet of opening
L_{CLOG} 1 #
USE 1 GRATE

Orifice
Q_{DES} = 32.3 cfs
C_D = 5.35
H = 1.5 ft
A = 4.9 ft^2
A_{CLOG} = 7.4 ft^2
One grate provides 4.7 ft^2 of opening
A_{CLOG} = #
USE 2 GRATES

2-grates govern

Solution

For Catch Basin CB13 (OS23A)

Weir
Q_{DES} = 16.2 cfs
C_D = 3
H = 0.75 ft
L = 8 ft
L_{CLOG} = 12
One grate provides 10-feet of opening
L_{CLOG} /10= 1.25
USE 1 GRATE

Orifice
Q_{DES} = 16.2 cfs
C_D = 5.35
H = 0.75 ft
A = 3.5 ft^2
A_{CLOG} = 5.2 ft^2
One grate provides 4.7 ft^2 of opening
A_{CLOG} /4.7= 1.12
USE 2 GRATES

2-grates govern

PSOMAS

Project Name: Kolb Road
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GRATED INLET DESIGN

General Equations

Wier

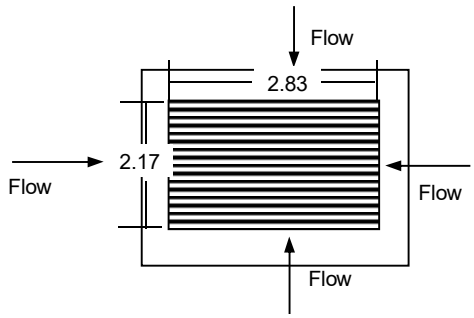
$$Q = C_s L H^{3/2}$$

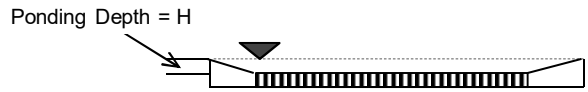
where
- L = Length of Opening (ft)
- C_D = Weir Coefficient
- H = Height of Opening (ft)
- Q = 100-year Peak Discharge (cfs)

Orifice

$$Q = C_s A H^{1/2}$$

where
- A = Effective Area
- Cs = Orifice Coefficient
- H = Depth of ponding
- Q = 100-year Peak Discharge (cfs)





For PC/COT EF-1 Type Grate
Effective Area = 4.66 ft^2/Grate (Per PC/COT SD-311)
Effective Horizontal Opening = 2.83 ft Perimeter = 2.83(2) + 2.17(2) = 10 feet
Clogging factor = 50%

Solution

For Catch Basin CB12B (OS24A)

Weir
Q_{DES} = 4 cfs
C_D = 3
H = 0.5 ft
L = 4 ft
L_{CLOG} = 6
One grate provides 10-feet of opening
L_{CLOG} /10= 0.57
USE 1 GRATE

Orifice
Q_{DES} = 4 cfs
C_D = 5.35
H = 0.5 ft
A = 1.1 ft^2
A_{CLOG} = 1.6 ft^2
One grate provides 4.7 ft^2 of opening
A_{CLOG} /4.7= 0.34
USE 1 GRATE

1-grate governs

Solution

For Catch Basin CB11B (OS24B)

Weir
Q_{DES} = 2.7 cfs
C_D = 3
H = 0.5 ft
L = 3 ft
L_{CLOG} = 4
One grate provides 10-feet of opening
L_{CLOG} /10= 0.38
USE 1 GRATE

Orifice
Q_{DES} = 2.7 cfs
C_D = 5.35
H = 0.5 ft
A = 0.7 ft^2
A_{CLOG} = 1.1 ft^2
One grate provides 4.7 ft^2 of opening
A_{CLOG} /4.7= 0.23
USE 1 GRATE

1-grate governs

PSOMAS

Project Name: Kolb Road
Project Number # : 7PIM160201 Made by CLR Date 7/12/18
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GRATED INLET DESIGN

General Equations

Wier

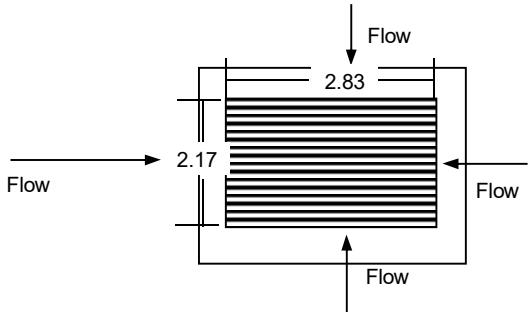
$$Q = C_s L H^{3/2}$$

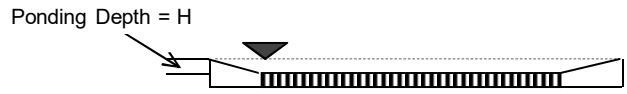
where
- L = Length of Opening (ft)
- C_D = Weir Coefficient
- H = Height of Opening (ft)
- Q = 100-year Peak Discharge (cfs)

Orifice

$$Q = C_s A H^{1/2}$$

where
- A = Effective Area
- Cs = Orifice Coefficient
- H = Depth of ponding
- Q = 100-year Peak Discharge (cfs)





For PC/COT EF-1 Type Grate
Effective Area = 4.66 ft^2/Grate (Per PC/COT SD-311)
Effective Horizontal Opening = 2.83 ft Perimeter = 2.83(2) + 2.17(2) = 10 feet
Clogging factor = 50%

Solution

For Catch Basin CB9 (OS24C)

Weir

Q_{DES}	=	3	cfs
C_D	=	3	
H	=	1	ft
L	**=**	**3**	**ft**
L_{CLOG}	**=**	**4**	

One grate provides 10-feet of opening

L_{CLOG} /10= #

USE 1 GRATE

Orifice

Q_{DES}	=	2.9	cfs
C_D	=	5.35	
H	=	0.5	ft
A	**=**	0.8	ft^2
A_{CLOG}	**=**	1.1	ft^2

One grate provides 4.7 ft^2 of opening

A_{CLOG} /4.7= #

USE 1 GRATE

1-grate governs

Solution

For Catch Basin CB6B (OS24D)

Weir

Q_{DES}	=	#	cfs
C_D	=	3	
H	=	1	ft
L	**=**	**5**	**ft**
L_{CLOG}	**=**	**8**	

One grate provides 10-feet of opening

L_{CLOG} /10= 0.79

USE 1 GRATE

Orifice

Q_{DES}	=	15.8	cfs
C_D	=	5.35	
H	=	1	ft
A	**=**	3.0	ft^2
A_{CLOG}	**=**	4.4	ft^2

One grate provides 4.7 ft^2 of opening

A_{CLOG} /4.7= 0.94

USE 1 GRATE

1-grate governs

PSOMAS

Project Name: Kolb Road
Project Number # : 7PIM160201 Made by CLR Date 7/12/18
Reference: COT SMDDFM Checked By _____ Date _____

GRATED INLET DESIGN

General Equations

Wier

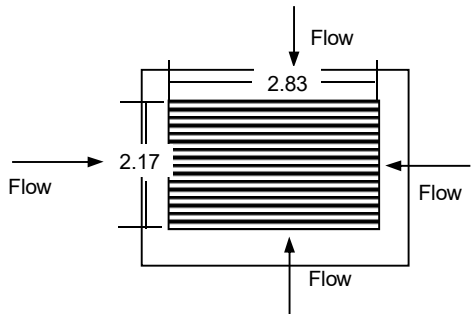
$$Q = C_s L H^{3/2}$$

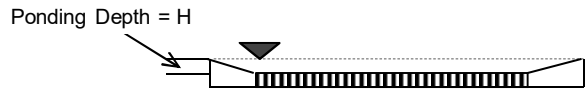
where
- L = Length of Opening (ft)
- C_D = Weir Coefficient
- H = Height of Opening (ft)
- Q = 100-year Peak Discharge (cfs)

Orifice

$$Q = C_s A H^{1/2}$$

where
- A = Effective Area
- Cs = Orifice Coefficient
- H = Depth of ponding
- Q = 100-year Peak Discharge (cfs)





For PC/COT EF-1 Type Grate
Effective Area = 4.66 ft^2/Grate (Per PC/COT SD-311)
Effective Horizontal Opening = 2.83 ft Perimeter = 2.83(2) + 2.17(2) = 10 feet
Clogging factor = 50%

Solution

For Catch Basin CB1H (OS26A)

Weir
Q_{DES} = 0.5 cfs
C_D = 3
H = 0.5 ft
L = 0 ft
L_{CLOG} = 1
One grate provides 10-feet of opening
L_{CLOG} /10= 0.07
USE 1 GRATE

Orifice
Q_{DES} = 0.5 cfs
C_D = 5.35
H = 0.5 ft
A = 0.1 ft^2
A_{CLOG} = 0.2 ft^2
One grate provides 4.7 ft^2 of opening
A_{CLOG} /4.7= 0.04
USE 1 GRATE

1-grate governs

Solution

For Catch Basin CB1G (OS27A)

Weir
Q_{DES} = 5 cfs
C_D = 3
H = 1 ft
L = 2 ft
L_{CLOG} = 3
One grate provides 10-feet of opening
L_{CLOG} /10= 0.25
USE 1 GRATE

Orifice
Q_{DES} = 5 cfs
C_D = 5.35
H = 1 ft
A = 0.9 ft^2
A_{CLOG} = 1.4 ft^2
One grate provides 4.7 ft^2 of opening
A_{CLOG} /4.7= 0.30
USE 1 GRATE

1-grate governs

PSOMAS

Project Name: Kolb Road
Project Number # : 7PIM160201 Made by CLR Date 7/12/18
Reference: COT SMDDFM Checked By _____ Date _____

GRATED INLET DESIGN

General Equations

Wier

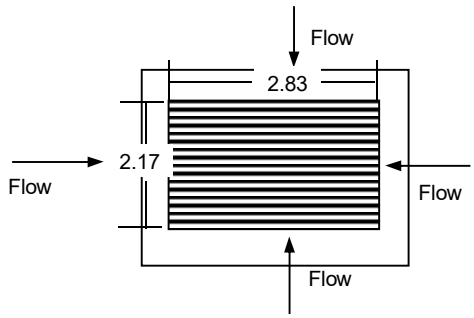
$$Q = C_s L H^{3/2}$$

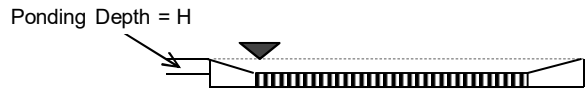
where
- L = Length of Opening (ft)
- C_D = Weir Coefficient
- H = Height of Opening (ft)
- Q = 100-year Peak Discharge (cfs)

Orifice

$$Q = C_s A H^{1/2}$$

where
- A = Effective Area
- Cs = Orifice Coefficient
- H = Depth of ponding
- Q = 100-year Peak Discharge (cfs)





For PC/COT EF-1 Type Grate
Effective Area = 4.66 ft^2/Grate (Per PC/COT SD-311)
Effective Horizontal Opening = 2.83 ft Perimeter = 2.83(2) + 2.17(2) = 10 feet
Clogging factor = 50%

Solution

For Catch Basin CB1E (OS28C)

Weir
Q_{DES} = 11 cfs
C_D = 3
H = 0.75 ft
L = 6 ft
L_{CLOG} = 8
One grate provides 10-feet of opening
L_{CLOG} /10= 0.85
USE 1 GRATE

Orifice
Q_{DES} = 11 cfs
C_D = 5.35
H = 0.75 ft
A = 2.4 ft^2
A_{CLOG} = 3.6 ft^2
One grate provides 4.7 ft^2 of opening
A_{CLOG} /4.7= 0.76
USE 1 GRATE

1-grate governs

Solution

For Catch Basin CB1D (OS27B)

Weir
Q_{DES} = 3.7 cfs
C_D = 3
H = 0.5 ft
L = 3 ft
L_{CLOG} = 5
One grate provides 10-feet of opening
L_{CLOG} /10= 0.52
USE 1 GRATE

Orifice
Q_{DES} = 3.7 cfs
C_D = 5.35
H = 0.5 ft
A = 1.0 ft^2
A_{CLOG} = 1.5 ft^2
One grate provides 4.7 ft^2 of opening
A_{CLOG} /4.7= 0.31
USE 1 GRATE

1-grate governs

PSOMAS

Project Name: Kolb Road
Project Number # : 7PIM160201 Made by CLR Date 7/12/18
Reference: COT SMDDFM Checked By Date

GRATED INLET DESIGN

General Equations

Wier

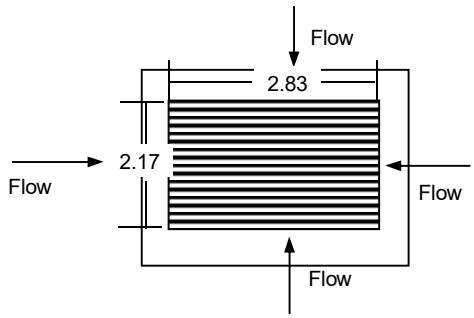
$$Q = C_s L H^{3/2}$$

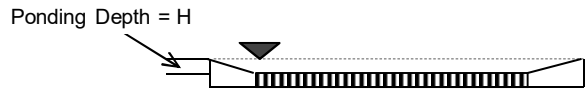
where
- L = Length of Opening (ft)
- C_D = Weir Coefficient
- H = Height of Opening (ft)
- Q = 100-year Peak Discharge (cfs)

Orifice

$$Q = C_s A H^{1/2}$$

where
- A = Effective Area
- Cs = Orifice Coefficient
- H = Depth of ponding
- Q = 100-year Peak Discharge (cfs)





For PC/COT EF-1 Type Grate
Effective Area = 4.66 ft^2/Grate (Per PC/COT SD-311)
Effective Horizontal Opening = 2.83 ft Perimeter = 2.83(2) + 2.17(2) = 10 feet
Clogging factor = 50%

Solution

For Catch Basin CB1A (OS27C)

Weir
- Q_{DES} = 1.4 cfs
- C_D = 3
- H = 0.5 ft
- **L = 1 ft**
- **L_{CLOG} = 2**

One grate provides 10-feet of opening
- **L_{CLOG} /10= 0.20**
- **USE 1 GRATE**

Orifice
- Q_{DES} = 1.4 cfs
- C_D = 5.35
- H = 0.5 ft
- **A = 0.4 ft^2**
- **A_{CLOG} = 0.6 ft^2**

One grate provides 4.7 ft^2 of opening
- **A_{CLOG} /4.7= 0.12**
- **USE 1 GRATE**

1-grate governs

APPENDIX 11

HEC-RAS RESULTS

EXISTING CONDITIONS

HEC-RAS HEC-RAS 5.0.4 April 2018
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X    X
X     X  X        X            X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X        X
X     X  X        X    X       X   X    X    X        X
X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: Kolb Road_Sunrise to Sabino Canyon
Project File : KolbRoad.prj
Run Date and Time: 9/4/2018 11:56:11 AM

Project in English units

PLAN DATA

Plan Title: ExistingFlow
Plan File : t:\7PIM160201\WATRES\GLOBAL\CALCS\Hydraulics\HEC-RAS\KolbRoad.p03

Geometry Title: KolbRd_Existing
Geometry File :
t:\7PIM160201\WATRES\GLOBAL\CALCS\Hydraulics\HEC-RAS\KolbRoad.g01

Flow Title : ExistingFlow
Flow File :
t:\7PIM160201\WATRES\GLOBAL\CALCS\Hydraulics\HEC-RAS\KolbRoad.f01

Plan Summary Information:

Number of:	Cross Sections	= 39	Multiple Openings	=	0
	Culverts	= 3	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

Computational Information
Water surface calculation tolerance = 0.01

```
    Critical depth calculation tolerance =  0.01
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
    Flow tolerance factor                =  0.001

Computation Options
    Critical depth computed only where necessary
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Average Conveyance
    Computational Flow Regime:     Subcritical Flow




FLOW DATA

Flow Title: ExistingFlow
Flow File : t:\7PIM160201\WATRES\GLOBAL\CALCS\Hydraulics\HEC-RAS\KolbRoad.f01

Flow Data (cfs)

  River           Reach           RS                    PF 1
  Sta 53+00 to 56+Sta 53+00 to 56+840                255.26
  Sta 53+00 to 56+Sta 53+00 to 56+800                 279.5
  Sta 70+00 to 78+Sta 70+00 to 78+2050                    79
  Sta 70+00 to 78+Sta 70+00 to 78+1950                   115
  Sta 70+00 to 78+Sta 70+00 to 78+1850                   135
  Sta 70+00 to 78+Sta 70+00 to 78+1800                   147
  Sta 70+00 to 78+Sta 70+00 to 78+1750                   203
  Sta 70+00 to 78+Sta 70+00 to 78+1600                   217
  Sta 70+00 to 78+Sta 70+00 to 78+1400                   264
  Sta 70+00 to 78+Sta 70+00 to 78+1128.78                299
  Sta 80+00 to 83+Sta 80+00 to 83+3530                   304


Boundary Conditions


  River           Reach           Profile                        Upstream
    Downstream


  Sta 53+00 to 56+Sta 53+00 to 56+PF 1                           Critical
      Critical
  Sta 70+00 to 78+Sta 70+00 to 78+PF 1                           Critical
      Critical
  Sta 80+00 to 83+Sta 80+00 to 83+PF 1                           Critical
      Critical
```

GEOMETRY DATA

Geometry Title: KolbRd_Existing
Geometry File : t:\7PIM160201\WATRES\GLOBAL\CALCS\Hydraulics\HEC-RAS\KolbRoad.g01

CROSS SECTION

RIVER: Sta 53+00 to 56+
REACH: Sta 53+00 to 56+ RS: 840

INPUT
Description:
Station Elevation Data num= 39

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2550.09	15.23	2550.13	17.28	2549.99	17.88	2549.95	20.87	2549.76
22.62	2549.61	28.2	2549.16	36.58	2548.01	40.83	2547.64	41.2	2547.61
50.94	2548.37	55.65	2548.74	64.79	2548.81	70.11	2548.76	78.65	2548.87
84.56	2548.88	92.5	2548.78	99.01	2548.74	103.07	2548.68	107.93	2548.55
110.73	2548.47	113.07	2548.32	114.12	2548.23	116.95	2547.75	123.84	2547.82
126.1	2547.85	129.02	2547.83	129.81	2547.88	139.85	2549.7	141.98	2550.11
144.67	2550.66	147.23	2551.2	149.57	2551.43	151.92	2551.66	156.43	2552.1
158.05	2552.3	163.59	2552.93	169.83	2553.2	169.89	2553.2		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.016	22.62	.035	139.85	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
22.62	139.85	40	40	40	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2549.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.		0.035	
W.S. Elev (ft)	2549.18	Reach Len. (ft)	40.00	40.00	40.00
Crit W.S. (ft)		Flow Area (sq ft)		76.96	
E.G. Slope (ft/ft)	0.009747	Area (sq ft)		76.96	

Q Total (cfs)	255.26	Flow (cfs)		255.26
Top Width (ft)	109.02	Top Width (ft)		109.02
Vel Total (ft/s)	3.32	Avg. Vel. (ft/s)		3.32
Max Chl Dpth (ft)	1.57	Hydr. Depth (ft)		0.71
Conv. Total (cfs)	2585.6	Conv. (cfs)		2585.6
Length Wtd. (ft)	40.00	Wetted Per. (ft)		109.33
Min Ch El (ft)	2547.61	Shear (lb/sq ft)		0.43
Alpha	1.00	Stream Power (lb/ft s)		1.42
Frctn Loss (ft)	0.52	Cum Volume (acre-ft)	0.01	0.43
0.62				
C & E Loss (ft)	0.04	Cum SA (acres)	0.01	0.30
0.32				

CROSS SECTION

RIVER: Sta 53+00 to 56+
REACH: Sta 53+00 to 56+ RS: 800

INPUT
Description:
Station Elevation Data num= 35

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2550.67	2	2550.63	2.470001	2550.62	2.610001	2550.62	2.860001	2550.61
2.900002	2550.61	3.910004	2550.59	4.400002	2550.56	4.420006	2550.57	4.690002	2550.51
12.41	2550.04	12.95	2550.09	13.13	2550.01	14.87	2549.89	19.85001	2549.13
29.84	2547.14	37.04	2546.54	42.94	2546.63	47.22	2546.48	53.03001	2546.75
55	2547.13	58.85001	2547.88	63.12	2547.97	70.47	2548.48	73.21001	2548.84
82.10001	2549.25	83.3	2549.37	91.18001	2549.13	93.38	2549.03	93.72	2549.04
101.45	2549.07	101.73	2549.07	103.47	2549.08	108.7	2549.26	122.98	2549.57

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.016	19.85001	.035	83.3	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
19.85001	83.3	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2548.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.55	Wt. n-Val.		0.035	
W.S. Elev (ft)	2548.24	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2548.24	Flow Area (sq ft)		46.78	
E.G. Slope (ft/ft)	0.017675	Area (sq ft)		46.78	
Q Total (cfs)	279.50	Flow (cfs)		279.50	
Top Width (ft)	42.68	Top Width (ft)		42.68	
Vel Total (ft/s)	5.98	Avg. Vel. (ft/s)		5.98	
Max Chl Dpth (ft)	1.76	Hydr. Depth (ft)		1.10	
Conv. Total (cfs)	2102.3	Conv. (cfs)		2102.3	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		42.95	
Min Ch El (ft)	2546.48	Shear (lb/sq ft)		1.20	
Alpha	1.00	Stream Power (lb/ft s)		7.18	
Frctn Loss (ft)	0.16	Cum Volume (acre-ft)	0.01	0.37	0.62
C & E Loss (ft)	0.15	Cum SA (acres)	0.01	0.23	0.32

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross
sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate

```
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Sta 53+00 to 56+
REACH: Sta 53+00 to 56+   RS: 750

INPUT
Description:
Station Elevation Data    num=      35
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2549.931.480011  2549.92.910004 2549.874.440002 2549.848.100006 2549.77
9.550003 2549.7410.90001 2549.73   13.19  2549.7   17.22 2549.62   18.11 2549.82
18.84001 2549.54   19.41 2549.3620.51001 2549.34   33.88 2547.6140.90001 2546.69
   47.84 2545.8652.76001 2545.5854.99001 2545.5557.85001  2545.5   62.91 2546.41
67.85001 2547.2273.06001 2547.0277.85001 2546.86    83.2 2546.5187.85001 2546.25
93.35001 2546.1697.85001 2546.02  103.49    2546  105.94 2545.95  107.02 2545.93
  107.86 2545.91  121.65 2545.84  145.49 2546.18  168.89 2547.24  169.07 2547.24

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   33.88    .03567.85001    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         33.8867.85001               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2547.70    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.04    Wt. n-Val.                  0.016      0.035
  0.045
  W.S. Elev (ft)           2547.66    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)                      Flow Area (sq ft)           0.01      46.27
 135.38
  E.G. Slope (ft/ft)      0.001280    Area (sq ft)                0.01      46.27
 135.38
  Q Total (cfs)             279.50    Flow (cfs)                  0.00      85.93
 193.57
  Top Width (ft)            135.57    Top Width (ft)              0.38      33.97
```

```
 101.22
  Vel Total (ft/s)            1.54    Avg. Vel. (ft/s)            0.28       1.86
   1.43
  Max Chl Dpth (ft)           2.16    Hydr. Depth (ft)            0.02       1.36
   1.34
  Conv. Total (cfs)         7811.0    Conv. (cfs)                  0.1     2401.4
 5409.5
  Length Wtd. (ft)           50.00    Wetted Per. (ft)            0.38      34.24
 101.69
  Min Ch El (ft)           2545.50    Shear (lb/sq ft)            0.00       0.11
   0.11
  Alpha                       1.05    Stream Power (lb/ft s)      0.00       0.20
   0.15
  Frctn Loss (ft)             0.01    Cum Volume (acre-ft)        0.01       0.32
   0.54
  C & E Loss (ft)             0.01    Cum SA (acres)              0.01       0.18
   0.26


Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: Sta 53+00 to 56+
REACH: Sta 53+00 to 56+   RS: 700

INPUT
Description:
Station Elevation Data    num=      36
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2549.17.5200043 2549.163.190002 2549.113.720001 2549.095.179993 2549.03
5.479996 2549.295.580002 2549.435.800003 2549.426.190002  2549.48.110001 2549.48
8.940002  2549.59.960007 2549.53   11.97 2549.5431.50999 2546.1538.67999 2544.26
43.60001 2544.2444.99001 2544.1548.67999  2543.9   53.77 2545.0758.67999 2545.92
   63.94 2545.49   68.69 2545.27   74.12 2545.33   78.69 2545.1684.28999 2544.72
   88.69 2544.43   94.46  2544.4   96.88 2544.42   97.93 2544.43   98.69 2544.43
  113.65 2544.55  138.85 2544.79  163.54 2544.92  187.75 2545.16  208.58  2546.2
     223    2548

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .01631.50999    .03558.67999    .045
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      31.5099958.67999               40      40      40             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2547.68    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.01    Wt. n-Val.                  0.016      0.035
  0.045
  W.S. Elev (ft)           2547.67    Reach Len. (ft)            40.00      40.00
  40.00
  Crit W.S. (ft)                      Flow Area (sq ft)           6.68      79.74
 413.49
  E.G. Slope (ft/ft)      0.000072    Area (sq ft)                6.68      79.74
 413.49
  Q Total (cfs)             279.50    Flow (cfs)                  4.35      58.32
 216.83
  Top Width (ft)            197.64    Top Width (ft)              8.78      27.17
 161.70
  Vel Total (ft/s)            0.56    Avg. Vel. (ft/s)            0.65       0.73
   0.52
  Max Chl Dpth (ft)           3.77    Hydr. Depth (ft)            0.76       2.93
   2.56
  Conv. Total (cfs)        32888.9    Conv. (cfs)                512.3     6862.4
25514.2
  Length Wtd. (ft)           40.00    Wetted Per. (ft)            8.91      27.63
 161.87
  Min Ch El (ft)           2543.90    Shear (lb/sq ft)            0.00       0.01
   0.01
  Alpha                       1.06    Stream Power (lb/ft s)      0.00       0.01
   0.01
  Frctn Loss (ft)             0.00    Cum Volume (acre-ft)        0.00       0.25
   0.22
  C & E Loss (ft)             0.00    Cum SA (acres)              0.00       0.15
   0.11



Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: Sta 53+00 to 56+
```

```
REACH: Sta 53+00 to 56+   RS: 660

INPUT
Description:
Station Elevation Data    num=      47
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  2549.92.330002  2549.9    3.25 2549.893.410004 2549.893.660004 2549.61
3.740005 2549.51     4.5 2549.485.290001 2549.445.849998 2549.41    6.25 2549.38
    10.3 2549.34    16.8 2549.16   22.53 2549.07   26.81 2548.98    32.7 2548.84
   36.81 2548.77   40.75 2548.61   41.81 2548.56   43.41 2548.49   44.16 2548.46
   45.36 2548.47   46.43 2548.47   46.49 2548.48   46.67 2548.48    46.7 2548.49
   46.82 2548.49   47.27 2548.52   51.08 2548.71   51.54 2548.73   52.14 2548.76
   52.92  2548.8   53.68 2548.84   54.27 2548.69   65.36 2545.97   76.55 2543.39
   81.47 2543.46   82.19 2543.39   86.55 2543.03   91.64 2543.54   96.55 2544.92
  101.82 2545.36  106.55 2545.67  111.99 2545.29  116.56  2544.9  122.16 2544.31
  126.56  2544.1  132.14 2543.77

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   54.27    .035  106.55    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         54.27  106.55               85      85      85             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2547.67    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.03    Wt. n-Val.                            0.035
  0.045
  W.S. Elev (ft)           2547.64    Reach Len. (ft)            85.00      85.00
  85.00
  Crit W.S. (ft)           2545.10    Flow Area (sq ft)                    144.23
  76.27
  E.G. Slope (ft/ft)      0.000259    Area (sq ft)                         144.23
  76.27
  Q Total (cfs)             279.50    Flow (cfs)                           203.17
  76.33
  Top Width (ft)             73.61    Top Width (ft)                        48.02
  25.59
  Vel Total (ft/s)            1.27    Avg. Vel. (ft/s)                       1.41
   1.00
  Max Chl Dpth (ft)           4.61    Hydr. Depth (ft)                       3.00
   2.98
  Conv. Total (cfs)        17354.4    Conv. (cfs)                         12614.7
 4739.7
  Length Wtd. (ft)           85.00    Wetted Per. (ft)                      48.77
```

```
  29.54
  Min Ch El (ft)           2543.03    Shear (lb/sq ft)                      0.05
   0.04
  Alpha                       1.07    Stream Power (lb/ft s)                0.07
   0.04
  Frctn Loss (ft)                     Cum Volume (acre-ft)                  0.14
   0.00
  C & E Loss (ft)                     Cum SA (acres)                        0.11
   0.03



CULVERT


RIVER: Sta 53+00 to 56+
REACH: Sta 53+00 to 56+   RS: 650

INPUT
Description:
Distance from Upstream XS =      10
Deck/Roadway Width        =      70
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0 2548.84    2539      40 2548.84    2539      80 2547.57    2539
     100  2547.5    2539     120  2547.5    2539

Upstream Bridge Cross Section Data
Station Elevation Data    num=      49
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2549.91      .7 2549.91    1.75  2549.9    3.14  2549.9    3.23 2549.89
    3.41 2549.89    3.58  2549.7    3.74 2549.51     4.5 2549.48    5.29 2549.44
    5.57 2549.42    5.85 2549.41    5.98  2549.4    6.25 2549.38    10.3 2549.34
    16.8 2549.16   22.53 2549.07   26.81 2548.98    32.7 2548.84   36.81 2548.77
   40.75 2548.61   41.81 2548.56   43.41 2548.49   44.16 2548.46   45.36 2548.47
   46.43 2548.47   46.49 2548.48   46.67 2548.48    46.7 2548.49   46.82 2548.49
   47.27 2548.52   51.08 2548.71   51.54 2548.73   52.14 2548.76   52.92  2548.8
   53.68 2548.84   54.27 2548.69   65.36 2545.97   76.55 2543.39   81.47 2543.46
   82.19 2543.39   86.55 2543.03   91.64 2543.54   96.55 2544.92  101.82 2545.36
  106.55 2545.67  111.99 2545.29  116.56  2544.9     120 2544.31

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   65.36    .035  106.55    .045

Bank Sta: Left   Right    Coeff Contr.   Expan.
```

```
         54.27  106.55             .1       .3

Downstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0 2548.51    2539      40 2548.45    2539      80 2547.57    2539
     100  2547.5    2539     120  2547.5    2539

Downstream Bridge Cross Section Data
Station Elevation Data    num=      32
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2548.07     .36 2548.06    1.87 2547.99    1.93 2547.99    1.95 2548.01
    2.42 2548.48    2.83 2548.46    2.89 2548.46    8.67 2548.59    8.68 2548.59
     8.7  2548.6   14.95 2548.51    23.3 2546.93   24.95 2546.57    31.5  2541.7
   34.68  2541.7      40  2541.7   44.62  2541.7    48.5  2541.7   54.66 2544.62
   54.69 2544.62   62.72 2544.12   64.69    2544   74.69 2544.49   74.73 2544.49
   84.69 2544.42   84.76 2544.42   93.14  2544.5   93.15  2544.5   94.69 2544.52
      95 2544.52     120 2544.77

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   24.95    .035   54.66    .045

Bank Sta: Left   Right    Coeff Contr.   Expan.
         24.95   54.66             .1       .3

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Culverts =  1

Culvert Name     Shape      Rise    Span
Culvert #1      Circular     3.5
FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 1 - Square edge entrance with headwall
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                10      70     .024     .024        0                   .7
      1
Number of Barrels =  4
Upstream   Elevation =  2543
Centerline Stations
```

```
    Sta.    Sta.    Sta.    Sta.
   77.39   81.89   86.39   90.89
Downstream Elevation =  2541.7
Centerline Stations
    Sta.    Sta.    Sta.    Sta.
   33.25   37.75   42.25   46.75

CULVERT OUTPUT  Profile #PF 1  Culv Group:  Culvert #1

  Q Culv Group (cfs)        273.22    Culv Full Len (ft)
  # Barrels                      4    Culv Vel US (ft/s)          8.76
  Q Barrel (cfs)             68.31    Culv Vel DS (ft/s)          8.95
  E.G. US. (ft)            2547.67    Culv Inv El Up (ft)      2543.00
  W.S. US. (ft)            2547.64    Culv Inv El Dn (ft)      2541.70
  E.G. DS (ft)             2544.86    Culv Frctn Ls (ft)          1.30
  W.S. DS (ft)             2544.01    Culv Exit Loss (ft)         0.67
  Delta EG (ft)               2.81    Culv Entr Loss (ft)         0.83
  Delta WS (ft)               3.64    Q Weir (cfs)                6.28
  E.G. IC (ft)             2547.40    Weir Sta Lft (ft)          76.87
  E.G. OC (ft)             2547.67    Weir Sta Rgt (ft)         120.00
  Culvert Control           Outlet    Weir Submerg                0.00
  Culv WS Inlet (ft)       2545.65    Weir Max Depth (ft)         0.17
  Culv WS Outlet (ft)      2544.29    Weir Avg Depth (ft)         0.14
  Culv Nml Depth (ft)         2.64    Weir Flow Area (sq ft)      6.23
  Culv Crt Depth (ft)         2.59    Min El Weir Flow (ft)    2547.51


Warning: During the culvert inlet control computations, the program could not
balance the culvert/weir flow.  The reported
         inlet energy grade answer may not be valid.
Note:    During subcritical analysis, the culvert direct step method, the solution
went to normal depth.

CROSS SECTION


RIVER: Sta 53+00 to 56+
REACH: Sta 53+00 to 56+   RS: 575

INPUT
Description:
Station Elevation Data    num=      32
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2548.07.3600006 2548.061.869995 2547.99    1.93 2547.991.949997 2548.01
2.419998 2548.482.830002 2548.462.889999 2548.468.669998 2548.59    8.68 2548.59
8.699997  2548.6   14.95 2548.51    23.3 2546.93   24.95 2546.57   34.15 2541.96
   34.68  2541.7      40 2541.69   44.62 2541.67   44.68 2541.68   54.66 2544.62
   54.69 2544.62   62.72 2544.12   64.69    2544   74.69 2544.49   74.73 2544.49
```

```
   84.69 2544.4284.75999 2544.42   93.14  2544.593.14999  2544.5   94.69 2544.52
      95 2544.52  114.85 2544.77

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   24.95    .035   54.66    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         24.95   54.66               25      25      25             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2544.86    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.85    Wt. n-Val.                            0.035
  0.000
  W.S. Elev (ft)           2544.01    Reach Len. (ft)            25.00      25.00
  25.00
  Crit W.S. (ft)           2544.01    Flow Area (sq ft)                     37.76
   0.00
  E.G. Slope (ft/ft)      0.016063    Area (sq ft)                          37.76
   0.00
  Q Total (cfs)             279.50    Flow (cfs)                           279.50
   0.00
  Top Width (ft)             22.86    Top Width (ft)                        22.52
   0.33
  Vel Total (ft/s)            7.40    Avg. Vel. (ft/s)                       7.40
   0.11
  Max Chl Dpth (ft)           2.34    Hydr. Depth (ft)                       1.68
   0.00
  Conv. Total (cfs)         2205.3    Conv. (cfs)                          2205.3
    0.0
  Length Wtd. (ft)           25.00    Wetted Per. (ft)                      23.41
   0.33
  Min Ch El (ft)           2541.67    Shear (lb/sq ft)                       1.62

  Alpha                       1.00    Stream Power (lb/ft s)                11.97

  Frctn Loss (ft)             0.40    Cum Volume (acre-ft)                   0.07
   0.00
  C & E Loss (ft)             0.02    Cum SA (acres)                         0.04
   0.00


Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
```

```
         depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Sta 53+00 to 56+
REACH: Sta 53+00 to 56+   RS: 550

INPUT
Description:
Station Elevation Data    num=      28
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2548.08.3300018 2548.07.7200012 2548.041.519997 2547.891.970001 2547.93
2.169998 2547.932.410004 2548.272.589996 2548.48       3 2548.483.190002 2548.47
4.449997 2548.485.029999 2548.496.379997 2548.538.879997 2548.59   11.55 2548.65
    27.5 2542.56   34.77 2540.25   39.68 2540.07      40 2540.07   44.77 2540.12
   49.81 2541.63   54.77 2542.86   59.78 2542.95   64.77 2543.26   69.75 2542.74
   74.77 2542.86   79.71 2543.04      80 2543.03

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016    27.5    .035   54.77    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          27.5   54.77               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2543.20    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.79    Wt. n-Val.                            0.035

  W.S. Elev (ft)           2542.41    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)           2542.41    Flow Area (sq ft)                     39.13

  E.G. Slope (ft/ft)      0.016107    Area (sq ft)                          39.13
```

Q Total (cfs)	279.50	Flow (cfs)	279.50
Top Width (ft)	24.98	Top Width (ft)	24.98
Vel Total (ft/s)	7.14	Avg. Vel. (ft/s)	7.14
Max Chl Dpth (ft)	2.34	Hydr. Depth (ft)	1.57
Conv. Total (cfs)	2202.3	Conv. (cfs)	2202.3
Length Wtd. (ft)	50.00	Wetted Per. (ft)	25.63
Min Ch El (ft)	2540.07	Shear (lb/sq ft)	1.53
Alpha	1.00	Stream Power (lb/ft s)	10.96
Frctn Loss (ft)	0.82	Cum Volume (acre-ft)	0.05
C & E Loss (ft)	0.02	Cum SA (acres)	0.03

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Sta 53+00 to 56+
REACH: Sta 53+00 to 56+ RS: 500

INPUT
Description:
Station Elevation Data num= 27

```
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2548.12.8499985  2548.1    1.25 2548.041.970001 2547.982.269997 2547.98
2.709999    25482.980003 2548.283.120003  2548.55.540001 2548.546.629997 2548.55
7.510002 2548.588.160004  2548.69.309998 2548.64   21.14  2544.8   27.83  2541.9
   34.94 2539.35   39.85 2539.16      40 2539.17   44.94 2539.46   49.89 2540.66
   54.94 2541.28   59.92 2542.03   64.94 2543.06   69.96 2542.84   74.94 2542.77
   79.99 2542.67      80 2542.67
```

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   21.14    .035   64.94    .045

Bank Sta: Left   Right    Coeff Contr.   Expan.
         21.14   64.94             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2542.31    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.74    Wt. n-Val.                            0.035

  W.S. Elev (ft)           2541.57    Reach Len. (ft)

  Crit W.S. (ft)           2541.57    Flow Area (sq ft)                     40.61

  E.G. Slope (ft/ft)      0.016584    Area (sq ft)                          40.61

  Q Total (cfs)             279.50    Flow (cfs)                           279.50

  Top Width (ft)             28.14    Top Width (ft)                        28.14

  Vel Total (ft/s)            6.88    Avg. Vel. (ft/s)                       6.88

  Max Chl Dpth (ft)           2.41    Hydr. Depth (ft)                       1.44

  Conv. Total (cfs)         2170.4    Conv. (cfs)                          2170.4

  Length Wtd. (ft)                    Wetted Per. (ft)                      28.75

  Min Ch El (ft)           2539.16    Shear (lb/sq ft)                       1.46

  Alpha                       1.00    Stream Power (lb/ft s)                10.07

  Frctn Loss (ft)                     Cum Volume (acre-ft)

  C & E Loss (ft)                     Cum SA (acres)



CROSS SECTION


RIVER: Sta 70+00 to 78+
```

```
REACH: Sta 70+00 to 78+   RS: 2050

INPUT
Description:
Station Elevation Data    num=      26
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2628.01.8499985 2628.021.540001 2628.042.139999 2628.072.759995 2627.96
6.259995 2628.08   13.81 2628.01   19.48 2628.49   23.82  2628.9   30.02 2629.13
   33.84 2629.47    36.7 2628.78   42.69  2628.3   43.51 2627.88   46.49 2628.13
   49.99 2628.58   50.76 2628.68   53.86 2629.01   61.64 2629.34   63.88 2629.36
66.25999 2629.21   73.62 2628.53   80.54 2628.54   83.63 2628.43   86.43 2628.81
   89.99 2629.45

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   33.84    .035   61.64    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         33.84   61.64               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2629.08    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.26    Wt. n-Val.                  0.016      0.035
  0.045
  W.S. Elev (ft)           2628.82    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)           2628.82    Flow Area (sq ft)          14.56       6.52
   3.97
  E.G. Slope (ft/ft)      0.004474    Area (sq ft)               14.56       6.52
   3.97
  Q Total (cfs)              79.00    Flow (cfs)                 65.23      10.31
   3.46
  Top Width (ft)             54.37    Top Width (ft)             22.94      15.49
  15.95
  Vel Total (ft/s)            3.15    Avg. Vel. (ft/s)            4.48       1.58
   0.87
  Max Chl Dpth (ft)           0.94    Hydr. Depth (ft)            0.63       0.42
   0.25
  Conv. Total (cfs)         1181.0    Conv. (cfs)                975.2      154.2
   51.7
  Length Wtd. (ft)           50.00    Wetted Per. (ft)           23.79      15.67
  15.99
  Min Ch El (ft)           2627.88    Shear (lb/sq ft)            0.17       0.12
   0.07
  Alpha                       1.70    Stream Power (lb/ft s)      0.77       0.18
```

```
   0.06
  Frctn Loss (ft)             0.22    Cum Volume (acre-ft)        0.31       1.12
   0.03
  C & E Loss (ft)             0.01    Cum SA (acres)              0.41       0.46
   0.05



Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 2000

INPUT
Description:
Station Elevation Data    num=      25
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2625.51.8799973 2625.561.110001 2625.571.709999 2625.516.290001 2624.98
   11.12 2625.04    16.3 2625.08   22.03 2625.88   26.32 2626.31   32.57 2627.18
   36.33 2627.53    38.8 2627.33   45.36 2627.08   46.86 2626.32   49.99 2627.25
   53.67 2628.34   56.36 2628.67   64.19 2628.06   66.37 2628.25   68.69 2628.17
   76.11 2629.15   79.33 2629.83   86.13 2630.62   88.87 2630.95   89.99 2631.08

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   36.33    .035   56.36    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         36.33   56.36               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1
```

```
  E.G. Elev (ft)           2626.34    Element                   Left OB    Channel
Right OB
  Vel Head (ft)               0.36    Wt. n-Val.                 0.016

  W.S. Elev (ft)           2625.98    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)           2625.98    Flow Area (sq ft)          16.40

  E.G. Slope (ft/ft)      0.004361    Area (sq ft)               16.40

  Q Total (cfs)              79.00    Flow (cfs)                 79.00

  Top Width (ft)             22.99    Top Width (ft)             22.99

  Vel Total (ft/s)            4.82    Avg. Vel. (ft/s)            4.82

  Max Chl Dpth (ft)           1.00    Hydr. Depth (ft)            0.71

  Conv. Total (cfs)         1196.2    Conv. (cfs)               1196.2

  Length Wtd. (ft)           50.00    Wetted Per. (ft)           23.55

  Min Ch El (ft)           2626.32    Shear (lb/sq ft)            0.19

  Alpha                       1.00    Stream Power (lb/ft s)      0.91

  Frctn Loss (ft)             0.21    Cum Volume (acre-ft)        0.29       1.12
   0.02
  C & E Loss (ft)             0.01    Cum SA (acres)              0.38       0.45
   0.04


Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
```

```
not a valid subcritical answer.  The
         program defaulted to critical depth.
Warning: There is no flow in the channel.  Check that the channel stations are
correctly coded. To force flow into the channel,
         a levee or ineffective flow may have to be added or the Manning's n of the
overbank could be increased.

CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1950

INPUT
Description:
Station Elevation Data    num=      27
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2623.511.720001 2623.511.900002  2623.52.639999 2623.489.480003 2622.94
   12.23 2622.74   13.55 2622.82   19.52 2623.23   21.93  2623.4   22.47 2623.45
23.31001  2623.6   32.71 2625.28   36.46 2625.47   42.96 2626.16   44.76 2625.21
   48.37 2624.04   49.37 2624.97   49.76 2625.14    53.2 2626.66   62.77 2626.75
   63.44 2626.78   63.93  2626.8   73.41  2628.5   74.09 2628.57   83.65  2629.3
   86.37 2629.68   89.76 2630.12

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   42.96    .035    53.2    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         42.96    53.2               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2624.50    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.43    Wt. n-Val.                  0.016      0.035

  W.S. Elev (ft)           2624.06    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)           2624.06    Flow Area (sq ft)          21.79       0.00

  E.G. Slope (ft/ft)      0.004208    Area (sq ft)               21.79       0.00

  Q Total (cfs)             115.00    Flow (cfs)                115.00       0.00

  Top Width (ft)             26.01    Top Width (ft)             25.91       0.10
```

Vel Total (ft/s)	5.28	Avg. Vel. (ft/s)	5.28	0.13
Max Chl Dpth (ft)	1.32	Hydr. Depth (ft)	0.84	0.01
Conv. Total (cfs)	1772.8	Conv. (cfs)	1772.8	0.0
Length Wtd. (ft)	50.00	Wetted Per. (ft)	26.57	0.11
Min Ch El (ft)	2624.04	Shear (lb/sq ft)	0.22	
Alpha	1.00	Stream Power (lb/ft s)	1.14	
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	0.27	1.12
0.02				
C & E Loss (ft)	0.00	Cum SA (acres)	0.35	0.45
0.04				

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+ RS: 1900

INPUT
Description:
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2620.67	1.020004	2620.68	3.169998	2620.74	3.200005	2620.74	3.82	2620.65
7.82	2620.28	10.57	2620.03	13.6	2620.24	20.6	2620.61	24.49	2621.32
30.63	2622.21	35.37	2623.11	40.67	2623.93	42.25	2623.91	44.47	2623.06
49.97	2622.05	50.62	2621.93	51.66	2622.71	59.96	2624.76	60.73	2624.97

```
   68.02 2626.49   70.76 2627.15    73.5 2627.48   80.52  2628.3   87.54 2628.98
   89.97 2629.19

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   42.25    .035   59.96    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         42.25   59.96               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2621.82    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.44    Wt. n-Val.                  0.016

  W.S. Elev (ft)           2621.38    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)           2621.38    Flow Area (sq ft)          21.60

  E.G. Slope (ft/ft)      0.004145    Area (sq ft)               21.60

  Q Total (cfs)             115.00    Flow (cfs)                115.00

  Top Width (ft)             24.87    Top Width (ft)             24.87

  Vel Total (ft/s)            5.32    Avg. Vel. (ft/s)            5.32

  Max Chl Dpth (ft)           1.35    Hydr. Depth (ft)            0.87

  Conv. Total (cfs)         1786.3    Conv. (cfs)               1786.3

  Length Wtd. (ft)           50.00    Wetted Per. (ft)           25.70

  Min Ch El (ft)           2621.93    Shear (lb/sq ft)            0.22

  Alpha                       1.00    Stream Power (lb/ft s)      1.16

  Frctn Loss (ft)             0.21    Cum Volume (acre-ft)        0.24       1.12
   0.02
  C & E Loss (ft)             0.00    Cum SA (acres)              0.32       0.45
   0.04


Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
```

```
         depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.
Warning: There is no flow in the channel.  Check that the channel stations are
correctly coded. To force flow into the channel,
         a levee or ineffective flow may have to be added or the Manning's n of the
overbank could be increased.

CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1850

INPUT
Description:
Station Elevation Data    num=      30
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2618.15.6999969 2618.17    3.82 2618.21    4.43 2618.124.479996 2618.12
    9.43 2617.67   11.77 2617.76   19.46 2618.12   22.66 2618.39   29.49 2618.76
   33.54 2620.17   39.53 2621.98   44.42 2622.09   49.56 2622.29   52.44 2621.55
   54.08 2621.18   54.69 2621.16   54.95 2620.99   55.01 2620.95   56.43 2620.69
   57.06 2621.16   57.88 2621.11   59.59 2621.6766.18999 2623.59   69.62 2624.43
   73.05 2625.06   79.38  2625.9   85.71    2626   89.41 2626.33   94.95 2626.92

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   49.56    .03566.18999    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         49.5666.18999               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2619.43    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.43    Wt. n-Val.                  0.016

  W.S. Elev (ft)           2619.00    Reach Len. (ft)            50.00      50.00
```

```
  50.00
  Crit W.S. (ft)           2619.00    Flow Area (sq ft)          25.59

  E.G. Slope (ft/ft)      0.004187    Area (sq ft)               25.59

  Q Total (cfs)             135.00    Flow (cfs)                135.00

  Top Width (ft)             30.17    Top Width (ft)             30.17

  Vel Total (ft/s)            5.27    Avg. Vel. (ft/s)            5.27

  Max Chl Dpth (ft)           1.33    Hydr. Depth (ft)            0.85

  Conv. Total (cfs)         2086.3    Conv. (cfs)               2086.3

  Length Wtd. (ft)           50.00    Wetted Per. (ft)           31.12

  Min Ch El (ft)           2620.69    Shear (lb/sq ft)            0.21

  Alpha                       1.00    Stream Power (lb/ft s)      1.13

  Frctn Loss (ft)             0.21    Cum Volume (acre-ft)        0.21       1.12
   0.02
  C & E Loss (ft)             0.00    Cum SA (acres)              0.29       0.45
   0.04


Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.
Warning: There is no flow in the channel.  Check that the channel stations are
correctly coded. To force flow into the channel,
         a levee or ineffective flow may have to be added or the Manning's n of the
overbank could be increased.

CROSS SECTION
```

```
RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1800

INPUT
Description:
Station Elevation Data    num=      30
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2615.582.639999 2615.672.850006 2615.643.370003 2615.556.690002 2615.37
8.300003 2615.249.950005 2615.36   18.34 2615.91   20.84  2615.9   28.37 2615.45
   31.72 2616.31    38.4 2617.86   44.11 2619.47   48.43 2620.39   53.49 2620.39
   58.46 2620.31   59.94 2619.88    61.4 2619.45   63.08 2619.18   64.51 2618.48
65.74001 2619.14   66.89 2619.5368.49001 2620.24   72.61 2620.72   78.25 2621.23
82.74001 2621.47   88.29 2621.85   94.78 2622.09   98.32  2622.2   99.94  2622.2

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   58.46    .03568.49001    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         58.4668.49001               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2616.95    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.44    Wt. n-Val.                  0.016

  W.S. Elev (ft)           2616.51    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)           2616.51    Flow Area (sq ft)          27.76

  E.G. Slope (ft/ft)      0.004210    Area (sq ft)               27.76

  Q Total (cfs)             147.00    Flow (cfs)                147.00

  Top Width (ft)             32.58    Top Width (ft)             32.58

  Vel Total (ft/s)            5.30    Avg. Vel. (ft/s)            5.30

  Max Chl Dpth (ft)           1.27    Hydr. Depth (ft)            0.85

  Conv. Total (cfs)         2265.5    Conv. (cfs)               2265.5

  Length Wtd. (ft)           50.00    Wetted Per. (ft)           33.70

  Min Ch El (ft)           2618.48    Shear (lb/sq ft)            0.22
```

```
  Alpha                        1.00    Stream Power (lb/ft s)      1.15

  Frctn Loss (ft)              0.21    Cum Volume (acre-ft)        0.18       1.12
   0.02
  C & E Loss (ft)              0.00    Cum SA (acres)              0.26       0.45
   0.04



Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.
Warning: There is no flow in the channel.  Check that the channel stations are
correctly coded. To force flow into the channel,
         a levee or ineffective flow may have to be added or the Manning's n of the
overbank could be increased.

CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1750

INPUT
Description:
Station Elevation Data    num=      30
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2613.89.8700027 2613.913.900002 2613.984.330002  2613.84.520004 2613.72
5.860001 2613.717.860001 2613.73   16.41 2614.04   18.36 2614.13   19.29 2614.07
   28.87  2613.7    34.8 2614.16   39.38 2614.41   49.02 2617.69   49.89 2617.98
   57.62  2618.6   60.39 2618.85    63.8 2618.9265.57001 2618.96   67.86 2618.85
   69.23 2618.35   70.27 2615.77   71.62 2617.94   73.87 2618.49   81.12 2619.53
   87.47 2620.23   91.63 2620.44   93.61 2620.28  102.14 2619.39   103.8 2619.39

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .01665.57001    .035   87.47    .045
```

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
65.57001	87.47	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2615.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.46	Wt. n-Val.	0.016		
W.S. Elev (ft)	2614.88	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2614.88	Flow Area (sq ft)	37.24		
E.G. Slope (ft/ft)	0.004035	Area (sq ft)	37.24		
Q Total (cfs)	203.00	Flow (cfs)	203.00		
Top Width (ft)	40.76	Top Width (ft)	40.76		
Vel Total (ft/s)	5.45	Avg. Vel. (ft/s)	5.45		
Max Chl Dpth (ft)	1.18	Hydr. Depth (ft)	0.91		
Conv. Total (cfs)	3195.6	Conv. (cfs)	3195.6		
Length Wtd. (ft)	50.00	Wetted Per. (ft)	41.93		
Min Ch El (ft)	2615.77	Shear (lb/sq ft)	0.22		
Alpha	1.00	Stream Power (lb/ft s)	1.22		
Frctn Loss (ft)	0.20	Cum Volume (acre-ft)	0.15	1.12	0.02
C & E Loss (ft)	0.00	Cum SA (acres)	0.21	0.45	0.04

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.

```
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.
Warning: There is no flow in the channel.  Check that the channel stations are
correctly coded. To force flow into the channel,
         a levee or ineffective flow may have to be added or the Manning's n of the
overbank could be increased.

CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1700

INPUT
Description:
Station Elevation Data    num=      29
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2611.771.940002  2611.82.150002 2611.722.550003 2611.554.360001 2611.57
8.480003 2611.25   17.71 2611.87   19.04 2611.91   21.61 2611.91   29.61 2611.98
   33.76 2612.44   40.18 2612.99   49.81 2615.09   50.75 2615.29   52.55 2615.24
   58.93 2614.77   61.32  2614.6    64.3 2613.66   65.33 2611.94   66.45 2613.33
   69.07  2614.2   71.74 2614.95   76.04    2616   82.17 2616.98   89.03 2617.01
   92.74    2617   93.83 2617.02   94.66 2617.02   98.93 2617.05

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   52.55    .035   76.04    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         52.55   76.04               30      30      30             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2613.30    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.48    Wt. n-Val.                  0.016      0.035

  W.S. Elev (ft)           2612.82    Reach Len. (ft)            30.00      30.00
  30.00
  Crit W.S. (ft)           2612.82    Flow Area (sq ft)          36.27       0.54

  E.G. Slope (ft/ft)      0.004023    Area (sq ft)               36.27       0.54

  Q Total (cfs)             203.00    Flow (cfs)                202.42       0.58
```

Top Width (ft)	39.40	Top Width (ft)	38.17	1.23
Vel Total (ft/s)	5.51	Avg. Vel. (ft/s)	5.58	1.07
Max Chl Dpth (ft)	1.57	Hydr. Depth (ft)	0.95	0.44
Conv. Total (cfs)	3200.7	Conv. (cfs)	3191.5	9.1
Length Wtd. (ft)	30.00	Wetted Per. (ft)	39.34	2.15
Min Ch El (ft)	2611.94	Shear (lb/sq ft)	0.23	0.06
Alpha	1.02	Stream Power (lb/ft s)	1.29	0.07
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	0.10	1.12
0.02				
C & E Loss (ft)	0.00	Cum SA (acres)	0.17	0.45
0.04				

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+ RS: 1670

INPUT
Description:
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2610.49	3.340004	2610.56	3.620003	2610.49	4.019997	2610.41	5.68	2610.38

```
8.150002 2610.36   14.62 2610.37   18.72 2610.35   26.62 2610.51   29.29  2610.6
   30.68 2610.82   39.86 2611.94   46.73 2612.58   50.43 2613.23   57.56 2612.98
   58.93 2612.78   60.88 2612.48   63.33 2610.02   67.06 2611.39   71.45 2612.73
   77.07 2614.29   81.85 2615.42   91.57 2615.86   92.41 2615.93   94.03    2616
   98.93 2616.17

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   50.43    .035   81.85    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         50.43   81.85               70      70      70             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2611.98    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.48    Wt. n-Val.                  0.016      0.035

  W.S. Elev (ft)           2611.50    Reach Len. (ft)            70.00      70.00
  70.00
  Crit W.S. (ft)           2611.50    Flow Area (sq ft)          34.61       4.08

  E.G. Slope (ft/ft)      0.004067    Area (sq ft)               34.61       4.08

  Q Total (cfs)             203.00    Flow (cfs)                194.84       8.16

  Top Width (ft)             41.84    Top Width (ft)             36.27       5.57

  Vel Total (ft/s)            5.25    Avg. Vel. (ft/s)            5.63       2.00

  Max Chl Dpth (ft)           1.48    Hydr. Depth (ft)            0.95       0.73

  Conv. Total (cfs)         3183.0    Conv. (cfs)               3055.1      127.9

  Length Wtd. (ft)           70.00    Wetted Per. (ft)           37.36       6.45

  Min Ch El (ft)           2610.02    Shear (lb/sq ft)            0.24       0.16

  Alpha                       1.11    Stream Power (lb/ft s)      1.32       0.32

  Frctn Loss (ft)             0.47    Cum Volume (acre-ft)        0.08       1.12
   0.02
  C & E Loss (ft)             0.01    Cum SA (acres)              0.14       0.45
   0.04
```

```
Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1600

INPUT
Description:
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2608.13.9199982 2608.077.959999 2607.668.419998 2607.638.639999 2607.62
    9.25  2607.6   19.72 2607.21   23.42 2607.13    30.8 2607.05    31.2 2607.05
      40 2607.06   41.88 2607.07    51.6  2607.6   52.95 2607.66   53.44 2607.69
   55.38 2607.98   63.04 2608.81   63.73 2609.11   68.41 2609.47   74.81 2610.04
      80 2610.42

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   19.72    .035    51.6    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         19.72    51.6               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2608.59    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.45    Wt. n-Val.                  0.016      0.035
```

```
  0.045
  W.S. Elev (ft)           2608.14    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)           2608.14    Flow Area (sq ft)          10.23      31.01
   1.60
  E.G. Slope (ft/ft)      0.012655    Area (sq ft)               10.23      31.01
   1.60
  Q Total (cfs)             217.00    Flow (cfs)                 68.98     145.33
   2.69
  Top Width (ft)             56.81    Top Width (ft)             19.72      31.88
   5.21
  Vel Total (ft/s)            5.07    Avg. Vel. (ft/s)            6.74       4.69
   1.68
  Max Chl Dpth (ft)           1.08    Hydr. Depth (ft)            0.52       0.97
   0.31
  Conv. Total (cfs)         1929.0    Conv. (cfs)                613.2     1291.9
   24.0
  Length Wtd. (ft)           50.00    Wetted Per. (ft)           19.75      31.90
   5.24
  Min Ch El (ft)           2607.05    Shear (lb/sq ft)            0.41       0.77
   0.24
  Alpha                       1.14    Stream Power (lb/ft s)      2.76       3.60
   0.41
  Frctn Loss (ft)             0.56    Cum Volume (acre-ft)        0.04       1.09
   0.02
  C & E Loss (ft)             0.00    Cum SA (acres)              0.10       0.42
   0.04


Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1550

INPUT
```

Description:

Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2607.12.3499985	2607.111.010002	2607.151.559998	2607.118.580002	2606.7				
11.33	2606.88	19.26	2607.48	24.87	2607.76	29.93	2607.98	32.65	2608.02
34.91	2606.72	39.78	2605.41	40	2605.29	42.43	2604.02	48.32	2605.48
51.29	2606.08	58.07	2608.97	61.96	2610.42	63.96	2610.9	72.35	2611.26
73.6	2611.25	80	2611.27						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.016	32.65	.035	58.07	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
32.65	58.07	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2607.76	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.50	Wt. n-Val.	0.016	0.035
W.S. Elev (ft)	2607.27	Reach Len. (ft)	50.00	50.00
50.00				
Crit W.S. (ft)	2607.27	Flow Area (sq ft)	5.04	33.75
E.G. Slope (ft/ft)	0.010071	Area (sq ft)	5.04	33.75
Q Total (cfs)	217.00	Flow (cfs)	21.23	195.77
Top Width (ft)	36.54	Top Width (ft)	16.43	20.11
Vel Total (ft/s)	5.59	Avg. Vel. (ft/s)	4.21	5.80
Max Chl Dpth (ft)	3.25	Hydr. Depth (ft)	0.31	1.68
Conv. Total (cfs)	2162.3	Conv. (cfs)	211.6	1950.7
Length Wtd. (ft)	50.00	Wetted Per. (ft)	16.61	21.25
Min Ch El (ft)	2604.02	Shear (lb/sq ft)	0.19	1.00
Alpha	1.03	Stream Power (lb/ft s)	0.80	5.79
Frctn Loss (ft)	0.66	Cum Volume (acre-ft)	0.03	1.05
0.02				
C & E Loss (ft)	0.03	Cum SA (acres)	0.08	0.39

```
   0.04



Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1500

INPUT
Description:
Station Elevation Data    num=      26
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2606.29.4000015 2606.312.760002 2606.383.129997 2606.343.260002 2606.32
3.900002  2606.3    8.25  2606.2   12.08 2606.38    18.3 2606.37    23.2 2606.19
   28.34 2606.21   34.31 2605.33   38.39  2605.2   41.76 2604.63   47.48 2602.26
   51.22 2599.75   52.69 2601.59   54.93 2602.23   58.49 2603.26   67.66 2605.75
   68.53 2605.96   69.38 2606.37   78.31 2610.75    87.6 2610.84   88.36 2610.85
   94.93 2610.99

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   38.39    .035   67.66    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         38.39   67.66               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2604.82    Element                    Left OB    Channel
Right OB
```

Vel Head (ft)	0.85	Wt. n-Val.			0.035
W.S. Elev (ft)	2603.97	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2603.97	Flow Area (sq ft)			29.38
E.G. Slope (ft/ft)	0.018207	Area (sq ft)			29.38
Q Total (cfs)	217.00	Flow (cfs)			217.00
Top Width (ft)	17.76	Top Width (ft)			17.76
Vel Total (ft/s)	7.38	Avg. Vel. (ft/s)			7.38
Max Chl Dpth (ft)	4.22	Hydr. Depth (ft)			1.65
Conv. Total (cfs)	1608.2	Conv. (cfs)			1608.2
Length Wtd. (ft)	50.00	Wetted Per. (ft)			20.08
Min Ch El (ft)	2599.75	Shear (lb/sq ft)			1.66
Alpha	1.00	Stream Power (lb/ft s)			12.29
Frctn Loss (ft)	0.76	Cum Volume (acre-ft)	0.03	1.02	0.02
C & E Loss (ft)	0.00	Cum SA (acres)	0.07	0.36	0.04

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+ RS: 1450

```
INPUT
Description:
Station Elevation Data    num=      31
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2605.49   .0699 2605.49.5699997  2605.4.6700058 2605.38    7.25 2605.52
9.590004 2605.5716.39001 2605.64   19.59 2605.6726.56001 2605.39   29.59 2605.31
   36.73 2604.82   39.59 2604.78    46.9 2603.59    49.6 2603.29   57.07 2602.27
    59.6 2601.9367.24001 2601.2169.60001 2600.77   71.69 2597.88   71.87 2597.47
   71.98 2597.49   72.44  2597.6   73.13 2597.86   79.33 2600.42   83.23 2602.73
   89.34 2605.04   95.65 2607.86   99.34 2609.57  105.82  2610.8  109.34 2610.67
  111.98 2610.67

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .01667.24001    .035   79.33    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      67.24001   79.33               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2602.52    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.85    Wt. n-Val.                  0.016      0.035
  0.045
  W.S. Elev (ft)           2601.67    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)           2601.67    Flow Area (sq ft)           1.11      27.95
   1.31
  E.G. Slope (ft/ft)      0.012906    Area (sq ft)                1.11      27.95
   1.31
  Q Total (cfs)             217.00    Flow (cfs)                  4.36     209.38
   3.25
  Top Width (ft)             19.05    Top Width (ft)              4.85      12.09
   2.11
  Vel Total (ft/s)            7.14    Avg. Vel. (ft/s)            3.93       7.49
   2.48
  Max Chl Dpth (ft)           4.20    Hydr. Depth (ft)            0.23       2.31
   0.62
  Conv. Total (cfs)         1910.1    Conv. (cfs)                 38.4     1843.1
   28.6
  Length Wtd. (ft)           50.00    Wetted Per. (ft)            4.87      14.44
   2.45
  Min Ch El (ft)           2597.47    Shear (lb/sq ft)            0.18       1.56
   0.43
  Alpha                       1.07    Stream Power (lb/ft s)      0.72      11.68
```

```
   1.07
  Frctn Loss (ft)             0.54    Cum Volume (acre-ft)        0.03       0.98
   0.02
  C & E Loss (ft)             0.12    Cum SA (acres)              0.06       0.35
   0.04



Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1400

INPUT
Description:
Station Elevation Data    num=      35
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2605.122.340004 2605.182.520004 2605.162.970001 2605.094.540001 2605.13
9.970001 2605.2619.99001 2605.16   22.07 2605.16   31.84 2605.18   39.59 2604.44
42.78001 2604.27    46.8 2603.6453.71001 2602.59    59.2 2600.78   64.65 2598.94
   67.01 2598.7775.29001 2597.8875.49001 2597.87   75.95 2597.84   86.23 2597.16
   88.87 2596.6189.74001 2595.76   90.05 2595.88   91.67 2596.5393.32001 2597.57
   97.16 2598.1198.24001 2598.35  100.68 2598.99  105.82 2600.28   108.1 2600.73
  113.98 2600.94  119.03 2601.22  125.41 2601.28  129.97 2601.27  130.05 2601.27

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   67.01    .03598.24001    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         67.0198.24001               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1
```

```
  E.G. Elev (ft)           2599.58    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.45    Wt. n-Val.                  0.016      0.035
  0.045
  W.S. Elev (ft)           2599.14    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)                      Flow Area (sq ft)           0.72      48.08
   1.18
  E.G. Slope (ft/ft)      0.009475    Area (sq ft)                0.72      48.08
   1.18
  Q Total (cfs)             264.00    Flow (cfs)                  2.54     259.48
   1.99
  Top Width (ft)             37.20    Top Width (ft)              2.94      31.23
   3.02
  Vel Total (ft/s)            5.28    Avg. Vel. (ft/s)            3.51       5.40
   1.68
  Max Chl Dpth (ft)           3.38    Hydr. Depth (ft)            0.25       1.54
   0.39
  Conv. Total (cfs)         2712.2    Conv. (cfs)                 26.1     2665.7
   20.4
  Length Wtd. (ft)           50.00    Wetted Per. (ft)            2.98      32.22
   3.13
  Min Ch El (ft)           2595.76    Shear (lb/sq ft)            0.14       0.88
   0.22
  Alpha                       1.03    Stream Power (lb/ft s)      0.50       4.76
   0.38
  Frctn Loss (ft)             0.04    Cum Volume (acre-ft)        0.03       0.94
   0.02
  C & E Loss (ft)             0.12    Cum SA (acres)              0.06       0.32
   0.03


Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1350

INPUT
Description:
Station Elevation Data    num=      33
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2604.153.179993  2604.23.709991 2604.234.119995 2604.264.289993 2604.21
```

```
   11.52 2604.09   13.81 2604.06   15.63 2604.0624.74999 2604.09   28.27 2604.09
35.67999 2604.7636.23999 2604.74   46.62  2603.854.84999 2602.59   57.55 2602.12
60.96999 2601.5268.48999  2600.474.40999 2598.3279.12999    259690.01999 2594.12
90.06999 2594.1190.07999  2594.193.64999 2593.4896.03999 2593.0799.24999 2594.23
     101 2595.18  109.62 2597.98  111.94 2598.43  112.83 2598.71  114.85 2599.59
  122.87 2602.05  129.23  2602.1  133.65 2602.19

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .01674.40999    .035  109.62    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      74.40999  109.62               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2599.42    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.05    Wt. n-Val.                  0.016      0.035
  0.045
  W.S. Elev (ft)           2599.37    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)                      Flow Area (sq ft)           1.56     142.68
   3.91
  E.G. Slope (ft/ft)      0.000305    Area (sq ft)                1.56     142.68
   3.91
  Q Total (cfs)             264.00    Flow (cfs)                  1.58     260.49
   1.92
  Top Width (ft)             42.91    Top Width (ft)              2.98      35.21
   4.72
  Vel Total (ft/s)            1.78    Avg. Vel. (ft/s)            1.01       1.83
   0.49
  Max Chl Dpth (ft)           6.30    Hydr. Depth (ft)            0.52       4.05
   0.83
  Conv. Total (cfs)        15125.9    Conv. (cfs)                 90.8    14924.9
  110.2
  Length Wtd. (ft)           50.00    Wetted Per. (ft)            3.16      36.89
   4.94
  Min Ch El (ft)           2593.07    Shear (lb/sq ft)            0.01       0.07
   0.02
  Alpha                       1.04    Stream Power (lb/ft s)      0.01       0.13
   0.01
  Frctn Loss (ft)             0.01    Cum Volume (acre-ft)        0.03       0.83
   0.02
  C & E Loss (ft)             0.01    Cum SA (acres)              0.06       0.28
   0.03
```

```
CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1300

INPUT
Description:
Station Elevation Data    num=      38
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2603.39.7900085 2603.412.690002 2603.463.450012 2603.453.940002 2603.44
5.740005 2603.38 6.26001 2603.36   16.77 2603.1126.21001 2602.8827.83001 2602.85
29.64001 2602.7538.90001 2601.9147.21001 2601.3949.96001 2601.11   50.94 2601.05
   53.02 2600.72   61.02 2599.5565.96001 2599.26   71.88 2598.07   74.61  2597.3
   80.58  2596.182.85001 2595.6584.90001 2595.1393.92001 2592.8296.85001 2592.31
97.14001 2592.26  102.34 2591.32   102.8 2591.41  102.91 2591.18  103.29 2591.82
  104.61  2593.1  104.98 2593.38  105.91 2593.95  116.05 2600.19  126.92 2602.43
  127.11 2602.48  127.33 2602.49  136.85 2602.76

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .01665.96001    .035  116.05    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      65.96001  116.05               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2599.40    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.03    Wt. n-Val.                  0.016      0.035

  W.S. Elev (ft)           2599.37    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)                      Flow Area (sq ft)           0.11     199.20

  E.G. Slope (ft/ft)      0.000165    Area (sq ft)                0.11     199.20

  Q Total (cfs)             264.00    Flow (cfs)                  0.02     263.98

  Top Width (ft)             50.71    Top Width (ft)              1.94      48.76

  Vel Total (ft/s)            1.32    Avg. Vel. (ft/s)            0.18       1.33

  Max Chl Dpth (ft)           8.19    Hydr. Depth (ft)            0.06       4.08
```

```
  Conv. Total (cfs)        20582.9    Conv. (cfs)                  1.5    20581.4

  Length Wtd. (ft)           50.00    Wetted Per. (ft)            1.95      52.47

  Min Ch El (ft)           2591.18    Shear (lb/sq ft)            0.00       0.04

  Alpha                       1.00    Stream Power (lb/ft s)      0.00       0.05

  Frctn Loss (ft)             0.00    Cum Volume (acre-ft)        0.03       0.63
   0.01
  C & E Loss (ft)             0.01    Cum SA (acres)              0.05       0.24
   0.03



Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1250

INPUT
Description:
Station Elevation Data    num=      39
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2602.56     1.5 2602.611.580002 2602.612.810013 2602.574.550003 2602.54
10.35001 2602.4220.62001 2602.34   21.41 2602.33   22.13 2602.23   32.48 2601.17
   43.13 2598.9843.54001  2598.943.99001 2598.8354.61001 2597.2764.14001  2596.5
65.67001 2596.3766.22001 2596.33   68.45 2596.0274.87001 2595.19   76.44 2595.09
   82.38 2594.3187.50001 2593.4994.93001 2592.6898.57001  2592.399.96001 2592.13
  101.83 2591.91  109.63 2590.84  111.44 2590.65  112.31 2590.28  113.44 2590.96
  118.94 2593.02  120.69 2593.75  122.84 2595.03  131.76 2600.67  134.95  2601.3
  138.13 2601.53  139.11 2601.37  139.13 2601.37  139.96 2601.36

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .01664.14001    .035  122.84    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      64.14001  122.84           121.22  121.22  121.22             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1
```

```
  E.G. Elev (ft)           2599.39    Element                   Left OB    Channel
Right OB
  Vel Head (ft)               0.01    Wt. n-Val.                 0.016      0.035
  0.045
  W.S. Elev (ft)           2599.39    Reach Len. (ft)           121.22     121.22
 121.22
  Crit W.S. (ft)           2593.27    Flow Area (sq ft)          38.84     353.58
  15.00
  E.G. Slope (ft/ft)      0.000023    Area (sq ft)               38.84     353.58
  15.00
  Q Total (cfs)             264.00    Flow (cfs)                 24.56     235.85
   3.59
  Top Width (ft)             88.57    Top Width (ft)             22.98      58.70
   6.89
  Vel Total (ft/s)            0.65    Avg. Vel. (ft/s)            0.63       0.67
   0.24
  Max Chl Dpth (ft)           9.11    Hydr. Depth (ft)            1.69       6.02
   2.18
  Conv. Total (cfs)        54695.2    Conv. (cfs)               5088.0    48862.9
  744.2
  Length Wtd. (ft)          121.22    Wetted Per. (ft)           23.18      60.21
   8.15
  Min Ch El (ft)           2590.28    Shear (lb/sq ft)            0.00       0.01
   0.00
  Alpha                       1.04    Stream Power (lb/ft s)      0.00       0.01
   0.00
  Frctn Loss (ft)                     Cum Volume (acre-ft)        0.01       0.32
   0.01
  C & E Loss (ft)                     Cum SA (acres)              0.04       0.17
   0.02


CULVERT


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1240

INPUT
Description:
Distance from Upstream XS =      10
Deck/Roadway Width        =      95
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
```

```
       0    2600    2585      22  2599.3    2585      60  2598.6    2585
      80 2598.48    2585     110 2599.33    2585     140    2601    2585

Upstream Bridge Cross Section Data
Station Elevation Data    num=      39
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2602.56     1.5 2602.611.580002 2602.612.810013 2602.574.550003 2602.54
10.35001 2602.4220.62001 2602.34   21.41 2602.33   22.13 2602.23   32.48 2601.17
   43.13 2598.9843.54001  2598.943.99001 2598.8354.61001 2597.2764.14001  2596.5
65.67001 2596.3766.22001 2596.33   68.45 2596.0274.87001 2595.19   76.44 2595.09
   82.38 2594.3187.50001 2593.4994.93001 2592.6898.57001  2592.399.96001 2592.13
  101.83 2591.91  109.63 2590.84  111.44 2590.65  112.31 2590.28  113.44 2590.96
  118.94 2593.02  120.69 2593.75  122.84 2595.03  131.76 2600.67  134.95  2601.3
  138.13 2601.53  139.11 2601.37  139.13 2601.37  139.96 2601.36

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .01664.14001    .035  122.84    .045

Bank Sta: Left   Right    Coeff Contr.   Expan.
      64.14001  122.84             .1       .3

Downstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0 2600.11    2585   50.17 2598.76    2585   89.91 2598.39    2585
     125 2599.78    2585     140 2601.03    2585

Downstream Bridge Cross Section Data
Station Elevation Data    num=      42
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2601.391.769997 2601.33   13.57 2600.51   14.39 2600.43   15.56 2600.29
   17.39 2600.16   26.06 2599.82   26.39  2599.8   26.65 2599.79   26.86 2599.78
   27.02 2599.78   27.16 2599.77   27.28 2599.77   27.38 2599.76   27.47 2599.76
   28.01 2599.72   28.37 2599.72   28.39 2599.71   28.48 2599.71    28.5  2599.7
   28.52  2599.7   29.03 2599.67   41.12 2599.21   44.48  2599.2   54.24 2598.57
   59.94  2597.4   67.36 2595.79   71.39 2594.68   77.63  2590.6   79.22 2589.39
   80.12 2589.18   86.32 2587.67   89.64 2586.55   90.95 2586.11   93.18 2585.36
   93.42 2586.24   93.62 2586.39  106.35 2590.16  109.08 2590.34  119.47 2591.08
  124.54 2591.37  129.64 2592.29

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   77.63    .035  106.35    .045

Bank Sta: Left   Right    Coeff Contr.   Expan.
         77.63  106.35             .1       .3
```

```
Upstream Embankment side slope              =       4 horiz. to 1.0 vertical
Downstream Embankment side slope            =       4 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Culverts =  1

Culvert Name     Shape      Rise    Span
Culvert #1      Circular       3
FHWA Chart # 2 - Corrugated Metal Pipe Culvert
FHWA Scale # 1 - Headwall
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 10      95     .024     .024        0                   .7
      1
Number of Barrels =  2
Upstream   Elevation =  2589.86
Centerline Stations
    Sta.    Sta.
   110.3   114.3
Downstream Elevation =  2586.39
Centerline Stations
    Sta.    Sta.
   91.08   95.08

CULVERT OUTPUT  Profile #PF 1  Culv Group:  Culvert #1

  Q Culv Group (cfs)        178.39    Culv Full Len (ft)         95.00
  # Barrels                      2    Culv Vel US (ft/s)         12.62
  Q Barrel (cfs)             89.20    Culv Vel DS (ft/s)         12.62
  E.G. US. (ft)            2599.39    Culv Inv El Up (ft)      2589.86
  W.S. US. (ft)            2599.39    Culv Inv El Dn (ft)      2586.39
  E.G. DS (ft)             2590.16    Culv Frctn Ls (ft)          5.80
  W.S. DS (ft)             2589.30    Culv Exit Loss (ft)         1.71
  Delta EG (ft)               9.24    Culv Entr Loss (ft)         1.73
  Delta WS (ft)              10.08    Q Weir (cfs)               85.61
  E.G. IC (ft)             2599.28    Weir Sta Lft (ft)          41.23
  E.G. OC (ft)             2599.39    Weir Sta Rgt (ft)         110.72
  Culvert Control           Outlet    Weir Submerg                0.00
  Culv WS Inlet (ft)       2592.86    Weir Max Depth (ft)         0.89
  Culv WS Outlet (ft)      2589.39    Weir Avg Depth (ft)         0.59
  Culv Nml Depth (ft)         3.00    Weir Flow Area (sq ft)     41.29
  Culv Crt Depth (ft)         3.00    Min El Weir Flow (ft)    2598.49
```

```
Note:    The normal depth exceeds the height of the culvert.  The program assumes
that the normal depth is equal to the
         height of the culvert.
Note:    Culvert critical depth exceeds the height of the culvert.

CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1128.78

INPUT
Description:
Station Elevation Data    num=      42
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2601.391.769997 2601.33   13.57 2600.51   14.39 2600.43   15.56 2600.29
   17.39 2600.16   26.06 2599.82   26.39  2599.8   26.65 2599.79   26.86 2599.78
   27.02 2599.78   27.16 2599.77   27.28 2599.77   27.38 2599.76   27.47 2599.76
   28.01 2599.72   28.37 2599.72   28.39 2599.71   28.48 2599.71    28.5  2599.7
   28.52  2599.7   29.03 2599.67   41.12 2599.21   44.48  2599.2   54.24 2598.57
   59.94  2597.4   67.36 2595.79   71.39 2594.68   77.63  2590.6   79.22 2589.39
   80.12 2589.18   86.32 2587.67   89.64 2586.55   90.95 2586.11   93.18 2585.36
   93.42 2586.24   93.62 2586.39  106.35 2590.16  109.08 2590.34  119.47 2591.08
  124.54 2591.37  129.64 2592.29

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   77.63    .035  106.35    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         77.63  106.35            28.78   28.78   28.78             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2590.16    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.85    Wt. n-Val.                             0.035

  W.S. Elev (ft)           2589.30    Reach Len. (ft)            28.78      28.78
  28.78
  Crit W.S. (ft)           2589.30    Flow Area (sq ft)                     40.41

  E.G. Slope (ft/ft)      0.016523    Area (sq ft)                          40.41

  Q Total (cfs)             299.00    Flow (cfs)                           299.00
```

Top Width (ft)	23.88	Top Width (ft)		23.88
Vel Total (ft/s)	7.40	Avg. Vel. (ft/s)		7.40
Max Chl Dpth (ft)	3.94	Hydr. Depth (ft)		1.69
Conv. Total (cfs)	2326.1	Conv. (cfs)		2326.1
Length Wtd. (ft)	28.78	Wetted Per. (ft)		25.59
Min Ch El (ft)	2585.36	Shear (lb/sq ft)		1.63
Alpha	1.00	Stream Power (lb/ft s)		12.05
Frctn Loss (ft)	0.47	Cum Volume (acre-ft)	0.01	0.11
0.01				
C & E Loss (ft)	0.00	Cum SA (acres)	0.01	0.06
0.01				

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+ RS: 1100

INPUT
Description:
Station Elevation Data num= 37

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2601.44	.1299973	2601.43	.6199951	2601.39	.8300018	2601.37	1.75	2601.26
3.729996	2601.04	5.189995	2600.93	6.129997	2600.82	6.549995	2600.76	6.93	2600.73
8.790001	2600.78	21.73	2600.79	21.9	2600.76	22.86	2600.54	35.02	2597.71
37.18999	2597.2	43.11	2595.75	48.14	2594.65	50.21	2594.19	52.65	2593.89
61.25	2592.96	64.39999	2593.05	70.00999	2589.44	72.57	2587.94	74.00999	2587.64

```
   76.64 2586.85   83.06 2585.22   84.46 2584.75   85.35 2585.07   86.47 2585.47
   87.13 2585.63    91.6 2586.86  100.25 2589.26  101.79  2589.5  113.36 2592.07
  117.25 2593.01  125.35 2594.18

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .01670.00999    .035  100.25    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      70.00999  100.25               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2589.01    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.86    Wt. n-Val.                            0.035

  W.S. Elev (ft)           2588.15    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)           2588.15    Flow Area (sq ft)                     40.16

  E.G. Slope (ft/ft)      0.016329    Area (sq ft)                          40.16

  Q Total (cfs)             299.00    Flow (cfs)                           299.00

  Top Width (ft)             24.01    Top Width (ft)                        24.01

  Vel Total (ft/s)            7.45    Avg. Vel. (ft/s)                       7.45

  Max Chl Dpth (ft)           3.39    Hydr. Depth (ft)                       1.67

  Conv. Total (cfs)         2339.9    Conv. (cfs)                          2339.9

  Length Wtd. (ft)           50.00    Wetted Per. (ft)                      24.98

  Min Ch El (ft)           2584.75    Shear (lb/sq ft)                       1.64

  Alpha                       1.00    Stream Power (lb/ft s)                12.20

  Frctn Loss (ft)             0.74    Cum Volume (acre-ft)        0.01       0.08
   0.01
  C & E Loss (ft)             0.03    Cum SA (acres)              0.01       0.04
   0.01


Warning: The energy equation could not be balanced within the specified number of
```

```
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1050

INPUT
Description:
Station Elevation Data    num=      37
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2601.91.3099976 2601.91.5799866 2601.891.619995 2601.831.689995 2601.83
1.949989 2601.8112.77999 2601.2822.84999 2599.7123.44999 2599.64   23.73 2599.57
24.46999 2599.4231.49999 2597.6834.12999 2597.1639.87999 2596.17    44.8  2595.2
53.05999 2593.31   55.48 2592.76   56.91 2592.4466.14999 2590.1870.90999 2588.11
76.53999 2585.4286.77999 2584.9187.09999  2584.987.18999 2584.8988.49999 2583.45
88.93999 2584.3789.67999 2584.54   94.87 2585.7597.88999 2585.77   104.5 2586.63
  108.56 2587.02  110.42 2587.19  115.38 2587.66  118.19 2587.89  119.24    2588
  121.54 2588.62  129.68 2590.92

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .01676.53999    .03597.88999    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      76.5399997.88999               40      40      40             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2587.67    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.75    Wt. n-Val.                  0.016      0.035
  0.045
  W.S. Elev (ft)           2586.92    Reach Len. (ft)            40.00      40.00
  40.00
  Crit W.S. (ft)           2586.92    Flow Area (sq ft)           2.34      38.20
   5.17
```

```
  E.G. Slope (ft/ft)      0.013521    Area (sq ft)                2.34      38.20
   5.17
  Q Total (cfs)             299.00    Flow (cfs)                 19.49     266.45
  13.06
  Top Width (ft)             34.08    Top Width (ft)              3.13      21.35
   9.60
  Vel Total (ft/s)            6.54    Avg. Vel. (ft/s)            8.31       6.98
   2.53
  Max Chl Dpth (ft)           3.47    Hydr. Depth (ft)            0.75       1.79
   0.54
  Conv. Total (cfs)         2571.4    Conv. (cfs)                167.6     2291.5
  112.4
  Length Wtd. (ft)           40.00    Wetted Per. (ft)            3.47      22.74
   9.66
  Min Ch El (ft)           2583.45    Shear (lb/sq ft)            0.57       1.42
   0.45
  Alpha                       1.13    Stream Power (lb/ft s)      4.74       9.89
   1.14
  Frctn Loss (ft)             0.50    Cum Volume (acre-ft)        0.00       0.03
   0.00
  C & E Loss (ft)             0.00    Cum SA (acres)              0.01       0.02
   0.01


Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1010

INPUT
Description:
Station Elevation Data    num=      26
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  2591.2    4.25 2590.618.639999 2589.75   12.93 2588.32   18.78 2586.06
```

```
   21.61  2585.2   28.92 2584.11   30.29 2584.01   38.38 2582.77   38.96 2582.68
   39.06 2582.68   40.18 2582.78   41.89 2582.95   42.75 2582.35   43.24 2582.74
    43.9  2583.2   45.43 2583.48   48.36 2584.53   49.21 2584.58   56.32 2585.64
   59.35 2586.22    63.6 2586.66   69.49 2587.47    75.8 2588.89   77.89 2589.34
      80  2590.5

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   30.29    .035   48.36    .045

Bank Sta: Left   Right    Coeff Contr.   Expan.
         30.29   48.36             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2586.04    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.77    Wt. n-Val.                  0.016      0.035
  0.045
  W.S. Elev (ft)           2585.27    Reach Len. (ft)

  Crit W.S. (ft)           2585.27    Flow Area (sq ft)           6.15      35.65
   2.20
  E.G. Slope (ft/ft)      0.011433    Area (sq ft)                6.15      35.65
   2.20
  Q Total (cfs)             299.00    Flow (cfs)                 47.40     247.39
   4.20
  Top Width (ft)             32.45    Top Width (ft)              8.91      18.07
   5.47
  Vel Total (ft/s)            6.80    Avg. Vel. (ft/s)            7.70       6.94
   1.91
  Max Chl Dpth (ft)           2.92    Hydr. Depth (ft)            0.69       1.97
   0.40
  Conv. Total (cfs)         2796.4    Conv. (cfs)                443.3     2313.7
   39.3
  Length Wtd. (ft)                    Wetted Per. (ft)            9.00      18.86
   5.52
  Min Ch El (ft)           2582.35    Shear (lb/sq ft)            0.49       1.35
   0.28
  Alpha                       1.07    Stream Power (lb/ft s)      3.76       9.36
   0.54
  Frctn Loss (ft)                     Cum Volume (acre-ft)

  C & E Loss (ft)                     Cum SA (acres)
```

CROSS SECTION

RIVER: Sta 80+00 to 83+
REACH: Sta 80+00 to 83+ RS: 3530

INPUT
Description:
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2656.48	2.389999	2656.18	6.68	2655.53	11.79	2655.05	17.67	2654.43
22.62	2653.41	28.67	2652.14	35.87	2650.54	39.66	2649.8	39.78	2649.77
40	2649.74	43.07	2649.35	43.6	2649.24	43.71	2649.45	44.82	2649.57
47.18	2649.96	50.65	2650.15	59.95	2651.47	61.65	2651.77	63.07	2651.81
72.64	2652.22	80	2652.71						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	28.67	.035	61.65	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
28.67	61.65	30	30	30	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2652.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.71	Wt. n-Val.		0.035	0.045
W.S. Elev (ft)	2651.90	Reach Len. (ft)	30.00	30.00	30.00
Crit W.S. (ft)	2651.90	Flow Area (sq ft)		44.96	0.24
E.G. Slope (ft/ft)	0.016395	Area (sq ft)		44.96	0.24
Q Total (cfs)	304.00	Flow (cfs)		303.83	0.17
Top Width (ft)	35.35	Top Width (ft)		31.89	3.46
Vel Total (ft/s)	6.73	Avg. Vel. (ft/s)		6.76	0.72
Max Chl Dpth (ft)	2.66	Hydr. Depth (ft)		1.41	0.07
Conv. Total (cfs)	2374.2	Conv. (cfs)		2372.8	1.4
Length Wtd. (ft)	30.00	Wetted Per. (ft)		32.44	

```
   3.46
  Min Ch El (ft)           2649.24    Shear (lb/sq ft)                      1.42
   0.07
  Alpha                       1.01    Stream Power (lb/ft s)                9.59
   0.05
  Frctn Loss (ft)             0.47    Cum Volume (acre-ft)        0.01      0.41
   0.00
  C & E Loss (ft)             0.01    Cum SA (acres)              0.02      0.29
   0.01


Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Sta 80+00 to 83+
REACH: Sta 80+00 to 83+   RS: 3500

INPUT
Description:
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2655.767.910004 2654.91   14.43 2653.66   18.36 2653.12    27.4 2650.43
   28.81 2650.07    36.5 2648.94    37.7 2648.63   38.17 2648.64   38.55 2648.59
      40 2648.28   40.56 2648.16   40.81 2648.66   44.52 2649.21   49.71 2649.48
    59.4 2650.56   60.16  2650.6    61.9 2650.68   70.61 2651.09    74.4 2650.98
      80 2650.89

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   28.81    .035    59.4    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         28.81    59.4               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1
```

```
  E.G. Elev (ft)           2651.59    Element                   Left OB    Channel
Right OB
  Vel Head (ft)               0.68    Wt. n-Val.                 0.045      0.035
  0.045
  W.S. Elev (ft)           2650.91    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)           2650.91    Flow Area (sq ft)           1.32      45.10
   1.30
  E.G. Slope (ft/ft)      0.014943    Area (sq ft)                1.32      45.10
   1.30
  Q Total (cfs)             304.00    Flow (cfs)                  2.99     299.40
   1.62
  Top Width (ft)             42.28    Top Width (ft)              3.02      30.59
   8.67
  Vel Total (ft/s)            6.37    Avg. Vel. (ft/s)            2.26       6.64
   1.25
  Max Chl Dpth (ft)           2.75    Hydr. Depth (ft)            0.44       1.47
   0.15
  Conv. Total (cfs)         2486.9    Conv. (cfs)                 24.4     2449.2
   13.2
  Length Wtd. (ft)           50.00    Wetted Per. (ft)            3.14      31.18
   8.70
  Min Ch El (ft)           2648.16    Shear (lb/sq ft)            0.39       1.35
   0.14
  Alpha                       1.07    Stream Power (lb/ft s)      0.89       8.96
   0.17
  Frctn Loss (ft)             0.79    Cum Volume (acre-ft)        0.01       0.38
   0.00
  C & E Loss (ft)             0.02    Cum SA (acres)              0.02       0.27
   0.00


Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
```

```
         program defaulted to critical depth.

CROSS SECTION


RIVER: Sta 80+00 to 83+
REACH: Sta 80+00 to 83+   RS: 3450

INPUT
Description:
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2653.274.230003 2652.87    5.82 2652.716.559998 2652.65   16.32 2651.59
   21.92 2650.62   26.81 2649.88   29.51 2648.59   36.86 2645.32      40 2645.44
   50.46 2645.87   51.86 2645.93   52.81 2645.85   53.24 2645.25   57.88 2648.11
   62.35 2649.48   70.26 2649.23   72.84 2649.28   78.42 2649.58      80 2649.69

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   26.81    .035   62.35    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         26.81   62.35               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2648.39    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.84    Wt. n-Val.                            0.035

  W.S. Elev (ft)           2647.56    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)           2647.56    Flow Area (sq ft)                     41.45

  E.G. Slope (ft/ft)      0.016520    Area (sq ft)                          41.45

  Q Total (cfs)             304.00    Flow (cfs)                           304.00

  Top Width (ft)             25.15    Top Width (ft)                        25.15

  Vel Total (ft/s)            7.33    Avg. Vel. (ft/s)                       7.33

  Max Chl Dpth (ft)           2.31    Hydr. Depth (ft)                       1.65

  Conv. Total (cfs)         2365.2    Conv. (cfs)                          2365.2

  Length Wtd. (ft)           50.00    Wetted Per. (ft)                      26.61
```

Min Ch El (ft)	2645.25	Shear (lb/sq ft)		1.61
Alpha	1.00	Stream Power (lb/ft s)		11.78
Frctn Loss (ft)	0.84	Cum Volume (acre-ft)	0.01	0.33
C & E Loss (ft)	0.01	Cum SA (acres)	0.02	0.24

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Sta 80+00 to 83+
REACH: Sta 80+00 to 83+ RS: 3400

INPUT
Description:
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2649.16	5.690002	2649.05	9.139999	2648.77	14.15	2647.74	19.36	2647.32
22.6	2647.09	29.57	2646.48	38.65	2642.78	39.47	2642.47	40	2642.61
40.13	2642.65	43.75	2643.61	44.44	2643.53	44.73	2642.84	45.76	2643.72
48.72	2644.91	51.49	2645.42	53.97	2645.61	57.64	2646.07	64.19	2647.33
66.09	2647.58	74.4	2648.02	74.54	2648.03	75.22	2648.05	80	2648.23

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	29.57	.035	57.64	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
29.57	57.64	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2646.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.82	Wt. n-Val.		0.035	
W.S. Elev (ft)	2645.97	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2645.97	Flow Area (sq ft)		41.88	
E.G. Slope (ft/ft)	0.017078	Area (sq ft)		41.88	
Q Total (cfs)	304.00	Flow (cfs)		304.00	
Top Width (ft)	26.07	Top Width (ft)		26.07	
Vel Total (ft/s)	7.26	Avg. Vel. (ft/s)		7.26	
Max Chl Dpth (ft)	3.50	Hydr. Depth (ft)		1.61	
Conv. Total (cfs)	2326.2	Conv. (cfs)		2326.2	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		27.99	
Min Ch El (ft)	2642.47	Shear (lb/sq ft)		1.60	
Alpha	1.00	Stream Power (lb/ft s)		11.58	
Frctn Loss (ft)	0.86	Cum Volume (acre-ft)	0.01	0.28	
C & E Loss (ft)	0.00	Cum SA (acres)	0.02	0.21	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

```
RIVER: Sta 80+00 to 83+
REACH: Sta 80+00 to 83+   RS: 3350

INPUT
Description:
Station Elevation Data    num=      22
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2648.233.199997 2648.11    4.18 2648.05   13.46 2647.58   17.52 2647.52
   23.72 2646.89   30.86 2646.18   33.99 2645.61   34.81 2645.64   38.47 2640.65
      40 2641.09   41.13 2641.41   43.71  2642.4   44.35  2642.6   48.23 2643.26
   55.18 2643.96    58.5 2644.39   59.49 2644.66   68.76 2647.15   72.83 2648.64
   79.02 2650.96      80 2651.02

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   34.81    .035   68.76    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         34.81   68.76               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2645.56    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.86    Wt. n-Val.                             0.035

  W.S. Elev (ft)           2644.71    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)           2644.71    Flow Area (sq ft)                     40.93

  E.G. Slope (ft/ft)      0.017329    Area (sq ft)                          40.93

  Q Total (cfs)             304.00    Flow (cfs)                           304.00

  Top Width (ft)             24.17    Top Width (ft)                        24.17

  Vel Total (ft/s)            7.43    Avg. Vel. (ft/s)                       7.43

  Max Chl Dpth (ft)           4.06    Hydr. Depth (ft)                       1.69

  Conv. Total (cfs)         2309.4    Conv. (cfs)                          2309.4

  Length Wtd. (ft)           50.00    Wetted Per. (ft)                      26.71

  Min Ch El (ft)           2640.65    Shear (lb/sq ft)                       1.66
```

Alpha	1.00	Stream Power (lb/ft s)		12.31
Frctn Loss (ft)	0.72	Cum Volume (acre-ft)	0.01	0.23
C & E Loss (ft)	0.05	Cum SA (acres)	0.02	0.18

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Sta 80+00 to 83+
REACH: Sta 80+00 to 83+ RS: 3300

INPUT
Description:
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2644.87	4.120003	2644.7	4.470001	2644.68	5.639999	2644.57	14.73	2643.78
17.46	2643.45	25	2642.73	30.8	2642.61	35.26	2642.58	36.87	2641.14
39.87	2639.13	40	2639.21	41.66	2640.28	45.52	2641.27	46.89	2641.56
59.77	2644.5	60.89	2644.76	70.03	2646.87	72.77	2647.56	80	2650.27

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	35.26	.035	59.77	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
35.26	59.77	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2644.12	Element	Left OB	Channel

Right OB

Vel Head (ft)	0.71	Wt. n-Val.	0.045	0.035
W.S. Elev (ft)	2643.42	Reach Len. (ft)	50.00	50.00
50.00				
Crit W.S. (ft)	2643.42	Flow Area (sq ft)	10.43	39.45
E.G. Slope (ft/ft)	0.012266	Area (sq ft)	10.43	39.45
Q Total (cfs)	304.00	Flow (cfs)	27.04	276.96
Top Width (ft)	37.18	Top Width (ft)	17.43	19.75
Vel Total (ft/s)	6.10	Avg. Vel. (ft/s)	2.59	7.02
Max Chl Dpth (ft)	4.28	Hydr. Depth (ft)	0.60	2.00
Conv. Total (cfs)	2744.9	Conv. (cfs)	244.1	2500.7
Length Wtd. (ft)	50.00	Wetted Per. (ft)	17.46	21.62
Min Ch El (ft)	2639.13	Shear (lb/sq ft)	0.46	1.40
Alpha	1.22	Stream Power (lb/ft s)	1.19	9.81
Frctn Loss (ft)	0.70	Cum Volume (acre-ft)	0.01	0.19
C & E Loss (ft)	0.01	Cum SA (acres)	0.01	0.16

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Sta 80+00 to 83+

REACH: Sta 80+00 to 83+ RS: 3250

INPUT
Description:
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2642.95	.9400024	2642.84	1.379997	2642.93	2.260002	2643.16	6.440002	2643.21
12.47	2642.53	14.53	2642.31	24.01	2641.54	34.59	2639.38	35.55	2639.17
39.81	2638.38	40	2638.35	41.85	2638.11	42.87	2637.98	43.15	2637.86
43.36	2637.7	44.5	2637.93	45.08	2637.97	47.09	2638.34	54.65	2640.73
58.62	2642.02	66.87	2643.65	74.64	2645.02	76.43	2645.21	79.56	2645.47
80	2645.52								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.016	24.01	.035	58.62	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
24.01	58.62	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2641.52	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.81	Wt. n-Val.		0.035
W.S. Elev (ft)	2640.72	Reach Len. (ft)	50.00	50.00
50.00				
Crit W.S. (ft)	2640.72	Flow Area (sq ft)		42.17
E.G. Slope (ft/ft)	0.016160	Area (sq ft)		42.17
Q Total (cfs)	304.00	Flow (cfs)		304.00
Top Width (ft)	26.56	Top Width (ft)		26.56
Vel Total (ft/s)	7.21	Avg. Vel. (ft/s)		7.21
Max Chl Dpth (ft)	3.02	Hydr. Depth (ft)		1.59
Conv. Total (cfs)	2391.4	Conv. (cfs)		2391.4
Length Wtd. (ft)	50.00	Wetted Per. (ft)		27.32
Min Ch El (ft)	2637.70	Shear (lb/sq ft)		1.56
Alpha	1.00	Stream Power (lb/ft s)		11.23

```
  Frctn Loss (ft)             0.81    Cum Volume (acre-ft)                  0.14

  C & E Loss (ft)             0.01    Cum SA (acres)                        0.13



Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Sta 80+00 to 83+
REACH: Sta 80+00 to 83+   RS: 3200

INPUT
Description:
Station Elevation Data    num=      35
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2640.94.5299988 2640.895.209999 2641.125.739998  2641.15.949997 2641.06
6.510002 2641.086.610001 2641.076.620003 2641.07    6.93 2641.06   10.29 2640.99
   17.09 2640.85    17.9 2640.83   18.05 2640.82   18.14  2640.8   18.24 2640.81
   24.05 2641.23   24.41 2641.27   24.76 2641.23    28.4 2641.12   28.95 2641.08
   29.29 2641.04    32.6 2639.54   36.36 2637.77   38.46 2636.15   39.96 2636.15
   43.25 2636.13      44 2636.14   46.47 2636.14   47.95 2637.07   52.77 2638.23
   59.29 2640.11   64.31 2642.02   68.01 2642.34   75.84 2643.19      80 2643.72

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   29.29    .035   64.31    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         29.29   64.31              100     100     100             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1
```

```
  E.G. Elev (ft)           2639.90    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.93    Wt. n-Val.                            0.035

  W.S. Elev (ft)           2638.98    Reach Len. (ft)           100.00     100.00
 100.00
  Crit W.S. (ft)           2638.98    Flow Area (sq ft)                     39.38

  E.G. Slope (ft/ft)      0.016051    Area (sq ft)                          39.38

  Q Total (cfs)             304.00    Flow (cfs)                           304.00

  Top Width (ft)             21.57    Top Width (ft)                        21.57

  Vel Total (ft/s)            7.72    Avg. Vel. (ft/s)                       7.72

  Max Chl Dpth (ft)           2.85    Hydr. Depth (ft)                       1.83

  Conv. Total (cfs)         2399.5    Conv. (cfs)                          2399.5

  Length Wtd. (ft)          100.00    Wetted Per. (ft)                      22.90

  Min Ch El (ft)           2636.13    Shear (lb/sq ft)                       1.72

  Alpha                       1.00    Stream Power (lb/ft s)                13.30

  Frctn Loss (ft)                     Cum Volume (acre-ft)                   0.09

  C & E Loss (ft)                     Cum SA (acres)                         0.10



Warning: During subcritical analysis, the water surface upstream of culvert went to
critical depth.

CULVERT


RIVER: Sta 80+00 to 83+
REACH: Sta 80+00 to 83+   RS: 3177

INPUT
Description:
Distance from Upstream XS =      23
Deck/Roadway Width        =      55
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
```

```
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    32.6 2639.54    2630      80 2639.54    2630

Upstream Bridge Cross Section Data
Station Elevation Data    num=      35
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2640.94.5299988 2640.895.209999 2641.125.739998  2641.15.949997 2641.06
6.510002 2641.086.610001 2641.076.620003 2641.07    6.93 2641.06   10.29 2640.99
   17.09 2640.85    17.9 2640.83   18.05 2640.82   18.14  2640.8   18.24 2640.81
   24.05 2641.23   24.41 2641.27   24.76 2641.23    28.4 2641.12   28.95 2641.08
   29.29 2641.04    32.6 2639.54   36.36 2637.77   38.46 2636.15   39.96 2636.15
   43.25 2636.13      44 2636.14   46.47 2636.14   47.95 2637.07   52.77 2638.23
   59.29 2640.11   64.31 2642.02   68.01 2642.34   75.84 2643.19      80 2643.72

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   29.29    .035   64.31    .045

Bank Sta: Left   Right    Coeff Contr.   Expan.
         29.29   64.31             .1       .3

Downstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0 2638.17    2630      80 2638.17    2630

Downstream Bridge Cross Section Data
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2638.09.1999969 2638.077.459999 2636.72   10.75 2636.42   15.36 2635.84
    21.3  2635.2   23.26 2635.16   29.09  2634.5   31.85  2634.1   33.24  2634.1
      36    2633   42.39    2633   49.12 2634.89   52.94 2635.79   60.51 2637.09
   63.09 2637.48   63.49 2637.48      65 2637.59   74.04 2637.74      80 2637.66

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .0457.459999    .035   63.49    .045

Bank Sta: Left   Right    Coeff Contr.   Expan.
      7.459999   63.49             .1       .3

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
```

```
Weir crest shape                            = Broad Crested

Number of Culverts =  1

Culvert Name     Shape      Rise    Span
Culvert #1      Circular       4
FHWA Chart # 2 - Corrugated Metal Pipe Culvert
FHWA Scale # 1 - Headwall
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 23      55     .024     .024        0                   .7
      1
Number of Barrels =  3
Upstream   Elevation =  2633.26
Centerline Stations
    Sta.    Sta.    Sta.
      38      43      48
Downstream Elevation =  2631.28
Centerline Stations
    Sta.    Sta.    Sta.
      35      40      45

CULVERT OUTPUT  Profile #PF 1  Culv Group:  Culvert #1

  Q Culv Group (cfs)        304.00    Culv Full Len (ft)         16.33
  # Barrels                      3    Culv Vel US (ft/s)          9.86
  Q Barrel (cfs)            101.33    Culv Vel DS (ft/s)          8.06
  E.G. US. (ft)            2638.41    Culv Inv El Up (ft)      2633.26
  W.S. US. (ft)            2638.98    Culv Inv El Dn (ft)      2631.28
  E.G. DS (ft)             2636.27    Culv Frctn Ls (ft)          1.22
  W.S. DS (ft)             2635.59    Culv Exit Loss (ft)         0.33
  Delta EG (ft)               2.14    Culv Entr Loss (ft)         0.59
  Delta WS (ft)               3.39    Q Weir (cfs)
  E.G. IC (ft)             2638.41    Weir Sta Lft (ft)
  E.G. OC (ft)             2638.88    Weir Sta Rgt (ft)
  Culvert Control            Inlet    Weir Submerg
  Culv WS Inlet (ft)       2636.31    Weir Max Depth (ft)
  Culv WS Outlet (ft)      2635.28    Weir Avg Depth (ft)
  Culv Nml Depth (ft)         2.44    Weir Flow Area (sq ft)
  Culv Crt Depth (ft)         3.05    Min El Weir Flow (ft)    2639.55


Warning: During subcritical analysis, the water surface upstream of culvert went to
critical depth.
Note:    During the supercritical calculations a hydraulic jump occurred inside of
the culvert.
```

CROSS SECTION

RIVER: Sta 80+00 to 83+
REACH: Sta 80+00 to 83+ RS: 3100

INPUT
Description:
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2638.09	.1999969	2638.07	7.459999	2636.72	10.75	2636.42	15.36	2635.84
21.3	2635.2	23.26	2635.16	29.09	2634.5	31.85	2634.1	33.24	2634.1
36	2633	42.39	2633	49.12	2634.89	52.94	2635.79	60.51	2637.09
63.09	2637.48	63.49	2637.48	65	2637.59	74.04	2637.74	80	2637.66

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	7.459999	.035	63.49	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
7.459999	63.49	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2636.27	Element	Left OB	Channel
Vel Head (ft)	0.68	Wt. n-Val.		0.035
W.S. Elev (ft)	2635.59	Reach Len. (ft)	50.00	50.00
Crit W.S. (ft)	2635.59	Flow Area (sq ft)		45.88
E.G. Slope (ft/ft)	0.017013	Area (sq ft)		45.88
Q Total (cfs)	304.00	Flow (cfs)		304.00
Top Width (ft)	34.42	Top Width (ft)		34.42
Vel Total (ft/s)	6.63	Avg. Vel. (ft/s)		6.63
Max Chl Dpth (ft)	2.59	Hydr. Depth (ft)		1.33
Conv. Total (cfs)	2330.7	Conv. (cfs)		2330.7
Length Wtd. (ft)	50.00	Wetted Per. (ft)		35.06
Min Ch El (ft)	2633.00	Shear (lb/sq ft)		1.39

Alpha	1.00	Stream Power (lb/ft s)	9.21
Frctn Loss (ft)	0.84	Cum Volume (acre-ft)	0.05
C & E Loss (ft)	0.00	Cum SA (acres)	0.04

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Sta 80+00 to 83+
REACH: Sta 80+00 to 83+ RS: 3050

INPUT
Description:
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2636.41	1.68	2636.31	7.059998	2636.01	9.779999	2635.45	17.61	2634.37
25.66	2633.21	28.16	2632.75	33.09	2632.04	37.3	2631.37	38.71	2631.32
40	2631.48	45.19	2632.1	49.26	2633.01	53.09	2634.03	59.81	2634.89
60.99	2634.89	64.51	2634.86	69.67	2634.73	74.52	2634.66	78.99	2634.59
80	2634.57								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	9.779999	.035	59.81	.045

Bank Sta: Left	Right	Coeff Contr.	Expan.
9.779999	59.81	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2634.60	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.72	Wt. n-Val.		0.035
W.S. Elev (ft)	2633.88	Reach Len. (ft)		
Crit W.S. (ft)	2633.88	Flow Area (sq ft)		44.65
E.G. Slope (ft/ft)	0.016463	Area (sq ft)		44.65
Q Total (cfs)	304.00	Flow (cfs)		304.00
Top Width (ft)	31.49	Top Width (ft)		31.49
Vel Total (ft/s)	6.81	Avg. Vel. (ft/s)		6.81
Max Chl Dpth (ft)	2.56	Hydr. Depth (ft)		1.42
Conv. Total (cfs)	2369.3	Conv. (cfs)		2369.3
Length Wtd. (ft)		Wetted Per. (ft)		31.95
Min Ch El (ft)	2631.32	Shear (lb/sq ft)		1.44
Alpha	1.00	Stream Power (lb/ft s)		9.78
Frctn Loss (ft)		Cum Volume (acre-ft)		
C & E Loss (ft)		Cum SA (acres)		

SUMMARY OF MANNING'S N VALUES

River:Sta 53+00 to 56+

Reach	River Sta.	n1	n2	n3
Sta 53+00 to 56+	840	.016	.035	.045
Sta 53+00 to 56+	800	.016	.035	.045
Sta 53+00 to 56+	750	.016	.035	.045
Sta 53+00 to 56+	700	.016	.035	.045
Sta 53+00 to 56+	660	.016	.035	.045
Sta 53+00 to 56+	650	Culvert		
Sta 53+00 to 56+	575	.016	.035	.045

Sta 53+00 to 56+	550	.016	.035	.045
Sta 53+00 to 56+	500	.016	.035	.045

River:Sta 70+00 to 78+

Reach	River Sta.	n1	n2	n3
Sta 70+00 to 78+	2050	.016	.035	.045
Sta 70+00 to 78+	2000	.016	.035	.045
Sta 70+00 to 78+	1950	.016	.035	.045
Sta 70+00 to 78+	1900	.016	.035	.045
Sta 70+00 to 78+	1850	.016	.035	.045
Sta 70+00 to 78+	1800	.016	.035	.045
Sta 70+00 to 78+	1750	.016	.035	.045
Sta 70+00 to 78+	1700	.016	.035	.045
Sta 70+00 to 78+	1670	.016	.035	.045
Sta 70+00 to 78+	1600	.016	.035	.045
Sta 70+00 to 78+	1550	.016	.035	.045
Sta 70+00 to 78+	1500	.016	.035	.045
Sta 70+00 to 78+	1450	.016	.035	.045
Sta 70+00 to 78+	1400	.016	.035	.045
Sta 70+00 to 78+	1350	.016	.035	.045
Sta 70+00 to 78+	1300	.016	.035	.045
Sta 70+00 to 78+	1250	.016	.035	.045
Sta 70+00 to 78+	1240	Culvert		
Sta 70+00 to 78+	1128.78	.016	.035	.045
Sta 70+00 to 78+	1100	.016	.035	.045
Sta 70+00 to 78+	1050	.016	.035	.045
Sta 70+00 to 78+	1010	.016	.035	.045

River:Sta 80+00 to 83+

Reach	River Sta.	n1	n2	n3
Sta 80+00 to 83+	3530	.045	.035	.045
Sta 80+00 to 83+	3500	.045	.035	.045
Sta 80+00 to 83+	3450	.045	.035	.045
Sta 80+00 to 83+	3400	.045	.035	.045
Sta 80+00 to 83+	3350	.045	.035	.045
Sta 80+00 to 83+	3300	.045	.035	.045
Sta 80+00 to 83+	3250	.016	.035	.045
Sta 80+00 to 83+	3200	.016	.035	.045
Sta 80+00 to 83+	3177	Culvert		
Sta 80+00 to 83+	3100	.045	.035	.045
Sta 80+00 to 83+	3050	.045	.035	.045

SUMMARY OF REACH LENGTHS

River: Sta 53+00 to 56+

Reach	River Sta.	Left	Channel	Right
Sta 53+00 to 56+	840	40	40	40
Sta 53+00 to 56+	800	50	50	50
Sta 53+00 to 56+	750	50	50	50
Sta 53+00 to 56+	700	40	40	40
Sta 53+00 to 56+	660	85	85	85
Sta 53+00 to 56+	650	Culvert		
Sta 53+00 to 56+	575	25	25	25
Sta 53+00 to 56+	550	50	50	50
Sta 53+00 to 56+	500			

River: Sta 70+00 to 78+

Reach	River Sta.	Left	Channel	Right
Sta 70+00 to 78+	2050	50	50	50
Sta 70+00 to 78+	2000	50	50	50
Sta 70+00 to 78+	1950	50	50	50
Sta 70+00 to 78+	1900	50	50	50
Sta 70+00 to 78+	1850	50	50	50
Sta 70+00 to 78+	1800	50	50	50
Sta 70+00 to 78+	1750	50	50	50
Sta 70+00 to 78+	1700	30	30	30
Sta 70+00 to 78+	1670	70	70	70
Sta 70+00 to 78+	1600	50	50	50
Sta 70+00 to 78+	1550	50	50	50
Sta 70+00 to 78+	1500	50	50	50
Sta 70+00 to 78+	1450	50	50	50
Sta 70+00 to 78+	1400	50	50	50
Sta 70+00 to 78+	1350	50	50	50
Sta 70+00 to 78+	1300	50	50	50
Sta 70+00 to 78+	1250	121.22	121.22	121.22
Sta 70+00 to 78+	1240	Culvert		
Sta 70+00 to 78+	1128.78	28.78	28.78	28.78
Sta 70+00 to 78+	1100	50	50	50
Sta 70+00 to 78+	1050	40	40	40
Sta 70+00 to 78+	1010			

River: Sta 80+00 to 83+

Reach	River Sta.	Left	Channel	Right
Sta 80+00 to 83+	3530	30	30	30
Sta 80+00 to 83+	3500	50	50	50
Sta 80+00 to 83+	3450	50	50	50
Sta 80+00 to 83+	3400	50	50	50
Sta 80+00 to 83+	3350	50	50	50
Sta 80+00 to 83+	3300	50	50	50
Sta 80+00 to 83+	3250	50	50	50
Sta 80+00 to 83+	3200	100	100	100
Sta 80+00 to 83+	3177	Culvert		
Sta 80+00 to 83+	3100	50	50	50
Sta 80+00 to 83+	3050			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

River: Sta 53+00 to 56+

Reach	River Sta.	Contr.	Expan.
Sta 53+00 to 56+	840	.1	.3
Sta 53+00 to 56+	800	.1	.3
Sta 53+00 to 56+	750	.1	.3
Sta 53+00 to 56+	700	.1	.3
Sta 53+00 to 56+	660	.1	.3
Sta 53+00 to 56+	650	Culvert	
Sta 53+00 to 56+	575	.1	.3
Sta 53+00 to 56+	550	.1	.3
Sta 53+00 to 56+	500	.1	.3

River: Sta 70+00 to 78+

Reach	River Sta.	Contr.	Expan.
Sta 70+00 to 78+	2050	.1	.3
Sta 70+00 to 78+	2000	.1	.3
Sta 70+00 to 78+	1950	.1	.3
Sta 70+00 to 78+	1900	.1	.3
Sta 70+00 to 78+	1850	.1	.3
Sta 70+00 to 78+	1800	.1	.3
Sta 70+00 to 78+	1750	.1	.3
Sta 70+00 to 78+	1700	.1	.3

Sta 70+00 to 78+	1670		.1	.3
Sta 70+00 to 78+	1600		.1	.3
Sta 70+00 to 78+	1550		.1	.3
Sta 70+00 to 78+	1500		.1	.3
Sta 70+00 to 78+	1450		.1	.3
Sta 70+00 to 78+	1400		.1	.3
Sta 70+00 to 78+	1350		.1	.3
Sta 70+00 to 78+	1300		.1	.3
Sta 70+00 to 78+	1250		.1	.3
Sta 70+00 to 78+	1240	Culvert		
Sta 70+00 to 78+	1128.78		.1	.3
Sta 70+00 to 78+	1100		.1	.3
Sta 70+00 to 78+	1050		.1	.3
Sta 70+00 to 78+	1010		.1	.3

River: Sta 80+00 to 83+

Reach	River Sta.		Contr.	Expan.
Sta 80+00 to 83+	3530		.1	.3
Sta 80+00 to 83+	3500		.1	.3
Sta 80+00 to 83+	3450		.1	.3
Sta 80+00 to 83+	3400		.1	.3
Sta 80+00 to 83+	3350		.1	.3
Sta 80+00 to 83+	3300		.1	.3
Sta 80+00 to 83+	3250		.1	.3
Sta 80+00 to 83+	3200		.1	.3
Sta 80+00 to 83+	3177	Culvert		
Sta 80+00 to 83+	3100		.1	.3
Sta 80+00 to 83+	3050		.1	.3

Profile Output Table - Standard Table 1

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Sta 80+00 to 83+	Sta 80+00 to 83+	3530	PF 1	304.00	2649.24	2651.90	2651.90	2652.61	0.016395	6.76	45.20	35.35	

```
      1.00
Sta 80+00 to 83+   Sta 80+00 to 83+   3500          PF 1       304.00     2648.16
 2650.91     2650.91     2651.59     0.014943       6.64       47.72       42.28
      0.96
Sta 80+00 to 83+   Sta 80+00 to 83+   3450          PF 1       304.00     2645.25
 2647.56     2647.56     2648.39     0.016520       7.33       41.45       25.15
      1.01
Sta 80+00 to 83+   Sta 80+00 to 83+   3400          PF 1       304.00     2642.47
 2645.97     2645.97     2646.79     0.017078       7.26       41.88       26.07
      1.01
Sta 80+00 to 83+   Sta 80+00 to 83+   3350          PF 1       304.00     2640.65
 2644.71     2644.71     2645.56     0.017329       7.43       40.93       24.17
      1.01
Sta 80+00 to 83+   Sta 80+00 to 83+   3300          PF 1       304.00     2639.13
 2643.42     2643.42     2644.12     0.012266       7.02       49.87       37.18
      0.88
Sta 80+00 to 83+   Sta 80+00 to 83+   3250          PF 1       304.00     2637.70
 2640.72     2640.72     2641.52     0.016160       7.21       42.17       26.56
      1.01
Sta 80+00 to 83+   Sta 80+00 to 83+   3200          PF 1       304.00     2636.13
 2638.98     2638.98     2639.90     0.016051       7.72       39.38       21.57
      1.01
Sta 80+00 to 83+   Sta 80+00 to 83+   3177                     Culvert


Sta 80+00 to 83+   Sta 80+00 to 83+   3100          PF 1       304.00     2633.00
 2635.59     2635.59     2636.27     0.017013       6.63       45.88       34.42
      1.01
Sta 80+00 to 83+   Sta 80+00 to 83+   3050          PF 1       304.00     2631.32
 2633.88     2633.88     2634.60     0.016463       6.81       44.65       31.49
      1.01
Sta 70+00 to 78+   Sta 70+00 to 78+   2050          PF 1        79.00     2627.88
 2628.82     2628.82     2629.08     0.004474       1.58       25.05       54.37
      0.43
Sta 70+00 to 78+   Sta 70+00 to 78+   2000          PF 1        79.00     2626.32
 2625.98     2625.98     2626.34     0.004361                  16.40       22.99
      0.00
Sta 70+00 to 78+   Sta 70+00 to 78+   1950          PF 1       115.00     2624.04
 2624.06     2624.06     2624.50     0.004208       0.13       21.79       26.01
      0.21
Sta 70+00 to 78+   Sta 70+00 to 78+   1900          PF 1       115.00     2621.93
 2621.38     2621.38     2621.82     0.004145                  21.60       24.87
      0.00
Sta 70+00 to 78+   Sta 70+00 to 78+   1850          PF 1       135.00     2620.69
 2619.00     2619.00     2619.43     0.004187                  25.59       30.17
      0.00
Sta 70+00 to 78+   Sta 70+00 to 78+   1800          PF 1       147.00     2618.48
 2616.51     2616.51     2616.95     0.004210                  27.76       32.58
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      0.00
Sta 70+00 to 78+   Sta 70+00 to 78+   1750          PF 1       203.00     2615.77
 2614.88     2614.88     2615.34     0.004035                   37.24       40.76
      0.00
Sta 70+00 to 78+   Sta 70+00 to 78+   1700          PF 1       203.00     2611.94
 2612.82     2612.82     2613.30     0.004023       1.07        36.81       39.40
      0.29
Sta 70+00 to 78+   Sta 70+00 to 78+   1670          PF 1       203.00     2610.02
 2611.50     2611.50     2611.98     0.004067       2.00        38.70       41.84
      0.41
Sta 70+00 to 78+   Sta 70+00 to 78+   1600          PF 1       217.00     2607.05
 2608.14     2608.14     2608.59     0.012655       4.69        42.84       56.81
      0.84
Sta 70+00 to 78+   Sta 70+00 to 78+   1550          PF 1       217.00     2604.02
 2607.27     2607.27     2607.76     0.010071       5.80        38.80       36.54
      0.79
Sta 70+00 to 78+   Sta 70+00 to 78+   1500          PF 1       217.00     2599.75
 2603.97     2603.97     2604.82     0.018207       7.38        29.38       17.76
      1.01
Sta 70+00 to 78+   Sta 70+00 to 78+   1450          PF 1       217.00     2597.47
 2601.67     2601.67     2602.52     0.012906       7.49        30.38       19.05
      0.87
Sta 70+00 to 78+   Sta 70+00 to 78+   1400          PF 1       264.00     2595.76
 2599.14                 2599.58     0.009475       5.40        49.98       37.20
      0.77
Sta 70+00 to 78+   Sta 70+00 to 78+   1350          PF 1       264.00     2593.07
 2599.37                 2599.42     0.000305       1.83       148.15       42.91
      0.16
Sta 70+00 to 78+   Sta 70+00 to 78+   1300          PF 1       264.00     2591.18
 2599.37                 2599.40     0.000165       1.33       199.31       50.71
      0.12
Sta 70+00 to 78+   Sta 70+00 to 78+   1250          PF 1       264.00     2590.28
 2599.39     2593.27     2599.39     0.000023       0.67       407.43       88.57
      0.05
Sta 70+00 to 78+   Sta 70+00 to 78+   1240                     Culvert


Sta 70+00 to 78+   Sta 70+00 to 78+   1128.78       PF 1       299.00     2585.36
 2589.30     2589.30     2590.16     0.016523       7.40        40.41       23.88
      1.00
Sta 70+00 to 78+   Sta 70+00 to 78+   1100          PF 1       299.00     2584.75
 2588.15     2588.15     2589.01     0.016329       7.45        40.16       24.01
      1.01
Sta 70+00 to 78+   Sta 70+00 to 78+   1050          PF 1       299.00     2583.45
 2586.92     2586.92     2587.67     0.013521       6.98        45.71       34.08
      0.92
Sta 70+00 to 78+   Sta 70+00 to 78+   1010          PF 1       299.00     2582.35
 2585.27     2585.27     2586.04     0.011433       6.94        44.00       32.45
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        0.87
  Sta 53+00 to 56+   Sta 53+00 to 56+   840           PF 1       255.26     2547.61
   2549.18                 2549.35     0.009747       3.32       76.96      109.02
        0.70
  Sta 53+00 to 56+   Sta 53+00 to 56+   800           PF 1       279.50     2546.48
   2548.24     2548.24     2548.79     0.017675       5.98       46.78       42.68
        1.01
  Sta 53+00 to 56+   Sta 53+00 to 56+   750           PF 1       279.50     2545.50
   2547.66                 2547.70     0.001280       1.86      181.66      135.57
        0.28
  Sta 53+00 to 56+   Sta 53+00 to 56+   700           PF 1       279.50     2543.90
   2547.67                 2547.68     0.000072       0.73      499.92      197.64
        0.08
  Sta 53+00 to 56+   Sta 53+00 to 56+   660           PF 1       279.50     2543.03
   2547.64     2545.10     2547.67     0.000259       1.41      220.50       73.61
        0.14
  Sta 53+00 to 56+   Sta 53+00 to 56+   650                     Culvert


  Sta 53+00 to 56+   Sta 53+00 to 56+   575           PF 1       279.50     2541.67
   2544.01     2544.01     2544.86     0.016063       7.40       37.76       22.86
        1.01
  Sta 53+00 to 56+   Sta 53+00 to 56+   550           PF 1       279.50     2540.07
   2542.41     2542.41     2543.20     0.016107       7.14       39.13       24.98
        1.01
  Sta 53+00 to 56+   Sta 53+00 to 56+   500           PF 1       279.50     2539.16
   2541.57     2541.57     2542.31     0.016584       6.88       40.61       28.14
        1.01
```

Profile Output Table - Culvert Only

```
  River              Reach              River Sta               Profile   E.G. US.
W.S. US.   E.G. IC   E.G. OC   Min El Weir Flow   Q Culv Group   Q Weir   Delta WS
Culv Vel US   Culv Vel DS
                                                                                (ft)
    (ft)      (ft)      (ft)               (ft)          (cfs)    (cfs)       (ft)
     (ft/s)        (ft/s)


  Sta 80+00 to 83+   Sta 80+00 to 83+   3177     Culvert #1     PF 1       2638.41
 2638.98   2638.41   2638.88            2639.55         304.00                3.39
       9.86          8.06
```

```
 Sta 70+00 to 78+   Sta 70+00 to 78+   1240     Culvert #1     PF 1       2599.39
2599.39   2599.28   2599.39            2598.49         178.39    85.61      10.08
     12.62         12.62
 Sta 53+00 to 56+   Sta 53+00 to 56+   650      Culvert #1     PF 1       2547.67
2547.64   2547.40   2547.67            2547.51         273.22     6.28       3.64
      8.76          8.95
```

PROPOSED CONDTIONS

HEC-RAS HEC-RAS 5.0.4 April 2018
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X    X
X     X  X        X            X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X        X
X     X  X        X    X       X   X    X    X        X
X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: Kolb Road_Sunrise to Sabino Canyon
Project File : KolbRoad.prj
Run Date and Time: 9/4/2018 11:56:27 AM

Project in English units

PLAN DATA

Plan Title: ProposedFlow
Plan File : t:\7PIM160201\WATRES\GLOBAL\CALCS\Hydraulics\HEC-RAS\KolbRoad.p01

Geometry Title: KolbRd_Proposed
Geometry File :
t:\7PIM160201\WATRES\GLOBAL\CALCS\Hydraulics\HEC-RAS\KolbRoad.g02

Flow Title : ProposedFlow
Flow File :
t:\7PIM160201\WATRES\GLOBAL\CALCS\Hydraulics\HEC-RAS\KolbRoad.f02

Plan Summary Information:

Number of:	Cross Sections	= 36	Multiple Openings	=	0
	Culverts	= 4	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

Computational Information
Water surface calculation tolerance = 0.01

```
    Critical depth calculation tolerance =  0.01
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
    Flow tolerance factor                =  0.001

Computation Options
    Critical depth computed only where necessary
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Average Conveyance
    Computational Flow Regime:     Subcritical Flow




FLOW DATA

Flow Title: ProposedFlow
Flow File : t:\7PIM160201\WATRES\GLOBAL\CALCS\Hydraulics\HEC-RAS\KolbRoad.f02

Flow Data (cfs)

  River           Reach           RS                   PF 1
  Sta 53+00 to 56+Sta 53+00 to 56+840                255.26
  Sta 53+00 to 56+Sta 53+00 to 56+800                287.81
  Sta 70+00 to 78+Sta 70+00 to 78+2050                    79
  Sta 70+00 to 78+Sta 70+00 to 78+1950                   115
  Sta 70+00 to 78+Sta 70+00 to 78+1850                   135
  Sta 70+00 to 78+Sta 70+00 to 78+1800                   147
  Sta 70+00 to 78+Sta 70+00 to 78+1750                   203
  Sta 70+00 to 78+Sta 70+00 to 78+1670                   217
  Sta 70+00 to 78+Sta 70+00 to 78+1350                   264
  Sta 70+00 to 78+Sta 70+00 to 78+1128.78                280
  Sta 70+00 to 78+Sta 70+00 to 78+1050                   283
  Sta 80+00 to 83+Sta 80+00 to 83+3530                   304
  Sta 80+00 to 83+Sta 80+00 to 83+3450                 326.2


Boundary Conditions


  River           Reach           Profile                       Upstream
    Downstream


  Sta 53+00 to 56+Sta 53+00 to 56+PF 1                           Critical
      Critical
  Sta 70+00 to 78+Sta 70+00 to 78+PF 1                           Critical
      Critical
```

Sta 80+00 to 83+Sta 80+00 to 83+PF 1 Critical
Critical

GEOMETRY DATA

Geometry Title: KolbRd_Proposed
Geometry File : t:\7PIM160201\WATRES\GLOBAL\CALCS\Hydraulics\HEC-RAS\KolbRoad.g02

CROSS SECTION

RIVER: Sta 53+00 to 56+
REACH: Sta 53+00 to 56+ RS: 840

INPUT
Description:
Station Elevation Data num= 57

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2550.09	15.23	2550.13	17.43	2549.98	17.88	2549.95	20.87	2549.76
22.62	2549.61	28.2	2549.16	36.58	2548.01	40.83	2547.64	41.2	2547.61
50.94	2548.37	55.65	2548.74	64.79	2548.81	70.11	2548.76	78.65	2548.87
84.56	2548.88	92.5	2548.78	99.01	2548.74	103.07	2548.68	107.93	2548.55
110.73	2548.47	113.07	2548.32	114.84	2548.11	116.95	2547.75	119.55	2547.77
120.22	2547.78	121.95	2547.8	123.84	2547.82	126.1	2547.85	126.72	2547.85
128	2547.84	128.03	2547.84	128.08	2547.79	130.36	2548.33	131.8	2548.67
138.92	2550.34	145.57	2551.9	147.65	2552.39	151.31	2553.25	152.12	2553.26
152.85	2553.27	155.46	2553.31	159.35	2553.36	160.99	2553.38	162.09	2553.4
162.68	2553.41	162.86	2553.41	163.06	2553.05	163.13	2552.92	163.57	2552.92
165.33	2553	166.69	2553.06	166.72	2553.04	166.76	2553.01	166.8	2553.04
166.85	2553.07	169.89	2553.13						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	22.62	.035	138.92	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
22.62	138.92	40	40	40	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2549.38	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.		0.035	

```
  W.S. Elev (ft)           2549.21    Reach Len. (ft)            40.00      40.00
  40.00
  Crit W.S. (ft)                      Flow Area (sq ft)                      77.38

  E.G. Slope (ft/ft)      0.009288    Area (sq ft)                           77.38

  Q Total (cfs)             255.26    Flow (cfs)                            255.26

  Top Width (ft)            106.52    Top Width (ft)                        106.52

  Vel Total (ft/s)            3.30    Avg. Vel. (ft/s)                        3.30

  Max Chl Dpth (ft)           1.60    Hydr. Depth (ft)                        0.73

  Conv. Total (cfs)         2648.6    Conv. (cfs)                           2648.6

  Length Wtd. (ft)           40.00    Wetted Per. (ft)                      106.90

  Min Ch El (ft)           2547.61    Shear (lb/sq ft)                        0.42

  Alpha                       1.00    Stream Power (lb/ft s)                  1.38

  Frctn Loss (ft)             0.51    Cum Volume (acre-ft)        0.01        0.77
   0.81
  C & E Loss (ft)             0.04    Cum SA (acres)              0.02        0.40
   0.49



CROSS SECTION


RIVER: Sta 53+00 to 56+
REACH: Sta 53+00 to 56+   RS: 800

INPUT
Description:
Station Elevation Data    num=      42
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2550.642.220001 2550.622.240005 2550.612.270004 2550.572.290001 2550.59
    2.32 2550.62       3 2550.614.390007 2550.584.690002 2550.584.740005 2550.73
4.860001 2551.085.370003 2551.087.040001 2551.09   11.47 2551.12   11.69 2551.12
12.49001 2551.13   13.44 2550.8117.42001  2549.5   17.47 2549.49   18.02 2549.41
    21.2 2548.79   27.87 2547.54   29.04  2547.3   37.04 2546.54   42.94 2546.63
   47.22 2546.4853.03001 2546.75      55 2547.1358.85001 2547.88   63.12 2547.97
   70.47 2548.4873.21001 2548.8482.10001 2549.25    83.3 2549.3791.18001 2549.13
   93.38 2549.03   93.72 2549.04  101.45 2549.07  101.73 2549.07  103.47 2549.08
```

```
   108.7 2549.26  122.98 2549.57

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   18.02    .035    83.3    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         18.02    83.3               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2548.83    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.56    Wt. n-Val.                             0.035

  W.S. Elev (ft)           2548.28    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)           2548.28    Flow Area (sq ft)                      48.01

  E.G. Slope (ft/ft)      0.017649    Area (sq ft)                           48.01

  Q Total (cfs)             287.81    Flow (cfs)                            287.81

  Top Width (ft)             43.57    Top Width (ft)                         43.57

  Vel Total (ft/s)            5.99    Avg. Vel. (ft/s)                        5.99

  Max Chl Dpth (ft)           1.79    Hydr. Depth (ft)                        1.10

  Conv. Total (cfs)         2166.4    Conv. (cfs)                           2166.4

  Length Wtd. (ft)           50.00    Wetted Per. (ft)                       43.82

  Min Ch El (ft)           2546.48    Shear (lb/sq ft)                        1.21

  Alpha                       1.00    Stream Power (lb/ft s)                  7.24

  Frctn Loss (ft)             0.12    Cum Volume (acre-ft)        0.01        0.71
   0.81
  C & E Loss (ft)             0.16    Cum SA (acres)              0.02        0.33
   0.49



Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
```

```
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Sta 53+00 to 56+
REACH: Sta 53+00 to 56+   RS: 750

INPUT
Description:
Station Elevation Data    num=      41
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2549.7710.74001 2549.7310.78001 2549.6910.79001 2549.68   10.83 2549.72
10.84001 2549.7312.37001 2549.7112.89001 2549.6913.18001 2549.6913.31001 2550.07
13.35001 2550.1913.85001 2550.19   18.25 2550.24   19.86 2550.2520.59001 2550.26
   20.86 2550.26   24.25 2549.13   25.61 2548.68   25.63 2548.68   25.66 2548.67
33.40001 2547.71   47.84 2545.8652.76001 2545.5854.99001 2545.5557.85001  2545.5
   62.91 2546.4167.85001 2547.2273.06001 2547.0277.85001 2546.86    83.2 2546.51
87.85001 2546.2593.35001 2546.1697.85001 2546.02  103.49    2546  105.94 2545.95
  107.02 2545.93  107.86 2545.91  121.65 2545.84  145.49 2546.18  168.89 2547.24
  169.07 2547.24

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .04533.40001    .035  169.07    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      33.40001  169.07               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2547.74    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.04    Wt. n-Val.                            0.035
```

```
  W.S. Elev (ft)           2547.71    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)                      Flow Area (sq ft)                    187.32

  E.G. Slope (ft/ft)      0.000858    Area (sq ft)                         187.32

  Q Total (cfs)             287.81    Flow (cfs)                           287.81

  Top Width (ft)            135.63    Top Width (ft)                       135.63

  Vel Total (ft/s)            1.54    Avg. Vel. (ft/s)                       1.54

  Max Chl Dpth (ft)           2.20    Hydr. Depth (ft)                       1.38

  Conv. Total (cfs)         9824.3    Conv. (cfs)                          9824.3

  Length Wtd. (ft)           50.00    Wetted Per. (ft)                     136.42

  Min Ch El (ft)           2545.50    Shear (lb/sq ft)                       0.07

  Alpha                       1.00    Stream Power (lb/ft s)                 0.11

  Frctn Loss (ft)             0.01    Cum Volume (acre-ft)        0.01       0.58
   0.81
  C & E Loss (ft)             0.01    Cum SA (acres)              0.02       0.23
   0.49


Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: Sta 53+00 to 56+
REACH: Sta 53+00 to 56+   RS: 700

INPUT
Description:
Station Elevation Data    num=      36
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2549.17.5200043 2549.163.190002 2549.113.720001 2549.095.179993 2549.03
5.479996 2549.295.580002 2549.435.800003 2549.426.190002  2549.48.110001 2549.48
```

```
8.940002  2549.59.960007 2549.53   11.97 2549.5431.50999 2546.1538.67999 2544.26
43.60001 2544.2444.99001 2544.1548.67999  2543.9   53.77 2545.0758.67999 2545.92
   63.94 2545.49   68.69 2545.27   74.12 2545.33   78.69 2545.1684.28999 2544.72
   88.69 2544.43   94.46  2544.4   96.88 2544.42   97.93 2544.43   98.69 2544.43
  113.65 2544.55  138.85 2544.79  163.54 2544.92  187.75 2545.16  208.58  2546.2
     223    2548

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .04531.50999    .03558.67999    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      31.5099958.67999               40      40      40             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2547.72    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.01    Wt. n-Val.                  0.045      0.035
  0.045
  W.S. Elev (ft)           2547.72    Reach Len. (ft)            40.00      40.00
  40.00
  Crit W.S. (ft)                      Flow Area (sq ft)           7.08      80.96
 420.76
  E.G. Slope (ft/ft)      0.000074    Area (sq ft)                7.08      80.96
 420.76
  Q Total (cfs)             287.81    Flow (cfs)                  1.69      60.54
 225.58
  Top Width (ft)            198.26    Top Width (ft)              9.04      27.17
 162.06
  Vel Total (ft/s)            0.57    Avg. Vel. (ft/s)            0.24       0.75
   0.54
  Max Chl Dpth (ft)           3.82    Hydr. Depth (ft)            0.78       2.98
   2.60
  Conv. Total (cfs)        33462.4    Conv. (cfs)                196.8     7038.3
26227.2
  Length Wtd. (ft)           40.00    Wetted Per. (ft)            9.17      27.63
 162.23
  Min Ch El (ft)           2543.90    Shear (lb/sq ft)            0.00       0.01
   0.01
  Alpha                       1.07    Stream Power (lb/ft s)      0.00       0.01
   0.01
  Frctn Loss (ft)             0.00    Cum Volume (acre-ft)        0.01       0.42
   0.57
  C & E Loss (ft)             0.00    Cum SA (acres)              0.01       0.14
   0.40
```

```
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: Sta 53+00 to 56+
REACH: Sta 53+00 to 56+   RS: 660

INPUT
Description:
Station Elevation Data    num=      54
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2549.91.6999969 2549.91    1.75  2549.93.139999  2549.93.229996 2549.89
3.410004 2549.893.580002  2549.73.740005 2549.51     4.5 2549.485.290001 2549.44
    5.57 2549.425.849998 2549.415.979996  2549.4    6.25 2549.38    10.3 2549.34
    16.8 2549.16   22.53 2549.07   26.81 2548.98    32.7 2548.84   36.81 2548.77
   40.75 2548.61   41.81 2548.56   43.41 2548.49   44.16 2548.46   45.36 2548.47
   46.43 2548.47   46.49 2548.48   46.67 2548.48    46.7 2548.49   46.82 2548.49
   47.27 2548.52   51.08 2548.71   51.54 2548.73   52.14 2548.76   52.92  2548.8
   53.68 2548.84   54.27 2548.69   65.36 2545.97   76.55 2543.39   81.47 2543.46
   82.19 2543.39   86.55 2543.03   91.64 2543.54   96.55 2544.92  101.82 2545.36
  106.55 2545.67  111.99 2545.29  116.56  2544.9  122.16 2544.31  126.56  2544.1
  132.14 2543.77  316.92    2544  326.65    2546     332    2548

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   65.36    .035  106.55    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         65.36  106.55                85      85      85             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2547.72    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.00    Wt. n-Val.                  0.045      0.035
  0.045
  W.S. Elev (ft)           2547.72    Reach Len. (ft)            85.00      85.00
  85.00
  Crit W.S. (ft)           2544.31    Flow Area (sq ft)           6.24     141.61
 817.09
  E.G. Slope (ft/ft)      0.000014    Area (sq ft)                6.24     141.61
 817.09
```

Q Total (cfs)	287.81	Flow (cfs)	0.69	50.44	236.68
Top Width (ft)	273.02	Top Width (ft)	7.13	41.19	224.70
Vel Total (ft/s)	0.30	Avg. Vel. (ft/s)	0.11	0.36	0.29
Max Chl Dpth (ft)	4.69	Hydr. Depth (ft)	0.87	3.44	3.64
Conv. Total (cfs)	77448.3	Conv. (cfs)	184.8	13573.0	63690.6
Length Wtd. (ft)	85.00	Wetted Per. (ft)	7.34	41.75	225.29
Min Ch El (ft)	2543.03	Shear (lb/sq ft)	0.00	0.00	0.00
Alpha	1.03	Stream Power (lb/ft s)	0.00	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)		0.32	0.00
C & E Loss (ft)		Cum SA (acres)	0.01	0.11	0.22

CULVERT

RIVER: Sta 53+00 to 56+
REACH: Sta 53+00 to 56+ RS: 650

INPUT
Description:
Distance from Upstream XS = 10
Deck/Roadway Width = 70
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	2548.84	2539	40	2548.84	2539	80	2547.57	2539
100	2547.5	2539	120	2547.5	2539			

Upstream Bridge Cross Section Data
Station Elevation Data num= 49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2549.91	.7	2549.91	1.75	2549.9	3.14	2549.9	3.23	2549.89
3.41	2549.89	3.58	2549.7	3.74	2549.51	4.5	2549.48	5.29	2549.44
5.57	2549.42	5.85	2549.41	5.98	2549.4	6.25	2549.38	10.3	2549.34
16.8	2549.16	22.53	2549.07	26.81	2548.98	32.7	2548.84	36.81	2548.77
40.75	2548.61	41.81	2548.56	43.41	2548.49	44.16	2548.46	45.36	2548.47

```
   46.43 2548.47   46.49 2548.48   46.67 2548.48    46.7 2548.49   46.82 2548.49
   47.27 2548.52   51.08 2548.71   51.54 2548.73   52.14 2548.76   52.92  2548.8
   53.68 2548.84   54.27 2548.69   65.36 2545.97   76.55 2543.39   81.47 2543.46
   82.19 2543.39   86.55 2543.03   91.64 2543.54   96.55 2544.92  101.82 2545.36
  106.55 2545.67  111.99 2545.29  116.56  2544.9     120 2544.31

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   65.36    .035  106.55    .045

Bank Sta: Left   Right    Coeff Contr.   Expan.
         65.36  106.55             .1       .3

Downstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0 2548.51    2539      40 2548.45    2539      80 2547.57    2539
     100  2547.5    2539     120  2547.5    2539

Downstream Bridge Cross Section Data
Station Elevation Data    num=      32
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2548.07     .36 2548.06    1.87 2547.99    1.93 2547.99    1.95 2548.01
    2.42 2548.48    2.83 2548.46    2.89 2548.46    8.67 2548.59    8.68 2548.59
     8.7  2548.6   14.95 2548.51    23.3 2546.93   24.95 2546.57    31.5  2541.7
   34.68  2541.7      40  2541.7   44.62  2541.7    48.5  2541.7   54.66 2544.62
   54.69 2544.62   62.72 2544.12   64.69    2544   74.69 2544.49   74.73 2544.49
   84.69 2544.42   84.76 2544.42   93.14  2544.5   93.15  2544.5   94.69 2544.52
      95 2544.52     120 2544.77

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   24.95    .035   54.66    .045

Bank Sta: Left   Right    Coeff Contr.   Expan.
         24.95   54.66             .1       .3

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Culverts =  1

Culvert Name     Shape      Rise    Span
```

```
Culvert #1      Circular     3.5
FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 1 - Square edge entrance with headwall
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 10      70     .024     .024        0                   .7
      1
Number of Barrels =  4
Upstream   Elevation =  2543
Centerline Stations
    Sta.    Sta.    Sta.    Sta.
   77.39   81.89   86.39   90.89
Downstream Elevation =  2541.7
Centerline Stations
    Sta.    Sta.    Sta.    Sta.
   33.25   37.75   42.25   46.75

CULVERT OUTPUT  Profile #PF 1  Culv Group:  Culvert #1

  Q Culv Group (cfs)        278.04    Culv Full Len (ft)
  # Barrels                      4    Culv Vel US (ft/s)          8.78
  Q Barrel (cfs)             69.51    Culv Vel DS (ft/s)          9.02
  E.G. US. (ft)            2547.72    Culv Inv El Up (ft)      2543.00
  W.S. US. (ft)            2547.72    Culv Inv El Dn (ft)      2541.70
  E.G. DS (ft)             2544.91    Culv Frctn Ls (ft)          1.30
  W.S. DS (ft)             2544.06    Culv Exit Loss (ft)         0.67
  Delta EG (ft)               2.81    Culv Entr Loss (ft)         0.84
  Delta WS (ft)               3.66    Q Weir (cfs)                9.77
  E.G. IC (ft)             2547.53    Weir Sta Lft (ft)          75.27
  E.G. OC (ft)             2547.72    Weir Sta Rgt (ft)         120.00
  Culvert Control           Outlet    Weir Submerg                0.00
  Culv WS Inlet (ft)       2545.68    Weir Max Depth (ft)         0.22
  Culv WS Outlet (ft)      2544.31    Weir Avg Depth (ft)         0.19
  Culv Nml Depth (ft)         2.68    Weir Flow Area (sq ft)      8.46
  Culv Crt Depth (ft)         2.61    Min El Weir Flow (ft)    2547.51


Note:    During subcritical analysis, the culvert direct step method, the solution
went to normal depth.

CROSS SECTION


RIVER: Sta 53+00 to 56+
REACH: Sta 53+00 to 56+   RS: 575

INPUT
```

```
Description:
Station Elevation Data    num=      32
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2548.07.3600006 2548.061.869995 2547.99    1.93 2547.991.949997 2548.01
2.419998 2548.482.830002 2548.462.889999 2548.468.669998 2548.59    8.68 2548.59
8.699997  2548.6   14.95 2548.51    23.3 2546.93   24.95 2546.57   34.15 2541.96
   34.68  2541.7      40 2541.69   44.62 2541.67   44.68 2541.68   54.66 2544.62
   54.69 2544.62   62.72 2544.12   64.69    2544   74.69 2544.49   74.73 2544.49
   84.69 2544.4284.75999 2544.42   93.14  2544.593.14999  2544.5   94.69 2544.52
      95 2544.52  114.85 2544.77

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   24.95    .035   54.66    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         24.95   54.66               25      25      25             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2544.91    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.86    Wt. n-Val.                            0.035
  0.045
  W.S. Elev (ft)           2544.06    Reach Len. (ft)            25.00      25.00
  25.00
  Crit W.S. (ft)           2544.06    Flow Area (sq ft)                     38.80
   0.06
  E.G. Slope (ft/ft)      0.015798    Area (sq ft)                          38.80
   0.06
  Q Total (cfs)             287.81    Flow (cfs)                           287.79
   0.02
  Top Width (ft)             24.78    Top Width (ft)                        22.77
   2.01
  Vel Total (ft/s)            7.41    Avg. Vel. (ft/s)                       7.42
   0.38
  Max Chl Dpth (ft)           2.38    Hydr. Depth (ft)                       1.70
   0.03
  Conv. Total (cfs)         2289.9    Conv. (cfs)                          2289.7
    0.2
  Length Wtd. (ft)           25.00    Wetted Per. (ft)                      23.67
   2.02
  Min Ch El (ft)           2541.67    Shear (lb/sq ft)                       1.62
   0.03
  Alpha                       1.00    Stream Power (lb/ft s)                11.99
   0.01
  Frctn Loss (ft)             0.40    Cum Volume (acre-ft)                   0.07
```

```
   0.00
  C & E Loss (ft)             0.02    Cum SA (acres)                          0.04
   0.00



Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Sta 53+00 to 56+
REACH: Sta 53+00 to 56+   RS: 550

INPUT
Description:
Station Elevation Data    num=      28
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2548.08.3300018 2548.07.7200012 2548.041.519997 2547.891.970001 2547.93
2.169998 2547.932.410004 2548.272.589996 2548.48       3 2548.483.190002 2548.47
4.449997 2548.485.029999 2548.496.379997 2548.538.879997 2548.59   11.55 2548.65
    27.5 2542.56   34.77 2540.25   39.68 2540.07      40 2540.07   44.77 2540.12
   49.81 2541.63   54.77 2542.86   59.78 2542.95   64.77 2543.26   69.75 2542.74
   74.77 2542.86   79.71 2543.04      80 2543.03

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   11.55    .035   54.77    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11.55   54.77               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2543.25    Element                    Left OB    Channel
Right OB
```

Vel Head (ft)	0.80	Wt. n-Val.		0.035
W.S. Elev (ft)	2542.44	Reach Len. (ft)	50.00	50.00
50.00				
Crit W.S. (ft)	2542.44	Flow Area (sq ft)		39.99
E.G. Slope (ft/ft)	0.016092	Area (sq ft)		39.99
Q Total (cfs)	287.81	Flow (cfs)		287.81
Top Width (ft)	25.23	Top Width (ft)		25.23
Vel Total (ft/s)	7.20	Avg. Vel. (ft/s)		7.20
Max Chl Dpth (ft)	2.37	Hydr. Depth (ft)		1.59
Conv. Total (cfs)	2268.8	Conv. (cfs)		2268.8
Length Wtd. (ft)	50.00	Wetted Per. (ft)		25.89
Min Ch El (ft)	2540.07	Shear (lb/sq ft)		1.55
Alpha	1.00	Stream Power (lb/ft s)		11.17
Frctn Loss (ft)	0.81	Cum Volume (acre-ft)		0.05
C & E Loss (ft)	0.02	Cum SA (acres)		0.03

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Sta 53+00 to 56+
REACH: Sta 53+00 to 56+ RS: 500

INPUT
Description:

```
Station Elevation Data    num=      30
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2548.12.8499985  2548.1    1.25 2548.041.970001 2547.982.269997 2547.98
2.709999    25482.980003 2548.283.120003  2548.53.410004 2548.493.620003 2548.49
4.980003 2548.51    5.68 2548.536.629997 2548.557.510002 2548.588.160004  2548.6
9.309998 2548.64   21.14  2544.8   27.83  2541.9   34.94 2539.35   39.85 2539.16
      40 2539.17   44.94 2539.46   49.89 2540.66   54.94 2541.28   59.92 2542.03
   64.94 2543.06   69.96 2542.84   74.94 2542.77   79.99 2542.67      80 2542.67

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   21.14    .035   64.94    .045

Bank Sta: Left   Right    Coeff Contr.   Expan.
         21.14   64.94             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2542.35    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.74    Wt. n-Val.                            0.035

  W.S. Elev (ft)           2541.61    Reach Len. (ft)

  Crit W.S. (ft)           2541.61    Flow Area (sq ft)                     41.59

  E.G. Slope (ft/ft)      0.016485    Area (sq ft)                          41.59

  Q Total (cfs)             287.81    Flow (cfs)                           287.81

  Top Width (ft)             28.47    Top Width (ft)                        28.47

  Vel Total (ft/s)            6.92    Avg. Vel. (ft/s)                       6.92

  Max Chl Dpth (ft)           2.45    Hydr. Depth (ft)                       1.46

  Conv. Total (cfs)         2241.6    Conv. (cfs)                          2241.6

  Length Wtd. (ft)                    Wetted Per. (ft)                      29.08

  Min Ch El (ft)           2539.16    Shear (lb/sq ft)                       1.47

  Alpha                       1.00    Stream Power (lb/ft s)                10.18

  Frctn Loss (ft)                     Cum Volume (acre-ft)

  C & E Loss (ft)                     Cum SA (acres)
```

CROSS SECTION

RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+ RS: 2050

INPUT
Description:
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
29.78	2629.16	33.4	2629.26	33.69	2629.26	33.78	2629.53	33.86	2629.76
34.36	2629.76	37.62	2629.8	40.36	2629.83	40.91	2629.83	41.36	2629.84
44.97	2628.93	49.36	2627.84	49.99	2627.85	50.26	2627.85	51.36	2627.88
54.05	2628.55	56.24	2629.1	56.26	2629.11	56.29	2629.11	60.28	2629.28
63.88	2629.36	66.25	999 2629.21	73.62	2628.53	80.54	2628.54	83.63	2628.43
86.43	2628.81	89.99	2629.45						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
29.78	.016	41.36	.035	89.99	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
41.36	89.99	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2629.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.29	Wt. n-Val.		0.035	
W.S. Elev (ft)	2629.11	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2629.11	Flow Area (sq ft)		18.20	
E.G. Slope (ft/ft)	0.023364	Area (sq ft)		18.20	
Q Total (cfs)	79.00	Flow (cfs)		79.00	
Top Width (ft)	32.87	Top Width (ft)		32.87	
Vel Total (ft/s)	4.34	Avg. Vel. (ft/s)		4.34	
Max Chl Dpth (ft)	1.27	Hydr. Depth (ft)		0.55	

Conv. Total (cfs)	516.8	Conv. (cfs)		516.8
Length Wtd. (ft)	50.00	Wetted Per. (ft)		33.26
Min Ch El (ft)	2627.84	Shear (lb/sq ft)		0.80
Alpha	1.00	Stream Power (lb/ft s)		3.46
Frctn Loss (ft)	1.04	Cum Volume (acre-ft)	0.00	0.75
C & E Loss (ft)	0.02	Cum SA (acres)	0.00	0.55

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+ RS: 2000

INPUT
Description:
Station Elevation Data num= 29

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9.439995	2626.06	18.8	2626.34	32.45	2626.74	32.74	2626.74	32.8	2626.9
32.91	2627.24	33.07	2627.25	33.41	2627.25	35.2	2627.27	39.42	2627.32
39.69	2627.32	40.42	2627.33	47.38	2625.09	49.32	2624.45	49.99	2624.47
53.88	2624.55	54.91	2624.58	65.03	2627.88	66.21	2628.28	66.22	2628.23
66.23	2628.24	66.25999	2628.24	66.37	2628.25	70.31	2628.87	76.11	2629.15
79.33	2629.83	86.13	2630.62	88.87	2630.95	89.99	2631.08		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

```
9.439995    .016   40.42    .035   65.03    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         40.42   65.03               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2626.42    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.49    Wt. n-Val.                            0.035

  W.S. Elev (ft)           2625.93    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)           2625.93    Flow Area (sq ft)                     14.03

  E.G. Slope (ft/ft)      0.018765    Area (sq ft)                          14.03

  Q Total (cfs)              79.00    Flow (cfs)                            79.00

  Top Width (ft)             14.27    Top Width (ft)                        14.27

  Vel Total (ft/s)            5.63    Avg. Vel. (ft/s)                       5.63

  Max Chl Dpth (ft)           1.48    Hydr. Depth (ft)                       0.98

  Conv. Total (cfs)          576.7    Conv. (cfs)                           576.7

  Length Wtd. (ft)           50.00    Wetted Per. (ft)                      14.72

  Min Ch El (ft)           2624.45    Shear (lb/sq ft)                       1.12

  Alpha                       1.00    Stream Power (lb/ft s)                 6.29

  Frctn Loss (ft)             0.91    Cum Volume (acre-ft)        0.00       0.73

  C & E Loss (ft)             0.01    Cum SA (acres)              0.00       0.52



Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
```

previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+ RS: 1950

INPUT
Description:
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
28.27	2624.26	34.19	2624.37	34.48	2624.37	34.59	2624.68	34.65	2624.86
35.16	2624.86	39.49	2624.88	41.19	2624.89	41.43	2624.89	42.19	2624.9
49.76	2622.35	50.75	2622.02	51.24	2621.85	53.47	2621.88	56.87	2621.93
57.27	2621.94	70.7	2626.32	78.33	2628.82	78.37	2628.9	78.38	2628.9
81.51	2629.14	82.11	2629.18	83.65	2629.3	86.37	2629.68	89.76	2630.12

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
28.27	.016	42.19	.035	70.7	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
42.19	70.7	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2624.17	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.58	Wt. n-Val.		0.035	
W.S. Elev (ft)	2623.58	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2623.58	Flow Area (sq ft)		18.75	
E.G. Slope (ft/ft)	0.017932	Area (sq ft)		18.75	
Q Total (cfs)	115.00	Flow (cfs)		115.00	
Top Width (ft)	16.20	Top Width (ft)		16.20	

Vel Total (ft/s)	6.13	Avg. Vel. (ft/s)		6.13
Max Chl Dpth (ft)	1.73	Hydr. Depth (ft)		1.16
Conv. Total (cfs)	858.8	Conv. (cfs)		858.8
Length Wtd. (ft)	50.00	Wetted Per. (ft)		16.74
Min Ch El (ft)	2621.85	Shear (lb/sq ft)		1.25
Alpha	1.00	Stream Power (lb/ft s)		7.69
Frctn Loss (ft)	0.90	Cum Volume (acre-ft)	0.00	0.71
C & E Loss (ft)	0.00	Cum SA (acres)	0.00	0.50

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+ RS: 1900

INPUT
Description:
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
23.76	2621.37	25.18	2621.43	32.85	2621.67	35.31	2621.75	35.6	2621.75
35.75	2622.18	35.77	2622.25	36.27	2622.25	37.27	2622.26	42.29	2622.33
42.52	2622.33	43.29	2622.34	49.34	2620.35	49.97	2620.15	52.31	2619.38
55.82	2619.46	58.32	2619.52	69.44	2623.25	86.06	2628.83	86.07	2628.84
86.11	2628.84	87.41	2628.96	87.54	2628.98	89.97	2629.19		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
23.76	.016	43.29	.035	69.44	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
43.29	69.44	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2621.72	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.59	Wt. n-Val.		0.035	
W.S. Elev (ft)	2621.14	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2621.14	Flow Area (sq ft)		18.72	
E.G. Slope (ft/ft)	0.018028	Area (sq ft)		18.72	
Q Total (cfs)	115.00	Flow (cfs)		115.00	
Top Width (ft)	16.18	Top Width (ft)		16.18	
Vel Total (ft/s)	6.14	Avg. Vel. (ft/s)		6.14	
Max Chl Dpth (ft)	1.75	Hydr. Depth (ft)		1.16	
Conv. Total (cfs)	856.5	Conv. (cfs)		856.5	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		16.72	
Min Ch El (ft)	2619.38	Shear (lb/sq ft)		1.26	
Alpha	1.00	Stream Power (lb/ft s)		7.74	
Frctn Loss (ft)	0.89	Cum Volume (acre-ft)	0.00	0.69	
C & E Loss (ft)	0.00	Cum SA (acres)	0.00	0.48	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+ RS: 1850

INPUT
Description:
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
23.61	2618.81	32.06	2619.09	36.03	2619.22	36.32	2619.22	36.36	2619.35
36.49	2619.72	36.99	2619.72	38.82	2619.75	43.02	2619.81	43.42	2619.82
44.03	2619.83	48.58	2618.34	53.08	2616.87	54.95	2616.92	57.05	2616.97
59.11	2617.02	74.85	2622.32	82.17	2624.79	86.06	2626.09	86.11	2626.03
88.46999	2626.24	89.41	2626.33	94.95	2626.92				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
23.61	.016	44.03	.035	74.85	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
44.03	74.85	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2619.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.63	Wt. n-Val.		0.035	
W.S. Elev (ft)	2618.78	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2618.78	Flow Area (sq ft)		21.25	
E.G. Slope (ft/ft)	0.017556	Area (sq ft)		21.25	
Q Total (cfs)	135.00	Flow (cfs)		135.00	
Top Width (ft)	17.10	Top Width (ft)		17.10	
Vel Total (ft/s)	6.35	Avg. Vel. (ft/s)		6.35	

Max Chl Dpth (ft)	1.91	Hydr. Depth (ft)		1.24
Conv. Total (cfs)	1018.9	Conv. (cfs)		1018.9
Length Wtd. (ft)	50.00	Wetted Per. (ft)		17.70
Min Ch El (ft)	2616.87	Shear (lb/sq ft)		1.32
Alpha	1.00	Stream Power (lb/ft s)		8.36
Frctn Loss (ft)	0.87	Cum Volume (acre-ft)	0.00	0.67
C & E Loss (ft)	0.00	Cum SA (acres)	0.00	0.46

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+ RS: 1800

INPUT
Description:
Station Elevation Data num= 29

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
25.98	2616.36	30.42001	2616.52	35.16	2616.68	35.45	2616.68	35.51	2616.85
35.62	2617.18	35.95	2617.19	36.13	2617.19	38.64	2617.23	42.18	2617.29
42.7	2617.3	43.12	2617.29	46.61	2616.2	52.27	2614.36	57.75	2614.51
58.32	2614.52	59.34	2614.87	59.94	2615.07	61.46	2615.58	72.48	2619.3
78.19	2621.22	78.24001	2621.23	78.25	2621.23	78.35001	2621.24	83.04	2621.56
88.29	2621.85	94.78	2622.09	98.32	2622.2	99.94	2622.2		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

```
   25.98    .016   43.12    .035   72.48    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         43.12   72.48               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2617.01    Element                   Left OB    Channel
Right OB
  Vel Head (ft)               0.65    Wt. n-Val.                            0.035

  W.S. Elev (ft)           2616.36    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)           2616.36    Flow Area (sq ft)                     22.78

  E.G. Slope (ft/ft)      0.017255    Area (sq ft)                0.00      22.78

  Q Total (cfs)             147.00    Flow (cfs)                           147.00

  Top Width (ft)             17.71    Top Width (ft)              0.03      17.68

  Vel Total (ft/s)            6.45    Avg. Vel. (ft/s)                       6.45

  Max Chl Dpth (ft)           2.00    Hydr. Depth (ft)                       1.29

  Conv. Total (cfs)         1119.1    Conv. (cfs)                          1119.1

  Length Wtd. (ft)           50.00    Wetted Per. (ft)                      18.30

  Min Ch El (ft)           2614.36    Shear (lb/sq ft)                       1.34

  Alpha                       1.00    Stream Power (lb/ft s)                 8.65

  Frctn Loss (ft)             0.85    Cum Volume (acre-ft)        0.00       0.64

  C & E Loss (ft)             0.01    Cum SA (acres)              0.00       0.44



Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
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```
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1750

INPUT
Description:
Station Elevation Data    num=      34
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   32.87 2614.45   36.29 2614.54   36.59 2614.54   36.63 2614.67   36.76 2615.04
   37.26 2615.04   39.09 2615.05   43.27 2615.08   44.28 2615.08   49.22 2613.42
    53.3 2612.05   56.02  2612.1   59.32 2612.15   63.23 2613.44    63.8 2613.63
   66.58 2614.55   72.98 2616.6674.82001 2617.26   80.91 2619.26   80.94 2619.49
81.06001 2619.52   81.12 2619.5382.07001 2619.6582.49001  2619.7   84.63 2619.93
   86.02 2620.08   87.47 2620.23   87.83 2620.25   88.44 2620.31   89.58  2620.4
   91.63 2620.44   93.61 2620.28  102.14 2619.39   103.8 2619.39

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   32.87    .016   44.28    .035   72.98    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         44.28   72.98               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2615.13    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.76    Wt. n-Val.                             0.035

  W.S. Elev (ft)           2614.37    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)           2614.37    Flow Area (sq ft)                     29.03

  E.G. Slope (ft/ft)      0.016889    Area (sq ft)                          29.03

  Q Total (cfs)             203.00    Flow (cfs)                            203.00
```

Top Width (ft)	19.61	Top Width (ft)	19.61
Vel Total (ft/s)	6.99	Avg. Vel. (ft/s)	6.99
Max Chl Dpth (ft)	2.32	Hydr. Depth (ft)	1.48
Conv. Total (cfs)	1562.1	Conv. (cfs)	1562.1
Length Wtd. (ft)	50.00	Wetted Per. (ft)	20.35
Min Ch El (ft)	2612.05	Shear (lb/sq ft)	1.50
Alpha	1.00	Stream Power (lb/ft s)	10.52
Frctn Loss (ft)	0.85	Cum Volume (acre-ft)	0.61
C & E Loss (ft)	0.01	Cum SA (acres)	0.42

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+ RS: 1700

INPUT
Description:
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
30.04	2612.31	33.51	2612.4	34.46	2612.42	34.76	2612.42	34.77	2612.45
34.93	2612.92	35.43	2612.92	35.84	2612.93	41.44	2612.97	41.57	2612.97
42.44	2612.98	49.41	2610.64	51.46	2609.96	53.06	2609.98	57.47	2610.06
58.93	2610.55	59.95	2610.88	65.18	2612.19	68.17	2613.25	71.74	2614.95
76.04	2616	82.17	2616.98	89.03	2617.01	92.74	2617	93.83	2617.02

```
   94.66 2617.02   98.93 2617.05

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   30.04    .016   42.44    .035   68.17    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         42.44   68.17               30      30      30             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2612.99    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.73    Wt. n-Val.                             0.035

  W.S. Elev (ft)           2612.26    Reach Len. (ft)            30.00      30.00
  30.00
  Crit W.S. (ft)           2612.26    Flow Area (sq ft)                      29.60

  E.G. Slope (ft/ft)      0.016976    Area (sq ft)                           29.60

  Q Total (cfs)             203.00    Flow (cfs)                            203.00

  Top Width (ft)             20.77    Top Width (ft)                         20.77

  Vel Total (ft/s)            6.86    Avg. Vel. (ft/s)                        6.86

  Max Chl Dpth (ft)           2.30    Hydr. Depth (ft)                        1.43

  Conv. Total (cfs)         1558.1    Conv. (cfs)                           1558.1

  Length Wtd. (ft)           30.00    Wetted Per. (ft)                       21.45

  Min Ch El (ft)           2609.96    Shear (lb/sq ft)                        1.46

  Alpha                       1.00    Stream Power (lb/ft s)                 10.03

  Frctn Loss (ft)             0.50    Cum Volume (acre-ft)                    0.58

  C & E Loss (ft)             0.00    Cum SA (acres)                          0.40



Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
```

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+ RS: 1670

INPUT
Description:
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
33.66	2611.26	35.97	2611.33	36.26	2611.33	36.42	2611.81	36.43	2611.82
36.93	2611.82	39.55	2611.85	42.93	2611.88	43.94	2611.88	52.05	2609.17
52.94	2608.87	53.61	2608.89	58.93	2608.98	58.95	2608.98	59.49	2609.17
63.15	2610.2	64.43	2610.43	71.45	2612.73	77.07	2614.29	81.85	2615.42
91.57	2615.86	92.41	2615.93	94.03	2616	98.93	2616.17		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
33.66	.016	43.94	.035	71.45	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
43.94	71.45	12.5	12.5	12.5	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2611.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.74	Wt. n-Val.		0.035	
W.S. Elev (ft)	2611.24	Reach Len. (ft)	12.50	12.50	12.50
Crit W.S. (ft)	2611.24	Flow Area (sq ft)		31.40	
E.G. Slope (ft/ft)	0.016278	Area (sq ft)		31.40	
Q Total (cfs)	217.00	Flow (cfs)		217.00	
Top Width (ft)	21.07	Top Width (ft)		21.07	

Vel Total (ft/s)	6.91	Avg. Vel. (ft/s)	6.91
Max Chl Dpth (ft)	2.37	Hydr. Depth (ft)	1.49
Conv. Total (cfs)	1700.8	Conv. (cfs)	1700.8
Length Wtd. (ft)	12.50	Wetted Per. (ft)	21.78
Min Ch El (ft)	2608.87	Shear (lb/sq ft)	1.46
Alpha	1.00	Stream Power (lb/ft s)	10.13
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	0.56
C & E Loss (ft)	0.14	Cum SA (acres)	0.39

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+ RS: 1657.75

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2610.25	19.38	2611.85	19.39	2612.35	26.792	612.498	32.14	2611.47
32.64	2611.47	32.652	606.423	33.65	2606.09	40	2606.09	46.35	2606.09
47.352	606.423	47.36	2611.47	47.86	2611.47	52.18	2612	55.12	2613

```
   59.51    2614   65.98    2615      80  2615.5

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   32.64    .035   47.36    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         32.64   47.36            207.5   207.5   207.5             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2609.88    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.28    Wt. n-Val.                             0.035

  W.S. Elev (ft)           2609.60    Reach Len. (ft)           207.50     207.50
 207.50
  Crit W.S. (ft)           2608.00    Flow Area (sq ft)                      51.32

  E.G. Slope (ft/ft)      0.003045    Area (sq ft)                           51.32

  Q Total (cfs)             217.00    Flow (cfs)                            217.00

  Top Width (ft)             14.71    Top Width (ft)                         14.71

  Vel Total (ft/s)            4.23    Avg. Vel. (ft/s)                        4.23

  Max Chl Dpth (ft)           3.51    Hydr. Depth (ft)                        3.49

  Conv. Total (cfs)         3932.6    Conv. (cfs)                           3932.6

  Length Wtd. (ft)          207.50    Wetted Per. (ft)                       21.17

  Min Ch El (ft)           2606.09    Shear (lb/sq ft)                        0.46

  Alpha                       1.00    Stream Power (lb/ft s)                  1.95

  Frctn Loss (ft)                     Cum Volume (acre-ft)                    0.55

  C & E Loss (ft)                     Cum SA (acres)                          0.38



CULVERT
```

```
RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1653

INPUT
Description:
Distance from Upstream XS =     3.5
Deck/Roadway Width        =     194
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
   43.94 2611.88    2595      70 2611.88    2595

Upstream Bridge Cross Section Data
Station Elevation Data    num=      27
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2610.37   12.95 2610.71   17.07 2610.82   35.97 2611.33   36.26 2611.33
   36.42 2611.81   36.43 2611.82   36.93 2611.82   39.55 2611.85   42.93 2611.88
   43.94 2611.88   52.05 2609.17   52.94 2608.87   52.95 2606.09   58.93 2606.09
   58.95 2606.09   59.49 2606.09   63.15 2606.09      66 2606.09   66.01 2610.94
   71.45 2612.73   77.07 2614.29   81.85 2615.42   91.57 2615.86   92.41 2615.93
   94.03    2616   98.93 2616.17

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   43.94    .035   71.45    .016

Bank Sta: Left   Right    Coeff Contr.   Expan.
         43.94   71.45             .1       .3

Downstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
      50 2604.58    2595      90 2604.58    2595

Downstream Bridge Cross Section Data
Station Elevation Data    num=      40
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2604.92     9.9 2605.26   11.18  2605.3   11.81 2605.32    19.4 2605.58
    24.1 2605.74   35.09 2606.11   35.41 2606.11   35.58 2606.57    35.6 2606.61
   36.14 2606.61   36.56 2606.62    42.7 2606.73   43.22 2606.74   43.79 2606.75
    49.2 2605.76   51.68 2605.31   52.59 2605.31   53.09 2604.18   54.23 2601.43
   54.26 2602.17   54.28 2602.66   57.71 2602.19    58.2 2602.12    59.6 2601.93
      65 2599.55   65.01 2598.13    70.6 2598.13   71.87 2598.13      78 2598.13
   78.01  2600.2   79.33 2600.42   80.93 2601.39   87.38 2603.85   89.34 2605.04
   95.65 2607.86   99.34 2609.57  105.82  2610.8  109.34 2610.67  111.98 2610.67

Manning's n Values        num=       3
```

```
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   52.59    .035   89.34    .016

Bank Sta: Left   Right    Coeff Contr.   Expan.
         52.59   89.34             .1       .3

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Culverts =  1

Culvert Name     Shape      Rise    Span
Culvert #1           Box       3       6
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                3.5     194     .013     .013        0                   .5
      1
Number of Barrels =  2
Upstream   Elevation =  2606.09
Centerline Stations
    Sta.    Sta.
      56      63
Downstream Elevation =  2598.13
Centerline Stations
    Sta.    Sta.
      68      75

CULVERT OUTPUT  Profile #PF 1  Culv Group:  Culvert #1

  Q Culv Group (cfs)        217.00    Culv Full Len (ft)
  # Barrels                      2    Culv Vel US (ft/s)          8.35
  Q Barrel (cfs)            108.50    Culv Vel DS (ft/s)         18.11
  E.G. US. (ft)            2609.88    Culv Inv El Up (ft)      2606.09
  W.S. US. (ft)            2609.60    Culv Inv El Dn (ft)      2598.13
  E.G. DS (ft)             2600.83    Culv Frctn Ls (ft)          5.11
  W.S. DS (ft)             2600.19    Culv Exit Loss (ft)         3.40
  Delta EG (ft)               9.05    Culv Entr Loss (ft)         0.54
  Delta WS (ft)               9.41    Q Weir (cfs)
  E.G. IC (ft)             2609.55    Weir Sta Lft (ft)
  E.G. OC (ft)             2609.88    Weir Sta Rgt (ft)
```

```
  Culvert Control           Outlet    Weir Submerg
  Culv WS Inlet (ft)       2608.26    Weir Max Depth (ft)
  Culv WS Outlet (ft)      2599.13    Weir Avg Depth (ft)
  Culv Nml Depth (ft)         0.96    Weir Flow Area (sq ft)
  Culv Crt Depth (ft)         2.17    Min El Weir Flow (ft)    2610.38


Note:    The flow in the culvert is entirely supercritical.

CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1450

INPUT
Description:
Station Elevation Data    num=      35
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2604.929.900002 2605.26   11.18  2605.311.81001 2605.32    19.4 2605.58
24.10001 2605.74   35.09 2606.11   35.41 2606.11   35.58 2606.5735.60001 2606.61
36.14001 2606.6136.56001 2606.62    42.7 2606.73   43.22 2606.74   43.79 2606.75
    49.2 2605.76   51.68 2605.31   52.59 2605.31   53.09 2604.18    61.4  2602.9
    61.9  2602.9      62 2598.13   64.12 2598.13   71.97 2598.13   76.36 2598.13
   78.38 2598.13   78.48  2602.9   78.98  2602.9   87.38 2603.85   89.34 2605.04
   95.65 2607.86   99.34 2609.57  105.82  2610.8  109.34 2610.67  111.98 2610.67

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   52.59    .035    61.4    .069   78.48    .035   89.34    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         52.59   89.34               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2600.83    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.64    Wt. n-Val.                            0.069

  W.S. Elev (ft)           2600.19    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)                      Flow Area (sq ft)                     33.90

  E.G. Slope (ft/ft)      0.045221    Area (sq ft)                          33.90

  Q Total (cfs)             217.00    Flow (cfs)                           217.00
```

Top Width (ft)	16.47	Top Width (ft)	16.47
Vel Total (ft/s)	6.40	Avg. Vel. (ft/s)	6.40
Max Chl Dpth (ft)	2.06	Hydr. Depth (ft)	2.06
Conv. Total (cfs)	1020.4	Conv. (cfs)	1020.4
Length Wtd. (ft)	50.00	Wetted Per. (ft)	20.51
Min Ch El (ft)	2598.13	Shear (lb/sq ft)	4.67
Alpha	1.00	Stream Power (lb/ft s)	29.87
Frctn Loss (ft)	2.68	Cum Volume (acre-ft)	0.51
C & E Loss (ft)	0.01	Cum SA (acres)	0.31

```
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Note:    Manning's n values were composited to a single value in the main channel.

CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1400

INPUT
Description:
Station Elevation Data    num=      29
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2604.511.169998 2604.55   11.32 2604.84   18.38 2605.04   34.34  2605.5
   34.63  2605.5   34.66 2605.59    34.8    2606    35.3    2606   40.39 2606.05
    41.3 2606.06   41.45 2606.07    42.3 2606.07   43.52 2605.6752.03001 2602.84
    54.3 2601.73   65.15 2598.36   71.15 2595.3671.49001 2595.3581.21001  2595.3
90.21001  2598.3  100.68 2598.99  105.82 2600.28   108.1 2600.73  113.98 2600.94
  119.03 2601.22  125.41 2601.28  129.97 2601.27  130.05 2601.27

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .01652.03001    .035   65.15    .06990.21001    .035   108.1    .045
```

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
52.03001	108.1	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2598.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.77	Wt. n-Val.		0.069	
W.S. Elev (ft)	2597.36	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2597.36	Flow Area (sq ft)		30.79	
E.G. Slope (ft/ft)	0.064460	Area (sq ft)		30.79	
Q Total (cfs)	217.00	Flow (cfs)		217.00	
Top Width (ft)	20.23	Top Width (ft)		20.23	
Vel Total (ft/s)	7.05	Avg. Vel. (ft/s)		7.05	
Max Chl Dpth (ft)	2.06	Hydr. Depth (ft)		1.52	
Conv. Total (cfs)	854.7	Conv. (cfs)		854.7	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		21.04	
Min Ch El (ft)	2595.30	Shear (lb/sq ft)		5.89	
Alpha	1.00	Stream Power (lb/ft s)		41.51	
Frctn Loss (ft)	1.42	Cum Volume (acre-ft)		0.47	
C & E Loss (ft)	0.11	Cum SA (acres)		0.28	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.

```
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.
Note:    Manning's n values were composited to a single value in the main channel.

CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1350

INPUT
Description:
Station Elevation Data    num=      34
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2603.48   12.27 2603.84   18.81 2604.0335.31999 2604.51   35.62 2604.51
   35.63 2604.5435.78999 2605.0136.28999 2605.0136.56999 2605.0240.02999 2605.06
   42.13 2605.08    43.3 2605.0943.64999 2604.9844.71999 2604.6648.59999  2603.5
55.63999 2601.16   74.37  2594.9  75.379  2594.476.46999 2593.8578.37999  2592.9
   79.59  2592.988.37999 2592.89  91.379 2593.8993.23999  2594.593.64999 2594.64
   94.39 2594.88   99.622596.437  109.62 2597.98  111.94 2598.43  112.83 2598.71
  114.85 2599.59  122.87 2602.05  129.23  2602.1  133.65 2602.19

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .01648.59999    .03576.46999    .06993.23999    .035  122.87    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      48.59999  122.87               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2596.22    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.42    Wt. n-Val.                             0.058

  W.S. Elev (ft)           2595.81    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)                      Flow Area (sq ft)                     50.98

  E.G. Slope (ft/ft)      0.017435    Area (sq ft)                          50.98

  Q Total (cfs)             264.00    Flow (cfs)                           264.00

  Top Width (ft)             25.85    Top Width (ft)                        25.85
```

Vel Total (ft/s)	5.18	Avg. Vel. (ft/s)	5.18
Max Chl Dpth (ft)	2.92	Hydr. Depth (ft)	1.97
Conv. Total (cfs)	1999.3	Conv. (cfs)	1999.3
Length Wtd. (ft)	50.00	Wetted Per. (ft)	26.93
Min Ch El (ft)	2592.89	Shear (lb/sq ft)	2.06
Alpha	1.00	Stream Power (lb/ft s)	10.67
Frctn Loss (ft)	0.93	Cum Volume (acre-ft)	0.43
C & E Loss (ft)	0.00	Cum SA (acres)	0.26

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+ RS: 1300

INPUT
Description:
Station Elevation Data num= 34

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2602.59	10.04001	2602.89	11.38	2602.92	11.85001	2602.94	12.76001	2602.96
34.91	2603.61	35.2	2603.61	35.26001	2603.79	35.37	2604.11	35.87	2604.11
38.35001	2604.14	41.89001	2604.18	42.36001	2604.18	42.89001	2604.19	48.95	2602.18
53.89001	2600.54	53.94	2600.56	56.89001	2600.05	59.91	2599.66	64.41	2598.16
70.22001	2596.23	75.79001	2594.71	77.79001	2593.71	79.66	2592.77	81.79001	2591.71
91.79001	2591.71	93.79	2593.71	100.79	2594.71	106.33	2596.15	116.05	2600.19
126.92	2602.43	127.11	2602.48	127.33	2602.49	136.85	2602.76		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.016	56.89001	.035	75.79001	.069	93.79	.035	116.05	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
56.89001	116.05	50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

```
  E.G. Elev (ft)           2595.30    Element                   Left OB    Channel
Right OB
  Vel Head (ft)               0.42    Wt. n-Val.                           0.060

  W.S. Elev (ft)           2594.87    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)                      Flow Area (sq ft)                    50.71

  E.G. Slope (ft/ft)      0.019835    Area (sq ft)                         50.71

  Q Total (cfs)             264.00    Flow (cfs)                          264.00

  Top Width (ft)             26.23    Top Width (ft)                       26.23

  Vel Total (ft/s)            5.21    Avg. Vel. (ft/s)                      5.21

  Max Chl Dpth (ft)           3.16    Hydr. Depth (ft)                      1.93

  Conv. Total (cfs)         1874.5    Conv. (cfs)                         1874.5

  Length Wtd. (ft)           50.00    Wetted Per. (ft)                     27.88

  Min Ch El (ft)           2591.71    Shear (lb/sq ft)                      2.25

  Alpha                       1.00    Stream Power (lb/ft s)               11.72

  Frctn Loss (ft)             0.24    Cum Volume (acre-ft)                  0.37

  C & E Loss (ft)             0.11    Cum SA (acres)                        0.23



Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Manning's n values were composited to a single value in the main channel.

CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1250

INPUT
Description:
```

```
Station Elevation Data    num=      34
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2601.9310.43001 2602.23   10.66 2602.2411.12001 2602.2533.56001 2602.91
33.85001 2602.9133.94001 2603.17   34.02 2603.4134.53001 2603.4137.89001 2603.45
40.56001 2603.4841.19001 2603.4841.56001 2603.4945.47001 2602.1464.46001 2596.58
65.04001  2596.5   66.59 2596.28   70.41 2595.0275.58001 2593.32   78.08  2592.5
78.99001 2592.0482.09001 2590.51   84.58 2590.5192.14001 2590.53   95.72 2591.72
98.17001 2592.54  118.82    2593   121.1    2594  122.84 2595.03  131.76 2600.67
  134.95  2601.3  138.13 2601.53  139.72 2601.49  139.96 2601.54

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .01645.47001    .03575.58001    .069  118.82    .035  131.76    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      45.47001  131.76           121.22  121.22  121.22             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2594.95    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.06    Wt. n-Val.                            0.064

  W.S. Elev (ft)           2594.89    Reach Len. (ft)           121.22     121.22
 121.22
  Crit W.S. (ft)           2592.99    Flow Area (sq ft)                    133.87

  E.G. Slope (ft/ft)      0.002107    Area (sq ft)                         133.87

  Q Total (cfs)             264.00    Flow (cfs)                           264.00

  Top Width (ft)             51.78    Top Width (ft)                        51.78

  Vel Total (ft/s)            1.97    Avg. Vel. (ft/s)                       1.97

  Max Chl Dpth (ft)           4.38    Hydr. Depth (ft)                       2.59

  Conv. Total (cfs)         5751.3    Conv. (cfs)                          5751.3

  Length Wtd. (ft)          121.22    Wetted Per. (ft)                      53.41

  Min Ch El (ft)           2590.51    Shear (lb/sq ft)                       0.33

  Alpha                       1.00    Stream Power (lb/ft s)                 0.65

  Frctn Loss (ft)                     Cum Volume (acre-ft)                   0.26
```

```
  C & E Loss (ft)                     Cum SA (acres)                        0.18



CULVERT


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1240

INPUT
Description:
Distance from Upstream XS =      32
Deck/Roadway Width        =      75
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    -.04  2599.5    2585   29.96  2599.5    2585   59.96  2599.5    2585
   79.96  2599.5    2585  117.96  2599.5    2585  139.96  2599.5    2585

Upstream Bridge Cross Section Data
Station Elevation Data    num=      27
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2601.93   10.43 2602.23   10.66 2602.24   11.12 2602.25   33.56 2602.91
   33.85 2602.91   33.94 2603.17   34.02 2603.41   34.53 2603.41   37.89 2603.45
   40.56 2603.48   41.19 2603.48   41.56 2603.49   59.91 2597.48   62.26 2596.65
   62.32 2596.65      80 2589.79    90.4 2589.79   99.96 2592.13  118.94 2593.02
  120.69 2593.75  122.84 2595.03  131.76 2600.67  134.95  2601.3  138.13 2601.53
  139.72 2601.49  139.96 2601.54

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   59.91    .035  131.76    .016

Bank Sta: Left   Right    Coeff Contr.   Expan.
         41.56  131.76             .1       .3

Downstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
      30    2600    2585  129.64    2600    2585

Downstream Bridge Cross Section Data
Station Elevation Data    num=      27
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2601.41   10.15 2601.53   15.69  2601.6   27.31  2601.7   31.35 2601.74
```

```
   33.28 2601.76   33.32  2599.5   33.34 2599.51   33.37 2599.51   35.82 2599.41
   41.12 2599.21   44.48  2599.2   54.24 2598.57   59.94  2597.4   67.36 2595.79
   71.39 2594.68   77.63  2590.6   79.22 2589.39   80.12 2589.18      82 2587.15
      92 2587.15   93.62 2587.15  106.35 2590.16  109.08 2590.34  119.47 2591.08
  124.54 2591.37  129.64 2592.29

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   54.24    .035  119.47    .016

Bank Sta: Left   Right    Coeff Contr.   Expan.
         71.39  119.47             .1       .3

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Culverts =  1

Culvert Name     Shape      Rise    Span
Culvert #1           Box       4      10
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 32      75     .013     .013        0                   .7
      1
Upstream   Elevation =  2589.79
           Centerline Station =  85
Downstream Elevation =  2587.15
           Centerline Station =  87

CULVERT OUTPUT  Profile #PF 1  Culv Group:  Culvert #1

  Q Culv Group (cfs)        264.00    Culv Full Len (ft)
  # Barrels                      1    Culv Vel US (ft/s)          9.47
  Q Barrel (cfs)            264.00    Culv Vel DS (ft/s)         16.83
  E.G. US. (ft)            2594.95    Culv Inv El Up (ft)      2589.79
  W.S. US. (ft)            2594.89    Culv Inv El Dn (ft)      2587.15
  E.G. DS (ft)             2589.31    Culv Frctn Ls (ft)          0.85
  W.S. DS (ft)             2588.52    Culv Exit Loss (ft)         3.81
  Delta EG (ft)               5.64    Culv Entr Loss (ft)         0.98
  Delta WS (ft)               6.37    Q Weir (cfs)
```

```
  E.G. IC (ft)             2594.24    Weir Sta Lft (ft)
  E.G. OC (ft)             2594.95    Weir Sta Rgt (ft)
  Culvert Control           Outlet    Weir Submerg
  Culv WS Inlet (ft)       2592.58    Weir Max Depth (ft)
  Culv WS Outlet (ft)      2588.72    Weir Avg Depth (ft)
  Culv Nml Depth (ft)         1.24    Weir Flow Area (sq ft)
  Culv Crt Depth (ft)         2.79    Min El Weir Flow (ft)    2600.01


Warning: Since the culvert has supercritical flow, the program should be run in
mixed flow in order to check if the cross section
         downstream of the culvert has supercritical flow.
Note:    The flow in the culvert is entirely supercritical.

CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1128.78

INPUT
Description:
Station Elevation Data    num=      26
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2601.41   10.15 2601.53   15.69  2601.6   27.31  2601.7   31.35 2601.74
   33.28 2601.76   33.32  2599.5   33.34 2599.51   33.37 2599.51   35.82 2599.41
   41.12 2599.21   44.48  2599.2   54.24 2598.57   59.94  2597.4   67.36 2595.79
   71.39 2594.68    73.4 2590.79    73.9 2590.79   76.46 2586.82   92.98 2586.52
   98.46  2587.9  106.35 2590.16  109.08 2590.34  119.47 2591.08  124.54 2591.37
  129.64 2592.29

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   71.39    .035  119.47    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         71.39  119.47            28.78   28.78   28.78             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2589.31    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.79    Wt. n-Val.                             0.035

  W.S. Elev (ft)           2588.52    Reach Len. (ft)            28.78      28.78
  28.78
  Crit W.S. (ft)           2588.52    Flow Area (sq ft)                     39.31
```

E.G. Slope (ft/ft)	0.016586	Area (sq ft)	39.31
Q Total (cfs)	280.00	Flow (cfs)	280.00
Top Width (ft)	25.26	Top Width (ft)	25.26
Vel Total (ft/s)	7.12	Avg. Vel. (ft/s)	7.12
Max Chl Dpth (ft)	2.00	Hydr. Depth (ft)	1.56
Conv. Total (cfs)	2174.1	Conv. (cfs)	2174.1
Length Wtd. (ft)	28.78	Wetted Per. (ft)	26.44
Min Ch El (ft)	2586.52	Shear (lb/sq ft)	1.54
Alpha	1.00	Stream Power (lb/ft s)	10.96
Frctn Loss (ft)	0.47	Cum Volume (acre-ft)	0.11
C & E Loss (ft)	0.01	Cum SA (acres)	0.08

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+ RS: 1100

INPUT
Description:
Station Elevation Data num= 32

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2601.38	8.839996	2601.39	17.72	2601.4	31.97	2601.38	32.26	2601.38
32.42	2601.84	32.43	2601.88	33.31	2601.88	36.35	2601.91	38.68	2601.93
39.02	2601.93	39.97	2601.94	46.55	2599.96	48.31	2599.43	49.14	2599.43

```
   50.22 2594.83    50.7 2594.13   52.65 2593.89    53.3 2593.82   54.02 2593.68
   61.25 2592.9664.39999 2593.0570.00999 2589.44   72.57 2587.94   77.01    2585
   85.32    2585    91.6 2586.86  100.25 2589.26  101.79  2589.5  113.36 2592.07
  117.25 2593.01  125.35 2594.18

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .01664.39999    .035  117.25    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      64.39999  117.25               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2588.43    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.89    Wt. n-Val.                            0.035

  W.S. Elev (ft)           2587.54    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)           2587.54    Flow Area (sq ft)                     36.95

  E.G. Slope (ft/ft)      0.015970    Area (sq ft)                          36.95

  Q Total (cfs)             280.00    Flow (cfs)                           280.00

  Top Width (ft)             20.88    Top Width (ft)                        20.88

  Vel Total (ft/s)            7.58    Avg. Vel. (ft/s)                       7.58

  Max Chl Dpth (ft)           2.54    Hydr. Depth (ft)                       1.77

  Conv. Total (cfs)         2215.7    Conv. (cfs)                          2215.7

  Length Wtd. (ft)           50.00    Wetted Per. (ft)                      22.01

  Min Ch El (ft)           2585.00    Shear (lb/sq ft)                       1.67

  Alpha                       1.00    Stream Power (lb/ft s)                12.68

  Frctn Loss (ft)             0.84    Cum Volume (acre-ft)                   0.09

  C & E Loss (ft)             0.07    Cum SA (acres)                         0.06
```

```
Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+   RS: 1050

INPUT
Description:
Station Elevation Data    num=      46
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2601.253.259995 2601.169.639992 2601.0125.30999 2600.6533.24999 2600.48
33.35999 2600.48   33.55 2600.49   33.66 2600.79   33.73 2600.9934.23999 2600.99
37.05999 2601.0240.39999 2601.07   41.16 2601.0841.42999 2601.08   42.98 2600.63
46.82999 2599.5149.05999 2598.8649.93999 2598.61    50.8 2598.6151.96999 2593.89
   52.34 2592.3452.35999 2592.7752.39999 2593.4753.05999 2593.31   53.98  2593.1
   55.48 2592.76   56.91 2592.4466.14999 2590.1870.90999 2588.1176.53999 2585.42
86.77999 2584.9187.09999  2584.987.18999 2584.8988.49999 2583.4588.93999 2584.37
89.67999 2584.54   94.87 2585.7597.88999 2585.77   104.5 2586.63  108.56 2587.02
  110.42 2587.19  115.38 2587.66  118.19 2587.89  119.24    2588  121.54 2588.62
  129.68 2590.92

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .01666.14999    .035  129.68    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      66.14999  129.68               40      40      40             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2587.51    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.66    Wt. n-Val.                            0.035

  W.S. Elev (ft)           2586.85    Reach Len. (ft)            40.00      40.00
  40.00
  Crit W.S. (ft)           2586.85    Flow Area (sq ft)                     43.55
```

E.G. Slope (ft/ft)	0.017541	Area (sq ft)	43.55
Q Total (cfs)	283.00	Flow (cfs)	283.00
Top Width (ft)	33.28	Top Width (ft)	33.28
Vel Total (ft/s)	6.50	Avg. Vel. (ft/s)	6.50
Max Chl Dpth (ft)	3.40	Hydr. Depth (ft)	1.31
Conv. Total (cfs)	2136.8	Conv. (cfs)	2136.8
Length Wtd. (ft)	40.00	Wetted Per. (ft)	35.06
Min Ch El (ft)	2583.45	Shear (lb/sq ft)	1.36
Alpha	1.00	Stream Power (lb/ft s)	8.84
Frctn Loss (ft)	0.70	Cum Volume (acre-ft)	0.04
C & E Loss (ft)	0.00	Cum SA (acres)	0.03

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Sta 70+00 to 78+
REACH: Sta 70+00 to 78+ RS: 1010

INPUT
Description:
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2591.2	4.25	2590.61	8.639999	2589.75	12.93	2588.32	18.78	2586.06

```
   21.61  2585.2   28.92 2584.11   30.29 2584.01   38.38 2582.77   38.96 2582.68
   39.06 2582.68   40.18 2582.78   41.89 2582.95   42.75 2582.35   43.24 2582.74
    43.9  2583.2   45.43 2583.48   48.36 2584.53   49.21 2584.58   56.32 2585.64
   59.35 2586.22    63.6 2586.66   69.49 2587.47    75.8 2588.89   77.89 2589.34
      80  2590.5

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .016   12.93    .035    75.8    .045

Bank Sta: Left   Right    Coeff Contr.   Expan.
         12.93    75.8             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2585.91    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.68    Wt. n-Val.                            0.035

  W.S. Elev (ft)           2585.23    Reach Len. (ft)

  Crit W.S. (ft)           2585.23    Flow Area (sq ft)                     42.68

  E.G. Slope (ft/ft)      0.017290    Area (sq ft)                          42.68

  Q Total (cfs)             283.00    Flow (cfs)                           283.00

  Top Width (ft)             32.04    Top Width (ft)                        32.04

  Vel Total (ft/s)            6.63    Avg. Vel. (ft/s)                       6.63

  Max Chl Dpth (ft)           2.88    Hydr. Depth (ft)                       1.33

  Conv. Total (cfs)         2152.2    Conv. (cfs)                          2152.2

  Length Wtd. (ft)                    Wetted Per. (ft)                      32.97

  Min Ch El (ft)           2582.35    Shear (lb/sq ft)                       1.40

  Alpha                       1.00    Stream Power (lb/ft s)                 9.27

  Frctn Loss (ft)                     Cum Volume (acre-ft)

  C & E Loss (ft)                     Cum SA (acres)
```

CROSS SECTION

RIVER: Sta 80+00 to 83+
REACH: Sta 80+00 to 83+ RS: 3530

INPUT
Description:
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2656.48	2.389999	2656.18	6.68	2655.53	11.79	2655.05	17.67	2654.43
22.62	2653.41	28.78	2652.15	35.87	2650.54	39.66	2649.8	40	2649.75
40.42	2649.68	43.6	2649.24	45.86	2649.69	50.65	2650.15	59.95	2651.47
61.65	2651.77	63.07	2651.81	72.64	2652.22	80	2652.71		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	28.78	.035	72.64	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
28.78	72.64	30	30	30	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2652.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.66	Wt. n-Val.		0.035	
W.S. Elev (ft)	2651.92	Reach Len. (ft)	30.00	30.00	30.00
Crit W.S. (ft)	2651.92	Flow Area (sq ft)		46.69	
E.G. Slope (ft/ft)	0.016864	Area (sq ft)		46.69	
Q Total (cfs)	304.00	Flow (cfs)		304.00	
Top Width (ft)	35.92	Top Width (ft)		35.92	
Vel Total (ft/s)	6.51	Avg. Vel. (ft/s)		6.51	
Max Chl Dpth (ft)	2.68	Hydr. Depth (ft)		1.30	
Conv. Total (cfs)	2340.9	Conv. (cfs)		2340.9	
Length Wtd. (ft)	30.00	Wetted Per. (ft)		36.37	

```
  Min Ch El (ft)           2649.24    Shear (lb/sq ft)                      1.35

  Alpha                       1.00    Stream Power (lb/ft s)                8.80

  Frctn Loss (ft)             0.51    Cum Volume (acre-ft)                  0.48
   0.00
  C & E Loss (ft)             0.01    Cum SA (acres)                        0.35
   0.01



Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Sta 80+00 to 83+
REACH: Sta 80+00 to 83+   RS: 3500

INPUT
Description:
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2655.767.910004 2654.91   14.43 2653.66   18.36 2653.12    27.4 2650.43
   28.81 2650.07   29.79  2649.9   31.54 2649.62   39.96 2648.29      40 2648.28
   40.56 2648.16   41.82  2648.4   49.71 2649.48    59.4 2650.56   60.16  2650.6
    61.9 2650.68   70.61 2651.09    74.4 2650.98      80 2650.89

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   18.36    .035   70.61    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         18.36   70.61               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1
```

```
  E.G. Elev (ft)           2651.46    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.63    Wt. n-Val.                            0.035

  W.S. Elev (ft)           2650.83    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)           2650.83    Flow Area (sq ft)                     47.77

  E.G. Slope (ft/ft)      0.017373    Area (sq ft)                          47.77

  Q Total (cfs)             304.00    Flow (cfs)                           304.00

  Top Width (ft)             38.97    Top Width (ft)                        38.97

  Vel Total (ft/s)            6.36    Avg. Vel. (ft/s)                       6.36

  Max Chl Dpth (ft)           2.67    Hydr. Depth (ft)                       1.23

  Conv. Total (cfs)         2306.4    Conv. (cfs)                          2306.4

  Length Wtd. (ft)           50.00    Wetted Per. (ft)                      39.39

  Min Ch El (ft)           2648.16    Shear (lb/sq ft)                       1.32

  Alpha                       1.00    Stream Power (lb/ft s)                 8.37

  Frctn Loss (ft)             0.84    Cum Volume (acre-ft)                   0.45
   0.00
  C & E Loss (ft)             0.02    Cum SA (acres)                         0.33
   0.01


Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION
```

```
RIVER: Sta 80+00 to 83+
REACH: Sta 80+00 to 83+   RS: 3450

INPUT
Description:
Station Elevation Data    num=      35
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2650.891.730003 2650.841.900002 2650.842.839996 2650.813.139999 2650.81
3.160004 2650.84    3.32 2651.313.360001 2651.313.839996  2651.37.980003 2651.31
   10.09 2651.31   10.59 2651.32   11.13 2651.32    12.2 2651.57   13.35 2651.83
    13.4 2651.77   13.41 2651.77   14.15 2651.73   16.32 2651.59   20.28 2651.09
   26.22 2650.01   26.81 2649.88   29.51 2648.59   36.86 2645.32      40 2645.44
   50.46 2645.87   51.86 2645.93   52.81 2645.85   53.24 2645.25   57.88 2648.11
   62.35 2649.48   70.26 2649.23   72.84 2649.28   78.42 2649.58      80 2649.69

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   26.81    .035   62.35    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         26.81   62.35               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2648.51    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.87    Wt. n-Val.                             0.035

  W.S. Elev (ft)           2647.64    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)           2647.64    Flow Area (sq ft)                     43.62

  E.G. Slope (ft/ft)      0.016348    Area (sq ft)                          43.62

  Q Total (cfs)             326.20    Flow (cfs)                            326.20

  Top Width (ft)             25.48    Top Width (ft)                         25.48

  Vel Total (ft/s)            7.48    Avg. Vel. (ft/s)                        7.48

  Max Chl Dpth (ft)           2.39    Hydr. Depth (ft)                        1.71

  Conv. Total (cfs)         2551.2    Conv. (cfs)                           2551.2

  Length Wtd. (ft)           50.00    Wetted Per. (ft)                       26.98

  Min Ch El (ft)           2645.25    Shear (lb/sq ft)                        1.65
```

```
  Alpha                        1.00    Stream Power (lb/ft s)                12.34

  Frctn Loss (ft)              0.83    Cum Volume (acre-ft)                   0.40
   0.00
  C & E Loss (ft)              0.01    Cum SA (acres)                         0.29
   0.01



Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Sta 80+00 to 83+
REACH: Sta 80+00 to 83+   RS: 3400

INPUT
Description:
Station Elevation Data    num=      33
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2649.151.300003 2649.171.720001 2649.182.330002 2649.192.419998 2649.17
3.370003 2648.953.400002 2648.943.419998 2648.946.040001 2648.866.120003 2648.86
9.139999 2648.77   14.15 2647.74   19.36 2647.32    22.6 2647.09   29.57 2646.48
   38.65 2642.78   39.47 2642.47      40 2642.61   40.13 2642.65   43.75 2643.61
   44.44 2643.53   44.73 2642.84   45.76 2643.72   48.72 2644.91   51.49 2645.42
   53.97 2645.61   57.64 2646.07   64.19 2647.33   66.09 2647.58    74.4 2648.02
   74.54 2648.03   75.22 2648.05      80 2648.23

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   14.15    .035   66.09    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         14.15   66.09               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1
```

```
  E.G. Elev (ft)           2646.91    Element                   Left OB    Channel
Right OB
  Vel Head (ft)               0.83    Wt. n-Val.                           0.035

  W.S. Elev (ft)           2646.08    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)           2646.08    Flow Area (sq ft)                    44.70

  E.G. Slope (ft/ft)      0.016662    Area (sq ft)                         44.70

  Q Total (cfs)             326.20    Flow (cfs)                          326.20

  Top Width (ft)             27.14    Top Width (ft)                       27.14

  Vel Total (ft/s)            7.30    Avg. Vel. (ft/s)                      7.30

  Max Chl Dpth (ft)           3.61    Hydr. Depth (ft)                      1.65

  Conv. Total (cfs)         2527.1    Conv. (cfs)                         2527.1

  Length Wtd. (ft)           50.00    Wetted Per. (ft)                     29.10

  Min Ch El (ft)           2642.47    Shear (lb/sq ft)                      1.60

  Alpha                       1.00    Stream Power (lb/ft s)               11.66

  Frctn Loss (ft)             0.84    Cum Volume (acre-ft)                  0.35
   0.00
  C & E Loss (ft)             0.01    Cum SA (acres)                        0.26
   0.01


Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION
```

```
RIVER: Sta 80+00 to 83+
REACH: Sta 80+00 to 83+   RS: 3350

INPUT
Description:
Station Elevation Data    num=      26
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2647.894.669998 2647.895.019997  2647.95.720001  2647.95.940002 2647.96
5.980003 2647.985.989998 2647.98    9.68  2647.8   13.46 2647.58   17.52 2647.52
   23.72 2646.89   30.86 2646.18   33.99 2645.61    34.9 2645.53   38.47 2640.65
      40 2641.14   40.14 2641.19   44.35  2642.6   48.23 2643.26   55.18 2643.96
    58.5 2644.39   59.49 2644.66   68.76 2647.15   72.83 2648.64   79.02 2650.96
      80 2651.02

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   23.72    .035   68.76    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         23.72   68.76               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2645.70    Element                   Left OB    Channel
Right OB
  Vel Head (ft)               0.89    Wt. n-Val.                            0.035

  W.S. Elev (ft)           2644.81    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)           2644.81    Flow Area (sq ft)                     43.18

  E.G. Slope (ft/ft)      0.017115    Area (sq ft)                          43.18

  Q Total (cfs)             326.20    Flow (cfs)                           326.20

  Top Width (ft)             24.62    Top Width (ft)                        24.62

  Vel Total (ft/s)            7.55    Avg. Vel. (ft/s)                       7.55

  Max Chl Dpth (ft)           4.16    Hydr. Depth (ft)                       1.75

  Conv. Total (cfs)         2493.4    Conv. (cfs)                          2493.4

  Length Wtd. (ft)           50.00    Wetted Per. (ft)                      27.23
```

```
  Min Ch El (ft)           2640.65    Shear (lb/sq ft)                      1.69

  Alpha                       1.00    Stream Power (lb/ft s)               12.80

  Frctn Loss (ft)             0.36    Cum Volume (acre-ft)                  0.30
   0.00
  C & E Loss (ft)             0.16    Cum SA (acres)                        0.23
   0.01



Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Sta 80+00 to 83+
REACH: Sta 80+00 to 83+   RS: 3300

INPUT
Description:
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2645.431.599998 2645.394.769997 2645.297.720001 2645.218.019997 2645.21
8.059998 2645.348.190002 2645.718.559998  2645.7   10.99  2645.7   14.82 2645.71
   15.84 2645.75      33 2637.91   44.78 2637.96   56.92  2643.9   59.77  2644.5
   60.89 2644.76   70.03 2646.87   72.77 2647.56      80 2650.27

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   15.84    .035   56.92    .045
```

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
15.84	56.92	30.85	30.85	30.85	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2641.83	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.36	Wt. n-Val.		0.035	
W.S. Elev (ft)	2641.47	Reach Len. (ft)	30.85	30.85	30.85
Crit W.S. (ft)		Flow Area (sq ft)		68.17	
E.G. Slope (ft/ft)	0.003942	Area (sq ft)		68.17	
Q Total (cfs)	326.20	Flow (cfs)		326.20	
Top Width (ft)	26.76	Top Width (ft)		26.76	
Vel Total (ft/s)	4.78	Avg. Vel. (ft/s)		4.78	
Max Chl Dpth (ft)	3.56	Hydr. Depth (ft)		2.55	
Conv. Total (cfs)	5195.6	Conv. (cfs)		5195.6	
Length Wtd. (ft)	30.85	Wetted Per. (ft)		28.35	
Min Ch El (ft)	2637.91	Shear (lb/sq ft)		0.59	
Alpha	1.00	Stream Power (lb/ft s)		2.83	
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)		0.23	0.00
C & E Loss (ft)	0.09	Cum SA (acres)		0.20	0.01

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Sta 80+00 to 83+
REACH: Sta 80+00 to 83+ RS: 3269.15

```
INPUT
Description:
Station Elevation Data    num=      25
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2645.333.959999 2645.14   10.15 2644.84   10.49 2644.82   12.02 2644.75
   12.14 2644.75   12.48 2644.73   12.56 2644.89   12.74 2645.2213.18999 2645.21
   13.52  2645.2   17.03 2645.09   19.42 2645.02   22.83 2644.92   22.97 2644.92
   23.57  2644.9   24.38 2644.87   31.21  2642.5   32.76  2642.5   42.23  2636.3
   65.53  2636.3   69.49 2637.27   78.23  2642.5   78.98  2642.5    88.6 2641.01

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   32.76    .035   78.23    .016

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         32.76   78.23           169.15  169.15  169.15             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)           2641.71    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.05    Wt. n-Val.                            0.035
  0.016
  W.S. Elev (ft)           2641.67    Reach Len. (ft)           169.15     169.15
 169.15
  Crit W.S. (ft)           2637.99    Flow Area (sq ft)                    182.44
   1.38
  E.G. Slope (ft/ft)      0.000279    Area (sq ft)                         182.44
   1.38
  Q Total (cfs)             326.20    Flow (cfs)                           325.28
   0.92
  Top Width (ft)             47.03    Top Width (ft)                        42.80
   4.23
  Vel Total (ft/s)            1.77    Avg. Vel. (ft/s)                       1.78
   0.66
  Max Chl Dpth (ft)           5.36    Hydr. Depth (ft)                       4.26
   0.33
  Conv. Total (cfs)        19538.4    Conv. (cfs)                         19483.3
   55.1
  Length Wtd. (ft)          169.15    Wetted Per. (ft)                      45.73
   4.93
  Min Ch El (ft)           2636.30    Shear (lb/sq ft)                       0.07
   0.00
  Alpha                       1.01    Stream Power (lb/ft s)                 0.12
   0.00
  Frctn Loss (ft)                     Cum Volume (acre-ft)                   0.15
```

```
  C & E Loss (ft)                     Cum SA (acres)                        0.17
   0.01



CULVERT


RIVER: Sta 80+00 to 83+
REACH: Sta 80+00 to 83+   RS: 3250

INPUT
Description:
Distance from Upstream XS =      14
Deck/Roadway Width        =     120
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       3
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0 2644.44    2632      40 2642.44    2632      90 2642.44    2632

Upstream Bridge Cross Section Data
Station Elevation Data    num=      25
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2645.333.959999 2645.14   10.15 2644.84   10.49 2644.82   12.02 2644.75
   12.14 2644.75   12.48 2644.73   12.56 2644.89   12.74 2645.2213.18999 2645.21
   13.52  2645.2   17.03 2645.09   19.42 2645.02   22.83 2644.92   22.97 2644.92
   23.57  2644.9   24.38 2644.87   31.21  2642.5   32.76  2642.5   42.23  2636.3
   65.53  2636.3   69.49 2637.27   78.23  2642.5   78.98  2642.5    88.6 2641.01

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   32.76    .035   78.23    .016

Bank Sta: Left   Right    Coeff Contr.   Expan.
         32.76   78.23             .1       .3

Downstream  Deck/Roadway Coordinates
    num=       3
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0 2644.44    2632      40 2642.44    2632      90 2642.44    2632

Downstream Bridge Cross Section Data
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2638.09      .2 2638.07    1.47 2637.93   10.75 2636.42   17.35 2635.68
    21.3  2635.2   29.09  2634.5   31.85 2631.83   33.24 2631.83      40 2631.83
```

```
   42.39 2631.83   49.12 2631.83   52.94 2635.79   60.51 2637.09   63.09 2637.48
   63.49 2637.48      65 2637.59   74.04 2637.74      80 2637.66

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   10.75    .035   60.51    .045

Bank Sta: Left   Right    Coeff Contr.   Expan.
         10.75   60.51             .1       .3

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Culverts =  1

Culvert Name     Shape      Rise    Span
Culvert #1       Ellipse    3.16       5
FHWA Chart # 29- Horizontal Ellipse; Concrete
FHWA Scale # 2 - Grooved end with headwall
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 14     120     .013     .013        0                   .4
      1
Number of Barrels =  3
Upstream   Elevation =  2636.98
Centerline Stations
    Sta.    Sta.    Sta.
      46      52      58
Downstream Elevation =  2632.5
Centerline Stations
    Sta.    Sta.    Sta.
      34      40      46

CULVERT OUTPUT  Profile #PF 1  Culv Group:  Culvert #1

  Q Culv Group (cfs)        326.20    Culv Full Len (ft)
  # Barrels                      3    Culv Vel US (ft/s)          9.79
  Q Barrel (cfs)            108.73    Culv Vel DS (ft/s)         17.78
  E.G. US. (ft)            2641.71    Culv Inv El Up (ft)      2636.98
  W.S. US. (ft)            2641.67    Culv Inv El Dn (ft)      2632.50
  E.G. DS (ft)             2635.19    Culv Frctn Ls (ft)          2.15
  W.S. DS (ft)             2634.76    Culv Exit Loss (ft)         3.79
```

```
  Delta EG (ft)              6.53    Culv Entr Loss (ft)         0.60
  Delta WS (ft)              6.91    Q Weir (cfs)
  E.G. IC (ft)            2641.50    Weir Sta Lft (ft)
  E.G. OC (ft)            2641.71    Weir Sta Rgt (ft)
  Culvert Control          Outlet    Weir Submerg
  Culv WS Inlet (ft)      2639.63    Weir Max Depth (ft)
  Culv WS Outlet (ft)     2634.06    Weir Avg Depth (ft)
  Culv Nml Depth (ft)        1.41    Weir Flow Area (sq ft)
  Culv Crt Depth (ft)        2.65    Min El Weir Flow (ft)    2642.45


Note:    The flow in the culvert is entirely supercritical.

CROSS SECTION


RIVER: Sta 80+00 to 83+
REACH: Sta 80+00 to 83+   RS: 3100

INPUT
Description:
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2638.09.1999969 2638.071.470001 2637.93   10.75 2636.42   17.35 2635.68
   28.07 2631.75   40.48 2631.75   49.12 2634.89   52.94 2635.79   60.51 2637.09
   63.09 2637.48   63.49 2637.48      65 2637.59   74.04 2637.74      80 2637.66

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   10.75    .035   60.51    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         10.75   60.51               50      50      50             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1


  E.G. Elev (ft)          2635.19    Element                   Left OB    Channel
Right OB
  Vel Head (ft)              0.43    Wt. n-Val.                            0.035

  W.S. Elev (ft)          2634.76    Reach Len. (ft)            50.00      50.00
  50.00
  Crit W.S. (ft)                     Flow Area (sq ft)                     62.13

  E.G. Slope (ft/ft)     0.005782    Area (sq ft)                          62.13

  Q Total (cfs)            326.20    Flow (cfs)                           326.20
```

Top Width (ft)	28.90	Top Width (ft)	28.90
Vel Total (ft/s)	5.25	Avg. Vel. (ft/s)	5.25
Max Chl Dpth (ft)	3.01	Hydr. Depth (ft)	2.15
Conv. Total (cfs)	4290.0	Conv. (cfs)	4290.0
Length Wtd. (ft)	50.00	Wetted Per. (ft)	29.96
Min Ch El (ft)	2631.75	Shear (lb/sq ft)	0.75
Alpha	1.00	Stream Power (lb/ft s)	3.93
Frctn Loss (ft)	0.46	Cum Volume (acre-ft)	0.06
C & E Loss (ft)	0.03	Cum SA (acres)	0.04

```
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: Sta 80+00 to 83+
REACH: Sta 80+00 to 83+   RS: 3050

INPUT
Description:
Station Elevation Data    num=      21
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 2636.41    1.68 2636.317.059998 2636.019.779999 2635.45   17.61 2634.37
   25.66 2633.21   28.16 2632.75   33.09 2632.04    37.3 2631.37   38.71 2631.32
      40 2631.48   45.19  2632.1   49.26 2633.01   53.09 2634.03   59.81 2634.89
   60.99 2634.89   64.51 2634.86   69.67 2634.73   74.52 2634.66   78.99 2634.59
      80 2634.57

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .0459.779999    .035   59.81    .045

Bank Sta: Left   Right    Coeff Contr.   Expan.
      9.779999   59.81             .1       .3
```

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	2634.70	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.74	Wt. n-Val.		0.035	
W.S. Elev (ft)	2633.96	Reach Len. (ft)			
Crit W.S. (ft)	2633.96	Flow Area (sq ft)		47.12	
E.G. Slope (ft/ft)	0.016402	Area (sq ft)		47.12	
Q Total (cfs)	326.20	Flow (cfs)		326.20	
Top Width (ft)	32.32	Top Width (ft)		32.32	
Vel Total (ft/s)	6.92	Avg. Vel. (ft/s)		6.92	
Max Chl Dpth (ft)	2.64	Hydr. Depth (ft)		1.46	
Conv. Total (cfs)	2547.0	Conv. (cfs)		2547.0	
Length Wtd. (ft)		Wetted Per. (ft)		32.79	
Min Ch El (ft)	2631.32	Shear (lb/sq ft)		1.47	
Alpha	1.00	Stream Power (lb/ft s)		10.19	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

SUMMARY OF MANNING'S N VALUES

River:Sta 53+00 to 56+

Reach	River Sta.	n1	n2	n3
Sta 53+00 to 56+	840	.045	.035	.045
Sta 53+00 to 56+	800	.045	.035	.045
Sta 53+00 to 56+	750	.045	.035	.045

Sta 53+00 to 56+	700		.045	.035	.045	
Sta 53+00 to 56+	660		.045	.035	.045	
Sta 53+00 to 56+	650	Culvert				
Sta 53+00 to 56+	575		.016	.035	.045	
Sta 53+00 to 56+	550		.016	.035	.045	
Sta 53+00 to 56+	500		.045	.035	.045	

River:Sta 70+00 to 78+

Reach	River Sta.	n1	n2	n3	n4	n5
Sta 70+00 to 78+	2050	.016	.035	.045		
Sta 70+00 to 78+	2000	.016	.035	.045		
Sta 70+00 to 78+	1950	.016	.035	.045		
Sta 70+00 to 78+	1900	.016	.035	.045		
Sta 70+00 to 78+	1850	.016	.035	.045		
Sta 70+00 to 78+	1800	.016	.035	.045		
Sta 70+00 to 78+	1750	.016	.035	.045		
Sta 70+00 to 78+	1700	.016	.035	.045		
Sta 70+00 to 78+	1670	.016	.035	.045		
Sta 70+00 to 78+	1657.75	.016	.035	.045		
Sta 70+00 to 78+	1653	Culvert				
Sta 70+00 to 78+	1450	.016	.035	.069	.035	.045
Sta 70+00 to 78+	1400	.016	.035	.069	.035	.045
Sta 70+00 to 78+	1350	.016	.035	.069	.035	.045
Sta 70+00 to 78+	1300	.016	.035	.069	.035	.045
Sta 70+00 to 78+	1250	.016	.035	.069	.035	.045
Sta 70+00 to 78+	1240	Culvert				
Sta 70+00 to 78+	1128.78	.016	.035	.045		

Sta 70+00 to 78+	1100	.016	.035	.045
Sta 70+00 to 78+	1050	.016	.035	.045
Sta 70+00 to 78+	1010	.016	.035	.045

River:Sta 80+00 to 83+

Reach	River Sta.	n1	n2	n3
Sta 80+00 to 83+	3530	.045	.035	.045
Sta 80+00 to 83+	3500	.045	.035	.045
Sta 80+00 to 83+	3450	.045	.035	.045
Sta 80+00 to 83+	3400	.045	.035	.045
Sta 80+00 to 83+	3350	.045	.035	.045
Sta 80+00 to 83+	3300	.045	.035	.045
Sta 80+00 to 83+	3269.15	.045	.035	.016
Sta 80+00 to 83+	3250	Culvert		
Sta 80+00 to 83+	3100	.045	.035	.045
Sta 80+00 to 83+	3050	.045	.035	.045

SUMMARY OF REACH LENGTHS

River: Sta 53+00 to 56+

Reach	River Sta.	Left	Channel	Right
Sta 53+00 to 56+	840	40	40	40
Sta 53+00 to 56+	800	50	50	50
Sta 53+00 to 56+	750	50	50	50
Sta 53+00 to 56+	700	40	40	40
Sta 53+00 to 56+	660	85	85	85
Sta 53+00 to 56+	650	Culvert		
Sta 53+00 to 56+	575	25	25	25
Sta 53+00 to 56+	550	50	50	50
Sta 53+00 to 56+	500			

River: Sta 70+00 to 78+

Reach	River Sta.	Left	Channel	Right

Sta 70+00 to 78+	2050	50	50	50
Sta 70+00 to 78+	2000	50	50	50
Sta 70+00 to 78+	1950	50	50	50
Sta 70+00 to 78+	1900	50	50	50
Sta 70+00 to 78+	1850	50	50	50
Sta 70+00 to 78+	1800	50	50	50
Sta 70+00 to 78+	1750	50	50	50
Sta 70+00 to 78+	1700	30	30	30
Sta 70+00 to 78+	1670	12.5	12.5	12.5
Sta 70+00 to 78+	1657.75	207.5	207.5	207.5
Sta 70+00 to 78+	1653	Culvert		
Sta 70+00 to 78+	1450	50	50	50
Sta 70+00 to 78+	1400	50	50	50
Sta 70+00 to 78+	1350	50	50	50
Sta 70+00 to 78+	1300	50	50	50
Sta 70+00 to 78+	1250	121.22	121.22	121.22
Sta 70+00 to 78+	1240	Culvert		
Sta 70+00 to 78+	1128.78	28.78	28.78	28.78
Sta 70+00 to 78+	1100	50	50	50
Sta 70+00 to 78+	1050	40	40	40
Sta 70+00 to 78+	1010			

River: Sta 80+00 to 83+

Reach	River Sta.	Left	Channel	Right
Sta 80+00 to 83+	3530	30	30	30
Sta 80+00 to 83+	3500	50	50	50
Sta 80+00 to 83+	3450	50	50	50
Sta 80+00 to 83+	3400	50	50	50
Sta 80+00 to 83+	3350	50	50	50
Sta 80+00 to 83+	3300	30.85	30.85	30.85
Sta 80+00 to 83+	3269.15	169.15	169.15	169.15
Sta 80+00 to 83+	3250	Culvert		
Sta 80+00 to 83+	3100	50	50	50
Sta 80+00 to 83+	3050			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Sta 53+00 to 56+

Reach	River Sta.	Contr.	Expan.

Sta 53+00 to 56+	840	.1	.3
Sta 53+00 to 56+	800	.1	.3
Sta 53+00 to 56+	750	.1	.3
Sta 53+00 to 56+	700	.1	.3
Sta 53+00 to 56+	660	.1	.3
Sta 53+00 to 56+	650	Culvert	
Sta 53+00 to 56+	575	.1	.3
Sta 53+00 to 56+	550	.1	.3
Sta 53+00 to 56+	500	.1	.3

River: Sta 70+00 to 78+

Reach	River Sta.	Contr.	Expan.
Sta 70+00 to 78+	2050	.1	.3
Sta 70+00 to 78+	2000	.1	.3
Sta 70+00 to 78+	1950	.1	.3
Sta 70+00 to 78+	1900	.1	.3
Sta 70+00 to 78+	1850	.1	.3
Sta 70+00 to 78+	1800	.1	.3
Sta 70+00 to 78+	1750	.1	.3
Sta 70+00 to 78+	1700	.1	.3
Sta 70+00 to 78+	1670	.1	.3
Sta 70+00 to 78+	1657.75	.1	.3
Sta 70+00 to 78+	1653	Culvert	
Sta 70+00 to 78+	1450	.1	.3
Sta 70+00 to 78+	1400	.1	.3
Sta 70+00 to 78+	1350	.1	.3
Sta 70+00 to 78+	1300	.1	.3
Sta 70+00 to 78+	1250	.1	.3
Sta 70+00 to 78+	1240	Culvert	
Sta 70+00 to 78+	1128.78	.1	.3
Sta 70+00 to 78+	1100	.1	.3
Sta 70+00 to 78+	1050	.1	.3
Sta 70+00 to 78+	1010	.1	.3

River: Sta 80+00 to 83+

Reach	River Sta.	Contr.	Expan.
Sta 80+00 to 83+	3530	.1	.3
Sta 80+00 to 83+	3500	.1	.3
Sta 80+00 to 83+	3450	.1	.3
Sta 80+00 to 83+	3400	.1	.3
Sta 80+00 to 83+	3350	.1	.3
Sta 80+00 to 83+	3300	.1	.3

```
 Sta 80+00 to 83+     3269.15         .1        .3
 Sta 80+00 to 83+     3250     Culvert
 Sta 80+00 to 83+     3100            .1        .3
 Sta 80+00 to 83+     3050            .1        .3
```

Profile Output Table - Standard Table 1

```
  River              Reach              River Sta     Profile   Q Total   Min Ch El
 W.S. Elev   Crit W.S.   E.G. Elev   E.G. Slope   Vel Chnl   Flow Area   Top Width
Froude # Chl
                                                                  (cfs)        (ft)
      (ft)        (ft)        (ft)      (ft/ft)     (ft/s)     (sq ft)        (ft)


  Sta 80+00 to 83+   Sta 80+00 to 83+   3530          PF 1       304.00     2649.24
   2651.92     2651.92     2652.58     0.016864       6.51       46.69       35.92
        1.01
  Sta 80+00 to 83+   Sta 80+00 to 83+   3500          PF 1       304.00     2648.16
   2650.83     2650.83     2651.46     0.017373       6.36       47.77       38.97
        1.01
  Sta 80+00 to 83+   Sta 80+00 to 83+   3450          PF 1       326.20     2645.25
   2647.64     2647.64     2648.51     0.016348       7.48       43.62       25.48
        1.01
  Sta 80+00 to 83+   Sta 80+00 to 83+   3400          PF 1       326.20     2642.47
   2646.08     2646.08     2646.91     0.016662       7.30       44.70       27.14
        1.00
  Sta 80+00 to 83+   Sta 80+00 to 83+   3350          PF 1       326.20     2640.65
   2644.81     2644.81     2645.70     0.017115       7.55       43.18       24.62
        1.01
  Sta 80+00 to 83+   Sta 80+00 to 83+   3300          PF 1       326.20     2637.91
   2641.47                 2641.83     0.003942       4.78       68.17       26.76
        0.53
  Sta 80+00 to 83+   Sta 80+00 to 83+   3269.15       PF 1       326.20     2636.30
   2641.67     2637.99     2641.71     0.000279       1.78      183.82       47.03
        0.15
  Sta 80+00 to 83+   Sta 80+00 to 83+   3250                    Culvert


  Sta 80+00 to 83+   Sta 80+00 to 83+   3100          PF 1       326.20     2631.75
   2634.76                 2635.19     0.005782       5.25       62.13       28.90
        0.63
  Sta 80+00 to 83+   Sta 80+00 to 83+   3050          PF 1       326.20     2631.32
   2633.96     2633.96     2634.70     0.016402       6.92       47.12       32.32
```

```
      1.01
Sta 70+00 to 78+   Sta 70+00 to 78+   2050          PF 1        79.00     2627.84
 2629.11     2629.11     2629.41     0.023364       4.34       18.20       32.87
      1.03
Sta 70+00 to 78+   Sta 70+00 to 78+   2000          PF 1        79.00     2624.45
 2625.93     2625.93     2626.42     0.018765       5.63       14.03       14.27
      1.00
Sta 70+00 to 78+   Sta 70+00 to 78+   1950          PF 1       115.00     2621.85
 2623.58     2623.58     2624.17     0.017932       6.13       18.75       16.20
      1.00
Sta 70+00 to 78+   Sta 70+00 to 78+   1900          PF 1       115.00     2619.38
 2621.14     2621.14     2621.72     0.018028       6.14       18.72       16.18
      1.01
Sta 70+00 to 78+   Sta 70+00 to 78+   1850          PF 1       135.00     2616.87
 2618.78     2618.78     2619.41     0.017556       6.35       21.25       17.10
      1.01
Sta 70+00 to 78+   Sta 70+00 to 78+   1800          PF 1       147.00     2614.36
 2616.36     2616.36     2617.01     0.017255       6.45       22.78       17.71
      1.00
Sta 70+00 to 78+   Sta 70+00 to 78+   1750          PF 1       203.00     2612.05
 2614.37     2614.37     2615.13     0.016889       6.99       29.03       19.61
      1.01
Sta 70+00 to 78+   Sta 70+00 to 78+   1700          PF 1       203.00     2609.96
 2612.26     2612.26     2612.99     0.016976       6.86       29.60       20.77
      1.01
Sta 70+00 to 78+   Sta 70+00 to 78+   1670          PF 1       217.00     2608.87
 2611.24     2611.24     2611.99     0.016278       6.91       31.40       21.07
      1.00
Sta 70+00 to 78+   Sta 70+00 to 78+   1657.75       PF 1       217.00     2606.09
 2609.60     2608.00     2609.88     0.003045       4.23       51.32       14.71
      0.40
Sta 70+00 to 78+   Sta 70+00 to 78+   1653                    Culvert


Sta 70+00 to 78+   Sta 70+00 to 78+   1450          PF 1       217.00     2598.13
 2600.19                 2600.83     0.045221       6.40       33.90       16.47
      0.79
Sta 70+00 to 78+   Sta 70+00 to 78+   1400          PF 1       217.00     2595.30
 2597.36     2597.36     2598.13     0.064460       7.05       30.79       20.23
      1.01
Sta 70+00 to 78+   Sta 70+00 to 78+   1350          PF 1       264.00     2592.89
 2595.81                 2596.22     0.017435       5.18       50.98       25.85
      0.65
Sta 70+00 to 78+   Sta 70+00 to 78+   1300          PF 1       264.00     2591.71
 2594.87                 2595.30     0.019835       5.21       50.71       26.23
      0.66
Sta 70+00 to 78+   Sta 70+00 to 78+   1250          PF 1       264.00     2590.51
 2594.89     2592.99     2594.95     0.002107       1.97      133.87       51.78
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      0.22
  Sta 70+00 to 78+   Sta 70+00 to 78+   1240                    Culvert


  Sta 70+00 to 78+   Sta 70+00 to 78+   1128.78       PF 1       280.00     2586.52
   2588.52     2588.52     2589.31     0.016586       7.12       39.31       25.26
      1.01
  Sta 70+00 to 78+   Sta 70+00 to 78+   1100          PF 1       280.00     2585.00
   2587.54     2587.54     2588.43     0.015970       7.58       36.95       20.88
      1.00
  Sta 70+00 to 78+   Sta 70+00 to 78+   1050          PF 1       283.00     2583.45
   2586.85     2586.85     2587.51     0.017541       6.50       43.55       33.28
      1.00
  Sta 70+00 to 78+   Sta 70+00 to 78+   1010          PF 1       283.00     2582.35
   2585.23     2585.23     2585.91     0.017290       6.63       42.68       32.04
      1.01
  Sta 53+00 to 56+   Sta 53+00 to 56+   840           PF 1       255.26     2547.61
   2549.21                 2549.38     0.009288       3.30       77.38      106.52
      0.68
  Sta 53+00 to 56+   Sta 53+00 to 56+   800           PF 1       287.81     2546.48
   2548.28     2548.28     2548.83     0.017649       5.99       48.01       43.57
      1.01
  Sta 53+00 to 56+   Sta 53+00 to 56+   750           PF 1       287.81     2545.50
   2547.71                 2547.74     0.000858       1.54      187.32      135.63
      0.23
  Sta 53+00 to 56+   Sta 53+00 to 56+   700           PF 1       287.81     2543.90
   2547.72                 2547.72     0.000074       0.75      508.81      198.26
      0.08
  Sta 53+00 to 56+   Sta 53+00 to 56+   660           PF 1       287.81     2543.03
   2547.72     2544.31     2547.72     0.000014       0.36      964.94      273.02
      0.03
  Sta 53+00 to 56+   Sta 53+00 to 56+   650                    Culvert


  Sta 53+00 to 56+   Sta 53+00 to 56+   575           PF 1       287.81     2541.67
   2544.06     2544.06     2544.91     0.015798       7.42       38.85       24.78
      1.00
  Sta 53+00 to 56+   Sta 53+00 to 56+   550           PF 1       287.81     2540.07
   2542.44     2542.44     2543.25     0.016092       7.20       39.99       25.23
      1.01
  Sta 53+00 to 56+   Sta 53+00 to 56+   500           PF 1       287.81     2539.16
   2541.61     2541.61     2542.35     0.016485       6.92       41.59       28.47
      1.01
```

```
  River              Reach              River Sta               Profile   E.G. US.
W.S. US.   E.G. IC   E.G. OC   Min El Weir Flow   Q Culv Group   Q Weir   Delta WS
Culv Vel US   Culv Vel DS
                                                                                (ft)
    (ft)      (ft)      (ft)               (ft)          (cfs)    (cfs)       (ft)
     (ft/s)        (ft/s)

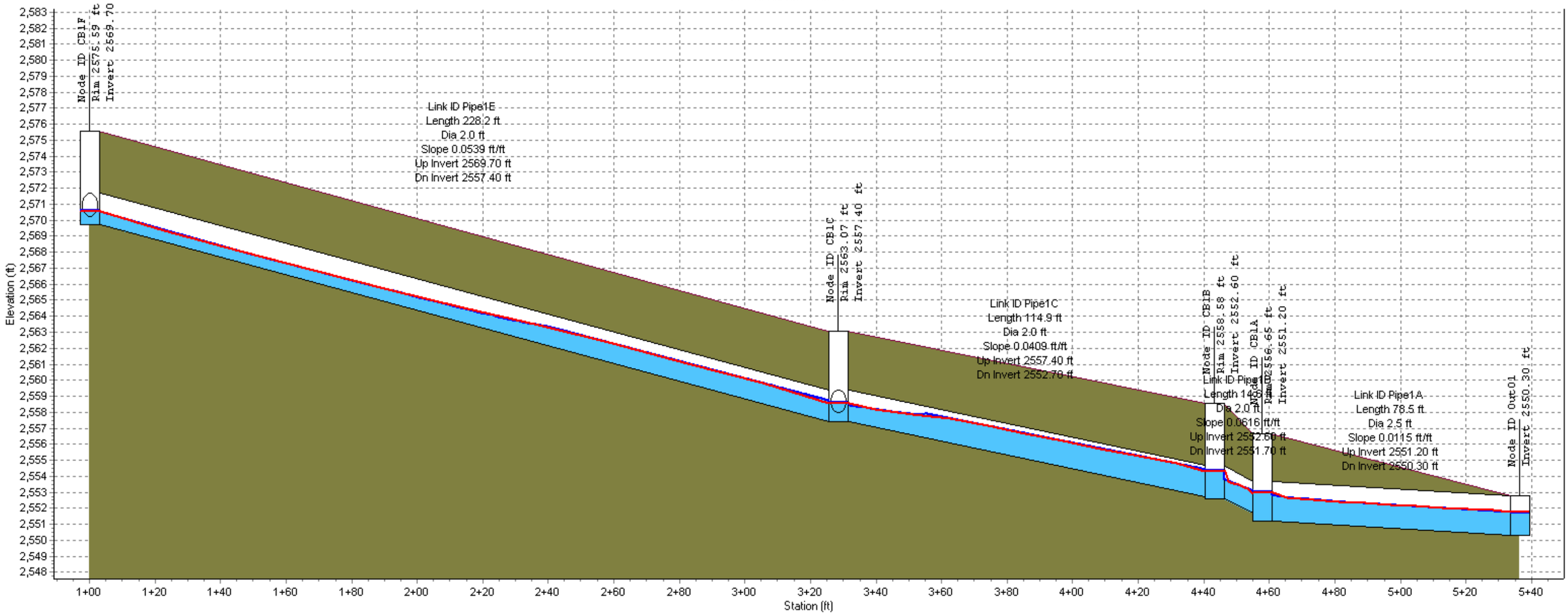

  Sta 80+00 to 83+   Sta 80+00 to 83+   3250     Culvert #1     PF 1       2641.71
 2641.67   2641.50   2641.71            2642.45         326.20                6.91
       9.79         17.78
  Sta 70+00 to 78+   Sta 70+00 to 78+   1653     Culvert #1     PF 1       2609.88
 2609.60   2609.55   2609.88            2610.38         217.00                9.41
       8.35         18.11
  Sta 70+00 to 78+   Sta 70+00 to 78+   1240     Culvert #1     PF 1       2594.95
 2594.89   2594.24   2594.95            2600.01         264.00                6.37
       9.47         16.83
  Sta 53+00 to 56+   Sta 53+00 to 56+   650      Culvert #1     PF 1       2547.72
 2547.72   2547.53   2547.72            2547.51         278.04     9.77       3.66
       8.78          9.02
```

APPENDIX 12

STORM AND SANITARY RESULTS

Profile Plot

Main Street Storm Sewer

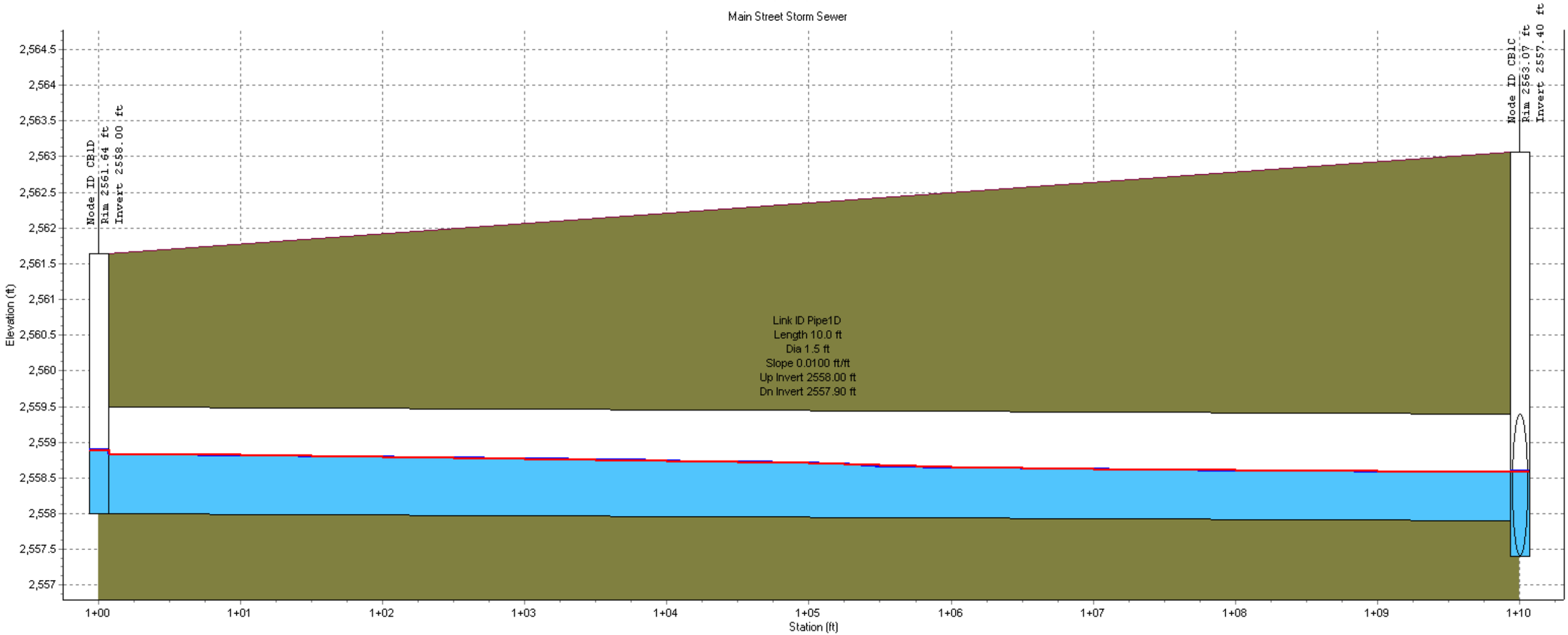


Node ID:	CB1F	CB1C	CB1B	CB1A	Out01
Rim (ft):	2575.59	2563.07	2558.58	2556.65	
Invert (ft):	2569.70	2557.40	2552.60	2551.20	2550.30
Min Pipe Cover (ft):					
Max HGL (ft):	2570.55	2558.59	2554.32	2552.99	2551.88

Link ID:	Pipe1E	Pipe1C	Pipe1B	Pipe1A
Length (ft):	228.2	114.9	14.6	78.5
Dia (ft):	2.0	2.0	2.0	2.5
Slope (ft/ft):	0.0539	0.0409	0.0616	0.0115
Up Invert (ft):	2569.70	2557.40	2552.60	2551.20
Dn Invert (ft):	2557.40	2552.70	2551.70	2550.30
Max Q (cfs):	19.2	23.2	25.4	27.6
Max Vel (ft/s):	12.82	10.08	9.05	7.42
Max Depth (ft):	1.02	1.40	1.51	1.62

Profile Plot

Main Street Storm Sewer



Node ID:	CB1D	CB1C
Rim (ft):	2561.64	2563.07
Invert (ft):	2558.00	2557.40
Min Pipe Cover (ft):		
Max HGL (ft):	2558.89	2558.59

Link ID:	Pipe1D
Length (ft):	10.0
Dia (ft):	1.5
Slope (ft/ft):	0.0100
Up Invert (ft):	2558.00
Dn Invert (ft):	2557.90
Max Q (cfs):	4.0
Max Vel (ft/s):	4.14
Max Depth (ft):	0.79

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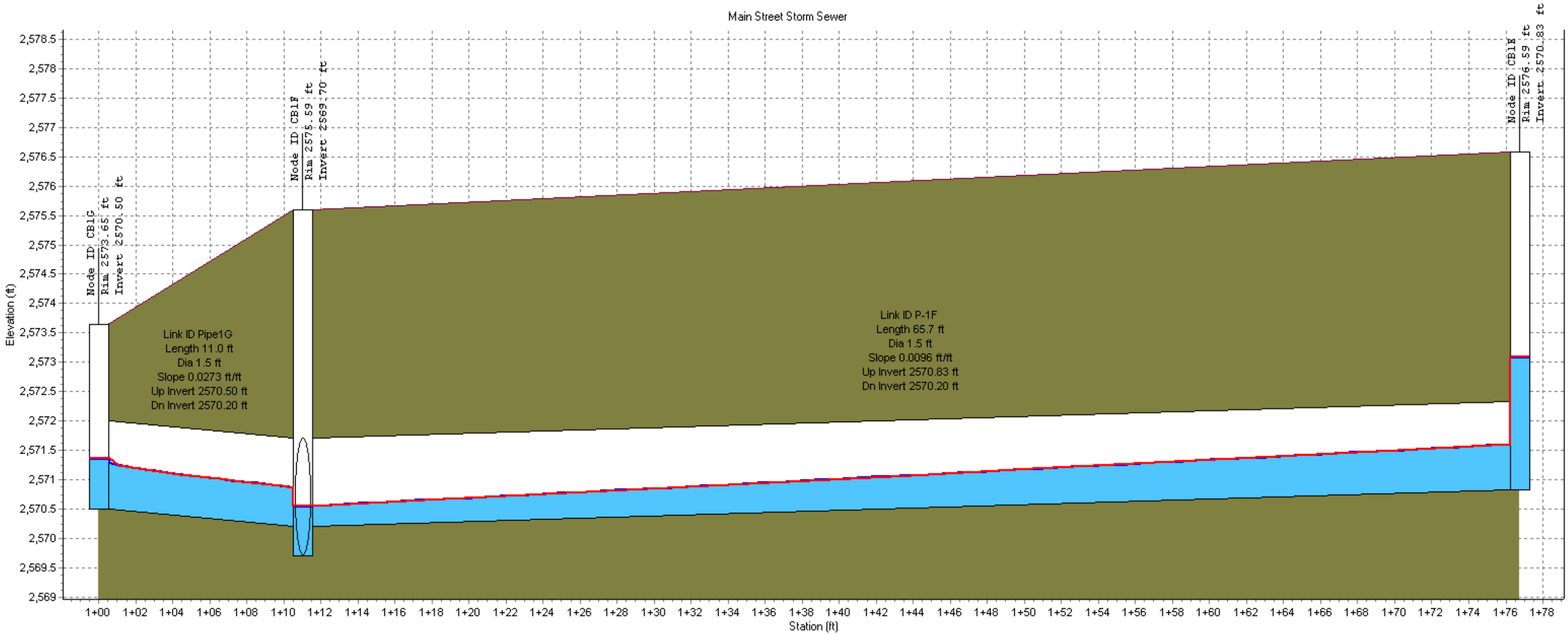
Profile Plot

Main Street Storm Sewer

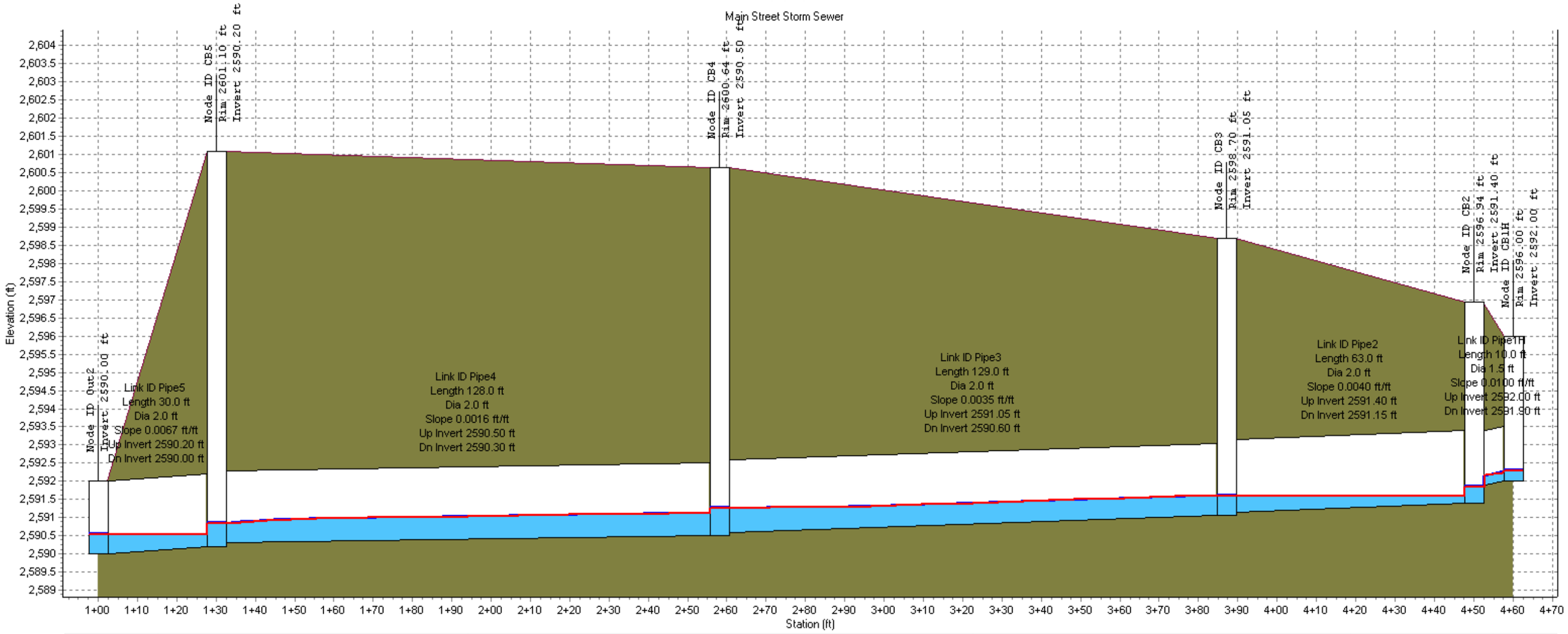


Node ID:	CB1G	CB1F	CB1E
Rim (ft):	2573.65	2575.59	2576.59
Invert (ft):	2570.50	2569.70	2570.83
Min Pipe Cover (ft):			
Max HGL (ft):	2571.36	2570.55	2573.09

Link ID:	Pipe1G	P-1F
Length (ft):	11.0	65.7
Dia (ft):	1.5	1.5
Slope (ft/ft):	0.0273	0.0096
Up Invert (ft):	2570.50	2570.83
Dn Invert (ft):	2570.20	2570.20
Max Q (cfs):	5.6	13.0
Max Vel (ft/s):	6.13	7.42
Max Depth (ft):	0.73	1.38

Profile Plot

Main Street Storm Sewer



Node ID:	Out2	CB5	CB4	CB3	CB2	CB1H
Rim (ft):		2601.10	2600.64	2598.70	2596.94	2596.00
Invert (ft):	2590.00	2590.20	2590.50	2591.05	2591.40	2592.00
Min Pipe Cover (ft):						
Max HGL (ft):	2590.54	2590.84	2591.27	2591.60	2591.85	2592.29

Link ID:	Pipe5	Pipe4	Pipe3	Pipe2	Pipe1H
Length (ft):	30.0	128.0	129.0	63.0	10.0
Dia (ft):	2.0	2.0	2.0	2.0	1.5
Slope (ft/ft):	0.0067	0.0016	0.0035	0.0040	0.0100
Up Invert (ft):	2590.20	2590.50	2591.05	2591.40	2592.00
Dn Invert (ft):	2590.00	2590.30	2590.60	2591.15	2591.90
Max Q (cfs):	2.6	2.2	1.9	1.1	0.5
Max Vel (ft/s):	3.32	2.46	2.56	2.37	2.48
Max Depth (ft):	0.59	0.65	0.61	0.45	0.26

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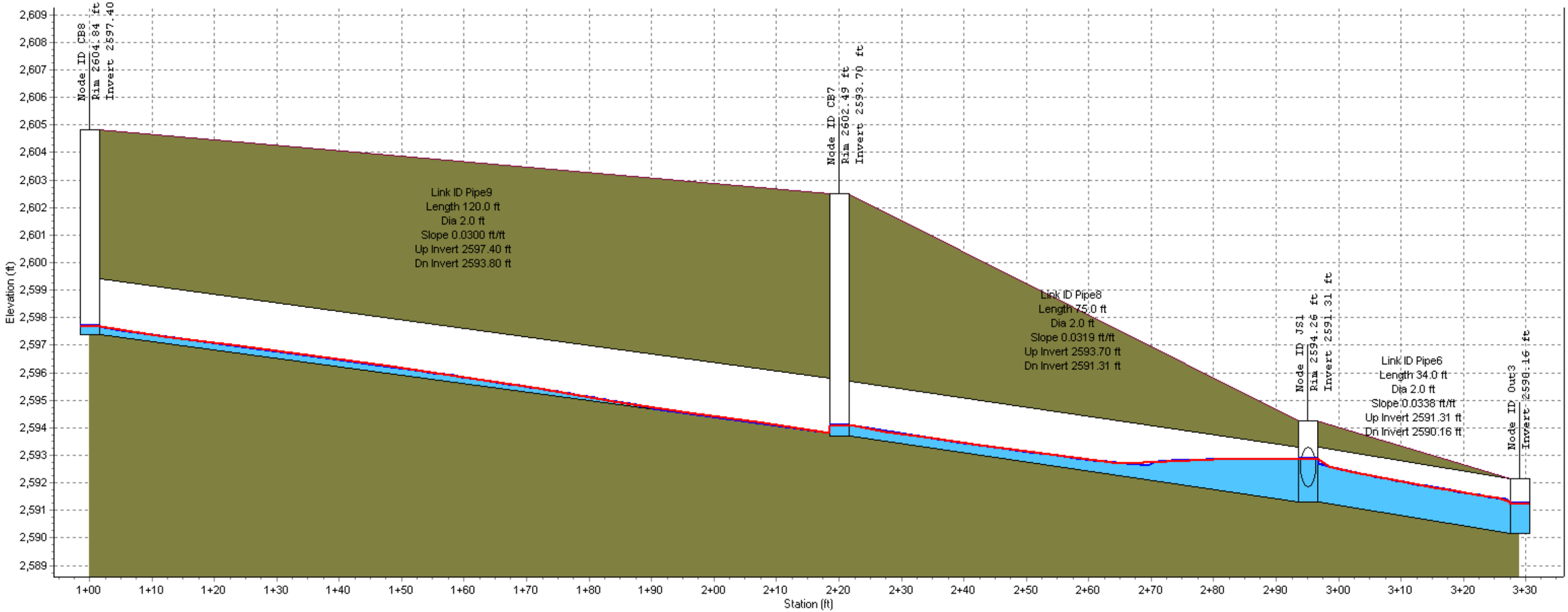
Profile Plot

Main Street Storm Sewer



Node ID:	CB8	CB7	JS1	Out3
Rim (ft):	2604.84	2602.49	2594.26	
Invert (ft):	2597.40	2593.70	2591.31	2590.16
Min Pipe Cover (ft):			0.95	
Max HGL (ft):	2597.69	2594.08	2593.01	2591.27

Link ID:	Pipe9	Pipe8	Pipe6
Length (ft):	120.0	75.0	34.0
Dia (ft):	2.0	2.0	2.0
Slope (ft/ft):	0.0300	0.0319	0.0338
Up Invert (ft):	2597.40	2593.70	2591.31
Dn Invert (ft):	2593.80	2591.31	2590.16
Max Q (cfs):	1.5	2.8	21.5
Max Vel (ft/s):	5.27	4.58	9.41
Max Depth (ft):	0.29	0.97	1.31

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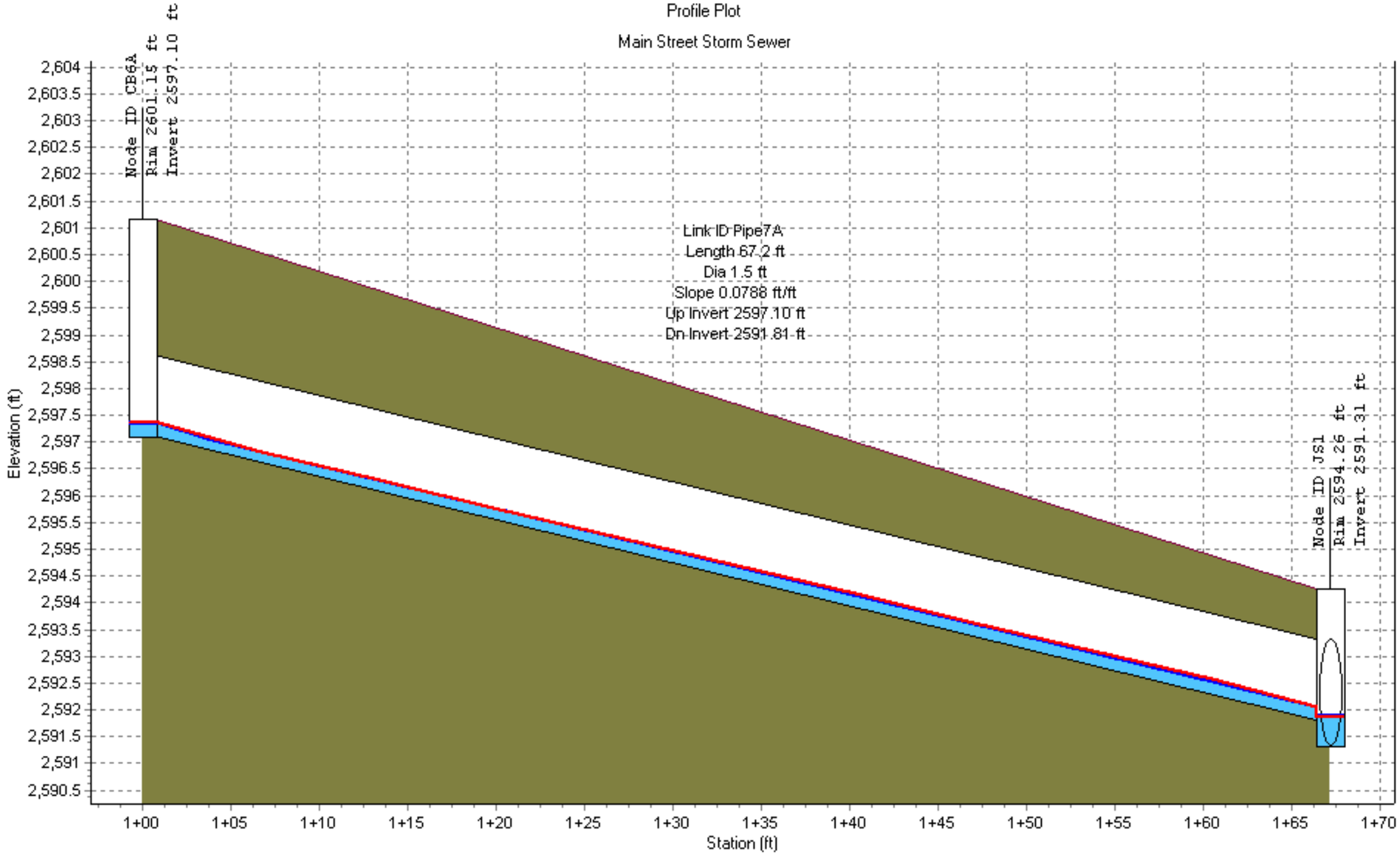
Profile Plot

Main Street Storm Sewer



Node ID:	CB6A		JS1
Rim (ft):	2601.15		2594.26
Invert (ft):	2597.10		2591.31
Min Pipe Cover (ft):			0.95
Max HGL (ft):	2597.35		2591.90
Link ID:		Pipe7A	
Length (ft):		67.2	
Dia (ft):		1.5	
Slope (ft/ft):		0.0788	
Up Invert (ft):		2597.10	
Dn Invert (ft):		2591.81	
Max Q (cfs):		1.4	
Max Vel (ft/s):		7.48	
Max Depth (ft):		0.25	

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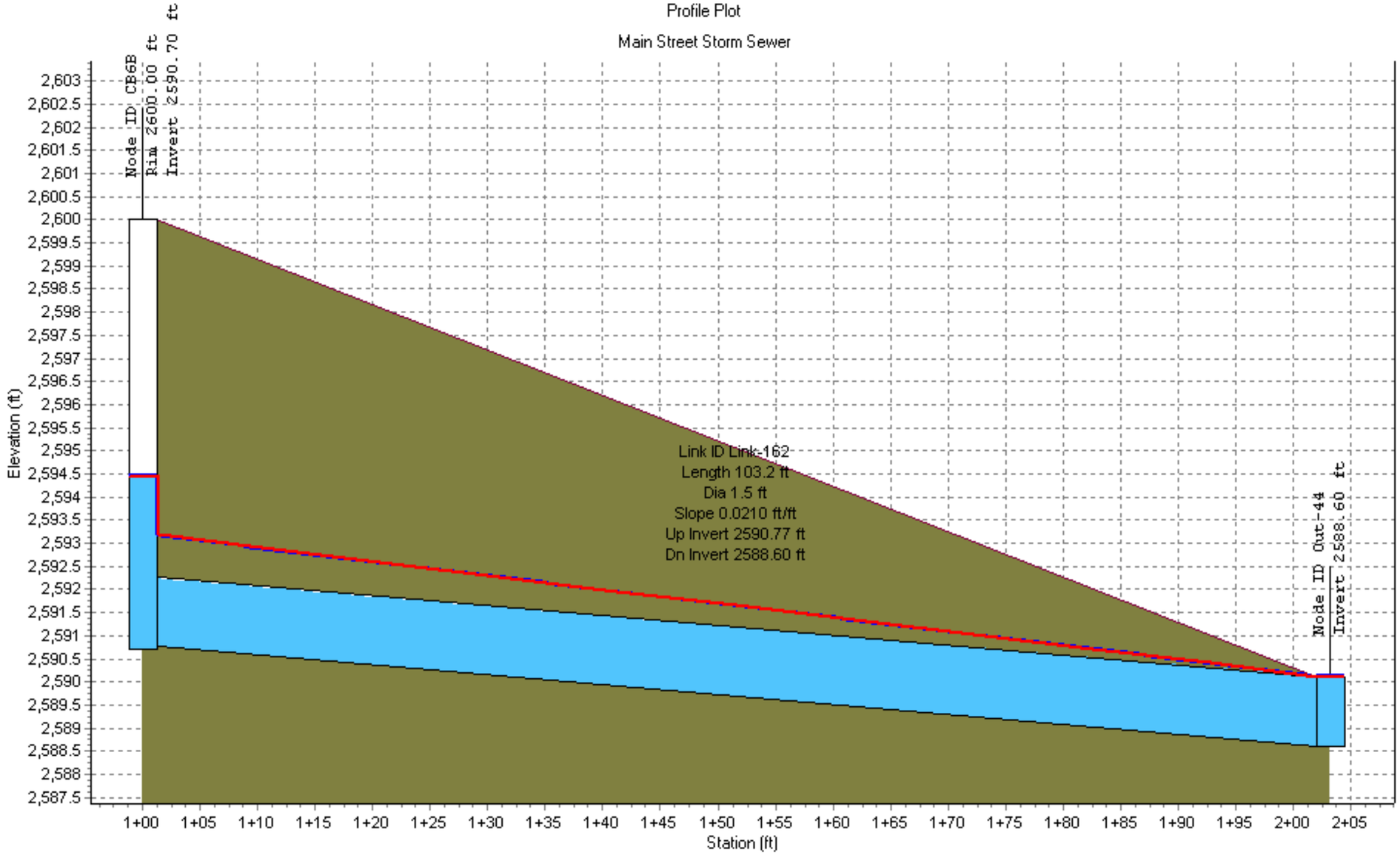
Profile Plot

Main Street Storm Sewer



Node ID:	CB6B	Out-44
Rim (ft):	2600.00	
Invert (ft):	2590.70	2588.60
Min Pipe Cover (ft):		
Max HGL (ft):	2594.45	2590.10

Link ID:	Link-162
Length (ft):	103.2
Dia (ft):	1.5
Slope (ft/ft):	0.0210
Up Invert (ft):	2590.77
Dn Invert (ft):	2588.60
Max Q (cfs):	16.3
Max Vel (ft/s):	9.22
Max Depth (ft):	1.50

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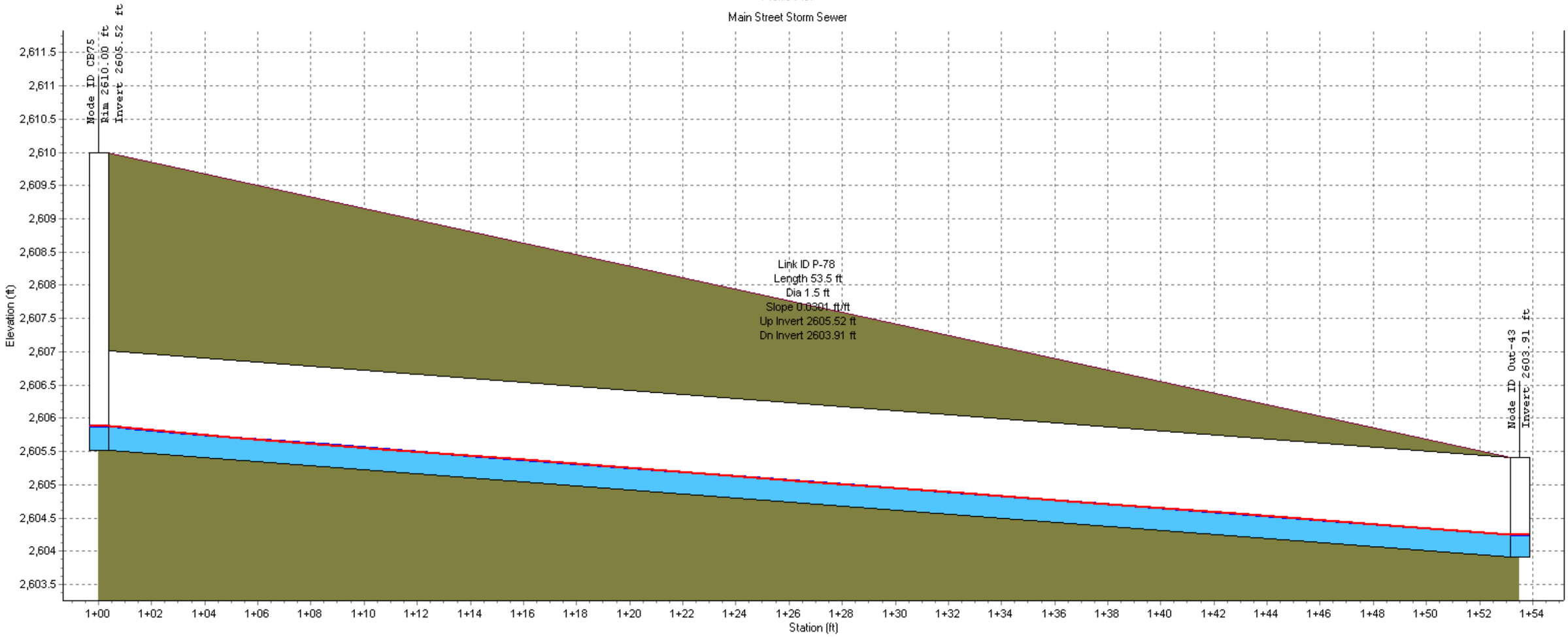
Profile Plot

Main Street Storm Sewer



Node ID:	CB75	Out-43
Rim (ft):	2610.00	
Invert (ft):	2605.52	2603.91
Min Pipe Cover (ft):		
Max HGL (ft):	2605.88	2604.25

Link ID:	P-78
Length (ft):	53.5
Dia (ft):	1.5
Slope (ft/ft):	0.0301
Up Invert (ft):	2605.52
Dn Invert (ft):	2603.91
Max Q (cfs):	1.8
Max Vel (ft/s):	5.59
Max Depth (ft):	0.35

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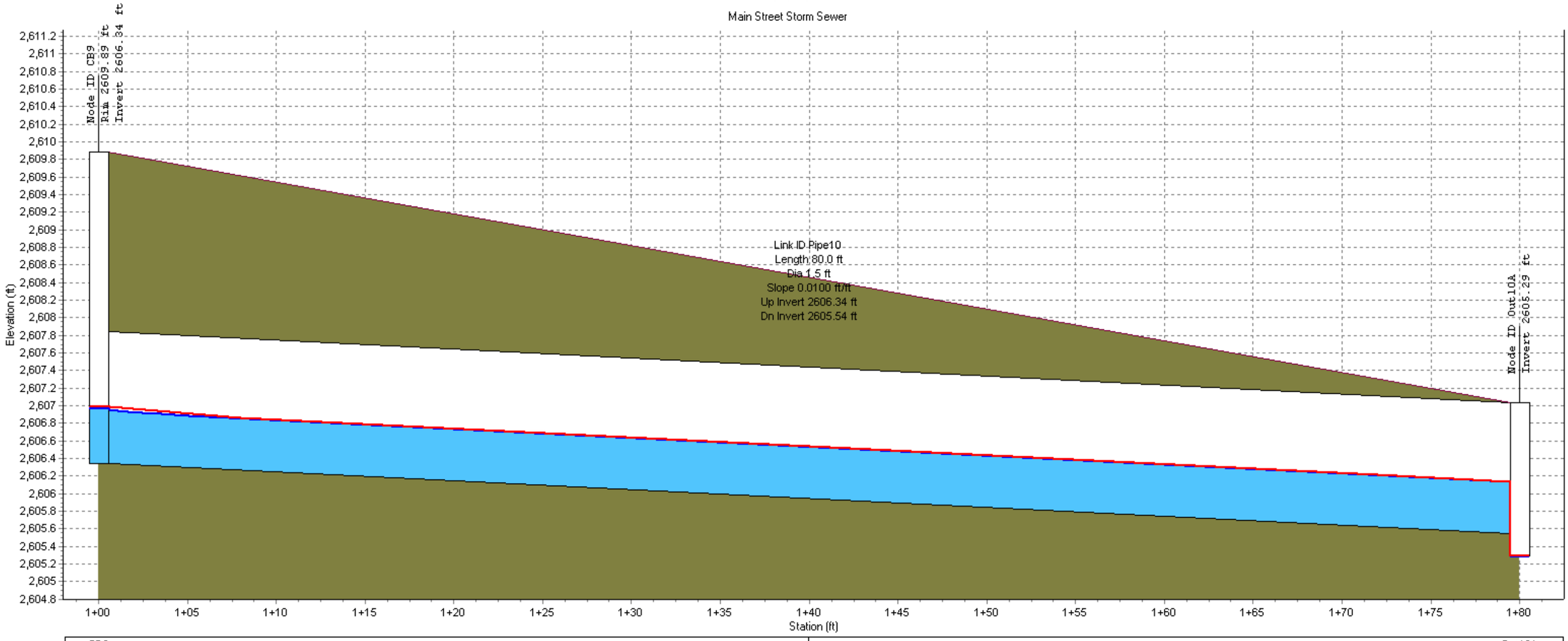
Profile Plot

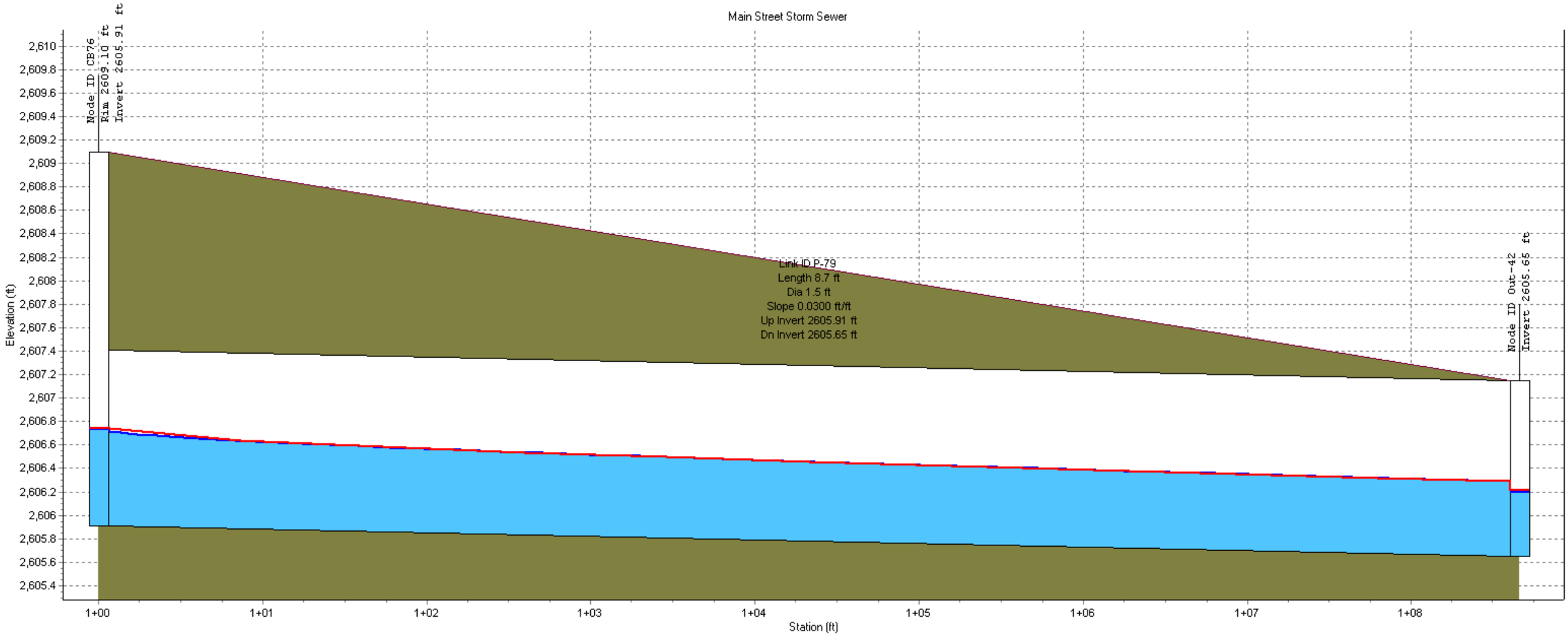
Main Street Storm Sewer



Node ID:	CB9		Out10A
Rim (ft):	2609.89		
Invert (ft):	2606.34		2605.29
Min Pipe Cover (ft):			
Max HGL (ft):	2606.98		2605.29
Link ID:		Pipe10	
Length (ft):		80.0	
Dia (ft):		1.5	
Slope (ft/ft):		0.0100	
Up Invert (ft):		2606.34	
Dn Invert (ft):		2605.54	
Max Q (cfs):		2.9	
Max Vel (ft/s):		4.28	
Max Depth (ft):		0.61	

Profile Plot

Main Street Storm Sewer



Node ID:	CB76	Out-42
Rim (ft):	2609.10	
Invert (ft):	2605.91	2605.65
Min Pipe Cover (ft):		
Max HGL (ft):	2606.74	2606.28

Link ID:	P-79
Length (ft):	8.7
Dia (ft):	1.5
Slope (ft/ft):	0.0300
Up Invert (ft):	2605.91
Dn Invert (ft):	2605.65
Max Q (cfs):	5.7
Max Vel (ft/s):	6.38
Max Depth (ft):	0.70

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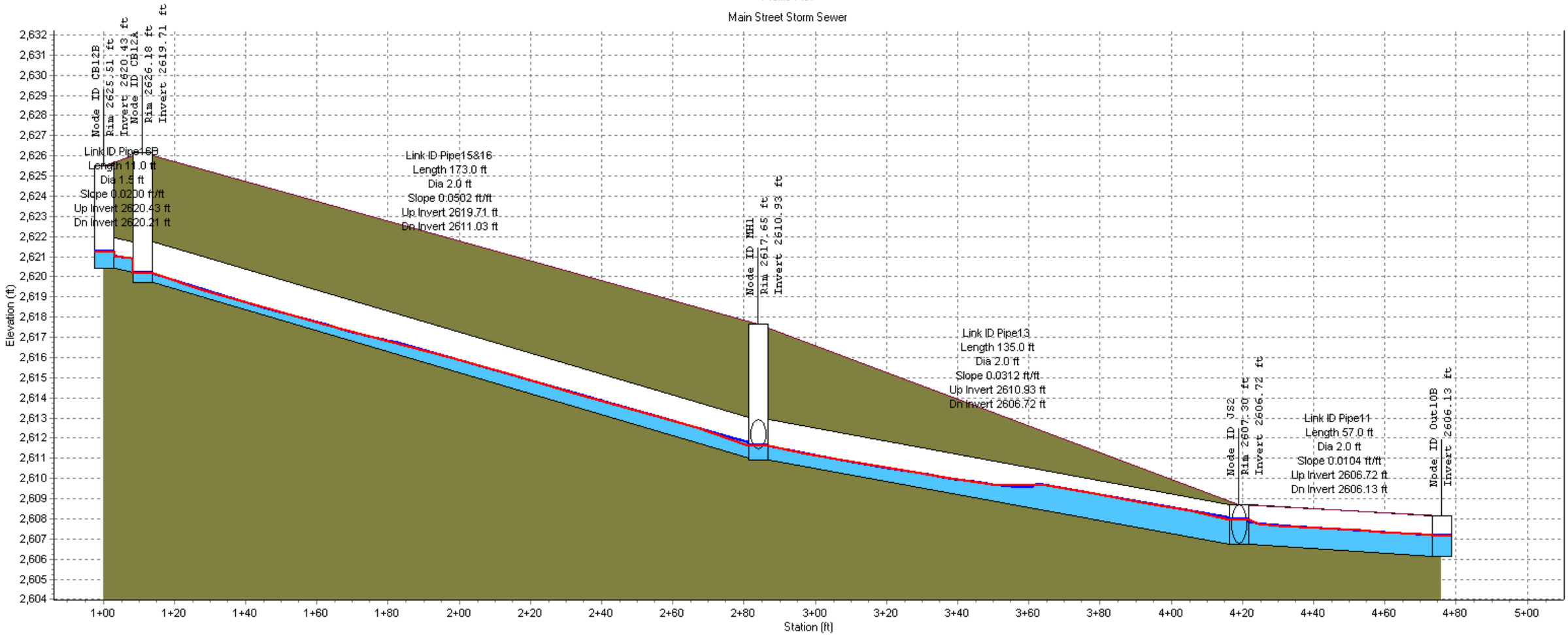
Profile Plot

Main Street Storm Sewer

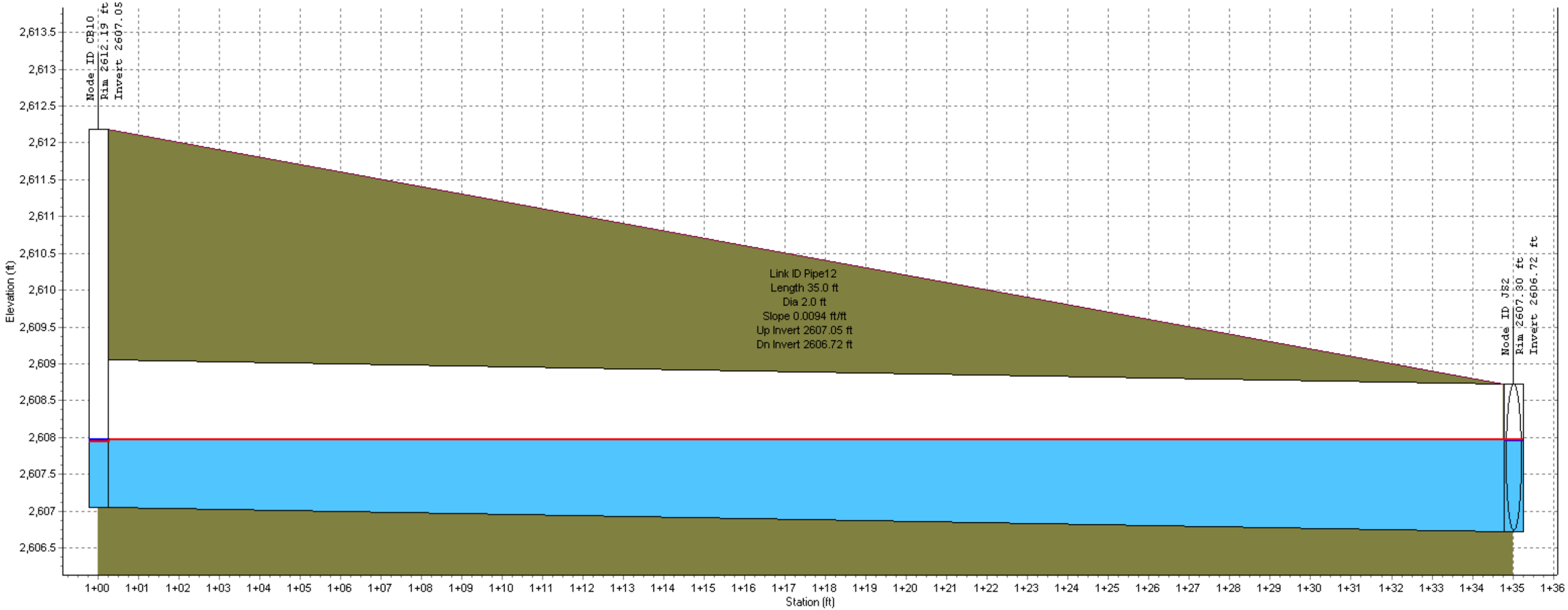


Node ID:	CB12B	CB12A	MH1	JS2	Out10B
Rim (ft):	2625.51	2626.18	2617.65	2607.30	
Invert (ft):	2620.43	2619.71	2610.93	2606.72	2606.13
Min Pipe Cover (ft):			4.62	0.00	
Max HGL (ft):	2621.22	2620.18	2611.75	2608.03	2607.19

Link ID:	Pipe16B	Pipe15&16	Pipe13	Pipe11
Length (ft):	11.0	173.0	135.0	57.0
Dia (ft):	1.5	2.0	2.0	2.0
Slope (ft/ft):	0.0200	0.0502	0.0312	0.0104
Up Invert (ft):	2620.43	2619.71	2610.93	2606.72
Dn Invert (ft):	2620.21	2611.03	2606.72	2606.13
Max Q (cfs):	4.5	6.2	10.6	11.0
Max Vel (ft/s):	5.32	8.36	7.61	5.78
Max Depth (ft):	0.68	0.54	0.98	1.14

Profile Plot

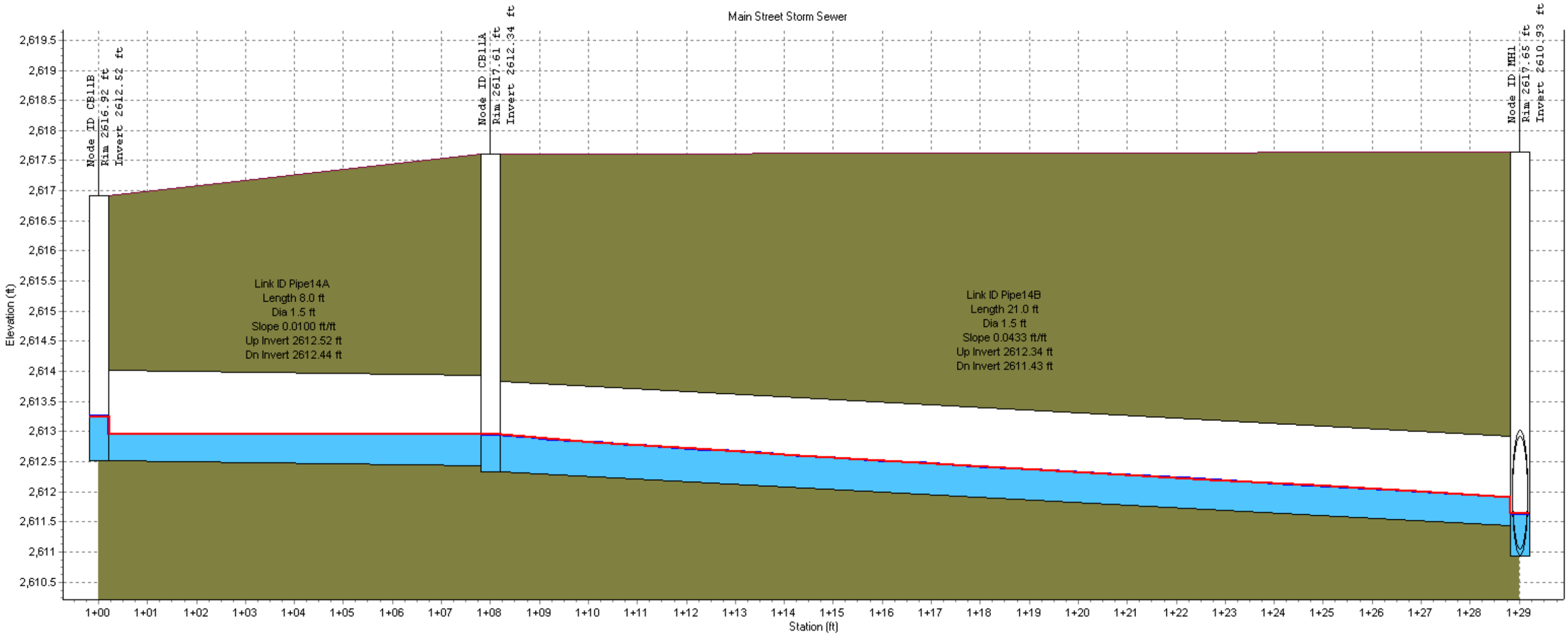
Main Street Storm Sewer



Node ID:	CB10		JS2
Rim (ft):	2612.19		2607.30
Invert (ft):	2607.05		2606.72
Min Pipe Cover (ft):			0.00
Max HGL (ft):	2607.97		2608.03
Link ID:		Pipe12	
Length (ft):		35.0	
Dia (ft):		2.0	
Slope (ft/ft):		0.0094	
Up Invert (ft):		2607.05	
Dn Invert (ft):		2606.72	
Max Q (cfs):		2.9	
Max Vel (ft/s):		3.88	
Max Depth (ft):		1.08	

Profile Plot

Main Street Storm Sewer



Node ID:	CB11B	CB11A	MH1
Rim (ft):	2616.92	2617.61	2617.65
Invert (ft):	2612.52	2612.34	2610.93
Min Pipe Cover (ft):			4.62
Max HGL (ft):	2613.25	2612.95	2611.75

Link ID:	Pipe14A	Pipe14B
Length (ft):	8.0	21.0
Dia (ft):	1.5	1.5
Slope (ft/ft):	0.0100	0.0433
Up Invert (ft):	2612.52	2612.34
Dn Invert (ft):	2612.44	2611.43
Max Q (cfs):	2.9	4.3
Max Vel (ft/s):	3.83	7.15
Max Depth (ft):	0.64	0.54

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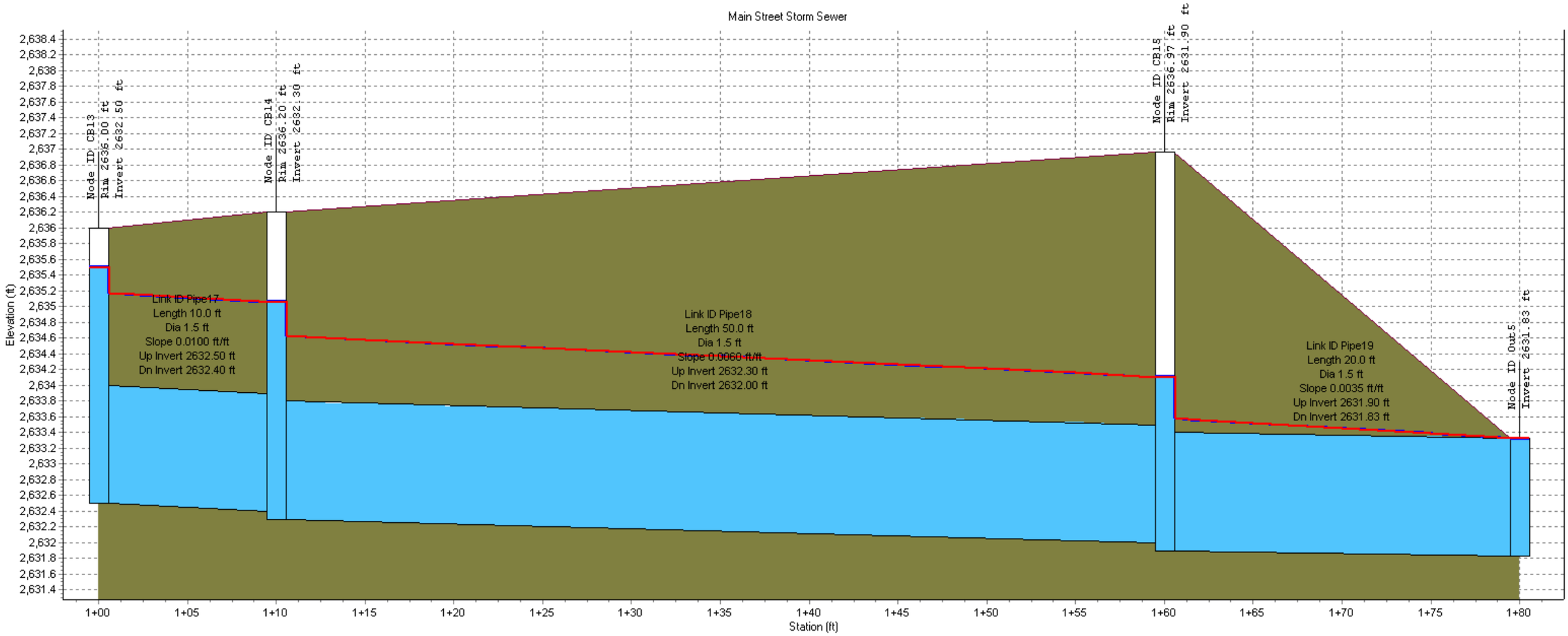
Profile Plot

Main Street Storm Sewer



Node ID:	CB13	CB14	CB15	Out5
Rim (ft):	2636.00	2636.20	2636.97	
Invert (ft):	2632.50	2632.30	2631.90	2631.83
Min Pipe Cover (ft):				
Max HGL (ft):	2635.50	2635.06	2634.11	2633.33

Link ID:	Pipe17	Pipe18	Pipe19
Length (ft):	10.0	50.0	20.0
Dia (ft):	1.5	1.5	1.5
Slope (ft/ft):	0.0100	0.0060	0.0035
Up Invert (ft):	2632.50	2632.30	2631.90
Dn Invert (ft):	2632.40	2632.00	2631.83
Max Q (cfs):	10.2	9.5	10.5
Max Vel (ft/s):	5.98	5.55	5.95
Max Depth (ft):	1.50	1.50	1.50

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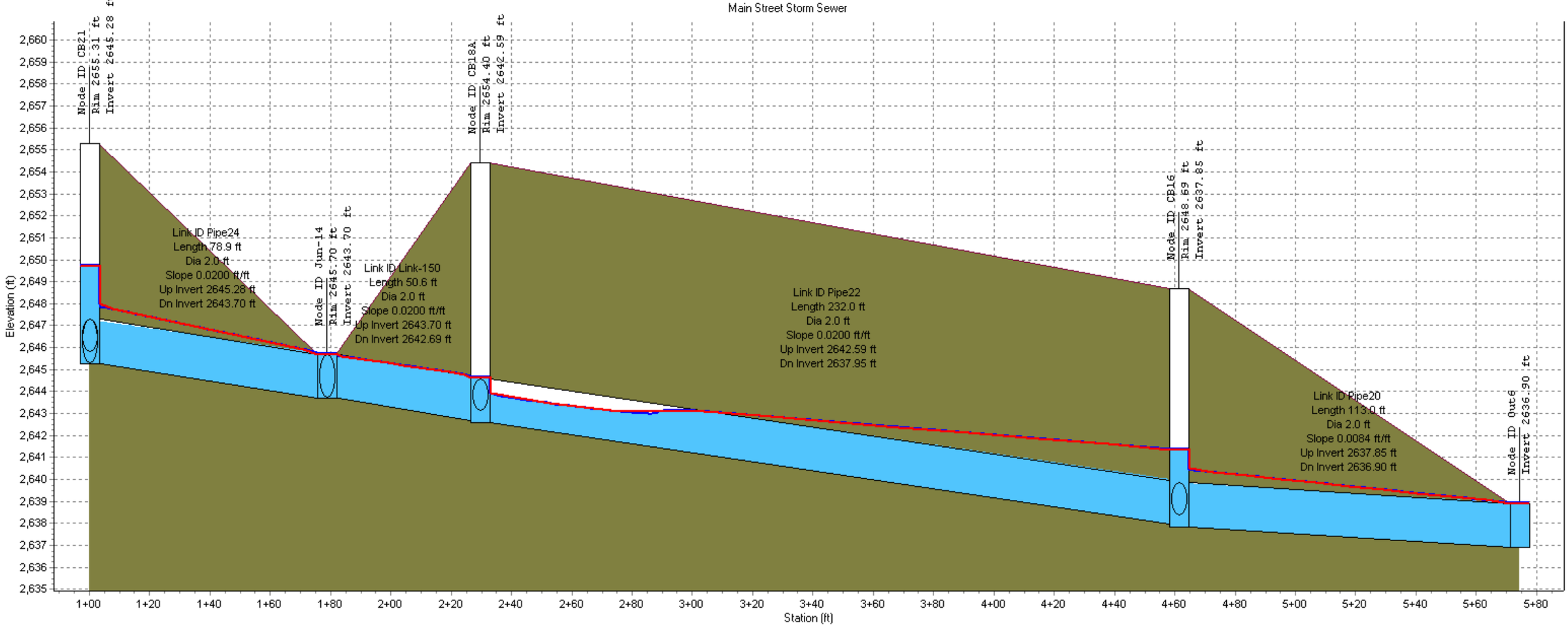
Profile Plot

Main Street Storm Sewer

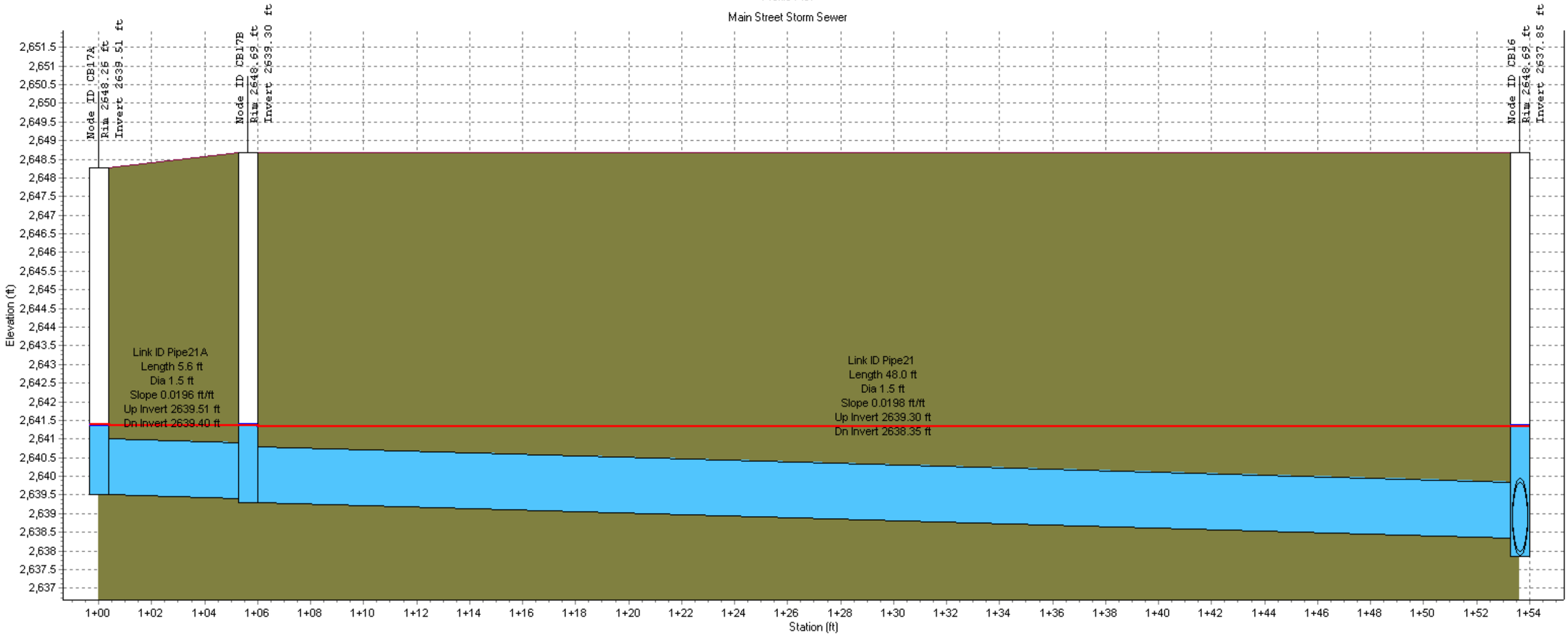


Node ID:	CB21	Jun-14	CB18A	CB16	Out6
Rim (ft):	2655.31	2645.70	2654.40	2648.69	
Invert (ft):	2645.28	2643.70	2642.59	2637.85	2636.90
Min Pipe Cover (ft):		0.00			
Max HGL (ft):	2649.72	2645.70	2644.62	2641.34	2638.90

Link ID:	Pipe24	Link-150	Pipe22	Pipe20
Length (ft):	78.9	50.6	232.0	113.0
Dia (ft):	2.0	2.0	2.0	2.0
Slope (ft/ft):	0.0200	0.0200	0.0200	0.0084
Up Invert (ft):	2645.28	2643.70	2642.59	2637.85
Dn Invert (ft):	2643.70	2642.69	2637.95	2636.90
Max Q (cfs):	33.8	22.1	22.9	24.3
Max Vel (ft/s):	10.75	7.88	7.99	7.72
Max Depth (ft):	2.00	1.97	2.00	2.00

Profile Plot

Main Street Storm Sewer



Node ID:	CB17A	CB17B	CB16
Rim (ft):	2648.26	2648.69	2648.69
Invert (ft):	2639.51	2639.30	2637.85
Min Pipe Cover (ft):			
Max HGL (ft):	2641.38	2641.38	2641.34

Link ID:	Pipe21A	Pipe21
Length (ft):	5.6	48.0
Dia (ft):	1.5	1.5
Slope (ft/ft):	0.0196	0.0198
Up Invert (ft):	2639.51	2639.30
Dn Invert (ft):	2639.40	2638.35
Max Q (cfs):	4.6	4.0
Max Vel (ft/s):	3.45	4.08
Max Depth (ft):	1.50	1.50

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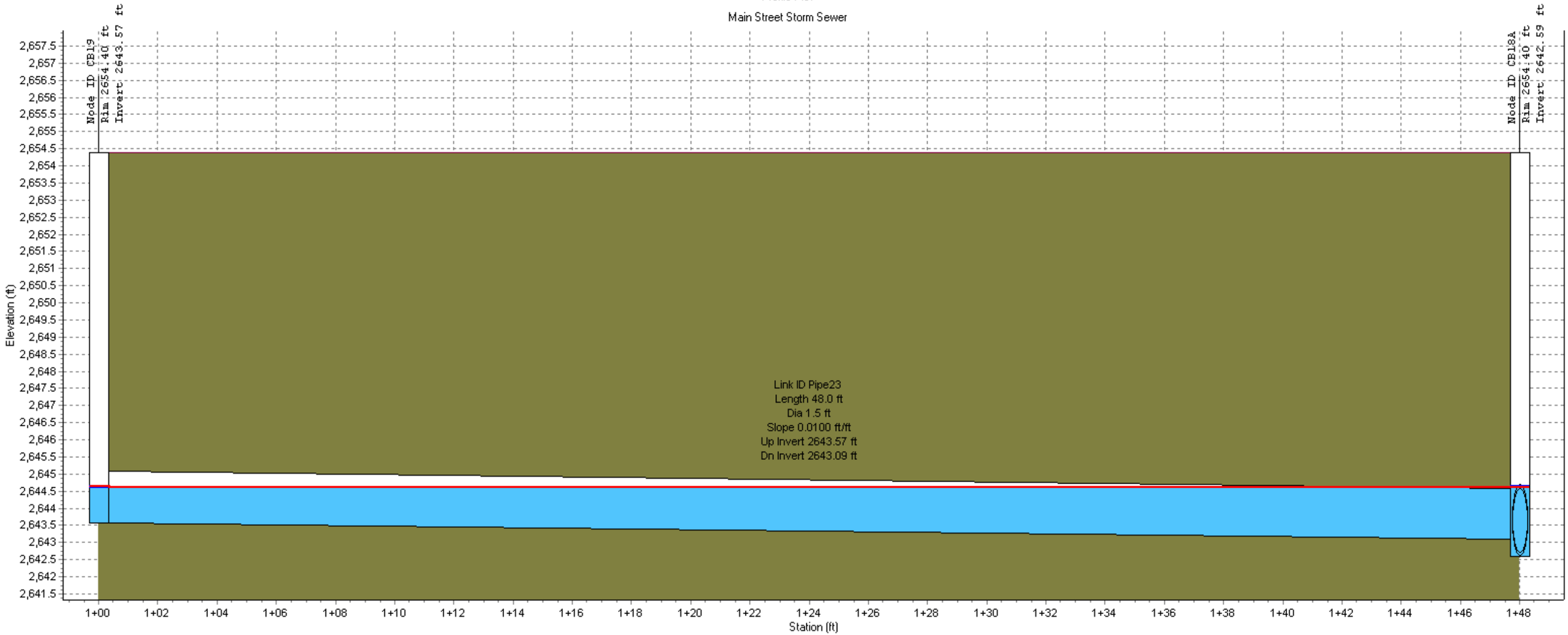
Profile Plot

Main Street Storm Sewer

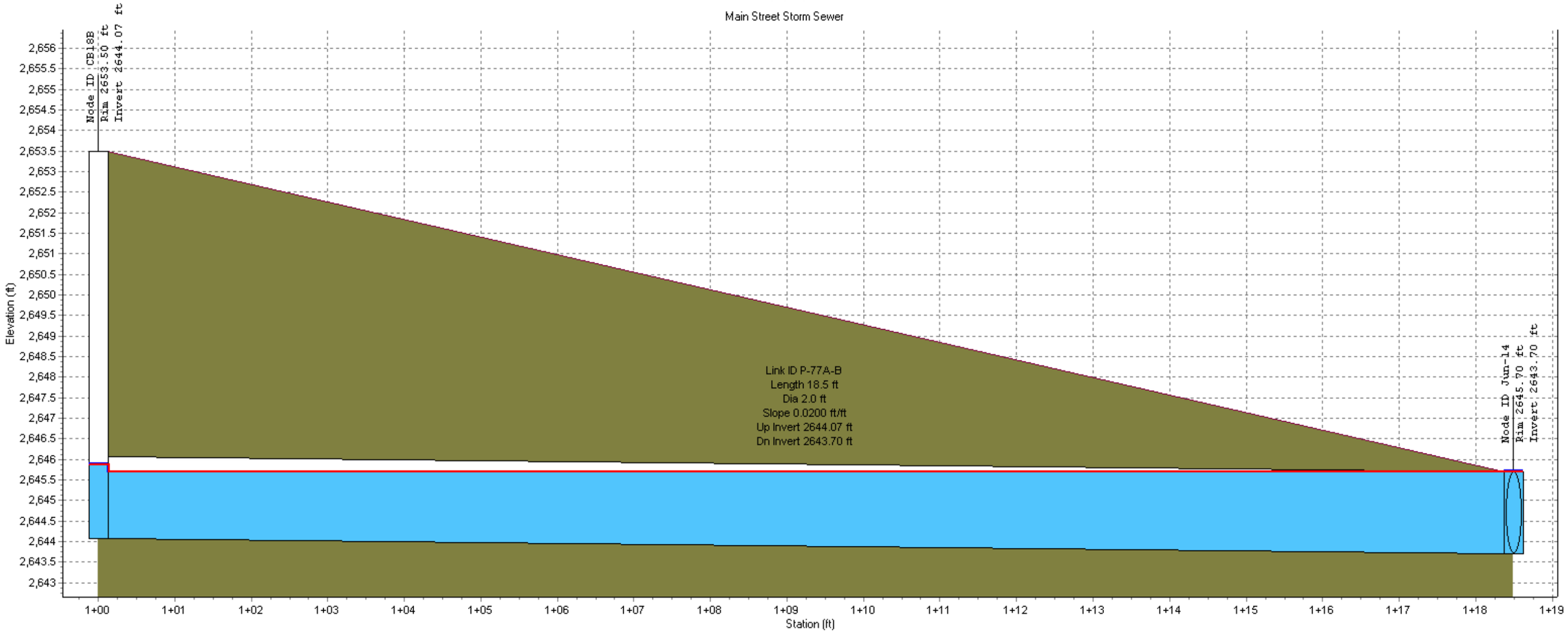


Node ID:	CB19	CB18A
Rim (ft):	2654.40	2654.40
Invert (ft):	2643.57	2642.59
Min Pipe Cover (ft):		
Max HGL (ft):	2644.63	2644.62

Link ID:	Pipe23
Length (ft):	48.0
Dia (ft):	1.5
Slope (ft/ft):	0.0100
Up Invert (ft):	2643.57
Dn Invert (ft):	2643.09
Max Q (cfs):	1.5
Max Vel (ft/s):	2.15
Max Depth (ft):	1.28

Profile Plot

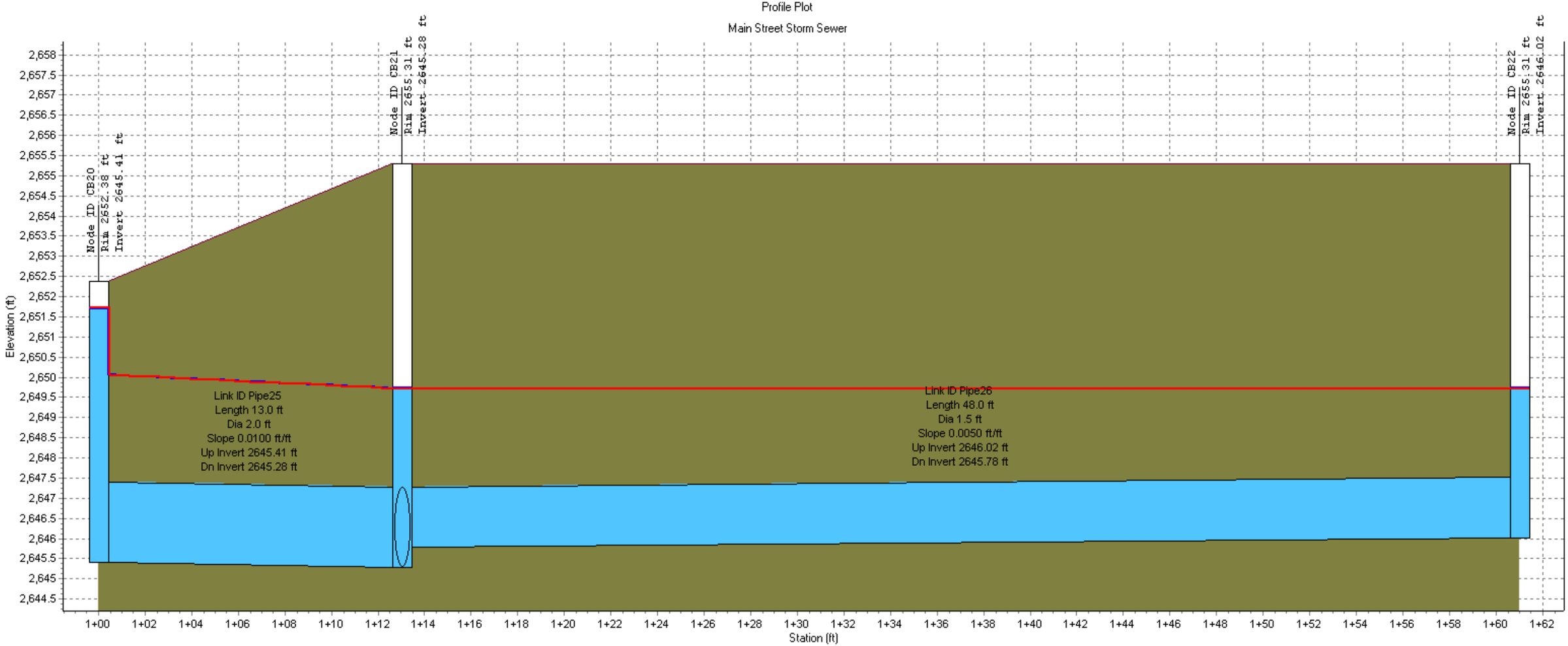
Main Street Storm Sewer



Node ID:	CB18B		Jun-14
Rim (ft):	2653.50		2645.70
Invert (ft):	2644.07		2643.70
Min Pipe Cover (ft):			0.00
Max HGL (ft):	2645.88		2645.70
Link ID:		P-77A-B	
Length (ft):		18.5	
Dia (ft):		2.0	
Slope (ft/ft):		0.0200	
Up Invert (ft):		2644.07	
Dn Invert (ft):		2643.70	
Max Q (cfs):		14.6	
Max Vel (ft/s):		6.35	
Max Depth (ft):		1.90	

Profile Plot

Main Street Storm Sewer

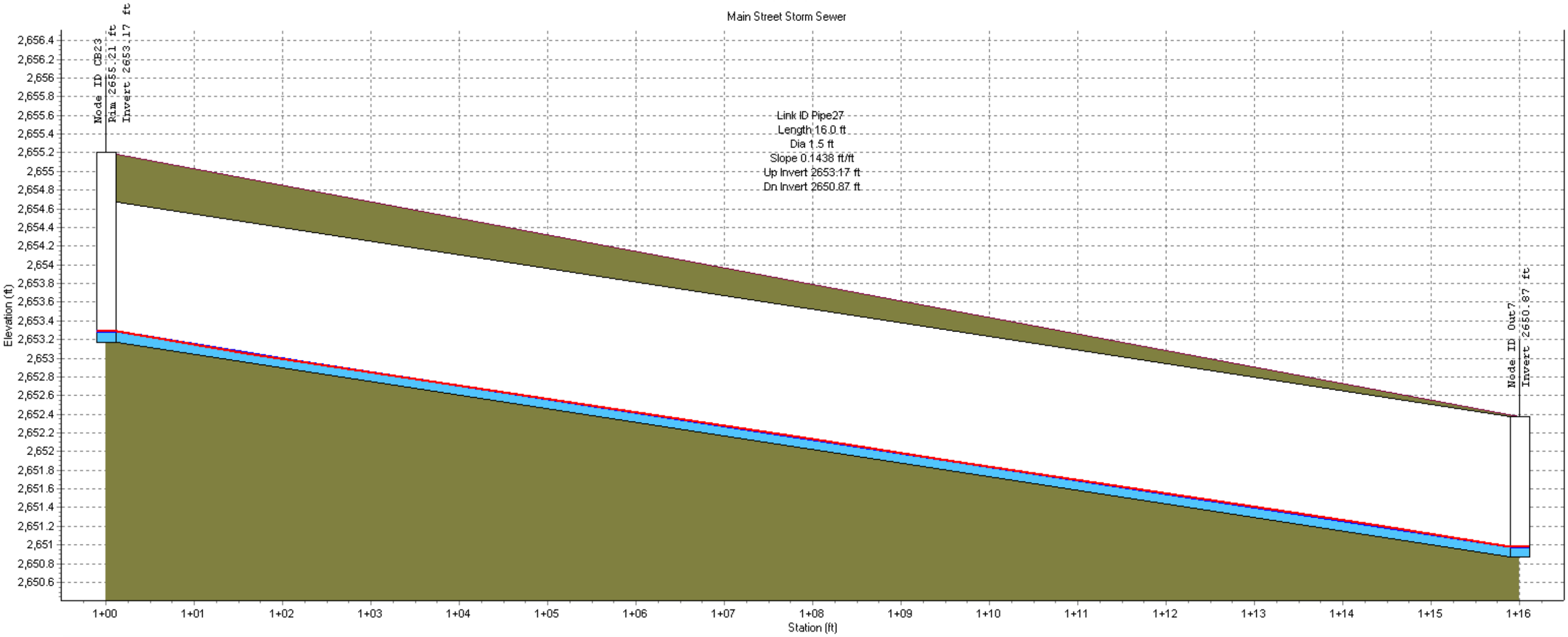


Node ID:	CB20	CB21	CB22
Rim (ft):	2652.38	2655.31	2655.31
Invert (ft):	2645.41	2645.28	2646.02
Min Pipe Cover (ft):			
Max HGL (ft):	2651.72	2649.72	2649.72

Link ID:	Pipe25	Pipe26
Length (ft):	13.0	48.0
Dia (ft):	2.0	1.5
Slope (ft/ft):	0.0100	0.0050
Up Invert (ft):	2645.41	2646.02
Dn Invert (ft):	2645.28	2645.78
Max Q (cfs):	35.4	10.3
Max Vel (ft/s):	12.95	6.81
Max Depth (ft):	2.00	1.50

Profile Plot

Main Street Storm Sewer



Node ID:	CB23		Out7
Rim (ft):	2655.21		
Invert (ft):	2653.17		2650.87
Min Pipe Cover (ft):			
Max HGL (ft):	2653.29		2650.98
Link ID:		Pipe27	
Length (ft):		16.0	
Dia (ft):		1.5	
Slope (ft/ft):		0.1438	
Up Invert (ft):		2653.17	
Dn Invert (ft):		2650.87	
Max Q (cfs):		0.4	
Max Vel (ft/s):		6.12	
Max Depth (ft):		0.11	

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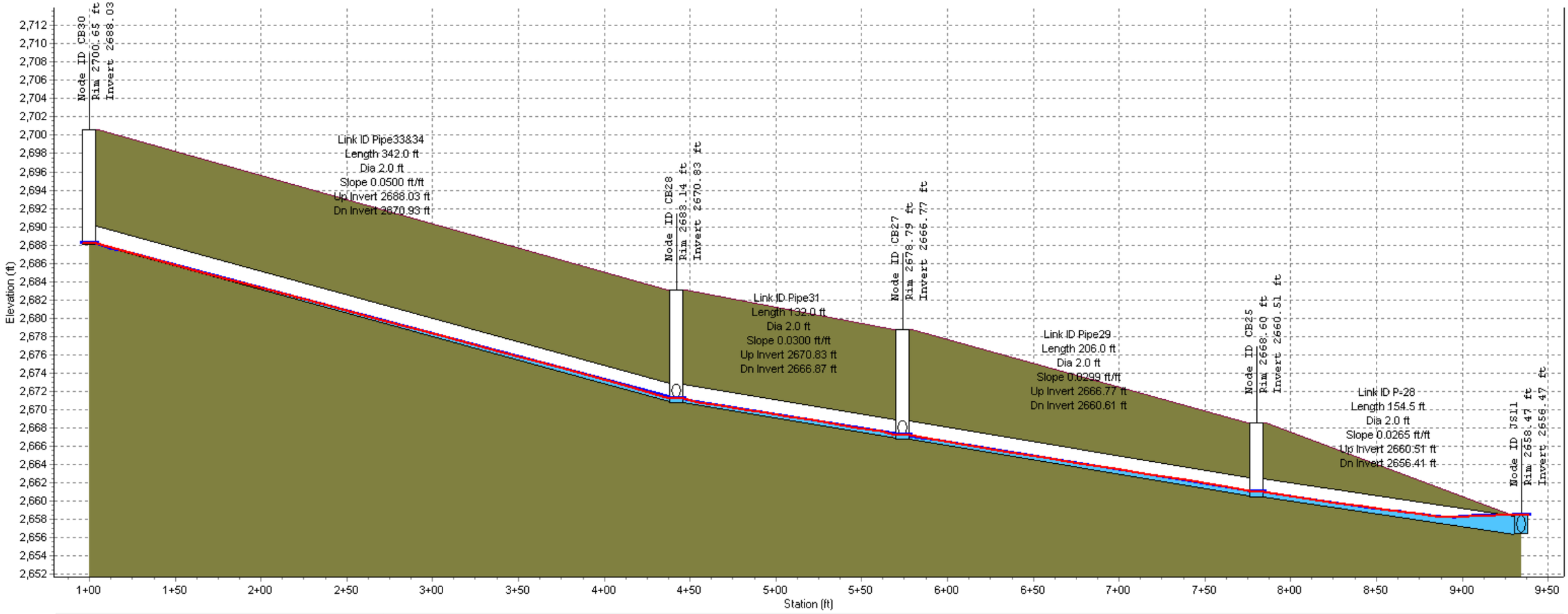
Profile Plot

Main Street Storm Sewer



Node ID:	CB30	CB28	CB27	CB25	JS11
Rim (ft):	2700.65	2683.14	2678.79	2668.60	2658.47
Invert (ft):	2688.03	2670.83	2666.77	2660.51	2656.47
Min Pipe Cover (ft):					0.00
Max HGL (ft):	2688.21	2671.23	2667.27	2661.06	2658.47

Link ID:	Pipe33&34	Pipe31	Pipe29	P-28
Length (ft):	342.0	132.0	206.0	154.5
Dia (ft):	2.0	2.0	2.0	2.0
Slope (ft/ft):	0.0500	0.0300	0.0299	0.0265
Up Invert (ft):	2688.03	2670.83	2666.77	2660.51
Dn Invert (ft):	2670.93	2666.87	2660.61	2656.41
Max Q (cfs):	0.8	2.7	4.3	5.2
Max Vel (ft/s):	4.19	6.19	7.20	2.48
Max Depth (ft):	0.24	0.40	0.49	1.27

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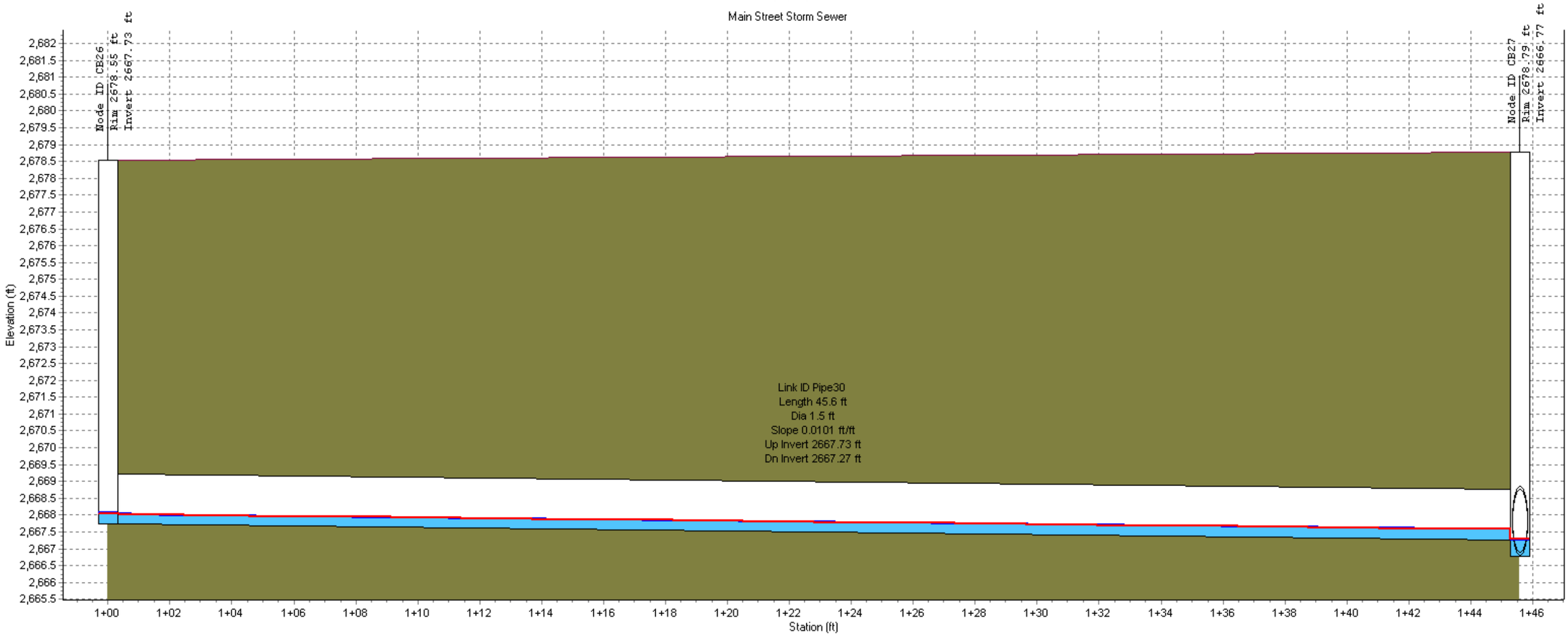
Profile Plot

Main Street Storm Sewer

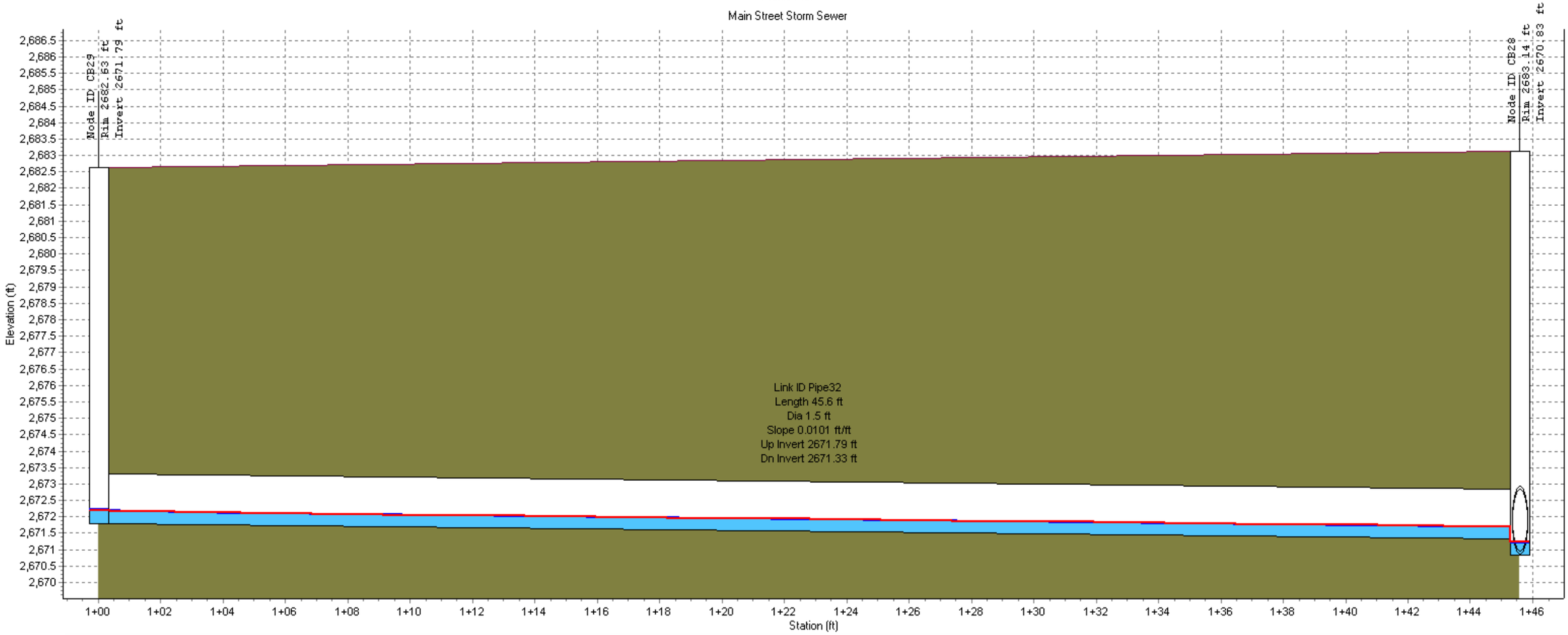


Node ID:	CB26	CB27
Rim (ft):	2678.55	2678.79
Invert (ft):	2667.73	2666.77
Min Pipe Cover (ft):		
Max HGL (ft):	2668.05	2667.27

Link ID:	Pipe30
Length (ft):	45.6
Dia (ft):	1.5
Slope (ft/ft):	0.0101
Up Invert (ft):	2667.73
Dn Invert (ft):	2667.27
Max Q (cfs):	0.8
Max Vel (ft/s):	3.00
Max Depth (ft):	0.31

Profile Plot

Main Street Storm Sewer



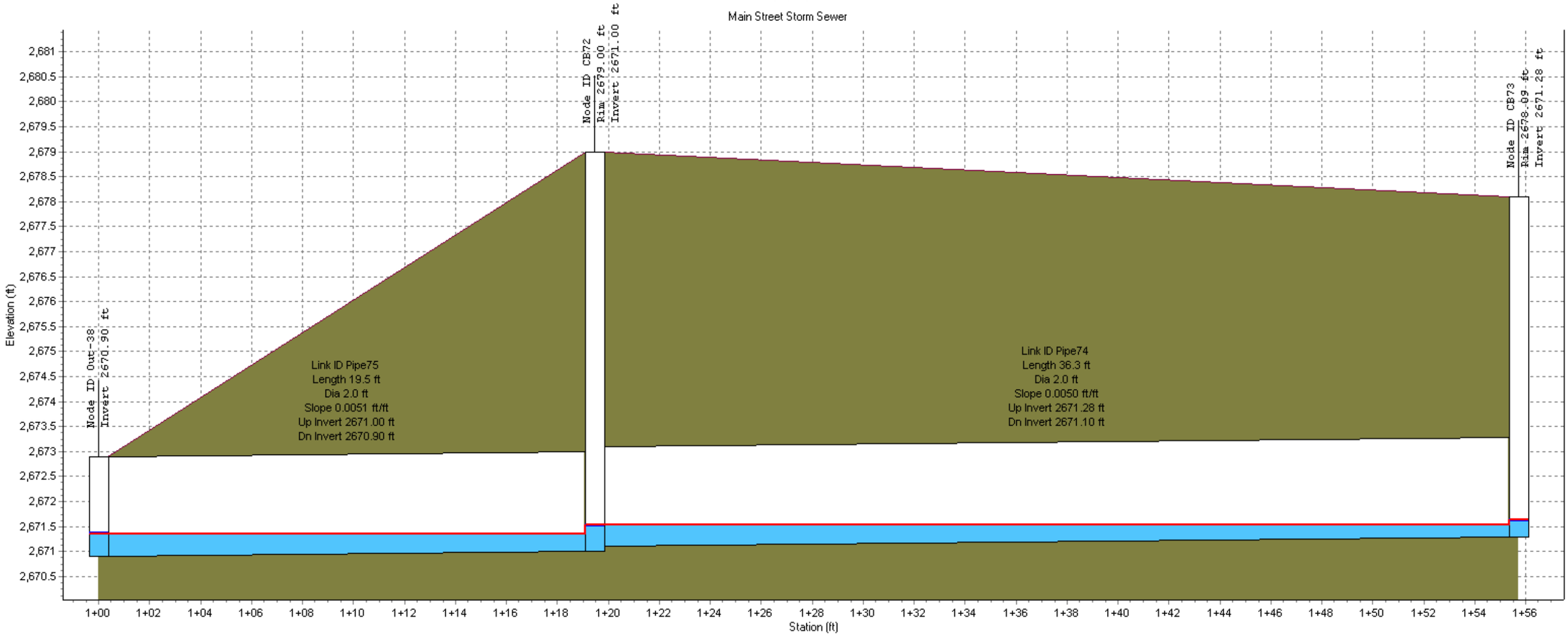
Node ID:	CB29	CB28
Rim (ft):	2682.63	2683.14
Invert (ft):	2671.79	2670.83
Min Pipe Cover (ft):		
Max HGL (ft):	2672.20	2671.23

Link ID:	Pipe32
Length (ft):	45.6
Dia (ft):	1.5
Slope (ft/ft):	0.0101
Up Invert (ft):	2671.79
Dn Invert (ft):	2671.33
Max Q (cfs):	1.3
Max Vel (ft/s):	3.38
Max Depth (ft):	0.39

11-10-2018 (10:43 AM)

Profile Plot

Main Street Storm Sewer



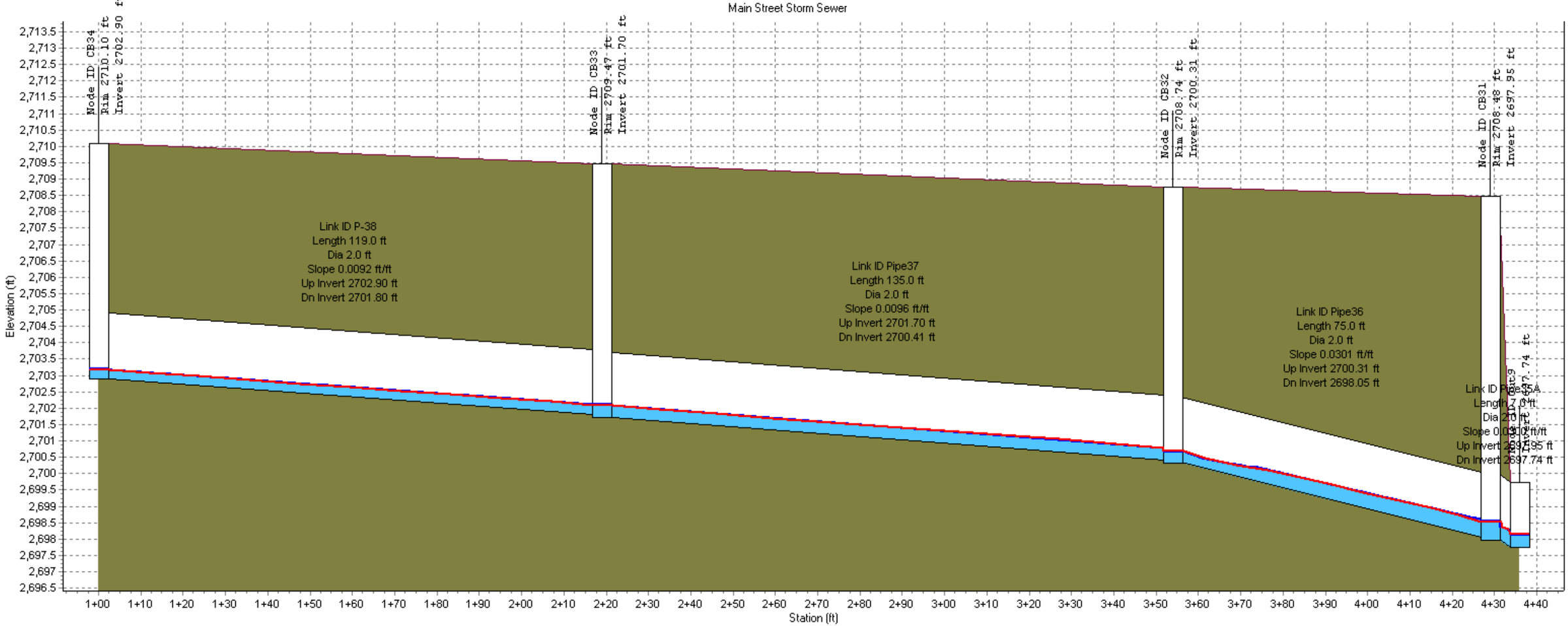
Node ID:	Out-38	CB72	CB73
Rim (ft):		2679.00	2678.09
Invert (ft):	2670.90	2671.00	2671.28
Min Pipe Cover (ft):			
Max HGL (ft):	2671.35	2671.53	2671.63

Link ID:	Pipe75	Pipe74
Length (ft):	19.5	36.3
Dia (ft):	2.0	2.0
Slope (ft/ft):	0.0051	0.0050
Up Invert (ft):	2671.00	2671.28
Dn Invert (ft):	2670.90	2671.10
Max Q (cfs):	1.5	0.8
Max Vel (ft/s):	2.59	1.91
Max Depth (ft):	0.49	0.39

11-10-2018 (10:43 AM)

Profile Plot

Main Street Storm Sewer



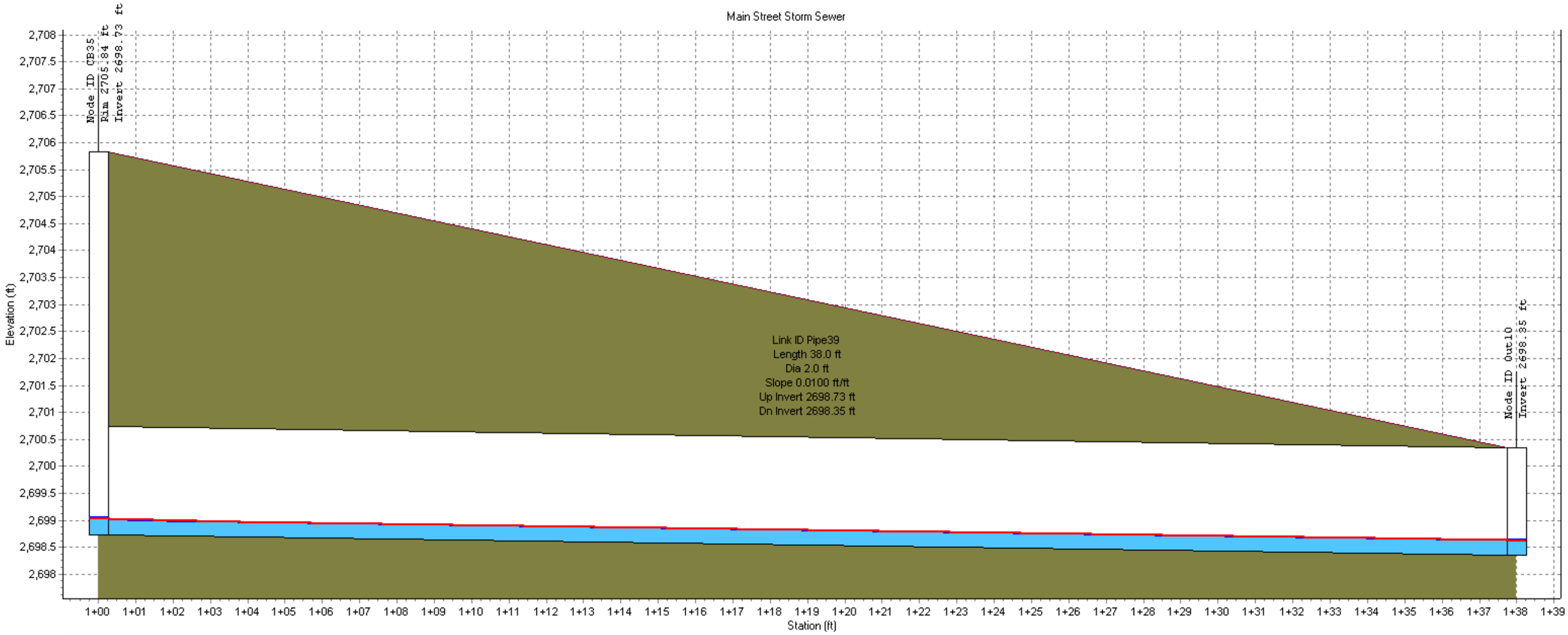
Node ID:	CB34	CB33	CB32	CB31 Out9
Rim (ft):	2710.10	2709.47	2708.74	2708.48
Invert (ft):	2702.90	2701.70	2700.31	2697.95 2697.74
Min Pipe Cover (ft):				
Max HGL (ft):	2703.17	2702.09	2700.68	2698.52 2698.14

Link ID:	P-38	Pipe37	Pipe36	Pipe35A
Length (ft):	119.0	135.0	75.0	7.0
Dia (ft):	2.0	2.0	2.0	2.0
Slope (ft/ft):	0.0092	0.0096	0.0301	0.0300
Up Invert (ft):	2702.90	2701.70	2700.31	2697.95
Dn Invert (ft):	2701.80	2700.41	2698.05	2697.74
Max Q (cfs):	0.7	1.5	2.4	2.9
Max Vel (ft/s):	2.71	3.50	5.00	4.99
Max Depth (ft):	0.28	0.38	0.42	0.49

11-10-2018 (10:43 AM)

Profile Plot

Main Street Storm Sewer



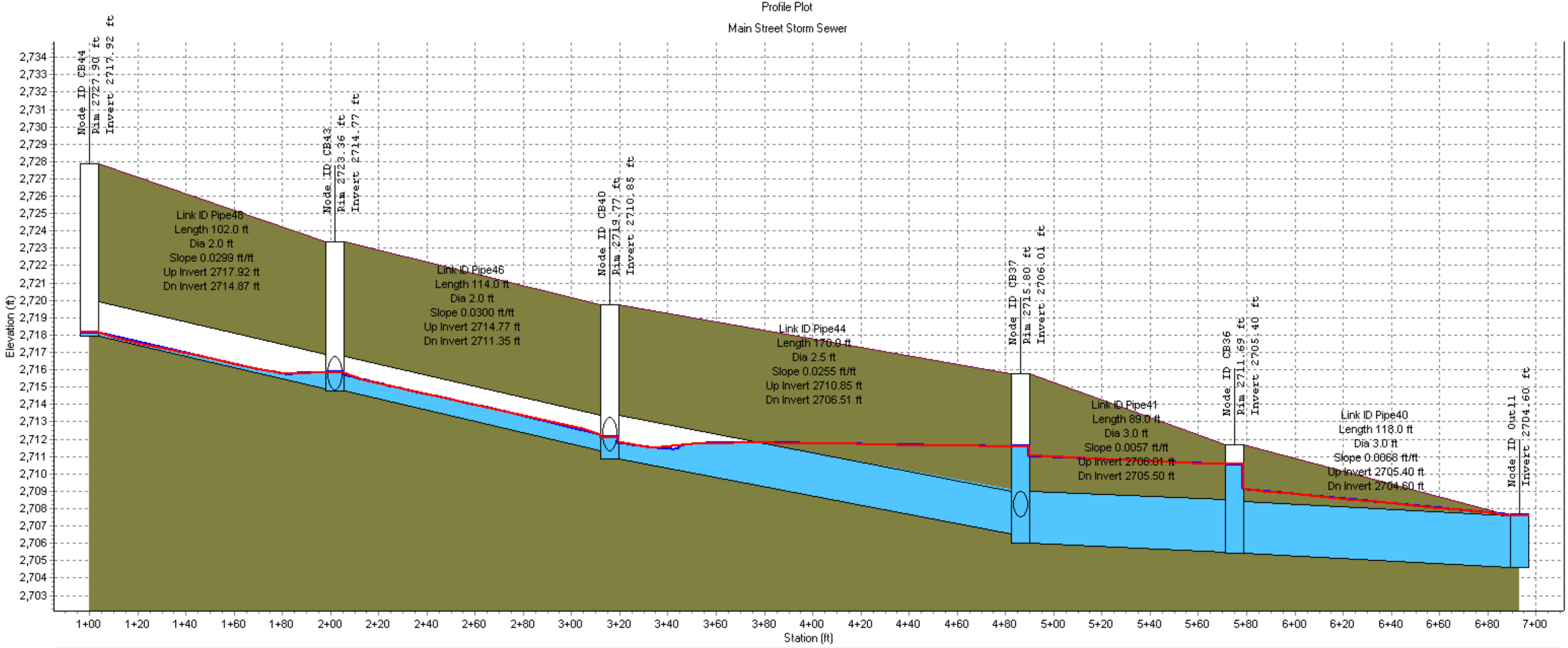
Node ID:	CB35	Out10
Rim (ft):	2705.84	
Invert (ft):	2698.73	2698.35
Min Pipe Cover (ft):		
Max HGL (ft):	2699.03	2698.63

Link ID:	Pipe39
Length (ft):	38.0
Dia (ft):	2.0
Slope (ft/ft):	0.0100
Up Invert (ft):	2698.73
Dn Invert (ft):	2698.35
Max Q (cfs):	0.8
Max Vel (ft/s):	2.92
Max Depth (ft):	0.29

11-10-2018 (10:43 AM)

Profile Plot

Main Street Storm Sewer

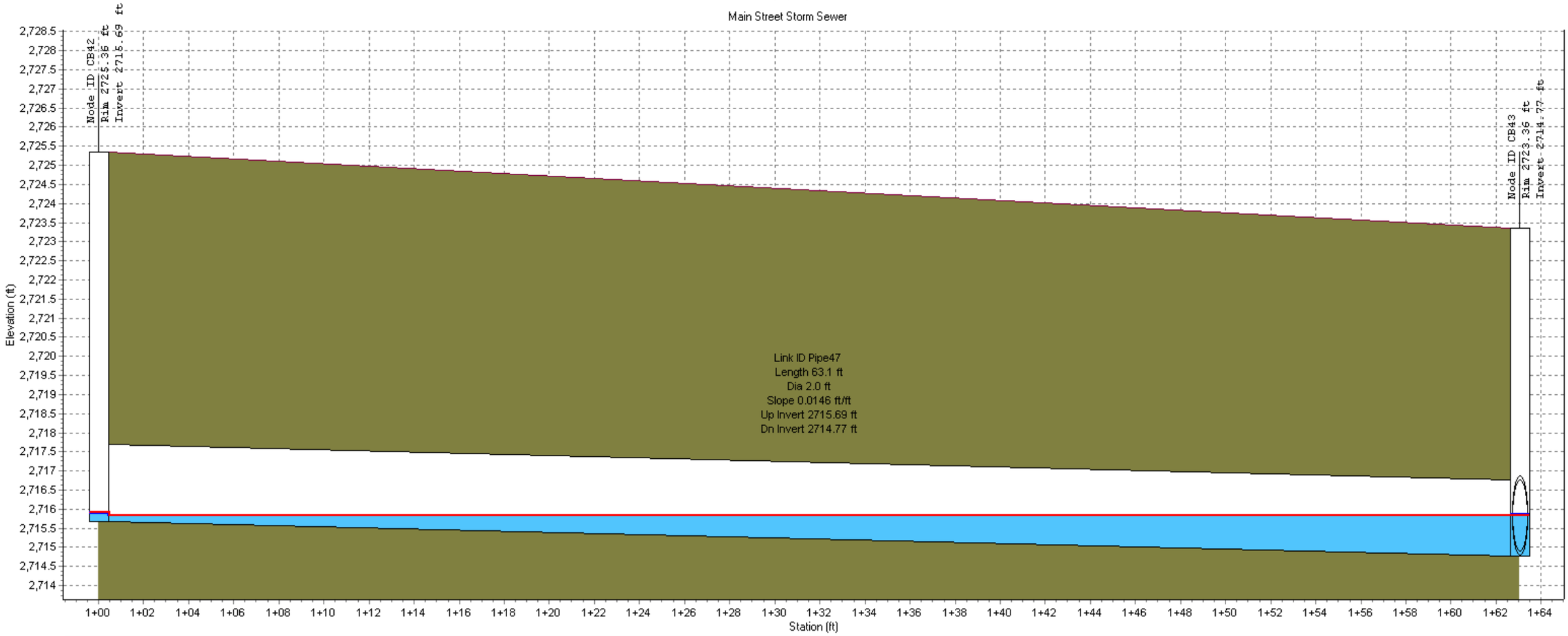


Node ID:	CB44	CB43	CB40	CB37	CB36	Out11
Rim (ft):	2727.90	2723.36	2719.77	2715.80	2711.69	
Invert (ft):	2717.92	2714.77	2710.85	2706.01	2705.40	2704.60
Min Pipe Cover (ft):						
Max HGL (ft):	2718.15	2715.84	2712.10	2711.56	2710.55	2707.60

Link ID:	Pipe48	Pipe46	Pipe44	Pipe41	Pipe40
Length (ft):	102.0	114.0	170.0	89.0	118.0
Dia (ft):	2.0	2.0	2.5	3.0	3.0
Slope (ft/ft):	0.0299	0.0300	0.0255	0.0057	0.0068
Up Invert (ft):	2717.92	2714.77	2710.85	2706.01	2705.40
Dn Invert (ft):	2714.87	2711.35	2706.51	2705.50	2704.60
Max Q (cfs):	1.0	14.9	17.0	41.9	67.5
Max Vel (ft/s):	1.30	9.48	4.30	5.93	9.55
Max Depth (ft):	0.60	1.00	1.87	3.00	3.00

Profile Plot

Main Street Storm Sewer



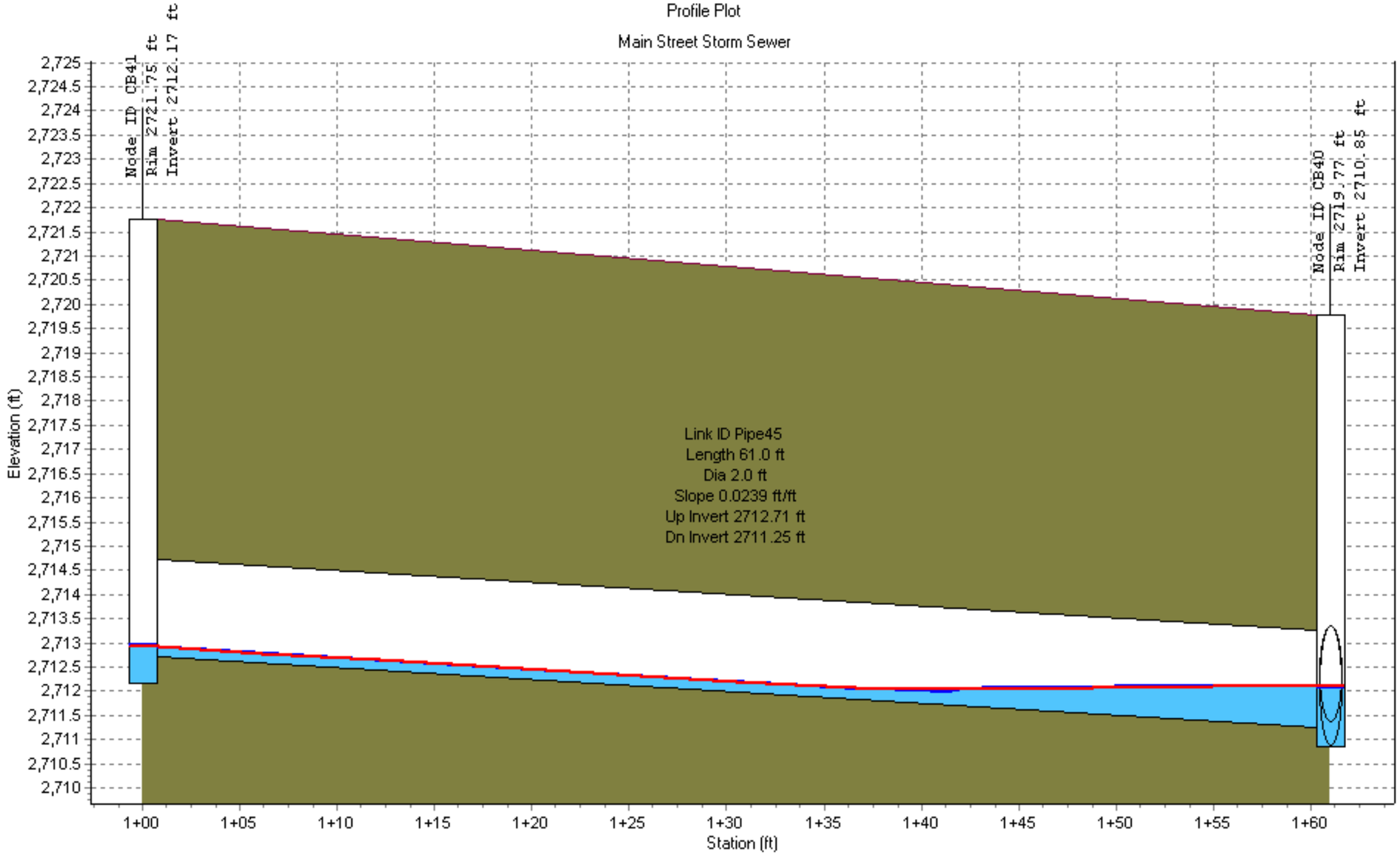
Node ID:	CB42	CB43
Rim (ft):	2725.36	2723.36
Invert (ft):	2715.69	2714.77
Min Pipe Cover (ft):		
Max HGL (ft):	2715.91	2715.84

Link ID:	Pipe47
Length (ft):	63.1
Dia (ft):	2.0
Slope (ft/ft):	0.0146
Up Invert (ft):	2715.69
Dn Invert (ft):	2714.77
Max Q (cfs):	0.6
Max Vel (ft/s):	0.68
Max Depth (ft):	0.65

11-10-2018 (10:43 AM)

Profile Plot

Main Street Storm Sewer

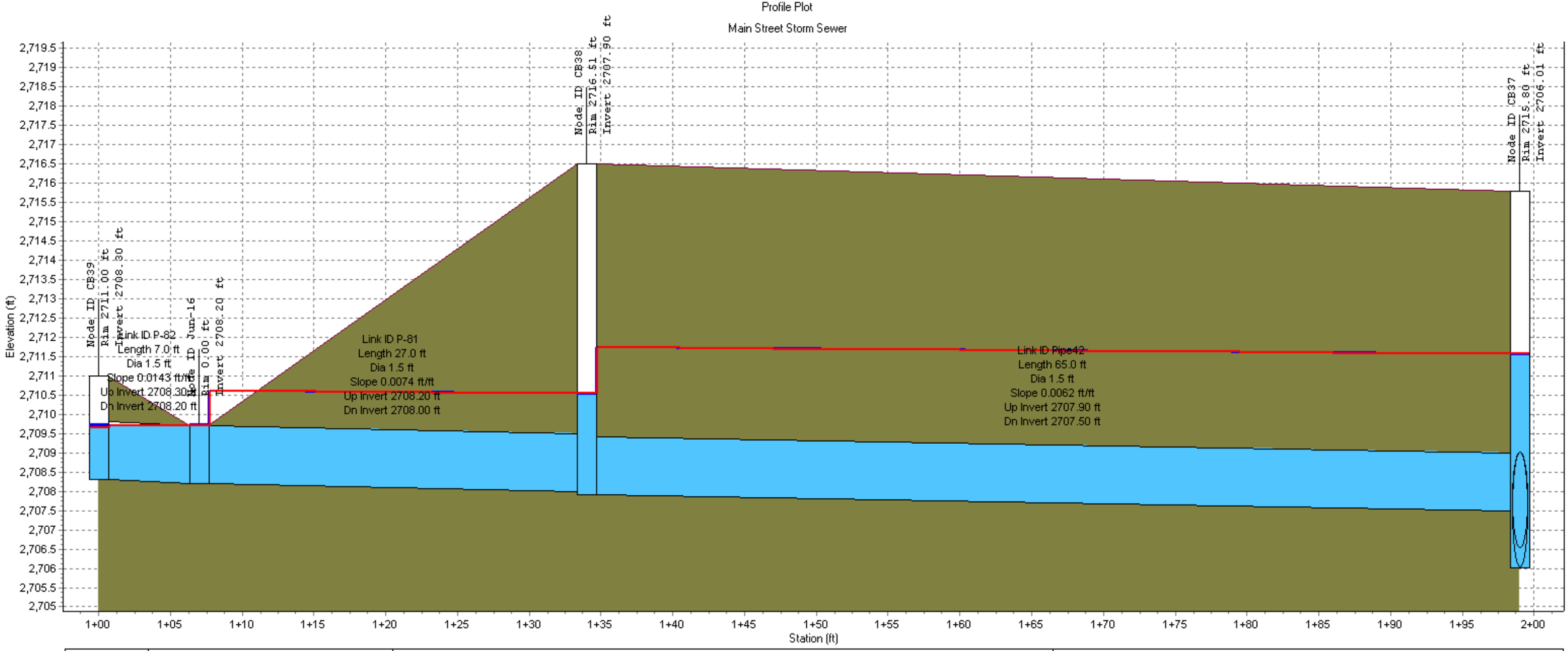


Node ID:	CB41		CB40
Rim (ft):	2721.75		2719.77
Invert (ft):	2712.17		2710.85
Min Pipe Cover (ft):			
Max HGL (ft):	2712.93		2712.10
Link ID:		Pipe45	
Length (ft):		61.0	
Dia (ft):		2.0	
Slope (ft/ft):		0.0239	
Up Invert (ft):		2712.71	
Dn Invert (ft):		2711.25	
Max Q (cfs):		0.8	
Max Vel (ft/s):		2.58	
Max Depth (ft):		0.54	

11-10-2018 (10:43 AM)

Profile Plot

Main Street Storm Sewer

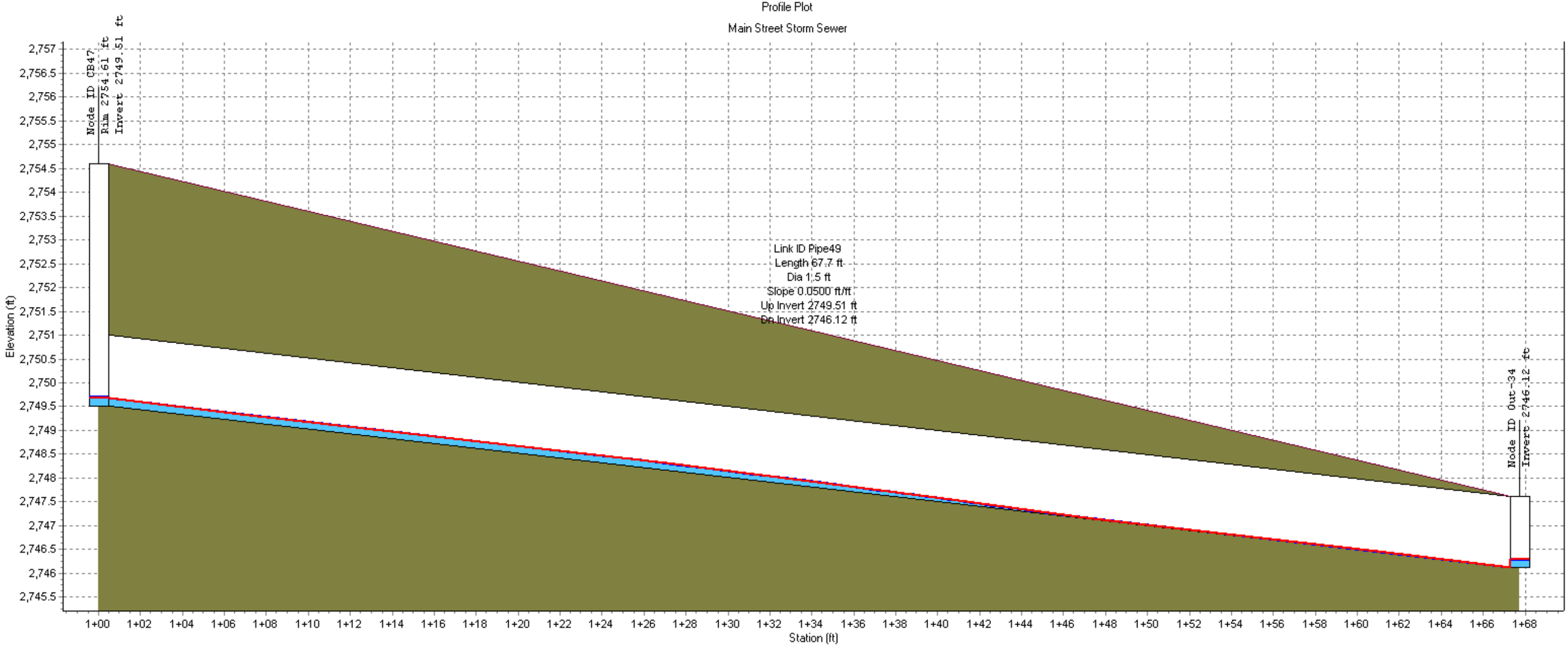


Node ID:	CB39	Jun-16	CB38	CB37
Rim (ft):	2711.00	0.00	2716.51	2715.80
Invert (ft):	2708.30	2708.20	2707.90	2706.01
Min Pipe Cover (ft):		0.00		
Max HGL (ft):	2709.71	2709.70	2710.54	2711.56

Link ID:	P-82	P-81	Pipe42	
Length (ft):	7.0	27.0	65.0	
Dia (ft):	1.5	1.5	1.5	
Slope (ft/ft):	0.0143	0.0074	0.0062	
Up Invert (ft):	2708.30	2708.20	2707.90	
Dn Invert (ft):	2708.20	2708.00	2707.50	
Max Q (cfs):	5.2	10.1	11.7	
Max Vel (ft/s):	3.98	6.43	7.17	
Max Depth (ft):	1.46	1.50	1.50	

Profile Plot

Main Street Storm Sewer

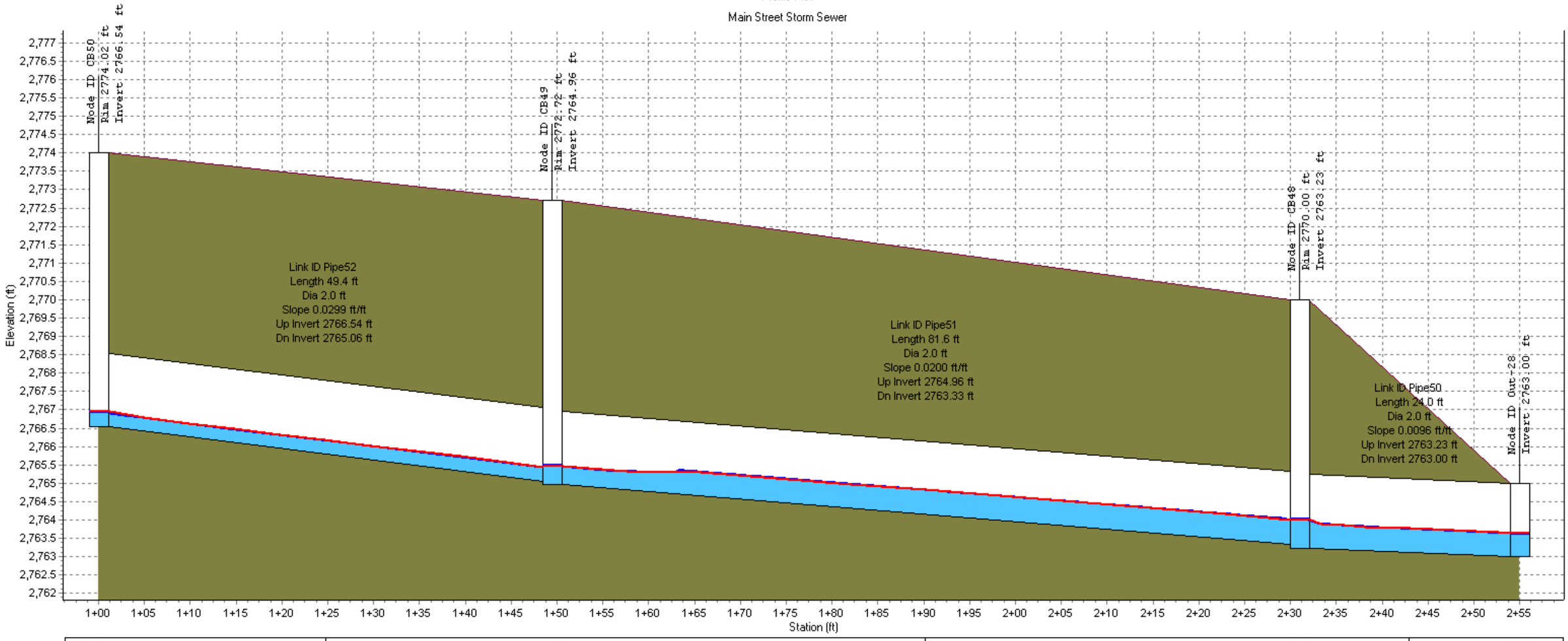


Node ID:	CB47		Out-34
Rim (ft):	2754.61		
Invert (ft):	2749.51		2746.12
Min Pipe Cover (ft):			
Max HGL (ft):	2749.69		2746.29
Link ID:		Pipe49	
Length (ft):		67.7	
Dia (ft):		1.5	
Slope (ft/ft):		0.0500	
Up Invert (ft):		2749.51	
Dn Invert (ft):		2746.12	
Max Q (cfs):		0.6	
Max Vel (ft/s):		4.90	
Max Depth (ft):		0.17	

11-10-2018 (10:43 AM)

Profile Plot

Main Street Storm Sewer



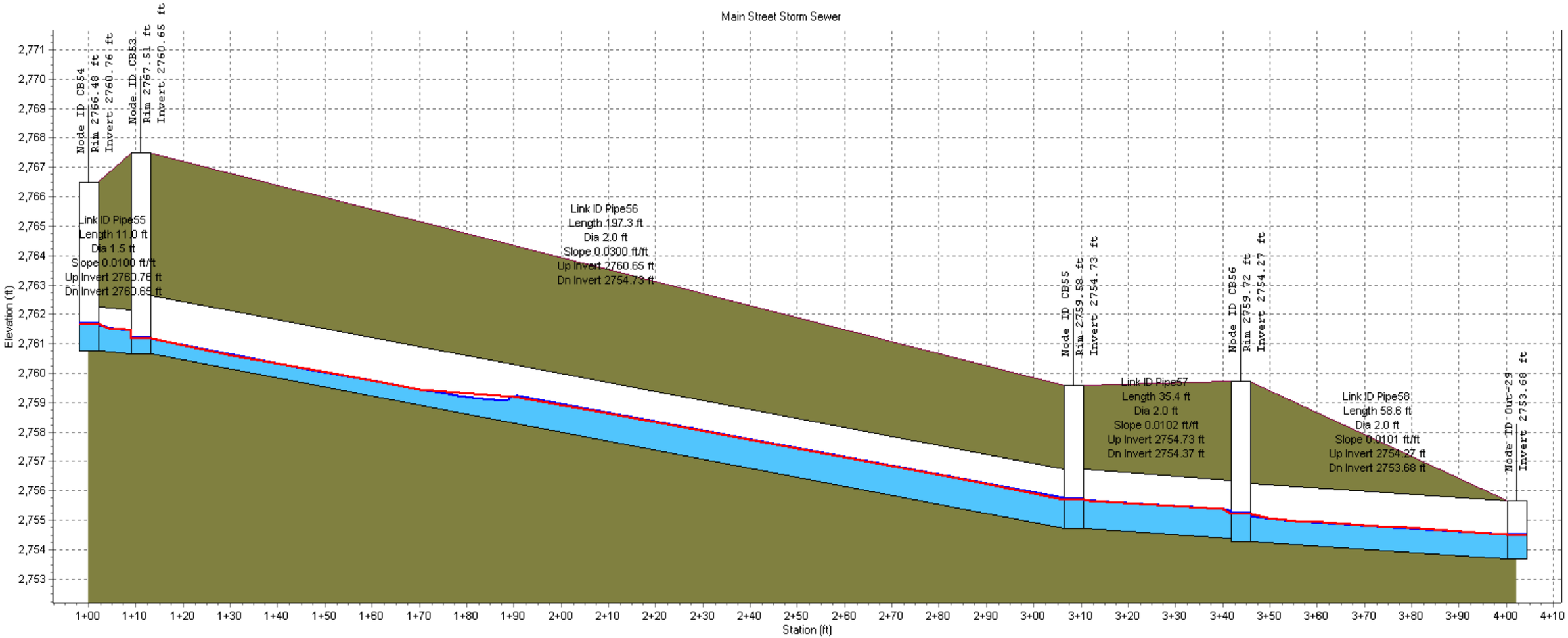
Node ID:	CB50	CB49	CB48	Out-28
Rim (ft):	2774.02	2772.72	2770.00	
Invert (ft):	2766.54	2764.96	2763.23	2763.00
Min Pipe Cover (ft):				
Max HGL (ft):	2766.95	2765.47	2764.00	2763.66

Link ID:	Pipe52	Pipe51	Pipe50
Length (ft):	49.4	81.6	24.0
Dia (ft):	2.0	2.0	2.0
Slope (ft/ft):	0.0299	0.0200	0.0096
Up Invert (ft):	2766.54	2764.96	2763.23
Dn Invert (ft):	2765.06	2763.33	2763.00
Max Q (cfs):	2.7	3.7	4.6
Max Vel (ft/s):	5.60	4.82	4.36
Max Depth (ft):	0.41	0.59	0.70

11-10-2018 (10:43 AM)

Profile Plot

Main Street Storm Sewer



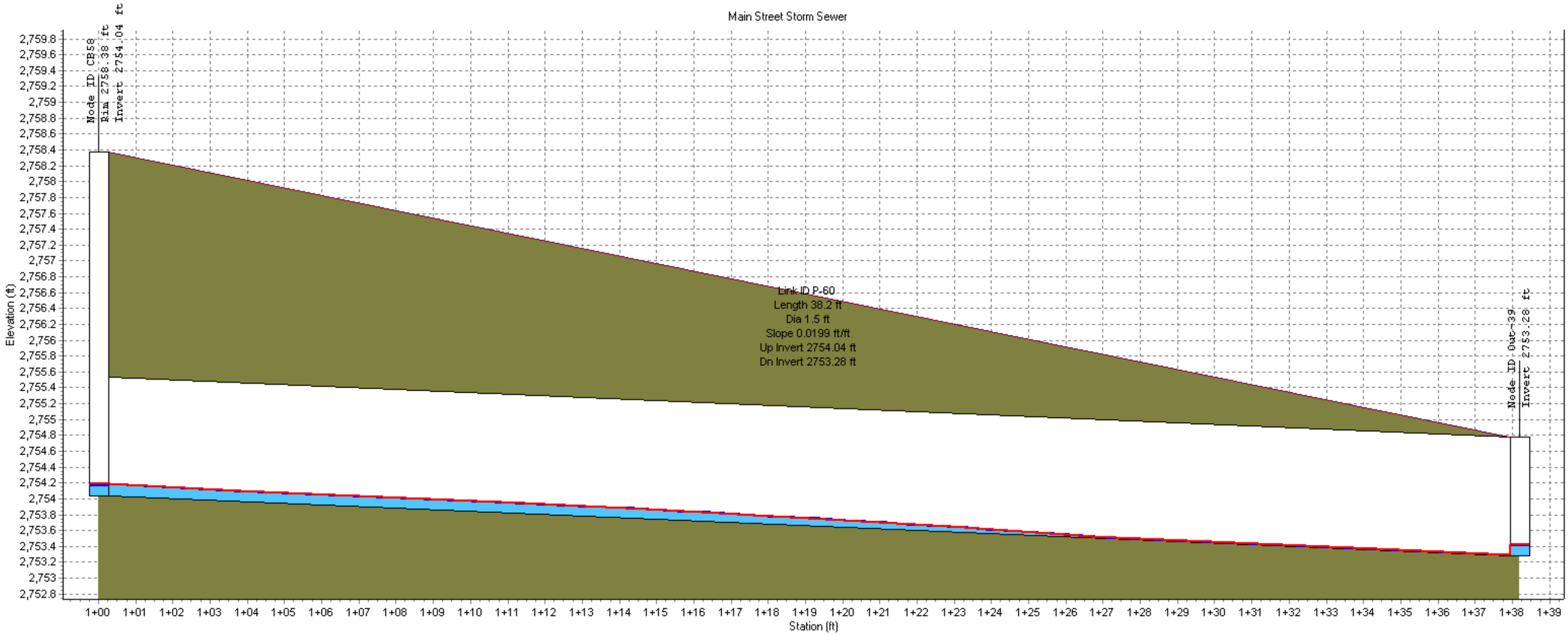
Node ID:	CB54	CB53	CB55	CB56	Out-29
Rim (ft):	2766.48	2767.51	2759.58	2759.72	
Invert (ft):	2760.76	2760.65	2754.73	2754.27	2753.68
Min Pipe Cover (ft):					
Max HGL (ft):	2761.68	2761.19	2755.70	2755.22	2754.49

Link ID:	Pipe55	Pipe56	Pipe57	Pipe58
Length (ft):	11.0	197.3	35.4	58.6
Dia (ft):	1.5	2.0	2.0	2.0
Slope (ft/ft):	0.0100	0.0300	0.0102	0.0101
Up Invert (ft):	2760.76	2760.65	2754.73	2754.27
Dn Invert (ft):	2760.65	2754.73	2754.37	2753.68
Max Q (cfs):	6.5	6.2	6.2	6.8
Max Vel (ft/s):	6.77	8.12	4.47	5.08
Max Depth (ft):	0.73	0.75	0.91	0.88

11-10-2018 (10:43 AM)

Profile Plot

Main Street Storm Sewer

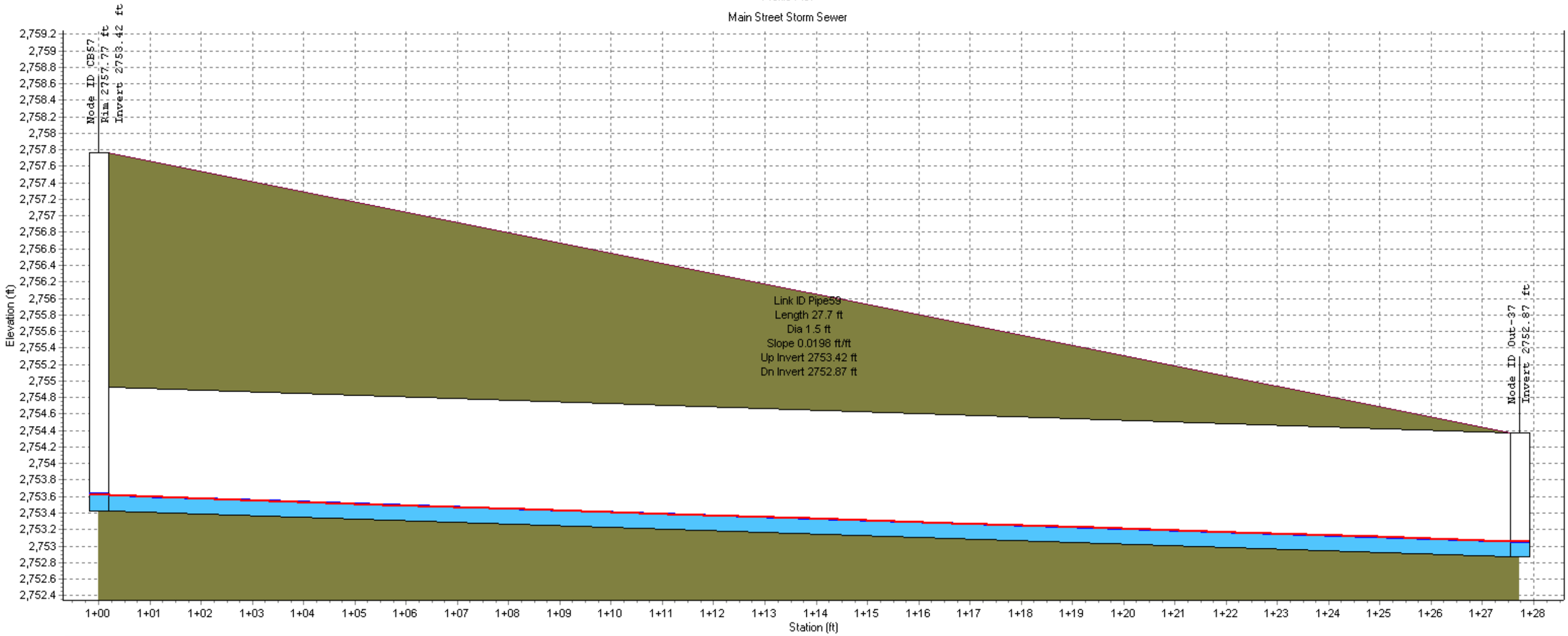


Node ID:	CB58	Out-39
Rim (ft):	2758.38	
Invert (ft):	2754.04	2753.28
Min Pipe Cover (ft):		
Max HGL (ft):	2754.18	2753.42

Link ID:	P-60
Length (ft):	38.2
Dia (ft):	1.5
Slope (ft/ft):	0.0199
Up Invert (ft):	2754.04
Dn Invert (ft):	2753.28
Max Q (cfs):	0.2
Max Vel (ft/s):	2.67
Max Depth (ft):	0.14

Profile Plot

Main Street Storm Sewer

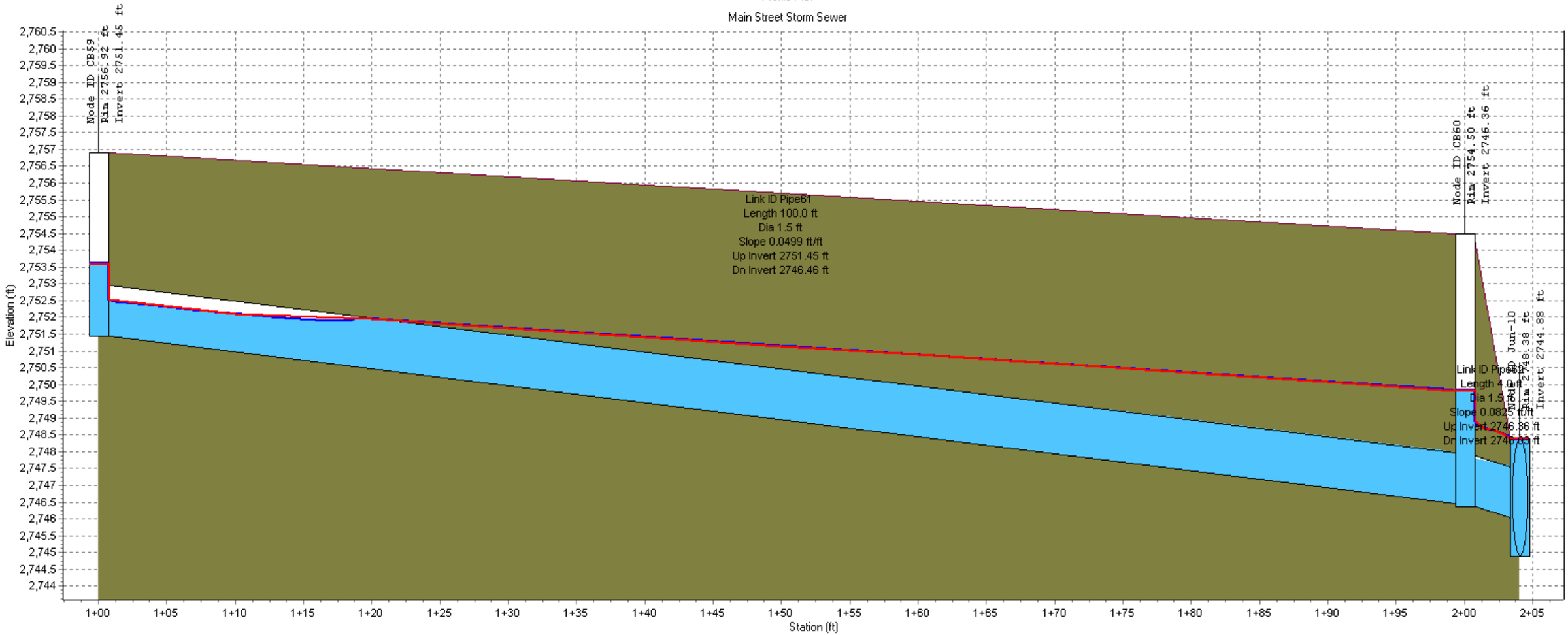


Node ID:	CB57		Out-37
Rim (ft):	2757.77		
Invert (ft):	2753.42		2752.87
Min Pipe Cover (ft):			
Max HGL (ft):	2753.63		2753.06
Link ID:		Pipe59	
Length (ft):		27.7	
Dia (ft):		1.5	
Slope (ft/ft):		0.0198	
Up Invert (ft):		2753.42	
Dn Invert (ft):		2752.87	
Max Q (cfs):		0.5	
Max Vel (ft/s):		3.24	
Max Depth (ft):		0.20	

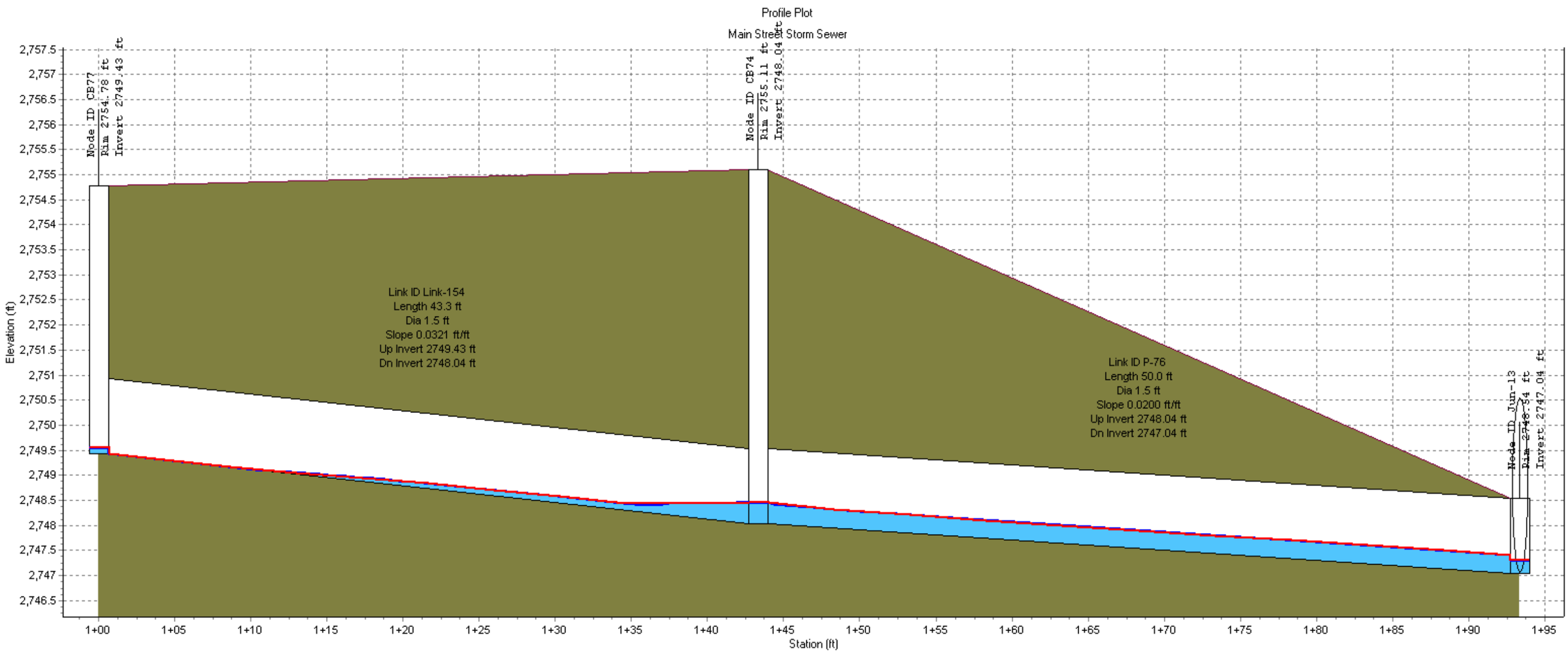
11-10-2018 (10:43 AM)

Profile Plot

Main Street Storm Sewer



Node ID:	CB59		CB60	Jun-10
Rim (ft):	2756.92		2754.50	2748.38
Invert (ft):	2751.45		2746.36	2744.88
Min Pipe Cover (ft):				0.00
Max HGL (ft):	2753.59		2749.82	2748.38
Link ID:		Pipe61	Pipe62	
Length (ft):		100.0	4.0	
Dia (ft):		1.5	1.5	
Slope (ft/ft):		0.0499	0.0825	
Up Invert (ft):		2751.45	2746.36	
Dn Invert (ft):		2746.46	2746.03	
Max Q (cfs):		16.6	16.7	
Max Vel (ft/s):		10.27	9.46	
Max Depth (ft):		1.50	1.50	



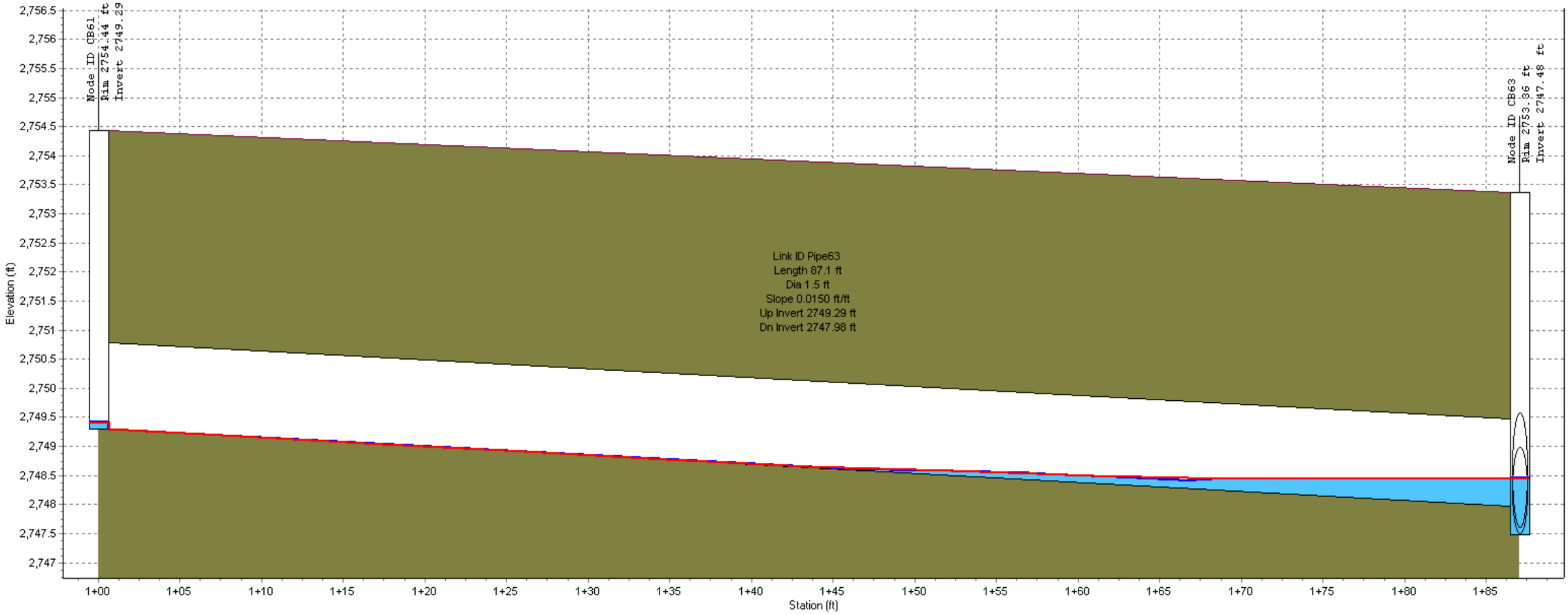
Node ID:	CB77	CB74	Jun-13
Rim (ft):	2754.78	2755.11	2748.54
Invert (ft):	2749.43	2748.04	2747.04
Min Pipe Cover (ft):			0.00
Max HGL (ft):	2749.55	2748.45	2747.30

Link ID:	Link-154	P-76
Length (ft):	43.3	50.0
Dia (ft):	1.5	1.5
Slope (ft/ft):	0.0321	0.0200
Up Invert (ft):	2749.43	2748.04
Dn Invert (ft):	2748.04	2747.04
Max Q (cfs):	0.2	1.7
Max Vel (ft/s):	0.95	6.10
Max Depth (ft):	0.26	0.33

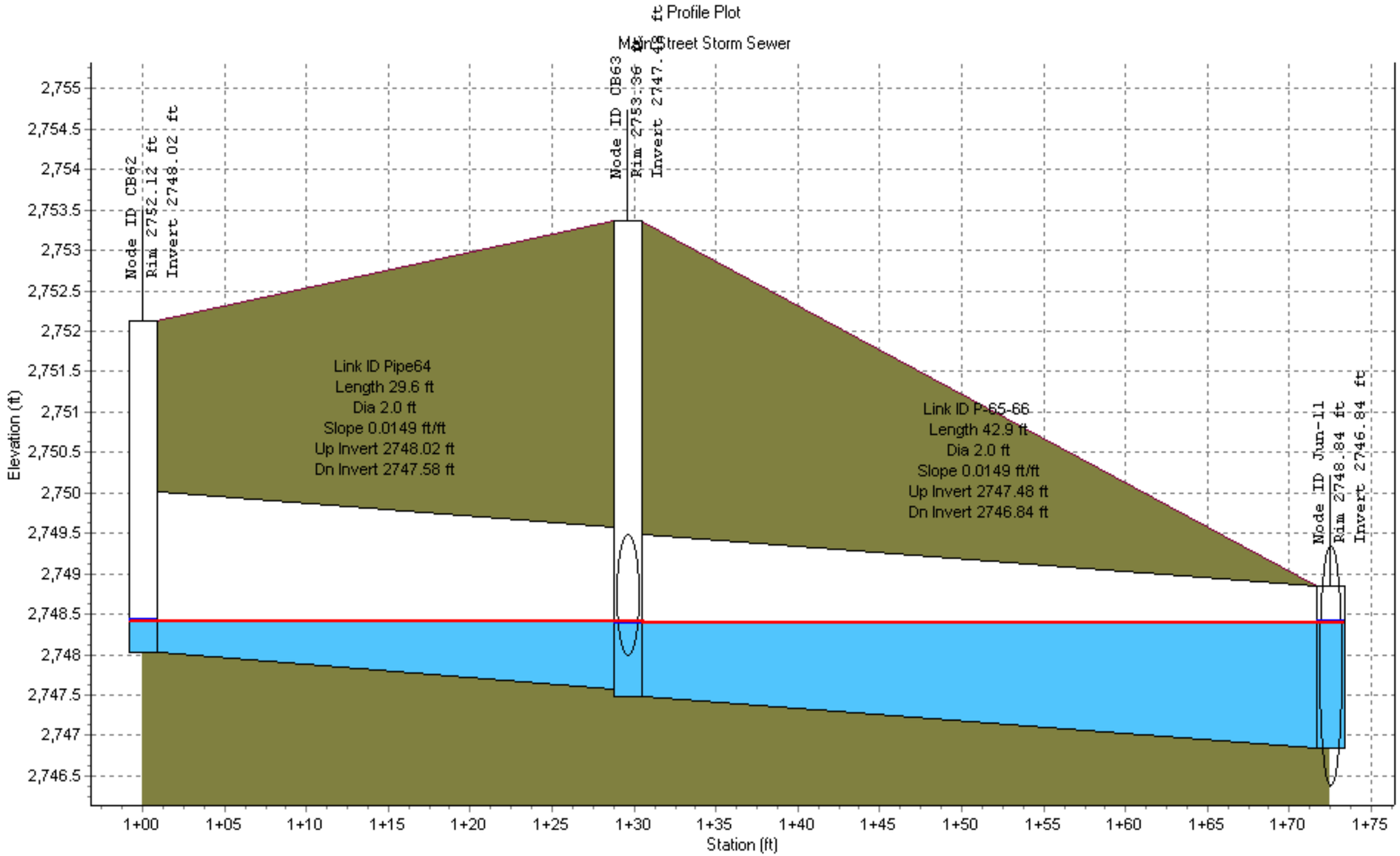
11-10-2018 (10:43 AM)

Profile Plot

Main Street Storm Sewer



Node ID:	CB61		CB63
Rim (ft):	2754.44		2753.36
Invert (ft):	2749.29		2747.48
Min Pipe Cover (ft):			
Max HGL (ft):	2749.41		2748.46
Link ID:		Pipe63	
Length (ft):		87.1	
Dia (ft):		1.5	
Slope (ft/ft):		0.0150	
Up Invert (ft):		2749.29	
Dn Invert (ft):		2747.98	
Max Q (cfs):		0.2	
Max Vel (ft/s):		1.52	
Max Depth (ft):		0.30	



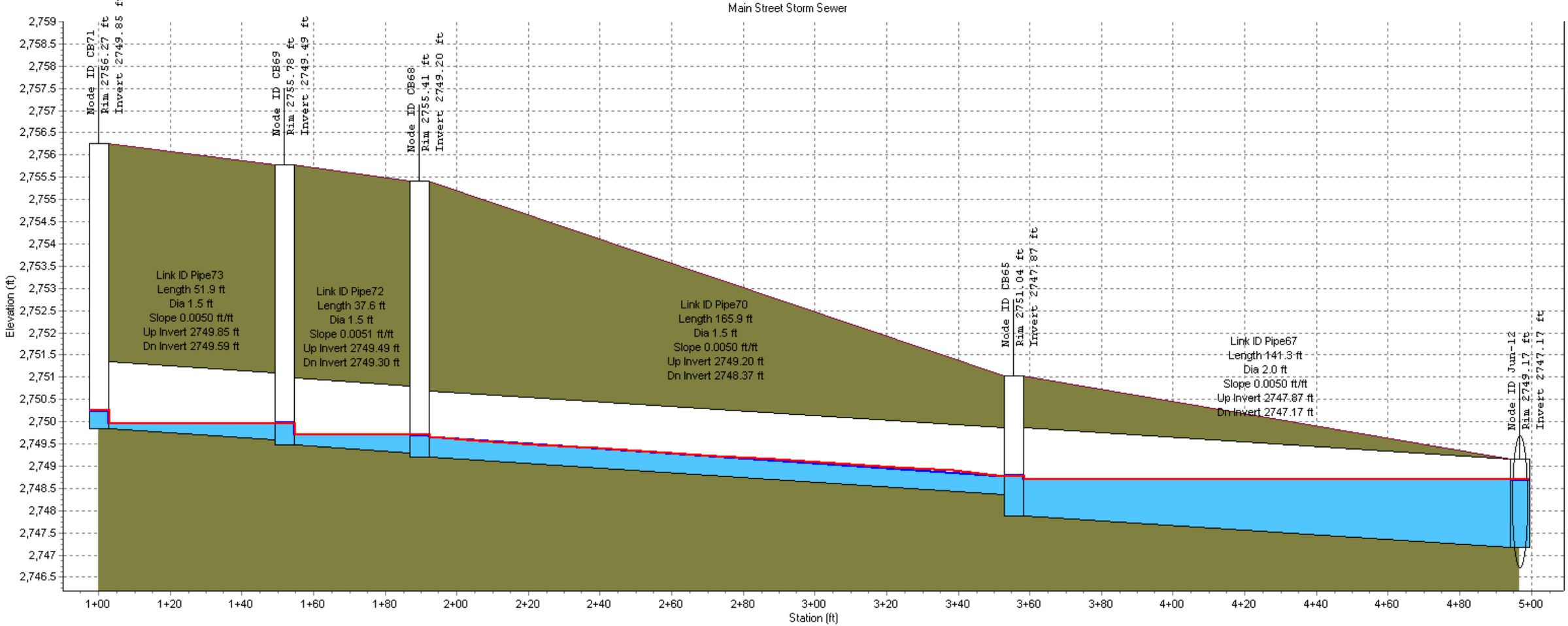
Node ID:	CB62	CB63	Jun-11
Rim (ft):	2752.12	2753.36	2748.84
Invert (ft):	2748.02	2747.48	2746.84
Min Pipe Cover (ft):			0.00
Max HGL (ft):	2748.42	2748.41	2748.70

Link ID:	Pipe64	P-65-66
Length (ft):	29.6	42.9
Dia (ft):	2.0	2.0
Slope (ft/ft):	0.0149	0.0149
Up Invert (ft):	2748.02	2747.48
Dn Invert (ft):	2747.58	2746.84
Max Q (cfs):	3.5	5.9
Max Vel (ft/s):	3.33	2.69
Max Depth (ft):	0.61	1.24

11-10-2018 (10:43 AM)

Profile Plot

Main Street Storm Sewer



Node ID:	CB71	CB69	CB68	CB65	Jun-12
Rim (ft):	2756.27	2755.78	2755.41	2751.04	2749.17
Invert (ft):	2749.85	2749.49	2749.20	2747.87	2747.17
Min Pipe Cover (ft):					0.00
Max HGL (ft):	2750.25	2749.97	2749.70	2748.78	2748.95

Link ID:	Pipe73	Pipe72	Pipe70	Pipe67
Length (ft):	51.9	37.6	165.9	141.3
Dia (ft):	1.5	1.5	1.5	2.0
Slope (ft/ft):	0.0050	0.0051	0.0050	0.0050
Up Invert (ft):	2749.85	2749.49	2749.20	2747.87
Dn Invert (ft):	2749.59	2749.30	2748.37	2747.17
Max Q (cfs):	0.8	1.1	1.4	4.9
Max Vel (ft/s):	2.42	2.67	2.93	2.24
Max Depth (ft):	0.39	0.44	0.47	1.22

Autodesk® Storm and Sanitary Analysis 2016 - Version 12.0.42 (Build 0)

****
Project Description
****
File Name ..... Kolb Road Stormdrain.SPF

****
Analysis Options
****
Flow Units ..... cfs
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. None
Starting Date APR-04-2018 23:59:59
Ending Date APR-06-2018 23:59:59
Report Time Step 00:05:00

****
Element Count
****
Number of subbasins 0
Number of nodes 120
Number of links 95

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
JS1	JUNCTION	2591.31	2594.26	0.00	
JS11	JUNCTION	2656.47	2658.47	0.00	
JS2	JUNCTION	2606.72	2608.72	0.00	
Jun-10	JUNCTION	2744.88	2748.38	0.00	
Jun-11	JUNCTION	2746.84	2749.84	0.00	
Jun-12	JUNCTION	2747.17	2750.17	0.00	
Jun-13	JUNCTION	2747.04	2750.54	0.00	
Jun-14	JUNCTION	2643.70	2645.70	0.00	
Jun-16	JUNCTION	2708.20	2709.70	0.00	
MH1	JUNCTION	2610.93	2617.65	0.00	
Out01	OUTFALL	2550.30	2552.80	0.00	
Out10	OUTFALL	2698.35	2700.35	0.00	
Out10A	OUTFALL	2605.29	2607.04	0.00	
Out10B	OUTFALL	2606.13	2608.13	0.00	
Out11	OUTFALL	2704.60	2707.60	0.00	
Out2	OUTFALL	2590.00	2592.00	0.00	
Out-27	OUTFALL	2653.67	2655.67	0.00	
Out-28	OUTFALL	2763.00	2765.00	0.00	
Out-29	OUTFALL	2753.68	2755.68	0.00	
Out3	OUTFALL	2590.16	2592.16	0.00	
Out-33	OUTFALL	2741.76	2745.26	0.00	
Out-34	OUTFALL	2746.12	2747.62	0.00	
Out-35	OUTFALL	2743.36	2746.36	0.00	
Out-36	OUTFALL	2743.36	2746.36	0.00	
Out-37	OUTFALL	2752.87	2754.37	0.00	
Out-38	OUTFALL	2670.90	2672.90	0.00	
Out-39	OUTFALL	2753.28	2754.78	0.00	
Out-41	OUTFALL	2741.73	2745.23	0.00	
Out-42	OUTFALL	2605.65	2607.15	0.00	
Out-43	OUTFALL	2603.91	2605.41	0.00	
Out-44	OUTFALL	2588.60	2590.10	0.00	

Out5	OUTFALL	2631.83	2633.33	0.00
Out6	OUTFALL	2636.90	2638.90	0.00
Out7	OUTFALL	2650.87	2652.37	0.00
Out9	OUTFALL	2697.74	2699.74	0.00

****
Inlet Summary
****

Inlet ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation	Inlet Rim Elevation	Ponded Area	Initial Water Elevation	Grate Clogging Factor
					ft	ft	ft²	ft	%
CB10	FHWA HEC-22 GENERIC	N/A	On Sag	1	2607.05	2612.19	10.00	2607.05	0.00
CB11A	FHWA HEC-22 GENERIC	N/A	On Sag	1	2612.34	2617.61	10.00	2612.34	0.00
CB11B	FHWA HEC-22 GENERIC	N/A	On Sag	1	2612.52	2616.92	10.00	2612.52	0.00
CB12A	FHWA HEC-22 GENERIC	N/A	On Sag	1	2619.71	2626.18	10.00	2619.71	0.00
CB12B	FHWA HEC-22 GENERIC	N/A	On Sag	1	2620.43	2625.51	10.00	2620.43	0.00
CB13	FHWA HEC-22 GENERIC	N/A	On Sag	1	2632.50	2636.00	10.00	2632.50	0.00
CB14	FHWA HEC-22 GENERIC	N/A	On Sag	1	2632.30	2636.20	10.00	2632.30	0.00
CB15	FHWA HEC-22 GENERIC	N/A	On Sag	1	2631.90	2636.97	10.00	2631.90	0.00
CB16	FHWA HEC-22 GENERIC	N/A	On Sag	1	2637.85	2648.69	10.00	2637.85	0.00
CB17A	FHWA HEC-22 GENERIC	N/A	On Sag	1	2639.51	2648.26	10.00	2639.51	0.00
CB17B	FHWA HEC-22 GENERIC	N/A	On Sag	1	2639.30	2648.69	10.00	2639.30	0.00
CB18A	FHWA HEC-22 GENERIC	N/A	On Sag	1	2642.59	2654.40	10.00	2642.59	0.00
CB18B	FHWA HEC-22 GENERIC	N/A	On Sag	1	2644.07	2653.50	10.00	2644.07	0.00
CB19	FHWA HEC-22 GENERIC	N/A	On Sag	1	2643.57	2654.40	10.00	2643.57	0.00
CB1A	FHWA HEC-22 GENERIC	N/A	On Sag	1	2551.20	2556.65	10.00	2551.20	0.00
CB1B	FHWA HEC-22 GENERIC	N/A	On Sag	1	2552.60	2558.58	10.00	2552.60	0.00
CB1C	FHWA HEC-22 GENERIC	N/A	On Sag	1	2557.40	2563.07	10.00	2557.40	0.00
CB1D	FHWA HEC-22 GENERIC	N/A	On Sag	1	2558.00	2561.64	10.00	2558.00	0.00
CB1E	FHWA HEC-22 GENERIC	N/A	On Sag	1	2570.83	2576.59	10.00	2570.83	0.00
CB1F	FHWA HEC-22 GENERIC	N/A	On Sag	1	2569.70	2575.59	10.00	2569.70	0.00
CB1G	FHWA HEC-22 GENERIC	N/A	On Sag	1	2570.50	2573.65	10.00	2570.50	0.00
CB1H	FHWA HEC-22 GENERIC	N/A	On Sag	1	2592.00	2596.00	10.00	2592.00	0.00
CB2	FHWA HEC-22 GENERIC	N/A	On Sag	1	2591.40	2596.94	10.00	2591.40	0.00
CB20	FHWA HEC-22 GENERIC	N/A	On Sag	1					

2645.41	2652.38	10.00	2645.41	0.00			
CB21		FHWA HEC-22 GENERIC		N/A		On Sag	1
2645.28	2655.31	10.00	2645.28	0.00			
CB22		FHWA HEC-22 GENERIC		N/A		On Sag	1
2646.02	2655.31	10.00	2646.02	0.00			
CB23		FHWA HEC-22 GENERIC		N/A		On Sag	1
2653.17	2655.21	10.00	2653.17	0.00			
CB25		FHWA HEC-22 GENERIC		N/A		On Sag	1
2660.51	2668.60	10.00	2660.51	0.00			
CB26		FHWA HEC-22 GENERIC		N/A		On Sag	1
2667.73	2678.55	10.00	2667.73	0.00			
CB27		FHWA HEC-22 GENERIC		N/A		On Sag	1
2666.77	2678.79	10.00	2666.77	0.00			
CB28		FHWA HEC-22 GENERIC		N/A		On Sag	1
2670.83	2683.14	10.00	2670.83	0.00			
CB29		FHWA HEC-22 GENERIC		N/A		On Sag	1
2671.79	2682.63	10.00	2671.79	0.00			
CB3		FHWA HEC-22 GENERIC		N/A		On Sag	1
2591.05	2598.70	10.00	2591.05	0.00			
CB30		FHWA HEC-22 GENERIC		N/A		On Sag	1
2688.03	2700.65	10.00	2688.03	0.00			
CB31		FHWA HEC-22 GENERIC		N/A		On Sag	1
2697.95	2708.48	10.00	2697.95	0.00			
CB32		FHWA HEC-22 GENERIC		N/A		On Sag	1
2700.31	2708.74	10.00	2700.31	0.00			
CB33		FHWA HEC-22 GENERIC		N/A		On Sag	1
2701.70	2709.47	10.00	2701.70	0.00			
CB34		FHWA HEC-22 GENERIC		N/A		On Sag	1
2702.90	2710.10	10.00	2702.90	0.00			
CB35		FHWA HEC-22 GENERIC		N/A		On Sag	1
2698.73	2705.84	10.00	2698.73	0.00			
CB36		FHWA HEC-22 GENERIC		N/A		On Sag	1
2705.40	2711.69	10.00	2705.40	0.00			
CB37		FHWA HEC-22 GENERIC		N/A		On Sag	1
2706.01	2715.80	10.00	2706.01	0.00			
CB38		FHWA HEC-22 GENERIC		N/A		On Sag	1
2707.90	2716.51	10.00	2707.90	0.00			
CB39		FHWA HEC-22 GENERIC		N/A		On Sag	1
2708.30	2711.00	10.00	2708.30	0.00			
CB4		FHWA HEC-22 GENERIC		N/A		On Sag	1
2590.50	2600.64	10.00	2590.50	0.00			
CB40		FHWA HEC-22 GENERIC		N/A		On Sag	1
2710.85	2719.77	10.00	2710.85	0.00			
CB41		FHWA HEC-22 GENERIC		N/A		On Sag	1
2712.17	2721.75	10.00	2712.17	0.00			
CB42		FHWA HEC-22 GENERIC		N/A		On Sag	1
2715.69	2725.36	10.00	2715.69	0.00			
CB43		FHWA HEC-22 GENERIC		N/A		On Sag	1
2714.77	2723.36	10.00	2714.77	0.00			
CB44		FHWA HEC-22 GENERIC		N/A		On Sag	1
2717.92	2727.90	10.00	2717.92	0.00			
CB47		FHWA HEC-22 GENERIC		N/A		On Sag	1
2749.51	2754.61	10.00	2749.51	0.00			
CB48		FHWA HEC-22 GENERIC		N/A		On Sag	1
2763.23	2770.00	10.00	2763.23	0.00			
CB49		FHWA HEC-22 GENERIC		N/A		On Sag	1
2764.96	2772.72	10.00	2764.96	0.00			
CB5		FHWA HEC-22 GENERIC		N/A		On Sag	1
2590.20	2601.10	10.00	2590.20	0.00			
CB50		FHWA HEC-22 GENERIC		N/A		On Sag	1
2766.54	2774.02	10.00	2766.54	0.00			
CB53		FHWA HEC-22 GENERIC		N/A		On Sag	1
2760.65	2767.51	10.00	2760.65	0.00			
CB54		FHWA HEC-22 GENERIC		N/A		On Sag	1
2760.76	2766.48	10.00	2760.76	0.00			
CB55		FHWA HEC-22 GENERIC		N/A		On Sag	1
2754.73	2759.58	10.00	2754.73	0.00			

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  CB56                FHWA HEC-22 GENERIC        N/A                        On Sag          1
2754.27      2759.72     10.00      2754.27       0.00
  CB57                FHWA HEC-22 GENERIC        N/A                        On Sag          1
2753.42      2757.77     10.00      2753.42       0.00
  CB58                FHWA HEC-22 GENERIC        N/A                        On Sag          1
2754.04      2758.38     10.00      2754.04       0.00
  CB59                FHWA HEC-22 GENERIC        N/A                        On Sag          1
2751.45      2756.92     10.00      2751.45       0.00
  CB60                FHWA HEC-22 GENERIC        N/A                        On Sag          1
2746.36      2754.50     10.00      2746.36       0.00
  CB61                FHWA HEC-22 GENERIC        N/A                        On Sag          1
2749.29      2754.44     10.00      2749.29       0.00
  CB62                FHWA HEC-22 GENERIC        N/A                        On Sag          1
2748.02      2752.12     10.00      2748.02       0.00
  CB63                FHWA HEC-22 GENERIC        N/A                        On Sag          1
2747.48      2753.36     10.00      2747.48       0.00
  CB65                FHWA HEC-22 GENERIC        N/A                        On Sag          1
2747.87      2751.04     10.00      2747.87       0.00
  CB68                FHWA HEC-22 GENERIC        N/A                        On Sag          1
2749.20      2755.41     10.00      2749.20       0.00
  CB69                FHWA HEC-22 GENERIC        N/A                        On Sag          1
2749.49      2755.78     10.00      2749.49       0.00
  CB6A                FHWA HEC-22 GENERIC        N/A                        On Sag          1
2597.10      2601.15     10.00      2597.10       0.00
  CB6B                FHWA HEC-22 GENERIC        N/A                        On Sag          1
2590.70      2600.00     10.00      2590.70       0.00
  CB7                 FHWA HEC-22 GENERIC        N/A                        On Sag          1
2593.70      2602.49     10.00      2593.70       0.00
  CB71                FHWA HEC-22 GENERIC        N/A                        On Sag          1
2749.85      2756.27     10.00      2749.85       0.00
  CB72                FHWA HEC-22 GENERIC        N/A                        On Sag          1
2671.00      2679.00     10.00      2671.00       0.00
  CB73                FHWA HEC-22 GENERIC        N/A                        On Sag          1
2671.28      2678.09     10.00      2671.28       0.00
  CB74                FHWA HEC-22 GENERIC        N/A                        On Sag          1
2748.04      2755.11     10.00      2748.04       0.00
  CB75                FHWA HEC-22 GENERIC        N/A                        On Sag          1
2605.52      2610.00     10.00      2605.52       0.00
  CB76                FHWA HEC-22 GENERIC        N/A                        On Sag          1
2605.91      2609.10     10.00      2605.91       0.00
  CB77                FHWA HEC-22 GENERIC        N/A                        On Sag          1
2749.43      2754.78     10.00      2749.43       0.00
  CB8                 FHWA HEC-22 GENERIC        N/A                        On Sag          1
2597.40      2604.84     10.00      2597.40       0.00
  CB9                 FHWA HEC-22 GENERIC        N/A                        On Sag          1
2606.34      2609.89     10.00      2606.34       0.00
  Exst42in-2          FHWA HEC-22 GENERIC        N/A                        On Sag          1
2749.76      2753.26     10.00      2749.76       0.00
  Inlet-131           FHWA HEC-22 GENERIC        N/A                        On Sag          1
2657.03      2662.03     10.00      2657.03       0.00
  Inlet-99            FHWA HEC-22 GENERIC        N/A                        On Sag          1
2749.76      2760.60     10.00      2749.76       0.00
  PE3aUS              FHWA HEC-22 GENERIC        N/A                        On Sag          1
2748.88      2755.00     10.00      2748.88       0.00
  PE3bUS              FHWA HEC-22 GENERIC        N/A                        On Sag          1
2748.88      2755.00     10.00      2748.88       0.00


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  Roadway and Gutter Summary
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  Inlet                     Roadway   Roadway     Roadway    Gutter   Gutter       Gutter
  ID                   Longitudinal     Cross   Manning's     Cross    Width   Depression
                              Slope     Slope   Roughness     Slope
                              ft/ft     ft/ft                 ft/ft       ft           in
  ---------------------------------------------------------------------------------------
  CB10                            -    0.0280      0.0160    0.0280     2.00         2.50
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CB11A	-	0.0280	0.0160	0.0280	2.00	2.50
CB11B	-	0.0280	0.0160	0.0280	2.00	2.50
CB12A	-	0.0200	0.0160	0.0620	2.00	2.00
CB12B	-	0.0280	0.0160	0.0280	2.00	2.50
CB13	-	0.0280	0.0160	0.0280	2.00	2.50
CB14	-	0.0200	0.0160	0.0620	2.00	2.00
CB15	-	0.0200	0.0160	0.0620	2.00	2.00
CB16	-	0.0280	0.0160	0.0280	2.00	2.50
CB17A	-	0.0200	0.0160	0.0620	2.00	2.00
CB17B	-	0.0280	0.0160	0.0280	2.00	2.50
CB18A	-	0.0280	0.0160	0.0280	2.00	2.50
CB18B	-	0.0200	0.0160	0.0620	2.00	2.00
CB19	-	0.0280	0.0160	0.0280	2.00	2.50
CB1A	-	0.0200	0.0160	0.0200	2.00	2.00
CB1B	-	0.0280	0.0160	0.0280	2.00	2.50
CB1C	-	0.0280	0.0160	0.0280	2.00	2.50
CB1D	-	0.0280	0.0160	0.0280	2.00	2.50
CB1E	-	0.0200	0.0160	0.0620	2.00	2.00
CB1F	-	0.0280	0.0160	0.0280	2.00	2.50
CB1G	-	0.0280	0.0160	0.0280	2.00	2.50
CB1H	-	0.0280	0.0160	0.0280	2.00	2.50
CB2	-	0.0280	0.0160	0.0280	2.00	2.50
CB20	-	0.0200	0.0160	0.0620	2.00	2.00
CB21	-	0.0280	0.0160	0.0280	2.00	2.50
CB22	-	0.0280	0.0160	0.0280	2.00	2.50
CB23	-	0.0200	0.0160	0.0620	2.00	2.00
CB25	-	0.0280	0.0160	0.0280	2.00	2.50
CB26	-	0.0280	0.0160	0.0280	2.00	2.50
CB27	-	0.0280	0.0160	0.0280	2.00	2.50
CB28	-	0.0280	0.0160	0.0280	2.00	2.50
CB29	-	0.0280	0.0160	0.0280	2.00	2.50
CB3	-	0.0208	0.0160	0.0280	2.00	2.50
CB30	-	0.0280	0.0160	0.0280	2.00	2.50
CB31	-	0.0200	0.0160	0.0620	2.00	2.00
CB32	-	0.0280	0.0160	0.0280	2.00	2.50
CB33	-	0.0280	0.0160	0.0280	2.00	2.50
CB34	-	0.0280	0.0160	0.0280	2.00	2.50
CB35	-	0.0280	0.0160	0.0280	2.00	2.50
CB36	-	0.0280	0.0160	0.0280	2.00	2.50
CB37	-	0.0280	0.0160	0.0280	2.00	2.50
CB38	-	0.0280	0.0160	0.0280	2.00	2.50
CB39	-	0.0200	0.0160	0.0620	2.00	2.00
CB4	-	0.0280	0.0160	0.0280	2.00	2.50
CB40	-	0.0280	0.0160	0.0280	2.00	2.50
CB41	-	0.0280	0.0160	0.0280	2.00	2.50
CB42	-	0.0280	0.0160	0.0280	2.00	2.50
CB43	-	0.0280	0.0160	0.0280	2.00	2.50
CB44	-	0.0280	0.0160	0.0280	2.00	2.50
CB47	-	0.0200	0.0160	0.0620	2.00	2.00
CB48	-	0.0200	0.0160	0.0620	2.00	2.00
CB49	-	0.0200	0.0160	0.0620	2.00	2.00
CB5	-	0.0280	0.0160	0.0280	2.00	2.50
CB50	-	0.0200	0.0160	0.0620	2.00	2.00
CB53	-	0.0200	0.0160	0.0620	2.00	2.00
CB54	-	0.0200	0.0160	0.0620	2.00	2.00
CB55	-	0.0200	0.0160	0.0620	2.00	2.00
CB56	-	0.0200	0.0160	0.0200	2.00	2.00
CB57	-	0.0200	0.0160	0.0620	2.00	2.00
CB58	-	0.0200	0.0160	0.0620	2.00	2.00
CB59	-	0.0200	0.0160	0.0620	2.00	2.00
CB60	-	0.0200	0.0160	0.0620	2.00	2.00
CB61	-	0.0200	0.0160	0.0620	2.00	2.00
CB62	-	0.0200	0.0160	0.0620	2.00	2.00
CB63	-	0.0200	0.0160	0.0620	2.00	2.00
CB65	-	0.0200	0.0160	0.0620	2.00	2.00
CB68	-	0.0200	0.0160	0.0620	2.00	2.00
CB69	-	0.0200	0.0160	0.0620	2.00	2.00

CB6A	-	0.0280	0.0160	0.0280	2.00	2.50
CB6B	-	0.0200	0.0160	0.0620	2.00	2.00
CB7	-	0.0280	0.0160	0.0280	2.00	2.50
CB71	-	0.0200	0.0160	0.0620	2.00	2.00
CB72	-	0.0200	0.0160	0.0620	2.00	2.00
CB73	-	0.0200	0.0160	0.0620	2.00	2.00
CB74	-	0.0200	0.0160	0.0620	2.00	2.00
CB75	-	0.0200	0.0160	0.0620	2.00	2.00
CB76	-	0.0200	0.0160	0.0620	2.00	2.00
CB77	-	0.0200	0.0160	0.0620	2.00	2.00
CB8	-	0.0280	0.0160	0.0280	2.00	2.50
CB9	-	0.0280	0.0160	0.0280	2.00	2.50
Exst42in-2	-	0.0200	0.0160	0.0620	2.00	2.00
Inlet-131	-	0.0200	0.0160	0.0620	2.00	2.00
Inlet-99	-	0.0200	0.0160	0.0620	2.00	2.00
PE3aUS	-	0.0200	0.0160	0.0620	2.00	2.00
PE3bUS	-	0.0200	0.0160	0.0620	2.00	2.00

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Link Summary
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Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
Exst42inDS	Jun-10	Out-33	CONDUIT	123.2	2.5325	0.0150
Exst42inUS	Inlet-99	Jun-10	CONDUIT	190.8	2.5577	0.0150
ExstPE2-DS	JS11	Out-27	CONDUIT	71.0	3.9456	0.0150
ExstPE2-US	Inlet-131	JS11	CONDUIT	14.0	3.9900	0.0150
Link-148	Exst42in-2	Jun-13	CONDUIT	145.9	1.8637	0.0150
Link-149	Jun-13	Out-41	CONDUIT	168.7	3.1474	0.0150
Link-150	Jun-14	CB18A	CONDUIT	50.6	1.9972	0.0150
Link-154	CB77	CB74	CONDUIT	43.3	3.2079	0.0150
P-1F	CB1E	CB1F	CONDUIT	65.7	0.9586	0.0150
P-28	CB25	JS11	CONDUIT	154.5	2.6143	0.0150
P-38	CB34	CB33	CONDUIT	119.0	0.9244	0.0150
P-60	CB58	Out-39	CONDUIT	38.2	1.9906	0.0150
P-65-66	CB63	Jun-11	CONDUIT	42.9	1.4911	0.0150
P-76	CB74	Jun-13	CONDUIT	50.0	2.0004	0.0150
P-77A-B	CB18B	Jun-14	CONDUIT	18.5	2.0011	0.0150
P-78	CB75	Out-43	CONDUIT	53.5	3.0093	0.0150
P-79	CB76	Out-42	CONDUIT	8.7	3.0023	0.0150
P-7B	CB6B	Out-44	CONDUIT	103.2	2.1035	0.0150
P-81	Jun-16	CB38	CONDUIT	27.0	0.7407	0.0150
P-82	CB39	Jun-16	CONDUIT	7.0	1.4286	0.0150
PE1aDS	Jun-12	Out-36	CONDUIT	41.0	9.2927	0.0150
PE1aUS	PE3aUS	Jun-12	CONDUIT	103.0	1.6990	0.0150
PE1cDS	Jun-11	Out-35	CONDUIT	38.0	9.1579	0.0150
PE3bUS	PE3bUS	Jun-11	CONDUIT	106.0	1.9245	0.0150
Pipe10	CB9	Out10A	CONDUIT	80.0	1.0000	0.0150
Pipe11	JS2	Out10B	CONDUIT	57.0	1.0351	0.0150
Pipe12	CB10	JS2	CONDUIT	35.0	0.9429	0.0150
Pipe13	MH1	JS2	CONDUIT	135.0	3.1185	0.0150
Pipe14A	CB11B	CB11A	CONDUIT	8.0	1.0000	0.0150
Pipe14B	CB11A	MH1	CONDUIT	21.0	4.3333	0.0150
Pipe15&16	CB12A	MH1	CONDUIT	173.0	5.0173	0.0150
Pipe16B	CB12B	CB12A	CONDUIT	11.0	2.0000	0.0150
Pipe17	CB13	CB14	CONDUIT	10.0	1.0000	0.0150
Pipe18	CB14	CB15	CONDUIT	50.0	0.6000	0.0150
Pipe19	CB15	Out5	CONDUIT	20.0	0.5000	0.0150
Pipe1A	CB1A	Out01	CONDUIT	78.5	1.1466	0.0150
Pipe1B	CB1B	CB1A	CONDUIT	14.6	6.1560	0.0150
Pipe1C	CB1C	CB1B	CONDUIT	114.9	4.0898	0.0150
Pipe1D	CB1D	CB1C	CONDUIT	10.0	1.0000	0.0150
Pipe1E	CB1F	CB1C	CONDUIT	228.2	5.3893	0.0150
Pipe1G	CB1G	CB1F	CONDUIT	11.0	2.7273	0.0150
Pipe1H	CB1H	CB2	CONDUIT	10.0	1.0000	0.0150

Pipe2	CB2	CB3	CONDUIT	63.0	0.5000	0.0150
Pipe20	CB16	Out6	CONDUIT	113.0	0.8407	0.0150
Pipe21	CB17B	CB16	CONDUIT	48.0	1.9792	0.0150
Pipe21A	CB17A	CB17B	CONDUIT	5.6	1.9573	0.0150
Pipe22	CB18A	CB16	CONDUIT	232.0	2.0000	0.0150
Pipe23	CB19	CB18A	CONDUIT	48.0	1.0000	0.0150
Pipe24	CB21	Jun-14	CONDUIT	78.8	2.0038	0.0150
Pipe25	CB20	CB21	CONDUIT	13.0	1.0000	0.0150
Pipe26	CB22	CB21	CONDUIT	48.0	0.5000	0.0150
Pipe27	CB23	Out7	CONDUIT	16.0	14.3750	0.0150
Pipe29	CB27	CB25	CONDUIT	206.0	2.9903	0.0150
Pipe3	CB3	CB4	CONDUIT	129.0	0.5000	0.0150
Pipe30	CB26	CB27	CONDUIT	45.6	1.0092	0.0150
Pipe31	CB28	CB27	CONDUIT	132.0	3.0000	0.0150
Pipe32	CB29	CB28	CONDUIT	45.6	1.0092	0.0150
Pipe33&34	CB30	CB28	CONDUIT	342.0	5.0000	0.0150
Pipe35A	CB31	Out9	CONDUIT	7.0	3.0000	0.0150
Pipe36	CB32	CB31	CONDUIT	75.0	3.0133	0.0150
Pipe37	CB33	CB32	CONDUIT	135.0	0.9556	0.0150
Pipe39	CB35	Out10	CONDUIT	38.0	1.0000	0.0150
Pipe4	CB4	CB5	CONDUIT	128.0	0.5000	0.0150
Pipe40	CB36	Out11	CONDUIT	118.0	0.6780	0.0150
Pipe41	CB37	CB36	CONDUIT	89.0	0.5730	0.0150
Pipe42	CB38	CB37	CONDUIT	65.0	0.6154	0.0150
Pipe44	CB40	CB37	CONDUIT	170.0	2.5529	0.0150
Pipe45	CB41	CB40	CONDUIT	61.0	2.3934	0.0150
Pipe46	CB43	CB40	CONDUIT	114.0	3.0000	0.0150
Pipe47	CB42	CB43	CONDUIT	63.0	1.4592	0.0150
Pipe48	CB44	CB43	CONDUIT	102.0	2.9902	0.0150
Pipe49	CB47	Out-34	CONDUIT	67.7	5.0044	0.0150
Pipe5	CB5	Out2	CONDUIT	30.0	0.6667	0.0150
Pipe50	CB48	Out-28	CONDUIT	24.0	0.9583	0.0150
Pipe51	CB49	CB48	CONDUIT	81.6	1.9978	0.0150
Pipe52	CB50	CB49	CONDUIT	49.4	2.9947	0.0150
Pipe55	CB54	CB53	CONDUIT	11.0	1.0000	0.0150
Pipe56	CB53	CB55	CONDUIT	197.3	3.0007	0.0150
Pipe57	CB55	CB56	CONDUIT	35.4	1.0181	0.0150
Pipe58	CB56	Out-29	CONDUIT	58.6	1.0067	0.0150
Pipe59	CB57	Out-37	CONDUIT	27.7	1.9834	0.0150
Pipe6	JS1	Out3	CONDUIT	34.0	3.3824	0.0150
Pipe61	CB59	CB60	CONDUIT	100.0	4.9900	0.0150
Pipe62	CB60	Jun-10	CONDUIT	4.0	8.2500	0.0150
Pipe63	CB61	CB63	CONDUIT	87.0	1.5049	0.0150
Pipe64	CB62	CB63	CONDUIT	29.6	1.4865	0.0150
Pipe67	CB65	Jun-12	CONDUIT	141.3	0.5000	0.0150
Pipe70	CB68	CB65	CONDUIT	165.9	0.5004	0.0150
Pipe72	CB69	CB68	CONDUIT	37.6	0.5059	0.0150
Pipe73	CB71	CB69	CONDUIT	51.9	0.5010	0.0150
Pipe74	CB73	CB72	CONDUIT	36.3	0.5000	0.0150
Pipe75	CB72	Out-38	CONDUIT	19.5	0.5136	0.0150
Pipe7A	CB6A	JS1	CONDUIT	67.2	7.8755	0.0150
Pipe8	CB7	JS1	CONDUIT	75.0	3.1867	0.0150
Pipe9	CB8	CB7	CONDUIT	120.0	3.0000	0.0150

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Cross Section Summary
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Link ID	Shape	Depth/ Diameter (ft)	Width (ft)	No. of Barrels	Cross Sectional Area (ft²)	Full Flow Hydraulic Radius (ft)	Design Flow Capacity (cfs)

Exst42inDS	CIRCULAR	3.50	3.50	1	9.62	0.88	138.76
Exst42inUS	CIRCULAR	3.50	3.50	1	9.62	0.88	139.45
ExstPE2-DS	CIRCULAR	2.00	2.00	1	3.14	0.50	38.94
ExstPE2-US	CIRCULAR	2.00	2.00	1	3.14	0.50	39.16
Link-148	CIRCULAR	3.50	3.50	1	9.62	0.88	119.03
Link-149	CIRCULAR	3.50	3.50	1	9.62	0.88	154.69
Link-150	CIRCULAR	2.00	2.00	1	3.14	0.50	27.71
Link-154	CIRCULAR	1.50	1.50	1	1.77	0.38	16.31
P-1F	CIRCULAR	1.50	1.50	1	1.77	0.38	8.91
P-28	CIRCULAR	2.00	2.00	1	3.14	0.50	31.70
P-38	CIRCULAR	2.00	2.00	1	3.14	0.50	18.85
P-60	CIRCULAR	1.50	1.50	1	1.77	0.38	12.84
P-65-66	CIRCULAR	2.00	2.00	1	3.14	0.50	23.94
P-76	CIRCULAR	1.50	1.50	1	1.77	0.38	12.88
P-77A-B	CIRCULAR	2.00	2.00	1	3.14	0.50	27.73
P-78	CIRCULAR	1.50	1.50	1	1.77	0.38	15.79
P-79	CIRCULAR	1.50	1.50	1	1.77	0.38	15.77
P-7B	CIRCULAR	1.50	1.50	1	1.77	0.38	13.20
P-81	CIRCULAR	1.50	1.50	1	1.77	0.38	7.84
P-82	CIRCULAR	1.50	1.50	1	1.77	0.38	10.88
PE1aDS	CIRCULAR	3.00	3.00	1	7.07	0.75	176.21
PE1aUS	CIRCULAR	3.00	3.00	1	7.07	0.75	75.35
PE1cDS	CIRCULAR	3.00	3.00	1	7.07	0.75	174.93
PE3bUS	CIRCULAR	3.00	3.00	1	7.07	0.75	80.19
Pipe10	CIRCULAR	1.50	1.50	1	1.77	0.38	9.10
Pipe11	CIRCULAR	2.00	2.00	1	3.14	0.50	19.95
Pipe12	CIRCULAR	2.00	2.00	1	3.14	0.50	19.04
Pipe13	CIRCULAR	2.00	2.00	1	3.14	0.50	34.62
Pipe14A	CIRCULAR	1.50	1.50	1	1.77	0.38	9.10
Pipe14B	CIRCULAR	1.50	1.50	1	1.77	0.38	18.95
Pipe15&16	CIRCULAR	2.00	2.00	1	3.14	0.50	43.92
Pipe16B	CIRCULAR	1.50	1.50	1	1.77	0.38	12.87
Pipe17	CIRCULAR	1.50	1.50	1	1.77	0.38	

Pipe18	CIRCULAR	1.50	1.50	1	1.77	0.38	9.10
Pipe19	CIRCULAR	1.50	1.50	1	1.77	0.38	7.05
Pipe1A	CIRCULAR	2.50	2.50	1	4.91	0.63	6.44
Pipe1B	CIRCULAR	2.00	2.00	1	3.14	0.50	38.07
Pipe1C	CIRCULAR	2.00	2.00	1	3.14	0.50	48.65
Pipe1D	CIRCULAR	1.50	1.50	1	1.77	0.38	39.65
Pipe1E	CIRCULAR	2.00	2.00	1	3.14	0.50	9.10
Pipe1G	CIRCULAR	1.50	1.50	1	1.77	0.38	45.52
Pipe1H	CIRCULAR	1.50	1.50	1	1.77	0.38	15.03
Pipe2	CIRCULAR	2.00	2.00	1	3.14	0.50	9.10
Pipe20	CIRCULAR	2.00	2.00	1	3.14	0.50	13.86
Pipe21	CIRCULAR	1.50	1.50	1	1.77	0.38	17.98
Pipe21A	CIRCULAR	1.50	1.50	1	1.77	0.38	12.81
Pipe22	CIRCULAR	2.00	2.00	1	3.14	0.50	12.74
Pipe23	CIRCULAR	1.50	1.50	1	1.77	0.38	27.73
Pipe24	CIRCULAR	2.00	2.00	1	3.14	0.50	9.10
Pipe25	CIRCULAR	2.00	2.00	1	3.14	0.50	27.75
Pipe26	CIRCULAR	1.50	1.50	1	1.77	0.38	19.61
Pipe27	CIRCULAR	1.50	1.50	1	1.77	0.38	6.44
Pipe29	CIRCULAR	2.00	2.00	1	3.14	0.50	34.52
Pipe3	CIRCULAR	2.00	2.00	1	3.14	0.50	33.90
Pipe30	CIRCULAR	1.50	1.50	1	1.77	0.38	13.86
Pipe31	CIRCULAR	2.00	2.00	1	3.14	0.50	9.15
Pipe32	CIRCULAR	1.50	1.50	1	1.77	0.38	33.96
Pipe33&34	CIRCULAR	2.00	2.00	1	3.14	0.50	9.15
Pipe35A	CIRCULAR	2.00	2.00	1	3.14	0.50	43.84
Pipe36	CIRCULAR	2.00	2.00	1	3.14	0.50	33.96
Pipe37	CIRCULAR	2.00	2.00	1	3.14	0.50	34.03
Pipe39	CIRCULAR	2.00	2.00	1	3.14	0.50	19.17
Pipe4	CIRCULAR	2.00	2.00	1	3.14	0.50	19.61
Pipe40	CIRCULAR	3.00	3.00	1	7.07	0.75	13.86
Pipe41	CIRCULAR	3.00	3.00	1	7.07	0.75	47.60
Pipe42	CIRCULAR	1.50	1.50	1	1.77	0.38	43.76
							7.14

Pipe44	CIRCULAR	2.50	2.50	1	4.91	0.63	56.80
Pipe45	CIRCULAR	2.00	2.00	1	3.14	0.50	30.33
Pipe46	CIRCULAR	2.00	2.00	1	3.14	0.50	33.96
Pipe47	CIRCULAR	2.00	2.00	1	3.14	0.50	23.68
Pipe48	CIRCULAR	2.00	2.00	1	3.14	0.50	33.90
Pipe49	CIRCULAR	1.50	1.50	1	1.77	0.38	20.37
Pipe5	CIRCULAR	2.00	2.00	1	3.14	0.50	16.01
Pipe50	CIRCULAR	2.00	2.00	1	3.14	0.50	19.19
Pipe51	CIRCULAR	2.00	2.00	1	3.14	0.50	27.71
Pipe52	CIRCULAR	2.00	2.00	1	3.14	0.50	33.93
Pipe55	CIRCULAR	1.50	1.50	1	1.77	0.38	9.10
Pipe56	CIRCULAR	2.00	2.00	1	3.14	0.50	33.96
Pipe57	CIRCULAR	2.00	2.00	1	3.14	0.50	19.78
Pipe58	CIRCULAR	2.00	2.00	1	3.14	0.50	19.67
Pipe59	CIRCULAR	1.50	1.50	1	1.77	0.38	12.82
Pipe6	CIRCULAR	2.00	2.00	1	3.14	0.50	36.06
Pipe61	CIRCULAR	1.50	1.50	1	1.77	0.38	20.34
Pipe62	CIRCULAR	1.50	1.50	1	1.77	0.38	26.15
Pipe63	CIRCULAR	1.50	1.50	1	1.77	0.38	11.17
Pipe64	CIRCULAR	2.00	2.00	1	3.14	0.50	23.90
Pipe67	CIRCULAR	2.00	2.00	1	3.14	0.50	13.86
Pipe70	CIRCULAR	1.50	1.50	1	1.77	0.38	6.44
Pipe72	CIRCULAR	1.50	1.50	1	1.77	0.38	6.47
Pipe73	CIRCULAR	1.50	1.50	1	1.77	0.38	6.44
Pipe74	CIRCULAR	2.00	2.00	1	3.14	0.50	13.86
Pipe75	CIRCULAR	2.00	2.00	1	3.14	0.50	14.05
Pipe7A	CIRCULAR	1.50	1.50	1	1.77	0.38	25.55
Pipe8	CIRCULAR	2.00	2.00	1	3.14	0.50	35.00
Pipe9	CIRCULAR	2.00	2.00	1	3.14	0.50	33.96

**********	Volume acre-ft	Volume Mgallons
Rainfall Dependent I/I	---	---
Sewershed Rainfall	0.019	0.006
RDII Produced	0.018	0.006
RDII Ratio	0.935	

Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	1916.165	624.411
External Outflow	1623.873	529.163
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.345	0.112
Continuity Error (%)	0.000	

Node Depth Summary

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
JS1	0.56	0.60	2591.91	0	00:01	0	0	0:00:00
JS11	2.00	2.00	2658.47	0	00:00	289.15	2879	0:00:00
JS2	1.24	1.31	2608.03	0	00:02	0	0	0:00:00
Jun-10	3.50	3.50	2748.38	0	00:00	1575.34	2879	0:00:00
Jun-11	1.55	1.86	2748.70	0	00:00	0	0	0:00:00
Jun-12	1.53	1.79	2748.96	0	00:00	0	0	0:00:00
Jun-13	0.26	0.26	2747.30	0	00:02	0	0	0:00:00
Jun-14	2.00	2.00	2645.70	0	00:00	1115.20	2879	0:00:00
Jun-16	1.50	1.50	2709.70	0	00:01	522.60	2879	0:00:00
MH1	0.71	0.82	2611.75	0	00:01	0	0	0:00:00
Out01	1.44	1.58	2551.88	0	00:01	0	0	0:00:00
Out10	0.27	0.28	2698.63	0	00:00	0	0	0:00:00
Out10A	0.00	0.00	2605.29	0	00:00	0	0	0:00:00
Out10B	1.02	1.06	2607.19	0	00:02	0	0	0:00:00
Out11	3.00	3.00	2707.60	0	00:00	0	0	0:00:00
Out2	0.54	0.54	2590.54	0	12:15	0	0	0:00:00
Out-27	1.30	1.30	2654.97	0	00:05	0	0	0:00:00
Out-28	0.63	0.66	2763.66	0	00:01	0	0	0:00:00
Out-29	0.81	0.81	2754.49	0	00:02	0	0	0:00:00
Out3	0.46	0.48	2590.64	0	00:01	0	0	0:00:00
Out-33	2.28	2.29	2744.05	0	00:05	0	0	0:00:00
Out-34	0.17	0.17	2746.29	0	00:00	0	0	0:00:00
Out-35	1.03	1.07	2744.43	0	00:00	0	0	0:00:00
Out-36	1.03	1.07	2744.43	0	00:00	0	0	0:00:00
Out-37	0.19	0.19	2753.06	0	00:00	0	0	0:00:00
Out-38	0.45	0.45	2671.35	0	00:01	0	0	0:00:00
Out-39	0.14	0.14	2753.42	0	00:01	0	0	0:00:00
Out-41	0.25	0.25	2741.98	0	00:02	0	0	0:00:00
Out-42	0.56	0.63	2606.28	0	00:00	0	0	0:00:00
Out-43	0.33	0.34	2604.25	0	00:00	0	0	0:00:00
Out-44	1.50	1.50	2590.10	0	00:00	0	0	0:00:00
Out5	1.50	1.50	2633.33	0	00:00	0	0	0:00:00
Out6	2.00	2.00	2638.90	0	00:01	0	0	0:00:00
Out7	0.11	0.11	2650.98	0	00:00	0	0	0:00:00
Out9	0.40	0.40	2698.14	0	00:08	0	0	0:00:00

Node Flow Summary

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	hh:mm

JS1	JUNCTION	0.00	4.38	0	00:01	0.00		
JS11	JUNCTION	0.00	35.58	1	10:55	6.08	0	16:12
JS2	JUNCTION	0.00	12.27	0	00:02	0.00		
Jun-10	JUNCTION	0.00	138.73	0	00:05	50.14	0	00:00
Jun-11	JUNCTION	0.00	53.46	0	00:00	0.00		
Jun-12	JUNCTION	0.00	54.65	0	00:00	0.00		
Jun-13	JUNCTION	0.00	1.71	0	00:01	0.00		
Jun-14	JUNCTION	0.00	48.35	0	00:00	31.08	0	00:00
Jun-16	JUNCTION	0.00	15.40	0	00:00	13.01	0	00:01
MH1	JUNCTION	0.00	10.23	0	00:01	0.00		
Out01	OUTFALL	0.00	27.62	0	00:01	0.00		
Out10	OUTFALL	0.00	0.83	0	00:00	0.00		
Out10A	OUTFALL	0.00	2.92	0	00:01	0.00		
Out10B	OUTFALL	0.00	11.03	0	00:02	0.00		
Out11	OUTFALL	0.00	67.92	0	00:01	0.00		
Out2	OUTFALL	0.00	2.57	0	12:15	0.00		
Out-27	OUTFALL	0.00	29.50	0	00:44	0.00		
Out-28	OUTFALL	0.00	4.54	0	00:01	0.00		
Out-29	OUTFALL	0.00	6.77	0	00:02	0.00		
Out3	OUTFALL	0.00	4.57	0	00:01	0.00		
Out-33	OUTFALL	0.00	105.63	0	00:06	0.00		
Out-34	OUTFALL	0.00	0.56	0	00:01	0.00		
Out-35	OUTFALL	0.00	47.71	0	00:00	0.00		
Out-36	OUTFALL	0.00	48.18	0	00:00	0.00		
Out-37	OUTFALL	0.00	0.46	0	00:00	0.00		
Out-38	OUTFALL	0.00	1.54	0	00:01	0.00		
Out-39	OUTFALL	0.00	0.23	0	00:01	0.00		
Out-41	OUTFALL	0.00	1.61	0	00:02	0.00		
Out-42	OUTFALL	0.00	5.74	0	00:00	0.00		
Out-43	OUTFALL	0.00	1.82	0	00:00	0.00		
Out-44	OUTFALL	0.00	16.30	0	00:00	0.00		
Out5	OUTFALL	0.00	10.46	0	00:01	0.00		
Out6	OUTFALL	0.00	25.67	0	01:33	0.00		
Out7	OUTFALL	0.00	0.38	0	00:00	0.00		
Out9	OUTFALL	0.00	2.94	0	00:08	0.00		

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Inlet Depth Summary
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Inlet ID	Max Gutter Spread during Peak Flow ft	Max Gutter Water Elev during Peak Flow ft	Max Gutter Water Depth during Peak Flow ft	Time of Maximum Depth Occurrence days	hh:mm
CB10	3.53	2612.50	0.31	0	00:01
CB11A	3.95	2617.93	0.32	0	00:01
CB11B	10.79	2617.43	0.51	0	00:00
CB12A	4.06	2626.51	0.33	0	00:00
CB12B	13.85	2626.11	0.60	0	00:00
CB13	17.14	2636.69	0.69	0	00:00
CB14	3.07	2636.49	0.29	0	00:00
CB15	3.20	2637.27	0.30	0	00:00
CB16	2.50	2648.91	0.22	0	01:33
CB17A	4.92	2648.58	0.32	0	17:26
CB17B	3.02	2648.96	0.27	0	01:33
CB18A	1.25	2654.60	0.20	0	01:33
CB18B	35.88	2654.30	0.80	0	00:01
CB19	1.74	2654.53	0.13	0	01:34
CB1A	8.35	2556.98	0.33	0	00:01
CB1B	3.39	2558.88	0.30	0	00:01
CB1C	2.72	2563.32	0.25	0	00:01
CB1D	13.16	2562.22	0.58	0	00:01

CB1E	82.49	2578.49	1.90	0	00:00
CB1F	1.60	2575.84	0.25	0	00:00
CB1G	15.95	2574.30	0.65	0	00:00
CB1H	3.08	2596.19	0.19	0	00:01
CB2	2.63	2597.14	0.20	0	00:01
CB20	725.68	2667.14	14.76	0	00:00
CB21	2.89	2655.53	0.22	0	00:00
CB22	1.40	2655.42	0.11	0	00:00
CB23	0.39	2655.31	0.10	0	00:00
CB25	3.08	2668.87	0.27	0	13:14
CB26	1.29	2678.75	0.20	0	00:01
CB27	2.92	2679.04	0.25	1	20:05
CB28	2.20	2683.35	0.21	0	00:02
CB29	6.46	2683.02	0.39	0	00:01
CB3	2.99	2598.91	0.21	0	00:02
CB30	3.73	2700.91	0.26	0	01:34
CB31	1.39	2708.64	0.16	0	00:03
CB32	4.46	2709.06	0.32	1	23:48
CB33	3.66	2709.74	0.27	1	01:14
CB34	3.24	2710.33	0.23	0	00:02
CB35	2.71	2706.08	0.24	0	00:00
CB36	75.57	2714.01	2.32	0	00:00
CB37	143.84	2720.04	4.24	0	00:00
CB38	3.71	2716.82	0.31	0	00:00
CB39	4.86	2711.32	0.32	0	00:01
CB4	1.57	2600.76	0.12	0	12:15
CB40	5.41	2720.13	0.36	1	18:09
CB41	2.23	2721.98	0.23	0	00:00
CB42	2.55	2725.56	0.20	0	14:31
CB43	23.02	2724.22	0.86	0	19:57
CB44	1.59	2728.15	0.25	0	22:54
CB47	0.08	2754.75	0.14	0	00:00
CB48	0.10	2770.17	0.17	0	00:01
CB49	4.41	2773.04	0.32	0	00:00
CB5	0.61	2601.20	0.10	0	12:15
CB50	11.68	2774.50	0.48	0	00:00
CB53	0.10	2767.69	0.18	0	00:00
CB54	18.70	2767.10	0.62	0	00:00
CB55	2.44	2759.82	0.24	0	00:02
CB56	1.79	2759.85	0.13	0	00:02
CB57	2.40	2757.93	0.16	0	00:00
CB58	1.26	2758.46	0.08	0	00:01
CB59	152.57	2760.22	3.30	0	00:00
CB60	6.89	2754.89	0.39	0	00:00
CB61	0.82	2754.49	0.05	0	17:53
CB62	7.01	2752.51	0.39	0	00:01
CB63	6.89	2753.75	0.39	0	00:01
CB65	9.01	2751.47	0.43	0	00:01
CB68	1.37	2755.50	0.09	1	05:39
CB69	1.69	2755.89	0.11	0	05:22
CB6A	3.50	2601.46	0.31	0	00:01
CB6B	172.29	2603.70	3.70	0	00:00
CB7	4.13	2602.81	0.32	0	00:00
CB71	4.59	2756.57	0.30	0	00:02
CB72	4.42	2679.29	0.29	0	00:01
CB73	3.93	2678.35	0.26	0	00:00
CB74	7.04	2755.50	0.39	0	00:00
CB75	8.16	2610.41	0.41	0	00:00
CB76	17.30	2609.70	0.60	0	00:00
CB77	1.09	2754.85	0.07	1	15:36
CB8	4.39	2605.17	0.33	0	00:01
CB9	11.30	2610.41	0.52	0	00:01
Exst42in-2	0.00	2753.26	0.00	0	00:00
Inlet-131	49.71	2663.11	1.08	0	00:00
Inlet-99	5676.82	2874.39	113.79	0	00:00
PE3aUS	663.70	2768.36	13.36	0	00:00
PE3bUS	663.70	2768.36	13.36	0	00:00

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Inlet Flow Summary
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Inlet ID	Peak Flow cfs	Peak Lateral Flow cfs	Peak Flow Intercepted by Inlet cfs	Peak Flow Bypassing Inlet cfs	Inlet Efficiency during Peak Flow %	Total Flooding acre-in	Total Time Flooded minutes
CB10	1.05	1.05	-	-	-	0.000	0
CB11A	1.26	1.26	-	-	-	0.000	0
CB11B	2.70	2.70	-	-	-	0.000	0
CB12A	1.35	1.35	-	-	-	0.000	0
CB12B	4.00	4.00	-	-	-	0.000	0
CB13	8.40	8.40	-	-	-	0.002	0
CB14	0.91	0.91	-	-	-	0.004	0
CB15	0.95	0.95	-	-	-	0.000	0
CB16	0.73	0.73	-	-	-	0.000	0
CB17A	0.90	0.90	-	-	-	0.000	0
CB17B	0.88	0.88	-	-	-	0.000	0
CB18A	0.77	0.77	-	-	-	0.000	0
CB18B	9.70	9.70	-	-	-	0.000	0
CB19	0.41	0.41	-	-	-	0.000	0
CB1A	1.40	1.40	-	-	-	0.000	0
CB1B	1.06	1.06	-	-	-	0.000	0
CB1C	0.83	0.83	-	-	-	0.000	0
CB1D	3.70	3.70	-	-	-	0.000	0
CB1E	11.00	11.00	-	-	-	0.003	0
CB1F	0.99	0.99	-	-	-	0.000	0
CB1G	5.00	5.00	-	-	-	0.000	0
CB1H	0.52	0.52	-	-	-	0.000	0
CB2	0.62	0.62	-	-	-	0.000	0

CB20	32.30	32.30	-	-	-	0.022
0						
CB21	0.68	0.68	-	-	-	0.000
0						
CB22	0.33	0.33	-	-	-	0.010
0						
CB23	0.36	0.36	-	-	-	0.000
0						
CB25	0.90	0.90	-	-	-	0.000
0						
CB26	0.80	0.80	-	-	-	0.000
0						
CB27	0.79	0.79	-	-	-	0.000
0						
CB28	0.72	0.72	-	-	-	0.000
0						
CB29	1.25	1.25	-	-	-	0.000
0						
CB3	0.68	0.68	-	-	-	0.000
0						
CB30	0.77	0.77	-	-	-	0.000
0						
CB31	0.52	0.52	-	-	-	0.000
0						
CB32	0.95	0.95	-	-	-	0.000
0						
CB33	0.78	0.78	-	-	-	0.000
0						
CB34	0.69	0.69	-	-	-	0.000
0						
CB35	0.79	0.79	-	-	-	0.000
0						
CB36	24.70	24.70	-	-	-	0.005
0						
CB37	33.90	33.90	-	-	-	0.000
0						
CB38	1.14	1.14	-	-	-	0.006
0						
CB39	0.90	0.90	-	-	-	0.004
0						
CB4	0.37	0.37	-	-	-	0.000
0						
CB40	1.30	1.30	-	-	-	0.000
0						
CB41	0.79	0.79	-	-	-	0.000
0						
CB42	0.60	0.60	-	-	-	0.000
0						
CB43	13.30	13.30	-	-	-	0.000
0						
CB44	0.98	0.98	-	-	-	0.000
0						
CB47	0.56	0.56	-	-	-	0.000
0						
CB48	0.67	0.67	-	-	-	0.000
0						
CB49	0.92	0.92	-	-	-	0.000
0						
CB5	0.38	0.38	-	-	-	0.000
0						
CB50	2.56	2.56	-	-	-	0.000
0						
CB53	0.69	0.69	-	-	-	0.000
0						
CB54	4.76	4.76	-	-	-	0.000
0						
CB55	0.75	0.75	-	-	-	0.000

0						
CB56	0.55	0.55	-	-	-	0.000
0						
CB57	0.44	0.44	-	-	-	0.000
0						
CB58	0.23	0.23	-	-	-	0.000
0						
CB59	14.88	14.88	-	-	-	0.001
0						
CB60	1.35	1.35	-	-	-	0.009
0						
CB61	0.15	0.15	-	-	-	0.000
0						
CB62	1.40	1.40	-	-	-	0.000
0						
CB63	1.37	1.37	-	-	-	0.000
0						
CB65	1.92	1.92	-	-	-	0.000
0						
CB68	0.25	0.25	-	-	-	0.000
0						
CB69	0.31	0.31	-	-	-	0.000
0						
CB6A	1.41	1.41	-	-	-	0.000
0						
CB6B	15.80	15.80	-	-	-	0.002
0						
CB7	1.35	1.35	-	-	-	0.000
0						
CB71	0.84	0.84	-	-	-	0.000
0						
CB72	0.81	0.81	-	-	-	0.000
0						
CB73	0.72	0.72	-	-	-	0.000
0						
CB74	1.41	1.41	-	-	-	0.000
0						
CB75	1.70	1.70	-	-	-	0.000
0						
CB76	4.70	4.70	-	-	-	0.000
0						
CB77	0.20	0.20	-	-	-	0.000
0						
CB8	1.48	1.48	-	-	-	0.000
0						
CB9	2.90	2.90	-	-	-	0.000
0						
Exst42in-2	0.00	0.00	-	-	-	0.000
0						
Inlet-131	30.35	30.35	-	-	-	0.051
0						
Inlet-99	122.50	122.50	-	-	-	0.000
0						
PE3aUS	41.17	41.17	-	-	-	0.001
0						
PE3bUS	41.17	41.17	-	-	-	0.000
0						

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Outfall Loading Summary
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Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs

Out01	100.00	23.96	27.62
Out10	99.99	0.79	0.83
Out10A	99.99	2.90	2.92
Out10B	99.95	10.35	11.03
Out11	100.00	66.58	67.92
Out2	99.99	2.55	2.57
Out-27	99.99	29.48	29.50
Out-28	99.99	4.15	4.54
Out-29	99.99	6.74	6.77
Out3	99.98	4.24	4.57
Out-33	99.99	105.56	105.63
Out-34	99.99	0.56	0.56
Out-35	99.99	44.06	47.71
Out-36	99.99	44.46	48.18
Out-37	99.99	0.44	0.46
Out-38	99.99	1.53	1.54
Out-39	99.99	0.23	0.23
Out-41	99.97	1.61	1.61
Out-42	100.00	4.70	5.74
Out-43	100.00	1.70	1.82
Out-44	100.00	15.79	16.30
Out5	99.99	10.25	10.46
Out6	99.99	23.24	25.67
Out7	99.99	0.36	0.38
Out9	99.99	2.94	2.94
System	99.99	409.16	411.86

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Link Flow Summary
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Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Depth	Total Time minutes	Reported Condition
Exst42inDS	CONDUIT	0 00:06	12.42	1.02	105.63	138.76	0.76	0.83	0	Calculated
Exst42inUS	CONDUIT	0 13:03	14.09	1.00	122.50	139.45	0.88	1.00	2879	SURCHARGED
ExstPE2-DS	CONDUIT	0 00:44	10.66	1.44	29.50	38.94	0.76	0.83	0	Calculated
ExstPE2-US	CONDUIT	0 00:00	12.81	7.32	31.52	39.16	0.80	1.00	2879	SURCHARGED
Link-148	CONDUIT	0 00:00	0.00	1.00	0.00	119.03	0.00	0.04	0	Calculated
Link-149	CONDUIT	0 00:02	5.13	1.00	1.61	154.69	0.01	0.07	0	Calculated
Link-150	CONDUIT	0 00:01	7.87	1.67	22.15	27.71	0.80	1.00	0	Calculated
Link-154	CONDUIT	0 00:14	0.95	1.87	0.20	16.31	0.01	0.19	0	Calculated
P-1F	CONDUIT	0 00:00	7.58	1.00	13.27	8.91	1.49	0.97	0	> CAPACITY
P-28	CONDUIT	0 00:11	2.48	1.00	5.23	31.70	0.16			

0.64	0	Calculated								
P-38		CONDUIT	0	00:02	2.71	1.00	0.70	18.85	0.04	
0.14	0	Calculated								
P-60		CONDUIT	0	00:01	2.67	1.86	0.23	12.84	0.02	
0.10	0	Calculated								
P-65-66		CONDUIT	0	00:01	2.69	1.82	5.87	23.94	0.25	
0.70	0	Calculated								
P-76		CONDUIT	0	00:01	6.09	1.42	1.71	12.88	0.13	
0.22	0	Calculated								
P-77A-B		CONDUIT	0	00:00	6.39	4.56	14.14	27.73	0.51	
1.00	0	SURCHARGED								
P-78		CONDUIT	0	00:00	5.59	1.48	1.82	15.79	0.12	
0.24	0	Calculated								
P-79		CONDUIT	0	00:00	6.40	9.17	5.74	15.77	0.36	
0.55	0	Calculated								
P-7B		CONDUIT	0	00:00	9.22	1.00	16.30	13.20	1.23	
1.00	2880	SURCHARGED								
P-81		CONDUIT	0	00:00	9.36	2.11	13.75	7.84	1.75	
1.00	2879	SURCHARGED								
P-82		CONDUIT	0	00:01	3.98	9.36	5.02	10.88	0.46	
1.00	1	SURCHARGED								
PE1aDS		CONDUIT	0	00:00	16.26	4.24	48.18	176.21	0.27	
0.47	0	Calculated								
PE1aUS		CONDUIT	0	00:00	11.37	1.00	53.47	75.35	0.71	
0.66	0	Calculated								
PE1cDS		CONDUIT	0	00:00	16.00	4.55	47.71	174.93	0.27	
0.48	0	Calculated								
PE3bUS		CONDUIT	0	00:00	11.20	1.00	52.02	80.19	0.65	
0.62	0	Calculated								
Pipe10		CONDUIT	0	00:01	4.28	1.00	2.92	9.10	0.32	
0.41	0	Calculated								
Pipe11		CONDUIT	0	00:02	5.77	1.26	11.03	19.95	0.55	
0.59	0	Calculated								
Pipe12		CONDUIT	0	00:02	3.91	2.01	2.89	19.04	0.15	
0.58	0	Calculated								
Pipe13		CONDUIT	0	00:01	7.60	1.00	10.62	34.62	0.31	
0.50	0	Calculated								
Pipe14A		CONDUIT	0	00:01	3.83	7.56	2.90	9.10	0.32	
0.45	0	Calculated								
Pipe14B		CONDUIT	0	00:01	7.15	4.21	4.32	18.95	0.23	
0.38	0	Calculated								
Pipe15&16		CONDUIT	0	00:01	8.37	1.00	6.20	43.92	0.14	
0.30	0	Calculated								
Pipe16B		CONDUIT	0	00:00	5.32	6.47	4.46	12.87	0.35	
0.49	0	Calculated								
Pipe17		CONDUIT	0	00:00	6.17	6.05	10.72	9.10	1.18	
1.00	2879	SURCHARGED								
Pipe18		CONDUIT	0	00:00	5.67	1.09	9.58	7.05	1.36	
1.00	2879	SURCHARGED								
Pipe19		CONDUIT	0	00:01	5.92	2.65	10.46	6.44	1.63	
1.00	2879	SURCHARGED								
Pipe1A		CONDUIT	0	00:01	7.41	1.07	27.62	38.07	0.73	
0.72	0	Calculated								
Pipe1B		CONDUIT	0	00:01	9.06	8.04	25.35	48.65	0.52	
0.88	0	Calculated								
Pipe1C		CONDUIT	0	00:01	10.11	1.00	23.29	39.65	0.59	
0.81	0	Calculated								
Pipe1D		CONDUIT	0	00:01	4.14	6.05	3.95	9.10	0.43	
0.56	0	Calculated								
Pipe1E		CONDUIT	0	00:00	13.01	1.00	19.19	45.52	0.42	
0.54	0	Calculated								
Pipe1G		CONDUIT	0	00:00	6.13	7.03	5.61	15.03	0.37	
0.53	0	Calculated								
Pipe1H		CONDUIT	0	00:01	2.48	6.05	0.52	9.10	0.06	
0.18	0	Calculated								
Pipe2		CONDUIT	0	00:01	2.37	1.00	1.15	13.86	0.08	
0.23	0	Calculated								

Pipe20	CONDUIT	0	01:33	8.17	1.00	25.67	17.98	1.43	1.00	2878	SURCHARGED
Pipe21	CONDUIT	0	01:33	4.04	1.48	5.84	12.81	0.46	1.00	2878	SURCHARGED
Pipe21A	CONDUIT	0	00:02	3.44	12.60	4.49	12.74	0.35	1.00	2874	SURCHARGED
Pipe22	CONDUIT	0	00:01	7.84	1.00	22.81	27.73	0.82	1.00	2875	SURCHARGED
Pipe23	CONDUIT	0	00:01	2.17	1.26	1.43	9.10	0.16	0.88	0	Calculated
Pipe24	CONDUIT	0	00:00	11.63	1.07	34.67	27.75	1.25	1.00	2879	SURCHARGED
Pipe25	CONDUIT	0	00:00	12.96	5.49	32.73	19.61	1.67	1.00	2880	SURCHARGED
Pipe26	CONDUIT	0	00:00	6.98	1.10	12.09	6.44	1.88	1.00	2880	SURCHARGED
Pipe27	CONDUIT	0	00:00	6.12	8.28	0.38	34.52	0.01	0.08	0	Calculated
Pipe29	CONDUIT	1	10:23	7.20	1.00	4.33	33.90	0.13	0.25	0	Calculated
Pipe3	CONDUIT	0	00:02	2.56	1.00	1.85	13.86	0.13	0.30	0	Calculated
Pipe30	CONDUIT	0	00:01	3.00	1.33	0.80	9.15	0.09	0.21	0	Calculated
Pipe31	CONDUIT	0	00:03	6.18	1.00	2.74	33.96	0.08	0.20	0	Calculated
Pipe32	CONDUIT	0	00:01	3.38	1.33	1.26	9.15	0.14	0.26	0	Calculated
Pipe33&34	CONDUIT	0	00:12	4.14	1.00	0.77	43.84	0.02	0.12	0	Calculated
Pipe35A	CONDUIT	0	00:08	4.99	13.45	2.94	33.96	0.09	0.24	0	Calculated
Pipe36	CONDUIT	1	07:46	5.00	1.26	2.42	34.03	0.07	0.21	0	Calculated
Pipe37	CONDUIT	1	22:02	3.50	1.00	1.47	19.17	0.08	0.19	0	Calculated
Pipe39	CONDUIT	0	00:00	2.92	1.88	0.83	19.61	0.04	0.15	0	Calculated
Pipe4	CONDUIT	0	12:15	2.46	1.00	2.19	13.86	0.16	0.33	0	Calculated
Pipe40	CONDUIT	0	00:01	9.61	1.00	67.92	47.60	1.43	1.00	2879	SURCHARGED
Pipe41	CONDUIT	0	00:01	6.31	1.00	44.63	43.76	1.02	1.00	2879	SURCHARGED
Pipe42	CONDUIT	0	00:00	7.15	1.00	12.19	7.14	1.71	1.00	2879	SURCHARGED
Pipe44	CONDUIT	0	11:58	4.30	1.00	16.97	56.80	0.30	0.75	0	Calculated
Pipe45	CONDUIT	0	00:00	2.58	1.45	0.82	30.33	0.03	0.27	0	Calculated
Pipe46	CONDUIT	0	12:34	9.48	1.00	14.88	33.96	0.44	0.50	0	Calculated
Pipe47	CONDUIT	0	00:05	0.68	1.23	0.60	23.68	0.03	0.32	0	Calculated
Pipe48	CONDUIT	0	00:06	1.31	1.00	0.98	33.90	0.03	0.30	0	Calculated
Pipe49	CONDUIT	0	00:01	4.90	1.36	0.56	20.37	0.03	0.12	0	Calculated
Pipe5	CONDUIT	0	12:15	3.32	2.19	2.57	16.01	0.16	0.29	0	Calculated
Pipe50	CONDUIT	0	00:01	4.35	2.94	4.54	19.19	0.24	0.37	0	Calculated
Pipe51	CONDUIT	0	00:01	4.89	1.03	3.73	27.71	0.13	0.31	0	Calculated
Pipe52	CONDUIT	0	00:00	5.60	1.90	2.68	33.93	0.08	0.21	0	Calculated
Pipe55	CONDUIT	0	00:00	6.73	5.50	6.47	9.10	0.71			

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0.54           0  Calculated
  Pipe56               CONDUIT      0  00:00      8.10    1.00        6.23       33.96      0.18
0.38           0  Calculated
  Pipe57               CONDUIT      0  00:02      4.47    2.03        6.21       19.78      0.31
0.46           0  Calculated
  Pipe58               CONDUIT      0  00:02      5.08    1.22        6.77       19.67      0.34
0.44           0  Calculated
  Pipe59               CONDUIT      0  00:00      3.24    2.56        0.46       12.82      0.04
0.14           0  Calculated
  Pipe6                CONDUIT      0  00:01      6.86    2.87        4.57       36.06      0.13
0.27           0  Calculated
  Pipe61               CONDUIT      0  00:00     10.21    1.00       15.47       20.34      0.76
1.00        2879  SURCHARGED
  Pipe62               CONDUIT      0  00:00      9.70   27.18       17.14       26.15      0.66
1.00        2879  SURCHARGED
  Pipe63               CONDUIT      0  00:15      1.60    1.00        0.15       11.17      0.01
0.32           0  Calculated
  Pipe64               CONDUIT      0  00:01      3.33    2.64        3.47       23.90      0.15
0.46           0  Calculated
  Pipe67               CONDUIT      0  00:01      2.24    1.00        4.91       13.86      0.35
0.67           0  Calculated
  Pipe70               CONDUIT      0  16:51      2.93    1.00        1.40        6.44      0.22
0.36           0  Calculated
  Pipe72               CONDUIT      0  00:03      2.67    1.41        1.15        6.47      0.18
0.29           0  Calculated
  Pipe73               CONDUIT      0  00:01      2.42    1.02        0.84        6.44      0.13
0.26           0  Calculated
  Pipe74               CONDUIT      0  00:01      1.92    1.72        0.75       13.86      0.05
0.19           0  Calculated
  Pipe75               CONDUIT      0  00:01      2.59    3.21        1.54       14.05      0.11
0.24           0  Calculated
  Pipe7A               CONDUIT      0  00:01      7.48    1.59        1.41       25.55      0.06
0.16           0  Calculated
  Pipe8                CONDUIT      0  00:01      5.49    1.28        2.98       35.00      0.09
0.25           0  Calculated
  Pipe9                CONDUIT      0  00:00      5.22    1.00        1.49       33.96      0.04
0.15           0  Calculated


  ********************************
  Highest Flow Instability Indexes
  ********************************
  Link Pipe21A (41)
  Link Pipe21 (38)
  Link Pipe20 (38)
  Link Pipe46 (31)
  Link Pipe22 (16)

  WARNING 107 : Initial water surface elevation defined for Junction JS1 is below junction invert
elevation.
                Assumed initial water surface elevation equal to invert elevation.
  WARNING 107 : Initial water surface elevation defined for Junction JS11 is below junction
invert elevation.
                Assumed initial water surface elevation equal to invert elevation.
  WARNING 108 : Surcharge elevation defined for Junction JS11 is below junction maximum
elevation. Assumed surcharge elevation equal to maximum elevation.
  WARNING 107 : Initial water surface elevation defined for Junction JS2 is below junction invert
elevation.
                Assumed initial water surface elevation equal to invert elevation.
  WARNING 108 : Surcharge elevation defined for Junction JS2 is below junction maximum elevation.
Assumed surcharge elevation equal to maximum elevation.
  WARNING 107 : Initial water surface elevation defined for Junction Jun-10 is below junction
invert elevation.
                Assumed initial water surface elevation equal to invert elevation.
  WARNING 108 : Surcharge elevation defined for Junction Jun-10 is below junction maximum
elevation. Assumed surcharge elevation equal to maximum elevation.
  WARNING 107 : Initial water surface elevation defined for Junction Jun-11 is below junction
```

invert elevation.
Assumed initial water surface elevation equal to invert elevation.
WARNING 108 : Surcharge elevation defined for Junction Jun-11 is below junction maximum elevation. Assumed surcharge elevation equal to maximum elevation.
WARNING 107 : Initial water surface elevation defined for Junction Jun-12 is below junction invert elevation.
Assumed initial water surface elevation equal to invert elevation.
WARNING 108 : Surcharge elevation defined for Junction Jun-12 is below junction maximum elevation. Assumed surcharge elevation equal to maximum elevation.
WARNING 107 : Initial water surface elevation defined for Junction Jun-13 is below junction invert elevation.
Assumed initial water surface elevation equal to invert elevation.
WARNING 108 : Surcharge elevation defined for Junction Jun-13 is below junction maximum elevation. Assumed surcharge elevation equal to maximum elevation.
WARNING 107 : Initial water surface elevation defined for Junction Jun-14 is below junction invert elevation.
Assumed initial water surface elevation equal to invert elevation.
WARNING 108 : Surcharge elevation defined for Junction Jun-14 is below junction maximum elevation. Assumed surcharge elevation equal to maximum elevation.
WARNING 106 : Max/rim elevation defined for Junction Jun-16 is below junction invert elevation.
Assumed max/rim elevation equal to invert elevation.
WARNING 107 : Initial water surface elevation defined for Junction Jun-16 is below junction invert elevation.
Assumed initial water surface elevation equal to invert elevation.
WARNING 107 : Initial water surface elevation defined for Junction MH1 is below junction invert elevation.
Assumed initial water surface elevation equal to invert elevation.
WARNING 108 : Surcharge elevation defined for Junction MH1 is below junction maximum elevation. Assumed surcharge elevation equal to maximum elevation.
WARNING 138 : Initial water surface elevation defined for Inlet CB10 is below catchbasin invert elevation.
Assumed initial water surface elevation equal to catchbasin inlet invert elevation.
WARNING 138 : Initial water surface elevation defined for Inlet CB11A is below catchbasin invert elevation.
Assumed initial water surface elevation equal to catchbasin inlet invert elevation.
WARNING 138 : Initial water surface elevation defined for Inlet CB11B is below catchbasin invert elevation.
Assumed initial water surface elevation equal to catchbasin inlet invert elevation.
WARNING 138 : Initial water surface elevation defined for Inlet CB12A is below catchbasin invert elevation.
Assumed initial water surface elevation equal to catchbasin inlet invert elevation.
WARNING 138 : Initial water surface elevation defined for Inlet CB12B is below catchbasin invert elevation.
Assumed initial water surface elevation equal to catchbasin inlet invert elevation.
WARNING 138 : Initial water surface elevation defined for Inlet CB13 is below catchbasin invert elevation.
Assumed initial water surface elevation equal to catchbasin inlet invert elevation.
WARNING 138 : Initial water surface elevation defined for Inlet CB14 is below catchbasin invert elevation.
Assumed initial water surface elevation equal to catchbasin inlet invert elevation.
WARNING 138 : Initial water surface elevation defined for Inlet CB15 is below catchbasin invert elevation.
Assumed initial water surface elevation equal to catchbasin inlet invert elevation.
WARNING 138 : Initial water surface elevation defined for Inlet CB16 is below catchbasin invert elevation.
Assumed initial water surface elevation equal to catchbasin inlet invert elevation.
WARNING 138 : Initial water surface elevation defined for Inlet CB17A is below catchbasin invert elevation.

```
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB17B is below catchbasin
invert elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB18A is below catchbasin
invert elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB18B is below catchbasin
invert elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB19 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB1A is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB1B is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB1C is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB1D is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB1E is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB1F is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB1G is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB1H is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB2 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB20 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB21 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB22 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB23 is below catchbasin invert
```

```
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB25 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB26 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB27 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB28 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB29 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB3 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB30 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB31 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB32 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB33 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB34 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB35 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB36 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB37 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB38 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB39 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
```

```
  WARNING 138 : Initial water surface elevation defined for Inlet CB4 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB40 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB41 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB42 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB43 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB44 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB47 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB48 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB49 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB5 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB50 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB53 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB54 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB55 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB56 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB57 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB58 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
```

```
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB59 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB60 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB61 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB62 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB63 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB65 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB68 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB69 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB6A is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB6B is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB7 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB71 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB72 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB73 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB74 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB75 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB76 is below catchbasin invert
elevation.
```

```
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB77 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB8 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet CB9 is below catchbasin invert
elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet Exst42in-2 is below catchbasin
invert elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet Inlet-131 is below catchbasin
invert elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet Inlet-99 is below catchbasin
invert elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet PE3aUS is below catchbasin
invert elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 138 : Initial water surface elevation defined for Inlet PE3bUS is below catchbasin
invert elevation.
                Assumed initial water surface elevation equal to catchbasin inlet invert
elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit Exst42inDS is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit P-28 is below downstream node
invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit PE1aDS is below upstream node
invert elevation.
                Assumed conduit inlet invert elevation equal to upstream node invert elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit PE1aDS is below downstream
node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit PE1aUS is below downstream
node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit PE1cDS is below upstream node
invert elevation.
                Assumed conduit inlet invert elevation equal to upstream node invert elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit PE1cDS is below downstream
node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit PE3bUS is below upstream node
invert elevation.
                Assumed conduit inlet invert elevation equal to upstream node invert elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit PE3bUS is below downstream
node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
```

```
  WARNING 005 : Minimum slope used for Conduit Pipe19.
  WARNING 005 : Minimum slope used for Conduit Pipe2.
  WARNING 005 : Minimum slope used for Conduit Pipe26.
  WARNING 005 : Minimum slope used for Conduit Pipe3.
  WARNING 005 : Minimum slope used for Conduit Pipe4.
  WARNING 005 : Minimum slope used for Conduit Pipe67.
  WARNING 005 : Minimum slope used for Conduit Pipe74.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height
dimensions for Node JS2.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height
dimensions for Node Jun-11.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height
dimensions for Node Jun-12.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height
dimensions for Node Jun-13.

  Analysis began on:  Mon Dec 17 10:01:57 2018
  Analysis ended on:  Mon Dec 17 10:02:09 2018
  Total elapsed time: 00:00:12
```

APPENDIX 13

SEDIMENTATION POTENTIAL ANALYSIS

PSOMAS

Project Name: Kolb Road (Sunrise to Sabino Canyon)
Project Number #: 7PIM160201 Made By: EB Date: 8/16/2018
Reference: COT SMDDFM Section 11.5 Checked By: CLR Date: 8/17/2018

Sedimentation at Culvert Crossings

$$R_s = \frac{Q_{ac}}{Q_p}\left(\frac{S_{ac}}{S_p}\right)^{1.66}\left(\frac{n_{ac}}{n_p}\right)^{-1.55}\left(\frac{R_{ac}}{R_p}\right)^{0.91}$$

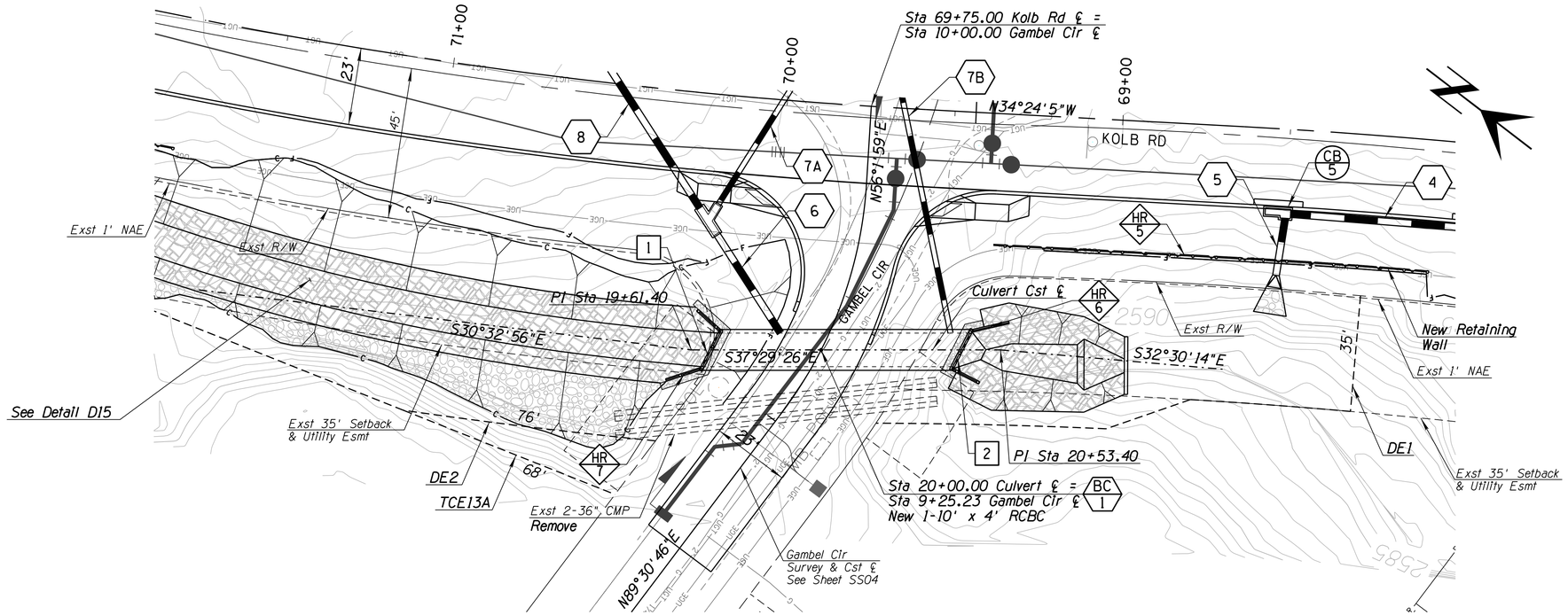
Q_{ac} = Discharge in Approach Channel, in cfs
Q_p = Total culvert discharge, in cfs
S_{ac} = Longitudinal slope of approach channel, in ft/ft
S_p = Longitudinal slope of culvert, in ft/ft (Never to exceed critical slope)
n_{ac} = Manning's roughness coefficient for the approach channel
n_p = Mannings roughness coefficient for the culvert
R_{ac} = Hydraulic radius of flow in approach channel, in ft
R_p = Hydraulic radius of flow within the culvert, in ft

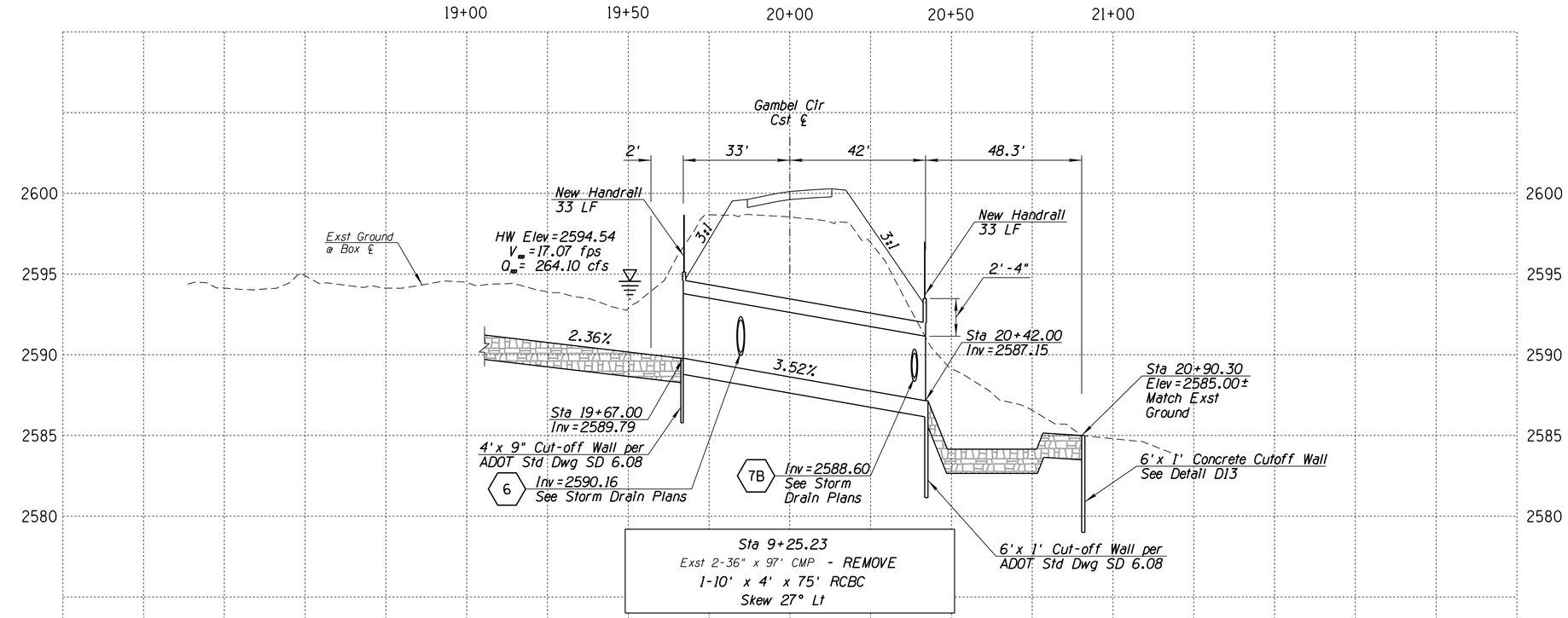
Culvert Number	Culvert Type	Concentration Point	Q_{ac} (cfs)	Q_p (cfs)	S_{ac} (ft/ft)	S_p (ft/ft)	n_{ac}	n_p	R_{ac} (ft)	R_p (ft)	R_s
PE-3	3-36" RCP	2B	123.53	123.53	0.0100	0.0250	0.035	0.013	1.11	0.68	0.07
P13	1-24" RCP	6	19.96	19.96	0.0571	0.0500	0.035	0.013	0.44	0.46	0.26
P12	2-24" RCP	7	22.4	22.4	0.0500	0.0500	0.035	0.013	0.43	0.36	0.25
P11	2-24" RCP	8	13.9	13.9	0.0485	0.0520	0.035	0.013	0.36	0.29	0.23
P9	1-38"X24" HERCP	12	33.9	33.9	0.0500	0.0400	0.035	0.013	0.53	0.58	0.29
P4	1-36" RCP	14	54.6	54.6	0.0100	0.0300	0.035	0.013	0.89	0.73	0.04
P3	3-30" RCP	16	71.4	71.4	0.0525	0.0380	0.035	0.013	0.65	0.51	0.46
P10	1-38"X24" HERCP	9	21.63	21.63	0.0485	0.0300	0.035	0.013	0.44	0.51	0.42
BC2	2-6'X3' RCBC	23	220.47	220.47	0.0300	0.0410	0.035	0.013	1.24	0.89	0.17
BC1	1-10'X4' RCBC	24	264.1	264.1	0.0500	0.0350	0.035	0.013	1.12	1.27	0.35
P1	3-38"X60" HERCP	22	348.81	348.81	0.0125	0.0374	0.035	0.013	1.56	0.93	0.06
PE1	1-24" RCP	20	49.36	49.36	0.0100	0.0050	0.035	0.013	0.74	0.51	0.96
P5	1-19"X30" HERCP	14	4.4	4.4	0.0100	0.0300	0.035	0.013	0.32	0.27	0.04
P14	1-34"53" HERCP	6A	80.68	80.68	0.0150	0.0150	0.035	0.013	0.94	0.96	0.21
P15	2-30" RCP	2A	43	43	0.0200	0.0361	0.035	0.013	0.67	0.47	0.11
P6	1-23"X14" HERCP	10	16.4	16.4	0.0050	0.0050	0.035	0.013	0.63	0.44	0.30
P7	1-18" RCP	11	5.4	5.4	0.0100	0.0100	0.035	0.013	0.37	0.38	0.21
P16	1-38"X24" HERCP	17B	51.9	51.9	0.0839	0.0510	0.035	0.013	0.58	0.65	0.44
P2	1-36" RCP	17B	51.9	51.9	0.1000	0.1021	0.035	0.013	0.53	0.56	0.20
PE2	2-24" RCP	18	76.8	76.8	0.0050	0.0049	0.035	0.013	0.72	0.51	0.30

*Rp based on normal depth

APPENDIX 14
PLAN AND PROFILE SHEETS
FOR
CROSS DRAINAGE
AND
STORMDRAIN

CROSS CULVERT
PLAN AND PROFILE SHEETS





Notes:

1. Inlet headwall and wingwall dimensions shall be based on ADOT Std Dwg SD 6.08 with 4' height, 15° skew and 2:1 slopes.
2. Outlet headwall and wingwall dimensions shall be based on ADOT Std Dwg SD 6.08 with 5' height, 20° skew and 2:1 slopes.
3. RCBC shall be constructed per ADOT Std Dwg SD 6.01.
4. Handrail shall be installed on headwalls and wingwalls as shown on the plans & per PAG Std Dtl 105.
5. For inlet protection, see Detail D15.
6. For outlet protection, see Detail D13.
7. For storm drain pipe connection to RCBC, see Detail D1.

1 Top Headwall Elev=2595.12

2 Top Headwall Elev=2593.48

Cross-Drainage Quantities

1 EA	Box Culvert 1 Bid Item # 6010161
20 LF	Concrete Cutoff Wall (1'x6') Bid Item # 6010716
63 LF	Handrail Bid Item # 9330008

No.	Revision Description	Engineer	Date

		Date
Designed	M ASHBY	12/18
Drawn	C ZHANG	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12/17/18 ARIZONA U.S.A. Expires 03/31/19

PSOMAS
333 E. Wetmore Road, Suite 450
Tucson, AZ 85705
(520) 292-2300 (520) 292-1290 fax
www.psomas.com

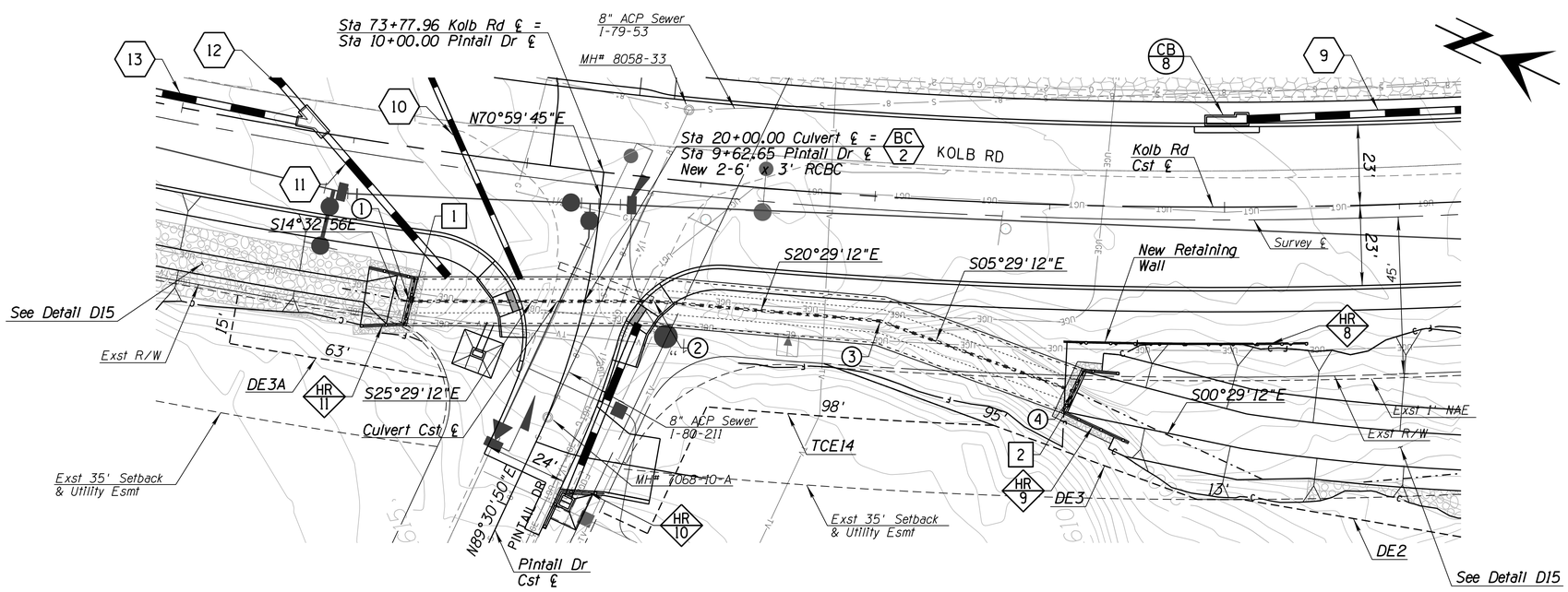
CROSS CULVERT PLAN AND PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 69+83

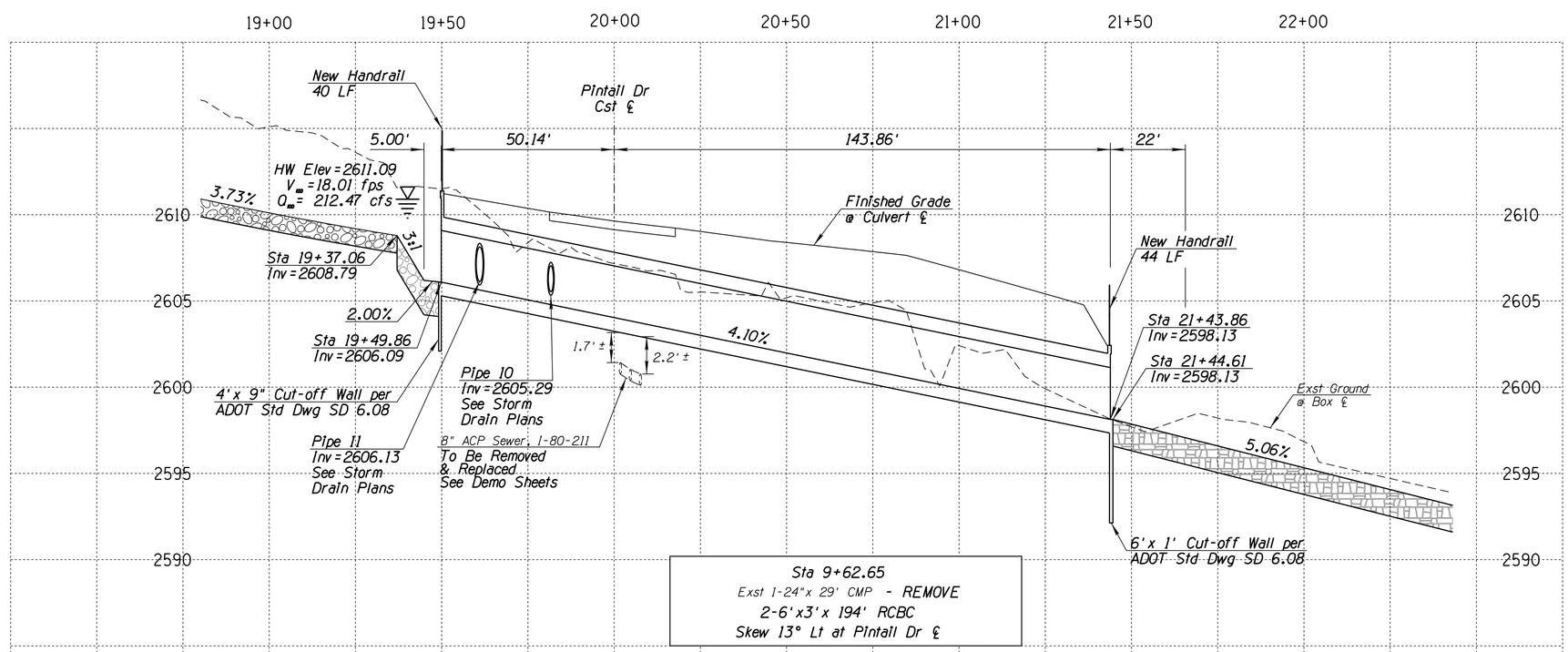
Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

0 20' 40'

Scales: Horiz. 1"=20' Vert. 1"=4'

SHEET DR01 OF DR19





Notes:

1. Inlet headwall and wingwall dimensions shall be based on ADOT Std Dwg SD 6.08. with 3' height, 15° skew and 4:1 slopes and modified as follows:
   θ_1 =90°,
   L=M=4'-9 1/2",
   E=13'-4"
   G=12'-6"
2. Outlet Headwall and wingwall dimensions shall be based on ADOT Std Dwg SD 6.08. with 3' height, 25° skew and 4:1 slopes and modified as follows:
   E=20'
   G=10'
   θ_2 =70°
3. RCBC shall be constructed per ADOT Std Dwg SD 6.05.
4. Handrail shall be installed on headwalls as shown on the plans & per PAG Std Dtl 105.
5. For inlet protection, see Detail D15.
6. For outlet protection, see Detail D15.
7. For storm drain pipe connection to RCBC, see Detail D1.

(1) PI Sta 19+49.86

(2) PI Sta 20+19.86, 5°

(3) PI Sta 20+84.86, 15°

(4) PI Sta 21+43.86

[1] Top Headwall Elev=2611.38

[2] Top Headwall Elev=2602.43

Cross-Drainage Quantities

1 EA	Box Culvert Bid Item # 6010162
83 LF	Handrail Bid Item # 9330008

0 20' 40'

Call at least two full working days before you begin excavation
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Arizona Blue Stake, Inc.
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In Maricopa County: (602) 263-1100

Scales: Horiz. 1"=20' Vert. 1"=4'

SHEET DR02 OF DR19

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

No.	Revision Description	Engineer	Date

		Date
Designed	M ASHBY	12/18
Drawn	C ZHANG	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12/17/18 ARIZONA U.S.A. Expires 03/31/19

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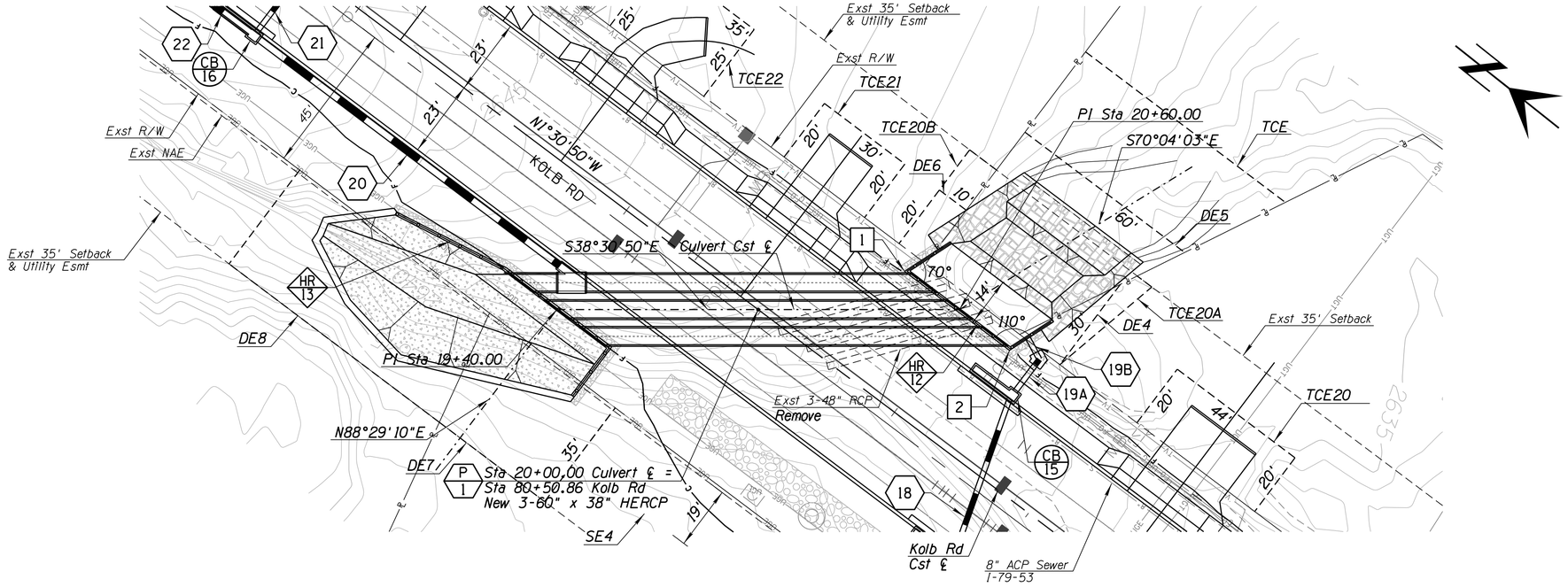
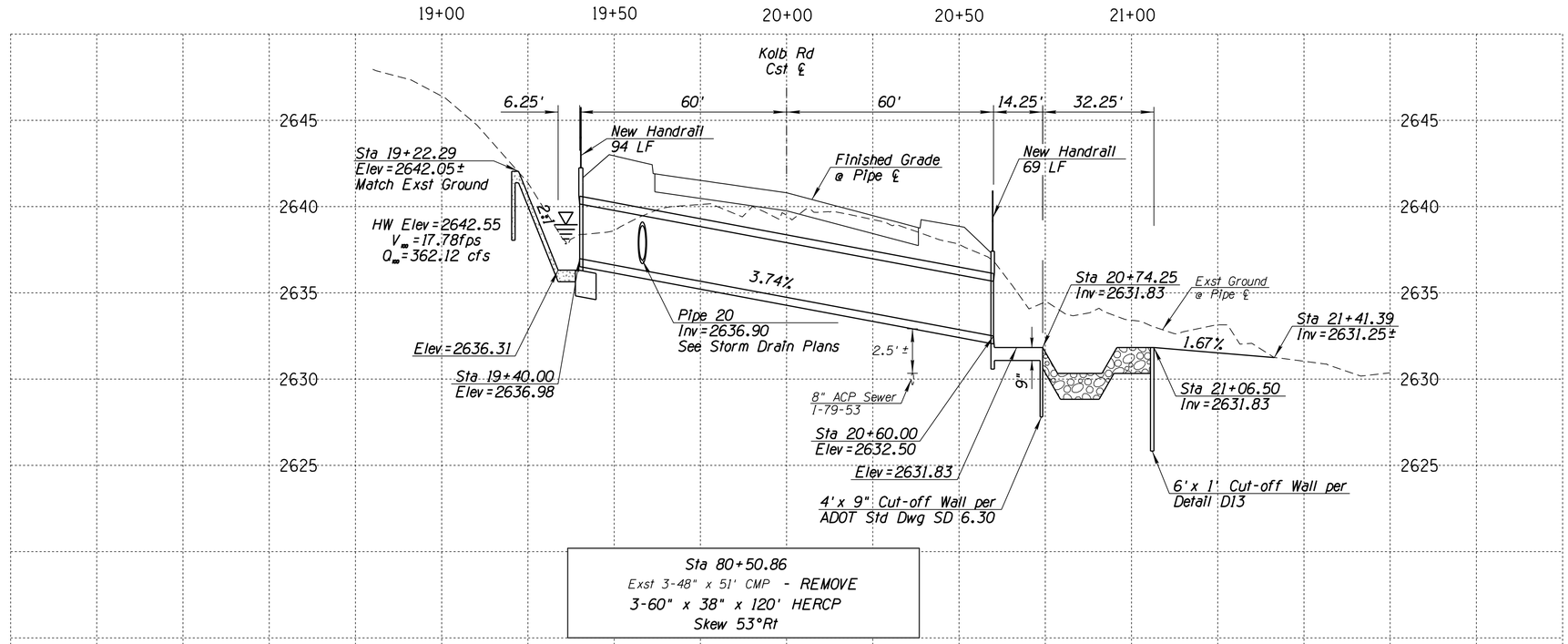
CROSS CULVERT PLAN AND PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
Sta 9+62.65





Notes:

1. See Detail D14 for inlet headwall and wingwall information.
2. Outlet headwall and wingwall dimensions shall be based ADOT Std Dwg SD-6.30 (4 of 5) with 3-48" diameter pipe, 45° Skew 4:1 slope (modifications as shown).
3. Pipes shall be installed per ADOT Std Dwgs C-13.10 and C-13.15.
4. Handrail shall be installed on headwalls as shown on the plans & per PAG Std Dtl 105.
5. For drop inlet, see Detail D14.
6. For outlet protection, see Detail D13.

1 Top Headwall Elev=2638.75

2 Top Headwall Elev=2636.67

Cross-Drainage Quantities

360 LF	38"x60" RCP, Class HE-II Bid Item # 5011275
1 EA	Drop Inlet Bid Item # 5030182
2 EA	Pipe Culvert Headwall Bid Item # 6016087
45 LF	Concrete Cutoff Wall (1'x6') Bid Item # 6010716
4 EA	Concrete Wingwall Bid Item # 6016110
162 LF	Handrail Bid Item # 9330008

0 20' 40'

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Scales: Horiz. 1"=20' Vert. 1"=4'

SHEET DR03 OF DR19

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

Designed	M ASHBY	Date 12/18
Drawn	C ZHANG	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

No.	Revision Description	Engineer	Date

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 11/27/18 ARIZONA U.S.A. Expires 03/31/19

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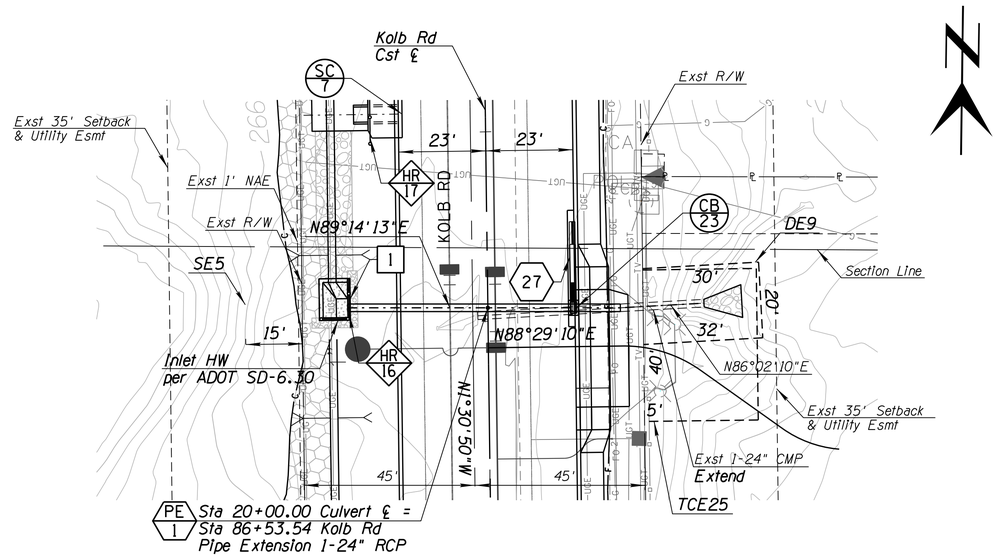
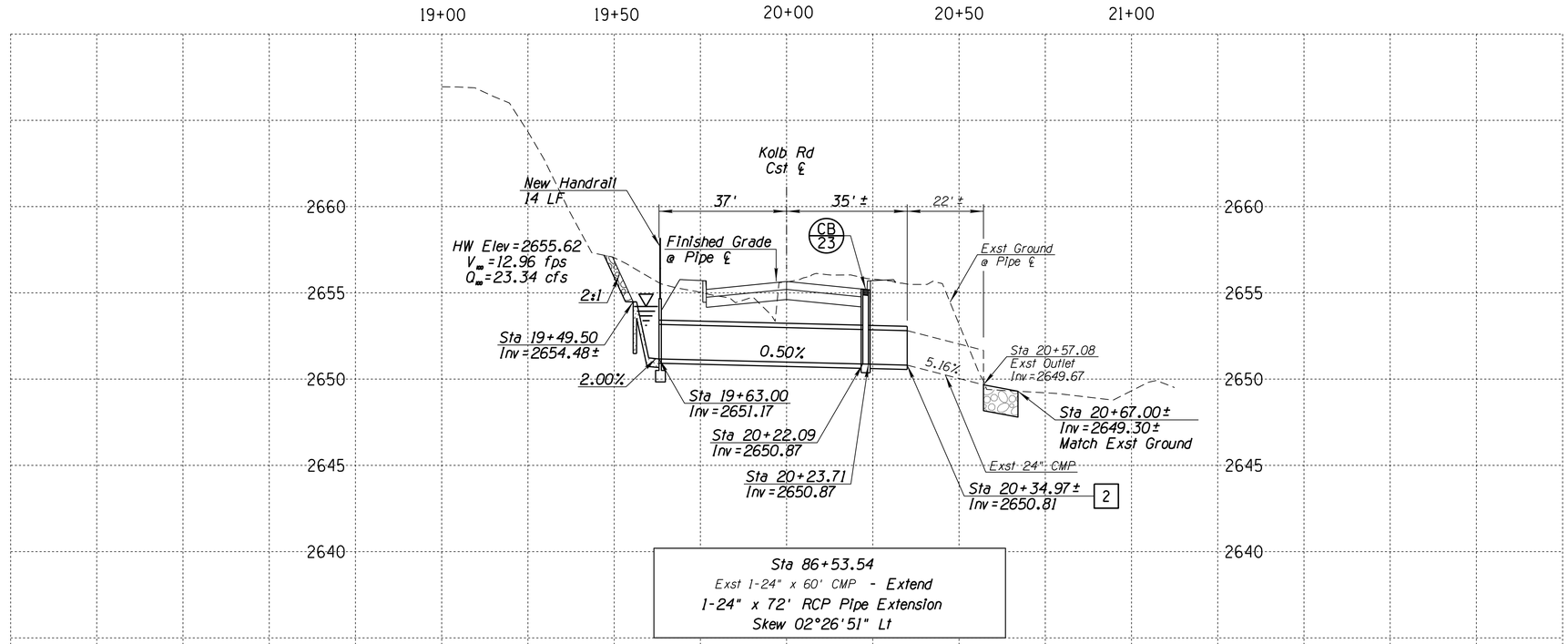
CROSS CULVERT PLAN AND PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
Sta 80+51





Notes:

1. Inlet "L" shaped headwall dimensions shall be based on ADOT Std Dwg SD-6.30 (2 of 5) for a 30" diameter pipe and modified as follows:
   G=7'-6"
   L=15'-6".
2. Pipe shall be installed per ADOT Std Dwgs C-13.10 and C-13.15.
3. Handrail shall be installed on headwall as shown on the plans & per PAG Std Dtl 105.
4. For drop inlet, see Detail D14.
5. For outlet protection, See Detail D12.

1 Top Headwall Elev=2654.67

2 Connect New RCP to Exst CMP
See Detail D2

Cross-Drainage Quantities

72 LF	24" RCP, Class III Bid Item # 5011023
1 EA	Drop Inlet Bid Item # 5030182
1 EA	Pipe Culvert Headwall Bid Item # 6016087
14 LF	Handrail Bid Item # 9330008

0 20' 40'

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In Maricopa County: (602) 263-1100

Scales: Horiz. 1"=20' Vert. 1"=4'

SHEET DR04 OF DR19

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

No.	Revision Description	Engineer	Date

		Date
Designed	M ASHBY	12/18
Drawn	C ZHANG	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 11/27/18 ARIZONA U.S.A. Expires 03/31/19

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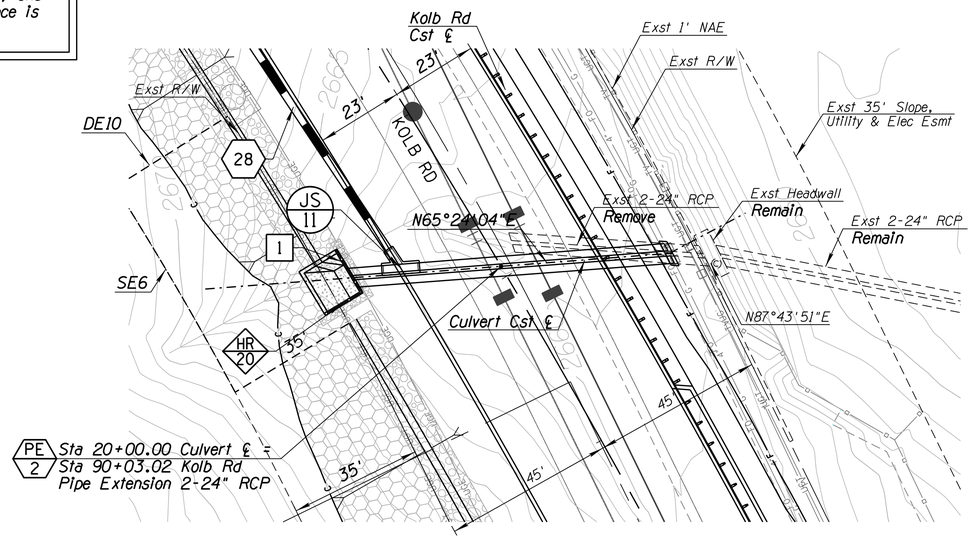
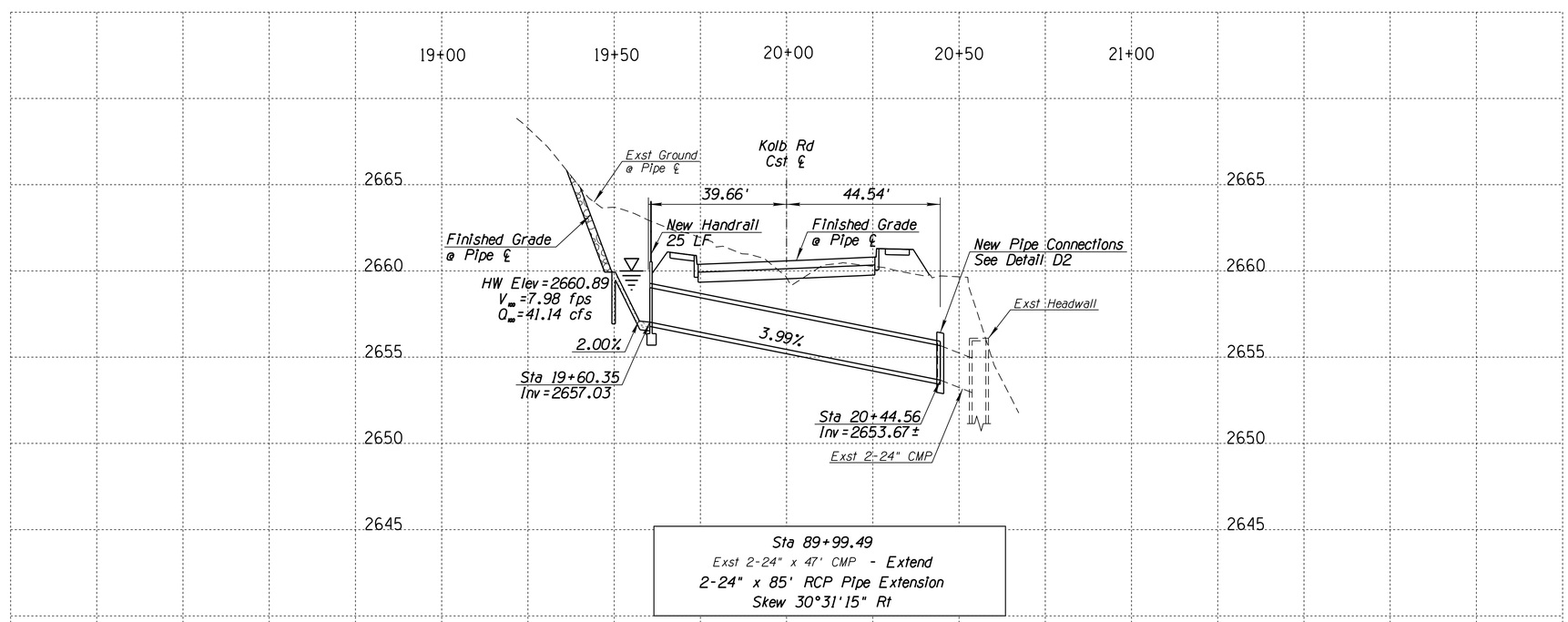
CROSS CULVERT PLAN AND PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
Sta 86+54

The contractor shall survey the existing invert elevation of the existing CMPs at Sta 20+44.56 a mimimum of 7 calendar days prior to construction of any of the new pipe for PE-2, as well as prior to construction of JS-11 and Pipe 28, and the contractor shall notify the Engineer if the difference is more than ± 0.10' than what is listed on this sheet.





Sta 89+99.49
Exst 2-24" x 47' CMP - Extend
2-24" x 85' RCP Pipe Extension
Skew 30°31'15" Rt

Notes:

1. Inlet "L" shaped headwall dimensions shall be based on ADOT Std Dwg SD-6.30 (2 of 5) for 30" diameter pipe and modified as follows: G=11'-0"
2. Pipes shall be installed per ADOT Std Dwgs C-13.10 and C-13.15.
3. Handrail shall be installed on headwall as shown on the plans & per PAG Std Dtl 105.
4. For drop inlet, see Detail D14.
5. For new RCP connection to exst CMP, see Detail D2.

1 Top Headwall Elev=2660.53

Cross-Drainage Quantities

170 LF	24" RCP, Class III Bid Item # 5011023
1 EA	Drop Inlet Bid Item # 5030182
1 EA	Pipe Culvert Headwall Bid Item # 6016087
1 EA	Junction Structure Bid Item # 9300140
24 LF	Handrail Bid Item # 9330008

0 20' 40'

Scales: Horiz. 1"=20' Vert. 1"=4'

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SHEET DR05 OF DR19

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

No.	Revision Description	Engineer	Date

		Date
Designed	M ASHBY	12/18
Drawn	C ZHANG	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12/17/18 ARIZONA U.S.A. Expires 03/31/19

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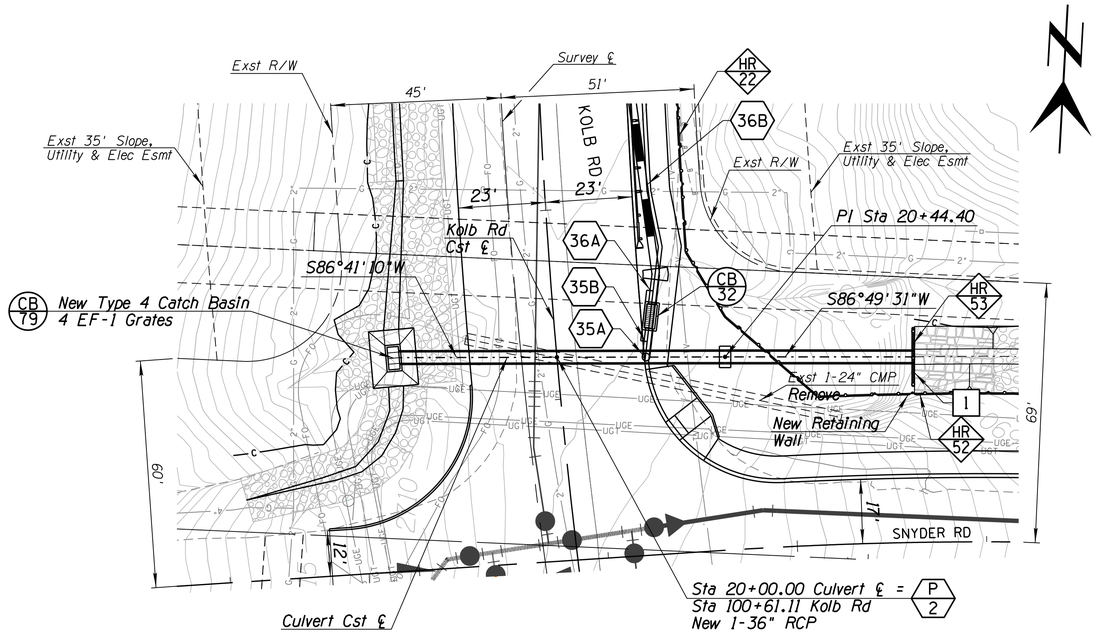
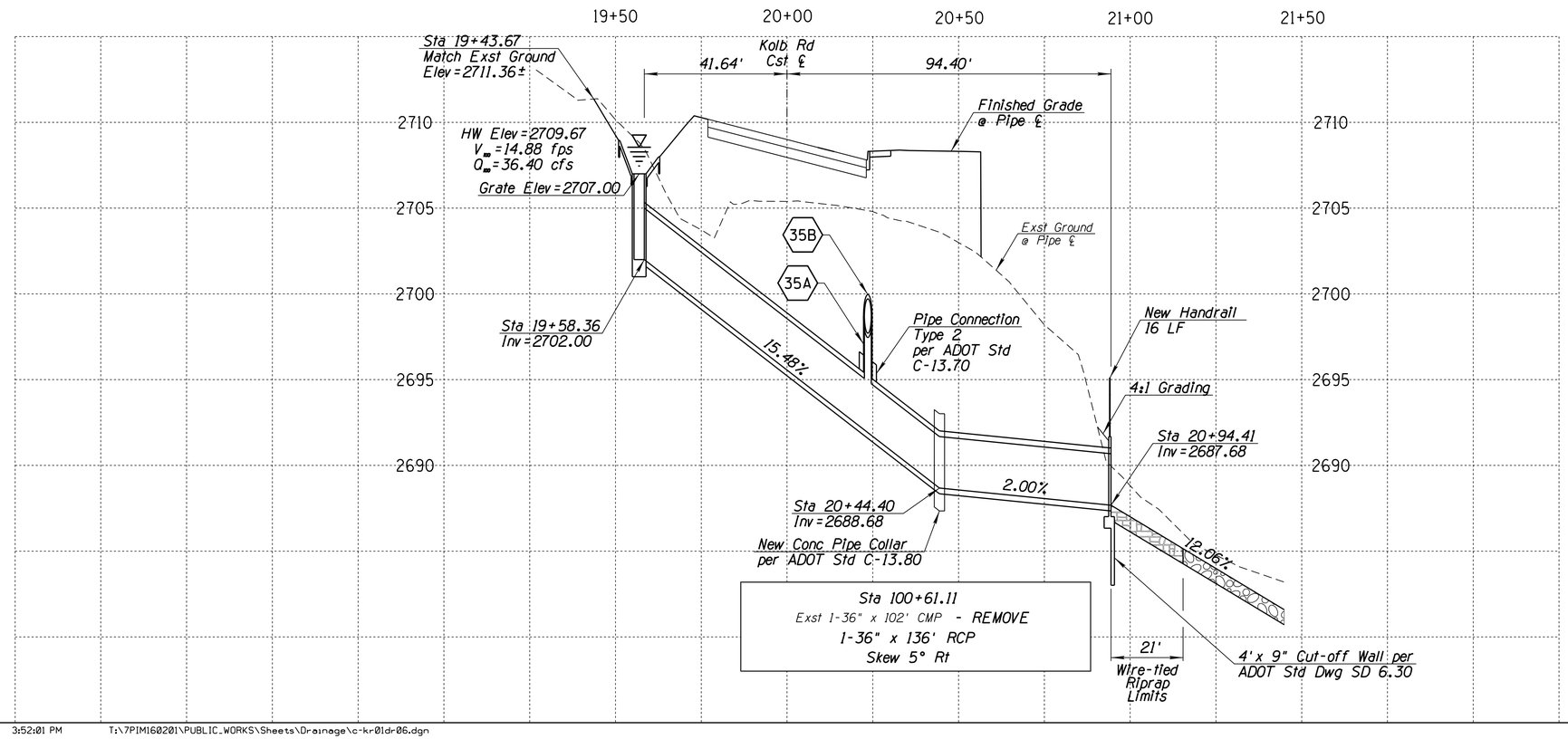
PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

CROSS CULVERT PLAN AND PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
Sta 89+99





Notes:

1. Outlet headwall dimensions shall be based on ADOT Std Dwg SD-6.30 (2 of 5) for a 36" diameter pipe.
2. Outlet headwall shall include a 4' cut-off wall per ADOT Std Dwg SD-6.30.
3. Pipes shall be installed per ADOT Std Dwgs C-13.10 and C-13.15.
4. Handrail shall be installed on headwall as shown on the plans & per PAG Std Dtl 105.
5. For shoulder grading, and catch basin inlet information, see Detail D15.
6. New outlet protection, see Detail D15.

1 Top Headwall Elev=2691.68

Cross-Drainage Quantities

136 LF	36" RCP, Class IV Bid Item # 5011044
1 EA	PAG Type 4 Off-Road CB Quad, D-8' or Less Bid Item # 5030740
1 EA	Pipe Culvert Headwall Bid Item # 6016087
15 LF	Handrail Bid Item # 9330008

No.	Revision Description	Engineer	Date

		Date
Designed	M ASHBY	12/18
Drawn	C ZHANG	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 10/17/18 ARIZONA U.S.A. Expires 03/31/19

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CROSS CULVERT PLAN AND PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 100+61

0 20' 40'

Call at least two full working days before you begin excavation
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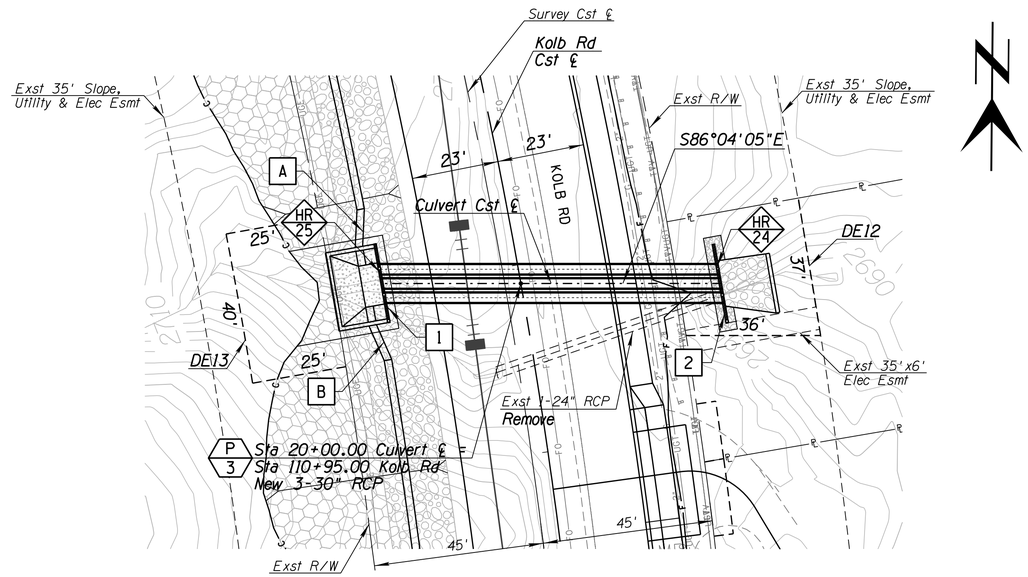
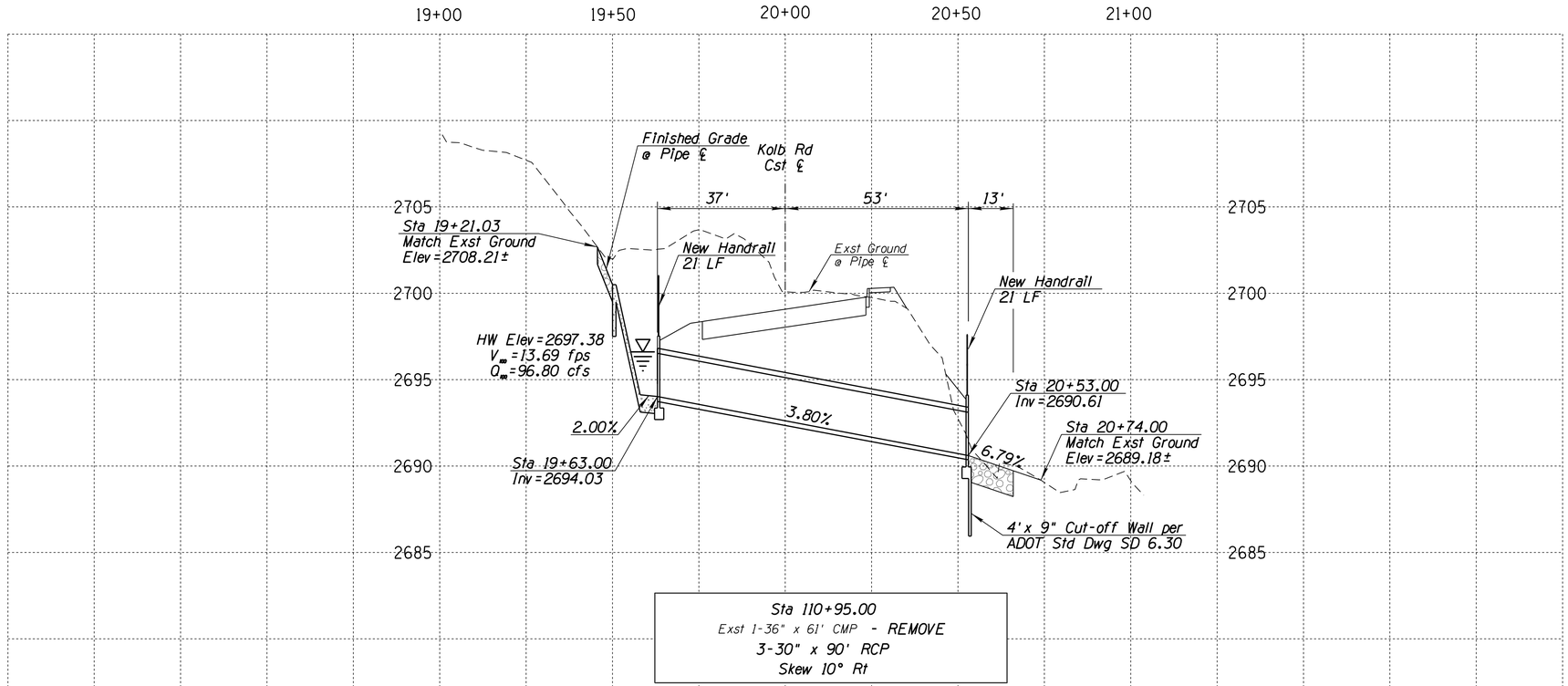
In Maricopa County: (602) 263-1100

Scales: Horiz. 1"=20' Vert. 1"=4'

SHEET DR06 OF DR19





Notes:

1. Inlet and Outlet headwalls dimensions shall be based on ADOT Std Dwg SD-6.30 (2 of 5) for a 30" diameter pipe.
2. Outlet headwall shall include a 4' cut-off wall per ADOT Std Dwg SD-6.30.
3. Pipes shall be installed per ADOT Std Dwgs C-13.10 and C-13.15.
4. Handrail shall be installed on headwalls as shown on the plans & per PAG Std Dtl 105.
5. New drop inlet, see Detail D14.
6. New outlet protection, see Detail D12.

A Transition roadside channel from Sta 111+22.36, 37.00' Lt to Sta 111+12.39, 39.34' Lt

B Transition roadside channel from Sta 110+80.82, 37.00' Lt to Sta 110+90.81, 39.43' Lt

1 Top Headwall Elev=2697.53

2 Top Headwall Elev=2694.11

Cross-Drainage Quantities

270 LF	30" RCP, Class III Bid Item # 5011033
1 EA	Drop Inlet Bid Item # 5030182
2 EA	Pipe Culvert Headwall Bid Item # 6016087
44 LF	Handrail Bid Item # 9330008

0 20' 40'

Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

Scales: Horiz. 1"=20' Vert. 1"=4'

SHEET DR07 OF DR19

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

No.	Revision Description	Engineer	Date

		Date
Designed	M ASHBY	12/18
Drawn	C ZHANG	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12/17/18 ARIZONA U.S.A. Expires 03/31/19

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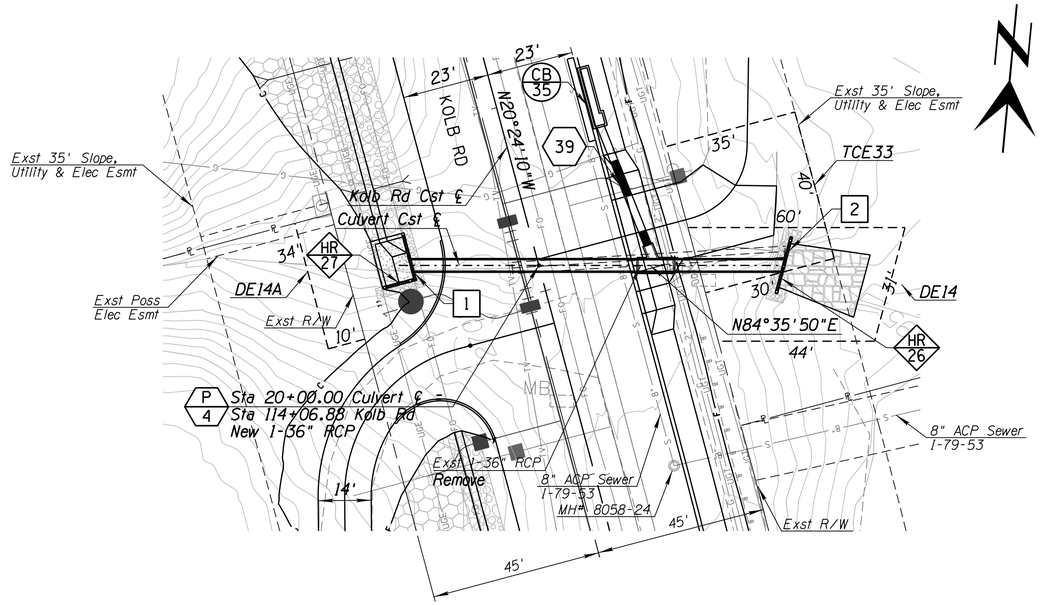
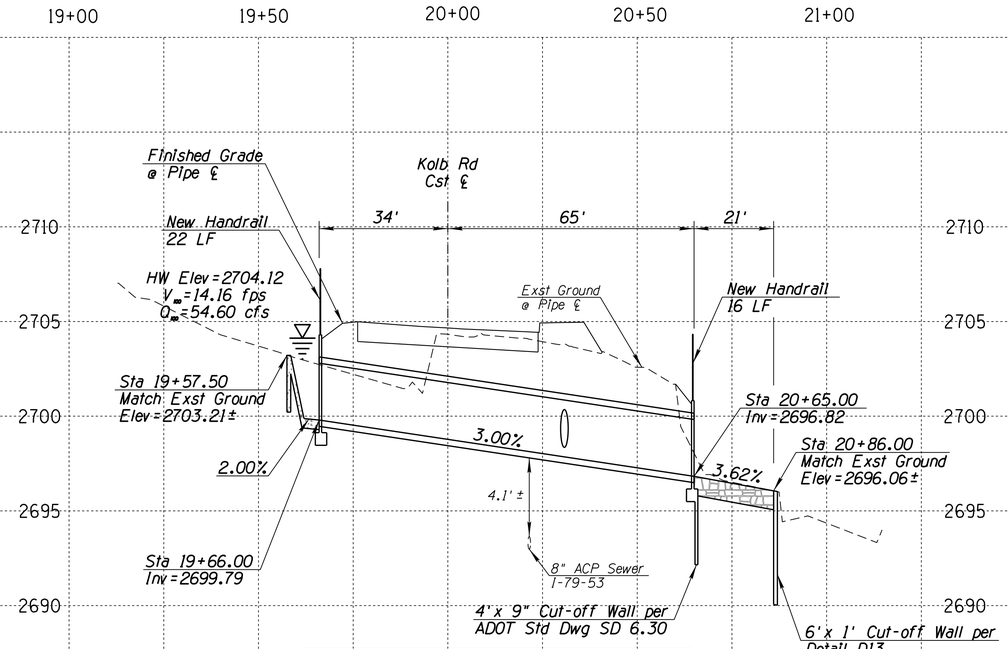
CROSS CULVERT PLAN AND PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 110+95





Sta 114+06.88
Exst 1-36" x 61' CMP - REMOVE
1-36" x 99' RCP
Skew 10° Rt

Notes:

1. Inlet "L" shaped headwall dimensions shall be based on ADOT Std Dwg SD-6.30 (2 of 5) for a 42" diameter pipe.
2. Outlet headwall dimensions shall be based on ADOT Std Dwg SD-6.30 (2 of 5) for a 36" diameter pipe with 4' cut-off wall.
3. Pipe shall be installed per ADOT Std Dwgs C-13.10 and C-13.15.
4. Handrail shall be installed on headwalls as shown on the plans & per PAG Std Dtl 105.
5. For drop inlet, see Detail D14.
6. For outlet protection, see Detail D12.

1 Top Headwall Elev=2704.29

2 Top Headwall Elev=2700.83

Cross-Drainage Quantities

99 LF	36" RCP, Class III Bid Item # 5011043
1 EA	Drop Inlet Bid Item # 5030182
17 LF	Concrete Cutoff Wall (1'x6') Bid Item # 6010716
2 EA	Pipe Culvert Headwall Bid Item # 6016087
35 LF	Handrail Bid Item # 9330008

0 20' 40'

Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

Scales: Horiz. 1"=20' Vert. 1"=4'

SHEET DR08 OF DR19

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

No.	Revision Description	Engineer	Date

		Date
Designed	M ASHBY	12/18
Drawn	C ZHANG	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12/17/18 ARIZONA U.S.A. Expires 03/31/19

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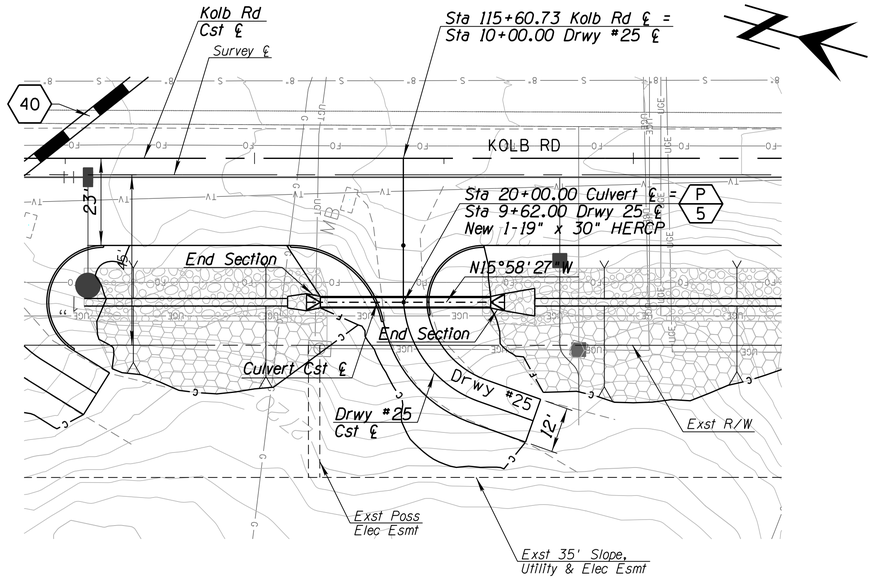
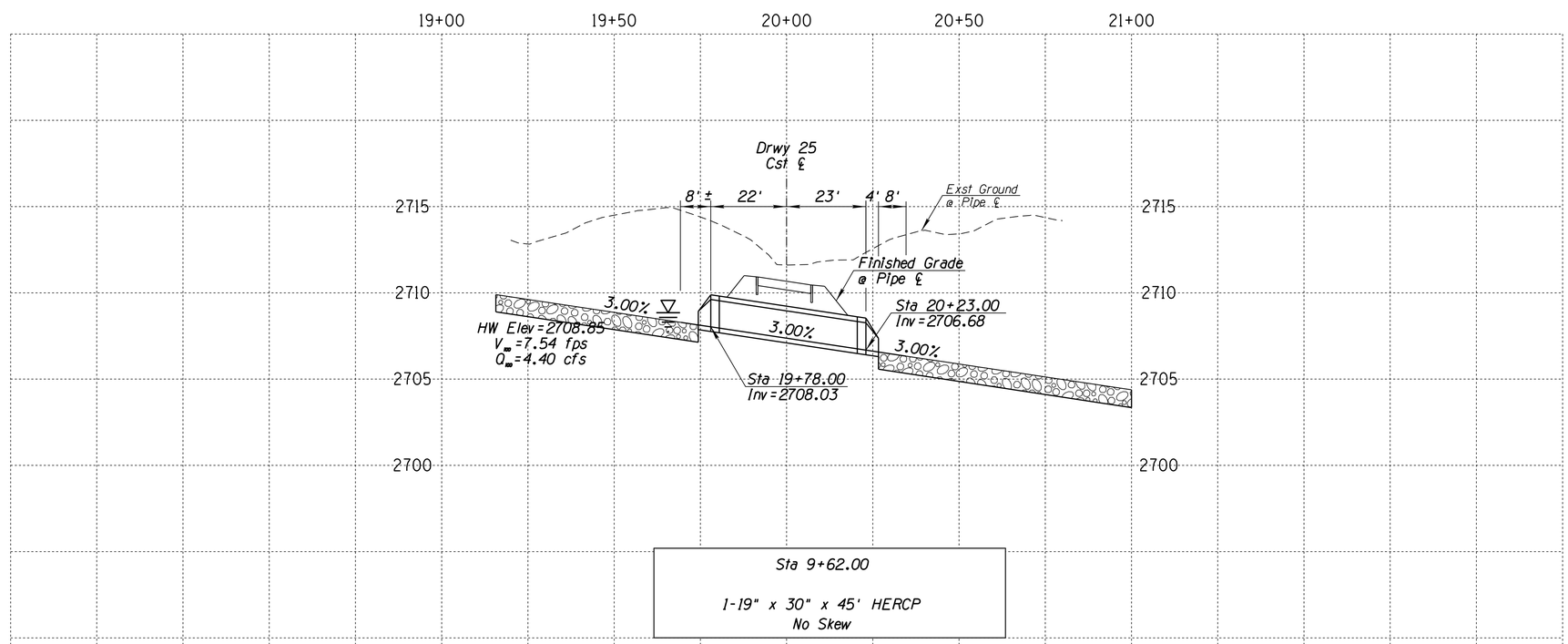
CROSS CULVERT PLAN AND PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 114+07





Notes:

1. Inlet and outlet end section dimensions shall be based on ADOT Std Dwg C-13.20 for a 30"x19" HERCP.
2. Pipes shall be installed per ADOT Std Dwgs C-13.10 and C-13.15.
3. New inlet and outlet protection, see Detail D12.

Cross-Drainage Quantities

45 LF	19"x30" RCP, Class HE-IV Bid Item # 5011224
2 EA	19"x30" End Section Bid Item # 5014127

0 20' 40'

Scales: Horiz. 1"=20' Vert. 1"=4'

Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

SHEET DR09 OF DR19

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

No.	Revision Description	Engineer	Date

		Date
Designed	M ASHBY	12/18
Drawn	C ZHANG	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K. THORNTON	12/18

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12/17/18 ARIZONA U.S.A. Expires 03/31/19

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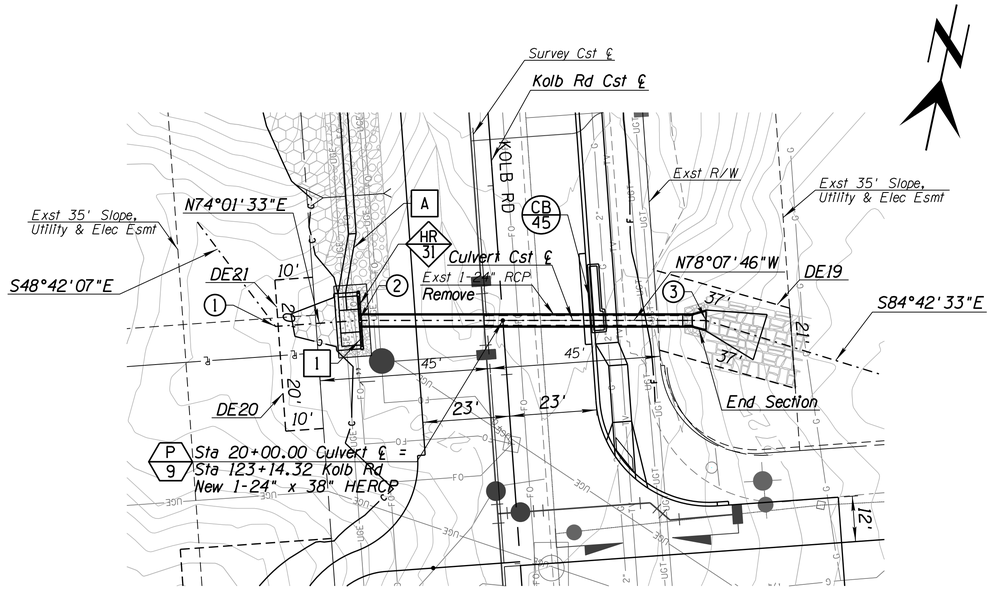
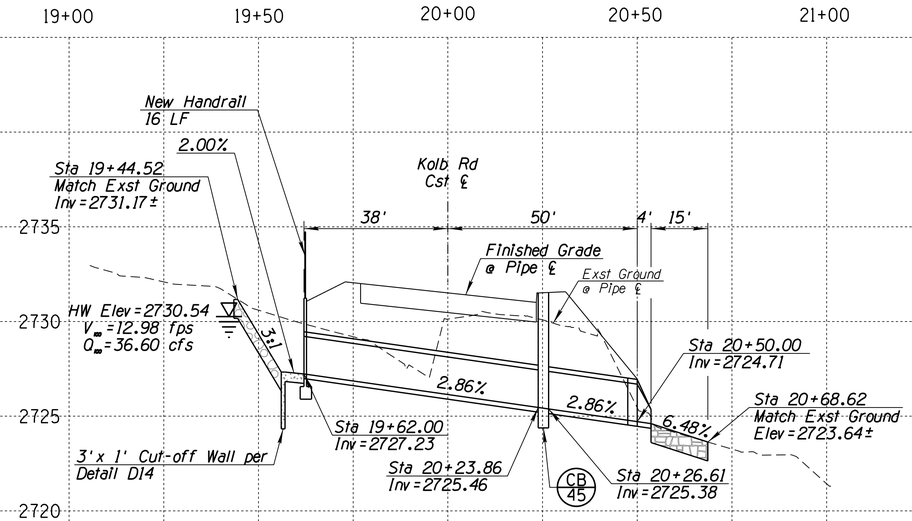
CROSS CULVERT PLAN AND PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 115+37





Sta 123+14.32
Exst 1-24" x 35" x 61' ARCH - REMOVE
1-24" x 38" x 88' HERCP
Skew 04°06'13" Rt

Notes:

1. Inlet headwall dimensions shall be based on ADOT Std Dwg SD-6.30 (2 of 5) for a 36" diameter pipe.
2. Outlet end section dimensions shall be based on ADOT Std Dwg C-13.20 for a 38"x24" HERCP.
3. Pipe shall be installed per ADOT Std Dwgs C-13.10 and C-13.15.
4. Handrail shall be installed on headwall as shown on the plans & per PAG Std Dtl 105.
5. New drop inlet, see Detail D14.
6. New outlet protection, see Detail D12.

(1) PI Sta 19+39.92

(2) PI Sta 19+62.00

(3) PI Sta 20+53.63

A Transition roadside channel from Sta 123+40.00, 37.00' Lt to Sta 123+24.54, 40.90' Lt

1 Top Headwall Elev=2731.23

Cross-Drainage Quantities

88 LF	24"x38" RCP, Class HE-II Bid Item # 5011224
1 EA	24"x38" End Section Bid Item # 5014140
1 EA	Drop Inlet Bid Item # 5030182
1 EA	Pipe Culvert Headwall Bid Item # 6016087
16 LF	Handrail Bid Item # 9330008

0 20' 40'

Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

Scales: Horiz. 1"=20' Vert. 1"=4'

SHEET DR10 OF DR19

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

Designed	M ASHBY	Date 12/18
Drawn	C ZHANG	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

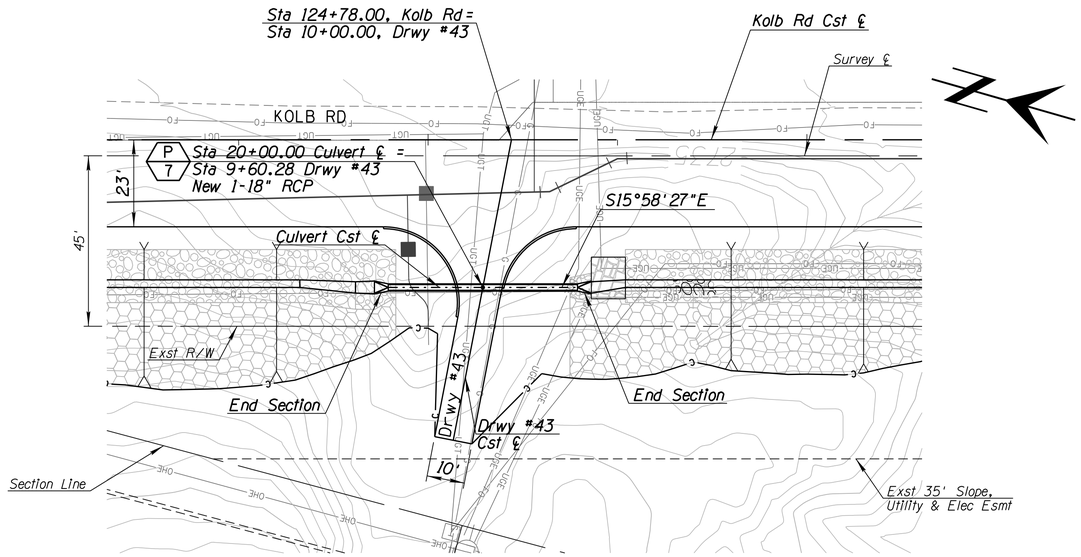
No.	Revision Description	Engineer	Date

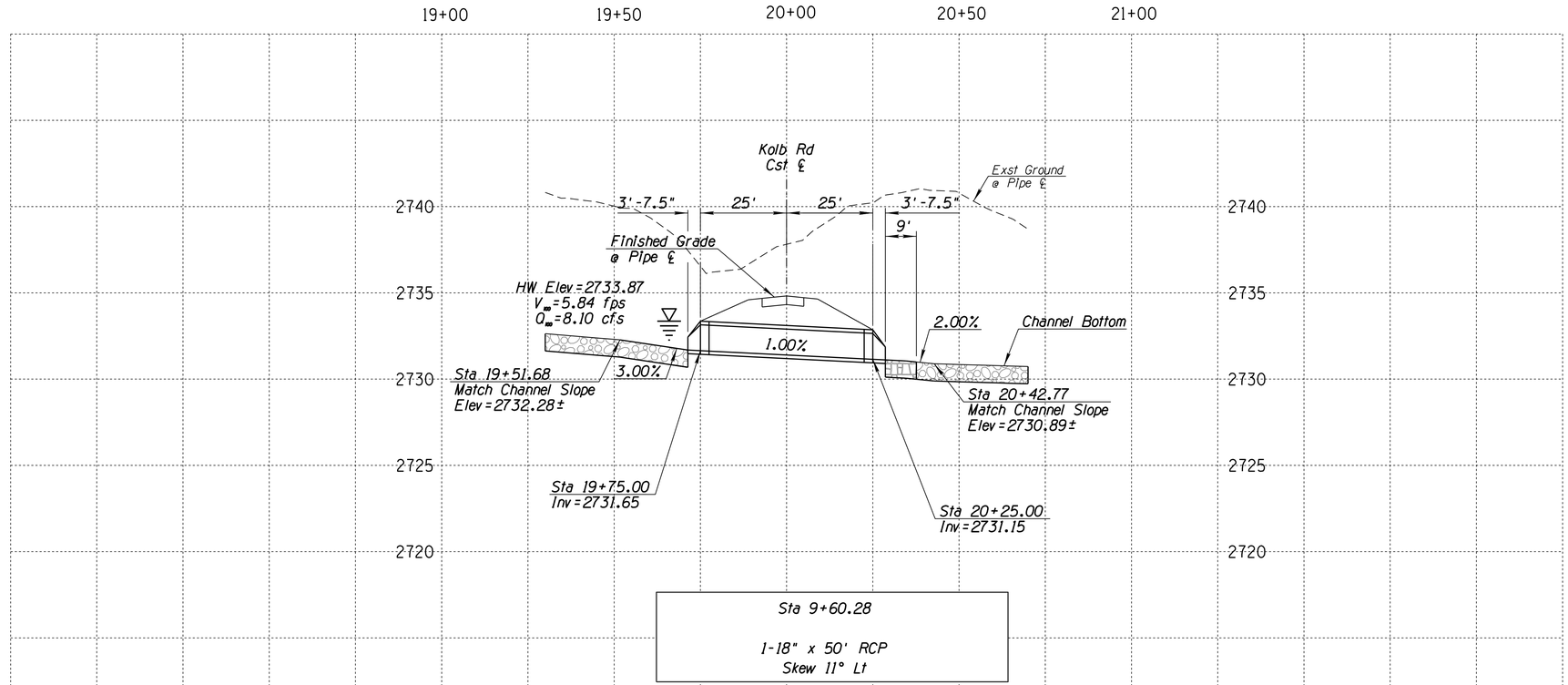
PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12/17/18 ARIZONA U.S.A. Expires 03/31/19

PSOMAS
333 E. Wetmore Road, Suite 450
Tucson, AZ 85705
(520) 292-2300 (520) 292-1290 fax
www.psomas.com

CROSS CULVERT PLAN AND PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
Sta 123+14





Notes:

1. Inlet and outlet end section dimensions shall be based on ADOT Std Dwg C-13.20 for an 18" diameter pipe.
2. Pipes shall be installed per ADOT Std Dwgs C-13.10 and C-13.15.
3. New inlet and outlet protection, see Detail D12.

Cross-Drainage Quantities

50 LF	18" RCP, Class IV Bid Item # 5011014
2 EA	18" End Section Bid Item # 5014118

No.	Revision Description	Engineer	Date

		Date
Designed	M ASHBY	12/18
Drawn	C ZHANG	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

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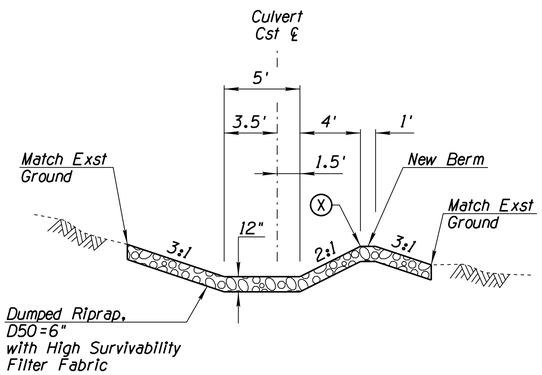
CROSS CULVERT PLAN AND PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 127+09

0 20' 40'

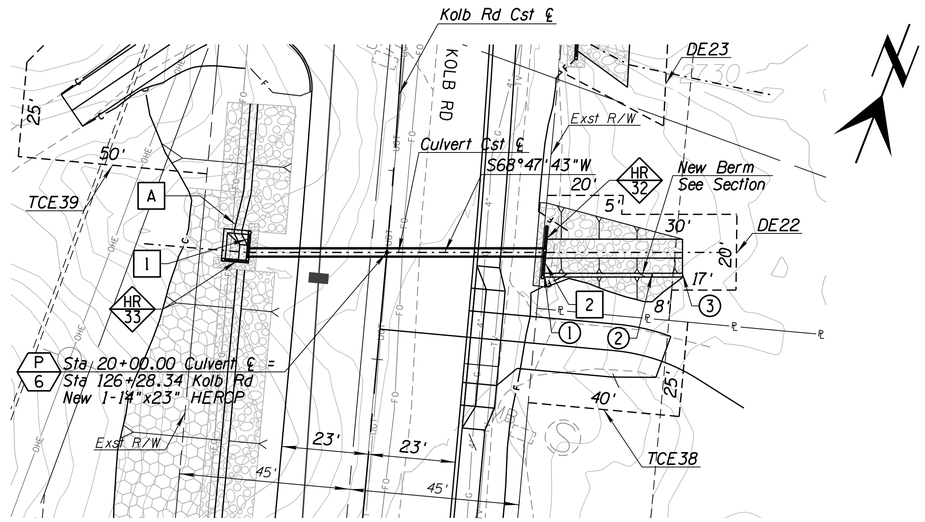
Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

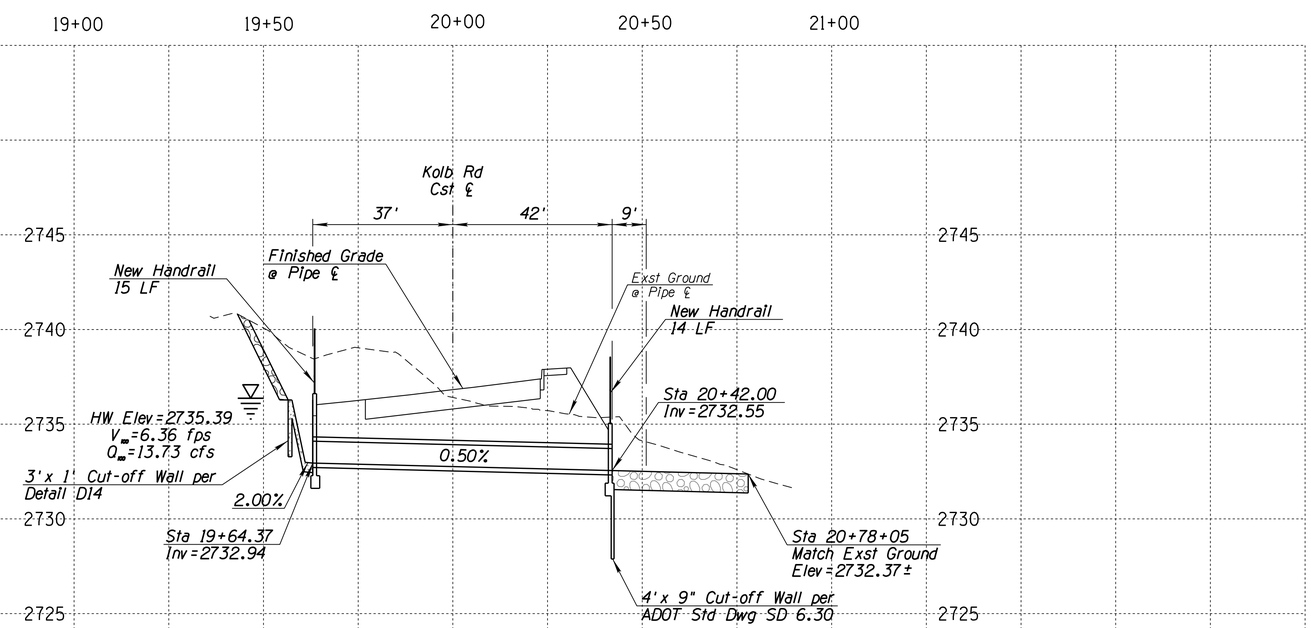
Scales: Horiz. 1"=20' Vert. 1"=4'

SHEET DR11 OF DR19



SECTION
NTS





Sta 126+28.34

1-14" x 23" x 79' HERCP
Skew 4° Lt

Notes:

1. Inlet "L" shaped headwall dimensions shall be based ADOT Std Dwg SD-6.30 (2 of 5) for a 24" diameter pipe and modified as follows:
   G=6'-6"
2. Outlet headwall dimensions shall be based on ADOT Std Dwg SD-6.30 (2 of 5) for a 18" diameter pipe and modified as follows:
   L=14'-0"
3. Pipe shall be installed per ADOT Std Dwgs C-13.10 and C-13.15.
4. Handrail shall be installed on headwalls as shown on the plans & per PAG Std Dtl 105.
5. For drop inlet, see Detail D14.
6. For outlet ptotection, see Detail D12.

A — Transition roadside channel from Sta 126+41.14, 39.00' Lt to Sta 126+30.97, 40.61' Lt

1 — Top Headwall Elev=2736.61

2 — Top Headwall Elev=2735.05

1 — Sta 20+41.52, 5.50' Rt
Top of Berm, Elev=2734.55

2 — Sta 20+70.04, 5.50' Rt
Top of Berm, Elev=2734.41

3 — Sta 20+78.04, 5.50' Rt
Top of Berm, Elev=2731.91±
Match Exst Ground

Cross-Drainage Quantities

79 LF	14"x23" RCP, Class HE-III Bid Item # 5011213
1 EA	Drop Inlet Bid Item # 5030182
2 EA	Pipe Culvert Headwall Bid Item # 6016087
28 LF	Handrail Bid Item # 9330008

0 20' 40'

Call at least two full working days before you begin excavation.
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In Maricopa County: (602) 263-1100

Scales: Horiz. 1"=20' Vert. 1"=4'

SHEET DR12 OF DR19

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

No.	Revision Description	Engineer	Date

		Date
Designed	M ASHBY	12/18
Drawn	C ZHANG	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12/17/18 ARIZONA U.S.A. Expires 03/31/19

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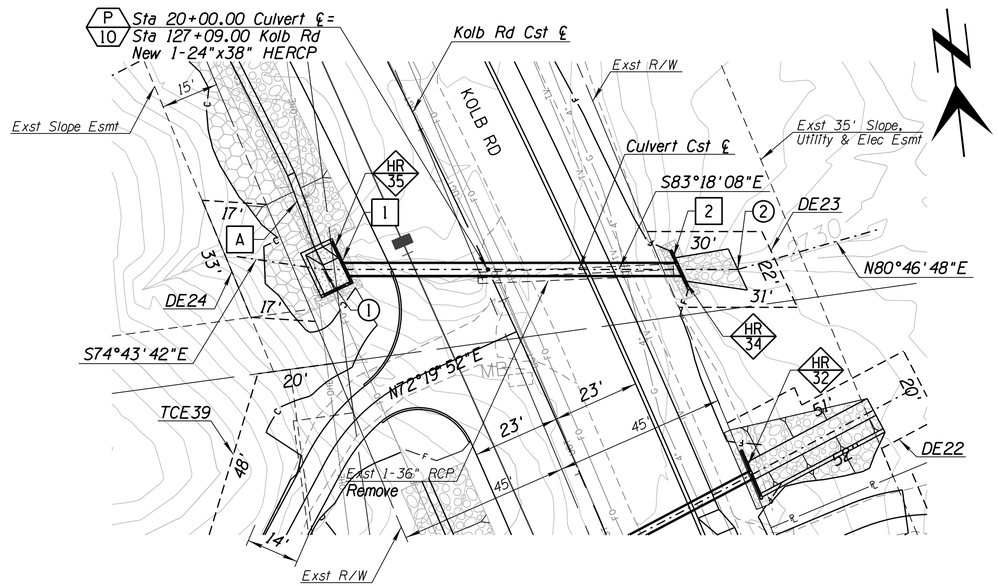
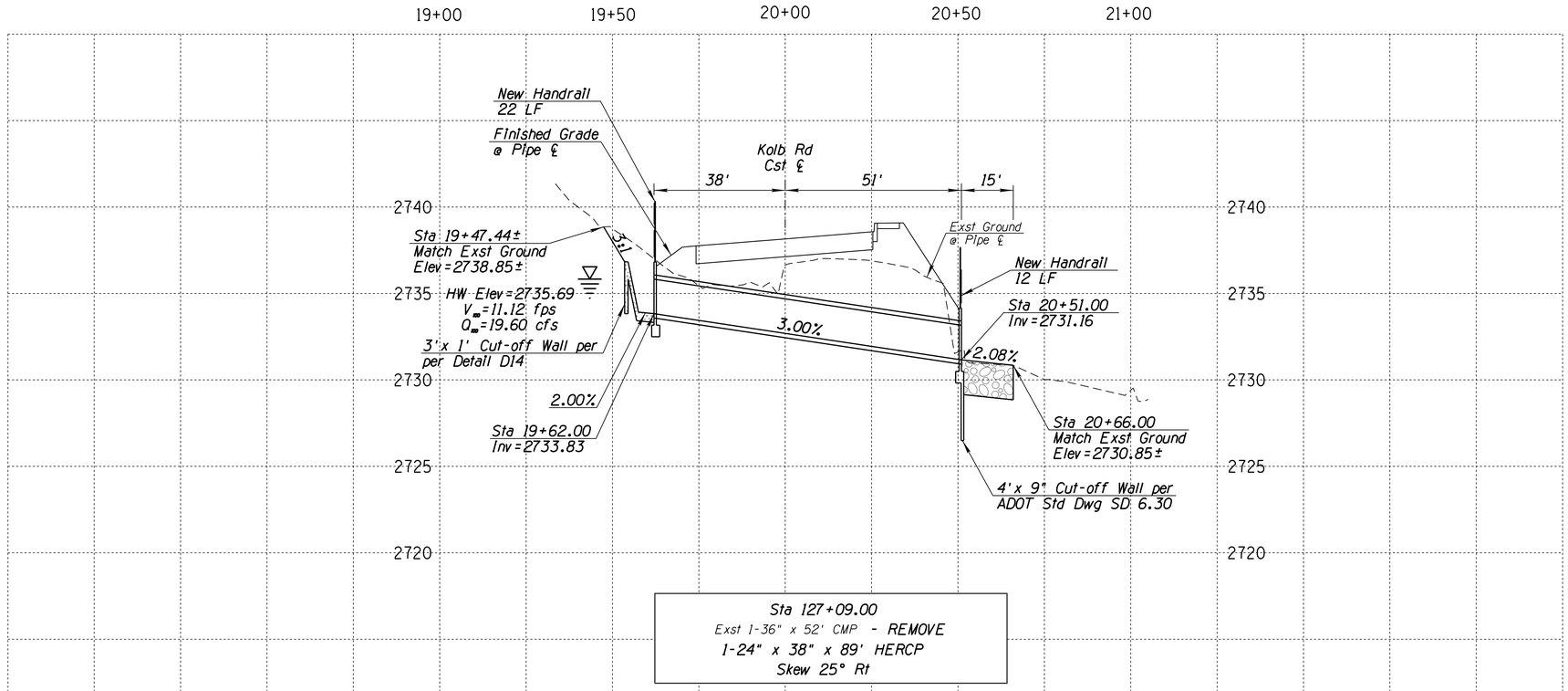
CROSS CULVERT PLAN AND PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 127+09





Sta 127+09.00
Exst 1-36" x 52' CMP - REMOVE
1-24" x 38" x 89' HERCP
Skew 25° Rt

Notes:

1. Inlet "L" shaped headwall dimensions shall be based on ADOT Std Dwg SD-6.30 (2 of 5) for a 42" pipe and modified as follows:
   D=3'-8
2. Outlet headwall dimensions shall be based on ADOT Std Dwg SD-6.30 (2 of 5) for a 24" pipe with 4' cut-off wall.
3. Pipe shall be installed per ADOT Std Dwgs C-13.10 and C-13.15.
4. Handrail shall be installed on headwalls as shown on the plans & per PAG Std Dtl 105.
5. For drop inlet, see Detail D14.
6. For outlet protection, see Detail D12.

(1) PI Sta 19+56.48

(2) PI Sta 20+66.00

A — Transition roadside channel from Sta 127+54.50, 37.00' Lt to Sta 127+34.21, 38.87' Lt

1 — Top Headwall Elev=2736.83

2 — Top Headwall Elev=2734.16

Cross-Drainage Quantities

89 LF	24"x38" RCP, Class HE-III Bid Item # 5011243
1 EA	Drop Inlet Bid Item # 5030182
2 EA	Pipe Culvert Headwall Bid Item # 6016087
34 LF	Handrail Bid Item # 9330008

0 20' 40'

Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

Scales: Horiz. 1"=20' Vert. 1"=4'

SHEET DR13 OF DR19

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

No.	Revision Description	Engineer	Date

		Date
Designed	M ASHBY	12/18
Drawn	C ZHANG	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 11/27/18 ARIZONA U.S.A. Expires 03/31/19

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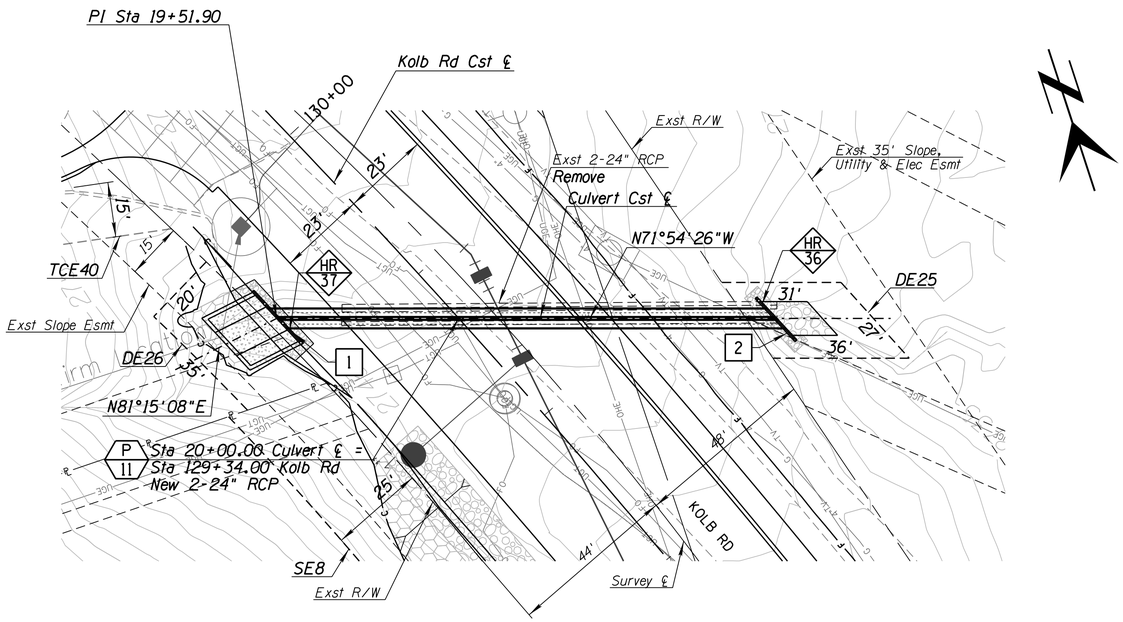
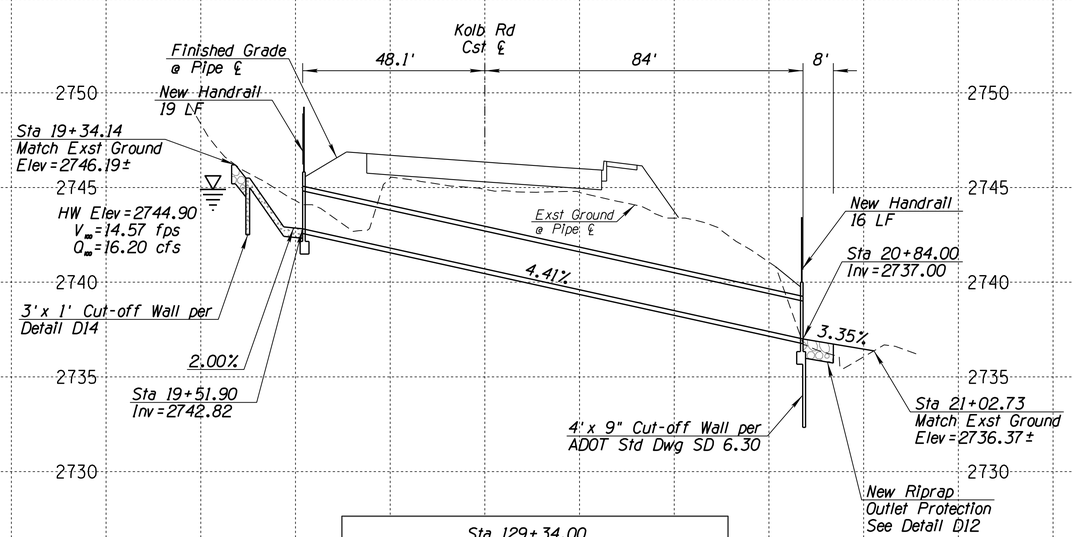
CROSS CULVERT PLAN AND PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 127+09





Sta 129+34.00
Exst 2-24" x 115' CMP - REMOVE
2-24" x 132' RCP
Skew 42° Rt

Notes:

1. Inlet headwall dimensions shall be based on ADOT Std Dwg SD-6.30 (2 of 5) for a 24" diameter pipe with these modified dimensions: L=15'-0".
2. Outlet headwall dimensions shall be based on ADOT Std Dwg SD-6.30 (2 of 5) for a 24" diameter pipe.
2. Pipes shall be installed per ADOT Std Dwgs C-13.10 and C-13.15.
3. Handrail shall be installed on headwalls as shown on the plans & per PAG Std Dtl 105.
4. New drop inlet, see Detail DI4.
5. New outlet protection, see Detail DI2.

1 Top Headwall Elev=2745.82

2 Top Headwall Elev=2738.96

Cross-Drainage Quantities

264 LF	24" RCP, Class III Bid Item # 5011023
1 EA	Drop Inlet Bid Item # 5030182
2 EA	Pipe Culvert Headwall Bid Item # 6016087
35 LF	Handrail Bid Item # 9330008

Designed	M ASHBY	Date 12/18
Drawn	C ZHANG	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

No.	Revision Description	Engineer	Date

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12/17/18 ARIZONA U.S.A. Expires 03/31/19

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CROSS CULVERT PLAN AND PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
Sta 129+34

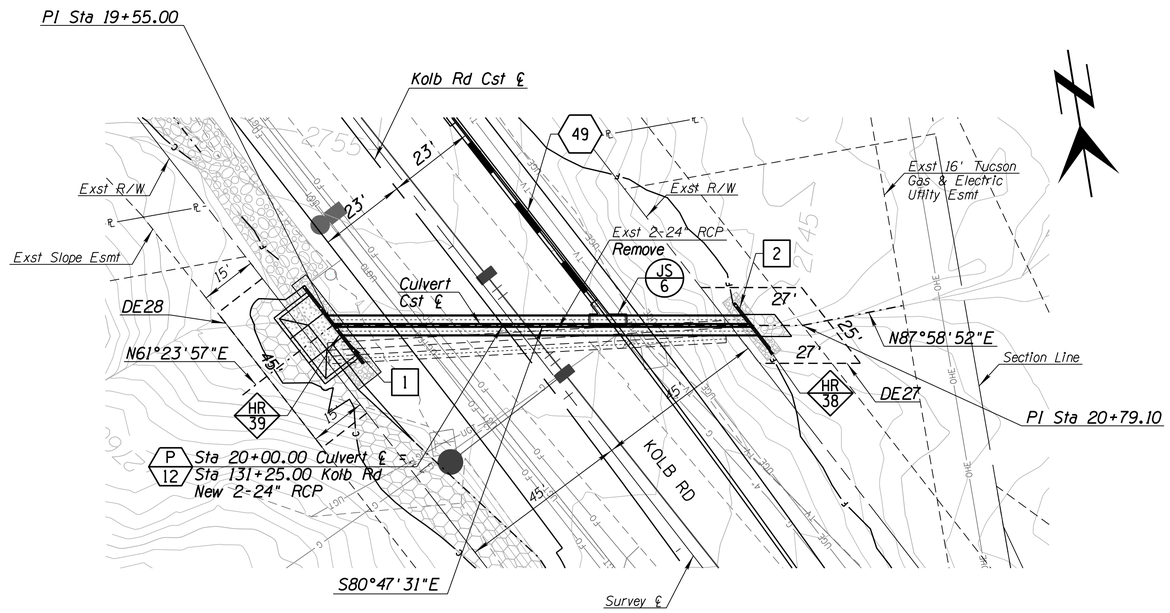
Call at least two full working days before you begin excavation.
ARIZONA 811
Arizona Blue Stake, Inc.
Dial 8-1-1 or 1-800-STAKE-IT (782-5348)
In Maricopa County: (602) 263-1100

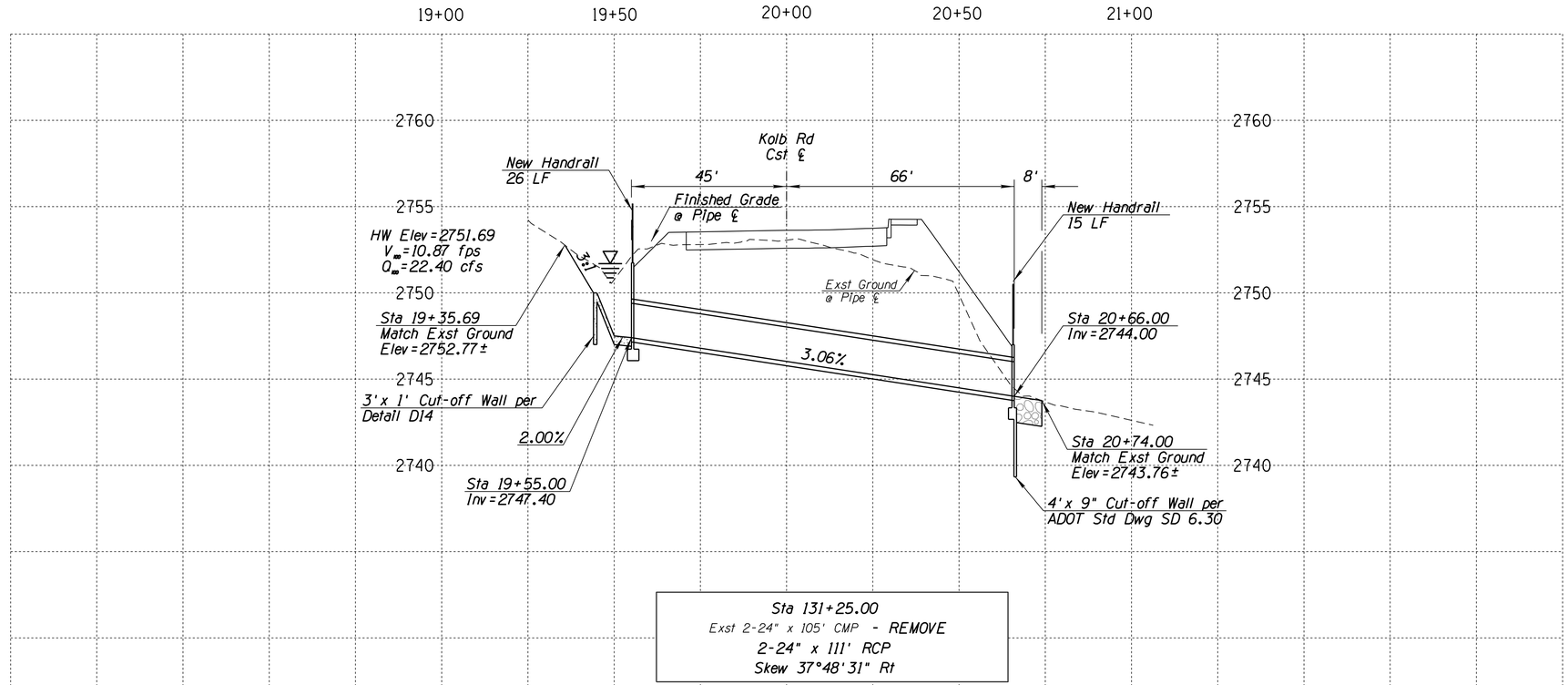
0 20' 40'

Scales: Horiz. 1"=20' Vert. 1"=4'

SHEET DR14 OF DR19

12/17/2018 3:52:17 PM T:\7PIM160201\PUBLIC_WORKS\Sheets\Drainage\c-kr01dr14.dgn





Sta 131+25.00
Exst 2-24" x 105' CMP - REMOVE
2-24" x 111' RCP
Skew 37°48'31" Rt

Notes:

1. Inlet headwall dimensions shall be based on ADOT Std Dwg SD-6.30 (2 of 5) for a 42" diameter pipe with these modified dimensions:
   D=5'-0"
   E=3'-0"
   L=22'-0"
2. Outlet headwall dimensions shall be based on ADOT Std Dwg SD-6.30 (2 of 5) for a 24" diameter pipe.
3. Outlet headwall shall include a 4' cut-off wall per ADOT Std Dwg SD-6.30.
4. Pipes shall be installed per ADOT Std Dwgs C-13.10 and C-13.15.
5. Handrail shall be installed on headwalls as shown on the plans & per PAG Std Dtl 105.
6. New drop inlet, see Detail DI4.
7. New outlet protection, see Detail DI2.

1 Top Headwall Elev=2752.71

2 Top Headwall Elev=2747.16

Cross-Drainage Quantities

222 LF	24" RCP, Class II Bid Item # 5011022
1 EA	Drop Inlet Bid Item # 5030182
2 EA	Pipe Culvert Headwall Bid Item # 6016087
42 LF	Handrail Bid Item # 9330008

0 20' 40'

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Scales: Horiz. 1"=20' Vert. 1"=4'

SHEET DR15 OF DR19

ADOT TRACS NO. 0000 PM PPM T0109 OIC, FEDERAL PROJECT NO. STP-PPM-0(257)D

No.	Revision Description	Engineer	Date

		Date
Designed	M ASHBY	12/18
Drawn	C ZHANG	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12/17/18 ARIZONA U.S.A. Expires 03/31/19

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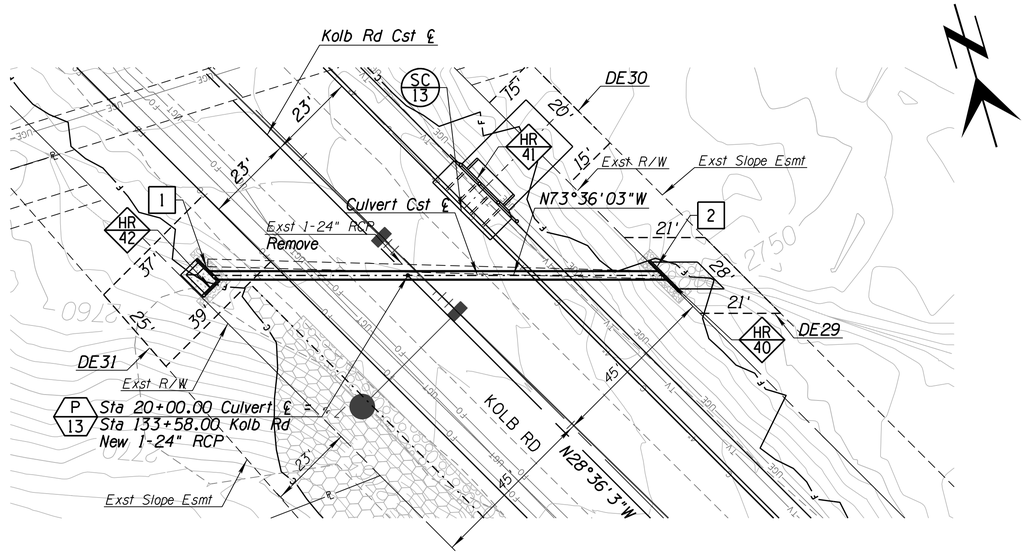
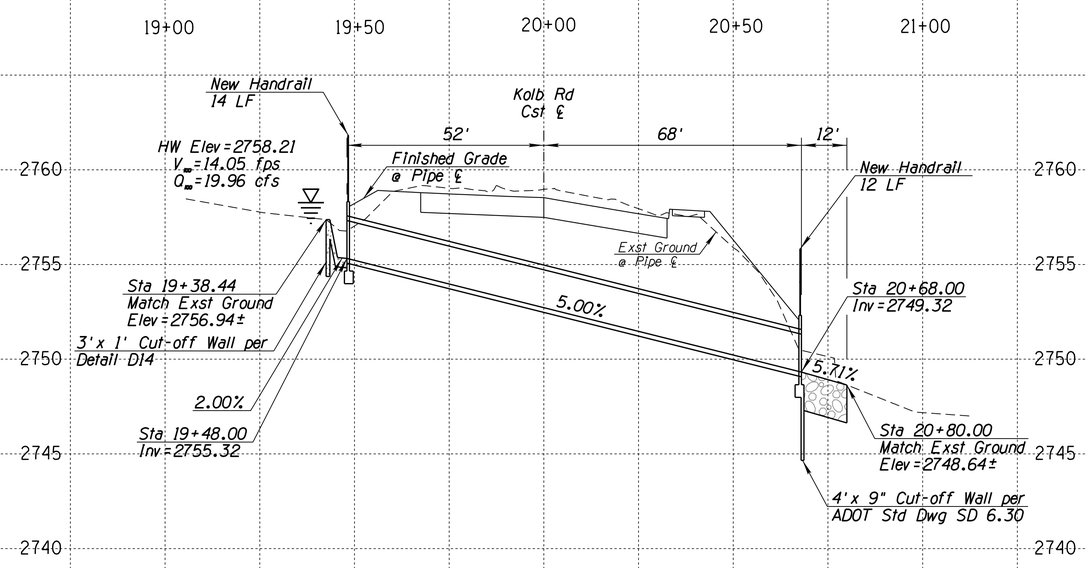
CROSS CULVERT PLAN AND PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
Sta 131+25





Sta 133+58.00
Exst 1-24" x 105' CMP - REMOVE
1-24" x 120' RCP
Skew 45° Rt

Notes:

1. Inlet "L" shaped headwall and outlet headwall dimensions shall be based ADOT Std Dwg SD-6.30 (2 of 5) for a 24" diameter pipe. Outlet headwall shall include 4' cut-off wall.
2. Pipes shall be installed per ADOT Std Dwgs C-13.10 and C-13.15.
3. Handrail shall be installed on headwalls as shown on the plans & per PAG Std Dtl 105.
4. For drop inlet, see Detail DI4.
5. For outlet protection, see Detail DI2.

1 Top Headwall Elev=2758.32

2 Top Headwall Elev=2752.32

Cross-Drainage Quantities

120 LF	24" RCP, Class III Bid Item # 5011023
1 EA	Drop Inlet Bid Item # 5030182
2 EA	Pipe Culvert Headwall Bid Item # 6016087
26 LF	Handrail Bid Item # 9330008

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

Designed	M ASHBY	12/18
Drawn	C ZHANG	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

No.	Revision Description	Engineer	Date

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

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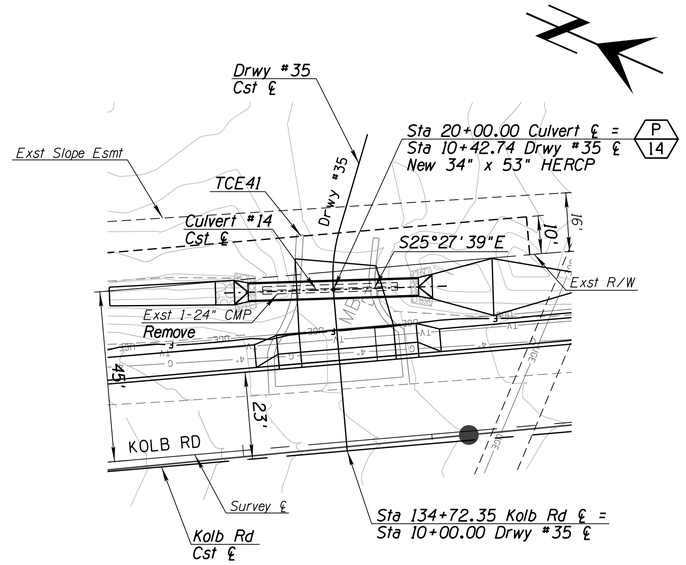
CROSS CULVERT PLAN AND PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
Sta 133+58

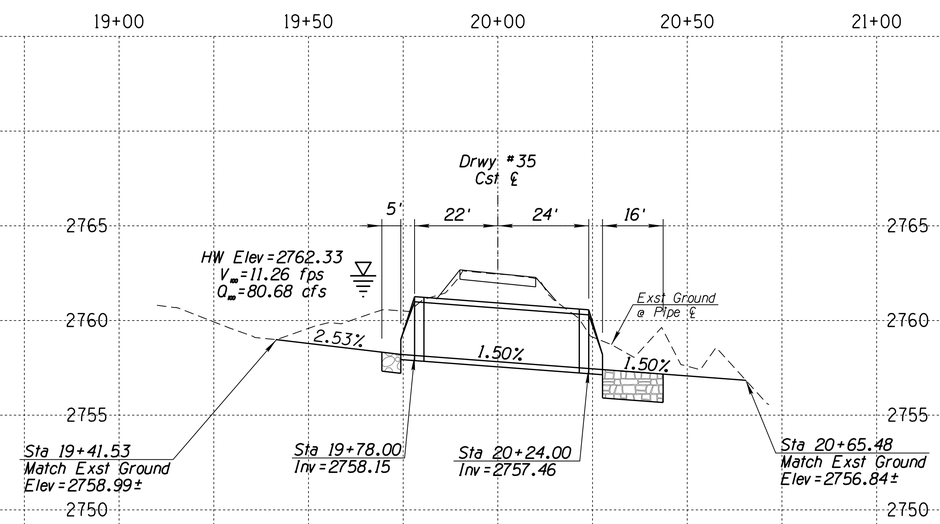
Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

0 20' 40'

Scales: Horiz. 1"=20' Vert. 1"=4'

SHEET DR16 OF DR19





Sta 10+42.74
Exst 1-24" x 105' CMP - REMOVE
1-34" x 53" x 45' HERCP
No Skew

Notes:

1. Inlet and outlet end section dimensions shall be based on ADOT Std Dwg C-13.20 for a 53"x34" HERCP.
2. Pipes shall be installed per ADOT Std Dwgs C-13.10 and C-13.15.
3. New outlet protection, see Detail DI2.

Cross-Drainage Quantities

45 LF	34"x53" RCP, Class HE-II Bid Item # 5011282
2 EA	34"x53" RCP End Section Bid Item # 5014150

0 20' 40'

Scales: Horiz. 1"=20' Vert. 1"=4'

Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

SHEET DR17 OF DR19

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

Designed	M ASHBY	Date 12/18
Drawn	C ZHANG	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

No.	Revision Description	Engineer	Date

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12/17/18 ARIZONA U.S.A. Expires 03/31/19

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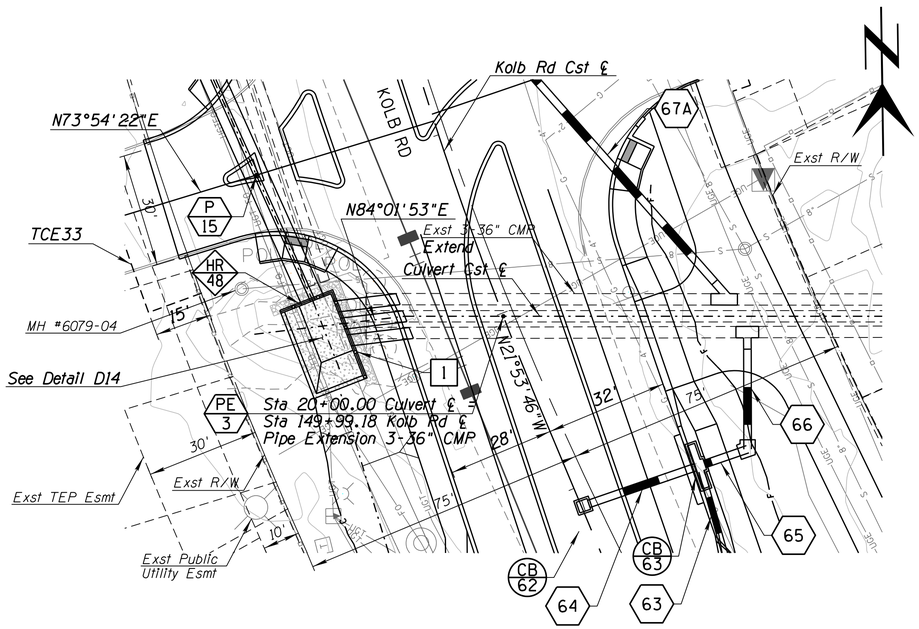
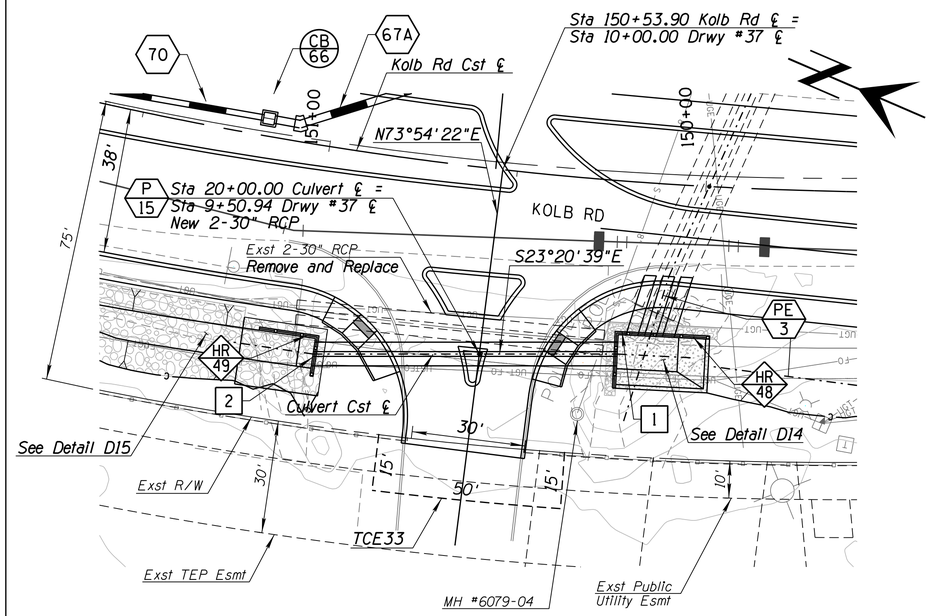
CROSS CULVERT PLAN AND PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 115+37



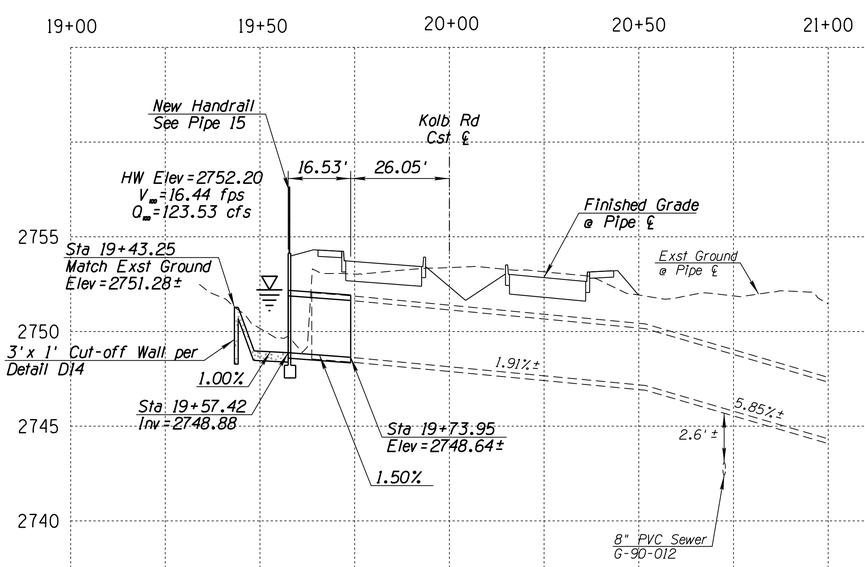


Notes:

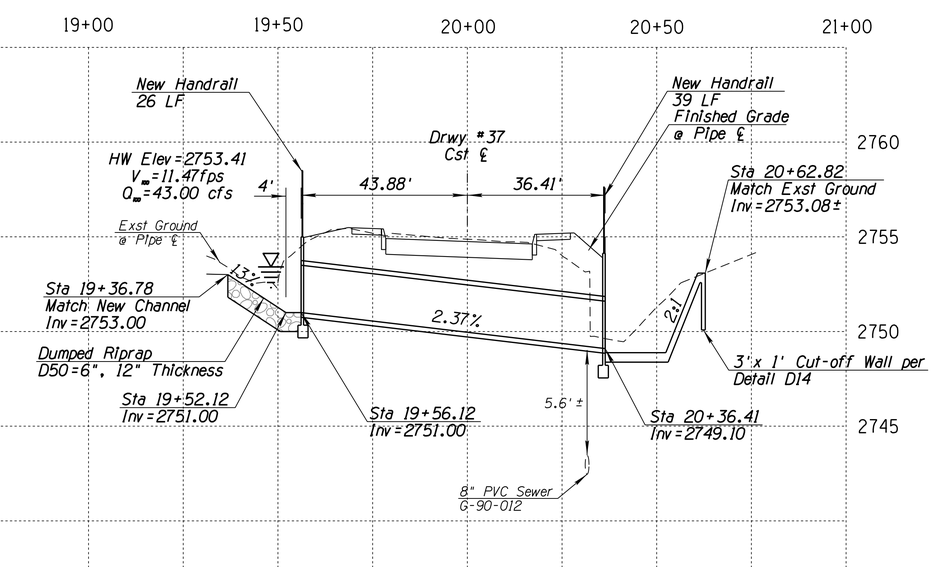
1. Pipe Extension 3 Inlet "L" shaped headwall dimensions shall be based on ADOT Std Dwg SD-6.30 (2 of 5) for 42" diameter pipes and modified as follows:
   D=5'-11"
   G=14'-2"
   L=22'-0"
2. Pipe 15 Inlet "L" shaped headwall dimensions shall be based on ADOT Std Dwg SD-6.30 (2 of 5) for 36" diameter pipes and modified as follows:
   F=2'-3"
   G=15'-0"
   L=8'-0"
3. Pipes shall be installed per ADOT Std Dwgs C-13.10 and C-13.15.
4. Handrail shall be installed on headwalls as shown on the plans & per PAG Std Dtl 105.
5. For drop inlet, see Detail D14.

1 Top Headwall Elev=2754.13

2 Top Headwall Elev=2755.00



Sta 149+99.18
Exst 3-36" x 154' CMP - EXTEND
Skew 21°02'26" Rt
3-36" x 17' Pipe Extension
Skew 6°49'30" Lt



Sta 9+50.94
Exst 2-30" x 82' CMP - REMOVE
2-30" x 81' RCP
Skew 07°15'01" Rt

Cross-Drainage Quantities

162 LF	30" RCP, Class III Bid Item # 5011033
51 LF	36" RCP, Class III Bid Item # 5011043
1 EA	Drop Inlet Bid Item # 5030182
2 EA	Pipe Culvert Headwall Bid Item # 6016087
65 LF	Handrail Bid Item # 9330008

0 20' 40'

Call at least two full working days before you begin excavation
ARIZONA 811
Arizona Blue Stake, Inc.
Dial 8-1-1 or 1-800-STAKE-IT (782-5348)
In Maricopa County: (602) 263-1100

Scales: Horiz. 1"=20' Vert. 1"=4'

SHEET DR18 OF DR19

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

No.	Revision Description	Engineer	Date

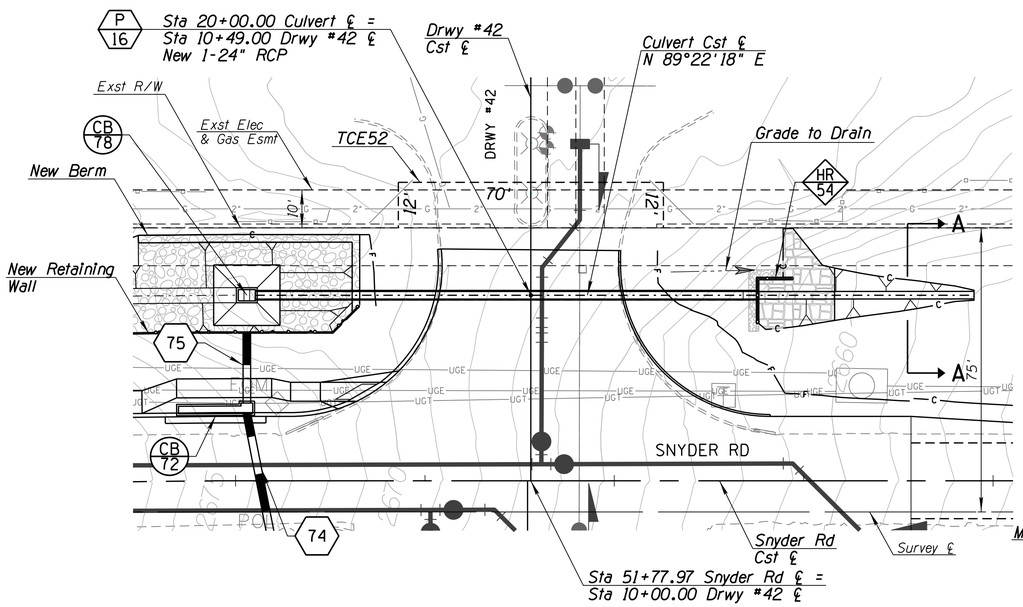
		Date
Designed	M ASHBY	12/18
Drawn	C ZHANG	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

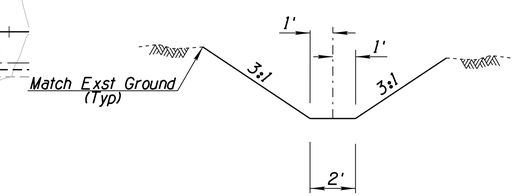
Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 03/13/18 ARIZONA U.S.A. Expires 03/31/19

PSOMAS
333 E. Wetmore Road, Suite 450
Tucson, AZ 85705
(520) 292-2300 (520) 292-1290 fax
www.psomas.com

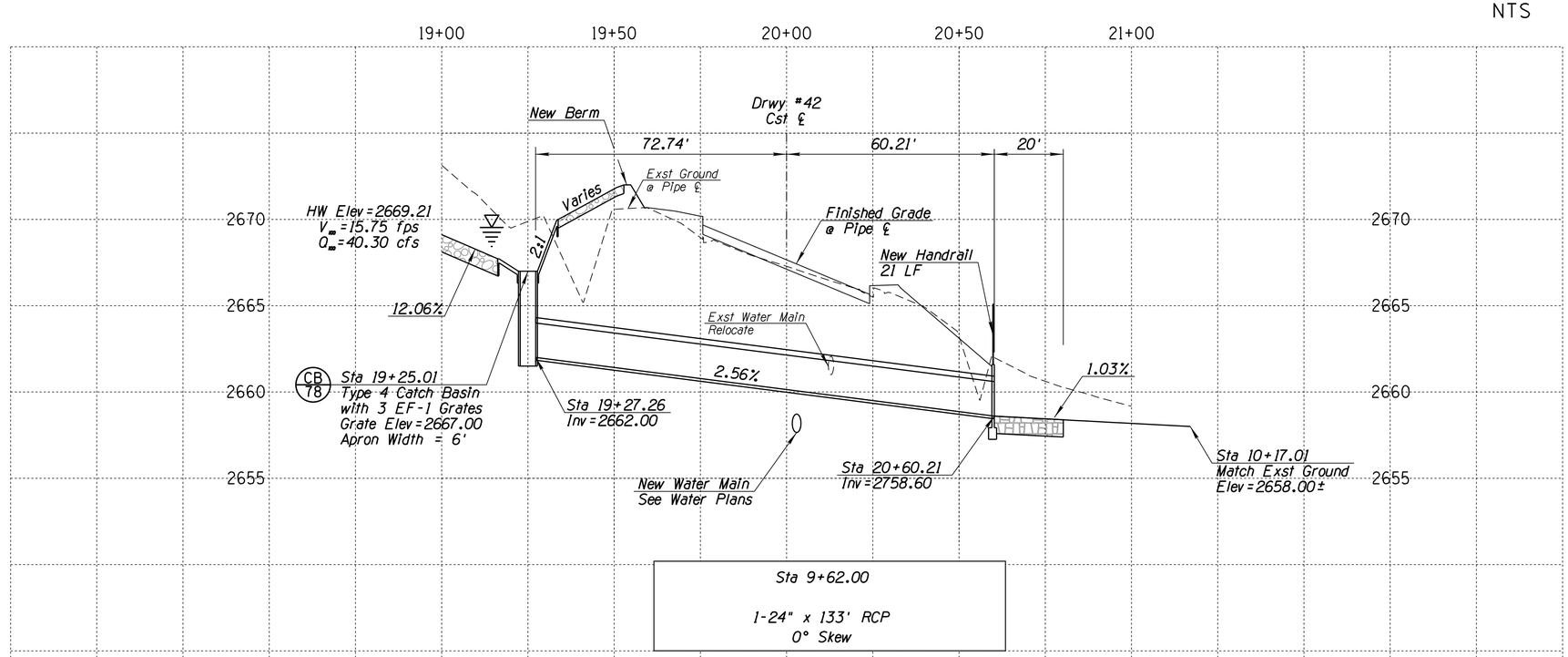
PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

CROSS CULVERT PLAN AND PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 150+00 & STA 150+50





SECTION A
NTS



Sta 9+62.00

1-24" x 133' RCP
0° Skew

Notes:

1. Outlet headwall shall be based on ADOT Std Dwg SD 6.30 for a 24" diameter pipe with these modified dimensions:
   F=4'-1"
   G=9'-0"
   L=15'-0"
2. Pipes shall be installed per ADOT Std Dwgs C-13.10 and C-13.15.
3. For catch basin inlet, channel and berm information, see Detail D15.
4. New outlet protection, see Detail D12.

1 Top Headwall Elev=2661.60

Cross-Drainage Quantities

133 LF	24" RCP, Class III Bid Item # 5011023
1 EA	PAG Type 4 Off-Road CB Triple, D=8' or Less Bid Item # 5030738
1 EA	Pipe Culvert Headwall Bid Item # 6016087
21 LF	Handrail Bid Item # 9330008

0 20' 40'

Call at least two full working days before you begin excavation
ARIZONA 811
Arizona Blue Stake, Inc.
Dial 8-1-1 or 1-800-STAKE-IT (782-5348)
In Maricopa County: (602) 263-1100

Scales: Horiz. 1"=20' Vert. 1"=4'

SHEET DR19 OF DR19

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

No.	Revision Description	Engineer	Date

		Date
Designed	M ASHBY	12/18
Drawn	C ZHANG	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil)
CERTIFICATE NO. 34738
KEVIN TODD THORNTON
Date Signed 12/17/18
ARIZONA U.S.A.
Expires 03/31/19

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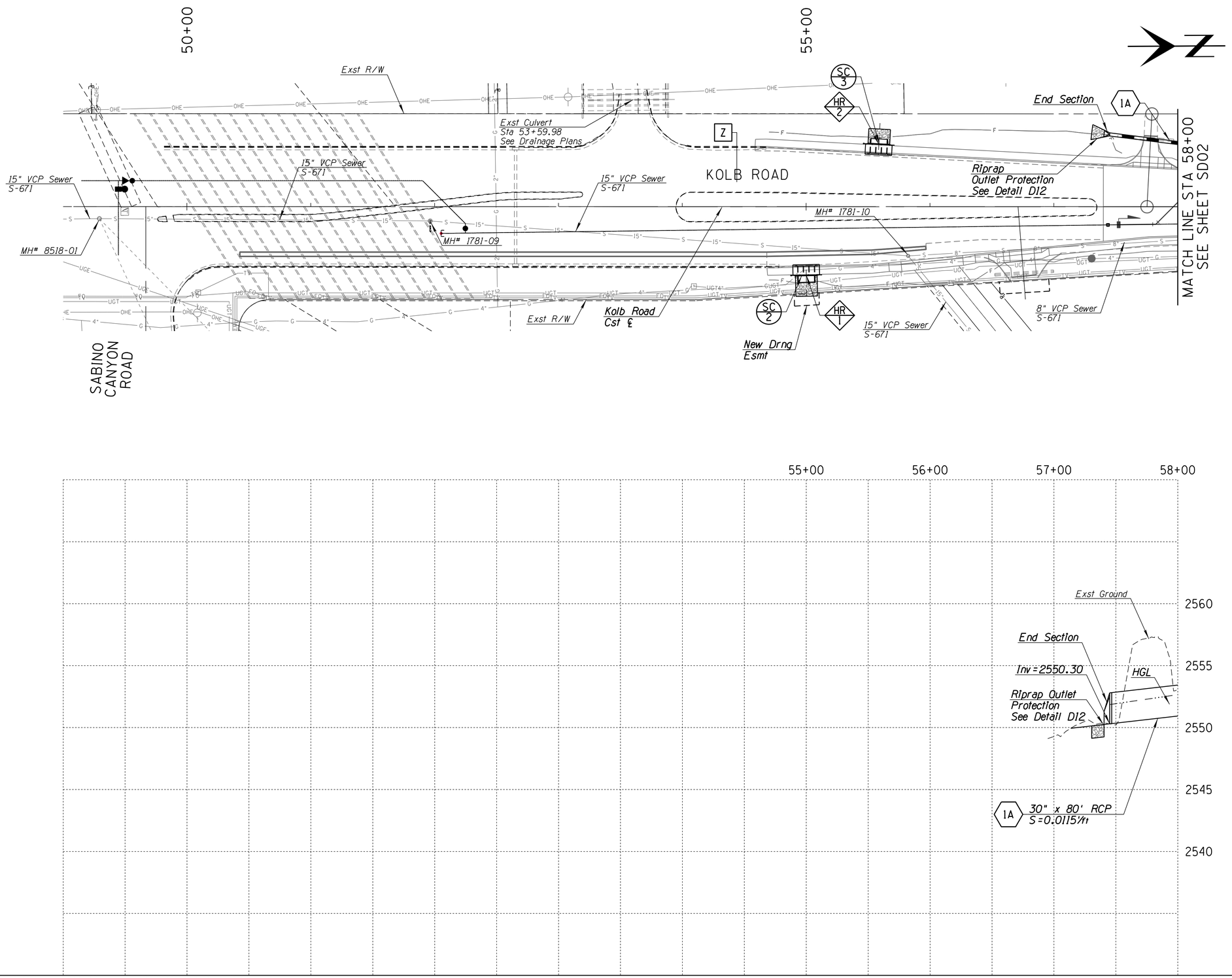
Tucson, AZ 85705
(520) 292-2300 (520) 292-1290 fax
www.psomas.com

CROSS CULVERT PLAN AND PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 115+37

STORMDRAIN
PLAN AND PROFILE



Storm Drain Quantities

55 LF	30" Reinforced Conc Pipe Class III Bid Item # 5011033
1 EA	Conc End Section, 30" ADOT C-13.20 Bid Item # 5014130
24 LF	Sidewalk Scupper Type 3 Bid Item # 5030093
10 LF	Embankment Spillway Bid Item # 9170001

0 40' 80'

Scales: Horiz. 1"=40' Vert. 1"=4'

SHEET SD01 OF SD16

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

		Date
Designed	E BARNES	12/18
Drawn	E BARNES	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

No.	Revision Description	Engineer	Date

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12/17/18 ARIZONA U.S.A. Expires 03/31/19

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www.psomas.com

STORM DRAIN PLAN & PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 49+00 TO STA 58+00

Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

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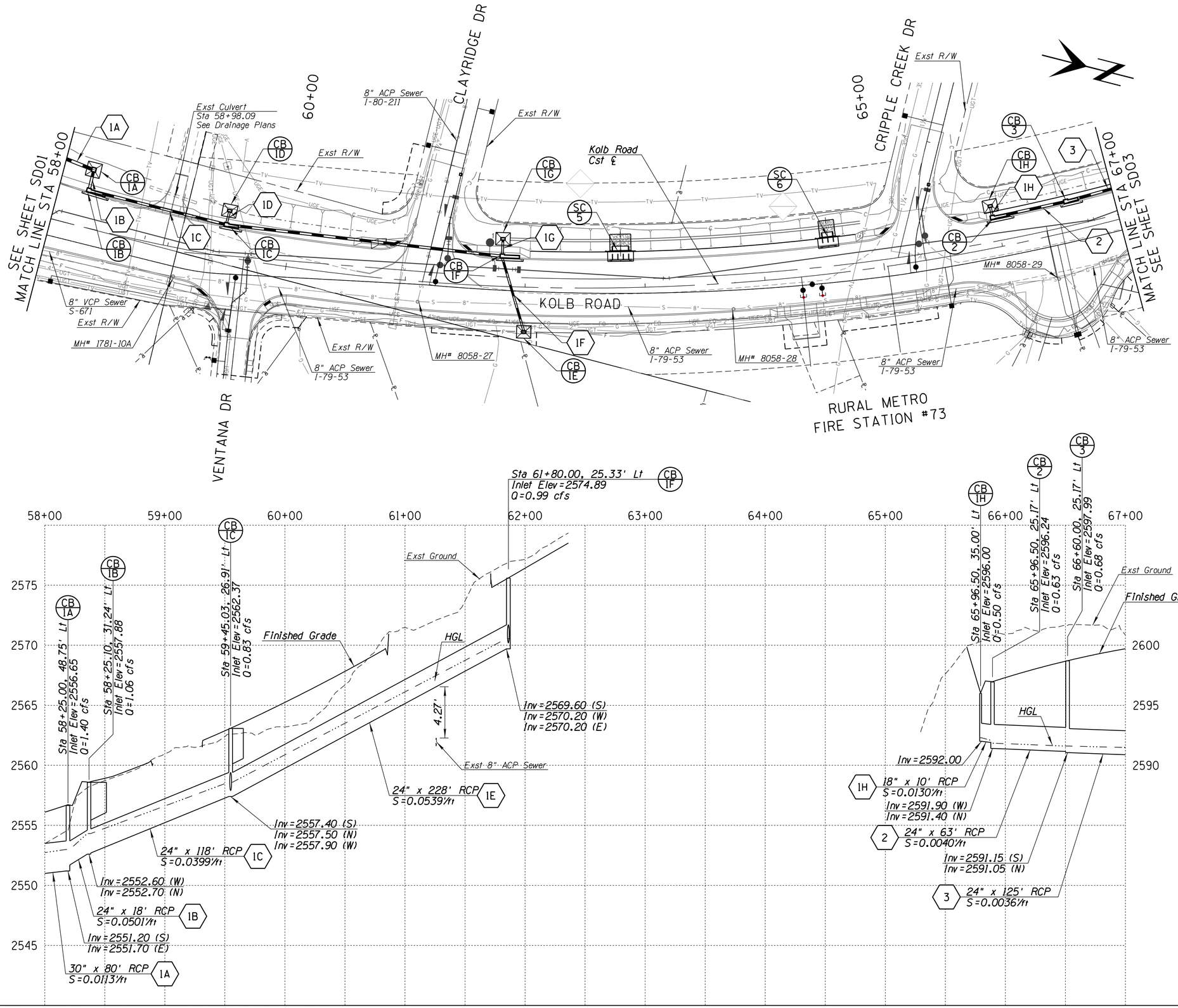

Storm Drain Quantities

30 LF	18" Reinforced Conc. Pipe Class II Bid Item # 5011010
64 LF	18" Reinforced Conc Pipe Class IV Bid Item # 5011014
403	24" Reinforced Conc Pipe Class II Bid Item # 5011022
53 LF	24" Reinforced Conc Pipe Class III Bid Item # 5011023
23 LF	30" Reinforced Conc Pipe Class III Bid Item # 5011033
20 LF	Sidewalk Scupper Type 3 Bid Item # 5030093
2 EA	PAG Type 3 CB 8' Wing, D=8' or Less Bid Item # 5030714
3 EA	PAG Type 3 CB 12' Wing, D=8' or Less Bid Item # 5030716
4 EA	PAG Type 4, Off-Road CB Single, D=8' or less Bid Item # 5030734
1 EA	PAG Type 4, Off-Road CB Double, D=8' or Less Bid Item # 5030736
8 LF	Embankment Spillway Bid Item # 9170003

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

		Date
Designed	E BARNES	12/18
Drawn	E BARNES	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

No.	Revision Description	Engineer	Date

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12/17/18 ARIZONA U.S.A. Expires 03/31/19

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Tucson, AZ 85705
(520) 292-2300
www.psomas.com
(520) 292-1290 fax

STORM DRAIN PLAN & PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 58+00 TO STA 67+00

Call at least two full working days before you begin excavation
ARIZONA 811
Arizona Blue Stake, Inc.
Dial 8-1-1 or 1-800-STAKE-IT (782-5348)
In Maricopa County: (602) 263-1100

0 40' 80'

Scales: Horiz. 1"=40' Vert. 1"=4'

SHEET SD02 OF SD16

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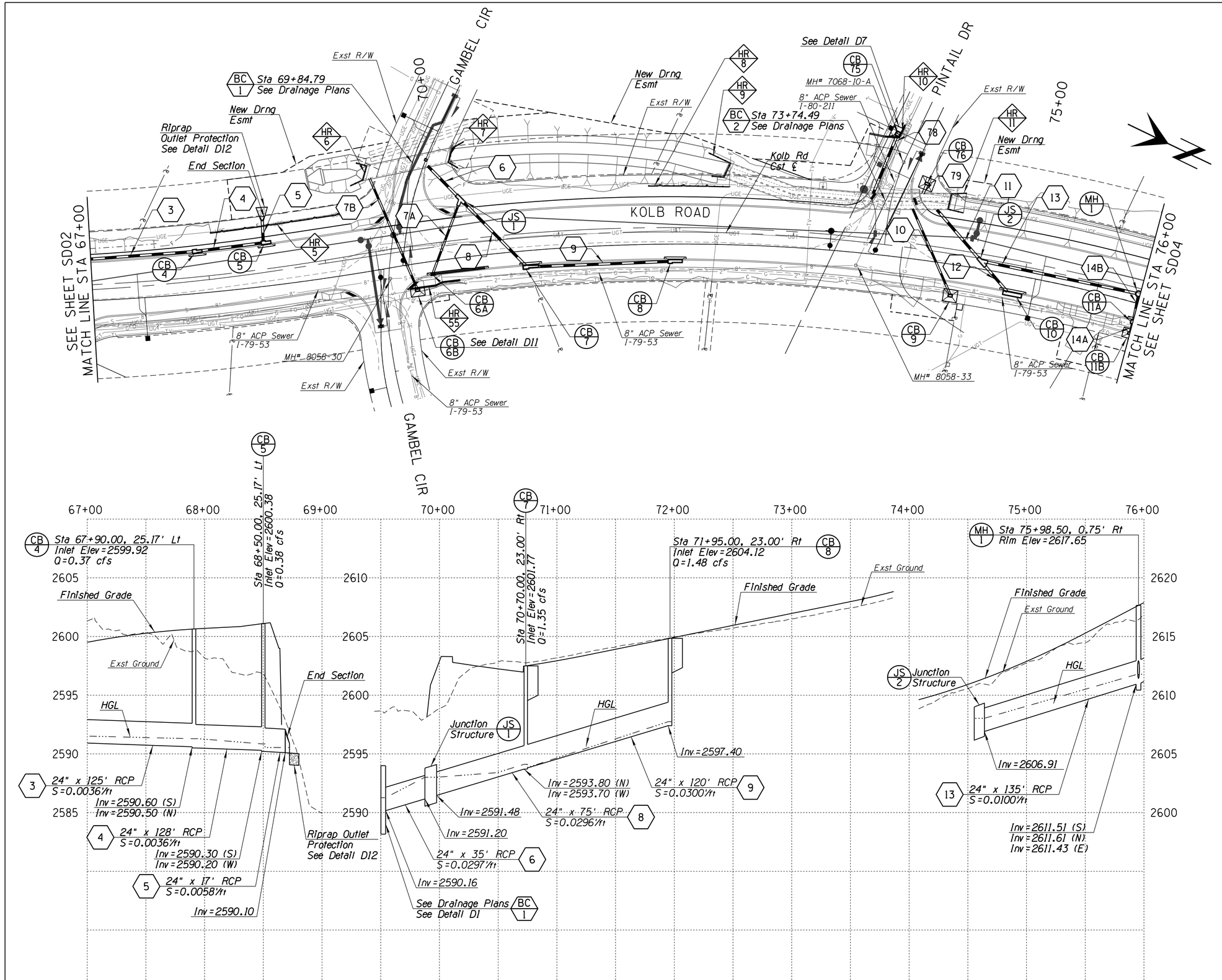

Storm Drain Quantities

42 LF	18" Slotted Pipe Bid Item # 5010100
103 LF	18" Reinforced Conc Pipe Class III Bid Item # 5011012
142 LF	18" Reinforced Conc Pipe Class IV Bid Item # 5011014
338 LF	24" Reinforced Conc Pipe Class II Bid Item # 5011022
326 LF	24" Reinforced Conc Pipe Class III Bid Item # 5011023
1 EA	Conc End Section, 24" ADOT C-13.20 Bid Item # 5014124
1 EA	ADOT C-15.30 CB Single, H=8' or Less Bid Item # 5030120
2 EA	PAG Type 3 CB 4' Wing, D=Over 8' Bid Item # 5030713
1 EA	PAG Type 3 CB 8' Wing, D=8' or Less Bid Item # 5030714
1 EA	PAG Type 3 CB 12' Wing, D=8' or Less Bid Item # 5030716
3 EA	PAG Type 4, Off-Road CB Single, D=8' or Less Bid Item # 5030734
1 EA	PAG Type 4, Off-Road CB Double, D=8' or Less Bid Item # 5030736
1 EA	Storm Drain Manhole Dtl 300 Bid Item # 5050000
2 EA	Junction Structure Bid Item # 6016211
1 EA	PAG Type 3 CB 8' Wing, D=Over 8', Mod. Bid Item # 9300131
1 EA	PAG Type 3 CB, 12' Wing, D=8' or Less, Mod. Bid Item # 9300132

Designed	E. BARNES	12/18
Drawn	E. BARNES	12/18
Checked	M. ASHBY	12/18
Proj. Engr.	K. THORNTON	12/18

No.	Revision Description	Engineer	Date

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD HORNTON Date Signed 12/18/18 ARIZONA, U.S.A. Expires 03/31/21

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STORM DRAIN PLAN & PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 67+00 TO STA 76+00

Call at least two full working days before you begin excavation.
ARIZONA 811
Arizona Blue Stake, Inc.
Dial 8-1-1 or 1-800-STAKE-IT (782-5348)
In Maricopa County: (602) 263-1100

0 40' 80'

Scales: Horiz. 1"=40' Vert. 1"=4'

SHEET SD03 OF SD16

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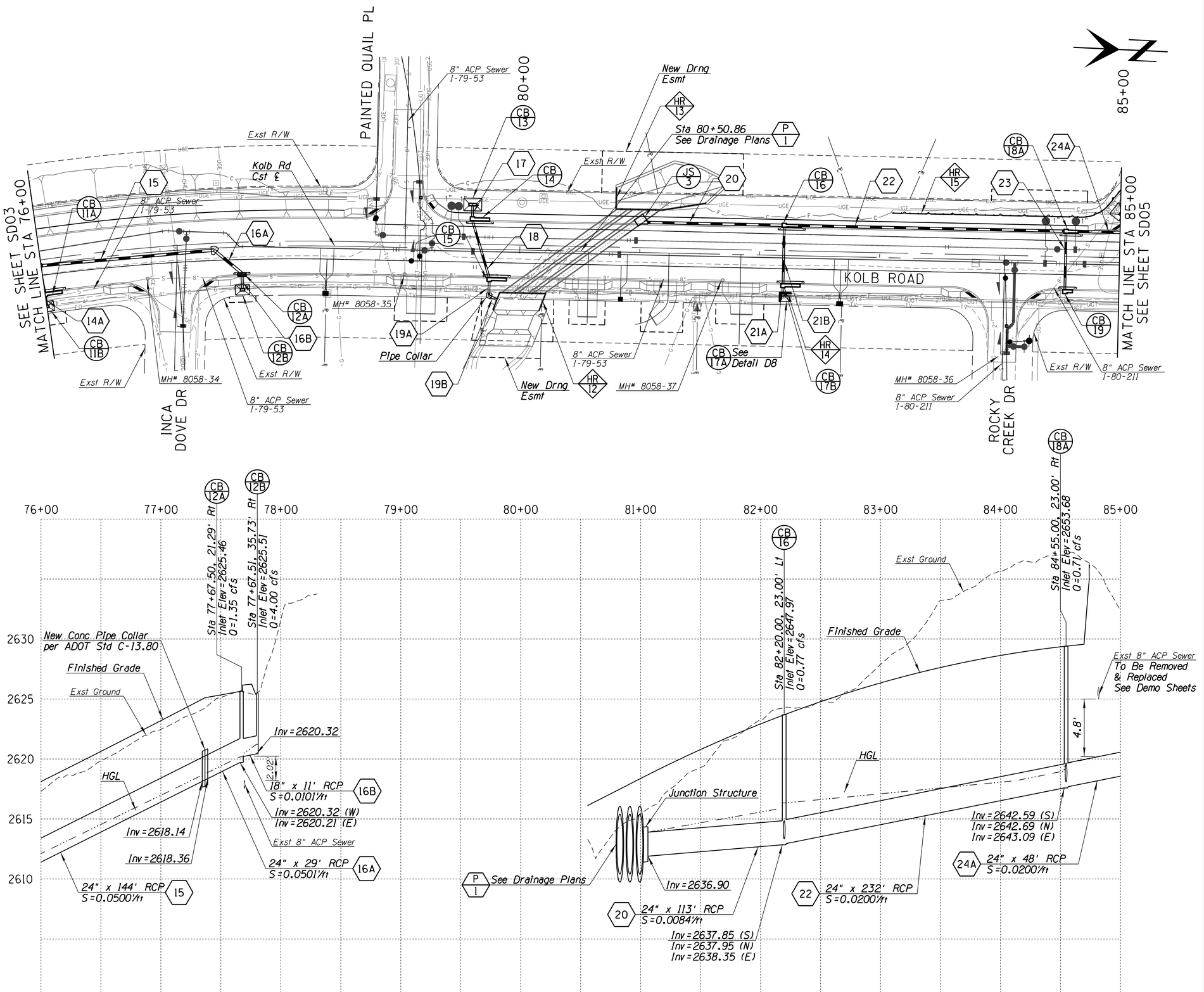

Storm Drain Quantities

93 LF	18" Reinforced Conc Pipe Class II Bid Item # 5011010
48 LF	18" Reinforced Conc Pipe Class III Bid Item # 5011012
80 LF	18" Reinforced Conc Pipe Class IV Bid Item # 5011014
175 LF	24" Reinforced Conc Pipe Class II Bid Item # 5011022
388 LF	24" Reinforced Conc Pipe Class III Bid Item # 5011023
1 EA	PAG Type 1 CB Double, D=8' or Less Bid Item # 5030705
1 EA	PAG Type 3 CB 4' Wing, D=Over 8' Bid Item # 5030713
1 EA	PAG Type 3 CB 8' Wing, D=Over 8' Bid Item # 5030715
3 EA	PAG Type 3 CB 12' Wing, D=8' or Less Bid Item # 5030716
2 EA	PAG Type 3 CB 12' Wing, D=Over 8' Bid Item # 5030717
3 EA	PAG Type 4, Off-Road CB Single, D=8' or Less Bid Item # 5030734
1 EA	PAG Type 4, Off-Road CB Double, D=8' or Less Bid Item # 5030736
1 EA	Junction Structure Bid Item # 6016211

		Date
Designed	E BARNES	12/18
Drawn	E BARNES	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

No.	Revision Description	Engineer	Date

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12/17/18 ARIZONA U.S.A. Expires 03/31/19

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333 E. Wetmore Road, Suite 450
Tucson, AZ 85705
(520) 292-2300 (520) 292-1290 fax
www.psomas.com

STORM DRAIN PLAN & PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 76+00 TO STA 85+00

Call at least two full working days before you begin excavation ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

0 40' 80'

Scales: Horiz. 1"=40' Vert. 1"=4'

SHEET SD04 OF SD16

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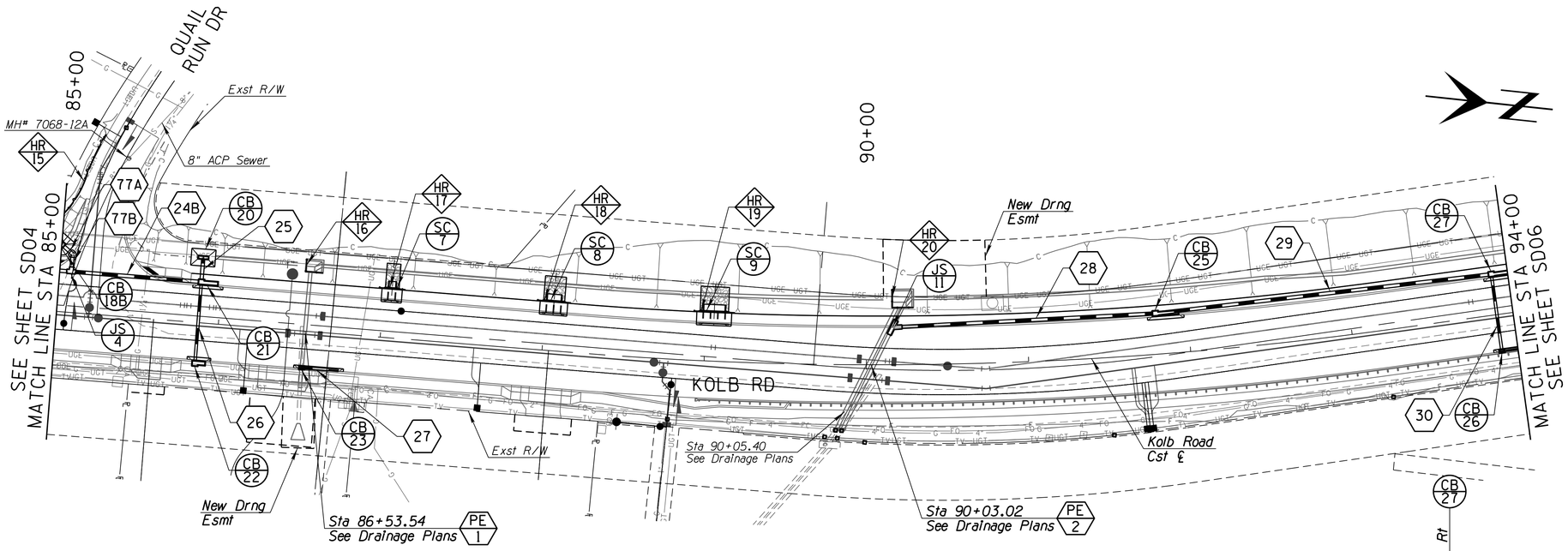

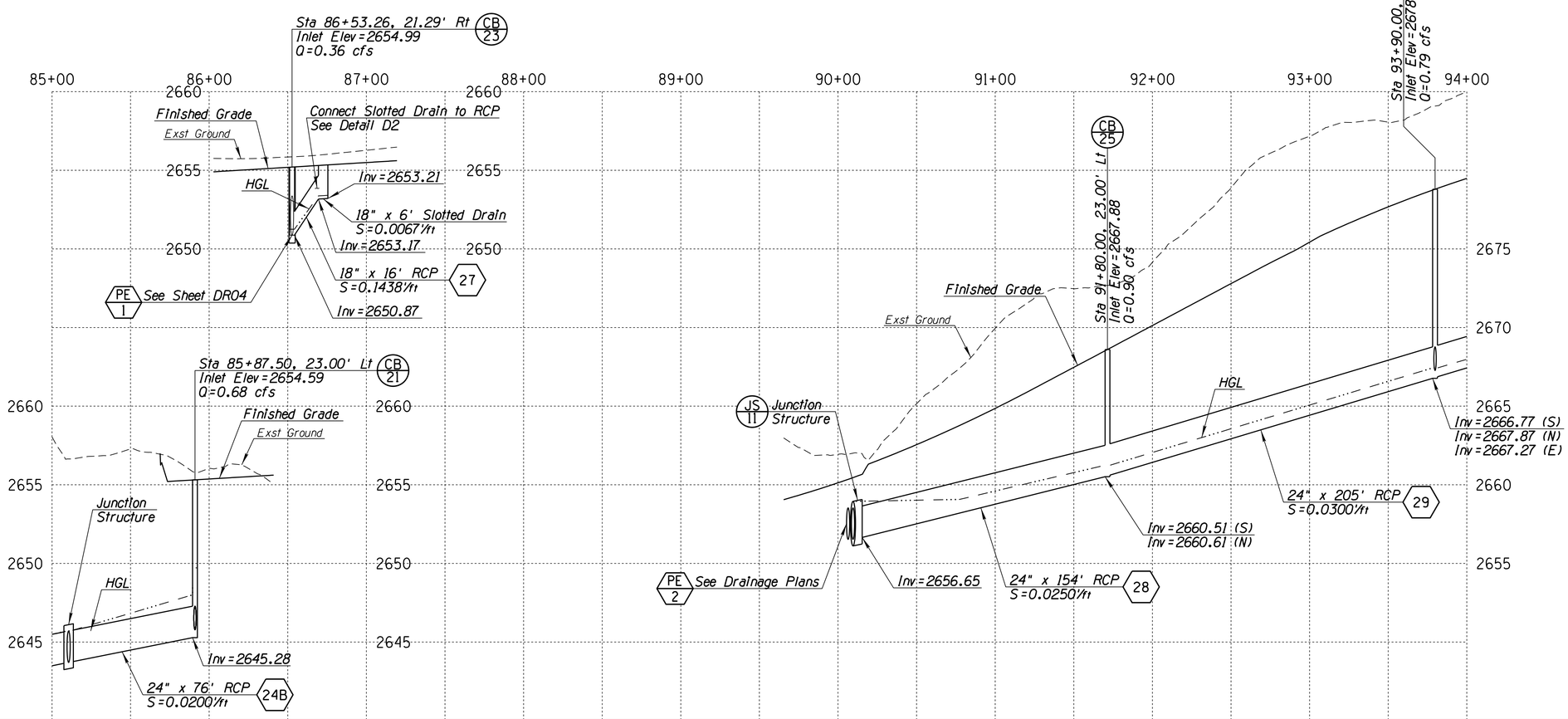

Storm Drain Quantities

38 LF	18" Slotted Pipe Bid Item # 5010100
47 LF	18" Reinforced Conc Pipe Class II Bid Item # 5011010
46 LF	18" Reinforced Conc Pipe Class III Bid Item # 5011012
15 LF	18" Reinforced Conc Pipe Class IV Bid Item # 5011014
16 LF	24" Reinforced Conc Pipe Class II Bid Item # 5011022
454 LF	24" Reinforced Conc Pipe Class III Bid Item # 5011023
24 LF	Sidewalk Scupper Type 3 Bid Item # 5030093
1 EA	ADOT C-15.30 CB Single, H=8' or Less Bid Item # 5030120
1 EA	ADOT C-15.30 CB Single, H=Over 8' Bid Item # 5030121
1 EA	PAG Type 3 CB 4' Wing, D=Over 8' Bid Item # 5030713
1 EA	PAG Type 3 CB 8' Wing, D=Over 8' Bid Item # 5030715
1 EA	PAG Type 3 CB 12' Wing, D=8' or Less Bid Item # 5030716
1 EA	PAG Type 3 CB 12' Wing, D=Over 8' Bid Item # 5030717
1 EA	PAG Type 4, Off-Road CB Single, D=8' or Less Bid Item # 5030734
1 EA	PAG Type 4, Off-Road CB Double, D=8' or Less Bid Item # 5030736
2 EA	Junction Structure Bid Item # 6016211
12 LF	Embankment Spillway Bid Item # 9170001

0 40' 80'

Scales: Horiz. 1"=40' Vert. 1"=4'

SHEET SD05 OF SD16

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

		Date
Designed	E BARNES	12/18
Drawn	E BARNES	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	

No.	Revision Description	Engineer	Date

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) KEVIN TODD THORNTON 34738 Date Signed 12/17/18 ARIZONA U.S.A.

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333 E. Wetmore Road, Suite 450
Tucson, AZ 85705
(520) 292-2300 (520) 292-1290 fax
www.psomas.com

STORM DRAIN PLAN & PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 85+00 TO STA 103+00

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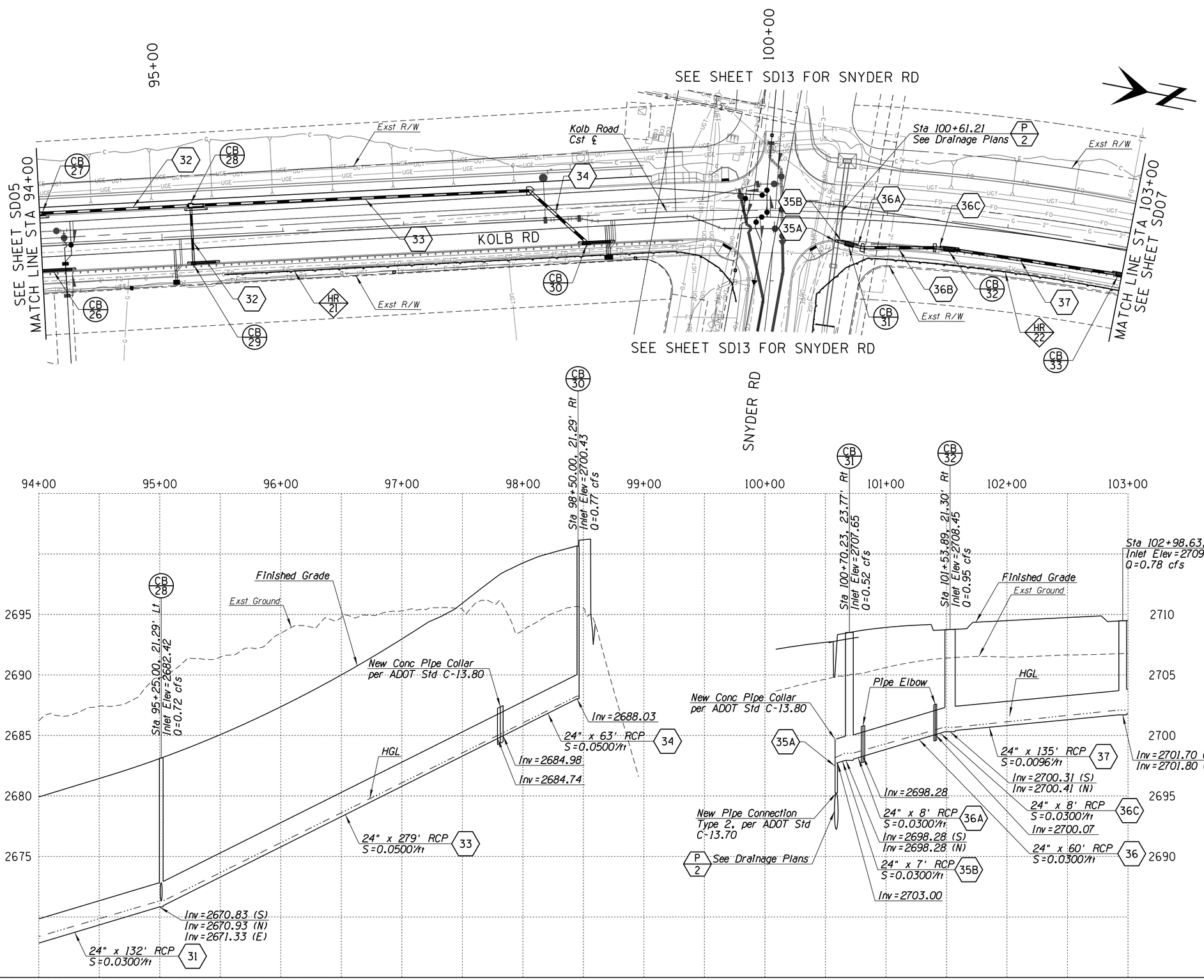

Storm Drain Quantities

32 LF	18" Slotted Pipe Bid Item # 5010100
46 LF	18" Reinforced Conc Pipe Class III Bid Item # 5011012
143 LF	24" Reinforced Conc Pipe Class II Bid Item # 5011022
274 LF	24" Reinforced Conc Pipe Class III Bid Item # 5011023
279 LF	24" Reinforced Conc Pipe Class IV Bid Item # 5011024
1 EA	ADOT C-15.30 CB Single, H=Over 8' Bid Item # 5030121
1 EA	ADOT C-15.30 CB Double, H=Over 8' Bid Item # 5030126
1 EA	PAG Type 1 CB Double, D=8' or Less Bid Item # 5030705
1 EA	PAG Type 1 CB Double, D=Over 8' Bid Item #5030707
1 EA	PAG Type 1 CB Triple, D=8' or Less Bid Item #5030708
1 EA	PAG Type 3 CB 8' Wing, D=Over 8' Bid Item # 5030715

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

Designed	E. BARNES	12/18
Drawn	E. BARNES	12/18
Checked	M. ASHBY	12/18
Proj. Engr.	K. THORNTON	12/18

No.	Revision Description	Engineer	Date

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12/17/18 ARIZONA U.S.A. Expires 03/31/19

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STORM DRAIN PLAN & PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 94+00 TO STA 103+00

Call at least two full working days before you begin excavation
ARIZONA 811
Arizona Blue Stake, Inc.
Dial 8-1-1 or 1-800-STAKE-IT (782-5348)
In Maricopa County: (602) 263-1100

0 40' 80'

Scales: Horiz. 1"=40' Vert. 1"=4'

SHEET SD06 OF SD16

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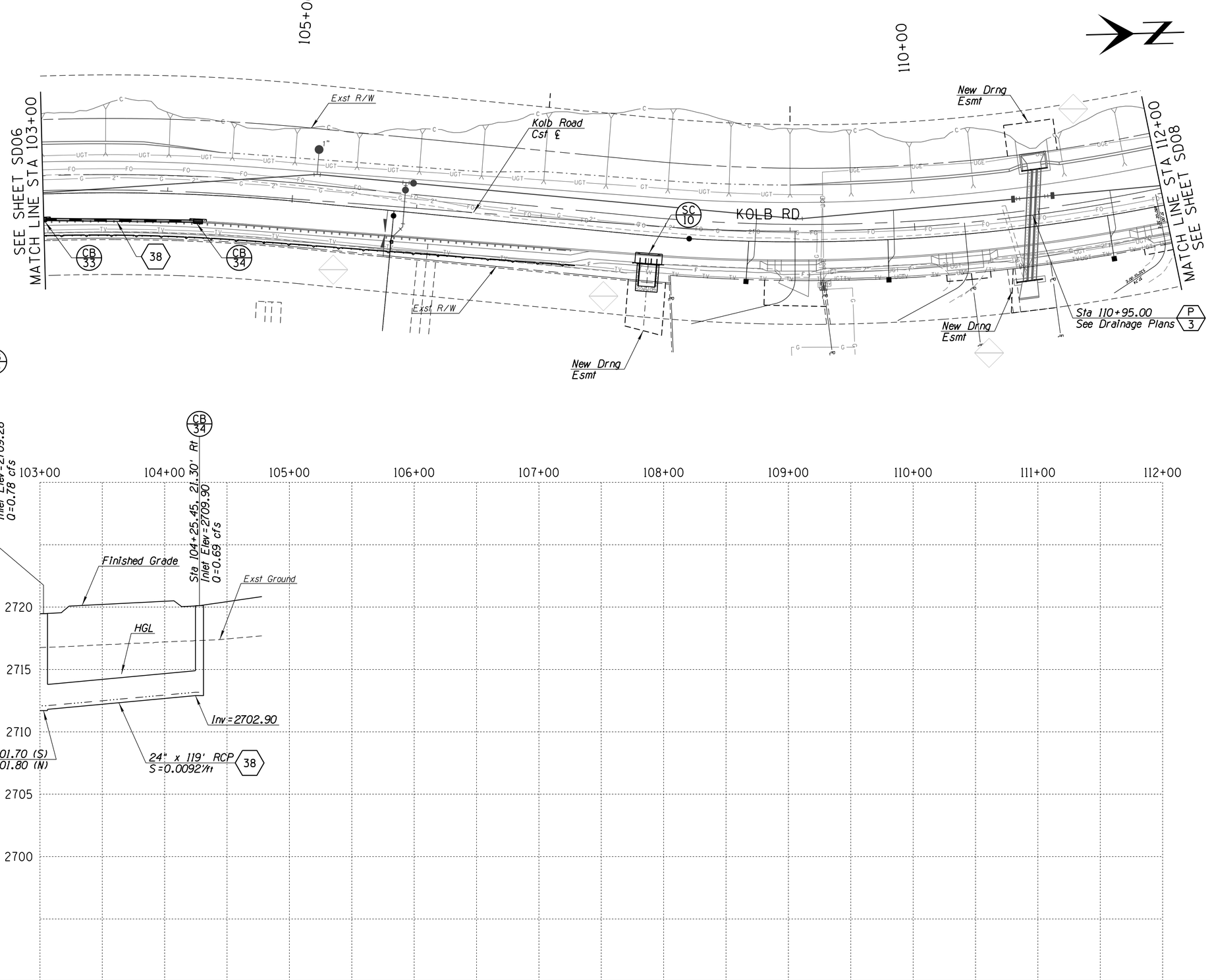

Storm Drain Quantities

119 LF	24" Reinforced Conc Pipe Class II Bid Item # 5011022
12 LF	Sidewalk Scupper Type 3 Bid Item # 5030093
1 EA	PAG Type 1 CB Double, D=8' or Less Bid Item # 5030705
18 LF	Embankment Spillway Bid Item # 9170001

0 40' 80'

Scales: Horiz. 1"=40' Vert. 1"=4'

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SHEET SD07 OF SD16

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

Designed	E BARNES	Date
Drawn	E BARNES	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

No.	Revision Description	Engineer	Date

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12-17-18 ARIZONA, U.S.A. Expires 03/31/

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

PSOMAS
333 E. Wetmore Road, Suite 450
Tucson, AZ 85705
(520) 292-2300 (520) 292-1290 fax
www.psomas.com

STORM DRAIN PLAN & PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 103+00 TO STA 112+00

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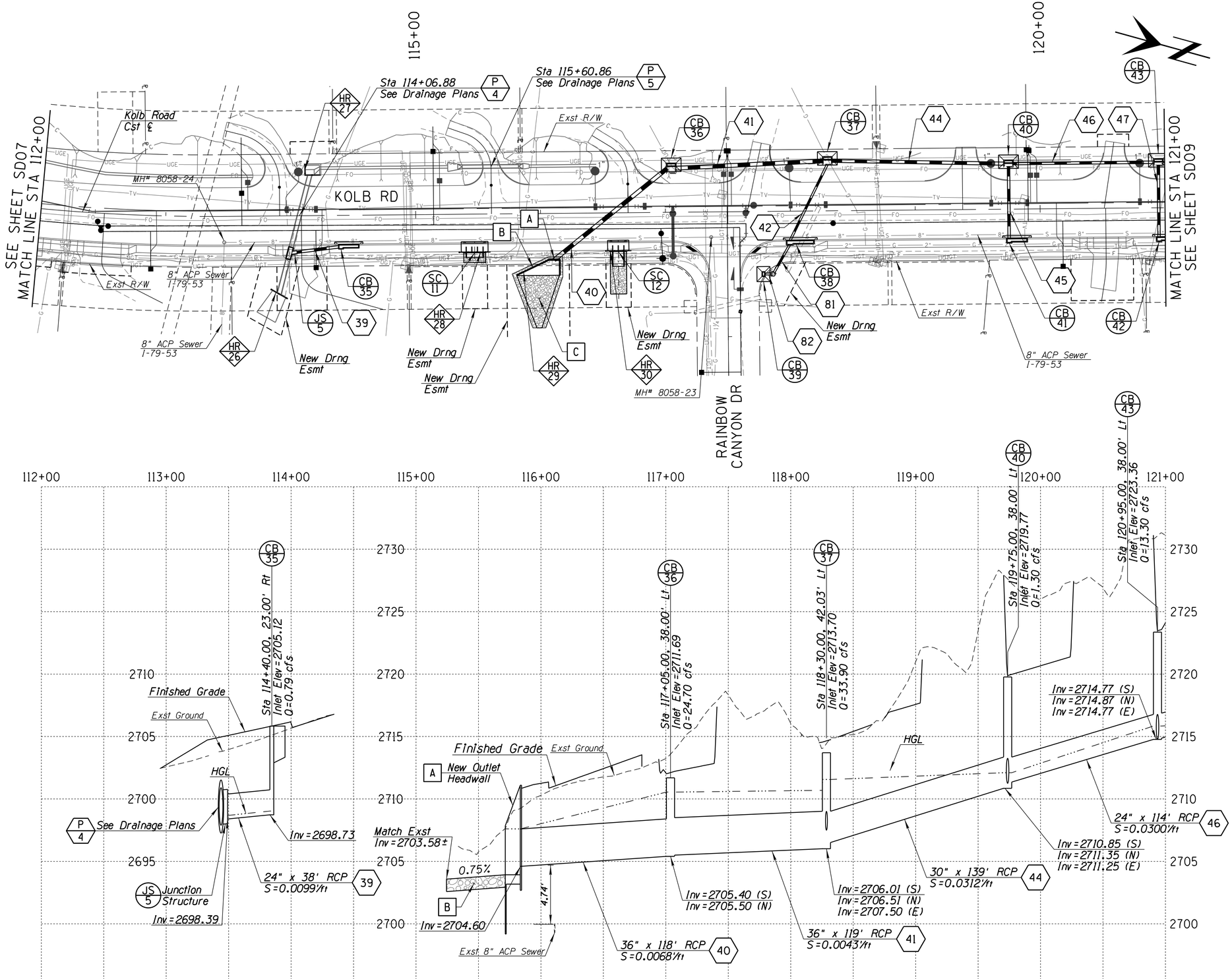

Storm Drain Quantities

96 LF	18" Reinforced Conc Pipe Class II Bid Item # 5011010
7 LF	18" Reinforced Conc Pipe Class IV Bid Item # 5011014
264 LF	24" Reinforced Conc Pipe Class II Bid Item # 5011022
139 LF	30" Reinforced Conc Pipe Class II Bid Item # 5011032
119 LF	36" Reinforced Conc Pipe Class II Bid Item # 5011042
117 LF	36" Reinforced Conc Pipe Class III Bid Item # 5011043
20 LF	Sidewalk Scupper Type 3 Bid Item # 5030093
3 EA	PAG Type 3 CB 12' Wing, D=8' or Less Bid Item # 5030716
1 EA	PAG Type 4, Off-Road CB Single, D=8' or Less Bid Item # 5030734
1 EA	Pipe Culvert Headwall Bid Item # 6016087
2 EA	Concrete Wingwall Bid Item # 6016110
1 EA	Junction Structure Bid Item # 6016211
16 LF	Embankment Spillway Bid Item # 9170001
1 EA	PAG Type 3 CB Mod. 16' Wing, D=Over 8' Bid Item # 9300135
2 EA	PAG Type 4, Off-Road CB Mod. Single, D=8' or Less Bid Item # 9300138
2 EA	PAG Type 4, Off-Road CB Mod. Single, D=Over 8' Bid Item # 9300139

A Outlet headwall dimensions shall be based on ADOT Std Dwg 6.30 (4 of 5) for a 60" pipe diameter, 4:1 slope, and 45° skew.

B Outlet wingwall dimensions shall be based on ADOT Std Dwg 6.30 (3 of 5) for a 60" diameter, 4:1 slope, and 45° skew.

C New outlet protection, see Detail D12.

0 40' 80'

Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

Scales: Horiz. 1"=40' Vert. 1"=4'

SHEET SD08 OF SD16

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

No.	Revision Description	Engineer	Date

		Date
Designed	E. BARNES	12/18
Drawn	E. BARNES	12/18
Checked	M. ASHBY	12/18
Proj. Engr.	K. THORNTON	

Registered Professional Engineer (Civil) 34738 KEVIN TODD THORNTON Date Signed 12/18/18 ARIZONA U.S.A. Expires 03/31/19

PSOMAS
333 E. Wetmore Road, Suite 450
Tucson, AZ 85705
(520) 292-2300 (520) 292-1290 fax
www.psomas.com

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

STORM DRAIN PLAN & PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 112+00 TO STA 121+00

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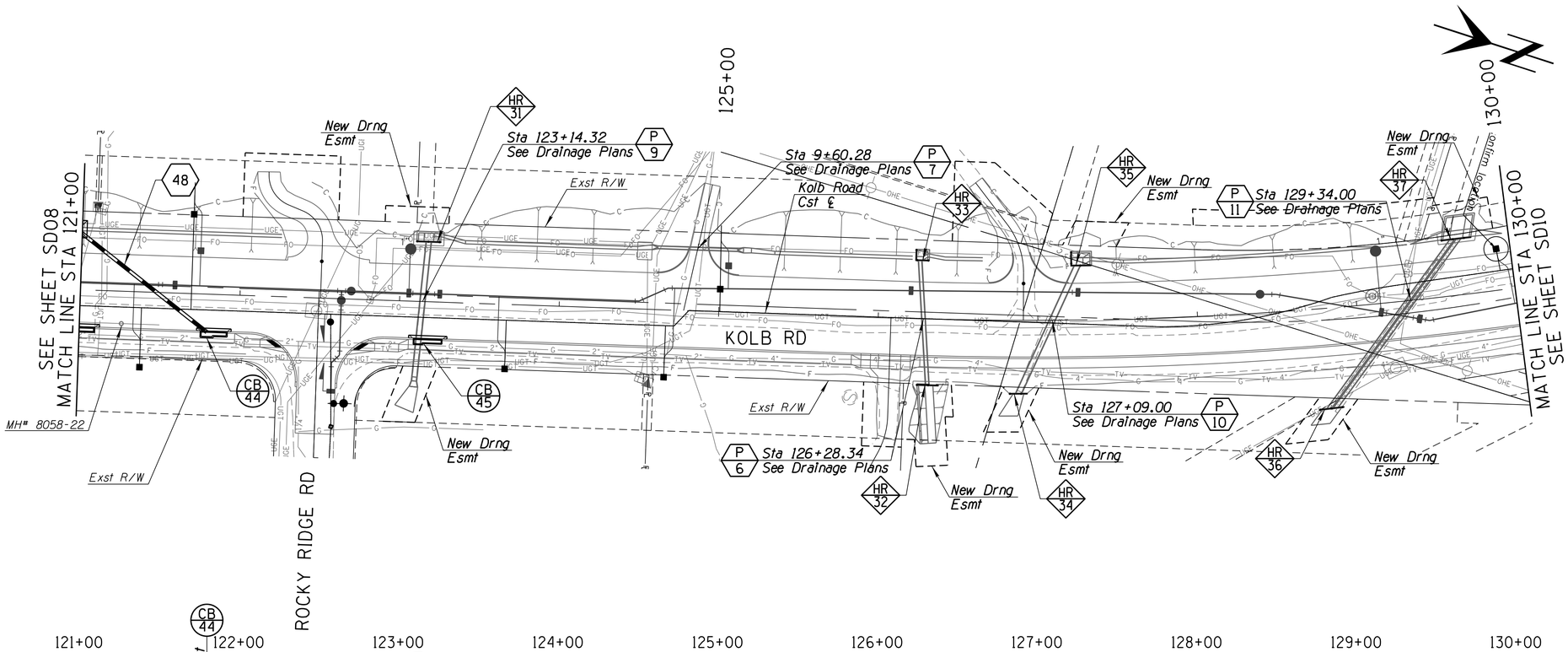

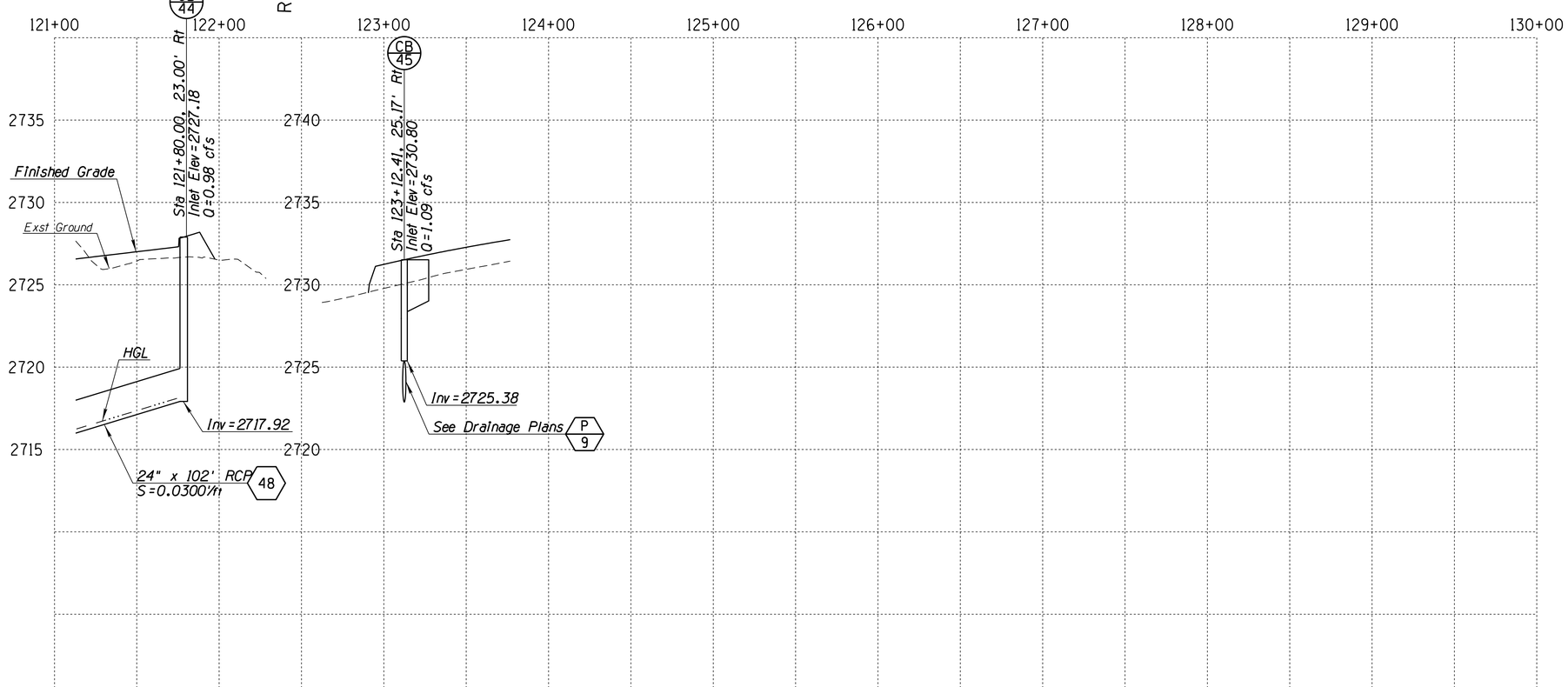

Storm Drain Quantities

102 LF	24" Reinforced Conc Pipe Class II Bid Item # 5011022
1 EA	PAG Type 3 CB Mod. 8' Wing, D=Over 8' Bid Item # 9300131
1 EA	PAG Type 3 CB Mod. 12' Wing, D=8' or Less Bid Item # 9300132

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

		Date
Designed	E BARNES	12/18
Drawn	E BARNES	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

No.	Revision Description	Engineer	Date

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12/17/18 ARIZONA U.S.A. Expires 03/31/19

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STORM DRAIN PLAN & PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 121+00 TO STA 130+00

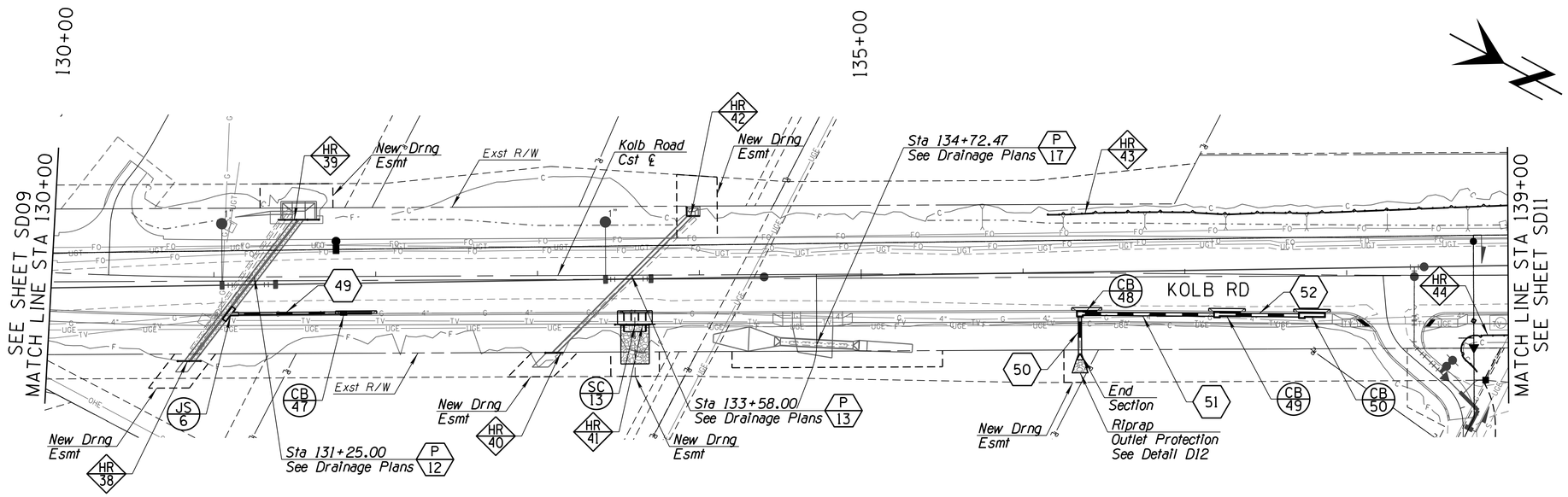
0 40' 80'

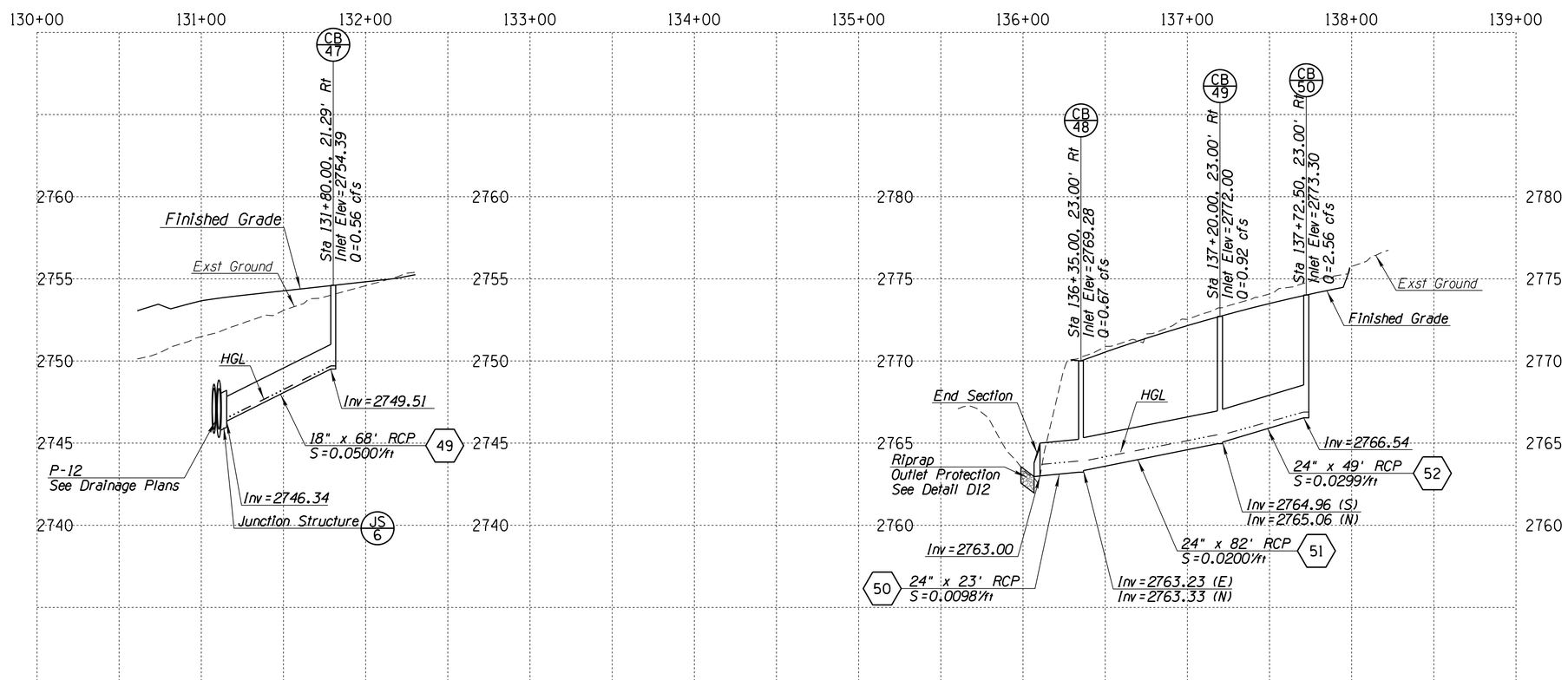
Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

Scales: Horiz. 1"=40' Vert. 1"=4'

SHEET SD09 OF SD16

12/17/2018 3:52:45 PM T:\7PIM160201\PUBLIC_WORKS\Sheets\StormDrain\c-kr01sd09.dgn





Storm Drain Quantities

16 LF	18" Slotted Pipe Bid Item # 5010100
64 LF	18" Reinforced Conc Pipe Class II Bid Item # 5011010
154 LF	24" Reinforced Conc Pipe Class II Bid Item # 5011022
1 EA	Conc End Section, 24" ADOT C-13.20 Bid Item # 5014124
12 LF	Sidewalk Scupper Type 3 Bid Item # 5030093
1 EA	PAG Type 3 CB 8' Wing, D=8' or Less Bid Item # 5030714
2 EA	PAG Type 3 CB 12' Wing, D=8' or Less Bid Item # 5030716
1 EA	PAG Type 4 CB Single, D=8' or Less Bid Item # 5030730
1 EA	Junction Structure Bid Item # 6016211
4 LF	Embankment Spillway Bid Item # 9170001

0 40' 80'

Scales: Horiz. 1"=40' Vert. 1"=4'

SHEET SD10 OF SD16

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

No.	Revision Description	Engineer	Date

		Date
Designed	E BARNES	12/18
Drawn	E BARNES	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12/17/18 ARIZONA U.S.A. Expires 03/31/19

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Tucson, AZ 85705
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www.psomas.com

STORM DRAIN PLAN & PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 130+00 TO STA 139+00

Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

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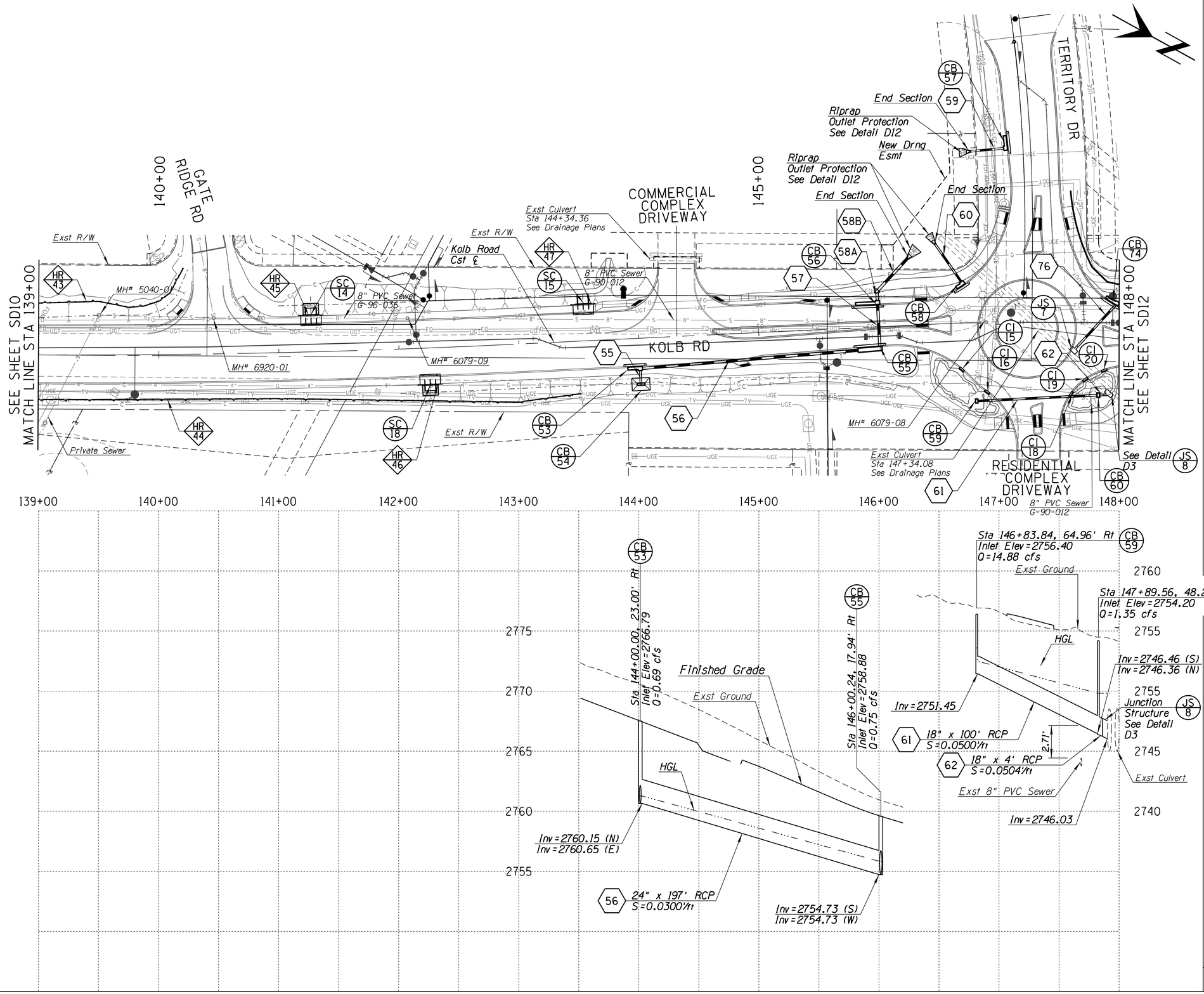

Storm Drain Quantities

162 LF	18" Reinforced Conc Pipe Class II Bid Item # 5011010
66 LF	18" Reinforced Conc Pipe Class IV Bid Item # 5011014
8 LF	24" Reinforced Conc Pipe Class II Bid Item # 5011022
253 LF	24" Reinforced Conc Pipe Class III Bid Item # 5011023
2 EA	Conc End Section, 18" ADOT C-13.20 Bid Item # 5014118
1 EA	Conc End Section, 24" ADOT C-13.20 Bid Item # 5014124
24 LF	Sidewalk Scupper Type 3 Bid Item # 5030093
1 EA	PAG Type 3 CB 4' Wing, D=8' or Less Bid Item # 5030712
3 EA	PAG Type 3 CB 8' Wing, D=8' or Less Bid Item # 5030714
1 EA	PAG Type 3 CB 16' Wing, D=8' or Less Bid Item # 5030718
2 EA	PAG Type 4, Off-Road CB Single, D=8' or Less Bid Item # 5030734
1 EA	PAG Type 4, Off-Road CB Double, D=8' or Less Bid Item # 5030736
5 EA	Curb Inlets Incidental
2 EA	Junction Structure Bid Item # 6016211
18 LF	Embankment Spillway Bid Item # 9170001
1 EA	PAG Type 3 CB 16' Wing, D=8' or less, Mod. Bid Item # 9300134

0 40' 80'

Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

Scales: Horiz. 1"=40' Vert. 1"=4'

SHEET SD11 OF SD16

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

Designed	E. BARNES	12/18
Drawn	E. BARNES	12/18
Checked	M. ASHBY	12/18
Proj. Engr.	K. THORNTON	12/18

No.	Revision Description	Engineer	Date

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12/18/18 ARIZONA, U.S.A. Expires 03/31/19

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PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

STORM DRAIN PLAN & PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 139+00 TO STA 148+00

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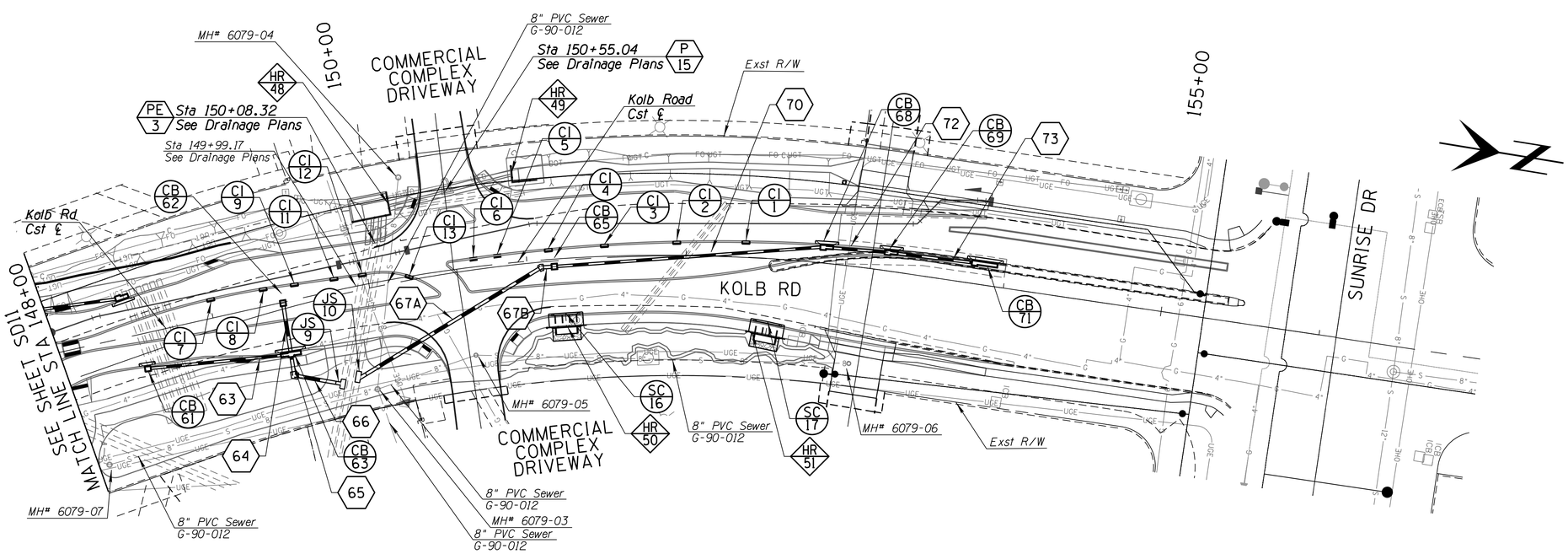

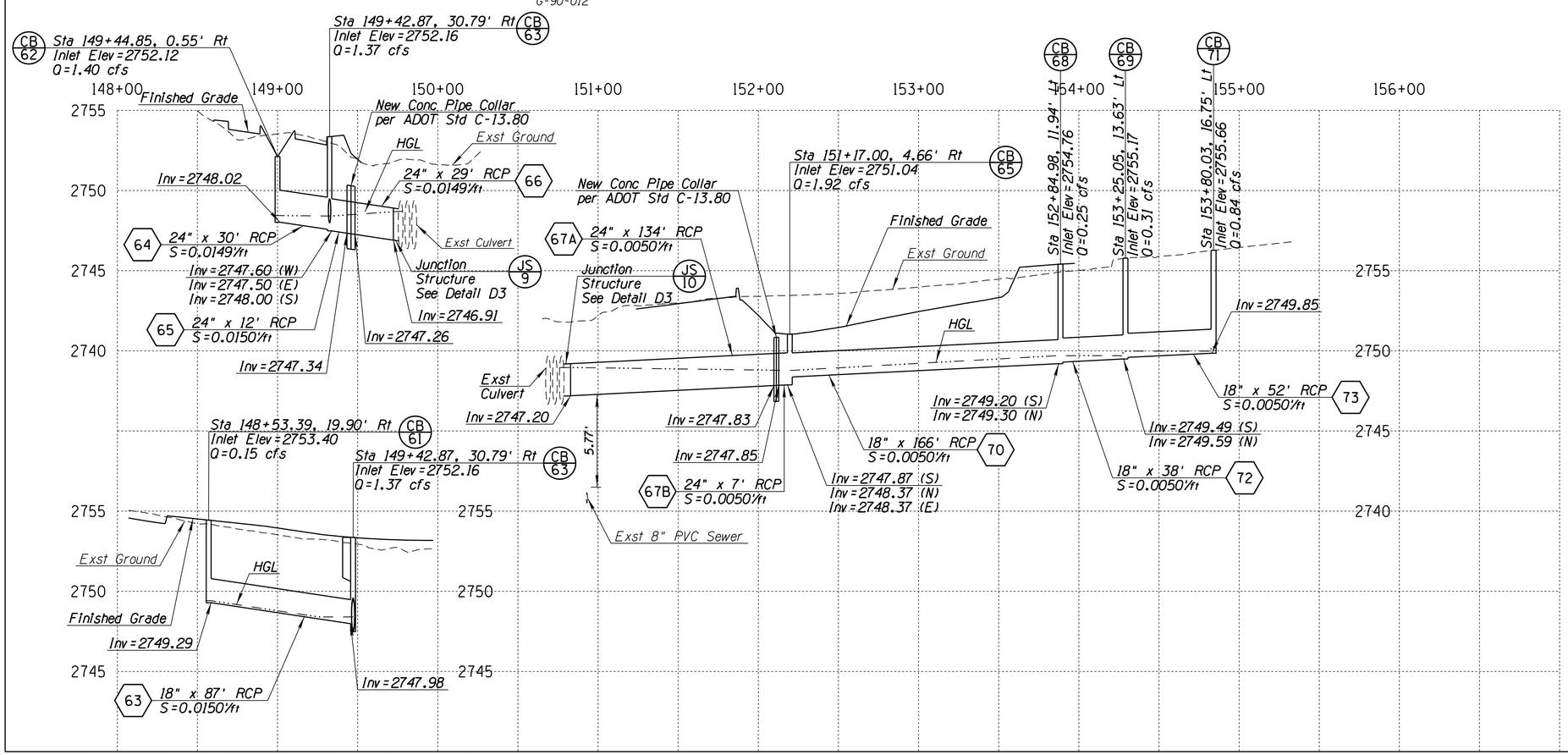

Storm Drain Quantities

223 LF	18" Reinforced Conc Pipe Class II Bid Item # 5011010
166 LF	18" Reinforced Conc Pipe Class IV Bid Item # 5011014
38 LF	24" Reinforced Conc Pipe Class II Bid Item # 5011022
165 LF	24" Reinforced Conc Pipe Class III Bid Item # 5011023
24 LF	Sidewalk Scupper Type 3 Bid Item # 5030093
1 EA	PAG Type 3 CB Sump Only, D=8' or Less Bid Item # 5030710
3 EA	PAG Type 3 CB 4' Wing, D=8' or Less Bid Item # 5030712
1 EA	PAG Type 3 CB 12' Wing, D=8' or Less Bid Item # 5030716
2 EA	PAG Type 4, Off-Road CB Double, D=8' or Less Bid Item # 5030736
12 EA	Curb Inlets Incidental
2 EA	Junction Structure Bid Item # 6016211
9 LF	Embankment Spillway Bid Item # 9170001
1 EA	PAG Type 3 CB Two 4' Wings, D=8' or Less Bid Item # 9300130

No.	Revision Description	Engineer	Date

		Date
Designed	E. BARNES	12/18
Drawn	E. BARNES	12/18
Checked	M. ASHBY	12/18
Proj. Engr.	K. THORNTON	

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12/17/18 ARIZONA U.S.A. Expires 03/31/19

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www.psomas.com

STORM DRAIN PLAN & PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
STA 148+00 TO STA 157+02

0 40' 80'

Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

Scales: Horiz. 1"=40' Vert. 1"=4'

SHEET SD12 OF SD16

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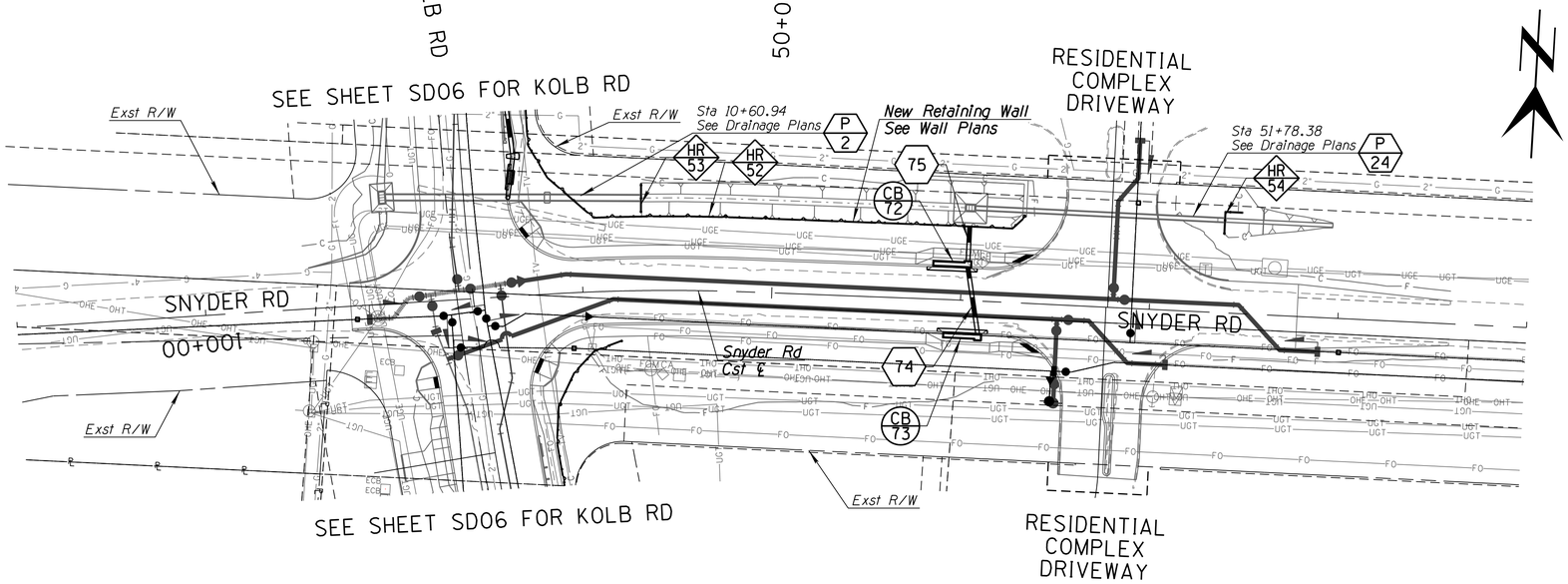

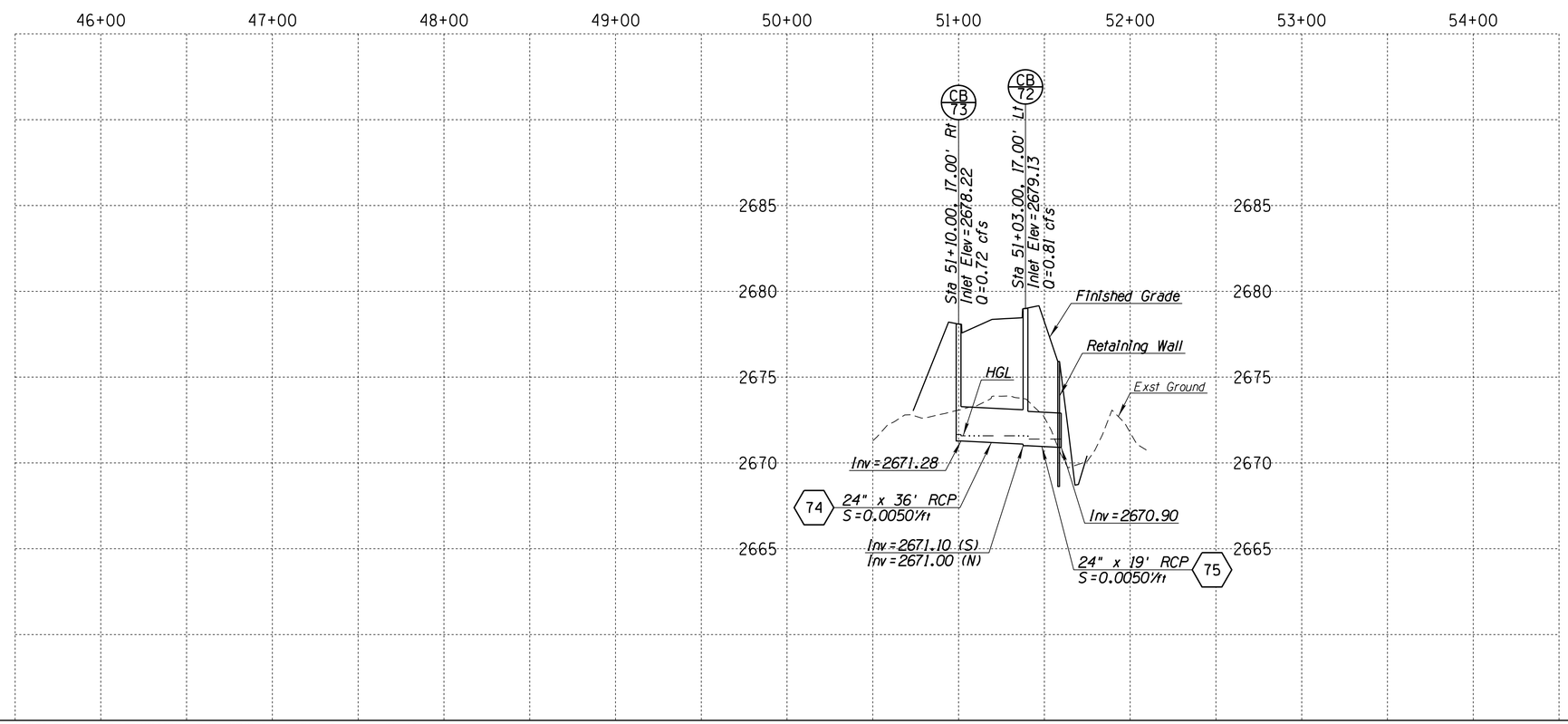

Storm Drain Quantities

55 LF	24" Reinforced Conc Pipe Class II Bid Item # 5011022
2 EA	PAG Type 3 CB 16' Wing, D=8' or Less Bid Item # 5030718

0 40' 80'

Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

Scales: Horiz. 1"=40' Vert. 1"=4'

SHEET SD13 OF SD16

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

Designed	E BARNES	12/18
Drawn	E BARNES	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

No.	Revision Description	Engineer	Date

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 11/27/18 ARIZONA U.S.A. Expires 03/31/19

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STORM DRAIN PLAN & PROFILE
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
SNYDER ROAD STA 46+00 TO STA 54+00

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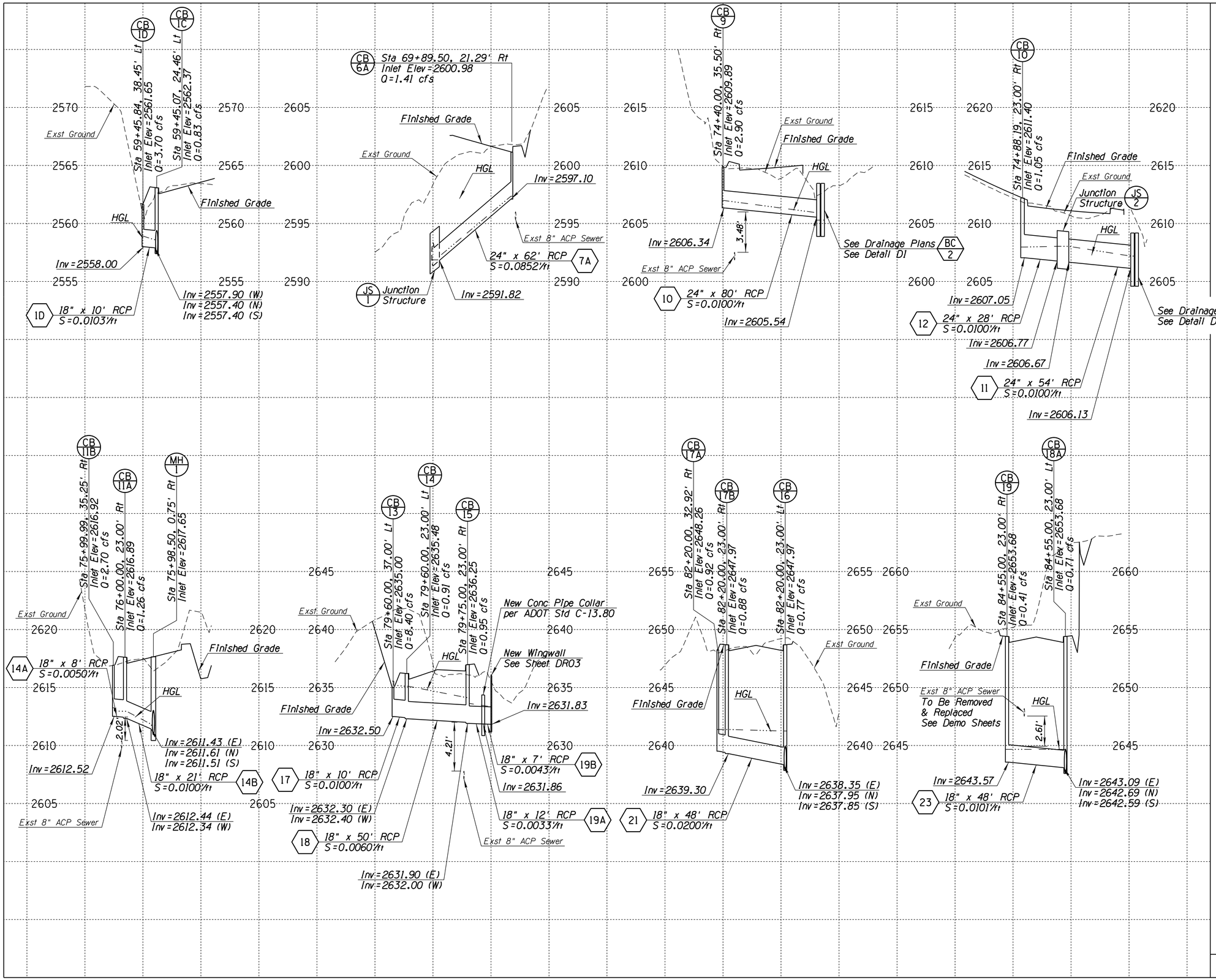

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

No.	Revision Description	Engineer	Date

		Date
Designed	E. BARNES	12/18
Drawn	E. BARNES	12/18
Checked	M. ASHBY	12/18
Proj. Engr.	K. THORNTON	12/18

Registered Professional Engineer (Civil) — CERTIFICATE NO. 34738 — KEVIN TODD THORNTON — Date Signed 12/17/18 — ARIZONA U.S.A. — Expires 03/31/19

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PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

STORM DRAIN PROFILES
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
KOLB ROAD PROFILES

Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County: (602) 263-1100

Scales: Horiz. 1"=40' Vert. 1"=4'

SHEET SD14 OF SD16

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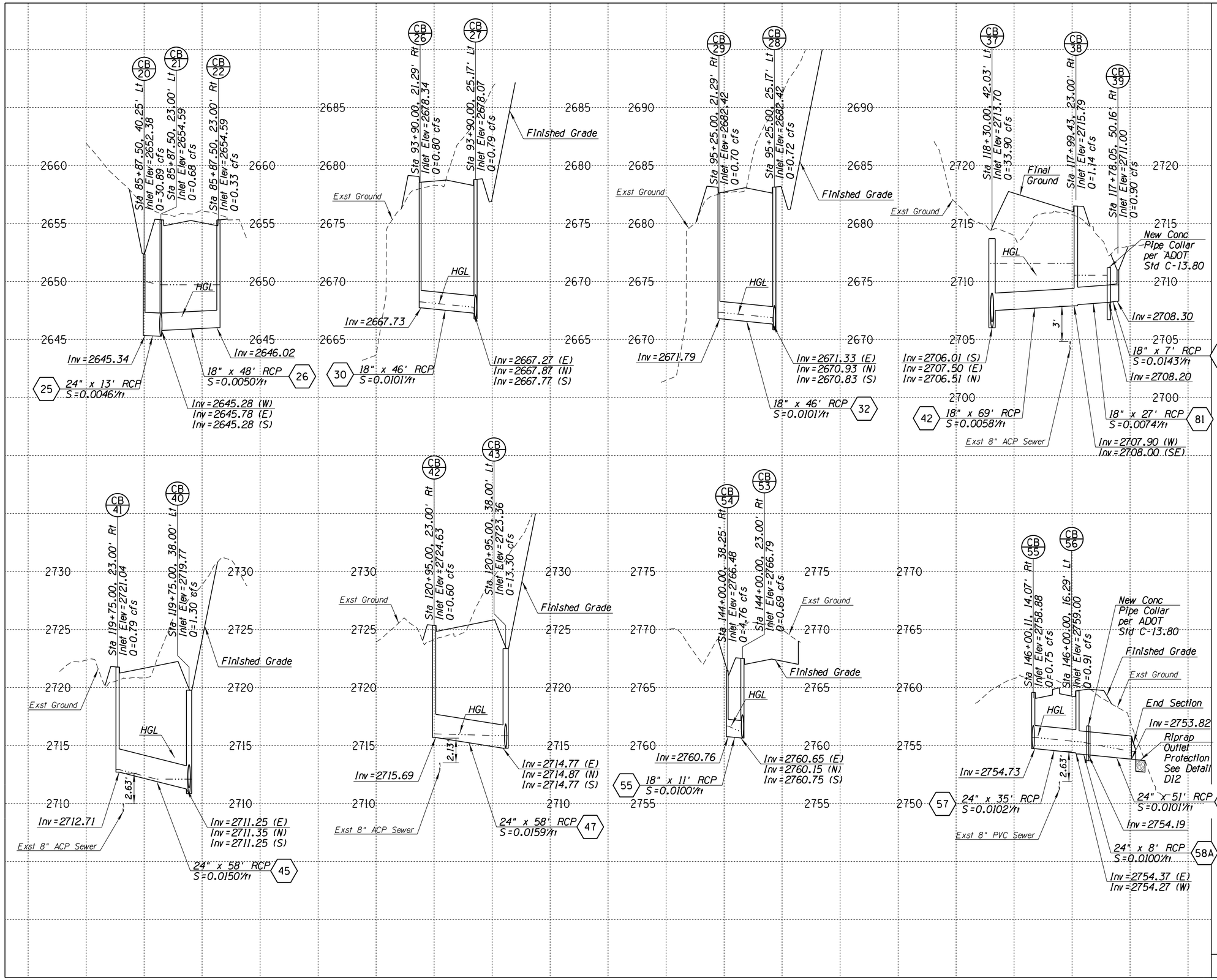

Scales: Horiz. 1"=40' Vert. 1"=4'

SHEET SD15 OF SD16

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

No.	Revision Description	Engineer	Date

		Date
Designed	E BARNES	12/18
Drawn	E BARNES	12/18
Checked	M ASHBY	12/18
Proj. Engr.	K THORNTON	12/18

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12/17/18 ARIZONA U.S.A. Expires 03/31/19

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PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

STORM DRAIN PROFILES
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
KOLB ROAD PROFILES

Call at least two full working days before you begin excavation. ARIZONA 811 Arizona Blue Stake, Inc. Dial 8-1-1 or 1-800-STAKE-IT (782-5348) In Maricopa County (602) 263-1100

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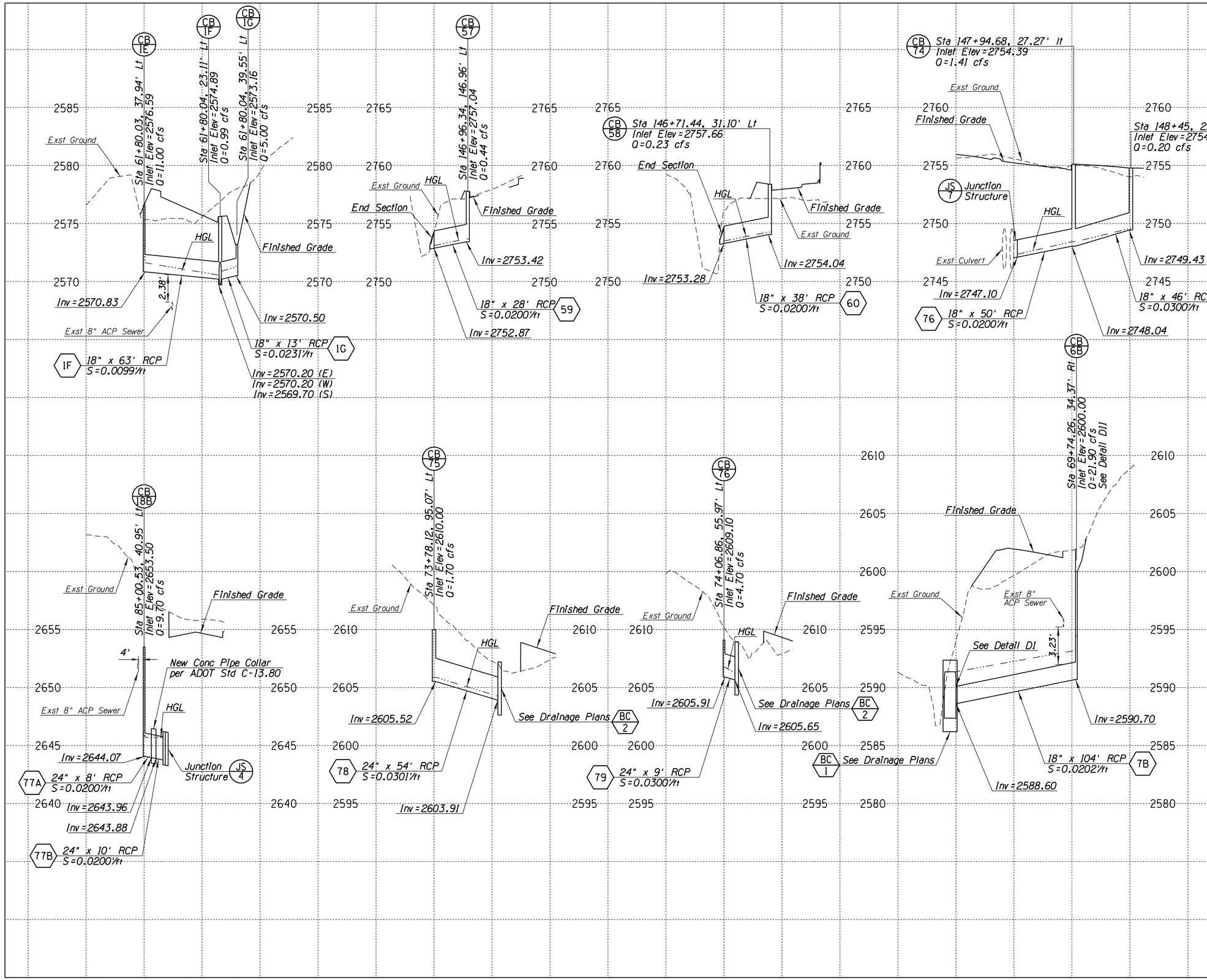

0 40' 80'

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Scales: Horiz. 1"=40' Vert. 1"=4'

SHEET SD16 OF SD16

ADOT TRACS NO. 0000 PM PPM T0109 01C, FEDERAL PROJECT NO. STP-PPM-0(257)D

No.	Revision Description	Engineer	Date

		Date
Designed	E. BARNES	12/18
Drawn	E. BARNES	12/18
Checked	M. ASHBY	12/18
Proj. Engr.	K. THORNTON	12/18

PIMA COUNTY DEPARTMENT OF TRANSPORTATION, ANA M. OLIVARES, P.E., DIRECTOR

Registered Professional Engineer (Civil) CERTIFICATE NO. 34738 KEVIN TODD THORNTON Date Signed 12/17/18 ARIZONA U.S.A. Expires 03/31/19

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STORM DRAIN PROFILES
FOR
KOLB ROAD
SABINO CANYON RD TO SUNRISE DR
KOLB ROAD PROFILES

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