FINAL DRAINAGE REPORT

Marksheffel Road

From Constitution Ave. to Dublin Rd.

Prepared For:

El Paso County Department of Transportation
3460 N. Marksheffel Rd.
Colorado Springs, Colorado 80922

(719) 520-6460

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Date:

May 2008

FINAL DRAINAGE REPORT FOR
MARKSHEFFEL ROAD

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Certification Page

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City/County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Douglas P. Stewart

Douglas P. Stewart, PE
Registered Professional Engineer
State of Colorado
No. 29899

Seal

COLORADO REGISTERED PROFESSIONAL ENGINEER DOUGLAS P. STEWART 29899 5/15/08

Developer's Statement:

I, the developer have read and will comply with all of the requirements specified in this drainage report and plan.

____
Business Name

By: ______________________________

Title: ______________________________

Address: ______________________________

____

EL PASO COUNTY ONLY:

Filed in accordance with Section 51.1 of the El Paso Land Development Code, as amended.

John A. McCarty ______________________________ 7-3-08

Director of Public Works | Date

CITY OF COLORADO SPRINGS ONLY:

Filed in accordance with Section 15-3-906 of the Code of the City of Colorado Springs, 1980 as amended.

______________________________ ______________

City Engineer | Date

FINAL DRAINAGE REPORT FOR
MARKSHEFFEL ROAD

I. GENERAL LOCATION AND DESCRIPTION

A. Location

1. The property is located partially within the jurisdiction of El Paso County and partially within the jurisdiction of the City of Colorado Springs, Colorado. The project limits are along the existing Marksheffel Road corridor between Dublin Road to the north and Constitution Avenue to the south, or a distance of approximately 4 miles. Marksheffel Road runs north and south and the corridor is located approximately 8 miles east of Interstate 25. Constitution Avenue is a major east-west route in the northeast portion of the City of Colorado Springs.

2. The project is located in Township 13 South, Range 65 West. At Constitution Avenue, the alignment for Marksheffel Road forms the boundary between Sections 32 and 33. The north end of the alignment, at Dublin Road, forms the boundary between Sections 16 and 17. The site location is shown in **Figure 1**.

3. Two major drainageways exist in the vicinity of the project limits: Sand Creek and East Fork Sand Creek. The existing Marksheffel Road is a rural section with no curb and gutter. Culverts of various materials cross Marksheffel Road at low points along the existing roadway alignment.

4. Existing developments adjacent to the corridor include the following:

   - Eastview Estates
   - Willowind at Stetson Hills
   - Banning Lewis Ranch
   - Carriages at Indigo Ranch
   - Indigo Ranch at Stetson Ridge
   - Stetson Ridge Highlands
   - Chaparral Point at Indigo Ranch
   - Gray Fox Heights

   See excerpts from drainage reports for these developments in **Appendix D.**

B. Description of Property

1. <u>Description:</u> The original Marksheffel right-of-way is 30 feet on both sides of the north-south section line. The proposed right-of-way will vary to a maximum of 105 feet from the section line. The existing pavement width is approximately 24 feet and the roadway is classified as a principal arterial. The proposed right-of-way width for

this project is 160 feet. Additional drainage easements will be required for drainage facilities outside of the right-of-way, including headwalls, wingwalls, culverts, ditches, water quality ponds, and access roads. The length of the project limits for this study within the Marksheffel Road corridor is approximately 4 miles from Dublin to Constitution. The total acreage within the right-of-way limits is approximately 77.6 acres.

2. Ground Cover: In undeveloped areas, existing ground cover consists of rangeland grasses, and some shrubs. In developed areas, ground cover consists of bare ground, buildings, roadways, parking lots, sidewalks, lawn grasses, and various residential landscaping.

3. General Topography: The topography of the land varies along the Marksheffel Road corridor, which crosses multiple ridges and valleys. Drainage channels meander from one side of the roadway to the other. Slopes vary from 0.7% to 12%.

4. General Soils Conditions: Soils in the area consist of the Blakeland, Blendon, and Truckton formations. These soils are generally sandy loams and loamy sands in Hydrologic Soil Groups A and B. See the soil map and tables in **Appendix E**.

5. Drainageways: There are no major drainageways within the project limits. Some minor drainageways tributary to East Fork Sand Creek within the project limits create flooding across Marksheffel Road.

6. Irrigation Facilities: There are no major irrigation facilities within the project area.

7. Proposed Land Use: The Marksheffel Road corridor will be upgraded from the existing rural two-lane section to a six-lane principal arterial roadway. Only 4 lanes will be constructed during the first phase.

8. Utilities: Major utilities within the right-of-way of the project limits include:

   - CSU Gas
   - Rocky Mountain Gas
   - Mountain View Electric
   - Cherokee Metro Water
   - 360 Networks
   - Adelphia Fibre Optics
   - Qwest Telecommunications.

   Each utility will be relocated as needed to accommodate the roadway improvements.

LOCATON MAP

FIGURE 1

II. DRAINAGE BASINS AND SUB-BASINS

A. Major Basin Descriptions

1. The project area lies within the East Fork Sand Creek watershed. This study is based on the Sand Creek Drainage Basin Planning Study Preliminary Design Report, Revised March 1996.

2. The Preliminary/Final Drainage Report for Marksheffel Road Colorado Tech Drive to US Highway 24 and East Fork Sand Creek (Revised December 2004) was used as a basis of design for allowable flows crossing Constitution Avenue within a proposed drainage system from north to south. Subbasins OS1 and OS2, routed to Design Point 1, in the 2004 report provided a capacity limit for designing the upstream drainage system.

3. There are no FEMA regulated floodplains within the project limits as shown on the attached Flood Insurance Rate Maps. See **Figures 2a, 2b, and 2c**.

B. Sub-basin Description

1. Historically, drainage from the roadway and adjacent tributary areas has been conveyed to the East Fork Sand Creek channel via grass-lined/earth roadside ditches. The roadside ditches have evidence of scouring and sediment deposition depending on grades. At parcel access points, stormwater flows overtop the driveways and travel either back to the roadside ditches or cross the road to a parallel ditch.

2. Dublin Blvd. is the northern end of the project limits. Historically, runoff flowed from north to south across Dublin. Recently, the Banning Lewis development has constructed Pond 93 at the northeast corner of Dublin and Marksheffel. The new drainage system at this intersection has been designed to route flows from Marksheffel Road north of Dublin through the detention pond, then discharging through a storm pipe aligned along the east side of existing Marksheffel Road. The pipe will discharge to the existing drainageway in Toy Ranches Estates.

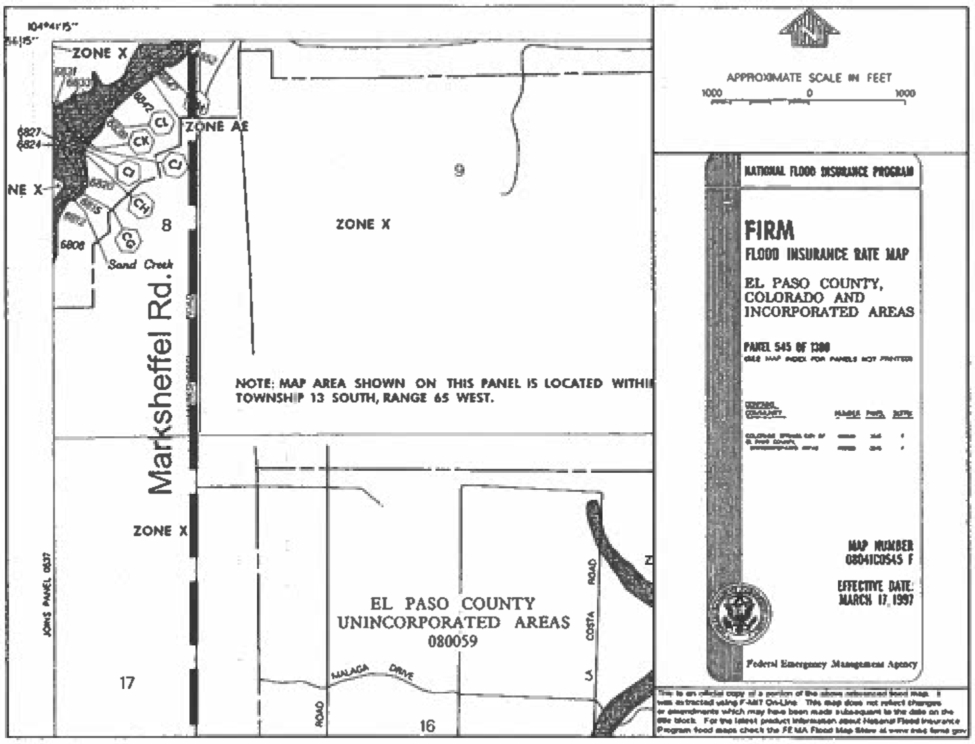
3. Constitution Avenue is the southern end of the project limits. Historically, runoff flowed from north to south across Constitution. According to a drainage study performed by Matrix Design Group for Marksheffel Road south of Constitution Avenue, existing flows would be conveyed though 3 culverts: one 24-inch pipe on either side of Marksheffel and a third pipe a few hundred feet west of Marksheffel. Only one of these three pipes was found in a recent survey: a 24-inch RCP on the west side of Marksheffel. Future flows from Marksheffel north of Constitution will be collected and conveyed through a 48-inch pipe running south from Marksheffel Road to East Fork Sand Creek. The Matrix Design Group Study designed the future 48-inch pipe on the south side of Constitution Avenue to convey the 100-year flow (131 cfs) when flowing full.

4. There are multiple drainage subbasins tributary to culverts crossing under Marksheffel Road. Some flow east to west and others west to east. All flows within the project limits ultimately end up in East Fork Sand Creek on the east side of Marksheffel Road. Existing culverts appear to be undersized to convey the design flow based on frequent reports of flooding and roadway overtopping at these culvert locations.

5. Although some properties within these drainage basins are currently undeveloped, the majority of properties within the project limits are either currently being developed or are slated for future development. The land use map in **Appendix F** shows a combination of residential, commercial, and industrial properties along this corridor.

6. Off-site drainage flow patterns will vary along the proposed roadway. Off-site flow from undeveloped parcels will be collected in one of two ways: 1) flow directly onto the roadway and collected in the curb inlet systems; and 2) flow will be conveyed by a swale to an inlet or culvert connected to the roadway drainage system. When the sites are developed in the future, runoff will be detained to historic flow rates and discharged to the system. Other off-site flow will be passed by culvert from one side of Marksheffel Road to the other without being introduced to the roadway drainage system.

FEMA MAP



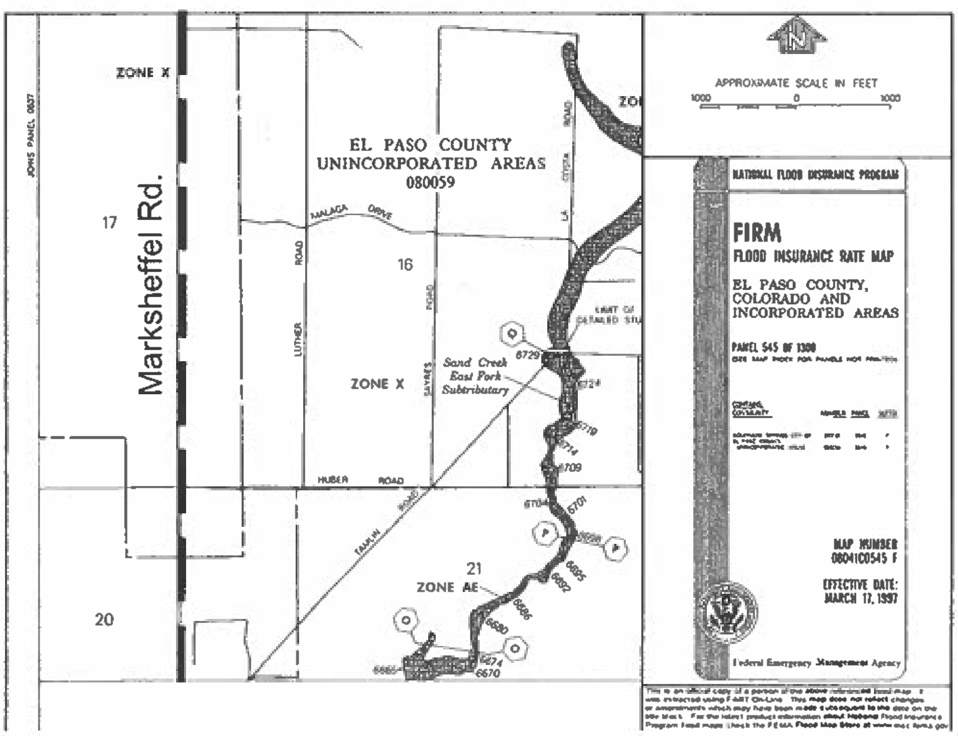
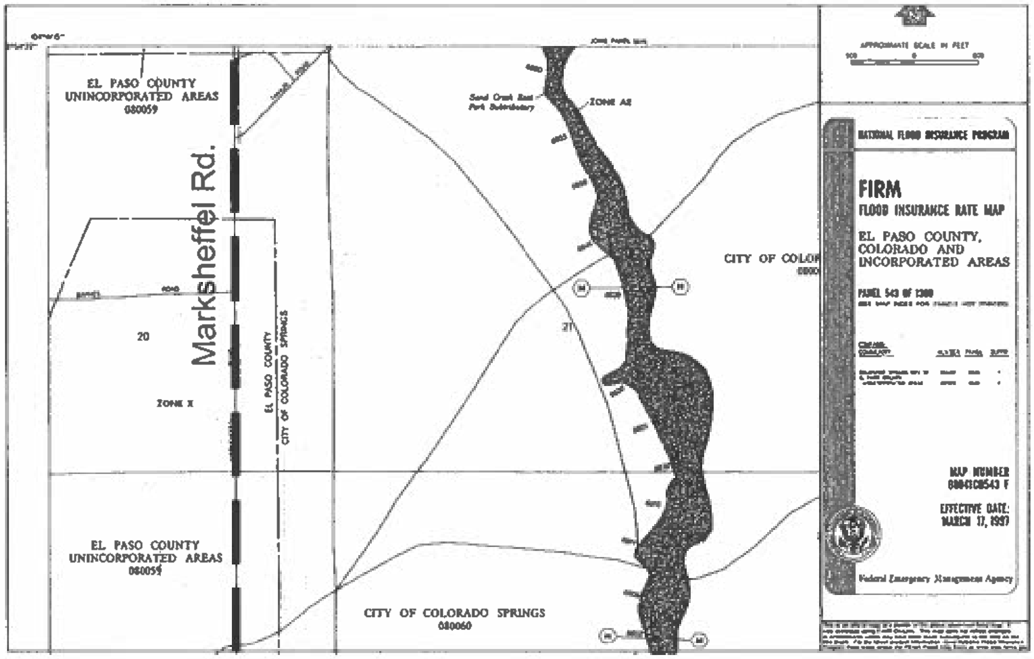


FIGURE 2a

FEMA MAP



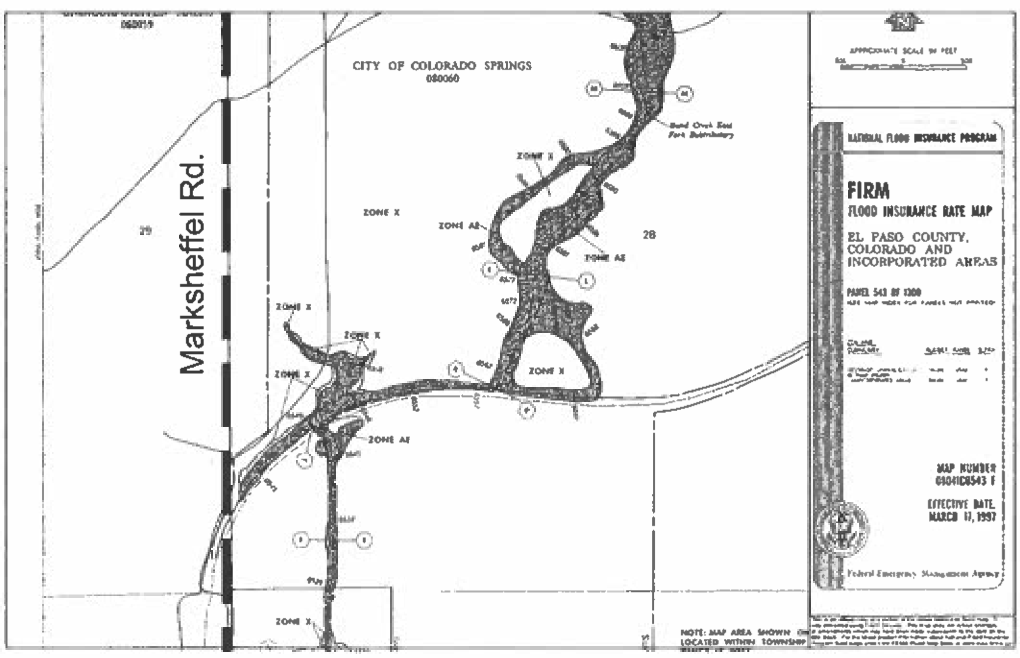
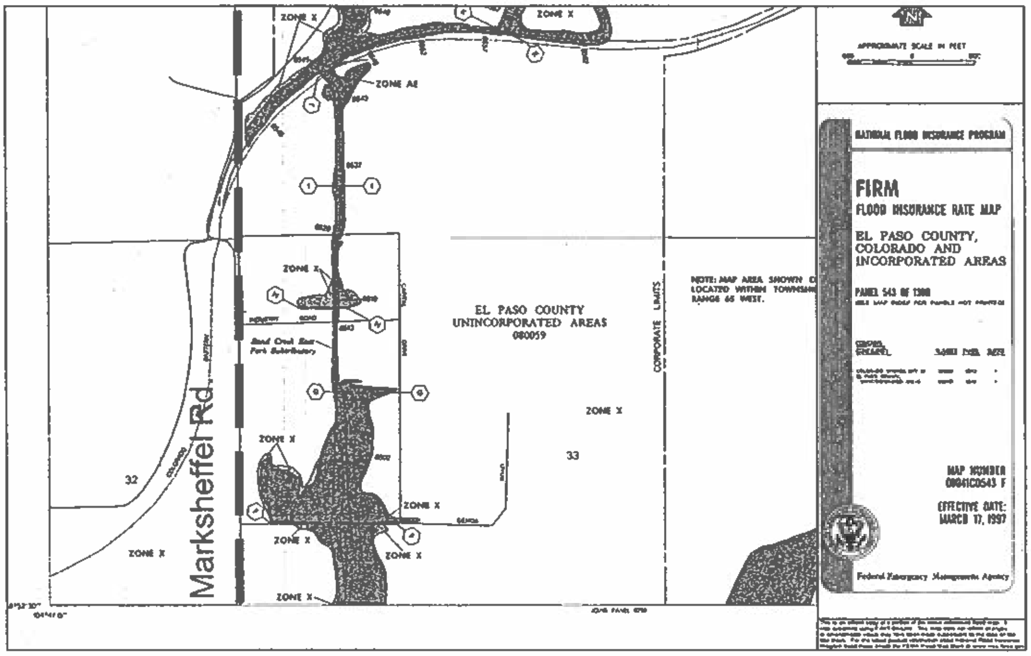


FIGURE 2b

FEMA MAP



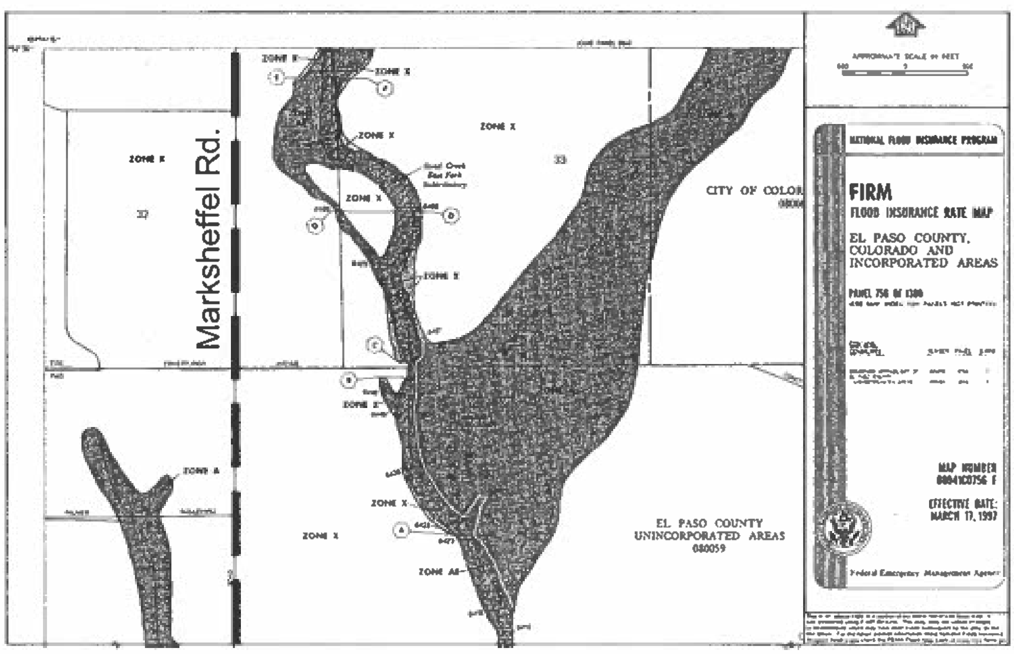


FIGURE 2c

III. DRAINAGE DESIGN CRITERIA

A. Development Criteria Reference

1. The Drainage Criteria from the City of Colorado Springs/El Paso Drainage Criteria Manual was reviewed and used for the hydrologic and hydraulic analysis in this study. The El Paso County Engineering Manual was also reviewed.

2. See **Appendix D** for a list of past drainage studies adjacent to the project area.

B. General Hydrologic Criteria

1. Design Storm Recurrence Interval – The 10-year storm was used for the initial storm in this study. The 100-year storm was used for the major storm.

2. Calculation Method – For this study, there are 13 existing drainage basins that were analyzed in order to determine the discharges at selected locations along the roadway alignment. Because 12 of these basins are less than 100 acres, the Rational Method was used to compute the flows at cross culvert locations. One basin (B-EFSC-8) was larger than 100 acres and for this basin; the Soil Conservation Service (SCS) TR-55 method was used.

3. Stormwater detention is not required for this project as directed by El Paso County and the City of Colorado Springs. Ponds will be created for stormwater quality purposes.

4. Where adjacent properties are developed and their runoff is directed to Marksheffel Road, the design accounted for these existing condition flows in the Marksheffel Road storm system. Runoff from undeveloped properties adjacent to Marksheffel was calculated for historic conditions in the storm system design. This assumes that when the property is developed in the future, the development will limit their runoff to historic condition flows.

C. Hydrologic Criteria

1. Design rainfall. Rainfall intensities for use in the Rational Method were taken from Figure 5-1 in the City of Colorado Springs/El Paso County Drainage Criteria Manual.

2. The hydrologic groups for the soils in the area are Type A and B as determined by published soils data from the Natural Resources Conservation Service (NRCS). See **Appendix E**.

3. The Rational Method was used to determine runoff for the 10-year and 100-year events for basins less than 100 acres. The SCS TR-55 method was used for basins larger than 100 acres.

4. There were no calculations for detention for this project.

5. The peak runoff for the 10-year and the 100-year storm events were determined for existing and developed conditions.

6. The maximum allowable discharge in the gutter on each side of the street for the initial storm is 34 cfs. This is the allowable discharge for arterial streets with vertical curbs.

D. Hydraulic Criteria

1. The hydraulic capacity of the storm pipe systems was determined using Inroads for the on-site storm drainage system and CulvertMaster for the off-site drainage through cross culverts.

2. Culverts -

   Minimum Size = 18"
   HW/D (Initial) < 1
   HW/D (Major) - No shoulder encroachment of flows.
   Minimum Velocity = 2.5 fps
   Maximum Velocity = As per Table 10-3, 10-4 in City of Colorado Springs/El Paso County Drainage Criteria Manual. See **Appendix B**.

   According to the El Paso County Engineering Criteria Manual, velocities are to be between 3 and 12 ft/s (in general); Entrances are rounded, beveled, or expanded; Flared end sections are required for outlets and inlets that do not have headwalls; Inlet aprons shall be used as necessary transitions between culvert and improved approach channels.

3. Pavement Drainage

   Spread (Initial) - 1 lane maximum inundation, leave 1-10 foot lane free in each direction. No flow over crown and 6-inch allowable depth at the flowline.

   Spread (Major) - No curb overtopping, maximum 6-inch depth at flowline. 18.7 Ft. Maximum allowable spread for 6" curb.

4. Storm Drains
   Manhole Spacing

   18"-36" - 500 foot maximum
   42"-60" - 600 foot maximum
   >66" - 750 foot maximum

   Minimum velocity = 2.5 fps
   Maximum velocity = 18 fps

   Minimum slopes as per Table 6-3 of Colorado Springs/El Paso County Drainage Criteria Manual. See **Appendix B**.

According to the El Paso County Engineering Criteria Manual, the minimum gradient is 0.5% or a minimum velocity of 4 fps with the pipe flowing one quarter full (Initial storm). Pipes designed to flow full and free of pressure heads except for short runs where grade changes and small pressure head cannot be avoided.

5. Freeboard - Bridges

   Two feet of freeboard is required between the low girder elevation of the structure and the 100-year water surface elevation.

6. Channels

   Concrete, riprap, or soil cement is required for velocities > 6 fps. For grouted riprap or soil cement, the maximum side slope is 2:1. For riprap channels, the maximum side slope is 2.5:1.

   Grass lined channels - maximum side slope is 4:1. Because the channels are incorporated along the roadway, shoulder slopes have a maximum slope of 6:1. Maximum velocity allowed in a grass lined channel as per Table 10-4 of Colorado Springs/El Paso County Drainage Criteria Manual. See **Appendix B**.

   Channel flow depth can be no greater than 5.0 feet for a 100-year flow of 1500 cfs or less.

   Channel width can be no less than 8.0 feet for flows of 400 cfs or more.

7. Pipe Materials/Design Life

   Design Life = 100 Years for Principal Arterial

   Reinforced Concrete Pipe (RCP) n=0.013

   According to the El Paso County Engineering Manual, all storm sewers within County ROW are required to be RCP (Class 3 minimum) or pipes of other materials with a comparable design life. According to County representatives, only RCP will be allowed for this project. See DCM1 for design information on other pipe materials.

E. Water Quality Requirements

1. Water quality measures for this project shall meet the requirements of the City and County's MS4 water quality permit.

2. MS4 water quality ponds will be used to treat runoff from disturbed areas within the project limits. The Water Quality Capture Volume (WQCV) will be the 80th percentile rainfall that is used in the UDFCD water quality capture volume (WQCV) calculations. The UDFCD WQCV calculations will be used for this project. Dry ponds will be used to reduce maintenance requirements.

3. Channels where velocities exceed 6 fps will be stabilized using check dams, erosion control blankets, riprap, or other approved means.

4. Vehicle Tracking Control (VTC) pads will be used where construction vehicles enter and exit the construction areas onto adjacent roadways.

5. Future water quality basins will be used as interim construction sedimentation basins throughout the construction process. The sedimentation basins will be modified at the end of the project or at the end of each segment of completed roadway to construct the permanent water quality ponds.

F. Waivers from Criteria

1. There are no waivers from criteria.

IV. DRAINAGE FACILITY DESIGN

A. General Concept

1. Off-site runoff will be conveyed across Marksheffel Road in two ways: 1) runoff from larger drainage swales will be conveyed across Marksheffel Road through a culvert to the other side, and 2) runoff from smaller areas will be collected in the roadway drainage systems.

2. On-site runoff will be collected by inlets and conveyed through RCP storm pipe.

3. All flow from the project site will eventually flow to East Fork Sand Creek.

4. Coordination with adjacent developers' designs was required to determine developed drainage basins and design flows directed to Marksheffel Road. See **Appendix D** for excerpts from past drainage reports.

B. Off-Site Basins

1. Off-site basins have flows that originate off of the project site and those flows are conveyed to or through the project site.

2. Some off-site basins are currently undeveloped, but will be developed in the future. Based on past drainage studies of proposed adjacent developments, some drainage areas will be reduced in size, so that a smaller area of developed flow will impact on-site drainage facilities.

3. Existing condition flows were calculated for each drainage basin contributing flows to existing culverts under Marksheffel within the project limits. These flows were compared to the results of the developed flows to Marksheffel found in past drainage studies. The higher flows were used to determine the size of the proposed culverts along Marksheffel assuming more offsite flows would cross

Marsheffel Road during the interim phase prior to the adjacent sites being fully developed.

C. On-Site Basins

1. Generally, all on-site subbasins are similar in that they are made up of roadway pavement, sidewalk pavement, curbs and gutters, and pervious area.
2. Each basin flows to a Type R curb inlet, either on a continuous grade or in a sump condition.
3. The curb inlets on a continuous grade are designed to intercept the 10-year flow with a 20% clogging factor.
4. The curb inlets in a sump condition are designed to intercept the 100-year flow so that there is not curb overtopping.
5. Storm pipes are designed to convey the 10-year flow, except at sump locations where they are designed to convey the 100-year flow.
6. Culverts are designed to convey the 100-year flow with no roadway overtopping.
7. Type C median inlets are used to intercept flows from the depressed median areas. Since only minor flows are conveyed by these inlets and the inlets may be removed for future roadway widening, the adjacent Type R curb inlets were sized to intercept the future median flows as well. The Type R inlets have been designed to accommodate for one additional lane in each direction.

Descriptions of each basins storm drain system:

- Constitution System - Station 260+00 to 280+00
  Storm system flows are conveyed south to Constitution Ave. at Station 260+00. The system will tie into a future system south of Constitution.

- Water Quality Pond #5 - Station 280+00 to 299+00
  Storm system flows are conveyed south to Pond #5 located at Station 280+00. The pond outfalls east to the East Fork of Sand Creek.

- Water Quality Pond #4 - Station 299+00 to 342+00
  Storm system flows are conveyed south to Pond #4 located at Station 301+00. The pond outfalls east to the East Fork of Sand Creek.

- Water Quality Pond #3 - Station 342+00 to 434+00
  Storm system flows are conveyed south to Pond #3 located at Station 345+00. The pond outfalls southeast to the East Fork of Sand Creek.

- Water Quality Pond #2 - Station 434+00 to 456+00

Storm system flows are conveyed to a low point adjacent to Pond #2 at Station 445+00. The pond outfalls southeast to the East Fork of Sand Creek.

- Water Quality Pond #1 - Station 456+00 to 473+00 (end of project)
  Storm system flows are conveyed to a low point adjacent to Pond #1 at Station 465+00. The pond outfalls southeast to the East Fork of Sand Creek.

- Banning Lewis Ranch Pond #93 Outfall - Station 469+00
  Pond #93 pond outfall is conveyed to bypass ditch at Station 469+00 on the east side of Marksheffel Road. Existing manholes will be adjusted to accommodate the proposed Marksheffel Road profile. The bypass ditch conveys flow south around Pond #1 and ties into the pond's spillway.

D. Specific Details

1. Existing Conditions Drainage Basins

There are 13 drainage basins contributing flows to existing culverts across Marksheffel Road within the project limits. All basins, but one, are less than 100 acres, so stormwater runoff was calculated using the Rational Method. One basin is larger than 100 acres, therefore the SCS TR55 method was used to calculate runoff from this basin. A summary of the existing conditions basin parameters and runoff results for the 10-year and 100-year flows is shown in **Table 1**. Details of the hydrologic analyses are included in **Appendix A**. A drainage basin map is included in **Appendix G**.

2. Existing Culverts

Existing culverts crossing Marksheffel Road within the project limits were surveyed and analyzed for flow capacity. Some existing culverts are reinforced concrete while others are corrugated steel. CulvertMaster was used to determine flow capacity based on a headwater depth to culvert diameter ratio of 1.5. A summary of the resulting culvert capacities are shown in **Table 2**. Details of the CulvertMaster analysis are included in **Appendix A**.

3. Proposed Conditions Off-Site Drainage Basins

Proposed conditions off-site basin delineations were made based on information from development drainage plans, where developments do not yet exist or are currently being constructed. In most cases, these proposed drainage basins are smaller than the existing drainage basins. A summary of the proposed conditions off-site basin parameters and runoff results for the 10-year and 100-year flows is shown in **Table 3**. Details of the hydrologic analyses are included in **Appendix A**. A drainage basin map is included in **Appendix G**.

4. Proposed Culverts

Proposed culverts for minor drainageways across Marksheffel Road will be placed near the location of the existing culverts. Three culvert locations of the existing 13 crossings will continue to convey flows from one side of Marksheffel to the other. Flows from the remaining basins will be collected and conveyed by the Marksheffel on-site drainage system. A summary of the resulting culvert capacities are shown in **Table 4** for the proposed culverts. Details of the CulvertMaster analysis are included in **Appendix A**.

5. <u>Water Quality Ponds</u>

   a. Water quality treatment ponds have been designed to treat stormwater runoff from the improved roadway facilities. UDFCD Water Quality Capture Volume (WQCV) was used to calculate the volume of runoff to be treated and the size of facility to treat the runoff. **Table 5** shows a summary of water quality facilities that will be constructed for this project. Detailed calculations for the pond capacity are included in **Appendix A.**

   b. The permanent water quality ponds will be used as interim sediment catchment ponds during construction. The sediment ponds are to be cleaned out periodically during construction. They will be regraded, compacted, and vegetated upon completion of the roadway.

6. Government Agency Requirements

   a. This project shall meet State MS4 requirements.

   b. There are no other known Government Agency Requirements for this Project.

Marksheffel Road

Table 1

Existing Drainage Basin Parameters and Runoff Summary
Rational Method

BASIN ID	CULVERT LOCATION (Roadway STA)	BASIN LENGTH (ft)	AREA (sq ft)	AREA (acre)	% IMP.	SOIL GROUP (%)			Weighted 10-year 'C' Values	Weighted 100-year 'C' Values	Total Time of Concentration (min)	I_{10} (in/hr)	I_{100} (in/hr)	Q_{10} (cfs)	Q_{100} (cfs)
						A	B	C/D							
B-EFSC-15	280+75	1380	807970	19	52%	100			0.52	0.60	16.92	3.68	5.57	35.4	61.7
B-EFSC-14	286+20	890	776109	18	63%	100			0.63	0.72	10.72	4.53	6.84	50.6	87.4
B-EFSC-13	299+80	2100	1509072	35	32%	79	21		0.32	0.37	23.28	3.12	4.71	34.3	60.8
B-EFSC-12	309+40	1350	510533	12	34%		100		0.34	0.39	22.72	3.16	4.78	12.5	21.7
B-EFSC-11	313+00	2000	1588832	36	41%		100		0.41	0.48	26.66	2.89	4.37	43.0	76.1
B-EFSC-10	323+00	2100	1160136	27	21%		100		0.21	0.26	48.20	2.01	3.04	11.0	21.0
B-EFSC-8	343+00	N/A	12325683	283	28%		100		SEE SCS GRAPHICAL PEAK DISCHARGE METHOD					165	379
B-EFSC-7	359+00	1550	1535450	35	15%		100		0.15	0.20	45.56	2.08	3.15	11.0	22.2
B-EFSC-6	371+00	2250	917291	21	15%		100		0.15	0.20	70.09	1.56	2.36	4.9	10.0
B-EFSC-5	382+60	2050	812573	19	21%		100		0.21	0.26	42.64	2.17	3.29	8.3	15.9
B-EFSC-4	395+70	1350	1025104	24	30%		100		0.30	0.36	25.65	2.95	4.47	20.7	37.6
B-EFSC-2	445+00	1450	697458	16	15%		100		0.15	0.20	43.15	2.16	3.26	5.2	10.4
B-EFSC-1	465+00	3700	2899492	67	15%	77	23		0.15	0.20	80.45	1.42	2.15	14.2	28.6

Table 2

Existing Culvert Hydraulic Summary

Culvert Name	Basin No.	Side Street Culvert Location	Culvert Station	Number of Culverts	Culvert Size (D) (ft)	Culvert Type	Upstream Invert El.	Downstream Invert El.	Length (ft)	Slope (ft/ft)	Headwater El.	Headwater Depth (HW) (ft)	HW/D [1]	Velocity at Outlet (fps)	Overtopping El.	Freeboard [2] (ft)	Q capacity [1] (cfs)
E1-n	EFSC-1		466+00	1	2	RCP	6792.60	6791.33	91.59	0.0139	6795.60	3.00	1.50	9.93	6797.12	1.51	46.9[3]
E1-s				1	2	RCP	6792.62	6791.18	91.69	0.0157	6795.62	3.00	1.50	9.93	6797.12	1.50	
E2-n	EFSC-2		445+00	1	2.5	CSP	6772.16	6770.35	108.91	0.0167	6775.91	3.75	1.50	8.36	6781.59	5.68	71.3[3]
E2-s				1	2.5	CSP	6772.22	6770.03	109.10	0.0200	6775.97	3.75	1.50	8.36	6781.59	5.62	
E3	EFSC-3	Huber Rd.	419+00	1	1	CSP	6776.70	6775.19	71.00	0.0213	6776.70	1.50	1.50	3.84	6778.20	1.50	
E4	EFSC-4		395+00	1	3.5	CSP	6700.00	6698.31	33.13	0.0510	6705.25	5.25	1.50	15.95	6706.04	0.79	96.3
E5	EFSC-5		380+00	1	1.5	CSP	6667.60	6665.69	66.39	0.0288	6669.85	2.25	1.50	6.71	6670.80	0.95	10.6
E6	EFSC-6		371+00	1	1.5	CSP	6626.52	6624.93	67.18	0.0237	6628.77	2.25	1.50	6.44	6629.37	0.60	9.8
E7	EFSC-7		359+00	1	27"x18"	CSP	6600.51	6599.44	40.09	0.0268	6603.51	3.00	1.50	7.96	6603.52	0.01	22.6
E8	EFSC-8		343+00	1	1.5 - 2	CSP	6568.11	6567.46	60.41	0.0108	6570.74	2.63	1.50	6.69	6572.07	1.33	16.5
E9	EFSC-9	N Carefree Cir	329+00	1	2	CSP	6562.93	6561.86	174.66	0.0061	6565.93	3.00	1.50	6.13	6565.93	0.00	
E10	EFSC-10		322+00	1	3.5	RCP	6552.59	6551.29	78.16	0.0166	6557.84	5.25	1.50	13.46	6559.56	1.72	95.1
E11	EFSC-11		313+00	1	2.5	CSP	6530.19	6528.27	97.55	0.0197	6533.94	3.75	1.50	8.38	6535.25	1.31	35.8
E12	EFSC-12		309+00	1	2	CSP	6526.84	6525.61	97.20	0.0127	6529.84	3.00	1.50	6.87	6531.14	1.30	17.4
		Industry Dr.	308+00	1			6524.34	6523.36	100.76	0.0097							
E13-n	EFSC-13		300+00	1	1.5	CSP	6512.47	6512.16	40.15	0.0078	6514.72	2.25	1.50	4.95	6514.75	0.03	16.3[3]
E13-s				1	1.5	CSP	6512.27	6512.12	40.93	0.0037	6514.72	2.45	1.64	4.95	6514.75	0.03	
		Driveway	297+00	1	1.5	CSP	6513.46	6513.07	88.09	0.0044							
E14	EFSC-14		287+00	1	1.5	CSP	6499.70	6498.43	46.85	0.0270	6501.95	2.25	1.50	6.69	6502.36	0.41	10.5
E15	EFSC-15	Electronic Dr.	280+00	1	1.5	CSP	6491.11	6489.67	78.71	0.0184	6493.36	2.25	1.50	6.28	6492.50	-0.86	9.4
		Constitution	260+00	1	2	RCP	6447.60	6446.22	130.95	0.0105	6450.60	3.00	1.50	8.42	6450.60	0.00	

Notes

(1) HW/D = 1.5 for capacity calculations

(2) Headwater elevation to crown of road

(3) Total flow to multiple-culvert system

Table 3

Proposed Off-Site Drainage Basin Parameters and Runoff Summary
Rational Method

EXISTING BASIN ID	PROPOSED BASIN ID	DITCH LOCATION (STA to STA)	CULVERT LOCATION (Roadway STA)	BASIN LENGTH (ft)	AVG. BASIN WIDTH (ft)	AREA (sq ft)	AREA (acre)	% IMP.	SOIL GROUP (%)			Weighted 10-year 'C' Values	Weighted 100-year 'C' Values	Total Time of Concentration (min)	I_{10} (in/hr)	I_{100} (in/hr)	Q_{10} (cfs)	Q_{100} (cfs)
									A	B	C/D							
	OS-A *		465 H1 (465+40)	900	200	219514	5.0	54%	100			0.54	0.64	16.07	3.78	5.71	10.3	18.3
	OS-B *		465 H1 (465+40)	900	200	118310	2.7	54%		100		0.54	0.64	14.71	3.94	5.96	5.8	10.3
	OS-C		445 F1 (444+60)	1350	200	290347	6.7	54%		100		0.54	0.64	16.20	See Inroads Basin Reports			
	OS-P2A	Sta. 448+00 to Sta. 456+00		940	200	239190	5.5	15%		100		0.15	0.20	27.02	2.87	4.34	2.4	4.8
	OS-P2B	Pond 2 Bypass Sta. 448+00		788	200	165308	3.8	15%		100		0.15	0.20	22.91	3.15	4.76	1.8	3.6
	OS-P2A&B (Combined)	Roadside Ditch and Bypass		1380	200	404498	9.3	15%		100		0.15	0.20	29.42	2.73	4.13	3.8	7.7
	OS-D		420 R2 (420+00)	1100	200	228062	5.2	54%		100		0.54	0.64	20.31	See Inroads Basin Reports			
	OS-E1	See Inroads Basin Report	417 R2	350	200	42988	1.0	90%		100		0.90	0.95	5.00	See Inroads Basin Reports			
	OS-E2	See Inroads Basin Report	413 R2	500	200	58172	1.3	54%		100		0.54	0.64	12.36	See Inroads Basin Reports			
	OS-F1	Sta. 337+00 to Sta. 343+50				305135	7.0	21%		100		0.21	0.26	20.70	3.32	5.02	4.8	9.1
BEFSC-8	OS-F		343+00	7550		12196800	280	54%		100		See TR-55 Calculations					242.00	491.0
BEFSC-4	OS-G	Sta. 393+00 to 408+00	396 R2 (395+90)	1100	200	946494	21.7	30%		100		0.30	0.36	25.03	2.99	4.53	19.4	35.2
BEFSC-5	OS-H1	Sta. 381+00 to 393+00	Ditch to 382R2		200	740083	17.0	21%		100		0.21	0.26	25.33	See Inroads Basin Reports			
BEFSC-5	OS-H2	Sta. 380+00	Ditch to 380R2		200	48421	1.1	21%		100		0.21	0.26	5.00	See Inroads Basin Reports			
BEFSC-6	OS-I	Sta. 370+00 to 381+00	Ditch to 370R1		200	787490	18.1	15%		100		0.15	0.20	28.78	2.77	4.18	7.5	15.1
BEFSC-7	OS-J1	Sta. 355+00 to Sta. 370+00	Ditch to 359R1		200	1333343	30.6	21%		100		0.21	0.26	20.88	3.31	5.00	20.8	39.8
	OS-J2 (Pond 3 Bypass)	Sta. 346+00 to Sta. 355+00	Pond 3 Bypass Ditch		200	640996	14.7	21%		100		0.21	0.26	29.57	2.72	4.11	8.2	15.7
	OS-P4A (Pond 4 Bypass)	Sta. 301+50 to Sta. 332+50	Pond 4 Bypass Ditch			688468	15.8	26%		100		0.26	0.31	31.46	2.62	3.97	10.6	19.2

* OS-A and OS-B are for future flows, use Indigo Ranch at Stetson Ridge Drainage Report Design Point #58 Q10 = 60 CFS and Q100=92 CFS for Interim condition.

Marksheffel Road

Table 4

Proposed Culvert Hydraulic Summary

Culvert Name	Basin No.	Culvert Id	Culvert Station	Number of Culverts	Culvert Size (D) (ft)	Culvert Type	Upstream Invert El.	Downstream Invert El.	Total Length (ft)	Slope (ft/ft)	Headwater El.	Headwater Depth (HW) (ft)	HW/D (1)	Velocity at Outlet (fps)	Overtopping El.	Freeboard (2) (ft)	Design Q(100)(3) (cfs)
A	DP#58	465H1	466+00	1	4.5	RCP	6793.00	6791.50	16.00	0.0938	6797.62	4.62	1.03	To Stormdrain	6798.00	0.38	92(4)
C	OS-C	444F1	444+00	1	2.5	RCP	6774.95	6774.76	37.00	0.0051	6777.94	2.99	1.20	4.89	6780.00	2.06	24(5)
F	OS-F	343H1	343+00	1	10x6	RCB	6567.82	6565.89	274.00	0.0070	6575.20	7.38	1.23	14.69	6580.00	4.80	491

Notes

(1) HW/D = 1.5 for capacity calculations
(2) Headwater elevation to crown of road
(3) Q calculated using CulvertMaster
(4) Q based on Indigo Ranch at Stetson Ridge Drainage Report DP#58
(5) Q based on reduction of basin area from Indigo Ranch at Stetson Ridge Drainage Report DP#59 due to capture of roadway drainage in curb and gutter system contributing to Pond #2.

Table 5 Water Quality Ponds

Pond Name	Roadway Station for Pond Inlet	WQCV Pond Volume (ac-ft) Required	Provided	Pond Surface Area (ac)	Pond Bottom Elevation	WQ Weir Crest Elevation	100-Yr Stage	Pond Berm Elevation
WQ Pond 1	466+00 Right	0.24	.45	0.51	6788	6790	6791.7	6794
WQ Pond 2	443+00 Right	0.31	0.44	0.42	6770	6772	6772.9	6775
WQ Pond 3	344+00 Right	1.44	1.83	1.51	6566	6570.5	6572.4	6576
WQ Pond 4	300+00 Right	0.54	0.67	0.63	6512	6514	6515.6	6518
WQ Pond 5	280+00 Right	0.27	0.41	0.45	6482	6484	6485.5	6488

V. CONCLUSIONS

A. Compliance with standards.

1. Drainage work is in compliance with City of Colorado Springs and El Paso County drainage criteria.

2. Drainage work is in compliance with Major Drainageway Planning Studies.

B. Drainage Concept

1. Culvert systems crossing Marksheffel Road will be designed to convey existing conditions 100-year storm runoff from off-site areas. It is assumed that any increased runoff from future development will be detained to historic, pre-developed conditions.

2. On-site runoff from a 10-year storm event will be collected in curb inlets and conveyed in reinforced concrete storm pipes, so that roadway surface spread requirements are met. The on-site 100-year flow will not overtop the curbs.

3. Some minor off-site flow will be directed to the on-site storm curb inlet collection systems. Other larger off-site runoff will be conveyed to area inlets connected to the on-site pipe system.

4. Water Quality ponds will be designed to hold the runoff volume from the 80th percentile rainfall event; meeting UDFCD Water Quality Capture Volume (WQCV) criteria.

VI. REFERENCES

A. City of Colorado Springs and El Paso County Drainage Criteria Manual 1, October 1994.

B. City of Colorado Springs and El Paso County Drainage Criteria Manual 2, November 2002.

C. Urban Storm Drainage Criteria Manual, Urban Drainage and Flood Control District, June 2001.

D. NRCS TR-55 Urban Hydrology for Small Urban Watersheds, 1986.

E. Sand Creek Drainage Basin Planning Study, Preliminary Design Report, City of Colorado Springs, El Paso County, Colorado, Kiowa Engineering Corporation, revised March 1996.

F. Natural Resources Conservation Services, Web Soil Survey 1.1.

G. Final Drainage Report for Indigo Ranch at Stetson Ridge filing No. 3 & 4 and Master Development Drainage Plan Amendment for Stetson Ridge, for Classic Communities, by Classic Consulting Engineers & Surveyors, July 2004.

H. Preliminary and Final Drainage Report for Stetson Ridge Highlands, for Stetson Ridge Partners, LLC, by JPS Engineering, June 21, 2004.

I. Final Drainage Report and Plan for Willowind at Stetson Hills Filing Nos. 1, 2, and 3, by Leigh Whitehead & Associates, Inc., March 2001.

J. Final Drainage Report and Plan for Willowind Filing at Stetson Hills Filing No. 4, by Leigh Whitehead & Associates, Inc., September 2004.

K. Master Development Drainage Plan for Eastview Estates and Final Drainage Report for Eastview Estates Filing No. 1, for Lennar Communities Colorado, by JR Engineering, August 2004.

L. Preliminary/Final Drainage Report for the Banning Lewis Ranch Filing 1, by TC&B, November 2004.

M. Final Drainage Report for Banning Lewis Ranch Filing 2, by TC&B, February 2005.

N. Final Drainage Report for Chaparral Point at Indigo Ranch Filing No. 1, for Classic Communities, by Classic Consulting Engineers & Surveyors, LLC, January 2004.

O. Final Drainage Report for Indigo Ranch at Stetson Ridge Filing No. 5, for Classic Communities, by Classic Consulting Engineers & Surveyors, LLC., February 2007.

P. Preliminary/Final Drainage Report for Marksheffel Road Colorado Tech Drive to US Highway 24 and East Fork Sand Creek, for El Paso County, by Matrix Design Group, Inc., Revised December 2004.

VII. APPENDICES

A. Hydrologic and Hydraulic Computations

B. Standard Design Charts and Tables

C. Water Quality Enhancement BMP's

D. Excerpts from Supporting Documents

E. Soils Map

F. Land Use Map

G. Drainage Basin Boundary Map

APPENDIX A

Hydrologic and Hydraulic Computations

Existing and Proposed Off-site Basin Hydrology

Methodology

Off-site basins were calculated using contours obtained from the USGS.
Basin limits are presented on the following sheet with low points cooresponding to each basin.
Soil groups were determinted from downloaded El Paso Conty soil information from USDA's Soil Data Mart.
Existing land uses were determined from an aerial image.
10 and 100 year C values for each land use type were obtained from The City of Colorado Springs / El Paso County Drainage Criteria Manual. If a basin consisted of multiple types, a weighted average was calculated.
Time of concentration was calculated using the equations listed at the bottome of page 9
Rainfall intensity was determined using the Storm Rainfall Time Intensity-Frequency Curves from the criteria manual. (Fig 5-1)
Flows were calculated using the Rational Method.

Marksheffel
Off-site Existing Roadway Basin Calculations - Rational Method
Basin Parameters

BY: RF
DATE: 4/16/2007
UPDATED BY: GCS
DATE: 4/16/2008

BASIN ID	CULVERT LOCATION (STA)	BASIN LENGTH (ft)	AREA (sq ft)	AREA (acre)	% IMP.	SOIL GROUP (%)		
						A	B	C/D
B-EFSC-15	280+75	1380	807970	18.5	0.52	100		
B-EFSC-14	286+20	890	776109	17.8	0.63	100		
B-EFSC-13	299+80	2100	1509072	34.6	0.32	79	21	
B-EFSC-12	309+40	1350	510533	11.7	0.34		100	
B-EFSC-11	313+00	2000	1588832	36.5	0.41		100	
B-EFSC-10	323+00	2100	1160136	26.6	0.21		100	
B-EFSC-8	343+00	7300	12325683	283.0	0.28		100	
B-EFSC-7	359+00	1550	1535450	35.2	0.15		100	
B-EFSC-6	371+00	2250	917291	21.1	0.15		100	
B-EFSC-5 (OS-H)	382+60	2050	812573	18.7	0.21		100	
B-EFSC-4	395+70	1350	1025104	23.5	0.30		100	
B-EFSC-2	445+00	1450	697458	16.0	0.15		100	
B-EFSC-1	465+00	3700	2899492	66.6	0.15	77	23	

Note: EFSC = East Fork Sand Creek

Marksheffel
Off-site Existing Roadway Basin Calculations - Rational Method
10 Year "C" Values

BY: RF
DATE: 4/16/2007
UPDATED BY: GCS
DATE: 4/16/2008

BASIN ID	UNDEVELOPED / HISTORICAL Frequency	%	LIGHT INDUSTRIAL Frequency	%	HEAVY INDUSTRIAL Frequency	%	RESIDENTIAL 1/4 ACRE Frequency	%	PAVED ROADS Frequency	%	TOTAL FREQUENCY
B-EFSC-15	0.15	35	0.70	60	0.90	0	0.50	0	0.90	5	0.52
B-EFSC-14	0.15	15	0.70	80	0.90	0	0.50	0	0.90	5	0.63
B-EFSC-13	0.15	75	0.70	10	0.90	0	0.50	0	0.90	15	0.32
B-EFSC-12	0.15	75	0.70	0	0.90	0	0.50	0	0.90	25	0.34
B-EFSC-11	0.15	55	0.70	40	0.90	0	0.50	0	0.90	5	0.41
B-EFSC-10	0.15	90	0.70	10	0.90	0	0.50	0	0.90	0	0.21
B-EFSC-8	0.15	70	0.70	0	0.90	0	0.50	25	0.90	5	0.28
B-EFSC-7	0.15	100	0.70	0	0.90	0	0.50	0	0.90	0	0.15
B-EFSC-6	0.15	100	0.70	0	0.90	0	0.50	0	0.90	0	0.15
B-EFSC-5	0.15	90	0.70	10	0.90	0	0.50	0	0.90	0	0.21
B-EFSC-4	0.15	75	0.70	20	0.90	0	0.50	0	0.90	5	0.30
B-EFSC-2	0.15	100	0.70	0	0.90	0	0.50	0	0.90	0	0.15
B-EFSC-1	0.15	100	0.70	0	0.90	0	0.50	0	0.90	0	0.15

Marksheffel
Off-site Existing Roadway Basin Calculations - Rational Method
100 Year "C" Values

BY: RF
DATE: 4/16/2007
UPDATED BY: GCS
DATE: 4/16/2008

BASIN ID	UNDEVELOPED / HISTORICAL Frequency	%	LIGHT INDUSTRIAL Frequency	%	HEAVY INDUSTRIAL Frequency	%	RESIDENTIAL 1/4 ACRE Frequency	%	PAVED ROADS Frequency	%	TOTAL FREQUENCY
B-EFSC-15	0.20	35	0.80	60	0.90	0	0.60	0	0.95	5	0.60
B-EFSC-14	0.20	15	0.80	80	0.90	0	0.60	0	0.95	5	0.72
B-EFSC-13	0.20	75	0.80	10	0.90	0	0.60	0	0.95	15	0.37
B-EFSC-12	0.20	75	0.80	0	0.90	0	0.60	0	0.95	25	0.39
B-EFSC-11	0.20	55	0.80	40	0.90	0	0.60	0	0.95	5	0.48
B-EFSC-10	0.20	90	0.80	10	0.90	0	0.60	0	0.95	0	0.26
B-EFSC-8	0.20	70	0.80	0	0.90	0	0.60	25	0.95	5	0.34
B-EFSC-7	0.20	100	0.80	0	0.90	0	0.60	0	0.95	0	0.20
B-EFSC-6	0.20	100	0.80	0	0.90	0	0.60	0	0.95	0	0.20
B-EFSC-5	0.20	90	0.80	10	0.90	0	0.60	0	0.95	0	0.26
B-EFSC-4	0.20	75	0.80	20	0.90	0	0.60	0	0.95	5	0.36
B-EFSC-2	0.20	100	0.80	0	0.90	0	0.60	0	0.95	0	0.20
B-EFSC-1	0.20	100	0.80	0	0.90	0	0.60	0	0.95	0	0.20

Markshe[illegible]
Off-site [illegible]ng Roadway Basin Calculations - Rational Method
Time of Concentration

BY: RF
DATE: 4/16/2007
UPDATED: 4/16/08

TIME OF CONCENTRATION																							
SUB-BASIN DATA			INITIAL/OVERLAND TIME (Ti)							TRAVEL TIME (Tt)								TOTAL	Tc CHECK (Urbanized Basins)			FINAL Tc	REMARKS
BASIN ID	COMP. C_{100}	AREA (acre)	ELEV. START (ft)	ELEV. END (ft)		INIT. C_{100}	LENGTH (ft)	SLOPE (SI)%	Ti (Min.) (1)	LENGTH (ft)	ELEV. START (ft)	ELEV. END (ft)	DELTA ELEV. (ft)	LONG. SLOPE (ft/ft)	Paved(P) or Grass Waterway(GW) or Short Pasture(SP)	VEL. (fps) (2)	Tt (Min.) (3)	Ti+Tt (Min.)	Urban-Yes (Y) or No (N)	LENGTH. (ft)	Tc = (L/180) + 10	6 minute min (minutes)	
B-EFSC-15	0.60	18.5	6535	6523		0.60	300	4.0	10.2	1080	6523	6488	35	0.0324	GW	2.7	6.7	16.9	N	N/A	N/A	16.9	
B-EFSC-14	0.72	17.8	6537	6523		0.72	300	4.7	7.4	590	6523	6500	23	0.0390	GW	3.0	3.3	10.7	N	N/A	N/A	10.7	
B-EFSC-13	0.37	34.6	6616	6600		0.37	300	5.3	13.6	1800	6600	6523	77	0.0428	GW	3.1	9.7	23.3	N	N/A	N/A	23.3	
B-EFSC-12	0.39	11.7	6621	6603		0.39	500	3.6	19.5	850	6603	6532	71	0.0835	GW	4.3	3.3	22.7	N	N/A	N/A	22.7	
B-EFSC-11	0.48	36.5	6628	6624		0.48	300	1.3	18.3	1700	6624	6538	86	0.0506	GW	3.4	8.4	26.7	N	N/A	N/A	26.7	
B-EFSC-10	0.26	26.6	6628	6625		0.26	300	1.0	27.2	1800	6625	6550	75	0.0417	SP	1.4	21.0	48.2	N	N/A	N/A	48.2	
B-EFSC-8	SEE SCS GRAPHICAL PEAK DISCHARGE METHOD																						
B-EFSC-7	0.20	35.2	6688	6686		0.20	300	0.7	33.3	1250	6686	6612	74	0.0592	SP	1.7	12.2	45.6	N	N/A	N/A	45.6	
B-EFSC-6	0.20	21.1	6747	6740		0.20	1000	0.7	59.9	1250	6740	6634	106	0.0848	SP	2.0	10.2	70.1	N	N/A	N/A	70.1	
B-EFSC-5	0.26	18.7	6747	6735		0.26	400	3.0	21.9	1650	6735	6676	59	0.0358	SP	1.3	20.8	42.6	N	N/A	N/A	42.6	
B-EFSC-4	0.36	23.5	6764	6750		0.36	300	4.7	14.4	1050	6750	6698	52	0.0495	SP	1.6	11.2	25.7	N	N/A	N/A	25.7	
B-EFSC-2	0.20	16.0	6831	6828		0.20	300	1.0	29.2	1150	6828	6784	44	0.0383	SP	1.4	14.0	43.1	N	N/A	N/A	43.1	
B-EFSC-1	0.20	66.6	6905	6898		0.20	900	0.8	54.9	2800	6898	6708	190	0.0679	SP	1.8	25.6	80.4	N	N/A	N/A	80.4	

N/A Not Applicable
(1) Ti = 1.87*(1.1-C)*L^0.5*S^-0.33, Where (S) is in Percent
(2) V=1.5 ft/s (Pipe/Conc. Ditch Flow) (Fig 7-2, CDOT)
(3) Tt = L/V, WHERE V=CV SW^0.5 and CV = 20 (Paved), 15 (Grass Waterway), 7 (Short Pasture/Lawns)

Marksheffel
Off-site Existing Roadway Basin Calculations - Rational Method
Calculated Runoff

BY: RF
DATE: 4/16/2007
UPDATED BY: GCS
DATE: 4/16/2008

		RATIONAL FLOWS						
BASIN ID	AREA (acre)	C_{10}	C_{100}	I_{10} (in/hr)$_1$	I_{100} (in/hr)$_1$	Q_{10} (cfs)	Q_{100} (cfs)	COMMENTS
B-EFSC-15	18.5	0.52	0.60	3.68	5.57	35.4	61.7	
	18.5					35.4	61.7	
B-EFSC-14	17.8	0.63	0.72	4.53	6.84	50.6	87.4	
	17.8					50.6	87.4	
B-EFSC-13	34.6	0.32	0.37	3.12	4.71	34.3	60.8	
	34.6					34.3	60.8	
B-EFSC-12	11.7	0.34	0.39	3.16	4.78	12.5	21.7	
	11.7					12.5	21.7	
B-EFSC-11	36.5	0.41	0.48	2.89	4.37	43.0	76.1	
	36.5					43.0	76.1	
B-EFSC-10	26.6	0.21	0.26	2.01	3.04	11.0	21.0	
	26.6					11.0	21.0	
B-EFSC-8	283.0	SEE SCS GRAPHICAL PEAK DISCHARGE METHOD						
	283.0							
B-EFSC-7	35.2	0.15	0.20	2.08	3.15	11.0	22.2	
	35.2					11.0	22.2	
B-EFSC-6	21.1	0.15	0.20	1.56	2.36	4.9	10.0	
	21.1					4.9	10.0	
B-EFSC-5	18.7	0.21	0.26	2.17	3.29	8.3	15.9	
	18.7					8.3	15.9	
B-EFSC-4	23.5	0.30	0.36	2.95	4.47	20.7	37.6	
	23.5					20.7	37.6	
B-EFSC-2	16.0	0.15	0.20	2.16	3.26	5.2	10.4	
	16.0					5.2	10.4	
B-EFSC-1	66.6	0.15	0.20	1.42	2.15	14.2	28.6	
	66.6					14.2	28.6	

Marksheffel Road

BY: RF
DATE: 4/16/2007
UPDATED BY: GCS
DATE: 4/16/2008

Table 1

Existing Drainage Basin Parameters and Runoff Summary
Rational Method

BASIN ID	CULVERT LOCATION (Roadway STA)	BASIN LENGTH (ft)	AREA (sq ft)	AREA (acre)	% IMP.	SOIL GROUP (%)			Weighted 10-year 'C' Values	Weighted 100-year 'C' Values	Total Time of Concentration (min)	I_{10} (in/hr)	I_{100} (in/hr)	Q_{10} (cfs)	Q_{100} (cfs)
						A	B	C/D							
B-EFSC-15	280+75	1380	807970	19	52%	100			0.52	0.60	16.92	3.68	5.57	35.4	61.7
B-EFSC-14	286+20	890	776109	18	63%	100			0.63	0.72	10.72	4.53	6.84	50.6	87.4
B-EFSC-13	299+80	2100	1509072	35	32%	79	21		0.32	0.37	23.28	3.12	4.71	34.3	60.8
B-EFSC-12	309+40	1350	510533	12	34%		100		0.34	0.39	22.72	3.16	4.78	12.5	21.7
B-EFSC-11	313+00	2000	1588832	36	41%		100		0.41	0.48	26.66	2.89	4.37	43.0	76.1
B-EFSC-10	323+00	2100	1160136	27	21%		100		0.21	0.26	48.20	2.01	3.04	11.0	21.0
B-EFSC-8	343+00	N/A	12325683	283	28%		100		SEE SCS GRAPHICAL PEAK DISCHARGE METHOD					165	379
B-EFSC-7	359+00	1550	1535450	35	15%		100		0.15	0.20	45.56	2.08	3.15	11.0	22.2
B-EFSC-6	371+00	2250	917291	21	15%		100		0.15	0.20	70.09	1.56	2.36	4.9	10.0
B-EFSC-5	382+60	2050	812573	19	21%		100		0.21	0.26	42.64	2.17	3.29	8.3	15.9
B-EFSC-4	395+70	1350	1025104	24	30%		100		0.30	0.36	25.65	2.95	4.47	20.7	37.6
B-EFSC-2	445+00	1450	697458	16	15%		100		0.15	0.20	43.15	2.16	3.26	5.2	10.4
B-EFSC-1	465+00	3700	2899492	67	15%	77	23		0.15	0.20	80.45	1.42	2.15	14.2	28.6

Marksheffel

Proposed Off-site Basin Calculations - Rational Method

BY: RF
DATE: 4/16/2007
UPDATED BY: GCS
DATE: 5/2/2008

ethodology

Off-site basins were calculated using contours obtained from the USGS and proposed contours for this project.
Basin limits are presented on the following sheet with low points cooresponding to each basin.
Soil groups were determinted from downloaded El Paso Conty soil information from USDA's Soil Data Mart.
Proposed land uses were obtained from El Paso county.
10 and 100 year C values for each land use type were obtained from The City of Colorado Springs / El Paso County Drainage Criteria Manual. If a basin consisted of multiple types, a weighted average was calculated.
Time of concentration was calculated using the equations listed at the bottome of page 5
Rainfall intensity was determined using the Storm Rainfall Time Intensity-Frequency Curves from the criteria manual. (Fig 5-1)
Flows were calculated using the Rational Method.
See Inroads Storm and Sanitary reports for offsite basins that contribute to the proposed systems.

Note

OS-A and OS-B are calculated for proposed future basins for Indigo Ranch at Stetson Ridge.
However for interim condition culvert 465H1 is designed for larger flows contributing from Design Point #58 from Classic Homes, Final Drainage Report dated July 2004 for Indigo Ranch at Stetson Ridge Filing No. 3 & 4
Q10 approximately 60 CFS
Q100 = 92 CFS

Marksheffel
Off-site Proposed Roadway Basin Calculations - Rational Method
Basin Parameters

BY: RF
DATE: 4/16/2007
UPDATED BY: GCS
DATE: 5/2/2008

BASIN ID	DITCH LOCATION (STA to STA)	CULVERT / INLET LOCATION (STA)	BASIN LENGTH (ft)	AREA (sq ft)	AREA (acre)	% IMP.	SOIL GROUP (%)		
							A	B	C/D
OS-A		465 H1 (465+40)	900	219514	5.0	0.54	100		
OS-B		465 H1 (465+40)	900	118310	2.7	0.54		100	
OS-C		445 F1 (444+60)	1350	290347	6.7	0.54		100	
OS-P2A	Sta. 448+00 to Sta. 456+00		940	239190	5.5	0.15		100	
OS-P2B	Pond 2 Bypass Sta. 448+00		788	165308	3.8	0.15		100	
OS-P2A&B (Combined)	Roadside Ditch and Bypass		1380	404498	9.3	0.15		100	
OS-D	See Inroads Basin Report	420 R2 (420+00)	1100	228062	5.2	0.54		100	
OS-E1	See Inroads Basin Report	417 R2	350	42988	1.0	0.90		100	
OS-E2	See Inroads Basin Report	413 R2	500	58172	1.3	0.54		100	
OS-F1	Sta. 337+00 to Sta. 343+50			305135	7.0	0.21		100	
OS-F		322+00	2100	11486118	263.7	0.21		100	
OS-G	Sta. 393+00 to 408+00	396 R2 (395+90)	1100	946494	21.7	0.30		100	
OS-H1	Sta. 381+00 to 393+00	Ditch to 382R2		740083	17.0	0.21		100	
OS-H2	Sta. 380+00	Ditch to 380R2		48421	1.1	0.21		100	
OS-I	Sta. 370+00 to 381+00	Ditch to 370R1		787490	18.1	0.15		100	
OS-J1	Sta. 355+00 to Sta. 370+00	Ditch to 359R1		1333343	30.6	0.21		100	
OS-J2 (Pond 3 Bypass)	Sta. 346+00 to Sta. 355+00	Pond 3 Bypass Ditch		640996	14.7	0.21		100	
OS-P4A (Pond 4 Bypass)	Sta. 301+50 to Sta. 332+50	Pond 4 Bypass Ditch		688468	15.8	0.26		100	

Marksheffel
Off-site Proposed Roadway Basin Calculations - Rational Method
10 Year "C" Values

BY: RF
DATE: 4/16/2007
UPDATED BY: GCS
DATE: 5/2/2008

BASIN ID	UNDEVELOPED / HISTORICAL Frequency *	% **	LIGHT INDUSTRIAL Frequency *	% **	HEAVY INDUSTRIAL Frequency *	% **	RESIDENTIAL 1/4 ACRE Frequency *	% **	PAVED ROADS Frequency *	% **	TOTAL FREQUENCY
OS-A	0.15	0	0.70	0	0.90	0	0.50	90	0.90	10	0.54
OS-B	0.15	0	0.70	0	0.90	0	0.50	90	0.90	10	0.54
OS-C	0.15	0	0.70	0	0.90	0	0.50	90	0.90	10	0.54
OS-P2A	0.15	100	0.70	0	0.90	0	0.50	0	0.90	0	0.15
OS-P2B	0.15	100	0.70	0	0.90	0	0.50	0	0.90	0	0.15
OS-P2A&B (Combined)	0.15	100	0.70	0	0.90	0	0.50	0	0.90	0	0.15
OS-D	0.15	0	0.70	0	0.90	0	0.50	90	0.90	10	0.54
OS-E1	0.15	0	0.70	0	0.90	0	0.50	0	0.90	100	0.90
OS-E2	0.15	0	0.70	0	0.90	0	0.50	90	0.90	10	0.54
OS-F1	0.15	90	0.70	10	0.90	0	0.50	0	0.90	0	0.21
OS-F	0.15	90	0.70	10	0.90	0	0.50	0	0.90	0	0.21
OS-G	0.15	75	0.70	20	0.90	0	0.50	0	0.90	5	0.30
OS-H1	0.15	90	0.70	10	0.90	0	0.50	0	0.90	0	0.21
OS-H2	0.15	90	0.70	10	0.90	0	0.50	0	0.90	0	0.21
OS-I	0.15	100	0.70	0	0.90	0	0.50	0	0.90	0	0.15
OS-J1	0.15	90	0.70	10	0.90	0	0.50	0	0.90	0	0.21
OS-J2 (Pond 3 Bypass)	0.15	90	0.70	10	0.90	0	0.50	0	0.90	0	0.21
OS-P4A (Pond 4 Bypass)	0.15	86	0.70	0	0.90	0	0.50	0	0.90	14	0.26

* Runoff frequencies obtained from Urban Drainage and Flood Control District Drainage Manual
** % Impervious values estimated from arial photo of existing area and survey information.

Marksheffel
Off-site Proposed Roadway Basin Calculations - Rational Method
100 Year "C" Values

BY: RF
DATE: 4/16/2007
UPDATED BY: GCS
DATE: 5/2/2008

BASIN ID	UNDEVELOPED / HISTORICAL Frequency *	% **	LIGHT INDUSTRIAL Frequency *	% **	HEAVY INDUSTRIAL Frequency *	% **	RESIDENTIAL 1/4 ACRE Frequency *	% **	PAVED ROADS Frequency *	% **	TOTAL FREQUENCY
OS-A	0.20	0	0.80	0	0.90	0	0.60	90	0.95	10	0.64
OS-B	0.20	0	0.80	0	0.90	0	0.60	90	0.95	10	0.64
OS-C	0.20	0	0.80	0	0.90	0	0.60	90	0.95	10	0.64
OS-P2A	0.20	100	0.80	0	0.90	0	0.60	0	0.95	0	0.20
OS-P2B	0.20	100	0.80	0	0.90	0	0.60	0	0.95	0	0.20
OS-P2A&B (Combined)	0.20	100	0.80	0	0.90	0	0.60	0	0.95	0	0.20
OS-D	0.20	0	0.80	0	0.90	0	0.60	90	0.95	10	0.64
OS-E1	0.20	0	0.80	0	0.90	0	0.60	0	0.95	100	0.95
OS-E2	0.20	0	0.80	0	0.90	0	0.60	90	0.95	10	0.64
OS-F1	0.20	90	0.80	10	0.90	0	0.60	0	0.95	0	0.26
OS-F	0.20	90	0.80	10	0.90	0	0.60	0	0.95	0	0.26
OS-G	0.20	75	0.80	20	0.90	0	0.60	0	0.95	5	0.36
OS-H1	0.20	90	0.80	10	0.90	0	0.60	0	0.95	0	0.26
OS-H2	0.20	90	0.80	10	0.90	0	0.60	0	0.95	0	0.26
OS-I	0.20	100	0.80	0	0.90	0	0.60	0	0.95	0	0.20
OS-J1	0.20	90	0.80	10	0.90	0	0.60	0	0.95	0	0.26
OS-J2 (Pond 3 Bypass)	0.20	90	0.80	10	0.90	0	0.60	0	0.95	0	0.26
OS-P4A (Pond 4 Bypass)	0.20	86	0.80	0	0.90	0	0.60	0	0.95	14	0.31

* Runoff frequencies obtained from Urban Drainage and Flood Control District Drainage Manual
** % Impervious values estimated from arial photo of existing area and survey information.

Markshe
Off-site Proposed Roadway Basin Calculations - Rational Method
Time of Concentration

BY: RF UPDATED BY: GCS
DATE: 4/16/2007 DATE: 5/2/2008

TIME OF CONCENTRATION

SUB-BASIN DATA			INITIAL/OVERLAND TIME (Ti)						TRAVEL TIME (Tt)									TOTAL	Tc CHECK (Urbanized Basins)			FINAL Tc	REMARKS
BASIN ID	COMP. C_{10}	AREA (acre)	ELEV. START (ft)	ELEV. END (ft)	INIT. C_{10}	LENGTH (ft)	SLOPE (Si)%	Ti (Min.) (1)	LENGTH (ft)	ELEV. START (ft)	ELEV. END (ft)	DELTA ELEV. (ft)	LONG. SLOPE (ft/ft)	Paved(P) or Grass Waterway(GW) or Short Pasture(SP)	VEL. (fps) (2)	Tt (Min.) (3)	Ti+Tt (Min.)	Urban-Yes (Y) or No (N)	LENGTH. (ft)	Tc = (L/180) + 10	5 minute min (minutes)	
OS-A	0.54	5.0	6814.00	6800.00	0.54	300	4.7	10.9	600	6800.00	6790.00	10.0	0.0167	GW	1.9	5.2	16.1	N	N/A	N/A	16.1	
OS-B	0.54	2.7	6812.00	6800.00	0.54	200	6.0	8.2	700	6800.00	6790.00	10.0	0.0143	GW	1.8	6.5	14.7	N	N/A	N/A	14.7	
OS-C	0.54	6.7	6816.00	6800.00	0.54	150	10.7	5.9	1200	6800.00	6780.00	20.0	0.0167	GW	1.9	10.3	16.2	N	N/A	N/A	16.2	
OS-P2A	0.15	5.5	6818.00	6811.00	0.15	300	2.3	23.3	640	6811.00	6788.00	23.0	0.0359	GW	2.8	3.8	27.0	N	N/A	N/A	27.0	
OS-P2B	0.15	3.8	6818.00	6804.00	0.15	300	4.7	18.5	488	6804.00	6770.00	34.0	0.0697	SP	1.8	4.4	22.9	N	N/A	N/A	22.9	
OS-P2A&B (Combined)	0.15	9.3	6818.00	6811.00	0.15	300	2.3	23.3	1080	6811.00	6770.00	41.0	0.0380	GW	2.9	6.2	29.4	N	N/A	N/A	29.4	
OS-D	0.54	5.2	6800.00	6794.00	0.54	200	3.0	10.3	900	6794.00	6785.00	9.0	0.0100	GW	1.5	10.0	20.3	N	N/A	N/A	20.3	
OS-E1	0.90	1.0	6787.00	6774.00	0.90	50	26.0	0.9	300	6774.00	6772.00	2.0	0.0067	P	1.6	3.1	4.0	N	N/A	N/A	5.0	
OS-E2	0.54	1.3	6787.00	6774.00	0.54	300	4.3	11.2	200	6774.00	6770.00	4.0	0.0200	P	2.8	1.2	12.4	N	N/A	N/A	12.4	
OS-F1	0.21	7.0	6626.00	6611.00	0.21	300	5.0	16.9	763	6611.00	6572.00	39.0	0.0511	GW	3.4	3.7	20.7	N	N/A	N/A	20.7	
OS-F	0.21	263.7	6628.00	6625.00	0.21	300	1.0	28.8	1800	6625.00	6550.00	75.0	0.0417	SP	1.4	21.0	49.8	N	N/A	N/A	49.8	
OS-G	0.30	21.7	6760.00	6750.00	0.30	300	3.3	17.4	800	6750.00	6700.00	50.0	0.0625	SP	1.8	7.6	25.0	N	N/A	N/A	25.0	
OS-H1	0.21	17.0	6746.00	6736.00	0.21	300	3.3	19.4	1250	6736.00	6668.00	68.0	0.0544	GW	3.5	6.0	25.3	N	N/A	N/A	25.3	
OS-H2	0.21	1.1	6706.00	6695.00	0.21	40	27.5	3.5	350	6695.00	6660.00	35.0	0.1000	GW	4.7	1.2	4.8	N	N/A	N/A	5.0	
OS-I	0.15	18.1	6748.00	6738.00	0.15	300	3.3	20.7	1784	6738.00	6631.00	107.0	0.0600	GW	3.7	8.1	28.8	N	N/A	N/A	28.8	
OS-J1	0.21	30.6	6688.00	6666.00	0.21	300	7.3	14.9	1170	6666.00	6610.00	56.0	0.0479	GW	3.3	5.9	20.9	N	N/A	N/A	20.9	
OS-J2 (Pond 3 Bypass)	0.21	14.7	6647.00	6640.00	0.21	300	2.3	21.8	1500	6640.00	6571.00	69.0	0.0460	GW	3.2	7.8	29.6	N	N/A	N/A	29.6	
OS-P4A (Pond 4 Bypass)	0.26	15.8	6560.00	6541.00	0.26	114	16.7	6.6	2320	6541.00	6516.00	25.0	0.0108	GW	1.6	24.8	31.5	N	N/A	N/A	31.5	Tc Calculated to Sta. 302+00

N/A Not Applicable
(1) Ti = 1.87*(1.1-C)*L^0.5*S^-0.33 , Where (S) is in percent
(2) V=1.5 ft/s (Pipe/Conc. Ditch Flow) (Fig 7-2, CDOT)
(3) Tt = L/V, WHERE V=CV SW^0.5 and CV = 20 (Paved), 15 (Grass Waterway), 7 (Short Pasture/Lawns)

Markshefffel
Off-site Proposed Roadway Basin Calculations - Rational Method
Calculated Runoff

BY: RF
DATE: 4/16/2007
UPDATED BY: GCS
DATE: 5/2/2008

		RATIONAL FLOWS						
BASIN ID	AREA (acre)	C_{10}	C_{100}	I_{10} (in/hr)$_1$	I_{100} (in/hr)$_1$	Q_{10} (cfs)	Q_{100} (cfs)	COMMENTS
OS-A	5.0	0.54	0.64	3.78	5.71	10.3	18.3	Use DP # 58 for Interim
								See note on Page 1
OS-B	2.7	0.54	0.64	3.94	5.96	5.8	10.3	Use DP # 58 for Interim
								See note on Page 1
OS-C	6.7	0.54	0.64					See Inroads Basins
OS-P2A	5.5	0.15	0.20	2.87	4.34	2.4	4.8	
OS-P2B	3.8	0.15	0.20	3.15	4.76	1.8	3.6	
OS-P2A&B (Combined)	9.3	0.15	0.20	2.73	4.13	3.8	7.7	
OS-D	5.2	0.54	0.64					See Inroads Basins
OS-E1	1.0	0.90	0.95					See Inroads Basins
OS-E2	1.3	0.54	0.64					See Inroads Basins
OS-F1	7.0	0.21	0.26	3.32	5.02	4.8	9.1	
OS-F	263.7	0.21	0.26	See TR-55 Calculations				
OS-G	21.7	0.30	0.36					See Inroads Basins
OS-H1	17.0	0.21	0.26					See Inroads Basins
OS-H2	1.1	0.21	0.26					See Inroads Basins
OS-I	18.1	0.15	0.20	2.77	4.18	7.5	15.1	
OS-J1	30.6	0.21	0.26	3.31	5.00	20.8	39.8	Ditch to 359R1
OS-J2 (Pond 3 Bypass)	14.7	0.21	0.26	2.72	4.11	8.2	15.7	Pond 3 Bypass Ditch
OS-P4A (Pond 4 Bypass)	15.8	0.26	0.31	2.62	3.97	10.6	19.2	Pond 4 Bypass Ditch

Intensity (in./hr) = (28.5xP1)/(10+Tc)^0.786
P 10 year,1hour (in.)= 1.72
P 100 year,1hour (in.)= 2.6

BY:
DATE: 4/16/2007
UPDATED BY: GCS
DATE: 5/2/2008

Table 3

Proposed Off-Site Drainage Basin Parameters and Runoff Summary
Rational Method

EXISTING BASIN ID	PROPOSED BASIN ID	DITCH LOCATION (STA to STA)	CULVERT LOCATION (Roadway STA)	BASIN LENGTH (ft)	AVG. BASIN WIDTH (ft)	AREA (sq ft)	AREA (acre)	% IMP.	SOIL GROUP (%)			Weighted 10-year 'C' Values	Weighted 100-year 'C' Values	Total Time of Concentration (min)	I_{10} (in/hr)	I_{100} (in/hr)	Q_{10} (cfs)	Q_{100} (cfs)
									A	B	C/D							
	OS-A *		465 H1 (465+40)	900	200	219514	5.0	54%	100			0.54	0.64	16.07	3.78	5.71	10.3	18.3
	OS-B *		465 H1 (465+40)	900	200	118310	2.7	54%		100		0.54	0.64	14.71	3.94	5.96	5.8	10.3
	OS-C		445 F1 (444+60)	1350	200	290347	6.7	54%		100		0.54	0.64	16.20	See Inroads Basin Reports			
	OS-P2A	Sta. 448+00 to Sta. 456+00		940	200	239190	5.5	15%		100		0.15	0.20	27.02	2.87	4.34	2.4	4.8
	OS-P2B	Pond 2 Bypass Sta. 448+00		788	200	165308	3.8	15%		100		0.15	0.20	22.91	3.15	4.76	1.8	3.6
	OS-P2A&B (Combined)	Roadside Ditch and Bypass		1380	200	404498	9.3	15%		100		0.15	0.20	29.42	2.73	4.13	3.8	7.7
	OS-D		420 R2 (420+00)	1100	200	228062	5.2	54%		100		0.54	0.64	20.31	See Inroads Basin Reports			
	OS-E1	See Inroads Basin Report	417 R2	350	200	42988	1.0	90%		100		0.90	0.95	5.00	See Inroads Basin Reports			
	OS-E2	See Inroads Basin Report	413 R2	500	200	58172	1.3	54%		100		0.54	0.64	12.36	See Inroads Basin Reports			
	OS-F1	Sta. 337+00 to Sta. 343+50				305135	7.0	21%		100		0.21	0.26	20.70	3.32	5.02	4.8	9.1
BEFSC-8	OS-F		343+00	7550		12196800	280	54%		100		See TR-55 Calculations					242.00	491.0
BEFSC-4	OS-G	Sta. 393+00 to 408+00	396 R2 (395+90)	1100	200	946494	21.7	30%		100		0.30	0.36	25.03	2.99	4.53	19.4	35.2
BEFSC-5	OS-H1	Sta. 381+00 to 393+00	Ditch to 382R2		200	740083	17.0	21%		100		0.21	0.26	25.33	See Inroads Basin Reports			
BEFSC-5	OS-H2	Sta. 380+00	Ditch to 380R2		200	48421	1.1	21%		100		0.21	0.26	5.00	See Inroads Basin Reports			
BEFSC-6	OS-I	Sta. 370+00 to 381+00	Ditch to 370R1		200	787490	18.1	15%		100		0.15	0.20	28.78	2.77	4.18	7.5	15.1
BEFSC-7	OS-J1	Sta. 355+00 to Sta. 370+00	Ditch to 359R1		200	1333343	30.6	21%		100		0.21	0.26	20.88	3.31	5.00	20.8	39.8
	OS-J2 (Pond 3 Bypass)	Sta. 346+00 to Sta. 355+00	Pond 3 Bypass Ditch		200	640996	14.7	21%		100		0.21	0.26	29.57	2.72	4.11	8.2	15.7
	OS-P4A (Pond 4 Bypass)	Sta. 301+50 to Sta. 332+50	Pond 4 Bypass Ditch			688468	15.8	26%		100		0.26	0.31	31.46	2.62	3.97	10.6	19.2

* OS-A and OS-B are for future flows, use Design Point #58 Q10 = 60 CFS and Q100=92 CFS for Interim condition.

Marksheffel Road
Culvert Hydrology for Basins Larger than 100 acres

Hydrologic Method - SCS Graphical Peak Discharge Method

10-Year
Existing Conditions

Contributing Drainage Area Data

Basin ID	Basin Area (Acres)	Basin Area (sq mi)	Upper Elevation (feet)	Lower Elevation (feet)	Basin Length (feet)	Average Slope (ft/ft)
B-EFSC-8 (OS-F)	283.00	0.4422	6,764	6,566	7,700	0.026

Time of Concentration Calculations

	Sheet flow					Shallow Concentrated Flow				Open Channel Flow								
Basin ID	Flow length (ft)	Slope (ft/ft)	Manning's n	2-yr, 24 hr Rainfall (in)*	Computed Travel Time Tt (hr)	Shallow Concentrated Flow Length (ft)	Slope (ft/ft)	Avg Velocity from Fig 3-1 TR-55 (ft/s)	Computed Travel Time (hr)	Flow Length (ft)	Slope (ft/ft)	Cross-sectional flow area (ft^2)	Wetted Perimeter (ft)	Hydraulic Radius	Manning's n for Open Channels	Computed Average flow Velocity (ft/s)	Computed Travel Time (hr)	Time of Conc. (hr)
B-EFSC-8 (OS-F)	300	0.046667	0.06	2.0	0.170	1100	0.05	3.6	0.085	6,300	0.02	34	37	0.92	0.040	5.1	0.34	0.60

Notes:
1.) Manning's n values estimated based on site reconnaissance and available references
2.) 2-yr, 24-hr rainfall obtained from City of Colorado Springs / El Paso County Drainage Criteria Manual.
3.) Flow length for open channel flow = measured basin length-(sheet flow length + shallow conc flow length)
4.) Assumed average channel geometry for open channel flow computations: triangular channel, 10:1 sideslopes.
5.) Open channel flow calculations assume bank full flow for estimating hydraulic radius.

Graphical Peak Discharge Computations

Existing Culvert ID (MP)	Hydrologic Soil Group	Weighted Curve Number	10-Yr, 24-hour Rainfall P(in)	Initial Abstract., Ia (in)	Computed Ia/P	Time of Conc. (hr)	Unit Peak Discharge (csm/in)	Runoff, Q (in) Table 2-1 TR 55	**Computed 10-yr Peak Discharge (cfs)**
EFSC-8	B	72	3.0	0.778	0.26	0.60	460	0.81	164.8

Notes:
1.) Hydrologic soil group was obtained from NCRS soils data. CN values obtained from Table 2-2a TR-55 for Urban Areas.
2.) 10-yr, 24-hr rainfall obtained from City of Colorado Springs / El Paso County Drainage Criteria Manual
3.) Unit Peak Discharge for Type II rainfall distribution from Exhibit 4-II TR-55.

B-EFSC-8 Existing Channel 10Yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.02000	ft/ft
Left Side Slope	10.00	ft/ft (H:V)
Right Side Slope	10.00	ft/ft (H:V)
Discharge	165.00	ft^3/s

Results

Normal Depth	1.83	ft
Flow Area	33.45	ft^2
Wetted Perimeter	36.76	ft
Top Width	36.58	ft
Critical Depth	1.76	ft
Critical Slope	0.02449	ft/ft
Velocity	4.93	ft/s
Velocity Head	0.38	ft
Specific Energy	2.21	ft
Froude Number	0.91	
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	1.83	ft
Critical Depth	1.76	ft
Channel Slope	0.02000	ft/ft
Critical Slope	0.02449	ft/ft

Marksheffel Road
Culvert Hydrology for Basins Larger than 100 acres

100-Year

Hydrologic Method - SCS Graphical Peak Discharge Method

Existing Conditions

Contributing Drainage Area Data

Basin ID	Basin Area (Acres)	Basin Area (sq mi)	Upper Elevation (feet)	Lower Elevation (feet)	Basin Length (feet)	Average Slope (ft/ft)
B-EFSC-8	283.00	0.4422	6,764	6,566	7,700	0.026
(OS-F)						

Time of Concentration Calculations

	Sheet flow					Shallow Concentrated Flow				Open Channel Flow								
Basin ID	Flow length (ft)	Slope (ft/ft)	Manning's n	2-yr, 24 hr Rainfall (in)*	Computed Travel Time Tt (hr)	Shallow Concentrated Flow Length (ft)	Slope (ft/ft)	Avg Velocity from Fig 3-1 TR-55 (ft/s)	Computed Travel Time (hr)	Flow Length (ft)	Slope (ft/ft)	Cross-sectional flow area (ft^2)	Wetted Perimeter (ft)	Hydraulic Radius	Manning's n for Open Channels	Computed Average flow Velocity (ft/s)	Computed Travel Time (hr)	Time of Conc. (hr)
B-EFSC-8	300	0.046667	0.06	2.0	0.170	1100	0.05	3.6	0.085	6,300	0.02	62	50	1.24	0.040	6.3	0.28	0.53
(OS-F)																		

Notes:
1.) Manning's n values estimated based on site reconnaissance and available references
2.) 2-yr, 24-hr rainfall obtained from City of Colorado Springs / El Paso County Drainage Criteria Manual.
3.) Flow length for open channel flow = measured basin length-(sheet flow length + shallow conc flow length)
4.) Assumed average channel geometry for open channel flow computations: triangular channel, 10:1 sideslopes.
5.) Open channel flow calculations assume bank full flow for estimating hydraulic radius.

Graphical Peak Discharge Computations

Existing Culvert ID (MP)	Hydrologic Soil Group	Weighted Curve Number	100-Yr, 24-hour Rainfall P(in)	Initial Abstract., Ia (in)	Computed Ia/P	Time of Conc. (hr)	Unit Peak Discharge (csm/in)	Runoff, Q (in) Table 2-1 TR-55	Computed 100-yr Peak Discharge (cfs)
EFSC-8	B	72	4.4	0.778	0.18	0.53	490	1.75	379.2

Notes:
1.) Hydrologic soil group was obtained from NCRS soils data. CN values obtained from Table 2-2a TR-55 for Urban Areas.
2.) 100-yr, 24-hr rainfall obtained from City of Colorado Springs / El Paso County Drainage Criteria Manual
3.) Unit Peak Discharge for Type II rainfall distribution from Exhibit 4-II TR-55.

B-EFSC-8 Existing Channel 100Yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.02000	ft/ft
Left Side Slope	10.00	ft/ft (H:V)
Right Side Slope	10.00	ft/ft (H:V)
Discharge	379.00	ft³/s

Results

Normal Depth	2.50	ft
Flow Area	62.41	ft²
Wetted Perimeter	50.21	ft
Top Width	49.96	ft
Critical Depth	2.46	ft
Critical Slope	0.02192	ft/ft
Velocity	6.07	ft/s
Velocity Head	0.57	ft
Specific Energy	3.07	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	2.50	ft
Critical Depth	2.46	ft
Channel Slope	0.02000	ft/ft
Critical Slope	0.02192	ft/ft

Marksheffel Road
Culvert Hydrology for Basins Larger than 100 acres

Hydrologic Method - SCS Graphical Peak Discharge Method

10-Year
Future Conditions

Contributing Drainage Area Data

Basin ID	Basin Area (Acres)	Basin Area (sq mi)	Upper Elevation (feet)	Lower Elevation (feet)	Basin Length (feet)	Average Slope (ft/ft)
OS-F	264.00	0.4125	6,764	6,566	7,700	0.026

Time of Concentration Calculations

	Sheet flow					Shallow Concentrated Flow				Open Channel Flow								
Basin ID	Flow length (ft)	Slope (ft/ft)	Manning's n	2-yr, 24 hr Rainfall (in)*	Computed Travel Time Tt (hr)	Shallow Concentrated Flow Length (ft)	Slope (ft/ft)	Avg Velocity from Fig 3-1 TR-55 (ft/s)	Computed Travel Time (hr)	Flow Length (ft)	Slope (ft/ft)	Cross-sectional flow area (ft^2)	Wetted Perimeter (ft)	Hydraulic Radius	Manning's n for Open Channels	Computed Average flow Velocity (ft/s)	Computed Travel Time (hr)	Time of Conc. (hr)
OS-F	300	0.046667	0.06	2.0	0.170	1100	0.05	3.6	0.085	6,300	0.02	45	43	1.05	0.040	5.6	0.31	0.57

Notes:
1.) Manning's n values estimated based on site reconnaissance and available references
2.) 2-yr, 24-hr rainfall obtained from City of Colorado Springs / El Paso County Drainage Criteria Manual.
3.) Flow length for open channel flow = measured basin length-(sheet flow length + shallow conc flow length)
4.) Assumed average channel geometry for open channel flow computations: triangular channel, 10:1 sideslopes.
5.) Open channel flow calculations assume bank full flow for estimating hydraulic radius.

Graphical Peak Discharge Computations

Existing Culvert ID (MP)	Hydrologic Soil Group	Weighted Curve Number	100-Yr, 24 hour Rainfall P(in)	Initial Abstract., Ia (in)	Computed Ia/P	Time of Conc. (hr)	Unit Peak Discharge (csm/in)	Runoff, Q (in) Table 2-1 TR-55	Computed 100-yr Peak Discharge (cfs)
OS-F	B	80	3	0.500	0.17	0.57	470	1.25	242.3

Notes:
1.) Hydrologic soil group was obtained from NCRS soils data. CN values obtained from Table 2-2a TR-55 for Urban Areas.
2.) 100-yr, 24-hr rainfall obtained from City of Colorado Springs / El Paso County Drainage Criteria Manual
3.) Unit Peak Discharge for Type II rainfall distribution from Exhibit 4-II TR-55.

OS-F Proposed Channel 10Yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.02000	ft/ft
Left Side Slope	10.00	ft/ft (H:V)
Right Side Slope	10.00	ft/ft (H:V)
Discharge	242.00	ft³/s

Results

Normal Depth	2.11	ft
Flow Area	44.57	ft²
Wetted Perimeter	42.43	ft
Top Width	42.22	ft
Critical Depth	2.05	ft
Critical Slope	0.02327	ft/ft
Velocity	5.43	ft/s
Velocity Head	0.46	ft
Specific Energy	2.57	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	2.11	ft
Critical Depth	2.05	ft
Channel Slope	0.02000	ft/ft
Critical Slope	0.02327	ft/ft

Marksheffel Road
Culvert Hydrology for Basins Larger than 100 acres

Hydrologic Method - SCS Graphical Peak Discharge Method

100-Year
Future Conditions

Contributing Drainage Area Data

Basin ID	Basin Area (Acres)	Basin Area (sq mi)	Upper Elevation (feet)	Lower Elevation (feet)	Basin Length (feet)	Average Slope (ft/ft)
OS-F	264.00	0.4125	6,764	6,566	7,700	0.026

Time of Concentration Calculations

	Sheet flow					Shallow Concentrated Flow				Open Channel Flow								
Basin ID	Flow length (ft)	Slope (ft/ft)	Manning's n	2-yr, 24 hr Rainfall (in)*	Computed Travel Time Tt (hr)	Shallow Concentrated Flow Length (ft)	Slope (ft/ft)	Avg Velocity from Fig 3-1 TR-55 (ft/s)	Computed Travel Time (hr)	Flow Length (ft)	Slope (ft/ft)	Cross-sectional flow area (ft^2)	Wetted Perimeter (ft)	Hydraulic Radius	Manning's n for Open Channels	Computed Average flow Velocity (ft/s)	Computed Travel Time (hr)	Time of Conc. (hr)
OS-F	300	0.046667	0.06	2.0	0.170	1100	0.05	3.6	0.085	6,300	0.02	76	55	1.38	0.040	6.7	0.26[illegible]	0.51

Notes:
1.) Manning's n values estimated based on site reconnaissance and available references
2.) 2-yr, 24-hr rainfall obtained from City of Colorado Springs / El Paso County Drainage Criteria Manual.
3.) Flow length for open channel flow = measured basin length-(sheet flow length + shallow conc flow length)
4.) Assumed average channel geometry for open channel flow computations: triangular channel, 10:1 sideslopes.
5.) Open channel flow calculations assume bank full flow for estimating hydraulic radius.

Graphical Peak Discharge Computations

Existing Culvert ID (MP)	Hydrologic Soil Group	Weighted Curve Number	100-Yr, 24 hour Rainfall P(in)	Initial Abstract., Ia (in)	Computed Ia/P	Time of Conc. (hr)	Unit Peak Discharge (csm/in)	Runoff, Q (in) Table 2-1 TR-55	**Computed 100-yr Peak Discharge (cfs)**
OS-F	B	80	4.4	0.500	0.11	0.51	500	2.38	**490.9**

Notes:
1.) Hydrologic soil group was obtained from NCRS soils data. CN values obtained from Table 2-2a TR-55 for Urban Areas.
2.) 100-yr, 24-hr rainfall obtained from City of Colorado Springs / El Paso County Drainage Criteria Manual
3.) Unit Peak Discharge for Type II rainfall distribution from Exhibit 4-II TR-55.

OS-F Proposed Channel 100Yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.02000	ft/ft
Left Side Slope	10.00	ft/ft (H:V)
Right Side Slope	10.00	ft/ft (H:V)
Discharge	491.00	ft³/s

Results

Normal Depth	2.75	ft
Flow Area	75.78	ft²
Wetted Perimeter	55.33	ft
Top Width	55.06	ft
Critical Depth	2.72	ft
Critical Slope	0.02118	ft/ft
Velocity	6.48	ft/s
Velocity Head	0.65	ft
Specific Energy	3.41	ft
Froude Number	0.97	
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	2.75	ft
Critical Depth	2.72	ft
Channel Slope	0.02000	ft/ft
Critical Slope	0.02118	ft/ft

Water Quality Treatment Calculations / Spillway Design

El Paso County - Marksheffel Road
Water Quality Treatment Calculations

Description: Calculations for Water Quality Capture Volume (WQCV)
By: A. Menchaca
Date: May 5, 2008

WQ WATERSHED ID	#1
LOCATION	466+00 Right
BMP TYPE	Water Quality Treatment Pond
GROUNDWATER EL.	N/A
CONTRIBUTING WATERSHED AREA	456+20 to 473+02
TOTAL (FT^2)	332,571
TOTAL (AC)	7.63
IMPERVIOUS AREA (I=100)	
PROJECT	
HWY & CD (FT^2)	259,334
HWY & CD (AC)	5.95
LOCAL (FT^2)	-
LOCAL (AC)	0.00
OFFSITE	
LOCAL (FT^2)	-
LOCAL (AC)	0.00
TOTAL	5.95
PERVIOUS AREA (I=0)	
(FT^2)	73,237
(AC)	1.68
IMPERVIOUS RATIO	0.78
UDFCD WQCV	
Watershed Inches	0.32
Volume (ac-ft)	0.201
Design Volume (ac-ft)	**0.24**
WQCV PROVIDED	
STAGE	**6790**
STORAGE (AC-FT)	**0.45**

BASED ON URBAN DRAINAGE AND FLOOD CONTROL DISTRICT DRAINAGE CRITERIA MANUAL VOLUME III FIGURE SQ-2 (EQUATION, 40 HOUR DRAIN TIME)

Water Quality Basin

	Stage Ft.	Area SF	Inc. Vol. CF	Total Vol. CF	Total Vol. AF
BOTTOM	6788	7453		0	0.00
			8605		
	6789	9756		8605	0.20
			2001		
	6789.2	**10249.6**		10605	**0.24**
			8989		
WQ STAGE	6790	12224		19595	0.45
			13459		
	6791	14694		24064	0.55
			15923		
	6792	17152		39987	0.92
			18412		
	6793	19672		53930	1.24
			20981		
	6794	22290		88370	2.03

El Paso County - Marksheffel Road
Orifice Plate Design

WQ WATERSHED ID	#1	
LOCATION	466+00 Right	
BMP TYPE	Water Quality Treatment Pond	
WQCV	0.241	AC-FT
DEPTH OF WATER QUALITY (D_{WQ})	2.0	FT
HEIGHT OF ORIFICE PLATE	2.0	FT
K40	0.39	
REQUIRED AREA PER ROW (A)	0.615	IN^2
HOLE DIAMETER	1-0	IN
NUMBER OF COLUMNS	1	
NUMBER OF ROWS	5	

El Paso County - Marksheffel Road
Water Quality Treatment Calculations

Description: Calculations for Water Quality Capture Volume (WQCV)
By: A. Menchaca
Date: May 5, 2008

WQ WATERSHED ID	#2
LOCATION	443+00 Right
BMP TYPE	Water Quality Treatment Pond
GROUNDWATER EL.	N/A
CONTRIBUTING WATERSHED AREA	434+00 to 456+20
TOTAL (FT^2)	**406,372**
TOTAL (AC)	9.33
IMPERVIOUS AREA (I=100)	
PROJECT	
HWY & CD (FT^2)	**325,166**
HWY & CD (AC)	7.46
LOCAL (FT^2)	-
LOCAL (AC)	0.00
OFFSITE	
LOCAL (FT^2)	-
LOCAL (AC)	0.00
TOTAL	7.46
PERVIOUS AREA (I=0)	
(FT^2)	81,206
(AC)	1.86
IMPERVIOUS RATIO	0.80
UDFCD WQCV	
Watershed Inches	0.33
Volume (ac-ft)	0.255
Design Volume (ac-ft)	**0.31**
WQCV PROVIDED	
STAGE	**6772**
STORAGE (AC-FT)	**0.44**

BASED ON URBAN DRAINAGE AND FLOOD CONTROL DISTRICT DRAINAGE CRITERIA MANUAL VOLUME III FIGURE SQ-2 (EQUATION, 40 HOUR DRAIN TIME)

Water Quality Basin

	Stage Ft.	Area SF	Inc. Vol. CF	Total Vol. CF	Total Vol. AF
BOTTOM	6770	7524			
			8543		
	6771	9561		8543	0.20
			5053		
WQ STAGE	**6771.5**	**10650.5**		13595	0.31
			5598		
WEIR CREST	6772	11740		19193	0.44
			12820		
	6773	13899		32013	0.73
			14996		
	6774	16092		47008	1.08
			17228		
TOP	6775	18364		55694	1.28

El Paso County - Marksheffel Road
Orifice Plate Design

WQ WATERSHED ID	#2	
LOCATION	443+00 Right	
BMP TYPE	Water Quality Treatment Pond	
WQCV	0.306	AC-FT
DEPTH OF WATER QUALITY (D_{WQ})	2.0	FT
HEIGHT OF ORIFICE PLATE	2.0	FT
K40	0.39	
REQUIRED AREA PER ROW (A)	0.782	IN^2
HOLE DIAMETER	1.0	IN
NUMBER OF COLUMNS	1	
NUMBER OF ROWS	5	

El Paso County - Marksheffel Road
Water Quality Treatment Calculations

Description: Calculations for Water Quality Capture Volume (WQCV)
By: A. Menchaca
Date: May 5, 2008

WQ WATERSHED ID: #3
LOCATION: 344+00 Right
BMP TYPE: Water Quality Treatment Pond

GROUNDWATER EL.

CONTRIBUTING WATERSHED AREA: 336+00 to 434+00
TOTAL (FT^2): 1,690,732
TOTAL (AC): 38.81

IMPERVIOUS AREA (I=100)
PROJECT
HWY & CD (FT^2): 1,456,848
HWY & CD (AC): 33.44

LOCAL (FT^2): -
LOCAL (AC): 0.00

OFFSITE
LOCAL (FT^2): -
LOCAL (AC): 0.00

TOTAL: 33.44

PERVIOUS AREA (I=0)
(FT^2): 233,884
(AC): 5.37

IMPERVIOUS RATIO: 0.86

UDFCD WQCV
Watershed Inches: 0.37
Volume (ac-ft): 1.199
Design Volume (ac-ft): 1.44

BASED ON URBAN DRAINAGE AND FLOOD CONTROL DISTRICT DRAINAGE CRITERIA MANUAL VOLUME III FIGURE SQ-2 (EQUATION, 40 HOUR DRAIN TIME)

WQCV PROVIDED
STAGE: 6770.5
STORAGE (AC-FT): 1.83

Water Quality Basin

	Stage Ft.	Area SF	Inc. Vol. CF	Total Vol. CF	Total Vol. AF
BOTTOM	6566	312			
			3325		
	6567	6337		3325	0.08
			10384		
	6568	14430		13708	0.31
			18745		
	6569	23059		32453	0.75
			28704		
	6570	34348		61156	1.40
			1726		
WQ STAGE	6570.05	34692.2		62882	1.44
WEIR CREST = 6570.5			36064		
	6571	41232		98946	2.27
			43656		
	6572	46079		142602	3.27
			48492		
	6573	50905		191094	4.39
			53347		
	6574	55788		244440	5.61
			58265		
TOP	6575	60742		299381	6.87
			63361		
	6576	65979		352358	8.09

El Paso County - Marksheffel Road
Orifice Plate Design

WQ WATERSHED ID	#3	
LOCATION	344+00 Right	
BMP TYPE	Water Quality Treatment Por	
WQCV	1.44	AC-FT
DEPTH OF WATER QUALITY (D_{WQ})	4.5	FT
K40	1.15	
REQUIRED AREA PER ROW (A)	1.248	IN^2
HOLE DIAMETER	1-3/16	IN
NUMBER OF COLUMNS	1	
NUMBER OF ROWS	12	

El Paso County - Marksheffel Road
Water Quality Treatment Calculations

Description: Calculations for Water Quality Capture Volume (WQCV)
By: A. Menchaca
Date: May 5, 2008

WQ WATERSHED ID	#4
LOCATION	300+00 Right
BMP TYPE	Water Quality Treatment Pond
GROUNDWATER EL.	
CONTRIBUTING WATERSHED AREA	300+00 to 336+00
TOTAL (FT^2)	**640,827**
TOTAL (AC)	14.71
IMPERVIOUS AREA (I=100)	
PROJECT	
HWY & CD (FT^2)	**546,746**
HWY & CD (AC)	12.55
LOCAL (FT^2)	-
LOCAL (AC)	0.00
OFFSITE	
LOCAL (FT^2)	-
LOCAL (AC)	0.00
TOTAL	12.55
PERVIOUS AREA (I=0)	
(FT^2)	94,081
(AC)	2.16
IMPERVIOUS RATIO	0.85
UDFCD WQCV	
Watershed Inches	0.36
Volume (ac-ft)	0.447
Design Volume (ac-ft)	**0.54**
	23351
WQCV PROVIDED	
STAGE	**6514**
STORAGE (AC-FT)	**0.67**

BASED ON URBAN DRAINAGE AND FLOOD CONTROL DISTRICT DRAINAGE CRITERIA MANUAL VOLUME III FIGURE SQ-2 (EQUATION, 40 HOUR DRAIN TIME)

Water Quality Basin

	Stage Ft.	Area SF	Inc. Vol. CF	Total Vol. CF	Total Vol. AF
BOTTOM	6512	11946			
			13206		
	6513	14466		13206	0.30
			10128		
WQ STAGE	**6513.66**	**16224.9**		23334	**0.54**
			5671		
WEIR	6514	17131		29005	0.67
			18391		
	6515	19651		47396	1.09
			20905		
	6516	22159		68301	1.57
			23447		
	6517	24735		91748	2.11
			26075		
TOP	6518	27414		104616	2.40

El Paso County - Marksheffel Road
Orifice Plate Design

WQ WATERSHED ID	#4	
LOCATION	300+00 Right	
BMP TYPE	Water Quality Treatment Poı	
WQCV	0.54	AC-FT
DEPTH OF WATER QUALITY (D_{WQ})	2.0	FT
K40	0.39	
REQUIRED AREA PER ROW (A)	1.367	IN^2
HOLE DIAMETER	1-3/8	IN
NUMBER OF COLUMNS	1	
NUMBER OF ROWS	5	

El Paso County - Marksheffel Road
Water Quality Treatment Calculations

Description: Calculations for Water Quality Capture Volume (WQCV)
By: A. Menchaca
Date: May 5, 2008

WQ WATERSHED ID	#5
LOCATION	280+00 Right
BMP TYPE	Water Quality Treatment Pond
GROUNDWATER EL.	
CONTRIBUTING WATERSHED AREA	280+50 to 300+00
TOTAL (FT^2)	344,379
TOTAL (AC)	7.91
IMPERVIOUS AREA (I=100)	
PROJECT	
HWY & CD (FT^2)	282,140
HWY & CD (AC)	6.48
LOCAL (FT^2)	-
LOCAL (AC)	0.00
OFFSITE	
LOCAL (FT^2)	-
LOCAL (AC)	0.00
TOTAL	6.48
PERVIOUS AREA (I=0)	
(FT^2)	62,239
(AC)	1.43
IMPERVIOUS RATIO	0.82
UDFCD WQCV	
Watershed Inches	0.34
Volume (ac-ft)	0.225
Design Volume (ac-ft)	0.27
WQCV PROVIDED	
STAGE	6484
STORAGE (AC-FT)	0.41

BASED ON URBAN DRAINAGE AND FLOOD CONTROL DISTRICT DRAINAGE CRITERIA MANUAL VOLUME III FIGURE SQ-2 (EQUATION, 40 HOUR DRAIN TIME)

	Water Quality Basin				
	Stage Ft.	Area SF	Inc. Vol. CF	Total Vol. CF	Total Vol. AF
BOTTOM	6482	6757			
			7802		
	6483	8846		7802	0.18
			4108		
WQ STAGE	6483.44	9828.08		11910	0.27
			5854		
WEIR	6484	11078		17764	0.41
			12164		
	6485	13250		29928	0.69
			14297		
	6486	15344		44225	1.02
			16418		
	6487	17492		60643	1.39
			18621		
TOP	6488	19750		79264	1.82

El Paso County - Marksheffel Road
Orifice Plate Design

WQ WATERSHED ID	#5	
LOCATION	280+00 Right	
BMP TYPE	Water Quality Treatment Po	
WQCV	0.27	AC-FT
DEPTH OF WATER QUALITY (D_{WQ})	2	FT
K40	0.39	
REQUIRED AREA PER ROW (A)	0.687	IN^2
HOLE DIAMETER	1-0	IN
NUMBER OF COLUMNS	1	
NUMBER OF ROWS	5	

El Paso County - Marksheffel Road
Water Quality Pond Spillway Calculations

Pond Bottom	6788.0
Weir Crest	6790.0
100-yr stage	6791.7

POND #1

Q100	151	CFS
CW	3.3	FT^0.5/S
L	20	FT

H (FT)	Q (CFS)
0	0.0
0.2	5.9
0.4	16.7
0.6	30.7
0.8	47.2
1	66.0
1.2	86.8
1.4	109.3
1.6	133.6
1.7	146.3
1.74	151.5

Pond Bottom	6770.0
Weir Crest	6772.0
100-yr stage	6772.9

POND #2

Q100	63	CFS
CW	3.3	FT^0.5/S
L	22	FT

H (FT)	Q (CFS)
0	0.0
0.2	6.5
0.4	18.4
0.6	33.7
0.8	51.9
0.91	63.0
1	72.6
1.2	95.4
1.4	120.3
1.6	146.9
1.8	175.3

Pond Bottom	6566.0
Weir Crest	6570.5
100-yr stage	6572.4

POND #3

Q100	193	CFS
CW	3.3	FT^0.5/S
L	22	FT

H (FT)	Q (CFS)
0	0.0
0.6	33.7
0.8	51.9
1	72.6
1.2	95.4
1.4	120.3
1.5	133.4
1.6	146.9
1.8	175.3
1.92	193.1
2	205.3

Pond Bottom	6512.0
Weir Crest	6514.0
100-yr stage	6515.6

POND #4

Q100	211	CFS
CW	3.3	FT^0.5/S
L	32	FT

H (FT)	Q (CFS)
0	0.0
0.6	49.1
0.8	75.6
1	105.6
1.2	138.8
1.4	174.9
1.5	194.0
1.59	211.7
1.65	223.8
1.7	234.1

Pond Bottom	6482.0
Weir Crest	6484.0
100-yr stage	6485.5

POND #5

Q100	191	CFS
CW	3.3	FT^0.5/S
L	32	FT

H (FT)	Q (CFS)
0	0.0
0.6	49.1
0.8	75.6
1	105.6
1.2	138.8
1.4	174.9
1.5	194.0
1.5	194.0
1.6	213.7
1.7	234.1

Pond1 Spillway

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.078	
Channel Slope	0.06900	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	20.00	ft
Discharge	151.00	ft³/s

Results

Normal Depth	1.21	ft
Flow Area	30.10	ft²
Wetted Perimeter	29.99	ft
Top Width	29.69	ft
Critical Depth	1.12	ft
Critical Slope	0.09147	ft/ft
Velocity	5.02	ft/s
Velocity Head	0.39	ft
Specific Energy	1.60	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	1.21	ft
Critical Depth	1.12	ft
Channel Slope	0.06900	ft/ft
Critical Slope	0.09147	ft/ft

Pond1 Spillway

Messages

Notes	12" riprap n=0.078 grouted riprap n=0.012

Pond 2 Spillway

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.078	
Channel Slope	0.12500	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	22.00	ft
Discharge	63.00	ft³/s

Results

Normal Depth	0.59	ft
Flow Area	14.26	ft²
Wetted Perimeter	26.83	ft
Top Width	26.69	ft
Critical Depth	0.61	ft
Critical Slope	0.10870	ft/ft
Velocity	4.42	ft/s
Velocity Head	0.30	ft
Specific Energy	0.89	ft
Froude Number	1.07	
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	0.59	ft
Critical Depth	0.61	ft
Channel Slope	0.12500	ft/ft
Critical Slope	0.10870	ft/ft

Pond 2 Spillway

Messages

Notes	12" riprap n=0.078 grouted riprap n=0.012

Pond 3 Spillway

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.078	
Channel Slope	0.07000	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	22.00	ft
Discharge	193.00	ft³/s

Results

Normal Depth	1.32	ft
Flow Area	36.03	ft²
Wetted Perimeter	32.89	ft
Top Width	32.57	ft
Critical Depth	1.24	ft
Critical Slope	0.08850	ft/ft
Velocity	5.36	ft/s
Velocity Head	0.45	ft
Specific Energy	1.77	ft
Froude Number	0.90	
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	1.24	ft
Channel Slope	0.07000	ft/ft
Critical Slope	0.08850	ft/ft

Pond 3 Spillway

Messages

Notes	12" riprap n=0.078 grouted riprap n=0.012

Pond 4 Spillway

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.078	
Channel Slope	0.04000	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	32.00	ft
Discharge	211.00	ft³/s

Results

Normal Depth	1.34	ft
Flow Area	50.08	ft²
Wetted Perimeter	43.05	ft
Top Width	42.72	ft
Critical Depth	1.06	ft
Critical Slope	0.09110	ft/ft
Velocity	4.21	ft/s
Velocity Head	0.28	ft
Specific Energy	1.62	ft
Froude Number	0.69	
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	1.34	ft
Critical Depth	1.06	ft
Channel Slope	0.04000	ft/ft
Critical Slope	0.09110	ft/ft

Pond 4 Spillway

Messages

Notes	12" riprap n=0.078 grouted riprap n=0.012

Pond 5 Spillway

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.078	
Channel Slope	0.04000	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	32.00	ft
Discharge	191.00	ft³/s

Results

Normal Depth	1.27	ft
Flow Area	46.90	ft²
Wetted Perimeter	42.44	ft
Top Width	42.12	ft
Critical Depth	0.99	ft
Critical Slope	0.09283	ft/ft
Velocity	4.07	ft/s
Velocity Head	0.26	ft
Specific Energy	1.52	ft
Froude Number	0.68	
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	1.27	ft
Critical Depth	0.99	ft
Channel Slope	0.04000	ft/ft
Critical Slope	0.09283	ft/ft

Pond 5 Spillway

Messages

Notes	12" riprap n=0.078 grouted riprap n=0.012

El PASO COUNTY - MARKSHEFFEL ROAD
POND SPILLWAY RIPRAP SIZING

	Pond 1	Pond 2	Pond 3	Pond 4	Pond 5
Weir crest length (ft)	20	22	22	32	32
Rundown Slope (ft/ft)	0.069	0.13	0.07	0.04	0.04
Q cfs	151	63	193	211	191
n	0.078	0.078	0.078	0.078	0.078
Velocity (from Flowmaster, ft/s)	5.02	4.42	5.36	4.21	4.07
Normal depth (from Flowmaster, ft)	1.21	0.59	1.32	1.34	1.27
Fr	0.88	1.07	0.9	0.69	0.68
Riprap sizing parameter	2.44	2.40	2.59	1.86	1.81
Riprap size determined	VL	VL	VL	VL	VL

All of velocities are less than the 5.5 ft/s requirement in UDFCD major drainage chapter, section 7.3
Minimum length of protection downstream of culverts is 3*diameter, max is 10* diameter
Using estimated maximum depth of 2 ft, use downstream riprap pad 20 ft long
Extend out from weir crest at 15 degree angle (plan view)

El PASO COUNTY - MARKSHEFFEL ROAD
WQCV OUTLET LOW TAILWATER BASIN RIPRAP DESIGN

	Pond 1	
Pipe Diameter (in)	18	
Pipe Slope %	1.15	
Afull ft2	1.77	
Rfull ft	0.38	
Qfull cfs	11.3	
Vfull ft/s	6.4	
Qdesign	0.30	
Q/Qfull	0.03	
d/D (from UDFCD Fig HS-20a)	0.43	
Q/D2.5	0.11	
d/D (from UDFCD Fig HS-20b)	0.26	
d	0.39	
A/Afull (from UDFCD Fig HS-20a)	0.20	
A ft2	0.35	
V ft/s	0.85	
Pd	3.64	
Riprap Type (from UDFCD Fig HS-20c)	L	9"
T ft (minimum thickness)	1.31	
L1 ft	6	
L2 ft	0.52	
L Design ft (length)	6	
W ft (width)	6	
B ft (cutoff wall depth)	2.06	

Riprap Pad for Ponds 1,2,4,5
1.5 ft thick
Type L
6ft wide, 6ft long
3 ft cutoff wall

(Pond 3 discharges to spillway)

El PASO COUNTY - MARKSHEFFEL ROAD
CULVERT AND STORM SEWER OUTLET PROTECTION

Rip rap pad - designed using UDFCD DCM Ch Major Drainage, Section 7

Structure	Size	D(ft)	Slope %	Q100	Flow Type	Q/D^2.5	Normal Depth ft	Supercritical Correction Da	Q/D^1.5	Tailwater ft	Y/D	UDFCD Fig MD-21 Rock Size	d50	UDFCD Fig MD-23 1/2tanT	Lp	Check 3D	Check 10D	Lp	Cutoff Wall Depth B
280-F2	54"	4.5	1	191	Supercritical	4.4	2.7	3.58	28.2	3.6	1.01	L	9	4.1	21	13.5	45	24	3.75
300-F1	76"x48"	4	0.5	211	Subcritical	6.6	3.5		26.4	3.6	0.90	L	9	4.1	27	12	40	26	3.5
344-F1	54"	4.5	0.68	193	Subcritical	4.5	2.9		20.2	2.4	0.53	H	18	4.8	49	13.5	45	45	5.25
444-F2	36"	3	0.82	63	Subcritical	4.0	2.6		12.1	2.9	0.97	L	9	6.7	6	9	30	9	3
465-F2	54"	4.5	0.53	151	Subcritical	3.5	3.0		15.8	3.8	0.84	L	9	6.7	18	13.5	45	20	3.75

Low Tailwater Basins

	HERCP 30x19 308-F2	426-F2	428-F2
Pipe Diameter (in)	19	18	18
Pipe Slope %	1	1.55	1.67
Afull ft2	3.28	1.77	1.77
Rfull ft	0.52	0.38	0.38
Qfull cfs	24.4	13.1	13.6
Vfull ft/s	7.4	7.4	7.7
Qdesign	20	7	2
Q/Qfull	0.82	0.53	0.15
d/D (from UDFCD Fig HS-20a)	0.8	0.3	0.56
Q/D2.5	6.34	2.54	0.73
d/D (from UDFCD Fig HS-20b)	0.88	0.3	0.55
d	1.27	0.45	0.825
A/Afull (from UDFCD Fig HS-20a)	0.83	0.25	0.56
A ft2	2.72	0.44	0.99
V ft/s	7.35	15.84	2.02
Pd	9.73	16.30	5.54
Riprap Type (ftom UDFCD Fig HS-20c)	L	L	L
T ft (minimum thickness)	1.31	1.31	1.31
L1 ft	6.33	6	6
L2 ft	4.62	9.70	1.24
L Design ft (length)	6.33	9.7029	6
W ft (width)	6.33	6	6
B ft (cutoff wall depth)	2.10	2.06	2.06

	343-H2
Box Width (ft)	10
Box Height (ft)	6
Pipe Slope %	0.7
Afull ft2	60.00
Rfull ft	1.88
Qfull cfs	874.9
Vfull ft/s	14.6
Qdesign	491.00
Q/Qfull	0.56
d/H (from UDFCD Fig HS-20a)	0.66
Q/(wH^1.5)	3.34
d/H (from UDFCD Fig HS-20b)	0.58
d	3.48
A/Afull (from UDFCD Fig HS-20a)	0.58
A ft2	34.80
V ft/s	14.11
Pd	17.64
Riprap Type (ftom UDFCD Fig HS-20c)	L
T ft (minimum thickness)	1.31
L1 ft	24
L2 ft	17.28
L Design ft (length)	24
W ft (width)	24
B ft (cutoff wall depth)	4.31

Proposed On-site Basin Hydrology and Stormdrain Reports

(Inroads Storm and Sanitary)

Drainage Reports

Element Type: Area

Date: Friday, April 18, 2008 11:06:26 AM

Drainage Data File: MS-10YR-NORTH

ID	AttachTo	Peak (cfs)	RunoffCoef	Intensity (in/h)	TimeofConc (min)	Area (ac)
A33L1	33L1	1.97	0.90	5.83	5.00	0.37
A343R1	343R1	9.32	0.75	5.83	5.00	2.13
A344L1	344L1	9.32	0.75	5.83	5.00	2.13
A347L1	347L1	6.69	0.75	5.83	5.00	1.53
A347R1	347R1	6.71	0.75	5.83	5.00	1.53
A34L1	34L1	2.10	0.90	5.83	5.00	0.40
A34R1	34R1	3.40	0.90	5.83	5.00	0.65
A359L1	359L1	6.31	0.75	5.83	5.00	1.44
A359R1	359R1	6.28	0.75	5.83	5.00	1.44
A363L1	363L1	3.13	0.75	5.83	5.00	0.72
A363R1	363R1	3.16	0.75	5.83	5.00	0.72
A366L1	366L1	6.64	0.90	5.83	5.00	1.26
A366R1	366R1	6.97	0.90	5.83	5.00	1.32
A373L1	373L1	5.78	0.90	5.83	5.00	1.10
A373R1	373R1	7.07	0.90	5.83	5.00	1.34
A379R1	379R1	1.90	0.90	5.83	5.00	0.36
A380L1	380L1	1.76	0.90	5.83	5.00	0.33
A380R1	380R1	1.13	0.90	5.83	5.00	0.21
A382L1	382L1	4.26	0.90	5.83	5.00	0.81
A382R1	382R1	2.84	0.90	5.83	5.00	0.54
A386L1	386L1	9.96	0.90	5.83	5.00	1.89
A386R1	386R1	8.01	0.75	5.83	5.00	1.83
A396L1	396L1	2.45	0.75	5.83	5.00	0.56
A396R1	396R1	2.51	0.75	5.83	5.00	0.57
A399L1	399L1	4.04	0.75	5.83	5.00	0.92
A399R1	399R1	4.10	0.75	5.83	5.00	0.94
A404L1	404L1	7.69	0.75	5.83	5.00	1.76
A404R1	404R1	9.87	0.90	5.83	5.00	1.87
A413L1	413L1	4.14	0.90	5.83	5.00	0.79
A413R1	413R1	3.22	0.90	5.83	5.00	0.61
A417R1	417R1	3.37	0.90	5.83	5.00	0.64

A420L1	420L1	0.35	0.90	5.83	5.00	0.07
A420L2	420L2	3.72	0.90	5.83	5.00	0.71
A420R1	420R1	2.59	0.90	5.83	5.00	0.49
A424L1	424L1	10.52	0.90	5.83	5.00	2.00
A424R1	424R1	8.88	0.90	5.83	5.00	1.69
A42L1	42L1	1.15	0.90	5.83	5.00	0.22
A441L1	441L1	5.80	0.75	5.83	5.00	1.33
A441R1	441R1	5.82	0.75	5.83	5.00	1.33
A444L1	444L1	5.36	0.75	5.83	5.00	1.23
A444R1	444R1	5.35	0.75	5.83	5.00	1.22
A447L1	447L1	7.64	0.75	5.83	5.00	1.75
A447R1A	447R1	7.04	0.75	5.83	5.00	1.61
A45R1	45R1	2.22	0.90	5.83	5.00	0.42
A463R1	463R1	7.13	0.90	5.83	5.00	1.35
A464L1	464L1	7.10	0.90	5.83	5.00	1.35
A464R1	464R1	3.54	0.90	5.83	5.00	0.67
A465L1	465L1	2.64	0.90	5.83	5.00	0.50
A466L1	466L1	8.65	0.90	5.83	5.00	1.64
A466R1	468R1	8.99	0.90	5.83	5.00	1.71
OD-D	420R2	9.49	0.54	3.36	20.30	5.24
OS-C	P444F1	13.56	0.54	3.77	16.20	6.67
OS-E1	417R2	5.19	0.90	5.83	5.00	0.99
OS-E2	413R2	3.07	0.54	4.26	12.40	1.34
OS-G	396R2	19.56	0.30	3.00	25.00	21.73
OS-H1	382R2	10.63	0.21	2.98	25.30	16.99
OS-H2	380R2	1.36	0.21	5.83	5.00	1.11
OS-I	370R1	7.49	0.15	2.76	28.80	18.08
OS-J1	359R2	13.06	0.21	2.03	47.41	30.61

Number of items reported: 59

Network Outfall Report

Date: Friday, April 18, 2008 11:11:22 AM

Drainage Data File: MS-10YR-NORTH

Inlets: 427R1

Inlet ID	Clogging (%)	Capacity (cfs)	(cfs)	QGrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
427R1	50	1.00	0.00	0.000	6.4	0.11	100.0	6790.70	2.92	0.0000	0.0200

Pipes: P427R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P427R1	18	0.0050	21	6786.08	6785.97	1.00	7.43	2.93	6786.45	6786.34	0.013

Manholes: 427M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
427M1	4.00	6785.97 (W)	6785.87 (S)	6791.07	1.00

Pipes: P427M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P427M1	18	0.0233	316	6785.87	6778.53	1.00	16.02	5.05	6786.12	6778.78	0.013

Inlets: 424L1

Inlet ID	Clogging (%)	Capacity (cfs)	(cfs)	QGrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
424L1	20	8.98	10.52	0.000	14.5	0.42	85.3	6784.61	15.00	0.0207	0.0200

Pipes: P424L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N

P424L1	18	0.0050	99	6779.02	6778.53	8.98	7.43	5.08	6780.77	6780.03	0.013

Inlets: 424R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
424R1	20	8.05	8.88	0.000	13.6	0.40	90.7	6784.54	15.00	0.0200	0.0200

Pipes: P424R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P424R1	18	0.0050	35	6779.50	6779.32	8.05	7.43	4.56	6781.05	6780.82	0.013

Manholes: 424M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
424M1	5.00	6778.53 (N) 6779.32 (E) 6778.53 (W)	6778.03 (S)	6785.40	17.76

Pipes: P424M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P424M1	24	0.0200	339	6778.03	6771.25	17.76	31.99	10.45	6779.09	6772.31	0.013

Inlets: 420L2

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
420L2	20	4.54	3.72	0.000	10.8	0.34	86.4	6778.20	10.00	0.0200	0.0200

Pipes: P420L2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N

P420L2	24	0.0050	11	6771.65	6771.59	4.54	16.00	4.38	6772.38	6772.32	0.013

Inlets: 420L1

Inlet ID	Clogging (%)	Capacity (cfs)	Q (cfs)	GrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
420L1	20	1.06	0.35	0.000	4.5	0.22	100.0	6777.73	15.00	0.0200	0.0200

Pipes: P420L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P420L1	24	0.0050	102	6771.39	6770.88	5.60	15.99	4.64	6772.21	6771.70	0.013

Inlets: 420R2

Inlet ID	Clogging (%)	Capacity (cfs)	Q (cfs)	GrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
420R2	50	9.49	9.49	0.000	6.9	0.57	100.0	6773.20	2.92	0.0000	0.1667

Pipes: P420R2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P420R2	24	0.0100	36	6770.00	6769.64	9.49	22.62	6.88	6770.90	6770.54	0.013

Inlets: 420R1

Inlet ID	Clogging (%)	Capacity (cfs)	Q (cfs)	GrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
420R1	20	3.42	2.59	0.000	8.9	0.30	100.0	6777.80	15.00	0.0200	0.0200

Pipes: P420R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N

P420R1	24	0.0088	35	6769.54	6769.23	11.43	21.23	6.88	6770.58	6770.27	0.013

Manholes: 420M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
420M1	5.00	6771.25 (N) 6769.23 (E) 6770.88 (W)	6769.23 (S)	6778.58	25.38

Pipes: P420M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P420M1	30	0.0100	164	6769.23	6767.59	25.38	41.02	8.80	6770.65	6769.01	0.013

Inlets: 45R1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
45R1	20	2.22	2.22	0.000	2.5	0.17	100.0	6774.40	10.00	0.0000	0.0100

Pipes: P45R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P45R1	18	0.0100	66	6769.81	6769.15	2.22	10.50	4.72	6770.28	6769.62	0.013

Inlets: 42L1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
42L1	20	1.96	1.96	0.000	5.4	0.23	99.9	6772.35	10.00	0.0400	0.0200

Pipes: P42L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P42L1	18	0.0050	188	6769.34	6768.40	1.96	7.43	3.55	6769.86	6768.93	0.013

Manholes: 418M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
418M1	5.00	6767.59 (N) 6769.15 (E) 6768.40 (W)	6767.09 (S)	6775.35	27.58

Pipes: P418M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P418M1	36	0.0080	202	6767.09	6765.47	27.58	59.66	8.27	6768.52	6766.90	0.013

Inlets: 417R2

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
417R2	50	5.19	5.19	0.000	4.6	0.38	100.0	6772.15	2.92	0.0000	0.1667

Pipes: P417R2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P417R2	18	0.0100	10	6768.15	6768.05	5.19	10.50	5.93	6768.90	6768.79	0.013

Inlets: 417R1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
417R1	0	3.37	3.37	0.000	11.3	0.35	100.0	6772.48	10.00	0.0067	0.0200

Pipes: P417R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P417R1	18	0.0101	36	6767.95	6767.59	8.55	10.53	6.64	6768.98	6768.62	0.013

Manholes: 417M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
417M1	5.00	6765.47 (N) 6767.59 (E)	6765.37 (S)	6773.34	32.13

Pipes: P417M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P417M1	36	0.0080	283	6765.37	6763.10	32.13	59.66	8.60	6766.94	6764.67	0.013

Inlets: 413R2

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
413R2	50	3.07	3.07	0.000	3.2	0.27	100.0	6770.23	2.92	0.0000	0.1667

Pipes: P413R2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P413R2	18	0.0100	10	6766.04	6765.94	3.07	10.50	5.16	6766.60	6766.50	0.013

Inlets: 413R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
413R1	20	3.22	3.22	0.000	11.1	0.35	100.0	6770.55	10.00	0.0067	0.0200

Pipes: P413R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P413R1	18	0.0200	35	6765.84	6765.14	5.42	14.86	7.75	6766.47	6765.76	0.013

Inlets: 413L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
413L1	20	4.14	4.14	0.000	12.4	0.37	100.0	6770.55	15.00	0.0067	0.0200

Pipes: P413L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P413L1	18	0.0200	102	6765.55	6763.51	4.14	14.86	7.20	6766.09	6764.05	0.013

Manholes: 413M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
413M1	5.00	6763.10 (N) 6765.14 (E) 6763.51 (W)	6763.00 (S)	6771.41	38.13

Pipes: P413M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P413M1	36	0.0081	495	6763.00	6759.00	38.13	59.95	8.99	6764.74	6760.74	0.013

Manholes: 408M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
408M1	5.00	6759.00 (N)	6758.90 (S)	6766.92	37.28

Pipes: P408M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P408M1	36	0.0366	486	6758.90	6741.10	37.28	127.64	15.67	6760.01	6742.21	0.013

Inlets: 404L1

Inlet ID	Clogging (%)	Capacity (cfs)	Q	GrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
404L1	20	6.46	7.69	0.000	10.1	0.33	84.0	6746.77	15.00	0.0580	0.0200

Pipes: P404L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P404L1	18	0.0050	65	6742.06	6741.74	6.46	7.43	4.73	6743.30	6742.98	0.013

Inlets: 404L2

Inlet ID	Clogging (%)	Capacity (cfs)	Q	GrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
404L2	20	0.00	0.00	0.000	0.0	0.00	0.0	6745.90	2.92	0.0100	0.0200

Pipes: P404L2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P404L2	18	0.0050	34	6741.64	6741.47	6.39	7.43	4.73	6742.89	6742.71	0.013

Inlets: 404R1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
404R1	20	7.53	9.87	0.000	11.3	0.35	76.3	6746.63	15.00	0.0582	0.0200

Pipes: P404R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P404R1	18	0.0050	26	6741.92	6741.79	7.53	7.43	4.26	6743.22	6743.07	0.013

Manholes: 404M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
404M1	5.00	6741.10 (N) 6741.79 (E) 6741.47 (W)	6741.00 (S)	6747.34	44.32

Pipes: P404M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P404M1	36	0.0596	496	6741.00	6711.50	44.32	162.79	19.60	6742.07	6712.57	0.013

Inlets: 399L1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
399L1	20	5.03	4.04	0.000	8.7	0.30	95.4	6717.28	15.00	0.0500	0.0200

Pipes: P399L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P399L1	18	0.0050	101	6712.57	6712.06	5.03	7.43	4.51	6713.76	6713.25	0.013

Inlets: 399R1

Inlet ID	Clogging (%)	Capacity (cfs)	Q	GrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
399R1	20	5.83	4.10	0.000	9.6	0.32	90.6	6717.16	15.00	0.0500	0.0200

Pipes: P399R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P399R1	18	0.0050	26	6712.45	6712.32	5.83	7.43	4.65	6713.68	6713.54	0.013

Manholes: 399M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
399M1	5.00	6711.50 (N) 6712.32 (E) 6712.06 (W)	6711.40 (S)	6717.87	49.67

Pipes: P399M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P399M1	36	0.0428	302	6711.40	6698.50	49.67	137.97	17.92	6712.64	6699.74	0.013

Inlets: 396R2

Inlet ID	Clogging (%)	Capacity (cfs)	Q	GrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
396R2	50	19.56	19.56	0.000	7.7	0.64	100.0	6703.00	2.92	0.0000	0.1667

Pipes: P396R2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P396R2	30	0.0100	41	6699.00	6698.59	19.56	41.02	8.26	6700.22	6699.80	0.013

Inlets: 396R1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
396R1	20	3.11	2.51	0.000	8.5	0.30	100.0	6706.61	15.00	0.0200	0.0200

Pipes: P396R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P396R1	30	0.0100	25	6698.49	6698.24	21.11	41.02	8.42	6699.76	6699.51	0.013

Inlets: 396L1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
396L1	20	2.69	2.45	0.000	8.0	0.29	100.0	6706.65	15.00	0.0192	0.0200

Pipes: P396L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P396L1	18	0.0200	100	6701.46	6699.46	2.69	14.86	6.38	6701.90	6699.89	0.013

Manholes: 396M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
396M1	7.00	6698.50 (N) 6698.24 (E) 6699.46 (W)	6698.00 (S)	6707.30	70.50

Pipes: P396M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P396M1	42	0.0200	487	6698.00	6688.26	70.50	142.28	14.75	6699.74	6690.00	0.013

Manholes: 391M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
391M1	6.00	6688.26 (N)	6688.16 (S)	6700.88	69.59

Pipes: P391M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P391M1	42	0.0291	380	6688.16	6677.10	69.59	171.61	16.90	6689.71	6678.65	0.013

Inlets: 387R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
387R1	50	0.00	0.00	0.000	0.0	0.00	0.0	6685.27	2.92	0.0005	0.0200

Pipes: P387R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P387R1	18	0.0100	25	6680.00	6679.75	0.00	0.00	0.00	0.00	0.00	0.013

Manholes: 387M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
387M1	6.00	6677.10 (N) 6679.75 (W)	6676.91 (S)	6685.43	68.99

Pipes: P387M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P387M1	42	0.0330	108	6676.91	6673.34	68.99	182.69	17.66	6678.41	6674.83	0.013

Inlets: 386L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
386L1	20	7.99	9.96	0.000	12.3	0.37	80.2	6680.05	15.00	0.0396	0.0200

Pipes: P386L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P386L1	18	0.0050	97	6675.34	6674.86	7.99	7.41	4.52	6676.94	6676.36	0.013

Inlets: 386R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
386R1	20	6.93	8.01	0.000	11.1	0.35	86.6	6679.84	15.00	0.0407	0.0200

Pipes: P386R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P386R1	18	0.0050	33	6674.61	6674.44	6.93	7.43	4.78	6675.88	6675.70	0.013

Manholes: 386M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
386M1	6.00	6673.34 (N) 6674.44 (E) 6674.86 (W)	6673.24 (S)	6680.69	76.31

Pipes: P386M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P386M1	42	0.0330	369	6673.24	6661.07	76.31	182.77	18.14	6674.82	6662.65	0.013

Inlets: 382R2

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
382R2	50	10.63	10.63	0.000	4.7	0.40	100.0	6667.32	2.92	0.0000	0.1667

Pipes: P382R2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P382R2	24	0.0050	11	6662.75	6662.69	10.63	16.00	3.38	6664.76	6664.42	0.013

Inlets: 382R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
382R1	20	3.91	2.84	0.000	8.7	0.30	100.0	6667.64	15.00	0.0285	0.0200

Pipes: P382R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P382R1	24	0.0050	35	6662.59	6662.42	12.62	16.00	5.64	6664.24	6664.06	0.013

Inlets: 382L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
382L1	20	6.00	4.26	15.000	10.8	0.34	96.3	6667.66	15.00	0.0288	0.0200

Pipes: P382L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P382L1	18	0.0050	102	6663.04	6662.54	6.00	7.43	4.68	6664.28	6663.76	0.013

Manholes: 382M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
382M1	6.00	6661.07 (N) 6662.42 (E) 6662.54 (W)	6660.97 (S)	6668.51	91.05

Pipes: P383M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P383M1	42	0.0330	133	6660.97	6656.59	91.05	182.77	18.98	6662.72	6658.34	0.013

Inlets: 380R2

Inlet ID	Clogging (%)	Capacity (cfs)	Q (cfs)	GrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
380R2	50	1.36	1.36	0.000	1.7	0.14	100.0	6663.45	2.92	0.0000	0.1667

Pipes: P380R2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P380R2	18	0.0050	10	6659.10	6659.05	1.36	7.43	3.20	6660.07	6660.02	0.013

Inlets: 380R1

Inlet ID	Clogging (%)	Capacity (cfs)	Q (cfs)	GrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
380R1	20	1.13	1.13	15.000	4.1	0.21	100.0	6663.87	15.00	0.0287	0.0200

Pipes: P380R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P380R1	18	0.0050	35	6658.85	6658.67	2.48	7.43	3.78	6659.91	6659.72	0.013

Inlets: 380L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
380L1	20	1.99	1.76	0.000	6.0	0.25	100.0	6663.73	15.00	0.0290	0.0200

Pipes: P380L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P380L1	18	0.0050	102	6658.98	6658.47	1.99	7.40	3.55	6659.51	6659.00	0.013

Manholes: 380M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
380M1	6.00	6656.59 (N) 6658.67 (E) 6658.47 (W)	6656.50 (S)	6664.53	93.04

Pipes: P380M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P380M1	42	0.0416	156	6656.50	6650.01	93.04	205.11	20.80	6658.15	6651.66	0.013

Inlets: 33L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
33L1	20	1.97	1.97	0.000	4.4	0.21	100.0	6656.59	5.00	0.0000	0.0200

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P296M1	24	0.0050	296	6511.59	6510.11	4.86	16.00	4.47	6512.35	6510.87	0.013

Inlets: 293L1

Inlet ID	Clogging (%)	Capacity (cfs)	Q (cfs)	GrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
293L1	20	2.54	2.54	15.000	9.3	0.31	100.0	6517.95	10.00	0.0091	0.0200

Pipes: P293L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P293L1	18	0.0200	76	6513.26	6511.74	2.54	14.86	6.28	6513.67	6512.16	0.013

Inlets: 293R2

Inlet ID	Clogging (%)	Capacity (cfs)	Q (cfs)	GrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
293R2	50	0.00	0.00	0.000	0.0	0.00	0.0	6515.29	2.92	0.0000	0.1250

Pipes: P293R2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P293R2	18	0.0100	23	6511.64	6511.41	2.52	10.50	4.88	6512.14	6511.91	0.013

Inlets: 293R1

Inlet ID	Clogging (%)	Capacity (cfs)	Q (cfs)	GrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
293R1	20	2.43	2.43	15.000	10.4	0.34	100.0	6515.03	10.00	0.0050	0.0200

Pipes: P293R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N

P293R1	18	0.0100	27	6510.33	6510.06	2.43	10.50	4.83	6510.82	6510.55	0.013

Manholes: 293M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
293M1	4.00	6510.11 (N) 6510.06 (E) 6511.41 (W)	6509.83 (S)	6515.72	9.25

Pipes: P293M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P293M1	24	0.0130	297	6509.83	6505.97	9.25	25.79	7.53	6510.66	6506.80	0.013

Inlets: 290L1

Inlet ID	Clogging (%)	Capacity (cfs)	Q (cfs)	GrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
290L1	20	2.44	2.46	15.000	6.8	0.26	99.4	6511.25	10.00	0.0292	0.0200

Pipes: P290L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P290L1	18	0.0050	102	6506.55	6506.04	2.44	7.43	3.77	6507.60	6507.08	0.013

Inlets: 290R1

Inlet ID	Clogging (%)	Capacity (cfs)	Q (cfs)	GrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
290R1	20	2.38	2.39	15.000	6.9	0.26	99.9	6511.20	10.00	0.0262	0.0200

Pipes: P290R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P290R1	18	0.0050	27	6506.50	6506.36	2.38	7.43	3.74	6507.55	6507.40	0.013

Manholes: 290M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
290M1	4.00	6505.97 (N) 6506.36 (E) 6506.04 (W)	6505.92 (S)	6511.89	13.33

Pipes: P290M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P290M1	24	0.0280	268	6505.92	6498.42	13.33	37.85	11.00	6506.74	6499.23	0.013

Pipes: P287H1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P287H1	48	0.0544	23	6500.00	6498.73	50.25	334.91	19.17	6501.05	6499.77	0.013

Inlets: 287L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
287L1	20	2.48	2.46	15.000	8.5	0.30	100.0	6504.70	10.00	0.0125	0.0200

Pipes: P287L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P287L1	48	0.0050	100	6498.75	6498.25	52.19	101.57	8.14	6500.78	6500.28	0.013

Inlets: 287R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
287R1	20	2.47	2.47	15.000	8.5	0.30	100.0	6504.70	10.00	0.0125	0.0200

Pipes: P287R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P287R1	18	0.0100	25	6500.00	6499.74	2.47	10.50	4.86	6500.49	6500.24	0.013

Manholes: 287M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
287M1	7.00	6498.42 (N) 6499.74 (E) 6498.25 (W)	6498.15 (S)	6505.39	65.38

Pipes: P287M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P287M1	42	0.0150	389	6498.16	6492.31	65.38	123.22	13.00	6499.97	6494.13	0.013

Inlets: 283L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
283L1	20	3.47	3.49	15.000	10.1	0.33	99.7	6502.18	10.00	0.0117	0.0200

Pipes: P28311

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P28311	18	0.0100	102	6497.48	6496.46	3.47	10.50	5.33	6498.07	6497.06	0.013

Inlets: 283R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
283R1	20	3.48	3.50	15.000	10.1	0.33	99.6	6502.18	10.00	0.0119	0.0200

Pipes: P283R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P283R1	18	0.0200	26	6497.49	6496.97	3.48	14.86	6.86	6497.98	6497.47	0.013

Manholes: 283M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
283M1	6.00	6492.31 (N) 6496.97 (E) 6496.46 (W)	6492.21 (S)	6502.87	69.55

Pipes: P283M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P283M1	42	0.0150	244	6492.21	6488.56	69.55	123.04	13.18	6494.09	6491.62	0.013

Inlets: 281L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
281L1	50	0.00	0.00	0.000	0.0	0.00	0.0	6497.00	2.92	0.0000	0.1667

Pipes: P281R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P281R1	18	0.0101	38	6491.97	6491.59	0.00	0.00	0.00	0.00	0.00	0.013

Manholes: 281M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
281M1	6.00	6488.56 (N) 6491.59 (W)	6488.42 (S)	6497.59	69.55

Pipes: P281M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P281M1	48	0.0225	62	6488.42	6487.02	68.73	215.46	5.47	6491.56	6490.68	0.013

Pipes: P280H1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P280H1	42	0.0119	16	6488.80	6488.61	40.20	109.75	4.18	6491.79	6491.73	0.013

Inlets: 280L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
280L1	30	3.24	3.22	0.000	8.2	0.29	100.0	6495.52	15.00	0.0241	0.0200

Pipes: P280L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P280L1	42	0.0150	106	6488.61	6487.02	42.74	123.22	4.44	6491.64	6490.57	0.013

Manholes: 280M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
280M1	8.00	6487.02 (N) 6487.02 (W)	6486.92 (E)	6495.90	109.57

Pipes: P280M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P280M1	48	0.0169	25	6486.92	6486.50	109.57	186.48	8.72	6490.25	6490.08	0.013

Inlets: 280R1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
280R1	20	3.24	3.24	15.000	8.2	0.29	100.0	6495.22	15.00	0.0243	0.0200

Pipes: P280R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P280R1	54	0.0100	125	6483.25	6482.00	111.93	196.88	8.21	6486.85	6485.60	0.013

Number of items reported: 44

Network Outfall Report

Date: Wednesday, April 30, 2008 5:32:21 PM

Drainage Data File: MS-10YR-SOUTH

Inlets: 330L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
330L1	20	3.81	4.30	0.000	9.1	0.31	88.6	6576.08	10.00	0.0279	0.0200

Pipes: P330L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P330L1	18	0.0050	16	6571.09	6571.02	3.81	7.43	2.15	6572.55	6572.31	0.013

Inlets: 330L2

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
330L2	20	0.49	0.00	0.000	1.9	0.16	100.0	6575.37	10.00	0.0279	0.0200

Pipes: P330L2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P330L2	18	0.0050	69	6570.93	6570.58	4.28	7.43	4.35	6572.07	6571.73	0.013

Inlets: 330L4

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
330L4	50	0.00	0.00	0.000	0.0	0.00	0.0	6573.30	2.92	0.0000	0.1000

Pipes: P330L4

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P330L4	18	0.0100	44	6569.30	6568.86	0.00	0.00	0.00	0.00	0.00	0.013

Inlets: 330L5

Inlet ID	Clogging (%)	Capacity (cfs)	Q (cfs)	GrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
330L5	20	0.00	0.00	0.000	0.0	0.00	0.0	6574.66	2.92	0.0278	0.1000

Pipes: P330L5

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P330L5	18	0.0050	30	6568.76	6568.61	4.23	7.43	4.34	6569.92	6569.76	0.013

Inlets: 330R2

Inlet ID	Clogging (%)	Capacity (cfs)	Q (cfs)	GrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
330R2	20	3.80	4.28	0.000	9.1	0.31	88.7	6576.11	10.00	0.0279	0.0200

Pipes: P330R2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P330R2	18	0.0050	13	6571.12	6571.06	3.80	7.43	2.15	6572.60	6572.36	0.013

Inlets: 330R1

Inlet ID	Clogging (%)	Capacity (cfs)	Q (cfs)	GrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
330R1	20	0.49	0.00	0.000	1.9	0.15	100.0	6575.47	10.00	0.0279	0.0200

Pipes: P330R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P330R1	18	0.0050	30	6570.97	6570.82	4.27	7.43	4.35	6572.13	6571.97	0.013

Manholes: 330M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
330M1	5.00	6570.82 (E) 6568.61 (W)	6568.53 (S)	6576.23	8.39

Pipes: P330M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P330M1	18	0.0323	246	6568.53	6560.58	8.39	18.88	10.37	6569.23	6561.28	0.013

Inlets: 23L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate	Cover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
23L1	50	9.30	9.30	0.000	3.1	0.39	100.0	6566.00	2.92	0.0000	0.2500

Pipes: P23L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P23L1	24	0.0050	37	6562.00	6561.82	9.30	16.00	2.96	6564.00	6563.58	0.013

Inlets: 22L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate	Cover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
22L1	20	4.93	5.12	0.000	17.8	0.29	96.3	6571.32	15.00	0.0249	0.0081

Pipes: P22L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P22L1	18	0.0100	87	6565.95	6565.08	4.93	10.50	5.85	6567.13	6566.25	0.013

Manholes: 23M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
23M1	4.00	6561.82 (NE) 6565.08 (W)	6561.72 (S)	6570.64	12.13

Pipes: P23M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P23M1	24	0.0050	41	6561.72	6561.52	12.13	16.00	5.60	6563.36	6563.14	0.013

Inlets: 23L2

Inlet ID	Clogging (%)	Capacity (cfs)	Q (cfs)	GrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
23L2	20	2.69	2.50	0.000	16.0	0.21	100.0	6570.21	10.00	0.0000	0.0087

Pipes: P23L2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P23L2	30	0.0050	74	6561.42	6561.05	13.64	29.00	5.82	6562.63	6562.26	0.013

Inlets: 23L3

Inlet ID	Clogging (%)	Capacity (cfs)	Q (cfs)	GrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
23L3	20	6.30	6.30	0.000	16.2	0.41	100.0	6569.06	15.00	0.0072	0.0169

Pipes: P23L3

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P23L3	30	0.0051	190	6560.95	6559.99	17.19	29.23	6.19	6562.33	6561.36	0.013

Manholes: 328M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
328M1	5.00	6560.58 (N) 6559.99 (W)	6559.41 (S)	6569.23	21.83

Pipes: P328M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P328M1	30	0.0173	405	6559.41	6552.40	21.83	53.94	10.41	6560.51	6553.51	0.013

Inlets: 324R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
324R1	20	6.73	6.73	0.000	13.7	0.40	99.9	6558.94	15.00	0.0111	0.0200

Pipes: P324R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P324R1	18	0.0050	30	6554.94	6554.79	6.73	7.43	4.76	6556.20	6556.04	0.013

Inlets: 324L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
324L1	20	5.46	5.46	0.000	12.4	0.38	100.0	6558.84	15.00	0.0114	0.0200

Pipes: P324L1

Pipe ID	Diam.	Slope	Length	Inv. In	Inv. Out	Total Flow	Capacity	Velocity	Entrance HGL	Exit HGL	Mannings N

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P324L1	18	0.0050	102	6554.84	6554.33	5.46	7.43	4.59	6556.05	6555.53	0.013

Manholes: 324M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
324M1	5.00	6552.40 (N) 6554.79 (E) 6554.33 (W)	6552.30 (S)	6559.70	28.28

Pipes: P324M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P324M1	30	0.0160	594	6552.30	6542.80	28.28	51.87	10.79	6553.62	6544.12	0.013

Pipes: P318F1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P318F1	36	0.0100	97	6543.92	6542.95	38.69	66.70	9.78	6545.56	6544.59	0.013

Inlets: 318L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate	Cover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
318L1	20	5.64	5.68	0.000	10.9	0.34	99.2	6553.20	15.00	0.0229	0.0200

Pipes: P318L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P318L1	36	0.0100	73	6542.85	6542.12	41.29	66.70	9.93	6544.56	6543.82	0.013

Inlets: 318R2

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
318R2	20	0.00	0.00	0.000	0.0	0.00	0.0	6550.87	2.92	0.0268	0.1000

Pipes: P318R2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P318R2	36	0.0100	20	6542.02	6541.82	41.18	66.70	9.93	6543.73	6543.53	0.013

Inlets: 318R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
318R1	20	5.86	5.99	0.000	10.8	0.34	97.8	6550.42	15.00	0.0258	0.0200

Pipes: P318R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P318R1	18	0.0100	29	6546.43	6546.14	5.86	10.50	6.10	6547.23	6546.94	0.013

Manholes: 318M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
318M1	7.00	6542.80 (N) 6546.14 (E) 6541.82 (W)	6541.00 (S)	6551.19	68.23

Pipes: P318M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P318M1	42	0.0201	593	6541.00	6529.10	68.23	142.49	14.65	6542.71	6530.81	0.013

Inlets: 312L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
312L1	20	5.06	5.02	0.000	11.0	0.35	100.0	6536.40	15.00	0.0171	0.0200

Pipes: P312L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P312L1	18	0.0100	97	6532.40	6531.43	5.06	10.50	5.89	6533.13	6532.17	0.013

Inlets: 312R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
312R1	20	5.07	4.93	0.000	11.0	0.35	100.0	6536.30	15.00	0.0173	0.0200

Pipes: P312R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P312R1	18	0.0100	35	6532.30	6531.95	5.07	10.50	5.89	6533.03	6532.69	0.013

Manholes: 312M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
312M1	6.00	6529.10 (N) 6531.95 (E) 6531.43 (W)	6529.00 (S)	6537.16	72.01

Pipes: P312M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P312M1	42	0.0170	279	6529.00	6524.24	72.01	131.33	13.96	6530.85	6526.09	0.013

Inlets: 309R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
309R1	50	0.00	0.00	0.000	0.0	0.00	0.0	6531.57	2.92	0.0000	0.1000

Pipes: P309R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P309R1	18	0.0100	23	6526.57	6526.34	0.00	0.00	0.00	0.00	0.00	0.013

Manholes: 309M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
309M1	6.00	6524.24 (N) 6526.34 (W)	6524.14 (S)	6532.26	72.01

Pipes: P309M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P309M1	42	0.0247	53	6524.14	6522.82	71.56	158.17	16.03	6525.79	6524.47	0.013

Inlets: 308L2

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
308L2	50	11.24	11.24	0.000	13.7	0.41	100.0	6530.04	2.92	0.0000	0.0902

Pipes: P308L2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P308L2	24	0.0100	15	6526.03	6525.88	11.24	22.62	7.19	6527.03	6526.87	0.013

Inlets: 308L1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
308L1	20	3.53	3.53	0.000	9.3	0.31	100.0	6530.47	15.00	0.0172	0.0200

Pipes: P308L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P308L1	24	0.0100	96	6525.78	6524.82	14.74	22.62	7.67	6526.95	6525.99	0.013

Inlets: 308R1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
308R1	20	3.29	3.29	0.000	9.1	0.31	100.0	6530.37	15.00	0.0168	0.0200

Pipes: P308R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P308R1	18	0.0100	34	6526.37	6526.03	3.29	10.50	5.25	6526.95	6526.60	0.013

Manholes: 308M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
308M1	7.00	6522.82 (N) 6526.03 (E) 6524.82 (W)	6522.72 (S)	6531.23	79.94

Pipes: P308M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P308M1	48	0.0139	590	6522.72	6514.50	79.94	169.53	13.29	6524.65	6516.43	0.013

Pipes: P302F1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P302F1	48	0.0329	35	6517.70	6516.54	53.45	260.66	16.31	6518.93	6517.77	0.013

Inlets: 302L1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
302L1	20	5.89	5.89	0.000	15.3	0.43	100.0	6522.54	15.00	0.0050	0.0200

Pipes: P302L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P302L1	42	0.0100	99	6516.44	6515.45	58.07	100.61	10.83	6518.35	6517.36	0.013

Inlets: 302R1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
302R1	20	5.73	5.73	0.000	15.1	0.43	100.0	6522.53	15.00	0.0050	0.0200

Pipes: P302R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P302R1	24	0.0100	24	6517.53	6517.29	5.73	22.62	6.01	6518.22	6517.97	0.013

Manholes: 302M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
302M1	9.00	6514.50 (N) 6517.29 (E) 6515.45 (W)	6514.40 (S)	6523.22	115.15

Pipes: P302M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P302M1	76	0.0095	140	6514.40	6513.07	115.15	259.31	12.68	6516.26	6514.93	0.013

Manholes: 301M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
301M1	8.00	6513.07 (N)	6512.97 (SE)	6521.93	115.15

Pipes: P301M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P301M1	76	0.0050	40	6512.97	6512.77	114.73	188.20	10.05	6515.20	6515.00	0.013

Inlets: 299L1

Inlet ID	Clogging (%)	Capacity (cfs)	Q (cfs)	GrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
299L1	30	5.86	5.86	0.400	15.2	0.43	100.0	6521.01	15.00	0.0050	0.0200

Pipes: P299L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P299L1	24	0.0131	77	6517.00	6516.00	5.86	25.86	6.66	6517.65	6516.65	0.013

Inlets: 299R1

Inlet ID	Clogging (%)	Capacity (cfs)	Q (cfs)	GrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
299R1	50	0.00	0.00	0.000	0.0	0.00	0.0	6519.20	2.92	0.0146	0.1000

Pipes: P299R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P299R1	24	0.0193	53	6515.90	6514.88	5.82	31.42	7.64	6516.48	6515.46	0.013

Inlets: 299R2

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length Long. (ft)	Slope (%)	Cross Slope (%)
299R2	30	2.95	2.95	0.000	11.4	0.35	100.0	6518.87	15.00	0.0050	0.0200

Pipes: P299R2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P299R2	30	0.0100	109	6514.78	6513.69	8.12	41.02	1.66	6516.44	6515.88	0.013

Manholes: 300M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
300M1	8.00	6513.69 (S) 6512.77 (NW)	6512.67 (E)	6521.33	119.29

Pipes: P300M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P300M1	76	0.0050	126	6512.67	6512.04	119.29	187.89	6.00	6515.86	6515.60	0.013

Number of items reported: 76

Drainage Reports

Element Type: Area

Date: Thursday, May 01, 2008 12:54:46 PM

Drainage Data File: MS_SOUTH45_100

ID	AttachTo	Peak (cfs)	RunoffCoef	Intensity (in/h)	TimeofConc (min)	Area (ac)
A23L2	23L2	3.78	0.90	8.82	5.00	0.48
A260R1	260R1	8.31	0.95	8.82	5.00	0.99
A261L1	261L1	5.64	0.95	8.82	5.00	0.67
A261R1	261R1	4.51	0.95	8.82	5.00	0.54
A264L1	264L1	7.53	0.95	8.82	5.00	0.90
A264R1	264R1	7.15	0.95	8.82	5.00	0.85
A269L1	269L1	7.32	0.95	8.82	5.00	0.87
A269R2	269R2	7.66	0.95	8.82	5.00	0.91
A274L1	274L1	10.08	0.95	8.82	5.00	1.20
A274R1	274R1	10.05	0.95	8.82	5.00	1.20
A280L1	280L1	5.14	0.95	8.82	5.00	0.61
A280R1	280R1	5.17	0.95	8.82	5.00	0.62
A283L1	283L1	5.55	0.95	8.82	5.00	0.66
A283R1	283R1	5.57	0.95	8.82	5.00	0.66
A287L1	287L1	4.08	0.82	8.82	5.00	0.56
A287R1	287R1	4.08	0.82	8.82	5.00	0.56
A290L1	290L1	4.07	0.82	8.82	5.00	0.56
A290R1	290R1	3.95	0.82	8.82	5.00	0.55
A293L1	293L1	4.21	0.82	8.82	5.00	0.58
A293R1	293R1	4.02	0.82	8.82	5.00	0.56
A296L1	296L1	4.20	0.82	8.82	5.00	0.58
A296R1	296R1	3.94	0.82	8.82	5.00	0.55
A299L1	299L1	4.83	0.95	8.82	5.00	0.58
A299R2	299R2	4.70	0.95	8.82	5.00	0.56
A302L1	302L1	9.39	0.95	8.82	5.00	1.12
A302R1	302R1	9.13	0.95	8.82	5.00	1.09
A308L1	308L1	5.62	0.95	8.82	5.00	0.67
A308R1	308R1	5.23	0.95	8.82	5.00	0.62
A312L1	312L1	8.30	0.82	8.82	5.00	1.15
A312R1	312R1	8.16	0.82	8.82	5.00	1.13
A318L1	318L1	9.05	0.95	8.82	5.00	1.08

A318R1	318R1	9.53	0.95	8.82	5.00	1.14
A324L1	324L1	8.69	0.95	8.82	5.00	1.04
A324R1	324R1	10.72	0.95	8.82	5.00	1.28
A330L1	330L1	7.11	0.82	8.82	5.00	0.98
A330R2	330R2	7.08	0.82	8.82	5.00	0.98
OS-K	23L1	17.41	0.26	5.11	20.00	13.11
OS-L	22L1	8.18	0.95	8.82	5.00	0.98
OS-M	23L3	10.04	0.95	8.82	5.00	1.20
OS-O	P318F1	68.51	0.48	4.25	28.00	33.59
OS-P	308L2	3.60	0.50	8.82	5.00	0.82
OS-Q	308L2	17.66	0.50	8.82	5.00	4.00
OS-R	P302F1	101.01	0.50	7.03	10.00	28.74
OS-S	299L1	5.95	0.80	7.03	10.00	1.06
OS-T	P287H1	10.19	0.80	7.03	10.00	1.81
OS-U	P287H1	16.29	0.80	7.03	10.00	2.90
OS-V	P287H1	60.34	0.80	7.03	10.00	10.73
OS-W	P280H1	68.48	0.80	7.03	10.00	12.18
OS-Y	261R2	38.45	0.50	7.03	10.00	10.94

Number of items reported: 49

Network Outfall Report

Date: Tuesday, March 04, 2008 10:11:55 AM

Drainage Data File: MS_SOUTH45

Inlets: 274L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length Long. (ft)	Slope (%)	Cross Slope (%)
274L1	20	8.61 10.08	0.000	13.8	0.40	84.8	6479.24	15.00	0.0242	0.0200

Pipes: P274L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P274L1	18	0.0050	107	6474.54	6474.01	8.61	7.43	4.87	6476.24	6475.51	0.013

Inlets: 274R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length Long. (ft)	Slope (%)	Cross Slope (%)
274R1	20	8.90 10.05	0.000	14.1	0.41	83.2	6479.34	15.00	0.0242	0.0200

Pipes: P274R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P274R1	18	0.0050	27	6474.64	6474.51	8.90	7.43	5.04	6476.21	6476.01	0.013

Manholes: 274M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
274M1	4.006474.51 (E) 6474.01 (W)	6473.91 (S)		6480.03	17.18

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Pipes: P274M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P274M1	24	0.0210	470	6473.91	6464.04	17.18	32.78	10.56	6474.93	6465.07	0.013

Inlets: 269L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
269L1	20	8.04	7.32	0.000	13.6	0.40	90.8	6468.85	15.00	0.0200	0.0200

Pipes: P269L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P269L1	18	0.0050	76	6464.85	6464.47	8.04	7.43	4.55	6466.95	6466.14	0.013

Inlets: 269R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
269R1	50	3.86	3.85	0.000	6.3	0.31	100.0	6469.44	1.46	0.0000	0.1000

Pipes: P269R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P269R1	18	0.0050	29	6464.36	6464.22	11.73	7.43	6.64	6466.11	6465.72	0.013

Inlets: 269R2

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
269R2	20	8.41	7.66	0.000	13.9	0.41	88.9	6468.95	15.00	0.0200	0.0200

Pipes: P269R2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P269R2	18	0.0050	27	6464.95	6464.82	8.41	7.43	4.76	6466.50	6466.32	0.013

Manholes: 269M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
269M1	4.00	6464.04 (N) 6464.82 (E) 6464.22 (W)	6463.96 (S)	6469.64	35.73

Pipes: P269M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P269M1	30	0.0215	495	6463.96	6453.30	35.73	60.19	12.78	6465.35	6454.69	0.013

Inlets: 264R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
264R1	20	7.66	7.15	0.000	13.3	0.39	93.4	6458.82	15.00	0.0189	0.0200

Pipes: P264R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P264R1	18	0.0195	35	6454.00	6453.31	7.66	14.67	8.39	6454.77	6454.08	0.013

Inlets: 264L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
264L1	20	7.70	7.53	0.000	13.2	0.39	92.3	6458.82	15.00	0.0203	0.0200

Pipes: P264L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P264L1	18	0.0100	102	6454.33	6453.31	7.70	10.50	6.49	6455.29	6454.26	0.013

Manholes: 264M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
264M1	5.00	6453.30 (N) 6453.31 (E) 6453.31 (W)	6453.22 (S)	6459.68	48.71

Pipes: P264M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P264M1	30	0.0207	330	6453.22	6446.40	48.71	58.99	13.43	6454.95	6450.09	0.013

Inlets: 261R2

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
261R2	50	38.45	38.45	0.000	11.2	0.93	100.0	6450.50	2.92	0.0000	0.1667

Pipes: P261R2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P261R2	30	0.0050	17	6445.01	6444.92	38.45	29.00	7.83	6451.28	6451.51	0.013

Inlets: 261R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
261R1	20	5.04	4.51	0.000	9.8	0.32	99.6	6452.08	15.00	0.0282	0.0200

Pipes: P261R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P261R1	36	0.0050	35	6444.92	6444.75	42.41	47.16	6.00	6451.29	6450.35	0.013

Inlets: 261L1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length Long. (ft)	Slope Cross (%)	Slope (%)
261L1	20	6.19	5.64	0.000	11.7	0.36	98.5	6452.08	15.00	0.0200	0.0200

Pipes: P261L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P261L1	18	0.0100	102	6448.08	6447.06	6.19	10.50	3.50	6451.44	6449.93	0.013

Manholes: 261M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
261M1	6.006446.40 6444.75 6447.06	(N)6444.75 (E) (W)	(S)	6452.95	89.37

Pipes: P261M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P261M1	42	0.0070	108	6444.75	6444.00	89.37	83.89	9.29	6449.86	6448.77	0.013

Inlets: 260R1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length Long. (ft)	Slope Cross (%)	Slope (%)
260R1	20	8.31	8.31	0.000	12.5	0.38	100.0	6450.17	15.00	0.0000	0.0200

Pipes: P260R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P260R1	24	0.0050	19	6445.46	6445.37	8.31	16.00	2.65	6450.42	6450.39	0.013

Manholes: 259M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
259M1	4.006445.37	(N)6445.27	(W)	6450.59	8.31

Pipes: P259M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P259M1	24	0.0100	99	6445.27	6444.27	8.29	22.62	2.64	6450.25	6448.69	0.013

Manholes: 259M2

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
259M2	6.006444.00 6444.27	(N)6443.96 (E)	(S)	6451.30	95.27

Pipes: P259M2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P259M2	42	0.0070	119	6443.96	6443.13	95.27	83.89	9.90	6448.60	6447.51	0.013

Manholes: 258M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
258M1	6.006443.13	(N)6443.03	(SE)	6448.63	95.27

Pipes: P258M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P258M1	42	0.0050	34	6443.03	6442.86	94.52	71.14	9.82	6446.71	6446.36	0.013

Number of items reported: 36

Network Outfall Report

Date: Wednesday, April 30, 2008 4:27:25 PM

Drainage Data File: MS_SOUTH45_100

Inlets: 296L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
296L1	20	4.34	4.20	15.000	13.3	0.39	100.0	6519.53	10.00	0.0052	0.0200

Pipes: P296L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P296L1	18	0.0200	102	6514.84	6512.80	4.34	14.86	7.29	6515.39	6513.36	0.013

Inlets: 296R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
296R1	20	3.94	3.94	15.000	12.9	0.38	100.0	6516.53	10.00	0.0050	0.0200

Pipes: P296R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P296R1	18	0.0050	27	6511.83	6511.69	3.94	7.43	4.27	6512.96	6512.82	0.013

Manholes: 296M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
296M1	4.00	6511.69 (E) 6512.80 (W)	6511.59 (S)	6517.22	8.18

Pipes: P296M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P296M1	24	0.0050	296	6511.59	6510.11	8.18	16.00	5.12	6512.60	6511.13	0.013

Inlets: 293L1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
293L1	20	4.15	4.21	15.000	11.7	0.36	98.5	6517.95	10.00	0.0091	0.0200

Pipes: P293L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P293L1	18	0.0200	76	6513.26	6511.74	4.15	14.86	7.20	6513.80	6512.28	0.013

Inlets: 293R2

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
293R2	50	0.00	0.00	0.000	0.0	0.00	0.0	6515.29	2.92	0.0000	0.1250

Pipes: P293R2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P293R2	18	0.0100	23	6511.64	6511.41	4.11	10.50	5.58	6512.29	6512.06	0.013

Inlets: 293R1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
293R1	20	4.02	4.02	15.000	13.0	0.39	100.0	6515.03	10.00	0.0050	0.0200

Pipes: P293R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P293R1	18	0.0100	27	6510.33	6510.06	4.02	10.50	5.55	6510.97	6510.71	0.013

Manholes: 293M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
293M1	4.00	6510.11 (N) 6510.06 (E) 6511.41 (W)	6509.83 (S)	6515.72	15.47

Pipes: P293M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P293M1	24	0.0130	297	6509.83	6505.97	15.47	25.79	8.58	6510.95	6507.09	0.013

Inlets: 290L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
290L1	20	3.68	4.07	15.000	8.9	0.30	89.1	6511.25	10.00	0.0292	0.0200

Pipes: P290L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P290L1	18	0.0050	102	6506.55	6506.04	3.68	7.43	4.19	6509.83	6507.17	0.013

Inlets: 290R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
290R1	20	3.61	3.95	15.000	8.9	0.30	91.4	6511.20	10.00	0.0262	0.0200

Pipes: P290R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P290R1	18	0.0050	27	6506.50	6506.36	3.61	7.43	4.17	6507.62	6507.47	0.013

Manholes: 290M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
290M1	4.00	6505.97 (N) 6506.36 (E) 6506.04 (W)	6505.92 (S)	6511.89	21.71

Pipes: P290M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P290M1	24	0.0280	268	6505.92	6498.42	21.71	37.85	12.46	6507.00	6499.50	0.013

Pipes: P287H1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P287H1	48	0.0544	23	6500.00	6498.73	86.82	334.91	6.91	6505.77	6505.62	0.013

Inlets: 287L1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length Long. (ft)	Slope Cross (%)	Slope (%)
287L1	20	4.30	4.08	15.000	11.2	0.35	94.9	6504.70	10.00	0.0125	0.0200

Pipes: P287L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P287L1	48	0.0050	100	6498.75	6498.25	90.37	101.57	7.19	6505.16	6502.28	0.013

Inlets: 287R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
287R1	20	4.22	4.08	15.000	11.1	0.35	95.5	6504.70	10.00	0.0125	0.0200

Pipes: P287R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P287R1	18	0.0100	25	6500.00	6499.74	4.22	10.50	5.62	6500.66	6500.40	0.013

Manholes: 287M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
287M1	7.00	6498.42 (N) 6499.74 (E) 6498.25 (W)	6498.15 (S)	6505.39	111.85

Pipes: P287M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P287M1	42	0.0150	389	6498.16	6492.31	111.85	123.22	14.51	6500.77	6494.93	0.013

Inlets: 283L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
283L1	20	5.15	5.55	15.000	12.7	0.38	89.1	6502.18	10.00	0.0117	0.0200

Pipes: P283L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P283L1	18	0.0100	102	6497.48	6496.46	5.15	10.50	5.91	6498.22	6497.20	0.013

Inlets: 283R1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
283R1	20	5.13	5.57	15.000	12.6	0.38	89.0	6502.18	10.00	0.0119	0.0200

Pipes: P283R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P283R1	18	0.0200	26	6497.49	6496.97	5.13	14.86	7.63	6498.09	6497.58	0.013

Manholes: 283M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
283M1	6.00	6492.31 (N) 6496.97 (E) 6496.46 (W)	6492.21 (S)	6502.87	117.95

Pipes: P283M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P283M1	42	0.0150	244	6492.21	6488.56	117.95	123.04	14.56	6494.96	6491.31	0.013

Inlets: 281L1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
281L1	50	0.00	0.00	0.000	0.0	0.00	0.0	6497.00	2.92	0.0000	0.1667

Pipes: P281R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P281R1	18	0.0101	38	6491.97	6491.59	0.00	0.00	0.00	0.00	0.00	0.013

Manholes: 281M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
281M1	6.00	6488.56 (N) 6491.59 (W)	6488.42 (S)	6497.59	117.95

Pipes: P281M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P281M1	48	0.0225	62	6488.42	6487.02	116.67	215.46	17.49	6490.52	6489.12	0.013

Pipes: P280H1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P280H1	42	0.0119	16	6488.80	6488.61	68.48	109.68	12.03	6490.80	6490.62	0.013

Inlets: 280L1

Inlet ID	Clogging (%)	Capacity (cfs)	Q (cfs)	GrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
280L1	30	5.69	5.14	0.000	10.8	0.34	98.8	6495.52	15.00	0.0241	0.0200

Pipes: P280L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P280L1	42	0.0150	106	6488.61	6487.02	73.02	123.22	13.35	6490.55	6488.96	0.013

Manholes: 280M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
280M1	8.00	6487.02 (N) 6487.02 (W)	6486.92 (E)	6495.90	186.71

Pipes: P280M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P280M1	48	0.0169	25	6486.92	6486.50	186.71	186.48	16.92	6490.20	6489.78	0.013

Inlets: 280R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
280R1	20	5.16	5.17	15.000	10.3	0.33	99.9	6495.22	15.00	0.0243	0.0200

Pipes: P280R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P280R1	54	0.0100	125	6483.25	6482.00	190.48	196.65	13.97	6486.85	6485.60	0.013

Number of items reported: 44

Network Outfall Report

Date: Wednesday, April 30, 2008 5:28:42 PM

Drainage Data File: MS_SOUTH45_100

Inlets: 330L1

Inlet ID	Clogging (%)	Capacity (cfs)	Q (cfs)	GrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
330L1	20	5.22	7.11	0.000	11.5	0.36	73.5	6576.08	10.00	0.0279	0.0200

Pipes: P330L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P330L1	18	0.0050	16	6571.09	6571.02	5.22	7.43	4.55-92233720368547760.00		6572.21	0.013

Inlets: 330L2

Inlet ID	Clogging (%)	Capacity (cfs)	Q (cfs)	GrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
330L2	20	1.88	0.00	0.000	5.9	0.24	100.0	6575.37	10.00	0.0279	0.0200

Pipes: P330L2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P330L2	18	0.0050	69	6570.93	6570.58	7.09	7.43	4.78-92233720368547760.00		6571.85	0.013

Inlets: 330L4

Inlet ID	Clogging (%)	Capacity (cfs)	Q (cfs)	GrateCover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
330L4	50	0.00	0.00	0.000	0.0	0.00	0.0	6573.30	2.92	0.0000	0.1000

Pipes: P330L4

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P330L4	18	0.0100	44	6569.30	6568.86	0.00	0.00	0.00	0.00	0.00	0.013

Inlets: 330L5

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
330L5	20	0.00	0.00	0.000	0.0	0.00	0.0	6574.66	2.92	0.0278	0.1000

Pipes: P330L5

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P330L5	18	0.0050	30	6568.76	6568.61	7.00	7.43	3.96	6572.10	6570.09	0.013

Inlets: 330R2

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
330R2	20	5.21	7.08	0.000	11.5	0.36	73.6	6576.11	10.00	0.0279	0.0200

Pipes: P330R2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P330R2	18	0.0050	13	6571.12	6571.06	5.21	7.43	2.95	6572.80	6572.55	0.013

Inlets: 330R1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
330R1	20	1.87	0.00	0.000	5.9	0.24	100.0	6575.47	10.00	0.0279	0.0200

Pipes: P330R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P330R1	18	0.0050	30	6570.97	6570.82	7.06	7.43	4.78	6572.25	6572.08	0.013

Manholes: 330M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
330M1	5.00	6570.82 (E) 6568.61 (W)	6568.53 (S)	6576.23	13.90

Pipes: P330M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P330M1	18	0.0323	246	6568.53	6560.58	13.90	18.88	11.68	6569.49	6561.53	0.013

Inlets: 23L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
23L1	50	17.41	17.41	0.000	4.7	0.59	100.0	6566.00	2.92	0.0000	0.2500

Pipes: P23L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P23L1	24	0.0050	37	6562.00	6561.82	17.41	16.00	5.54	6565.15	6564.68	0.013

Inlets: 22L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
22L1	20	6.71	8.18	0.000	22.0	0.33	82.1	6571.32	15.00	0.0249	0.0081

Pipes: P22L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P22L1	18	0.0100	87	6565.95	6565.08	6.71	10.50	6.30	6567.20	6566.33	0.013

Manholes: 23M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
23M1	4.00	6561.82 (NE) 6565.08 (W)	6561.72 (S)	6570.64	21.24

Pipes: P23M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P23M1	24	0.0050	41	6561.72	6561.52	21.24	16.00	6.76	6564.28	6564.23	0.013

Inlets: 23L2

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
23L2	20	5.25	3.78	0.000	29.9	0.33	100.0	6570.21	10.00	0.0000	0.0087

Pipes: P23L2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P23L2	30	0.0050	74	6561.42	6561.05	24.21	29.00	4.93	6564.13	6563.68	0.013

Inlets: 23L3

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
23L3	20	9.47	10.04	0.000	19.5	0.46	94.3	6569.06	15.00	0.0072	0.0169

Pipes: P23L3

Pipe ID	Diam.	Slope	Length	Inv. In	Inv. Out	Total Flow	Capacity	Velocity	Entrance HGL	Exit HGL	Mannings N

	(in)	(%)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(ft/s)	(ft)	(ft)	
P23L3	30	0.0051	190	6560.95	6559.99	29.85	29.23	6.08	6563.19	6562.17	0.013

Manholes: 328M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
328M1	5.00	6560.58 (N) 6559.99 (W)	6559.41 (S)	6569.23	37.52

Pipes: P328M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P328M1	30	0.0173	405	6559.41	6552.40	37.52	53.94	11.87	6560.94	6553.93	0.013

Inlets: 324R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
324R1	20	9.74	10.72	0.000	16.6	0.46	90.8	6558.94	15.00	0.0111	0.0200

Pipes: P324R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P324R1	18	0.0050	30	6554.94	6554.79	9.74	7.43	5.51	6556.57	6556.29	0.013

Inlets: 324L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
324L1	20	8.75	8.69	0.000	15.5	0.44	94.5	6558.84	15.00	0.0114	0.0200

Pipes: P324L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N

P324L1	18	0.0050	102	6554.84	6554.33	8.75	7.43	4.95	6556.56	6555.83	0.013

Manholes: 324M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
324M1	5.00	6552.40 (N) 6554.79 (E) 6554.33 (W)	6552.30 (S)	6559.70	47.32

Pipes: P324M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P324M1	30	0.0160	594	6552.30	6542.80	47.32	51.87	11.98	6554.18	6544.68	0.013

Pipes: P318F1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P318F1	36	0.0100	97	6543.92	6542.95	68.51	66.70	9.69	6548.26	6547.06	0.013

Inlets: 318L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
318L1	20	8.04	9.05	0.000	13.3	0.39	88.9	6553.20	15.00	0.0229	0.0200

Pipes: P318L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P318L1	36	0.0100	73	6542.85	6542.12	72.64	66.70	10.28	6546.05	6545.18	0.013

Inlets: 318R2

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
318R2	20	0.00	0.00	0.000	0.0	0.00	0.0	6550.87	2.92	0.0268	0.1000

Pipes: P318R2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P318R2	36	0.0100	20	6542.02	6541.82	72.46	66.70	10.25	6545.10	6544.82	0.013

Inlets: 318R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
318R1	20	8.21	9.53	0.000	13.2	0.39	86.1	6550.42	15.00	0.0258	0.0200

Pipes: P318R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P318R1	18	0.0100	29	6546.43	6546.14	8.21	10.50	6.58	6547.43	6547.14	0.013

Manholes: 318M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
318M1	7.00	6542.80 (N) 6546.14 (E) 6541.82 (W)	6541.00 (S)	6551.19	116.90

Pipes: P318M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P318M1	42	0.0201	593	6541.00	6529.10	116.90	142.49	16.53	6543.41	6532.46	0.013

Inlets: 312L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
312L1	20	8.77	8.30	0.000	14.6	0.42	89.4	6536.40	15.00	0.0171	0.0200

Pipes: P312L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P312L1	18	0.0100	97	6532.40	6531.43	8.77	10.50	4.96	6533.45	6532.76	0.013

Inlets: 312R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
312R1	20	9.14	8.16	0.000	15.0	0.43	87.3	6536.30	15.00	0.0173	0.0200

Pipes: P312R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P312R1	18	0.0100	35	6532.30	6531.95	9.14	10.50	5.17	6533.57	6533.29	0.013

Manholes: 312M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
312M1	6.00	6529.10 (N) 6531.95 (E) 6531.43 (W)	6529.00 (S)	6537.16	123.85

Pipes: P312M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P312M1	42	0.0170	279	6529.00	6524.24	123.85	131.33	12.87	6531.95	6527.63	0.013

Inlets: 309R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
309R1	50	0.00	0.00	0.000	0.0	0.00	0.0	6531.57	2.92	0.0000	0.1000

Pipes: P309R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P309R1	18	0.0100	23	6526.57	6526.34	0.00	0.00	0.00	0.00	0.00	0.013

Manholes: 309M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
309M1	6.00	6524.24 (N) 6526.34 (W)	6524.14 (S)	6532.26	123.85

Pipes: P309M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P309M1	42	0.0247	53	6524.14	6522.82	123.10	158.17	12.79	6527.10	6526.20	0.013

Inlets: 308L2

Inlet ID	Clogging (%)	Capacity (cfs)	QGrate (cfs)	Cover	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
308L2	50	21.26	21.26	0.000	7.5	0.63	100.0	6530.04	2.92	0.0000	0.1667

Pipes: P308L2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P308L2	24	0.0100	15	6526.03	6525.88	21.26	22.62	6.77	6529.49	6528.85	0.013

Inlets: 308L1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length Long. (ft)	Slope Cross (%)	Slope (%)
308L1	20	6.56	5.62	0.000	12.4	0.37	98.4	6530.47	15.00	0.0172	0.0200

Pipes: P308L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P308L1	24	0.0100	96	6525.78	6524.82	27.78	22.62	8.84	6528.32	6526.82	0.013

Inlets: 308R1

Inlet ID	Clogging (%)	Capacity (cfs)		QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length Long. (ft)	Slope Cross (%)	Slope (%)
308R1	20	6.48	5.23	0.000	12.4	0.37	98.8	6530.37	15.00	0.0168	0.0200

Pipes: P308R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P308R1	18	0.0100	34	6526.37	6526.03	6.48	10.50	6.25	6527.61	6527.27	0.013

Manholes: 308M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
308M1	7.00	6522.82 (N) 6526.03 (E) 6524.82 (W)	6522.72 (S)	6531.23	139.07

Pipes: P308M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P308M1	48	0.0139	590	6522.72	6514.50	139.07	169.53	11.07	6525.94	6520.59	0.013

Pipes: P302F1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P302F1	48	0.0329	35	6517.70	6516.54	101.01	260.66	8.04	6524.47	6523.32	0.013

Inlets: 302L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length Long. (ft)	Slope (%)	Cross Slope (%)
302L1	20	9.41 9.39	0.000	18.5	0.50	99.2	6522.54	15.00	0.0050	0.0200

Pipes: P302L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P302L1	42	0.0100	99	6516.44	6515.45	108.45	100.61	11.27	6521.83	6520.96	0.013

Inlets: 302R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length Long. (ft)	Slope (%)	Cross Slope (%)
302R1	20	9.17 9.13	0.000	18.3	0.49	99.5	6522.53	15.00	0.0050	0.0200

Pipes: P302R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P302R1	24	0.0100	24	6517.53	6517.29	9.17	22.62	2.92	6521.87	6520.31	0.013

Manholes: 302M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
302M1	9.00	6514.50 (N) 6517.29 (E) 6515.45 (W)	6514.40 (S)	6523.22	204.62

Pipes: P302M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P302M1	76	0.0095	140	6514.40	6513.07	204.62	259.31	10.28	6520.25	6519.39	0.013

Manholes: 301M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
301M1	8.00	6513.07 (N)	6512.97 (SE)	6521.93	204.62

Pipes: P301M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P301M1	76	0.0050	40	6512.97	6512.77	203.95	188.20	10.25	6518.31	6517.90	0.013

Inlets: 299L1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
299L1	30	9.74	9.80	0.400	18.8	0.50	98.6	6521.01	15.00	0.0050	0.0200

Pipes: P299L1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P299L1	24	0.0131	77	6517.00	6516.00	9.74	25.86	3.10	6519.05	6518.91	0.013

Inlets: 299R1

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)	Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length (ft)	Long. Slope (%)	Cross Slope (%)
299R1	50	0.00	0.00	0.000	0.0	0.00	0.0	6519.20	2.92	0.0146	0.1000

Pipes: P299R1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P299R1	24	0.0193	53	6515.90	6514.88	9.68	31.42	3.08	6518.89	6518.83	0.013

Inlets: 299R2

Inlet ID	Clogging (%)	Capacity (cfs)	QGrateCover (cfs)		Spread (ft)	Depth (ft)	Efficiency (%)	Elevation (ft)	Length Long. (ft)	Slope (%)	Cross Slope (%)
299R2	30	4.74	4.70	0.000	13.9	0.40	100.0	6518.87	15.00	0.0050	0.0200

Pipes: P299R2

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P299R2	30	0.0100	109	6514.78	6513.69	13.39	41.02	2.73	6518.69	6516.93	0.013

Manholes: 300M1

MH ID	Width (ft)	Inv. In (ft)	Inv. Out (ft)	Rim Elev. (ft)	Total Flow (cfs)
300M1	8.00	6513.69 (S) 6512.77 (NW)	6512.67 (E)	6521.33	211.47

Pipes: P300M1

Pipe ID	Diam. (in)	Slope (%)	Length (ft)	Inv. In (ft)	Inv. Out (ft)	Total Flow (cfs)	Capacity (cfs)	Velocity (ft/s)	Entrance HGL (ft)	Exit HGL (ft)	Mannings N
P300M1	76	0.0050	126	6512.67	6512.04	211.47	187.89	10.63	6516.86	6516.04	0.013

Number of items reported: 76

Existing Culvert Calculations

Culvert Calculator Report
E1

Solve For: Discharge

Culvert Summary

Allowable HW Elevation	6,795.62 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	6,795.62 ft	Discharge	46.93 cfs
Inlet Control HW Elev.	6,795.62 ft	Tailwater Elevation	6,792.18 ft
Outlet Control HW Elev.	6,795.58 ft	Control Type	Inlet Control

Grades

Upstream Invert	6,792.62 ft	Downstream Invert	6,791.18 ft
Length	92.00 ft	Constructed Slope	0.015652 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	1.41 ft
Slope Type	Steep	Normal Depth	1.39 ft
Flow Regime	Supercritical	Critical Depth	1.72 ft
Velocity Downstream	9.93 ft/s	Critical Slope	0.009964 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	2		

Outlet Control Properties

Outlet Control HW Elev.	6,795.58 ft	Upstream Velocity Head	1.04 ft
Ke	0.20	Entrance Loss	0.21 ft

Inlet Control Properties

Inlet Control HW Elev.	6,795.62 ft	Flow Control	Submerged
Inlet Type	Beveled ring, 33.7° bevels	Area Full	6.3 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
E2

Solve For: Discharge

Culvert Summary

Allowable HW Elevation	6,775.97 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	6,775.97 ft	Discharge	71.27 cfs
Inlet Control HW Elev.	6,775.55 ft	Tailwater Elevation	6,771.03 ft
Outlet Control HW Elev.	6,775.97 ft	Control Type	Outlet Control

Grades

Upstream Invert	6,772.22 ft	Downstream Invert	6,770.03 ft
Length	110.00 ft	Constructed Slope	0.019909 ft/ft

Hydraulic Profile

Profile	CompositeM2PressureProfile	Depth, Downstream	2.03 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	2.03 ft
Velocity Downstream	8.36 ft/s	Critical Slope	0.026270 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	2.50 ft
Section Size	30 inch	Rise	2.50 ft
Number Sections	2		

Outlet Control Properties

Outlet Control HW Elev.	6,775.97 ft	Upstream Velocity Head	0.82 ft
Ke	0.20	Entrance Loss	0.16 ft

Inlet Control Properties

Inlet Control HW Elev.	6,775.55 ft	Flow Control	Submerged
Inlet Type	Beveled ring, 33.7° (1.5:1) bevels	Area Full	9.8 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
E3 at Huber Rd.

Solve For: Discharge

Culvert Summary

Allowable HW Elevation	6,778.20 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	6,778.20 ft	Discharge	3.02 cfs
Inlet Control HW Elev.	6,777.86 ft	Tailwater Elevation	6,776.19 ft
Outlet Control HW Elev.	6,778.20 ft	Control Type	Outlet Control

Grades

Upstream Invert	6,776.70 ft	Downstream Invert	6,775.19 ft
Length	71.00 ft	Constructed Slope	0.021268 ft/ft

Hydraulic Profile

Profile	PressureProfile	Depth, Downstream	1.00 ft
Slope Type	N/A	Normal Depth	0.92 ft
Flow Regime	N/A	Critical Depth	0.74 ft
Velocity Downstream	3.84 ft/s	Critical Slope	0.029878 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	1.00 ft
Section Size	12 inch	Rise	1.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,778.20 ft	Upstream Velocity Head	0.23 ft
Ke	0.20	Entrance Loss	0.05 ft

Inlet Control Properties

Inlet Control HW Elev.	6,777.86 ft	Flow Control	Transition
Inlet Type	Beveled ring, 33.7° (1.5:1) bevels	Area Full	0.8 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
E4

Solve For: Discharge

Culvert Summary

Allowable HW Elevation	6,705.25 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	6,705.25 ft	Discharge	96.30 cfs
Inlet Control HW Elev.	6,705.25 ft	Tailwater Elevation	6,699.31 ft
Outlet Control HW Elev.	6,705.24 ft	Control Type	Inlet Control

Grades

Upstream Invert	6,700.00 ft	Downstream Invert	6,698.31 ft
Length	33.13 ft	Constructed Slope	0.051011 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	2.10 ft
Slope Type	Steep	Normal Depth	1.59 ft
Flow Regime	Supercritical	Critical Depth	3.03 ft
Velocity Downstream	15.95 ft/s	Critical Slope	0.008427 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.50 ft
Section Size	42 inch	Rise	3.50 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,705.24 ft	Upstream Velocity Head	1.84 ft
Ke	0.20	Entrance Loss	0.37 ft

Inlet Control Properties

Inlet Control HW Elev.	6,705.25 ft	Flow Control	Submerged
Inlet Type	Beveled ring, 33.7° bevels	Area Full	9.6 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
E5

Solve For: Discharge

Culvert Summary

Allowable HW Elevation	6,669.85 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	6,669.85 ft	Discharge	10.55 cfs
Inlet Control HW Elev.	6,669.69 ft	Tailwater Elevation	6,666.69 ft
Outlet Control HW Elev.	6,669.85 ft	Control Type	Outlet Control

Grades

Upstream Invert	6,667.60 ft	Downstream Invert	6,665.69 ft
Length	66.93 ft	Constructed Slope	0.028537 ft/ft

Hydraulic Profile

Profile	CompositeM2PressureProfile	Depth, Downstream	1.25 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.25 ft
Velocity Downstream	6.71 ft/s	Critical Slope	0.033481 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	1.50 ft
Section Size	18 inch	Rise	1.50 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,669.85 ft	Upstream Velocity Head	0.55 ft
Ke	0.20	Entrance Loss	0.11 ft

Inlet Control Properties

Inlet Control HW Elev.	6,669.69 ft	Flow Control	Submerged
Inlet Type	Beveled ring, 33.7° (1.5:1) bevels	Area Full	1.8 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
E6

Solve For: Discharge

Culvert Summary

Allowable HW Elevation	6,628.77 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	6,628.77 ft	Discharge	9.84 cfs
Inlet Control HW Elev.	6,628.50 ft	Tailwater Elevation	6,625.96 ft
Outlet Control HW Elev.	6,628.77 ft	Control Type	Outlet Control

Grades

Upstream Invert	6,626.52 ft	Downstream Invert	6,624.93 ft
Length	67.18 ft	Constructed Slope	0.023668 ft/ft

Hydraulic Profile

Profile	CompositeM2PressureProfile	Depth, Downstream	1.21 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.21 ft
Velocity Downstream	6.44 ft/s	Critical Slope	0.030798 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	1.50 ft
Section Size	18 inch	Rise	1.50 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,628.77 ft	Upstream Velocity Head	0.48 ft
Ke	0.20	Entrance Loss	0.10 ft

Inlet Control Properties

Inlet Control HW Elev.	6,628.50 ft	Flow Control	Submerged
Inlet Type	Beveled ring, 33.7° (1.5:1) bevels	Area Full	1.8 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
E7

Solve For: Discharge

Culvert Summary

Allowable HW Elevation	6,603.51 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	6,603.51 ft	Discharge	22.57 cfs
Inlet Control HW Elev.	6,603.40 ft	Tailwater Elevation	6,600.44 ft
Outlet Control HW Elev.	6,603.51 ft	Control Type	Outlet Control

Grades

Upstream Invert	6,600.51 ft	Downstream Invert	6,599.44 ft
Length	40.09 ft	Constructed Slope	0.026690 ft/ft

Hydraulic Profile

Profile	CompositeM2PressureProfile	Depth, Downstream	1.69 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.69 ft
Velocity Downstream	7.96 ft/s	Critical Slope	0.032137 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,603.51 ft	Upstream Velocity Head	0.80 ft
Ke	0.20	Entrance Loss	0.16 ft

Inlet Control Properties

Inlet Control HW Elev.	6,603.40 ft	Flow Control	Submerged
Inlet Type	Beveled ring, 33.7° (1.5:1) bevels	Area Full	3.1 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
E8

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	6,570.74 ft	Headwater Depth/Height	1.31
Computed Headwater Elevation	6,570.74 ft	Discharge	16.47 cfs
Inlet Control HW Elev.	6,570.38 ft	Tailwater Elevation	6,568.46 ft
Outlet Control HW Elev.	6,570.74 ft	Control Type	Outlet Control

Grades			
Upstream Invert	6,568.11 ft	Downstream Invert	6,567.46 ft
Length	60.41 ft	Constructed Slope	0.010760 ft/ft

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	1.46 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.46 ft
Velocity Downstream	6.69 ft/s	Critical Slope	0.023057 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	6,570.74 ft	Upstream Velocity Head	0.43 ft
Ke	0.20	Entrance Loss	0.09 ft

Inlet Control Properties			
Inlet Control HW Elev.	6,570.38 ft	Flow Control	Transition
Inlet Type	Beveled ring, 33.7° (1.5:1) bevels	Area Full	3.1 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
E9 at Carefree

Solve For: Discharge

Culvert Summary

Allowable HW Elevation	6,565.93 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	6,565.93 ft	Discharge	13.52 cfs
Inlet Control HW Elev.	6,564.89 ft	Tailwater Elevation	6,562.86 ft
Outlet Control HW Elev.	6,565.93 ft	Control Type	Outlet Control

Grades

Upstream Invert	6,562.93 ft	Downstream Invert	6,561.86 ft
Length	174.66 ft	Constructed Slope	0.006126 ft/ft

Hydraulic Profile

Profile	CompositeM2PressureProfile	Depth, Downstream	1.32 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.32 ft
Velocity Downstream	6.13 ft/s	Critical Slope	0.020204 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,565.93 ft	Upstream Velocity Head	0.29 ft
Ke	0.20	Entrance Loss	0.06 ft

Inlet Control Properties

Inlet Control HW Elev.	6,564.89 ft	Flow Control	Unsubmerged
Inlet Type	Beveled ring, 33.7° (1.5:1) bevels	Area Full	3.1 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
E10

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	6,557.84 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	6,557.84 ft	Discharge	95.10 cfs
Inlet Control HW Elev.	6,557.84 ft	Tailwater Elevation	6,552.16 ft
Outlet Control HW Elev.	6,557.78 ft	Control Type	Inlet Control

Grades			
Upstream Invert	6,552.59 ft	Downstream Invert	6,551.29 ft
Length	78.16 ft	Constructed Slope	0.016633 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	2.41 ft
Slope Type	Steep	Normal Depth	2.23 ft
Flow Regime	Supercritical	Critical Depth	3.01 ft
Velocity Downstream	13.46 ft/s	Critical Slope	0.008273 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.50 ft
Section Size	42 inch	Rise	3.50 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	6,557.78 ft	Upstream Velocity Head	1.81 ft
Ke	0.20	Entrance Loss	0.36 ft

Inlet Control Properties			
Inlet Control HW Elev.	6,557.84 ft	Flow Control	N/A
Inlet Type	Beveled ring, 33.7° bevels	Area Full	9.6 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
E11

Solve For: Discharge

Culvert Summary

Allowable HW Elevation	6,533.94 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	6,533.94 ft	Discharge	35.78 cfs
Inlet Control HW Elev.	6,533.53 ft	Tailwater Elevation	6,529.27 ft
Outlet Control HW Elev.	6,533.94 ft	Control Type	Outlet Control

Grades

Upstream Invert	6,530.19 ft	Downstream Invert	6,528.27 ft
Length	97.55 ft	Constructed Slope	0.019682 ft/ft

Hydraulic Profile

Profile	CompositeM2PressureProfile	Depth, Downstream	2.03 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	2.03 ft
Velocity Downstream	8.38 ft/s	Critical Slope	0.026391 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	2.50 ft
Section Size	30 inch	Rise	2.50 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,533.94 ft	Upstream Velocity Head	0.83 ft
Ke	0.20	Entrance Loss	0.17 ft

Inlet Control Properties

Inlet Control HW Elev.	6,533.53 ft	Flow Control	N/A
Inlet Type	Beveled ring, 33.7° (1.5:1) bevels	Area Full	4.9 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
E12

Solve For: Discharge

Culvert Summary

Allowable HW Elevation	6,529.84 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	6,529.84 ft	Discharge	17.41 cfs
Inlet Control HW Elev.	6,529.22 ft	Tailwater Elevation	6,526.61 ft
Outlet Control HW Elev.	6,529.84 ft	Control Type	Outlet Control

Grades

Upstream Invert	6,526.84 ft	Downstream Invert	6,525.61 ft
Length	97.20 ft	Constructed Slope	0.012654 ft/ft

Hydraulic Profile

Profile	CompositeM2PressureProfile	Depth, Downstream	1.50 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.50 ft
Velocity Downstream	6.87 ft/s	Critical Slope	0.024125 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,529.84 ft	Upstream Velocity Head	0.48 ft
Ke	0.20	Entrance Loss	0.10 ft

Inlet Control Properties

Inlet Control HW Elev.	6,529.22 ft	Flow Control	N/A
Inlet Type	Beveled ring, 33.7° (1.5:1) bevels	Area Full	3.1 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
E13

Solve For: Discharge

Culvert Summary

Allowable HW Elevation	6,514.72 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	6,514.72 ft	Discharge	12.39 cfs
Inlet Control HW Elev.	6,513.88 ft	Tailwater Elevation	6,513.12 ft
Outlet Control HW Elev.	6,514.72 ft	Control Type	Outlet Control

Grades

Upstream Invert	6,512.47 ft	Downstream Invert	6,512.12 ft
Length	100.00 ft	Constructed Slope	0.003500 ft/ft

Hydraulic Profile

Profile	CompositeM2PressureProfile	Depth, Downstream	1.00 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	0.96 ft
Velocity Downstream	4.95 ft/s	Critical Slope	0.021553 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	1.50 ft
Section Size	18 inch	Rise	1.50 ft
Number Sections	2		

Outlet Control Properties

Outlet Control HW Elev.	6,514.72 ft	Upstream Velocity Head	0.19 ft
Ke	0.20	Entrance Loss	0.04 ft

Inlet Control Properties

Inlet Control HW Elev.	6,513.88 ft	Flow Control	N/A
Inlet Type	Beveled ring, 33.7° (1.5:1) bevels	Area Full	3.5 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
E14

Solve For: Discharge

Culvert Summary

Allowable HW Elevation	6,501.95 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	6,501.95 ft	Discharge	10.48 cfs
Inlet Control HW Elev.	6,501.78 ft	Tailwater Elevation	6,499.43 ft
Outlet Control HW Elev.	6,501.95 ft	Control Type	Outlet Control

Grades

Upstream Invert	6,499.70 ft	Downstream Invert	6,498.43 ft
Length	46.85 ft	Constructed Slope	0.027108 ft/ft

Hydraulic Profile

Profile	CompositeM2PressureProfile	Depth, Downstream	1.24 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.24 ft
Velocity Downstream	6.69 ft/s	Critical Slope	0.033228 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	1.50 ft
Section Size	18 inch	Rise	1.50 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,501.95 ft	Upstream Velocity Head	0.55 ft
Ke	0.20	Entrance Loss	0.11 ft

Inlet Control Properties

Inlet Control HW Elev.	6,501.78 ft	Flow Control	N/A
Inlet Type	Beveled ring, 33.7° (1.5:1) bevels	Area Full	1.8 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
E15

Solve For: Discharge

Culvert Summary

Allowable HW Elevation	6,493.36 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	6,493.36 ft	Discharge	9.41 cfs
Inlet Control HW Elev.	6,493.03 ft	Tailwater Elevation	6,490.43 ft
Outlet Control HW Elev.	6,493.36 ft	Control Type	Outlet Control

Grades

Upstream Invert	6,491.11 ft	Downstream Invert	6,489.43 ft
Length	78.71 ft	Constructed Slope	0.021344 ft/ft

Hydraulic Profile

Profile	CompositeM2PressureProfile	Depth, Downstream	1.19 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.19 ft
Velocity Downstream	6.28 ft/s	Critical Slope	0.029345 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	1.50 ft
Section Size	18 inch	Rise	1.50 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,493.36 ft	Upstream Velocity Head	0.44 ft
Ke	0.20	Entrance Loss	0.09 ft

Inlet Control Properties

Inlet Control HW Elev.	6,493.03 ft	Flow Control	N/A
Inlet Type	Beveled ring, 33.7° (1.5:1) bevels	Area Full	1.8 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report
Constitution

Solve For: Discharge

Culvert Summary

Allowable HW Elevation	6,450.60 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	6,450.60 ft	Discharge	23.42 cfs
Inlet Control HW Elev.	6,450.60 ft	Tailwater Elevation	6,447.22 ft
Outlet Control HW Elev.	6,450.56 ft	Control Type	Inlet Control

Grades

Upstream Invert	6,447.60 ft	Downstream Invert	6,446.22 ft
Length	130.95 ft	Constructed Slope	0.010538 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	1.66 ft
Slope Type	Steep	Normal Depth	1.66 ft
Flow Regime	Supercritical	Critical Depth	1.72 ft
Velocity Downstream	8.42 ft/s	Critical Slope	0.009937 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,450.56 ft	Upstream Velocity Head	1.03 ft
Ke	0.20	Entrance Loss	0.21 ft

Inlet Control Properties

Inlet Control HW Elev.	6,450.60 ft	Flow Control	N/A
Inlet Type	Beveled ring, 33.7° bevels	Area Full	3.1 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Proposed Culvert Calculations

Culvert Calculator Report
280H1 (10 Year) (OS-W)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,492.30 ft	Headwater Depth/Height	0.96
Computed Headwater Elevation	6,492.16 ft	Discharge	40.00 cfs
Inlet Control HW Elev.	6,491.72 ft	Tailwater Elevation	6,491.64 ft
Outlet Control HW Elev.	6,492.16 ft	Control Type	Outlet Control

Grades

Upstream Invert	6,488.80 ft	Downstream Invert	6,488.61 ft
Length	16.00 ft	Constructed Slope	0.011875 ft/ft

Hydraulic Profile

Profile	S1	Depth, Downstream	3.03 ft
Slope Type	Steep	Normal Depth	1.46 ft
Flow Regime	Subcritical	Critical Depth	1.97 ft
Velocity Downstream	4.52 ft/s	Critical Slope	0.004299 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.50 ft
Section Size	42 inch	Rise	3.50 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,492.16 ft	Upstream Velocity Head	0.36 ft
Ke	0.50	Entrance Loss	0.18 ft

Inlet Control Properties

Inlet Control HW Elev.	6,491.72 ft	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	9.6 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
280H1 (100 Year) (OS-W)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,493.30 ft	Headwater Depth/Height	1.28
Computed Headwater Elevation	6,493.29 ft	Discharge	69.00 cfs
Inlet Control HW Elev.	6,493.18 ft	Tailwater Elevation	6,490.55 ft
Outlet Control HW Elev.	6,493.29 ft	Control Type	Entrance Control

Grades

Upstream Invert	6,488.80 ft	Downstream Invert	6,488.61 ft
Length	16.00 ft	Constructed Slope	0.011875 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	2.32 ft
Slope Type	Steep	Normal Depth	2.01 ft
Flow Regime	Supercritical	Critical Depth	2.60 ft
Velocity Downstream	10.21 ft/s	Critical Slope	0.005767 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.50 ft
Section Size	42 inch	Rise	3.50 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,493.29 ft	Upstream Velocity Head	1.26 ft
Ke	0.50	Entrance Loss	0.63 ft

Inlet Control Properties

Inlet Control HW Elev.	6,493.18 ft	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	9.6 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
287H1 (10 Year) (OS-T,U&V)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,505.00 ft	Headwater Depth/Height	0.84
Computed Headwater Elevation	6,503.34 ft	Discharge	50.00 cfs
Inlet Control HW Elev.	6,503.02 ft	Tailwater Elevation	6,502.75 ft
Outlet Control HW Elev.	6,503.34 ft	Control Type	Outlet Control

ASSUMED TOP OF 48" P287L1 INV. = 6498.75

Grades

Upstream Invert	6,500.00 ft	Downstream Invert	6,498.73 ft
Length	23.40 ft	Constructed Slope	0.054274 ft/ft

Hydraulic Profile

Profile	CompositePressureProfileS1	Depth, Downstream	4.02 ft
Slope Type	N/A	Normal Depth	1.04 ft
Flow Regime	Subcritical	Critical Depth	2.12 ft
Velocity Downstream	3.98 ft/s	Critical Slope	0.003978 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	4.00 ft
Section Size	48 inch	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,503.34 ft	Upstream Velocity Head	0.62 ft
Ke	0.50	Entrance Loss	0.31 ft

Inlet Control Properties

Inlet Control HW Elev.	6,503.02 ft	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	12.6 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
287H1 (100 Year) (OS-T,U&V)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,505.00 ft	Headwater Depth/Height	1.20
Computed Headwater Elevation	6,504.78 ft	Discharge	87.00 cfs
Inlet Control HW Elev.	6,504.49 ft	Tailwater Elevation	6,502.75 ft
Outlet Control HW Elev.	6,504.78 ft	Control Type	Entrance Control

— ASSUMED TOP OF 48" P287L1 INV. = 6498.75

Grades

Upstream Invert	6,500.00 ft	Downstream Invert	6,498.73 ft
Length	23.40 ft	Constructed Slope	0.054274 ft/ft

Hydraulic Profile

Profile	CompositePressureProfileS1S2	Depth, Downstream	4.02 ft
Slope Type	N/A	Normal Depth	1.39 ft
Flow Regime	N/A	Critical Depth	2.83 ft
Velocity Downstream	6.92 ft/s	Critical Slope	0.005101 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	4.00 ft
Section Size	48 inch	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,504.78 ft	Upstream Velocity Head	1.30 ft
Ke	0.50	Entrance Loss	0.65 ft

Inlet Control Properties

Inlet Control HW Elev.	6,504.49 ft	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	12.6 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
302F1 (10 Year) (OS-R)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,523.00 ft	Headwater Depth/Height	0.96
Computed Headwater Elevation	6,521.52 ft	Discharge	54.00 cfs
Inlet Control HW Elev.	6,521.00 ft	Tailwater Elevation	6,521.00 ft — 302M1 HGL
Outlet Control HW Elev.	6,521.52 ft	Control Type	Outlet Control

Grades

Upstream Invert	6,517.70 ft	Downstream Invert	6,516.54 ft
Length	35.20 ft	Constructed Slope	0.032955 ft/ft

Hydraulic Profile

Profile	CompositePressureProfileS1	Depth, Downstream	4.46 ft
Slope Type	N/A	Normal Depth	1.24 ft
Flow Regime	Subcritical	Critical Depth	2.21 ft
Velocity Downstream	4.30 ft/s	Critical Slope	0.004068 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	4.00 ft
Section Size	48 inch	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,521.52 ft	Upstream Velocity Head	0.38 ft
Ke	0.50	Entrance Loss	0.19 ft

Inlet Control Properties

Inlet Control HW Elev.	6,521.00 ft	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	12.6 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
302F1 (100 Year) (OS-R)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,523.00 ft	Headwater Depth/Height	1.33
Computed Headwater Elevation	6,523.00 ft	Discharge	101.00 cfs
Inlet Control HW Elev.	6,522.89 ft	Tailwater Elevation	6,521.00 ft
Outlet Control HW Elev.	6,523.00 ft	Control Type	Entrance Control

302 MI
HGL

Grades

Upstream Invert	6,517.70 ft	Downstream Invert	6,516.54 ft
Length	35.20 ft	Constructed Slope	0.032955 ft/ft

Hydraulic Profile

Profile	CompositePressureProfileS1S2	Depth, Downstream	4.46 ft
Slope Type	N/A	Normal Depth	1.73 ft
Flow Regime	N/A	Critical Depth	3.05 ft
Velocity Downstream	8.04 ft/s	Critical Slope	0.005747 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	4.00 ft
Section Size	48 inch	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,523.00 ft	Upstream Velocity Head	1.50 ft
Ke	0.50	Entrance Loss	0.75 ft

Inlet Control Properties

Inlet Control HW Elev.	6,522.89 ft	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	12.6 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
308F1 (10 Year) (OS-P4A)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,529.08 ft	Headwater Depth/Height	0.99
Computed Headwater Elev:	6,528.10 ft	Discharge	11.00 cfs
Inlet Control HW Elev.	6,527.99 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	6,528.10 ft	Control Type	Entrance Control

Grades

Upstream Invert	6,526.50 ft	Downstream Invert	6,525.06 ft
Length	143.00 ft	Constructed Slope	0.010070 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	0.79 ft
Slope Type	Steep	Normal Depth	0.79 ft
Flow Regime	Supercritical	Critical Depth	0.96 ft
Velocity Downstream	7.03 ft/s	Critical Slope	0.004212 ft/ft

Section

Section Shape	Horizontal Ellipse	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.52 ft
Section Size	19x30 inch	Rise	1.60 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,528.10 ft	Upstream Velocity Head	0.42 ft
Ke	0.50	Entrance Loss	0.21 ft

Inlet Control Properties

Inlet Control HW Elev.	6,527.99 ft	Flow Control	Unsubmerged
Inlet Type	Square edge with headwall (horizontal ellipse)	Area Full	3.3 ft²
K	0.01000	HDS 5 Chart	29
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
308F1 (100 Year) (OS-P4A)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,529.08 ft	Headwater Depth/Height	1.49
Computed Headwater Elev:	6,528.89 ft	Discharge	19.00 cfs
Inlet Control HW Elev.	6,528.89 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	6,528.82 ft	Control Type	Inlet Control

Grades

Upstream Invert	6,526.50 ft	Downstream Invert	6,525.06 ft
Length	143.00 ft	Constructed Slope	0.010070 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	1.03 ft
Slope Type	Steep	Normal Depth	1.03 ft
Flow Regime	Supercritical	Critical Depth	1.28 ft
Velocity Downstream	8.31 ft/s	Critical Slope	0.006136 ft/ft

Section

Section Shape	Horizontal Ellipse	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.52 ft
Section Size	19x30 inch	Rise	1.60 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,528.82 ft	Upstream Velocity Head	0.70 ft
Ke	0.50	Entrance Loss	0.35 ft

Inlet Control Properties

Inlet Control HW Elev.	6,528.89 ft	Flow Control	Submerged
Inlet Type	Square edge with headwall (horizontal ellipse)	Area Full	3.3 ft²
K	0.01000	HDS 5 Chart	29
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
318F1 (10 Year) (OS-O)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,547.00 ft	Headwater Depth/Height	1.13
Computed Headwater Elev:	6,547.40 ft	Discharge	39.00 cfs
Inlet Control HW Elev.	6,547.23 ft	Tailwater Elevation	6,545.85 ft
Outlet Control HW Elev.	6,547.40 ft	Control Type	Entrance Control

Grades

Upstream Invert	6,544.00 ft	Downstream Invert	6,542.95 ft
Length	105.00 ft	Constructed Slope	0.010000 ft/ft

Hydraulic Profile

Profile	CompositeS1S2	Depth, Downstream	2.90 ft
Slope Type	Steep	Normal Depth	1.65 ft
Flow Regime	N/A	Critical Depth	2.03 ft
Velocity Downstream	5.57 ft/s	Critical Slope	0.005319 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.00 ft
Section Size	36 inch	Rise	3.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,547.40 ft	Upstream Velocity Head	0.91 ft
Ke	0.50	Entrance Loss	0.45 ft

Inlet Control Properties

Inlet Control HW Elev.	6,547.23 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	7.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
318F1 (100 Year) (OS-O)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,555.00 ft	Headwater Depth/Height	1.93
Computed Headwater Eleva	6,549.79 ft	Discharge	69.00 cfs
Inlet Control HW Elev.	6,549.79 ft	Tailwater Elevation	6,545.85 ft
Outlet Control HW Elev.	6,549.19 ft	Control Type	Inlet Control

Grades

Upstream Invert	6,544.00 ft	Downstream Invert	6,542.95 ft
Length	105.00 ft	Constructed Slope	0.010000 ft/ft

Hydraulic Profile

Profile	CompositeS1S2	Depth, Downstream	2.56 ft
Slope Type	Steep	Normal Depth	2.56 ft
Flow Regime	N/A	Critical Depth	2.64 ft
Velocity Downstream	10.73 ft/s	Critical Slope	0.009614 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.00 ft
Section Size	36 inch	Rise	3.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,549.19 ft	Upstream Velocity Head	1.70 ft
Ke	0.50	Entrance Loss	0.85 ft

Inlet Control Properties

Inlet Control HW Elev.	6,549.79 ft	Flow Control	Submerged
Inlet Type	Square edge w/headwall	Area Full	7.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
343H1 (10 Year) (OS-F)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,577.82 ft	Headwater Depth/Height	0.77
Computed Headwater Eleva	6,572.42 ft	Discharge	242.00 cfs
Inlet Control HW Elev.	6,572.00 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	6,572.42 ft	Control Type	Entrance Control

Grades

Upstream Invert	6,567.82 ft	Downstream Invert	6,565.89 ft
Length	274.00 ft	Constructed Slope	0.007044 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	2.01 ft
Slope Type	Steep	Normal Depth	1.99 ft
Flow Regime	Supercritical	Critical Depth	2.63 ft
Velocity Downstream	12.05 ft/s	Critical Slope	0.003134 ft/ft

Section

Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	10.00 ft
Section Size	10 x 6 ft	Rise	6.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,572.42 ft	Upstream Velocity Head	1.32 ft
Ke	0.50	Entrance Loss	0.66 ft

Inlet Control Properties

Inlet Control HW Elev.	6,572.00 ft	Flow Control	Unsubmerged
Inlet Type	30 to 75° wingwall flares	Area Full	60.0 ft²
K	0.02600	HDS 5 Chart	8
M	1.00000	HDS 5 Scale	1
C	0.03470	Equation Form	1
Y	0.86000		

Culvert Calculator Report
343H1 (100 Year) (OS-F)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,580.00 ft	Headwater Depth/Height	1.23
Computed Headwater Eleva	6,575.20 ft	Discharge	491.00 cfs
Inlet Control HW Elev.	6,574.64 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	6,575.20 ft	Control Type	Entrance Control

Grades

Upstream Invert	6,567.82 ft	Downstream Invert	6,565.89 ft
Length	274.00 ft	Constructed Slope	0.007044 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	3.34 ft
Slope Type	Steep	Normal Depth	3.26 ft
Flow Regime	Supercritical	Critical Depth	4.22 ft
Velocity Downstream	14.69 ft/s	Critical Slope	0.003445 ft/ft

Section

Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	10.00 ft
Section Size	10 x 6 ft	Rise	6.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,575.20 ft	Upstream Velocity Head	2.11 ft
Ke	0.50	Entrance Loss	1.05 ft

Inlet Control Properties

Inlet Control HW Elev.	6,574.64 ft	Flow Control	Unsubmerged
Inlet Type	30 to 75° wingwall flares	Area Full	60.0 ft²
K	0.02600	HDS 5 Chart	8
M	1.00000	HDS 5 Scale	1
C	0.03470	Equation Form	1
Y	0.86000		

Culvert Calculator Report
426F1 (10 Year) (40% OS-D)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,787.50 ft	Headwater Depth/Height	0.81
Computed Headwater Eleva	6,787.22 ft	Discharge	4.00 cfs
Inlet Control HW Elev.	6,787.11 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	6,787.22 ft	Control Type	Entrance Control

Grades

Upstream Invert	6,786.00 ft	Downstream Invert	6,785.00 ft
Length	65.00 ft	Constructed Slope	0.015385 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	0.57 ft
Slope Type	Steep	Normal Depth	0.57 ft
Flow Regime	Supercritical	Critical Depth	0.77 ft
Velocity Downstream	6.49 ft/s	Critical Slope	0.005413 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.50 ft
Section Size	18 inch	Rise	1.50 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,787.22 ft	Upstream Velocity Head	0.30 ft
Ke	0.50	Entrance Loss	0.15 ft

Inlet Control Properties

Inlet Control HW Elev.	6,787.11 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	1.8 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
426F1 (100 Year) (40% OS-D)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,788.60 ft	Headwater Depth/Height	1.14
Computed Headwater Eleva	6,787.72 ft	Discharge	7.00 cfs
Inlet Control HW Elev.	6,787.63 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	6,787.72 ft	Control Type	Entrance Control

Grades

Upstream Invert	6,786.00 ft	Downstream Invert	6,785.00 ft
Length	65.00 ft	Constructed Slope	0.015385 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	0.79 ft
Slope Type	Steep	Normal Depth	0.78 ft
Flow Regime	Supercritical	Critical Depth	1.02 ft
Velocity Downstream	7.45 ft/s	Critical Slope	0.006768 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.50 ft
Section Size	18 inch	Rise	1.50 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,787.72 ft	Upstream Velocity Head	0.46 ft
Ke	0.50	Entrance Loss	0.23 ft

Inlet Control Properties

Inlet Control HW Elev.	6,787.63 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	1.8 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
428F1 (10 Year) (15% OS-D)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,791.75 ft	Headwater Depth/Height	0.55
Computed Headwater Elev:	6,791.08 ft	Discharge	2.00 cfs
Inlet Control HW Elev.	6,790.98 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	6,791.08 ft	Control Type	Entrance Control

Grades

Upstream Invert	6,790.25 ft	Downstream Invert	6,789.35 ft
Length	54.00 ft	Constructed Slope	0.016667 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	0.39 ft
Slope Type	Steep	Normal Depth	0.39 ft
Flow Regime	Supercritical	Critical Depth	0.53 ft
Velocity Downstream	5.49 ft/s	Critical Slope	0.004944 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.50 ft
Section Size	18 inch	Rise	1.50 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,791.08 ft	Upstream Velocity Head	0.20 ft
Ke	0.50	Entrance Loss	0.10 ft

Inlet Control Properties

Inlet Control HW Elev.	6,790.98 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	1.8 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
428F1 (100 Year) (15% OS-D)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,793.00 ft	Headwater Depth/Height	0.69
Computed Headwater Elev:	6,791.28 ft	Discharge	3.00 cfs
Inlet Control HW Elev.	6,791.18 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	6,791.28 ft	Control Type	Entrance Control

Grades

Upstream Invert	6,790.25 ft	Downstream Invert	6,789.35 ft
Length	54.00 ft	Constructed Slope	0.016667 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	0.48 ft
Slope Type	Steep	Normal Depth	0.48 ft
Flow Regime	Supercritical	Critical Depth	0.66 ft
Velocity Downstream	6.16 ft/s	Critical Slope	0.005125 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.50 ft
Section Size	18 inch	Rise	1.50 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,791.28 ft	Upstream Velocity Head	0.25 ft
Ke	0.50	Entrance Loss	0.13 ft

Inlet Control Properties

Inlet Control HW Elev.	6,791.18 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	1.8 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
444F1 (10 Year) (OS-C)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,777.45 ft	Headwater Depth/Height	1.02
Computed Headwater Elev:	6,777.49 ft	Discharge	14.00 cfs
Inlet Control HW Elev.	6,777.26 ft	Tailwater Elevation	6,777.26 ft
Outlet Control HW Elev.	6,777.49 ft	Control Type	Outlet Control

— CROWN OF 444 L1
30" INVERT = 6774.76

Grades

Upstream Invert	6,774.95 ft	Downstream Invert	6,774.76 ft
Length	37.00 ft	Constructed Slope	0.005135 ft/ft

Hydraulic Profile

Profile	S1	Depth, Downstream	2.50 ft
Slope Type	Steep	Normal Depth	1.22 ft
Flow Regime	Subcritical	Critical Depth	1.26 ft
Velocity Downstream	2.85 ft/s	Critical Slope	0.004540 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.50 ft
Section Size	30 inch	Rise	2.50 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,777.49 ft	Upstream Velocity Head	0.13 ft
Ke	0.50	Entrance Loss	0.07 ft

Inlet Control Properties

Inlet Control HW Elev.	6,777.26 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	4.9 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
444F1 (100 Year) (OS-C)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,780.00 ft	Headwater Depth/Height	1.20
Computed Headwater Elev:	6,777.94 ft	Discharge	24.00 cfs
Inlet Control HW Elev.	6,777.59 ft	Tailwater Elevation	6,777.26 ft
Outlet Control HW Elev.	6,777.94 ft	Control Type	Outlet Control

— CROWN OF 444 L1
30" INVERT = 6774.76

Grades

Upstream Invert	6,774.95 ft	Downstream Invert	6,774.76 ft
Length	37.00 ft	Constructed Slope	0.005135 ft/ft

Hydraulic Profile

Profile	M1	Depth, Downstream	2.50 ft
Slope Type	Mild	Normal Depth	1.72 ft
Flow Regime	Subcritical	Critical Depth	1.67 ft
Velocity Downstream	4.89 ft/s	Critical Slope	0.005553 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.50 ft
Section Size	30 inch	Rise	2.50 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,777.94 ft	Upstream Velocity Head	0.38 ft
Ke	0.50	Entrance Loss	0.19 ft

Inlet Control Properties

Inlet Control HW Elev.	6,777.59 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	4.9 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
465H1 (10 Year) (Stetson Ridge DP #58)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,798.00 ft	Headwater Depth/Height	0.79
Computed Headwater Eleva	6,796.58 ft	Discharge	60.00 cfs
Inlet Control HW Elev.	6,796.07 ft	Tailwater Elevation	6,794.63 ft
Outlet Control HW Elev.	6,796.58 ft	Control Type	Entrance Control

Grades

Upstream Invert	6,793.00 ft	Downstream Invert	6,791.50 ft
Length	16.26 ft	Constructed Slope	0.092251 ft/ft

Hydraulic Profile

Profile	CompositeS1S2	Depth, Downstream	3.13 ft
Slope Type	Steep	Normal Depth	0.96 ft
Flow Regime	N/A	Critical Depth	2.25 ft
Velocity Downstream	5.08 ft/s	Critical Slope	0.003720 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	4.50 ft
Section Size	54 inch	Rise	4.50 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,796.58 ft	Upstream Velocity Head	0.88 ft
Ke	0.50	Entrance Loss	0.44 ft

Inlet Control Properties

Inlet Control HW Elev.	6,796.07 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	15.9 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Calculator Report
465H1 (100 Year) (Stetson Ridge DP #58)

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,798.00 ft	Headwater Depth/Height	1.03
Computed Headwater Eleva	6,797.62 ft	Discharge	92.00 cfs
Inlet Control HW Elev.	6,797.14 ft	Tailwater Elevation	6,794.63 ft
Outlet Control HW Elev.	6,797.62 ft	Control Type	Entrance Control

Grades

Upstream Invert	6,793.00 ft	Downstream Invert	6,791.50 ft
Length	16.26 ft	Constructed Slope	0.092251 ft/ft

Hydraulic Profile

Profile	CompositeS1S2	Depth, Downstream	3.13 ft
Slope Type	Steep	Normal Depth	1.19 ft
Flow Regime	N/A	Critical Depth	2.81 ft
Velocity Downstream	7.79 ft/s	Critical Slope	0.004280 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	4.50 ft
Section Size	54 inch	Rise	4.50 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,797.62 ft	Upstream Velocity Head	1.20 ft
Ke	0.50	Entrance Loss	0.60 ft

Inlet Control Properties

Inlet Control HW Elev.	6,797.14 ft	Flow Control	Unsubmerged
Inlet Type	Square edge w/headwall	Area Full	15.9 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Wingwall Calculations

Marksheffel
Wingwall Design

BY: GCS
DATE: 4/29/2008

Structure	Rise	Skew angle (θ)	Fill slope (Z)	k	θ_a	θ_b	m	L (calculated)	La (design)	Lb (design)
280H1	3.5	90	4	3.5	60	60	4.83	5.3	20	20
280H2	4	73.2	4	1	45	80	5.33	18.1	24	16
287H1	4	63.74	4	3.5	30	80	5.33	8.2	12	12
343H1	6	55.2	3	2	52.2	58.8	7.33	19.5	20	20
343H2	6	52.3	6	2	30.8	90	7.33	40.4	34	66
344H1	4.5	90	4	1.25	60	60	5.83	18.3	18	18
465H1	4.5	65.5	4	1.25	40	70	5.83	20.1	20	10
465H2	4.5	89.5	4	1.25	60	60	5.83	18.3	20	20

Note: CDOT standard detail M-601-2 used as design reference
k= 0.5 (Rise) -1 , However varies for grading on 280H1 and 287H1
m= (Rise) +1.33

Proposed Ditch Calculations

Grass-lined Channel

Description:	Grass lined 6:1 (10 Yr)	
Begin Sta.	261+00	Right
End Sta.	276+00	Right
	Based on FHWA HEC No. 15 - Design of Roadside Channels	
Calc by:	G. Selover	
Last revised:	14 Mar 2006 12:00 AM	

Channel Flow:

Grass-lining Properties

Stem height:	0.33	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.141	

Channel Geometry

Height:	2.0	ft
Bottom Width:	2.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.0200	ft/ft

Channel Hydraulics

Flow Depth	0.83	ft	
Area	5.8	sq.ft.	
Topwidth	11.9	ft	
Perimeter	12.1	ft	
Hyd Radius	0.48	ft	
$AR^{2/3}$	3.53		
Aspect, T/d	36.2		
n =	0.037		
Flow	20.00	cfs	20 cfs (A261R2 10yr)
Velocity	3.5	ft/s	

Grass-lined Channel

Description: Grass lined 6:1 (100 Yr)
Begin Sta. 261+00 Right
End Sta. 276+00 Right
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G. Selover
Last revised: 14 Mar 2006 12:00 AM

Channel Flow:

Grass-lining Properties

Stem height:	0.33	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.141	

Channel Geometry

Height:	2.0	ft
Bottom Width:	2.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.0200	ft/ft

Channel Hydraulics

Flow Depth	1.05	ft	
Area	8.7	sq.ft.	
Topwidth	14.6	ft	
Perimeter	14.8	ft	
Hyd Radius	0.59	ft	
$AR^{2/3}$	6.15		
Aspect, T/d	44.3		
n =	0.034		
Flow	38.00	cfs	38 cfs (A261R2 100yr)
Velocity	4.3	ft/s	

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Pond #4E Bypass + Outfall (10Yr)

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	3.2	ft
Bottom Width:	25.0	ft
Side Slope:	4.0	H : 1 V
Slope	0.006	ft/ft

Channel Hydraulics

Flow Depth	1.7	ft
Area	52.9	sq.ft.
Topwidth	38.4	ft
Perimeter	38.8	ft
Hyd Radius	1.36	ft
$AR^{2/3}$	65.04	
Aspect, T/d	76.7	
n =	0.051	
Flow	141.0	cfs
Velocity	2.7	ft/s

11 cfs (P4A 10yr Bypass Basin)
130 cfs (Pond 4 10 yr Outfall approx.)
141

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Pond #4E Bypass + Outfall (100 Yr)

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	3.2	ft
Bottom Width:	25.0	ft
Side Slope:	4.0	H : 1 V
Slope	0.006	ft/ft

Channel Hydraulics

Flow Depth	2.1	ft	+ 1 ft. Freeboard =	3.1 Ft.
Area	69.4	sq.ft.		
Topwidth	41.7	ft		
Perimeter	42.2	ft		
Hyd Radius	1.65	ft		
$AR^{2/3}$	96.71			
Aspect, T/d	83.3			20 cfs (P4A 100yr Bypass Basin)
n =	0.047			206 cfs (Pond 4 100 yr Outfall approx.)
Flow	226.0	cfs		226
Velocity	3.3	ft/s		

Riprap Lined Channel

Description: Normal depth trapezoidal channel w/ stone lining
HEC No. 15 (third edition) - Design of Roadside Channels
Calc by: G.Selover
Last Revised: 5/5/2008 17:22
Location: Pond #4E Bypass + Outfall (100 Yr)

Channel Flow:

Stone-lining Properties

Stone, D_{50}:	9.0	in
Thickness:	1.50	ft

Channel Geometry

Height	3.0	ft
Bottom Width	25.0	ft
Side Slope	4.0	ft H : 1 ft V
Slope	0.0055	ft/ft

Channel Hydraulics

Flow Depth	2.34	ft	+ 1 ft. Freeboard = 3.3 Ft.
Area	80.3	sq.ft.	
Topwidth	43.7	ft	
Perimeter	44.3	ft	
Hyd Radius	1.81	ft	
da	1.84	ft	
$AR^{2/3}$	119.49		
Aspect, T/d	18.7		
da/D_{50}	2.5		
α	0.061		(where $n = \alpha D_{50}^{1/6}$)
n-value	0.058		
Flow	226.00	cfs	20 cfs (P4ABC 100yr Bypass Basin)
Stream Power	77.6	ft-lb/s/ft	206 cfs (Pond 4 100 yr Outfall approx.
Velocity	2.8	fps	226
τ_o	0.62	lb/ft^2	
τ_d	**0.80**	lb/ft^2	
Froude No.	0.37		
Particle Reynolds No.	4.0E+04		
Shields No.	0.047		

	min	used
Factor of safety	1.0	1.2

Riprap Stability:

Lining Performance

Δ_{bed}	1.00	
$\tau_{p,lining-bed}$	**3.63**	lb/ft^2
Δ_{bank}	1.00	
$\tau_{p,lining-bank}$	**3.63**	lb/ft^2

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Pond #4D Bypass (10 Yr)

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	2.5	ft
Bottom Width:	4.0	ft
Side Slope:	4.0	H : 1 V
Slope	0.010	ft/ft

Channel Hydraulics

Flow Depth	0.8	ft	+ 1 ft. Freeboard =	1.8 Ft.
Area	6.2	sq.ft.		
Topwidth	10.7	ft		
Perimeter	10.9	ft		
Hyd Radius	0.57	ft		
$AR^{2/3}$	4.21			
Aspect, T/d	21.4			
n =	0.057			
Flow	11.0	cfs		11 cfs (P4A 10 Yr Bypass Basin)
Velocity	1.8	ft/s		

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Pond #4D Bypass (100 Yr)

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	2.5	ft
Bottom Width:	4.0	ft
Side Slope:	4.0	H : 1 V
Slope	0.010	ft/ft

Channel Hydraulics

Flow Depth	1.1	ft	+ 1 ft. Freeboard = 2.1 Ft.
Area	9.0	sq.ft.	
Topwidth	12.6	ft	
Perimeter	12.9	ft	
Hyd Radius	0.70	ft	
$AR^{2/3}$	7.05		
Aspect, T/d	25.3		
n =	0.052		
Flow	20.0	cfs	20 cfs (P4A 100yr Bypass Basin)
Velocity	2.2	ft/s	

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Pond #4C Bypass (10 Yr)

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	2.0	ft
Bottom Width:	4.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.025	ft/ft

Channel Hydraulics

Flow Depth	0.6	ft	+ 1 ft. Freeboard =	1.6 Ft.
Area	4.1	sq.ft.		
Topwidth	10.7	ft		
Perimeter	10.8	ft		
Hyd Radius	0.38	ft		
$AR^{2/3}$	2.16			
Aspect, T/d	21.4			
n =	0.046			
Flow	11.0	cfs		11 cfs (P4A 10 Yr Bypass Basin)
Velocity	2.7	ft/s		

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Pond #4C Bypass (100 Yr)

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	2.0	ft
Bottom Width:	4.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.025	ft/ft

Channel Hydraulics

Flow Depth	0.7	ft	+ 1 ft. Freeboard = 1.7 Ft.
Area	6.0	sq.ft.	
Topwidth	12.6	ft	
Perimeter	12.8	ft	
Hyd Radius	0.47	ft	
$AR^{2/3}$	3.62		
Aspect, T/d	25.3		
n =	0.043		
Flow	20.0	cfs	20 cfs (P4A 100 Yr Bypass Basin)
Velocity	3.3	ft/s	

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Pond #4B Bypass (10 Yr)

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	2.0	ft
Bottom Width:	4.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.013	ft/ft

Channel Hydraulics

Flow Depth	0.7	ft	+ 1 ft. Freeboard =	1.7 Ft.
Area	6.0	sq.ft.		
Topwidth	12.6	ft		
Perimeter	12.7	ft		
Hyd Radius	0.47	ft		
$AR^{2/3}$	3.59			
Aspect, T/d	25.2			
n =	0.055			
Flow	11.0	cfs		11 cfs (P4A 10 Yr Bypass Basin)
Velocity	1.8	ft/s		

Grass-lined Channel

Description:	Stable channel design using grass cover Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by:	G Selover
Last revised:	05 May 2008 5:22 PM
Location:	Pond #4B Bypass (100 Yr)

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	2.0	ft
Bottom Width:	4.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.013	ft/ft

Channel Hydraulics

Flow Depth	0.9	ft	+ 1 ft. Freeboard = 1.9 Ft.
Area	8.7	sq.ft.	
Topwidth	15.0	ft	
Perimeter	15.1	ft	
Hyd Radius	0.57	ft	
$AR^{2/3}$	6.01		
Aspect, T/d	30.0		
n =	0.051		
Flow	20.0	cfs	20 cfs (P4A 10 Yr Bypass Basin)
Velocity	2.3	ft/s	

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Pond #4A Bypass (10 Yr)

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	2.0	ft
Bottom Width:	4.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.040	ft/ft

Channel Hydraulics

Flow Depth	0.5	ft	+ 1 ft. Freeboard =	1.5 Ft.
Area	3.2	sq.ft.		
Topwidth	9.6	ft		
Perimeter	9.7	ft		
Hyd Radius	0.33	ft		
$AR^{2/3}$	1.51			
Aspect, T/d	19.2			
n =	0.041			
Flow	11.0	cfs		11 cfs (P4A 10 Yr Bypass Basin)
Velocity	3.5	ft/s		

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Pond #4A Bypass (100 Yr)

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	2.0	ft
Bottom Width:	4.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.040	ft/ft

Channel Hydraulics

Flow Depth	0.6	ft	+ 1 ft. Freeboard = 1.6 Ft.
Area	4.6	sq.ft.	
Topwidth	11.2	ft	
Perimeter	11.3	ft	
Hyd Radius	0.41	ft	
$AR^{2/3}$	2.51		
Aspect, T/d	22.5		
n =	0.037		
Flow	20.0	cfs	20 cfs (P4A 100 Yr Bypass Basin)
Velocity	4.4	ft/s	

Grass-lined Channel

Description:	Stable channel design using grass cover Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by:	G Selover
Last revised:	05 May 2008 5:22 PM
Location:	Pond #3B Bypass (10 Yr)

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	2.0	ft
Bottom Width:	0.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.063	ft/ft

Channel Hydraulics

Flow Depth	0.6	ft	+ 1 ft. Freeboard =	1.6 Ft.
Area	1.9	sq.ft.		
Topwidth	6.7	ft		
Perimeter	6.8	ft		
Hyd Radius	0.28	ft		
$AR^{2/3}$	0.80			
Aspect, T/d	13.5			
n =	0.036			
Flow	8.2	cfs		8.2 cfs (OS-J2 10 Yr)
Velocity	4.3	ft/s		

Riprap Lined Channel

Description: Normal depth trapezoidal channel w/ stone lining
HEC No. 15 (third edition) - Design of Roadside Channels
Calc by: G.Selover
Last Revised: 5/5/2008 17:22
Location: Pond #3B Bypass (10 Yr)

Channel Flow:

Stone-lining Properties

Stone, D_{50}:	9.0	in
Thickness:	1.50	ft

Channel Geometry

Height	2.0	ft
Bottom Width	0.0	ft
Side Slope	6.0	ft H : 1 ft V
Slope	0.0625	ft/ft

Channel Hydraulics

Flow Depth	0.75	ft	+ 1 ft. Freeboard = 1.8 Ft.
Area	3.4	sq.ft.	
Topwidth	9.0	ft	
Perimeter	9.1	ft	
Hyd Radius	0.37	ft	
da	0.38	ft	
$AR^{2/3}$	1.75		
Aspect, T/d	12.0		
da/D_{50}	0.5		
α	0.083		(where $n = \alpha D_{50}^{1/6}$)
n-value	0.079		
Flow	8.20	cfs	8.2 cfs (OS-J2 10 Yr)
Stream Power	32.0	ft-lb/s/ft	
Velocity	2.4	fps	
τ_o	1.44	lb/ft²	
τ_d	**2.93**	lb/ft²	
Froude No.	0.70		
Particle Reynolds No.	7.6E+04		
Shields No.	0.070		

	min	used
Factor of safety	1.1	1.2

Riprap Stability:

Lining Performance

Δ_{bed}	1.00	
$\tau_{p,lining-bed}$	**5.41**	lb/ft²
Δ_{bank}	1.09	
$\tau_{p,lining-bank}$	**4.94**	lb/ft²

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Pond #3A Bypass (10 Yr)

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	2.0	ft
Bottom Width:	0.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.017	ft/ft

Channel Hydraulics

Flow Depth	0.7	ft	+ 1 ft. Freeboard = 1.7 Ft.
Area	2.6	sq.ft.	
Topwidth	7.9	ft	
Perimeter	8.0	ft	
Hyd Radius	0.33	ft	
$AR^{2/3}$	1.23		
Aspect, T/d	15.8		
n =	0.058		
Flow	4.1	cfs	4.1 cfs (50% of OS-J2 10 Yr)
Velocity	1.6	ft/s	

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Pond #3A Bypass (100 Yr)

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	2.0	ft
Bottom Width:	0.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.017	ft/ft

Channel Hydraulics

Flow Depth	0.8	ft	+ 1 ft. Freeboard =	1.8 Ft.
Area	4.0	sq.ft.		
Topwidth	9.8	ft		
Perimeter	9.9	ft		
Hyd Radius	0.40	ft		
$AR^{2/3}$	2.18			
Aspect, T/d	19.6			
n =	0.053			
Flow	7.9	cfs		7.9 cfs (50% of OS-J2 100 Yr)
Velocity	2.0	ft/s		

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Ditch OS-I (10 Yr)
Sta. 370+00 to 381+00, Right

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	1.0	ft
Bottom Width:	0.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.050	ft/ft

Channel Hydraulics

Flow Depth	0.5	ft
Area	1.6	sq.ft.
Topwidth	6.2	ft
Perimeter	6.2	ft
Hyd Radius	0.25	ft
$AR^{2/3}$	0.63	
Aspect, T/d	12.3	
n =	0.041	
Flow	5.1	cfs
Velocity	3.2	ft/s

5.1 cfs (67% OS-I 10 Yr)

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Ditch OS-I (100 Yr)
Sta. 370+00 to 381+00, Right

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	1.0	ft
Bottom Width:	0.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.050	ft/ft

Channel Hydraulics

Flow Depth	0.6	ft	
Area	2.5	sq.ft.	
Topwidth	7.7	ft	
Perimeter	7.9	ft	
Hyd Radius	0.32	ft	
$AR^{2/3}$	1.17		
Aspect, T/d	15.5		
n =	0.038		
Flow	10.3	cfs	10.3 cfs (67% OS-I 100 Yr)
Velocity	4.1	ft/s	

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Ditch OS-H (10 Yr)
Sta. 381+00 to 393+00, Right

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	1.0	ft
Bottom Width:	0.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.050	ft/ft

Channel Hydraulics

Flow Depth	0.6	ft
Area	1.9	sq.ft.
Topwidth	6.8	ft
Perimeter	6.9	ft
Hyd Radius	0.28	ft
$AR^{2/3}$	0.83	
Aspect, T/d	13.7	
n =	0.040	
Flow	7.0	cfs
Velocity	3.6	ft/s

7.0 cfs (67% OS-H 10 Yr)

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Ditch OS-H (100 Yr)
Sta. 381+00 to 393+00, Right

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	2.0	ft
Bottom Width:	0.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.050	ft/ft

Channel Hydraulics

Flow Depth	0.7	ft	
Area	3.0	sq.ft.	
Topwidth	8.4	ft	
Perimeter	8.5	ft	
Hyd Radius	0.35	ft	
$AR^{2/3}$	1.46		
Aspect, T/d	16.8		
n =	0.036		
Flow	13.3	cfs	13.3 cfs (67% OS-H 100 Yr)
Velocity	4.5	ft/s	

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Ditch OS-G2 (10 Yr)
Sta. 393+00 to Sta. 396+00, Right

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	1.0	ft
Bottom Width:	0.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.025	ft/ft

Channel Hydraulics

Flow Depth	0.6	ft	
Area	2.3	sq.ft.	
Topwidth	7.5	ft	
Perimeter	7.6	ft	
Hyd Radius	0.31	ft	
$AR^{2/3}$	1.05		
Aspect, T/d	14.9		
n =	0.050		
Flow	4.9	cfs	4.9 cfs (25% OS-G 10 Yr)
Velocity	2.1	ft/s	

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Ditch OS-G2 (100 Yr)
Sta. 393+00 to Sta. 396+00, Right

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	1.0	ft
Bottom Width:	0.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.025	ft/ft

Channel Hydraulics

Flow Depth	0.6	ft	
Area	2.3	sq.ft.	
Topwidth	7.5	ft	
Perimeter	7.6	ft	
Hyd Radius	0.31	ft	
$AR^{2/3}$	1.05		
Aspect, T/d	14.9		
n =	0.050		
Flow	4.9	cfs	4.9 cfs (25% OS-G 100 Yr)
Velocity	2.1	ft/s	

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Ditch OS-G1 (10 Yr)
Sta. 396+00 to Sta. 408+00, Right

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	1.0	ft
Bottom Width:	0.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.060	ft/ft

Channel Hydraulics

Flow Depth	0.5	ft	
Area	1.7	sq.ft.	
Topwidth	6.3	ft	
Perimeter	6.4	ft	
Hyd Radius	0.26	ft	
$AR^{2/3}$	0.68		
Aspect, T/d	12.6		
n =	0.038		
Flow	6.5	cfs	6.5 cfs (33% OS-G 10 Yr)
Velocity	3.9	ft/s	

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Ditch OS-G1 (100 Yr)
Sta. 396+00 to Sta. 408+00, Right

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	1.0	ft
Bottom Width:	0.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.060	ft/ft

Channel Hydraulics

Flow Depth	0.6	ft
Area	2.4	sq.ft.
Topwidth	7.7	ft
Perimeter	7.8	ft
Hyd Radius	0.31	ft
$AR^{2/3}$	1.13	
Aspect, T/d	15.3	
n =	0.035	
Flow	11.7	cfs
Velocity	4.8	ft/s

11.7 cfs (33% OS-G 10 Yr)

Grass-lined Channel

Description:	Stable channel design using grass cover Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by:	G Selover
Last revised:	05 May 2008 5:22 PM
Location:	Ditch OS-D (10 Yr) Sta. 420+00 to Sta. 430+00

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	2.0	ft
Bottom Width:	0.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.020	ft/ft

Channel Hydraulics

Flow Depth	0.8	ft	+ 1 ft. Freeboard =	1.8 Ft.
Area	3.6	sq.ft.		
Topwidth	9.3	ft		
Perimeter	9.5	ft		
Hyd Radius	0.38	ft		
$AR^{2/3}$	1.92			
Aspect, T/d	18.7			
n =	0.050			
Flow	8.0	cfs		8 cfs (OS-D 10 Yr)
Velocity	2.2	ft/s		

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Ditch OS-D (100 Yr)
Sta. 420+00 to Sta. 430+00

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	2.0	ft
Bottom Width:	0.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.020	ft/ft

Channel Hydraulics

Flow Depth	0.9	ft	+ 1 ft. Freeboard =	1.9 Ft.
Area	5.3	sq.ft.		
Topwidth	11.3	ft		
Perimeter	11.5	ft		
Hyd Radius	0.46	ft		
$AR^{2/3}$	3.20			
Aspect, T/d	22.6			
n =	0.047			
Flow	14.4	cfs		14.4 cfs (OS-D 100 Yr)
Velocity	2.7	ft/s		

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Pond #2B (10 Yr)

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	2.0	ft
Bottom Width:	0.0	ft
Side Slope:	4.0	H : 1 V
Slope	0.017	ft/ft

Channel Hydraulics

Flow Depth	0.7	ft	+ 1 ft. Freeboard =	1.7 Ft.
Area	2.2	sq.ft.		
Topwidth	5.9	ft		
Perimeter	6.1	ft		
Hyd Radius	0.36	ft		
$AR^{2/3}$	1.09			
Aspect, T/d	11.8			
n =	0.055			
Flow	3.8	cfs		3.8 cfs (OS-P2AB 10 Yr)
Velocity	1.8	ft/s		

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Pond #2B (100 Yr)

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	2.0	ft
Bottom Width:	0.0	ft
Side Slope:	4.0	H : 1 V
Slope	0.017	ft/ft

Channel Hydraulics

Flow Depth	0.9	ft	+ 1 ft. Freeboard =	1.9 Ft.
Area	3.4	sq.ft.		
Topwidth	7.4	ft		
Perimeter	7.6	ft		
Hyd Radius	0.45	ft		
$AR^{2/3}$	2.01			
Aspect, T/d	14.8			
n =	0.050			
Flow	7.7	cfs		7.7 cfs (OS-P2AB 100 Yr)
Velocity	2.2	ft/s		

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Pond #2A (10 Yr)

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	2.0	ft
Bottom Width:	0.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.025	ft/ft

Channel Hydraulics

Flow Depth	0.5	ft	+ 1 ft. Freeboard = 1.5 Ft.
Area	1.5	sq.ft.	
Topwidth	5.9	ft	
Perimeter	6.0	ft	
Hyd Radius	0.24	ft	
$AR^{2/3}$	0.57		
Aspect, T/d	11.8		
n =	0.055		
Flow	2.4	cfs	2.4 cfs (OS-P2A 10 Yr)
Velocity	1.7	ft/s	

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: Pond #2A (100 Yr)

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	2.0	ft
Bottom Width:	0.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.025	ft/ft

Channel Hydraulics

Flow Depth	0.6	ft	+ 1 ft. Freeboard =	1.6 Ft.
Area	2.3	sq.ft.		
Topwidth	7.4	ft		
Perimeter	7.5	ft		
Hyd Radius	0.30	ft		
$AR^{2/3}$	1.03			
Aspect, T/d	14.8			
n =	0.051			
Flow	4.8	cfs		4.8 cfs (OS-P2A 100 Yr)
Velocity	2.1	ft/s		

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: BLR Pond #93**B** Bypass (100 Yr)
Sta. 468+00, Right, Bypass Pond South

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	2.5	ft
Bottom Width:	8.0	ft
Side Slope:	4.0	H : 1 V
Slope	0.010	ft/ft

Channel Hydraulics

Flow Depth	1.4	ft	+ 1 ft. Freeboard =	2.4 Ft.
Area	19.5	sq.ft.		
Topwidth	19.4	ft		
Perimeter	19.7	ft		
Hyd Radius	0.99	ft		
$AR^{2/3}$	19.31			
Aspect, T/d	38.8			
n =	0.046			
Flow	63.0	cfs		63 cfs (Detention Basin #93 100 Yr)
Velocity	3.2	ft/s		

Grass-lined Channel

Description: Stable channel design using grass cover
Based on FHWA HEC No. 15 - Design of Roadside Channels
Calc by: G Selover
Last revised: 05 May 2008 5:22 PM
Location: BLR Pond #93A Bypass (100 Yr)
Sta. 468+00 to 471+80, Right

Channel Flow:

Grass-lining Properties

Stem height:	0.50	ft
Growth form:	Bunch	
Condition:	Fair	
Cs =	2.0	
Cn =	0.176	

Channel Geometry

Height:	2.0	ft
Bottom Width:	8.0	ft
Side Slope:	6.0	H : 1 V
Slope	0.020	ft/ft

Channel Hydraulics

Flow Depth	1.0	ft	+ 1 ft. Freeboard =	2.0 Ft.
Area	14.7	sq.ft.		
Topwidth	20.4	ft		
Perimeter	20.6	ft		
Hyd Radius	0.71	ft		
$AR^{2/3}$	11.77			
Aspect, T/d	40.9			
n =	0.039			
Flow	63.0	cfs		63 cfs (Detention Basin #93 100 Yr)
Velocity	4.3	ft/s		

APPENDIX B

Standard Design Charts and Tables

DCM VOLUME II

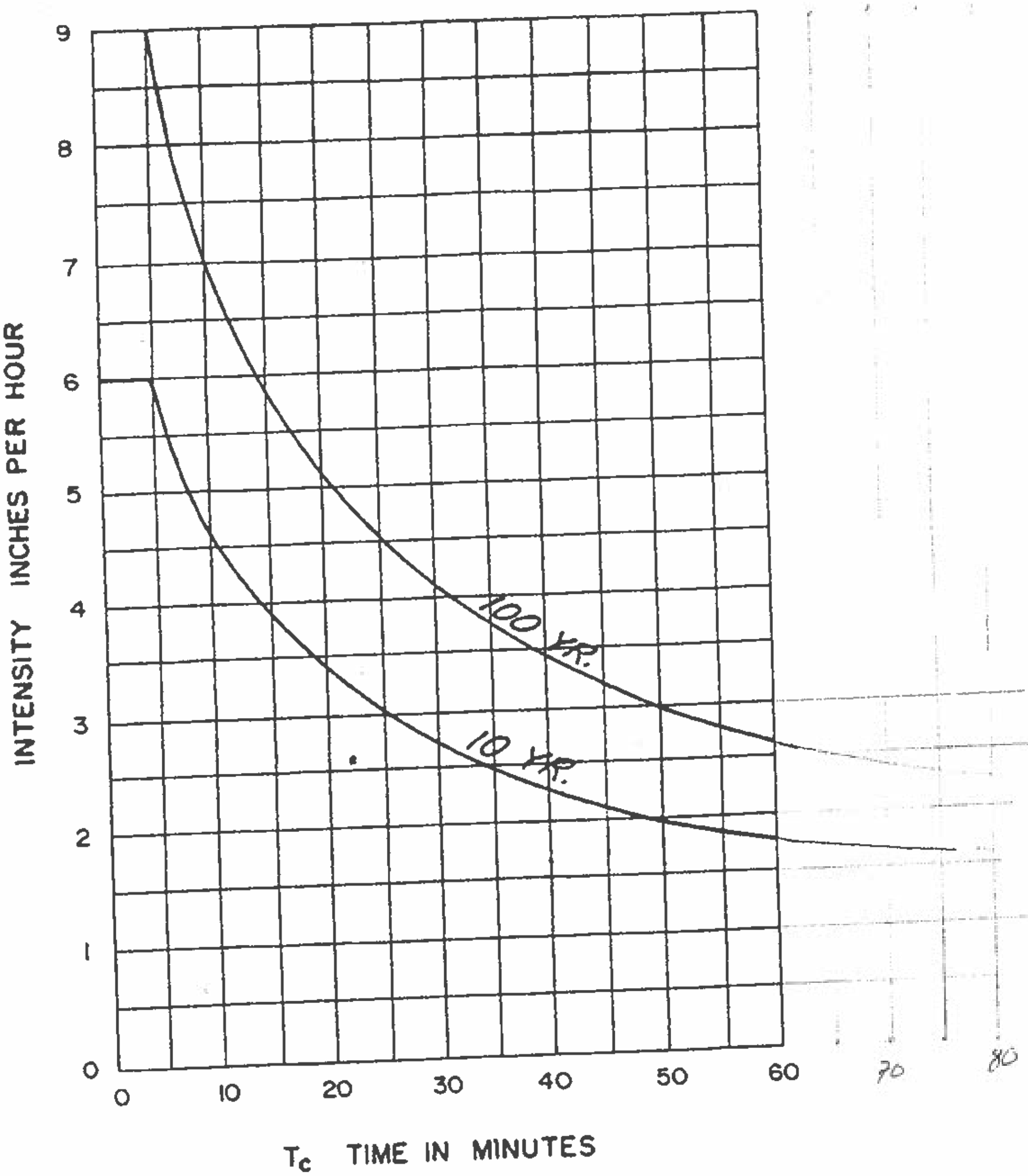
TABLE 5-1

RECOMMENDED AVERAGE RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUS

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	"C" FREQUENCY 10 A&B*	10 C&D*	100 A&B*	100 C&D*
Business					
Commercial Areas	95	0.90	0.90	0.90	0.90
Neighborhood Areas	70	0.75	0.75	0.80	0.80
Residential					
1/8 Acre or less	65	0.60	0.70	0.70	0.80
1/4 Acre	40	0.50	0.60	0.60	0.70
1/3 Acre	30	0.40	0.50	0.55	0.60
1/2 Acre	25	0.35	0.45	0.45	0.55
1 Acre	20	0.30	0.40	0.40	0.50
Industrial					
Light Areas	80	0.70	0.70	0.80	0.80
Heavy Areas	90	0.80	0.80	0.90	0.90
Parks and Cemeteries	7	0.30	0.35	0.55	0.60
Playgrounds	13	0.30	0.35	0.60	0.65
Railroad Yard Areas	40	0.50	0.55	0.60	0.65
Undeveloped Areas					
Historic Flow Analysis- Greenbelts, Agricultural	2	0.15	0.25	0.20	0.30
Pasture/Meadow	0	0.25	0.30	0.35	0.45
Forest	0	0.10	0.15	0.15	0.20
Exposed Rock	100	0.90	0.90	0.95	0.95
Offsite Flow Analysis (when land use not defined)	45	0.55	0.60	0.65	0.70
Streets					
Paved	100	0.90	0.90	0.95	0.95
Gravel	80	0.80	0.80	0.85	0.85
Drive and Walks	100	0.90	0.90	0.95	0.95
Roofs	90	0.90	0.90	0.95	0.95
Lawns	0	0.25	0.30	0.35	0.45

* Hydrologic Soil Group

9/30/90



RE: Based upon Pikes Peak area council of governments/ areawide urban runoff control manual.

HDR Infrastructure, Inc.
A Centerra Company

The City of Colorado Springs / El Paso County
Drainage Criteria Manual

Storm Rainfall
Time Intensity-Frequency Curves

Date
OCT. 1987

Figure
5 - 1

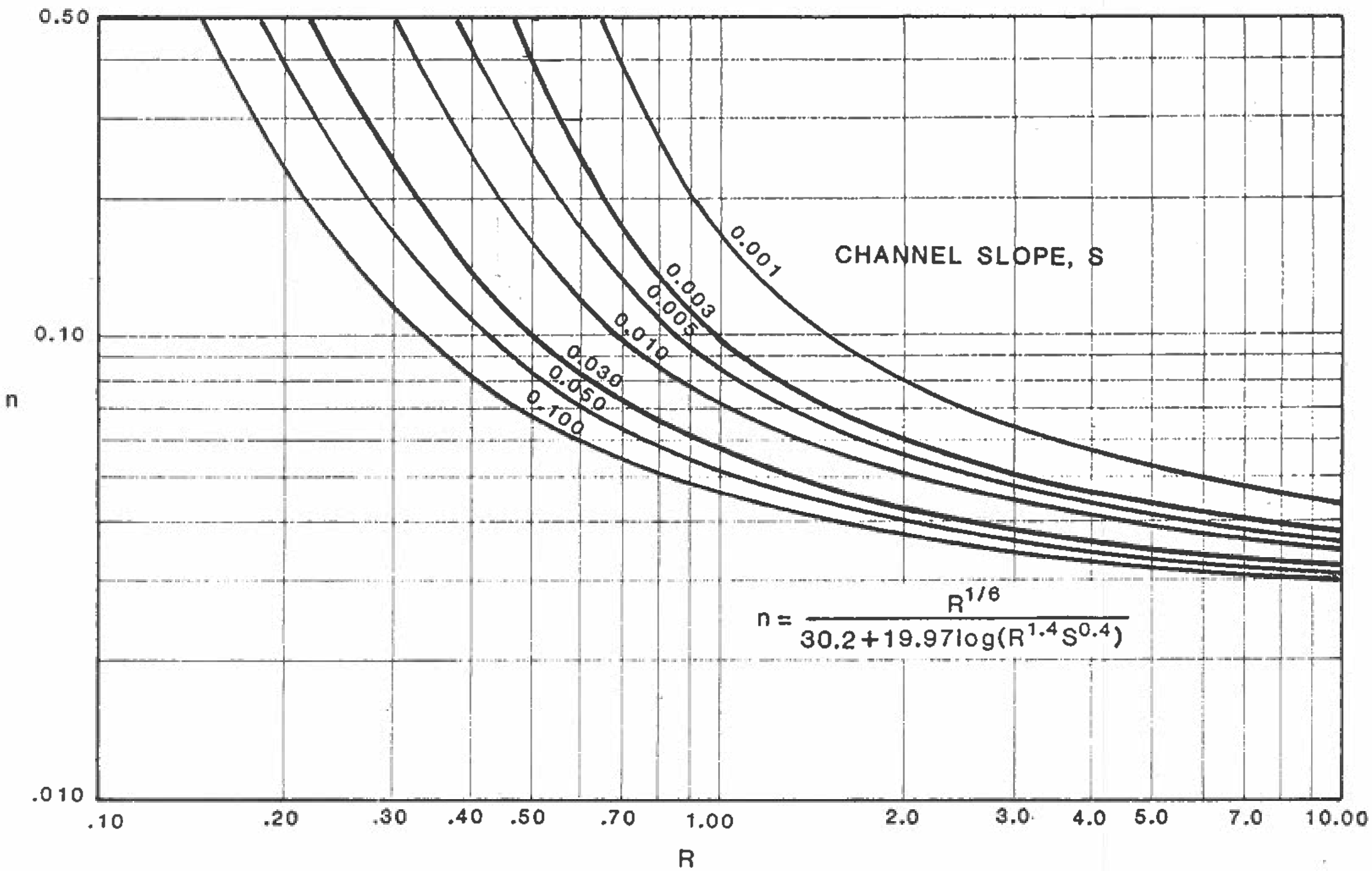


Chart 7. Manning's n versus hydraulic radius, R, for class C vegetation. (after 5)

TABLE 6-3

MINIMUM SLOPE REQUIRED FOR SCOURING VELOCITY*

Pipe Size (inches)	Concrete Pipe Slope (ft/ft)	Corrugated Metal Pipe Slope (ft/ft)
15	0.0021	0.0074
18	0.0018	0.0060
21	0.0015	0.0049
24	0.0013	0.0041
27	0.0011	0.0035
30	0.0009	0.0031
36	0.0007	0.0024
42	0.0006	0.0020
48	0.0005	0.0016
54	0.0004	0.0014
60	0.0004	0.0012
66	0.0004	0.0011
72	0.0003	0.0010
78	0.0003	0.0009
84	0.0003	0.0008
96	0.0002	0.0007

* These slopes are based on pipe flowing at 0.8 depth

This table indicates grades for concrete pipe (n=0.013) and for corrugated metal pipe (n=0.024) to produce a velocity of 2.5 fps.

For determining hydraulic conditions in partially filled pipes, see Table XVI contained in the publication "Design and Construction of Sanitary and Storm Sewers", 1969 by the ASCE and WPCF.

TABLE 10-2 (Continued)

TYPICAL ROUGHNESS COEFFICIENTS FOR OPEN CHANNELS

Type of Channel and Description	Minimum	Normal	Maximum
c. Concrete bottom float finished with sides of			
1. Dressed stone in mortar	0.015	0.017	0.020
2. Random stone in mortar	0.017	0.020	0.024
3. Cement rubble masonry, plastered	0.016	0.020	0.024
4. Cement rubble masonry	0.020	0.025	0.030
5. Dry rubble or riprap	0.020	0.030	0.035
d. Gravel bottom with sides of			
1. Formed concrete	0.017	0.020	0.025
2. Random stone in mortar	0.020	0.023	0.026
3. Dry rubble or riprap	0.023	0.033	0.036
e. Asphalt			
1. Smooth		0.013	
2. Rough		0.016	
f. Grassed	0.030	0.040	0.050

TABLE 10-3

MAXIMUM PERMISSIBLE DESIGN
OPEN CHANNEL FLOW VELOCITIES IN EARTH*

Soil Types	Permissible Mean Channel Velocity (ft/sec)
Fine Sand (noncolloidal)	2.0
Coarse Sand (noncolloidal)	4.0
Sandy Loam (noncolloidal)	2.5
Silt Loam (noncolloidal)	3.0
Ordinary Firm Loam	3.5
Silty Clay	3.5
Fine Gravel	5.0
Stiff Clay (very colloidal)	5.0
Graded, Loam to Cobbles (noncolloidal)	5.0
Graded, Silt to Cobbles (colloidal)	5.5
Alluvial Silts (noncolloidal)	3.5
Alluvial Silts (colloidal)	5.0
Coarse Gravel (noncolloidal)	6.0
Cobbles and Shingles	5.5
Hard Shales and Hard Pans	6.0
Soft Shales	3.5
Soft Sandstone	8.0
Sound rock (usu. igneous or hard metamorphic)	20.0

* These velocities shall be used in conjunction with scour calculations and as approved by City/County.

TABLE 10-4

MAXIMUM PERMISSIBLE VELOCITIES FOR EARTH CHANNELS WITH VARIED GRASS LININGS AND SLOPES

Channel Slope	Lining	Permissible Mean Channel Velocity * (ft/sec)
0 - 5%	Sodded grass	7
	Bermudagrass	6
	Reed canarygrass	5
	Tall fescue	5
	Kentucky bluegrass	5
	Grass-legume mixture	4
	Red fescue	2.5
	Redtop	2.5
	Sericea lespedeza	2.5
	Annual lespedeza	2.5
	Small grains (temporary)	2.5
5 - 10%	Sodded grass	6
	Bermudagrass	5
	Reed canarygrass	4
	Tall fescue	4
	Kentucky bluegrass	4
	Grass-legume mixture	3
Greater than 10%	Sodded grass	5
	Bermudagrass	4
	Reed canarygrass	3
	Tall fescue	3
	Kentucky bluegrass	3

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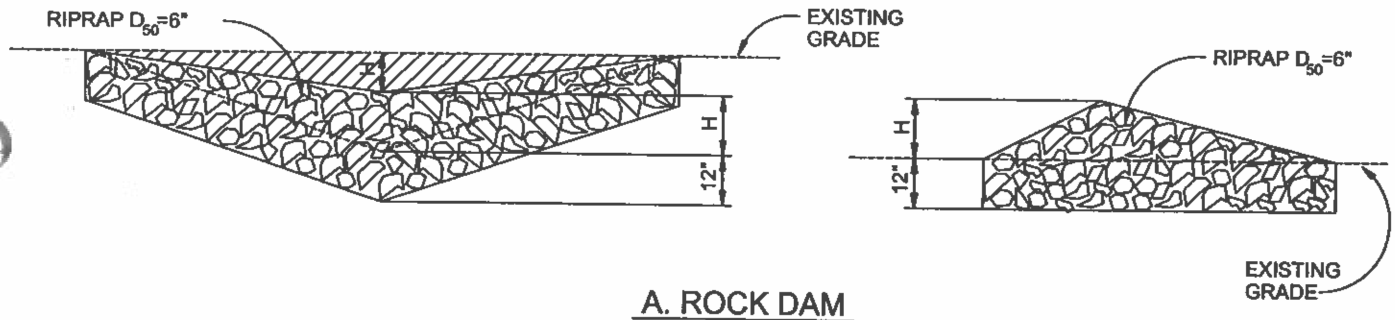
* For highly erodible soils, decrease permissible velocities by 25%.

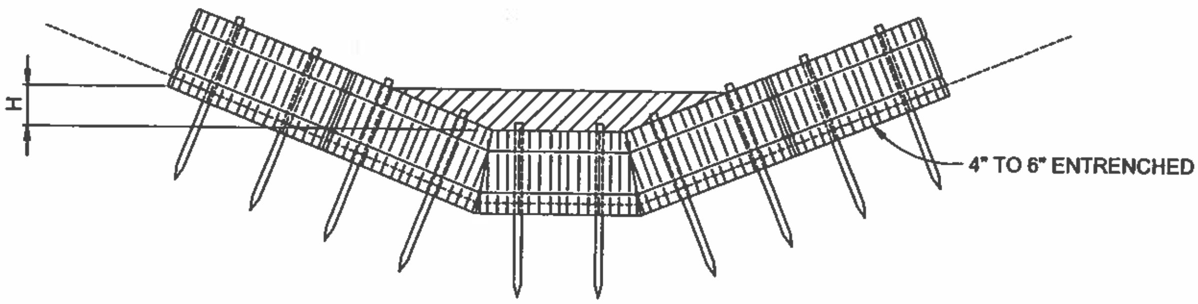
* Grass lined channels are dependent upon assurances of continuous growth and maintenance of grass.

APPENDIX C

Water Quality Enhancement BMPs

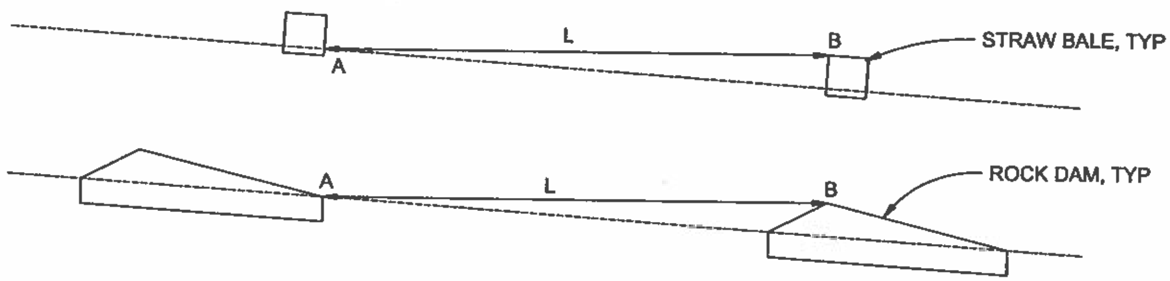


A. ROCK DAM



B. STRAW BALE CHECK DAM

(SEE STRAW BALE BARRIER INSTALATION)



L= THE DISTANCE SUCH THAT POINTS A AND B ARE AT THE SAME ELEVATION.

C. SPACING CHECK DAMS

CHECK DAM

NTS

CHECK DAM NOTES

INSTALLATION REQUIREMENTS

1. STRAW BALES USED AS CHECK DAMS ARE TO MEET THE REQUIREMENTS STATED IN FIGURE SBB-2.

2. THE "H" DIMENSION SHALL BE SELECTED TO PROVIDE WEIR FLOW CONVEYANCE FOR 2-YEAR FLOW OR GREATER.

MAINTENANCE REQUIREMENTS

1. REGULAR INSPECTIONS ARE TO BE MADE OF ALL CHECK DAMS, ESPECIALLY AFTER STORM EVENTS.

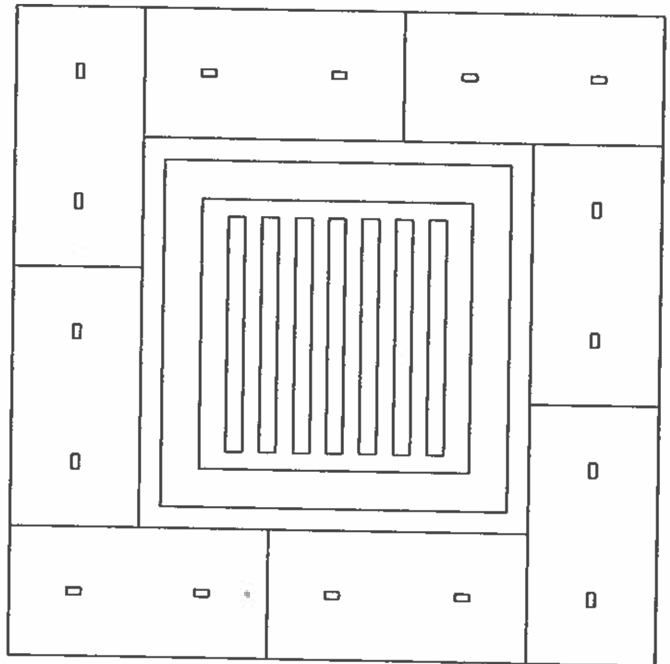
2. REPLACE STONE AS NECESSARY TO MAINTAIN THE CORRECT HEIGHT OF THE DAM.

3. ACCUMULATED SEDIMENT AND DEBRIS IS TO BE REMOVED FROM BEHIND THE DAMS AFTER EACH STORM OR WHEN 1/2 OF THE ORIGINAL HEIGHT OF THE DAM IS REACHED.

3. CHECK DAMS ARE TO REMAIN IN PLACE AND OPERATIONAL UNTIL THE DRAINAGE AREA AND CHANNEL ARE PERMANENTLY STABILIZED.

4. WHEN CHECK DAMS ARE REMOVED THE CHANNEL LINING OR VEGETATION IS TO BE RESTORED.

City of Colorado Springs Stormwater Quality	Figure CD-1 Check Dam Construction Detail and Maintenance Requirements



STRAW BALE INLET PROTECTION

NTS

STRAW BALE INLET PROTECTION NOTES

INSTALLATION REQUIREMENTS

1. INLET PROTECTION SHALL BE INSTALLED IMMEDIATELY AFTER CONSTRUCTION OF INLET.

2. BALES ARE TO BE PLACED IN A SINGLE ROW AROUND THE INLET WITH THE END OF THE BALES TIGHTLY ABUTTING ONE ANOTHER.

3. SEE STRAW BALE BARRIER FIGURE SBB-2 FOR INSTALLATION REQUIREMENTS.

MAINTENANCE REQUIREMENTS

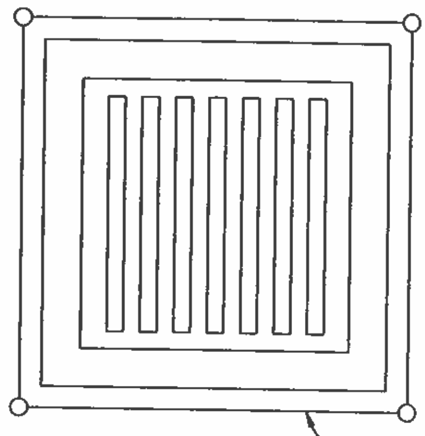
1. CONTRACTOR SHALL INSPECT STRAW BALE INLET PROTECTION IMMEDIATELY AFTER EACH RAINFALL, AT LEAST DAILY DURING PROLONGED RAINFALL, AND WEEKLY DURING PERIODS NO RAINFALL.

2. DAMAGED OR INEFFECTIVE INLET PROTECTION SHALL PROMPTLY BE REPAIRED, REPLACING BALES IF NECESSARY, AND UNENTRENCHED BALES NEED TO BE REPAIRED WITH COMPACTED BACKFILL MATERIAL.

3. SEDIMENT SHALL BE REMOVED FROM BEHIND STRAW BALES WHEN IT ACCUMULATES TO APPROXIMATELY 1/3 THE HEIGHT OF THE BARRIER.

4. INLET PROTECTION SHALL BE REMOVED WHEN ADEQUATE VEGETATIVE COVER IS ATTAINED WITHIN THE DRAINAGE AREA AS APPROVED BY THE CITY.

City of Colorado Springs Stormwater Quality	Figure IP-2 Straw Bale Inlet Protection Construction Detail and Maintenance Requirements



FILTER FABRIC INLET PROTECTION

NTS

FILTER FABRIC INLET PROTECTION NOTES

INSTALLATION REQUIREMENTS

1. INLET PROTECTION SHALL BE INSTALLED IMMEDIATELY AFTER CONSTRUCTION OF INLET.

2. SEE SILT FENCE FIGURE SF-2 FOR INSTALLATION REQUIREMENTS.

3. POSTS ARE TO BE PLACED AT EACH CORNER OF THE INLET AND AROUND THE EDGES AT A MAXIMUM SPACING OF 3 FEET.

MAINTENANCE REQUIREMENTS

1. CONTRACTOR SHALL INSPECT INLET PROTECTION IMMEDIATELY AFTER EACH RAINFALL, AT LEAST DAILY DURING PROLONGED RAINFALL, AND WEEKLY DURING PERIODS NO RAINFALL.

2. DAMAGED, COLLAPSED, UNENTRENCHED OR INEFFECTIVE INLET PROTECTION SHALL BE PROMPTLY REPAIRED OR REPLACED.

3. SEDIMENT SHALL BE REMOVED FROM BEHIND FILTER FABRIC WHEN IT ACCUMULATES TO HALF THE EXPOSED GEOTEXTILE HEIGHT.

4. FILTER FABRIC PROTECTION SHALL BE REMOVED WHEN ADEQUATE VEGETATIVE COVER IS ATTAINED IN THE DRAINAGE AREA AS APPROVED BY THE CITY.

City of Colorado Springs Stormwater Quality	Figure IP-1 Filter Fabric Inlet Protection Construction Detail and Maintenance Requirements

MULCHING NOTES

INSTALLATION REQUIREMENTS

1. ALL DISTURBED AREAS MUST BE MULCHED WITHIN 21 DAYS AFTER FINAL GRADE AND SEEDED AREAS ARE TO BE MULCHED WITHIN 24 HOURS AFTER SEEDING.

2. MATERIAL USED FOR MULCH CAN BE CERTIFIED CLEAN, WEED- AND SEED-FREE LONG STEMMED FIELD OR MARSH HAY, OR STRAW OF OATS, BARLEY, WHEAT, RYE, OR TRITICALE CERTIFIED BY THE COLORADO DEPARTMENT OF AGRICULTURE WEED FREE FORAGE CERTIFICATION PROGRAM.

3. HYDRAULIC MULCHING MATERIAL SHALL CONSIST OF VIRGIN WOOD FIBER MANUFACTURED FROM CLEAN WHOLE WOOD CHIPS. WOOD CHIPS CANNOT CONTAIN ANY GROWTH OR GERMINATION INHIBITORS OR BE PRODUCED FROM RECYCLED MATERIAL. GRAVEL CAN ALSO BE USED.

4. MULCH IS TO BE APPLIED EVENLY AT A RATE OF 2 TONS PER ACRE.

5. MULCH IS TO BE ANCHORED EITHER BY CRIMPING (TUCKING MULCH FIBERS 4 INCHES INTO THE SOIL), USING NETTING (USED ON SMALL AREAS WITH STEEP SLOPES), OR WITH A TACKIFIER.

6. HYDRAULIC MULCHING AND TACKIFIERS ARE NOT TO BE USED IN THE PRESENCE OF FREE SURFACE WATER.

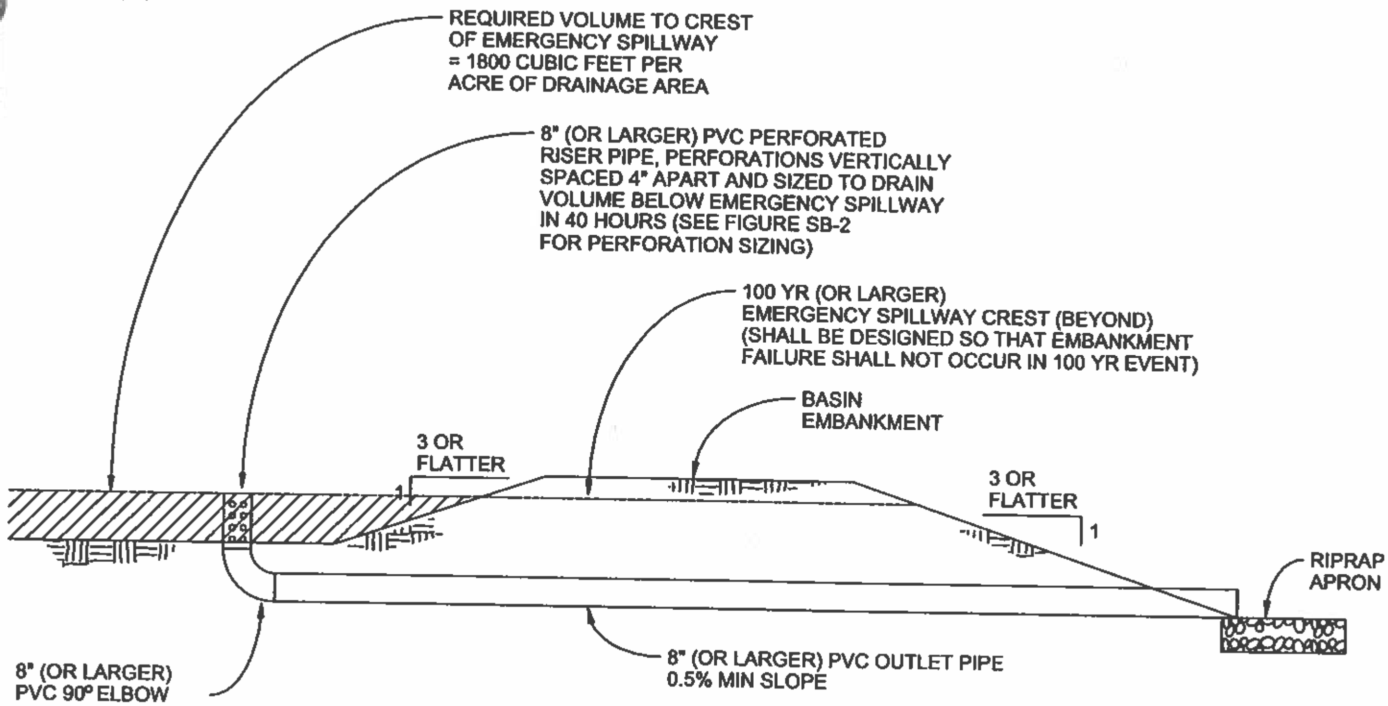
MAINTENANCE REQUIREMENTS

1. REGULAR INSPECTIONS ARE TO BE MADE OF ALL MULCHED AREAS.

2. MULCH IS TO BE REPLACED IMMEDIATELY IN THOSE AREAS IT HAS BEEN REMOVED, AND IF NECESSARY THE AREA SHOULD BE RESEEDED.

City of Colorado Springs Stormwater Quality	Figure MU-1 Mulching Construction Detail and Maintenance Requirements

BASIN GEOMETRY:
$\frac{\text{LENGTH (L)}}{\text{WIDTH (W)}} \geq 2$



SEDIMENT BASIN
NTS

SEDMENT BASIN NOTES

INSTALLATION REQUIREMENTS

1. SEDIMENT BASINS SHALL BE INSTALLED BEFORE ANY CLEARING AND/OR GRADING IS UNDERTAKEN.

2. THE AREA UNDER WHICH THE EMBANKMENT IS TO BE INSTALLED SHALL BE CLEARED, GRUBBED, AND STRIPPED OF ALL VEGETATION AND ROOT MAT.

3. THE OUTLET OF THE BASIN SHALL BE DESIGNED TO DRAIN ITS VOLUME IN 40 HOURS.

4. THE OUTLET IS TO BE LOCATED AT THE FURTHEST DISTANCE FROM THE INLET OF THE BASIN. BAFFLES MAY BE NEEDED TO INCREASE THE FLOW LENGTH AND SETTLING TIME.

5. EMBANKMENT MATERIAL SHALL CONSIST OF SOIL WITH A MINIMUM OF 15% PASSING A #200 SIEVE. EXCAVATED SOIL CAN BE USED IF IT MEETS THIS REQUIREMENT.

6. EMBANKMENT IS TO BE COMPACTED TO AT LEAST 90% OF MAXIMUM DENSITY AND WITHIN 2% OF OPTIMUM MOISTURE CONTENT ACCORDING TO ASTM D 698.

7. WHEN A BASIN IS INSTALLED NEAR A RESIDENTIAL AREA, FOR SAFETY REASONS, A SIGN SHALL BE POSTED AND THE AREA SECURED WITH A FENCE.

MAINTENANCE REQUIREMENTS

1. CONTRACTOR SHALL INSPECT SEDIMENT BASINS AFTER EACH RAINFALL, AT LEAST DAILY DURING PROLONGED RAINFALL, AND WEEKLY DURING PERIODS NO RAINFALL.

2. SEDIMENT BASINS SHALL BE CLEANED OUT BEFORE SEDIMENT HAS FILLED HALF THE VOLUME OF THE BASIN.

3. SEDIMENT BASINS SHALL REMAIN OPERATIONAL AND PROPERLY MAINTAINED UNTIL THE SITE AREA IS PERMANENTLY STABILIZED WITH ADEQUATE VEGETATIVE COVER AND/OR OTHER PERMANENT STRUCTURE AS APPROVED BY THE CITY.

City of Colorado Springs Stormwater Quality	Figure SB-1 Sediment Basin Construction Detail and Maintenance Requirements

Required Area per Row (in^2)

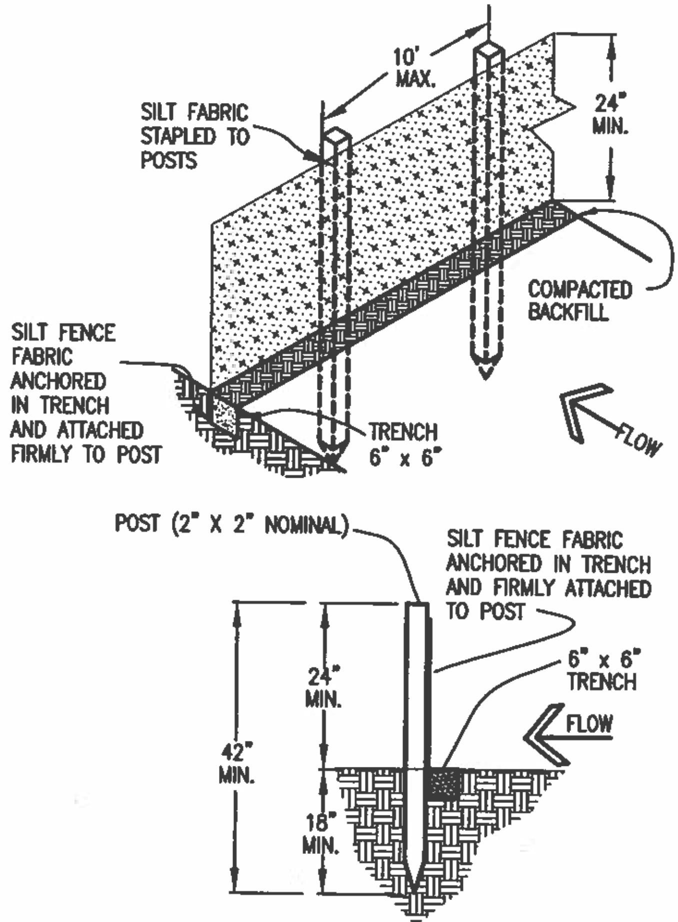
		Depth at Outlet (ft)							
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
Design Volume (acre-ft)	2	15.04	7.71	5.10	3.76	2.95	2.41	2.02	1.73
	1	7.52	3.86	2.55	1.88	1.48	1.21	1.01	0.87
	0.6	4.51	2.31	1.53	1.13	0.89	0.72	0.61	0.52
	0.4	3.01	1.54	1.02	0.75	0.59	0.48	0.40	0.35
	0.2	1.50	0.77	0.51	0.38	0.30	0.24	0.20	0.17
	0.1	0.75	0.39	0.26	0.19	0.15	0.12	0.10	0.09
	0.06	0.45	0.23	0.15	0.11	0.09	0.07	0.06	0.05
	0.04	0.30	0.15	0.10	0.08	0.06	0.05	0.04	0.03
	0.02	0.15	0.08	0.05	0.04	0.03	0.02	0.02	0.02
	0.01	0.08	0.04	0.03	0.02	0.01	0.01	0.01	0.01

TABLE SB-1

Circular Perforation Sizing

Hole Diameter (in)	Hole Diameter (in)	Area per Row (in^2)		
		n = 1	n = 2	n = 3
1/4	0.250	0.05	0.10	0.15
5/16	0.313	0.08	0.15	0.23
3/8	0.375	0.11	0.22	0.33
7/16	0.438	0.15	0.30	0.45
1/2	0.500	0.20	0.39	0.59
9/16	0.563	0.25	0.50	0.75
5/8	0.625	0.31	0.61	0.92
11/16	0.688	0.37	0.74	1.11
3/4	0.750	0.44	0.88	1.33
7/8	0.875	0.60	1.20	1.80
1	1.000	0.79	1.57	2.36
1 1/8	1.125	0.99	1.99	2.98
1 1/4	1.250	1.23	2.45	3.68
1 3/8	1.375	1.48	2.97	4.45
1 1/2	1.500	1.77	3.53	5.30
1 5/8	1.625	2.07	4.15	6.22
1 3/4	1.750	2.41	4.81	7.22
1 7/8	1.875	2.76	5.52	8.28
2	2.000	3.14	6.28	9.42
n = Number of columns of perforations				
Minimum steel plate thickness		1/4"	5/16"	3/8"

TABLE SB-2



SILT FENCE

SILT FENCE NOTES

INSTALLATION REQUIREMENTS

1. SILT FENCES SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.

2. WHEN JOINTS ARE NECESSARY, SILT FENCE GEOTEXTILE SHALL BE SPLICED TOGETHER ONLY AT SUPPORT POST AND SECURELY SEALED.

3. METAL POSTS SHALL BE "STUDDED TEE" OR "U" TYPE WITH MINIMUM WEIGHT OF 1.33 POUNDS PER LINEAR FOOT. WOOD POSTS SHALL HAVE A MINIMUM DIAMETER OR CROSS SECTION DIMENSION OF 2 INCHES.

4. THE FILTER MATERIAL SHALL BE FASTENED SECURELY TO METAL OR WOOD POSTS USING WIRE TIES, OR TO WOOD POSTS WITH 3/4" LONG #9 HEAVY-DUTY STAPLES. THE SILT FENCE GEOTEXTILE SHALL NOT BE STAPLED TO EXISTING TREES.

5. WHILE NOT REQUIRED, WIRE MESH FENCE MAY BE USED TO SUPPORT THE GEOTEXTILE. WIRE FENCE SHALL BE FASTENED SECURELY TO THE UPSLOPE SIDE OF THE POSTS USING HEAVY-DUTY WIRE STAPLES AT LEAST 3/4" LONG, TIE WIRES OR HOG RINGS. THE WIRE SHALL EXTEND INTO THE TRENCH A MINIMUM OF 6" AND SHALL NOT EXTEND MORE THAN 3' ABOVE THE ORIGINAL GROUND SURFACE.

6. ALONG THE TOE OF FILLS, INSTALL THE SILT FENCE ALONG A LEVEL CONTOUR AND PROVIDE AN AREA BEHIND THE FENCE FOR RUNOFF TO POND AND SEDIMENT TO SETTLE. A MINIMUM DISTANCE OF 5 FEET FROM THE TOE OF THE FILL IS RECOMMENDED.

7. THE HEIGHT OF THE SILT FENCE FROM THE GROUND SURFACE SHALL BE MINIMUM OF 24 INCHES AND SHALL NOT EXCEED 36 INCHES; HIGHER FENCES MAY INPOUND VOLUMES OF WATER SUFFICIENT TO CAUSE FAILURE OF THE STRUCTURE.

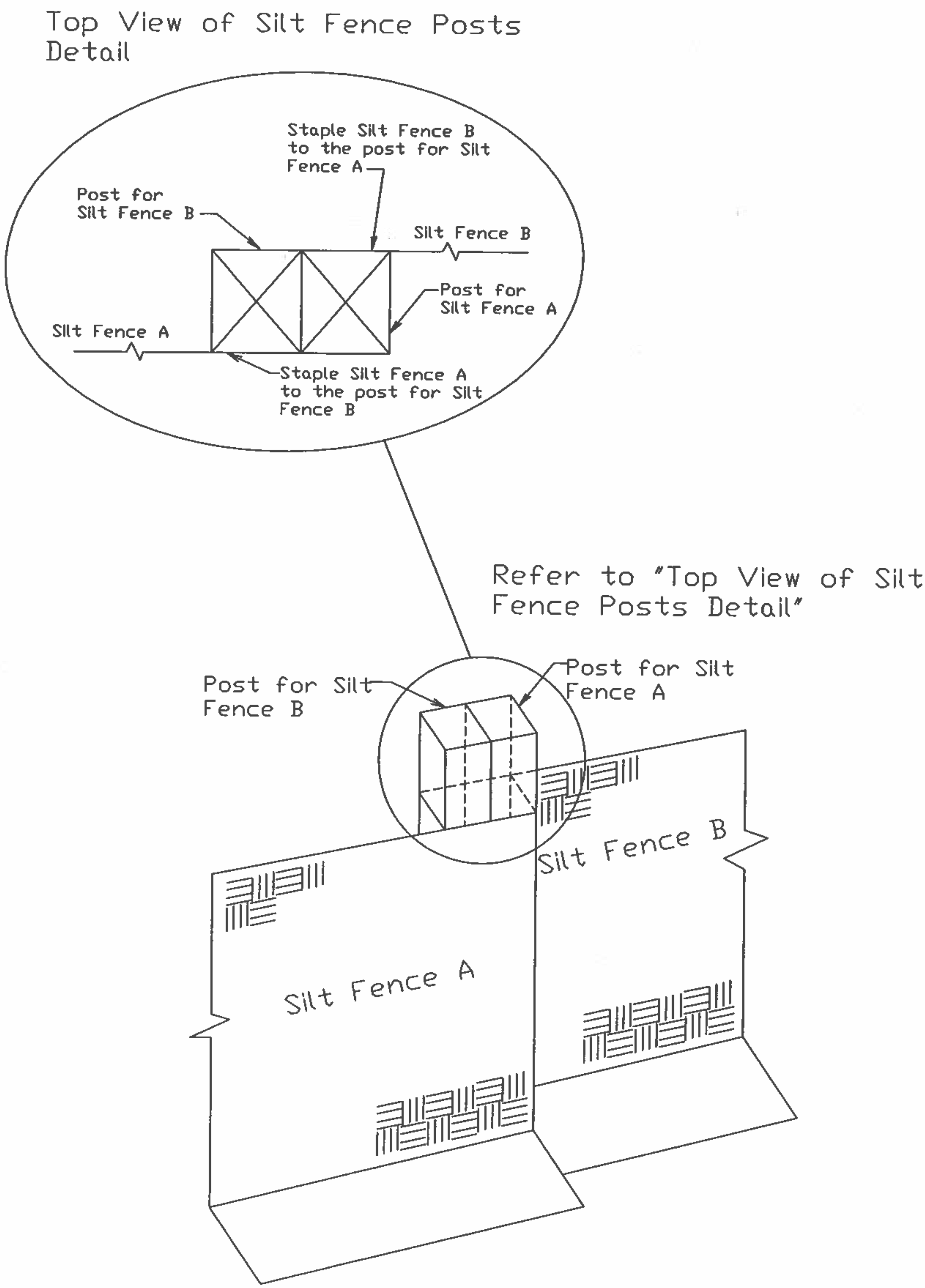
MAINTENANCE REQUIREMENTS

1. CONTRACTOR SHALL INSPECT SILT FENCES IMMEDIATELY AFTER EACH RAINFALL, AT LEAST DAILY DURING PROLONGED RAINFALL, AND WEEKLY DURING PERIODS OF NO RAINFALL. DAMAGED, COLLAPSED, UNENTRENCHED OR INEFFECTIVE SILT FENCES SHALL BE PROMPTLY REPAIRED OR REPLACED.

2. SEDIMENT SHALL BE REMOVED FROM BEHIND SILT FENCE WHEN IT ACCUMULATES TO HALF THE EXPOSED GEOTEXTILE HEIGHT.

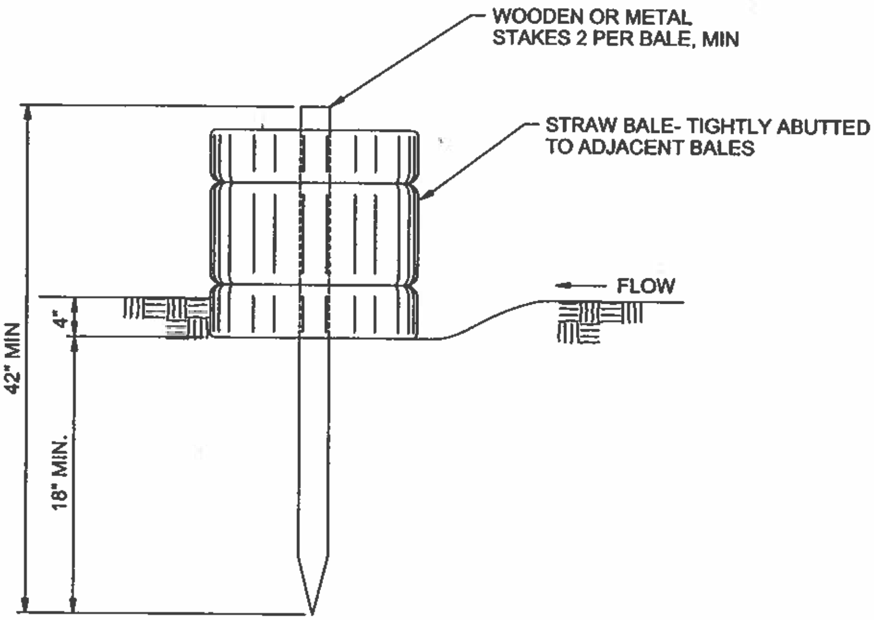
3. SILT FENCES SHALL BE REMOVED WHEN ADEQUATE VEGETATIVE COVER IS ATTAINED AS APPROVED BY THE CITY.

City of Colorado Springs Stormwater Quality	Figure SF-2 Silt Fence Construction Detail and Maintenance Requirements



City of Colorado Springs
Stormwater Quality

Figure SF-3
Silt Fence Joint Tying
Construction Detail and Maintenance Requirements



STRAW BALE BARRIER

NTS

STRAW BALE BARRIER NOTES

INSTALLATION REQUIREMENTS

1. STRAW BALE BARRIERS SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.

2. BALES SHALL CONSIST OF APPROXIMATELY 5 CUBIC FEET OF CERTIFIED WEED FREE HAY OR STRAW AND WEIGH NOT LESS THAN 35 POUNDS.

3. BALES ARE TO BE PLACED IN A SINGLE ROW WITH THE END OF THE BALES TIGHTLY ABUTTING ONE ANOTHER.

4. EACH BALE IS TO BE SECURELY ANCHORED WITH AT LEAST TWO STAKES AND THE FIRST STAKE IS TO BE DRIVEN TOWARD THE PREVIOUSLY LAID BALE TO FORCE THE BALES TOGETHER.

5. STAKES ARE TO BE A MINIMUM OF 42 INCHES LONG. METAL STAKES SHALL BE STANDARD "T" OR "U" TYPE WITH MINIMUM WEIGHT OF 1.33 POUNDS PER LINEAR FOOT. WOOD STAKES SHALL HAVE A MINIMUM DIAMETER OR CROSS SECTION DIMENSION OF 2 INCHES.

6. BALES ARE TO BE BOUND WITH EITHER WIRE OR STRING AND ORIENTED SUCH THAT THE BINDINGS ARE AROUND THE SIDES AND NOT ALONG THE TOPS AND BOTTOMS OF THE BALE.

7. GAPS BETWEEN BALES ARE TO BE CHINKED (FILLED BY WEDGING) WITH STRAW OR THE SAME MATERIAL OF THE BALE.

8. END BALES ARE TO EXTEND UPSLOPE SO THE TRAPPED RUNOFF CANNOT FLOW AROUND THE ENDS OF THE BARRIER.

MAINTENANCE REQUIREMENTS

1. CONTRACTOR SHALL INSPECT STRAW BALE BARRIERS IMMEDIATELY AFTER EACH RAINFALL, AT LEAST DAILY DURING PROLONGED RAINFALL, AND WEEKLY DURING PERIODS NO RAINFALL.

2. DAMAGED OR INEFFECTIVE BARRIERS SHALL PROMPTLY BE REPAIRED, REPLACING BALES IF NECESSARY, AND UNENTRENCHED BALES NEED TO BE REPAIRED WITH COMPACTED BACKFILL MATERIAL.

3. SEDIMENT SHALL BE REMOVED FROM BEHIND STRAW BALE BARRIERS WHEN IT ACCUMULATES TO APPROXIMATELY 1/2 THE HEIGHT OF THE BARRIER.

4. STRAW BALE BARRIERS SHALL BE REMOVED WHEN ADEQUATE VEGETATIVE COVER IS ATTAINED AS APPROVED BY THE CITY.

City of Colorado Springs Stormwater Quality	Figure SBB-2 Straw Bale Barrier Construction Detail and Maintenance Requirements

RECOMMENDED ANNUAL GRASSES

SPECIES (COMMON NAME)	GROWTH SEASON	SEEDING DATE	POUNDS OF PURE LIVE SEED (PLS) (PLS/ACRE)	PLANTING DEPTH (INCHES)
1. OATS	COOL	MARCH 16 - APRIL 30	35-50	1-2
2. SPRING WHEAT	COOL	MARCH 16 - APRIL 30	25-35	1-2
3. SPRING BARLEY	COOL	MARCH 16 - APRIL 30	25-35	1-2
4. ANNUAL RYEGRASS	COOL	MARCH 16 - JUNE 30	10-15	1/2
5. MILLET	WARM	MAY 16 - JULY 15	3-15	1/2-3/4
6. SUDANGRASS	WARM	MAY 16 - JULY 15	5-10	1/2-3/4
7. SORGHUM	WARM	MAY 16 - JULY 15	5-10	1/2-3/4
8. WINTER WHEAT	COOL	SEPTEMBER 1 - 30	20-35	1-2
9. WINTER BARLEY	COOL	SEPTEMBER 1 - 30	20-35	1-2
10. WINTER RYE	COOL	SEPTEMBER 1 - 30	20-35	1-2
11. TRITICALE	COOL	SEPTEMBER 1 - 30	25-40	1-2

THIS TABLE WAS TAKEN FROM UDFCD FOR RECOMMENDED ANNUAL GRASSES FOR THE DENVER METROPOLITAN AREA. THIS TABLE MAY BE USED UNLESS A SITE-SPECIFIC SEED MIX IS REQUESTED AND APPROVED.

TABLE TS-1

TEMPORARY SEEDING NOTES

INSTALLATION REQUIREMENTS

1. DISTURBED AREAS ARE TO BE SEEDED WITHIN 21 DAYS AFTER CONSTRUCTION ACTIVITY OR GRADING ENDS IF SEASON ALLOWS.

2. IF NECESSARY, SOIL IS TO BE CONDITIONED FOR PLANT GROWTH BY APPLYING TOPSOIL, FERTILIZER, OR LIME.

3. SOIL IS TO BE TILLED IMMEDIATELY PRIOR TO APPLYING SEEDS. COMPACT SOILS ESPECIALLY NEED TO BE LOOSENED.

4. SEEDBED DEPTH IS TO BE 4 INCHES FOR SLOPES FLATTER THAN 2:1, AND 1 INCH FOR SLOPES STEEPER THAN 2:1.

5. ANNUAL GRASSES LISTED IN TABLE TS-1 ARE TO BE USED FOR TEMPORARY SEEDING. SEED MIXES ARE NOT TO CONTAIN ANY NOXIOUS WEED SEEDS INCLUDING RUSSIAN OR CANADIAN THISTLE, KNAPWEED, PURPLE LOOSESTRIFE, EUROPEAN BINDWEED, JOHNSON GRASS, AND LEAFY SPURGE.

6. TABLE TS-1 ALSO PROVIDES REQUIREMENTS FOR SEEDING RATES, SEEDING DATES, AND PLANTING DEPTHS FOR THE APPROVED TYPES OF ANNUAL GRASSES.

7. SEEDING IS TO BE APPLIED USING MECHANICAL TYPE DRILLS EXCEPT WHERE SLOPES ARE STEEP OR ACCESS IS LIMITED THEN HYDRAULIC SEEDING MAY BE USED.

8. ALL SEEDED AREAS ARE TO BE MULCHED (SEE FACTSHEET ON MULCHING).

9. IF HYDRAULIC SEEDING IS USED THEN HYDRAULIC MULCHING SHALL BE DONE SEPARATELY TO AVOID SEEDS BECOMING ENCAPSULATED IN THE MULCH.

MAINTENANCE REQUIREMENTS

1. REGULAR INSPECTIONS ARE TO BE MADE OF ALL SEEDED AREAS TO ENSURE GROWTH.

2. AREAS WHERE GROWTH IS NOT OCCURRING QUICKLY OR THE MULCH HAS BEEN REMOVED SHALL BE RE-SEEDED AS SOON AS POSSIBLE AND RE-MULCHED IF NEEDED.

3. SEEDED AREAS ARE NOT TO BE DRIVEN OVER WITH CONSTRUCTION EQUIPMENT OR VEHICLES.

City of Colorado Springs Stormwater Quality	Figure TS-1 Temporary Seeding Construction Detail and Maintenance Requirements

APPENDIX D

Excerpts from Supporting Documents

B-EFSC-1

FINAL DRAINAGE REPORT
FOR
INDIGO RANCH AT STETSON RIDGE FILING NO. 3 & 4
AND
MASTER DEVELOPMENT DRAINAGE PLAN AMENDMENT
FOR
STETSON RIDGE

JULY 2004

PREPARED FOR:
CLASSIC COMMUNITIES
6385 CORPORATE DRIVE, SUITE 200
COLORADO SPRINGS, CO 80919
(719) 592-9333

PREPARED BY:
CLASSIC CONSULTING ENGINEERS & SURVEYORS, LLC
6385 CORPORATE DRIVE, SUITE 101
COLORADO SPRINGS, CO 80919

1016.60

Design Point 58 (Q_5 = 48 cfs, Q_{100} = 92 cfs) consists of developed flows from single family residential lots, a future commercial development, and adjacent streets from a 3.97-acre Basin OS-1A, 4.66-acre Basin OS-3A, 1.19-acre Basin OS-7A, 6.37-acre Basin OS-8A, and 3.75-acre Basin OS-10A. Runoff from these basins will be conveyed in existing road side ditches along Marksheffel to a single 42" RCP culvert or a pair of proposed 36" RCP culverts (Pipe Run 79). Dual culverts may be necessary due to grading constraints which will limit available head over pipe.

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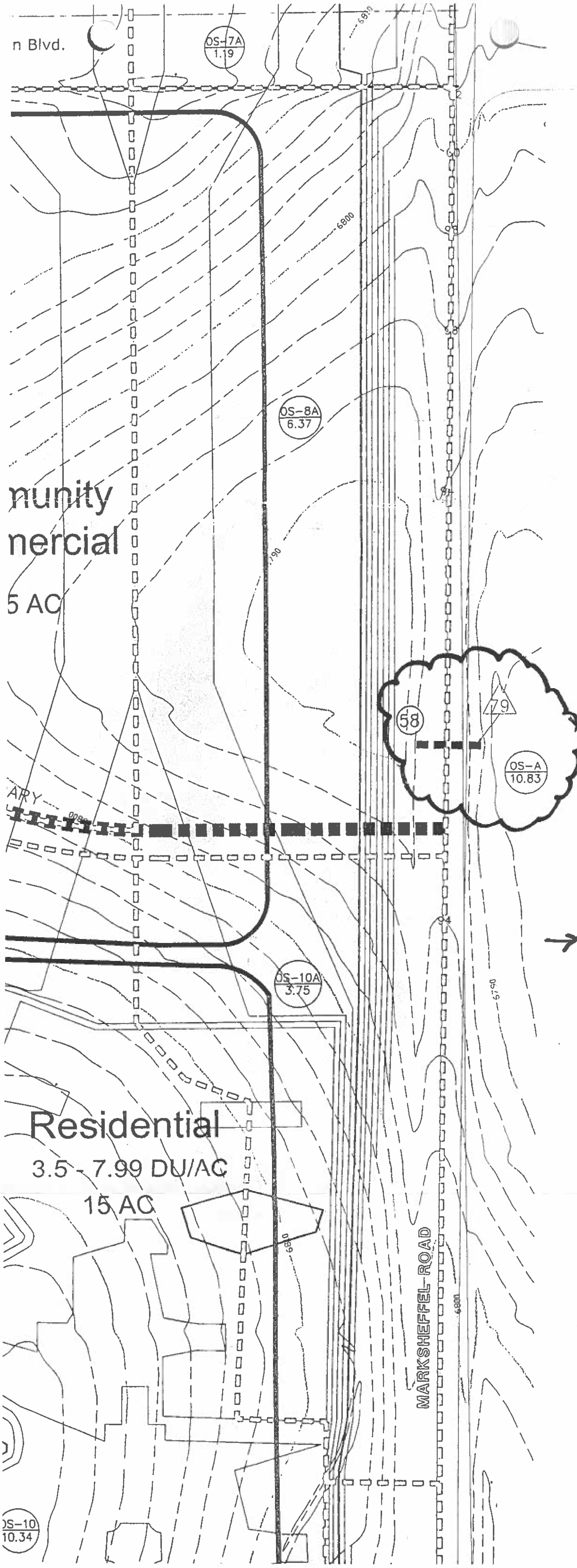
Developed flows from to Design Points 58 and 59 will not exceed the Historic flow crossing Marksheffel Road to the east. Unless, flows from these areas have been anticipated in the Master Development Drainage Plan for Banning Lewis Ranch to discharge into the Toy Ranches Subdivision. If no assumption has been made then existing culverts under Marksheffel Road will not be removed and replaced due to no additional storm water conveyance.

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and October 1994. The Rational Method was used to estimate storm water runoff anticipated from design storms with 5-year and 100-year recurrence interval.

FLOODPLAIN STATEMENT

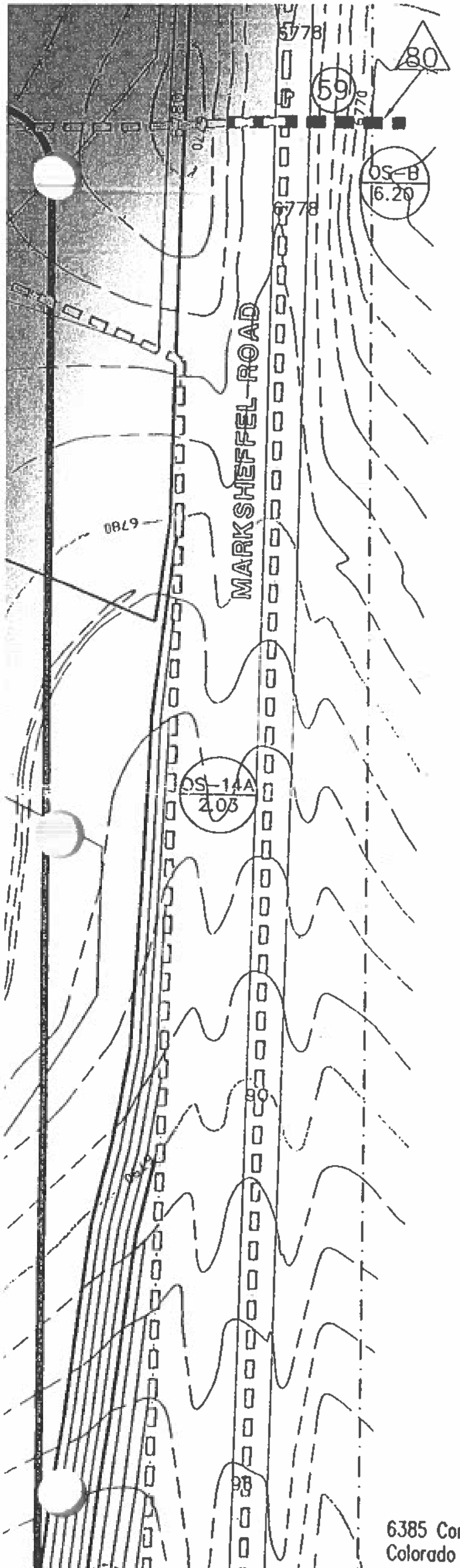
A portion of this site is located within a floodplain as determined by the Flood Insurance Rate Maps (F.I.R.M.) Map Number 08041C 0537F, 008041C 0545F, and 08041C 0543, effective date, March 17, 1997 (See Appendix).



LL	1	[illegible]
MM	3	[illegible]
NN	3	7
OO	4	9
PP	2	5
QQ	4	7
RR	4	9
SS	3	6
TT	3	7
UU	4	9
VV	3	5
WW	4	8
XX	10	20
YY	7	12
OS-0	16	33
OS-1	41	83
OS-1A	14	26
OS-2	42	87
OS-3	25	44
OS-3A	15	28
OS-4	31	55
OS-5	27	55
OS-6	26	69
OS-7	24	46
OS-7A	5	10
OS-8	19	40
OS-8A	13	28
OS-9	25	47
OS-10	21	44
OS-10A	11	20
OS-11	20	37
OS-12	35	70
OS-13	19	38
OS-13A	18	37
OS-13B	17	35
OS-14	35	68
OS-14A	9	17
OS-15	14	30
OS-16	8	16
OS-A	44	82
OS-B	25	47
OS-C	6	12
OS-D	3	6
OS-E	5	10
PT-6	3	6

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY	
COLLECTION BOUNDARY	
FUTURE STORM PIPE	
FUTURE STORM PIPE	
DESIGN POINT	25
BASIN IDENTIFIER	BB
AREA IN ACRES	10.0
PIPE RUN	32
PREVIOUSLY STUDIED PIPE RUN	32



40	42	87
41	25	44
42	31	55
43	27	55
44	12	23
45	12	23
46	19	40
47	25	47
48	20	37
49	35	70
50	6	12
51	13	27
52	3	7
53	1	3
54	10	24
55	13	26
56	12	24
57	12	22
58	48	92
59	24	46

INDIGO RANCH AT STETSON RIDGE
PRELIMINARY DRAINAGE MAP
1016.60
5-3-04
1 OF 1

CLASSIC[SM]
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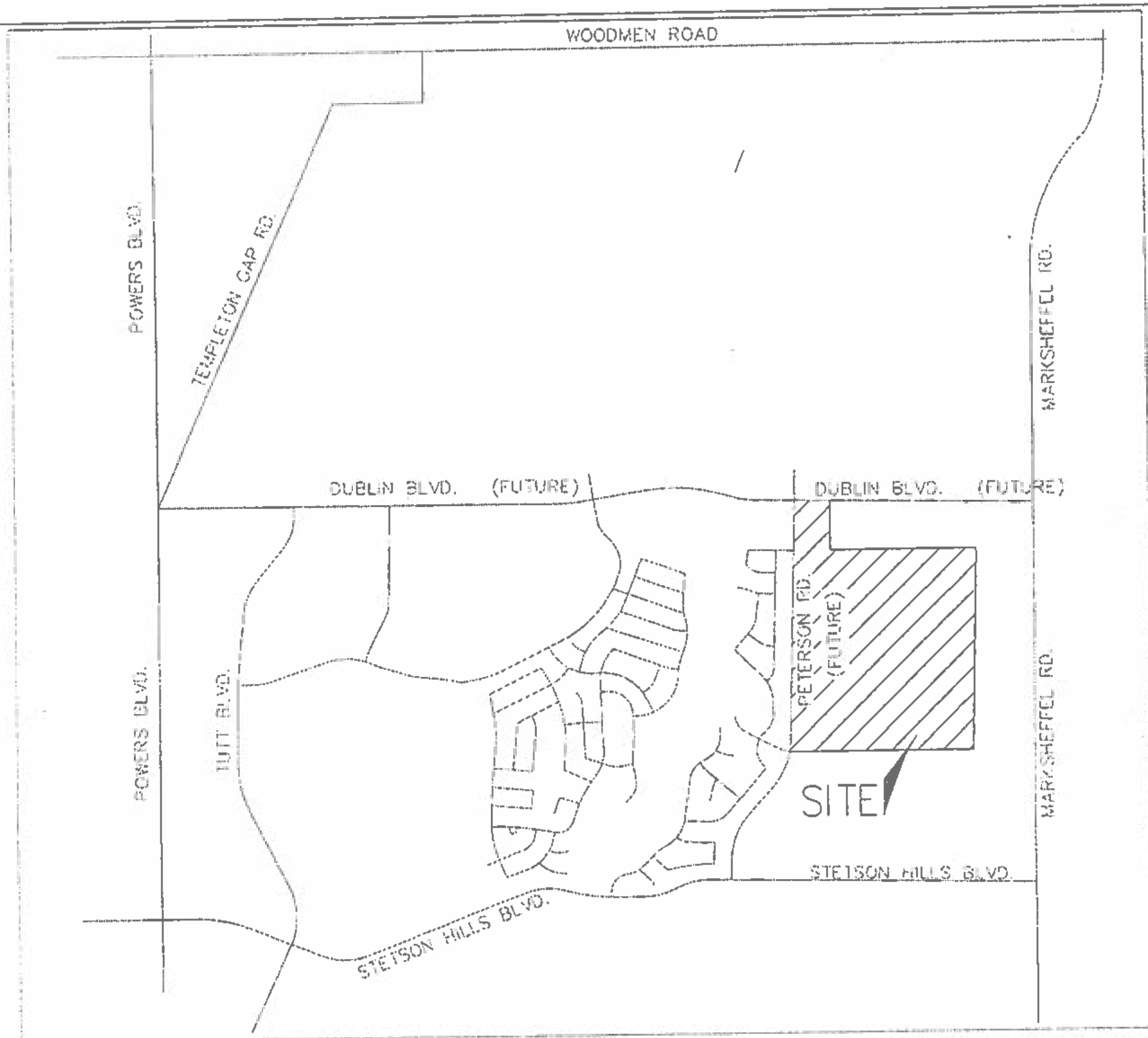

VICINITY MAP
NTS

JOB NAME: *STETSON RIDGE SUBDIVISION, FILING NO. 3*
JOB NUMBER: *1016.60*
DATE: *07/07/04*
CALCULATED BY: *DLM*

FINAL DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Inlet Size
					I(5)	I(100)	Q(5)	Q(100)	
47	OS-9	6.34	6.59	10.6	4.01	7.12	25	47	
48	OS-11	5.25	5.54	12.6	3.74	6.65	20	37	
49	OS-12	13.16	15.04	25.9	2.63	4.67	35	70	
50	E	1.41	1.65	9.9	4.12	7.32	6	12	4' SUMP INLET
51	C, F, G	3.99	4.63	17.0	3.27	5.81	13	27	18' AT-GRADE INLET
52	75% I	0.98	1.16	16.0	3.36	5.98	3	7	4' SUMP INLET
53	25% I	0.33	0.39	8.0	4.44	7.90	1	3	4' SUMP INLET
54	FB-51, D, H	3.15	4.19	18.2	3.16	5.62	10	24	12' SUMP INLET
55	A, B	3.97	4.51	16.8	3.28	5.83	13	26	12' SUMP INLET
56	P, R, S	3.63	4.03	15.5	3.41	6.06	12	24	12' SUMP INLET
57	Q, T	2.35	2.48	5.7	4.94	8.78	12	22	12' SUMP INLET
58	OS-1A, OS-3A, OS-8A, 10A	14.17	15.33	16.0	3.36	5.97	48	92	
59	OS-13B, OS-14A	7.02	7.76	16.0	3.36	5.97	24	46	

JOB NAME: *STETSON RIDGE SUBDIVISION, FILING NO. 3*
JOB NUMBER: *1016.60*
DATE: *07/07/04*
CALCULATED BY: *DLM*

* PIPES ARE LISTED AT MAXIMUM SIZE REQUIRED TO ACCOMMODATE Q100 FLOWS AT MINIMUM GRADE.
REFER TO INDIVIDUAL PIPE SHEETS FOR HYDRAULIC INFORMATION.

FINAL DRAINAGE REPORT ~ PIPE ROUTING SUMMARY

Pipe Run	Design Points/Pipe Run	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		
					I(5)	I(100)	Q(5)	Q(100)	Pipe Size*
70	DP-50	1.41	1.65	9.9	4.12	7.32	6	12	18" RCP
71	DP-55	3.97	4.51	16.8	3.28	5.83	13	26	24" RCP
72	70, 71	5.38	6.15	16.8	3.28	5.83	18	36	24" RCP
73	69, 72	71.92	79.32	26.4	2.60	4.63	187	367	66" RCP
74	41, 73	88.54	97.94	30.0	2.42	4.31	214	422	78" RCP
75	DP- 56	3.63	4.03	15.5	3.41	6.06	12	24	24" RCP
76	74, 75	92.17	101.97	30.0	2.42	4.31	223	439	78" RCP
77	DP-57	2.35	2.48	5.68	4.94	8.78	12	22	24" RCP
78	76, 77	94.52	104.45	30.10	2.42	4.30	229	449	78" RCP
79	DP-58	14.17	15.33	16.00	3.36	5.97	48	92	42" RCP
80	DP-59	7.02	7.76	16.03	3.36	5.97	24	46	30" RCP
81	DP-7	5.29	6.17	16.01	3.36	5.97	18	37	24" RCP
82	DP-8	13.04	14.42	25.27	2.67	4.74	35	68	36" RCP
83	DP-9	15.12	16.62	25.27	2.67	4.74	40	79	36" RCP

PIPE 79
Worksheet for Circular Channel

Project Description	
Worksheet	STORM SEWE
Flow Element	Circular Chann
Method	Manning's Forı
Solve For	Full Flow Slope

Input Data		
Mannings Coeffic	).013	
Diameter	42	in
Discharge	92.00	cfs

Results		
Slope	008363	ft/ft
Depth	3.50	ft
Flow Area	9.6	ft²
Wetted Perime	0.00	ft
Top Width	0.00	ft
Critical Depth	2.97	ft
Percent Full	100.0	%
Critical Slope	007893	ft/ft
Velocity	9.56	ft/s
Velocity Head	1.42	ft
Specific Energ	4.92	ft
Froude Numbe	0.00	
Maximum Disc	98.96	cfs
Discharge Full	92.00	cfs
Slope Full	008363	ft/ft
Flow Type	N/A	

B-EFSC-2

CLASSIC
CONSULTING
ENGINEERS & SURVEYORS

FINAL DRAINAGE REPORT
FOR
INDIGO RANCH AT STETSON RIDGE FILING NO. 3 & 4
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FOR
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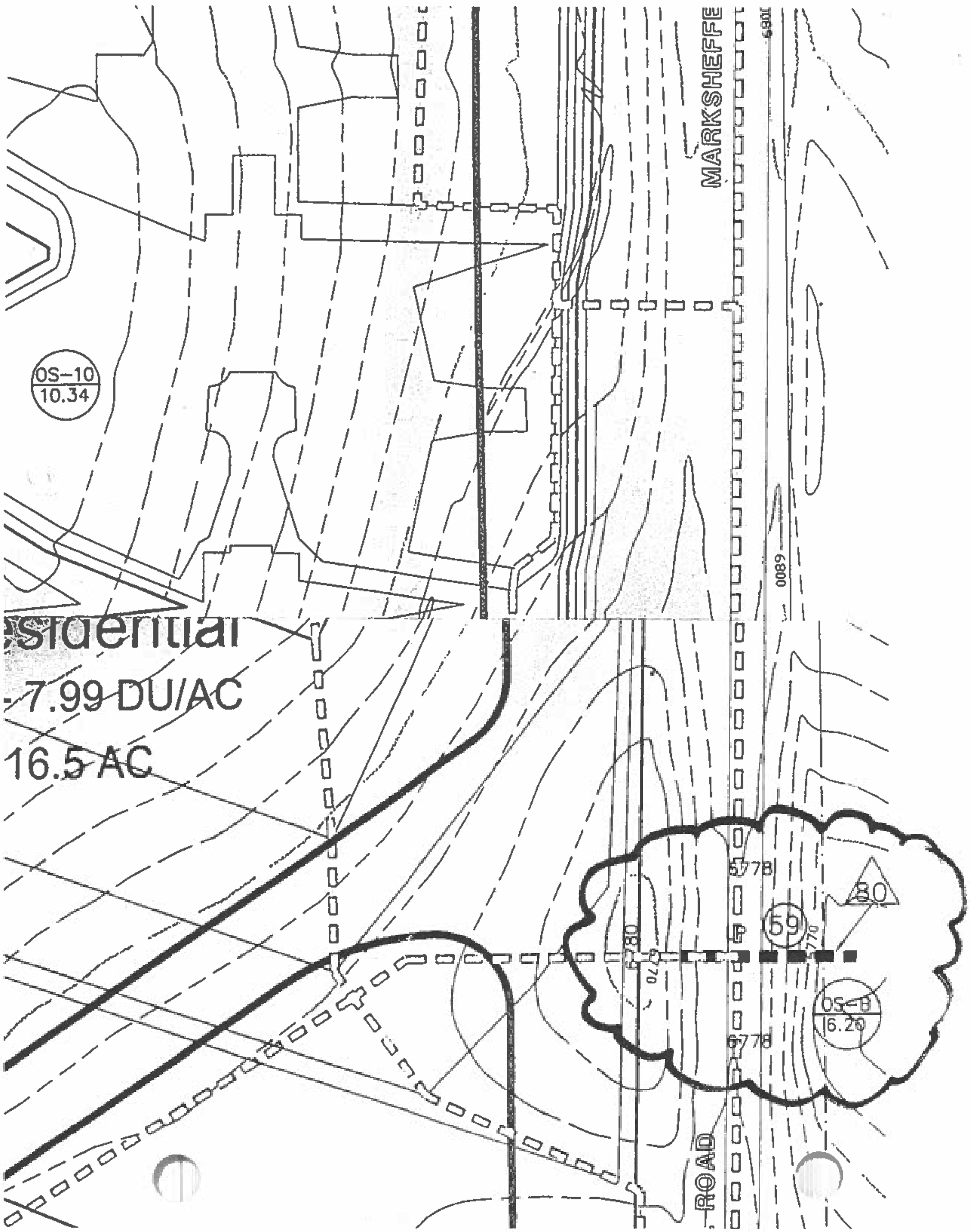


FUTURE STORM PIPE

DESIGN POINT (25)

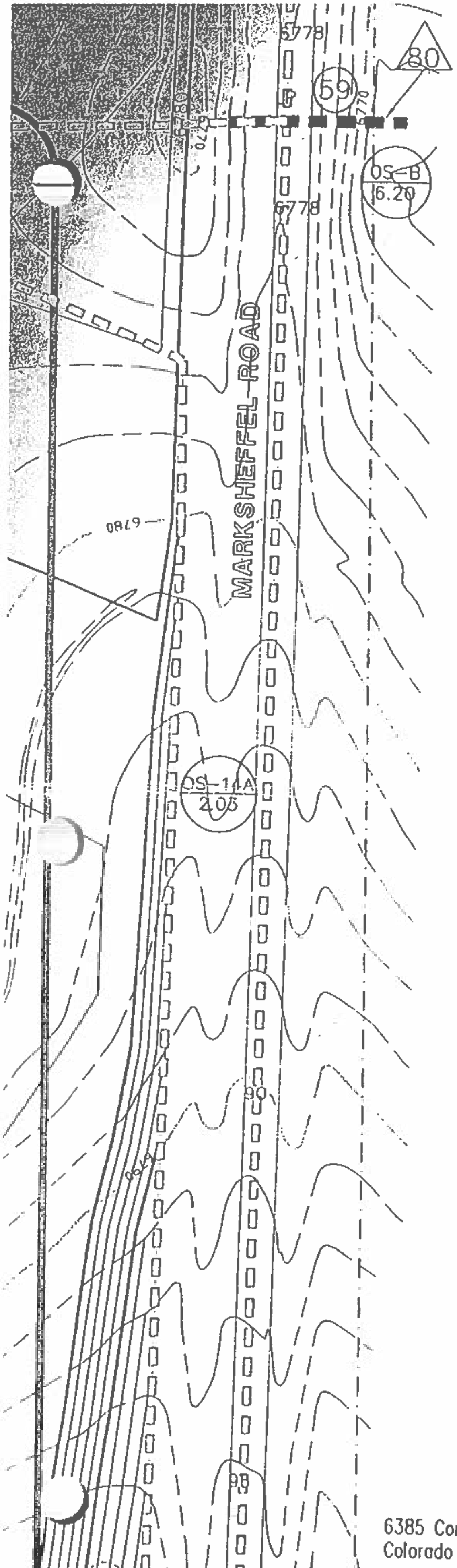
BASIN IDENTIFIER / AREA IN ACRES (BB / 10.0)

PIPE RUN (32)

PREVIOUSLY STUDIED PIPE RUN (32)

DESIGN POINT SUMMARY (X)

DESIGN POINT	Q5 (CFS)	Q100 (CFS)
35	2	5
36	3	6
37	9	19
38	7	15
39	41	83
40	42	87
41	25	44
42	31	55
43	27	55
44	12	23
45	12	23
46	19	40
47	25	47
48	20	37
49	35	70
50	6	12



40	42	87
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43	27	55
44	12	23
45	12	23
46	19	40
47	25	47
48	20	37
49	35	70
50	6	12
51	13	27
52	3	7
53	1	3
54	10	24
55	13	26
56	12	24
57	12	22
58	48	92
59	24	46

INDIGO RANCH AT STETSON RIDGE
PRELIMINARY DRAINAGE MAP
1016.60
5-3-04
1 OF 1

CLASSIC℠
CONSULTING
ENGINEERS & SURVEYORS

6385 Corporate Drive, Suite 101
Colorado Springs, Colorado 80919

(719)785-0790
(719)785-0799 (Fax)

VICINITY MAP
NTS

JOB NAME: *STETSON RIDGE SUBDIVISION, FILING NO. 3*
JOB NUMBER: *1016.60*
DATE: *07/07/04*
CALCULATED BY: *DLM*

FINAL DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Inlet Size
					I(5)	I(100)	Q(5)	Q(100)	
47	OS-9	6.34	6.59	10.6	4.01	7.12	25	47	
48	OS-11	5.25	5.54	12.6	3.74	6.65	20	37	
49	OS-12	13.16	15.04	25.9	2.63	4.67	35	70	
50	E	1.41	1.65	9.9	4.12	7.32	6	12	4' SUMP INLET
51	C, F, G	3.99	4.63	17.0	3.27	5.81	13	27	18' AT-GRADE INLET
52	75% I	0.98	1.16	16.0	3.36	5.98	3	7	4' SUMP INLET
53	25% I	0.33	0.39	8.0	4.44	7.90	1	3	4' SUMP INLET
54	FB-51, D, H	3.15	4.19	18.2	3.16	5.62	10	24	12' SUMP INLET
55	A, B	3.97	4.51	16.8	3.28	5.83	13	26	12' SUMP INLET
56	P, R, S	3.63	4.03	15.5	3.41	6.06	12	24	12' SUMP INLET
57	Q, T	2.35	2.48	5.7	4.94	8.78	12	22	12' SUMP INLET
58	OS-1A, OS-3A, OS-8A, 10A	14.17	15.33	16.0	3.36	5.97	48	92	
→ 59	OS-13B, OS-14A	7.02	7.76	16.0	3.36	5.97	24	46	

JOB NAME: *STETSON RIDGE SUBDIVISION, FILING NO. 3*
JOB NUMBER: *1016.60*
DATE: *07/07/04*
CALCULATED BY: *DLM*

* PIPES ARE LISTED AT MAXIMUM SIZE REQUIRED TO ACCOMMODATE Q100 FLOWS AT MINIMUM GRADE.
REFER TO INDIVIDUAL PIPE SHEETS FOR HYDRAULIC INFORMATION.

FINAL DRAINAGE REPORT ~ PIPE ROUTING SUMMARY

Pipe Run	Design Points/Pipe Run	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Pipe Size*
70	DP-50	1.41	1.65	9.9	4.12	7.32	6	12	18" RCP
71	DP-55	3.97	4.51	16.8	3.28	5.83	13	26	24" RCP
72	70, 71	5.38	6.15	16.8	3.28	5.83	18	36	24" RCP
73	69, 72	71.92	79.32	26.4	2.60	4.63	187	367	66" RCP
74	41, 73	88.54	97.94	30.0	2.42	4.31	214	422	78" RCP
75	DP- 56	3.63	4.03	15.5	3.41	6.06	12	24	24" RCP
76	74, 75	92.17	101.97	30.0	2.42	4.31	223	439	78" RCP
77	DP-57	2.35	2.48	5.68	4.94	8.78	12	22	24" RCP
78	76, 77	94.52	104.45	30.10	2.42	4.30	229	449	78" RCP
79	DP-58	14.17	15.33	16.00	3.36	5.97	48	92	42" RCP
80	DP-59	7.02	7.76	16.03	3.36	5.97	24	46	30" RCP
81	DP-7	5.29	6.17	16.01	3.36	5.97	18	37	24" RCP
82	DP-8	13.04	14.42	25.27	2.67	4.74	35	68	36" RCP
83	DP-9	15.12	16.62	25.27	2.67	4.74	40	79	36" RCP

PIPE 80
Worksheet for Circular Channel

Project Description	
Worksheet	STORM SEWE
Flow Element	Circular Chann
Method	Manning's Forr
Solve For	Full Flow Slope

Input Data		
Mannings Coeffic	).013	
Diameter	30	in
Discharge	16.00	cfs

Results		
Slope	012579	ft/ft
Depth	2.50	ft
Flow Area	4.9	ft²
Wetted Perime	0.00	ft
Top Width	0.00	ft
Critical Depth	2.24	ft
Percent Full	100.0	%
Critical Slope	011106	ft/ft
Velocity	9.37	ft/s
Velocity Head	1.36	ft
Specific Energ	3.86	ft
Froude Numbe	0.00	
Maximum Disc	49.48	cfs
Discharge Full	46.00	cfs
pe Full	012579	ft/ft
Flow Type	N/A	

PRELIMINARY & FINAL DRAINAGE REPORT
FOR
STETSON RIDGE HIGHLANDS

Prepared for:

Stetson Ridge Partners, LLC
511 N. Tejon Street
Colorado Springs, CO 80903

June 21, 2004
Revised May 17, 2005
Revised June 7, 2005

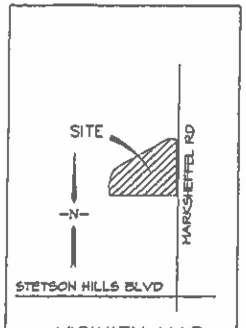
Prepared by:

JPS
ENGINEERING

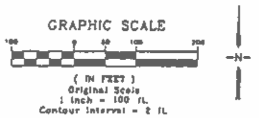
19 E. Willamette Avenue
Colorado Springs, CO 80903
(719)-477-9429
(719)-471-0766 fax

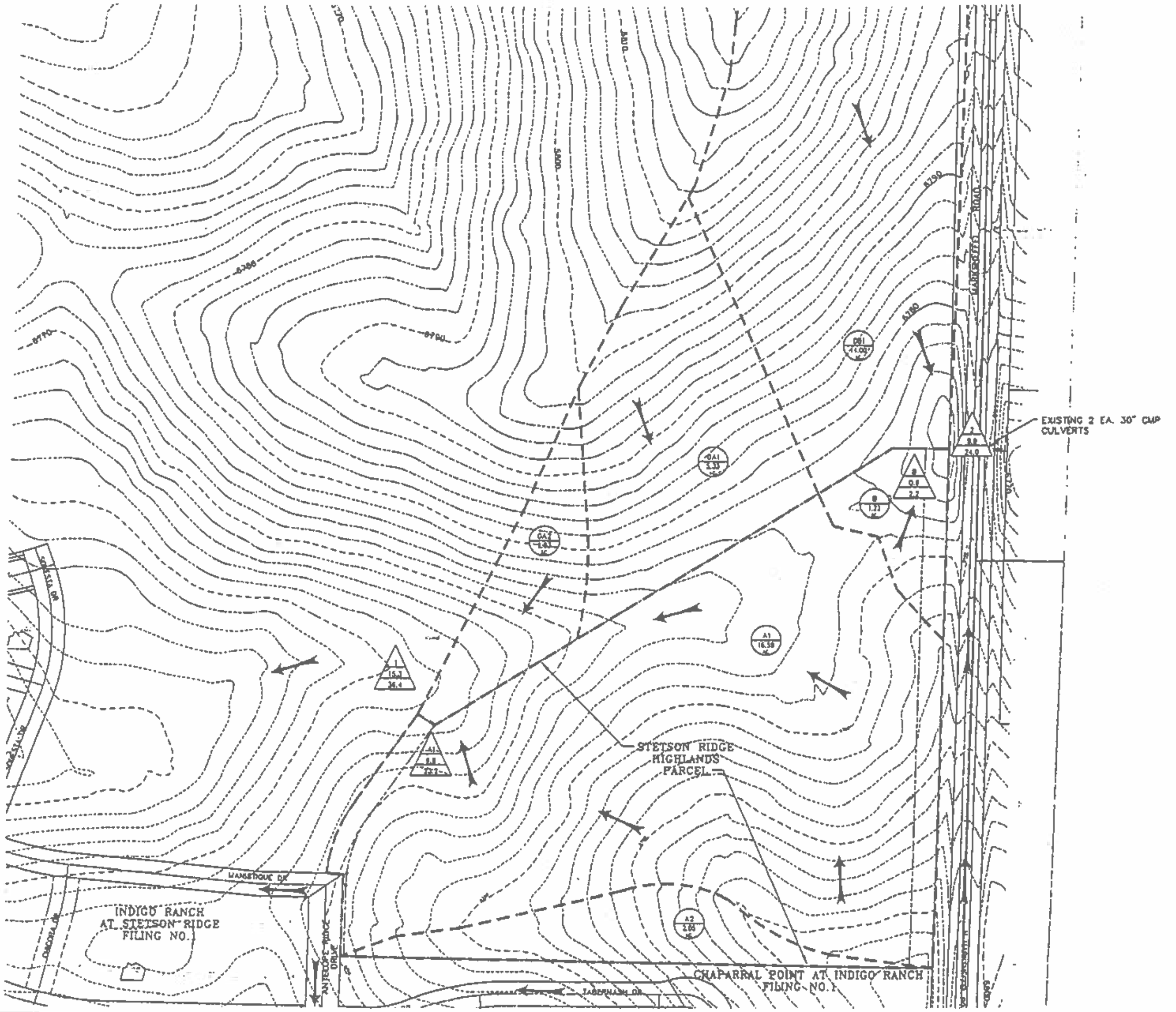
JPS Project No. 050401

(5)



VICINITY MAP
NTS





JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766

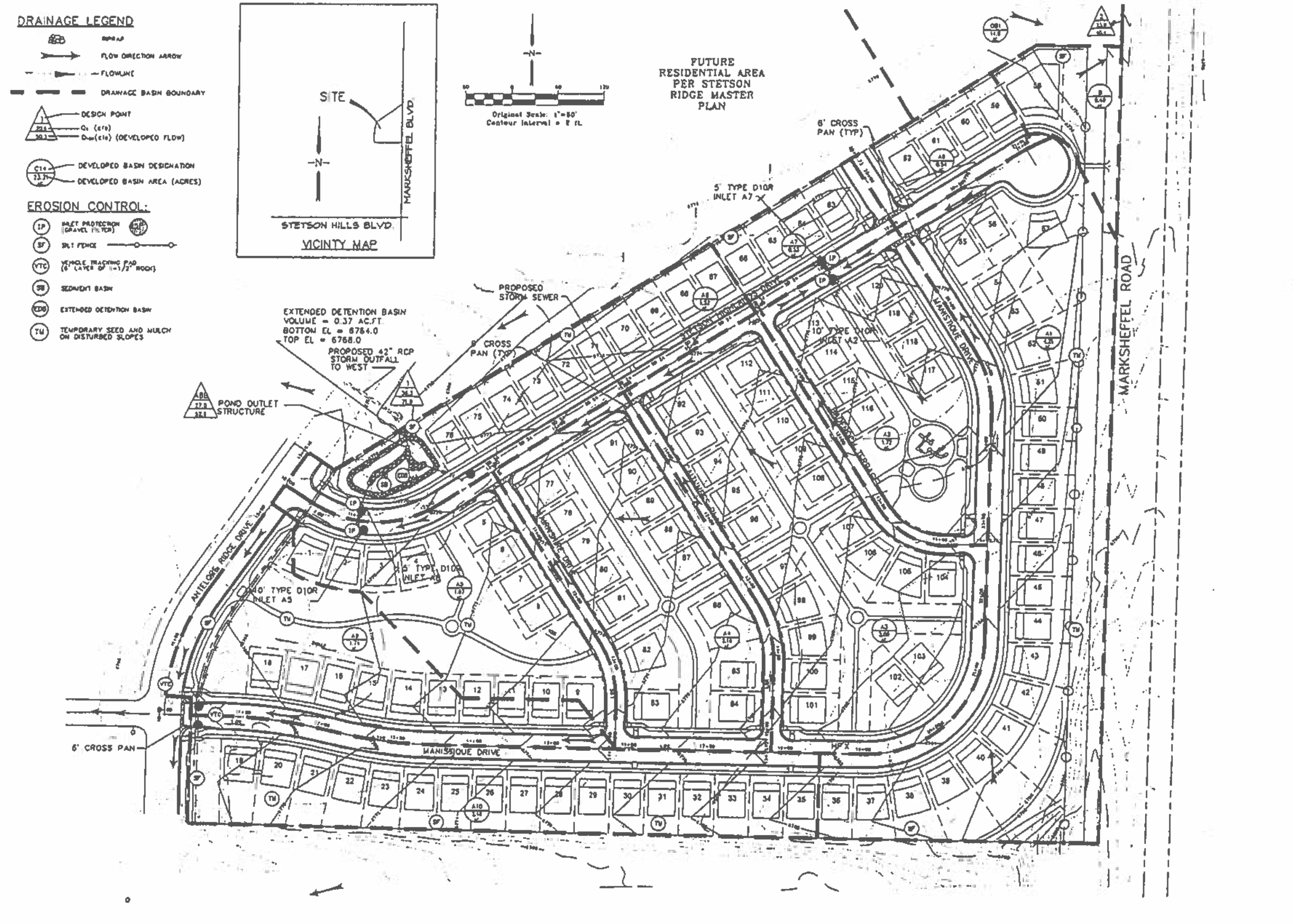
STETSON RIDGE HIGHLANDS

HISTORIC DRAINAGE PLAN

NO.	REVISION	BY	DATE

HORIZ. SCALE:	1"=100'	DRAWN:	BAJ
VERT. SCALE:	N/A	DESIGNED:	JPS
SURVEYED:	PMS	CHECKED:	JPS
CREATED:	8/12/04	LAST MODIFIED:	8/17/06
PROJECT NO.:	050401	MODIFIED BY:	BAJ

SHEET: EX1



STETSON RIDGE HIGHLANDS

DEVELOPED DRAINAGE PLAN

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766

HORZ. SCALE: 1"=80'	DRAWN: BJ		
VERT. SCALE: N/A	DESIGNED: JPS		
SURVEYOR: PMS	CHECKED: JPS		
CREATED: 3/20/04	LAST MODIFIED: 5/07/09		
PROJECT NO: 050101	MODIFIED BY: BJ		

SHEET: D1.01

STETSON RIDGE HIGHLANDS SUBDIVISION
RATIONAL METHOD - DRAINAGE CALCULATIONS

HISTORIC FLOWS

BASIN	DESIGN POINT	AREA (AC)	C 5-YEAR[7]	C 100-YEAR[7]	OVERLAND LENGTH (FT)	SLOPE (%)	Tco[1] (MIN)	CHANNEL LENGTH (FT)	CONVEYANCE COEFFICIENT K	SLOPE (%)	SCS[2] VELOCITY (FT/S)	Tt[3] (MIN)	TOTAL Tc[4] (MIN)	INTENSITY[5] 5-YR (IN/HR)	INTENSITY[5] 100-YR (IN/HR)	PEAK FLOW Q5[6] (CFS)	PEAK FLOW Q100[6] (CFS)
OA1		5.33	0.25	0.35	660	5.3	22.6	500	1.50	1	1.50	5.6	28.1	2.45	4.25	3.26	7.93
OA2		2.03	0.25	0.35			0.0	350	1.50	2.3	2.27	2.6	2.6				
A1	A1	16.59	0.25	0.35	500	4.8	20.3	950	1.50	1.1	1.57	10.1	30.4	2.35	4.00	9.75	23.23
A2	A2	2.05	0.25	0.35	750	3.7	27.1	0				0.0	27.1	2.50	4.30	1.28	3.09
A1,A2	A	18.64	0.25	0.35									30.4	2.35	4.00	10.95	26.10
OA1-2,A1,A2	1	26.00	0.25	0.35									30.7	2.35	4.00	15.28	36.40
OB1		14.00	0.25	0.35	600	6.0	20.6	450	1.50	1.1	1.57	4.8	25.4	2.60	4.50	9.10	22.05
B	B	1.22	0.25	0.35	390	3.6	19.7	0				0.0	19.7	3.00	5.10	0.92	2.18
OB1,B	2	15.22	0.25	0.35									25.4	2.60	4.50	9.89	23.97

1) OVERLAND FLOW Tco = (1.87*(1.1-RUNOFF COEFFICIENT)*(OVERLAND FLOW LENGTH^(0.5)/(SLOPE^(0.333))
2) SCS VELOCITY = K * ((SLOPE(%))^0.5)
K = 0.25 FOR MEADOW
K = 1.0 FOR BARE SOIL
K = 1.5 FOR GRASS CHANNEL
K = 2.0 FOR PAVEMENT
3) GUTTER/SWALE FLOW, Tt = (GUTTER LENGTH/ SCS VELOCITY) / 60 SEC
4) Tc = Tco + Tt
*** IF TOTAL TIME OF CONCENTRATION IS LESS THAN 5 MINUTES, THEN 5 MINUTES IS USED
5) INTENSITY BASED ON I-D-F CURVE IN EL PASO COUNTY DRAINAGE CRITERIA MANUAL
6) Q = CiA
7) WEIGHTED AVERAGE C VALUES FOR COMBINED BASINS

STETSON RIDGE HIGHLANDS SUBDIVISION
RATIONAL METHOD - DRAINAGE CALCULATIONS

DEVELOPED FLOWS

BASIN	DESIGN POINT	AREA (AC)	C 5-YEAR[7]	C 100-YEAR[7]	OVERLAND LENGTH (FT)	SLOPE (%)	Tco[1] (MIN)	CHANNEL LENGTH (FT)	CONVEYANCE COEFFICIENT K	SLOPE (%)	SCS[2] VELOCITY (FT/S)	Tt[3] (MIN)	TOTAL Tc[4] (MIN)	INTENSITY[5] 5-YR (IN/HR)	INTENSITY[5] 100-YR (IN/HR)	PEAK FLOW Q5[6] (CFS)	PEAK FLOW Q100[6] (CFS)
A1	A1	4.21	0.53	0.60	90	2.2	7.5	860	2.00	1.0	2.00	7.2	14.7	3.45	5.80	7.70	14.65
A2		1.72	0.53	0.60			0.0	100	2.00	1.0	2.00	0.8	0.8				
A1,A2	A2	5.93	0.53	0.60									15.5	3.45	5.80	10.84	20.64
A3		3.09	0.53	0.60	100	1.8	8.4	520	2.00	2.0	2.83	3.1	11.5	3.90	6.70	6.39	12.42
A4		2.16	0.53	0.60			0.0	200	2.00	1.0	2.00	1.7	1.7	5.20	9.00	5.95	11.66
A3,A4	A4	5.25	0.53	0.60									13.2	3.55	6.20	9.88	19.53
A5		1.67	0.53	0.60			0.0	360	2.00	1.0	2.00	3.0	3.0	5.20	9.00	4.60	9.02
A3-A5	A5	6.92	0.53	0.60									16.2	3.30	5.70	12.10	23.67
A6		0.54	0.53	0.60			0.0	240	2.00	1.0	2.00	2.0	2.0	5.20	9.00	1.49	2.92
A7		0.53	0.53	0.60			0.0	100	2.00	1.0	2.00	0.8	0.8				
A6,A7	A7	1.07	0.53	0.60									2.8	5.20	9.00	2.95	5.78
A1,A2,A6,A7	A7A	7.00	0.53	0.60									15.5	3.45	5.80	12.80	24.36
A8	A8	1.52	0.53	0.60			0.0	650	2.00	1.0	2.00	5.4	5.4	5.10	8.80	4.11	8.03
A5,A8	A8A	8.44	0.53	0.60									16.2	3.30	5.70	14.76	28.86
A1-A8	A8B	15.44	0.53	0.60									16.2	3.30	5.70	27.00	52.80
OA1,OA2		7.36	0.53	0.60	700	5.1	15.7	700	1.50	2.0	2.12	5.5	21.2	3.00	5.25	11.70	23.18
OA1-2,A1-A10	1	22.80	0.53	0.60									21.2	3.00	5.25	36.25	71.82
A9	A9	0.69	0.53	0.60	50	2.0	5.8	480	2.00	1.7	2.61	3.1	8.8	4.10	7.15	1.50	2.96
A10		2.18	0.53	0.60	40	1.4	5.8	800	2.00	1.9	2.76	4.8	10.6	4.00	6.90	4.62	9.03
A9,A10	A10	2.87	0.53	0.60									10.6	4.00	6.90	6.08	11.88
OB1		14.00	0.53	0.60	600	6.0	13.8	450	1.50	1.1	1.57	4.8	18.6	3.05	5.30	22.63	44.52
B	B	0.49	0.25	0.35	100	6.0	8.4	0				0.0	8.4	4.20	7.50	0.51	1.29
OB1,B	2	14.49	0.52	0.59									18.6	3.05	5.30	23.00	45.43

1) OVERLAND FLOW Tco = (1.87*(1.1-RUNOFF COEFFICIENT)*(OVERLAND FLOW LENGTH^(0.5)/(SLOPE^(0.333))
2) SCS VELOCITY = K * ((SLOPE(%))^0.5)
K = 0.70 FOR MEADOW / FOREST
K = 1.0 FOR BARE SOIL
K = 1.5 FOR GRASS CHANNEL
K = 2.0 FOR PAVEMENT
3) GUTTER/SWALE FLOW, Tt = (CHANNEL LENGTH/ SCS VELOCITY) / 60 SEC
4) Tc = Tco + Tt
*** IF TOTAL TIME OF CONCENTRATION IS LESS THAN 5 MINUTES, THEN 5 MINUTES IS USED
5) INTENSITY BASED ON I-D-F CURVE IN EL PASO COUNTY DRAINAGE CRITERIA MANUAL
6) Q = CiA
7) WEIGHTED AVERAGE C VALUES FOR COMBINED BASINS

FINAL
DRAINAGE REPORT AND PLAN
FOR
WILLOWIND AT STETSON HILLS
FILING NOS. 1, 2 AND 3

March, 2001

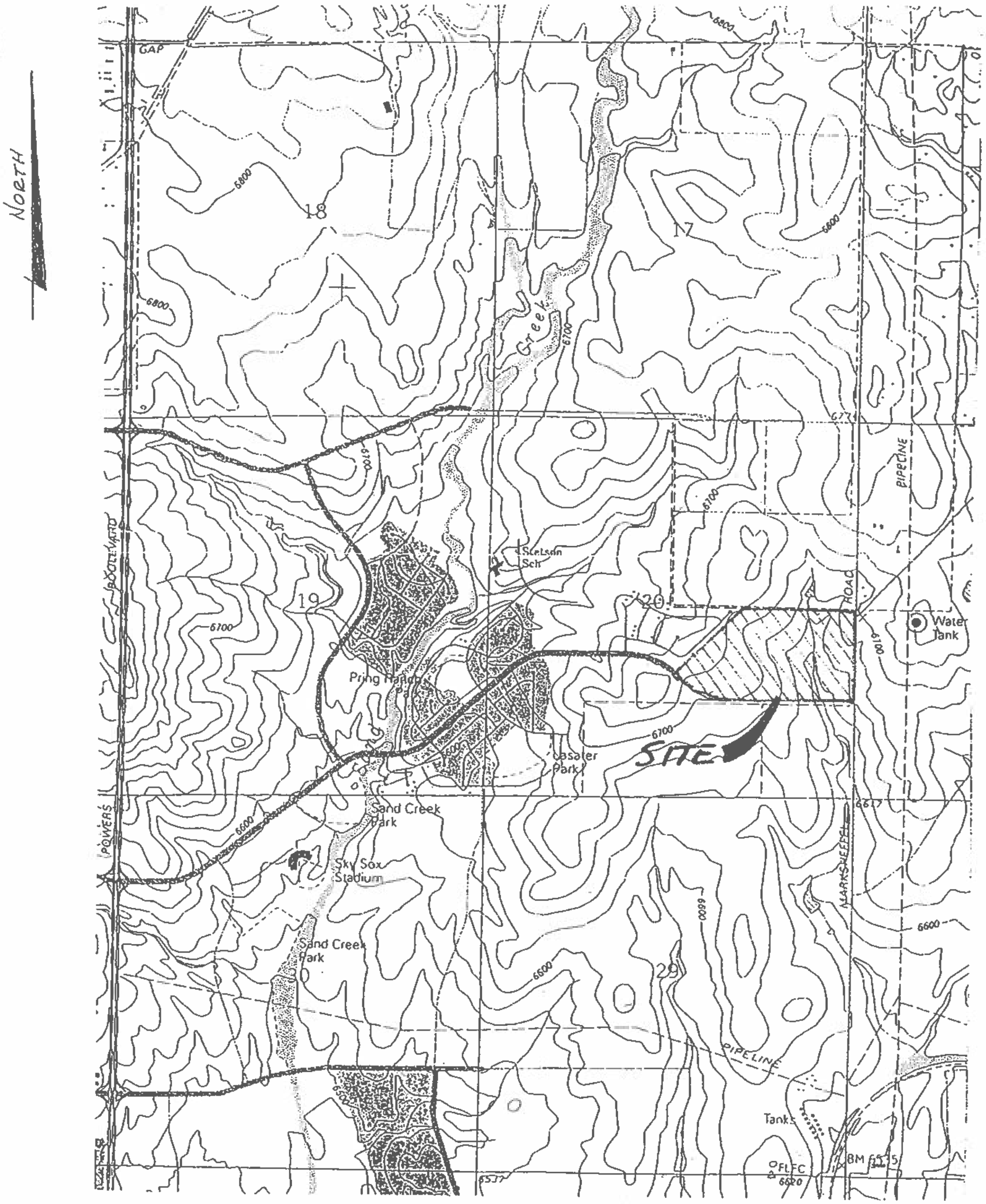
Leigh
& Whitehead
Associates, Inc.

CONSULTING CIVIL ENGINEERS & SURVEYORS
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, CO 80909-5061

LWA Project No. 00085.30

RETURN WITHIN 2 WEEKS TO:
CITY OF COLORADO SPRINGS
SUBDIVISION ENGINEERING
30 SOUTH NEVADA AVE., SUITE 702
COLORADO SPRINGS, CO 80903
(719) 385-5979

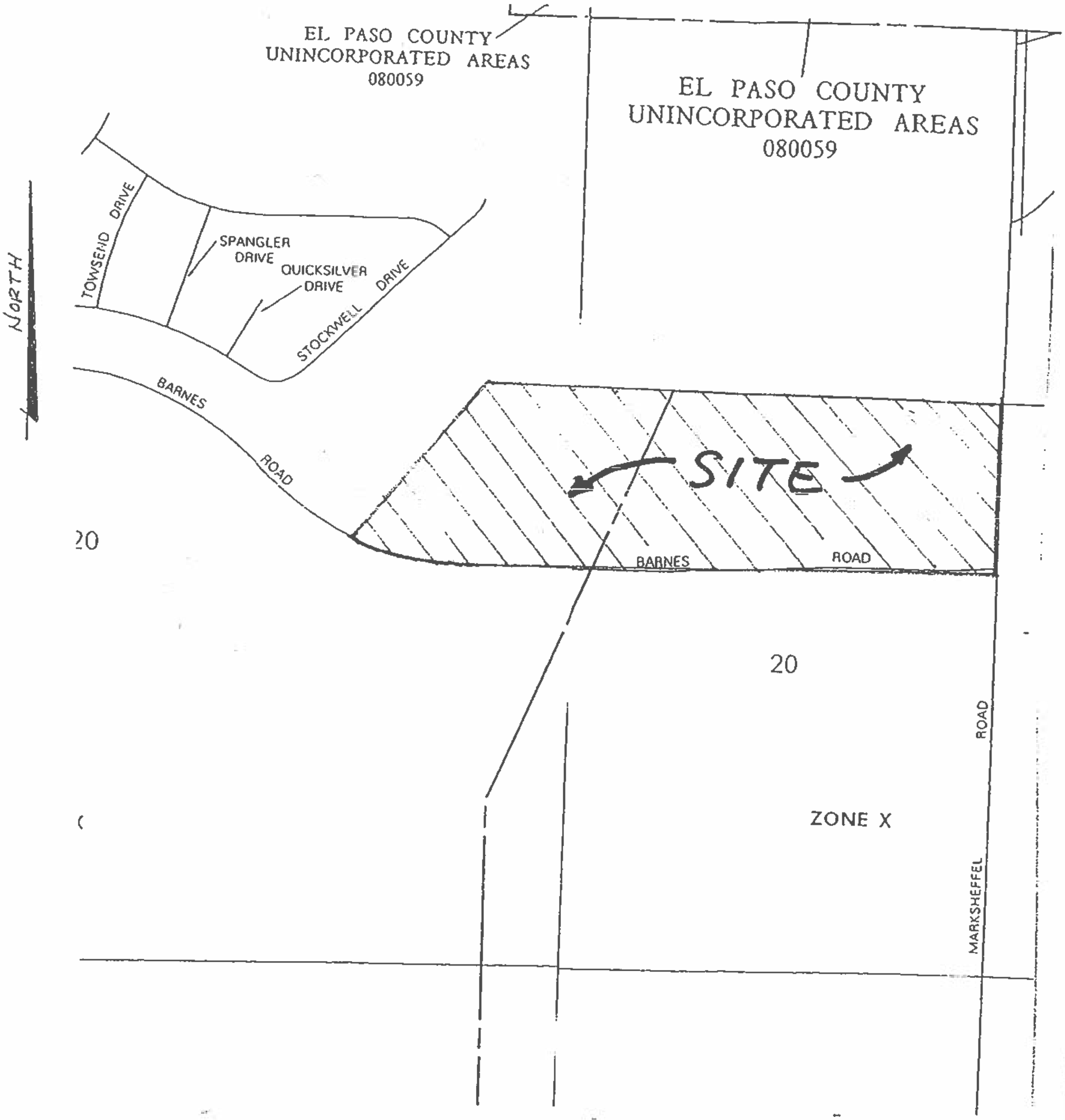
~~RETURN WITHIN 2 WEEKS TO:~~
~~CITY OF COLORADO SPRINGS~~
~~STORM WATER & SUBDIVISION~~
~~101 W. COSTILLA SUITE 113~~
~~COLORADO SPRINGS, CO 80903~~
~~(719) 385-5979~~



REF: Falcon Hill "Quad"

LOCATION MAP

Leigh
& Whitehead
Associates, Inc.
CONSULTING CIVIL ENGINEERS & SURVEYORS
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, CO 80909-5061



FEMA MAP

DATE: MARCH 17, 1997

PLATE NO. 08041C0539 F
08041C0543 F

Leigh & Whitehead Associates, Inc.

CONSULTING CIVIL ENGINEERS & SURVEYORS
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, CO 80909-5061

RUNOFF COMPUTATIONS
RATIONAL METHOD

00085PR.WK4

WILLOWIND AT STETSON HILLS
BARNES ROAD & MARKSHEFFEL ROAD
COLORADO SPRINGS, COLORADO

LEIGH WHITEHEAD & ASSOCIATES,INC.
Engineers, Surveyors & Planners
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, COLORADO
(719) 636-5179

TABLE A:
PROPOSED CONDITIONS

LWA # 00085.30

08-Nov-2000

BASIN	AREA	SOIL TYPE	C 5 / C 100	GEOMETRY LENGTH	GEOMETRY SLOPE	GEOMETRY HEIGHT	Tt 5 / Tt 100	V / Tt	tc 5 / tc 100	i 5 / i 100	Q5	Q100	COMMENTS
A1	4.66	B	0.60	300		16.0	9.32	2.89	11.98	3.75	10.5		
		97	0.70		5.33		7.46	2.66	10.12	7.04		23.0	
A2	1.82	B	0.60	80		3.0	5.41	5.02	8.13	4.40	4.8		
		97	0.70		3.75		4.33	2.72	7.05	8.10		10.3	
A3	3.15	B	0.60	60		1.0	6.12	Varies	9.17	4.20	7.9		
		97	0.70		1.67		4.90	3.05	7.95	7.75		17.1	
A4	0.22	B	0.90	10		0.2	0.94	5.31	1.54	5.20	1.0		
		97	0.95		2.00		0.71	0.60	1.31	9.00		1.9	
DP - 1	9.85	B	0.60	300		16.0	9.32	Varies	14.71	3.41	20.1		A1 through A4
		97	0.70		5.33		7.46	5.39	12.85	6.34		43.7	
A5	0.93	B	0.90	20		0.4	1.33	5.21	3.22	5.20	4.4		
		97	0.95		2.00		1.00	1.89	2.69	9.00		8.0	
OS - A6	6.95	B	0.90	20		0.4	1.33	6.16	8.50	4.32	27.0		
		97	0.95		2.00		1.00	7.17	8.17	7.67		50.6	
A7	1.20	B	0.90	20		0.4	1.33	5.50	3.15	5.20	5.6		
		97	0.95		2.00		1.00	1.82	2.82	9.00		10.3	
A	18.93	B	0.75	300		16.0	6.52	Varies	13.99	3.49	49.5		
		97	0.82		5.33		5.22	7.47	12.69	6.38		99.0	
B1	8.10	B	0.60	300		17.0	9.14	Varies	12.90	3.62	17.6		
		97	0.70		5.67		7.31	3.76	11.07	6.78		38.4	
B2	1.29	B	0.60	250		15.0	8.18	Varies	9.13	4.20	3.3		
		97	0.70		6.00		6.55	0.95	7.50	7.92		7.2	
DP - 2	9.39	B	0.60	300		17.0	9.14	Varies	13.64	3.53	19.9		B1 & B2
		97	0.70		5.67		7.31	4.50	11.81	6.59		43.3	
B3	0.66	B	0.60	235		32.0	6.05	Varies	7.30	4.58	1.8		
		97	0.70		13.62		4.84	1.25	6.09	8.51		3.9	
OS - B4	3.99	B	0.36	300		5.0	20.25	Varies	22.31	2.75	3.9		
		97	0.58		1.67		14.23	2.06	16.29	5.66		13.1	

RUNOFF COMPUTATIONS
RATIONAL METHOD

WILLOWIND AT STETSON HILLS
BARNES ROAD. & MARKSHEFFEL ROAD
COLORADO SPRINGS, COLORADO

LEIGH WHITEHEAD & ASSOCIATES,INC.
Engineers, Surveyors & Planners
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, COLORADO
(719) 636-5179

TABLE A:
PROPOSED CONDITIONS

LWA # 00085.30

08-Nov-2000

BASIN	AREA	SOIL TYPE	C 5 / C 100	GEOMETRY LENGTH	SLOPE	HEIGHT	Tt 5 / Tt 100	V / Tt	tc 5 / tc 100	i 5 / i 100	Q5	Q100	COMMENTS
B5	1.22	B	0.60	200		13.0	7.13	3.09	8.85	4.26	3.1		
		97	0.70		6.50		5.70	1.72	7.42	7.95		6.8	
DP - 3	5.87	B	0.44	300		5.0	18.06	Varies	20.67	2.86	7.4		B3 through B5
		97	0.62		1.67		13.14	2.61	15.75	5.75		20.9	
B6	0.67	B	0.60	100		2.0	7.44	6.85	8.19	4.39	1.8		
		97	0.70		2.00		5.95	0.75	6.70	8.24		3.9	
B7	0.60	B	0.60	60		1.0	6.12	6.32	7.33	4.57	1.6		
		97	0.70		1.67		4.90	1.21	6.11	8.51		3.6	
B8	1.73	B	0.60	250		18.0	7.71	3.68	9.25	4.18	4.3		
		97	0.70		7.20		6.17	1.54	7.71	7.84		9.5	
DP - 4	8.87	B	0.49	300		5.0	16.69	Varies	21.39	2.81	12.2		B3 through B8
		97	0.65		1.67		12.31	4.70	17.01	5.54		31.9	
B9	0.67	B	0.60	275		19.0	8.19	3.57	8.75	4.27	1.7		
		97	0.70		6.91		6.55	0.56	7.11	8.07		3.8	
B10	0.88	B	0.60	100		3.0	6.51	3.88	9.13	4.20	2.2		
		97	0.70		3.00		5.21	2.62	7.83	7.79		4.8	
DP - 5	19.81	B	0.55	300		5.0	15.05		19.75	2.93	32.0		B1 through B10
		97	0.68		1.67		11.49	4.70	16.19	5.67		76.4	
B11	0.65	B	0.60	35		2.0	3.11	Varies	4.12	5.20	2.0		
		97	0.70		5.71		2.49	1.01	3.50	9.00		4.1	
DP - 6	20.46	B	0.55	300		5.0	15.05	Varies	21.87	2.78	31.2		B1 through B11
		97	0.68		1.67		11.49	6.82	18.31	5.33		74.2	
OS - B12	39.56	B	0.60	250		2.0	15.91	Varies	20.13	2.90	68.9		
		97	0.70		0.80		12.73	4.22	16.95	5.55		153.6	
B13	1.59	B	0.60	130		8.0	5.85	4.99	7.85	4.46	4.3		
		97	0.70		6.15		4.68	2.00	6.68	8.25		9.2	
DP - 7	41.15	B	0.60	250		2.0	15.91	Varies	22.18	2.76	68.0		OS - B12 & B13
		97	0.70		0.80		12.73	6.27	19.00	5.23		150.6	

RUNOFF COMPUTATIONS
RATIONAL METHOD

00085PR.WK4

LEIGH WHITEHEAD & ASSOCIATES,INC.
Engineers, Surveyors & Planners
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, COLORADO
(719) 636-5179

WILLOWIND AT STETSON HILLS
BARNES ROAD & MARKSHEFFEL ROAD
COLORADO SPRINGS, COLORADO

TABLE A:
PROPOSED CONDITIONS

LWA # 00085.30

08-Nov-2000

BASIN	AREA	SOIL TYPE	C 5 / C 100	GEOMETRY LENGTH	GEOMETRY SLOPE	GEOMETRY HEIGHT	Tt 5 / Tt 100	V / Tt	tc 5 / tc 100	i 5 / i 100	Q5	Q100	COMMENTS
DP - 8	61.61	B	0.58	300		5.0	14.23	Varies	21.05	2.83	101.3		B1 through B13
		97	0.69		1.67		11.22	6.82	18.04	5.37		228.4	
B14	0.85	B	0.90	20		0.4	1.33	4.87	3.49	5.72	4.4		
		97	0.95		2.00		1.00	2.16	3.16	10.24		8.3	
DP - 9	62.46	B	0.58	300		5.0	14.23	Varies	21.05	2.83	102.7		B1 through B14
		97	0.69		1.67		11.22	6.82	18.04	5.37		231.5	
B15	1.59	B	0.60	80		2.0	6.18	5.05	9.05	4.22	4.0		
		97	0.70		2.50		4.94	2.87	7.81	7.80		8.7	
B16	3.09	B	0.60	230		6.0	10.33	Varies	12.45	3.68	6.8		
		97	0.70		2.61		8.27	2.12	10.39	6.96		15.1	
B17	0.59	B	0.60	50		1.0	5.26	5.80	6.44	4.78	1.7		
		97	0.70		2.00		4.21	1.18	5.39	8.86		3.7	
DP - 10	5.27	B	0.60	230		6.0	10.33	Varies	12.45	3.68	11.6		B15 through B17
		97	0.70		2.61		8.27	2.12	10.39	6.96		25.7	
B18	2.67	B	0.60	240		14.0	8.09	5.28	9.48	4.14	6.6		
		97	0.70		5.83		6.48	1.39	7.87	7.78		14.5	
B19	0.65	B	0.60	50		1.0	5.26	Varies	6.99	4.65	1.8		
		97	0.70		2.00		4.21	1.73	5.94	8.59		3.9	
DP - 11	8.59	B	0.60	230		6.0	10.33	Varies	13.47	3.55	18.3		B15 through B19
		97	0.70		2.61		8.27	3.14	11.41	6.69		40.2	
B20	3.05	B	0.60	220		7.0	9.47	4.82	10.61	3.95	7.2		
		97	0.70		3.18		7.57	1.14	8.71	7.48		16.0	
B21	0.58	B	0.60	50		1.0	5.26	Varies	6.34	4.81	1.7		
		97	0.70		2.00		4.21	1.08	5.29	8.91		3.6	
B22	0.20	B	0.60	35		1.0	3.91	5.36	5.20	5.13	0.6		
		97	0.70		2.86		3.13	0.50	9.00	7.38		1.0	
DP - 12	3.83	B	0.60	220		7.0	9.47	Varies	11.91	3.76	8.6		B20 through B22
		97	0.70		3.18		7.57	2.44	10.01	7.07		19.0	

RUNOFF COMPUTATIONS
RATIONAL METHOD

00085PR WK4

WILLOWIND AT STETSON HILLS
BARNES ROAD. & MARKSHEFFEL ROAD
COLORADO SPRINGS. COLORADO

LEIGH WHITEHEAD & ASSOCIATES,INC.
Engineers, Surveyors & Planners
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, COLORADO
(719) 636-5179

TABLE A:
PROPOSED CONDITIONS

LWA # 00085.30

05-Feb-2001

BASIN	AREA	SOIL TYPE	C 5 / C 100	GEOMETRY LENGTH	SLOPE	HEIGHT	Tt 5 / Tt 100	V / Tt	tc 5 / tc 100	i 5 / i 100	Q5	Q100	COMMENTS
B23	1.0	B	0.60	90		1.0	8.57	2.89	10.82	3.92	2.4		
		97	0.70		1.11		6.85	2.25	9.10	7.35		5.2	
DP - 13	4.84	B	0.60	220		7.0	9.47	Varies	14.24	3.46	10.0		B20 through B23
		97	0.70		3.18		7.57	4.77	12.34	6.46		21.9	
DP - 14	13.43	B	0.60	220		7.0	9.47	Varies	14.24	3.46	27.9		B15 through B23
		97	0.70		3.18		7.57	4.77	12.34	6.46		60.7	
B	75.89	B	0.59	300		4.0	15.02	Varies	22.07	2.76	123.7		Basin B
		97	0.69		1.33		12.08	7.05	19.13	5.21		272.9	
C	0.36	B	0.90	10		0.2	0.94	6.45	1.87	5.20	1.7		
		97	0.95		2.00		0.71	0.93	1.64	9.00		3.1	
OS - D1	4.55	B	0.71	100		2.0	5.80	Varies	9.99	4.05	13.1		
		97	0.79		2.00		4.61	4.19	8.80	7.45		26.8	
OS - D2	1.84	B	0.90	20		0.4	1.33	5.92	4.85	5.20	8.6		
		97	0.95		2.00		1.00	3.52	4.52	9.00		15.7	
DP - 15	6.39	B	0.76	100		2.0	5.08	Varies	12.77	3.64	17.7		OS - D1 & OS - D2
		97	0.84		2.00		3.87	7.71	11.56	6.64		35.7	
OS - D3	0.67	B	0.90	20		0.4	1.33	3.40	3.14	5.20	3.1		
		97	0.95		2.00		1.00	1.81	2.81	9.00		5.7	
D	7.06	B	0.77	100		2.0	4.91	Varies	12.62	3.66	19.9		Basin D
		97	0.85		2.00		3.72	7.71	11.43	6.68		40.1	
OS - B12 (Undev. Flow)	39.56	B	0.25	1000		51.0	29.36	Varies	36.16	2.07	20.5		Undeveloped Runoff
		97	0.35		5.10		25.91	6.80	32.71	3.65		53.2	Entering 42" RCP @ OS-B12
DP - 9 (Undev. Flow)	47.35	B	0.25	1000		51.0	29.36	Varies	39.24	1.97	23.3		Undeveloped Runoff
		97	0.35		5.10		25.91	9.88	35.75	3.64		60.3	Entering 54" RCP @ DP-9

RUNOFF COMPUTATIONS
WEIGHTED RUNOFF COEFFICIENT (C)

WILLOWIND AT STETSON HILLS
BARNES ROAD & MARKSHEFFEL ROAD
COLORADO SPRINGS, COLORADO

TABLE A
PROPOSED CONDITIONS

LWA # 00085.30

00085PR.WK4

LEIGH WHITEHEAD & ASSOCIATES, INC.
Engineers, Surveyors & Planners
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, COLORADO
(719) 636-5179

08-Nov-2000

Basin	Area	Total Area	Percent Cover	C5"	Wtd. "C5"	C100"	Wtd. "C100"	Type Of Cover
A	9.63	18.93	50.87%	0.60	0.31	0.70	0.36	Single Family
	9.30	18.93	49.13%	0.90	0.44	0.95	0.47	Road
	18.93		100.00%		0.75		0.82	
OS - B4	3.17	3.99	79.45%	0.30	0.24	0.55	0.44	Park
	0.82	3.99	20.55%	0.60	0.12	0.70	0.14	Single Family
	3.99		100.00%		0.36		0.58	
DP - 3	3.17	5.87	54.00%	0.30	0.16	0.55	0.30	Park
	2.70	5.87	46.00%	0.60	0.28	0.70	0.32	Single Family
	5.87		100.00%		0.44		0.62	
DP - 4	3.17	8.87	35.74%	0.30	0.11	0.55	0.20	Park
	5.70	8.87	64.26%	0.60	0.39	0.70	0.45	Single Family
	8.87		100.00%		0.49		0.65	
DP - 5	3.17	19.81	16.00%	0.30	0.05	0.55	0.09	Park
	16.64	19.81	84.00%	0.60	0.50	0.70	0.59	Single Family
	19.81		100.00%		0.55		0.68	
DP - 6	3.17	20.46	15.49%	0.30	0.05	0.55	0.09	Park
	17.29	20.46	84.51%	0.60	0.51	0.70	0.59	Single Family
	20.46		100.00%		0.55		0.68	
DP - 8	3.17	61.61	5.15%	0.30	0.02	0.55	0.03	Park
	58.44	61.61	94.85%	0.60	0.57	0.70	0.66	Single Family
	61.61		100.00%		0.58		0.69	
DP - 9	3.17	62.46	5.08%	0.30	0.02	0.55	0.03	Park
	59.29	62.46	94.92%	0.60	0.57	0.70	0.66	Single Family
	62.46		100.00%		0.58		0.69	
B	3.17	75.89	4.18%	0.30	0.01	0.55	0.02	Park
	72.72	75.89	95.82%	0.60	0.57	0.70	0.67	Single Family
	75.89		100.00%		0.59		0.69	
OS - D1	3.28	4.55	72.09%	0.63	0.45	0.73	0.53	Single Family
	1.27	4.55	27.91%	0.90	0.25	0.95	0.27	Road
	4.55		100.00%		0.71		0.79	
DP - 15	3.28	6.39	51.33%	0.63	0.32	0.73	0.37	Single Family
	3.11	6.39	48.67%	0.90	0.44	0.95	0.46	Road
	6.39		100.00%		0.76		0.84	
D	3.28	7.06	46.46%	0.63	0.29	0.73	0.34	Single Family
	3.78	7.06	53.54%	0.90	0.48	0.95	0.51	Road
	7.06		100.00%		0.77		0.85	

RUNOFF COMPUTATIONS
TRAVEL TIME CALCULATIONS

WILLOWIND AT STETSON HILLS
BARNES ROAD & MARKSHEFFEL ROAD
COLORADO SPRINGS, COLORADO

LEIGH WHITEHEAD & ASSOCIATES,INC.
Engineers, Surveyors & Planners
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, COLORADO
(719) 636-5179

00085PR.WK4

LWA # 00085.30

TABLE A
PROPOSED CONDITIONS

08-Nov-2000

BASIN	"P" or "K" (TR-55)	"n"	Area	"WP" or "Pipe Dia."	HIGH ELEV	LOW ELEV	LENGTH	HEIGHT	SLOPE	"V"	"TT" (min)	COMMENTS
A1		0.016	2.83	17.39	6712.0	6707.0	460	5.0	1.09%	2.89	2.66	Ramp Curb
A2		0.016	2.83	17.39	6704.0	6677.0	820	27.0	3.29%	5.02	2.72	Ramp Curb
A3		0.016	2.83	17.39	6705.0	6704.0	90	1.0	1.25%	3.09	0.43	Ramp Curb
		0.016	4.49	21.51	6704.0	6671.0	955	33.0	3.46%	6.06	2.62	Vertical Curb
							1035				3.05	
A4		0.016	2.83	17.39	6677.0	6670.0	190	7.0	3.68%	5.31	0.60	Ramp Curb
DP - 1		0.016	2.83	17.39	6712.0	6707.0	460	5.0	1.09%	2.89	2.66	Ramp Curb
		0.016	4.49	21.51	6707.0	6670.0	1020	37.0	3.63%	6.22	2.73	Vertical Curb
							1480				5.39	
A5		0.016	4.49	21.51	6670.0	6655.0	590	15.0	2.54%	5.21	1.89	Vertical Curb
OS - A6		0.016	4.49	21.51	6766.0	6672.0	2650	94.0	3.55%	6.16	7.17	Vertical Curb
A7		0.016	4.49	21.51	6672.0	6655.0	600	17.0	2.83%	5.50	1.82	Vertical Curb
A		0.016	2.83	17.39	6712.0	6707.0	460	5.0	1.09%	2.89	2.66	Ramp Curb
		0.016	4.49	21.51	6707.0	6670.0	1020	37.0	3.63%	6.22	2.73	Vertical Curb
		0.016	4.49	21.51	6670.0	6655.0	630	15.0	2.38%	5.04	2.08	Vertical Curb
							2110				7.47	
B1		0.03	4.00	8.25	6713.0	6709.0	130	4.0	3.08%	5.36	0.40	Grass Swale
		0.016	2.83	17.39	6709.0	6706.0	115	3.0	2.61%	4.47	0.43	Ramp Curb
		0.016	2.83	17.39	6706.0	6679.0	860	27.0	3.14%	4.90	2.92	Ramp Curb
							1105				3.76	
B2		0.03	4.00	8.25	6682.0	6678.0	110	4.0	3.64%	5.83	0.31	Grass Swale
		0.016	2.83	17.39	6678.0	6667.0	230	11.0	4.78%	6.05	0.63	Ramp Curb
							340				0.95	
DP - 2		0.03	4.00	8.25	6713.0	6709.0	130	4.0	3.08%	5.36	0.40	Grass Swale
		0.016	2.83	17.39	6709.0	6706.0	115	3.0	2.61%	4.47	0.43	Ramp Curb
		0.016	2.83	17.39	6706.0	6667.0	1130	39.0	3.45%	5.14	3.66	Ramp Curb
							1375				4.50	
B3		0.016	2.83	17.39	6697.0	6696.0	120	1.0	0.83%	2.53	0.79	Ramp Curb
		0.016	2.83	17.39	6696.0	6680.0	210	16.0	7.62%	7.64	0.46	Ramp Curb
							330				1.25	
OS - B4	2.0				6728.0	6721.0	170	7.0	4.12%	4.06	0.70	Sheet Flow
		0.016	4.00	8.25	6721.0	6696.0	820	25.0	3.05%	10.01	1.37	Grass Swale
							990				2.06	
B5		0.016	2.83	17.39	6697.0	6693.0	320	4.0	1.25%	3.09	1.72	Ramp Curb
DP - 2	2.0				6728.0	6721.0	170	7.0	4.12%	4.06	0.70	Sheet Flow
		0.016	4.00	8.25	6721.0	6696.0	820	25.0	3.05%	10.01	1.37	Grass Swale
		0.016	2.83	17.39	6696.0	6693.0	135	3.0	2.22%	4.13	0.55	Ramp Curb
							1125.0				2.61	
B6		0.016	2.83	17.39	6690.0	6671.0	310	19.0	6.13%	6.85	0.75	Ramp Curb
B7		0.016	2.83	17.39	6695.0	6671.0	460	24.0	5.22%	6.32	1.21	Ramp Curb

$$V = \frac{1.486}{n} \cdot \frac{A^{0.67}}{P} \cdot S^{0.5}$$

RUNOFF COMPUTATIONS
TRAVEL TIME CALCULATIONS

WILLOWIND AT STETSON HILLS
BARNES ROAD, & MARKSHEFFEL ROAD
COLORADO SPRINGS, COLORADO

LEIGH WHITEHEAD & ASSOCIATES,INC.
Engineers, Surveyors & Planners
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, COLORADO
(719) 636-5179

00085PR.WK4

LWA # 00085.30

TABLE A:
PROPOSED CONDITIONS

[illegible]

BASIN	"P" or "K" (TR-55)	"n"	Area	"WP" or "Pipe Dia."	HIGH ELEV.	LOW ELEV.	LENGTH	HEIGHT	SLOPE	"V"	"TT" (min)	COMMENTS
B8		0.016	2.83	17.39	6678.0	6672.0	340	6.0	1.76%	3.68	1.54	Ramp Curb
DP - 4	2.0				6728.0	6721.0	170	7.0	4.12%	4.06	0.70	Sheet Flow
		0.03	4.00	8.25	6721.0	6696.0	820	25.0	3.05%	5.34	2.56	Grass Swale
		0.016	2.83	17.39	6696.0	6693.0	135	3.0	2.22%	4.13	0.55	Ramp Curb
		0.016	2.83	17.39	6693.0	6671.0	365	22.0	6.03%	6.79	0.90	Ramp Curb
							1490.0				4.70	
B9		0.016	2.83	17.39	6669.0	6667.0	120	2.0	1.67%	3.57	0.56	Ramp Curb
B10		0.016	2.83	17.39	6678.0	6666.0	610	12.0	1.97%	3.88	2.62	Ramp Curb
DP - 5	2.0				6728.0	6721.0	170	7.0	4.12%	4.06	0.70	Sheet Flow
		0.03	4.00	8.25	6721.0	6696.0	820	25.0	3.05%	5.34	2.56	Grass Swale
		0.016	2.83	17.39	6696.0	6693.0	135	3.0	2.22%	4.13	0.55	Ramp Curb
		0.016	2.83	17.39	6693.0	6671.0	365	22.0	6.03%	6.79	0.90	Ramp Curb
		0.016	2.83	17.39	6671.0	6667.0	225	4.0	1.78%	3.69	1.02	Ramp Curb
							1715				5.71	
B11		0.016	2.97	17.43	6666.0	6663.0	115	3.0	2.61%	4.61	0.42	Vertical Curb
		0.016	4.49	21.51	6663.0	6658.0	190	5.0	2.63%	5.30	0.60	Vertical Curb
							305				1.01	
DP - 6	2.0				6728.0	6721.0	170	7.0	4.12%	4.06	0.70	Sheet Flow
		0.03	4.00	8.25	6721.0	6696.0	820	25.0	3.05%	5.34	2.56	Grass Swale
		0.016	2.83	17.39	6696.0	6693.0	135	3.0	2.22%	4.13	0.55	Ramp Curb
		0.016	2.83	17.39	6693.0	6671.0	365	22.0	6.03%	6.79	0.90	Ramp Curb
		0.016	2.83	17.39	6671.0	6667.0	225	4.0	1.78%	3.69	1.02	Ramp Curb
		0.016	2.97	17.43	6667.0	6663.0	145	4.0	2.76%	4.74	0.51	Vertical Curb
		0.016	4.49	21.51	6663.0	6658.0	190	5.0	2.63%	5.30	0.60	Vertical Curb
							2050				6.82	
OS - B12		0.016	2.83	17.39	6733.0	6707.0	780	26.0	3.33%	5.05	2.57	Ramp Curb
		0.016	4.49	21.51	6707.0	6672.0	715	35.0	4.90%	7.23	1.65	Vertical Curb
							1495				4.22	
B13		0.016	4.49	21.51	6672.0	6658.0	600	14.0	2.33%	4.99	2.00	Vertical Curb
DP - 7		0.016	2.83	17.39	6733.0	6707.0	780	26.0	3.33%	5.05	2.57	Ramp Curb
		0.016	4.49	21.51	6707.0	6672.0	715	35.0	4.90%	7.23	1.65	Vertical Curb
		0.016	4.49	21.51	6672.0	6658.0	610	14.0	2.30%	4.95	2.05	Vertical Curb
							2105				6.27	
DP - 8	2.0				6728.0	6721.0	170	7.0	4.12%	4.06	0.70	Sheet Flow
		0.03	4.00	8.25	6721.0	6696.0	820	25.0	3.05%	5.34	2.56	Grass Swale
		0.016	2.83	17.39	6696.0	6693.0	135	3.0	2.22%	4.13	0.55	Ramp Curb
		0.016	2.83	17.39	6693.0	6671.0	365	22.0	6.03%	6.79	0.90	Ramp Curb
		0.016	2.83	17.39	6671.0	6667.0	225	4.0	1.78%	3.69	1.02	Ramp Curb
		0.016	2.97	17.43	6667.0	6663.0	145	4.0	2.76%	4.74	0.51	Vertical Curb
		0.016	4.49	21.51	6663.0	6658.0	190	5.0	2.63%	5.30	0.60	Vertical Curb
							2050				6.82	
B14		0.016	4.49	21.51	6672.0	6658.0	630	14.0	2.22%	4.87	2.16	Vertical Curb

$$V = \frac{1.486}{n} \frac{A^{0.67}}{P} S^{0.5}$$

RUNOFF COMPUTATIONS
TRAVEL TIME CALCULATIONS

WILLOWIND AT STETSON HILLS
BARNES ROAD & MARKSHEFFEL ROAD
COLORADO SPRINGS COLORADO

LWA # 00085.30

TABLE A
PROPOSED CONDITIONS

00085PR.WK4

LEIGH WHITEHEAD & ASSOCIATES, INC.
Engineers, Surveyors & Planners
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, COLORADO
(719) 636-5179

[illegible]

BASIN	"P" or "K" (TR-55)	"n"	Area	"WP" or "Pipe Dia."	HIGH ELEV.	LOW ELEV.	LENGTH	HEIGHT	SLOPE	"V"	"TT" (min.)	COMMENTS
DP - 9	2.0				6728.0	6721.0	170	7.0	4.12%	4.06	0.70	Sheet Flow
		0.03	4.00	8.25	6721.0	6696.0	820	25.0	3.05%	5.34	2.56	Grass Swale
		0.016	2.83	17.39	6696.0	6693.0	135	3.0	2.22%	4.13	0.55	Ramp Curb
		0.016	2.83	17.39	6693.0	6671.0	365	22.0	6.03%	6.79	0.90	Ramp Curb
		0.016	2.83	17.39	6671.0	6667.0	225	4.0	1.78%	3.69	1.02	Ramp Curb
		0.016	2.97	17.43	6667.0	6663.0	145	4.0	2.76%	4.74	0.51	Vertical Curb
		0.016	4.49	21.51	6663.0	6658.0	190	5.0	2.63%	5.30	0.60	Vertical Curb
							2050				6.82	
B15		0.016	2.83	17.39	6708.0	6679.0	870	29.0	3.33%	5.05	2.87	Ramp Curb
B16		0.016	2.83	17.39	6702.0	6697.0	200	5.0	2.50%	4.38	0.76	Ramp Curb
		0.016	2.83	17.39	6697.0	6679.0	450	18.0	4.00%	5.53	1.36	Ramp Curb
							650				2.12	
B17		0.016	2.83	17.39	6696.0	6678.0	410	18.0	4.39%	5.80	1.18	Ramp Curb
DP - 10		0.016	2.83	17.39	6702.0	6697.0	200	5.0	2.50%	4.38	0.76	Ramp Curb
		0.016	2.83	17.39	6697.0	6679.0	450	18.0	4.00%	5.53	1.36	Ramp Curb
							650				2.12	
B18		0.016	2.83	17.39	6683.0	6667.0	440	16.0	3.64%	5.28	1.39	Ramp Curb
B19		0.016	2.83	17.39	6681.0	6666.0	450	15.0	3.33%	5.05	1.48	Ramp Curb
		0.016	2.97	17.43	6666.0	6662.0	90	4.0	4.44%	6.02	0.25	Vertical Curb
							540				1.73	
DP - 11		0.016	2.83	17.39	6702.0	6697.0	200	5.0	2.50%	4.38	0.76	Ramp Curb
		0.016	2.83	17.39	6697.0	6678.0	450	19.0	4.22%	5.69	1.32	Ramp Curb
		0.016	2.83	17.39	6678.0	6666.0	280	12.0	4.29%	5.73	0.81	Ramp Curb
		0.016	2.97	17.43	6666.0	6662.0	90	4.0	4.44%	6.02	0.25	Vertical Curb
							1020				3.14	
B20		0.016	2.83	17.39	6703.0	6693.0	330	10.0	3.03%	4.82	1.14	Ramp Curb
B21		0.016	2.83	17.39	6697.0	6693.0	95	4.0	4.21%	5.68	0.28	Ramp Curb
		0.016	2.83	17.39	6693.0	6683.0	260	10.0	3.85%	5.43	0.80	Ramp Curb
							355				1.08	
B22		0.016	2.83	17.39	6683.0	6677.0	160	6.0	3.75%	5.36	0.50	Ramp Curb
DP - 12		0.016	2.83	17.39	6703.0	6693.0	330	10.0	3.03%	4.82	1.14	Ramp Curb
		0.016	2.83	17.39	6693.0	6677.0	420	16.0	3.81%	5.40	1.30	Ramp Curb
							750				2.44	
B23		0.016	2.97	17.43	6667.0	6663.0	390	4.0	1.03%	2.89	2.25	Vertical Curb
DP - 13		0.016	2.83	17.39	6703.0	6693.0	330	10.0	3.03%	4.82	1.14	Ramp Curb
		0.016	2.83	17.39	6693.0	6677.0	420	16.0	3.81%	5.40	1.30	Ramp Curb
		0.016	2.97	17.43	6667.0	6663.0	400	4.0	1.00%	2.85	2.34	Vertical Curb
							1150				4.77	
DP - 14		0.016	2.83	17.39	6703.0	6693.0	330	10.0	3.03%	4.82	1.14	Ramp Curb
		0.016	2.83	17.39	6693.0	6677.0	420	16.0	3.81%	5.40	1.30	Ramp Curb
		0.016	2.97	17.43	6667.0	6663.0	400	4.0	1.00%	2.85	2.34	Vertical Curb
							1150				4.77	

$$V = \frac{1.486}{n} \cdot A^{0.67} \cdot S^{0.5}$$
$$P$$

RUNOFF COMPUTATIONS
TRAVEL TIME CALCULATIONS

WILLOWIND AT STETSON HILLS
BARNES ROAD & MARKSHEFFEL ROAD
COLORADO SPRINGS, COLORADO

LEIGH WHITEHEAD & ASSOCIATES,INC.
Engineers, Surveyors & Planners
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, COLORADO
(719) 636-5179

0008SPR.WK4

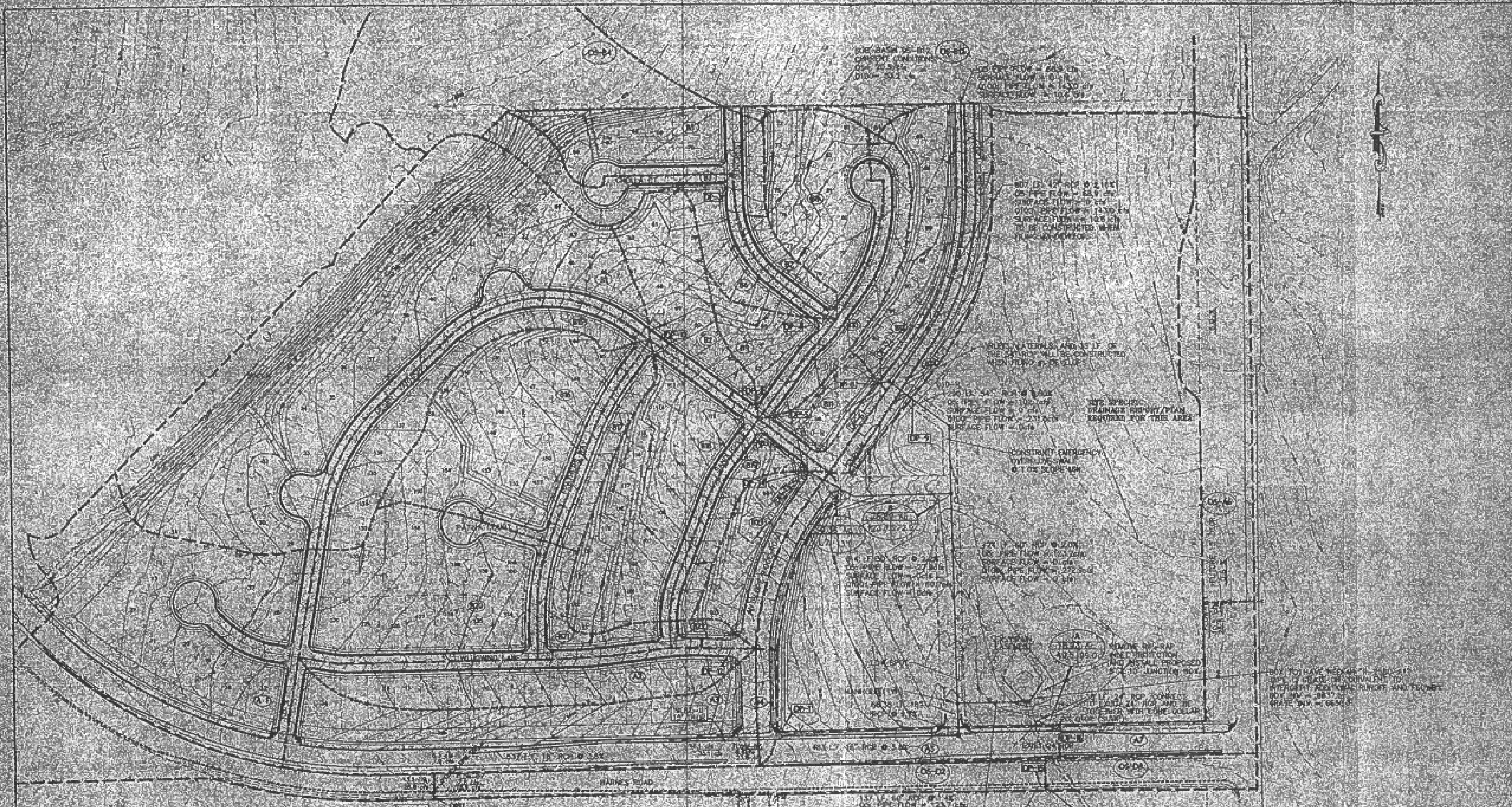
LWA # 00085.30

TABLE A
PROPOSED CONDITIONS

[illegible]

BASIN	"P" or "K" (TR-55)	"n"	Area	"WP" or "Pipe Dia."	HIGH ELEV	LOW ELEV	LENGTH	HEIGHT	SLOPE	"V"	"TT" (min.)	COMMENTS
B	2.0				6728.0	6721.0	170	7.0	4.12%	4.06	0.70	Sheet Flow
		0.03	4.00	8.25	6721.0	6696.0	820	25.0	3.05%	5.34	2.56	Grass Swale
		0.016	2.83	17.39	6696.0	6693.0	135	3.0	2.22%	4.13	0.55	Ramp Curb
		0.016	2.83	17.39	6693.0	6671.0	365	22.0	6.03%	6.79	0.90	Ramp Curb
		0.016	2.83	17.39	6671.0	6667.0	225	4.0	1.78%	3.69	1.02	Ramp Curb
		0.016	2.97	17.43	6667.0	6663.0	145	4.0	2.76%	4.74	0.51	Vertical Curb
		0.016	4.49	21.51	6663.0	6658.0	190	5.0	2.63%	5.30	0.60	Vertical Curb
		0.013		3.5	6652.0	6648.0	200	4.0	2.00%	14.79	0.23	3.5' Dia. RCP
							2250				7.05	
C		0.016	4.49	21.51	6677.0	6663.0	360	14.0	3.89%	6.45	0.93	Vertical Curb
OS - D1		0.016	2.83	17.39	6734.0	6720.0	400	14.0	3.50%	5.18	1.29	Ramp Curb
		0.016	4.49	21.51	6720.0	6696.0	920	24.0	2.61%	5.28	2.90	Vertical Curb
							1320				4.19	
OS - D2		0.016	4.49	21.51	6696.0	6655.0	1250	41.0	3.28%	5.92	3.52	Vertical Curb
DP - 15		0.016	2.83	17.39	6734.0	6720.0	400	14.0	3.50%	5.18	1.29	Ramp Curb
		0.016	4.49	21.51	6720.0	6696.0	920	24.0	2.61%	5.28	2.90	Vertical Curb
		0.016	4.49	21.51	6696.0	6655.0	1250	41.0	3.28%	5.92	3.52	Vertical Curb
							2570				7.71	
OS - D3		0.016	4.49	21.51	6659.0	6655.0	370	4.0	1.08%	3.40	1.81	Vertical Curb
D		0.016	2.83	17.39	6734.0	6720.0	400	14.0	3.50%	5.18	1.29	Ramp Curb
		0.016	4.49	21.51	6720.0	6696.0	920	24.0	2.61%	5.28	2.90	Vertical Curb
		0.016	4.49	21.51	6696.0	6655.0	1250	41.0	3.28%	5.92	3.52	Vertical Curb
							2570				7.71	

$$V = \frac{1.486}{n} \frac{A^{0.67}}{P} S^{0.5}$$



GRAPHIC SCALE

LEGEND
BASIN MAJOR
BASIN MINOR
TIME OF CONCENTRATION
BASIN DESIGNATIONS

BASIN	AREA	Q5	Q100
A1	4.66	10.5	23.0
A2	1.87	4.8	10.3
A3	3.15	7.9	17.1
A4	0.22	1.0	1.8
A5	[illegible]	4.4	8.0
OS-A6	8.95	22.0	50.8
A7	1.30	3.6	10.3
A	18.93	46.9	99.0
B1	8.10	17.6	36.4
B2	1.28	3.3	7.2
B3	0.66	1.8	3.9
OS-B4	3.96	5.9	13.3
B5	1.22	3.1	6.6

BASIN	AREA	Q5	Q100
B6	0.67	1.8	3.9
B7	0.60	1.6	3.8
B8	1.73	4.3	8.5
B9	0.67	1.7	3.8
B10	0.66	2.2	4.6
B11	0.85	2.0	4.3
OS-B12	36.56	68.9	103.6
B13	1.59	4.3	9.2
B14	0.85	4.4	8.3
B15	1.59	4.0	8.7
B16	3.09	6.8	15.1
B17	0.59	1.7	3.7

BASIN	AREA	Q5	Q100
B18	2.87	6.8	14.5
B19	0.85	1.9	3.9
B20	3.05	7.2	15.9
B21	0.56	1.7	3.6
B22	0.20	0.6	1.0
B23	1.0	2.4	5.2
B	75.89	123.7	272.8
C	0.36	1.7	3.1
OS-01	4.55	13.1	26.8
OS-02	1.64	8.6	15.7
OS-03	0.87	3.1	5.7
D	9.24	19.3	40.1

DESIGN POINT	AREA	Q5	Q100
OS-D1	4.56	13.1	26.8
DP-1	9.25	20.1	43.7
DP-2	3.06	15.9	43.3
DP-3	3.27	7.8	19.9
DP-4	6.87	12.2	17.9
DP-5	15.81	32.0	56.4
DP-6	20.46	31.2	74.2
DP-7	41.15	68.0	150.8
DP-8	61.87	108.3	228.4
DP-9	62.46	102.7	231.5
DP-10	5.27	11.6	23.7
DP-11	8.58	18.3	40.2
DP-12	3.83	8.6	19.0
DP-13	4.48	10.0	21.9
DP-14	13.83	27.9	60.7
DP-15	6.39	17.7	35.7
DP-16	18.53	42.6	99.0

EMERGENCY OVERFLOW SWALE

LEIGH WHITEHEAD & ASSOCIATES

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DESIGN AND DRAWINGS NOT TO BE REUSED WITHOUT WRITTEN PERMISSION OF ENGINEER

SHEET TITLE: FINAL DRAINAGE PLAN

PROJECT NAME: WILLOWIND AT STETSON HILLS

BENCHMARK

REVISIONS

SCALE: 1" = 100'

DRAWN BY:

CHECKED BY:

SHEET NO. 1 OF 1

PROJECT NO.

DRAWING NAME

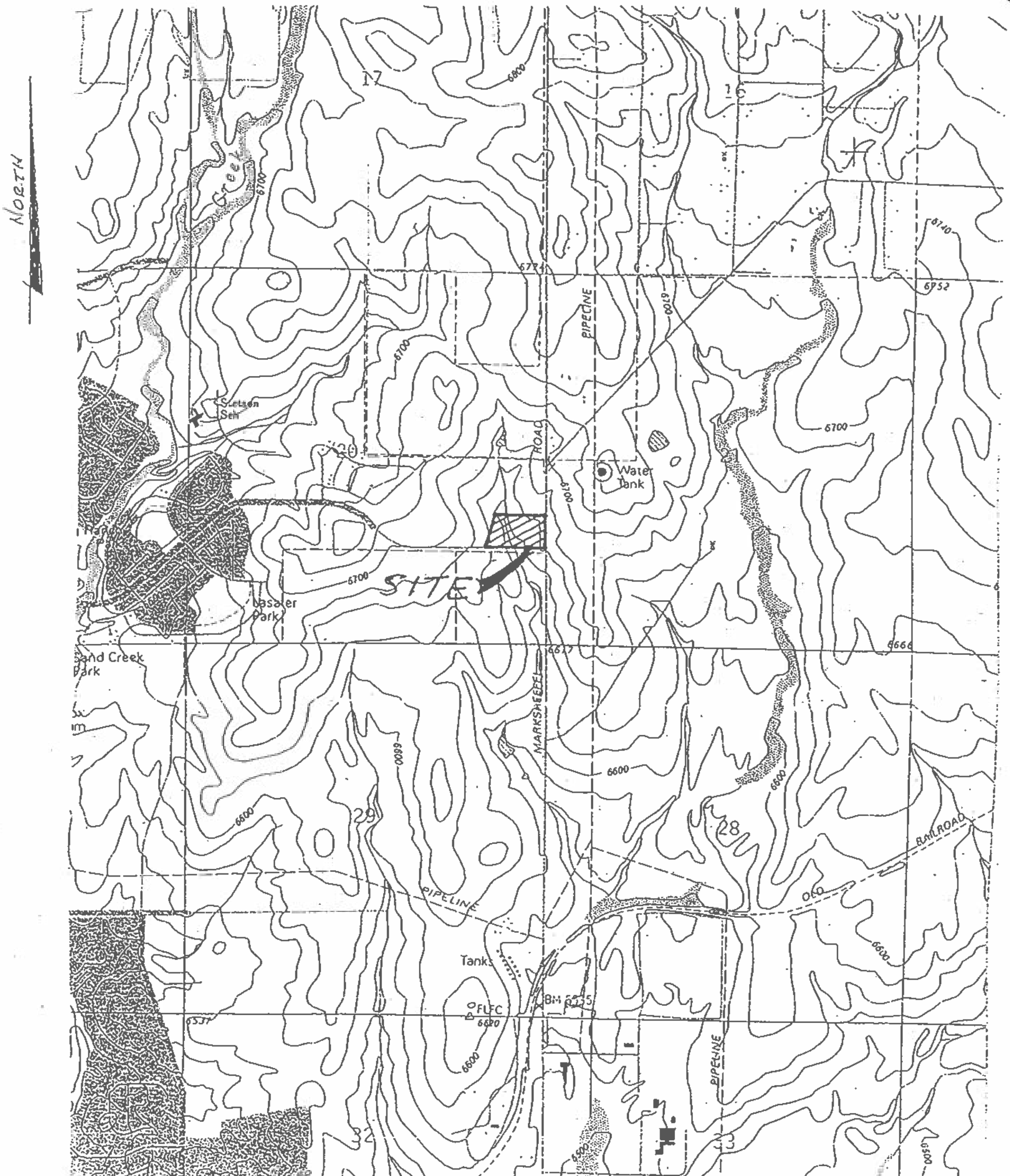
FINAL
DRAINAGE REPORT AND PLAN
FOR
WILLOWIND FILING AT STETSON HILLS
FILING NO. 4

September, 2004

Leigh
& Whitehead
Associates, Inc.

CONSULTING CIVIL ENGINEERS & SURVEYORS
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, CO 80909-5061

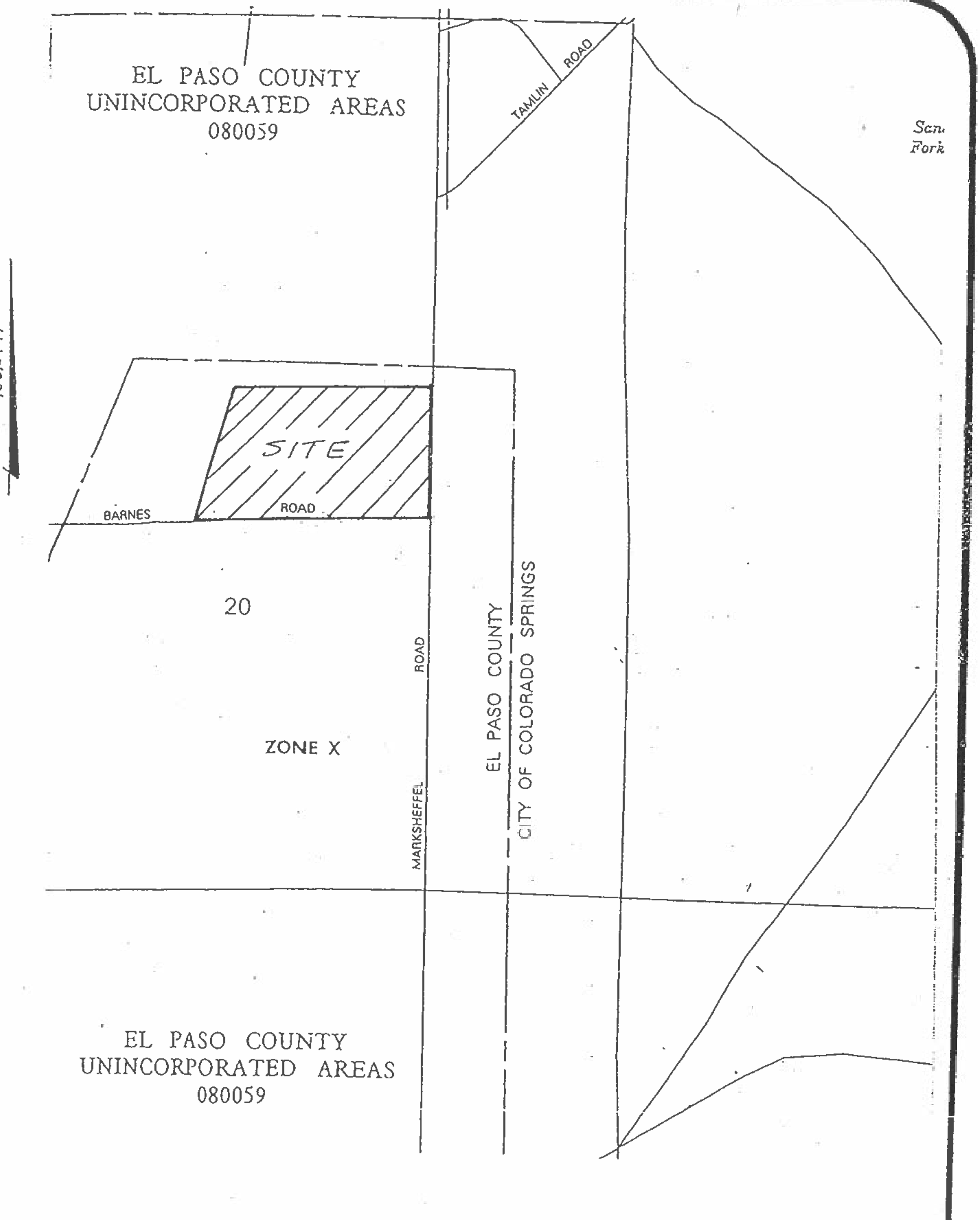
LWA Project No. 03012.64



REF: FALCON NW "QUAD" 1994

LOCATION MAP

Leigh & Whitehead Associates, Inc.
CONSULTING CIVIL ENGINEERS & SURVEYORS
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, CO 80909-5061



FEMA MAP

DATE: MARCH 17, 1997

PLATE NO. 08041C0543 F

Leigh & Whitehead Associates, Inc.
CONSULTING CIVIL ENGINEERS & SURVEYORS
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, CO 80909-5061

RUNOFF COMPUTATIONS --- RATIONAL METHOD

WILLOWIND FILING NO. 4
MARKSHEFFEL ROAD and BARNES ROAD
COLORADO SPRINGS, COLORADO

LEIGH WHITEHEAD & ASSOCIATES,INC.
Engineers, Surveyors & Planners
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, COLORADO
(719) 636-5179

TABLE A: LWA # 03012.62 27-Apr-04
PROPOSED CONDITIONS

BASIN	AREA	SOIL TYPE	C 5 / C 100	GEOMETRY LENGTH	GEOMETRY HEIGHT	Tt 5 / Tt 100	V / Tt	tc 5 / tc 100	i 5 / i 100	Q5	Q100	COMMENTS
				SLOPE								
A	1.08	B	0.60	115.0	3.0	7.31	4.64	7.94	4.46	2.9		
		97	0.70	2.61		5.85	0.63	6.48	8.46		6.4	
B1	1.89	B	0.60	155.0	3.0	9.36	3.05	11.74	3.85	4.4		
		97	0.70	1.94		7.49	2.38	9.87	7.34		9.7	
B2	0.58	B	0.60	200.0	9.0	8.05		8.05	4.43	1.5		
		97	0.70	4.50		6.44		6.44	8.47		3.4	
DP-1	2.47	B	0.60	155.0	3.0	9.36	Varies	12.83	3.71	5.5		Basin B1 & B2
		97	0.70	1.94		7.49	3.47	10.96	7.05		12.2	
B3	0.95	B	0.60	40.0	1.0	4.37	3.58	6.00	4.86	2.8		
		97	0.70	2.50		3.50	1.63	5.13	9.03		6.0	
B4	1.12	B	0.60	120.0	6.0	6.02	2.68	7.51	4.54	3.0		
		97	0.70	5.00		4.82	1.49	6.31	8.53		6.7	
DP-2	4.54	B	0.60	155.0	3.0	9.36	Varies	13.78	3.60	9.8		Basin B1 to B4
		97	0.70	1.94		7.49	4.42	11.91	6.81		21.7	
B5	1.08	B	0.60	85.0	2.0	6.50	3.65	7.87	4.47	2.9		
		97	0.70	2.35		5.20	1.37	6.57	8.42		6.4	
B6	0.56	B	0.60	90.0	2.0	6.82	2.94	8.58	4.34	1.5		
		97	0.70	2.22		5.45	1.76	7.21	8.18		3.2	
B7	0.64	B	0.60	45.0	1.0	4.82	2.39	5.80	4.91	1.9		
		97	0.70	2.22		3.86	0.98	4.84	9.16		4.1	
DP-3	6.82	B	0.60	155.0	3.0	9.36	Varies	14.87	3.48	14.2		Basin B1 to B7
		97	0.70	1.94		7.49	5.51	13.00	6.57		31.3	
B8	0.71	B	0.60	300.0	7.0	12.24	Varies	14.29	3.54	1.5		
		97	0.70	2.33		9.80	2.05	11.85	6.83		3.4	
B	7.53	B	0.60	155.0	3.0	9.36	Varies	16.71	3.29	14.9		
		97	0.70	1.94		7.49	7.35	14.84	6.19		32.6	
C	0.58	B	0.60	225.0	11.0	8.31		8.31	4.39	1.5		
		97	0.70	4.89		6.65		6.65	8.39		3.4	

03012.WK4

RUNOFF COMPUTATIONS RATIONAL METHOD

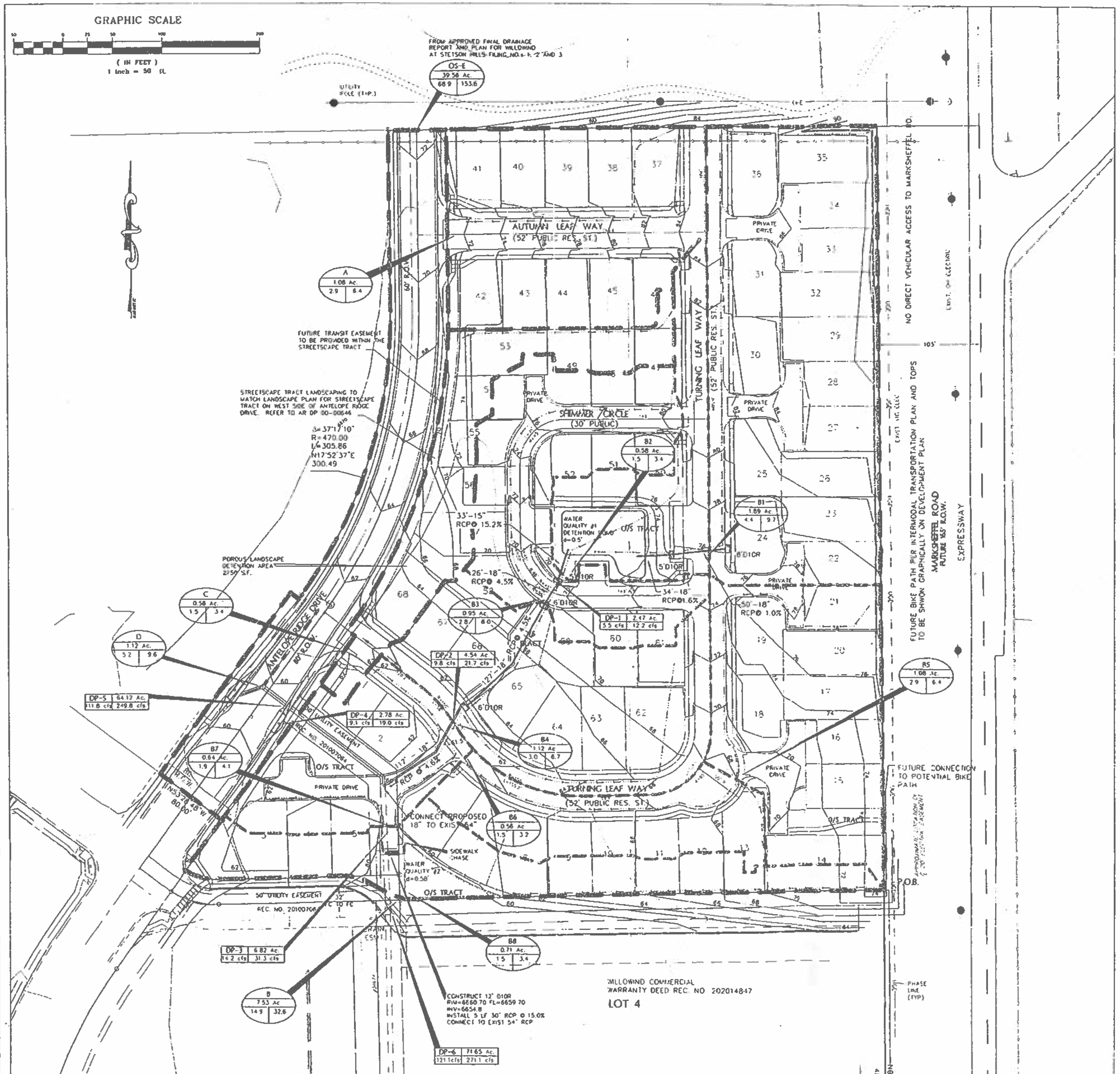
WILLOWIND FILING NO. 4
MARKSHEFFEL ROAD and BARNES ROAD
COLORADO SPRINGS, COLORADO

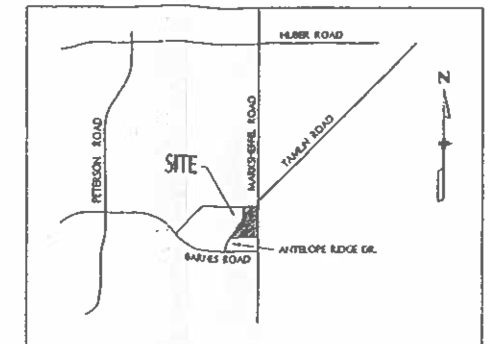
LEIGH WHITEHEAD & ASSOCIATES,INC.
Engineers, Surveyors & Planners
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, COLORADO
(719) 636-5179

TABLE A: LWA # 03012.62
PROPOSED CONDITIONS

27-Apr-04

BASIN	AREA	SOIL TYPE	C 5 / C 100	GEOMETRY LENGTH	GEOMETRY SLOPE	GEOMETRY HEIGHT	Tt 5 / Tt 100	V / Tt	tc 5 / tc 100	i 5 / i 100	Q5	Q100	COMMENTS
D	1.12	B	0.90	10.0		0.2	0.94	2.94	4.34	5.20	5.2		
		97	0.95		2.00		0.71	3.40	4.11	9.00		9.6	
DP-4	2.78	B	0.72	115.0		3.0	5.55	Varies	7.46	4.55	9.1		
		8	0.80		2.61		4.38	1.91	6.29	8.53		19.0	
OS - E	39.56	B	0.60	250.0		2.0	15.91	Varies	20.13	2.90	68.8		Basin OS-B12 From
		8	0.70		0.80		12.73	4.22	16.95	5.55		153.7	Willowind # 1, 2 & 3
DP-5	64.12	B	0.59	300.0		5.0	13.96	Varies	20.80	2.95	111.8		
		8	0.69		1.67		11.22	6.84	18.06	5.65		249.8	
DP-6	71.65	B	0.59	300.0		4.0	15.02	Varies	22.09	2.86	121.1		
		8	0.69		1.33		12.08	7.07	19.15	5.48		271.1	





VICINITY MAP
NOT TO SCALE

LEGEND

PROPOSED		EXISTING FIRE HYDRANT
PROPOSED		EXISTING LIGHT
PROPOSED		EXISTING ELECT. TRANSFORMER
PROPOSED		EXISTING CONC. PAD
PROPOSED		EXISTING WATER VALVE
PROPOSED		EXISTING SAN. SEWER MANHOLE
		EXISTING SAN. SEWER
		EXISTING WATER
	UGE	EXISTING UNDERGROUND ELECTRIC
	UGT	EXISTING UNDERGROUND TELEPHONE
	OHE	EXISTING OVERHEAD ELECTRIC
	T	EXISTING TELEPHONE
	E	EXISTING ELECTRIC
		PROPOSED WATER
		PROPOSED STORM
		PROPOSED SAN.SEWER
		MAIN BASIN BOUNDARY
		SUB BASIN BOUNDARY
		DRAINAGE FLOW

DESIGN POINT — CP-1 | 14.4 — AREA
5 YR FLOW — 5.6 | 28.9 — 100 YR FLOW

OS-3B — BASIN
3.4 Ac. — AREA
5 YR FLOW — 25 | 250 — 100 YR FLOW

CONTOUR INTERVAL = 2 FT

TOPOGRAPHIC SURVEY SHOWN HAS NOT BEEN FIELD VERIFIED BY LEIGH WHITEHEAD & ASSOC.

DETENTION POND DATA

Q5 IN CFS	Q5 OUT CFS	DETAINED CFS	MAX W.S. ELEVATION	Q100 IN CFS	Q100 OUT CFS	DETAINED CFS	MAX W.S. ELEVATION
5.5	1.1	4.4	6671.13	12.2	3.6	8.6	6671.72

ENGINEERS
PLANNERS
SURVEYORS
LEIGH WHITEHEAD & ASSOCIATES
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, CO 80909

SHEET TITLE: PROPOSED DRAINAGE PLAN

PROJECT NAME: WILLOWIND AT STETSON HILLS FILING NO. 4 COLORADO SPRINGS, CO.

BENCHMARK:

REVISIONS:

SCALE: 1" = 50'
DATE: 7-28-04
DRAWN BY: SCJ/LJ
CHECKED BY: LAB

SHEET NO: 1 OF 1

PROJECT NO: 03012
DRAWING NAME: WW4-TOPO082803
VIEW: PP-COND. DRAIN

J·R ENGINEERING
A Westrian Company

MASTER DEVELOPMENT DRAINAGE PLAN FOR EASTVIEW ESTATES AND FINAL DRAINAGE REPORT FOR EASTVIEW ESTATES FILING NO. 1

August 2004

Prepared For:

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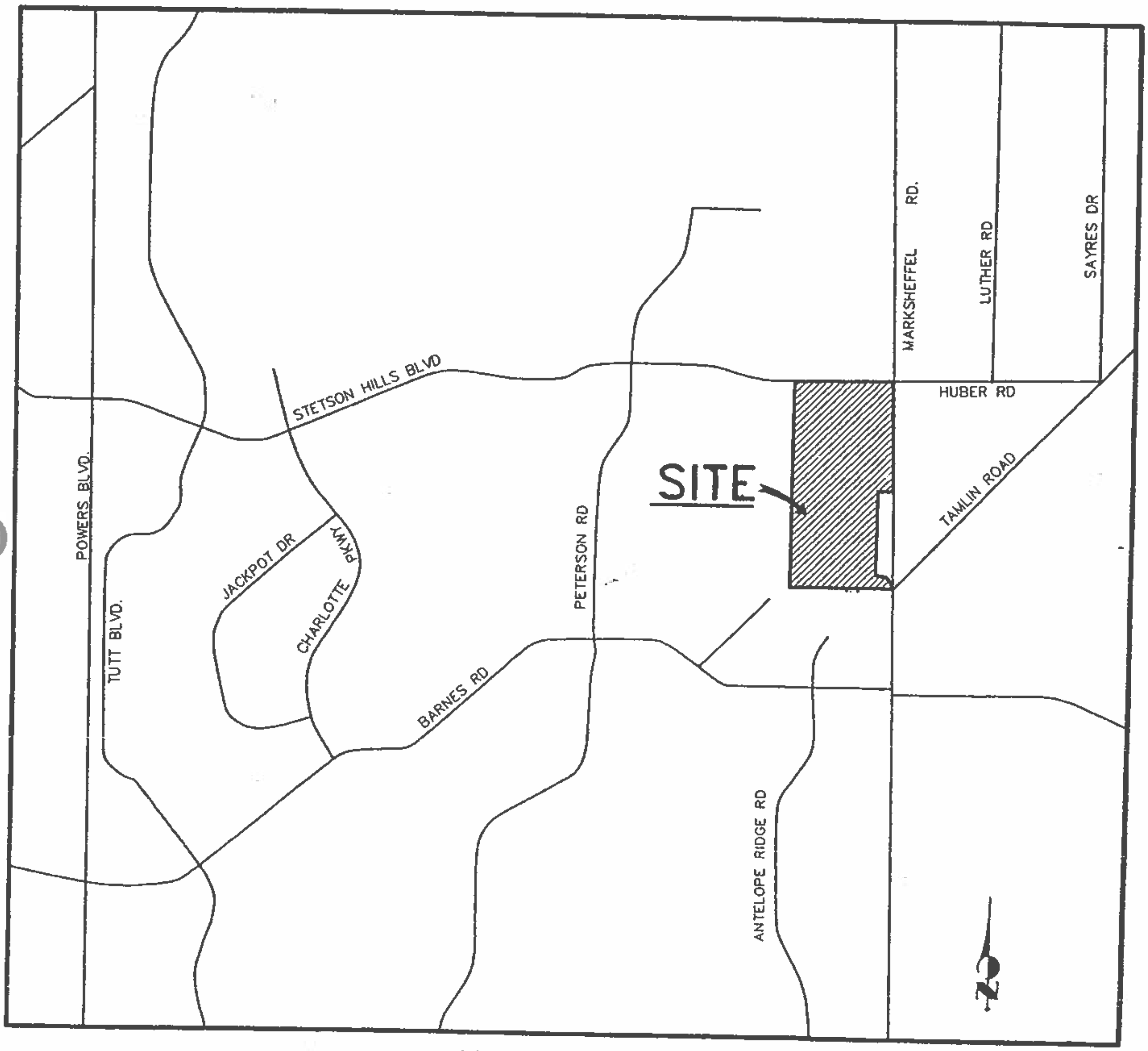
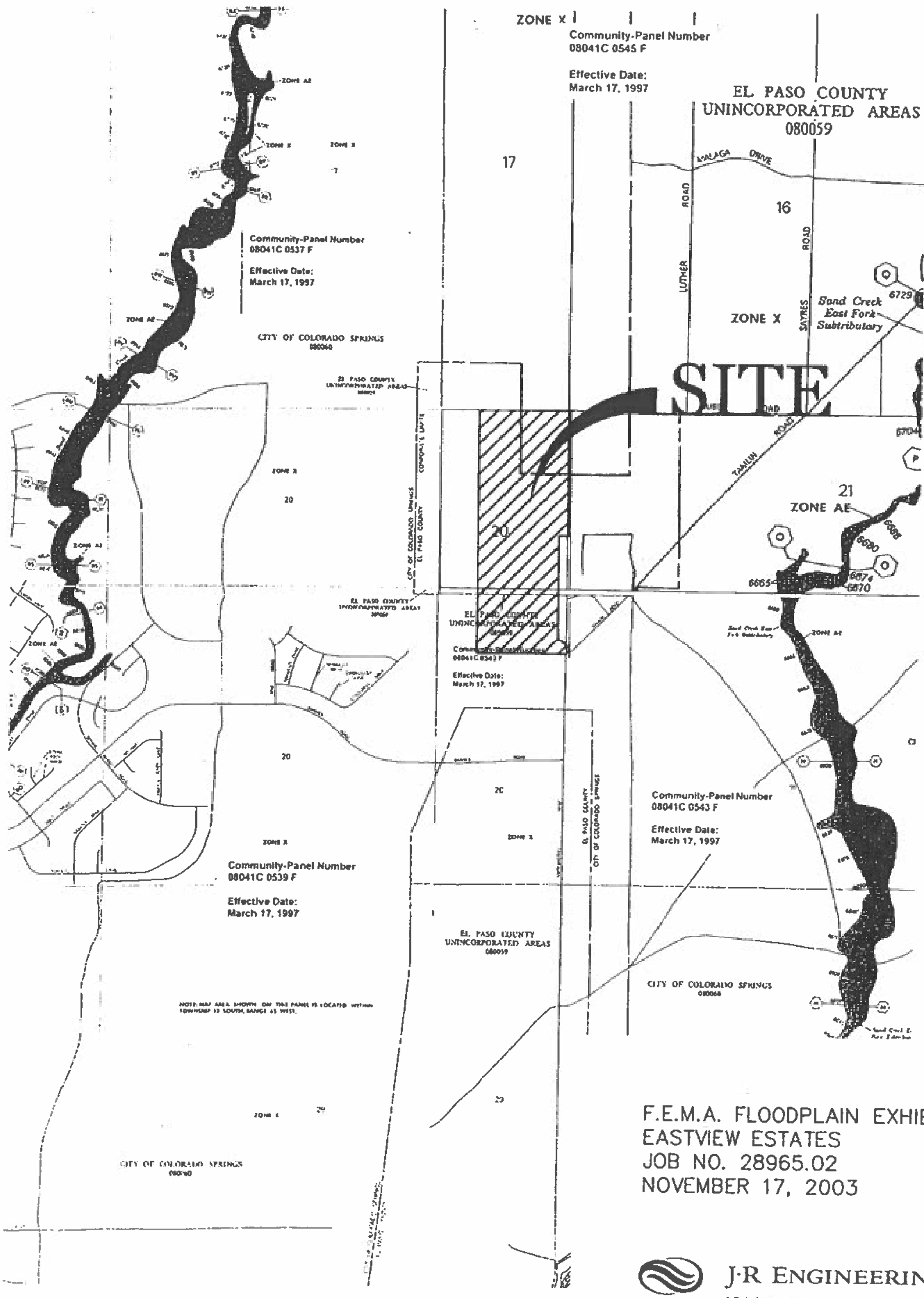
Job No. 28965.02



VICINITY MAP
N.T.S.



F.E.M.A. FLOODPLAIN EXHIBIT
EASTVIEW ESTATES
JOB NO. 28965.02
NOVEMBER 17, 2003

J·R ENGINEERING
A Subsidiary of Westrian

4310 ArrowsWest Drive • Colorado Springs, CO 80907
719-593-2593 • Fax 719-528-6613 • www.jrengineering.com

Eas[illegible]ew
Master Development Drainage Plan
(Area Drainage Summary)

		WEIGHTED		*OVERLAND*				*STREET / CHANNEL FLOW*				*Tc*	*INTENSITY*		*TOTAL FLOWS*	
BASIN	AREA TOTAL *(Acres)*	C_5 * For Calcs See Runoff Summary	C_{100}	C_5	Length *(ft)*	Slope *(%)*	T_C *(min)*	Length *(ft)*	Slope *(%)*	Velocity *(fps)*	T_t *(min)*	TOTAL *(min)*	I_5 *(in/hr)*	I_{100} *(in/hr)*	Q_5 *(c.f.s.)*	Q_{100} *(c.f.s.)*
A	11.3	0.76	0.83	0.25	75	33.3	4.3	750 75	2.0% 3.0%	4.9 6.1	2.5 0.2	7.1	4.6	8.2	*39.8*	*76.5*
														CA=	*8.60*	*9.28*
B	4.6	0.57	0.67	0.25	232	4.0	15.3	658	6.0%	8.6	1.3	16.6	3.3	5.9	*8.6*	*17.9*
														CA=	*2.59*	*3.05*
C	5.7	0.57	0.67	0.25	246	6.3	13.6	385	6.0%	8.6	0.7	14.3	3.5	6.3	*11.6*	*24.2*
														CA=	*3.27*	*3.84*
D	6.7	0.57	0.67	0.25	164	4.9	12.1	139 678	1.5% 1.1%	4.3 3.7	0.5 3.1	15.7	3.4	6.0	*12.9*	*27.0*
														CA=	*3.80*	*4.47*
E	4.9	0.57	0.67	0.25	115	3.0	11.8	168 123 152	3.1% 2.0% 3.0%	6.1 4.9 6.1	0.5 0.4 0.4	13.1	3.7	6.5	*10.3*	*21.5*
														CA=	*2.80*	*3.29*
F	2.9	0.57	0.67	0.25	290	4.8	16.1	420	3.4%	6.4	1.1	17.2	3.2	5.8	*5.4*	*11.3*
														CA=	*1.66*	*1.95*
G	7.2	0.57	0.67	0.25	207	5.3	13.2	469 265	3.9% 4.0%	6.9 7.0	1.1 0.6	15.0	3.5	6.2	*14.2*	*29.7*
														CA=	*4.10*	*4.82*

Calculated by: JLH
Date: 5/7/2004
Checked by:

Eastview
Master Development Drainage Plan
(Area Drainage Summary)

		WEIGHTED		*OVERLAND*				*STREET / CHANNEL FLOW*				*Tc*	*INTENSITY*		*TOTAL FLOWS*	
BASIN	AREA TOTAL *(Acres)*	C_5	C_{100}	C_5	Length *(ft)*	Slope *(%)*	T_C *(min)*	Length *(ft)*	Slope *(%)*	Velocity *(fps)*	T_t *(min)*	TOTAL *(min)*	I_5 *(in/hr)*	I_{100} *(in/hr)*	Q_5 *(c.f.s.)*	Q_{100} *(c.f.s.)*
		* For Calcs See Runoff Summary														
H	5.3	0.57	0.67	0.25	291	2.8	19.4	564	4.0%	7.0	1.3	20.8	3.0	5.3	**8.9**	**18.6**
														CA=	3.00	3.53
I	3.9	0.57	0.67	0.25	137	10.2	8.6	650	4.0%	7.0	1.5	11.5	3.9	6.9	**8.5**	**17.8**
								638	5.1%	7.9	1.3					
														CA=	2.19	2.58
J	8.1	0.57	0.67	0.25	550	4.4	22.9					22.9	2.8	5.0	**12.9**	**27.0**
														CA=	4.59	5.39
K	5.3	0.57	0.67	0.25	180	8.3	10.6	498	5.0%	7.8	1.1	12.5	3.8	6.7	**11.4**	**23.8**
								346	4.0%	7.0	0.8					
														CA=	3.03	3.56
L	3.5	0.57	0.67	0.25	149	9.4	9.3	595	4.0%	7.0	1.4	10.7	4.0	7.1	**7.9**	**16.5**
														CA=	1.97	2.31
M	3.0	0.57	0.67	0.25	177	4.5	12.9	751	4.0%	7.0	1.8	17.5	3.2	5.7	**5.5**	**11.5**
				0.25	31.9	33.3	2.8									
														CA=	1.70	2.00

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Eastview
Master Development Drainage Plan
(Area Drainage Summary)

		WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY		TOTAL FLOWS	
BASIN	AREA TOTAL (Acres)	C_5	C_{100}	C_5	Length (ft)	Slope (%)	T_C (min)	Length (ft)	Slope (%)	Velocity (fps)	T_t (min)	TOTAL (min)	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)
		*For Calcs See Runoff Summary														
O	2.0	0.57	0.67	0.25	138	3.6	12.2					12.2	3.8	6.7	4.4	9.2
														CA=	1.16	1.37
P	1.3	0.57	0.67	0.25	66	4.5	7.9					7.9	4.5	8.0	3.2	6.7
														CA=	0.71	0.84
Q	0.8	0.57	0.67	0.25	67	8.0	6.6					6.6	4.7	8.4	2.2	4.6
														CA=	0.47	0.55
R	0.5	0.90	0.95					75 150 200	2.0% 4.6% 1.0%	4.9 7.5 3.5	0.3 0.3 1.0	5.0	5.1	9.1	2.1	3.9
														CA=	0.41	0.43
OS-A	8.3	0.31	0.41	0.27	300	4.7	16.1	200 530	3.2% 1.0%	6.3 3.5	0.5 2.5	19.2	3.1	5.5	7.9	18.6
														CA=	2.56	3.39
OS-B	1.8	0.84	0.90	0.9	50	2.0	2.1	200 700	3.2% 6.0%	6.3 8.6	0.5 1.4	5.0	5.1	9.1	7.5	14.3
														CA=	1.47	1.58

Calculated by: JLH
Date: 5/7/2004
Checked by:

Eas[illegible]ew
Master Development Drainage Plan
(Area Routing Summary)

		CA EQUIVALENT		Initial Tc	ROUTING				Tc	INTENSITY		TOTAL FLOWS	
ANALYSIS POINTS	CONTRIBUTING BASINS AND ANALYSIS POINTS	CA_5	CA_{100}	For Basin/ Analysis Pt	Length	Slope	Velocity	T_t	TOTAL	I_5	I_{100}	Q_5	Q_{100}
		* For Calcs See Runoff Summary		(min)	(ft)	(%)	(fps)	(min)	(min)	(in/hr)	(in/hr)	(c.f.s.)	(c.f.s.)
AP-0	OS-B	1.47	1.58	5.0	425.0	2.3%	5.3	1.3	6.3	4.8	8.5	9.0	17.1
	R	0.41	0.43										
	TOTAL	1.88	2.01						6.3		CA=	1.88	2.01
AP-1	OS-A	2.56	3.39	19.2					19.2	3.1	5.5	34	69.4
	BASIN A	8.60	9.28									* (42.7)	* (83.4)
	TOTAL	11.16	12.67						19.2		CA=	13.87	15.22
AP-2	POND OUTFALL	6.80	8.00	6.2					6.2	4.8	8.6	32.7	68.6
	(FUTURE)												* (40.0)
	TOTAL	6.80	8.00						6.2		CA=	6.80	4.65
AP-3	BASIN F	1.66	1.95	17.2					17.2	3.2	5.8	5.4	11.3
	TOTAL	1.66	1.95						17.2		CA=	1.66	1.95
AP-4	BASIN B	2.59	3.05	16.6					16.6	3.3	5.9	21.1	44.9
	BASIN C	3.27	3.84										
	FLOW-BY AP-0	0.54	0.75										
	TOTAL	6.40	7.64						16.6		CA=	6.40	7.64
AP-5	BASIN D	3.80	4.47	15.7					15.7	3.4	6.0	15.3	32.1
	BASIN P	0.71	0.84										
	TOTAL	4.51	5.31						15.7		CA=	4.51	5.31

* (See Report for complete description of value)

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Eas[illegible]w
Master Development Drainage Plan
(Area Routing Summary)

		CA EQUIVALENT		Initial Tc	ROUTING				Tc	INTENSITY		TOTAL FLOWS	
ANALYSIS POINTS	CONTRIBUTING BASINS AND ANALYSIS POINTS	CA_5	CA_{100}	For Basin/ Analysis Pt	Length	Slope	Velocity	T_t	TOTAL	I_5	I_{100}	Q_5	Q_{100}
		* For Calcs See Runoff Summary		(min)	(ft)	(%)	(fps)	(min)	(min)	(in/hr)	(in/hr)	(c.f.s.)	(c.f.s.)
AP-6	BASIN E	2.80	3.29	13.1					13.1	3.7	6.5	12.0	25.1
		0.47	0.55										
	TOTAL	3.27	3.84						13.1		CA=	3.27	3.84
AP-7	BASIN G	4.10	4.82	15.0					15.0	3.5	6.2	14.2	29.7
	TOTAL	4.10	4.82						15.0		CA=	4.10	4.82
AP-8	BASIN H	3.00	3.53	20.8					20.8	3.0	5.3	8.9	18.6
	TOTAL	3.00	3.53						20.8		CA=	3.00	3.53
AP-9	BASIN I	2.19	2.58	11.5					11.5	3.9	6.9	8.5	17.8
	TOTAL	2.19	2.58						11.5		CA=	2.19	2.58
AP-10	BASIN L	1.97	2.31	17.5					17.5	3.2	5.7	11.8	24.7
	BASIN M	1.70	2.00										
	TOTAL	3.67	4.31						17.5		CA=	3.67	4.31
AP-11	BASIN K	3.03	3.56	12.5					12.5	3.2	5.7	16.5	39.3
	FLOWBY AP-9	1.07	1.66										
	FLOWBY AP-10	1.01	1.63										
	TOTAL	5.11	6.86						17.5		CA=	5.11	6.86
AP-12	BASIN J	4.59	5.39	22.9					22.9	2.8	5.0	12.9	27.0
		4.59	5.39						22.9		CA=	4.59	5.39
AP-13	FLOWBY AP-11	0.76	1.45	12.5					12.5	3.8	6.7	2.8	9.7
	TOTAL	0.76	1.45						12.5			0.76	1.45
AP-14	BASIN O	1.16	1.37	12.2					12.2	3.8	6.7	4.4	9.2
	TOTAL	1.16	1.37						12.2			1.16	1.37

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Eastview
Master Development Drainage Plan
(Storm Drain Routing Summary)

STORM DRAIN POINT	CONTRIBUTING BASINS AND ANALYSIS POINTS	CA EQUIVALENT		Initial Tc	ROUTING				Tc	INTENSITY		TOTAL FLOWS	
		CA_5	CA_{100}	For Basin/ Analysis Pt	Length	Slope	Velocity	T_t	TOTAL	I_5	I_{100}	Q_5	Q_{100}
		* For Calcs See Runoff Summary		(min)	(ft)	(%)	(fps)	(min)	(min)	(in/hr)	(in/hr)	(c.f.s.)	(c.f.s.)
SD-1*	INLET @ AP-0	1.34	1.26	6.3					6.3	4.8	8.5	39	50
	AP-2	6.80	4.65										
	TOTAL	8.14	5.91						6.3		CA=	8.14	5.91
SD-2	SD-1	8.14	5.91	17.2	535.0	2.0%	10.0	0.9	18.1	3.2	5.6	51	87
	AP-3	1.66	1.95										
	AP-4	6.40	7.64										
	TOTAL	16.19	15.49						18.1		CA=	16.19	15.49
SD-3	SD-2	16.19	15.80	17.2	860.0	2.0%	10.0	1.4	18.7	3.1	5.6	51	88
	TOTAL	16.19	15.80						18.7		CA=	16.19	15.80
SD-4	AP-7	4.10	4.82	20.8					20.8	3.0	5.3	21	44
	AP-8	3.00	3.53										
	TOTAL	7.10	8.35						20.8		CA=	7.10	8.35
SD-5*	INLET @ AP-9	1.12	0.92	20.8	180.0	2.0%	10.0	0.3	21.1	2.9	5.2	24	48
	SD-4	7.10	8.35										
	TOTAL	8.22	9.27						21.1		CA=	8.22	9.27
SD-6*	INLETS @ AP-10	2.66	2.68	20.8	505.0	4.0%	10.0	0.8	21.6	2.9	5.2	32	62
	SD-5	8.22	9.27										
	TOTAL	10.89	11.95						21.6		CA=	10.89	11.95

* - CA values intercepted by inlet are calculated by subtracting the CA values from the Flowby CA value on the at-grade inlet spreadsheet

Calculated by: JLH
Date: 5/7/2004
Checked by: ______

Eastview
Master Drainage Development Plan
(Storm Drain Routing Summary)

		CA EQUIVALENT		Initial Tc	ROUTING				Tc	INTENSITY		TOTAL FLOWS	
STORM DRAIN POINT	CONTRIBUTING BASINS AND ANALYSIS POINTS	CA_5	CA_{100}	For Basin/ Analysis Pt	Length	Slope	Velocity	T_i	TOTAL	I_5	I_{100}	Q_5	Q_{100}
		* For Calcs See Runoff Summary		(min)	(ft)	(%)	(fps)	(min)	(min)	(in/hr)	(in/hr)	(c.f.s.)	(c.f.s.)
SD-7*	SD-6	10.89	11.95	21.6	27.0	3.5%	10.0	0.0	21.6	2.9	5.2	42	82
	INLETS @ AP-11	3.60	3.96										
	TOTAL	14.49	15.91						21.6		CA=	14.49	15.91
SD-8	WQ POND AP-12	4.59	5.39	22.9					22.9	2.8	5.0	13	27
		4.59	5.39						22.9				
SD-9	SD-7	14.49	15.91	22.9	50.0	4.0%	10.0	0.1	22.9	2.8	5.0	54	106
	SD-8	4.59	5.39										
	TOTAL	19.08	21.30						22.9		CA=	19.08	21.30

* - CA values intercepted by inlet are calculated by subtracting the CA values from the Flowby CA value on the at-grade inlet spreadsheet

Calculated by: JLH
Date: 5/7/2004
Checked by: ______

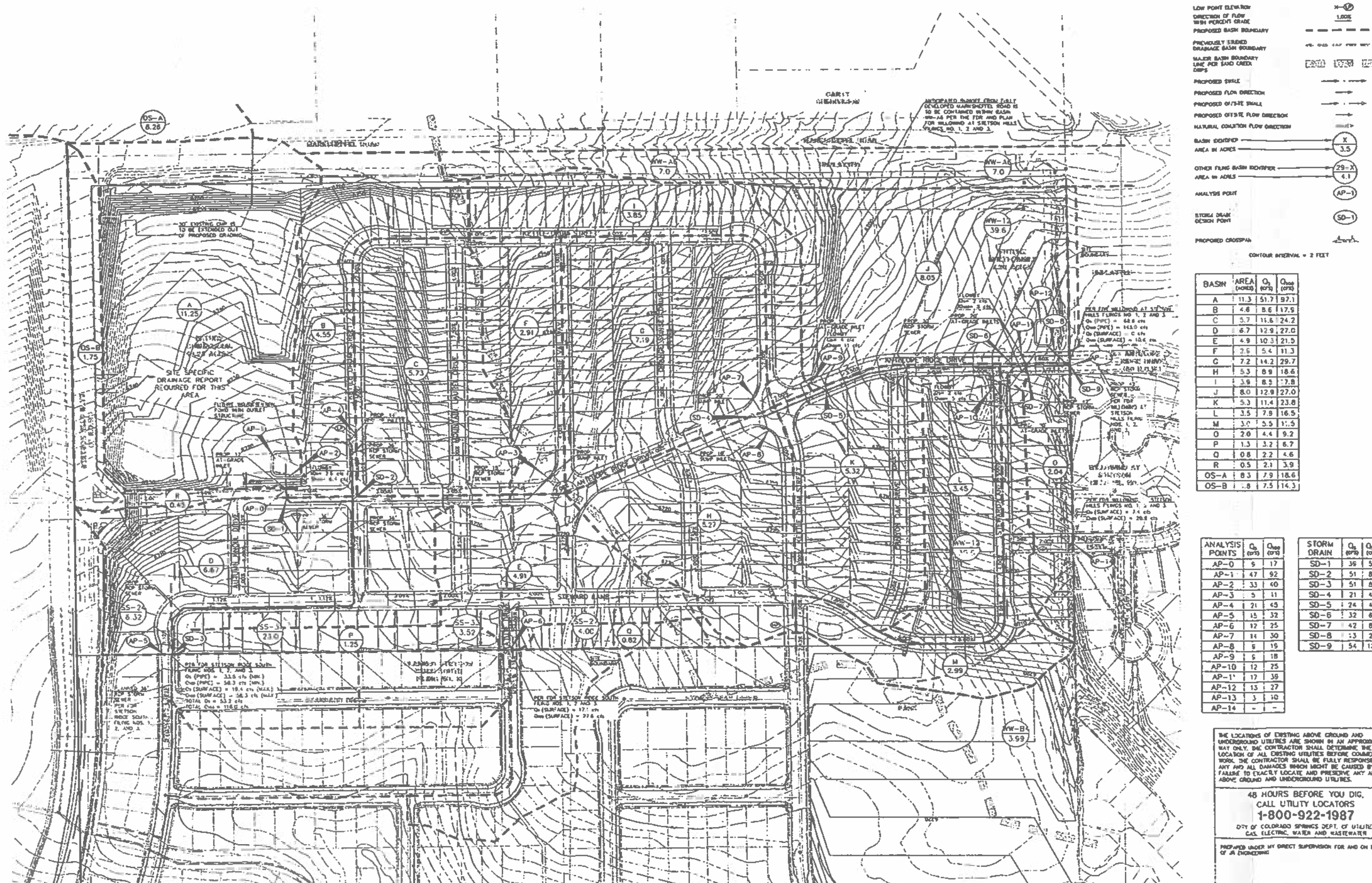
EASTVIEW

CITY OF COLORADO SPRINGS, COUNTY OF EL PASO, STATE OF COLORADO

MASTER DEVELOPMENT DRAINAGE PLAN

AUGUST 2004

100 50 0 100 200
SCALE: 1" = 100'



CONTOUR INTERVAL = 2 FEET

BASIN	AREA (ACRES)	Q_5 (CFS)	Q_{100} (CFS)
A	11.3	51.7	97.1
B	4.6	8.6	17.9
C	5.7	11.6	24.2
D	6.7	12.9	27.0
E	4.9	10.3	21.5
F	2.6	5.4	11.3
G	7.2	14.2	29.7
H	5.3	8.9	18.6
I	3.9	8.5	17.8
J	8.0	12.9	27.0
K	5.3	11.4	23.8
L	3.5	7.9	16.5
M	3.0	5.5	11.5
O	2.0	4.4	9.2
P	1.3	3.2	6.7
Q	0.8	2.2	4.6
R	0.5	2.1	3.9
OS-A	8.3	7.9	18.6
OS-B	[illegible].8	7.5	14.3

ANALYSIS POINTS	Q_5 (CFS)	Q_{100} (CFS)
AP-0	5	17
AP-1	47	92
AP-2	33	40
AP-3	5	11
AP-4	21	45
AP-5	15	32
AP-6	12	25
AP-7	14	30
AP-8	5	15
AP-9	5	18
AP-10	12	25
AP-1[illegible]	17	39
AP-12	13	27
AP-13	3	10
AP-14	-	-

STORM DRAIN	Q_5 (CFS)	Q_{100} (CFS)
SD-1	36	50
SD-2	51	87
SD-3	51	88
SD-4	21	44
SD-5	24	48
SD-6	32	62
SD-7	42	82
SD-8	[illegible]3	27
SD-9	54	108

THE LOCATIONS OF EXISTING ABOVE GROUND AND UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL ABOVE GROUND AND UNDERGROUND UTILITIES.

48 HOURS BEFORE YOU DIG,
CALL UTILITY LOCATORS
1-800-922-1987
CITY OF COLORADO SPRINGS DEPT. OF UTILITIES
GAS, ELECTRIC, WATER AND WASTEWATER

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF JR ENGINEERING

AARON B. [illegible], COLORADO P.E. #34208 DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, JR ENGINEERING APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR
US HOME CORPORATION
7222 Commerce Center Drive
Suite 118
Colorado Springs, CO 80919
Ph. (719) 593-8583
Fax (719) 593-0435

JR ENGINEERING
A Westrian Company

H-SCALE	1" = 100'
V-SCALE	N/A
DATE	12/16/03
DESIGNED BY	DRM
DRAWN BY	HAL
CHECKED BY	

No.	REVISION	BY	DATE

EASTVIEW
MASTER DEVELOPMENT DRAINAGE PLAN

SHEET 1 OF 1
JOB NO 28965.02

PRELIMINARY/FINAL DRAINAGE REPORT
FOR
THE BANNING LEWIS RANCH
FILING 1

Patrick W. McNamara, P.E., P.L.S
Project Director 12/6/04

COLORADO REGISTERED
PATRICK W. McNAMARA
14123
P.E. AND P.L.S.

TC&B Job No. 052.251395.0001

November 2004

STANDAR[illegible]RM SF-3
STORM DRAINAGE SYSTEM DESIGN - DEVELOPED

DESIGN STORM: 5 YEAR

PROJECT NAME: BLR - Filing No. 1 - Phase 1
PROJECT NUMBER: 052-251395-0001

CALC'ED BY: TWT/JOE
CHECKED BY: CLK

DATE: 10/28/2003
REVISED: 5/3/2004

		DIRECT RUNOFF							TOTAL RUNOFF				INLET			STREET		PIPE			TRAVEL TIME			
Tributary Sub-basins	Design Pt.	Area Desig.	Area (Ac)	Runoff Coef.	Tc (Min)	C*A	I (in/Hr)	Q (cfs)	Tc (Min)	C*A	I (in/Hr)	Q (cfs)	Inlet Design Flow (cfs)	Interception Flow (cfs)	Carryover Flow (cfs)	Slope (%)	St. Flow (cfs)	Design Flow (cfs)	Slope(%)	Pipe Size (in)	Length (ft)	Velocity (fps)	Tt	Remarks
DP56 & DP57	201	S01	10.54	0.35	13.8	3.69	3.55	13.1	13.8	5.84	3.55	20.7						20.7	0.50	42				CULVERT (w/ flow DP56)
																		22.3	0.50	42				(w/ pipe flow from DP2a)
	1	R01	0.20	0.56	6.0	0.11	4.85	0.5																
R01	1	R02	1.95	0.56	13.1	1.09	3.62	3.9	13.1	1.20	3.62	4.3	4.3	4.3	0.0			4.3	0.50	24				SUMP (comb. w/ S01 pipe flow)
	2a	R03a	1.17	0.56	9.6	0.65	4.13	2.7					2.7	1.6	1.1			1.6	0.50	18				ON-GRADE
R03a	2	R03	1.03	0.56	8.9	0.58	4.24	2.4								1.00	1.1				560	2.0	4.7	FLOW TO DP201
R03	2	R04	0.20	0.56	6.0	0.11	4.85	0.5	8.9	0.69	4.24	2.9	4.0	4.0	0.0			4.0	0.50	24				SUMP (W/CO FROM DP2a)
S01, R01, R02, R03, R04	2								13.1	1.89	3.62	5.3						6.4	0.50	24				COMBINED PIPE FLOW w/CO DP2a
	3	R05	0.99	0.56	9.3	0.56	4.18	2.3					2.3	0.9	1.4			0.9	0.50	18				ON-GRADE
R05, I01, I02	302															4.0	1.4	11.1	0.50	36	2032	4.0	8.5	COMBINED CULVERT FLOW
R05	3a	R05a	4.27	0.56	13.2	2.39	3.61	8.6					8.6	6.6	2.1			6.6	0.50	24				ON-GRADE
R05	4	R06	1.01	0.56	7.9	0.57	4.43	2.5	17.7	3.51	3.14	9.2				2.95	1.4				756	3.4	3.7	STREET FLOW
																								DISCHARGE DOWNSTREAM Q minus interception flows
	5	R07	0.39	0.57	5.2	0.22	5.03	1.1																
R07	[illegible]	R08	2.71	0.57	10.6	1.56	3.96	6.2	10.6	1.78	3.96	7.1	7.1	7.1	0.0			7.1	0.50	24				SUMP
	6	R09	5.29	0.56	16.3	2.96	3.27	9.7					9.7	4.3	5.4			10.9	0.50	30				ON-GRADE (w/pipe flow DP3)
R09	7a	R10	0.37	0.57	6.5	0.21	4.73	1.0	17.3	3.17	3.18	5.8				1.3	5.4				132	2.2	1.0	STREET FLOW Q minus DP6 interception flow
	7	R11	3.89	0.57	12.9	2.23	3.64	8.1					8.1	4.0	4.1			4.0	0.50	18				ON-GRADE
R11	7a	R11a	0.15	0.57	5.0	0.08	5.09	0.4	13.3	2.32	3.59	4.3				3.3	4.4				88	3.6	0.4	STREET FLOW Q minus DP7 interception flow
R09, R10, R11, R11a									17.3	5.49	3.18	9.1	9.1	9.1	0.0									SUMP W/ C.O.
R09, R10, R11, R11a																		13.2	0.50	30				COMBINED PIPE FLOW (DP7)
R09, R10, R11, R11a, R7, R8																		20.2	0.50	36				COMBINED PIPE FLOW (DP5)
	8	R12	0.92	0.56	5.0	0.51	5.09	2.6																
R12 & POND 93 DISCHARGE																								DISCHARGE DOWNSTREAM
												29.6												COMBINED FLOW W/ POND 93
	216	S16	22.94	0.35	22.9	8.03	2.75	22.0																SUBDIVISION FLOW
	217	S17	10.13	0.35	14.8	3.55	3.43	12.1																SUBDIVISION FLOW
S16,S17	216								22.9	11.58	2.75	31.8				0.5		31.8	0.50	48	675	1.4	8.0	COMBINED FLOW - CULVERT

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN - INTERIM

DESIGN STORM 5-YEAR

PROJECT NAME: BLR Filing No. 1a Street Improvements
PROJECT NUMBER: 052-251395-0001

CALCED BY: TWT
CHECKED BY: CLK

DATE: 10/28/2003
REVISED: 2/9/2004

Tributary Sub-basins	Design Pt.	Direct Runoff: Area Desg	Area (Ac)	Runoff Coef	Tc (Min)	C*A	I (In/Hr)	Q (cfs)	Total Runoff: Tc (Min)	C*A	I (In/Hr)	Q (cfs)	Inlet: Inlet Design Flow (cfs)	Interception Flow (cfs)	Carryover Flow (cfs)	Street: Slope (%)	St. Flow (cfs)	Pipe: Design Flow (cfs)	Slope (%)	Pipe Size (in)	Travel Time: Length (ft)	Velocity (fps)	Tt	Remarks
	301	101	13.13	0.16	14.2	2.10	3.49	7.3																TEMPORARY SWALE FLOW
	302	102	4.91	0.16	12.5	0.79	3.70	2.9																TEMPORARY SWALE FLOW
	303	103	3.92	0.16	16.8	0.63	3.22	2.0																TEMPORARY SWALE FLOW
	304	104	40.78	0.16	24.4	6.52	2.65	17.3																TEMPORARY SWALE FLOW
	305	105	0.75	0.16	19.0	0.12	3.03	0.4																TEMPORARY SWALE FLOW
	306	106	22.94	0.16	14.0	3.67	3.52	12.9																TEMPORARY SWALE FLOW
	307	107	5.89	0.16	14.8	0.94	3.42	3.2																TEMPORARY SWALE FLOW
	308	108	10.13	0.16	14.8	1.62	3.43	5.6																TEMPORARY SWALE FLOW
	309	109	26.83	0.16	21.1	4.29	2.87	12.3																TEMPORARY SWALE FLOW
	310	110	0.76	0.16	11.2	0.12	3.88	0.5																TEMPORARY SWALE FLOW
	311	111	4.60	0.16	15.0	0.74	3.41	2.5																TEMPORARY SWALE FLOW
	312	112	2.58	0.16	15.6	0.41	3.34	1.4																TEMPORARY SWALE FLOW
	313	113	1.11	0.16	10.8	0.18	3.93	0.7																TEMPORARY SWALE FLOW
	314	114	0.85	0.16	11.6	0.14	3.82	0.5																TEMPORARY SWALE FLOW
	315	115	1.01	0.16	11.9	0.16	3.78	0.6																TEMPORARY SWALE FLOW
	316	116	7.83	0.16	16.0	1.25	3.30	4.1																TEMPORARY SWALE FLOW
	317	117	3.09	0.16	14.2	0.49	3.49	1.7																TEMPORARY SWALE FLOW
	318	118	1.71	0.16	12.7	0.27	3.68	1.0																TEMPORARY SWALE FLOW
	319	119	3.90	0.16	20.4	0.62	2.92	1.8																TEMPORARY SWALE FLOW
	320	120	5.36	0.16	14.4	0.86	3.47	3.0																TEMPORARY SWALE FLOW
	321	121	8.88	0.16	13.6	1.42	3.56	5.1																TEMPORARY SWALE FLOW
	322	122	1.57	0.16	13.9	0.25	3.53	0.9																TEMPORARY SWALE FLOW
	323	123	3.36	0.16	13.1	0.54	3.62	1.9																TEMPORARY SWALE FLOW
	324	124	2.36	0.16	12.3	0.38	3.73	1.4																TEMPORARY SWALE FLOW
	325	125	1.69	0.16	12.4	0.27	3.71	1.0																TEMPORARY SWALE FLOW
	326	126	8.72	0.16	14.2	1.40	3.49	4.9																TEMPORARY SWALE FLOW
	327	127	8.19	0.16	14.4	1.31	3.47	4.6																TEMPORARY SWALE FLOW
	328	128	1.22	0.16	12.3	0.20	3.73	0.7																TEMPORARY SWALE FLOW
	329	129	17.14	0.16	17.7	2.74	3.14	8.6																TEMPORARY SWALE FLOW
	330	130	7.51	0.16	14.3	1.20	3.48	4.2																TEMPORARY SWALE FLOW
	331	131	5.28	0.16	16.5	0.85	3.26	2.8																TEMPORARY SWALE FLOW
	332	132	7.82	0.16	15.8	1.25	3.32	4.2																TEMPORARY SWALE FLOW

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN - INTERIM

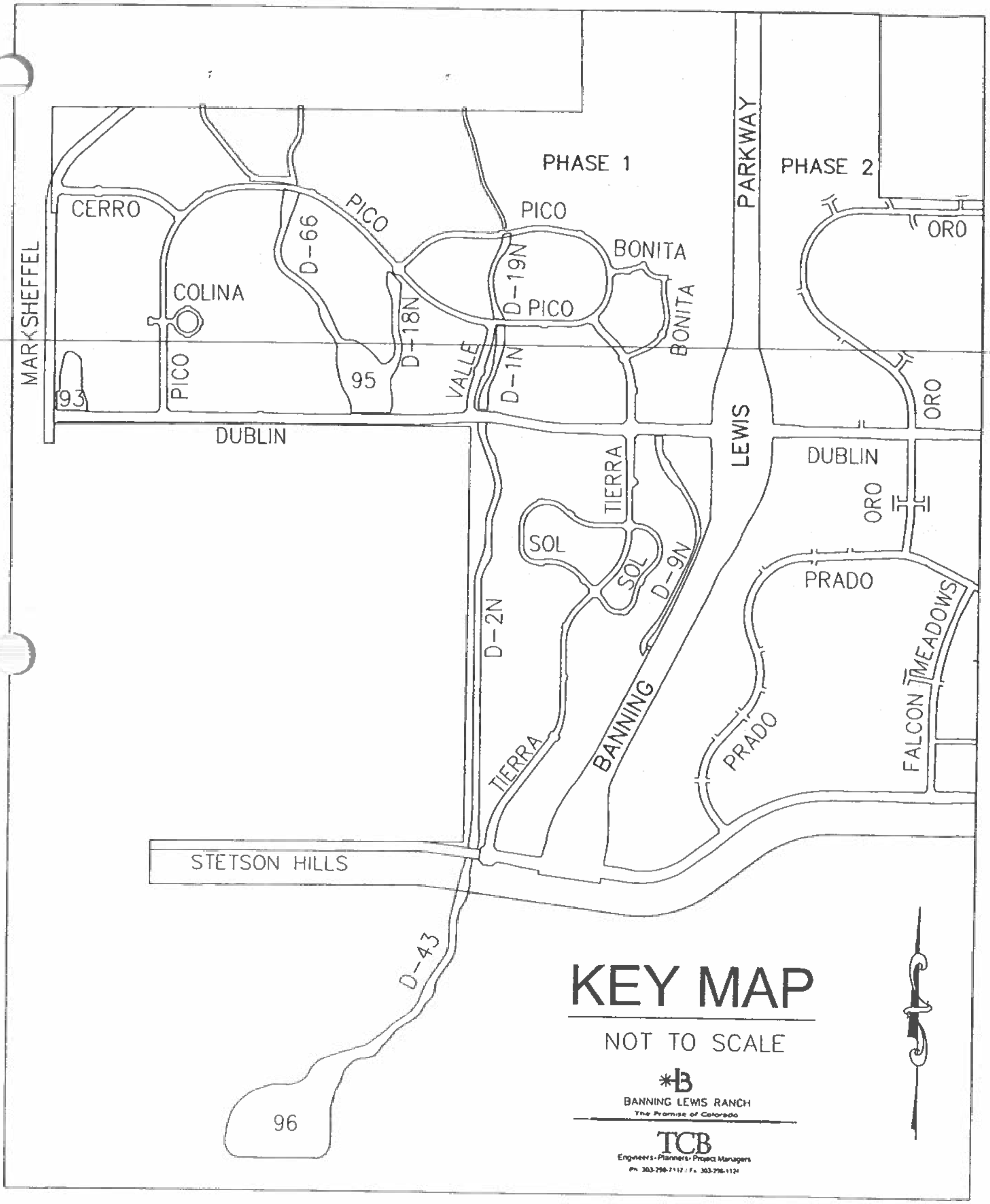
DESIGN STORM: 100 YEAR

PROJECT NAME: BLR - Filing No. 1a Street Improvements
PROJECT NUMBER: 052-251395-0001

CALC'ED BY: TWT
CHECKED BY: CLK

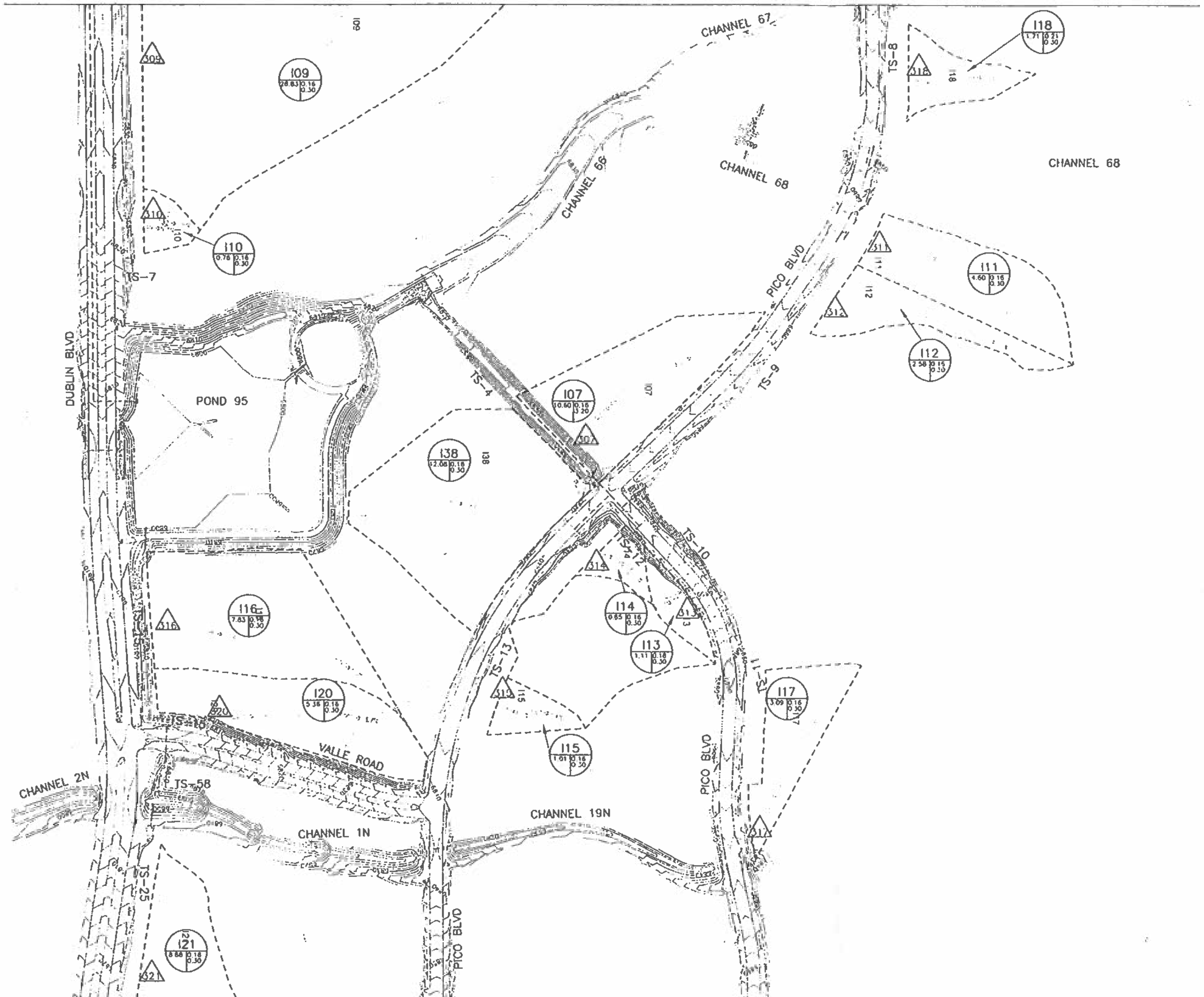
DATE: 10/28/2003
REVISED: 2/9/2004

Tributary Sub basins	Design Pt	DIRECT RUNOFF: Area Desig	Area (Ac)	Runoff Coef	Tc (Min)	C*A	I (in/Hr)	Q (cfs)	TOTAL RUNOFF: Tc (Min)	C*A	I (in/Hr)	Q (cfs)	INLET: Inlet Design Flow (cfs)	Interception Flow (cfs)	Carryover Flow (cfs)	STREET: Slope (%)	St Flow (cfs)	PIPE: Design Flow (cfs)	Slope (%)	Pipe Size (in)	TRAVEL TIME: Length (ft)	Velocity (fps)	Tt	Remarks
	[illegible]	101	13.13	0.30	14.2	3.94	6.1	24.2																
	302	102	4.91	0.30	12.5	1.47	6.5	9.6																TEMPORARY SWALE FLOW
	303	103	3.92	0.30	16.8	1.18	5.7	6.7																TEMPORARY SWALE FLOW
	304	104	40.78	0.30	24.4	12.23	4.7	57.0																TEMPORARY SWALE FLOW
	305	105	0.75	0.30	19.0	0.23	5.3	1.2																TEMPORARY SWALE FLOW
	[illegible]	106	22.94	0.30	14.0	6.88	6.2	42.6																TEMPORARY SWALE FLOW
	307	107	5.89	0.30	14.8	1.77	6.0	10.6																TEMPORARY SWALE FLOW
	308	108	10.13	0.30	14.8	3.04	6.0	18.3																TEMPORARY SWALE FLOW
	[illegible]	109	26.83	0.30	21.1	8.05	5.0	40.6																TEMPORARY SWALE FLOW
	310	110	0.76	0.30	11.2	0.23	6.8	1.6																TEMPORARY SWALE FLOW
	311	111	4.60	0.30	15.0	1.38	6.0	8.3																TEMPORARY SWALE FLOW
	312	112	2.58	0.30	15.6	0.77	5.9	4.6																TEMPORARY SWALE FLOW
	313	113	1.11	0.30	10.8	0.33	6.9	2.3																TEMPORARY SWALE FLOW
	314	114	0.85	0.30	11.6	0.25	6.7	1.7																TEMPORARY SWALE FLOW
	315	115	1.01	0.30	11.9	0.30	6.7	2.0																TEMPORARY SWALE FLOW
	316	116	7.83	0.30	16.0	2.35	5.8	13.7																TEMPORARY SWALE FLOW
	317	117	3.09	0.30	14.2	0.93	6.1	5.7																TEMPORARY SWALE FLOW
	318	118	1.71	0.30	12.7	0.51	6.5	3.3																TEMPORARY SWALE FLOW
	319	119	3.90	0.30	20.4	1.17	5.1	6.0																TEMPORARY SWALE FLOW
	320	120	5.36	0.30	14.4	1.61	6.1	9.8																TEMPORARY SWALE FLOW
	321	121	8.88	0.30	13.6	2.66	6.3	16.7																TEMPORARY SWALE FLOW
	322	122	1.57	0.30	13.9	0.47	6.2	2.9																TEMPORARY SWALE FLOW
	323	123	3.36	0.30	13.1	1.01	6.4	6.4																TEMPORARY SWALE FLOW
	324	124	2.36	0.30	12.3	0.71	6.6	4.7																TEMPORARY SWALE FLOW
	325	125	1.69	0.30	12.4	0.51	6.5	3.3																TEMPORARY SWALE FLOW
	326	126	8.72	0.30	14.2	2.62	6.1	16.1																TEMPORARY SWALE FLOW
	327	127	8.19	0.30	14.4	2.46	6.1	15.0																TEMPORARY SWALE FLOW
	328	128	1.22	0.30	12.3	0.37	6.6	2.4																TEMPORARY SWALE FLOW
	329	129	17.14	0.30	17.7	5.14	5.5	28.5																TEMPORARY SWALE FLOW
	330	130	7.51	0.30	14.3	2.25	6.1	13.8																TEMPORARY SWALE FLOW
	331	131	5.28	0.30	16.5	1.59	5.7	9.1																TEMPORARY SWALE FLOW
	332	132	7.82	0.30	15.8	2.35	5.8	13.7																TEMPORARY SWALE FLOW

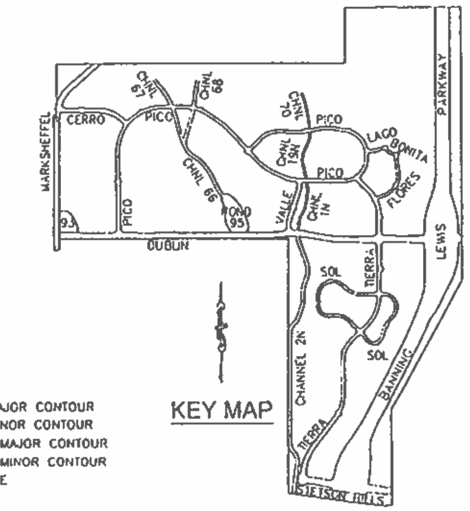

PHASE 1
PHASE 2
PARKWAY
LEWIS
MARKSHEFFEL
CERRO
PICO
PICO
PICO
PICO
COLINA
BONITA
BONITA
D-66
D-19N
D-18N
D-1N
VALLE
95
93
ORO
ORO
ORO
DUBLIN
DUBLIN
TIERRA
TIERRA
SOL
SOL
D-9N
D-2N
PRADO
PRADO
MEADOWS
FALCON
BANNING
STETSON HILLS
D-43
96
KEY MAP
NOT TO SCALE
BANNING LEWIS RANCH
The Promise of Colorado
TCB
Engineers-Planners-Project Managers

BANNING LEWIS RANCH
DRAINAGE EXHIBIT
BEING LOCATED IN SECTIONS 3, 9, 10, 11, 12, 13, 14, 15, 21, 22, 23, 25, 26, 27, 28, 33, 34, 35, T.13S., R.65W. AND 1, 2, 3, 4, 8, 9, 10, 11, 12, 14, 15, 16, T.14S., R.65W., AND 6, 7, T.14S., R.64W., ALL WITHIN THE 6TH PRINCIPAL MERIDIAN, CITY OF COLORADO SPRINGS, COUNTY OF EL PASO, STATE OF COLORADO

SEE SHEET 1 OF 4



SEE SHEET 3 OF 4



SYMBOLS
GENERAL LEGEND

- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- 6450 PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- CENTER LINE
- EASEMENT
- DRAINAGE BASIN AND ROAD RIGHT-OF-WAY
- BASIN INTERIM BOUNDRY
- INTERIM DEVELOPED FLOW PATH
- INITIAL INTERIM FLOW PATH
- 54 DESIGN POINT
- R04 BASIN ID; 0.55 5 YEAR "C" VALUE; 0.60 100 YEAR "C" VALUE; 1.00 AREA IN ACRES
- RIPRAP
- TS-14 TEMPORARY SWALE

200 0 100 200 400
ORIGINAL SCALE 1" = 200'

SUMMARY RUNOFF TABLE – INTERIM

BASIN	AREA (acres)	DESIGN PT	Q5	Q100	CUMULATIVE Q5	CUMULATIVE Q100
107	5.89	307	3.2	10.6	3.2	10.6
110	0.76	310	0.5	1.6	0.5	1.6
111	4.60	311	2.5	8.3	2.5	8.3
112	2.58	312	1.4	4.6	1.4	4.6
113	1.11	313	0.7	2.3	0.7	2.3
114	0.85	314	0.5	1.7	0.5	1.7
115	1.01	315	0.6	2.0	0.6	2.0
116	7.63	316	4.1	13.7	4.1	13.7
117	3.09	317	1.7	5.7	1.7	5.7
120	5.36	320	3.0	9.8	3.0	9.8
121	8.88	321	5.1	16.7	5.1	16.7

48 HOURS BEFORE YOU DIG CALL UTILITY LOCATORS
1-800-922-1987
City of Colorado Springs Dept. of Utilities Gas, Electric, Water and Wastewater
The locations of existing underground utilities are shown in an approximate way only. The contractor shall determine the exact location of all existing utilities before commencing work. The contractor shall be fully responsible for any and all damages which might be caused by his failure to exactly locate and preserve any and all underground utilities.

BANNING LEWIS RANCH

TCB
Engineers Planners Project Managers

INTERIM CONDITION
BANNING LEWIS RANCH
FILING 1

NO.	DATE	REVISION	BY
1	11/01/04	REVISED PER CITY COMMENTS	TCB

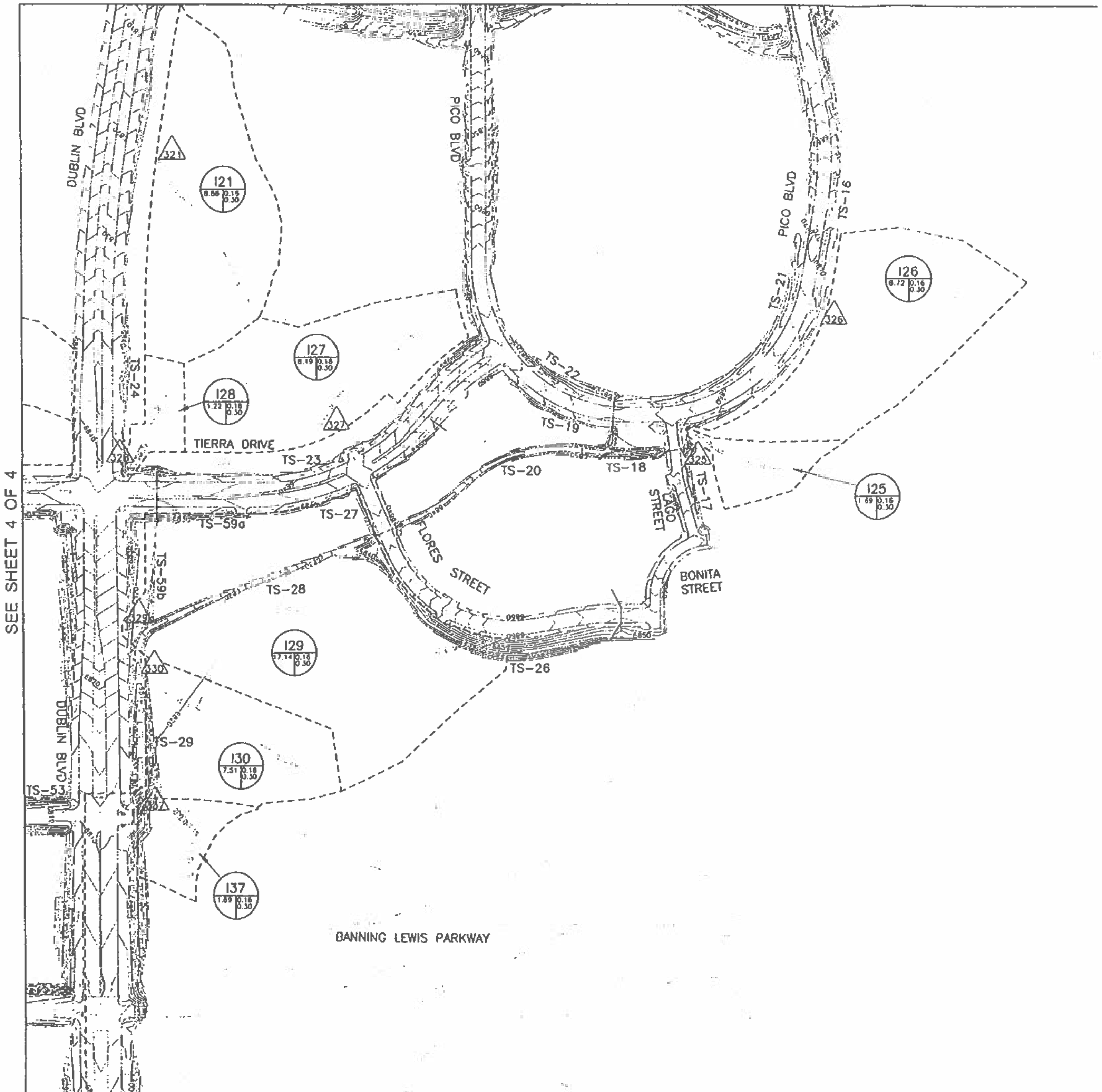
Unit: LDS	Scale:	Date: OCTOBER 28, 2004
Designed: IWT	Checked:	Job No. 052251395
Drawn: IIT	Approved:	Sheet 2 of 4

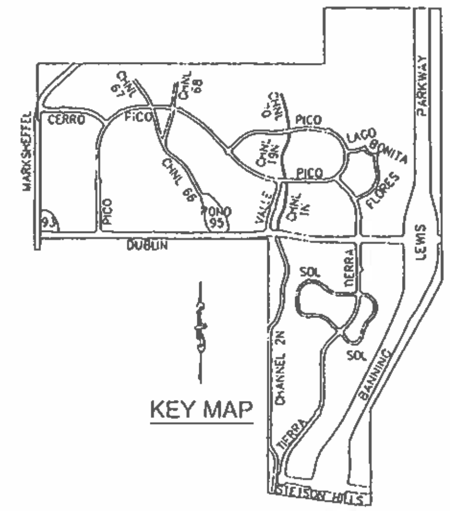
BANNING LEWIS RANCH

DRAINAGE EXHIBIT

BEING LOCATED IN SECTIONS 3, 9, 10, 11, 12, 13, 14, 15, 21, 22, 23, 25, 26, 27, 28, 33, 34, 35, T.13S., R.65W. AND 1, 2, 3, 4, 8, 9, 10, 11, 12, 14, 15, 16, T.14S., R.65W., AND 6, 7, T.14S., R.64W., ALL WITHIN THE 6TH PRINCIPAL MERIDIAN, CITY OF COLORADO SPRINGS, COUNTY OF EL PASO, STATE OF COLORADO

SEE SHEET 2 OF 4





SYMBOLS
GENERAL LEGEND

- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- 5450 — PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- CENTER LINE
- EASEMENT
- DRAINAGE BASIN AND ROAD RIGHT-OF-WAY
- BASIN INTERIM BOUNDRY
- INTERIM DEVELOPED FLOW PATH
- INITIAL INTERIM FLOW PATH
- 54 DESIGN POINT
- R04 / 1.00 / 0.45 / 0.60: BASIN ID; 5 YEAR "C" VALUE; 100 YEAR "C" VALUE; AREA IN ACRES
- RIPRAP
- TS-14 TEMPORARY SWALE

200 0 100 200 400
ORIGINAL SCALE 1" = 200'

SUMMARY RUNOFF TABLE – INTERIM

BASIN	AREA (acres)	DESIGN PT	Q5	Q100	CUMULATIVE Q5	CUMULATIVE Q100
125	1.69	325	1.0	3.3	1.0	3.3
126	8.72	326	4.9	16.1	4.9	16.1
127	8.19	327	4.6	15.0	4.6	15.0
128	1.22	328	0.7	2.4	0.7	2.4
129	17.14	329	8.6	28.5	8.6	28.5
130	7.51	330	4.2	13.8	4.2	13.8
137	1.89	337	1.1	3.7	1.1	3.7

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BANNING LEWIS RANCH

TCB
Engineers Planners Project Managers

INTERIM CONDITION

BANNING LEWIS RANCH

FILING 1

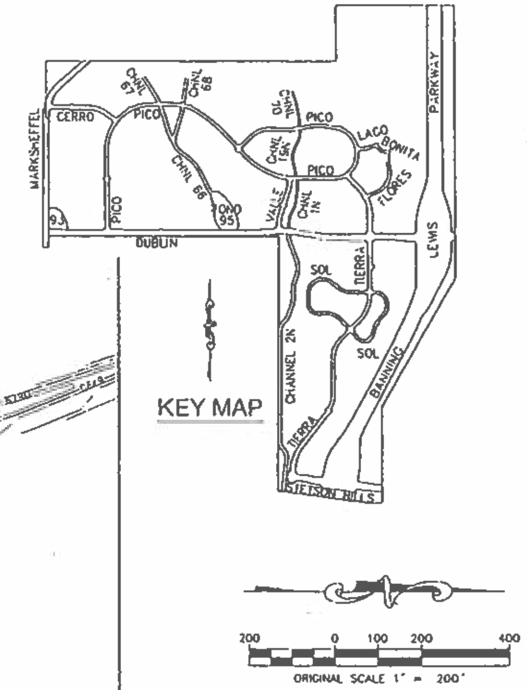
NO.	DATE	REVISION	BY
1	11/01/04	REVISED PER CITY COMMENTS	TCB

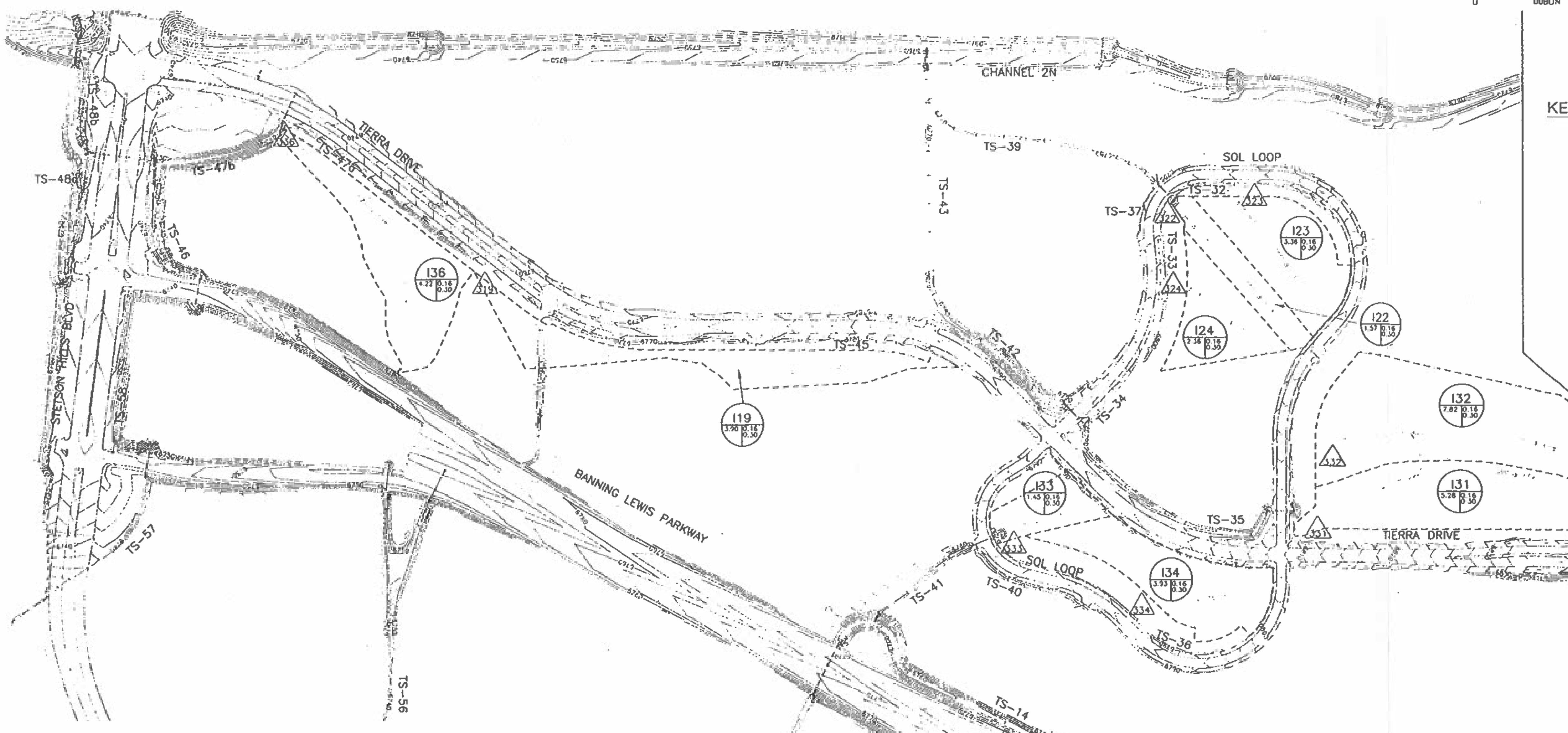
Unit: LDS	Scale:	Date: OCTOBER 28, 2004
Designed: FWT	Checked:	Job No. 052251395
Drawn: IIT	Approved:	Sheet 3 of 4

BANNING LEWIS RANCH

DRAINAGE EXHIBIT

BEING LOCATED IN SECTIONS 3, 9, 10, 11, 12, 13, 14, 15, 21, 22, 23, 25, 26, 27, 28, 33, 34, 35, T.13S., R.65W. AND 1, 2, 3, 4, 8, 9, 10, 11, 12, 14, 15, 16, T.14S., R.65W., AND 6, 7, T.14S., R.64W., ALL WITHIN THE 6TH PRINCIPAL MERIDIAN, CITY OF COLORADO SPRINGS, COUNTY OF EL PASO, STATE OF COLORADO





SUMMARY RUNOFF TABLE – INTERIM

BASIN	AREA (acres)	DESIGN PT	Q5	Q100	CUMULATIVE Q5	CUMULATIVE Q100
119	3.90	319	1.8	6.0	1.8	6.0
122	1.57	322	0.9	2.9	0.9	2.9
123	3.36	323	1.9	6.4	1.9	6.4
124	2.35	324	1.4	4.7	1.4	4.7
131	5.28	331	2.8	9.1	2.8	9.1
132	7.82	332	4.2	13.7	4.2	13.7
133	1.45	333	0.9	2.9	0.9	2.9
134	3.93	334	2.3	7.7	2.3	7.7
136	4.22	336	2.2	7.3	2.2	7.3

SYMBOLS

GENERAL LEGEND

EXISTING MAJOR CONTOUR
EXISTING MINOR CONTOUR
5450 PROPOSED MAJOR CONTOUR
PROPOSED MINOR CONTOUR
CENTER LINE
EASEMENT
DRAINAGE BASIN AND ROAD
RIGHT-OF-WAY
BASIN INTERIM BOUNDRY
INTERIM DEVELOPED FLOW PATH
INITIAL INTERIM FLOW PATH
54 DESIGN POINT
R04 1.00 0.45 0.60 BASIN ID
5 YEAR "C" VALUE
100 YEAR "C" VALUE
AREA IN ACRES
RIPRAP
TS-14 TEMPORARY SWALE

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BANNING LEWIS RANCH

TCB
Engineers · Planners · Project Managers

INTERIM CONDITION
BANNING LEWIS RANCH
FILING 1

NO.	DATE	REVISION	BY
1	11/01/04	REVISED PER CITY COMMENTS	TCB

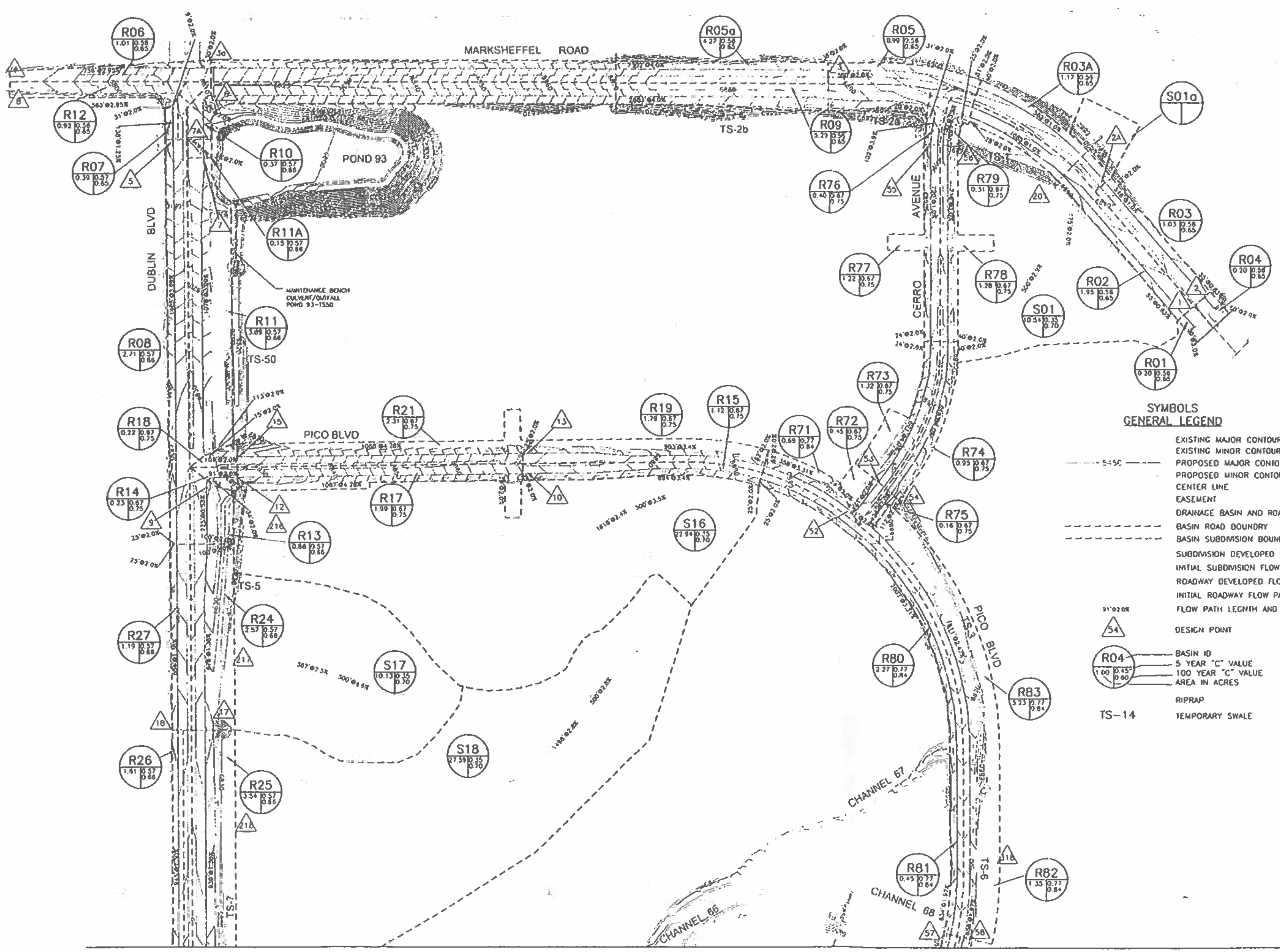
Unit: LDS	Scale:	Date: OCTOBER 28, 2004
Designed: TWT	Checked:	Job No. 052251395
Drawn: TT	Approved:	Sheet 4 of 4

BANNING LEWIS RANCH

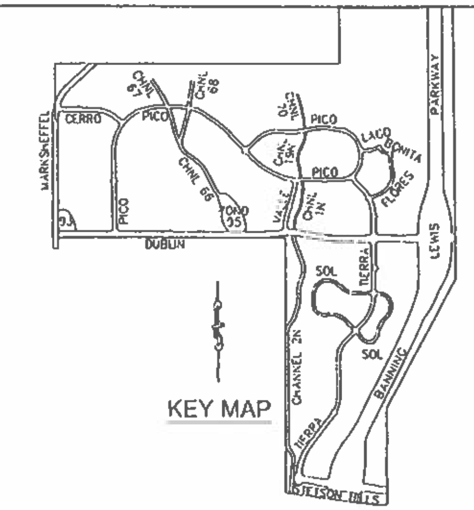
DRAINAGE EXHIBIT

BEING LOCATED IN SECTIONS 3, 9, 10, 11, 12, 13, 14, 15, 21, 22, 23, 25, 26, 27, 28, 33, 34, 35, T.13S., R.65W. AND 1, 2, 3, 4, 8, 9, 10, 11, 12, 14, 15, 16, T.14S., R.65W., AND 6, 7, T.14S., R.64W., ALL WITHIN THE 6TH PRINCIPAL MERIDIAN, CITY OF COLORADO SPRINGS, COUNTY OF EL PASO, STATE OF COLORADO

ORIGINAL SCALE 1" = 200'



SEE SHEET 2 OF 4



SYMBOLS
GENERAL LEGEND

- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- 6450 PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- CENTER LINE
- EASEMENT
- DRAINAGE BASIN AND ROAD RIGHT-OF-WAY
- BASIN ROAD BOUNDRY
- BASIN SUBDIVISION BOUNDARY
- SUBDIVISION DEVELOPED FLOW PATH
- INITIAL SUBDIVISION FLOW PATH
- ROADWAY DEVELOPED FLOW PATH
- INITIAL ROADWAY FLOW PATH
- 91'@2.0% FLOW PATH LENGTH AND SLOPE
- 54 DESIGN POINT
- R04 — BASIN ID; 0.45 — 5 YEAR "C" VALUE; 0.60 — 100 YEAR "C" VALUE; 1.00 — AREA IN ACRES
- RIPRAP
- TS-14 TEMPORARY SWALE

SUMMARY RUNOFF TABLE – FINAL

BASIN	AREA (acres)	DESIGN PT	Q5	Q100	CUMULATIVE Q5	CUMULATIVE Q100
R01	0.20	1	0.5	1.1	0.5	1.1
R02	1.95	1	3.9	8.1	4.3	8.9
R03a	1.17	2a	2.7	5.5	2.7	5.5
R03	1.03	2	2.4	5.0	2.4	5.0
R04	0.20	2	0.5	1.1	2.9	5.9
R05	0.99	3	2.3	4.8	2.3	4.8
R05a	4.27	3a	8.6	17.7	8.6	17.7
R06	1.01	4	2.5	5.1	9.2	18.5
R07	0.39	5	1.1	2.3	1.1	2.3
R08	2.71	5	6.2	12.6	7.1	14.4
R09	5.29	6	9.7	19.8	9.7	19.8
R10	0.37	7a	1.0	2.0	5.8	11.8
R11	3.89	7	8.1	16.8	8.1	16.8
R11a	0.15	7a	0.4	0.9	4.3	12.2
R12	0.92	8	2.6	5.4	2.6	5.4
R13	0.86	9	2.0	4.1	2.0	4.1
R14	0.23	12	0.8	1.5	2.6	5.2
R15	1.12	10	3.5	6.8	3.5	6.8
R17	1.99	12	6.0	11.9	10.5	20.8
R18	0.22	15	0.7	1.4	0.7	1.4
R19	1.79	13	5.1	10.0	5.1	10.0
R21	2.31	15	6.4	12.6	10.4	20.5
R24	2.57	17	5.5	11.2	5.5	11.2
R25	3.54	17	7.0	14.2	12.0	24.5
R26	1.61	18	3.7	7.5	3.7	7.5
R27	1.19	18	2.9	6.0	6.4	13.0
R71	0.69	52	2.7	5.1	2.7	5.1
R72	0.45	53	1.5	3.0	4.0	7.8
R73	1.32	53	4.4	8.7	8.3	16.1
R74	0.95	54	3.0	5.9	3.0	5.9
R75	0.16	54	0.5	1.1	3.5	6.9
R76	0.40	55	1.4	2.7	1.4	2.7
R77	1.22	55	3.4	6.8	4.6	9.0
R78	1.28	56	3.5	6.9	3.5	6.9
R79	0.31	56	1.1	2.1	4.4	8.6
R80	2.27	57	6.7	12.8	6.7	12.8
R81	0.45	57	1.8	3.4	8.1	15.4
R82	1.35	58	4.8	9.1	4.8	9.1
R83	5.23	58	14.5	27.7	18.2	34.8
S01	10.54	201	13.1	46.0	20.7	61.0
S16	22.94	216	22.0	77.6	22.0	77.6
S17	10.13	217	12.1	42.8	12.1	42.8
S18	27.59	218	27.7	97.5	27.7	97.5

1-800-922-1987

City of Colorado Springs Dept. of Utilities Gas, Electric, Water and Wastewater

BANNING LEWIS RANCH

TCB

FINAL CONDITION

BANNING LEWIS RANCH

FILING 1

NO.	DATE	REVISION	BY
1	11/01/04	REVISED PER CITY COMMENTS	

Unit: LOS	Scale:	Date: OCTOBER 28, 2004
Designed: TWT	Checked:	Job No. 052251395
Drawn: ITT	Approved:	Sheet 1 of 4

BANNING LEWIS RANCH

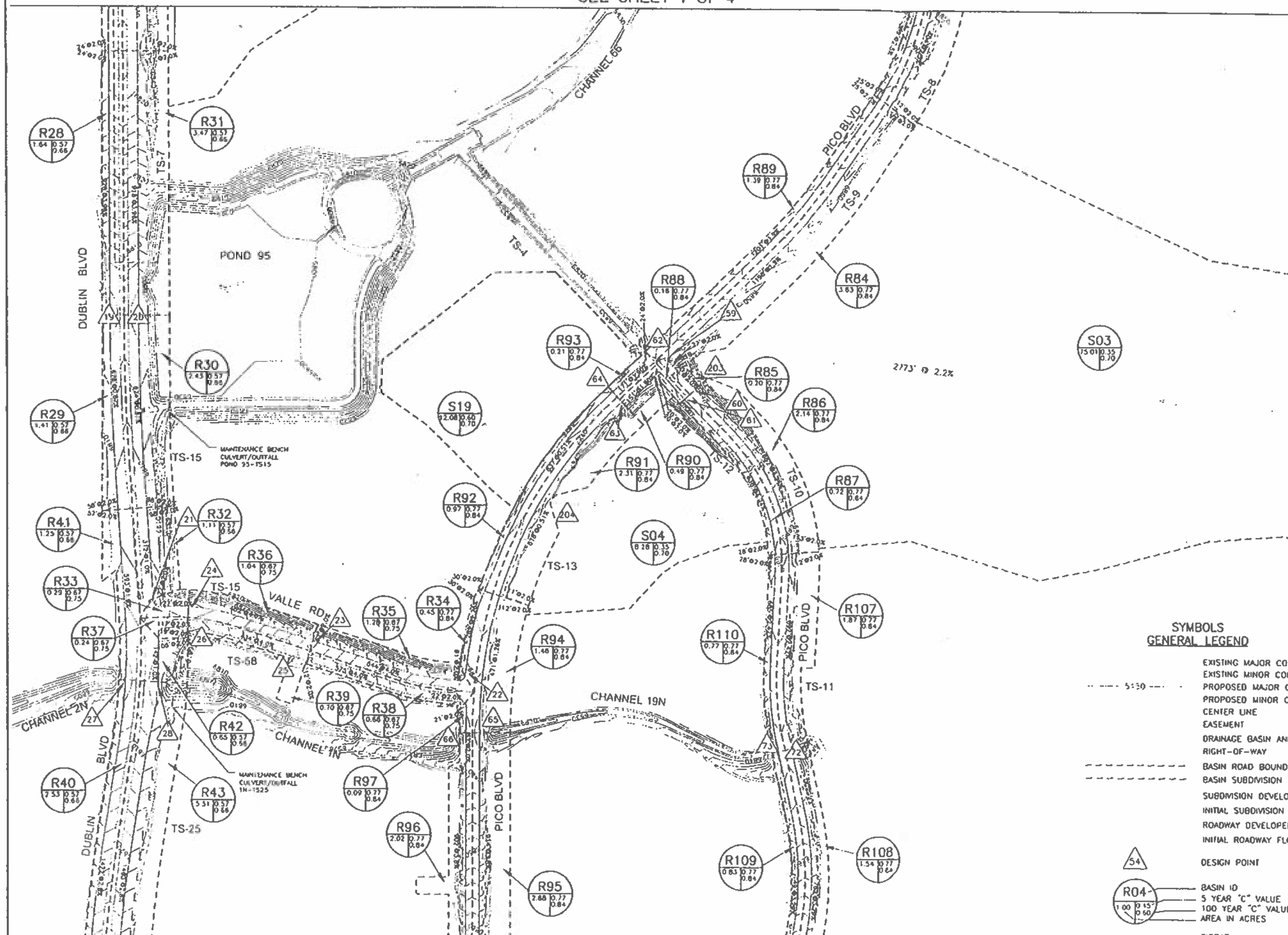
DRAINAGE EXHIBIT

BEING LOCATED IN SECTIONS 3, 9, 10, 11, 12, 13, 14, 15, 21, 22, 23, 25, 26, 27, 28, 33, 34, 35, T.13S., R.65W. AND 1, 2, 3, 4, 8, 9, 10, 11, 12, 14, 15, 16, T.14S., R.65W., AND 6, 7, T.14S., R.64W., ALL WITHIN THE 6TH PRINCIPAL MERIDIAN, CITY OF COLORADO SPRINGS, COUNTY OF EL PASO, STATE OF COLORADO

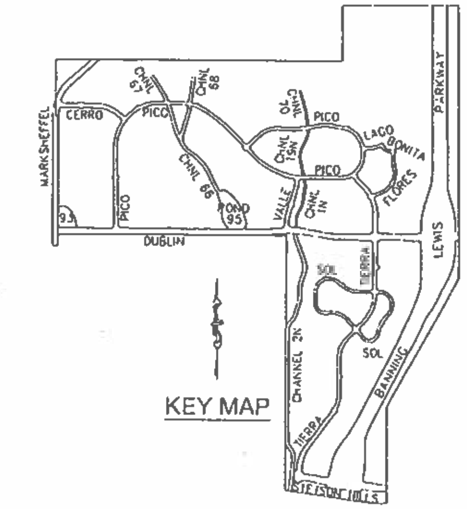
200 0 100 200 400

ORIGINAL SCALE 1" = 200'

SEE SHEET 1 OF 4



SEE SHEET 3 OF 4



SUMMARY RUNOFF TABLE – FINAL

BASIN	AREA (acres)	DESIGN PT	Q5	Q100	CUMULATIVE Q5	CUMULATIVE Q100
R28	1.64	19	4.2	8.6	4.2	8.6
R29	1.41	19	3.1	6.2	6.6	13.5
R30	2.43	20	5.0	10.2	5.0	10.2
R31	3.47	20	7.6	15.4	12.1	24.7
R32	1.11	21	2.6	5.2	2.6	5.2
R33	0.29	24	1.0	2.0	3.3	6.6
R34	0.45	22	1.8	3.4	1.8	3.4
R35	1.28	23	3.9	7.8	5.5	10.7
R36	1.04	24	3.3	6.4	10.8	15.6
R37	0.24	26	0.8	1.6	0.8	1.6
R38	0.66	25	2.2	4.4	2.2	4.4
R39	0.70	26	2.4	4.7	4.9	9.7
R40	2.53	27	5.7	11.5	5.7	11.5
R41	1.25	27	2.9	5.8	8.5	17.2
R42	0.65	28	1.6	3.2	1.6	3.2
R43	5.51	28	10.7	21.8	12.0	24.4
R84	3.63	59	10.5	20.1	10.5	20.1
R85	0.20	60	0.8	1.5	10.8	20.6
R86	2.14	60	7.4	14.2	16.9	32.2
R87	0.72	61	2.8	5.4	2.8	5.4
R88	0.16	61	0.6	1.2	3.5	6.6
R89	1.39	62	4.4	8.5	4.4	8.5
R90	0.49	63	1.9	3.7	1.9	3.7
R91	2.31	63	6.2	11.8	7.5	14.3
R92	0.97	64	2.8	5.3	2.8	5.3
R93	0.21	64	0.8	1.6	3.4	6.5
R94	1.46	65	4.9	9.4	4.9	9.4
R95	2.88	65	10.1	19.2	14.5	27.8
R96	2.02	66	8.0	15.2	8.0	15.2
R97	0.09	66	0.4	0.7	8.3	15.9
R107	1.87	72	6.2	11.9	6.2	11.9
R108	1.54	72	5.5	10.4	11.3	21.7
R109	0.83	73	3.2	6.0	3.2	6.0
R110	0.77	73	2.9	5.5	6.0	11.4
S03	75.01	203	64.1	225.6	64.1	225.6
S04	8.28	204	10.0	35.3	10.0	35.3

SYMBOLS
GENERAL LEGEND

EXISTING MAJOR CONTOUR
EXISTING MINOR CONTOUR
PROPOSED MAJOR CONTOUR
PROPOSED MINOR CONTOUR
CENTER LINE
EASEMENT
DRAINAGE BASIN AND ROAD RIGHT-OF-WAY
BASIN ROAD BOUNDRY
BASIN SUBDIVISION BOUNDARY
SUBDIVISION DEVELOPED FLOW PATH
INITIAL SUBDIVISION FLOW PATH
ROADWAY DEVELOPED FLOW PATH
INITIAL ROADWAY FLOW PATH
54 DESIGN POINT
R04 1.00 0.15 0.50 — BASIN ID, 5 YEAR "C" VALUE, 100 YEAR "C" VALUE, AREA IN ACRES
RIPRAP
TS-14 TEMPORARY SWALE

48 HOURS BEFORE YOU DIG CALL UTILITY LOCATORS
1-800-922-1987
City of Colorado Springs Dept. of Utilities Gas, Electric, Water and Wastewater

BANNING LEWIS RANCH

TCB

FINAL CONDITION
BANNING LEWIS RANCH
FILING 1

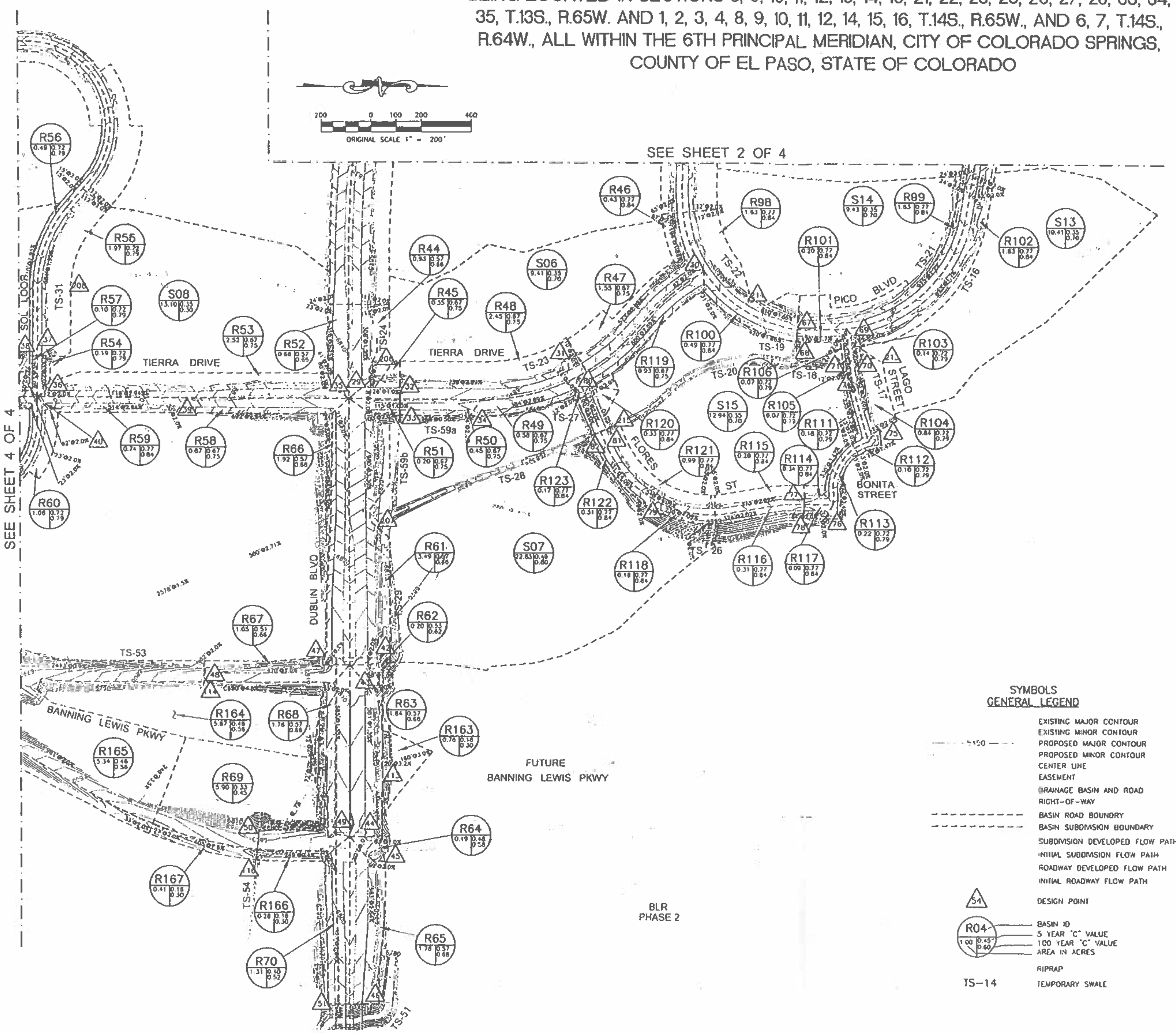
NO.	DATE	REVISION	BY
1	11/01/04	REVISED PER CITY COMMENTS	

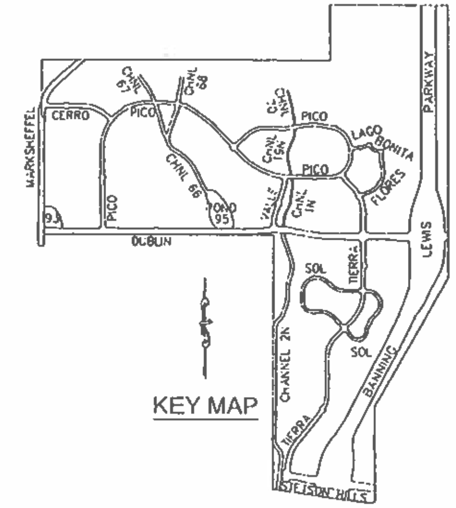
Unit: LDS	Scale:	Date: OCTOBER 28, 2004
Designed: TWT	Checked:	Job No. 052251395
Drawn: ITT	Approved:	Sheet 2 of 4

BANNING LEWIS RANCH

DRAINAGE EXHIBIT

BEING LOCATED IN SECTIONS 3, 9, 10, 11, 12, 13, 14, 15, 21, 22, 23, 25, 26, 27, 28, 33, 34, 35, T.13S., R.65W. AND 1, 2, 3, 4, 8, 9, 10, 11, 12, 14, 15, 16, T.14S., R.65W., AND 6, 7, T.14S., R.64W., ALL WITHIN THE 6TH PRINCIPAL MERIDIAN, CITY OF COLORADO SPRINGS, COUNTY OF EL PASO, STATE OF COLORADO





SUMMARY RUNOFF TABLE - FINAL

BASIN	AREA (acres)	DESIGN PT	Q5	Q100	CUMULATIVE Q5	CUMULATIVE Q100
R44	0.93	29	2.1	4.4	2.1	4.4
R45	0.35	32	1.2	2.4	1.9	3.9
R46	0.43	30	1.7	3.2	1.7	3.2
R47	1.55	31	4.6	9.1	6.1	11.9
R48	2.45	32	6.6	13.1	14.5	28.6
R49	0.58	34	2.0	3.9	2.0	3.9
R50	0.45	33	1.5	2.9	1.5	2.9
R51	0.20	33	0.7	1.3	2.1	4.1
R52	0.66	35	1.8	3.7	1.8	3.7
R61	3.49	42	7.5	15.3	7.5	15.3
R62	0.20	43	0.5	1.1	7.8	10.0
R63	1.84	44	4.7	9.7	4.6	10.0
R64	0.19	45	0.5	1.0	5.0	5.9
R65	1.76	46	4.3	8.6	4.3	8.6
R66	1.92	47	4.9	9.9	4.9	9.9
R67	1.05	48	2.2	4.6	15.1	32.1
R68	1.76	49	4.2	8.6	4.2	8.6
R69	5.90	50	7.7	18.4	11.7	22.6
R70	1.31	51	3.4	6.8	3.4	6.8
R98	1.63	67	5.2	9.8	5.2	9.8
R99	1.63	67	5.4	10.4	10.3	19.7
R100	0.49	68	1.9	3.6	1.9	3.6
R101	0.20	68	0.8	1.5	2.7	5.2
R102	1.63	69	5.4	10.2	5.4	10.2
R103	0.14	70	0.5	1.0	5.7	10.8
R104	0.84	70	2.7	5.3	8.2	15.7
R105	0.07	71	0.3	0.5	0.3	0.5
R106	0.07	71	0.3	0.5	0.5	1.0
R111	0.18	74	0.7	1.3	0.7	1.3
R112	0.10	75	0.4	0.7	0.4	0.7
R113	0.22	76	0.8	1.6	0.8	1.6
R114	0.34	77	1.3	2.5	1.3	2.5
R115	0.20	77	0.8	1.5	2.1	3.9
R116	0.31	78	1.2	2.4	1.2	2.4
R117	0.09	78	0.4	0.7	1.6	3.1
R118	0.16	79	0.6	1.2	0.6	1.2
R119	0.93	80	3.0	5.8	3.0	5.8
R120	0.33	81	1.3	2.5	4.0	7.8
R121	0.99	81	3.7	7.1	7.5	14.4
R122	0.31	82	1.2	2.3	1.2	2.3
R123	0.17	82	0.7	1.3	1.9	3.6
S06	9.41	206	10.3	36.4	10.3	36.4
S07	22.63	207	34.9	100.2	95.9	265.0
S08	13.10	208	15.2	53.6	15.2	53.6
S13	10.41	213	11.6	40.9	11.6	40.9
S14	9.43	214	10.9	38.5	10.9	38.5
S15	12.94	215	14.8	52.1	44.7	134.8
R53	2.52	36	6.8	13.4	8.0	15.7
R54	0.15	37	0.7	1.3	8.2	16.3
R55	1.97	37	5.7	11.1	13.5	26.5
R56	0.49	38	1.7	3.3	1.7	3.3
R57	0.10	38	0.4	0.7	2.0	3.9
R58	0.87	39	2.8	5.6	2.8	5.6
R59	0.74	40	2.9	5.6	0.0	0.0
R60	1.06	41	3.2	6.2	6.9	13.4
R163	0.76	113	0.5	1.6	0.5	1.6
R164	5.67	114	10.4	22.4	10.4	22.4
R165	5.34	115	7.9	17.0	7.9	17.0
R166	0.28	116	0.2	0.6	0.2	0.6
R167	0.41	116	0.3	0.9	0.6	0.9

48 HOURS BEFORE YOU DIG CALL UTILITY LOCATORS
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City of Colorado Springs Dept. of Utilities Gas, Electric, Water and Wastewater

BANNING LEWIS RANCH

TCB

FINAL CONDITION

BANNING LEWIS RANCH

FILING 1

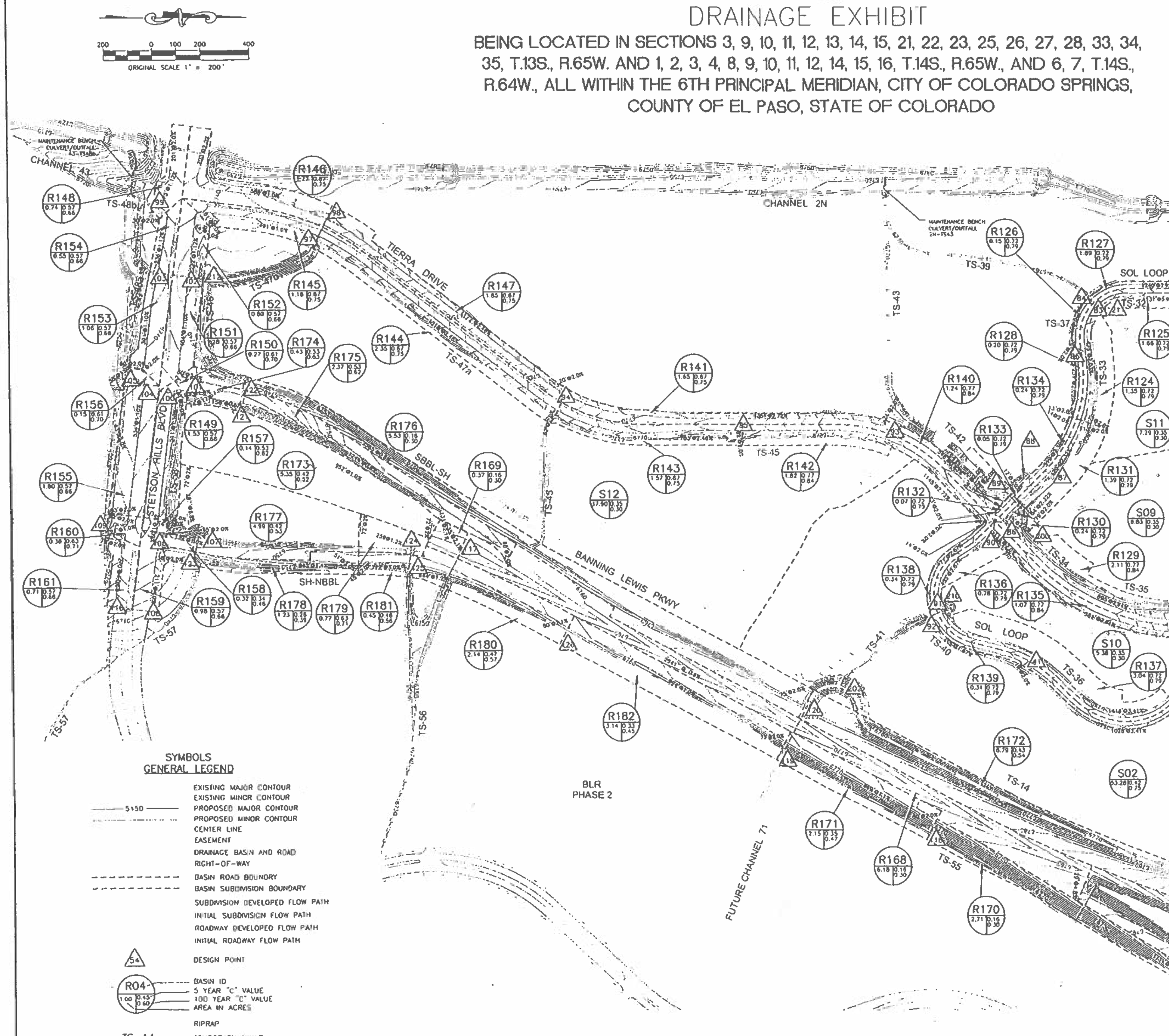
NO.	DATE	REVISION	BY
1	11/01/04	REVISED PER CITY COMMENTS	KB

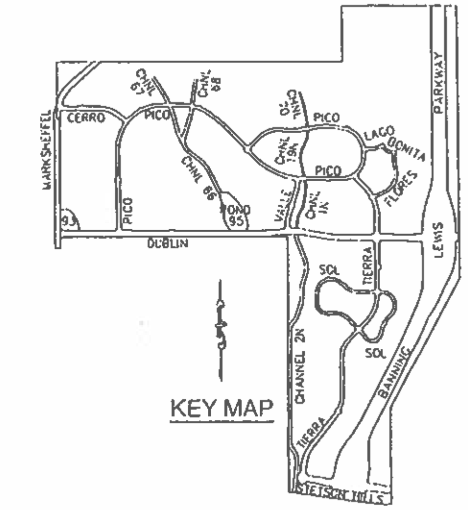
Unit: LOS	Scale:	Date: OCTOBER 28, 2004
Designed: TWT	Checked:	Job No. 052251395
Drawn: ill	Approved:	Sheet 3 of 4

BANNING LEWIS RANCH

DRAINAGE EXHIBIT

BEING LOCATED IN SECTIONS 3, 9, 10, 11, 12, 13, 14, 15, 21, 22, 23, 25, 26, 27, 28, 33, 34, 35, T.13S., R.65W. AND 1, 2, 3, 4, 8, 9, 10, 11, 12, 14, 15, 16, T.14S., R.65W., AND 6, 7, T.14S., R.64W., ALL WITHIN THE 6TH PRINCIPAL MERIDIAN, CITY OF COLORADO SPRINGS, COUNTY OF EL PASO, STATE OF COLORADO





SUMMARY RUNOFF TABLE - FINAL

BASIN	AREA (acres)	DESIGN PT	Q5	Q100	CUMULATIVE Q5	CUMULATIVE Q100
R124	1.35	83	4.1	8.0	4.1	8.0
R125	1.66	83	5.5	10.7	9.3	17.9
R126	0.15	84	0.5	1.0	0.5	1.0
R127	1.89	84	5.3	10.2	5.7	11.0
R128	0.20	85	0.7	1.4	0.7	1.4
R129	2.11	86	7.1	13.5	7.1	13.5
R130	0.24	87	0.8	1.6	7.7	14.7
R131	1.39	87	4.3	8.4	11.9	22.8
R132	0.07	89	0.3	0.5	0.3	0.5
R133	0.05	89	0.2	0.4	0.4	0.8
R134	0.24	88	0.9	1.7	0.9	1.7
R135	1.07	90	3.8	7.3	3.8	7.3
R136	0.78	91	2.5	4.8	5.9	11.3
R137	3.04	91	9.2	17.8	15.0	29.0
R138	0.34	92	1.2	2.4	1.2	2.4
R139	0.31	92	1.1	2.2	2.4	4.6
R140	1.24	93	3.9	7.4	3.9	7.4
R141	1.65	94	4.6	8.9	4.6	8.9
R142	1.82	95	6.3	11.9	6.3	11.9
R143	1.57	95	4.4	8.7	9.3	17.9
R144	2.35	97	6.1	12.0	12.4	24.1
R145	1.16	97	3.3	6.5	25.7	50.2
R146	1.77	98	4.2	8.3	7.6	14.9
R147	1.85	98	5.2	10.3	11.7	23.0
R148	0.74	99	1.6	3.3	1.6	3.3
R149	1.53	100	3.5	7.1	3.5	7.1
R150	0.27	101	0.8	1.7	3.7	4.1
R151	1.28	102	3.1	6.3	3.1	6.3
R152	0.80	102	2.1	4.2	5.0	10.2
R153	1.08	103	2.6	5.3	2.6	5.3
R154	0.55	103	1.6	3.3	3.9	8.0
R155	1.80	104	4.4	8.9	4.4	8.9
R156	0.15	105	0.5	0.9	4.4	4.7
R157	0.14	106	0.3	0.7	0.3	0.7
R158	0.32	107	0.6	1.3	0.8	1.8
R159	0.98	108	2.8	5.7	2.8	5.7
R160	0.36	109	1.0	2.1	1.0	2.1
R161	0.71	110	1.8	3.6	1.8	3.6
R168	6.18	117	3.7	12.1	3.7	12.1
R169	0.37	117	0.2	0.8	3.9	12.9
R170	2.71	118	1.3	4.4	1.3	4.4
R171	2.15	119	2.6	6.2	2.6	6.2
R172	6.79	120	7.9	17.3	7.9	17.3
R173	5.35	121	7.4	16.5	7.4	16.5
R174	0.43	121	1.1	2.4	1.1	2.4
R175	2.37	121	4.0	8.2	14.6	31.1
R176	5.53	122	2.3	7.7	12.9	34.3
R177	4.99	107	9.3	20.5	9.3	20.5
R178	1.23	123	1.2	3.0	9.4	21.3
R179	0.77	124	2.1	4.3	2.1	4.3
R180	2.14	125	3.7	7.9	3.7	7.9
R181	0.45	125	0.9	2.0	6.2	16.5
R182	3.14	126	3.5	8.3	3.5	8.3
S02	53.28	202	56.1	175.9	56.1	175.9
S09	6.83	209	8.2	28.7	30.8	90.8
S10	5.38	210	8.2	22.0	6.2	22.0
S11	7.29	211	9.0	31.7	9.0	31.7
S12	37.90	212	31.1	109.6	53.2	182.7

48 HOURS BEFORE YOU DIG CALL UTILITY LOCATORS
1-800-922-1987
City of Colorado Springs Dept. of Utilities Gas, Electric, Water and Wastewater
The locations of existing underground utilities are shown in an approximate way only. The contractor shall determine the exact location of all existing utilities before commencing work. The contractor shall be fully responsible for any and all damages which might be caused by his failure to exactly locate and preserve any and all underground utilities.

BANNING LEWIS RANCH

TCB

FINAL CONDITION

BANNING LEWIS RANCH

FILING 1

NO.	DATE	REVISION	BY
1	11/01/04	REVISED PER CITY COMMENTS	TCB

Unit: LDS	Scale:	Date: OCTOBER 28, 2004
Designed: FWT	Checked:	Job No. 052251395
Drawn: IIT	Approved:	Sheet 4 of 4

FINAL DRAINAGE REPORT

FOR

BANNING LEWIS RANCH,

FILING 2

Charlton L. Kennedy, P.E.
Project Engineer

COLORADO REGISTERED
CHARLTON LESLIE KENNEDY
36550
2/18/05
PROFESSIONAL ENGINEER

Patrick W. McNamara, P.E. & P.L.S.
Project Director

COLORADO REGISTERED
PATRICK W. McNAMARA
24123
2/18/05
P.E. AND P.L.S.

TCB Job No. 052.251395.0001
February 2005

DETENTION BASIN 93 XP-SWMM INPUT/OUTPUT SUMMARY

Water Quality Ponding Elevation = **6801.00** feet

Orifice #1 (first junction box), top elevation = **6801.00** feet
Assumed box dimensions: 6 ft x 6 ft — Note: this can be flexible
Orifice Size = 21 inches
Flowline = 6798.55 feet

Orifice #2 (second junction box), top elevation = 6803.70 feet
Assumed box dimensions: 7 ft x 7 ft
Orifice Size = 30 inches
Flowline = 6798.55 feet

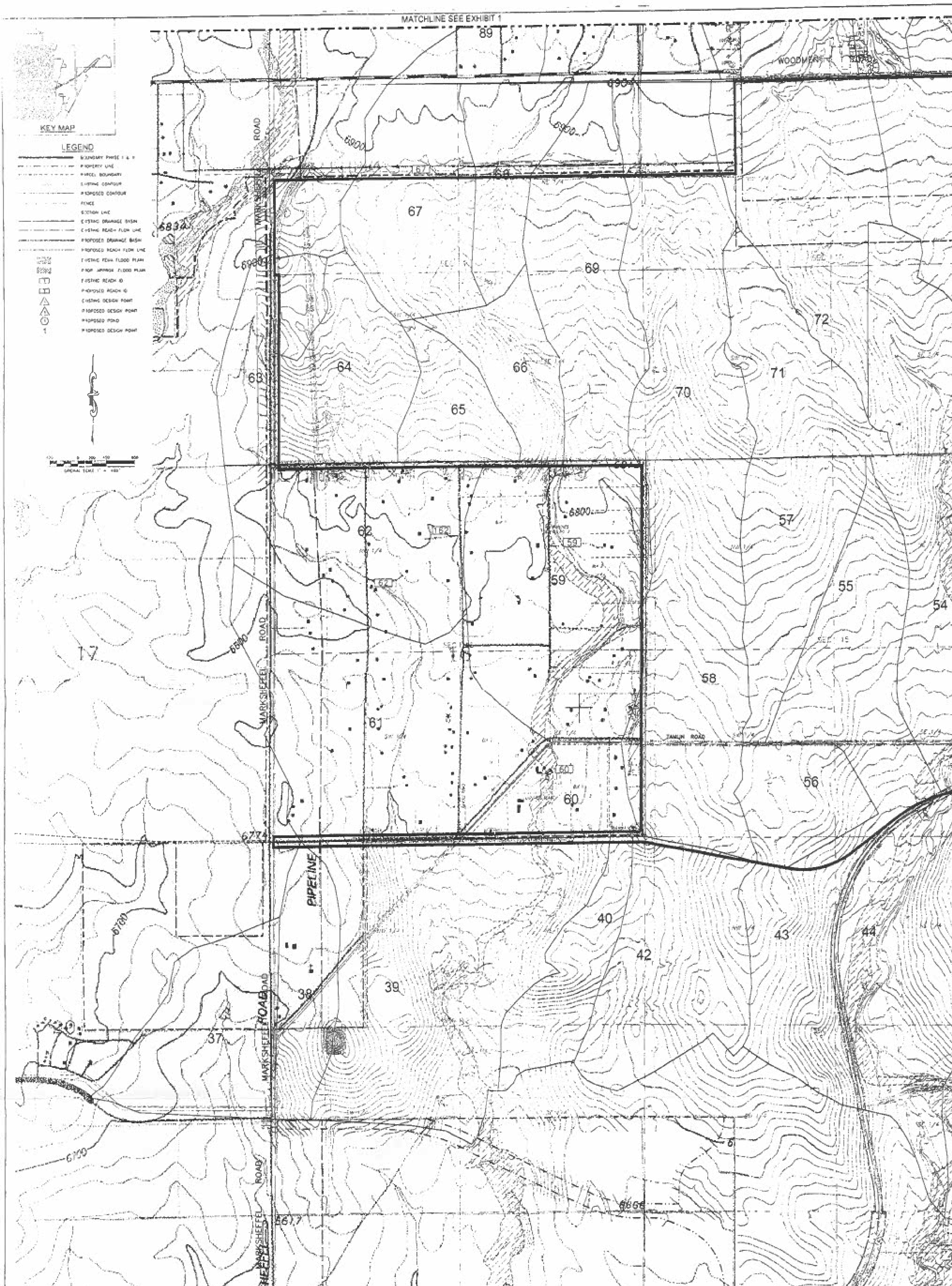
~~**Note: 2nd orifice assumed to be restrictor plate on 42" RCP outfall**~~

Hydraulic Results

	Peak Discharge at Outfall (cfs)			**Max. Ponding Elev. (feet)**
Frequency	**Allowable**	**Actual**	**Difference**	
2-year	20	**17.6**	-2.4	**6802.43**
5-year	27	**19.8**	-7.2	**6803.13**
10-year	32	**22.1**	-9.9	**6803.75**
25-year	61	**46.7**	-14.3	**6804.42**
100-year	63	**59.7**	-3.3	**6806.21**

Proposed and Existing Channel Flows Downstream of Phase I Only

TR-20 Reach ID	Controlling Detention Pond ID	Proposed 100- Year Developed Flow (cfs) Q	Existing 100- Year Developed Flow (cfs) So	Commments
59	95	628	812	
199	96	1654	2358	
62	93	103	126	



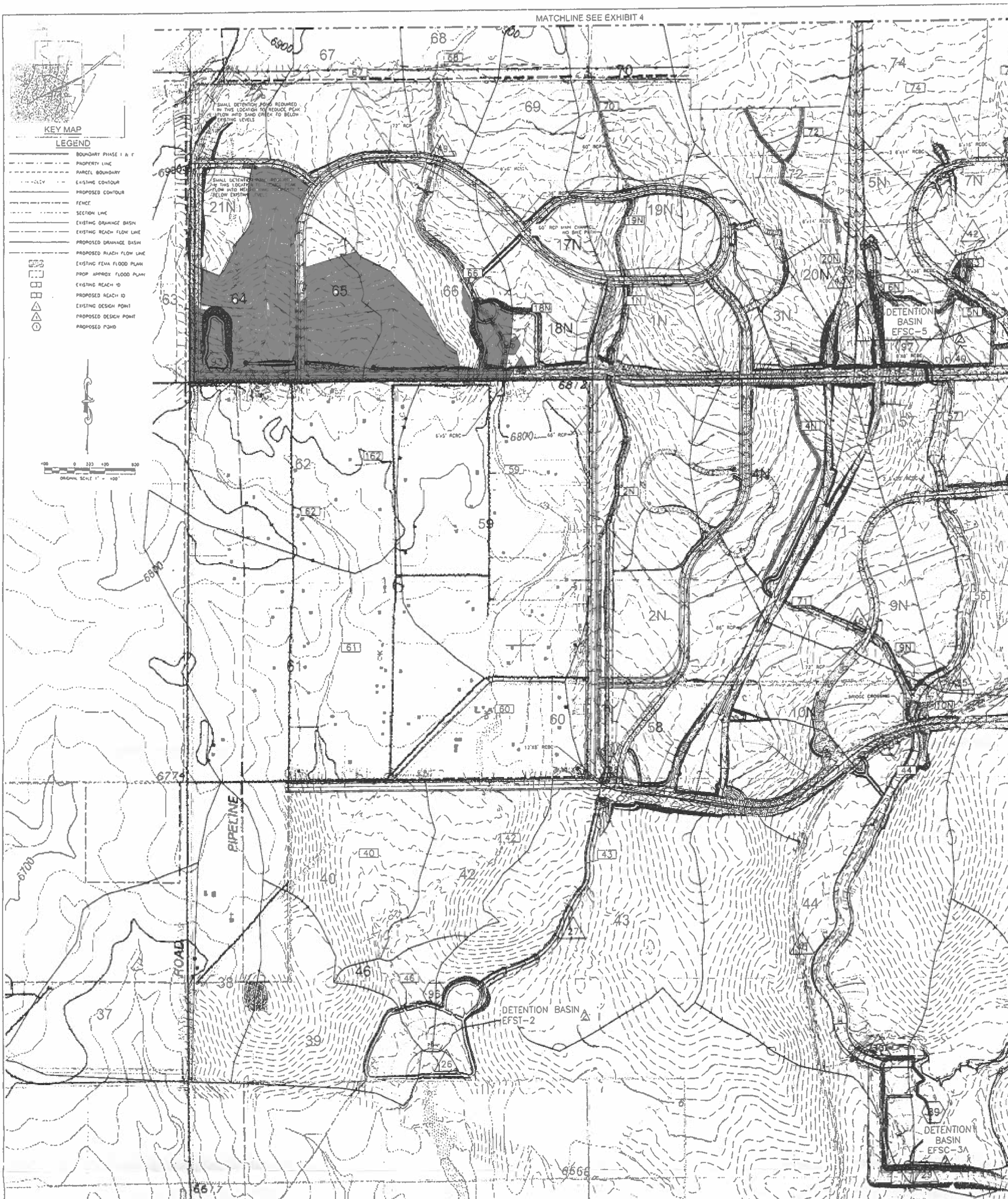
BANNING LEWIS RANCH PHASES I AND II
MASTER DEVELOPMENT DRAINAGE PLAN
CITY OF COLORADO SPRINGS
EL PASO COUNTY, COLORADO

EXISTING CONDITIONS

EXHIBIT 2

Turner Collie & Braden Inc.
ENGINEERS · PLANNERS · PROJECT MANAGERS

2



CHANNEL REACH IDENTIFICATION (SEE APPENDIX B, TABLE 1 FOR ADDITIONAL DETAIL)					
	DOWNSTREAM END OF CHANNEL				
CHANNEL REACH IDENTIFICATION*	Q (CFS)	v (fps)	b (FT)	d (FT)	TOP WIDTH INCLUDING FREEBOARD (ft)
1N	[illegible]	[illegible]	8.0	[illegible]	[illegible]
2N	[illegible]	[illegible]	16.0	[illegible]	[illegible]
4N	[illegible]	[illegible]	8.0	[illegible]	[illegible]
5N	[illegible]	[illegible]	11.0	[illegible]	[illegible]
6N	[illegible]	[illegible]	8.0	[illegible]	[illegible]
18N	[illegible]	[illegible]	8.0	[illegible]	[illegible]
19N	174	[illegible]	8.0	[illegible]	[illegible]
43	[illegible]	7.05	27.0	[illegible]	[illegible]
44*	2013	[illegible]	79.0	2.87	171.8
66*	844	6.90	13.0	2.87	[illegible]
67*	287	6.40	8.0	[illegible]	40.8
69*	[illegible]	[illegible]	8.0	2.22	[illegible]
70	[illegible]	[illegible]	8.0	[illegible]	34.1
71	[illegible]	[illegible]	8.0	[illegible]	[illegible]
72	[illegible]	[illegible]	8.0	[illegible]	[illegible]
74	[illegible]	[illegible]	40.0	[illegible]	[illegible]

*Reach data provided here for reaches with design per the MDDP only. Other reaches are shown for reference only.
*Data for this reach provided for areas where engineered channel cannot be avoided. Custom avoidance design is the preferred option where feasible.

NO	DATE	DESCRIPTION	BY

BANNING LEWIS RANCH PHASES I AND II
MASTER DEVELOPMENT DRAINAGE PLAN
CITY OF COLORADO SPRINGS
EL PASO COUNTY, COLORADO

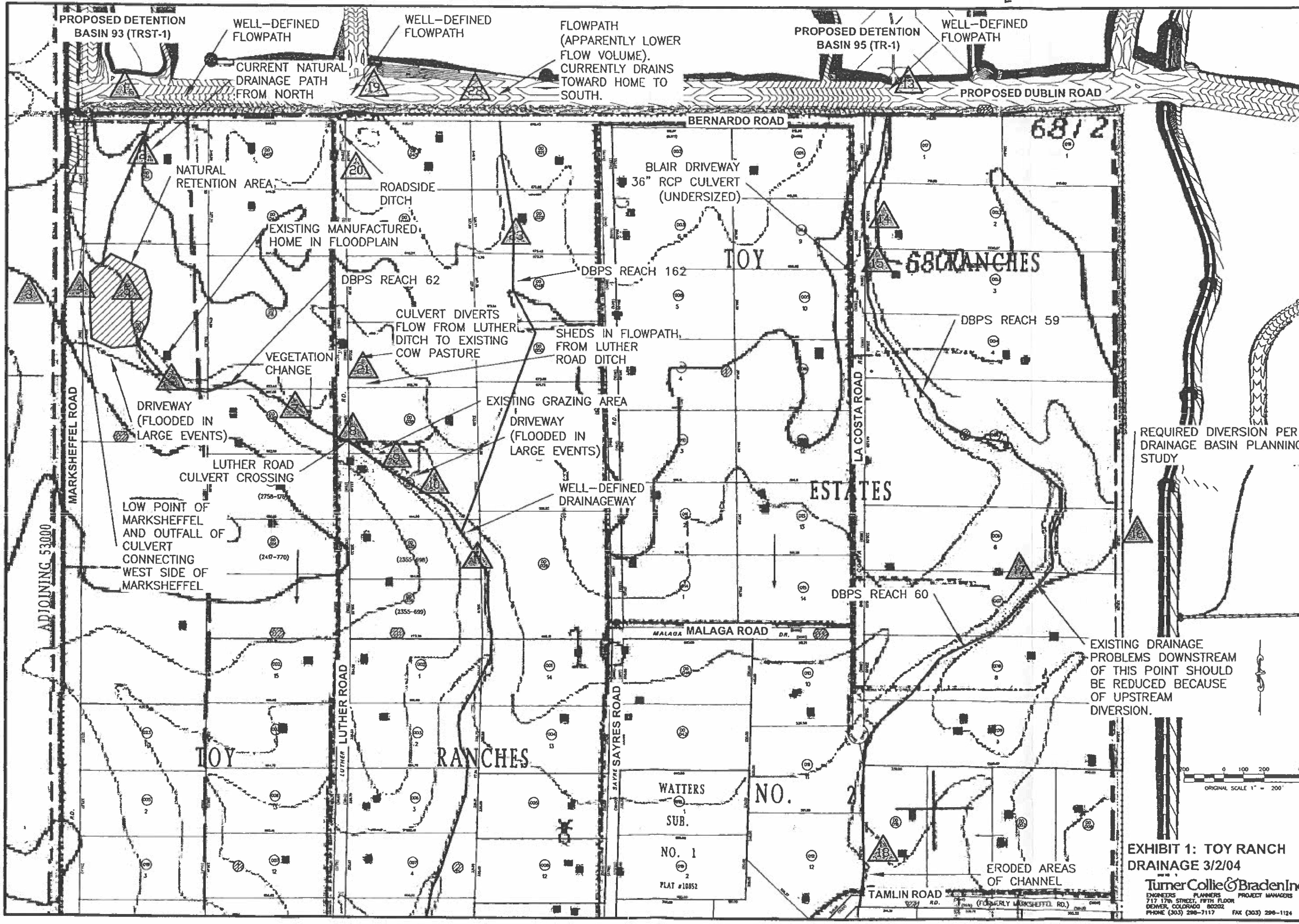
PROPOSED CONDITIONS
EXHIBIT 5

Turner Collie & Braden Inc.
ENGINEERS · PLANNERS · PROJECT MANAGERS

Scale 1" = 400'
Checked
Approved
Date APRIL 2003

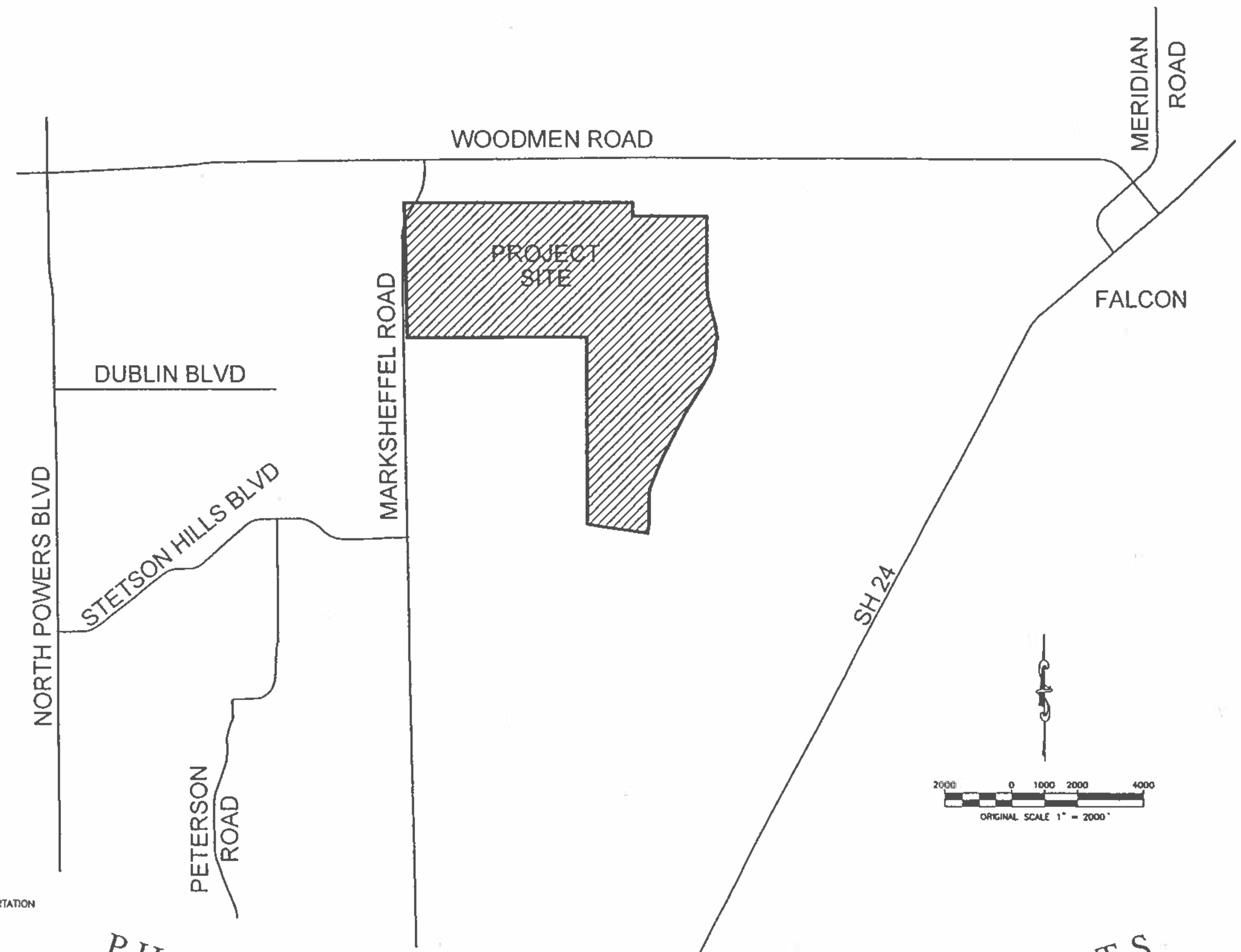
5

2


PROPOSED DETENTION BASIN 93 (TRST-1)
WELL-DEFINED FLOWPATH
CURRENT NATURAL DRAINAGE PATH FROM NORTH
WELL-DEFINED FLOWPATH
FLOWPATH (APPARENTLY LOWER FLOW VOLUME). CURRENTLY DRAINS TOWARD HOME TO SOUTH.
PROPOSED DETENTION BASIN 95 (TR-1)
WELL-DEFINED FLOWPATH
PROPOSED DUBLIN ROAD
BERNARDO ROAD
6812
NATURAL RETENTION AREA
ROADSIDE DITCH
BLAIR DRIVEWAY 36" RCP CULVERT (UNDERSIZED)
EXISTING MANUFACTURED HOME IN FLOODPLAIN
TOY
68 RANCHES
DBPS REACH 162
DBPS REACH 62
DBPS REACH 59
CULVERT DIVERTS FLOW FROM LUTHER DITCH TO EXISTING COW PASTURE
SHEDS IN FLOWPATH, FROM LUTHER ROAD DITCH
VEGETATION CHANGE
EXISTING GRAZING AREA
DRIVEWAY (FLOODED IN LARGE EVENTS)
DRIVEWAY (FLOODED IN LARGE EVENTS)
REQUIRED DIVERSION PER DRAINAGE BASIN PLANNING STUDY
LUTHER ROAD CULVERT CROSSING
WELL-DEFINED DRAINAGEWAY
ESTATES
LA COSTA ROAD
MARKSHEFFEL ROAD
LOW POINT OF MARKSHEFFEL AND OUTFALL OF CULVERT CONNECTING WEST SIDE OF MARKSHEFFEL
ADJOINING 53000
DBPS REACH 60
MALAGA ROAD
EXISTING DRAINAGE PROBLEMS DOWNSTREAM OF THIS POINT SHOULD BE REDUCED BECAUSE OF UPSTREAM DIVERSION.
LUTHER ROAD
SAYRES ROAD
TOY
RANCHES
WATTERS SUB. NO. 1
PLAT #10852
NO. 2
ERODED AREAS OF CHANNEL
TAMLIN ROAD
(FORMERLY MARKSHEFFEL RD.)
ORIGINAL SCALE 1" = 200'
EXHIBIT 1: TOY RANCH DRAINAGE 3/2/04
Turner Collie & Braden Inc.
ENGINEERS PLANNERS PROJECT MANAGERS
717 17th STREET, FIFTH FLOOR
DENVER, COLORADO 80202
PHONE (303) 298-7117 FAX (303) 296-1124

PROJECT NO. 2004–S133
FMS MAP NO. ______

BANNING LEWIS RANCH FILING NO. 2



INDEX OF SHEETS

LEGEND

- PROPERTY LINE
- EASEMENT
- CENTER LINE OF ROAD/HCL
- RIGHT OF WAY
- PROPOSED WATER LINE
- SANITARY SEWER
- STORM DRAIN
- SIDEWALK
- CURB & GUTTER
- POWER POLE
- RIPRAP
- INLET
- TYPE I MANHOLE – PIPE SIZE GREATER THAN 30" INSIDE DIAMETER
- TYPE II MANHOLE – PIPE SIZE 30" OR LESS INSIDE DIAMETER
- CULVERT
- ROCK CHECK STRUCTURE
- TRIANGULAR SILT DIKE
- EGL
- PROPOSED 100–YEAR WSEL
- LOW POINT OF CHANNEL CROSS SECTION (FLOWLINE)
- SILT FENCE
- 100–YR WSEL
- SILT DAM

2004–S133 1277429

WETLAND AVOIDANCE AREA
DO NOT DISTURB EXISTING GROUND
SURROUND WITH SILT FENCE

EXCAVATE AS NEEDED TO INSTALL RIPRAP FOR CHANNEL SIDE SLOPES BACKFILL TO ORIGINAL GRADE (NO FENCE ON PERIMETER)

WETLAND AVOIDANCE AREA
DO NOT DISTURB EXISTING GROUND
SURROUND WITH SILT FENCE

REINFORCED CONCRETE PIPE CULVERT WITH HEADWALL AND WINGWALLS

REINFORCED CONCRETE BOX CULVERT WITH HEADWALL AND WINGWALLS

THE ATTACHED CONSTRUCTION PLANS WERE PREPARED UNDER MY DIRECTION AND SUPERVISION AND ARE CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF. SAID PLANS HAVE BEEN PREPARED ACCORDING TO THE CRITERIA ESTABLISHED BY THE CITY.

SIGNED______________ DATE__________
FOR AND ON BEHALF OF TCB
PATRICK W. MCNAMARA P.E. & P.L.S.

ABBREVIATIONS

Δ = DELTA ANGLE
BLPW = BANNING LEWIS PARKWAY
BOW = BOTTOM OF WALL
CBC = CONCRETE BOX CULVERT
CDOT = COLORADO DEPARTMENT OF TRANSPORTATION
CL = CENTERLINE
DBL CBC = DOUBLE CONCRETE BOX CULVERT
DUB = DUBLIN BOULEVARD
e = DEFLECTION ANGLE
EGL = ENERGY GRADE LINE
FALCON = FALCON MEADOWS BOULEVARD
HCL = HORIZONTAL CONTROL LINE
l = LENGTH
LF = LINEAR FEET
NTS = NOT TO SCALE
ORO = VISTA DEL ORO BOULEVARD
PGL = PROFILE GRADE LINE
PRADO = VISTA DEL PRADO BOULEVARD
R = RADIUS
RCP = REINFORCED CONCRETE PIPE
ROW = RIGHT OF WAY
SH = STETSON HILLS BOULEVARD
STD = STANDARD
T = TANGENT
TOC = TOP OF CURB
TOW = TOP OF WALL
TPL CBC = TRIPLE CONCRETE BOX CULVERT
(TYP) = TYPICAL
WSEL = WATER SURFACE ELEVATION
YR = YEAR

PHASE ONE - CHANNEL IMPROVEMENTS

FOR REVIEW ONLY

SURVEYOR
SURVCON INC.
PROFESSIONAL SURVEYORS
7800 E. Dorado Pl, Suite 101
Greenwood Village, CO 80111
PH. (303) 858-0404

OWNER
The Banning Lewis Ranch Company
4100 MacArthur Blvd., Suite 200
P. O. Box 7150
Newport Beach, CA 92658-7150

ENGINEER
TCB
ENGINEERS · PLANNERS · PROJECT MANAGERS
717 17th 5th Floor - Denver, Colorado 80202
Phone (303) 298-7117 - Fax (303) 296-1124

BANNING LEWIS RANCH
The Promise of Colorado

TCB
Engineers · Planners · Project Managers
Ph: 303-298-7117 / Fx. 303-296-1124

SURVCON INC.
PROFESSIONAL SURVEYORS

APPROVED SEGMENT	POND/REACH	BEGIN STATION	END STATION	SHEET NUMBERS	DRAINAGE DESIGN
SEGMENT 1	POND 93	-	-	4, 5, 6	FOR THE CITY ENGINEER DATE
SEGMENT 1	POND 95	-	-	7, 8, 9, 13, 14	FOR THE CITY ENGINEER DATE
SEGMENT 1	REACH 66	11+76.18	14+29.25	9, 10	FOR THE CITY ENGINEER DATE
SEGMENT 1	REACH 67	14+29.25	26+15.03	10, 11, 31	FOR THE CITY ENGINEER DATE
SEGMENT 1	REACH 68	1+00.00	11+16.19	10, 12, 31	FOR THE CITY ENGINEER DATE
SEGMENT 1	REACH 1N	106+65.88	118+96.43	26, 27, 32, 33	FOR THE CITY ENGINEER DATE
SEGMENT 1	REACH 19N	118+96.43	131+98.87	27, 28, 32	FOR THE CITY ENGINEER DATE
SEGMENT 1	CONSTRUCTION REVISION POND 93	-	-	R-7 2, 5	FOR THE CITY ENGINEER DATE
SEGMENT 1	CONSTRUCTION REVISION POND 95	-	-	R-7 8,13, 14, 34, 35, 37	FOR THE CITY ENGINEER DATE
SEGMENT					FOR THE CITY ENGINEER DATE
SEGMENT					FOR THE CITY ENGINEER DATE
SEGMENT					FOR THE CITY ENGINEER DATE
SEGMENT					FOR THE CITY ENGINEER DATE
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SEGMENT					FOR THE CITY ENGINEER DATE
SEGMENT					FOR THE CITY ENGINEER DATE

Drainage Design:
Drainage Basin Filed in Accordance with Section 7.7.906 of Colorado Springs 2001, As Amended

STATEMENT:

THE CITY OF COLORADO SPRINGS RECOGNIZED THE DESIGN ENGINEER AS HAVING RESPONSIBILITY FOR THE DESIGN; THE CITY HAS LIMITED ITS COPE OF REVIEW ACCORDINGLY.
RESUMBITTAL REQUIRED IF CONSTRUCTION HAS NOT COMMENCED WITHIN 130 DAYS AFTER REVIEW DATE.

DETAILED DRAINAGE CONSTRUCTION PLANS AND SPECIFICATIONS ENGINEER'S STATEMENT:

THESE DETAILED PLANS AND SPECIFICATIONS WERE PREPARED UNDER MY DIRECTION AND SUPERVISION. SAID DETAILED PLANS AND SPECIFICATIONS HAVE BEEN PREPARED ACCORDING TO THE CRITERIA ESTABLISHED BY THE CITY FOR DETAILED DRAINAGE PLANS AND SPECIFICATIONS, AND SAID DETAILED PLANS AND SPECIFICATIONS ARE IN CONFORMITY WITH THE MASTER PLAN OF THE DRAINAGE BASIN. SAID DETAILED DRAINAGE PLANS AND SPECIFICATIONS MEET THE PURPOSES FOR WHICH THE PARTICULAR DRAINAGE FACILITIES ARE DESIGNED. I ACCEPT RESPONSIBILITY FOR ANY LIABILITY CAUSED BY ANY NEGLIGENT ACTS, ERRORS OR OMISSIONS ON MY PART IN PREPARATION OF THE DETAILED DRAINAGE PLANS AND SPECIFICATIONS.

DETAILED DRAINAGE CONSTRUCTION PLANS AND SPECIFICATIONS CITY'S STATEMENT:

CITY PLAN REVIEW IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH CITY DESIGN CRITERIA. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE CITY THROUGH THE APPROVAL OF THIS DOCUMENT ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

1-800-922-1987

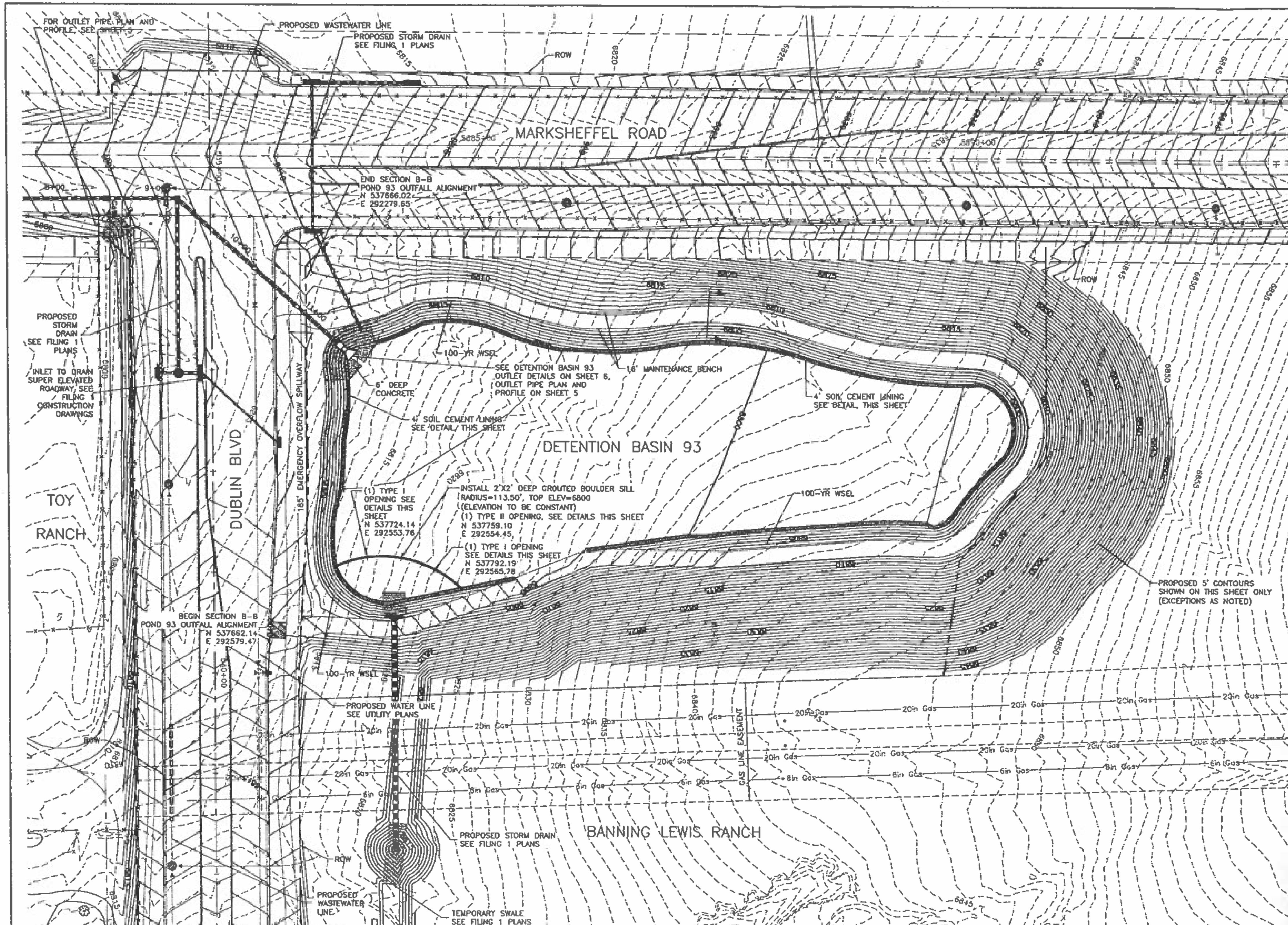
BANNING LEWIS RANCH

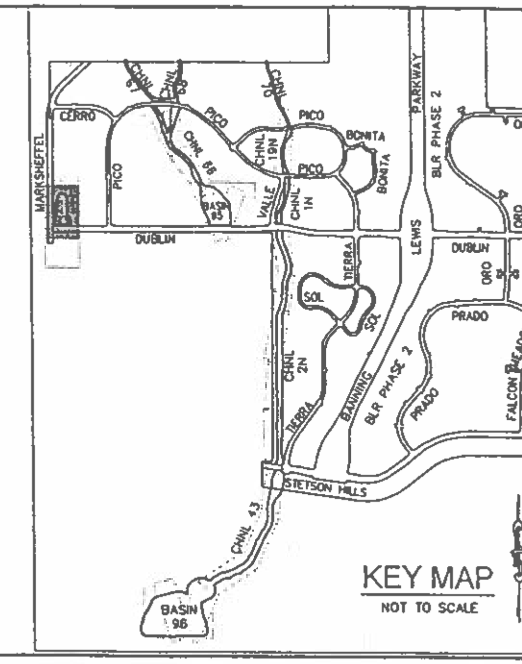
TCB

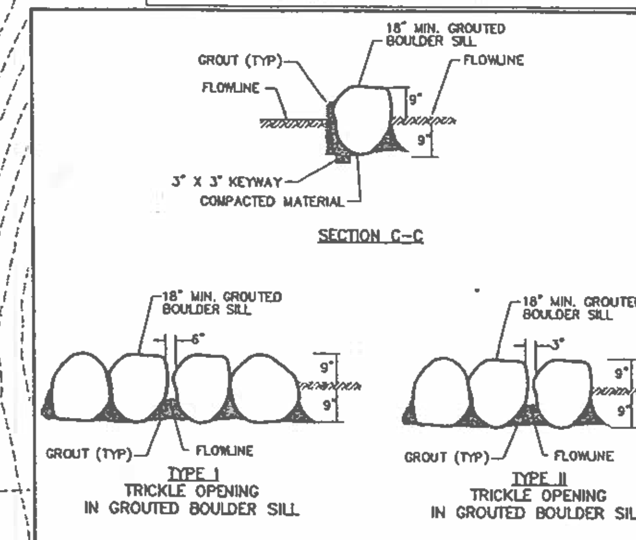
SIGNATURE SHEET

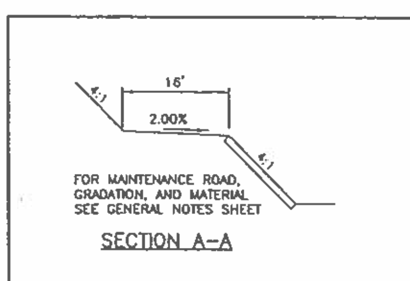
NO.	DATE	REVISION	BY

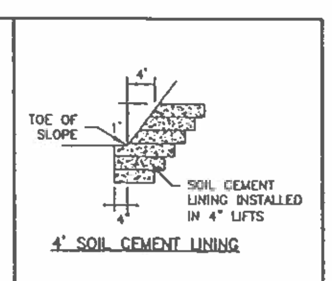
Unit:	Scale: Horz. None Vert. None	Date: FEBRUARY 14, 2005
Designed: CLK	Checked: PWM	Job No. 251395











PROPOSED DETENTION BASIN 93					
	Q2	Q5	Q10	Q25	Q100
IN	123 cfs	161 cfs	195 cfs	262 cfs	390 cfs
OUT	20 cfs	27 cfs	32 cfs	61 cfs	63 cfs

ORIGINAL SCALE 1" = 50'

PROPOSED DETENTION BASIN 93

100-YR WSEL = 6806.21
25-YR WSEL = 6804.42
10-YR WSEL = 6803.75
5-YR WSEL = 6803.13
2-YR WSEL = 6802.43
VOLUME = 23.9 AC-FT

RECOMMENDED MAINTENANCE SCHEDULE FOR DETENTION BASIN 93

CLEARING OF SEDIMENT FROM FULL POND AREA:
EVERY 5 YEARS AS NEEDED.

OUTLET STRUCTURE:
WEEKLY AS NEEDED.

REVIEW:
Drainage Design:
Drainage Basin Filed in Accordance with Section 7.7.906 of Colorado Springs 2001, As Amended

__________ Date __________

48 HOURS BEFORE YOU DIG CALL UTILITY LOCATORS
1-800-922-1987
City of Colorado Springs Dept. of Utilities Gas, Electric, Water and Wastewater

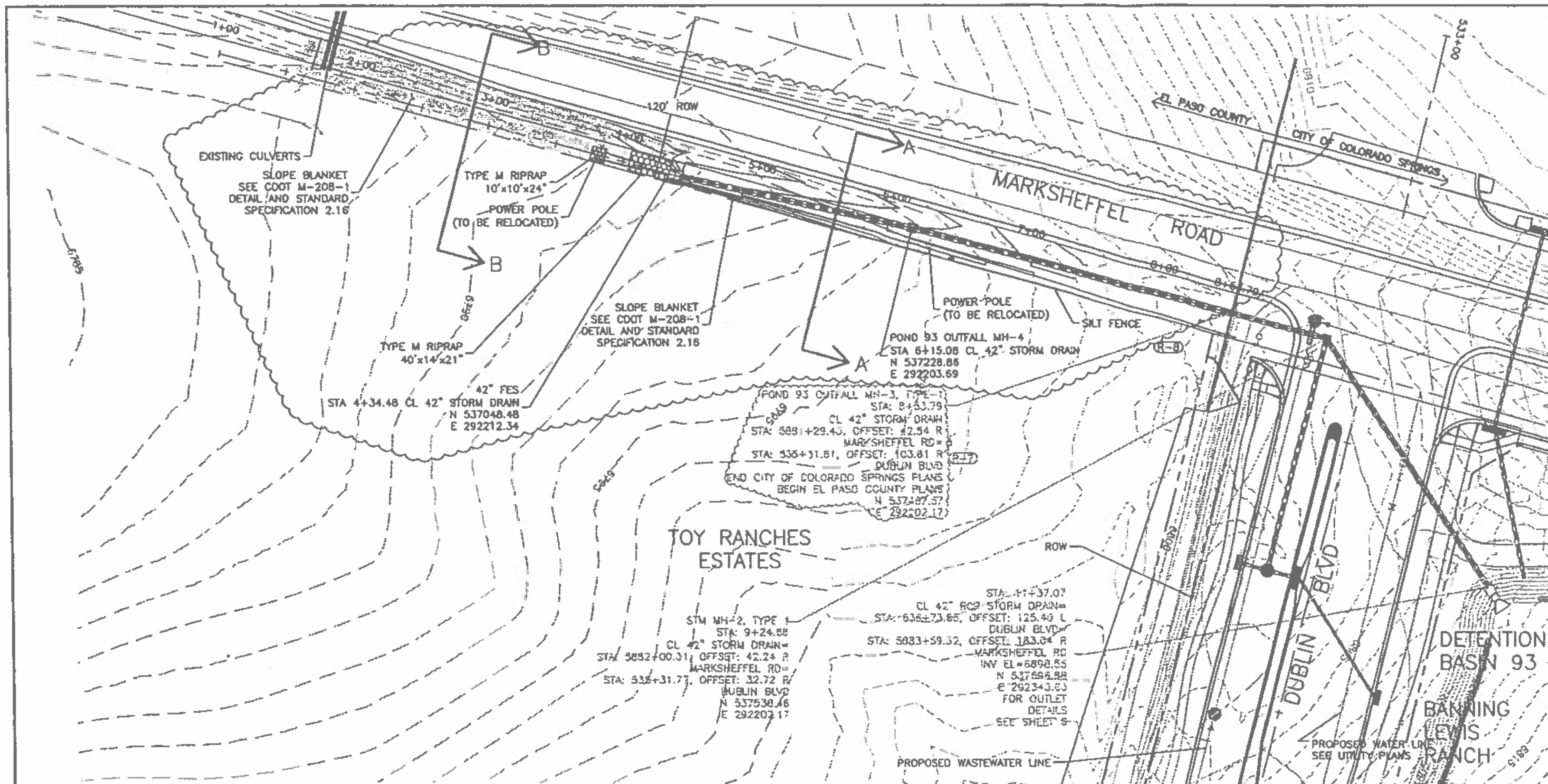
BANNING LEWIS RANCH

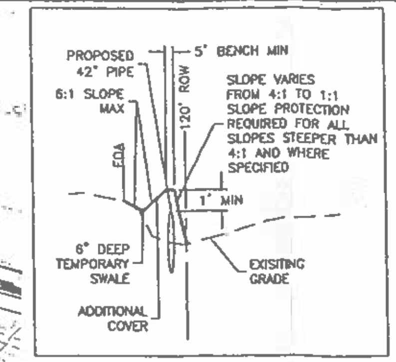
TCB

DETENTION BASIN 93

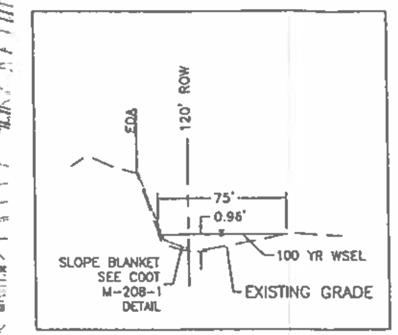
NO.	DATE	REVISION	BY
9	8/22/07	REVISED CHANNEL 1N AND 6B CULVERTS AND CHANNEL 43 GRADING	TCB
8	8/15/07	POND 93 REVISED OUTFALL ALIGNMENT	TCB
7	1/3/07	POND 93 AND 95 OUTFALL CONSTRUCTION REVISION	

Unit:	Scale: Horz. 50' Vert. N/A	Date: FEBRUARY 14, 2005
Designed: MAW	Checked: PWM	Job No. 251395

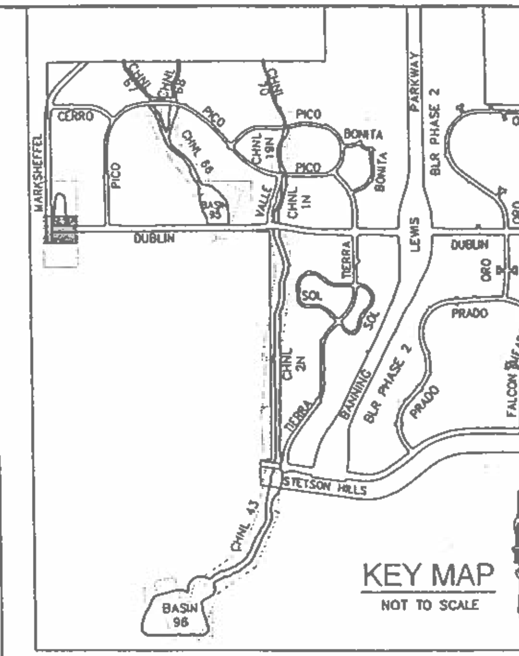




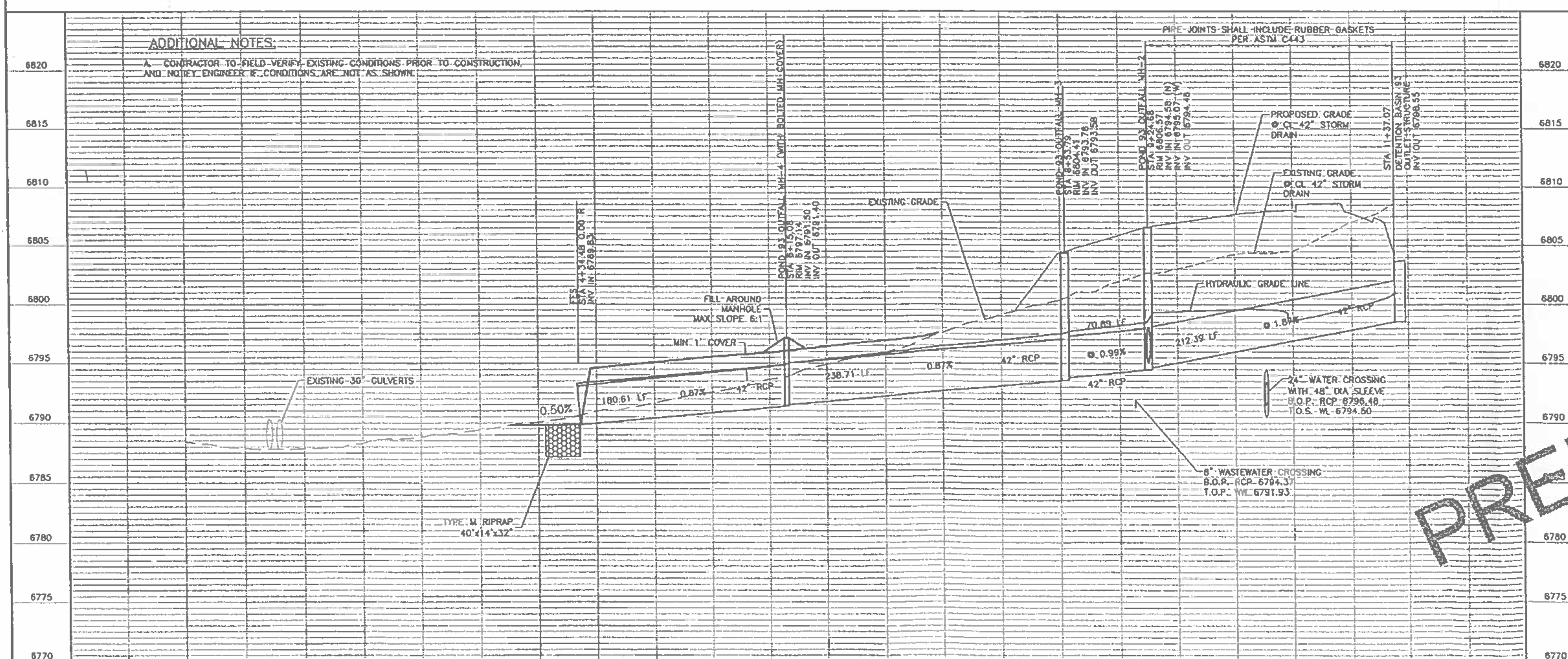
SECTION A–A (NTS)



SECTION B–B (NTS)



ORIGINAL SCALE 1" = 50'



NOTES:

1. SEE COLORADO DEPARTMENT OF TRANSPORTATION STANDARD DRAWINGS 601-1,601-2,601-3,601-10, AND 601-20 FOR ALL CONCRETE HEADWALL, WINGWALL, AND FOOTING DETAILS.
2. ALL TOE WALLS SHALL BE A DEPTH OF 5' UNLESS SPECIFIED ON PLANS DUE TO ADDITIONAL SCOUR DEPTH.
3. ALL HEADWALLS SHALL BE 1' ABOVE TOP OF CULVERT.
4. ALL SIDE SLOPES ARE PER THE TYPICAL SECTIONS, UNLESS NOTED OTHERWISE.
5. REFER TO BLR FILING 1, PHASE 1 – CONSTRUCTION PLANS FOR DETAILS REGARDING ROADS, ROADWAY GRADING AND STORM SEWER.

REVIEW:
Drainage Design:
Drainage Basin File in Accordance with Section 7.7.906 of Colorado Springs 2001, As Amended

Date ______

CALL 1-800-922-1987

BANNING LEWIS RANCH

TCB

Engineers · Planners · Project Managers

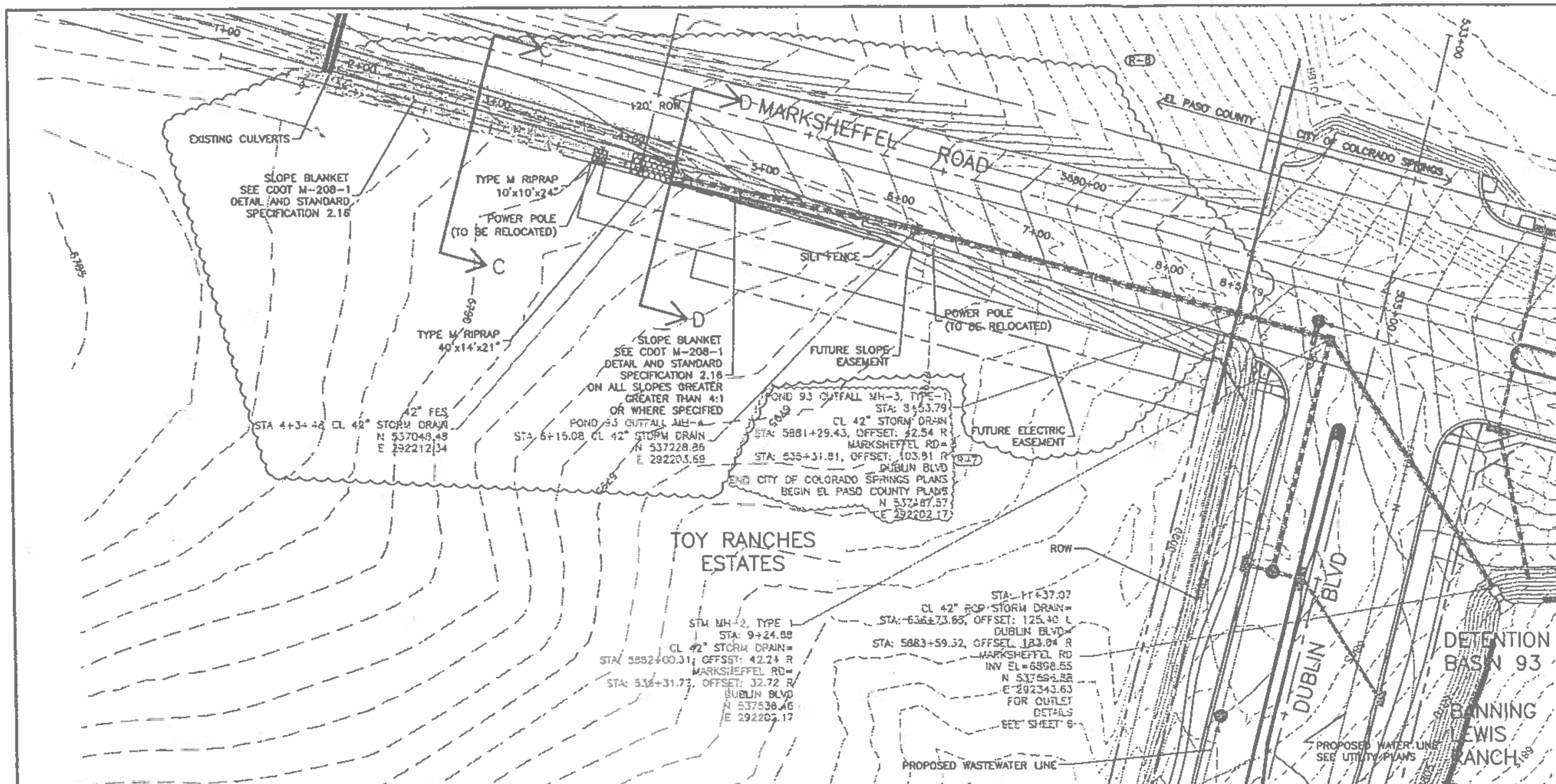
PRELIMINARY

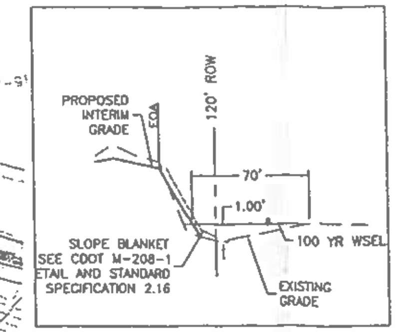
NOT FOR CONSTRUCTION

DETENTION BASIN 93
OUTLET PIPE – PLAN AND PROFILE
PROPOSED PIPE TO
EXISTING CONDITIONS

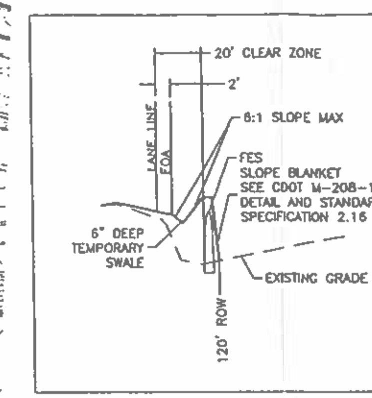
NO.	DATE	REVISION	BY
9	8/22/07	REVISED CHANNEL 1N AND 68 CULVERTS AND CHANNEL 43 GRADING	TCB
8	8/15/07	POND 93 REVISED OUTFALL ALIGNMENT	TCB
7	1/3/07	POND 93 AND 95 OUTFALL CONSTRUCTION REVISION	

Unit: LDS	Scale: Horz. 50' Vert. 5'	Date: FEBRUARY 14, 2005
Designed: MW	Checked: PWM	Job No. 251395

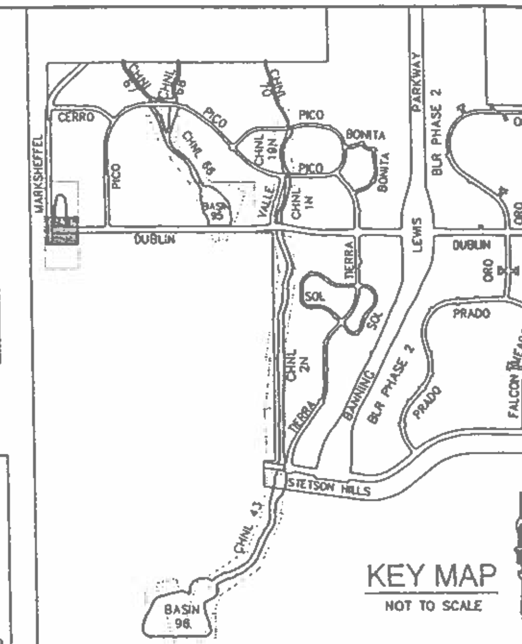




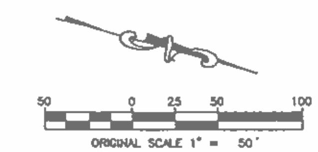
SECTION C–C (NTS)

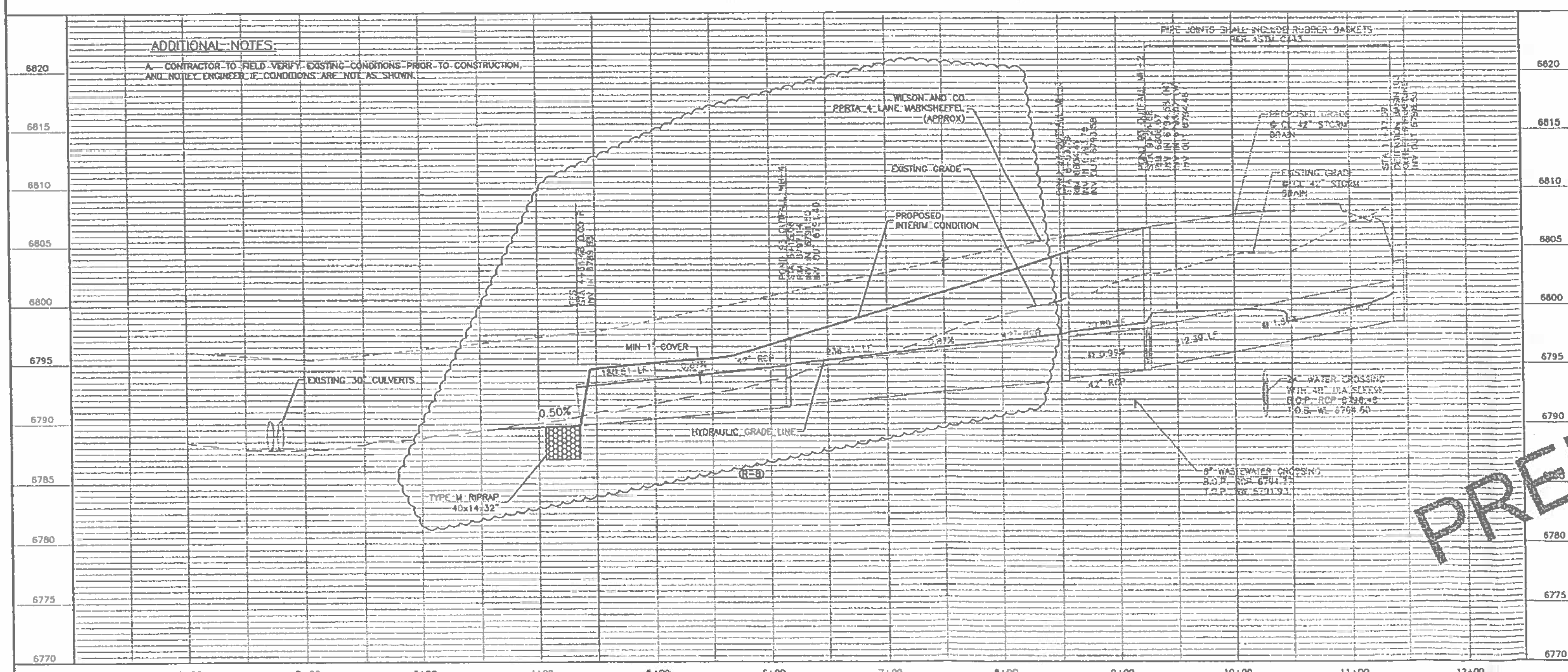


SECTION D–D (NTS)



KEY MAP
NOT TO SCALE





NOTES:

1. SEE COLORADO DEPARTMENT OF TRANSPORTATION STANDARD DRAWINGS 601-1,601-2,601-3,601-10, AND 601-20 FOR ALL CONCRETE HEADWALL, WINGWALL, AND FOOTING DETAILS.
2. ALL TOE WALLS SHALL BE A DEPTH OF 5' UNLESS SPECIFIED ON PLANS DUE TO ADDITIONAL SCOUR DEPTH.
3. ALL HEADWALLS SHALL BE 1' ABOVE TOP OF CULVERT.
4. ALL SIDE SLOPES ARE PER THE TYPICAL SECTIONS, UNLESS NOTED OTHERWISE.
5. REFER TO BLR FILING 1, PHASE 1 – CONSTRUCTION PLANS FOR DETAILS REGARDING ROADS, ROADWAY GRADING AND STORM SEWER.

REVIEW:
Drainage Design:
Drainage Basin Files ... Accordance with ... 7.7.206 of Colorado Springs 2001, As Amended

Date

PRELIMINARY
NOT FOR CONSTRUCTION

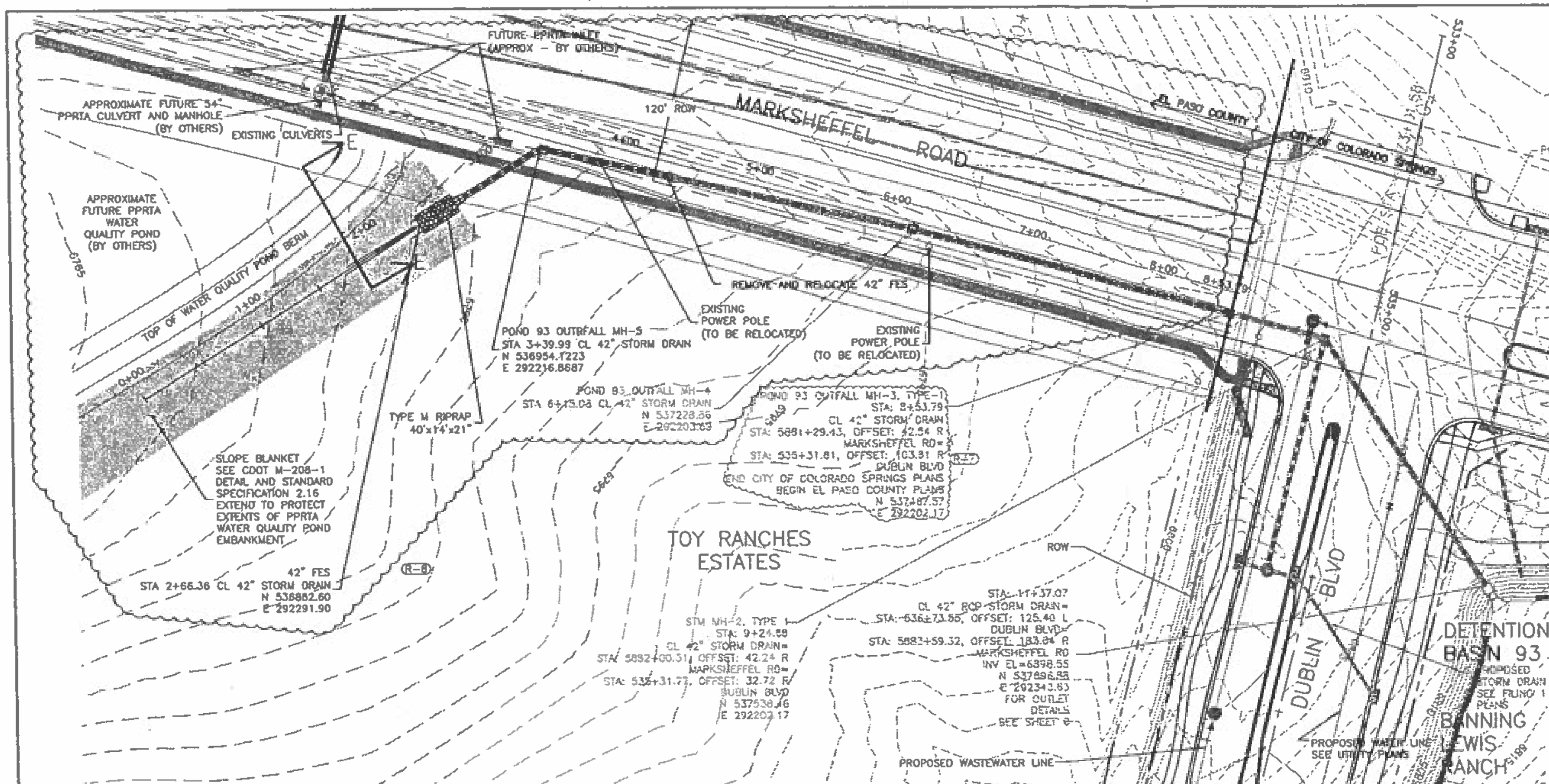
BANNING LEWIS RANCH

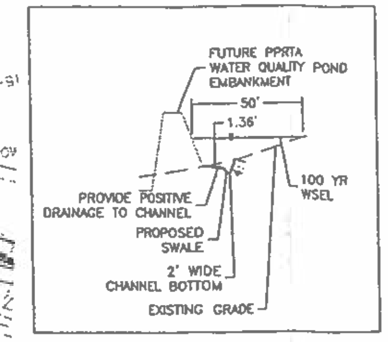
TCB

DETENTION BASIN 93
OUTLET PIPE – PLAN AND PROFILE
PROPOSED PIPE TO
TCB PROPOSED MARKSHEFFEL ROAD

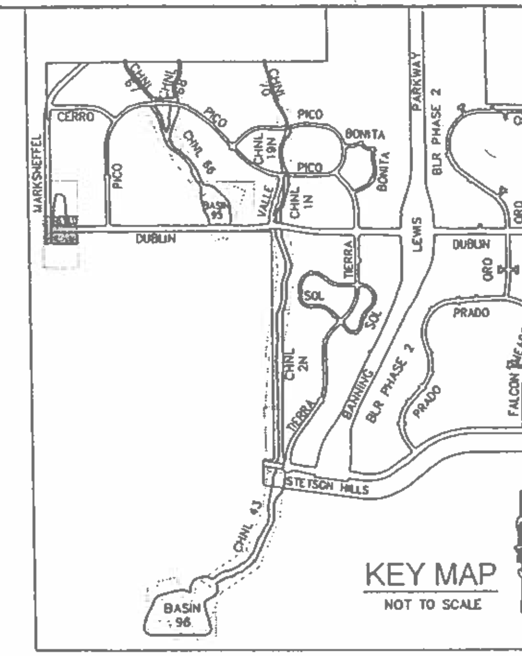
NO	DATE	REVISION	BY
9	8/22/07	REVISED CHANNEL 1N AND 6B CULVERTS AND CHANNEL 43 GRADING	TCB
8	8/16/07	POND 93 REVISED OUTFALL ALIGNMENT	TCB
7	1/3/07	POND 93 AND 95 OUTFALL CONSTRUCTION REVISION	

Unit: LDS	Scale: Horz. 50' Vert. 5'	Date: FEBRUARY 14, 2005	
Designed: MW	Checked: PWM	Job No. 251395	
Drawn: DFG	Approved: PWM	Sheet 50 of 41	



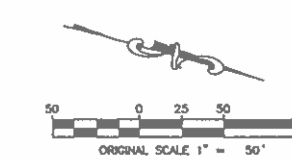


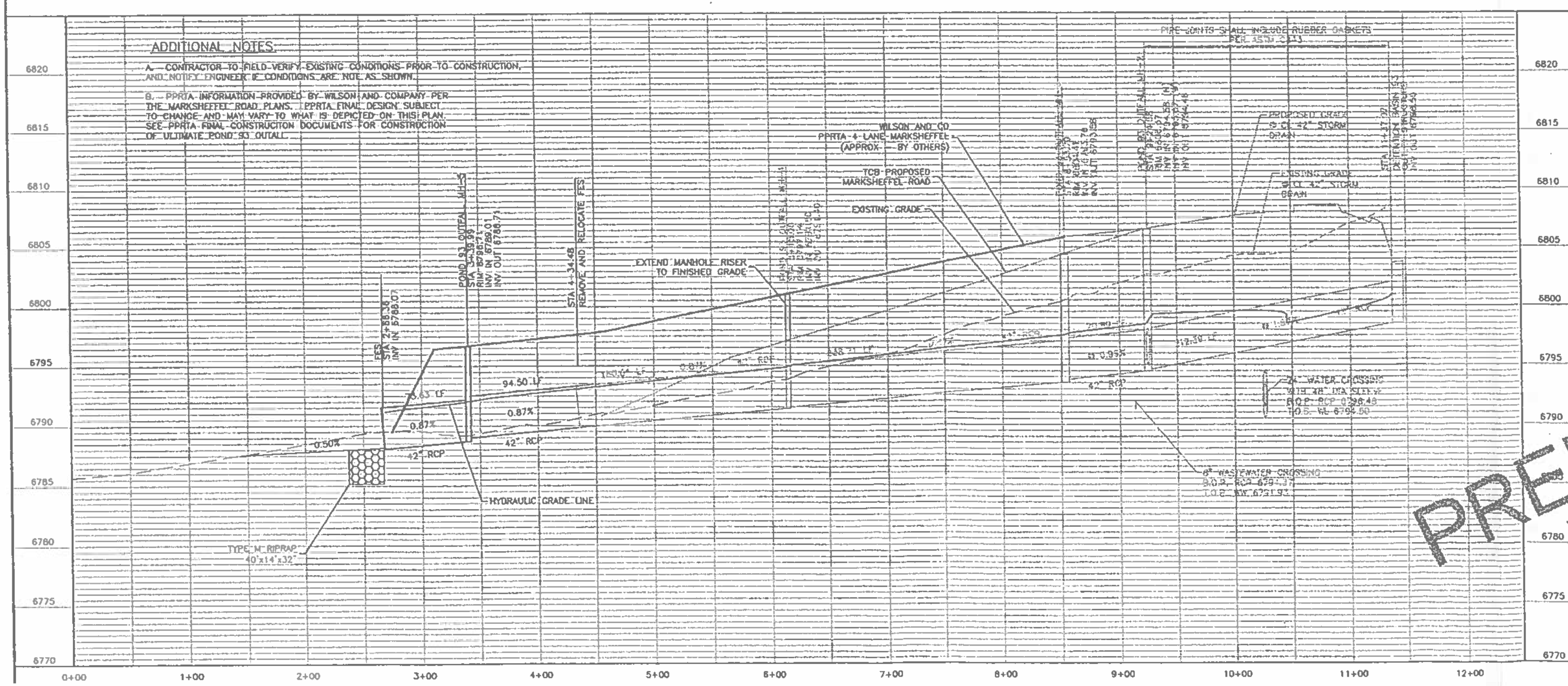
SECTION E-E (NTS)



KEY MAP
NOT TO SCALE

FOR INFORMATION ONLY
DO NOT CONSTRUCT
ACTUAL DESIGN PLANS SHALL BE DONE BY OTHERS.





ADDITIONAL NOTES:

A. CONTRACTOR TO FIELD VERIFY EXISTING CONDITIONS PRIOR TO CONSTRUCTION, AND NOTIFY ENGINEER IF CONDITIONS ARE NOT AS SHOWN.

B. PPRTA INFORMATION PROVIDED BY WILSON AND COMPANY PER THE MARKSHEFFEL ROAD PLANS. PPRTA FINAL DESIGN SUBJECT TO CHANGE AND MAY VARY TO WHAT IS DEPICTED ON THIS PLAN. SEE PPRTA FINAL CONSTRUCTION DOCUMENTS FOR CONSTRUCTION OF ULTIMATE POND 93 OUTALL.

NOTES:

1. SEE COLORADO DEPARTMENT OF TRANSPORTATION STANDARD DRAWINGS 601-1,601-2,601-3,601-10, AND 601-20 FOR ALL CONCRETE HEADWALL, WINGWALL, AND FOOTING DETAILS.
2. ALL TOE WALLS SHALL BE A DEPTH OF 5' UNLESS SPECIFIED ON PLANS DUE TO ADDITIONAL SCOUR DEPTH.
3. ALL HEADWALLS SHALL BE 1' ABOVE TOP OF CULVERT.
4. ALL SIDE SLOPES ARE PER THE TYPICAL SECTIONS, 3:1 UNLESS NOTED OTHERWISE.
5. REFER TO BLR FILING 1, PHASE 1 - CONSTRUCTION PLANS FOR DETAILS REGARDING ROADS, ROADWAY GRADING AND STORM SEWER.

PRELIMINARY
NOT FOR CONSTRUCTION

REVIEW:
Drainage Design:
Drainage Basin Files in Accordance with Section 7.2006 of Colorado Springs 2001, As Amended

Date ______

800-922-1987

BANNING LEWIS RANCH

TCB

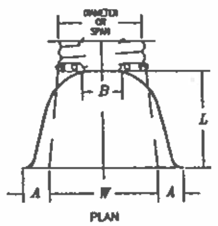
DETENTION BASIN 93
OUTLET PIPE - PLAN AND PROFILE
PROPOSED CONCEPT PIPE TO
WILSON AND CO. 4 LANE MARKSHEFFEL RD

NO.	DATE	REVISION	BY
9	6/22/07	REVISED CHANNEL 1N AND 6B CULVERTS AND CHANNEL 43 GRADING	TCB
8	6/15/07	POND 93 REVISED OUTFALL ALIGNMENT	TCB
7	1/3/07	POND 93 AND 95 OUTFALL CONSTRUCTION REVISION	

Unit: LOS	Scale: Horz. 50' Vert. 5'	Date: FEBRUARY 14, 2005
Designed: JSD	Checked: TWT	Job No. 251395
Drawn: JSD	Approved: TWT	Sheet 5C of 41

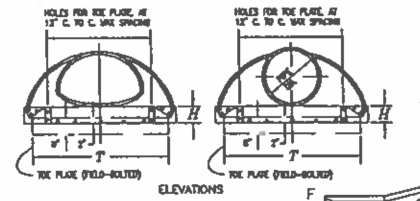
THIN-WALL ROUND PIPE

PIPE DIA.	THICKNESS	A	B	H	L	W	T
		(inches)					
12	0.064	6	6	6	21	24	34
18	0.064	8	10	6	31	36	46
21	0.064	8	12	6	36	42	53
24	0.064	10	13	6	41	48	58
30	0.079	12	16	8	51	60	70
36	0.079	14	19	9	60	72	84
42	0.109	16	22	11	69	84	106
48	0.109	18	27	12	78	90	112
54	0.109	18	30	12	84	102	124
60	0.109	18	33	12	87	114	134
66	0.109	18	36	12	87	120	142
72	0.109	18	39	12	87	126	146
78	0.109	18	42	12	87	132	154
84	0.109	18	45	12	87	138	160



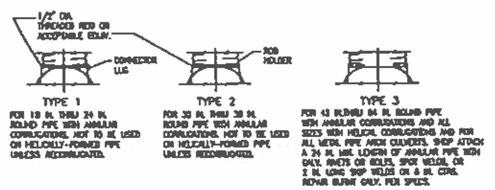
THIN-WALL PIPE ARCH

PIPE ARCH SPAN x RISE	THICKNESS	A (1"±)	B (4mm)	H (1"±)	L (1.5"±)	W (2"±)	T
		(inches)					
21 x 15	0.064	7	10	6	23	36	46
24 x 18	0.064	8	12	6	28	42	52
28 x 20	0.064	9	14	6	32	48	58
35 x 24	0.079	10	16	6	39	60	70
42 x 29	0.079	12	18	8	46	75	85
49 x 33	0.109	13	21	9	53	85	103
57 x 38	0.109	18	26	12	63	90	108
64 x 43	0.109	18	30	12	70	102	120
71 x 47	0.109	18	33	12	77	114	132

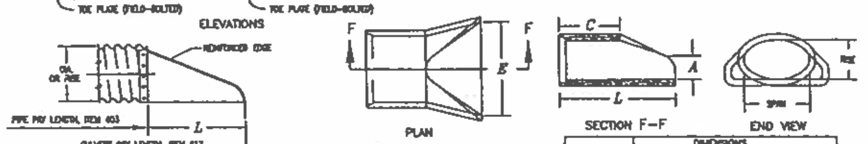


GENERAL NOTES

1. DIMENSIONS OF END SECTIONS MAY VARY SLIGHTLY FROM THOSE SHOWN ON THE TABLES DUE TO DIFFERENT MANUFACTURER'S VARIATIONS.
2. CONCRETE END SECTIONS ARE TO BE FURNISHED WITH TONGUE OR GROOVE AS REQUIRED.
3. DESIGN LENGTH OF CULVERT OR SIDE DRAIN IS BASED ON LENGTH OF END SECTION SHOWN IN TABLE. ANY ADDITIONAL PIPE REQUIRED TO PROVIDE THE DESIGN LENGTH SHALL BE FURNISHED BY AND AT THE EXPENSE OF THE CONTRACTOR.
4. INSIDE CONFIGURATION AND JOINT OF CONCRETE END SECTION AND PIPE SHALL MATCH.
5. END SECTIONS FOR CMP ARCH CULVERT SHALL MATCH THE DIMENSIONS OF THE CULVERT SHOWN ON THE PLANS.
7. GALVANIZED TOE PLATE AS SHOWN, WILL BE REQUIRED ON END SECTIONS FOR CORRUGATED STEEL PIPE AND SHALL BE THE SAME THICKNESS AS END SECTIONS. TOE PLATE SHALL BE FIELD-BOLTED TO END SECTION WITH 3/8" GALVANIZED BOLTS, NUTS AND WASHERS.
8. GALVANIZED STEEL SHALL BE IN CONFORMANCE WITH AASHTO M 111, M 218 OR M 232.
9. FOR TYPE SD END SECTIONS, BARS SHALL BE FABRICATED FROM NPS-3 GALVANIZED STEEL SCHEDULE 40 PIPE WHICH SHALL BE IN CONFORMANCE WITH ASTM A 53.
10. FOR A TYPE SD END SECTION, THE INSTALLATION OF ALTERNATIVE 1 OR ALTERNATIVE 2 END SECTION SHALL BE THE CONTRACTOR'S OPTION.
11. CONCRETE PIPE JOINT FASTENERS, WHERE SHOWN ON PLANS, SHALL BE INSTALLED SO THAT A MINIMUM OF 15 LINEAR FEET OF THE OUTLET END OF THE PIPE ARE MECHANICALLY LOCKED TOGETHER. END SECTION LENGTHS, WHEN USED, WILL BE INCLUDED IN THE 15 LF REQUIREMENT.
12. CONNECTIONS OF METAL END SECTIONS TO PLASTIC PIPE SHALL BE APPROVED BY THE ENGINEER.



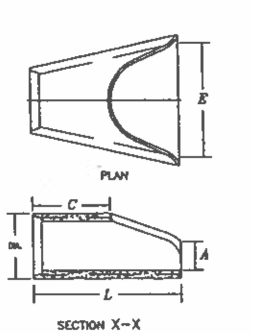
TYPICAL CONNECTIONS



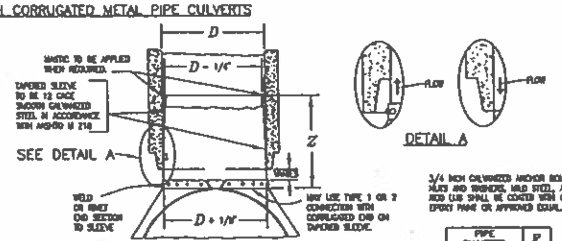
END SECTION AND CONNECTION DETAILS FOR ROUND AND ARCH CORRUGATED METAL PIPE CULVERTS

REINFORCED CONCRETE PIPE

PIPE I.D.	A	C	L	E
	(inches)			
18	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]	[illegible]	[illegible]	[illegible]
36	[illegible]	[illegible]	[illegible]	[illegible]
42	[illegible]	[illegible]	[illegible]	[illegible]
48	[illegible]	[illegible]	[illegible]	[illegible]
54	[illegible]	[illegible]	[illegible]	[illegible]
60	[illegible]	[illegible]	[illegible]	[illegible]
72	[illegible]	[illegible]	[illegible]	[illegible]



END SECTION FOR REINFORCED CONCRETE CIRCULAR PIPE



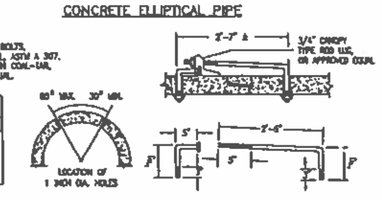
D	Z (MIN.)
(INCHES)	
18 - 24	12
30 & 36	16
42 & LARGER	24

STEEL END SECTION FOR CONCRETE PIPE
(ALTERNATIVE FOR CONCRETE END SECTION)

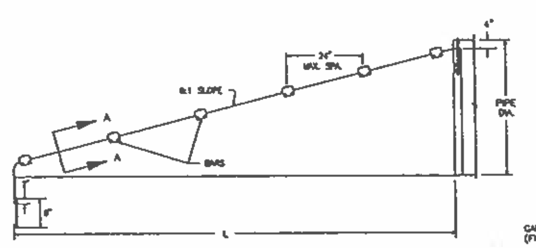
END SECTION FOR REINFORCED CONCRETE ELLIPTICAL PIPE

EQUIVALENT CIRCULAR DIA.	NOMINAL SPAN x RISE	A	C	L	E
	(inches)				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

PIPE DIAMETER	F
(inches)	
18 - 30	5
36 - 42	6
48 - 60	7
72 - 84	8



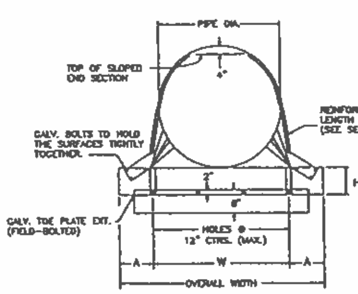
CONCRETE JOINT FASTENER
(TWO PER JOINT)



SIDE VIEW OF END SECTION – ALTERNATIVE 1

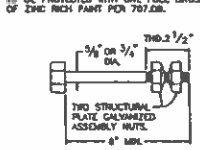
END SECTIONS FOR CIRCULAR PIPES

PIPE DIA. (in.)	MIN. THICK (in.)	A	H	W	OVERALL WIDTH	SLOPE	LENGTH L
		DIMENSION (INCHES)					
15	.064	6	6	21	37	6:1	30
18	.064	6	6	24	40	6:1	48
21	.064	6	6	27	43	6:1	66
24	.079	6	6	30	46	6:1	84
30	.079	12	9	36	60	6:1	120
36	.109	12	9	42	66	6:1	156

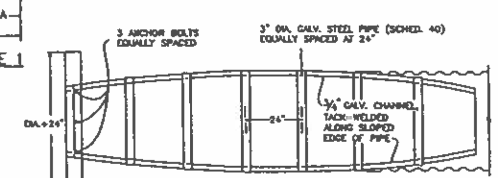


FRONT VIEW – ALTERNATIVE 1
(BARS NOT SHOWN)

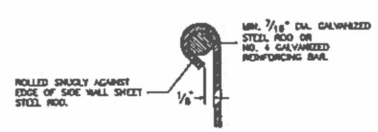
NOTE:
ALL CUT AND/OR WELDED SURFACES TO BE PROTECTED WITH ONE FULL BRUSH COAT OF ZINC RICH PAINT PER 707.08.



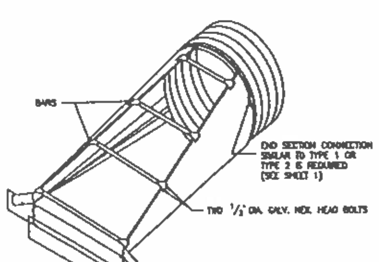
TYPICAL ANCHOR BOLT
(GALVANIZED)



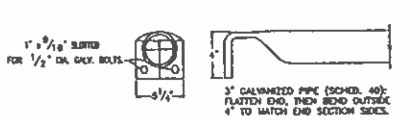
TOP VIEW – ALTERNATIVE 2



SECTION A-A

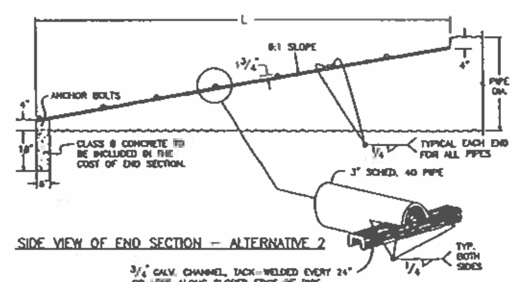


ALTERNATIVE 1



BAR END DETAILS
(FOR ALTERNATIVE 1)

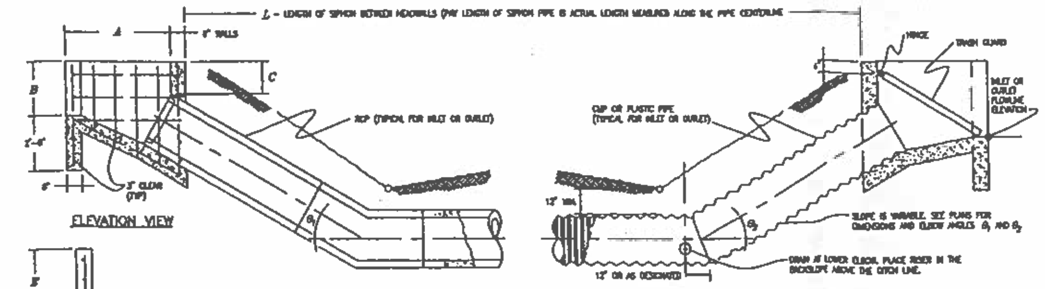
TYPE SD END SECTIONS FOR SIDE DRAIN

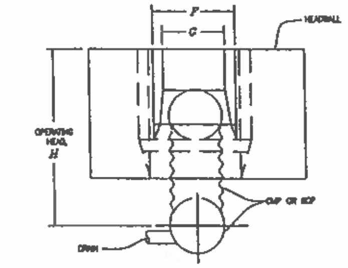


SIDE VIEW OF END SECTION – ALTERNATIVE 2

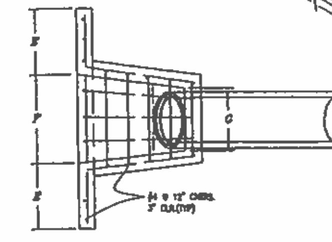
BAR END DETAIL
(FOR ALTERNATIVE 2)

M–603–10
NTS





END VIEW



PLAN VIEW

HEADWALL DIMENSIONS

PIPE DIAMETER INCHES	A	B	C	E	F	G
12	2'-0"	1'-6"	0'-6"	1'-6"	3'-0"	1'-6"
18	3'-9"	2'-0"	1'-2"	2'-3"	3'-0"	2'-1"
24	5'-0"	2'-6"	1'-6"	3'-0"	4'-0"	2'-8"
30	6'-3"	3'-0"	1'-11"	3'-6"	5'-0"	3'-3"
36	7'-6"	3'-6"	2'-3"	4'-6"	6'-0"	3'-10"

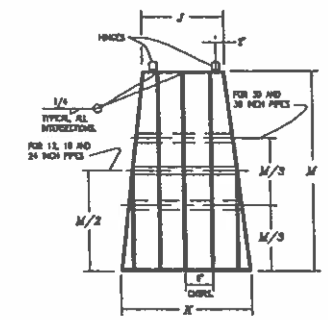
HEADWALL QUANTITIES

PIPE DIAMETER INCHES	CONCRETE CU. YDS.	REINF. STEEL LBS.
12	0.82	56
18	1.17	86
24	1.82	140
30	2.73	203
36	3.74	273

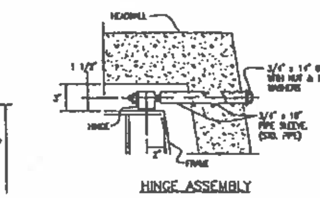
QUANTITIES FOR ONE HEADWALL AFTER DEDUCTION FOR PIPE.

GENERAL NOTES

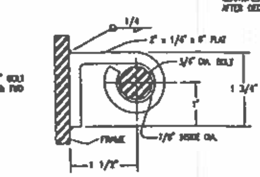
1. SIPHON DRAIN, VALVE AND VALVE BOX, AND TRASH GUARDS ARE TO BE PROVIDED ONLY WHEN CALLED FOR ON THE PLANS.
2. CONCRETE SHALL BE CLASS B.
3. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED 3/4".
4. THE LOCATION, SIZE, PIPE MATERIAL AND GOVERNING DIMENSIONS OF SIPHONS WILL BE SHOWN ON THE PLANS.
5. TO DETERMINE WALL THICKNESS OR CLASS FOR SIPHON PIPE, SEE APPROPRIATE TABLES ON STANDARD PLANS M-603.
6. COST OF JOINT SEALERS, GASKETS, FITTINGS AND CONNECTIONS SHALL BE INCLUDED IN THE BID PRICE FOR SIPHON PIPE.
7. TRASH GUARDS AND APPURTENANCES SHALL BE GALVANIZED IN ACCORDANCE WITH AASHTO M 111.
8. ALSO APPLICABLE TO M-603.



TRASH GUARD DETAILS



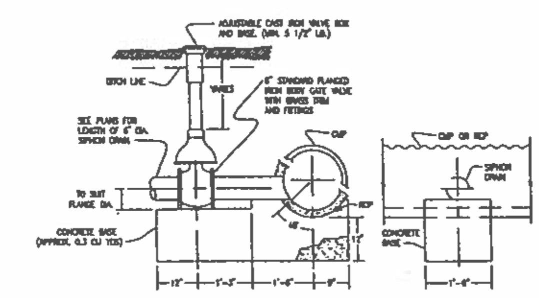
HINGE ASSEMBLY



HINGE

TRASH GUARD DIMENSIONS AND QUANTITIES

PIPE DIAMETER INCHES	BAR AND BRACE SIZE	NO. OF BRACES EACH	J	K	M	WEIGHT LBS.
12	3/8" x 2"	1	1'-0"	1'-6"	2'-6"	25.1
18	3/8" x 2"	1	1'-7"	2'-6"	3'-10"	74.4
24	3/8" x 2"	1	2'-2"	3'-6"	5'-2"	120.5
30	3/8" x 2 1/2"	2	2'-6"	4'-6"	6'-6"	126.9
36	3/8" x 2 1/2"	2	3'-4"	5'-6"	7'-10"	317.8



DRAIN DETAILS

NOTE: M-616-1 SHOWN TO DEPICT TRASH GUARD ONLY

M–616–1
NTS

REVIEW:
Drainage Design:
Drainage Basin Filed in Accordance with Section 7.7.906 of Colorado Springs 2001, As Amended

____________________ Date __________

48 HOURS BEFORE YOU DIG CALL UTILITY LOCATORS
1-800-922-1987
City of Colorado Springs Dept. of Utilities Gas, Electric, Water and Wastewater
The locations of existing underground utilities are shown in an approximate way only. The contractor shall determine the exact location of all existing utilities before commencing work. The contractor shall be fully responsible for any and all damages which might be caused by his failure to exactly locate and preserve any and all underground utilities.

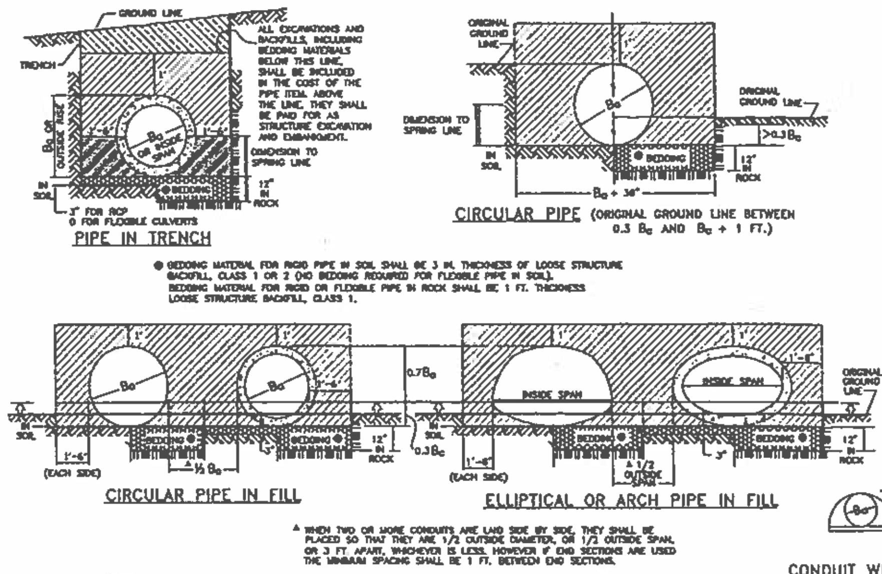
BANNING LEWIS RANCH

TCB
Engineers · Planners · Project Managers

DRAINAGE DETAILS

NO.	DATE	REVISION	BY
7	1/20/06	POND 93 AND 95 OUTFALL CONSTRUCTION REVISION	TCB

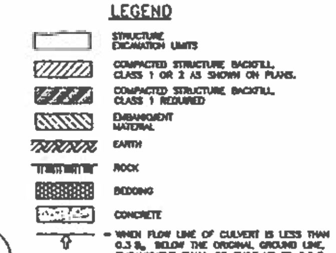
Unit: LDS	Scale: Horz. NONE Vert. NONE	Date: FEBRUARY 14, 2005
Designed: CLK	Checked: PWM	Job No. 251395
Drawn: BJW	Approved: PWM	Sheet 39 of 41

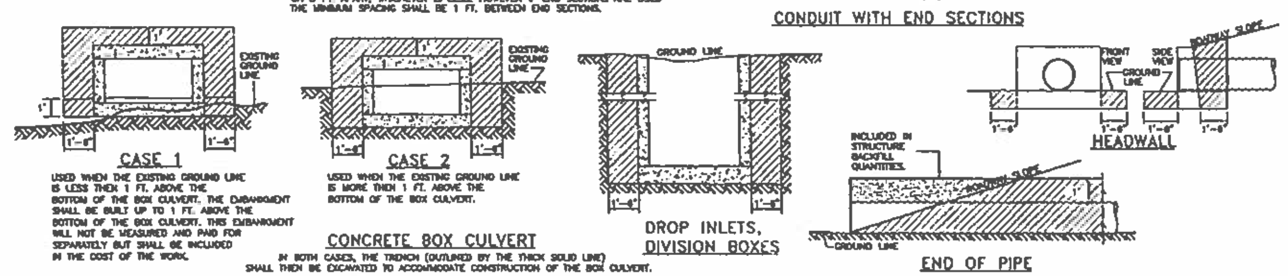


GENERAL NOTES

1. EXCAVATION AND BACKFILL PATTERNS DIFFERENT FROM THOSE INDICATED ON THESE SHEETS WILL BE SHOWN ELSEWHERE ON THE PLANS.
2. EXCAVATION FOR CHANNEL CHANGE OR CHANNEL IMPROVEMENT WILL BE EITHER UNCLASSIFIED EXCAVATION OR MUCK EXCAVATION AND WILL BE NOTED ON THE PLANS. EXCAVATION FROM THE CHANNEL FLOWLINE TO THE DEPTH REQUIRED FOR THE NEW STRUCTURE AND INCIDENTAL CHANNEL EXCAVATION WILL BE PAID FOR AS STRUCTURE EXCAVATION.
3. STRUCTURE FOOTINGS WHICH ARE LOCATED IN ROCK SHALL BE POURED OUT TO UNDISTURBED ROCK WITHOUT FORMING, ALL IN CONFORMANCE WITH 601.08.
4. STRUCTURAL PLATE CULVERTS WILL BE AS SHOWN IN THE PLANS.
5. B_i EQUALS THE INSIDE DIAMETER OF A PIPE AND B_c EQUALS THE OUTSIDE DIAMETER OF A PIPE. FOR THIN WALLED PIPES, IT IS ASSUMED THAT $B_c = B_i$.
6. STRUCTURE EXCAVATION AND BACKFILL QUANTITIES WILL BE COMPUTED AND SHOWN IN THE PLANS, FOR INFORMATION ONLY.

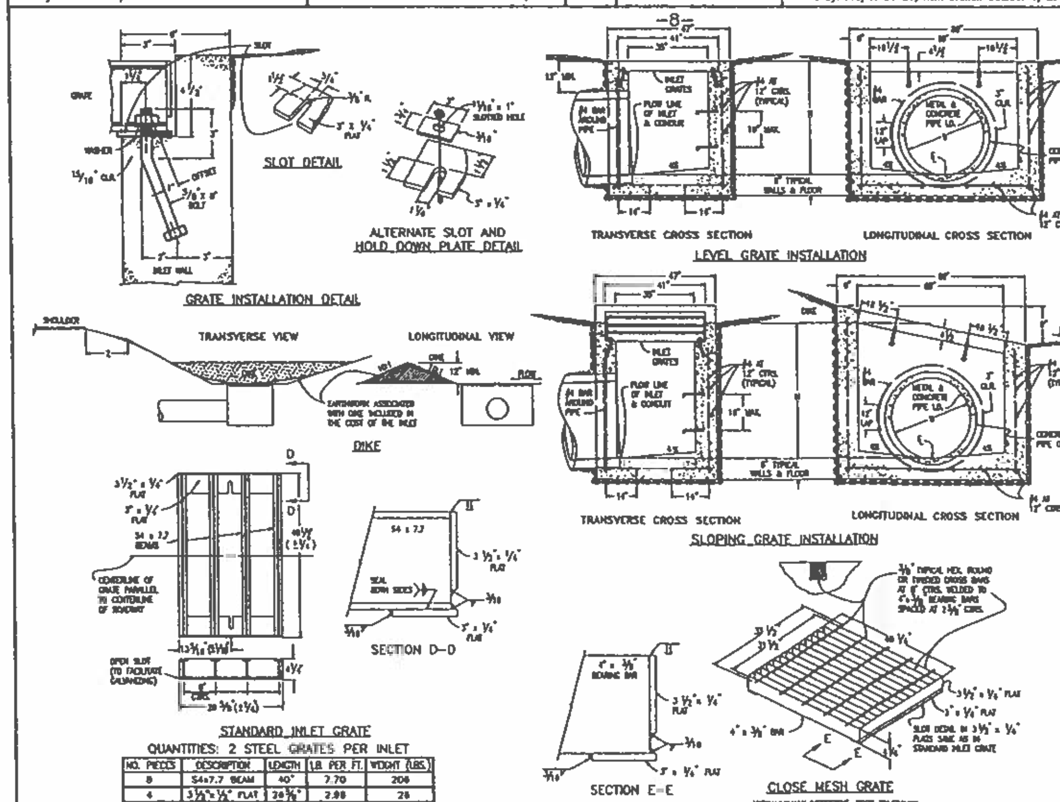
LEGEND

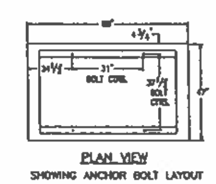




IN BOTH CASES, THE TRENCH (OUTLINED BY THE THICK SOLID LINE) SHALL THEN BE EXCAVATED TO ACCOMMODATE CONSTRUCTION OF THE BOX CULVERT.

Colorado Department of Transportation	Computer File Information	Standard Plan Revised	EXCAVATION & BACKFILL FOR STRUCTURES	STANDARD PLAN NO. M-206-1
Project Development Branch SD			Issued By: Project Development Branch October 1, 2000	Sheet No. 1 of 2





OUTLET PIPE D	MIN. H
1.5	3.0
2.0	3.0
2.5	3.5
3.0	4.0
3.5	4.5
4.0	5.0

GENERAL NOTES

1. CONCRETE SHALL BE CLASS B INLET. MAY BE CAST-IN-PLACE OR PRECAST.
   SEE PLANS FOR SIZE AND LOCATION OF CONDUIT.
2. STRUCTURAL STEEL FOR GRATES AND GRATE INSTALLATION HARDWARE SHALL BE GALVANIZED AND SHALL BE IN ACCORDANCE WITH 712.06.
3. STANDARD INLET GRATES SHALL BE USED ON ALL TYPE D INLETS UNLESS CLOSE MESH GRATES ARE SPECIFIED ON THE PLANS.
4. STEPS SHALL BE PROVIDED WHEN INLET DIMENSION "H" EXCEEDS 3'-6" AND SHALL BE IN ACCORDANCE WITH AASHTO M 199.
5. REINFORCING BARS SHALL BE EPOXY COATED, AND DEFORMED, AND SHALL HAVE A 2" MINIMUM CLEARANCE.

STANDARD INLET GRATE

QUANTITIES: 2 STEEL GRATES PER INLET

NO. PIECES	DESCRIPTION	LENGTH	LB. PER FT.	WEIGHT (LBS.)
8	S4x7.7 BEAM	40"	7.70	206
4	3½"x ½" FLAT	30⅝"	2.98	28
4	3"x ½" FLAT	30⅝"	2.55	24
				TOTAL 258 LBS.

QUANTITIES FOR ONE INLET

H FT.	CONCRETE CU. YD. ▼	STEEL LB. ▼	PIPE RANGE, D IN. CSP	RCP
3.0	1.5	127	18	18
3.5	1.7	148	18–24	18–24
4.0	1.9	157	18–30	18–30
4.5	2.0	178	18–36	18–36
5.0	2.2	187	18–42	18–42
5.5	2.4	208	18–	18–
6.0	2.6	215	18–	18–
6.5	2.8	236	18–	18–
7.0	2.9	243	18–	18–
7.5	3.1	264	18–	18–
8.0	3.3	271	18–	18–
8.5	3.5	292	18–	18–
9.0	3.6	299	18–	18–
9.5	3.8	320	18–	18–
10.0	4.0	327	18–42	18–42

▼ CONCRETE AND STEEL QUANTITIES ARE FOR ONE ENTIRE INLET BEFORE DEDUCTION FOR VOLUME OCCUPIED BY PIPE. WEIGHT OF STEEL INCLUDES A RING FOR THE MAXIMUM PIPE DIAMETER.

Colorado Department of Transportation	Computer File Information	Standard Plan Revised	INLET, TYPE D	STANDARD PLAN NO. M-604-11
Project Development Branch SD			Issued By: Project Development Branch October 1, 2000	Sheet No. 1 of 1

REVIEW:
Drainage Design:
Drainage Basin Filed in Accordance with Section 7.7.906 of Colorado Springs 2001, As Amended

______________ Date ______________

48 HOURS BEFORE YOU DIG CALL UTILITY LOCATORS
1-800-922-1987
City of Colorado Springs Dept. of Utilities Gas, Electric, Water and Wastewater

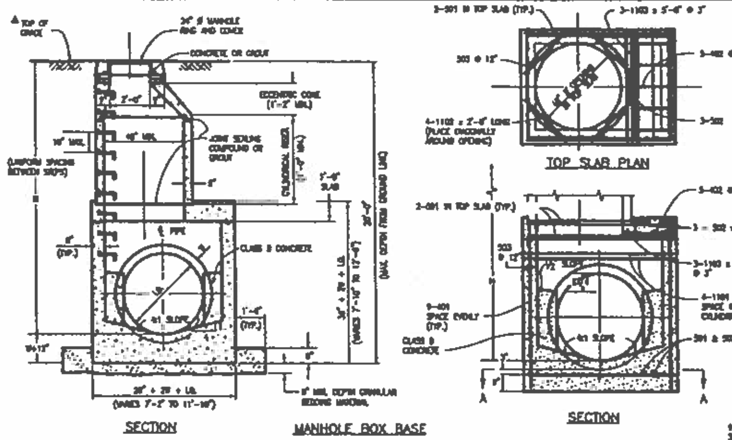
BANNING LEWIS RANCH

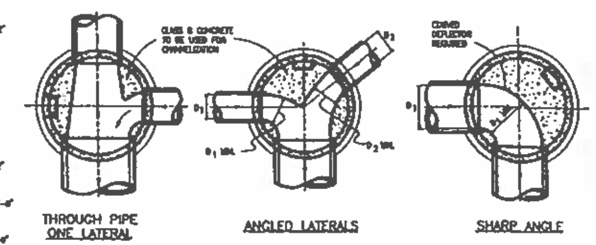
TCB

DRAINAGE DETAILS

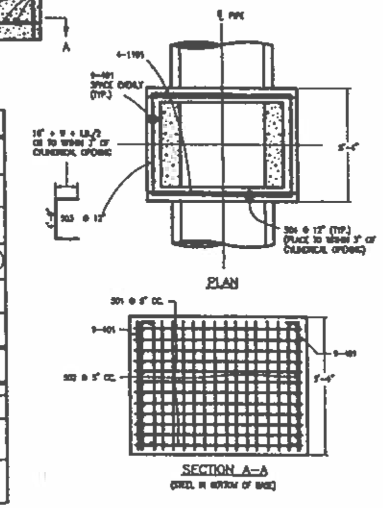
NO.	DATE	REVISION	BY
7	2/20/06	POND 93 AND 95 OUTFALL CONSTRUCTION REVISION	TCB

Unit: LDS	Scale: Horz. NONE Vert. NONE	Date: FEBRUARY 14, 2005
Designed: CLK	Checked: PWM	Job No. 251395
Drawn: BJM	Approved: PWM	Sheet 40 of 41





TYPICAL CHANNELIZATION DETAILS



GENERAL NOTES

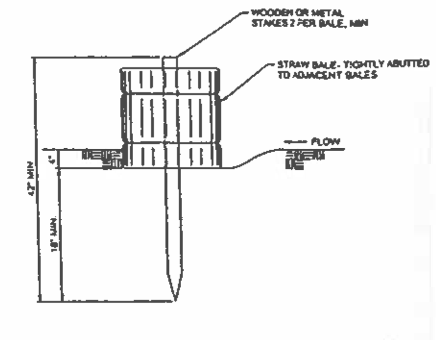
1. SINCE ALL PIPE ENTRIES INTO THE BASE ARE VARIABLE, THE DIMENSIONS SHOWN ARE TYPICAL. ACTUAL DIMENSIONS AND QUANTITIES FOR CONCRETE AND REINFORCEMENT SHALL BE AS REQUIRED BY THE WORK.
2. THE PRECAST FLAT TOP MAY BE USED ON ANY MANHOLE. THE ECCENTRIC CONE MAY BE USED WHEN THE MANHOLE "H" HEIGHT IS AT LEAST 8 FT.
3. THE 1R RING (FRAME) SHALL BE SET IN A BED OF GROUT. THE FRAME SHALL BE SURROUNDED WITH A CEMENT GROUT IN UNPAVED AREA, OR A CONCRETE COLLAR IN PAVED AREA. SEE DETAILS ON SHEETS 2 AND 3.
4. DESIGN OF BOX BASE IS BASED ON STRAIGHT RUNS OF CONDUIT OR CHANGE IN DIRECTION OF LESS THAN 45°. SPECIAL DESIGN IS REQUIRED FOR 45° OR GREATER.
5. PRECAST MANHOLES AND REINFORCEMENT SHALL CONFORM TO ASTM C 478 (AASHTO M 199).
6. CAST-IN-PLACE MANHOLES SHALL BE CLASS B CONCRETE.
7. STEPS SHALL BE REQUIRED WHEN THE MANHOLE DEPTH EXCEEDS 3 FT.-6 IN. AND SHALL BE IN ACCORDANCE WITH AASHTO M 199.
8. ALL REINFORCING STEEL SHALL HAVE A MINIMUM YIELD STRENGTH OF 60,000 PSI. VERTICAL STEEL SHALL BE PLACED AT ℄ OF WALL. ALL BARS SHALL HAVE A 2 MINIMUM CLEARANCE.
9. ALL PIPE ENTRIES INTO THE BASE OF MANHOLE SHALL BE CONNECTED BY OPEN CHANNELIZATION ADJUSTED FOR PIPE SIZE, SHAPE, SLOPE, AND DIRECTION OF FLOW. DETAILS SHOWN ARE TYPICAL FOR INSTALLATIONS WITH ALL INVERTS OF SAME RELATIVE ELEVATION. FOR EXCESSIVE ELEVATION DIFFERENCE BETWEEN INVERTS, SPECIAL BASE/CHANNEL DETAILS WILL BE SHOWN ON THE PLANS.
10. FLOW CHANNELS AND INVERTS SHALL BE FORMED BY SHAPING WITH CLASS B CONCRETE OR APPROVED GROUT.
11. STUB-OUTS SHALL EXTEND 2 FT. MINIMUM BEYOND OUTSIDE WALL SURFACE OF MANHOLE AND BE SATISFACTORILY PLUGGED.
12. CHECK WITH THE LOCAL GOVERNMENT AUTHORITY FOR ANY ADDITIONAL SANITARY SEWER SPECIFICATIONS, DETAILS, OR REGULATIONS.
13. THE SLOPE OF THE MANHOLE COVER SHALL MATCH THE ROADWAY PROFILE AND CROSS SLOPE.

QUANTITIES FOR CONCRETE MANHOLE BOX BASE

MARK	SIZE	TYPE	WT. #/FT.	BARS	I.D. 54"	60"	66"	72"	84"	96"	FORMULAS
401	4	I	0.668	NO. REQ'D. LENGTH WEIGHT #	18 8'-1" 97.2	18 8'-8" 104.2	18 9'-3" 111.2	18 9'-10" 118.2	18 11'-0" 132.3	18 12'-2" 146.3	401 BAR LENGTH = 32"+2W+I.D.
402	4	II	0.668	NO. REQ'D. LENGTH WEIGHT #	5 5'-5" 18.1	5 6'-0" 20.0	5 6'-7" 22.0	5 7'-2" 23.9	5 8'-4" 27.8	5 9'-6" 31.7	402 BAR LENGTH = I.D. + 2W
501	5	I	1.043	NO. REQ'D. LENGTH WEIGHT #	17 7'-5" 131.5	17 8'-0" 141.8	17 8'-7" 152.2	17 9'-2" 162.5	17 10'-4" 183.2	17 11'-6" 203.9	501 BAR LENGTH = 24" + I.D. + 2W
502	5	I	1.043	NO. REQ'D. LENGTH WEIGHT #	22 5'-0" 114.7	23 5'-0" 119.9	25 5'-0" 130.4	26 5'-0" 135.6	29 5'-0" 151.2	32 5'-0" 166.9	502 NUMBER BARS REQ'D. = $3 + \left(\frac{24+I.D.+2W}{6}+1\right)$
503	5	II	1.043	NO. REQ'D. LENGTH WEIGHT #	16 12'-10" 214.2	16 13'-5" 223.9	18 14'-0" 262.8	18 14'-7" 273.8	20 15'-9" 328.5	24 16'-11" 423.5	503 NUMBER BARS REQ'D. = $2\left(\frac{12+I.D.+2W}{12}+1\right)$ BAR LENGTH = 4'-0"+2(18+W+I.D./2)
504	5	I	1.043	NO. REQ'D. LENGTH WEIGHT #	12 8'-1" 101.2	14 8'-8" 126.6	14 9'-3" 135.1	16 9'-10" 164.1	18 11'-0" 206.5	20 12'-2" 253.8	504 NUMBER BARS REQ'D. = $2\left(\frac{2W+I.D.-4}{12}+1\right)$ BAR LENGTH = 32"+2W+I.D.
1101	11	I	5.313	NO. REQ'D. LENGTH WEIGHT #	4 7'-2" 152.3	4 7'-9" 164.7	4 8'-4" 177.1	4 8'-11" 189.5	4 10'-1" 214.3	4 11'-3" 239.1	1101 BAR LENGTH = 21" + I.D. + 2W
1102	11	I	5.313	NO. REQ'D. LENGTH WEIGHT #	4 2'-8" 56.7	4 2'-8" 56.7	4 2'-8" 56.7	4 2'-8" 56.7	4 2'-8" 56.7	4 56.7 2'-8"	BENDING TYPE I — STRAIGHT
1103	11	I	5.313	NO. REQ'D. LENGTH WEIGHT #	3 5'-0" 79.7	3 5'-0" 79.7	3 5'-0" 79.7	3 5'-0" 79.7	3 5'-0" 79.7	3 5'-0" 79.7	TYPE II — 4'-0"; 6"+W+I.D./2
REINFORCING STEEL TOTAL #					965.6	1,037.5	1,127.2	1,204.8	1,365.3	1,491.8	TYPE III — 12"; 12"; 3"; I.D.+2W-36"
CONCRETE - CUBIC YARDS - TOTAL					6.0	6.6	7.3	8.0	9.5	11.1	

NOTE: QUANTITIES ARE BASED ON SAME SIZE PIPE ENTRANCE TO AND EXIT FROM BASE AND A 4 FT. MANHOLE ENTRANCE INTO TOP SLAB OF BASE.

Colorado Department of Transportation 4201 East Arkansas Avenue Denver, Colorado 80222 Phone: (303) 757-9083 FAX: (303) 757-9820 Project Development Branch SD	Computer File Information Drawing File Name: 6040200103.dwg Acad Version: R14 Scale: NA Units: English	Standard Plan Revised Date / Comments	MANHOLES Issued By: Project Development Branch October 1, 2000
			STANDARD PLAN NO. M-604-20 Sheet No. 1 of 3



STRAW BALE BARRIER

NTS

STRAW BALE BARRIER NOTES

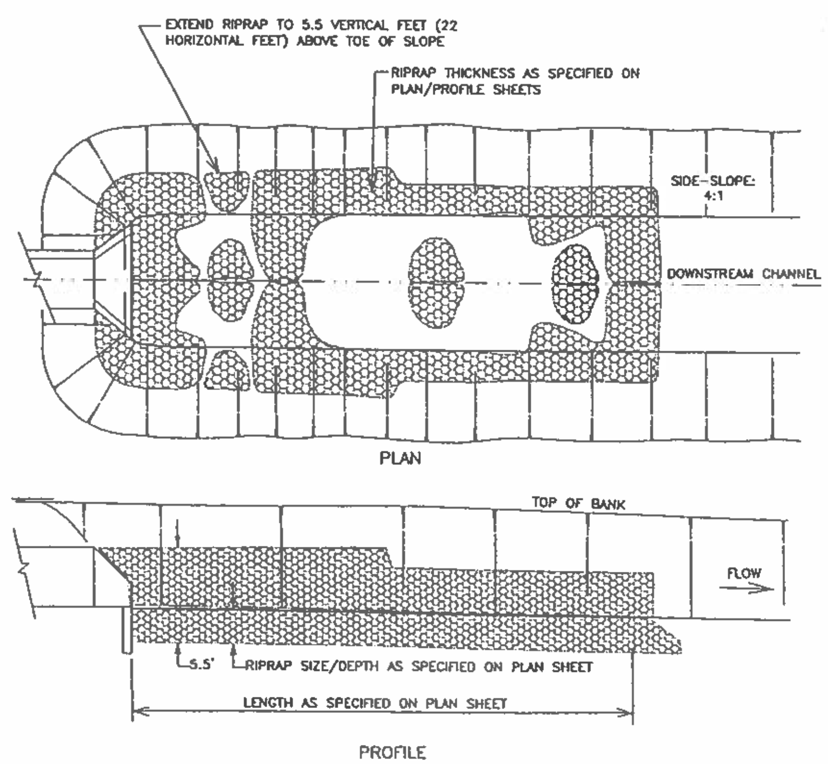
INSTALLATION REQUIREMENTS

1. STRAW BALE BARRIERS SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.
2. BALES SHALL CONSIST OF APPROXIMATELY 5 CUBIC FEET OF CERTIFIED WEED FREE HAY OR STRAW AND WEIGH NOT LESS THAN 35 POUNDS.
3. BALES ARE TO BE PLACED IN A SINGLE ROW WITH THE END OF THE BALES TIGHTLY ABUTTING ONE ANOTHER.
4. EACH BALE IS TO BE SECURELY ANCHORED WITH AT LEAST TWO STAKES AND THE FIRST STAKE IS TO BE DRIVEN TOWARD THE PREVIOUSLY LAID BALE TO FORCE THE BALES TOGETHER.
5. STAKES ARE TO BE A MINIMUM OF 42 INCHES LONG. METAL STAKES SHALL BE STANDARD "T" OR "U" TYPE WITH MINIMUM WEIGHT OF 1.33 POUNDS PER LINEAR FOOT. WOOD STAKES SHALL HAVE A MINIMUM DIAMETER OR CROSS SECTION DIMENSION OF 2 INCHES.
6. BALES ARE TO BE BOUND WITH EITHER WIRE OR STRING AND ORIENTED SUCH THAT THE BINDINGS ARE AROUND THE SIDES AND NOT ALONG THE TOPS AND BOTTOMS OF THE BALE.
7. GAPS BETWEEN BALES ARE TO BE CHINKED (FILLED BY WEDGING) WITH STRAW OR THE SAME MATERIAL OF THE BALE.
8. END BALES ARE TO EXTEND UPSLOPE SO THE TRAPPED RUNOFF CANNOT FLOW AROUND THE ENDS OF THE BARRIER.

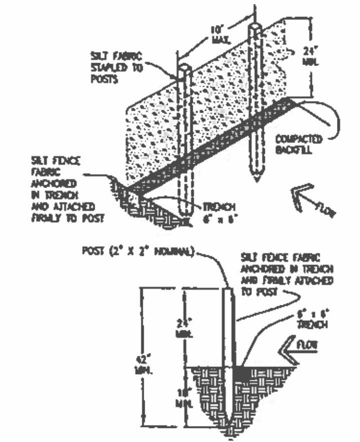
MAINTENANCE REQUIREMENTS

1. CONTRACTOR SHALL INSPECT STRAW BALE BARRIERS IMMEDIATELY AFTER EACH RAINFALL, AT LEAST DAILY DURING PROLONGED RAINFALL, AND WEEKLY DURING PERIODS NO RAINFALL.
2. DAMAGED OR INEFFECTIVE BARRIERS SHALL PROMPTLY BE REPAIRED, REPLACING BALES IF NECESSARY, AND UNENTRENCHED BALES NEED TO BE REPAIRED WITH COMPACTED BACKFILL MATERIAL.
3. SEDIMENT SHALL BE REMOVED FROM BEHIND STRAW BALE BARRIERS WHEN IT ACCUMULATES TO APPROXIMATELY 1/2 THE HEIGHT OF THE BARRIER.
4. STRAW BALE BARRIERS SHALL BE REMOVED WHEN ADEQUATE VEGETATIVE COVER IS ATTAINED AS APPROVED BY THE CITY.

City of Colorado Springs Stormwater Quality	Figure SBB-2 Straw Bale Barrier Construction Detail and Maintenance Requirements



CULVERT OUTLET EROSION PROTECTION DETAIL



SILT FENCE

SILT FENCE NOTES

INSTALLATION REQUIREMENTS

1. SILT FENCES SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.
2. WHEN JOINTS ARE NECESSARY, SILT FENCE GEOTEXTILE SHALL BE SPLICED TOGETHER ONLY AT SUPPORT POST AND SECURELY SEALED.
3. METAL POSTS SHALL BE "STUDDED TEE" OR "U" TYPE WITH MINIMUM WEIGHT OF 1.33 POUNDS PER LINEAR FOOT. WOOD POSTS SHALL HAVE A MINIMUM DIAMETER OR CROSS SECTION DIMENSION OF 2 INCHES.
4. THE FILTER MATERIAL SHALL BE FASTENED SECURELY TO METAL OR WOOD POSTS USING WIRE TIES, OR TO WOOD POSTS WITH 3/4" LONG #9 HEAVY-DUTY STAPLES. THE SILT FENCE GEOTEXTILE SHALL NOT BE STAPLED TO EXISTING TREES.
5. WHILE NOT REQUIRED, WIRE MESH FENCE MAY BE USED TO SUPPORT THE GEOTEXTILE. WIRE FENCE SHALL BE FASTENED SECURELY TO THE UPSLOPE SIDE OF THE POSTS USING HEAVY DUTY WIRE STAPLES AT LEAST 3/4" LONG, TIE WIRES OR HOG RINGS. THE WIRE SHALL EXTEND INTO THE TRENCH A MINIMUM OF 6" AND SHALL NOT EXTEND MORE THAN 3" ABOVE THE ORIGINAL GROUND SURFACE.
6. ALONG THE TOE OF FILLS, INSTALL THE SILT FENCE ALONG A LEVEL CONTOUR AND PROVIDE AN AREA BEHIND THE FENCE FOR RUNOFF TO POND AND SEDIMENT TO SETTLE. A MINIMUM DISTANCE OF 5 FEET FROM THE TOE OF THE FILL IS RECOMMENDED.
7. THE HEIGHT OF THE SILT FENCE FROM THE GROUND SURFACE SHALL BE MINIMUM OF 24 INCHES AND SHALL NOT EXCEED 36 INCHES; HIGHER FENCES MAY IMPOUND VOLUMES OF WATER SUFFICIENT TO CAUSE FAILURE OF THE STRUCTURE.

MAINTENANCE REQUIREMENTS

1. CONTRACTOR SHALL INSPECT SILT FENCES IMMEDIATELY AFTER EACH RAINFALL, AT LEAST DAILY DURING PROLONGED RAINFALL, AND WEEKLY DURING PERIODS OF NO RAINFALL. DAMAGED, COLLAPSED, UNENTRENCHED OR INEFFECTIVE SILT FENCES SHALL BE PROMPTLY REPAIRED OR REPLACED.
2. SEDIMENT SHALL BE REMOVED FROM BEHIND SILT FENCE WHEN IT ACCUMULATES TO HALF THE EXPOSED GEOTEXTILE HEIGHT.
3. SILT FENCES SHALL BE REMOVED WHEN ADEQUATE VEGETATIVE COVER IS ATTAINED AS APPROVED BY THE CITY.

City of Colorado Springs Stormwater Quality	Figure SF-2 Silt Fence Construction Detail and Maintenance Requirements

REVIEW:
Drainage Design:
Drainage Basin Filed in Accordance with Section 7.7.906 of Colorado Springs 2001, As Amended

________________ Date ________

48 HOURS BEFORE YOU DIG CALL UTILITY LOCATORS
1-800-922-1987
City of Colorado Springs Dept. of Utilities Gas, Electric, Water and Wastewater
The locations of existing underground utilities are shown in an approximate way only. The contractor shall determine the exact location of all existing utilities before commencing work. The contractor shall be fully responsible for any and all damages which might be caused by his failure to exactly locate and preserve any and all underground utilities.

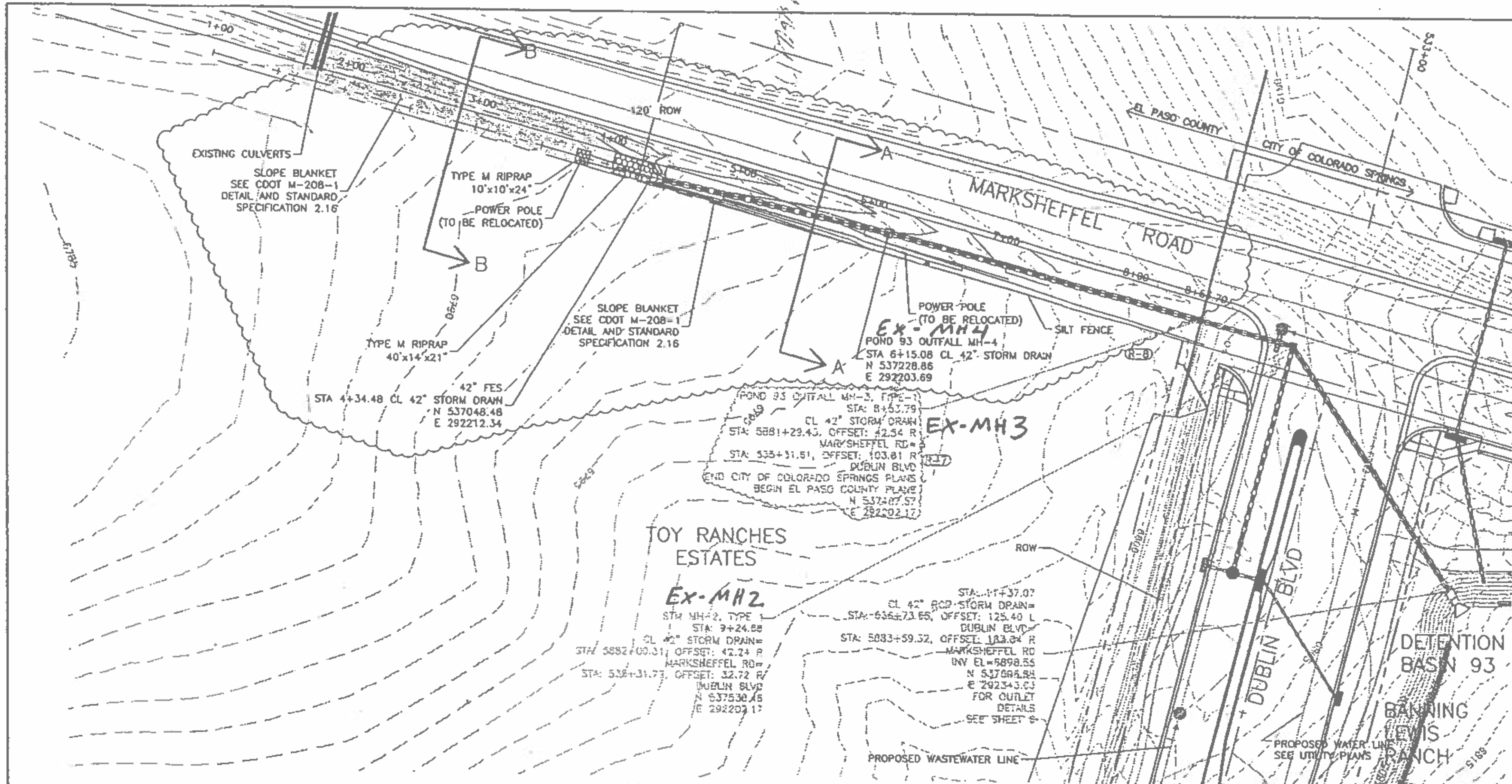
BANNING LEWIS RANCH

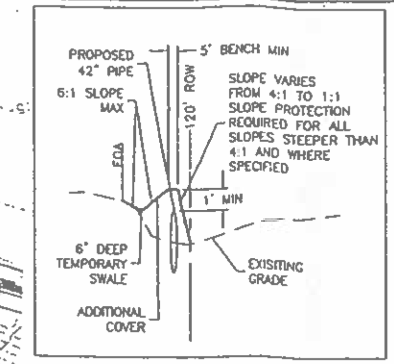
TCB
Engineers • Planners • Project Managers

DRAINAGE DETAILS

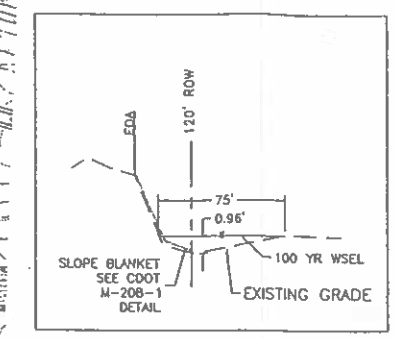
NO.	DATE	REVISION	BY
7	2/20/06	POND 93 AND 95 OUTFALL CONSTRUCTION REVISION	TCB

Unit: LDS	Scale: Horz. NONE Vert. NONE	Date: FEBRUARY 14, 2005
Designed: CLK	Checked: PWM	Job No. 251395

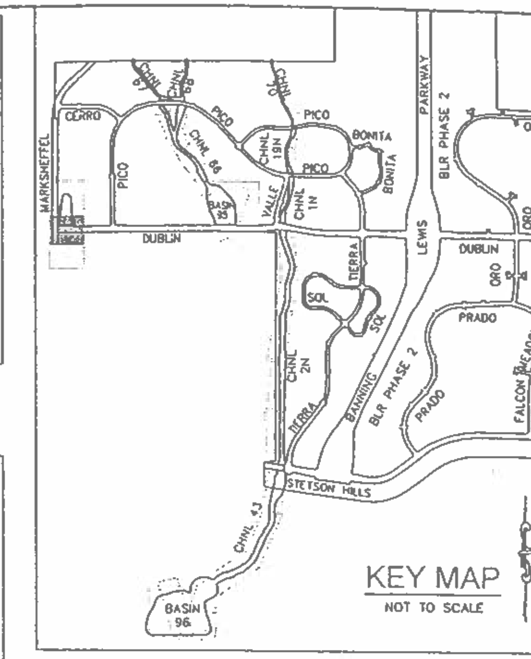




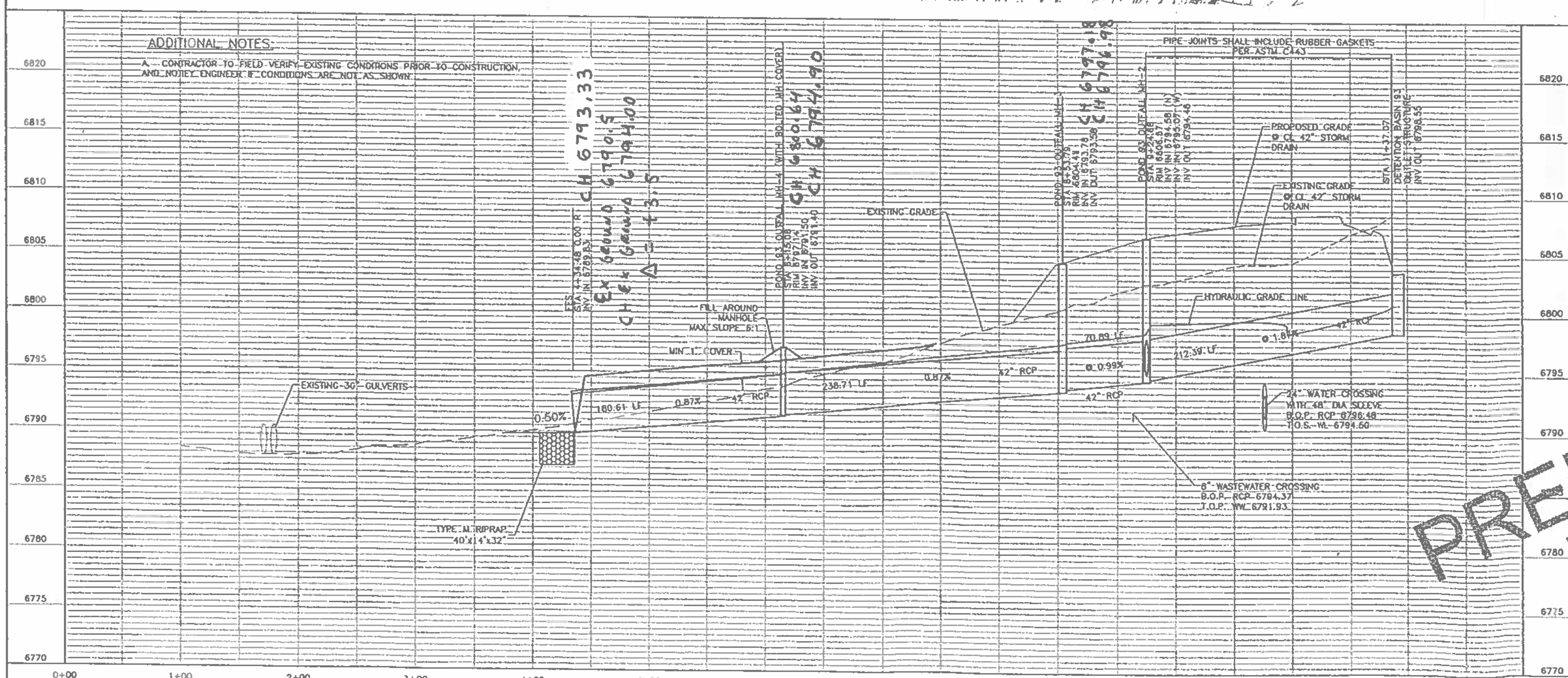
SECTION A-A (NTS)



SECTION B-B (NTS)



50 0 25 50 100
ORIGINAL SCALE 1" = 50'



NOTES:

1. SEE COLORADO DEPARTMENT OF TRANSPORTATION STANDARD DRAWINGS 601-1,601-2,601-3,601-10, AND 601-20 FOR ALL CONCRETE HEADWALL, WINGWALL, AND FOOTING DETAILS.
2. ALL TOE WALLS SHALL BE A DEPTH OF 5' UNLESS SPECIFIED ON PLANS DUE TO ADDITIONAL SCOUR DEPTH.
3. ALL HEADWALLS SHALL BE 1' ABOVE TOP OF CULVERT.
4. ALL SIDE SLOPES ARE PER THE TYPICAL SECTIONS, UNLESS NOTED OTHERWISE.
5. REFER TO BLR FILING 1, PHASE 1 — CONSTRUCTION PLANS FOR DETAILS REGARDING ROADS, ROADWAY GRADING AND STORM SEWER.

REVIEW:
Drainage Design:
Drainage Basin Files in Accordance with Section 7.2006 of Colorado Springs 2001, As Amended

Date ____________

1-800-922-1987

BANNING LEWIS RANCH

TCB

PRELIMINARY
NOT FOR CONSTRUCTION

DETENTION BASIN 93
OUTLET PIPE – PLAN AND PROFILE
PROPOSED PIPE TO
EXISTING CONDITIONS

NO.	DATE	REVISION	BY
9	6/22/07	REVISED CHANNEL 1N AND 68 CULVERTS AND CHANNEL 43 GRADING	TCB
8	6/15/07	POND 93 REVISED OUTFALL ALIGNMENT	TCB
7	1/3/07	POND 93 AND 95 OUTFALL CONSTRUCTION REVISION	

Unit: LDS	Scale: Horz. 50' Vert. 5'	Date: FEBRUARY 14, 2005
Designed: MW	Checked: PWM	Job No. 251395

FINAL DRAINAGE REPORT
FOR
CHAPARRAL POINT AT INDIGO RANCH
FILING NO. 1

JANUARY 2004

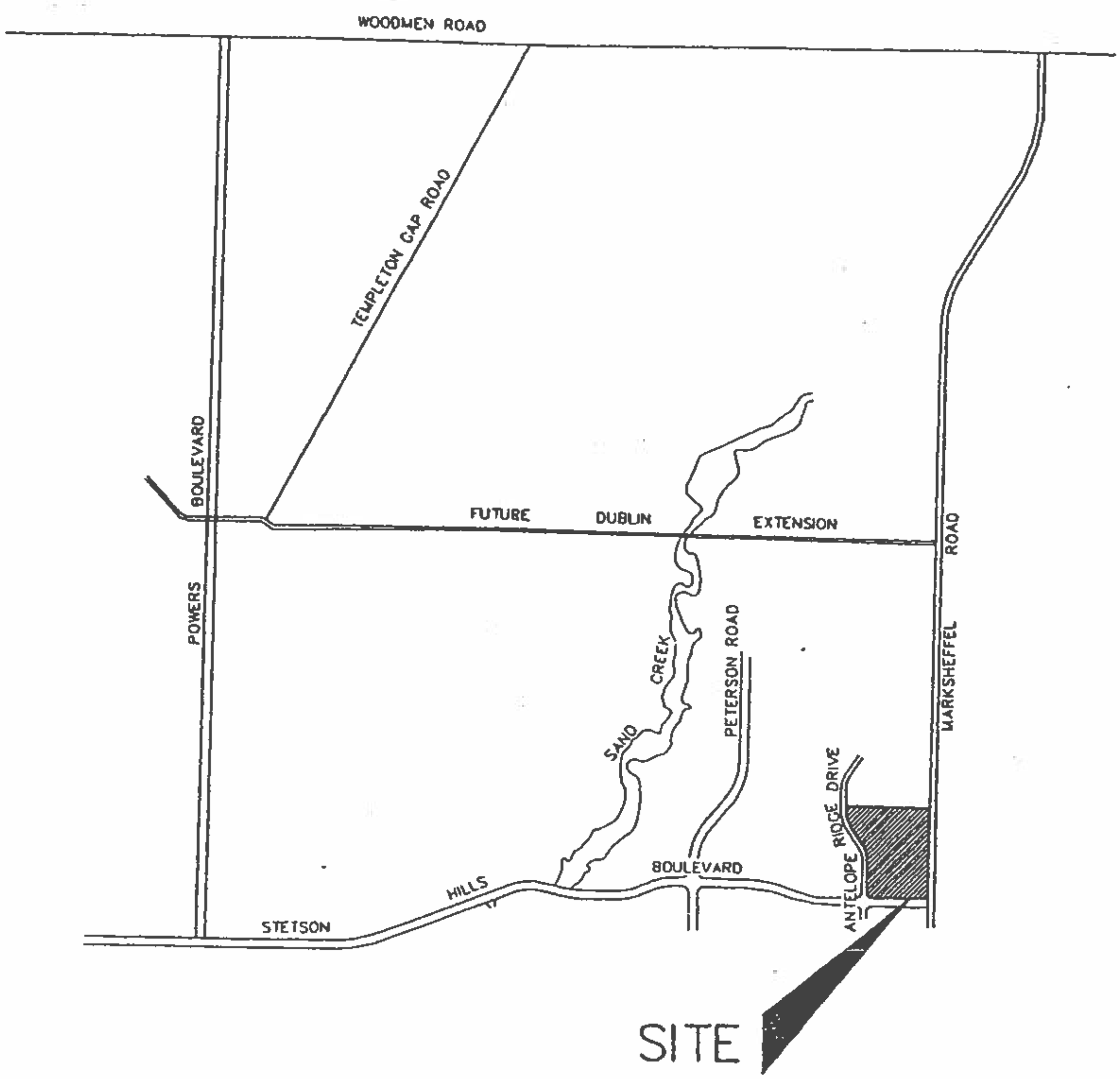
PREPARED FOR:

CLASSIC COMMUNITIES
6385 CORPORATE DRIVE, SUITE 200
COLORADO SPRINGS, CO 80919
(719) 592-9333

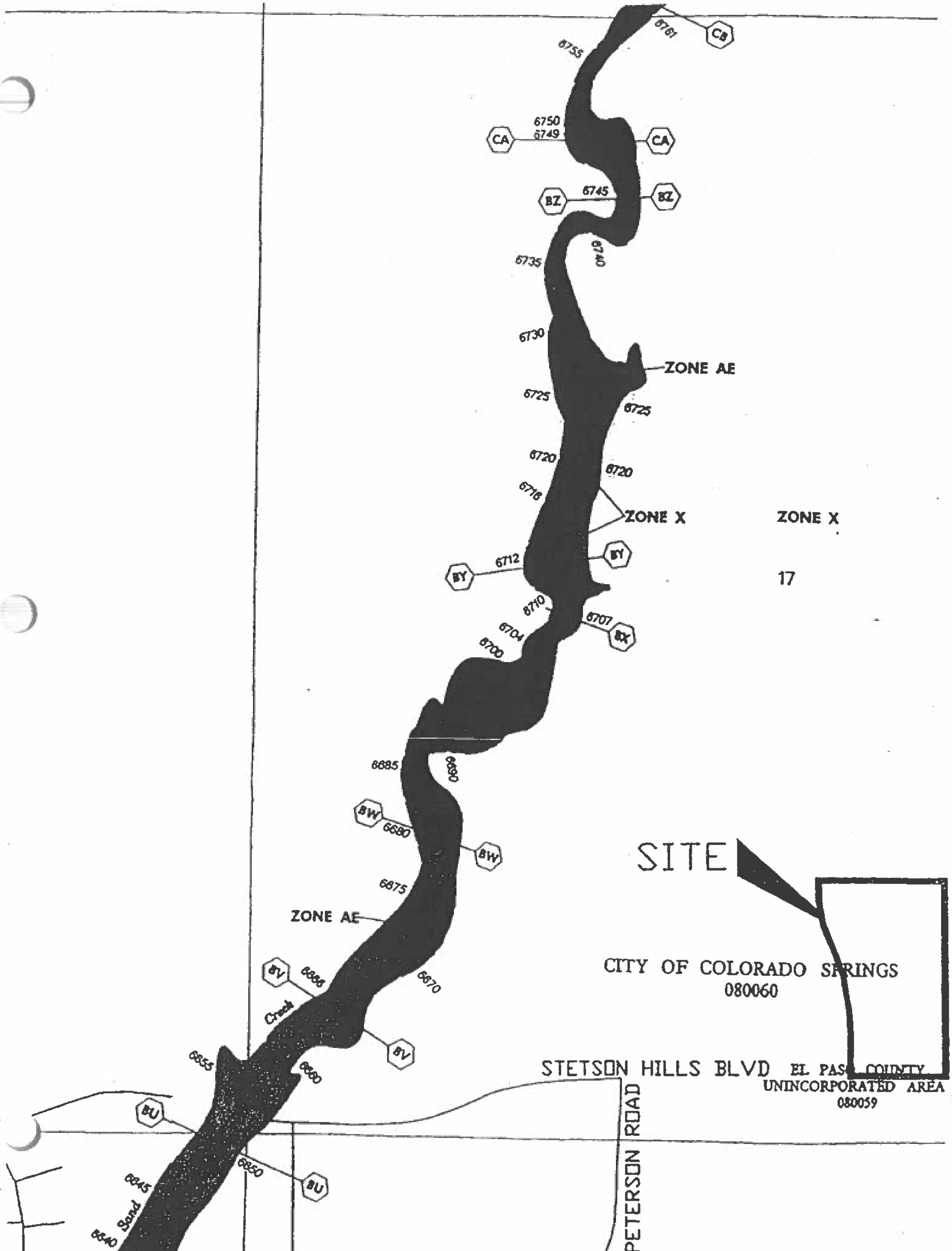
PREPARED BY:

CLASSIC CONSULTING ENGINEERS & SURVEYORS, LLC
6385 CORPORATE DRIVE, SUITE 304
COLORADO SPRINGS, CO 80919
(719) 785-0790

1016.30



VICINITY MAP



CB
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ZONE AE
BV
6665
6670
Creek
CITY OF COLORADO SPRINGS
080060
BV
6655
6660
STETSON HILLS BLVD
EL PASO COUNTY
UNINCORPORATED AREA
080059
BU
PETERSON ROAD
6850
BU
6845
Sand
6840

JOB NAME: *CHAPARRAL POINT AT INDIGO RANCH FILING NO. 1*

JOB NUMBER: *1016.30*

DATE: *01/07/04*

CALC'D BY: *DLG*

FINAL DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(5)	CA(100)	OVERLAND C(5)	Length (ft)	Height (ft)	Tc (min)	STREET / CHANNEL FLOW Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	I(5) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	Q(100) (cfs)
A	0.47	0.59	0.25	364	30	15.1	0	0.0%	0.0	0.0	15.1	3.45	6.13	2	4
B	0.57	0.61	0.25	80	26	4.5	0	0.0%	0.0	0.0	5.0	5.10	9.07	3	5
C	1.12	1.20	0.25	77	24	4.5	233	2.5%	5.5	0.7	5.2	5.06	8.99	6	11
D	0.42	0.45	0.25	200	4	17.9	0	0.0%	0.0	0.0	17.9	3.19	5.67	1	3
E	0.74	0.84	0.25	320	32	13.3	150	2.5%	5.5	0.5	13.8	3.60	6.40	3	5
F	0.43	0.46	0.25	200	6	15.6	0	0.0%	0.0	0.0	15.6	3.40	6.04	1	3
G	0.64	0.70	0.25	57	14	4.2	250	2.5%	5.5	0.8	5.0	5.10	9.07	3	6
H	0.53	0.58	0.25	250	14	14.2	0	0.0%	0.0	0.0	14.2	3.55	6.30	2	4
I	0.42	0.44	0.25	0	0	0.0	0	0.0%	0.0	0.0	5.0	5.10	9.07	2	4
J	0.36	0.38	0.25	120	4	11.7	0	0.0%	0.0	0.0	11.7	3.86	6.85	1	3
K	0.74	0.84	0.25	225	22	11.2	250	2.5%	5.5	0.8	12.0	3.82	6.79	3	6
L	0.24	0.29	0.25	200	20	10.5	0	0.0%	0.0	0.0	10.5	4.02	7.15	1	2
M	0.66	0.70	0.25	0	0	0.0	0	0.0%	0.0	0.0	5.0	5.10	9.07	3	6
N	0.47	0.50	0.25	0	0	0.0	0	0.0%	0.0	0.0	5.0	5.10	9.07	2	5
O	1.83	1.94	0.25	0	0	0.0	1700	2.5%	5.5	5.1	5.0	5.10	9.07	9	18
P	1.11	1.18	0.25	0	0	0.0	600	2.5%	5.5	1.8	5.0	5.10	9.07	6	11
Q	0.69	0.80	0.25	235	12	14.2	0	0.0%	0.0	0.0	14.2	3.55	6.30	2	5
R	0.52	0.55	0.25	0	0	0.0	0	0.0%	0.0	0.0	5.0	5.10	9.07	3	5
S	0.33	0.35	0.25	0	0	0.0	0	0.0%	0.0	0.0	5.0	5.10	9.07	2	3
T	0.50	0.54	0.25	200	6	15.6	0	0.0%	0.0	0.0	15.6	3.40	6.04	2	3
U	0.10	0.11	0.25	0	0	0.0	0	0.0%	0.0	0.0	5.0	5.10	9.07	1	1
V	0.89	0.95	0.25	125	2	15.2	0	0.0%	0.0	0.0	15.2	3.44	6.11	3	6

JOB NAME: *CHAPARRAL POINT AT INDIGO RANCH FILING NO. 1*
JOB NUMBER: *1016.30*
DATE: *01/07/04*
CALC'D BY: *DLG*

FINAL DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(5)	CA(100)	OVERLAND C(5)	Length (ft)	Height (ft)	Tc (min)	STREET / CHANNEL FLOW Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	I(5) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	Q(100) (cfs)
W1	0.51	0.54	0.25	0	0	0.0	0	0.0%	0.0	0.0	5.0	5.10	9.07	3	5
W2	0.20	0.21	0.25	0	0	0.0	0	0.0%	0.0	0.0	5.0	5.10	9.07	1	2
W3	0.50	0.53	0.25	0	0	0.0	0	0.0%	0.0	0.0	5.0	5.10	9.07	3	5
X	0.24	0.26	0.25	0	0	0.0	700	2.5%	5.5	2.1	5.0	5.10	9.07	1	2
Y	0.35	0.49	0.25	300	22	14.3	0	0.0%	0.0	0.0	14.3	3.54	6.30	1	3
Z	0.35	0.38	0.25	0	0	0.0	0	0.0%	0.0	0.0	5.0	5.10	9.07	2	3
AA	1.58	1.68	0.25	235	8	16.3	0	0.0%	0.0	0.0	16.3	3.33	5.93	5	10
BB	0.06	0.08	0.25	0	0	0.0	0	0.0%	0.0	0.0	5.0	5.10	9.07	0.3	0.8
CC	0.41	0.44	0.25	200	4	17.9	0	0.0%	0.0	0.0	17.9	3.19	5.67	1	3
DD	0.07	0.10	0.25	0	0	0.0	0	0.0%	0.0	0.0	5.0	5.10	9.07	0.4	0.9
EE	1.31	1.39	0.25	200	10	13.2	0	0.0%	0.0	0.0	13.2	3.66	6.51	5	9
FF	0.94	1.00	0.25	0	0	0.0	0	0.0%	0.0	0.0	5.0	5.10	9.07	5	9
GG	1.21	1.28	0.25	230	8	16.0	0	0.0%	0.0	0.0	16.0	3.36	5.98	4	8
HH	0.30	0.33	0.25	190	12	11.9	0	0.0%	0.0	0.0	11.9	3.83	6.80	1	2
II	0.05	0.07	0.25	0	0	0.0	0	0.0%	0.0	0.0	5.0	5.10	9.07	0.2	0.6
OS-1	0.98	1.04	0.25	0	0	0.0	0	0.0%	0.0	0.0	5.0	5.10	9.07	5	9
OS-2	1.35	1.43	0.25	0	0	0.0	0	0.0%	0.0	0.0	5.0	5.10	9.07	7	13
OS-3	0.14	0.14	0.25	0	0	0.0	0	0.0%	0.0	0.0	5.0	5.10	9.07	1	1
OS-4	0.14	0.14	0.25	0	0	0.0	0	0.0%	0.0	0.0	5.0	5.10	9.07	1	1
OS-5	2.50	3.50	0.25	600	12	31.0	0	0.0%	0.0	0.0	31.0	2.38	4.23	6	15

JOB NAME: *CHAPARRAL POINT AT INDIGO RANCH FILING NO. 1*
JOB NUMBER: *1016.30*
DATE: *01/07/04*
CALCULATED BY: *DLG*

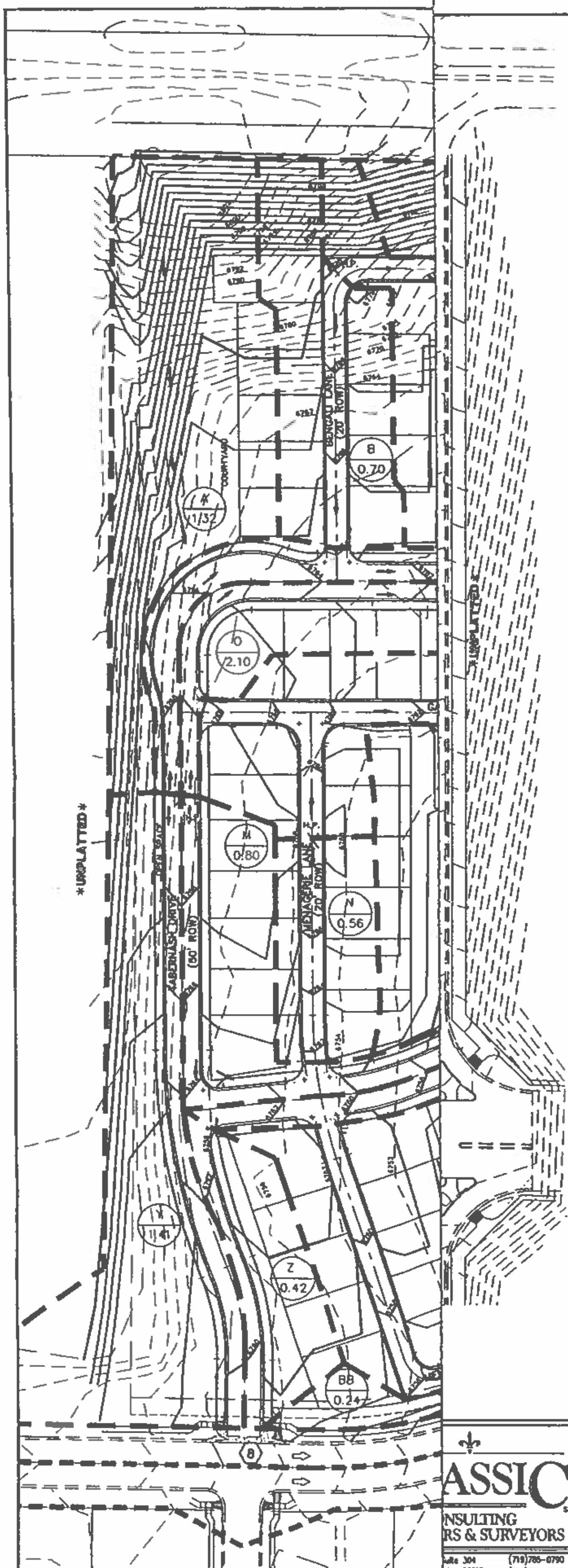
FINAL DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		
					I(5)	I(100)	Q(5)	Q(100)	Inlet Size
1	BASIN A, B, C, D, E, W1	3.08	4.22	17.9	3.19	5.67	10	24	12' D-10-R
2	BASINS F, G, H, W2, FLOW-BY DP-1	3.05	3.53	15.6	3.40	6.04	10	21	12' D-10-R
3	BASINS I, J, K, L ,W3, FLOW-BY DP 2	3.42	3.81	12.0	3.82	6.79	13	26	14' D-10-R
4	BASINS P, R, S	1.95	2.08	5.0	5.10	9.07	10	19	12' D-10-R
5	BASINS T, U, V, O, & FLOW-BY DP 4	4.30	4.41	15.6	3.40	6.04	15	27	14' D-10-R
6	BASINS M, N, & Q	1.81	1.99	14.2	3.55	6.30	6	13	4' D-10-R
7	BASIN X	0.24	0.26	5.0	5.10	9.07	1	2	4' D-10-R
8	BASINS Y & Z	0.70	0.87	14.3	3.54	6.30	2	5	N/A
9	BASIN AA	1.58	1.68	16.3	3.33	5.93	5	10	N/A
10	BASIN CC	0.41	0.44	17.9	3.19	5.67	1	3	N/A
11	BASIN EE	1.31	1.39	13.2	3.66	6.51	5	9	N/A
12	BASIN FF	0.94	1.00	5.0	5.10	9.07	5	9	N/A
13	BASIN GG	1.21	1.28	16.0	3.36	5.98	4	8	N/A
14	BASINS BB, DD, II, OS-1, OS-3, DP 8, & DP 12	2.93	3.29	14.3	3.54	6.30	10	21	10' D-10-R
15	BASIN OS-2 & OS-4	1.49	1.57	5.0	5.10	9.07	8	14	4' D-10-R

JOB NAME: *CHAPARRAL POINT AT INDIGO RANCH FILING NO. 1*
JOB NUMBER: *1016.30*
DATE: *01/07/04*
CALCULATED BY: *DLG*

FINAL DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		
					I(5)	I(100)	Q(5)	Q(100)	Inlet Size
16	BASIN HH	0.30	0.33	11.9	3.83	6.80	1	2	N/A
17	BASIN OS-5	2.50	3.50	31.0	2.38	4.23	6	15	N/A



60 30 0 60 120

SCALE: 1" = 60'

DESIGN POINT SUMMARY (X)		
DESIGN POINT	Q5 (CFS)	Q100 (CFS)
1	10	24
2	10	21
3	13	26
4	10	19
5	15	27
6	6	13
7	1	2
8	2	5
9	5	10
10	1	3
11	5	9
12	5	9
13	4	8
14	10	21
15	8	14
16	1	2
17	6	15

STORM PIPE SUMMARY (X)		
PIPE RUN	SIZE	MATL
1	24	RCP
2	24	RCP
3	30	RCP
4	24	RCP
5	30	RCP
6	18	RCP
7	24	RCP
8	NOT	USED
9	24	RCP
10	NOT	USED
11	30	RCP
12	24	RCP
13	24	RCP
14	30	RCP
15	30	RCP
16	18	RCP
17	18	RCP
18	18	RCP
19	NOT	USED
20	18	RCP
21	18	RCP
22	18	RCP
23	18	RCP
24	18	RCP

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY	
STORM SEWER	
BASIN IDENTIFIER	X
AREA IN ACRES	XXX
DESIGN POINT	X
PIPE RUN	X
DIRECTION OF FLOW	
EXISTING DIRECTION OF FLOW	

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do 80919 (719)785-0799 (Fax)

CHAPARRAL POINT AT INDIGO RANCH
FINAL DRAINAGE MAP

DESIGNED BY	VAS	SCALE	DATE 5/29/03
DRAWN BY	MES	(H) 1" = 60'	SHEET 1 OF 1
CHECKED BY		(V) 1" = N/A	JOB NO. [illegible]6.30

CLASSIC

60 30 0 60 120

SCALE: 1" = 60'

DESIGN POINT SUMMARY (X)		
DESIGN POINT	Q5 (CFS)	Q100 (CFS)
1	10	24
2	10	21
3	13	26
4	10	19
5	15	27
6	6	13
7	1	2
8	2	5
9	5	10
10	1	3
11	5	9
12	5	9
13	4	8
14	10	21
15	8	14
16	1	2
17	6	15

STORM PIPE SUMMARY (X)		
PIPE RUN	SIZE	MATL.
1	24	RCP
2	24	RCP
3	30	RCP
4	24	RCP
5	30	RCP
6	18	RCP
7	24	RCP
8	NOT	USED
9	24	RCP
10	NOT	USED
11	30	RCP
12	24	RCP
13	24	RCP
14	30	RCP
15	30	RCP
16	18	RCP
17	18	RCP
18	18	RCP
19	NOT	USED
20	18	RCP
21	18	RCP
22	18	RCP
23	18	RCP
24	18	RCP

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY	
STORM SEWER	
BASIN IDENTIFIER	X
AREA IN ACRES	XXX
DESIGN POINT	X
PIPE RUN	X
DIRECTION OF FLOW	
EXISTING DIRECTION OF FLOW	

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CHAPARRAL POINT AT INDIGO RANCH
FINAL DRAINAGE MAP

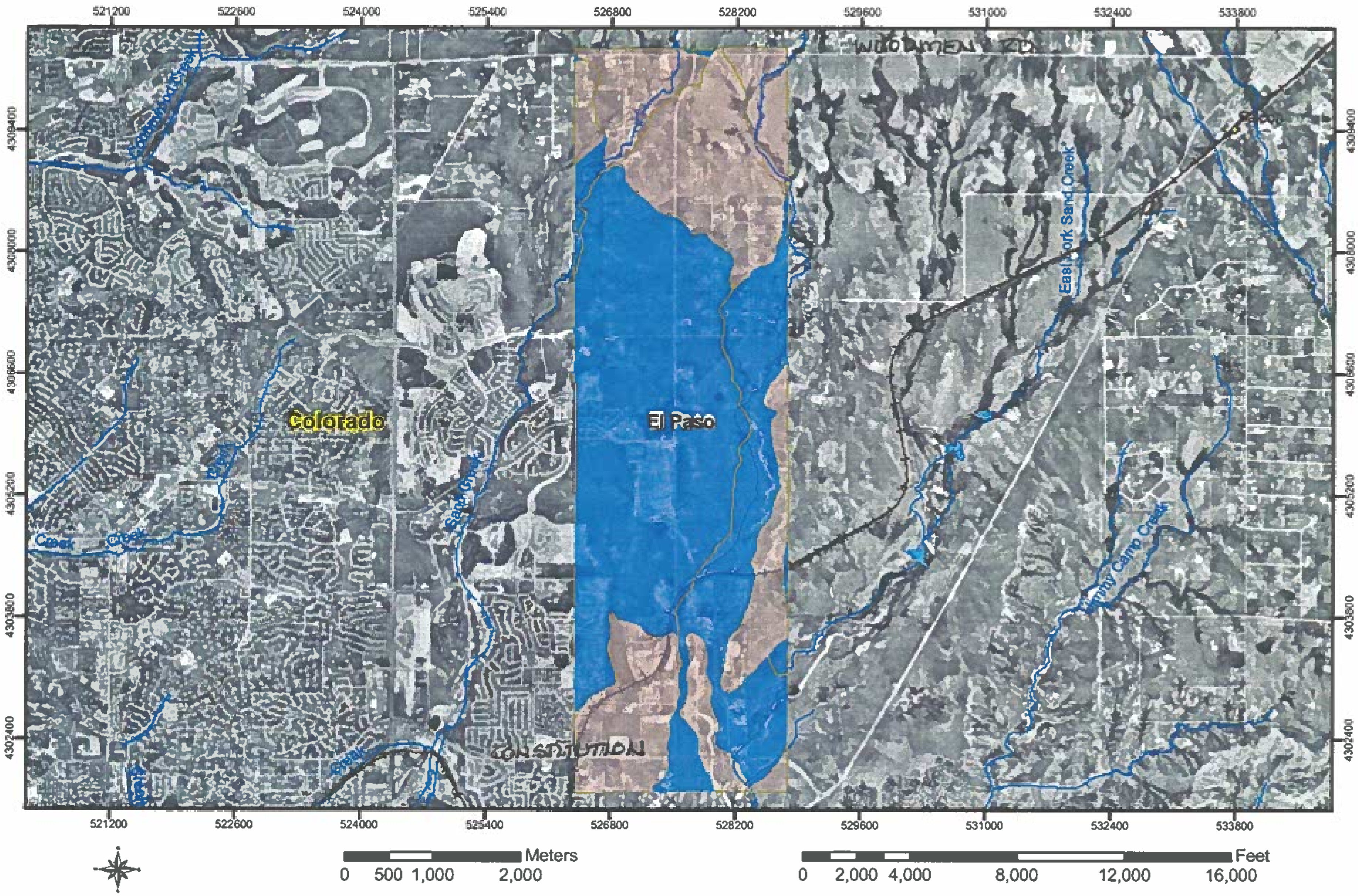
DESIGNED BY	VAS	SCALE	DATE 5/29/03
DRAWN BY	MES	(H) 1" = 60'	SHEET 1 OF 1
CHECKED BY		(V) 1" = N/A	JOB NO. 1016.30

APPENDIX E

Soils Map

HYDROLOGIC GROUP RATING FOR EL PASO COUNTY AREA, COLORADO

Marksheffel Road



Marksheffel Road

MAP LEGEND

Hydrologic Group

{Dominant Condition, <}

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available
- Soil Map Units
- Cities
- Detailed Counties
- Detailed States
- Interstate Highways
- Rails
- Water
- Hydrography
- Oceans

MAP INFORMATION

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov

Coordinate System: UTM Zone 13

Soil Survey Area: El Paso County Area, Colorado
Spatial Version of Data: 1
Soil Map Compilation Scale: 1:24000

Map comprised of aerial images photographed on these dates:
1999

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Tables - Hydrologic Group

Summary by Map Unit - El Paso County Area, Colorado

Soil Survey Area Map Unit Symbol	Map Unit Name	Rating	Total Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	1,426.4	27.8
9	Blakeland-Fluvaquentic Haplaquolls	A	262.5	5.1
10	Blendon sandy loam, 0 to 3 percent slopes	B	999.7	19.5
12	Bresser sandy loam, 3 to 5 percent slopes	B	7.8	0.2
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	170.1	3.3
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	A	124.9	2.4
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	5.1	0.1
85	Stapleton-Bernal sandy loams, 3 to 20 percent slopes	B	0.8	0.0
97	Truckton sandy loam, 3 to 9 percent slopes	B	2,128.8	41.5

Description - Hydrologic Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are placed into four groups A, B, C, and D, and three dual classes, A/D, B/D, and C/D. Definitions of the classes are as follows:

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only soils that are rated D in their natural condition are assigned to dual classes.

Parameter Summary - Hydrologic Group

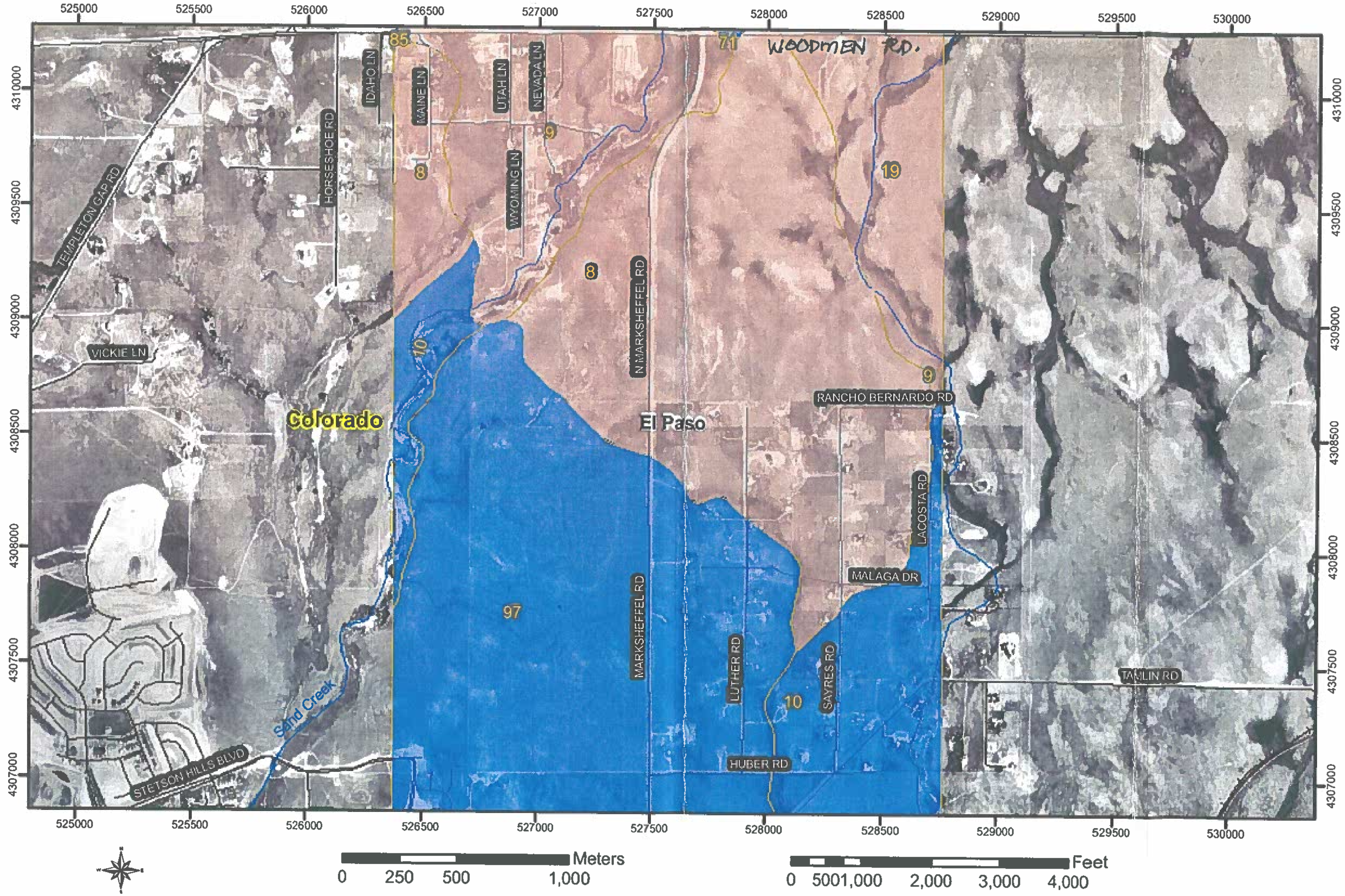
Aggregation Method: Dominant Condition

Component Percent Cutoff:

Tie-break Rule: Lower

HYDROLOGIC GROUP RATING FOR EL PASO COUNTY AREA, COLORADO

Woodmen Rd. to Huber Rd.

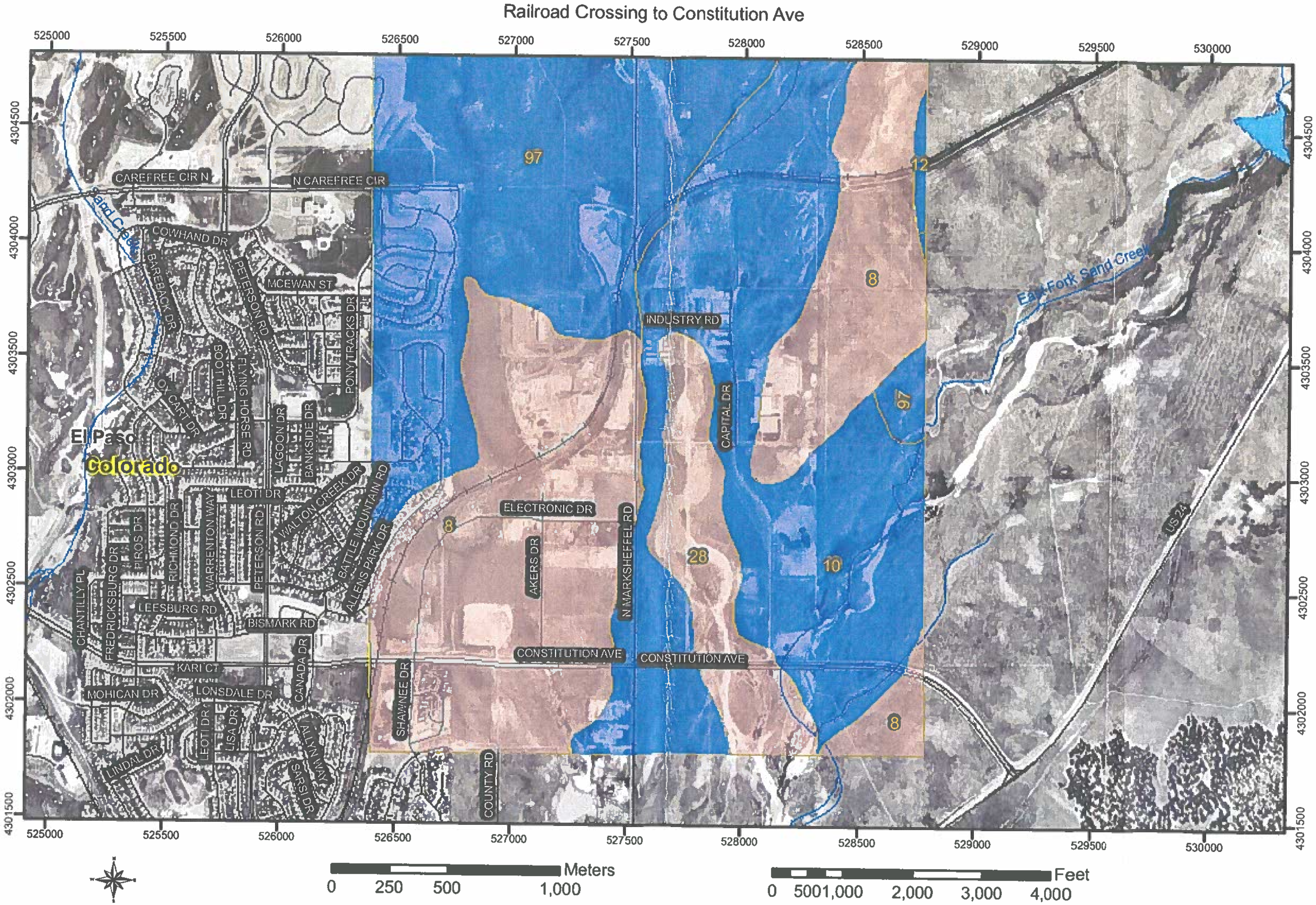


USDA Natural Resources Conservation Service

Web Soil Survey 1.1
National Cooperative Soil Survey

1/9/2007

HYDROLOGIC GROUP RATING FOR EL PASO COUNTY AREA, COLORADO



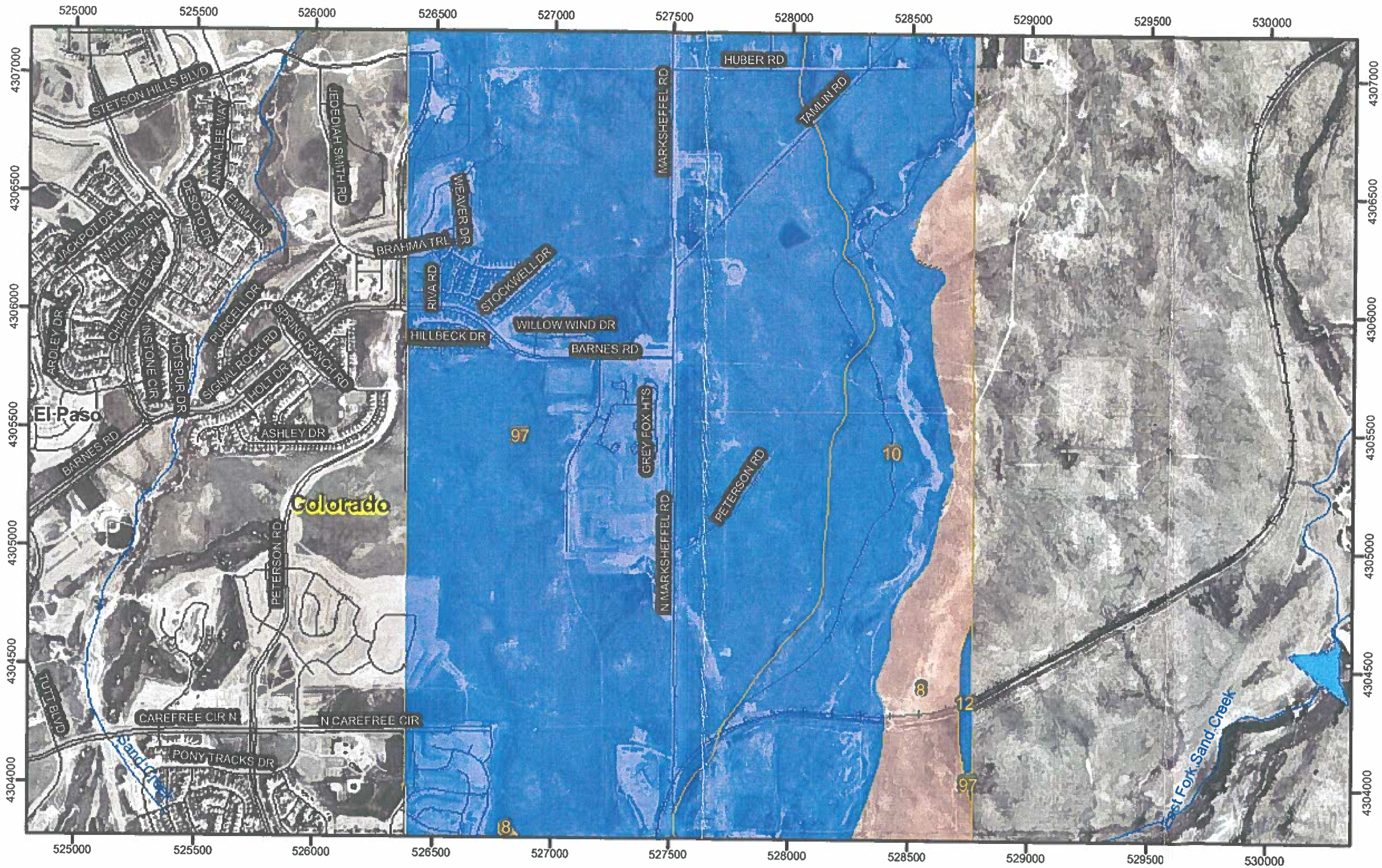
USDA Natural Resources Conservation Service

Web Soil Survey 1.1
National Cooperative Soil Survey

1/9/2007

HYDROLOGIC GROUP RATING FOR EL PASO COUNTY AREA, COLORADO

Huber Rd. to Railroad Crossing



0 250 500 1,000 Meters

0 500 1,000 2,000 3,000 4,000 Feet

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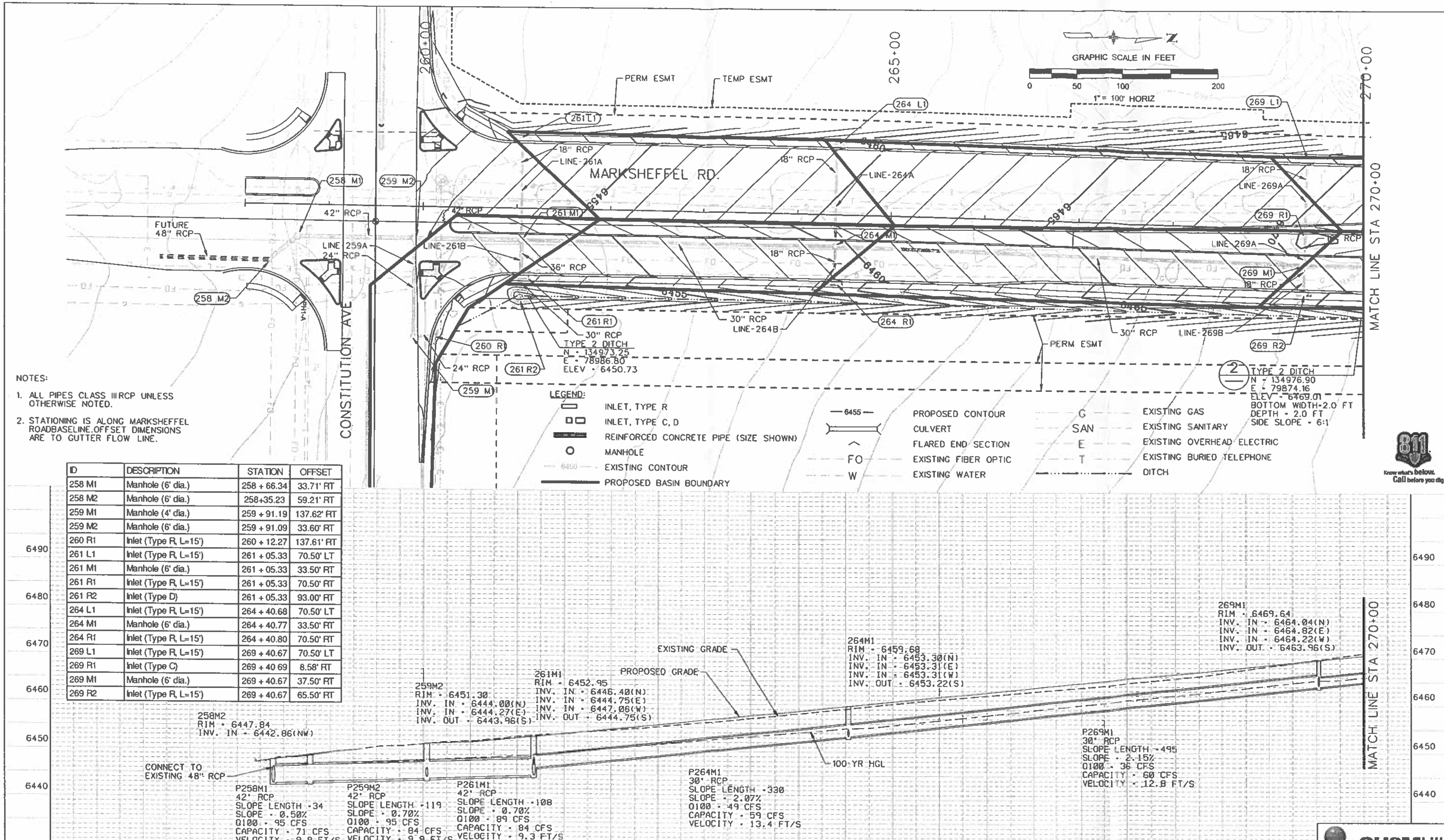

NOTES:

1. ALL PIPES CLASS III RCP UNLESS OTHERWISE NOTED.
2. STATIONING IS ALONG MARKSHEFFEL ROADBASELINE.OFFSET DIMENSIONS ARE TO GUTTER FLOW LINE.

ID	DESCRIPTION	STATION	OFFSET
258 M1	Manhole (6' dia.)	258 + 66.34	33.71' RT
258 M2	Manhole (6' dia.)	258+35.23	59.21' RT
259 M1	Manhole (4' dia.)	259 + 91.19	137.62' RT
259 M2	Manhole (6' dia.)	259 + 91.09	33.60' RT
260 R1	Inlet (Type R, L=15')	260 + 12.27	137.61' RT
261 L1	Inlet (Type R, L=15')	261 + 05.33	70.50' LT
261 M1	Manhole (6' dia.)	261 + 05.33	33.50' RT
261 R1	Inlet (Type R, L=15')	261 + 05.33	70.50' RT
261 R2	Inlet (Type D)	261 + 05.33	93.00' RT
264 L1	Inlet (Type R, L=15')	264 + 40.68	70.50' LT
264 M1	Manhole (6' dia.)	264 + 40.77	33.50' RT
264 R1	Inlet (Type R, L=15')	264 + 40.80	70.50' RT
269 L1	Inlet (Type R, L=15')	269 + 40.67	70.50' LT
269 R1	Inlet (Type C)	269 + 40 69	8.58' RT
269 M1	Manhole (6' dia.)	269 + 40.67	37.50' RT
269 R2	Inlet (Type R, L=15')	269 + 40.67	65.50' RT

Computer File Information
Creation Date: 10/23/07 Initials: LMS
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Sheet Revisions		
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Marksheffel Road
Drainage Plan and Profile

Designer: GCS
Detailer: ADH
Sheet Subset: Drainage
Structure Numbers
Subset Sheets: 1 of 16

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Project No./Code
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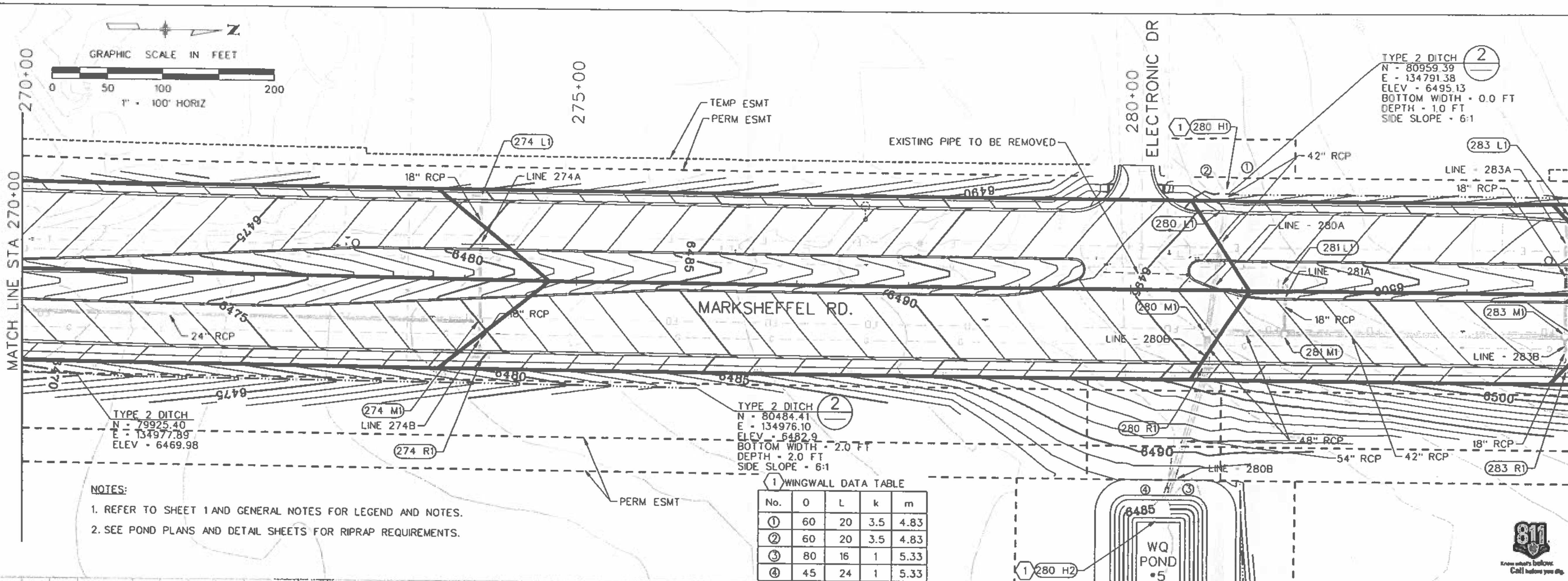
Sheet Number

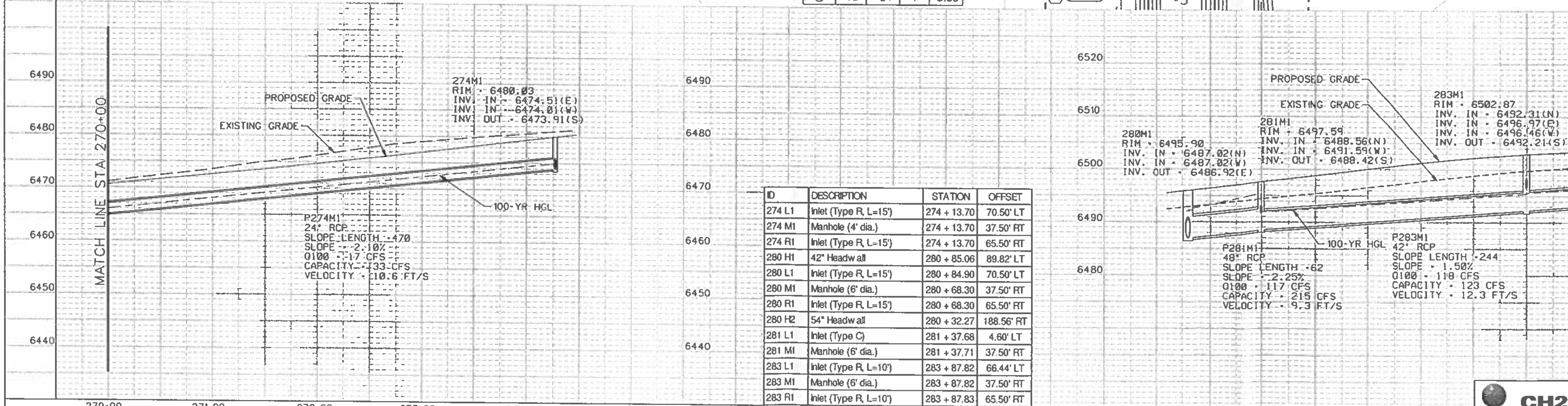


NOTES:

1. REFER TO SHEET 1 AND GENERAL NOTES FOR LEGEND AND NOTES.
2. SEE POND PLANS AND DETAIL SHEETS FOR RIPRAP REQUIREMENTS.

(1) WINGWALL DATA TABLE

No.	0	L	k	m
①	60	20	3.5	4.83
②	60	20	3.5	4.83
③	80	16	1	5.33
④	45	24	1	5.33



ID	DESCRIPTION	STATION	OFFSET
274 L1	Inlet (Type R, L=15')	274 + 13.70	70.50' LT
274 M1	Manhole (4' dia.)	274 + 13.70	37.50' RT
274 R1	Inlet (Type R, L=15')	274 + 13.70	65.50' RT
280 H1	42" Headwall	280 + 85.06	89.82' LT
280 L1	Inlet (Type R, L=15')	280 + 84.90	70.50' LT
280 M1	Manhole (6' dia.)	280 + 68.30	37.50' RT
280 R1	Inlet (Type R, L=15')	280 + 68.30	65.50' RT
280 H2	54" Headwall	280 + 32.27	188.56' RT
281 L1	Inlet (Type C)	281 + 37.68	4.60' LT
281 M1	Manhole (6' dia.)	281 + 37.71	37.50' RT
283 L1	Inlet (Type R, L=10')	283 + 87.82	66.44' LT
283 M1	Manhole (6' dia.)	283 + 87.82	37.50' RT
283 R1	Inlet (Type R, L=10')	283 + 87.83	65.50' RT

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Marksheffel Road
Drainage Plan and Profile

Designer: GCS
Detailer: ADH
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Structure Numbers
Subset Sheets: 2 of 16

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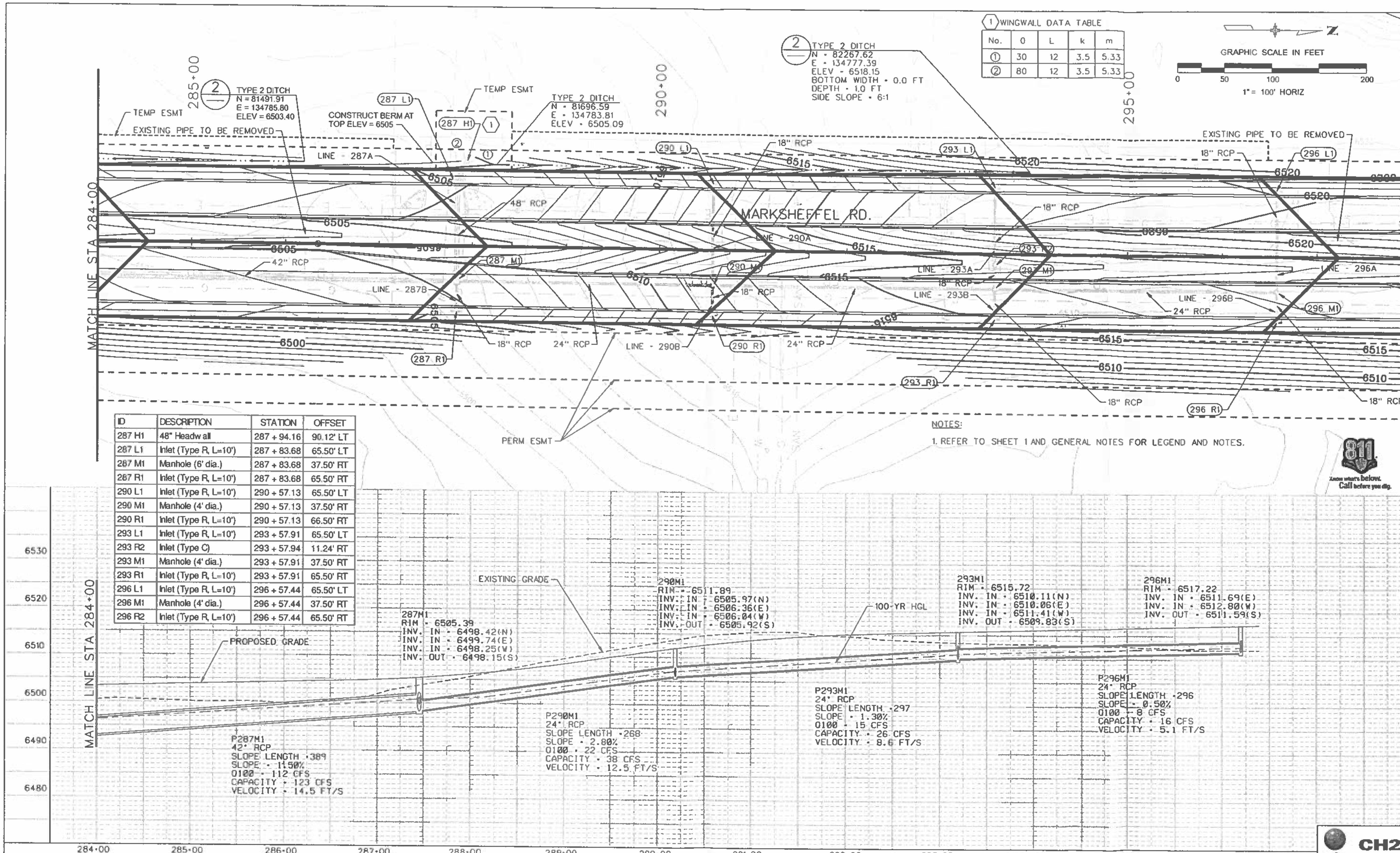
Sheet Number



1 WINGWALL DATA TABLE

No.	O	L	k	m
1	30	12	3.5	5.33
2	80	12	3.5	5.33

ID	DESCRIPTION	STATION	OFFSET
287 H1	48" Headwall	287 + 94.16	90.12' LT
287 L1	Inlet (Type R, L=10')	287 + 83.68	65.50' LT
287 M1	Manhole (6' dia.)	287 + 83.68	37.50' RT
287 R1	Inlet (Type R, L=10')	287 + 83.68	65.50' RT
290 L1	Inlet (Type R, L=10')	290 + 57.13	65.50' LT
290 M1	Manhole (4' dia.)	290 + 57.13	37.50' RT
290 R1	Inlet (Type R, L=10')	290 + 57.13	66.50' RT
293 L1	Inlet (Type R, L=10')	293 + 57.91	65.50' LT
293 R2	Inlet (Type C)	293 + 57.94	11.24' RT
293 M1	Manhole (4' dia.)	293 + 57.91	37.50' RT
293 R1	Inlet (Type R, L=10')	293 + 57.91	65.50' RT
296 L1	Inlet (Type R, L=10')	296 + 57.44	65.50' LT
296 M1	Manhole (4' dia.)	296 + 57.44	37.50' RT
296 R2	Inlet (Type R, L=10')	296 + 57.44	65.50' RT

NOTES:

1. REFER TO SHEET 1 AND GENERAL NOTES FOR LEGEND AND NOTES.

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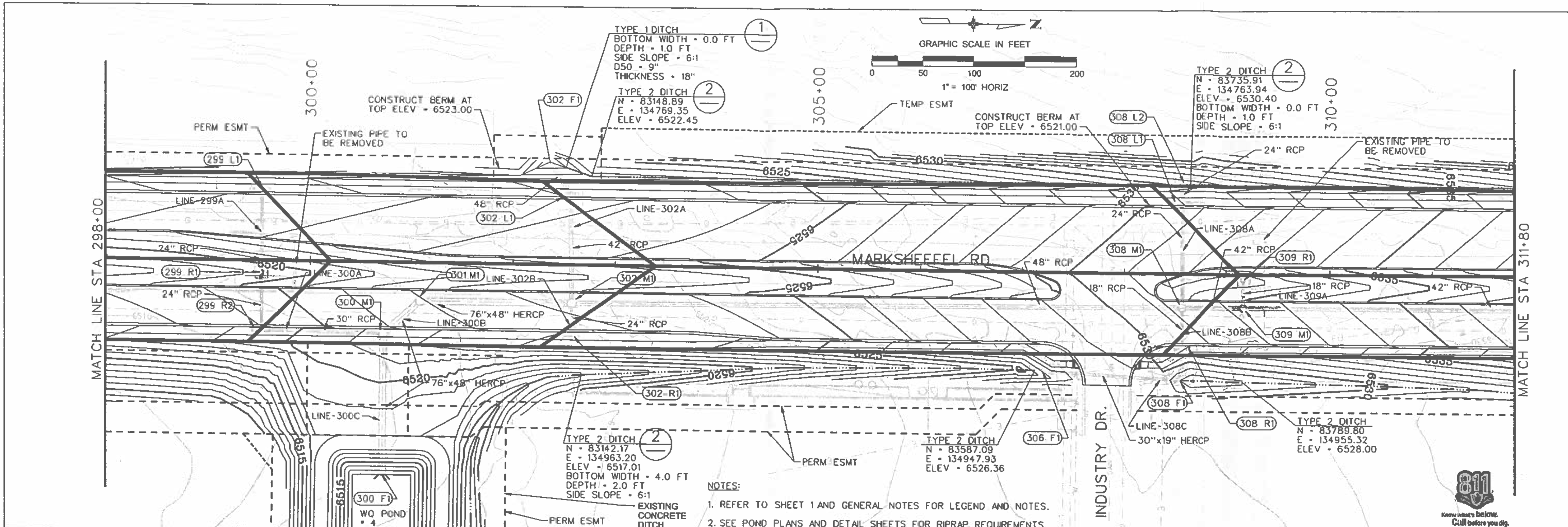
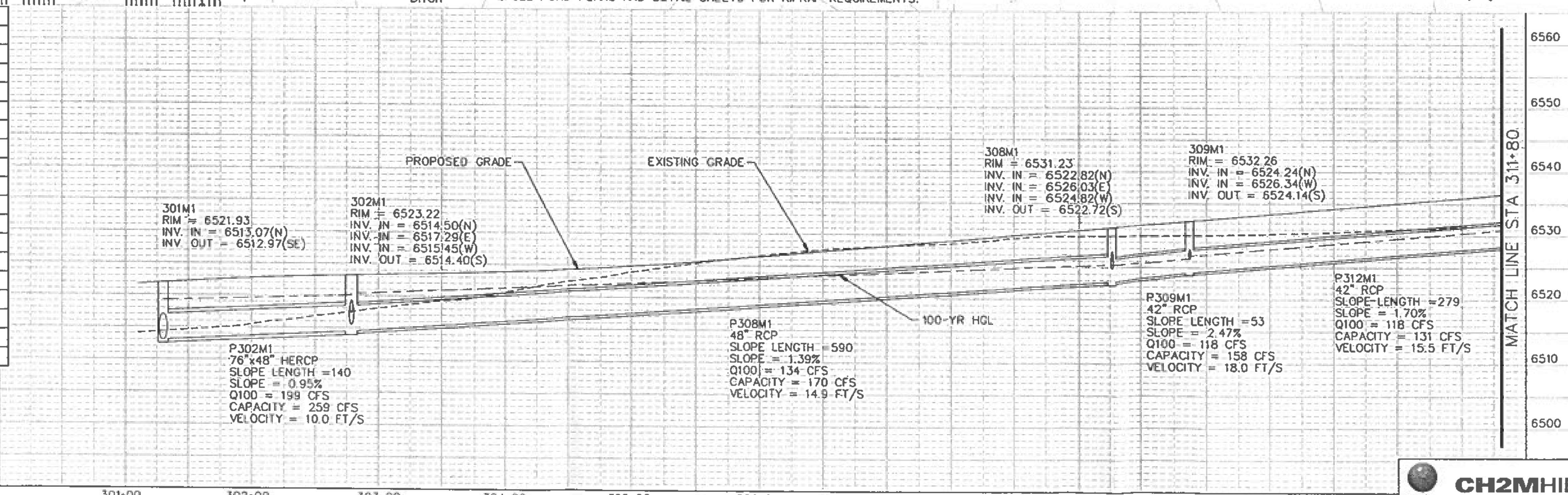


ID	DESCRIPTION	STATION	OFFSET
299 L1	Inlet (Type R, L=15')	299+52.24	65.50 LT
299 R1	Inlet (Type C)	299+52.46	11.83 RT
299 R2	Inlet (Type R, L=15')	299+52.56	65.50 RT
300 M1	Manhole (6' dia.)	300+73.19	69.86 RT
300 F1	76"x48" FES	300+72.89	208.00 RT
301 M1	Manhole (6' dia.)	301+09.03	37.36 RT
302 L1	Inlet (Type R, L=15')	302+55.75	65.50 LT
302 F1	42" FES	302+35.43	97.95 LT
302 M1	Manhole (6' dia.)	302+57.65	37.24 RT
302 R1	Inlet (Type R, L=15')	302+57.76	65.50 RT
306 F1	30"x19" FES	307+12.80	96.67 RT
308 F1	30"x19" FES	308+55.34	104.89 RT
308 L2	Inlet (Type D)	308+55.93	86.05 LT
308 L1	Inlet (Type R, L=15')	308+55.80	65.50 LT
308 M1	Manhole (6' dia.)	308+55.80	33.50 RT
308 R1	Inlet (Type R, L=15')	308+55.80	70.50 RT
309 R1	Inlet (Type C)	309+16.18	5.57 RT
309 M1	Manhole (6' dia.)	309+15.71	33.50 RT



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Marksheffel Road Drainage Plan and Profile

Designer: GCS
Detailer: ADH
Sheet Subset: Drainage
Structure Numbers
Subset Sheets: 4 of 16

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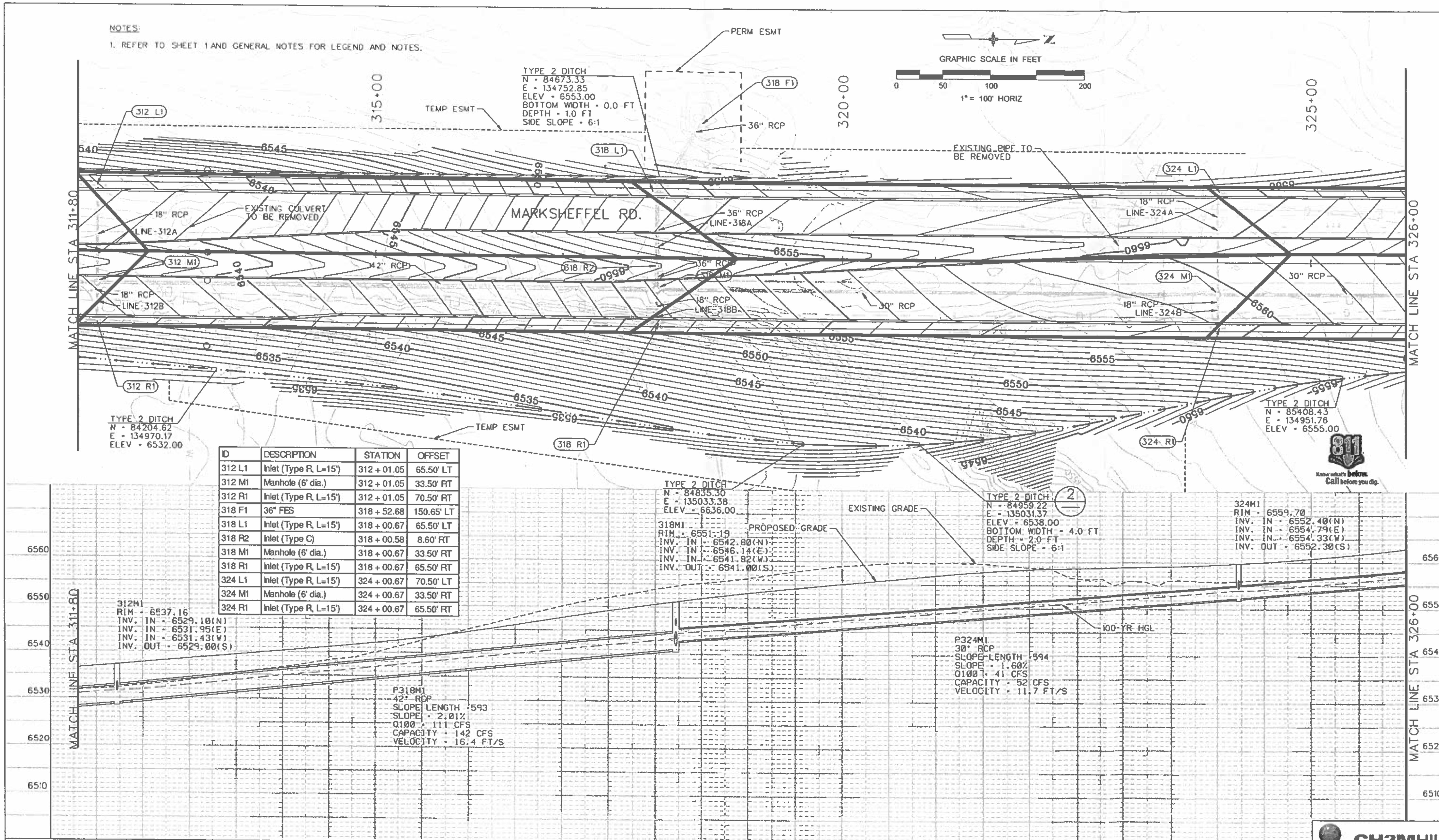
NOTES:

1. REFER TO SHEET 1 AND GENERAL NOTES FOR LEGEND AND NOTES.



ID	DESCRIPTION	STATION	OFFSET
312 L1	Inlet (Type R, L=15')	312 + 01.05	65.50' LT
312 M1	Manhole (6' dia.)	312 + 01.05	33.50' RT
312 R1	Inlet (Type R, L=15')	312 + 01.05	70.50' RT
318 F1	36" FES	318 + 52.68	150.65' LT
318 L1	Inlet (Type R, L=15')	318 + 00.67	65.50' LT
318 R2	Inlet (Type C)	318 + 00.58	8.60' RT
318 M1	Manhole (6' dia.)	318 + 00.67	33.50' RT
318 R1	Inlet (Type R, L=15')	318 + 00.67	65.50' RT
324 L1	Inlet (Type R, L=15')	324 + 00.67	70.50' LT
324 M1	Manhole (6' dia.)	324 + 00.67	33.50' RT
324 R1	Inlet (Type R, L=15')	324 + 00.67	65.50' RT

Computer File Information
Creation Date: 10/23/07 Initials: LMS
Print Date: 13-MAY-2008 Initials: ADH
File Name: drpp05ba.dgn

Sheet Revisions

Date:	Comments	Init.

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As Constructed
No Revisions:
Revised:
Void:

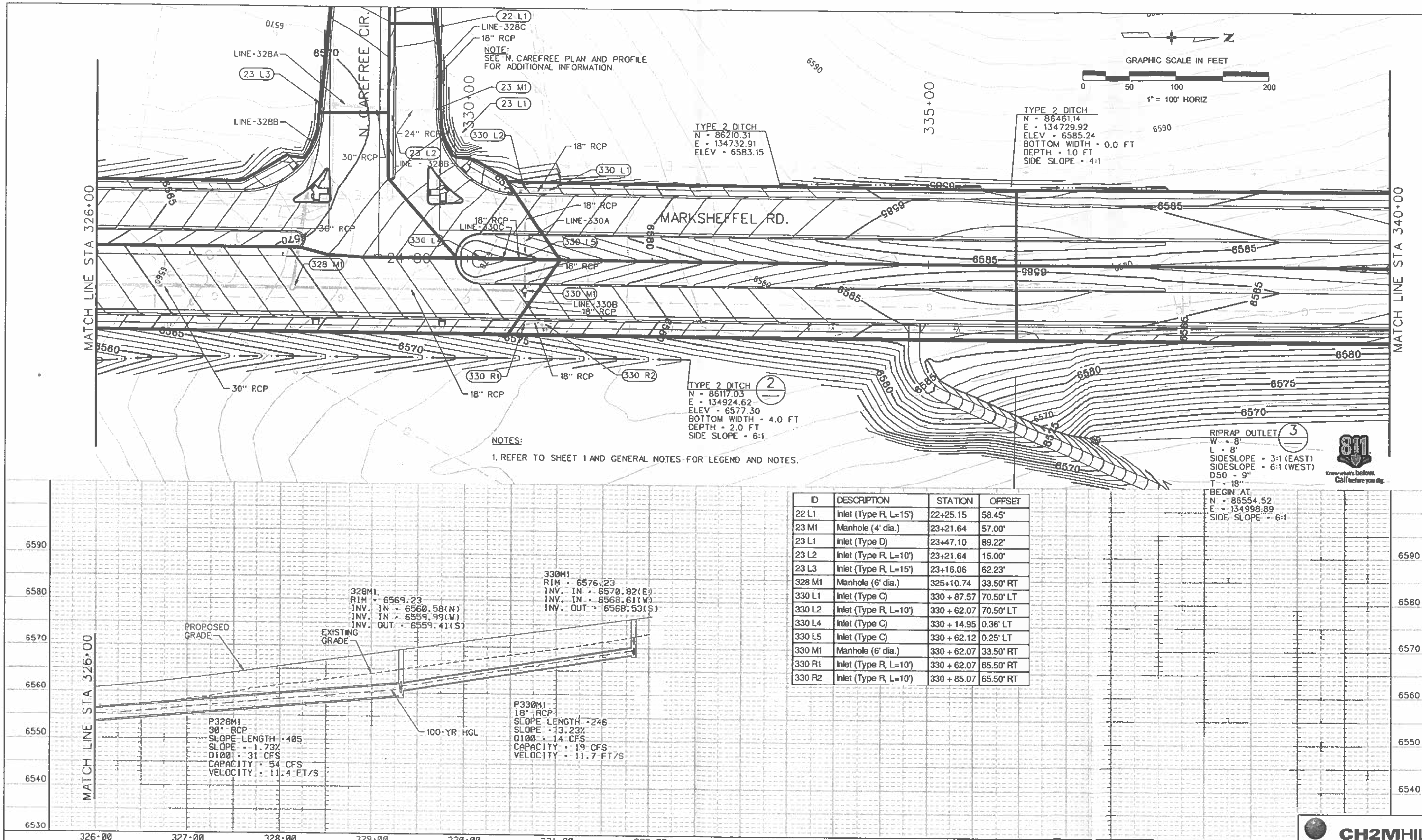
Marksheffel Road
Drainage Plan and Profile

Designer: GCS
Detailer: ADH
Sheet Subset: Drainage
Structure Numbers
Subset Sheets: 5 of 16

CH2MHILL 326

Project No./Code
PPRTA
75174
Sheet Number

PRELIMINARY - NOT FOR CONSTRUCTION



NOTES:

1. REFER TO SHEET 1 AND GENERAL NOTES FOR LEGEND AND NOTES.

ID	DESCRIPTION	STATION	OFFSET
22 L1	Inlet (Type R, L=15')	22+25.15	58.45'
23 M1	Manhole (4' dia.)	23+21.64	57.00'
23 L1	Inlet (Type D)	23+47.10	89.22'
23 L2	Inlet (Type R, L=10')	23+21.64	15.00'
23 L3	Inlet (Type R, L=15')	23+16.06	62.23'
328 M1	Manhole (6' dia.)	325+10.74	33.50' RT
330 L1	Inlet (Type C)	330 + 87.57	70.50' LT
330 L2	Inlet (Type R, L=10')	330 + 62.07	70.50' LT
330 L4	Inlet (Type C)	330 + 14.95	0.36' LT
330 L5	Inlet (Type C)	330 + 62.12	0.25' LT
330 M1	Manhole (6' dia.)	330 + 62.07	33.50' RT
330 R1	Inlet (Type R, L=10')	330 + 62.07	65.50' RT
330 R2	Inlet (Type R, L=10')	330 + 85.07	65.50' RT

Computer File Information

Creation Date: 10/23/07 Initials: SAK

Print Date: 13-MAY-2008 Initials: ADH

File Name: drpp06ba.dgn

Sheet Revisions

Date:	Comments	Init.

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Marksheffel Road
Drainage Plan and Profile

Designer: GCS

Detailer: ADH

Structure Numbers

Sheet Subset: Drainage

Subset Sheets: 6 of 16

CH2MHILL

Project No./Code

PPRTA
75174

Sheet Number

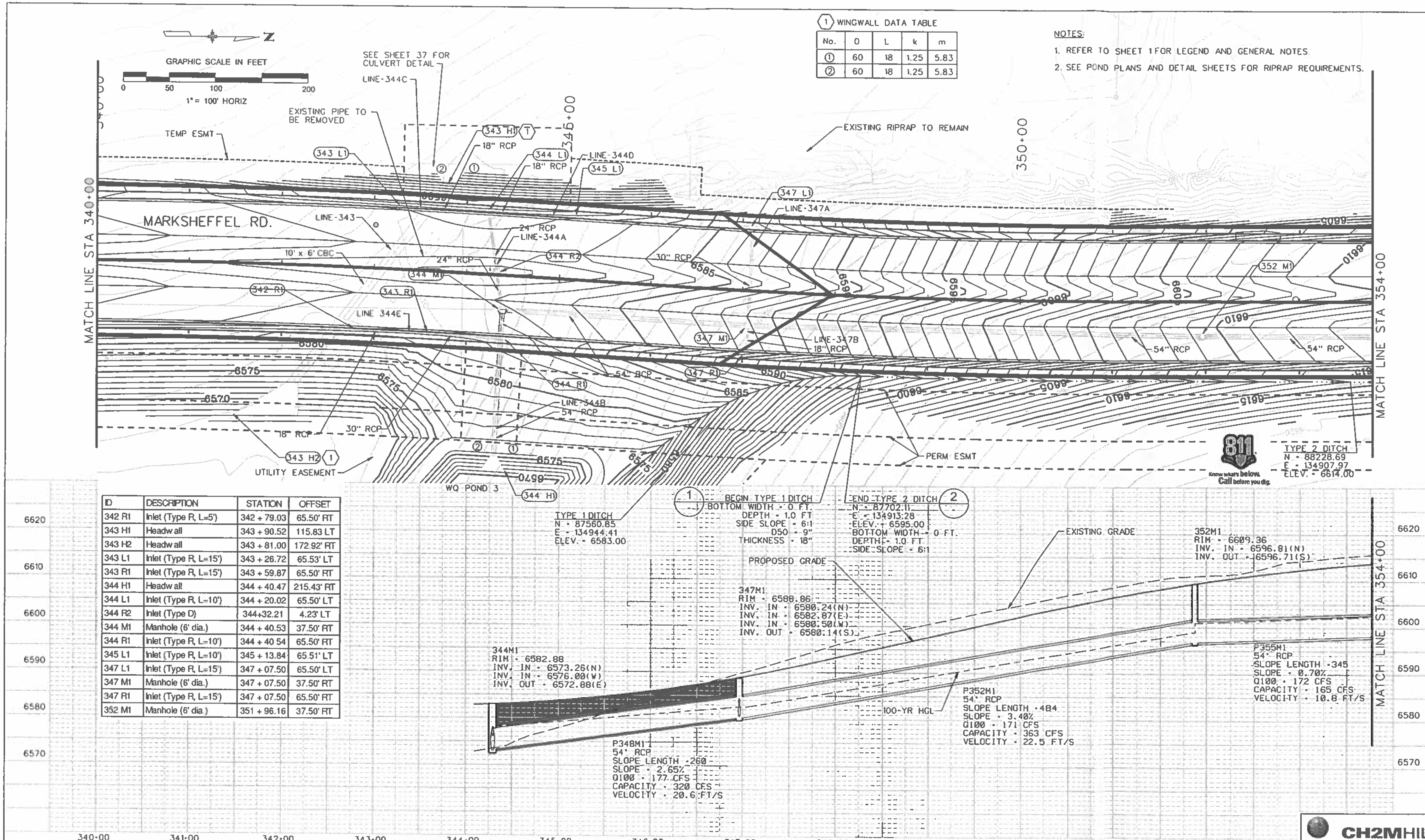
PRELIMINARY - NOT FOR CONSTRUCTION

NOTES:

1. REFER TO SHEET 1 FOR LEGEND AND GENERAL NOTES
2. SEE POND PLANS AND DETAIL SHEETS FOR RIPRAP REQUIREMENTS.

(1) WINGWALL DATA TABLE

No.	0	L	k	m
①	60	18	1.25	5.83
②	60	18	1.25	5.83



ID	DESCRIPTION	STATION	OFFSET
342 R1	Inlet (Type R, L=5')	342 + 79.03	65.50' RT
343 H1	Headwall	343 + 90.52	115.83 LT
343 H2	Headwall	343 + 81.00	172.92' RT
343 L1	Inlet (Type R, L=15')	343 + 26.72	65.53' LT
343 R1	Inlet (Type R, L=15')	343 + 59.87	65.50' RT
344 H1	Headwall	344 + 40.47	215.43' RT
344 L1	Inlet (Type R, L=10')	344 + 20.02	65.50' LT
344 R2	Inlet (Type D)	344+32.21	4.23' LT
344 M1	Manhole (6' dia.)	344 + 40.53	37.50' RT
344 R1	Inlet (Type R, L=10')	344 + 40.54	65.50' RT
345 L1	Inlet (Type R, L=10')	345 + 13.84	65.51' LT
347 L1	Inlet (Type R, L=15')	347 + 07.50	65.50' LT
347 M1	Manhole (6' dia.)	347 + 07.50	37.50' RT
347 R1	Inlet (Type R, L=15')	347 + 07.50	65.50' RT
352 M1	Manhole (6' dia.)	351 + 96.16	37.50' RT

Know what's below. Call before you dig.

Computer File Information
Creation Date: 10/23/07 Initials: LMS
Print Date: 13-MAY-2008 Initials: LMS
File Name: drpp07ba.dgn

Sheet Revisions

Date:	Comments	Init.

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Marksheffel Road
Drainage Plan and Profile

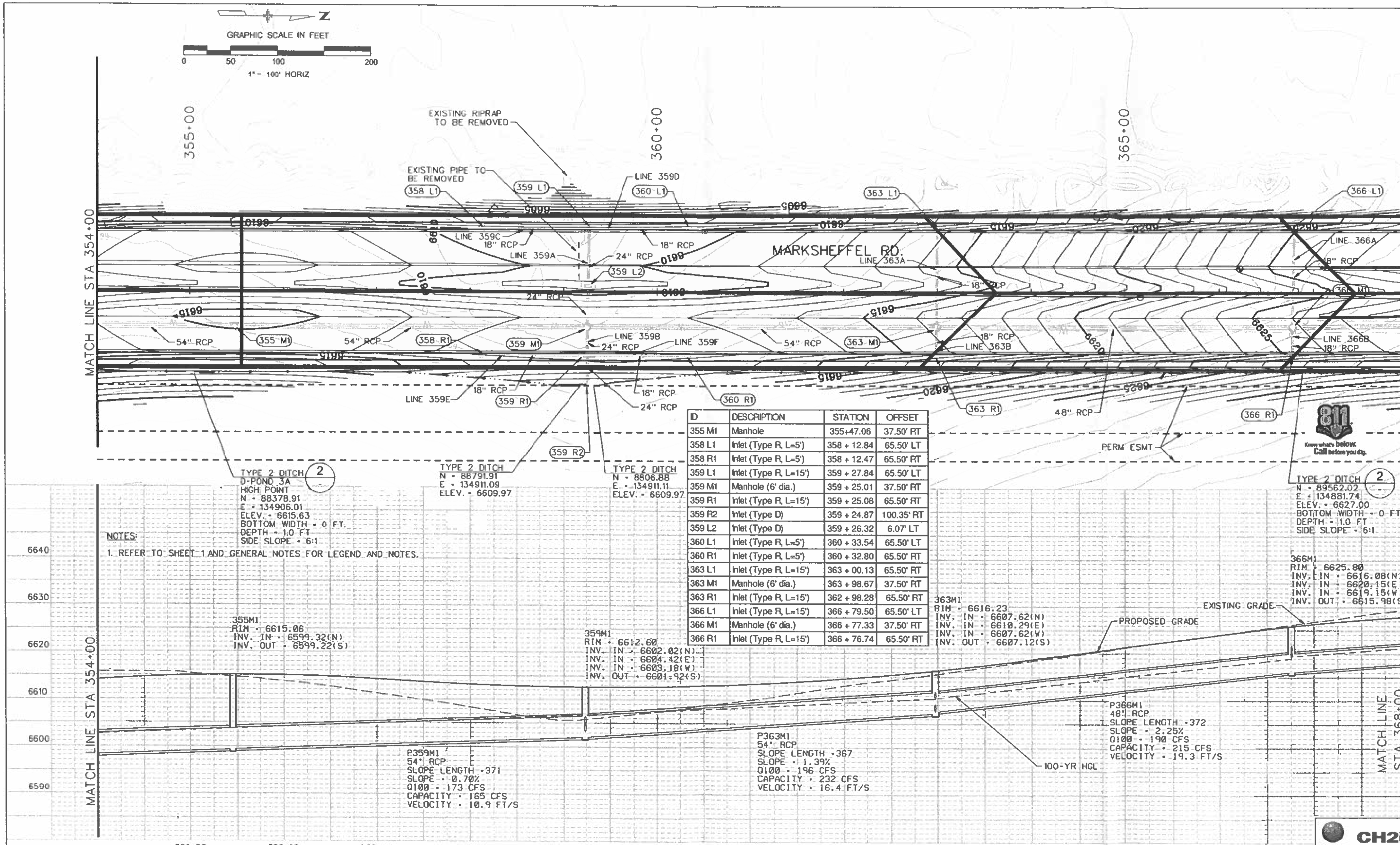
Designer: GCS
Detailer: LMS
Structure Numbers
Sheet Subset: Drainage
Subset Sheets: 7 of 16

CH2MHILL

Project No./Code
PPRTA
75174

Sheet Number

PRELIMINARY - NOT FOR CONSTRUCTION



ID	DESCRIPTION	STATION	OFFSET
355 M1	Manhole	355+47.06	37.50' RT
358 L1	Inlet (Type R, L=5')	358 + 12.84	65.50' LT
358 R1	Inlet (Type R, L=5')	358 + 12.47	65.50' RT
359 L1	Inlet (Type R, L=15')	359 + 27.84	65.50' LT
359 M1	Manhole (6' dia.)	359 + 25.01	37.50' RT
359 R1	Inlet (Type R, L=15')	359 + 25.08	65.50' RT
359 R2	Inlet (Type D)	359 + 24.87	100.35' RT
359 L2	Inlet (Type D)	359 + 26.32	6.07' LT
360 L1	Inlet (Type R, L=5')	360 + 33.54	65.50' LT
360 R1	Inlet (Type R, L=5')	360 + 32.80	65.50' RT
363 L1	Inlet (Type R, L=15')	363 + 00.13	65.50' RT
363 M1	Manhole (6' dia.)	363 + 98.67	37.50' RT
363 R1	Inlet (Type R, L=15')	362 + 98.28	65.50' RT
366 L1	Inlet (Type R, L=15')	366 + 79.50	65.50' LT
366 M1	Manhole (6' dia.)	366 + 77.33	37.50' RT
366 R1	Inlet (Type R, L=15')	366 + 76.74	65.50' RT

Computer File Information
Creation Date: 10/23/07 Initials: LMS
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File Name: drpp08ba.dgn

Sheet Revisions

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Marksheffel Road
Drainage Plan and Profile
Designer: GCS
Detailer: ADH
Sheet Subset: Drainage
Structure Numbers
Subset Sheets: 8 of 16

CH2MHILL
Project No./Code
PPRTA
75174
Sheet Number

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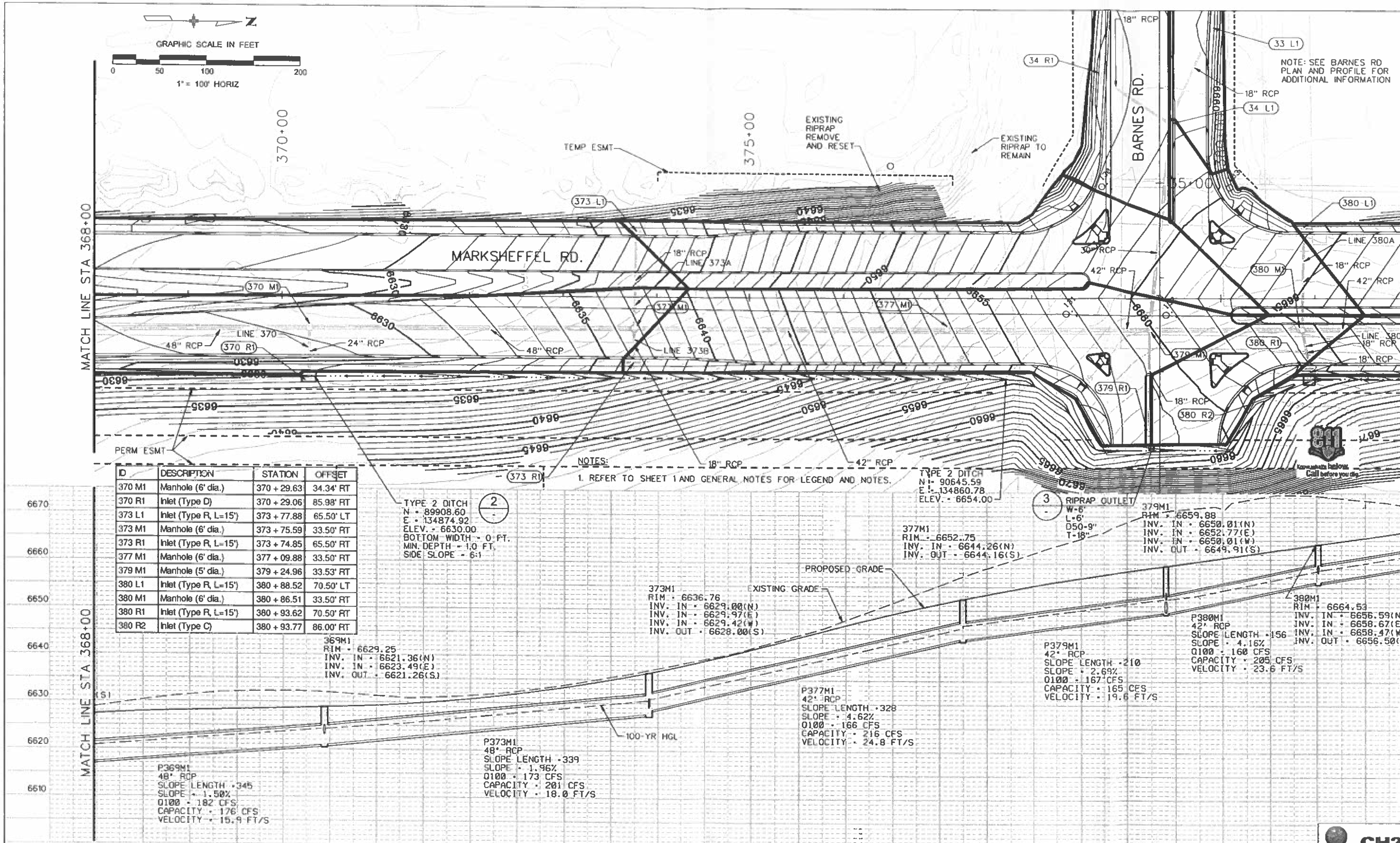

ID	DESCRIPTION	STATION	OFFSET
370 M1	Manhole (6' dia.)	370 + 29.63	34.34' RT
370 R1	Inlet (Type D)	370 + 29.06	85.98' RT
373 L1	Inlet (Type R, L=15')	373 + 77.88	65.50' LT
373 M1	Manhole (6' dia.)	373 + 75.59	33.50' RT
373 R1	Inlet (Type R, L=15')	373 + 74.85	65.50' RT
377 M1	Manhole (6' dia.)	377 + 09.88	33.50' RT
379 M1	Manhole (5' dia.)	379 + 24.96	33.53' RT
380 L1	Inlet (Type R, L=15')	380 + 88.52	70.50' LT
380 M1	Manhole (6' dia.)	380 + 86.51	33.50' RT
380 R1	Inlet (Type R, L=15')	380 + 93.62	70.50' RT
380 R2	Inlet (Type C)	380 + 93.77	86.00' RT

Computer File Information
Creation Date: 10/23/07 Initials: LMS
Print Date: 13-MAY-2008 Initials: ADH
File Name: drpp09ba.dgn

Sheet Revisions
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Marksheffel Road
Drainage Plan and Profile
Designer: GCS
Detailer: ADH
Sheet Subset: Drainage
Structure Numbers
Subset Sheets: 9 of 16

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Project No./Code
PPRTA
75174
Sheet Number

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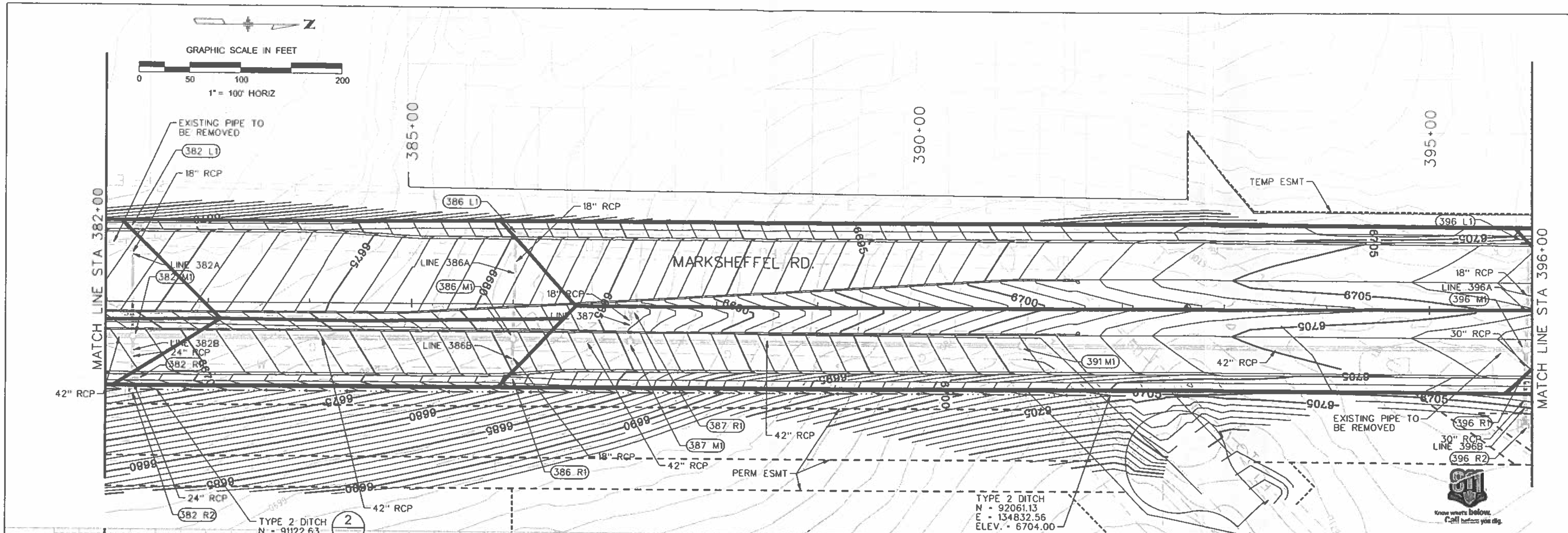

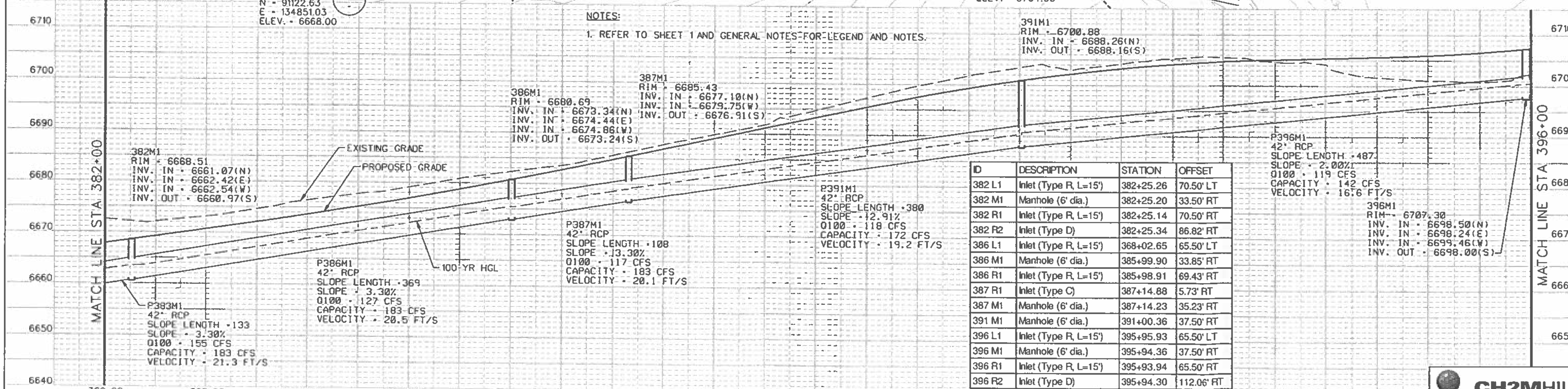

ID	DESCRIPTION	STATION	OFFSET
382 L1	Inlet (Type R, L=15')	382+25.26	70.50' LT
382 M1	Manhole (6' dia.)	382+25.20	33.50' RT
382 R1	Inlet (Type R, L=15')	382+25.14	70.50' RT
382 R2	Inlet (Type D)	382+25.34	86.82' RT
386 L1	Inlet (Type R, L=15')	368+02.65	65.50' LT
386 M1	Manhole (6' dia.)	385+99.90	33.85' RT
386 R1	Inlet (Type R, L=15')	385+98.91	69.43' RT
387 R1	Inlet (Type C)	387+14.88	5.73' RT
387 M1	Manhole (6' dia.)	387+14.23	35.23' RT
391 M1	Manhole (6' dia.)	391+00.36	37.50' RT
396 L1	Inlet (Type R, L=15')	395+95.93	65.50' LT
396 M1	Manhole (6' dia.)	395+94.36	37.50' RT
396 R1	Inlet (Type R, L=15')	395+93.94	65.50' RT
396 R2	Inlet (Type D)	395+94.30	112.06' RT

Computer File Information
Creation Date: 10/23/07 Initials: LMS
Print Date: 13-MAY-2008 Initials: ADH
File Name: drpp10ba.dgn

Sheet Revisions

Date:	Comments	Init.

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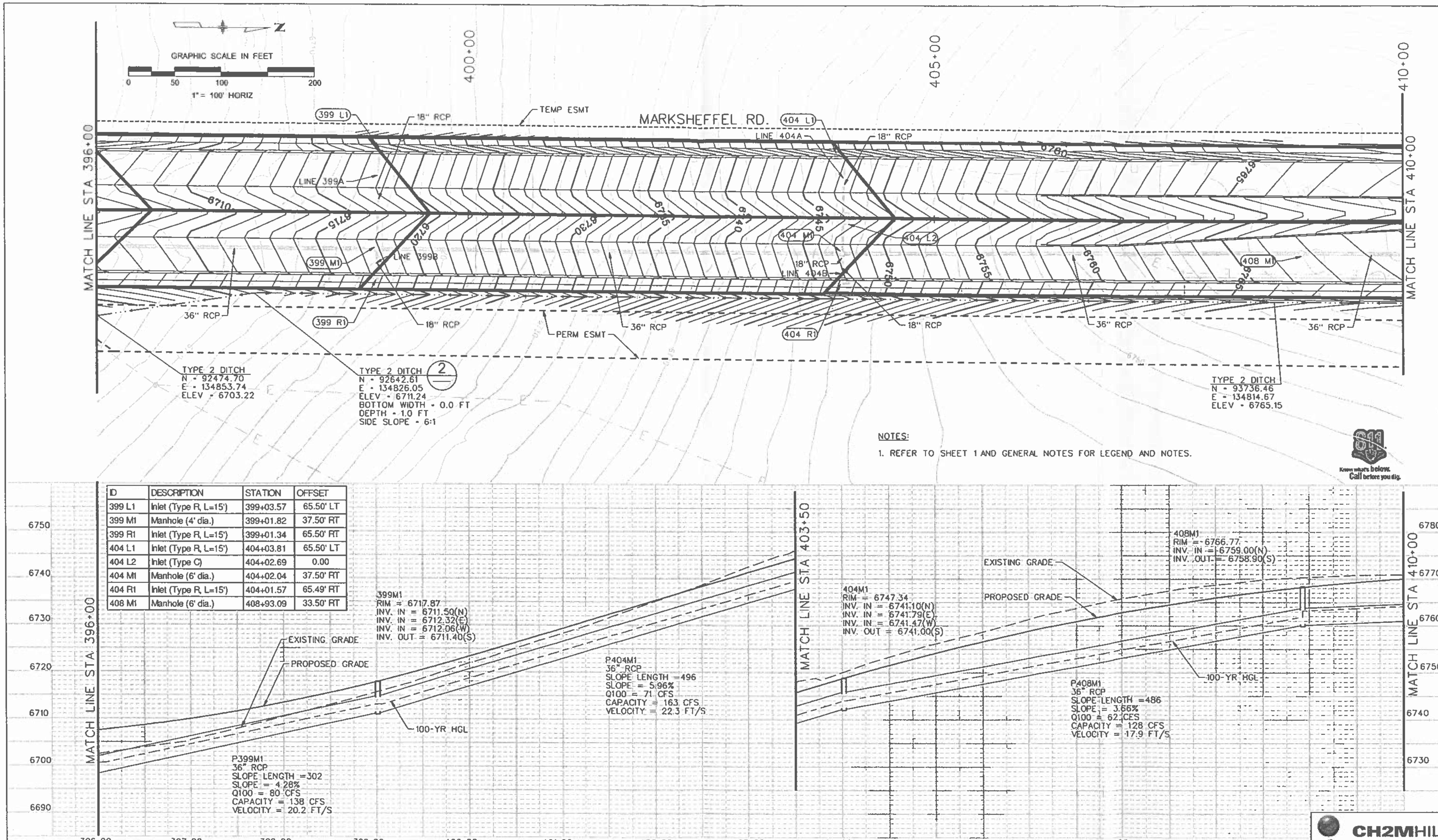
Marksheffel Road
Drainage Plan and Profile

Designer: GCS
Detailer: ADH
Structure Numbers
Sheet Subset: Drainage
Subset Sheets: 10 of 16

CH2MHILL

Project No./Code
PPRTA
75174
Sheet Number

PRELIMINARY - NOT FOR CONSTRUCTION



ID	DESCRIPTION	STATION	OFFSET
399 L1	Inlet (Type R, L=15')	399+03.57	65.50' LT
399 M1	Manhole (4' dia.)	399+01.82	37.50' RT
399 R1	Inlet (Type R, L=15')	399+01.34	65.50' RT
404 L1	Inlet (Type R, L=15')	404+03.81	65.50' LT
404 L2	Inlet (Type C)	404+02.69	0.00
404 M1	Manhole (6' dia.)	404+02.04	37.50' RT
404 R1	Inlet (Type R, L=15')	404+01.57	65.49' RT
408 M1	Manhole (6' dia.)	408+93.09	33.50' RT

Computer File Information
Creation Date: 10/23/07 Initials: LMS
Print Date: 13-MAY-2008 Initials: ADH
File Name: drpp11ba.dgn

Sheet Revisions

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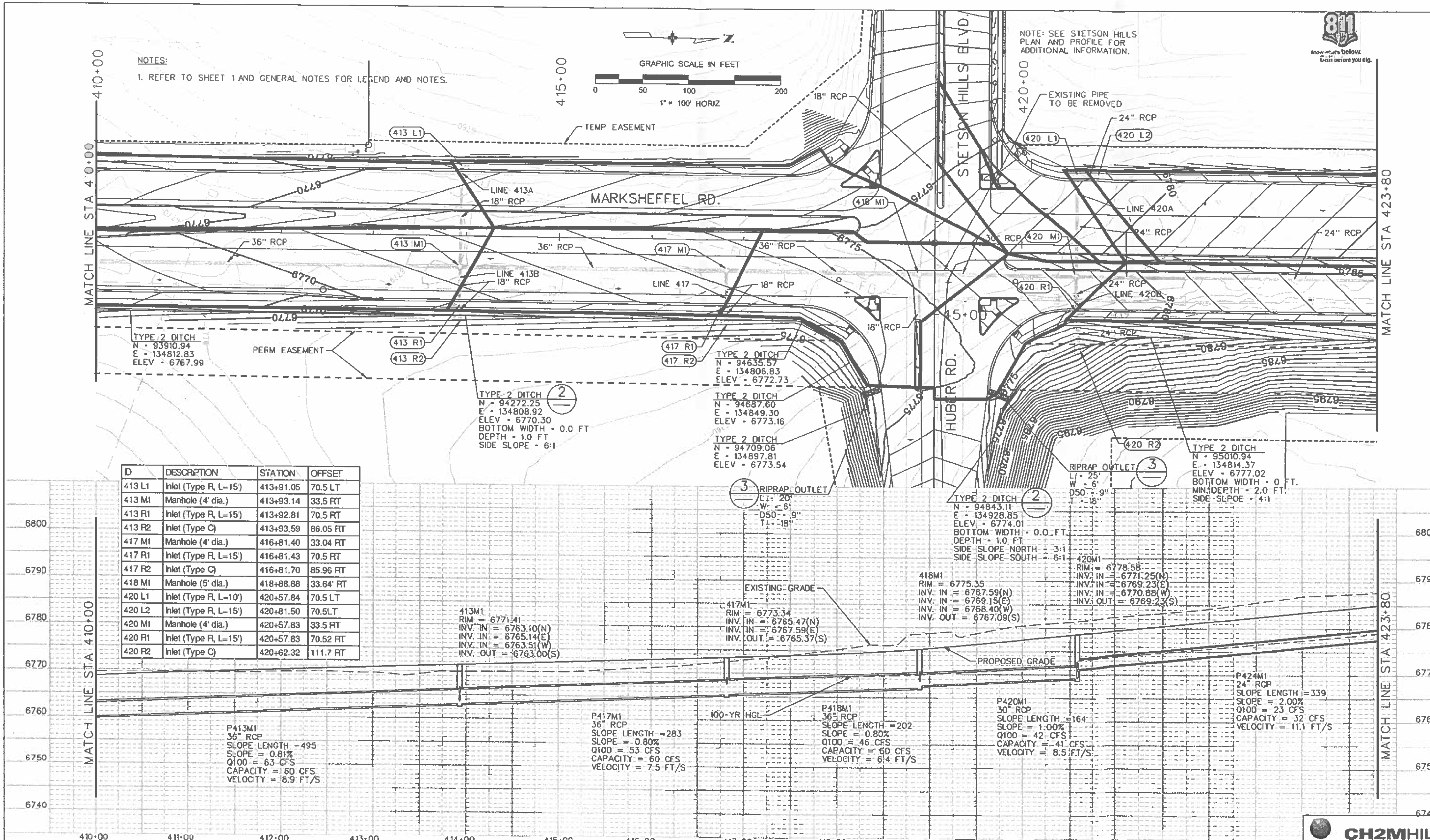
Marksheffel Road
Drainage Plan and Profile

Designer: GCS
Detailer: ADH
Sheet Subset: Drainage
Structure Numbers
Subset Sheets: 11 of 16

CH2MHILL

Project No./Code
PPRTA
75174
Sheet Number

PRELIMINARY - NOT FOR CONSTRUCTION



ID	DESCRIPTION	STATION	OFFSET
413 L1	Inlet (Type R, L=15')	413+91.05	70.5 LT
413 M1	Manhole (4' dia.)	413+93.14	33.5 RT
413 R1	Inlet (Type R, L=15')	413+92.81	70.5 RT
413 R2	Inlet (Type C)	413+93.59	86.05 RT
417 M1	Manhole (4' dia.)	416+81.40	33.04 RT
417 R1	Inlet (Type R, L=15')	416+81.43	70.5 RT
417 R2	Inlet (Type C)	416+81.70	85.96 RT
418 M1	Manhole (5' dia.)	418+88.88	33.64' RT
420 L1	Inlet (Type R, L=10')	420+57.84	70.5 LT
420 L2	Inlet (Type R, L=15')	420+81.50	70.5LT
420 M1	Manhole (4' dia.)	420+57.83	33.5 RT
420 R1	Inlet (Type R, L=15')	420+57.83	70.52 RT
420 R2	Inlet (Type C)	420+62.32	111.7 RT

Computer File Information
Creation Date: 10/23/07 Initials: LMS
Print Date: 13-MAY-2008 Initials: ADH
File Name: drpp12ba.dgn

Sheet Revisions

Date:	Comments	Init.

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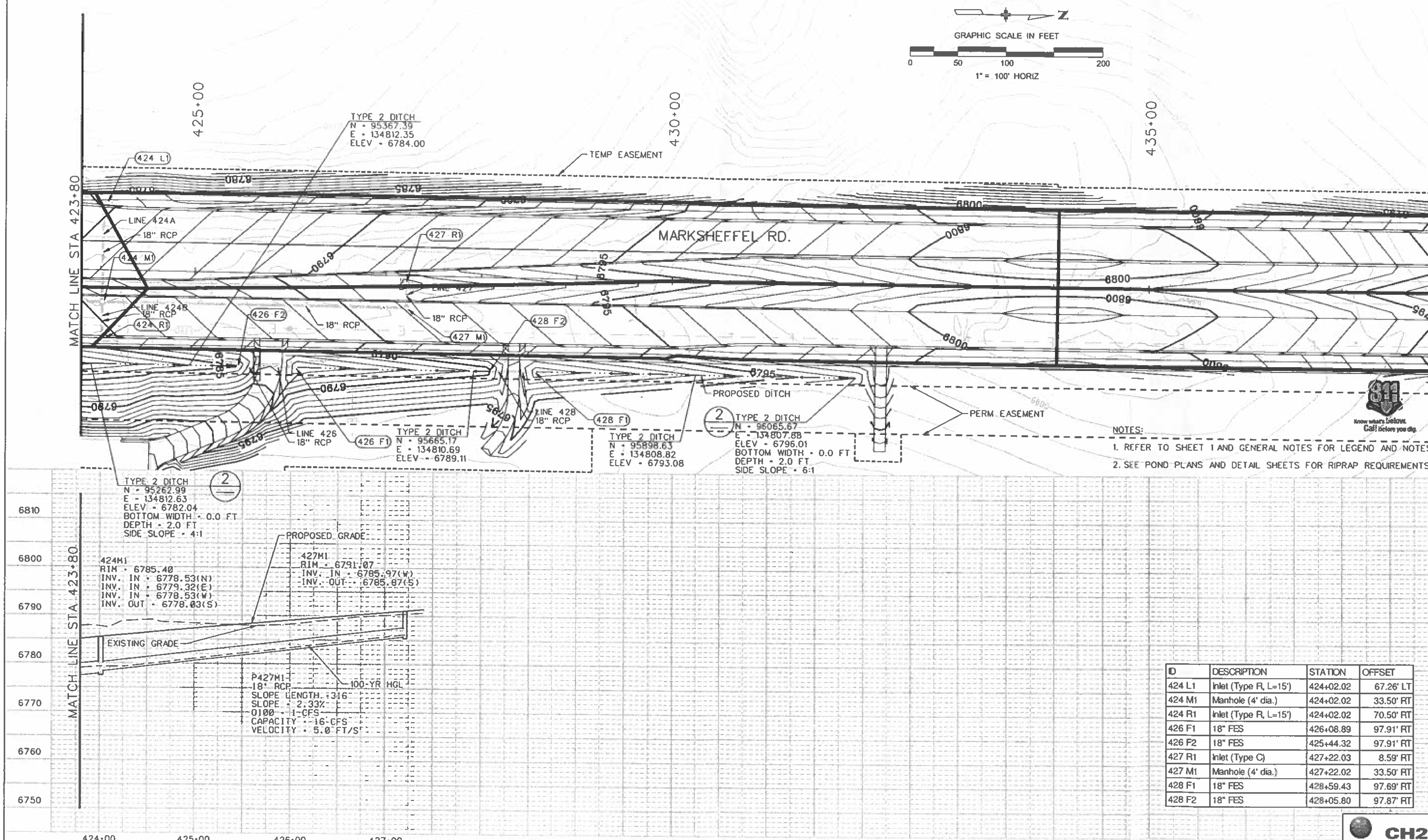
Marksheffel Road
Drainage Plan and Profile

Designer: GCS
Detailer: ADH
Sheet Subset: Drainage
Structure Numbers
Subset Sheets: 12 of 16

CH2MHILL

Project No./Code
PPRTA
75174
Sheet Number



NOTES:

1. REFER TO SHEET 1 AND GENERAL NOTES FOR LEGEND AND NOTES.
2. SEE POND PLANS AND DETAIL SHEETS FOR RIPRAP REQUIREMENTS.

ID	DESCRIPTION	STATION	OFFSET
424 L1	Inlet (Type R, L=15')	424+02.02	67.26' LT
424 M1	Manhole (4' dia.)	424+02.02	33.50' RT
424 R1	Inlet (Type R, L=15')	424+02.02	70.50' RT
426 F1	18" FES	426+08.89	97.91' RT
426 F2	18" FES	425+44.32	97.91' RT
427 R1	Inlet (Type C)	427+22.03	8.59' RT
427 M1	Manhole (4' dia.)	427+22.02	33.50' RT
428 F1	18" FES	428+59.43	97.69' RT
428 F2	18" FES	428+05.80	97.87' RT

CH2MHILL

Computer File Information			
Creation Date:	10/23/07	Initials:	LMS
Print Date:	13-MAY-2008	Initials:	ADH
File Name:	drpp13ba.dgn		

Sheet Revisions		
Date:	Comments	Init.

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Marksheffel Road
Drainage Plan and Profile

Designer: GCS
Detailer: ADH
Sheet Subset: Drainage
Structure Numbers
Subset Sheets: 13 of 16

Project No./Code
PPRTA
75174
Sheet Number

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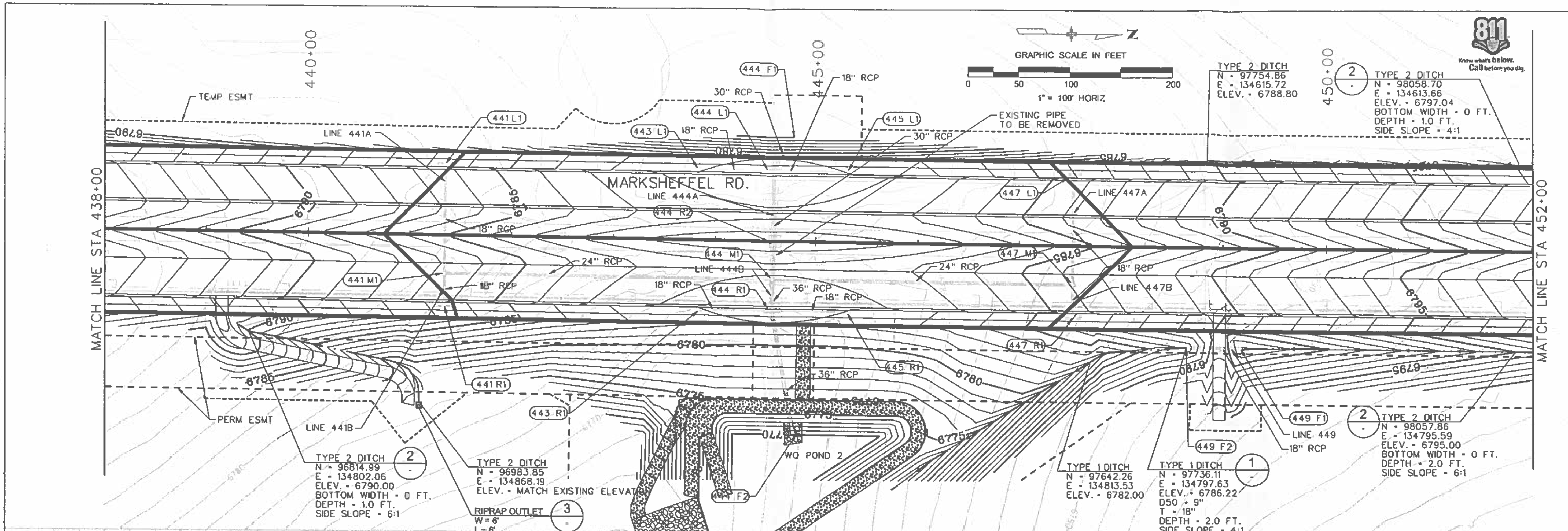
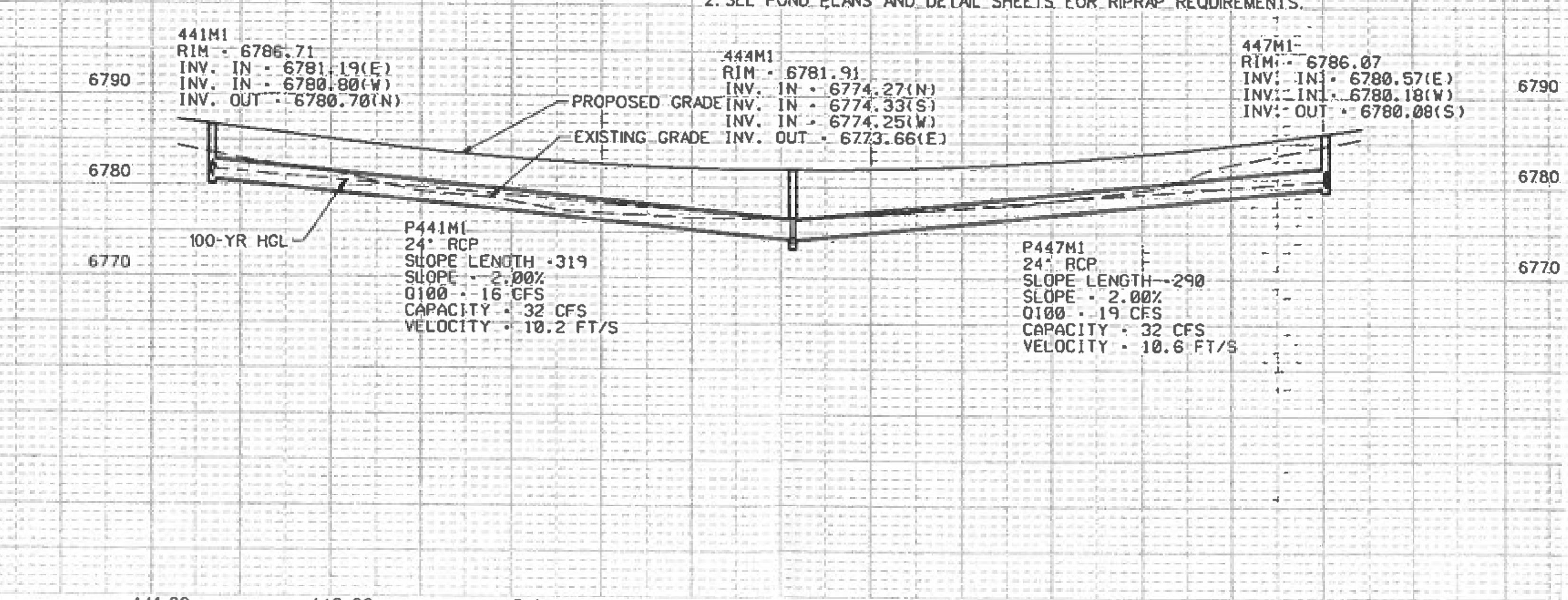


NOTES:

1. REFER TO SHEET 1 AND GENERAL NOTES FOR LEGEND AND NOTES.
2. SEE POND PLANS AND DETAIL SHEETS FOR RIPRAP REQUIREMENTS.



ID	DESCRIPTION	STATION	OFFSET
441 L1	Inlet (Type R, L=15')	441.35.00	65.50' LT
441 M1	Manhole (4' dia.)	441.35.00	37.50' RT
441 R1	Inlet (Type R, L=15')	441.35.00	65.50' RT
443 L1	Inlet (Type R, L=5')	443.83.42	65.50' LT
443 R1	Inlet (Type R, L=5')	443.83.42	65.50' RT
444 F1	30" FES	444.77.13	100.87' LT
444 F2	36" FES	444+79.61	188.88' RT
444 L1	Inlet (Type R, L=15')	444.57.50	65.50' LT
444 M1	Manhole (4' dia.)	444+57.48	37.49' RT
444 R1	Inlet (Type R, L=15')	444+57.50	65.50' RT
444 R2	Inlet (Type C)	444+50.66	0
445 L1	Inlet (Type R, L=5')	445+31.50	65.50' LT
445 R1	Inlet (Type R, L=5')	445.31.50	65.50' RT
447 L1	Inlet (Type R, L=15')	447+51.87	65.50' LT
447 M1	Manhole (4' dia.)	447+51.87	37.50' RT
447 R1	Inlet (Type R, L=15')	447+51.87	66.18' RT
449 F1	18" FES	449+20.92	97.86' RT
449 F2	18" FES	448+63.77	97.97' RT

Computer File Information	
Creation Date: 10/23/07	Initials: LMS
Print Date: 13-MAY-2008	Initials: ADH
File Name: drpp14ba.dgn	

Sheet Revisions		
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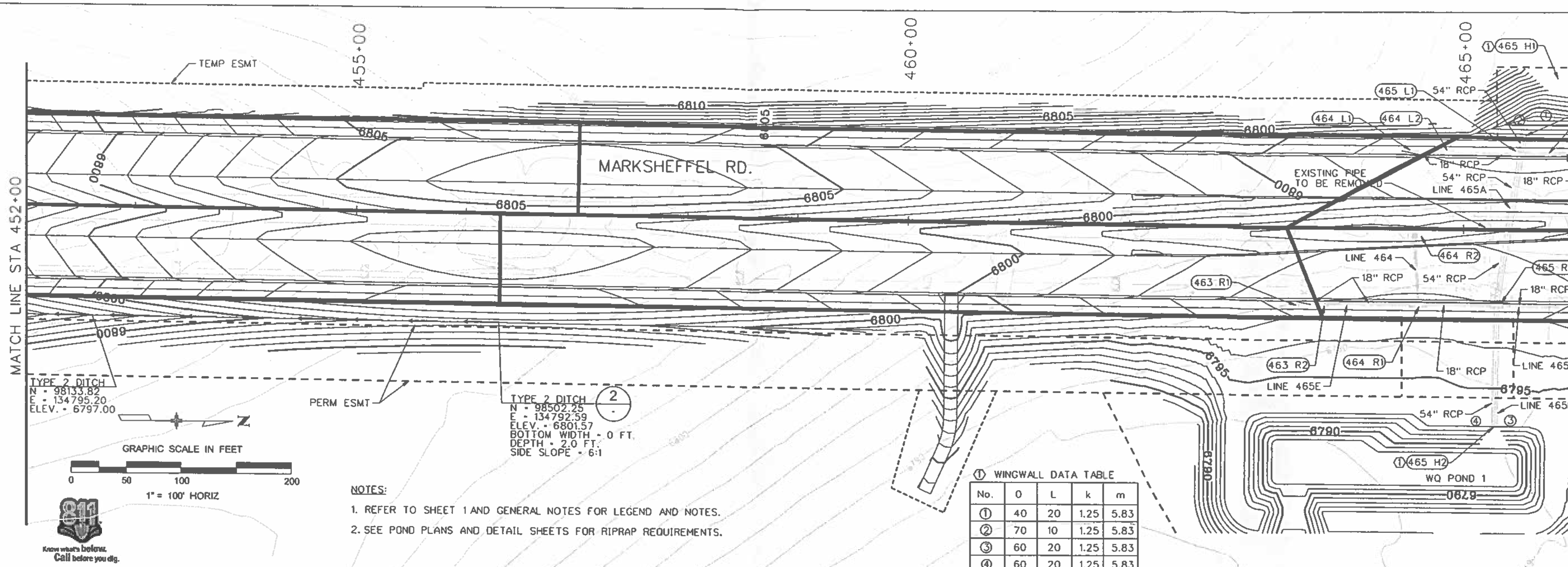
Marksheffel Road
Drainage Plan and Profile

Designer: GCS
Detailer: ADH
Structure Numbers
Sheet Subset: Drainage
Subset Sheets: 14 of 16

Project No./Code
PPRTA
75174
Sheet Number



NOTES:

1. REFER TO SHEET 1 AND GENERAL NOTES FOR LEGEND AND NOTES.
2. SEE POND PLANS AND DETAIL SHEETS FOR RIPRAP REQUIREMENTS.

① WINGWALL DATA TABLE

No.	O	L	k	m
①	40	20	1.25	5.83
②	70	10	1.25	5.83
③	60	20	1.25	5.83
④	60	20	1.25	5.83

ID	DESCRIPTION	STATION	OFFSET
463 R1	Inlet (Type R, L=15')	463+55.42	65.50' RT
463 R2	Inlet (Type R, L=5')	463+75.42	65.50' RT
464 L1	Inlet (Type R, L=15')	464+51.12	65.50' LT
464 L2	Inlet (Type R, L=10')	464+84.64	65.50' LT
464 R1	Inlet (Type R, L=15')	464+59.80	65.50' RT
464 R2	Inlet (Type C)	464+55.72	6.42' RT
465 H1	Headwall	465+54.54	84.78' RT
465 H2	Headwall	465+29.33	177.63' RT
465 L1	Inlet (Type R, L=15')	465.50.00	65.50' LT
465 R1	Inlet (Type R, L=10')	465+30.13	65.50' RT

Computer File Information
Creation Date: 10/23/07 Initials: LMS
Print Date: 13-MAY-2008 Initials: ADH
File Name: drpp15ba.dgn

Sheet Revisions

Date:	Comments	Init.

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Marksheffel Road
Drainage Plan and Profile

Designer: GCS
Detailer: ADH
Structure Numbers
Sheet Subset: Drainage
Subset Sheets: 15 of 16

CH2MHILL
Project No./Code
PPRTA
75174
Sheet Number

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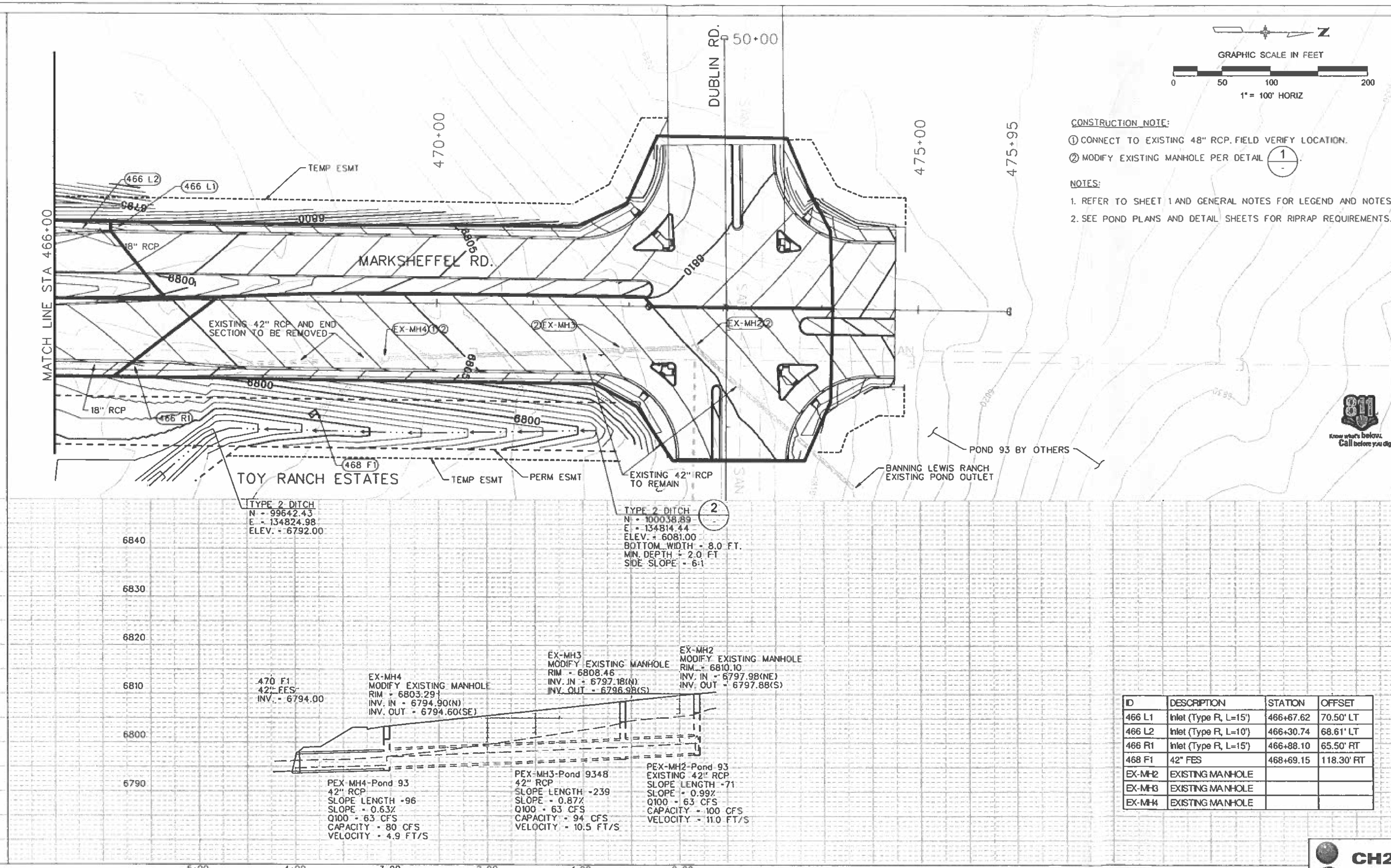
PRELIMINARY - NOT FOR CONSTRUCTION



CONSTRUCTION NOTE:

1. CONNECT TO EXISTING 48" RCP. FIELD VERIFY LOCATION.
2. MODIFY EXISTING MANHOLE PER DETAIL 1/-.

NOTES:

1. REFER TO SHEET 1 AND GENERAL NOTES FOR LEGEND AND NOTES.
2. SEE POND PLANS AND DETAIL SHEETS FOR RIPRAP REQUIREMENTS.

ID	DESCRIPTION	STATION	OFFSET
466 L1	Inlet (Type R, L=15')	466+67.62	70.50' LT
466 L2	Inlet (Type R, L=10')	466+30.74	68.61' LT
466 R1	Inlet (Type R, L=15')	466+88.10	65.50' RT
468 F1	42" FES	468+69.15	118.30' RT
EX-MH2	EXISTING MANHOLE		
EX-MH3	EXISTING MANHOLE		
EX-MH4	EXISTING MANHOLE		

Computer File Information

Creation Date: 10/23/07 Initials: LMS

Print Date: 13-MAY-2008 Initials: ADH

File Name: drpp16ba.dgn

Sheet Revisions

Date:	Comments	Init.

EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

PPRTA

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As Constructed

No Revisions:

Revised:

Void:

Marksheffel Road
Drainage Plan and Profile

Designer: GCS

Detailer: ADH

Sheet Subset: Drainage

Structure Numbers

Subset Sheets: 16 of 16

CH2MHILL

Project No./Code

PPRTA 75174

Sheet Number

LEGEND

EXISTING BASIN

PROPOSED BASIN ENTERING PIPE SYSTEM

PROPOSED BASIN ENTERING CULVERT

TYPE A SOIL

TYPE B SOIL

NOTE

1. SOIL INFORMATION OBTAINED FROM NRCS WEB SOIL SURVEY

* OFFSITE BYPASS DOES NOT ENTER STORM PIPE SYSTEM.

CH2MHILL

Computer File Information	
Creation Date: 03/22/07	Initials: RF
Print Date: 05/08/08	Initials: RF
File Name: EXSU03PL.dgn	

Sheet Revisions		
Date:	Comments	Init.

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As Constructed
No Revisions:
Revised:
Void:

Marksheffel Road
SOILS MAP

Designer: DS
Detailer: RF
Sheet Subset:
Structure Numbers
Subset Sheets: of

Project No./Code
PPRTA 75174
Sheet Number

N

800 0 800 1600

SCALE: 1"=800'

LEGEND

- RESIDENTIAL
- INDUSTRIAL
- UNDEVELOPED
- EXISTING BASIN

Computer File Information	
Creation Date: 03/20/07	Initials: RF
Print Date: 05/08/08	Initials: RF
File Name: EXSU01PL.dgn	

Sheet Revisions		
Date:	Comments	Init.

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As Constructed

No Revisions:

Revised:

Void:

Marksheffel Road
EXISTING LAND USE MAP

Designer: DS

Detailer: RF

Sheet Subset:

Structure Numbers

Subset Sheets: of

CH2MHILL

Project No./Code

PPRTA
75174

Sheet Number

N

800 0 800 1600

SCALE: 1"=800'

LEGEND

- RESIDENTIAL
- BUSINESS
- INDUSTRIAL
- HEAVY INDUSTRIAL
- UNDEVELOPED
- BASIN ENTERING PIPE SYSTEM
- BASIN ENTERING CULVERT

NOTE:
OFFSITE BYPASS DOES NOT ENTER STORM PIPE SYSTEM FOR OS-P2A, OS-P2B AND OS-P4A.

Computer File Information	
Creation Date: 03/22/07	Initials: RF
Print Date: 05/08/08	Initials: RF
File Name: EXSU02PL.dgn	

Sheet Revisions		
Date:	Comments	Init.

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As Constructed
No Revisions:
Revised:
Void:

Marksheffel Road
FUTURE LAND USE MAP

Designer: DS		Structure Numbers	
Detailer: RF			
Sheet Subset:		Subset Sheets:	of

CH2MHILL

Project No./Code
PPRTA
75174

Sheet Number

800 0 800 1600
SCALE: 1"=800'

LEGEND

- RESIDENTIAL
- BUSINESS
- INDUSTRIAL
- HEAVY INDUSTRIAL
- UNDEVELOPED
- BASIN ENTERING PIPE SYSTEM
- BASIN ENTERING CULVERT

NOTE:
OFFSITE BYPASS DOES NOT ENTER STORM PIPE SYSTEM FOR OS-P2A, OS-P2B AND OS-P4A.

Computer File Information	
Creation Date: 03/22/07	Initials: RF
Print Date: 05/08/08	Initials: RF
File Name: EXSU02PL.dgn	

Sheet Revisions		
Date:	Comments	Init.

EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

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As Constructed	Marksheffel Road FUTURE LAND USE MAP	
No Revisions:		
Revised:	Designer: DS	Structure Numbers
Void:	Detailer: RF	
	Sheet Subset:	Subset Sheets: of

CH2MHILL

Project No./Code
PPRTA 75174
Sheet Number