FAIRLANE PKWY - MDDP

CITY OF COLORADO SPRINGS

TRM

Interstate 25
Fairlane Parkway
Interchange

Addendum to
Preliminary Hydraulic Report
PHASE II

Prepared for: **SCHUCK HOLDINGS LLC.**

May 7, 1998

DMJM Project No. 3821.00/01

DMJM

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CITY OF COLORADO SPRINGS

I. INTRODUCTION

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FAIRLANE INTERCHANGE-ADDENDUM TO PRELIMINARY DRAINAGE REPORT PHASE II

I. INTRODUCTION

A. PURPOSE AND SCOPE

The purpose of this document is to provide an update to previous drainage studies to facilitate the proposed construction of Phase Two of Fairlane Parkway Interchange. This report is based upon the Colorado Department of Transportation Drainage Criteria developed in1995 and the City of Colorado Springs Drainage criteria developed in October 1987, revised November 1991. HEC-12 was utilized as an additional reference.

This study defines the general nature of existing historic runoff conditions and the preliminary impact of the development of Phase Two of Fairlane Parkway Interchange on existing downstream drainage facilities. This report also determines proposed drainage facilities designed to accommodate both offsite and onsite runoff occurring in Phase II.

More specifically this report includes determining the limits of contributory drainage basins and the major drainage facilities in Phase Two. The drainage basin data was established including: delineating basins, determining basin size, determining waterway geometries, and establishing vegetation cover and land use. Based on this hydrologic analysis, preliminary structure hydraulic design, structure cross sections, and a storm water management plan were produced. In the appendix; drainage basin maps, preliminary storm sewer design, structure cross sections, project design criteria, and three channel alternatives are included.

B. PROJECT LIMITS

The proposed Fairlane Interchange study area is located in north Colorado Springs in Sections 19, 20, 21, 15, 16, 17, Township12 South, Range 66, west of the Sixth Principal Meridian. The study area is displayed on Figure 1, page 3. It is bounded on the west by Interstate 25 (including its surface and proposed interchange ramps), on the north by a ridgeline that divides drainage north toward Black Squirrel Basin and south toward the Fairlane Parkway Interchange, to the east by the Kettle Creek Drainage Basin, and on the south by the proposed Fairlane Parkway. The construction of the project has been broken into two phases, with phase 1 ending at the intersection of present State Highway 83 (SH83) and existing Stout Allen Road and Phase Two ending with the future northern intersection of SH 83 and Fairlane Parkway. The proposed project disturbance area contains approximately 126.37 acres or .197 square miles; including ramp infield areas and a proposed detention pond site. Historically, the project area receives runoff from an area of about 227 acres to the northeast of the property. This area is currently undeveloped pasture land. A small ridge line along the southerly limits of the basin prevents this runoff from reaching Kettle Creek. An extended Powers Boulevard proposed by others may alter historic drainage patterns in offsite area O-1 (See Appendix A/Design Point 1).

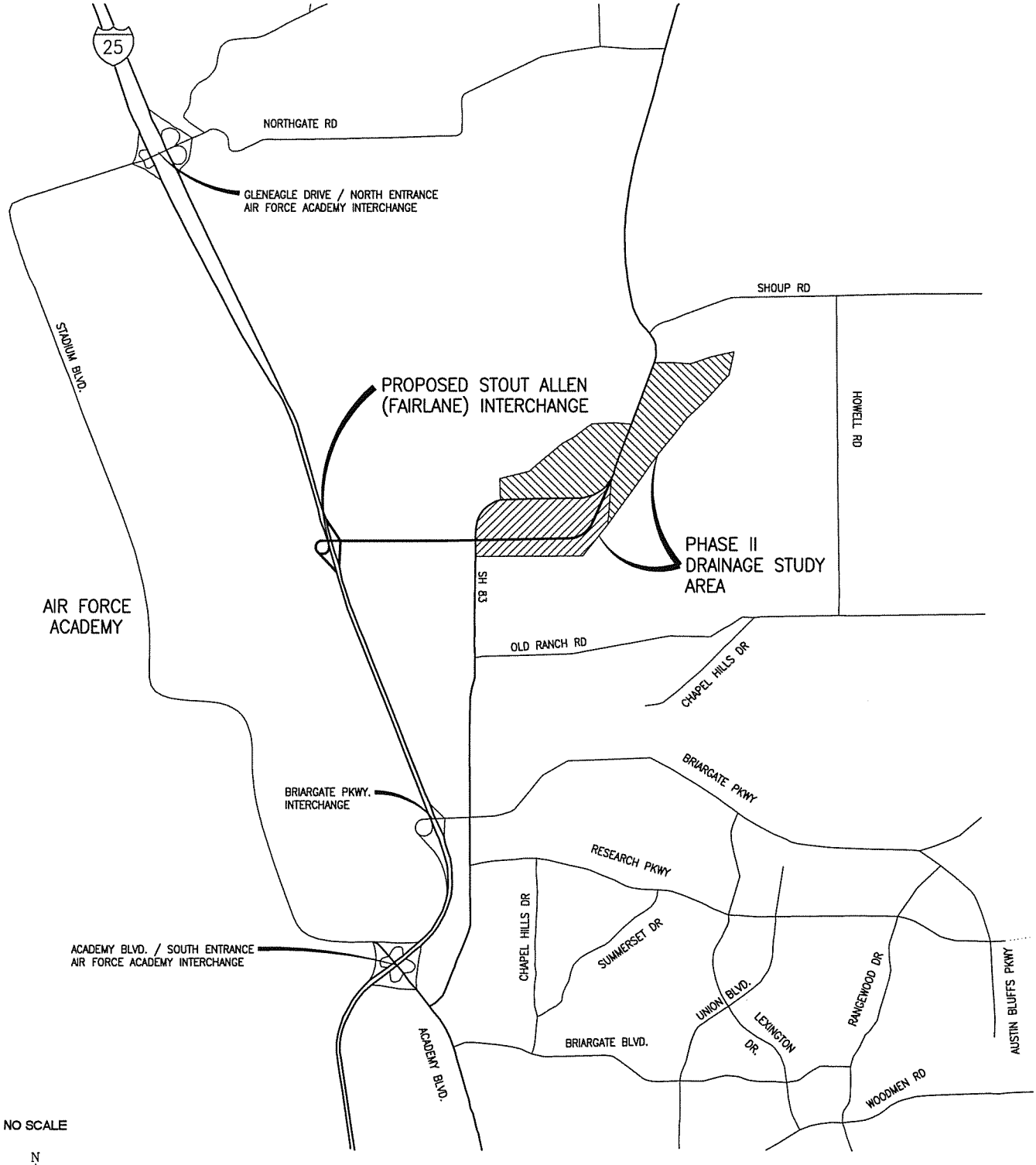
The current network of roadways and development has slightly affected drainage patterns:

Flows traveling southwest from the northeast sector of the project run into State Highway 83 (SH83) and are channelized north of this highway until crossing into the Pikes Peak Community College (PPCC) site in an existing 24" pipe at design point 2. The community college does not recognize this historic flow in their drainage report as flowing through their property and rather shows flow routed west in a roadside ditch where it is eventually discharged at the northeast corner of SH 83 and the existing Stout Allen Road at design point 4. The remainder of the flow from the PPCC is released from the property at historic levels from an onsite detention pond (under construction/design point 3).

The New Life Church has also constructed an onsite detention facility that releases flow at historic rates from its property to the northeast side of the Stout Allen, SH 83 Intersection.

All of the areas studied drain directly to Monument Creek to the west.

VICINITY MAP
PHASE II
FAIRLANE INTERCHANGE



NO SCALE

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Date Prepared: 05/07/98

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Figure 1

Job. No. 3821.00

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II. HYDROLOGY

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II. HYDROLOGY

A. GENERAL DISCUSSION

This report includes review of the drainage limits associated with the area surrounding the proposed project. The review included previous drainage reports and plans that were available from CDOT or the City of Colorado Springs (City). These drainage reports and plans include the following:

1. "Fairlane Technology Park - Hydrology Update," Ayres Associates, November 13, 1997.

2. "Master Development Drainage Report and Plan", Fairlane Technology Park., URS Project No. 42044. October 22, 1993, Revised January 6, 1994.

3. "Preliminary and Final Drainage Report and Plan", Fairlane Technology Park Filing No. 2. URS Project No. 42044. Revised January 6, 1994.

4. "Drainage Memorandum for Pikes Peak Community College North Campus", Colorado Springs, Colorado., El Paso County. URS Project No. 67.42154, October 7, 1996

5. "New Life Church Drainage Report," KLH Engineering, INC., April, 1991.

6. "Preliminary and Final Drainage Report for International Bible Society Filing NO. 1.", URS Project NO. 48404. August, 1988.

7. "Northgate Phase 1 Drainage Plan", URS Project No. 45206, June 15, 1987, Revised August 27, 1987.

8. "Northgate Phase 1 Drainage Plan", URS Project No. 45206, June 15, 1987, Revised August 27, 1987. Addendum Date October 6, 1987.

B. DRAINAGE AREA CHARACTERISTICS

The project is surrounded by undeveloped pasture land with parcels of recently developed light industrial and commercial land. The topography of the site consists of moderately sloping hills which slope in general from northeast to southwest at an average slope of slightly greater than 2%. Existing drainage paths within the basin are not clearly defined by channels or gullies, indicating runoff travels across the site in sheet flows. Offsite basins and on site sub-basins have been delineated and labeled on the "Drainage Basin Area" (DBA) sheets located in Appendix A.

Vegetation within the basin boundaries consists mostly of prairie grasses with some small stands of trees and scrub oak. In this study the undeveloped areas have been considered as pasture or

range land. Phase 2 soils consist mostly of Blakeland Sandy Loam soil type 8. This soil type generally exists in slope ranges between 1-9% and is Hydrologic Soil Type A. The majority of the offsite contributory areas to the northwest are classified as Petyon Pring Complex, Pring Course Sandy Loam, Stapleton Sandy Loam or Stapleton-Bernal-Sandy-Loam. These soils have evolved from material weathered from Arkosic sedimentary rock. Arkosic sedimentary rock is considered a sandstone with granitic source for sand. The sand sized Feldspar particles are much stronger than the cementing material in the sandstone and remaining as discrete particles after loss of cementation in the rock. The result is a granular soil considered to be part of the Hydrologic Soils Group B which is easily erodible by surface water runoff.

Basin soil and land use characteristics determine the resultant level of precipitation runoff that travels over the ground or infiltrates into the soil. The U.S. Soil Conservation Service classifies soils into four hydrologic groups (A, B, C, and D) according to runoff potential. Group A soils exhibit high infiltration rates when thoroughly wetted and are considered to have low runoff potential. Group B soils exhibit moderate infiltration rates when thoroughly wetted. Group C soils exhibit slow infiltration rates when thoroughly wetted. Group D soils exhibit very slow infiltration rates when thoroughly wetted and are considered to have high runoff potential.

In the case of this study. Phase 2 consists primarily of soil type A with low runoff potential. As a result of current City of Colorado Springs Criteria, type A soils are not allowed in runoff analysis where any grading or fill operations have or will occur. Therefore both phase 2 of the project were analyzed with soil type B.

C. DESIGN METHODS AND CRITERIA

Project design criteria were developed that incorporated critical elements of both CDOT and City of Colorado Springs criteria. The methods and criteria utilized are included in Appendix B. The design references used for this project are as follows:

1. "Drainage Design Manual, 1995 Draft", Colorado Department of Transportation, July 1995.

2. "Drainage Criteria Manual", City of Colorado Springs and El Paso County, October, 1987 including amendments in November, 1991 and October, 1994.

3. "Erosion Control and Stormwater Quality Guide", Colorado Department of Transportation, June, 1995.

4. "Soil Survey of El Paso County Area, Colorado" United States Department of Agriculture Soil Conservation Service. 1975.

5. "Design of Small Dams" United States Department of the Interior, Bureau of Reclamation. Revised Reprint, 1977.

6. "NOAA Atlas 2-Precipitation-Frequency Atlas of the Western U.S.," Volume III-Colorado. National Oceanic and Atmospheric Administration, 1973.

7. "Drainage of Highway Pavements", Hydraulic Engineering Circular No. 12, U.S. Department of Transportation/Federal Highway Administration, March 1984.

D. HYDROLOGIC CRITERIA

The design rainfall intensity for sizing of hydraulic structures is the 100 year storm intensity. The on-site calculations of this drainage study area based upon the criteria and requirements of the State Drainage Design Manual (State Manual) and the City of Colorado Springs Design Manual (City Manual). In accordance with chapter 6 of the City Manual, the Rational Method was applied to only basins less than 100 Acres. The Rational Method was used to calculate the 5 and 100 year frequency storm runoffs for any areas that were determined by hand calculations. The Rational Method is defined as follows:

$$Q=CiA$$

Q = maximum rate of runoff in cubic feet per second
C = a runoff coefficient as a ratio between the maximum rate of runoff and the average rate of rainfall intensity over a duration equal to the time of concentration
i = average intensity of rainfall in in/hr for a duration equal to the time of concentration.
A = area of basin or sub-basin in acres

The overall storm sewer system was analyzed using XPRAT storm sewer software. Information on the assumptions and methods used by this software is attached in Appendix D.

The time of concentration is defined as the time required for water to flow from the most remote point of the area to the point being investigated. The runoff coefficients are based on the subasin's historic and proposed land use. A table for these coefficients can be found in the design criteria in Appendix C. The rainfall time/intensity/frequency curve for Zone 11A was taken from the City Manual. (Appendix C).

The time of concentration for basins under with overland flows of less than 300 feet was calculated by utilizing the formula below from the City Manual.

$$Tc = 1.87\ (1.1-C_{10})L^{.5}S^{-.33}$$

Where C_{10} = adjusted runoff coefficient for 10 year flow
L = length of overland flow in feet

S = slope of flow path in percent; and
Tc = travel time in minutes

For basins over 100 acres, or for basins part of a larger analysis, the HEC-1 computer program was utilized. HEC-1 output can be viewed in Appendix C. The time of concentration used for the larger basins was calculated using the formula below with adjustments made for the project location west of the 105 meridian.

$$Tc = \frac{(11.9\ L^3)}{H}^{.385}$$

Where Tc = time of concentration in hours
L = length of longest watercourse in miles
H = elevation difference in feet

The adjustment table for watersheds west of the 105 meridian and mountainous timber-covered watersheds east of the 105 meridian is shown below:

CN	T'c/Tc
80	1.0
70	1.4
60	1.8
50	2.2

Rainfall depths of 3.0 and 4.4 inches were obtained from the NOAA Atlas 2 isopluvials for the project area for the 5-year 24-hour, 10-year 24 hour, and the 100-year 24 hour storm events respectively. Currently no analysis has been performed for the 2-hour 10 year and 2-hour 100 year storm events.

Flow capacities for the proposed road were based on the allowable capacities for major storms according to road type, major arterial and highway respectively. Design assumptions for these systems are located in the design criteria. (Appendix C).

E. OFFSITE HYDROLOGY

The offsite basin flows were calculated using the above hydrologic computation methods and were compared to flows established in the other studied basins. The flows generated by offsite flow analysis were then used to determine culvert capacities on I-25, size proposed pipes, determine grading and other drainage related items.

Offsite Basin O-1

Offsite Basin O-1 was last studied in report reference #1. This basin is shown as containing 170 Acres and producing a 100 year 24 hour historic flow of 230 CFS directly onto the northwest quadrant of the site. Reference #2 shows almost identical data of 169.1 acres and 230 CFS historic flow.

Offsite Basin O-2 (O-2A, O-2B)

Offsite Basin O-2 was last studied in report reference #1. This basin is shown as "not contributing" to the project site. This assumption may be based on the assertion that an existing 24" CMP would be removed. In fact this CMP is undersized but does transfer some flow from approximately 55 acres of OS-2 to the project site. Reference #2 shows this relationship correctly, displaying 55 acres of contributory area and 148.5 cfs 100 year flow. However, it should be noted that only approximately 35 CFS would be able to pass through the pipe in peak flow conditions before possible road overtop of cross basin flow diversion. For clarity OS-2 is broken into 2 parts in this report; OS-2B which does contribute to the project, and OS-2A which contributes to the Black Squirrel Basin.

A summary of design point flows is included below:

DESIGN POINT SUMMARY					
DS	HISTORIC 100 YEAR FLOW	DEVELOPED 100 YEAR FLOW	FLOW INCREASE + FLOW DECREASE -	FLOW CHANGE %	DESCRIPTION OF DESIGN POINT LOCATION
PT					
1	230	*30	-200	-86.96%	OFFSITE AREA O-1/POWERS EXT.
2	148.5	148.5	0	0.00%	CROSS CULVERT/O-2B TO B-9
3	173	60	-113	-65.32%	PIKES PEAK POND
4	178	34	-144	-80.90%	NEW LIFE POND
	*Preliminary Quantities-Assuming future alignment of Powers Boulevard				

CITY OF COLORADO SPRINGS

III. EXISTING STRUCTURE

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III. EXISTING STRUCTURE

A. GENERAL DISCUSSION

Existing drainage systems vary in design capacity and functionability on and around the project. As a result of the different design criteria and land use during the original construction of respective facilities, most existing systems were designed for lower flows. The following discussion will be organized by I-25 facilities, and other facilities in the project area and contributory offsite area.

B. EXISTING HIGHWAY/ROAD CROSSINGS/CHANNELS

There are five pipe crossings of I-25 in the project limits.

STATION 192+03/DESIGN POINT 1
A 42" RCP is proposed to collect flow from design point 1 into the trunkline.

STATION 162+02/DESIGN POINT 3
A 36" RCP is proposed to collect outflow from the Pikes Peak Community College detention pond and a small area of direct drainage.

OTHER FACILITIES

A 24" CMP exists due north of the Pike Peak Community College at design point 2; the pipe crosses perpendicular to SH 83. As previously stated this pipe carries flow from O-2A toward the community college. The college has rerouted the historic flow in a roadside ditch created by berming around the north quadrant of their property. Flow travels toward the New Life Church's Northern Boundary. At the New Life Church flow travels through a 24" RCP (reported as a 30" RCP in other references) and then continues to flow southwest in a roadside ditch to the intersection of existing SH 83 and existing Stout Allen Road at design point 4.

Two detention ponds exist that were designed and constructed/under construction by individual property owners. Pikes Peak Community College's pond was designed in October of 1996 and is presently under construction (design point 3) (Reference #4). It discharges at a rate of 55 CFS to the southeast which is shown as a decrease of 55.6% from the historic flow of 124 CFS. The New Life Church's pond system was designed in April 1991 and is currently operational (design point 4). This pond system discharge at a rate of 34 CFS which is just less than the capacity of the existing 30" culvert under SH 83.

CITY OF COLORADO SPRINGS

IV. DESIGN DISCUSSION

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IV. DESIGN DISCUSSION

A. GENERAL DISCUSSION

Overall, the design criteria of CDOT and the City has been established and the project design based on its guidelines. HEC-12 was also utilized during design to supplement the criteria.

B. SITE SPECIFIC CONDITIONS AND CONSTRAINTS

ROW constraints along the proposed Fairlane Parkway limit some of the choices in transferring drainage through the project.

At the intersection of SH 83 and proposed Fairlane Parkway a 36" water is located approximately 5' below the existing ground. As a result, a 2' X 6' RCBC is proposed to cross SH 83 and avoid alteration of this water line. Final elevations will be included in the final drainage report.

C. MAJOR DRAINAGE ALTERNATIVES

As a result of ROW a storm sewer system is required. At the time of this report it is not known if the drainage from this system will be routed to Pond A or Pond B. (See reference 2.)

D. PERMITTING REQUIREMENTS

A stormwater drainage permit will be prepared and submitted by the consultant.

A section 404 permit will not be submitted as there are no wetlands in the project limits.

A floodplain development permit will not be submitted as there are no designated flood plains within the project area.

V. RECOMMENDED DESIGN

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V. RECOMMENDED DESIGN

A. GENERAL DISCUSSION

Appendix A-includes drainage basin area sheets.
Appendix B-maps and preliminary design drawings for the recommended system.
Appendix C- includes the criteria and calculations for the recommended design.
Appendix D- channel alternatives

B. PROPOSED HYDRAULIC DESIGN

FAIRLANE PARKWAY

Phase 2 systems collect flow from Pikes Peak Community College and Offsite Area O-1 in addition to the flow from the project area. Flow from Phase 2 travels into Phase 1 and coordination of trunkline outfall construction will be detailed during final design.

For specific design information see Appendices.

CITY OF COLORADO SPRINGS

APPENDIX A

DRAINAGE BASIN AREA SHEETS

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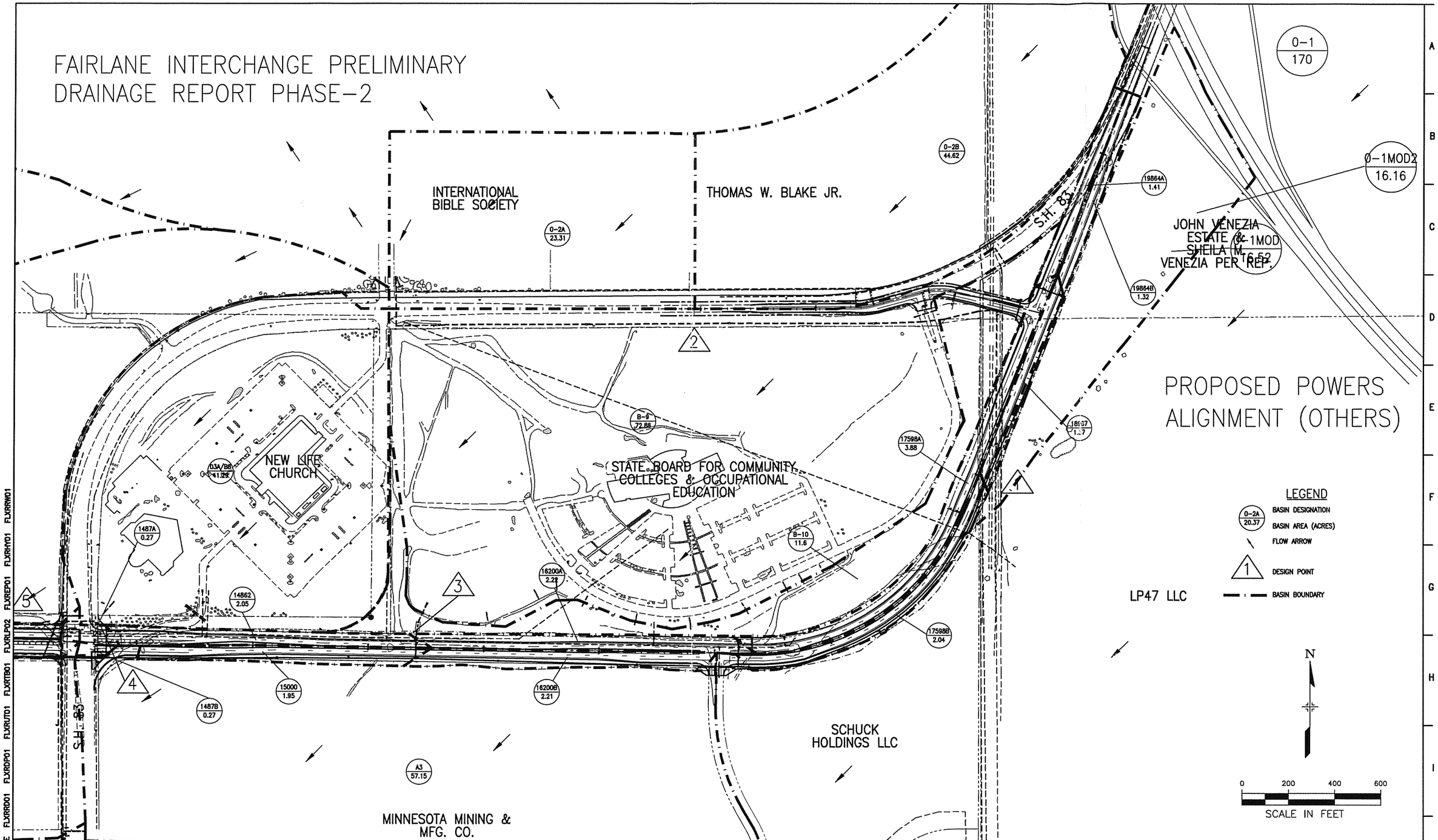
FAIRLANE INTERCHANGE PRELIMINARY DRAINAGE REPORT PHASE-2



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Index of Revisions		

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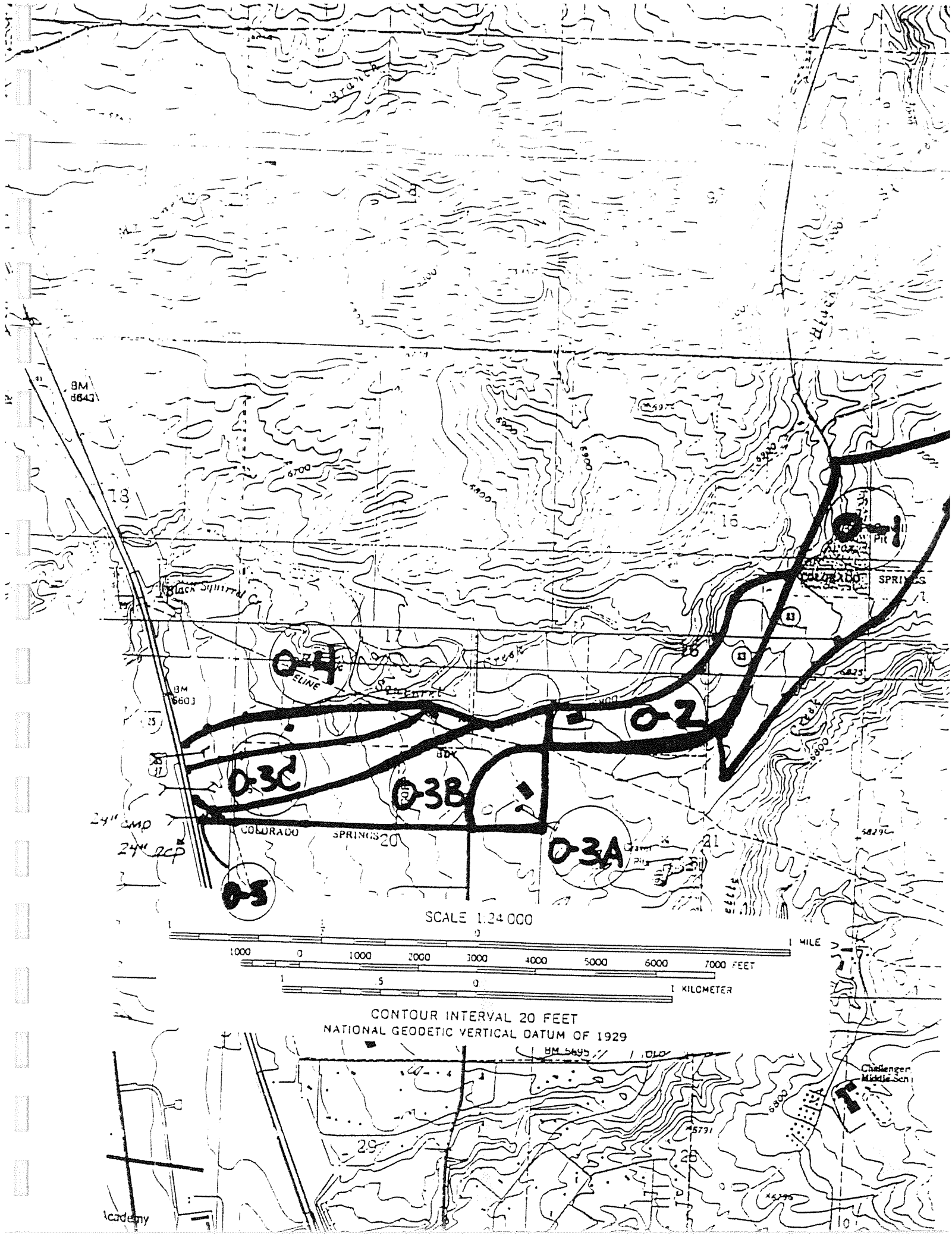
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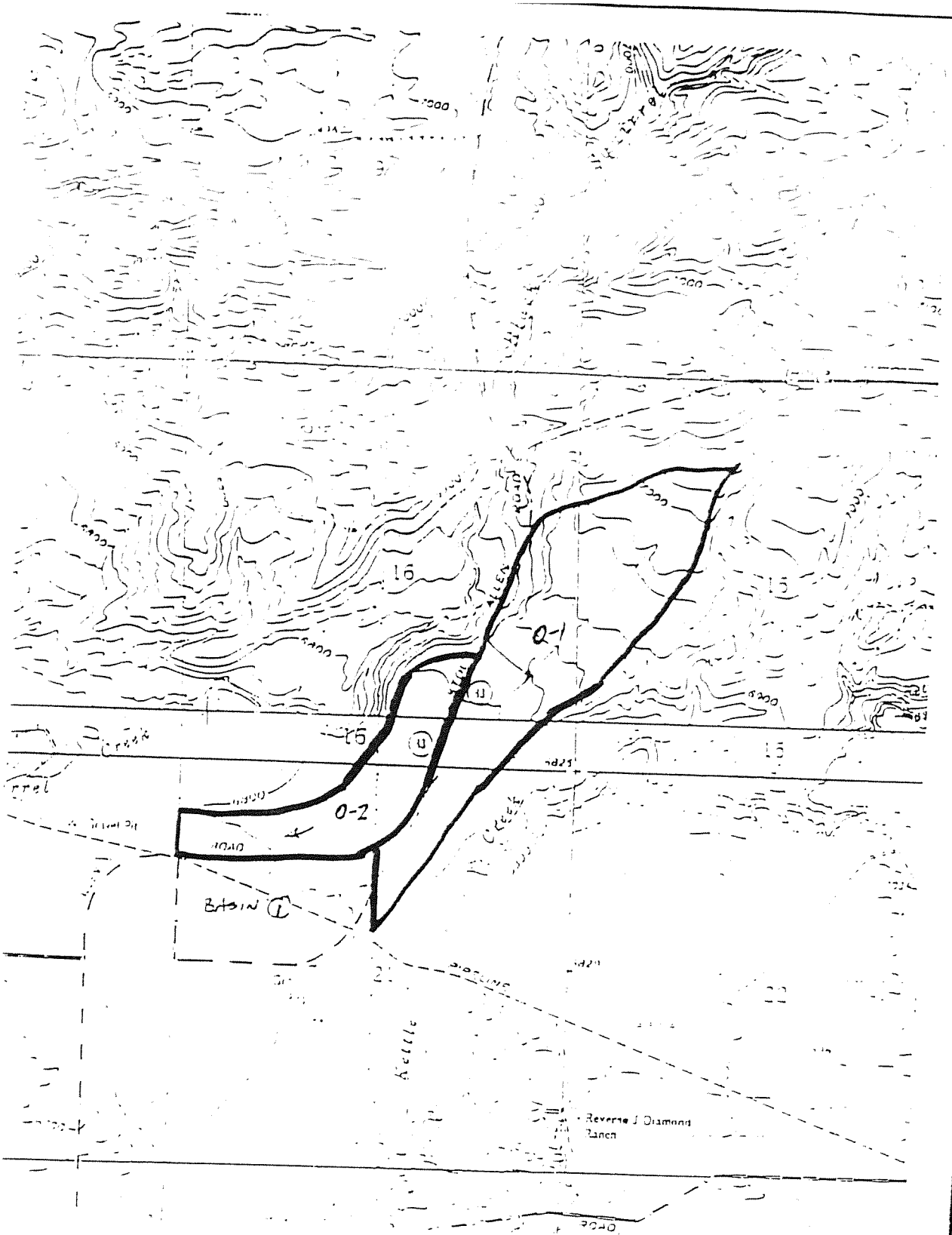
Academy



HISTORIC BASIN MAP

FIG1.DVG RJS 09/05/96

URS CONSULTANTS, INC.
COLORADO SPRINGS, COLORADO

PROJ NO. 67.42154

PIKES PEAK COMMMUNITY COLLEGE
NORTH CAMPUS BUILDING

FIGURE
2

CITY OF COLORADO SPRINGS

APPENDIX B

DRAINAGE PLAN SHEETS

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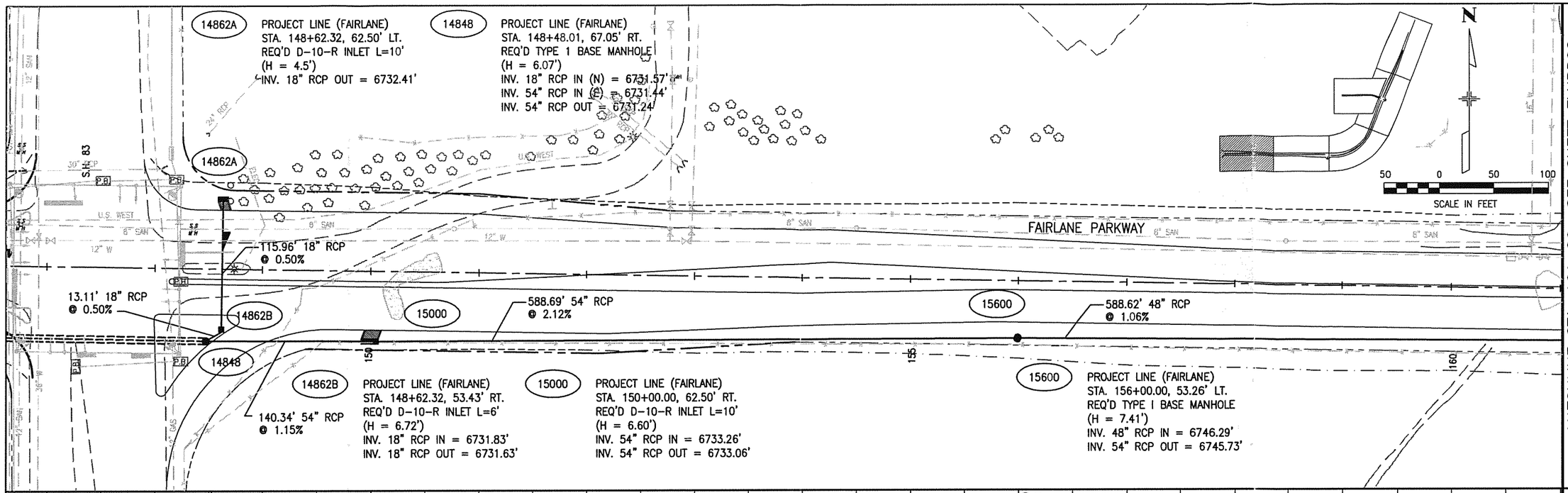

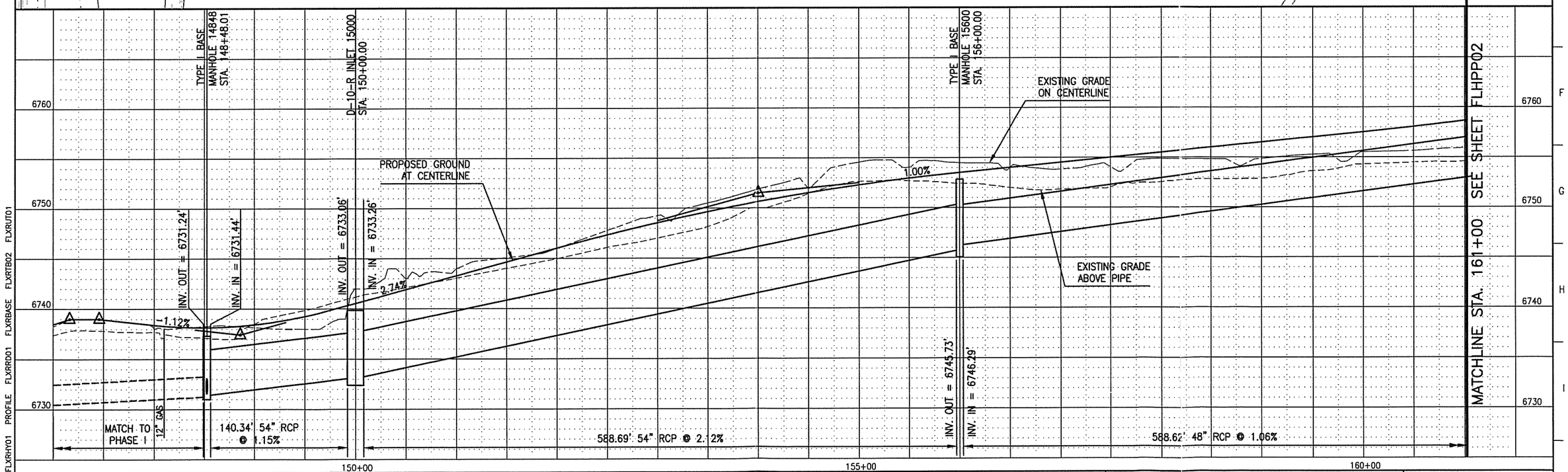

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As Constructed
No Revisions:
Revised:
Void:

FAIRLANE PARKWAY/S.H. 83 RELOCATION

FAIRLANE PARKWAY
DRAINAGE PLAN & PROFILE

Sheet Subset: DRAINAGE
Subset Sheets: FLHPP01 of 6

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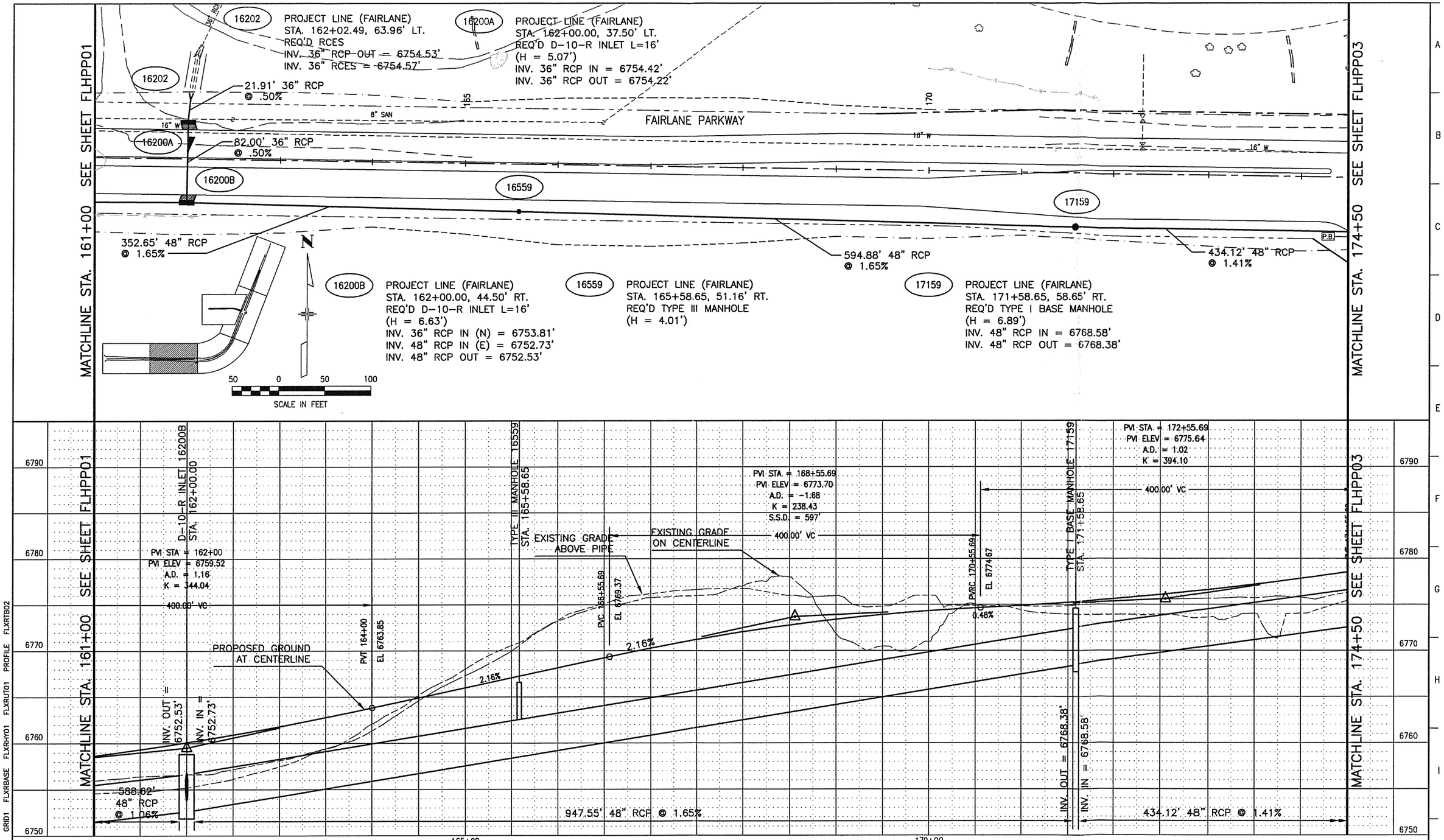

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No Revisions:
Revised:
Void:

FAIRLANE PARKWAY/S.H. 83 RELOCATION

FAIRLANE PARKWAY DRAINAGE PLAN & PROFILE

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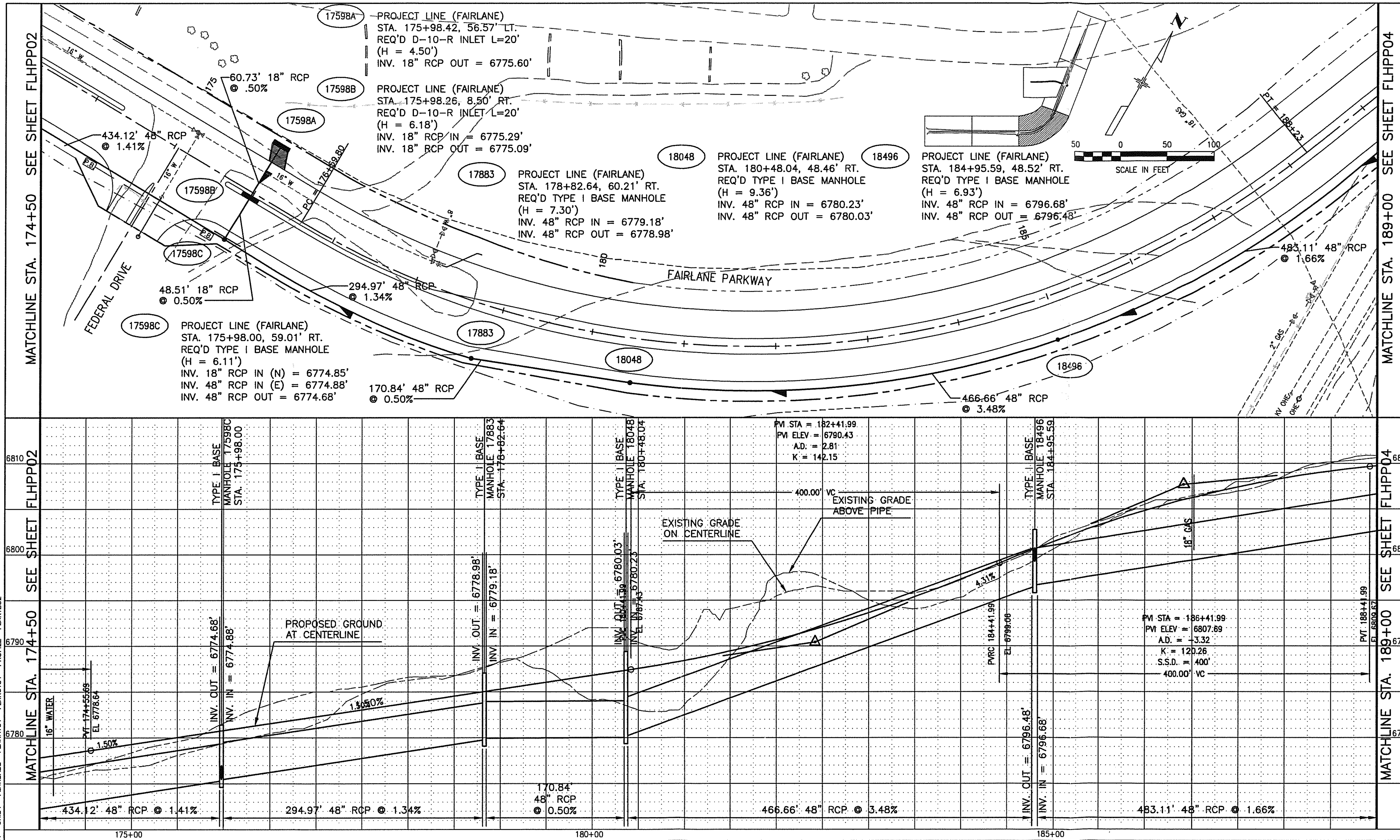

MATCHLINE STA. 174+50 SEE SHEET FLHPP02
MATCHLINE STA. 189+00 SEE SHEET FLHPP04
17598A PROJECT LINE (FAIRLANE)
STA. 175+98.42, 56.57' LT.
REQ'D D-10-R INLET L=20'
(H = 4.50')
INV. 18" RCP OUT = 6775.60'
17598B PROJECT LINE (FAIRLANE)
STA. 175+98.26, 8.50' RT.
REQ'D D-10-R INLET L=20'
(H = 6.18')
INV. 18" RCP IN = 6775.29'
INV. 18" RCP OUT = 6775.09'
60.73' 18" RCP
@ .50%
434.12' 48" RCP
@ 1.41%
17883 PROJECT LINE (FAIRLANE)
STA. 178+82.64, 60.21' RT.
REQ'D TYPE I BASE MANHOLE
(H = 7.30')
INV. 48" RCP IN = 6779.18'
INV. 48" RCP OUT = 6778.98'
18048 PROJECT LINE (FAIRLANE)
STA. 180+48.04, 48.46' RT.
REQ'D TYPE I BASE MANHOLE
(H = 9.36')
INV. 48" RCP IN = 6780.23'
INV. 48" RCP OUT = 6780.03'
18496 PROJECT LINE (FAIRLANE)
STA. 184+95.59, 48.52' RT.
REQ'D TYPE I BASE MANHOLE
(H = 6.93')
INV. 48" RCP IN = 6796.68'
INV. 48" RCP OUT = 6796.48'
SCALE IN FEET
FAIRLANE PARKWAY
FEDERAL DRIVE
48.51' 18" RCP
@ 0.50%
294.97' 48" RCP
@ 1.34%
17598C PROJECT LINE (FAIRLANE)
STA. 175+98.00, 59.01' RT.
REQ'D TYPE I BASE MANHOLE
(H = 6.11')
INV. 18" RCP IN (N) = 6774.85'
INV. 48" RCP IN (E) = 6774.88'
INV. 48" RCP OUT = 6774.68'
170.84' 48" RCP
@ 0.50%
466.66' 48" RCP
@ 3.48%
483.11' 48" RCP
@ 1.66%
TYPE I BASE MANHOLE 17598C STA. 175+98.00
TYPE I BASE MANHOLE 17883 STA. 178+82.64
TYPE I BASE MANHOLE 18048 STA. 180+48.04
TYPE I BASE MANHOLE 18496 STA. 184+95.59
PVI STA = 182+41.99
PVI ELEV = 6790.43
A.D. = 2.81
K = 142.15
400.00' VC
EXISTING GRADE ABOVE PIPE
EXISTING GRADE ON CENTERLINE
PROPOSED GROUND AT CENTERLINE
PVI STA = 186+41.99
PVI ELEV = 6807.69
A.D. = -3.32
K = 120.26
S.S.D. = 400'
400.00' VC
INV. OUT = 6774.68'
INV. IN = 6774.88'
INV. OUT = 6778.98'
INV. IN = 6779.18'
INV. OUT = 6780.03'
INV. IN = 6780.23'
INV. OUT = 6796.48'
INV. IN = 6796.68'
16" WATER
18" GAS
434.12' 48" RCP @ 1.41%
294.97' 48" RCP @ 1.34%
170.84' 48" RCP @ 0.50%
466.66' 48" RCP @ 3.48%
483.11' 48" RCP @ 1.66%
175+00
180+00
185+00

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FAIRLANE PARKWAY/S.H. 83 RELOCATION

FAIRLANE PARKWAY DRAINAGE PLAN & PROFILE

Sheet Subset: DRAINAGE | Subset Sheets: FLHPP03 of 6

Designer: RBB
Detailer: LDS
Checked: CLP
Sheet Number

10:00 XREF = FLXRRD01 GRID1 FLXRBASE FLXRHY01 FLXRUT01 PROFILE FLXRTB02

OLD S.H. 83 SEE SHEET FLHPP06

MATCHLINE STA. 189+00 SEE SHEET FLHPP03

MATCHLINE STA. 203+50 SEE SHEET FLHPP05

18967
PROJECT LINE (FAIRLANE)
STA. 189+66.98, 44.50' RT.
REQ'D D-10-R INLET L=6'
(H = 6.88')
INV. 48" RCP IN = 6804.89'
INV. 48" RCP OUT = 6804.69'

19195
PROJECT LINE (FAIRLANE)
STA. 191+95.28, 50.21' LT.
REQ'D TYPE I BASE MANHOLE
(H = 6.68')
INV. 42" RCP IN = 6807.05'
INV. 24" RCP IN = 6808.55'
INV. 48" RCP OUT = 6806.55'

19203
PROJECT LINE (FAIRLANE)
STA. 192+03.32, 56.17' RT.
REQ'D RCES
INV. 42" RCP IN = 6808.69'
INV. 42" RCES IN = 6809.09'

19471
PROJECT LINE (FAIRLANE)
STA. 194+70.73, 58.80' RT.
REQ'D TYPE I BASE MANHOLE
(H = 4.90')
INV. 24" RCP IN = 6810.67'
INV. 24" RCP OUT = 6810.77'

19864B
PROJECT LINE (FAIRLANE)
STA. 198+63.77, 56.51' RT.
REQ'D D-10-R INLET L=10'
(H = 6.33')
INV. 18" RCP IN = 6818.82'
INV. 24" RCP OUT = 6818.62'

19864A
PROJECT LINE (FAIRLANE)
STA. 198+63.77, 56.49' LT.
REQ'D D-10-R INLET L=10'
(H = 4.50')
INV. 18" RCP IN = 6819.38'

483.11' 48" RCP @ 1.66%
222.17' 48" RCP @ .75%
8.00' 42" RCP @ 0.50%
269.41' 24" RCP @ 0.71%
384.89' 24" RCP @ 2.06%
112.99' 18" RCP @ 0.50%

FAIRLANE PARKWAY
RELOCATED S.H. 83
STOUT ALLEN ROAD
115 KV OHE
115 KV OHE
AT&T F.O.
34.5kv ELEC.
12.5kv ELEC.
MOUNTAIN VIEW ELEC.
P.B.
SCALE IN FEET 50 0 50 100

PROFILE FLXRTB02 FLXRUT01 FLXRHY01 FLXRBASE GRID1 FLXRRD01 = 10:44 XREF

D-10-R INLET 18967 STA. 189+66.98
INV. OUT = 6804.69'
INV. IN = 6804.89'
AT&T F.O.
483.11' 48" RCP @ 1.66%
222.17' 48" RCP @ .75%
INV. OUT = 6806.55' TYPE I BASE MANHOLE 19195 STA. 191+95.28
INV. IN = 6808.55'
34.5 & 12.5 KV ELECTRIC
MOUNTAIN VIEW ELECTRIC
PVC 192+70.74 EL 6813.90
EXISTING GRADE ABOVE PIPE
269.41' 24" RCP @ 0.71%
INV. OUT = 6810.47' TYPE I BASE MANHOLE 19471 STA. 194+70.73
INV. IN = 6810.67'
PVI STA 194+70.74
PVI ELEV. 6815.88
A.D. 7.34
K 196.09
400.00' VC
PVI 196+70.74 EL 6820.54
PROPOSED GROUND AT CENTERLINE
EXISTING GRADE ON CENTERLINE
2.33%
384.89' 24" RCP @ 2.06%
INV. OUT = 6818.62'
D-10-R INLET 19864B STA. 198+63.77
6840 6830 6820 6810 6800
190+00 195+00 200+00

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FAIRLANE PARKWAY/S.H. 83 RELOCATION

FAIRLANE PARKWAY
DRAINAGE PLAN & PROFILE

Sheet Subset: DRAINAGE
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Designer: RBB
Detailer: LDS
Checked: CLP
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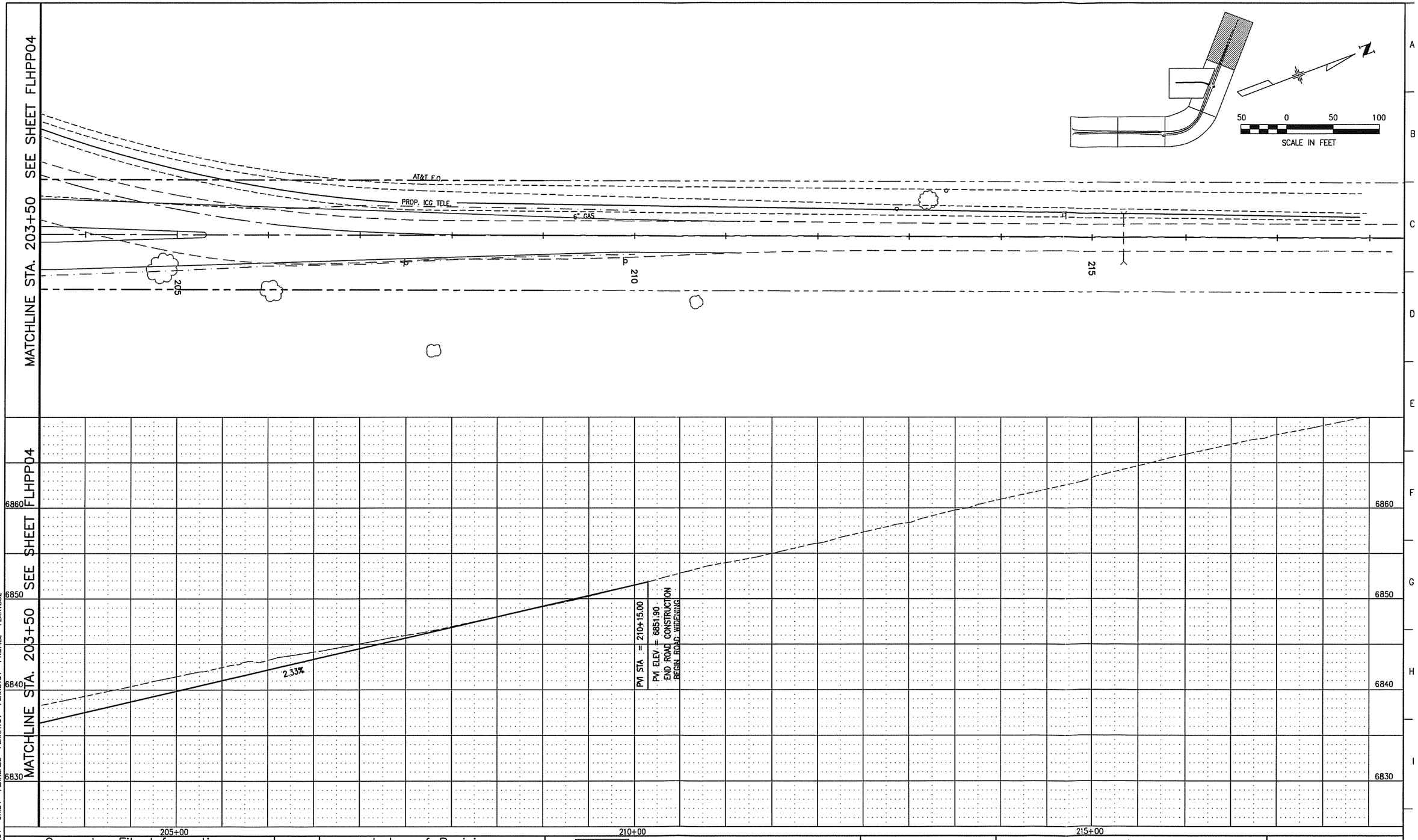

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FAIRLANE PARKWAY
DRAINAGE PLAN & PROFILE

Sheet Subset: DRAINAGE | Subset Sheets: FLHPP05 of 6

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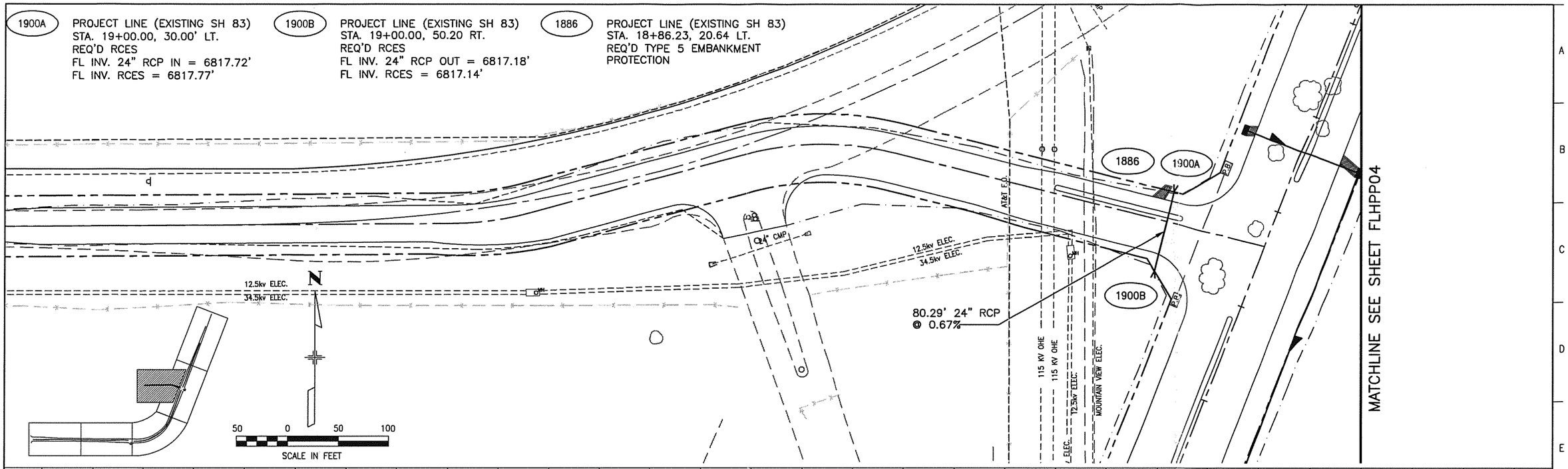
1900A PROJECT LINE (EXISTING SH 83)
STA. 19+00.00, 30.00' LT.
REQ'D RCES
FL INV. 24" RCP IN = 6817.72'
FL INV. RCES = 6817.77'

1900B PROJECT LINE (EXISTING SH 83)
STA. 19+00.00, 50.20 RT.
REQ'D RCES
FL INV. 24" RCP OUT = 6817.18'
FL INV. RCES = 6817.14'

1886 PROJECT LINE (EXISTING SH 83)
STA. 18+86.23, 20.64 LT.
REQ'D TYPE 5 EMBANKMENT PROTECTION



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Drawing File Name: Flhpp06.DWG		
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OLD S.H. 83 DRAINAGE PLAN & PROFILE

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Sheet Number

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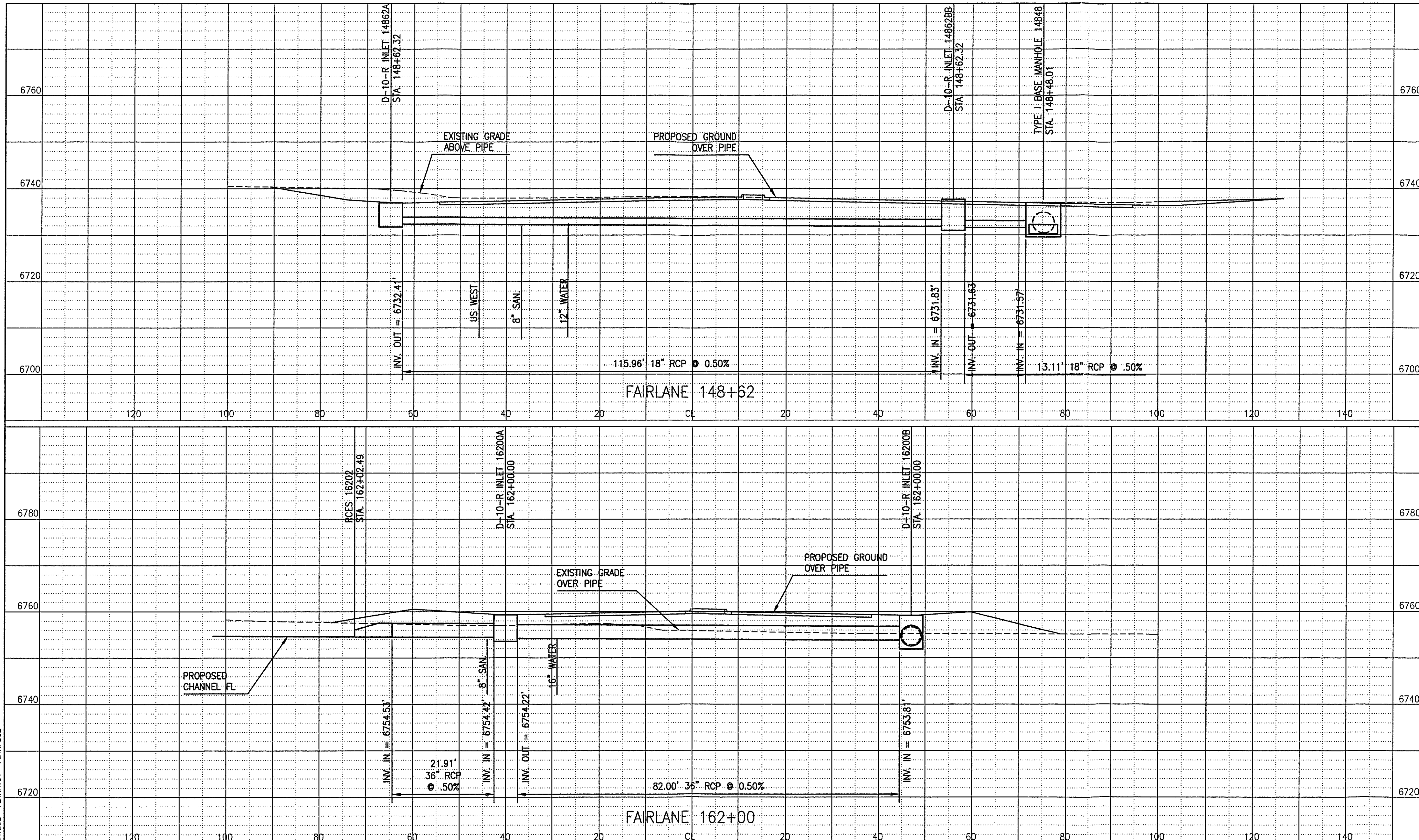

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FAIRLANE PARKWAY/S.H. 83 RELOCATION

STRUCTURE CROSS SECTIONS

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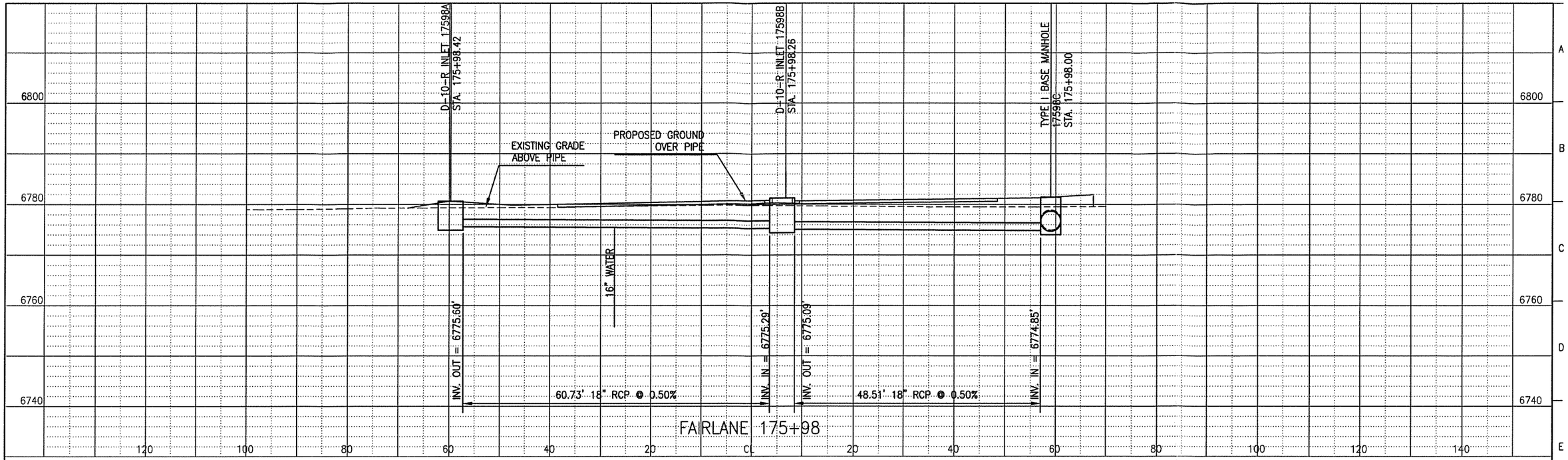

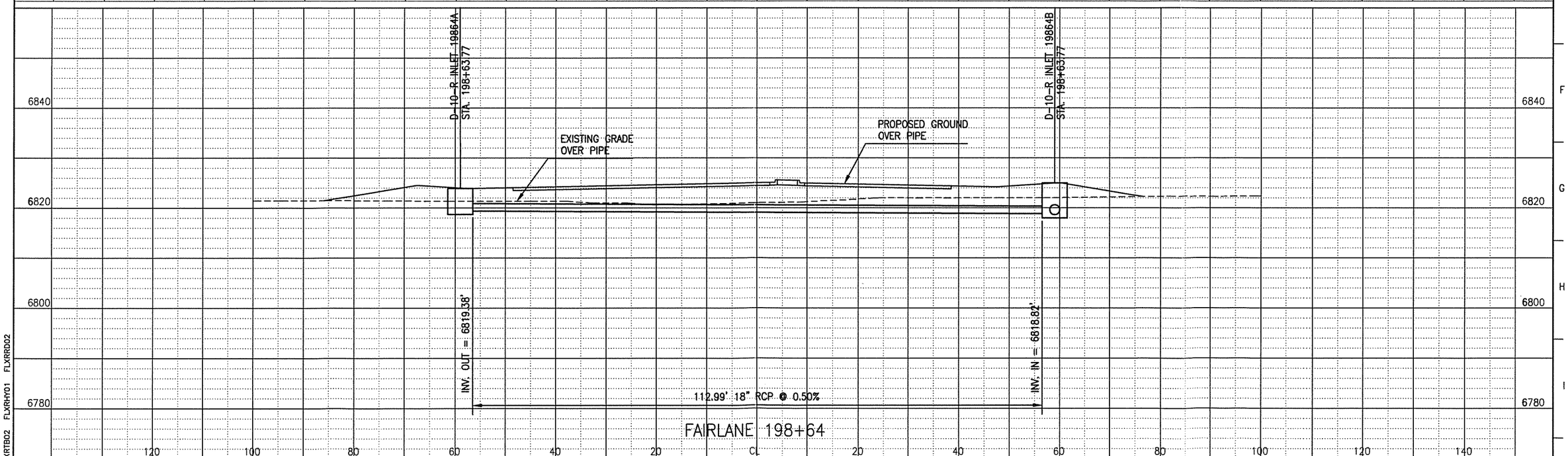

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STRUCTURE CROSS SECTIONS

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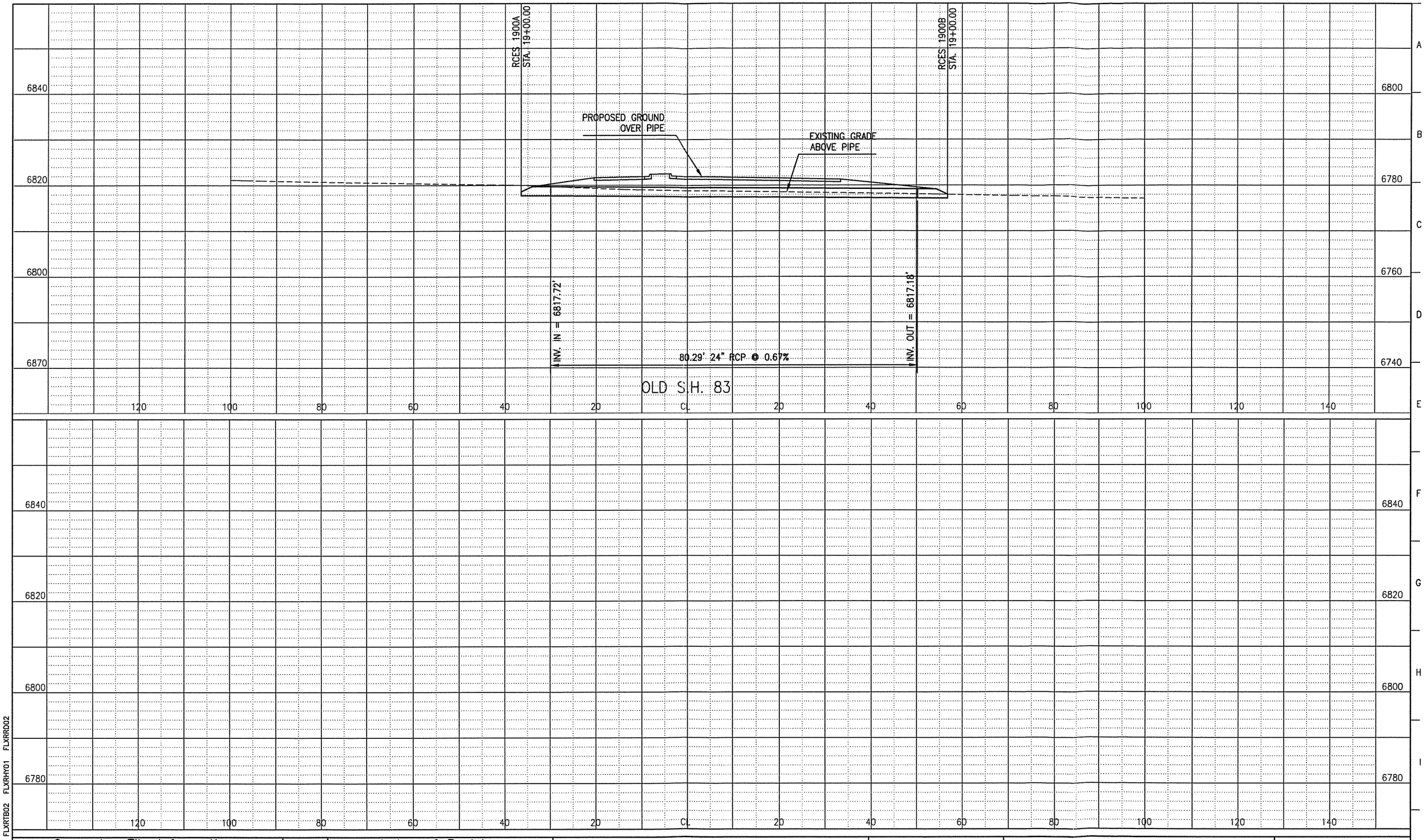

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FLXRHY01
FLXRTB02
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10:05

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Drawing File Name: FLXS03.DWG							
Acad Ver. R14	Scale: 1" = 10' Units: ENGLISH						

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No Revisions:	STRUCTURE CROSS SECTIONS	Detailer: LDS
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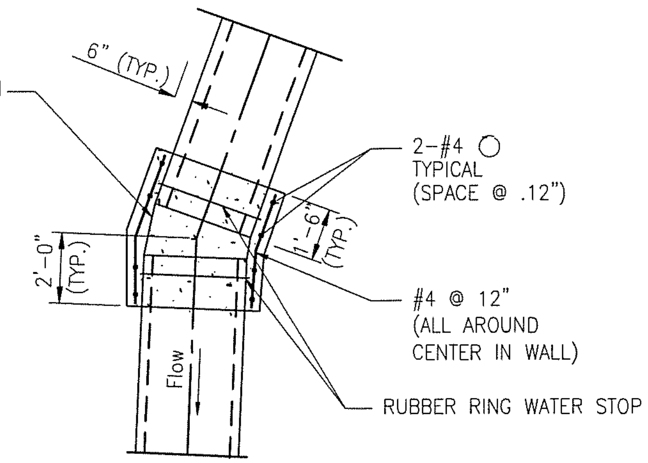
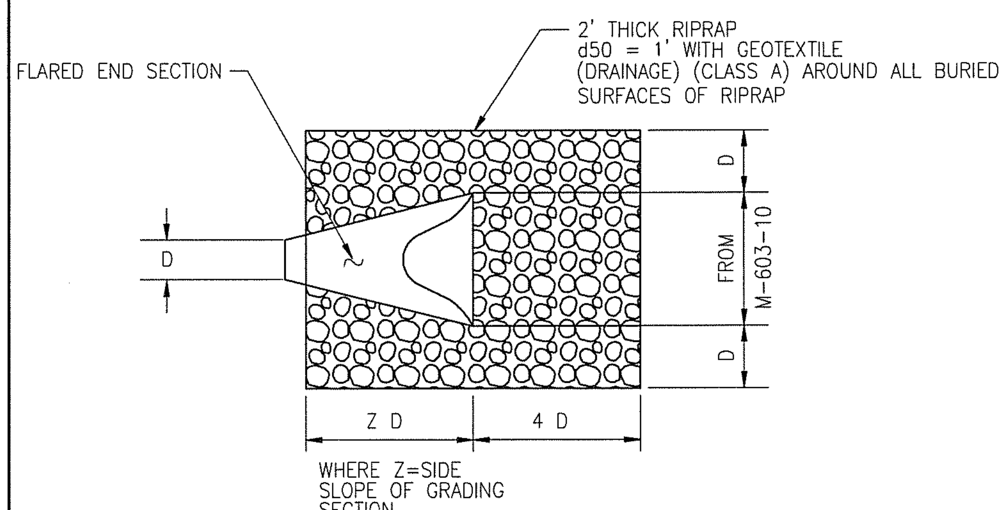


CONCRETE COLLAR DETAIL

NOTES:

1) ALL WORK TO BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS APPLICABLE TO THE PROJECT.
2) CONCRETE FOR COLLAR SHALL BE CLASS A OR B.
3) PAYMENT FOR CONCRETE, RUBBER RING, REINFORCED STEEL, AND ALL INCIDENTAL MATERIALS WILL NOT BE MADE SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF THE WORK.
4) PIPING MAY BE IN ANY DIRECTION.
5) REINFORCING SHALL HAVE fy=413,700 kPa



PIPE OUTLET EROSION PROTECTION

10.31 XREF = FLXRTB02

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FAIRLANE PARKWAY/S.H. 83 RELOCATION

MISC. HYDRAULIC DETAILS

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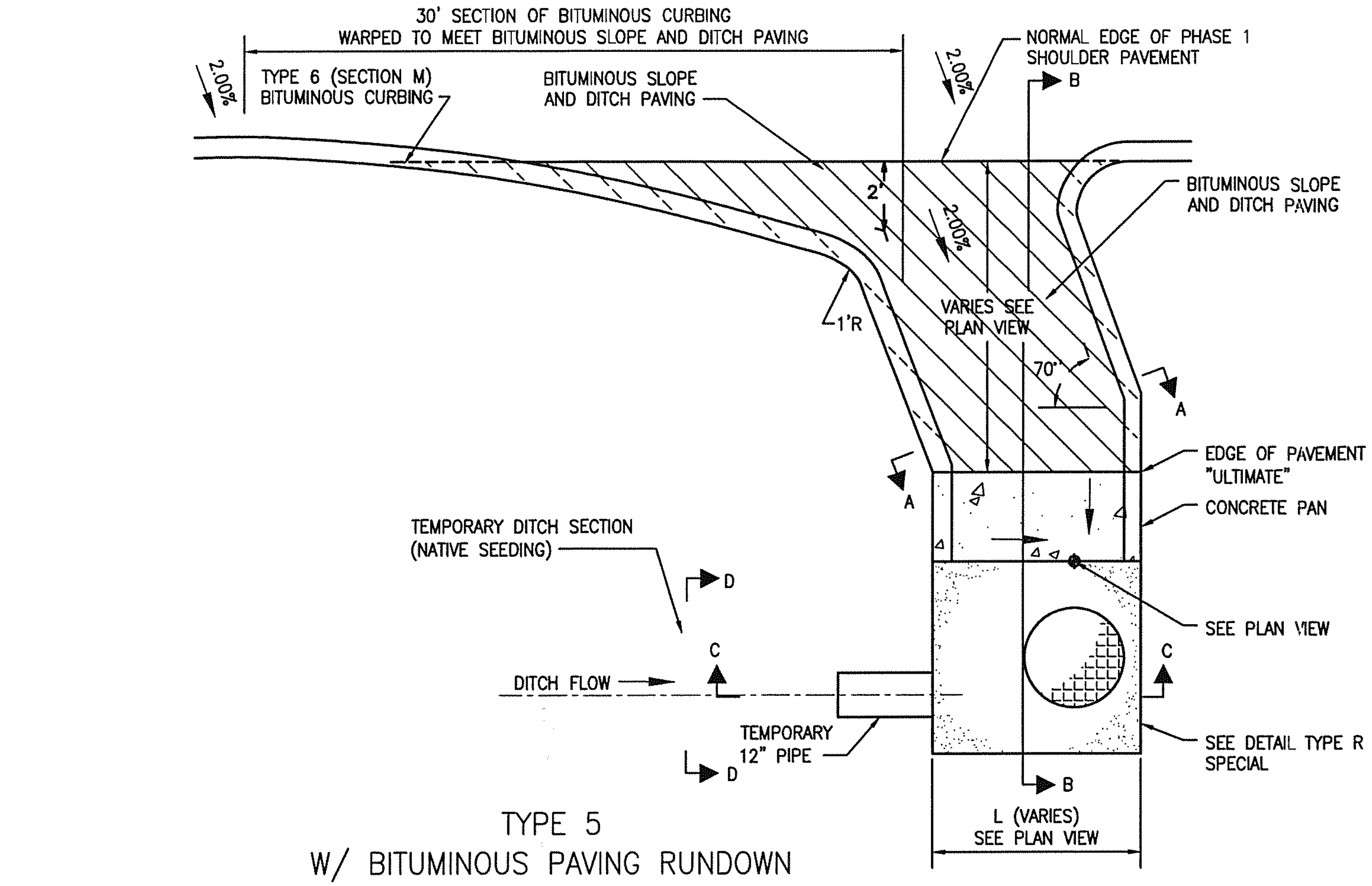
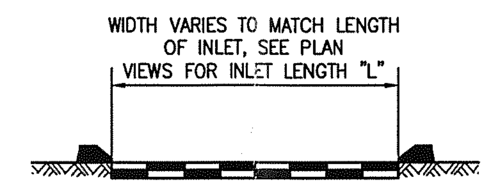
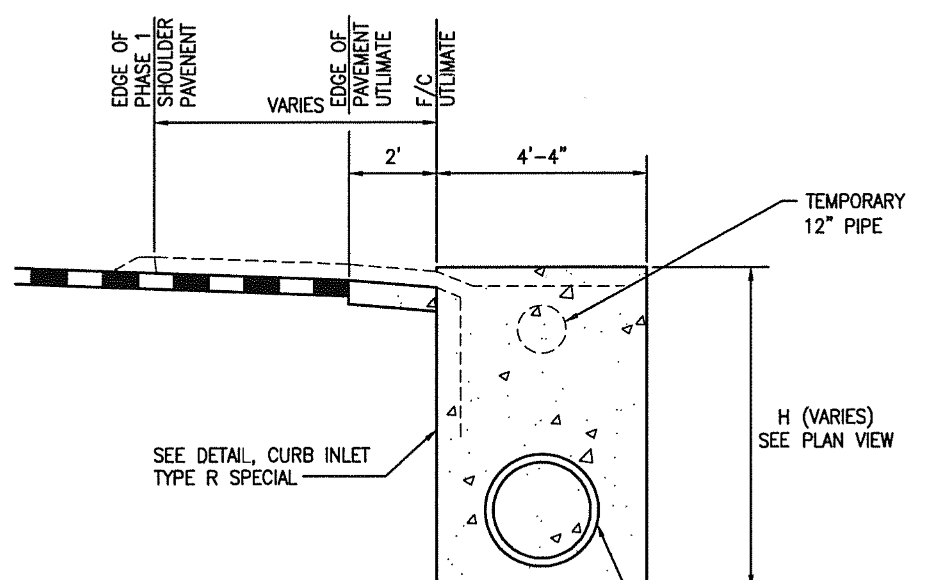


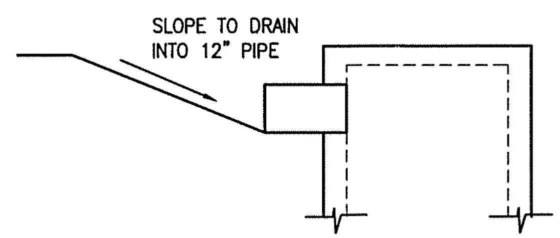
TYPE 5
W/ BITUMINOUS PAVING RUNDOWN



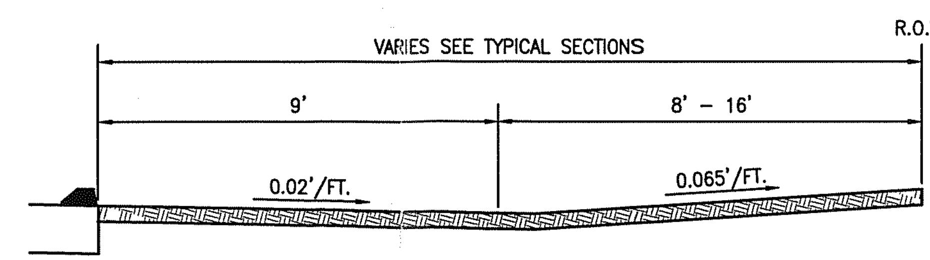
SECTION A–A
W/ 4" BITUMINOUS SLOPE
AND DITCH PAVING



SECTION B–B
WITH 4" BITUMINOUS
SLOPE AND DITCH PAVING &
CURB INLET TYPE R SPECIAL



SECTION C–C
SLOPE/STUB-OUT
SECTION



SECTION D–D
DITCH SECTION APPROACHING
TEMPORARY SECTION

NOTES:

IF THE EMBANKMENT PROTECTOR IS LOCATED IN THE BOTTOM OF A SAG VERTICAL CURVE BITUMINOUS CURB ON EACH SIDE TO ALLOW FOR FLOW FROM BOTH DIRECTIONS.

DETAILS OF BITUMINOUS CURBING ARE SHOWN ELSEWHERE IN THE PLANS.

STRUCTURE BACKFILL MATERIAL SHALL NOT BE USED IN THE WORK. EMBANKMENT MATERIAL SHALL BE USED WITH CONSTRUCTION REQUIREMENTS IN ACCORDANCE WITH SECTION 203. PAYMENT FOR EMBANKMENT MATERIAL SHALL BE INCLUDED IN THE PAY ITEM FOR EMBANKMENT PROTECTOR (TYPE 5).

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FAIRLANE PARKWAY/S.H. 83 RELOCATION

MOD. EMBANKMENT PROTECTOR
TYPE 5 / CURB INLET

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Sheet Number

10:31 XREF = FLXRTB02

CITY OF COLORADO SPRINGS

APPENDIX C

DESIGN CRITERIA AND CALCULATIONS

DMJM

Daniel, Mann, Johnson, & Mendenhall, Inc. (DMJM)
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DRAINAGE - PERMITS

STORMWATER DISCHARGE PERMIT

ANY CONSTRUCTION PROJECT WHICH DISTURBS OVER 5 ACRES REQUIRES A STORMWATER DISCHARGE PERMIT FROM CDPHE. THIS PROJECT IS EXPECTED TO DISTURB OVER THIS AMOUNT. THIS WILL INVOLVE CREATING A STORM WATER MANAGEMENT PLAN FOR THE PROJECT. THE KEY ELEMENTS OF THIS ARE EROSION CONTROL MEASURES AND A LIST OF BEST MANAGEMENT PRACTICES TO BE USED DURING CONSTRUCTION OF THE PROJECT. THE PLAN WILL BE SUBMITTED BY CDOT. A COPY OF THE LIKELY GENERAL PERMIT TO BE USED ON THE PROJECT IS INCLUDED. ADDITIONAL INFORMATION IS AVAILABLE.

CDOT DRAINAGE DESIGN MANUAL
CDPHE GENERAL PERMIT FORMS

SECTION 404 PERMIT

ANY CONSTRUCTION PROJECT WHICH DISTURBS JURISDICTIONAL WETLANDS OR "WATERS OF THE U.S." REQUIRES A 404 PERMIT FROM THE CORPS OF ENGINEERS. IT IS ANTICIPATED THAT THE PROJECT WILL EITHER REQUIRE NO PERMIT OR WILL BE PERMITTED UNDER A NATIONWIDE OR REGIONAL PERMIT. THE EXISTENCE OF WETLANDS WITHIN THE PROJECT WILL BE VERIFIED BY THE EA UPDATE FOR THE PROJECT. IT APPEARS THAT THERE MAY NOT BE ANY WETLANDS AFFECTED. ADDITIONAL INFORMATION IS AVAILABLE.

CDOT DRAINAGE DESIGN MANUAL

FLOODPLAIN DEVELOPMENT PERMIT

ANY PROJECT WHICH AFFECTS AREAS DESIGNATED AS FLOODPLAINS BY THE NATIONAL FLOOD INSURANCE ACT REQUIRE A PERMIT FROM FEMA. IT IS ANTICIPATED THAT THERE ARE NO DESIGNATED FLOODPLAINS WITHIN THE PROJECT AREA. THIS WILL BE VERIFIED WITH THE REGIONAL FLOOD PLAIN ADMINISTRATOR FOR THE PIKES PEAK AREA.

CDOT DRAINAGE DESIGN MANUAL

OTHER PERMITS

IT NEEDS TO BE VERIFIED IF A FUGITIVE DUST PERMIT OR OTHER PERMITS ARE REQUIRED FOR THIS PROJECT.

DRAINAGE - DATA COLLECTION

THE FOLLOWING REPORTS HAVE BEEN OBTAIN THAT ARE RELATED TO THE PROJECT:

PROJECT SPECIFIC

"FAIRLANE TECHNOLOGY PARK -HYDROLOGY UPDATE", AYRES AND ASSOCIATES, NOVEMBER 13, 1997.

"MASTER DEVELOPMENT DRAINAGE REPORT AND PLAN", FAIRLANE TECHNOLOGY PARK FILING NO.2", URS PROJECT # 42044, OCTOBER 22, 1993. REVISED JANUARY 6, 1994.

"PRELIMINARY AND FINAL DRAINAGE REPORT AND PLAN", FAIRLANE TECHNOLOGY PARK FILING NO.2", URS PROJECT # 42044, JANUARY 6, 1994.

"DRAINAGE MEMORANDUM FOR PIKES PEAK COMMUNITY COLLEGE NORTH CAMPUS", COLORADO SPRING, COLORADO., EL PASO COUNTY, URS PROJECT NO. 67.42154., OCTOBER 7, 1996

"NEW LIFE CHURCH DRAINAGE REPORT", KLH ENGINEERING, INC. APRIL, 1991.

"PRELIMINARY AND FINAL DRAINAGE REPORT FOR INTERNATIONAL BIBLE SOCIETY FILING NO. 1", URS PROJECT NO 48404, AUGUST, 1988.

"NORTHGATE PHASE 1 DRAINAGE PLAN", URS PROJECT NO. 45206, JUNE 15, 1987., REVISED AUGUST 27, 1987

"NORTHGATE PHASE 1 DRAINAGE PLAN", URS PROJECT NO. 45206, JUNE 15, 1987., REVISED AUGUST 27, 1987. ADDENDUM DATED OCTOBER 6, 1987

DRAINAGE - HYDROLOGY

I-25 MAINLINE DESIGN STORMS

I-25 CROSS CULVERTS WILL BE DESIGNED FOR THE 100 YEAR STORM — CDOT DRAINAGE DESIGN MANUAL

I-25 PARALLEL STORM SEWER - INITIAL STORM IS THE 5 YEAR STORM WITH A MAXIMUM ALLOWABLE SPREAD TO THE EDGE OF SHOULDER.

I-25 PARALLEL STORM SEWER - MAJOR STORM IS THE 100 YEAR STORM WITH A MAXIMUM ALLOWABLE SPREAD OF 4' ONTO ANY TRAVEL LANE.

I-25 PERMANENT ROADSIDE DITCHES WILL BE DESIGNED FOR THE 10 YEAR STORM. — CDOT DRAINAGE DESIGN MANUAL CRITERIA MANUAL

FAIRLANE PARKWAY DESIGN STORMS

FAIRLANE PARKWAY CROSS CULVERTS WILL BE DESIGNED FOR THE 100 YEAR STORM — CCS DRAINAGE CRITERIA MANUAL

FAIRLANE PARKWAY PARALLEL STORM SEWER - INITIAL STORM IS THE 5 YEAR STORM WITH A MAXIMUM DEPTH OF 6" @ FLOWLINE UP TO A MAXIMUM OF 34 CFS PER SIDE.

FAIRLANE PARKWAY PARALLEL STORM SEWER - MAJOR STORM IS THE 100 YEAR

STORM WITH A MAXIMUM DEPTH OF 8" @ FLOWLINE WITH NO CURB OVERTOPPING. MAX SPREAD ONTO ROAD IS TO THE OUTSIDE EDGE OF THE INNER LANE IN EACH DIRECTION.

RAMP DESIGN STORMS

RAMP CROSS CULVERTS WILL BE DESIGNED FOR THE 100 YEAR STORM — CDOT DRAINAGE DESIGN MANUAL

RAMP PARALLEL STORM SEWER - INITIAL STORM IS THE 5 YEAR STORM WITH A MAXIMUM ALLOWABLE SPREAD OF 4 FT. ONTO ONE TRAVEL LANE FOR MULTI-LANE RAMPS.

RAMP PARALLEL STORM SEWER - MAJOR STORM IS THE 100 YEAR STORM WITH A MAXIMUM ALLOWABLE SPREAD OF 12 FT. (ONE TRAVEL LANE) FOR MULTI-LANE RAMPS.

RAMP PERMANENT ROADSIDE DITCHES WILL BE DESIGNED FOR THE 10 YEAR STORM. — CDOT DRAINAGE DESIGN MANUAL CCS DRAINAGE

RAMP PERMANENT ROADSIDE DITCHES WILL BE CHECKED FOR THE 100 YEAR STORM TO ENSURE THAT THE WATER LEVEL IS BELOW THE PAVEMENT OR BASE.

OTHER ROADS

FOR CONCEPT DESIGN, ALL OTHER ROADS WILL NOT INCLUDE STORM SEWER UNLESS IT IS NECESSARY TO PREVENT FLOW FROM CROSSING OVER INTERSECTIONS AND THERE IS A STORM SEWER LINE NEARBY TO DISCHARGE INTO. — PROJECT SPECIFIC

FOR CONCEPT DESIGN, ALL OTHER ROADS WITH PERMANENT ROADSIDE DITCHES WILL BE DESIGNED FOR THE 10 YEAR STORM. THE ROUTING OF THE 100 YEAR STORM NEEDS TO BE CHECKED TO ENSURE THAT FLOODING OF THE ROAD OR NEARBY STRUCTURES DOES NOT OCCUR. — CDOT DRAINAGE DESIGN MANUAL

THIS CRITERIA NEEDS TO BE VERIFIED PRIOR TO DESIGN OF THE PROJECT.

HYDROLOGIC METHODS

THE OFFSITE DRAINAGE ANALYSIS WILL BE DEVELOPED USING THE PREVIOUS DRAINAGE STUDIES IN THE AREA. THE STANDARD USED IS THE CITY OF COLORADO SPRINGS STANDARD FOR BASINS OVER APPROXIMATELY (100 ACRES) IN TRIBUTARY AREA. THIS METHOD IS THE SCS METHOD TYPICALLY UTILIZING EITHER THE TR-20 OR HEC-1 COMPUTER PROGRAM. THE DESIGN STORM TO BE UTILIZED IS THE 100 YEAR 24 HOUR STORM WITH ANTECEDENT MOISTURE CONDITION II. — PROJECT SPECIFIC CCS DRAINAGE CRITERIA MANUAL

THE ONSITE DRAINAGE ANALYSIS WILL BE DEVELOPED FROM PROJECT

TOPOGRAPHY AND PREVIOUS DRAINAGE STUDIES IN THE AREA. THE METHOD USED WILL BE THE RATIONAL METHOD WHICH IS AS FOLLOWS FOR ENGLISH UNITS:

CDOT DRAINAGE DESIGN MANUAL

$Q=C\ i\ A$

WHERE: Q = THE RUNOFF IN CUBIC FEET PER SECOND (CFS)
C = RUNOFF COEFFICIENT OF THE AREA
i = THE AVERAGE RAINFALL INTENSITY IN IN/HR
A = THE AREA IN ACRES

VALUES FOR C AND i ARE PROVIDED FROM CDOT AND THE CITY, RESPECTIVELY. THE INTENSITIES ARE BASED ON THE TIME OF CONCENTRATION FOR A BASIN. THIS IS CALCULATED BASED ON THE FOLLOWING:

CDOT DRAINAGE DESIGN MANUAL

$T_c = T_i + T_t$

WHERE: T_c = TIME OF CONCENTRATION IN MINUTES
T_i = OVERLAND FLOW TIME IN MINUTES
T_t = TRAVEL TIME IN MINUTES

$$T_i = \frac{1.8\ (1.1-C)\ D^{.5}}{S^{0.33}}$$

WHERE: C = RUNOFF COEFFICIENT FROM THE RATIONAL METHOD
D = DISTANCE OF FLOW PATH IN FEET
(500 FT. MAX. NON-URBAN AREAS)
(300 FT. MAX. URBAN AREAS)
S = AVERAGE SLOPE OF BASIN IN %

VARIOUS METHODS ARE AVAILABLE TO ESTIMATE THE TRAVEL TIME BASED ON AVERAGE VELOCITIES OR EMPIRICAL FORMULAS.

DRAINAGE - CHANNELS

DESIGN OF CHANNELS AND ROADSIDE DITCHES WILL BE DONE USING MANNING'S EQUATION. IN SIMPLE CASES THIS WILL BE DONE ASSUMING UNIFORM FLOW AND DIRECT APPLICATION OF THE MANNING EQUATION TO DETERMINE THE NORMAL DEPTH. THIS IS AS FOLLOWS:

CDOT DRAINAGE DESIGN MANUAL

$Q = (1.49/n)\ A\ R^{2/3}\ S^{1/2}$

WHERE: Q = DISCHARGE IN CUBIC FEET PER SECOND (CFS)
n = MANNING'S ROUGHNESS COEFFICIENT
A = CROSS SECTIONAL AREA IN SQUARE FEET

R = HYDRAULIC RADIUS IN FEET
S = CHANNEL SLOPE IN FT/FT

VALUES OF MANNING'S ROUGHNESS COEFFICIENT ARE AVAILABLE IN THE CDOT MANUAL. THE INITIAL ANALYSIS SHOULD INCLUDE A CHECK OF THE FOLLOWING PARAMETERS:

CDOT DRAINAGE DESIGN MANUAL

$V = Q / A$

WHERE: V = AVERAGE VELOCITY IN FEET PER SECOND (FPS)

GENERALLY, THE VELOCITY SHOULD BE WITHIN THE FOLLOWING LIMITS FOR NATURAL OR GRASS LINED CHANNELS:

PROJECT SPECIFIC

V >2 FPS WHERE POSSIBLE
V < 3 FPS FOR BARE ERODIBLE SOILS
V < 5 FPS FOR BARE NON-ERODIBLE SOILS
V < 5 FPS FOR VEGETATED ERODIBLE SOILS
V < 7 FPS FOR VEGETATED NON-ERODIBLE SOILS

ADDITIONAL DETAILED INFORMATION IS AVAILABLE FOR THIS, IF NECESSARY. THE FROUDE NUMBER SHOULD ALSO BE CALCULATED FOR EACH CASE, AS FOLLOWS:

CCS DRAINAGE CRITERIA MANUAL

$$F_r = \frac{V}{(g\,d)^{0.5}}$$

WHERE: Fr = FROUDE NUMBER
g = ACCELERATION DUE TO GRAVITY (32.2 FPS^2)
d = NORMAL DEPTH IN FEET

IT SHOULD BE NOTED THAT THE FOLLOWING GUIDELINES SHOULD BE USED WHERE POSSIBLE WHEN CHECKING THE FROUDE NUMBER:

PROJECT SPECIFIC

$F_r = 1$	CRITICAL DEPTH
$F_r < 1$	SUBCRITICAL FLOW
$F_r > 1$	SUPERCRITICAL FLOW
$F_r < 0.9$ OR $F_r > 1.1$	DESIRABLE RANGE OF FROUDE NUMBERS SINCE THE FLOW IS GENERALLY UNSTABLE NEAR CRITICAL DEPTH.

FOR CASES WHERE GRADUALLY VARIED FLOW IS EXPECTED, THE U.S. ARMY CORPS OF ENGINEERS' HEC-2 COMPUTER PROGRAM WILL BE UTILIZED FOR THE PROJECT. CRITERIA FOR ELEMENTS OF CHANNEL PROTECTION WILL BE DEVELOPED IN MORE DETAIL AFTER THE CONCEPT LEVEL DESIGN IS DONE.

CDOT DRAINAGE DESIGN MANUAL

DRAINAGE - CROSS CULVERTS

FOR PURPOSES OF CONCEPT DESIGN, THE CROSS CULVERTS WILL BE ASSUMED TO BE REINFORCED CONCRETE PIPE (RCP) OR REINFORCED CONCRETE BOX CULVERTS (CBC). HOWEVER, SEVERAL CORRUGATED STEEL PIPES MAY BE EXTENDED WITH LIKE MATERIAL.
FOR CONCEPT DESIGN, USE A MANNING'S n VALUE OF 0.013 FOR RCP'S, 0.012 FOR CBC'S, AND .026 FOR CSP'S

PROJECT SPECIFIC

CROSS CULVERTS WILL BE INITIALLY SIZED BASED ON THE "HYDRAULIC DESIGN OF HIGHWAY CULVERTS" BY FHWA.

CDOT DRAINAGE DESIGN MANUAL

DRAINAGE - STORM SEWER

AREAS THAT REQUIRE STORM SEWER WILL BE DESIGNED WITH STORM SEWER DESIGN SOFTWARE. CONCEPTUAL DESIGN WILL ALSO UTILIZE SPREADSHEETS TO HELP ESTIMATE THE LOCATION AND NUMBER OF INLETS, PIPE SIZES AND KEY LOCATIONS.

INLETS

INLETS ARE REQUIRED 10 FT BEFORE THE POINT WHERE STREET CROSS SLOPE BEGINS TO SUPERELEVATE TOWARDS THE OPPOSITE SIDE TO PREVENT CROSS STREET FLOW.

CDOT DRAINAGE DESIGN MANUAL

SUMP INLETS REQUIRE FLANKING INLETS ON EACH SIDE OF THE SUMP INLET TO PROVIDE RELIEF FROM DEBRIS CLOGGING. SUMP INLETS ON I-25 SHOULD BE CHECKED TO ENSURE THAT THE 50 YEAR STORM DOES NOT CAUSE PONDING OF WATER OUTSIDE THE SHOULDER.

CDOT DRAINAGE DESIGN MANUAL

FOR SIMPLICITY IN CONCEPTUAL DESIGN, THE FOLLOWING FORMULAS WILL BE USED FOR DETERMINING THE APPROXIMATE INLET LOCATIONS:

THE ROAD CAPACITY IS BASED ON MANNING'S EQUATION WITH THE SIMPLIFYING ASSUMPTION THAT THE WETTED PERIMETER IS EQUAL TO THE WIDTH OF FLOW. ASSUME n=0.016.

HEC-12 FROM FHWA

THE INLETS ON FAIRLANE PARKWAY WILL BE CURB OPENING INLETS IN THE 8 INCH CURB. MODIFIED EMBANKMENT PROTECTORS TYPE 5 MAY BE USED IN THE INTERIM TO CONVEY FLOW FROM THE PHASE 1 PAVED SECTION TO THE ULTIMATE LOCATION OF THE TYPE R INLETS

CCS DESIGN MANUAL M-STANDARD

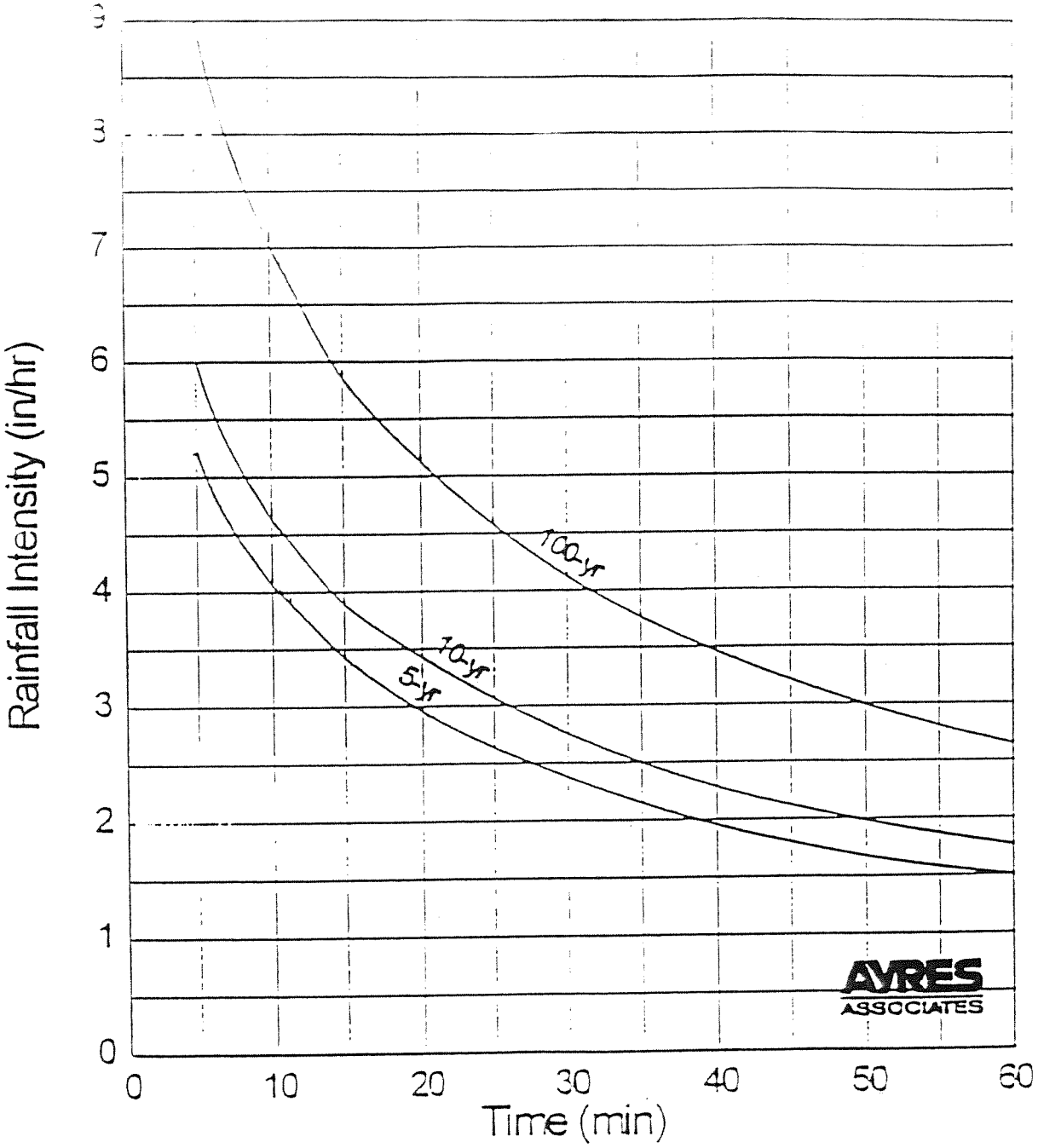
TABLE 5-1

RECOMMENDED AVERAGE RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUS

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	"C" FREQUENCY 10 A&B*	"C" FREQUENCY 10 C&D*	"C" FREQUENCY 100 A&B*	"C" FREQUENCY 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

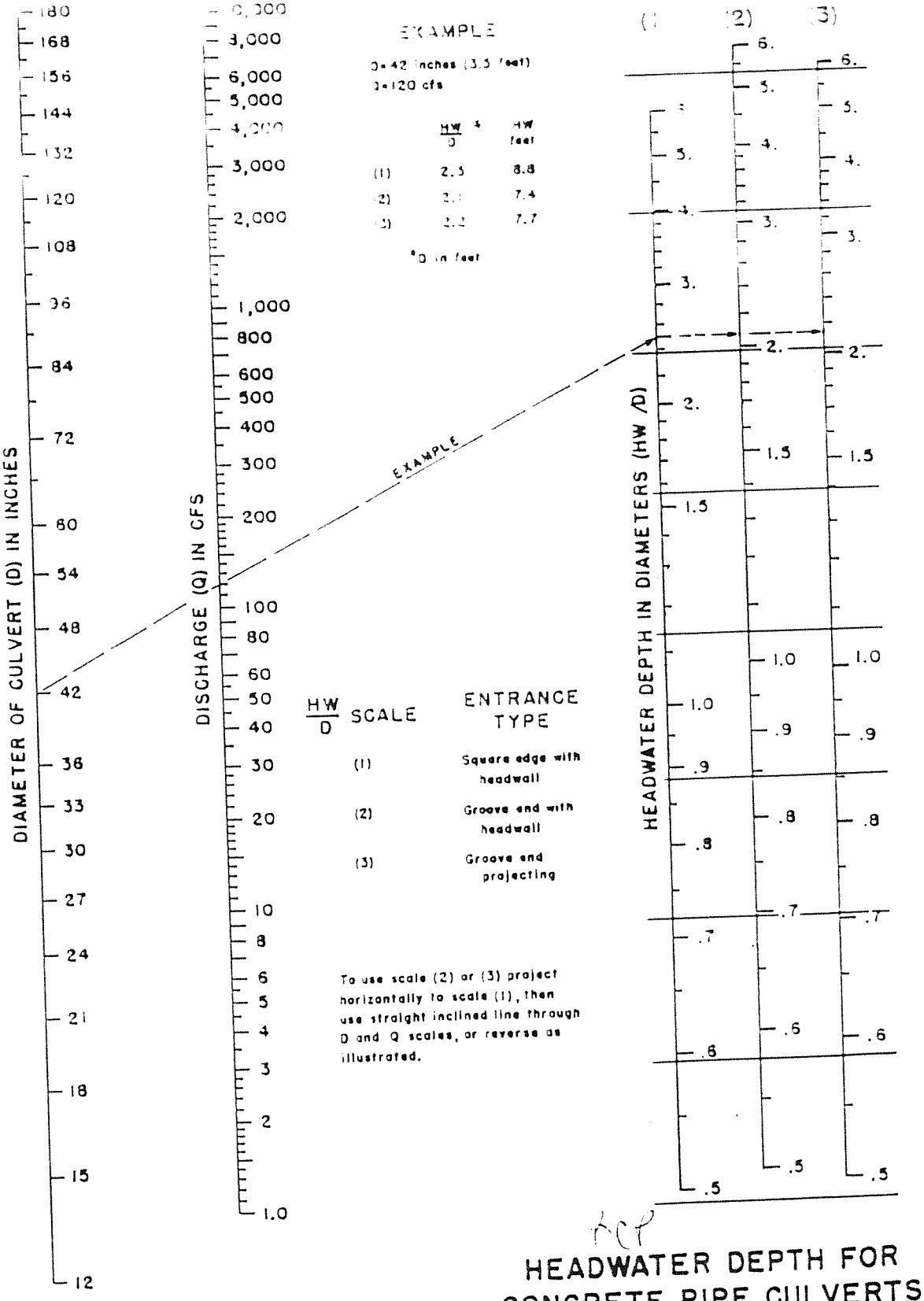
* Hydrologic Soil Group

9/30/90



Interim Release October 12, 1994 , Rainfall Intensity Curves
City Of Colorado Springs Drainage Criteria Manual

CHART 1



RCP

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 2&3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

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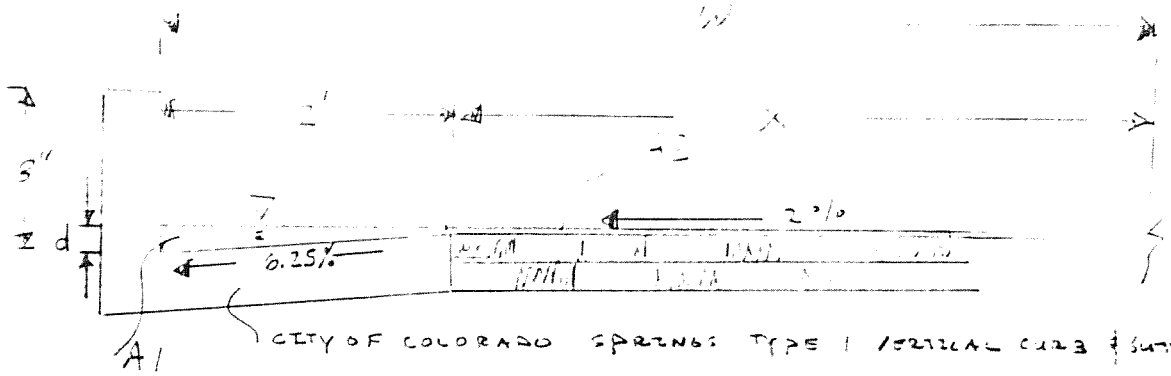
STANDARD STREET CAPACITY

CITY STREET - TYPE

JOB No 3321.07 | SHEET No.

DESIGNED BY | DATE

APPROVED



CITY OF COLORADO SPRINGS TYPE I VERTICAL CURB & GUTTER.

$(x)(.02) = d - .125 \qquad x = \frac{d - .125}{.02}$

$A_1 = \left(\frac{d + d - .125}{2}\right)(2') = 2d - .125$

$A_2 = \frac{(d - .125)}{2}\frac{(d - .125)}{.02} = \frac{d^2 - .25d + .0156}{.04}$

$= 25d^2 - 6.25d + .39$

$A = A_1 + A_2 = 25d^2 - 4.25d + .1265$

$P = w \qquad \frac{d - .125}{.02} + 2' = 50d - 6.25 + 2 = 50d - 4.25$

$n = .016$

$Q = \frac{1.49}{n} \frac{A^{5/3}}{P^{2/3}} S^{1/2}$

∴ FOR 6" DEPTH AT CURB $Q = 145.155\, S^{1/2}$

AT 6" DEPTH AT THE CURB $\qquad Q = \frac{1.49}{.016} \frac{4.39^{5/3}}{20.75^{2/3}} S^{1/2}$

$Q = 145.155\, S^{1/2}$

~~$Q = 356.87\, S^{1/2}$~~

AT 8" DEPTH $\qquad Q = \frac{1.49}{.016} \frac{8.64^{5/3}}{29.25^{2/3}} S^{1/2}$

$Q = 356.87\, S^{1/2}$ FOR $n = .013$

COMPARISON OF EXISTING AND PROPOSED CRITERIA

INITIAL STORM:

STREET TYPE	OLD	NEW
Hillside Residential ramp curb	flow spread to crown, maximum 25 cfs. per side, whichever is more restrictive	flow spread to crown max. 15 cfs. per side
Hillside Residential vertical curb	flow spread to crown, maximum 25 cfs. per side, whichever is more restrictive	6" allowable depth @ flowline max. 25 cfs. per side
Residential Street ramp curb	flow spread to crown	flow spread to crown max. 20 cfs. per side
Residential Street vertical curb	flow spread to crown	6" allowable depth @ flowline max. 34 cfs. per side
Collector Street	20 foot flow spread	6" allowable depth @ flowline, max. 34 cfs. per side, no overtopping the crown
Arterial Street	flow may encroach onto one outside lane	6" allowable depth @ flowline, max. 34 cfs. per side, one ten foot lane free of water in each direction

MAJOR STORM:

STREET TYPE	OLD	NEW
Hillside Residential Residential Streets Collector Streets	12" max. depth @ flowline no adjacent flooding	NO CHANGE
Arterial Streets	8" max. depth @ flowline (no curb overtopping)	NO CHANGE

CROSS FLOWS: No changes to any street types for the initial storm.
Only change for Major Storm is the Arterial street will now allow 12" max. depth @ flowline and 4" max. depth @ crown whichever is more restrictive. Existing criteria allows no crossflow.

INLET LENGTH CALCULATION CHART
FROM HEC-12 - USING 5 YEAR Q VALUES

INLET #	Street Flow	*Inlet Drop*	*Gutter Width*	*Total Spread*	*Cross Slope*	*Longitudinal Slope*	Equivalent Cross Slope	*Roughness Coefficient*	Ratio of flow in a chosen width	Cross slope of gutter measured from slope of street section	Length of inlet for total interception	*Length of inlet selected*		MUST BE > OR = TO 60% Efficiency	Actual Physical length of Inlet For 60%+ pickup
#	Q	a	W	T	Sx	S	Se	n	Eo	Sw'	Lt	L	L/Lt	E	L
19764A	3.898	0.333333	2	10.4	0.02	0.0238	0.092	0.016	0.43	0.17	17.27	4.00	0.23	37.8%	NO
19764A	3.898	0.333333	2	10.4	0.02	0.0238	0.092	0.016	0.43	0.17	17.27	8.00	0.46	67.4%	YES
19764B	3.898	0.333333	2	10.4	0.02	0.0238	0.092	0.016	0.43	0.17	17.27	4.00	0.23	37.8%	NO
19764B	3.898	0.333333	2	10.4	0.02	0.0238	0.092	0.016	0.43	0.17	17.27	8.00	0.46	67.4%	YES
17598A	17.705	0.333333	2	20.75	0.02	0.015	0.060	0.016	0.24	0.17	36.98	4.00	0.11	18.6%	NO
17598A	17.705	0.333333	2	20.75	0.02	0.015	0.060	0.016	0.24	0.17	36.98	10.00	0.27	43.3%	NO
17598A	17.705	0.333333	2	20.75	0.02	0.015	0.060	0.016	0.24	0.17	36.98	16.00	0.43	64.0%	YES
17598B	17.705	0.333333	2	20.75	0.02	0.015	0.060	0.016	0.24	0.17	36.98	4.00	0.11	18.6%	NO
17598B	17.705	0.333333	2	20.75	0.02	0.015	0.060	0.016	0.24	0.17	36.98	10.00	0.27	43.3%	NO
17598B	17.705	0.333333	2	20.75	0.02	0.015	0.060	0.016	0.24	0.17	36.98	14.00	0.38	57.5%	*YES
17598B	17.705	0.333333	2	20.75	0.02	0.015	0.060	0.016	0.24	0.17	36.98	16.00	0.43	64.0%	YES
16200A	15.491	0.333333	2	18.65	0.02	0.02	0.064	0.016	0.26	0.17	36.64	4.00	0.11	18.8%	NO
16200A	15.491	0.333333	2	18.65	0.02	0.02	0.064	0.016	0.26	0.17	36.64	10.00	0.27	43.7%	NO
16200A	15.491	0.333333	2	18.65	0.02	0.02	0.064	0.016	0.26	0.17	36.64	14.00	0.38	58.0%	*YES
16200B	15.491	0.333333	2	18.65	0.02	0.02	0.064	0.016	0.26	0.17	36.64	16.00	0.44	64.4%	YES
16200B	15.491	0.333333	2	18.65	0.02	0.02	0.064	0.016	0.26	0.17	36.64	4.00	0.11	18.8%	NO
16200B	15.491	0.333333	2	18.65	0.02	0.02	0.064	0.016	0.26	0.17	36.64	10.00	0.27	43.7%	NO
16200B	15.491	0.333333	2	18.65	0.02	0.02	0.064	0.016	0.26	0.17	36.64	14.00	0.38	58.0%	*YES
15000	11.335	0.333333	2	15.5	0.02	0.0274	0.071	0.016	0.31	0.17	32.93	16.00	0.44	64.4%	YES
15000	11.335	0.333333	2	15.5	0.02	0.0274	0.071	0.016	0.31	0.17	32.93	5.00	0.15	25.7%	NO
15000	11.335	0.333333	2	15.5	0.02	0.0274	0.071	0.016	0.31	0.17	32.93	10.00	0.30	47.9%	NO
14862A												14.00	0.43	63.1%	YES
14862A	IN SUMP USE SEPARATE METHOD TO CALCULATE CAPACITY.														
14862A															

INLET LENGTH CALCULATION CHART
FROM HEC-12 - USING 100 YEAR Q VALUES

INLET #	Street Flow	Inlet Drop	Gutter Width	Total Spread	Cross Slope	Longitudinal Slope	Equivalent Cross Slope	Roughness Coefficient	Ratio of flow in a chosen width	Cross slope of gutter measured from slope of street section	Length of inlet for total interception	Length of inlet selected		MUST BE > OR = TO 60% Efficiency	Actual Physical length of inlet For 60%+ pickup
#	Q	a	W	T	Sx	S	Se	n	Eo	Sw'	Lt	L	L/Lt	E	L
19764A	6.747	0.333333	2	13.05	0.02	0.0238	0.080	0.016	0.36	0.17	23.76	4.00	0.17	28.2%	NO
19764A	6.747	0.333333	2	13.05	0.02	0.0238	0.080	0.016	0.36	0.17	23.76	10.00	0.42	62.6%	YES
19764B	6.747	0.333333	2	13.05	0.02	0.0238	0.080	0.016	0.36	0.17	23.76	4.00	0.17	28.2%	NO
19764B	6.747	0.333333	2	13.05	0.02	0.0238	0.080	0.016	0.36	0.17	23.76	10.00	0.42	62.6%	YES
17598A	30.644	0.333333	2	25.55	0.02	0.015	0.053	0.016	0.20	0.17	50.14	4.00	0.08	13.9%	NO
17598A	30.644	0.333333	2	25.55	0.02	0.015	0.053	0.016	0.20	0.17	50.14	10.00	0.20	33.0%	NO
17598A	30.644	0.333333	2	25.55	0.02	0.015	0.053	0.016	0.20	0.17	50.14	18.00	0.36	55.1%	*YES
17598A	30.644	0.333333	2	25.55	0.02	0.015	0.053	0.016	0.20	0.17	50.14	20.00	0.40	60.0%	YES
17598B	30.644	0.333333	2	25.55	0.02	0.015	0.053	0.016	0.20	0.17	50.14	4.00	0.08	13.9%	NO
17598B	30.644	0.333333	2	25.55	0.02	0.015	0.053	0.016	0.20	0.17	50.14	10.00	0.20	33.0%	NO
17598B	30.644	0.333333	2	25.55	0.02	0.015	0.053	0.016	0.20	0.17	50.14	18.00	0.36	55.1%	*YES
16200A	26.811	0.333333	2	23	0.02	0.02	0.056	0.016	0.22	0.17	50.14	20.00	0.40	60.0%	YES
16200A	26.811	0.333333	2	23	0.02	0.02	0.056	0.016	0.22	0.17	49.80	4.00	0.08	14.0%	NO
16200A	26.811	0.333333	2	23	0.02	0.02	0.056	0.016	0.22	0.17	49.80	10.00	0.20	33.2%	NO
16200A	26.811	0.333333	2	23	0.02	0.02	0.056	0.016	0.22	0.17	49.80	18.00	0.36	55.4%	NO
16200B	26.811	0.333333	2	23	0.02	0.02	0.056	0.016	0.22	0.17	49.80	20.00	0.40	60.3%	YES
16200B	26.811	0.333333	2	23	0.02	0.02	0.056	0.016	0.22	0.17	49.80	4.00	0.08	14.0%	NO
16200B	26.811	0.333333	2	23	0.02	0.02	0.056	0.016	0.22	0.17	49.80	10.00	0.20	33.2%	NO
16200B	26.811	0.333333	2	23	0.02	0.02	0.056	0.016	0.22	0.17	49.80	18.00	0.36	55.4%	NO
15000	19.618	0.333333	2	19.25	0.02	0.0274	0.062	0.016	0.25	0.17	49.80	20.00	0.40	60.3%	YES
15000	19.618	0.333333	2	19.25	0.02	0.0274	0.062	0.016	0.25	0.17	44.99	5.00	0.11	19.1%	NO
15000	19.618	0.333333	2	19.25	0.02	0.0274	0.062	0.016	0.25	0.17	44.99	14.00	0.31	48.9%	NO
14862A											44.99	18.00	0.40	60.1%	YES
14862A	IN SUMP USE SEPARATE METHOD TO CALCULATE CAPACITY.														
14862A															

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Management

	JOB No.	SHEET No.
CHECK INLET CAPACITY HEC-12	DESIGNED BY	DATE
	APPROVED	REFERENCE

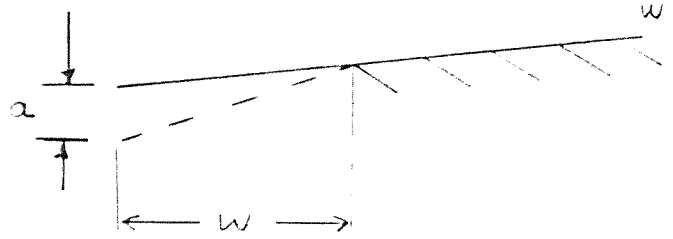
INLET [illegible] S = .0233

Q_S = 3.33

Q_{100} = 6.747 CFS ← [illegible]

SPREAD AT 6.747 CFS = 13.05' DEPTH AT CURB = .33'

? WHAT IS LENGTH OF SLOTTED OPENING INLET FOR TOTAL INTERCEPTION



HEC-12 PG. 61

→ HAVE COMPOSITE SLOPE SO USE S_E IN LIEU OF S_x - BELOW FIGURE S_E

LENGTH TOTAL INTERCEPTION $L_T = .6 Q^{.42} S^{.3} \left(\frac{1}{n S_x}\right)^{.6}$

$E_o = \frac{Q_w}{Q} = 1 - \left(1 - W/T\right)^{2.67} = 1 - \left(1 - 2/13.05\right)^{2.67}$ HEC-12 PG 61

$E_o = .36$ CHECK W/ CHART 4 $W/T = .153$

$S_w/S_x = \frac{.0625}{.02} = 3.125$ CHART 4 PG. 25

$E_o \approx .40$ ✓

USE $E_o = .36$

$S_E = S_x + S_w E_o$ ... $S_w \frac{a}{W} = \frac{.33'}{2'} = .165$

$\therefore S_E = .02 + (.165)(.36) = .0794$

→ USING S_E CALCULATE L_T

$L_T = .6 (6.75)^{.42} (.024)^{.3} \left(\frac{1}{(.016)(.0794)}\right)^{.6}$

$L_T = 23.9'$ CHECK W/ CHART 9 ≈ 24 ✓ CHART 9 PG 61

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Management

	JOB No. 3821	SHEET No.
CHECK INLET CAPACITY HEC-12	DESIGNED BY RBB	DATE 3 APR 93
	APPROVED	REFERENCE

USE AT REQUIRED TO DETERMINE REQUIRED INLET LENGTH FOR EFFICIENCY ≥ 60 %

HEC-12
CHART 10
PAGE 62

∴ TRY 5' INLET

$$L/L_T = \frac{5}{23.9} = .21$$

$$E = (1 - (1 - L/L_T)^{1.8} = 1 - (1 - .21)^{1.8}$$

$= .35$ 35% EFFICIENT

Pg 60
EQ #14

$$L/L_T = \frac{12}{23.9} = .42$$

$$E = (1 - (1 - L/L_T)^{1.8} = 1 - (1 - .42)^{1.8}$$

$= .63\%$ EFFICIENT

CHECK W/ CHART 10 ✓ 63%

CH 10
Pg 62

USE 10' INLET

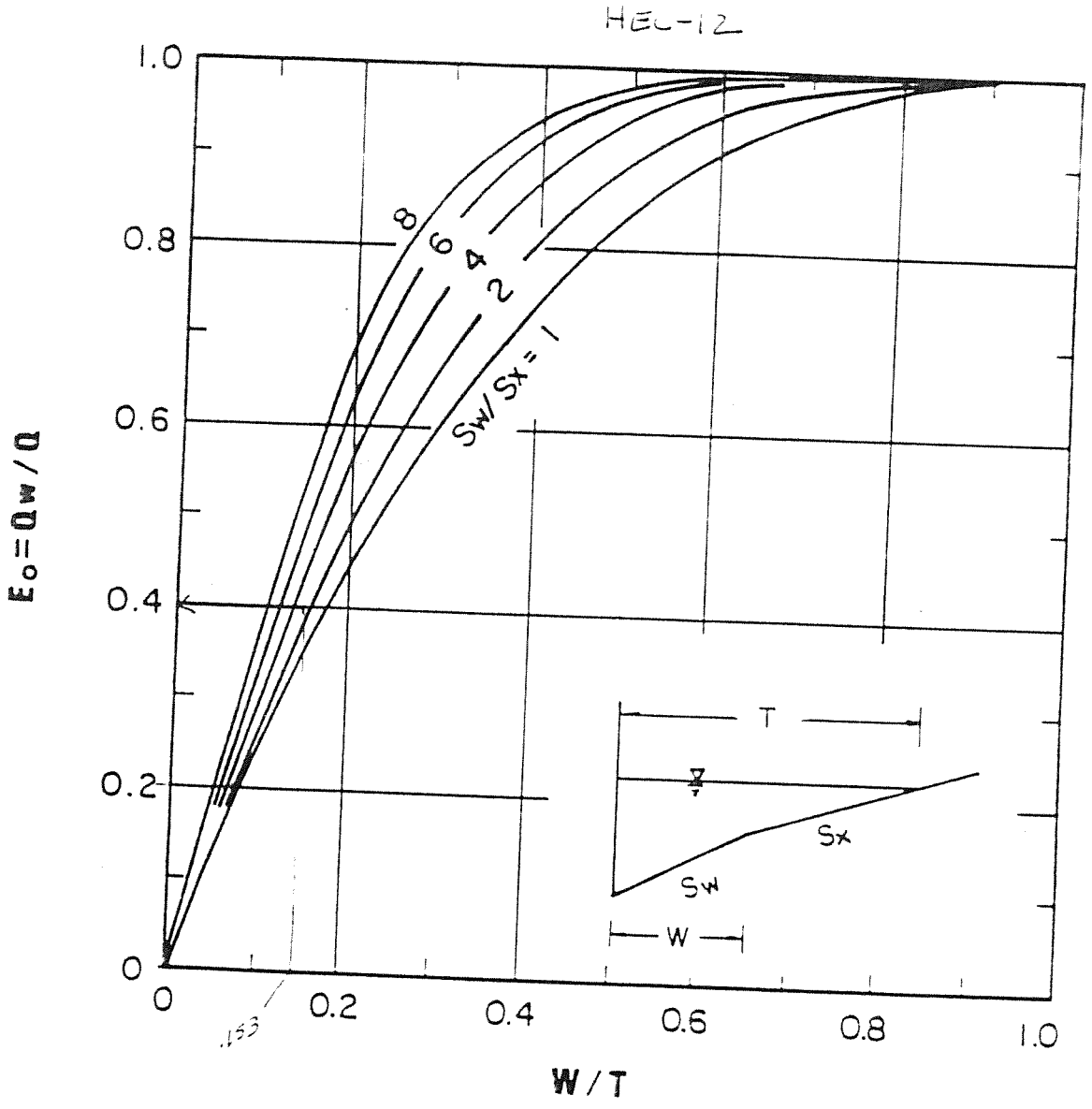


CHART 4. Ratio of frontal flow to total gutter flow.

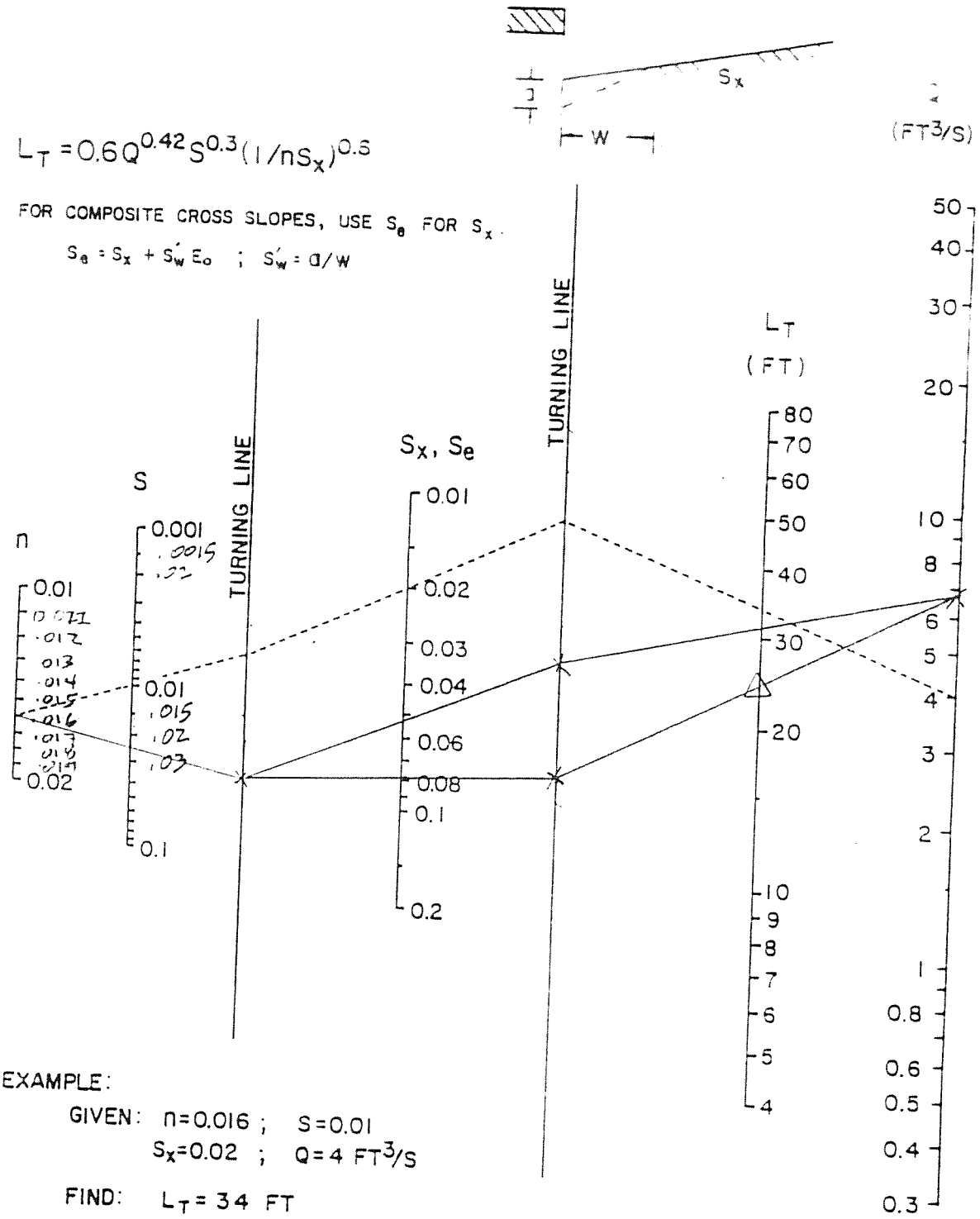


CHART 9. Curb-opening and slotted drain inlet length for total interception.

HEC-12

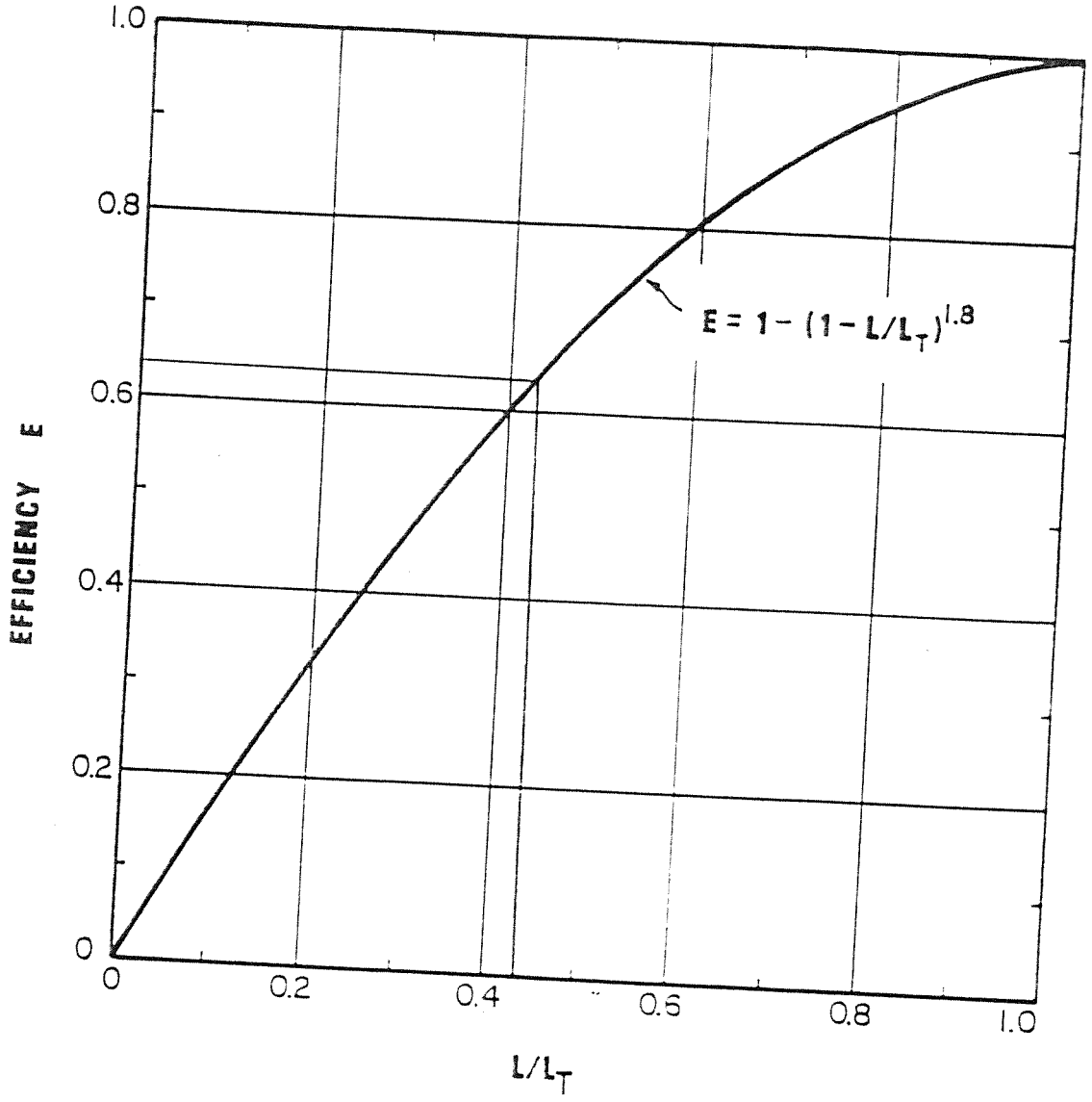


CHART 10. Curb–opening and slotted drain inlet interception efficiency.

DMJM

Planning
Architecture
Engineering
Program/Construction
Management

SEC-12	JOB No. 3321	SHEET No.
SUMP INLET	DESIGNED BY RBB	DATE 3 APR '02
	APPROVED	REFENCE

EQUATION FOR INTERCEPTION CAPACITY - DEPRESSED CURB OPENING ANSER

$Q_i = C_W (L + 1.8W) d^{1.5}$

$C_W = 2.3$ FOR DEPRESSED CURB OPENINGS

CHART 12 DEPRESSED CURB OPENING INLET CAPACITY IN SUMP LOCATIONS. CHART 12 PAGE 77

Q FROM Hydrology TO INLET = 14.904 CFS 100 YR STORM EXCEL Spdsht FORSTRECAP2

TRY 10' OPENING

$P = L + 1.8W = 10' + 1.8(2)' = 13.6$

$d_i = d + a = 8" = .67'$

$P = L + 1.8W$ OFF CHART

TRY 14' INLET / TRY 16' INLET

P = 17.6 / P = 19.6

FOR Q_{100} $d = .48'$ $d < h$

TRY DEPTH OF .5' → WHAT Q CAN 10' INLET PICK UP? 11 CFS

TRY DEPTH OF .70 → WHAT Q CAN 10' INLET PICK UP?

HEC-12

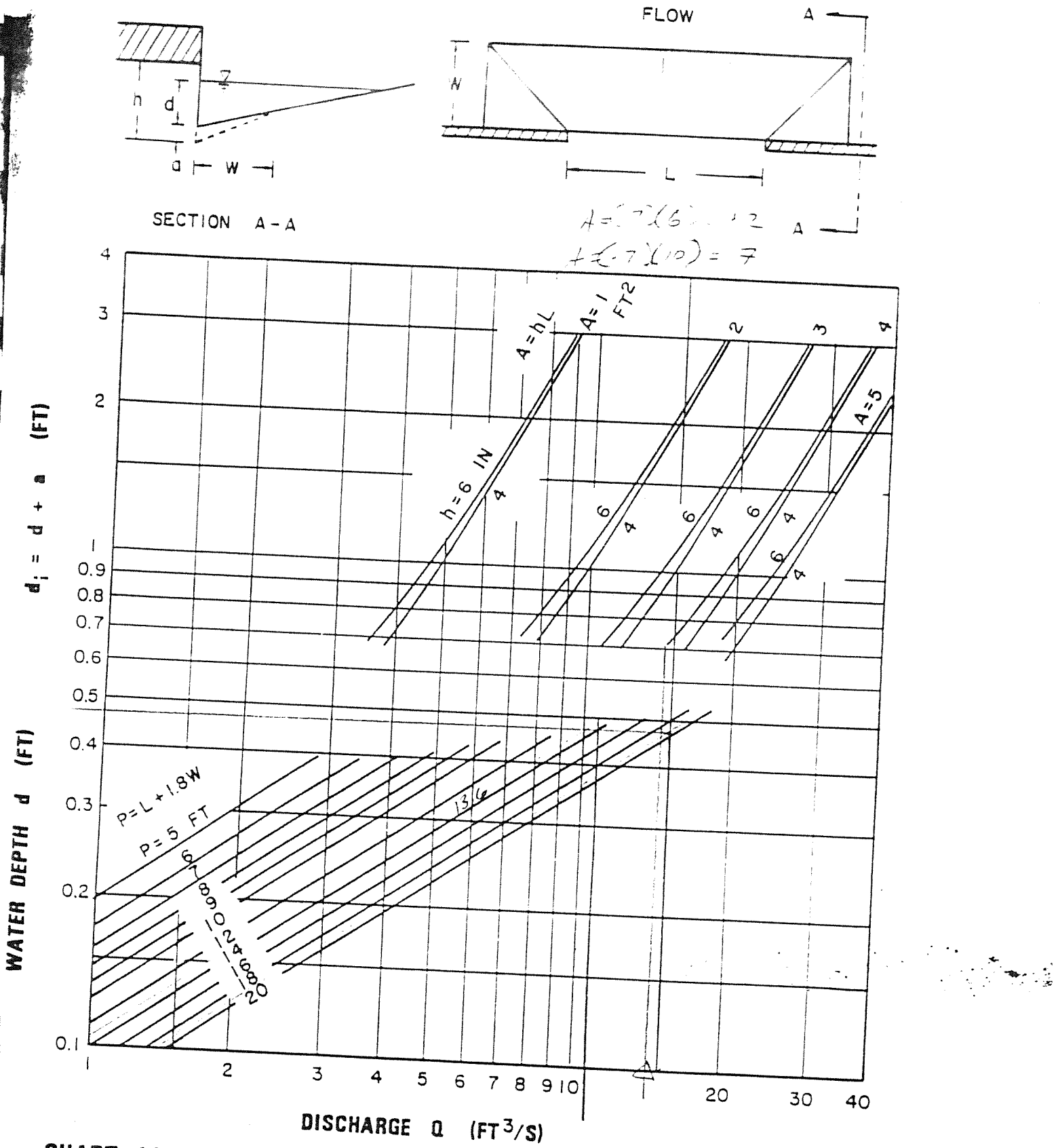


CHART 12. Depressed curb-opening inlet capacity in sump locations.

PHASE TWO STREET CAPACITY AND INLET SPACING CHART

ALL INLETS NOT INCLUDED HAVE BEEN PLACED ACCORDING TO GEOMETRIC CONTRAINTS
SUCH AS SUPER ELEVATION CHANGES, INTERSECTIONS, SUMP LOCATIONS ETC.

4/13/98 12:19

FAIRLANE INTERCHANGE

INITIAL CALCULATIONS FOR STORM SEWER IN FAIRLANE PARKWAY — 4/13/98

	Initial Storm - 5 Year Storm Rational Method Hydrology				MAX STREET CAPACITY Manning's Equation for Street Flow (2% Cross Slope)						Assumed 60% capture		ACTUAL SPREAD/DEPTH Manning's Equation for Street Flow (2% Cross Slope)						ROAD WIDTH	MAXIMUM ALLOW LENGTH
BASIN	C	A (acres)	I (in/hr)	Q (cms)	d (FT)	W (FT)	S (%)	A (FT2)	Q (CFS)	V (FPS)	FLOWBY (CFS)	RATIONAL + FLOWBY	d (FT)	W (FT)	S (%)	A (FT2)	Q (CFS)	PATH	ASSUME WIDEST	LENGTH BETWEEN INLETS
19764A	0.90	0.83	5.2	**3.898**	0.500	20.750	2.38%	4.390	**22.393**	5.10	1.56	**3.898**	0.293	10.400	2.38%	1.166	**3.895**	offsite -19764A		
19764B	0.90	0.83	5.2	**3.898**	0.500	20.750	2.38%	4.390	**22.393**	5.10	1.56	**3.898**	0.293	10.400	2.38%	1.166	**3.895**	offsite -19764A		
17598A	0.90	3.45	5.2	**16.146**	0.500	20.750	1.50%	4.390	**17.778**	4.05	6.46	**17.705**	0.500	20.750	1.50%	4.390	**17.778**	19764A-17598A	60	2504.70
17598B	0.90	3.45	5.2	**16.146**	0.500	20.750	1.50%	4.390	**17.778**	4.05	6.46	**17.705**	0.500	20.750	1.50%	4.390	**17.778**	19764B-17598B	60	2504.70
16200A	0.90	1.93	5.2	**9.032**	0.500	20.750	2.00%	4.390	**20.528**	4.68	3.61	**15.491**	0.458	18.650	2.00%	3.563	**15.562**	17598A-16200A	60	1401.18
16200B	0.90	1.93	5.2	**9.032**	0.500	20.750	2.00%	4.390	**20.528**	4.68	3.61	**15.491**	0.458	18.650	2.00%	3.563	**15.562**	17598B-16200B	60	1401.18
15000	0.90	1.65	5.2	**7.722**	0.500	20.750	2.74%	4.390	**24.027**	5.47	3.09	**11.335**	0.395	15.500	2.74%	2.487	**11.319**	17598B-16200B	60	GEOMETRY
14862A	0.90	1.84	5.2	**8.611**	0.500	20.750	2.00%	4.390	**20.528**	4.68	3.44	**12.224**	0.425	17.000	2.00%	2.974	**12.254**	17598B-16200B	60	GEOMETRY

1. ASSUME Tc= 5 Minutes
2. ASSUME n=0.016
3. BASED N ASSUMPTION #4, ASSUME MAXIMUM DEPTH OF FLOW @ GUTTER OF 6" OR .5 FT
4. ASSUME CITY STREET AND LEAVE ONE INSIDE 12 FT LANE (10' REQUIRED) OPEN FOR INITIAL STORM OR 6" AT FLOWLINE WHICHEVER IS MORE RESTRICTIVE

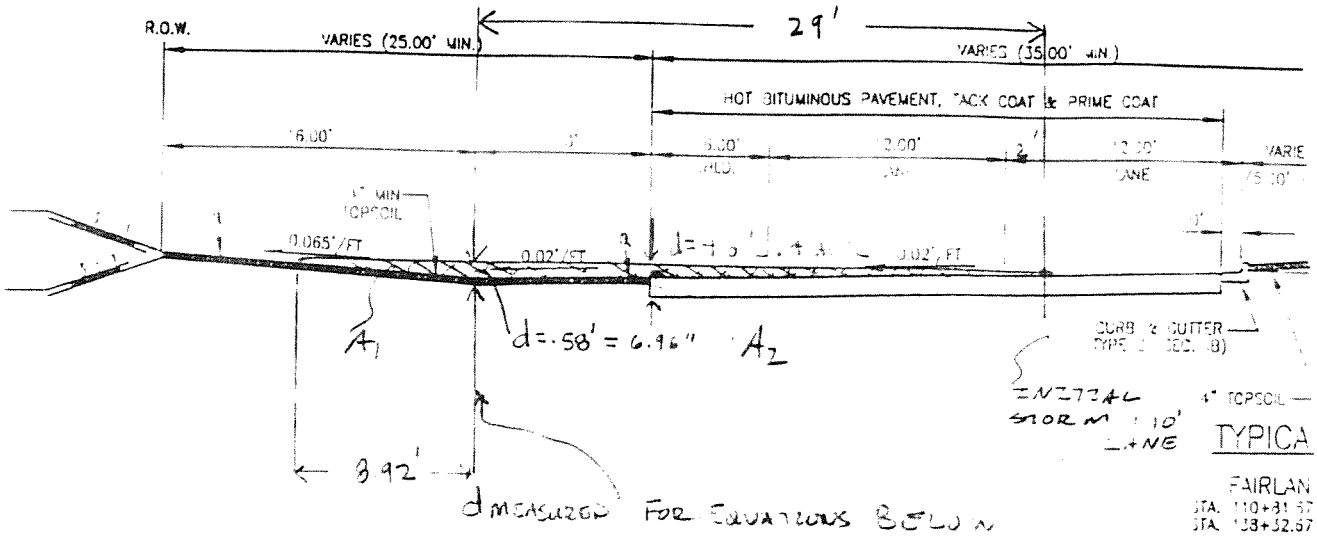
FAIRLANE INTERCHANGE

INITIAL CALCULATIONS FOR STORM SEWER IN FAIRLANE PARKWAY — 4/13/98

	Major Storm - 100 Year Storm Rational Method Hydrology				MAX STREET CAPACITY Manning's Equation for Street Flow (2% Cross Slope)						Assumed 60% capture		ACTUAL SPREAD/DEPTH Manning's Equation for Street Flow (2% Cross Slope)						ROAD WIDTH	MAXIMUM ALLOW LENGTH
BASIN	C	A (acres)	I (in/hr)	Q (cfs)	d (FT)	W (FT)	S (%)	A (FT2)	Q (CFS)	V (FPS)	FLOWBY (CFS)	RATIONAL + FLOWBY	d (FT)	W (FT)	S (%)	A (FT2)	Q (CFS)	PATH	ASSUME WIDEST	LENGTH BETWEEN INLETS
19764A	0.90	0.83	9.0	**6.747**	0.670	29.250	2.38%	8.640	**55.055**	6.37	2.70	**6.747**	0.346	13.050	2.38%	1.787	**6.823**	offsite -19764A		
19764B	0.90	0.83	9.0	**6.747**	0.670	29.250	2.38%	8.640	**55.055**	6.37	2.70	**6.747**	0.346	13.050	2.38%	1.787	**6.823**	offsite -19764A		
17598A	0.90	3.45	9.0	**27.945**	0.670	29.250	1.50%	8.640	**43.707**	5.06	11.18	**30.644**	0.596	25.550	1.50%	6.612	**30.628**	19764A-17598A	60	5 year/geometry dictates
17598B	0.90	3.45	9.0	**27.945**	0.670	29.250	1.50%	8.640	**43.707**	5.06	11.18	**30.644**	0.596	25.550	1.50%	6.612	**30.628**	19764B-17598B	60	5 year/geometry dictates
16200A	0.90	1.93	9.0	**15.633**	0.670	29.250	2.00%	8.640	**50.468**	5.84	6.25	**26.811**	0.545	23.000	2.00%	5.374	**26.852**	17598A-16200A	60	5 year/geometry dictates
16200B	0.90	1.93	9.0	**15.633**	0.670	29.250	2.00%	8.640	**50.468**	5.84	6.25	**26.811**	0.545	23.000	2.00%	5.374	**26.852**	17598B-16200B	60	5 year/geometry dictates
15000	0.90	1.65	9.0	**13.365**	0.670	29.250	2.74%	8.640	**59.072**	6.84	5.35	**19.618**	0.470	19.250	2.74%	3.790	**19.772**	17598B-16200B	60	5 year/geometry dictates
14862A	0.90	1.84	9.0	**14.904**	0.670	29.250	2.00%	8.640	**50.468**	5.84	5.96	**21.157**	0.497	20.600	2.00%	4.328	**20.144**	17598B-16200B	60	5 year/geometry dictates

1. ASSUME Tc= 5 Minutes
2. ASSUME n=0.016
3. ASSUME MAXIMUM DEPTH OF FLOW @ GUTTER OF .666 FT OR 8 INCHES (CITY OF COLORADO SPRINGS)
(New criteria allows 12" max at flowline and 4" max at crown of street whichever is more restrictive. In this case 12" at FL is more restrictive, however using 8" at flowline for 100 , the 5 year still controls spacing)

CARDER CONCRETE PRODUCTS COMPANY



INITIAL STORM

$$\text{AREA} = \text{AREA 1} + \text{AREA 2}$$

$$\text{AREA 1} = \frac{1}{2}\left(\frac{d}{.065}\right)(d) = \frac{d^2}{.13}$$

FOR INITIAL $d = .58$
$A_1 = 2.59$ ✓

$$\text{AREA 2} = \frac{1}{2}\left(\frac{d}{.02}\right)(d) = \frac{d^2}{.04}$$

FOR INITIAL $d = .58$
$A_2 = 8.41$ ✓

$$\underline{\text{AREA}} = \frac{d^2}{.13} + \frac{d^2}{.04} = \underline{32.6\,d^2}$$

$$\underline{P = W} = \frac{d}{.02} + \frac{d}{.065} = 50d + 15.38d = \underline{65.38d}$$

FOR INITIAL $d = .58$
$P = 37.92$ ✓

$n = .016$

$$Q = \frac{1}{n}\,\frac{A^{5/3}}{P^{2/3}}\,S^{1/2}$$

∴ FOR INITIAL STORM LEAVING 10' LANE OPEN

$$Q = \frac{1}{.016}\,\frac{11^{5/3}}{37.92^{2/3}}\,S^{1/2}$$

$$Q = (62.5)(4.32)\,S^{1/2}$$

$$\boxed{Q = 301.27\,S^{1/2}}$$

CARDER CONCRETE PRODUCTS COMPANY
8311 W. CARDER CT.
LITTLETON, CO 80125
(303) 791-1000 303) 791-1710 FAX

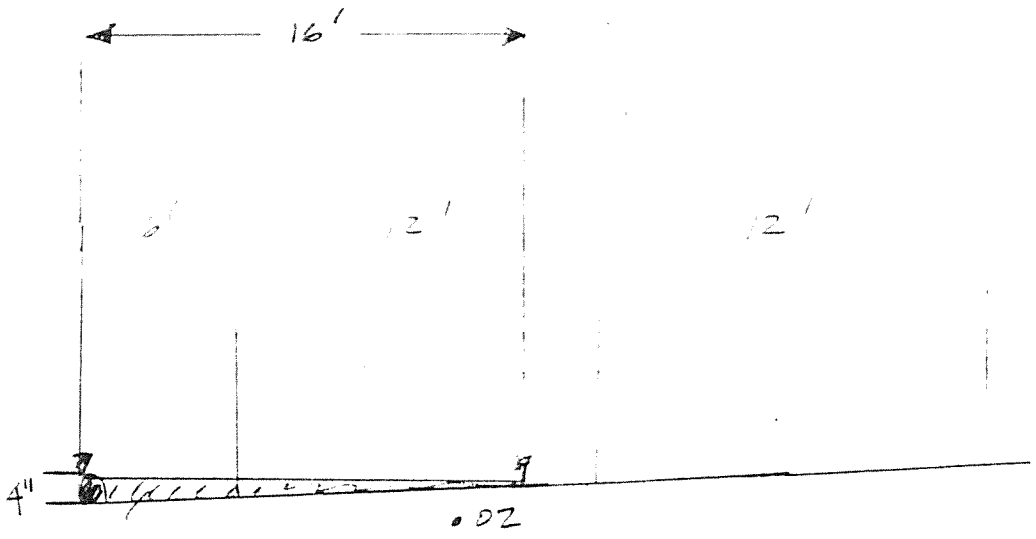
PAGE

Summary of Street Capacities

5 yr	ULTIMATE	$Q = 145.15\ S^{1/2}$	(6" DEPTH AT CURB (LEAVE 10' LANE OPEN
100 yr	ULTIMATE	$Q = 330.87\ S^{1/2}$	(6" DEPTH AT CURB
5 yr	INTERIM	$Q = 75.40\ S^{1/2}$	(4" CURB - 16' SPREAD
5 yr	INTERIM + DITCH	$Q = 301.27\ S^{1/2}$	(LEAVE 10' LANE OPEN) OVERTOP CURB
100 yr	INTERIM	$Q = 1547.63\ S^{1/2}$	(USE FULL DEPTH + POND TO CROWN)
100 yr	INTERIM + DITCH	$Q = 1547.63\ S^{1/2}$	(USE FULL DEPTH + POND TO CROWN)

By _____

CARDER CONCRETE PRODUCTS COMPANY
8311 W. CARDER CT.
LITTLETON, CO 80125
(303) 791-1600 (303) 791-1710 FAX



$$A = \frac{\left(\frac{4}{12} \times 16\right)}{2} = 2.67 \text{ FT}^2$$

$$P \approx W = 16'$$

$$R = \frac{2.67 \text{ FT}^2}{16'} = .167$$

$$Q = \frac{1.49}{.016} (2.67 \times .167)^{2/3} (.01)^{1/2}$$

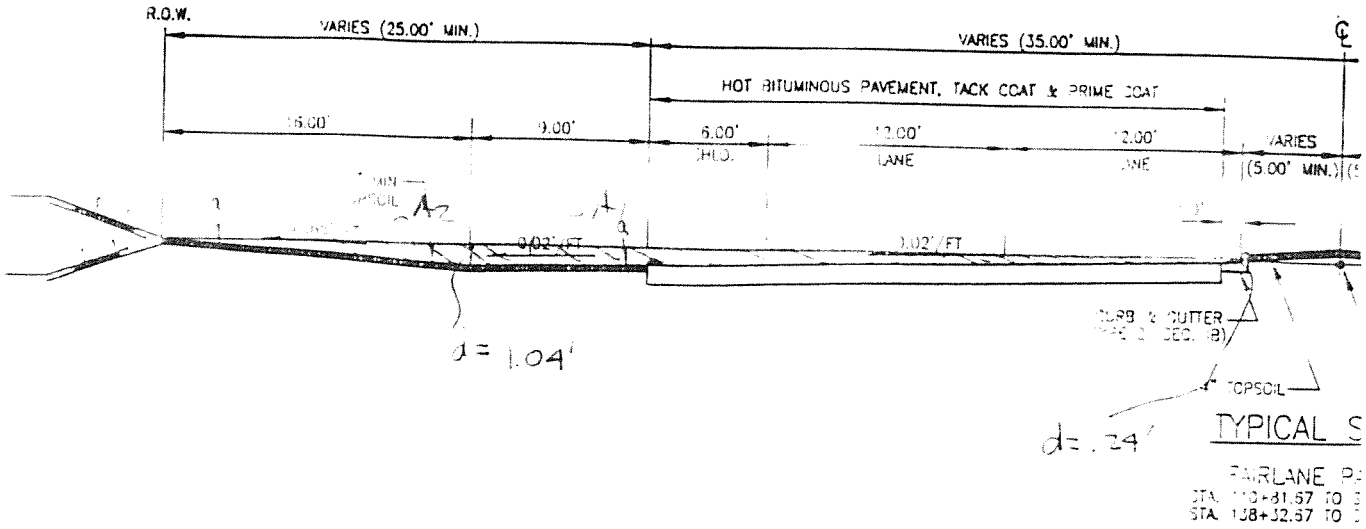
$$Q = 7.5 \text{ CFS}$$

$Q = 75.49 (S)^{1/2}$ SPREAD 16' SO LEAVES 14' TRAVEL LANE FOR 4" DEPTH AT FLOWLINE 5 & 100 YR

$Q = 171.7 S^{1/2}$ FOR 6" DEPTH AT FLOWLINE ULT 5 YEAR

$Q = 356.87 S^{1/2}$ FOR 8" DEPTH AT FLOWLINE ULT 100 YEAR

By _____



TYPICAL S

FAIRLANE P
STA 110+81.67 TO
STA 108+32.67 TO

MAJOR STORM – ASSUME FLOW TO EDGE OF INSIDE FL PONAL 2'

AREA = AREA 1 + AREA 2

$$\text{AREA 1} = \frac{1}{2}\left(\frac{d}{.065}\right)(d) = \frac{d^2}{.13}$$

FOR MAJOR $d = 1.04'$
$A_1 = 3.32\ FT^2$

AREA 2 =

$$\frac{1}{2}\left(\frac{d}{.02}\right)(d) = \text{ROUGH APPROX} \qquad 2' \text{ WIDE}$$

$$= \frac{d^2}{.04}$$

FOR MAJOR
$A_2 = 26$
$\text{AREA} = 25.6'$

$P = 56'$ (MIN)

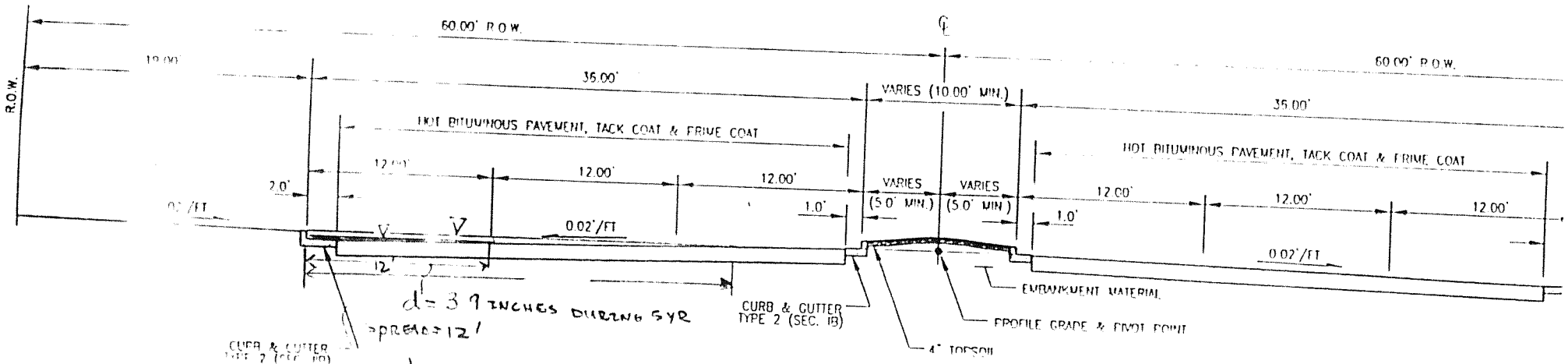
$A_{TOTAL} = 34.32$

$$Q = \frac{1}{n}\frac{A^{5/3}}{P^{2/3}} S^{1/2} = 1547.75\, S^{1/2}$$

$$\boxed{Q = 1547.63\, S^{1/2}}$$

TYPICAL SECTION

FAIRLANE PARKWAY
STA. 110+81.67 TO STA. 127+13.93
STA. 138+32.67 TO STA. 140+73.03



TYPICAL SECTION

ULTIMATE FAIRLANE PARKWAY

FOR INFORMATION ONLY-NOT PART OF THIS PROJECT

Computer File Information

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t Modification Date: 02/26/98	Initials: LLT
Path: S:\3821\CADD\PLANS\Phase1\	
wing File Name: FLCTY01.DWG	
d Ver. R14	Scale: NONE Units: ENGLISH

Index of Revisions

DMJM

DANIEL, MANN, JOHNSON, & MENDENHALL
1490 West Fillmore Street, Suite 101
Colorado Springs, Colorado 80904
Phone: (719) 471-9866 Fax: (719) 471-9063

As Construct

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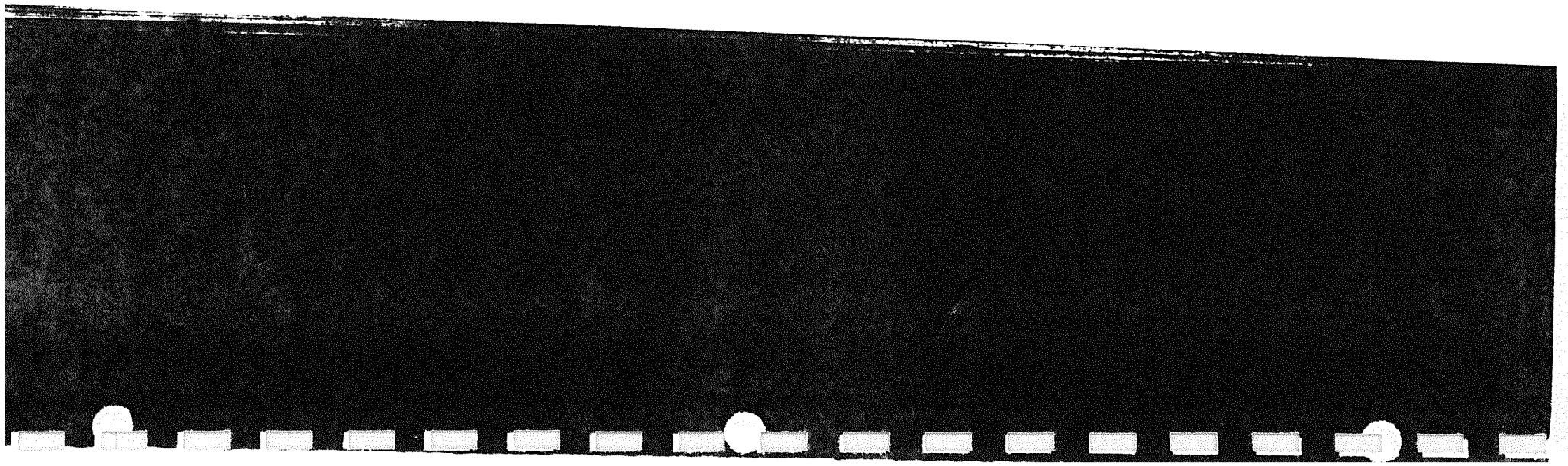
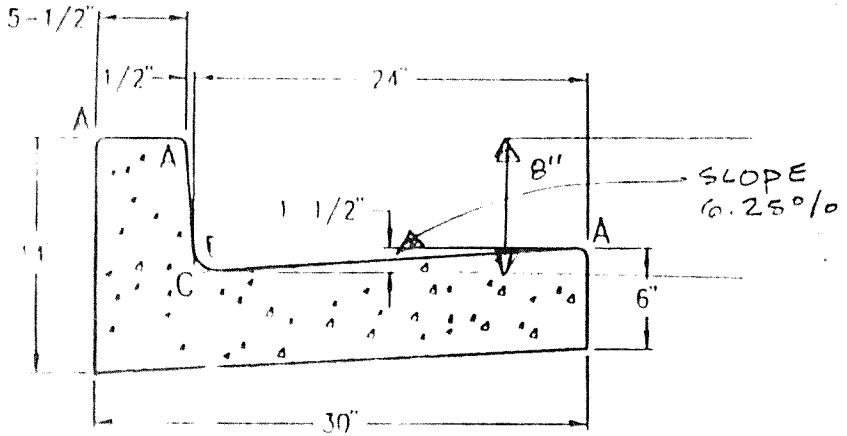
Revised: _

Void: _



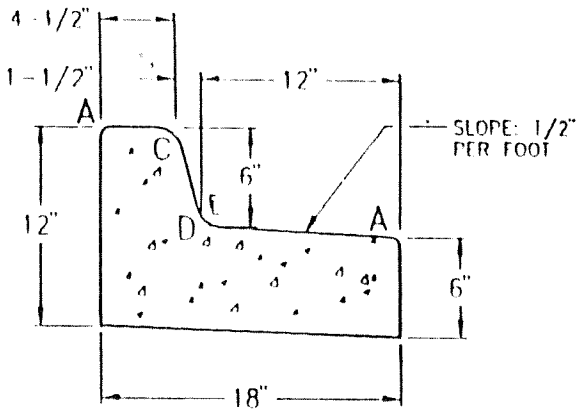


TYPE 1

VERTICAL CURB AND GUTTER

SCALE: 1" = 1'-0"

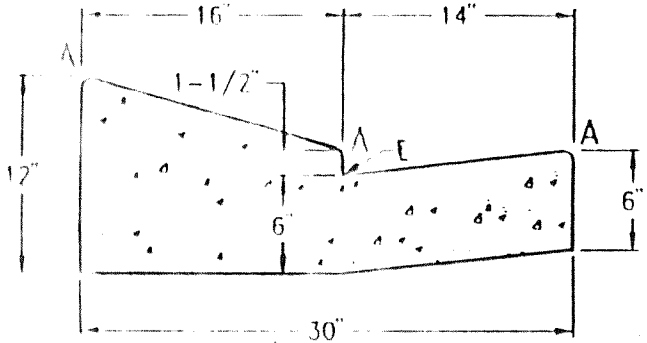
LENGTH FOR RADII
A = 1/2"
C = 1-1/2"
D = 1-1/2" TO 2"



TYPE 3

STANDARD MEDIAN CURB AND GUTTER

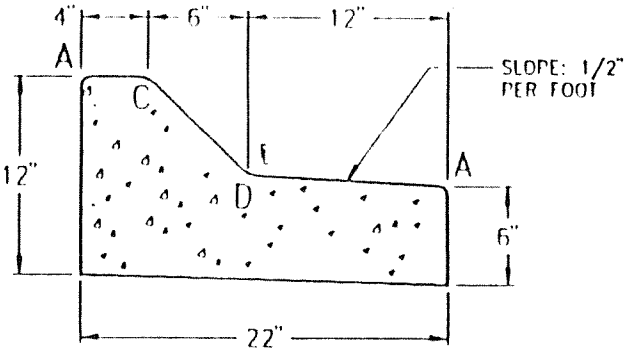
SCALE: 1" = 1'-0"



TYPE 2

RAMP CURB AND GUTTER

SCALE: 1" = 1'-0"



TYPE 4

MOUNTABLE MEDIAN CURB AND GUTTER

SCALE: 1" = 1'-0"

CITY OF COLORADO SPRINGS

Standard Curb & Gutter
Type 1, 2, 3, & 4

Approved by [signature] City Engineer

Drawn K | C | STD

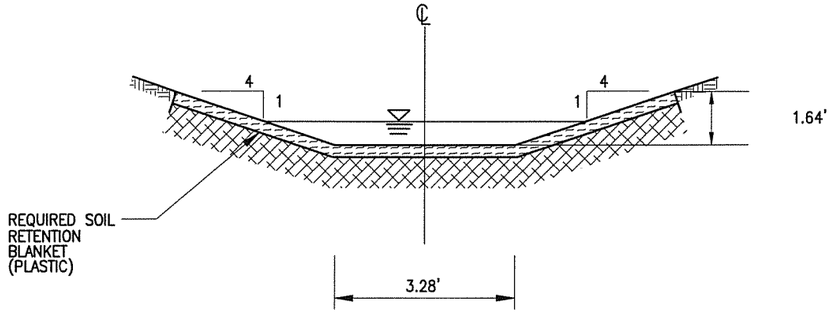
CITY OF COLORADO SPRINGS

APPENDIX D

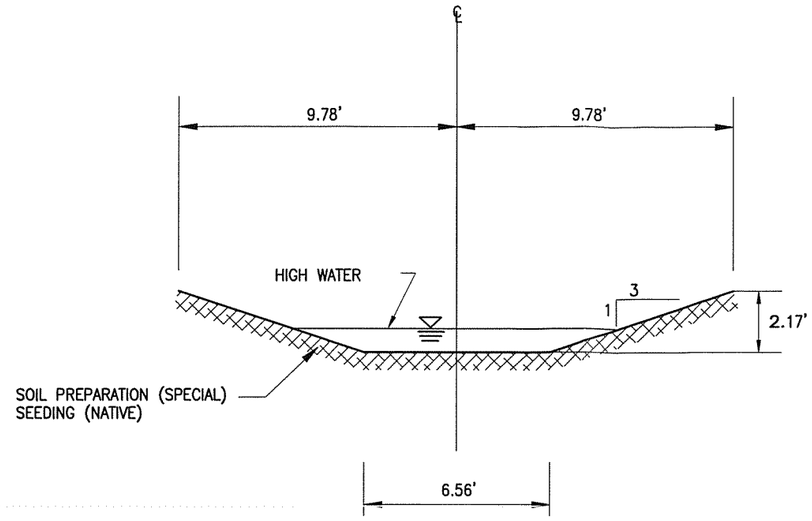
CHANNEL OPTIONS

DMJM

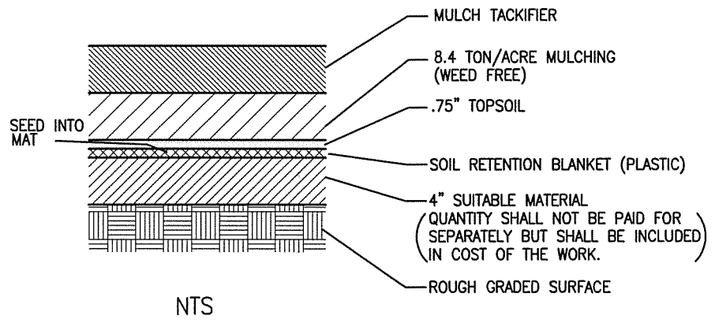
Daniel, Mann, Johnson, & Mendenhall, Inc. (DMJM)
1490 West Fillmore Street, Suite 101, Colorado Springs, Colorado 80904 - (719) 471-9866



DITCH OPTION #1
PLASTIC SOIL RETENTION
EROSION PROTECTION

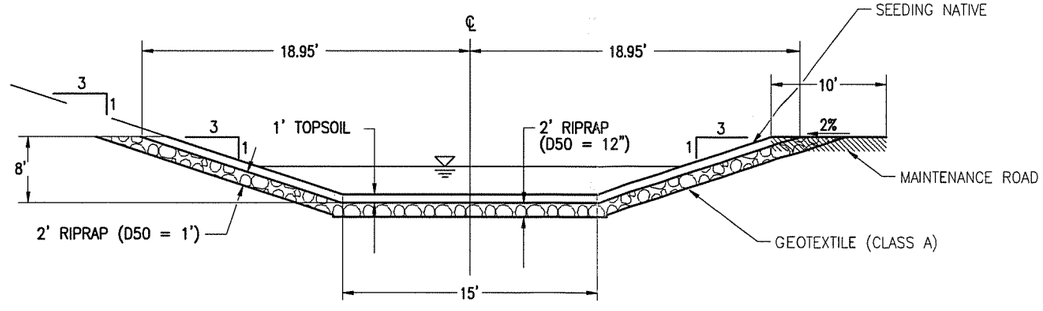


DITCH OPTION #2
NATURAL LINED GRASS CHANNEL



NTS

PLASTIC SOIL RETENTION
CHANNEL CROSS SECTION



DITCH OPTION #3
BURIED RIPRAP LINED CHANNEL

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Last Modification Date: 04/17/98		Initials: LDS
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Acad Ver. R14	Scale: NONE	Units: ENGLISH

Index of Revisions		

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As Constructed
No Revisions:
Revised:
Void:

FAIRLANE PARKWAY/S.H. 83 RELOCATION

CHANNEL SECTIONS

Sheet Subset: DRAINAGE | Subset Sheets: HYDT01 of 3

Designer:	RBB
Detailer:	LDS
Checked:	CLP
Sheet Number	

MASTER DEVELOPMENT DRAINAGE PLAN
FAIRLANE TECHNOLOGY PARK
FIGURE 3

LEGEND

- STUDY AREA BOUNDARY
- BASIN BOUNDARY
- SUBBASIN LINE
- FAIRLANE TECHNOLOGY PARK BOUNDARY
- DETENTION POND
- TRIBUTARY AREA
- HISTORIC 100 YR. FLOW
- DEVELOPED 10 YR. FLOW
- DEVELOPED 100 YR. FLOW
- DETENTION POND DISCHARGE 10 YR. STORM
- DETENTION POND DISCHARGE 100 YR. STORM
- HISTORIC DESIGN POINT
- DEVELOPED 10 YR. PEAK DISCHARGE
- DEVELOPED 100 YR. PEAK DISCHARGE
- PROPOSED CULVERT
- EXISTING CULVERT
- FAIRLANE TECHNOLOGY PARK FILING NO. 1
- EXISTING DITCH
- PROPOSED DRAINAGE FACILITIES

INDIVIDUAL BASIN FLOWS (RATIONAL METHOD)

BASIN	10 YEAR	100 YEAR	BASIN	10 YEAR	100 YEAR
O-1	123.0	230.0	A-8.4	12.2	20.3
O-2	77.0	148.5	A-9	98.1	172.6
A-1	125.4	220.6	A-10	81.2	143.0
A-2	120.8	212.2	A-11	38.9	68.5
A-3	108.2	190.4	B-1	9.7	15.4
A-4	76.4	134.3	B-2	114.0	178.0
A-5.1	127.4	224.4	B-3.1	22.1	35.1
A-5.2	45.4	79.8	B-3.2	31.3	49.6
A-6.1	91.6	160.0	B-4.1	89.2	157.0
A-6.2	55.1	96.2	B-4.2	37.3	65.5
A-7.1	75.3	128.6	B-5.1	132.6	231.6
A-7.2	47.9	81.7	B-5.2	166.5	292.9
A-7.3	7.0	11.1	C-1	54.6	95.9
A-8.1	(77.8)	(145.6)	C-2	47.8	81.5
A-8.2	26.3	45.6	C-3	25.7	45.2
A-8.3	8.6	13.7	C-4	123.0	214.9

(0.00) FROM PREVIOUS REPORT

STOUT ALLEN ROAD (FUTURE FAIRLANE PARKWAY)
REPUBLIC DRIVE
FEDERAL DRIVE
ROAD B
OLD RANCH ROAD
STATE HIGHWAY 83
INTERSTATE 25
DETENTION AREA BASIN 16.9 AC
DETENTION POND "A" 14.7 AC
DETENTION POND A (EXIST)
STORAGE = 55.8 ACRE FT.
DISCHARGE = 188 CFS
WATER SURFACE AREA = 8.2 ACRES
EMBANKMENT = 7.0 FT.
DETENTION POND B
REQUIRED STORAGE = 44.0 ACRE FT.
MAXIMUM DISCHARGE = 193.0 CFS
WATER SURFACE AREA = 10.1 ACRES
MAXIMUM EMBANKMENT = 10.0 FT.
PROPOSED TEMPORARY DITCH OR BUILD BERM TO FORM DITCH SEE DETAIL IN APPENDIX
PROPOSED REALIGNMENT OF STATE HIGHWAY 83
PROP. CONC CHANNEL B=4', D=3', Z=1.5/1 AND PROP. 30' DRAINAGE EASEMENT CAPACITY 134 CFS
EXISTING 30' DRAINAGE EASEMENT
PROP. CONC. CHANNEL B=6' D=3.6' Z=1.5/1
EXISTING CONCRETE LINED CHANNEL (EAST CHANNEL) CAPACITY 888 W/0.7' FREEBOARD ENCROACH ON FREEBOARD (TEMP.)
EXISTING CONCRETE LINED CHANNEL CAPACITY 843 CFS, REQUIRED 857 CFS=102%
EXISTING 16" INLET PICKUP 12.6, 100 YR BYPASS 7.9 CFS, 100 YR
11.6 CFS BYPASS
SCALE: 1"=200'

A 1 40.9 AC
A 2 37.6 AC
A 3 35.3 AC
A 4 23.8 AC
A 5.1 41.6 AC
A 5.2 14.8 AC
A 6.1 30.6 AC
A 6.2 18.4 AC
A 7.1 25.8 AC
A 7.2 16.4 AC
A 8.1 33.7 AC
A 8.2 9.8 AC
A 8.3 1.8 AC
A 8.4 3.4 AC
A 9 32.0 AC
A 10 26.5 AC
A 11 12.7 AC
B 1 1.8 AC
B 2 46.9 AC
B 3.1 4.1 AC
B 3.2 5.8 AC
B 4.1 29.1 AC
B 4.2 11.6 AC
B 5.1 44.3 AC
B 5.2 54.3 AC
C 1 17.0 AC
C 2 13.1 AC
C 3 8.0 AC
C 4 41.1 AC

SCANNED

MDDP
Fairlane Tech Park
URS
1994