Santan Freeway

56th Street to Kyrene Road

Final Drainage Report

September 8, 2000

Please replace the previous Santan Freeway (SR202L) 56th Street to Kyrene Road drainage report with the enclosed copy.

Thank you,

Jami Erickson

Jami Erickson
Project Engineer

HDR Engineering, Inc.

Employee Owned

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REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO.
25118
JEROME J.
ZOVNE
Date Signed
ARIZONA, U.S.A.

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I. INTRODUCTION

A. Scope and Purpose

This report summarizes the hydrologic and hydraulic analyses performed for the on-site and off-site drainage systems for the SR202L Santan Freeway, 56th Street to Kyrene Road, Project No. 202C 500, Arizona Department of Transportation (ADOT).

The drainage design for this project was prepared in accordance with current ADOT and FHWA design criteria. The drainage system will be compatible with existing adjacent ADOT, Flood Control District of Maricopa County (FCDMC), and City of Chandler local drainage improvements. The drainage facilities in this project will connect to the Southeast Valley Regional Drainage System (SEVRDS) which is currently under construction.

ADOT and FCDMC jointly sponsor the SEVRDS project, otherwise known as the Santan Channel Project. The West Channel in this project will connect to West Collector Channel in Phase III of the SEVRDS/Santan Channel Project.

The drainage laterals for the elevated portion of the Santan Freeway in this project will discharge to the West Collector Channel. The depressed portion of the freeway under Kyrene Road will drain to the Kyrene South Pump Station.

A set of drainage plans for the 100% submittal is included in Appendix A.

B. Project Location

The project is located in the City of Chandler, Maricopa County, Arizona. An exhibit of drainage facilities for this project in relation to adjacent projects is included in Appendix A.

C. Description of Improvements

1. Existing Conditions

This section of the Santan Freeway is bounded on the west by the I-10/SR202L system traffic interchange, on the south by the Gila River Indian Community (GRIC) boundary, and on the east by Kyrene Road.

To the north and east, the contributing watershed is part of a large watershed that drains the East Valley. The SEVRDS/Santan Channel intercepts the off-site flow originating in this watershed and will ultimately discharge these flows to the Gila Drain Floodway when the SEVRDS project is completed.

The FCDMC is constructing the SEVRDS project in three phases. Construction of Phase I, the Basin B excavation, is completed. Phase II

Basin B piping and outfall channel is complete and the Kyrene South Pump Station is under construction at this time. Phase III Santan east and west collector channels on the north side of the future SR202L from Price Road to approximately one-quarter mile west of the Gila Drain is also under construction.

This project will extend the West Collector Channel from the west end of the Phase III channel to 54th Street.

2. Proposed Roadway Improvements

The primary purpose of this project is to extend the Santan Freeway from 56th Street to Kyrene Road. It will connect the future Santan Freeway (SR202L) facilities east of Kyrene Road to the fully directional freeway-to-freeway system T.I. with Interstate 10 (I-10). The elevated portion of the freeway from 56th Street to just west of Kyrene Road will be drained to the West Channel along the north side of the freeway. The depressed section of the freeway under the future Kyrene Road bridge will be drained to the Kyrene South Storm Water Pump Station located in the Basin B site southwest of the SR202L/Kyrene Road interchange.

II. BACKGROUND

The original drainage concept for the Santan Freeway was developed for ADOT by HDR Engineering, Inc. (HDR) in February 1993 under the Price Expressway management consultant contract. The concept was to intercept off-site overland storm water in open channels parallel to and on the north side of the Santan Freeway improvements. Overland flows are intercepted by the east and west collector channels between Price Road and the I-10/SR202L interchange. The collected flows are discharged to the Basin B and the Santan Outfall Channel.

The concept for the Santan Freeway has been developed into the SEVRDS/Santan Channel Project by the FCDMC and ADOT as a joint project which is scheduled for completion by December 2000, except for the portion of the West Collector Channel that is included in this project.

III. OFF-SITE HYDROLOGY

The hydrologic analysis performed to define the off-site drainage system is detailed in Appendix B. The HEC-1 model (U.S. Army Corps of Engineers Flood Hydrograph Package, Version 4.1) of watershed hydrology, File Name: SEVRDS3A.DAT, output is included in Appendix A. It was adopted for this project without revision from the "Preliminary Drainage Report, Santan Channel-Phase 3, Southeast Valley Regional Drainage System," [DMJM, May 1999]. Design discharges for the ADOT 100-year, 24-hour design storm that are applicable to the portion of the Santan West Collector Channel in this project, were also defined in that report and were adopted for this project. Off-site hydrology for the Santan Freeway was developed by HDR in 1993 and has been used since to design the SEVRDS facilities. DMJM revised the outflow from the Basin B complex based on the final design for the Phase III Santan Channel project.

IV. ON-SITE DRAINAGE DESIGN

A. General Discussion

The on-site drainage for the SR202 from 56th Street to Kyrene Road is shown in Appendix D.

- The elevated section of SR202L east of 56th Street will convey the pavement run-off generated by the 10-year storm to the SEVRDS West Collector Channel on the north side of the freeway as shown in the Appendix A Exhibit.

- The depressed section of SR202L from Station 2065+50 to about one mile east of Kyrene Road is designed for the run-off generated by the 50-year storm for the ultimate project. This section will drain to the Kyrene South Pump Station that is under construction at this time under ADOT Project No. RAM 600-7-508. The collection system is shown in the Appendix A Exhibit.

- Additional flows east of the project limits drain into the Kyrene Pump Station. Final design of this segment is not complete and coordination will be required. Information on the proposed pipes east of the project limits was provided by DMJM in the I-10 /SR202L System Traffic Interchange Initial Drainage Report (30% Design), June 1999.

B. Design Criteria

The on-site hydrology will be analyzed in English units. The procedures described in the ADOT Highway Drainage Design Manual, Hydrology, (HDDM) December 1994 will be used. The Rational Method is used to develop the 50-year peak runoff for the depressed portion and the 10-year peak runoff for the elevated portion based on a site-specific Intensity-Duration Frequency (I-D-F) Graph. The Rational Formula is:

$$Q = C\,i\,A$$

where Q = the peak discharge in cfs

C = runoff coefficient

i = the average rainfall intensity, in inches/hour (in/hr) for the selected rainfall return period

A = the contributing drainage area in acres

Side slopes were assumed to be plated with topsoil plating and for the interim conditions, medians left unpaved. However, in anticipation of future additional lanes, roadway drainage analysis assumes that the medians are paved and slope in the same direction as the adjoining traveled way. Therefore, curb inlet catch

basins are sized for the ultimate freeway section including the medians. The temporary unpaved medians will be drained with catch basins that are sized to intercept median drainage only. These drains are assumed to be removed or capped when the ultimate freeway section is constructed.

The following values of "C" are used with a 10-year, 1-hour rainfall depth of 1.58 inches and with a 50-year, 1-hour rainfall depth of 2.23 inches:

- Paved surfaces – 0.95
- Highway slopes – 0.70

The rainfall intensity is estimated based upon the time of concentration at the point being analyzed. A site-specific I-D-F Graph, developed from the procedures in the HDDM, is used to estimate the average rainfall intensity. The initial time of concentration is calculated from Equation 2-2 of the HDDM as follows:

$$T_c = 11.4 \; L^{0.5} \; K_b^{0.52} \; S^{-0.31} \; I^{-0.38}$$

where T_c = time of concentration in hours

L = the length of the longest flow path in miles

K_b = the watershed resistance coefficient from Table 2-1, HDDM

S = the slope of the longest flow path in ft/mile

I = the average rainfall intensity in in/hr (same as Equation 2-1, HDDM)

The minimum T_c, and therefore the minimum rainfall duration, is ten (10) minutes.

Drainage areas, which include shoulders, median and side slopes, are identified by examination of the roadway plan and profile.

The following drainage criteria will be applied to the on-site hydrology design and are found in Chapter 600, HIGHWAY DRAINAGE DESIGN (ENGLISH UNIT EQUIVALENCIES) of the ADOT Roadway Design Guidelines (RDG), May 1996:

- Storm Drain Design Storm Frequency is 10 years for at grade/elevated main line, ramps and crossroads.
- Storm Drain Design Storm Frequency is 50 years for the depressed roadway which is defined as areas where the ultimate ponding depth could exceed 2.4 feet.
- Hydraulic grade line shall be at least 6 inches below the top of the catch basin grate for the Storm Drainage System.

- For the 10-year storm, the allowable spread (ponding width) shall not exceed the width of the roadway gutter, shoulder, parking lane and/or distress lane and one-half of the adjacent lane (for roadways with more than one lane). This equates to an allowable spread for the mainline of 16 or 18 feet with 10 ft. and 12 ft. shoulders, respectively. Ramps vary in width, therefore a minimum of one lane width (12 feet) shall remain open.

- For the 50-year storm, the allowable spread (ponding width) shall not exceed the width of the roadway gutter, shoulder, parking lane and/or distress lane plus the adjacent lane (for roadways with more than one lane), 22 or 24 feet.

- Inlet Capture Ratios shall conform to Table 606.2 of RDG.

- Restrictions on types of inlets are found in subsection 606.2.B of RDG.

- Minimum pipe size for storm drains shall be 24 inches except those pipes connecting catch basins to trunk lines may not be less than 18 inches.

- Desirable "self cleaning" velocity is 3 feet per sec (fps) flowing full. The minimum velocity flowing full is 2 fps.

The following pipe design criteria will be used on this project and are found in the ADOT Pipe Selection Guidelines and Procedures dated February 1, 1996 with March 21, 1996 Revisions.

- Pipe roughness values of 0.012 shall be used for all pipes except for non-reinforced cast-in-place concrete pipe (NRCIPCP) which has a pipe roughness value of 0.014.

- Approved pipe types are reinforced concrete pipe (RCP), non-reinforced concrete pipe (NRCP), non-reinforced cast-in-place concrete pipe (NRCIPCP) and corrugated high density polyethylene plastic pipe (CHDPEPP) Class S up to 42 inches in diameter in fills less than 10 feet.

C. Inlet Design

The standard catch basin inlets used for the freeway mainline and ramps are ADOT Standards C-15.91 and C-15.92. Slotted drains (ADOT Standard C-13.60) are attached to C-15.91 or C-15.92 in some locations to optimize the system. The location of inlets, storm drain manholes and trunk lines are shown in ADOT Standard Drawing C-13.65. Median catch basins are ADOT Standard C-15.81.

Inlets for catch basins located on Kyrene Road curb returns with ADOT Standard Type D, 6-inch, C-5.10 curb will be ADOT Standard C-15.10 and C-15.30 (10/95) with bicycle and pedestrian safe grates per C-15.50 (5/97).

HEC-12 design procedures are used for inlet calculations.

1. Pavement Inlet Design Procedure

The following steps were used to locate and size the mainline catch basins:

a. Assume a length of pavement for the initial inlet based upon the ultimate pavement width, and using the Rational Formula, calculate the 10-year peak and 50-year peak discharge value (Q) in cfs.

b. Utilizing HEC – 12 design procedures, calculate the spread for the 10-year return storm and RDG inlet capture ratios. Check spread and depth at curb against design criteria. Add slotted drain if necessary. Calculate bypass flow.

c. Check spread for the 50-year storm. Adjust inlet capacity accordingly if spread exceeds design criteria for 50-year storm.

d. Continue steps "a" through "c" until all mainline inlets have been located. Include by-pass flow from previous inlet when analyzing the next inlet.

D. Storm Drain Design

Based upon inlet locations, design the storm drain trunk line and catch basin laterals as follows:

1. Size the storm drain trunk line. Begin with HYDRAIN models from Appendix C of "I-10/SR202L System Traffic Interchange Preliminary Drainage Report (30% Design)" [DMJM, March 1999].

2. Define the maximum hydraulic grade line (HGL) at the end of the pipe run.

3. Calculate the HGL for the pipe network using ADOT accepted design procedures.

4. Review the HGL to determine if pipe size reductions are possible and confirm that the HGL is not higher than allowable at catch basins.

5. Iterate steps 3 and 4 as necessary to optimize the pipe network.

E. Main Storm Drain

HYDRAIN (Version 6.1) was used to analyze the design for the mainline storm drain system. The following procedures and assumptions were used in the analysis:

- Drainage lengths (see Appendix D) are limited to the desirable maximum distance between manholes.

Pipes under 33 inches in diameter – 330 feet
Pipes 36 and 39 inches in diameter – 440 feet
Pipes from 42 to 69 inches in diameter – 660 feet
Pipes 72 inches in diameter and larger – 1,200 feet

- Drainage area limits are based on the proposed locations of retaining walls and proposed profiles of the entrance and exit ramps.
- Areas are calculated in acres.
- The proposed mainline profile grade at each manhole station was calculated.
- The analysis assumes no by-pass from one drainage area to another.

F. Outlet Design

Outlets from the elevated segment of the freeway into the off-site drainage channel (West Channel) are designed for the 10-year frequency storm in the outlet culvert and for the 100-year frequency storm hydraulic grade line in the off-site channel.

Outlets to the existing portion of the West Channel will require sawcutting and replacement of a six-foot length of lining in order to install the outlet complete with collars and access prevention gate.

The 50-year frequency discharge to the Kyrene Pump Station is 160 cfs as indicated in the HYDRA run output. This is less than the approximate capacity of the pump station of 170 cfs at the design high water alarm level as determined from the pump characteristic curves for the station.

V. OFF-SITE DRAINAGE DESIGN

A. General Discussion

The off-site drainage design consists of approximately 2,534 feet of concrete-lined channel and 721 feet of 2 (6' x 6') concrete box culvert.

B. Coordination with Local Agencies and Adjacent Design Segments

The design of the collector channel north of SR202L between 54th Street and 56th Street is being coordinated with ADOT's design consultant for the I-10/SR202L System Interchange.

The downstream end of the channel connects to the west end of the portion of the West Collector Channel being constructed in Phase III of the SEVRDS project.

The design is also being coordinated with utilities such as water, sewer, gas, telephone and electric facilities as shown on the plans.

A 30-foot long portion of the box culvert is designed as a precast culvert and will be installed by open cut during a 72-hour shut-down of the Union Pacific Railway Company (UPRR) track. See Detail D3 for additional information. Permits from the UPRR are required to install this crossing and installation will require close coordination between the UPRR forces and the contractor. The permits are in process and are being coordinated with the ADOT Utilities and Railroad Section.

C. Design Criteria

The following design criteria applies to the off-site channel design. Most is found in the ADOT "Roadway Design Guidelines" (RDG), May 1996.

Cross-Section:

Side Slopes (maximum):

Aggregate and unlined channels – 3:1 (H:V).
Channels adjacent to a roadway without barrier protection – 4:1 (H:V).
Concrete-lined channels – 2:1 (H:V).

Bottom Width:

Channels adjacent to a roadway without a barrier protection – 8' minimum.
Concrete-lined channels – 8' minimum with 4' absolute minimum.

Cross-Slope:

2% cross-slope to one side with a 1' maximum drop across the total channel bottom width. The channel profile grade line will be defined as the low edge of the channel bottom.

Profile:

Earth and grass lined channels – minimum grade of 0.20%.
Smooth paved channels (concrete-lined) – preferred minimum grade of 0.10%.

Alignment:

Horizontal and vertical channel alignments are independent of the roadway stationing for the concrete-lined channels.

Transitions:

Vertical wall transitions are proposed for transitions into and out of box culverts between trapezoidal channel sections per Section 608.3 of the RDG. There are two of these in this project.

Hydraulic Analysis:

Flow Regime:

Channels are designed to convey flows in the sub-critical flow regime with a maximum desirable Froude number of 0.86.

Manning's "n" value:

Concrete-lined channel – 0.013 to 0.018

This analysis used Manning's "n" values of 0.016 for concrete-lined channels and 0.013 for box culverts.

Energy Loss Coefficients:

Gradual channel section transitions:
Expansion – 0.30
Contraction – 0.10

Freeboard:

Water surface elevation below natural ground: Minimum 1'
For Froude Numbers > 0.86

$$F = 0.20(y+\frac{V^2}{2g})$$

Maintenance Access:

One continuous 12' wide maintenance access road, at a minimum, is proposed for the off-site drainage channel system.

Ten-foot wide maintenance access ramps will be provided upstream and downstream of hydraulic structure transitions on the north side of the channel invert.

D. Hydraulic Analyses

1. Hydraulic Computer Models

A hydraulic model was developed for the West Collector Channel using the U.S. Army Corps of Engineers HEC-RAS computer program (Version 2.2). Summary output for the model is provided in Appendix E. The multi-barreled culvert uses the culvert routine in HEC-RAS.

The relationship between the HEC-RAS cross-section numbers and the construction centerline stationing and profiles are provided in Appendix E.

2. Channel Lining

The channel lining is comprised of a 6-inch thick layer of concrete with reinforcing steel. Two alternates for steel reinforcement are shown on the plans. Alternate No. 1 (Detail D9) consists of welded wire steel fabric with bars at the joints and cut off walls. Alternate No. 2 (Detail D11) consists entirely of tied steel reinforcement. The bidder will be required to select the alternate that the bid is based upon.

3. Maintenance Access

An access road (12 feet wide) is included to provide access for periodic maintenance. Access ramps into the channels (10 feet wide) will be provided upstream and downstream of all hydraulic structures. The ramps will provide access to the north side of the channel invert. There are two access ramps in this project.

VI. REFERENCES

Arizona Department of Transportation, "Highway Drainage Design Manual, Volume 1 – Hydrology," March 1993.

Arizona Department of Transportation, Roadway Engineering Group "Roadway Design Guidelines," May 1996.

Arizona Department of Transportation, Inlet Computer Program, Version 3.40, December 1995.

Arizona Department of Transportation, Intermodal Transportation Division, "Pipe Selection Guidelines and Procedures," February 1, 1996, with March 21, 1996 revisions.

DMJM, "I-10/SR202L System Traffic Interchange Preliminary Drainage Report (30% Design), Pecos Road Connector," Prepared for the Arizona Department of Transportation, March 1999.

DMJM, "Preliminary Drainage Report (60%) Submittal), Santan Channel – Phase 3, Southeast Valley Regional Drainage System," Prepared for the Arizona Department of Transportation and Flood Control District of Maricopa County, May 1999.

U.S. Army Corps of Engineers. "HEC-1 Flood Hydrograph Package User's Manual," Hydrologic Engineering Center, September 1990.

U.S. Army Corps of Engineers, HEC-RAS Computer Program, Version 2.2.

U.S. Department of Transportation, Federal Highway Administration, "Hydraulic Design of Highway Culverts," Hydraulic Design Series No. 5, September 1985.

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

U.S. Department of Transportation, Federal Highway Administration, "Hydraulic Design of Energy Dissipators for Culverts and Channels," Hydraulic Engineering Circular No. 14, September 1983.

APPENDIX A - Drainage Plans (100% Submittal - Not For Construction)

NOTE:
THE ZEROS IN PARENTHESIS (0, 0.0 & 0.00) IN THE HEADING OF SOME OF THE COLUMNS ARE THE RECOMMENDED PRECISION OF THE VALUE TO BE ENTERED IN THE COLUMN.

NOTE:
FOR PIPE CULVERT PLACEMENT SEE STANDARD DRAWING C-13.15

NOTE:
PIPE OPTIONS SELECTED ARE THOSE REQUIRED TO MEET MINIMUM SERVICE LIFE.
SHADED PIPE OPTION FIELDS ARE NOT ALLOWABLE ALTERNATES.

CSP - CORRUGATED STEEL PIPE
CAP - CORRUGATED ALUMINUM PIPE
RCP - REINFORCED CONCRETE PIPE
NRCP - NON-REINFORCED CONCRETE PIPE
NRCIPCP - NON-REINFORCED CAST-IN-PLACE CONCRETE PIPE
CHDPEPP - CORRUGATED HIGH DENSTIY POLYETHYLENE PLASTIC PIPE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			

Station	Plan Ref No.	⊘ Controlling Fill Height Range	Size, Corrugated (In.)	Size, Smooth (In.)	Length (0) (Ft.)	Skew (0) (Degree)	◪ Corrugation	Wall Thickness (0.00)	Zinc	Bit. Coated Zinc	Aluminum	Bit. Coated Aluminum	◪ Corrugation	Wall Thickness (0.00)	Uncoated	Bit. Coated (Coating)	Class - Non Trench (In.)	Class - Trench (In.)	Class (In.)	Min Wall Thickness (0)	AASHTO M-294 Type C	AASHTO M-294 Type S	C-13.20 & C-13.25	Detail - NRCP	NRCIPCP	CHDPEPP	Size, (In) Manhole End Sec (In.)	Standard or Detail (Each)	S-Single / D-Double (Ea)	Location (Catch basin, Manhole, Headwall & Junction Structure)	H (0.0) (Ft.)	L Wing (0.0) (Ft.)	L 18" Slotted Drn (0) (Ft.)	L 24" Slotted Drn (0) (Ft.)	Type (Grate)	Elev. (0.00) (Ft.)	Depth (Ft.)	L (0.0) (Ft.)	Inlet Depression (In.)	Pipe Exc (0) (Cubic Yard)	Pipe Bkfl (0) (Cubic Yard)	Drn Exc (0) (Cubic Yard)	Berm/Dike Emb (0) (Cubic Yard)	REMARKS
Sta 2035+20.0 Lt	1	3		24	122	3										II	II	2			X						C15.92		Lt	6.2									146	35			CB1
Sta 2035+29.7 Lt																																											
Sta 2035+20.0	2	3		24	98											II	II	2			X						C15.81			5.8						1186.56			136	28			CB2
Sta 2035+20.0 Lt																																											
Sta 2035+20.0 Rt	3	1		24	93											III	III	3			X						C15.92		Rt	4.0									97	26			CB3
Sta 2035+20.0																																											
Sta 2038+50.0 Lt	4	3		24	118											II	II	2			X						C15.92		Lt	7.1									215	33			CB4
Sta 2038+50.0 Lt																																											
Sta 2038+50.0 Rt	6	1		24	174											III	III	3			X						C15.92		Rt	4.0									196	49			CB6
Sta 2038+50.0 Lt																																											
Sta 2041+80.0 Lt	7	3		24	108											II	II	2			X						C15.92		Lt	6.6									164	31			CB7
Sta 2041+80.0 Lt																																											
Sta 2041+80.0	8	3		24	82											II	II	2			X						C15.81			5.9						1179.90			122	23			CB8
Sta 2041+80.0 Lt																																											
Sta 2041+80.0 Rt	9	1		24	91											III	III	3			X						C15.92		Rt	4.0									96	26			CB9
Sta 2041+80.0																																											
Sta 2045+10.0 Lt	10	3		24	96											II	II	2			X						C15.92		Lt	6.5									145	27			CB10
Sta 2045+10.0 Lt																																											
Sta 2045+10.0 Rt	12	1		24	174											III	III	3			X						C15.92		Rt	4.0									196	49			CB12
Sta 2045+10.0 Lt																																											
Sta 2048+40.0 Lt	13	3		24	85											II	II	2			X						C15.92		Lt	6.5									137	24			CB13
Sta 2048+40.0 Lt																																											
Sta 2048+40.0	14	3		24	82											II	II	2			X						C15.81			5.8						1173.23			117	23			CB14
Sta 2048+40.0 Lt																																											
Sta 2048+40.0 Rt	15	1		24	91											III	III	3			X						C15.92		Rt	4.0									95	26			CB15
Sta 2048+40.0																																											
Sheet Total																																								1862	400			

FILL HEIGHT RANGE TABLE (Ft.)													
RANGE NO.		1	2	3	4	5	6	7	8	9	10	11	12
FILL	>	1	3	5	8	11	15	20	25	30	40	55	70
HEIGHT (Ft.)	≤	3	5	8	11	15	20	25	30	40	55	70	90

⊘ SHOULD FIELD CONDITIONS VARY FROM THE RANGE INDICATED, CONTACT DESIGN FOR RE-EVALUATION OF PIPE DESIGN REQUIREMENTS.

◪ PIPE CORRUGATION			
A	2⅔x½	D	6x2
B	3x1	E	3x1 or 9x2½
C	9x2½		

NOTE:
All Catch Basin Offsets Are Measured to Face of Curb or Barrier Unless Otherwise Noted

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	JKE	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

NEW PIPE SUMMARY SHEET

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD
TRACS NO. H5416 01C
202 C 500
DWG NO. G-5.01
___ OF ___

Call Three Working Days Before You Dig
263-1100

REV. DATE: 07-31-98

\\eindm\56-kyrene\sm508803.dgn
Aug-00 13:31

SYSTIMEcccccc cccccDGNcSPECIFICATIONcccccc

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F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			

Station	Plan Ref No. ⬡	● Controlling Fill Height Range	Size, Corrugated (In.)	Size, Smooth (In.)	Length (0) (Ft.)	Skew (0) (Degree)	◪ Corrugation	Wall Thickness (0.00)	Zinc	Bit. Coated Zinc	Aluminum	Bit. Coated Aluminum	◪ Corrugation	Wall Thickness (0.00)	Uncoated	Bit. Coated	Class - Non Trench	Class - Trench	Class	Min Wall Thickness (0)	AASHTO M-294 Type C	AASHTO M-294 Type S	C-13.20 & C-13.25	Detail -	Size, (In) Manhole	Standard or Detail	End Sec (Each)	S-Single / D-Double	Location	H (0.0) (Ft.)	L Wing (0.0)	L 18" Slotted Drn (0)	L 24" Slotted Drn (0)	Type	Elev. (0.00)	Grate Depth (Ft.)	Grate L (0.0) (Ft.)	Inlet Depression In.	Inlet Depression Ft.	Pipe Exc (0) (Cubic Yard)	Pipe Bkfl (0)	Drn Exc (0)	Berm/Dike Emb (0)	REMARKS
Sta 2051+70.0 Lt	16	3		24	74											II	II	2			X				C15.92			Lt	6.5									128	21			CB16
Sta 2051+70.0 Lt																																													
Sta 2051+70.0 Rt	18	1		24	174											III	III	3			X				C15.92			Rt	4.0									196	49			CB18
Sta 2051+70.0 Lt																																													
Sta 2055+00.0 Lt	19	3		24	67											II	II	2			X				C15.92			Lt	6.5									107	19			CB19
Sta 2055+00.0 Lt																																													
Sta 2055+00.0	20	3		24	82											II	II	2			X				C15.81				5.8					1166.56				117	23			CB20
Sta 2055+00.0 Lt																																													
Sta 2055+00.0 Rt	21	1		24	91											III	III	3			X				C15.92			Rt	4.0									95	26			CB21
Sta 2055+00.0																																													
Sta 2058+30.0 Lt	22	3		24	53											II	II	2			X				C15.92			Lt	6.4									95	15			CB22
Sta 2058+30.0 Lt																																													
Sta 2058+30.0 Rt	24	1		24	174											III	III	3			X				C15.92			Rt	4									194	49			CB24
Sta 2058+30.0 Lt																																													
Sta 2061+60.0 Lt	25	3		24	42											II	II	2			X				C15.92			Lt	7.5									82	12			CB25
Sta 2061+60.0 Lt																																													
Sta 2061+60.0	26	3		24	82											II	II	2			X				C15.81				5.8					1159.89				134	23			CB26
Sta 2061+60.0 Lt																																													
Sta 2061+60.0 Rt	27	1		24	91											III	III	3			X				C15.92			Rt	4.0									95	26			CB27
Sta 2061+60.0																																													
Sta 2065+50.0 Lt	28	2		24	42											II	II	1			X				C15.92			Lt	5.7									42	12			CB28
Sta 2065+50.0 Lt																																													
Sta 2065+50.0	29	1		24	82											III	III	3			X				C15.81				4.8					1155.95				94	23			CB29
Sta 2065+50.0 Lt																																													
Sta 2065+50.0 Rt	30	3		24	100											II	II	2			X				C15.92			Rt	4.0									90	28			CB30
Sta 2065+50.0																																													
Sheet Total																																							1685	326			

100% SUBMITTAL - NOT FOR CONSTRUCTION

FILL HEIGHT RANGE TABLE (Ft.)

RANGE NO.		1	2	3	4	5	6	7	8	9	10	11	12
FILL	>	1	3	5	8	11	15	20	25	30	40	55	70
HEIGHT (Ft.)		3	5	8	11	15	20	25	30	40	55	70	90

● SHOULD [redacted] CONDITIONS VARY FROM THE RANGE INDICATED, CONTACT DESIGN FOR [redacted] ION OF PIPE DESIGN REQUIREMENTS.

◪ PIPE CORRUGATION			
A	2⅔x½	D	6x2
B	3x1	E	3x1 or 9x2½
C	9x2½		

NOTE:
All Catch Basin Offsets Are Measured to Face of Curb or Barrier Unless Otherwise Noted

[redacted]

263-1100

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	JKE	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

NEW PIPE SUMMARY SHEET

ROUTE 202L | LOCATION 56TH STREET - KYRENE RO[redacted]

TRACS NO. H5416 01C | 202 C 500

DWG NO. G-5.02 | ___ OF ___

REV. DATE: 07-31-98

FILE: c:\windm\56-kyrene\km508804.dgn
DATE: 31-Aug-00 13:31

cccccSYSTIMEccccc cccccUGNoSPECIFICATIONccccc

NOTE:
THE ZEROS IN PARENTHESIS (0, 0.0 & 0.00) IN THE HEADING OF SOME OF THE COLUMNS ARE THE RECOMMENDED PRECISION OF THE VALUE TO BE ENTERED IN THE COLUMN.

NOTE:
FOR PIPE CULVERT PLACEMENT SEE STANDARD DRAWING C-13.15

NOTE:
PIPE OPTIONS SELECTED ARE THOSE REQUIRED TO MEET MINIMUM SERVICE LIFE.
SHADED PIPE OPTION FIELDS ARE NOT ALLOWABLE ALTERNATES.

CSP - CORRUGATED STEEL PIPE
CAP - CORRUGATED ALUMINUM PIPE
RCP - REINFORCED CONCRETE PIPE
NRCP - NON-REINFORCED CONCRETE PIPE
NRCIPCP - NON-REINFORCED CAST-IN-PLACE CONCRETE PIPE
CHDPEPP - CORRUGATED HIGH DENSTIY POLYETHYLENE PLASTIC PLASTIC PIPE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			

Station	Plan Ref No.	◐ Controlling Fill Height Range	Size, Corrugated (In.)	Size, Smooth (In.)	Length (0) (Ft.)	Skew (0) (Degree)	◪ Corrugation	Wall Thickness (0.00)	Zinc	Blt. Coated Zinc	Aluminum	Blt. Coated Aluminum	◪ Corrugation	Wall Thickness (0.00)	Uncoated	Blt. Coated	Class - Non Trench	Class - Trench	Class	Min Wall Thickness (0)	AASHTO M-294 Type C	AASHTO M-294 Type S	C-13.20 & C-13.25	Detail -	Size, (In) Manhole	Standard or Detail	End Sec S-Single / D-Double	Location	H (0.0)	L Wing (0.0)	L 18" Slotted Drn (0)	L 24" Slotted Drn (0)	Type	Elev. (0.00)	Inlet Depression Depth (In.)	L (0.0) (Ft.)	Pipe Exc (0)	Pipe Bk Fl (0)	Drn Exc (0)	Berm/Dike Emb (0)	REMARKS
Sta 2069+50.0 Lt	31	1		24	178												III	III	3			X				C15.91		Lt	4.1								184	50			CB 31
Sta 2069+50.0 Rt																																										
Ramp B Sta 9+61.0 Rt	32	1		24	2												III	III	3			X				C15.81		Rt	4.0					1149.61			2	1			CB32
Ramp B Sta 9+61.0 Rt																																										
Sta 2069+50.0 Rt	33	1		24	42												III	III	3			X				C15.92		Rt	4.0								43	12			CB33
Sta 2069+50.0 Rt																																										
Sta 2069+50.0 Rt	34	1		24	250												III	III	3			X			24	C18.10		Rt	5.7					1152.66			270	71			MH1
Sta 2072+00.0 Rt																																										
Ramp A Sta 7+31.6 Lt	35	2		24	2												II	II	1			X				C15.81		Lt	6.1					1148.72			3	1			CB35
Ramp A Sta 7+31.6 Lt																																										
Sta 2072+00.0 Lt	36	3		24	190												II	II	2			X				C15.91		Lt	6.6								349	54			CB 34
Sta 2072+00.0 Rt																																										
Sta 2072+00.0 Rt	37	3		24	7												II	II	2			X				C15.91		Rt	8.1								17	2			CB 36
Sta 2072+00.0 Rt																																										
Ramp B Sta 9+61.0 Rt	38	3		24	66												II	II	2			X				C15.92		Rt	5.4		40						101	19			CB37
Sta 2072+52.8 Rt																																										Slotted Drain 20' Ea. Side
Sta 2072+00.0 Rt	39	4		30	284												III	III		3		X			24	C18.10		Rt	8.4					1150.14			622	97			MH2
Sta 2074+84.0 Rt																																										
Ramp A Sta 7+31.6 Lt	40	3		24	127												II	II	2			X				C15.91		Lt	6.0		40						147	31			CB38
Sta 2072+00.0 Lt																																										Slotted Drain 20' Ea. Side
Sta 2074+84.0 Lt	41	1		30	146												III	III	2	3		X				C15.91		Lt	5.0								170	50			CB39
Sta 2074+84.0 Rt																																										
Sta 2074+84.0 Rt	42	1		30	7												III	III	2	3		X				C15.91		Rt	5.2								9	2			CB40
Sta 2074+84.0 Rt																																										
Sta 2074+84.0 Rt	43	1		36	330												III	III	2	3		X			24	C18.10		Rt	7.1					1147.27			533	131			MH3
Sta 2078+14.0 Rt																																										
Sheet Total																															80						2450	521			

FILL HEIGHT RANGE TABLE (Ft.)												
RANGE NO.		1	2	3	4	5	6	7	8	9	10	11	12
FILL	>	1	3	5	8	11	15	20	25	30	40	55	70
HEIGHT (Ft.)	≤	3	5	8	11	15	20	25	30	40	55	70	90

◐ SHOULD FIELD CONDITIONS VARY FROM THE RANGE INDICATED, CONTACT DESIGN FOR RE-EVALUATION OF PIPE DESIGN REQUIREMENTS.

◪ PIPE CORRUGATION			
A	2⅔x½	D	6x2
B	3x1	E	3x1 or 9x2½
C	9x2½		

NOTE:
All Catch Basin Offsets Are Measured to Face of Curb or Barrier Unless Otherwise Noted

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	JKE	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

NEW PIPE SUMMARY SHEET

ROUTE 202L | LOCATION 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C | 202 C 500

DWG NO. G-5.03 ___ OF ___

CALL FOR ARIZONA BLUE STAKE, INC. 263-1100

REV. DATE: 07-31-98

FILE: c:\windm\56-kyrene\sm508805.dgn
DATE: 31-Aug-00 13:33

ccccccSYSTIMEcccccc cccccccUCNGSPECIFICATIONcccccc

NOTE:
THE ZEROS IN PARENTHESIS (0, 0.0 & 0.00) IN THE HEADING OF SOME OF THE COLUMNS ARE THE RECOMMENDED PRECISION OF THE VALUE TO BE ENTERED IN THE COLUMN.

NOTE:
FOR PIPE CULVERT PLACEMENT SEE STANDARD DRAWING C-13.15

NOTE:
PIPE OPTIONS SELECTED ARE THOSE REQUIRED TO MEET MINIMUM SERVICE LIFE.
SHADED PIPE OPTION FIELDS ARE NOT ALLOWABLE ALTERNATES.

CSP - CORRUGATED STEEL PIPE
CAP - CORRUGATED ALUMINUM PIPE
RCP - REINFORCED CONCRETE PIPE
NRCP - NON-REINFORCED CONCRETE PIPE
NRCIPCP - NON-REINFORCED CAST-IN-PLACE CONCRETE PIPE
CHDPEPP - CORRUGATED HIGH DENSTIY POLYETHYLENE PLASTIC PIPE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			

Station	Plan Ref No.	Controlling Fill Height Range	Size, Corrugated (In.)	Size, Smooth (In.)	Length (0) (Ft.)	Skew (0) (Degree)	CSP Corrugation	CSP Wall Thickness (0.00) (In.)	CSP Zinc Coating	CSP Blt. Coated Zinc Coating	CSP Aluminum Coating	CSP Blt. Coated Aluminum Coating	CAP Corrugation	CAP Wall Thickness (0.00) (In.)	CAP Uncoated Coating	CAP Blt. Coated Coating	RCP Class - Non Trench	RCP Class - Trench	RCP Class	RCP Min Wall Thickness (0) (In.)	NRCP AASHTO M-294 Type C	NRCIPCP AASHTO M-294 Type S	CHDPEPP C-13.20 & C-13.25	End Sec Detail - Size, (In) Manhole	End Sec Standard or Detail	End Sec S-Single / D-Double	End Treatment Location	End Treatment H (0.0) (Each)	End Treatment L Wing (0.0) (Ea)	End Treatment L 18" Slotted Drn (0) (Ft.)	End Treatment L 24" Slotted Drn (0) (Ft.)	End Treatment Type	End Treatment Elev. (0.00) (Ft.)	End Treatment Grate Depth (In.)	End Treatment Grate L (0.0) (Ft.)	Inlet Depression Pipe Exc (0) (Cubic Yard)	Inlet Depression Pipe Bk-fl (0) (Cubic Yard)	Inlet Depression Drn Exc (0) (Cubic Yard)	Inlet Depression Berm/Dike Emb (0) (Cubic Yard)	REMARKS
Sta 2078+14.0 Lt	44	I		24	145												III	III	3			X				C15.91		Lt	4.3								132	41			CB41
Sta 2078+14.0 Rt																																								
Sta 2078+14.0 Rt	45	I		24	7												III	III	3			X				C15.91		Rt	4.6								7	2			CB42
Sta 2078+14.0 Rt																																								
Sta 2078+14.0 Rt	46	I		36	386												II	II	2	4		X			24	C18.10		Rt	5.4					1143.93			501	154			MH4
Sta 2081+97.8 Rt																																								
Sta 2081+91.7 Lt	47	2		24	68	4											II	II	1			X				C15.91		Lt	5.8								86	19			CB43
Sta 2081+96.5																																								
Sta 2081+97.3 Rt	48	2		24	7												II	II	1			X				C15.91		Rt	6.1								11	2			CB44
Sta 2081+97.8 Rt																																								
Sta 2081+97.8 Rt	50	9		66	241	35												V								Det DD		Rt	19.3					1141.07			6547	177			MH5
Ramp B Sta 17+08.4 Rt																																								TIE INTO EXST. PIPE
Sta 2085+34.0 Rt	51	5		66	337												IV	IV		7						538		Rt	18.2								3821	278			CB65 MAG Det 538
Sta 2081+97.8 Rt																																								
Sta 2081+96.5	52	2		24	69	1											II	II	1			X				C15.81			5.5					1140.32			91	20			CB45
Sta 2081+97.3 Rt																																								
Ramp B Sta 12+00.0 Lt	53	3		24	63	5											II	II	2			X				C15.91		Lt	7.0								113	18			CB46
Sta 2074+84.0 Rt																																								
Sta 2087+00.0 Rt	54	5		66	106												IV	IV		7					24	C18.10		Rt	18.2					1140.46			1162	78			MH6
Sta 2085+97.0 Rt																																								
Sta 2085+34.0 Lt	56	3		24	68												II	II	2			X				C15.91		Lt	5.0		20						110	19			CB48
Sta 2085+34.0																																								Slotted Drain 20' W. Side
Sta 2085+34.0	57	4		24	65												III	III				X				C15.81			8.1					1139.52			229	18			CB49
Sta 2085+34.0 Rt																																								
Sta 2085+34.0 Rt	58	6		24	6												IV	IV								C15.91		Rt	14.9		20						43	2			CB50
Sta 2085+34.0 Rt																																								Slotted Drain 20' W. Side
Sheet Total																															40						12853	828			

FILL HEIGHT RANGE TABLE (Ft.)

RANGE NO.		1	2	3	4	5	6	7	8	9	10	11	12
FILL	>	1	3	5	8	11	15	20	25	30	40	55	70
HEIGHT (Ft.)		5	8	11	15	20	25	30	40	55	70	90	

SHOULD [illegible] CONDITIONS VARY FROM THE RANGE INDICATED, CONTACT DESIGN FOR R[illegible]N OF PIPE DESIGN REQUIREMENTS.

PIPE CORRUGATION			
A	$2\frac{2}{3}\times\frac{1}{2}$	D	6x2
B	3x1	E	3x1 or $9\times2\frac{1}{2}$
C	$9\times2\frac{1}{2}$		

NOTE:
All Catch Basin Offsets Are Measured to Face of Curb or Barrier Unless Otherwise Noted

263-1100

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	JKE	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

NEW PIPE SUMMARY S[illegible]

ROUTE 202L | LOCATION 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C | 202 C 500

DWG NO. G-5.04 ___ OF ___

REV. DATE: 07-31-98

FILE: c:\windm\56-kyrene\sm508806.dgn
DATE: 01-Sep-00 09:00

ccccccSYSTIMEccccc cccccDGNcSPECIFICATIONcccccc

NOTE:
THE ZEROS IN PARENTHESIS (0, 0.0 & 0.00) IN THE HEADING OF SOME OF THE COLUMNS ARE THE RECOMMENDED PRECISION OF THE VALUE TO BE ENTERED IN THE COLUMN.

NOTE:
FOR PIPE CULVERT PLACEMENT SEE STANDARD DRAWING C-13.15

NOTE:
PIPE OPTIONS SELECTED ARE THOSE REQUIRED TO MEET MINIMUM SERVICE LIFE.
SHADED PIPE OPTION FIELDS ARE NOT ALLOWABLE ALTERNATES.

CSP - CORRUGATED STEEL PIPE
CAP - CORRUGATED ALUMINUM PIPE
RCP - REINFORCED CONCRETE PIPE
NRCP - NON-REINFORCED CONCRETE PIPE
NRCIPCP - NON-REINFORCED CAST-IN-PLACE CONCRETE PIPE
CHDPEPP - CORRUGATED HIGH DENSTIY POLYETHYLENE PLASTIC PIPE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			

Station	Plan Ref No.	Controlling Fill Height Range	Size, Corrugated (In.)	Size, Smooth (In.)	Length (0) (Ft.)	Skew (0) (Degree)	Corrugation	Wall Thickness (0.00)	Zinc	Bit. Coated Zinc	Aluminum	Bit. Coated Aluminum	Corrugation	Wall Thickness (0.00)	Uncoated	Bit. Coated	Class - Non Trench	Class - Trench	Class	Min Wall Thickness	AASHTO M-294 Type C	AASHTO M-294 Type S	C-13.20 & C-13.25	Detail -	Size, (In) Manhole	Standard or Detail	End Sec	S-Single / D-Double	Location	H (0.0)	L Wing (0.0)	L 18" Slotted Drn (0)	L 24" Slotted Drn (0)	Type	Elev. (0.00)	Inlet Depression Depth (In.)	Inlet Depression L (0.0) (Ft.)	Pipe Exc (0)	Pipe Bk-fl (0)	Drn Exc (0)	Berm/Dike Emb (0)	REMARKS
Sta 2085+94.0 Rt	59	5		66	59											IV	IV		7					24	C18.10			Rt	18.0					1140.29			225	52			MH9
Sta 2085+34.0 Rt																																											
Sta 2085+94.0 Lt	60	1		24	67											III	III	3			X				C15.91			Lt	4.5		20						60	19			CB51
Sta 2085+94.0																																											Slotted Drain 20' East
Sta 2085+94.0	61	1		24	65											III	III	3			X				C15.81				4.1					1139.54			59	18			CB52
Sta 2085+94.0 Rt																																											
Sta 2085+94.0 Rt	62	1		24	7											III	III	3			X				C15.91			Rt	4.7		20						7	2			CB53
Sta 2085+94.0 Rt																																											Slotted Drain 20' East
Sta 2089+24.0 Rt	63	1		66	225											II	II		7					24	C18.10			Rt	9.0					1141.26			752	165			MH10
Sta 2087+00.0 Rt																																											
Sta 2089+24.0 Lt	64	1		24	134											III	III	3			X				C15.91			Lt	4.5								129	38			CB54
Sta 2089+24.0 Rt																																											
Sta 2089+24.0 Rt	65	1		24	7											III	III	3			X				C15.91			Rt	4.7								7	2			CB55
Sta 2089+24.0 Rt																																											
Sta 2092+54.0 Rt	66	2		66	327											II	II		7					24	C18.10			Rt	9.8					1142.33			1151	240			MH11
Sta 2089+24.0 Rt																																											
Sta 2092+54.0 Lt	67	1		24	134											III	III	3			X				C15.91			Lt	4.6								131	38			CB56
Sta 2092+54.0 Rt																																											
Sta 2092+54.0 Rt	68	1		24	7											III	III	3			X				C15.91			Rt	4.8								7	2			CB57
Sta 2092+54.0 Rt																																											
Sta 2095+84.0 Rt	69	3		66	331											II	II		7					24	C18.10			Rt	11.1					1143.93			1342	243			MH12
Sta 2092+54.0 Rt																																											
Ramp C Sta 13+82.0 Lt	70	3		24	104											II	II	2			X				C15.91			Lt	4.5		40						114	29			CB58
Sta 2095+84.0 Lt																																											
Sta 2095+84.0 Lt	71	1		24	134											III	III	3			X				C15.91			Lt	5.7								193	38			CB59
Sta 2095+84.0 Rt																																											Slotted Drain 20' Ea. Side
Sheet Total																															80						4180	886			

100% SUBMITTAL - NOT FOR CONSTRUCTION

FILL HEIGHT RANGE TABLE (Ft.)													
RANGE NO.		1	2	3	4	5	6	7	8	9	10	11	12
FILL	>	1	3	5	8	11	15	20	25	30	40	55	70
HEIGHT (Ft.)	≤	3	5	8	11	15	20	25	30	40	55	70	90

SHOULD FIELD CONDITIONS VARY FROM THE RANGE INDICATED, CONTACT DESIGN FOR RE-EVALUATION OF PIPE DESIGN REQUIREMENTS.

PIPE CORRUGATION			
A	2⅔x½	D	6x2
B	3x1	E	3x1 or 9x2½
C	9x2½		

NOTE:
All Catch Basin Offsets Are Measured to Face of Curb or Barrier Unless Otherwise Noted

263-1100

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	JKE	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

NEW PIPE SUMMARY SHEET

ROUTE 202L | LOCATION 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C | 202 C 500

DWG NO. G-5.05 | OF

REV. DATE: 07-31-98

FILE: c:\windm\56-kyrene\wn508809.dgn
DATE: 31-Aug-00 13:37

ccccccSYSTIMEcccccc cccccDGNcSPECIFICATIONcccccc

NOTE:
THE ZEROS IN PARENTHESIS (0, 0.0 & 0.00) IN THE HEADING OF SOME OF THE COLUMNS ARE THE RECOMMENDED PRECISION OF THE VALUE TO BE ENTERED IN THE COLUMN.

NOTE:
FOR PIPE CULVERT PLACEMENT SEE STANDARD DRAWING C-13.15

NOTE:
PIPE OPTIONS SELECTED ARE THOSE REQUIRED TO MEET MINIMUM SERVICE LIFE.
SHADED PIPE OPTION FIELDS ARE NOT ALLOWABLE ALTERNATES.

CSP - CORRUGATED STEEL PIPE
CAP - CORRUGATED ALUMINUM PIPE
RCP - REINFORCED CONCRETE PIPE
NRCP - NON-REINFORCED CONCRETE PIPE
NRCIPCP - NON-REINFORCED CAST-IN-PLACE CONCRETE PIPE
CHDPEPP - CORRUGATED HIGH DENSTIY POLYETHYLENE PLASTIC PIPE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			

Station	Plan Ref No.	Controlling Fill Height Range	Size, Corrugated (In.)	Size, Smooth (In.)	Length (0) (Ft.)	Skew (0) (Degree)	CSP Corrugation	CSP Wall Thickness (0.00) (In.)	CSP Coating: Zinc	CSP Coating: Bit. Coated Zinc	CSP Coating: Aluminum	CSP Coating: Bit. Coated Aluminum	CAP Corrugation	CAP Wall Thickness (0.00) (In.)	CAP Coating: Uncoated	CAP Coating: Bit. Coated	RCP Class - Non Trench	RCP Class - Trench	RCP Class	NRCP Min Wall Thickness (0) (In.)	NRCIPCP AASHTO M-294 Type C	CHDPEPP AASHTO M-294 Type S	Detail - C-13.20 & C-13.25	Size, (In) Manhole End Sec (Each)	End Treatment: Standard or Detail	End Treatment: Ea S-Single / D-Double	End Treatment: Catch basin, Manhole, Headwall & Junction Structure: Location	H (0.0) (Ft.)	L Wing (0.0) (Ft.)	L 18" Slotted Drn (0) (Ft.)	L 24" Slotted Drn (0) (Ft.)	Type	Elev. (0.00) (Grate)	Depth (Ft.)	Inlet Depression L (0.0) (In.)	Pipe Exc (0) (Cubic Yard)	Pipe Bk-fl (0) (Cubic Yard)	Drn Exc (0) (Cubic Yard)	Berm/Dike Emb (0) (Cubic Yard)	REMARKS
Sta 2095+84.0 Rt	72	2		24	7											II	II	I			X				C15.91		Rt	6.6								12	2			CB60
Sta 2095+84.0 Rt																																								
Ramp D Sta 14+84.0 Rt	73	3		66	224											II	II		7						C22.30		Rt									987	164			INSTALL PIPE PLUG
Sta 2095+84.0 Rt																																								
Ramp D Sta 11+69.2 Rt	74	3		24	44	1										II	II	2			X				C15.91		Rt	6.9		40						93	12			CB61
Sta 2094+85.3 Rt																																								Slotted Drain 20' Ea. Side
Sta 2085+34.0 Lt	77	1		24	7											III	III	3			X				C15.81		Lt	4.8					1140.17			7	2			CB64
Sta 2085+34.0 Lt																																								
Ramp C Sta 13+82.0 Lt	81	1		24	7											III	III	3			X				C15.81		Lt	4.6					1143.50			6	2			CB68
Ramp C Sta 13+82.0 Lt																																								
Ramp D Sta 11+69.2 Rt	82	1		24	7											III	III	3			X				C15.81		Rt	5.0					1142.59			9	2			CB69
Ramp D Sta 11+69.2 Rt																																								
Kyrene Sta 18+19.2 Rt	99	3		24	125	5										II	II	2			X				C15.30		Rt	7.3				EF2				186	35			CB101
Ramp A Sta 14+95.8 Rt																																								
Kyrene Sta 18+45.5 Lt	100	3		24	83	21										II	II	2			X				C15.30		Lt	5.0				EF2				40	23			CB100
Kyrene Sta 18+19.2 Rt																																								
Ramp A Sta 14+95.8 Rt	101	3		24	102	3										II	II	2			X			24	C18.10		Lt	5.3					1160.30			148	29			MH7
Ramp A Sta 14+91.6 Lt																																								
Kyrene Sta 21+75.2 Lt	102	3		24	80	14										II	II	2			X				C15.30		Lt	4.4				EF2				118	23			CB103
Kyrene Sta 21+56.0 Rt																																								
Kyrene Sta 21+76.3 Rt	103	3		24	131	59										II	II	2			X			24	C18.10		Rt	8.1					1164.47			539	37			MH8
Sta 2081+97.8 Rt																																								
Kyrene Sta 16+34.3 Lt	104	3		18	43	1										II	II	I			X				C15.10		Lt	5.0				EF2				58	12			CB104
Kyrene Sta 16+77.6 Lt																									DC															Tie to Exst Box
Kyrene Sta 15+30.2 Rt	105	1		18	50	6										IV	IV				X				C15.10		Rt	3.4		20		EF2				30	12			CB105
Kyrene Sta 15+83.5 Rt																																								Slotted Drain 10' Ea. Side
Sheet Total																														60							2033	355			

100% SUBMITTAL - NOT FOR CONSTRUCTION

FILL HEIGHT RANGE TABLE (Ft.)

RANGE NO.		1	2	3	4	5	6	7	8	9	10	11	12
FILL	>	1	3	5	8	11	15	20	25	30	40	55	70
HEIGHT (Ft.)	≤	3	5	8	11	15	20	25	30	40	55	70	90

SHOU[redacted] CONDITIONS VARY FROM THE RANGE INDICATED, CONTACT DESIGN FOR [redacted]ION OF PIPE DESIGN REQUIREMENTS.

PIPE CORRUGATION			
A	2⅔x½	D	6x2
B	3x1	E	3x1 or 9x2½
C	9x2½		

NOTE:
All Catch Basin Offsets Are Measured to Face of Curb or Barrier Unless Otherwise Noted

[redacted]

263-1100

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	JKE	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

NEW PIPE SUMMARY SHEET

ROUTE 202L | LOCATION 56TH STREET - KYRENE RO[redacted]

TRACS NO. H5416 01C | 202 C 500

DWG NO. G-5.06

___ OF ___

REV. DATE: 07-31-98

FILE: c:\windm\56-kyrene\wm508810.dgn
DATE: 31-Aug-00 13:41

ccccc SYSTIME ccccc cccccDGNSPECIFICATIONccccc

NOTE:
THE ZEROS IN PARENTHESIS (0, 0.0 & 0.00) IN THE HEADING OF SOME OF THE COLUMNS ARE THE RECOMMENDED PRECISION OF THE VALUE TO BE ENTERED IN THE COLUMN.

NOTE:
FOR PIPE CULVERT PLACEMENT SEE STANDARD DRAWING C-13.15

NOTE:
PIPE OPTIONS SELECTED ARE THOSE REQUIRED TO MEET MINIMUM SERVICE LIFE.
SHADED PIPE OPTION FIELDS ARE NOT ALLOWABLE ALTERNATES.

CSP - CORRUGATED STEEL PIPE
CAP - CORRUGATED ALUMINUM PIPE
RCP - REINFORCED CONCRETE PIPE
NRCP - NON-REINFORCED CONCRETE PIPE
NRCIPCP - NON-REINFORCED CAST-IN-PLACE CONCRETE PIPE
CHDPEPP - CORRUGATED HIGH DENSTIY POLYETHYLENE PLASTIC PIPE

F.A.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			

DESCRIPTION								CSP							CAP				RCP		NRCP	NRCIPCP	CHDPEPP	END TREATMENT												QUANTITIES	
				In.	In.	Ft.	Degree	In.	Coating						In.							In.		Each	Catch basin, Manhole, Headwall & Junction Structure											Cubic Yard	
Station	Plan Ref No.	● Controlling Fill Height Range	Size, Corrugated	Size, Smooth	Length (0)	Skew (0)	◪ Corrugation	Wall Thickness (0.00)	Zinc	Bit. Coated Zinc	Aluminum	Bit. Coated Aluminum	◪ Corrugation	Wall Thickness (0.00)	Uncoated	Bit. Coated	Class - Non Trench	Class - Trench	Class	Min Wall Thickness (0)	AASHTO M-294 Type C	AASHTO M-294 Type S	C-13.20 & C-13.25	Detail -	Size, (in) Manhole	Standard or Detail	End Sec	S-Single / D-Double	Location	H (0.0)	L Wing (0.0)	L 18" Slotted Drn (0)	L 24" Slotted Drn (0)	Type	Elev. (0.00)	Depth	Grate Ft. L (0.0)	Inlet Depression In.	Inlet Depression Ft.	Pipe Exc (0)	Pipe Bk fl (0)	Drn Exc (0)	Berm/Dike Emb (0)	REMARKS
Kyrene Sta 24+45.3 Lt	106	1		24	71	7										III	III	3		X				CI5.30		Lt	4.0				EF2					61	20			CB106
Kyrene Sta 24+36.6 Rt																																					
Kyrene Sta 24+36.3 Rt	107	1		24	261											III	III	3		X			24	CI8.10		Rt	3.1						1161.00			407	74			MH13
Kyrene Sta 21+76.3 Rt																																					
Kyrene Sta 21+56.0 Rt	108	3		15	19											II	II	1		X				CI5.30		Rt	8.0				EF2					45	4			CB102
Kyrene Sta 21+76.3 Rt																																					
Kyrene Sta 24+36.6 Rt	109	1		24	10											III	III	3		X				CI5.30		Rt	4.4				EF2					9	3			CB107
Kyrene Sta 24+36.3 Rt																																					
Kyrene Sta 15+83.5 Rt	110	1		24	90											III	III	3		X		DC				Rt														Tie to Exst. Box
Kyrene Sta 16+72.0 Rt																																					
W Channel Sta 12+40.0	401	3		24	20											II	II	2		X		DA		C22.30												41	6			West Channel Stub Out
																																					Install Pipe Plug
W. Channel Sta 39+50.0	402	3		24	22											II	II	2		X		DA		C22.30												69	6			West Channel Stub Out
																																					Install Pipe Plug
Sheet Total																																				632	113			

FILL HEIGHT RANGE TABLE (Ft.)													
RANGE NO.		1	2	3	4	5	6	7	8	9	10	11	12
FILL	>	1	3	5	8	11	15	20	25	30	40	55	70
HEIGHT (Ft.)	≤	3	5	8	11	15	20	25	30	40	55	70	90

● SHOULD FIELD CONDITIONS VARY FROM THE RANGE INDICATED, CONTACT DESIGN FOR RE-EVALUATION OF PIPE DESIGN REQUIREMENTS.

◪ PIPE CORRUGATION			
A	2⅔x½	D	6x2
B	3x1	E	3x1 or 9x2½
C	9x2½		

NOTE:
All Catch Basin Offsets Are Located to Face Of Curb or Barrier Unless Otherwise Noted

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JRE	09/00
DRAWN	JRE	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

NEW PIPE SUMMARY SHEET

ROUTE 202L | LOCATION 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C | 202 C 500

DWG NO. G-5.07 ___ OF ___

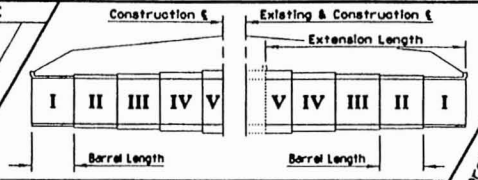
263-1100

REV. DATE: 07-31-98

FILE: c:\wkdm\56-kyrene\sm508820.dgn
DATE: 01-Sep-00 10:07

ccccSYSTIMEccccc cccccDGNSPECIFICATIONccccc

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



Plan Ref No. ◯ & ⓐ	Structure No.	New	Extend	No. of Barrels	Barrel Span (0.0)	Barrel Height (0.0)	Culvert Length (0.0)	Skew (Degree) (0)	B-01.10 Misc Details	B-01.11 Ext Details	◪ Standard or Detail	▲ Location	Inlet Wings	Outlet Wings	◪ Standard or Detail	Apron	◪ Standard or Detail	Scour/Bank Protection	◪ Standard or Detail	Energy Dissipaters	Detail	Linear Feet (0.0) ▲ Left of ℄ I	II	III	IV	V	▲ Right of ℄ V	IV	III	II	I	◐ Reinforcing Steel (0)	◐ Place Dowels	◐ Class S Conc f'c=3,000 psi	◐ Remove Str Conc (0)	◐ Str Exc (0)	◐ Structure Backfill (0)	Berm Emb (0)	Dike Emb (0)	Drainage Exc (0)	REMARKS
1		X	2	6.0	6.0	690.9		X		B-2.20		Left								01,03,08		690.9										40,460		963		5087	3034				
Station: 20+08.63 TO 26+99.57												Right																													
Existing:																																								
												Box Culvert Total																												
												Left																												
Station:												Right																												
Existing:																																								
												Box Culvert Total																												
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Station:												Right																												
Existing:																																								
												Box Culvert Total																												
												Sheet Total																												

NOTE:
FOR STRUCTURAL EXCAVATION, STRUCTURE BACKFILL PLACEMENT AND MEASUREMENT, SEE STANDARD DRAWING B-19.50

NOTE:
THE ZEROS IN PARENTHESIS (0, 0.0 & 0.00) IN THE HEADING OF SOME OF THE COLUMNS ARE THE RECOMMENDED PRECISION OF THE VALUE TO BE ENTERED IN THE COLUMN.

◐ TOTALS SHOWN FOR THE BOX CULVERT INCLUDE THE QUANTITIES FOR HEADWALLS, WINGS, APRONS, CURBS, CUT-OFF WALLS AND LAPS AT CONSTRUCTION JOINTS.

◪ STRUCTURES SECTION STANDARD DRAWINGS JUNE, 1992 (PUBLICATION NO. 31-002) (ENGLISH EDITION)

▲ Construction ℄ Looking Ahead

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JJZ	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

REINFORCED CONC BOX CULVERT AND BOX CULVERT EXTENSION SUMMARY SHEET

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE R[redacted]

TRACS NO. H5416 01C
20[redacted]00

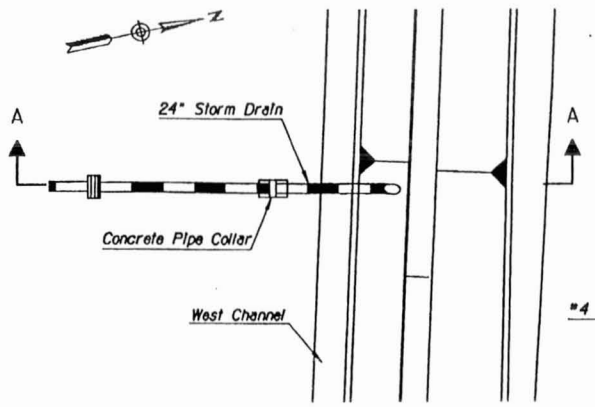
DWG NO. C-6.01
___ OF ___

REV. DATE: 07-31-98

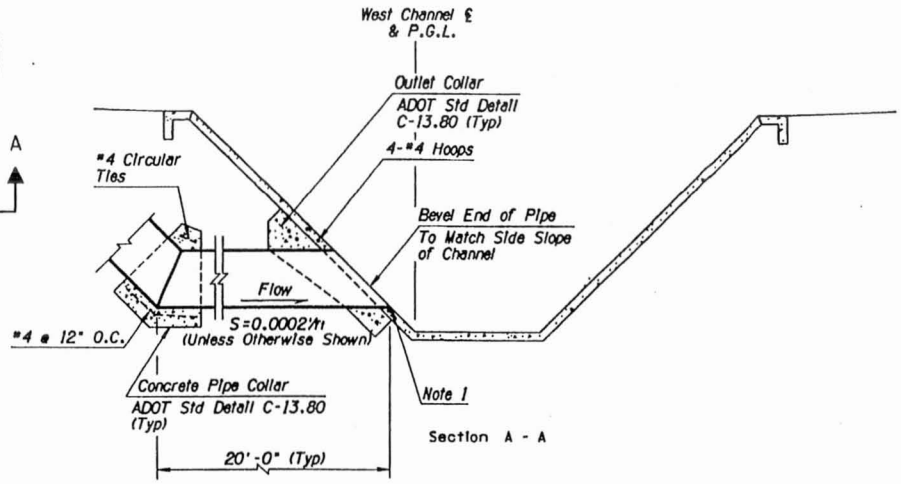
FILE: c:\wndm\58-kyrene\sm508807.dgn
DATE: 31-Aug-00 09:55

cccccSYSTIMEccccccc cccccDGNcSPECIFICATIONccccc

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
- 9	ARIZ.	202 C 500			
		202L MA 051			



Plan



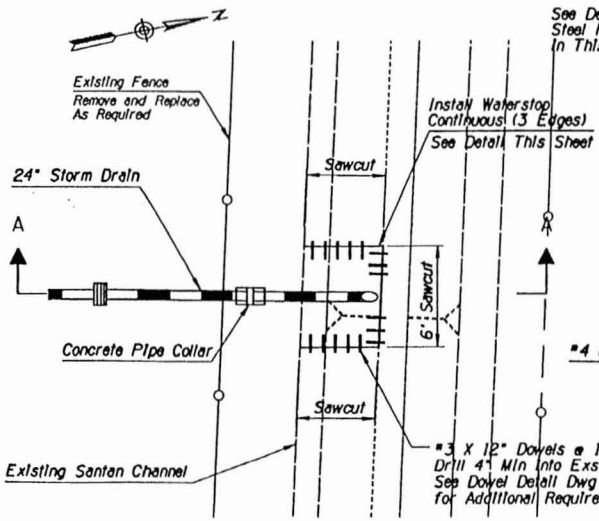
Section A - A

Notes:

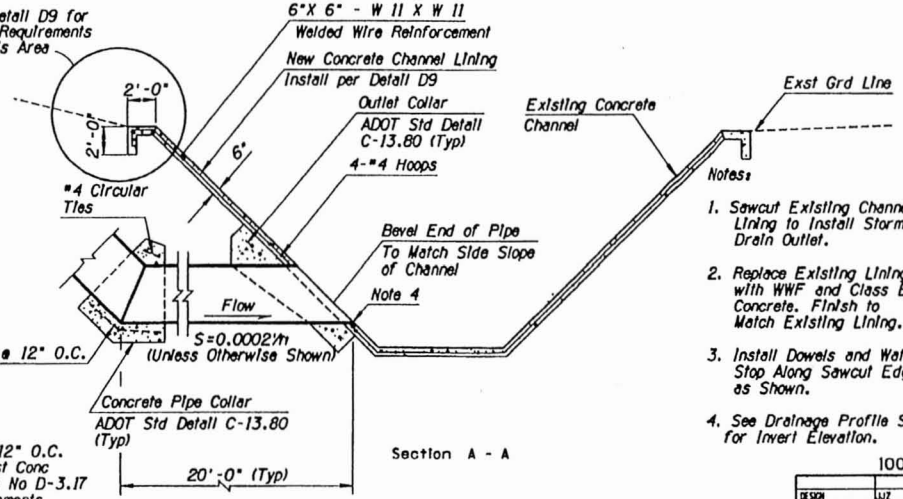
1. See Drainage Profile Sheets for Invert Elevations.

DETAIL DA

Storm Drain Outlet Detail



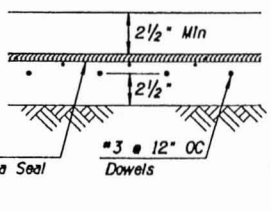
Plan



Section A - A

Notes:

1. Sawcut Existing Channel Lining to Install Storm Drain Outlet.
2. Replace Existing Lining with WWF and Class B Concrete. Finish to Match Existing Lining.
3. Install Dowels and Water Stop Along Sawcut Edge as Shown.
4. See Drainage Profile Sheets for Invert Elevation.



Waterstop Detail

DETAIL DB

Storm Drain Connection to Existing Concrete Channel

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JJZ	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES
STORM DRAIN OUTLET
DETAILS DA AND DB

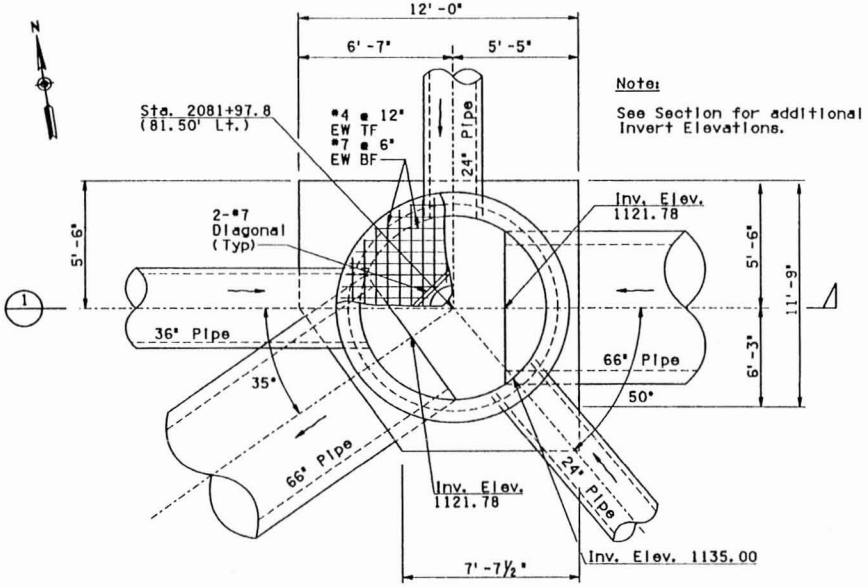
ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD
TRACS NO. H5416 01C
202 C 500
DWG NO. C-8.20
___ OF ___

263-1100

FILE: c:\windm\56-kyrene\dd508804.dgn
DATE: 31-Aug-00 10:49

ccccccSYSTIMEccccc cccccDGNcSPECIFICATIONccccc

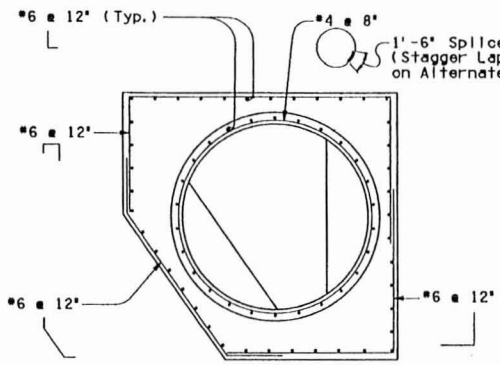
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



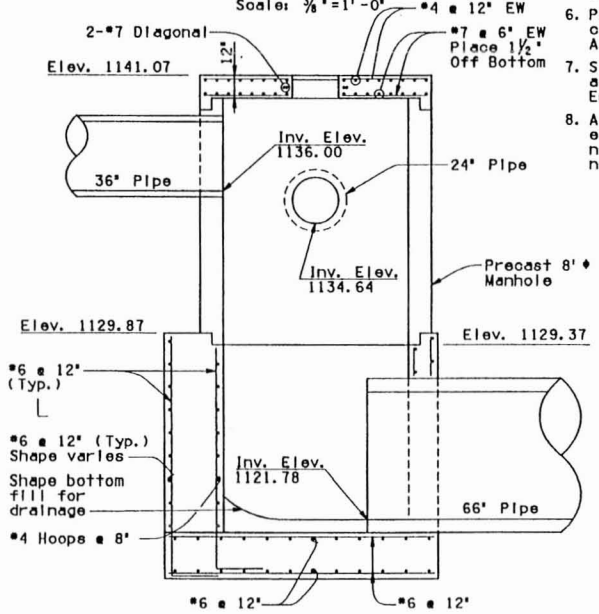
Note:

See Section for additional Invert Elevations.

PLAN VIEW
Scale: ⅜"=1'-0"



PARTIAL PLAN
Scale: ⅜"=1'-0"



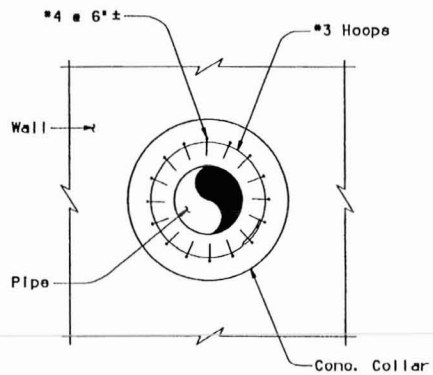
SECTION 1
Scale: ⅜"=1'-0"

NOTES:

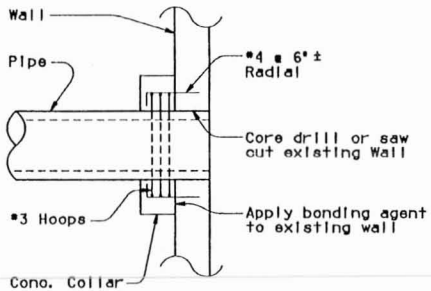
1. Construction Specifications- Arizona Department of Transportation on Standard Specifications for Road and Bridge Construction, Edition of 2000
2. All concrete shall be Class 'S' f'c = 4000 psi
3. Reinforcing steel shall conform to ASTM Specification A615 and shall be furnished as Grade 60.
4. All reinforcing steel shall have 2" clear cover unless noted otherwise.
5. Chamfer all corners ¾" per ADOT Standard B-19.10 unless noted otherwise.
6. Precast manhole section shall conform to the requirements of AASHTO M199.
7. See Std C-18.20 for manhole frame and cover type. ADOT Resident Engineer to provide cover verbage.
8. All dimension shown in feet and elevations shown in feet unless noted otherwise. Dimensions shall not be scaled drawings.

DETAIL DD

MANHOLE 5 DETAILS



ELEVATION
NTS



SECTION
NTS

DETAIL DC

PIPE PENETRATION DETAIL

100% SUBMITTAL - NOT FOR CONSTRUCTION

		DATE
DESIGN	BKV	9/00
DRAWN	TRK	9/00
CHECKED	PMT/JE	9/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

SR202L
DETAIL SHEET

202L ROUTE — 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C — 202 C

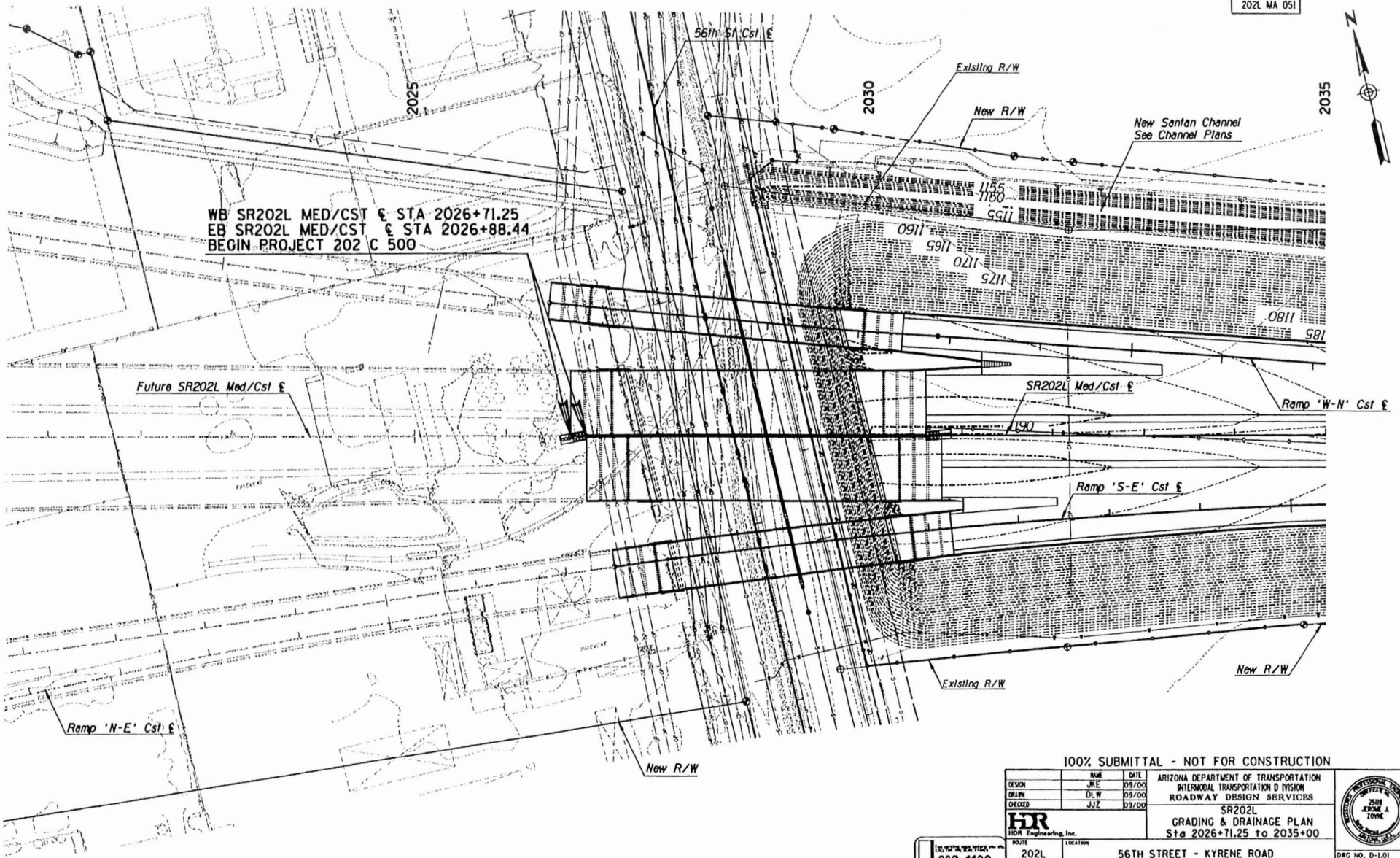
DWG. NO. G-8.21

___ OF ___

FILE: C:\WNDM\56-KYRENE\D1508821.DGN
DATE: 07-Sep-00 10:38

ooooooSYSTIMEoooooo oooooDGNoSPECIFICATIONoooooo

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SR202L
GRADING & DRAINAGE PLAN
Sta 2026+71.25 to 2035+00

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C | 202 C 500

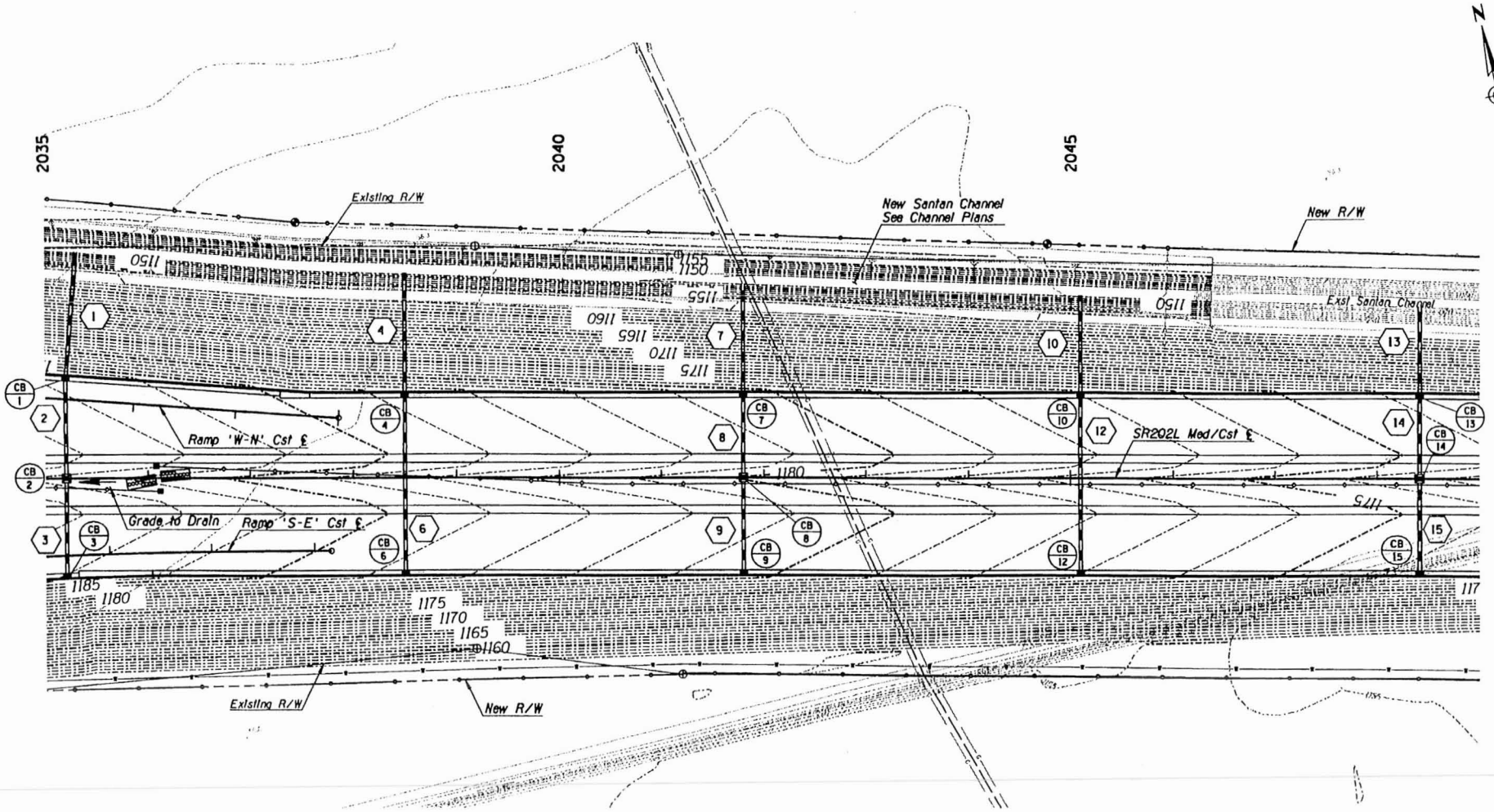
DRG NO. D-1.01
___ OF ___

263-1100

FILE: c:\windm\56-kyrene\dr508801.dgn
DATE: 28-Aug-00 14:27

ccccSYSTIMEcccccc cccccDGNcSPECIFICATIONcccccc

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SR202L
GRADING & DRAINAGE PLAN
Sta 2035+00 to [illegible]

263-1100

ROUTE	LOCATION	
202L	56TH STREET - KYRENE ROA[illegible]	DRG NO. D-1.02
TRACS NO. H5416 01C	202 C 500	___ OF ___

FILE: c:\windm\56-kyrene\dr508502.dgn
DATE: 25-Aug-00 16:24

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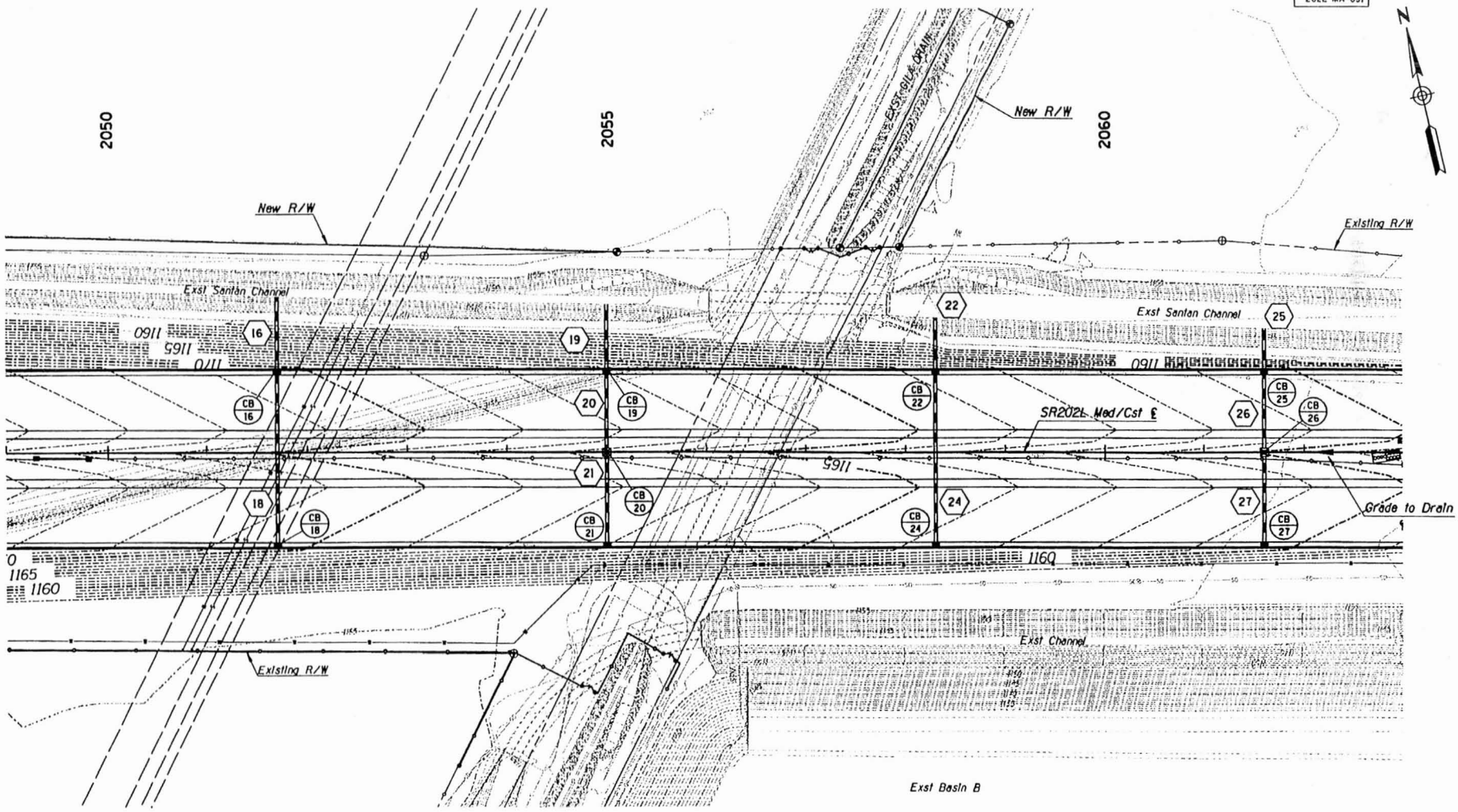
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SR202L
GRADING & DRAINAGE PLAN
Sta 2049+00 to 2063+00

263-1100

ROUTE	LOCATION	
202L	56TH STREET - KYRENE ROAD	
TRACS NO. H5416 01C		202 C 500

DWG NO. D-1.03

___ OF ___

FILE: c:\wndm\58-kyrene\dr508803.dgn
DATE: 25-Aug-00 16:25

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F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
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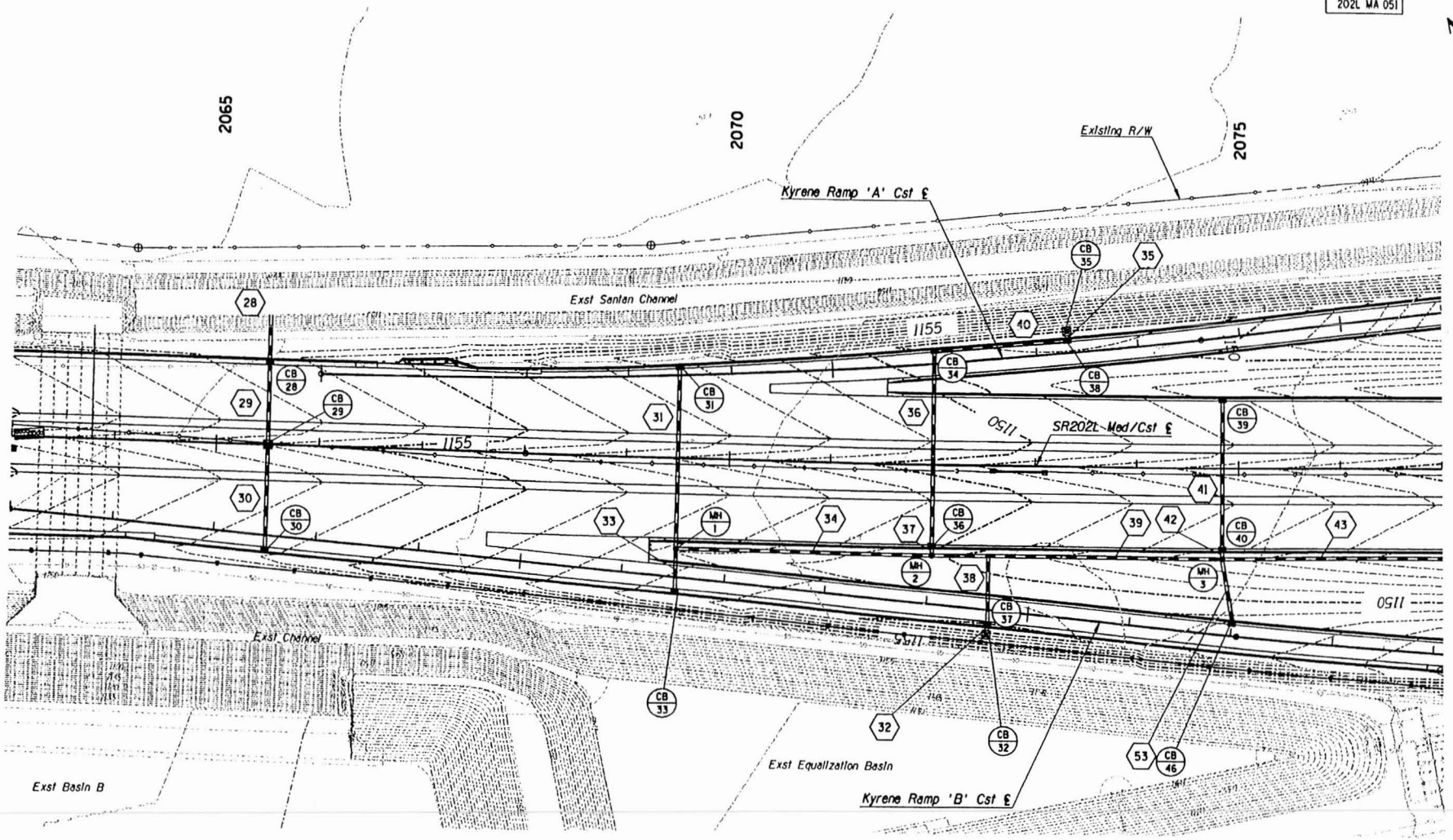
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SR202L
GRADING & DRAINAGE PLAN
Sta 2063+00 to 2[illegible]0

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE RO[illegible]

TRACS NO. H5416 01C

202 C 500

DWG NO. D-1.04

___ OF ___

CERTIFIED PROFESSIONAL ENGINEER SEAL
STATE OF ARIZONA
25118
JEROME J. ZOYNE
REGISTERED PROFESSIONAL ENGINEER (CIVIL)

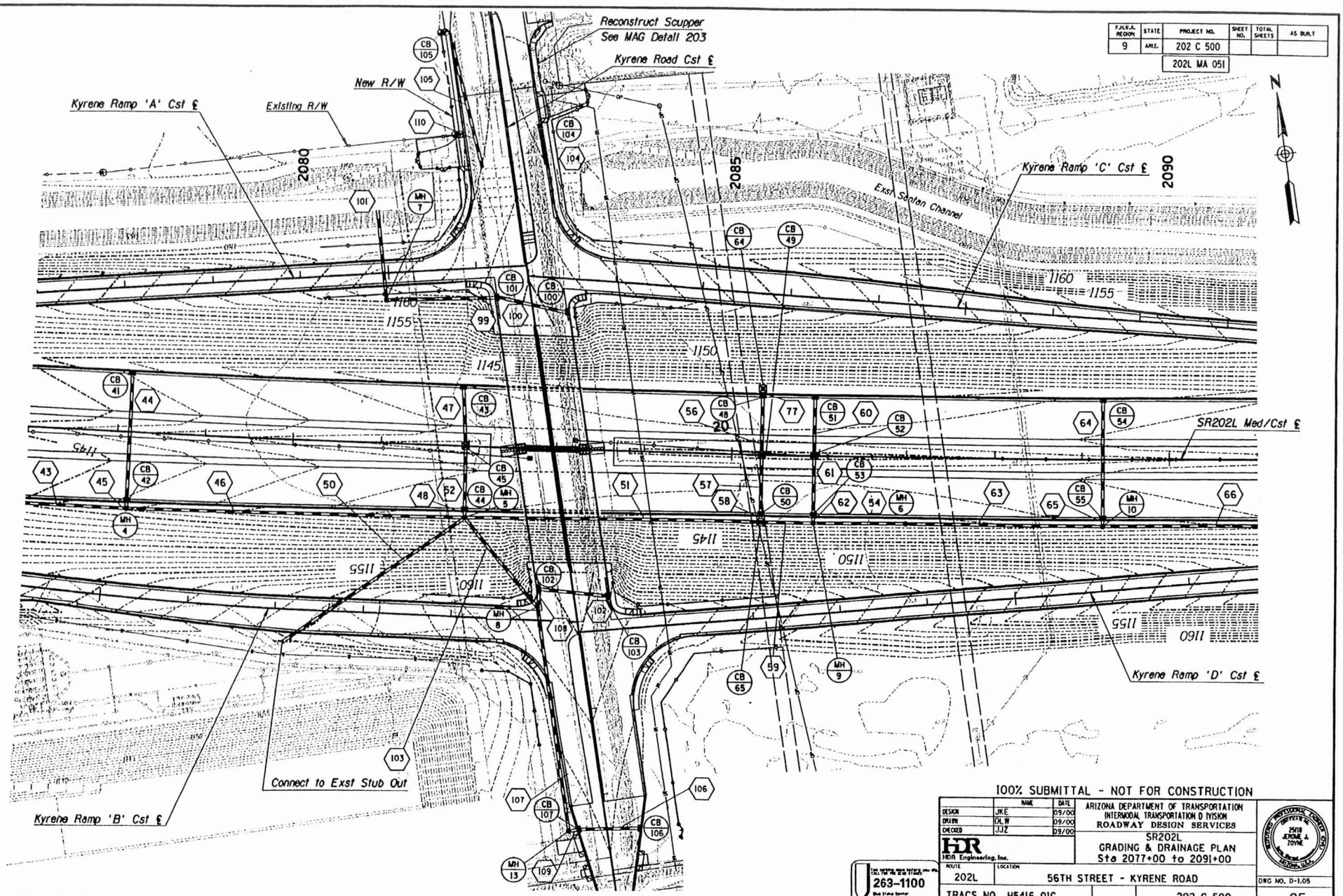
263-1100

FILE: c:\windrn\56-kyrene\dr508804.dgn
DATE: 25-Aug-00 16:26

ccccccSYSTIMEcccccc cccccccDGNcSPECIFICATIONcccccc

SURVEY NO. | DATE | LOCATION | REVISIONS | FINISHED PLANS

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	OLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SR202L
GRADING & DRAINAGE PLAN
Sta 2077+00 to 2091+00

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C

202 C 500

DWG NO. D-1.05

___ OF ___

263-1100

FILE: c:\windm\36-kyrene\d508805.dgn
DATE: 28-Aug-00 11:35

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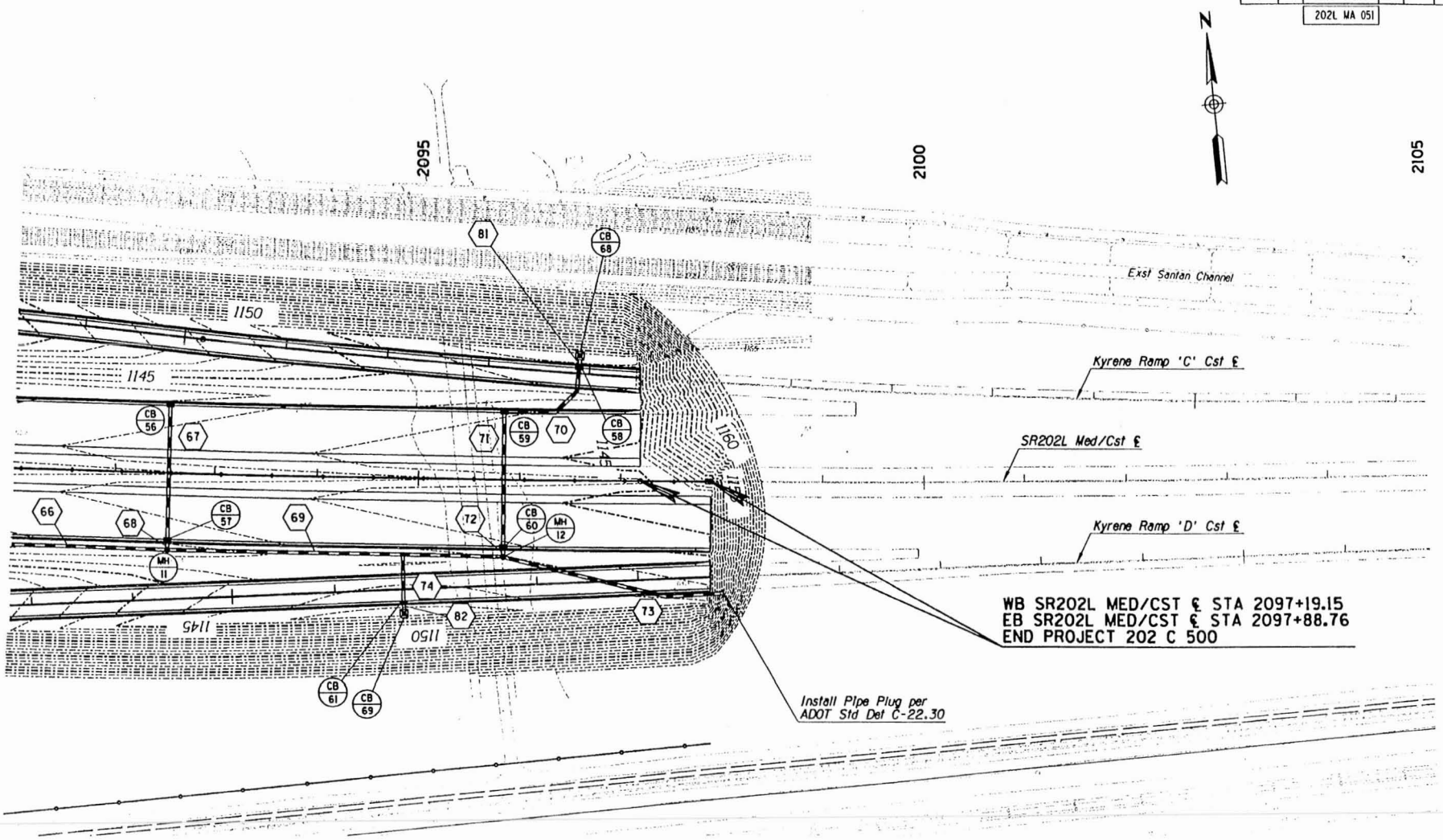
9	ARIZ.	202 C 500			

202L MA 051



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DKW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SR202L
GRADING & DRAINAGE PLAN
Sta 2091+00 to 2[illegible]00

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE RO[illegible]

TRACS NO. H5416 01C

202 C 500

DWG NO. D-1.06

___ OF ___

263-1100

FILE: c:\windm\56-kyrene\dr508806.dgn
DATE: 25-Aug-00 16:33

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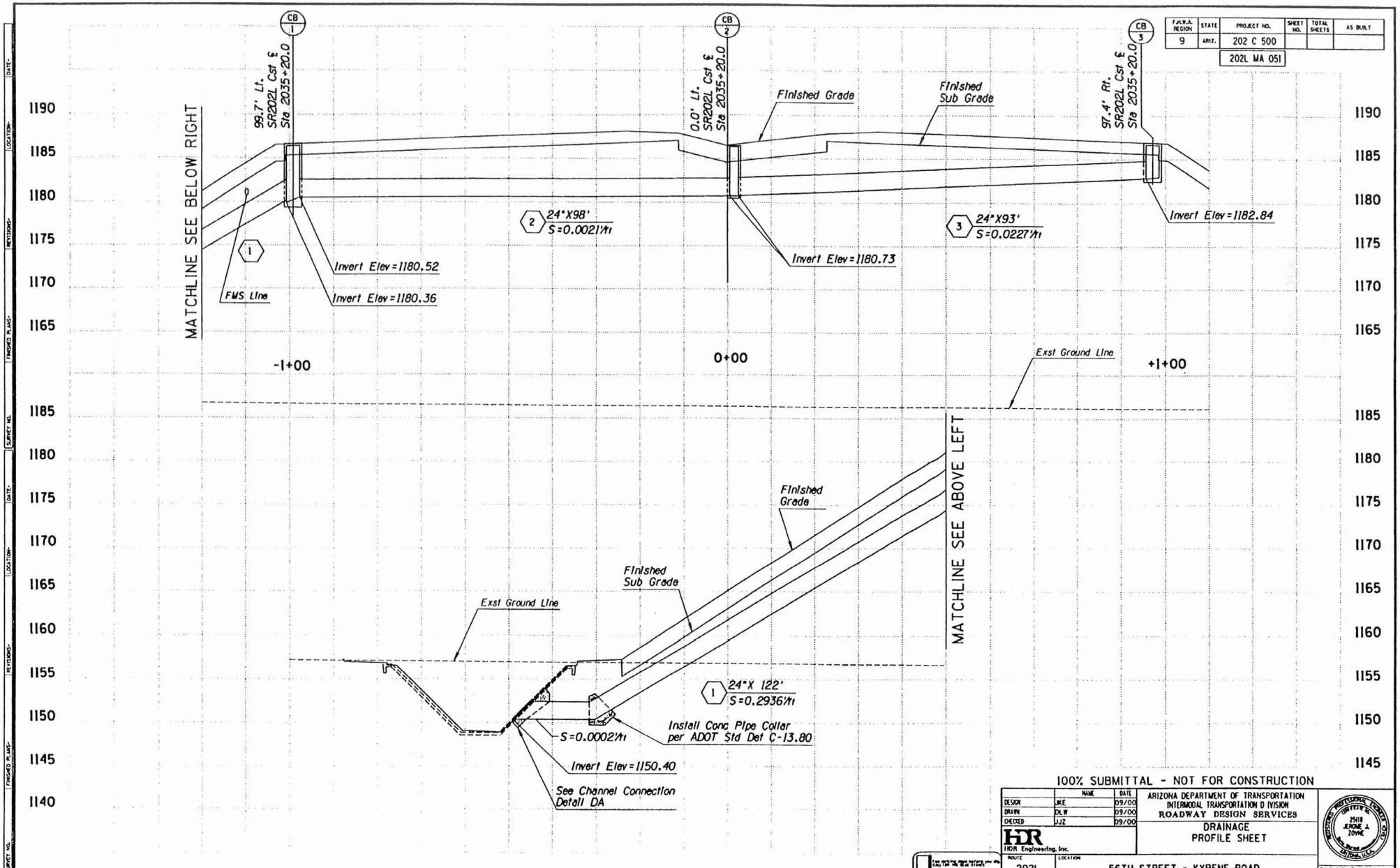
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DRAINAGE PROFILE SHEET

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C | 202 C 500

DRG NO. D-2.01

___ OF ___

263-1100

FILE: C:\WINDU\56-KYRENE\PD508801.DGN
DATE: 01-Sep-00 08:34

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F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
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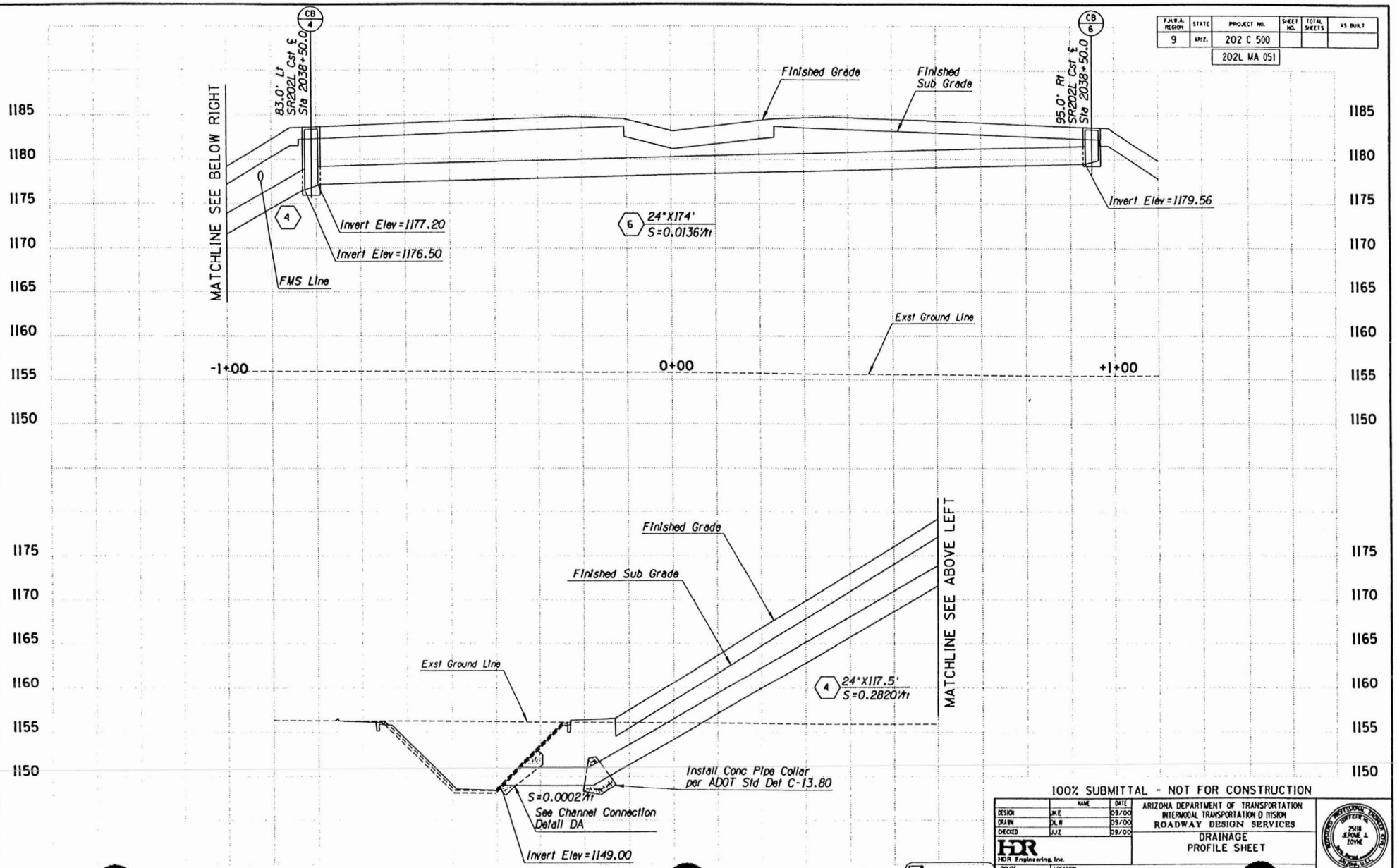
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DRAINAGE
PROFILE SHEET

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE R[illegible]

TRACS NO. H5416 01C

2[illegible]00

DWG NO. D-2.02

___ OF ___

263-1100

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DATE: 01-Sep-00 08:34

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F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
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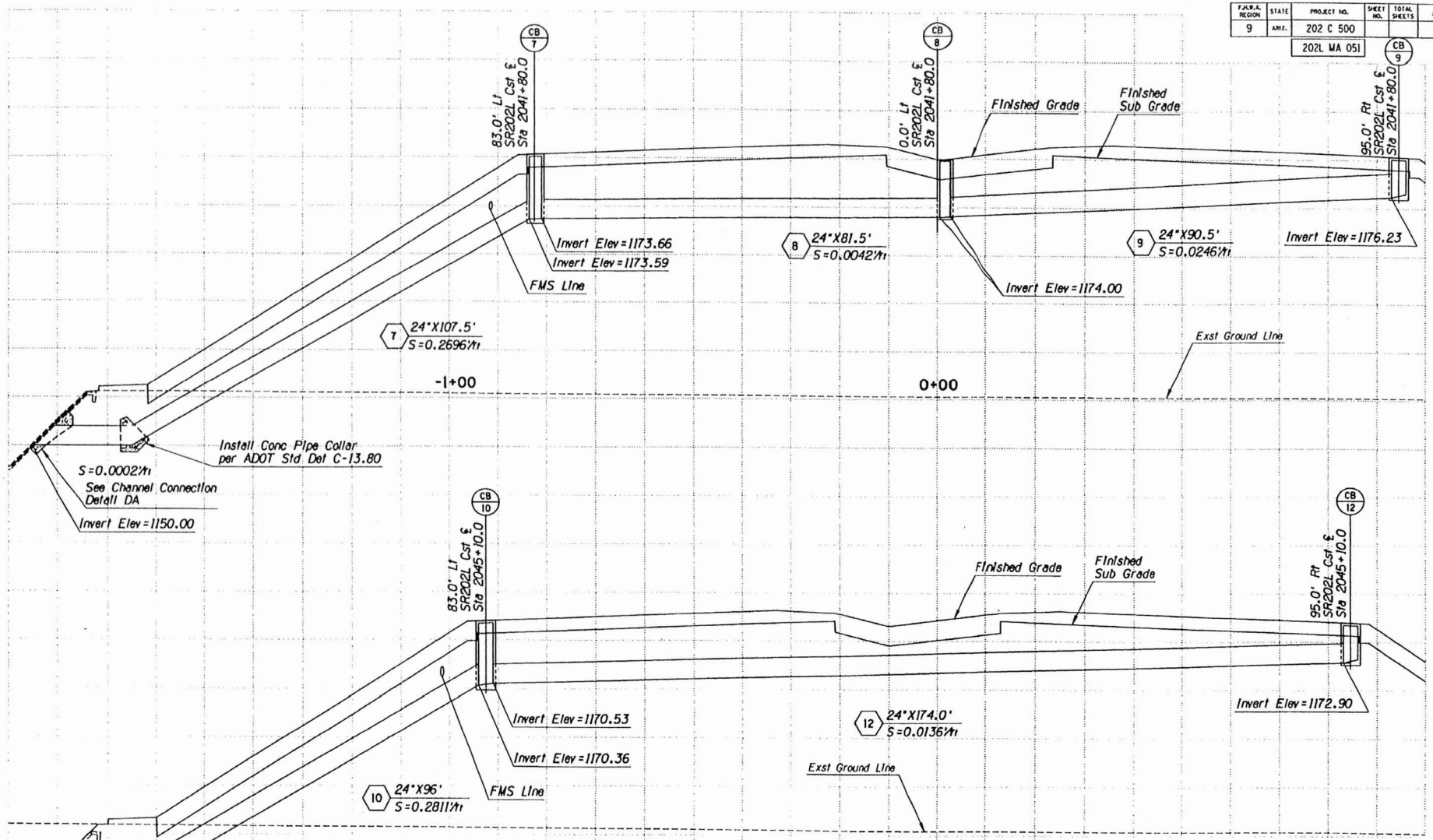
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DRAINAGE
PROFILE SHEET

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C | 202 C 500

DWG NO. D-2.03

___ OF ___

263-1100

FILE: c:\windm\56-kyrene\pd508803.dgn
DATE: 01-Sep-00 10:04

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F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
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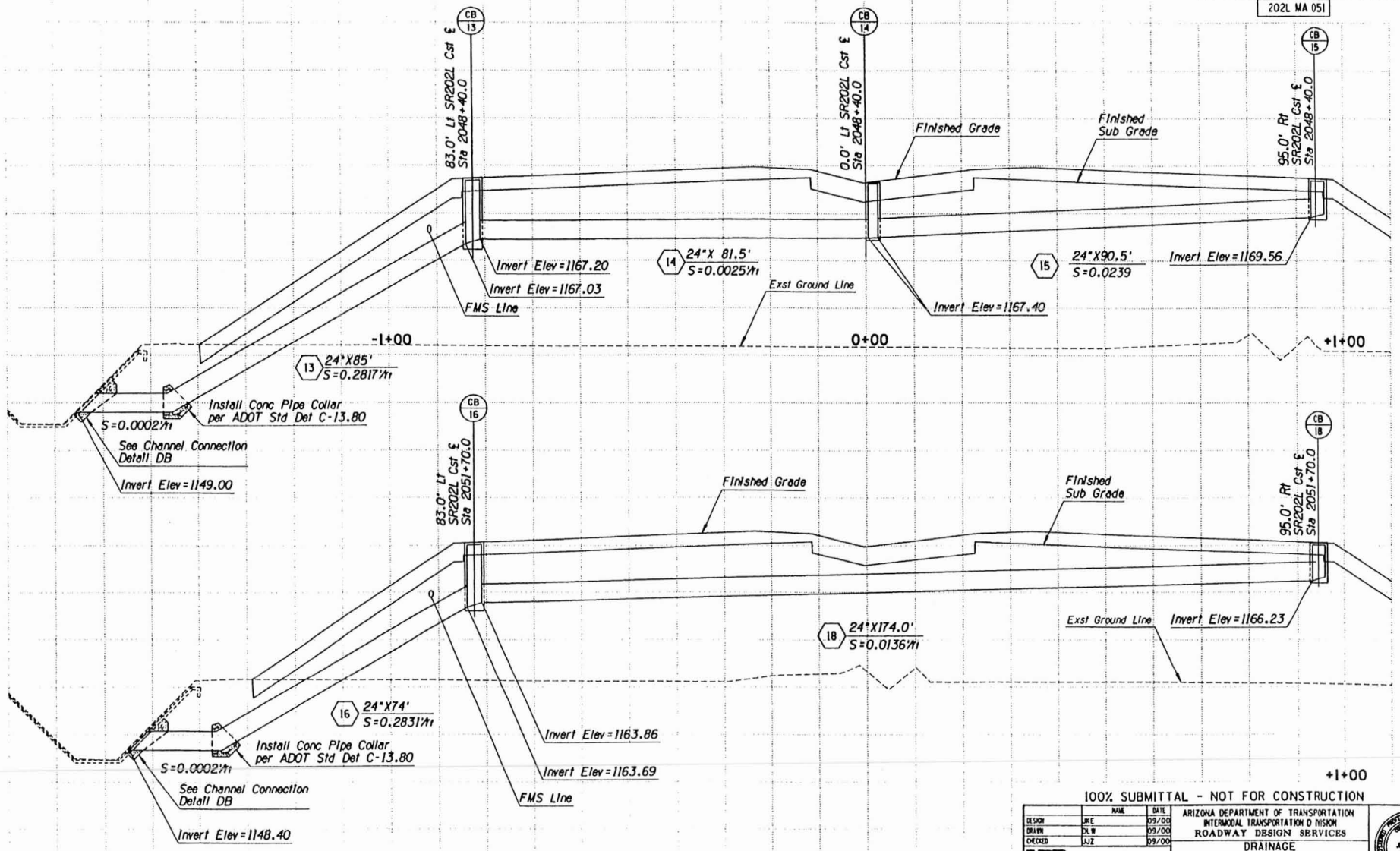
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DRAINAGE
PROFILE SHEET

263-1100

ROUTE	LOCATION	
202L	56TH STREET - KYRENE RO	
TRACS NO. H5416 01C		202 C 500

DWG NO. D-2.04

___ OF ___

FILE: c:\windm\56-kyrene\pd508804.dgn
DATE: 01-Sep-00 08:38

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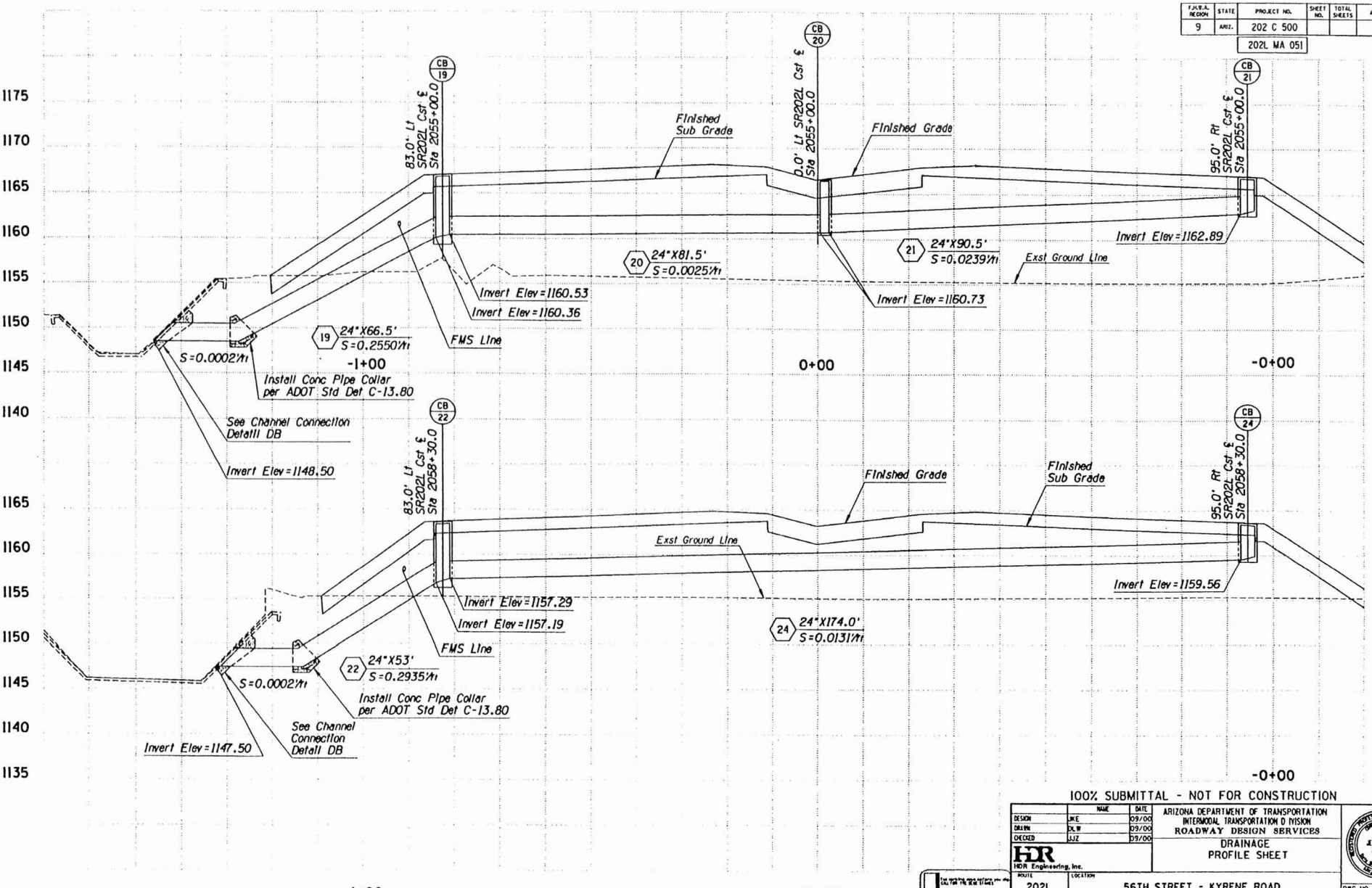
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DRAINAGE
PROFILE SHEET

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
Bat Stamp Center
CALL BEFORE YOU DIG

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 25418
JEROME J. ZOYNE
ARIZONA, U.S.A.

ROUTE	LOCATION	
202L	56TH STREET - KYRENE ROAD	
TRACS NO. H5416 01C		202 C 500

DWG NO. D-2.05

___ OF ___

FILE: c:\windm\56-kyrene\pd508805.dgn
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F.A.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
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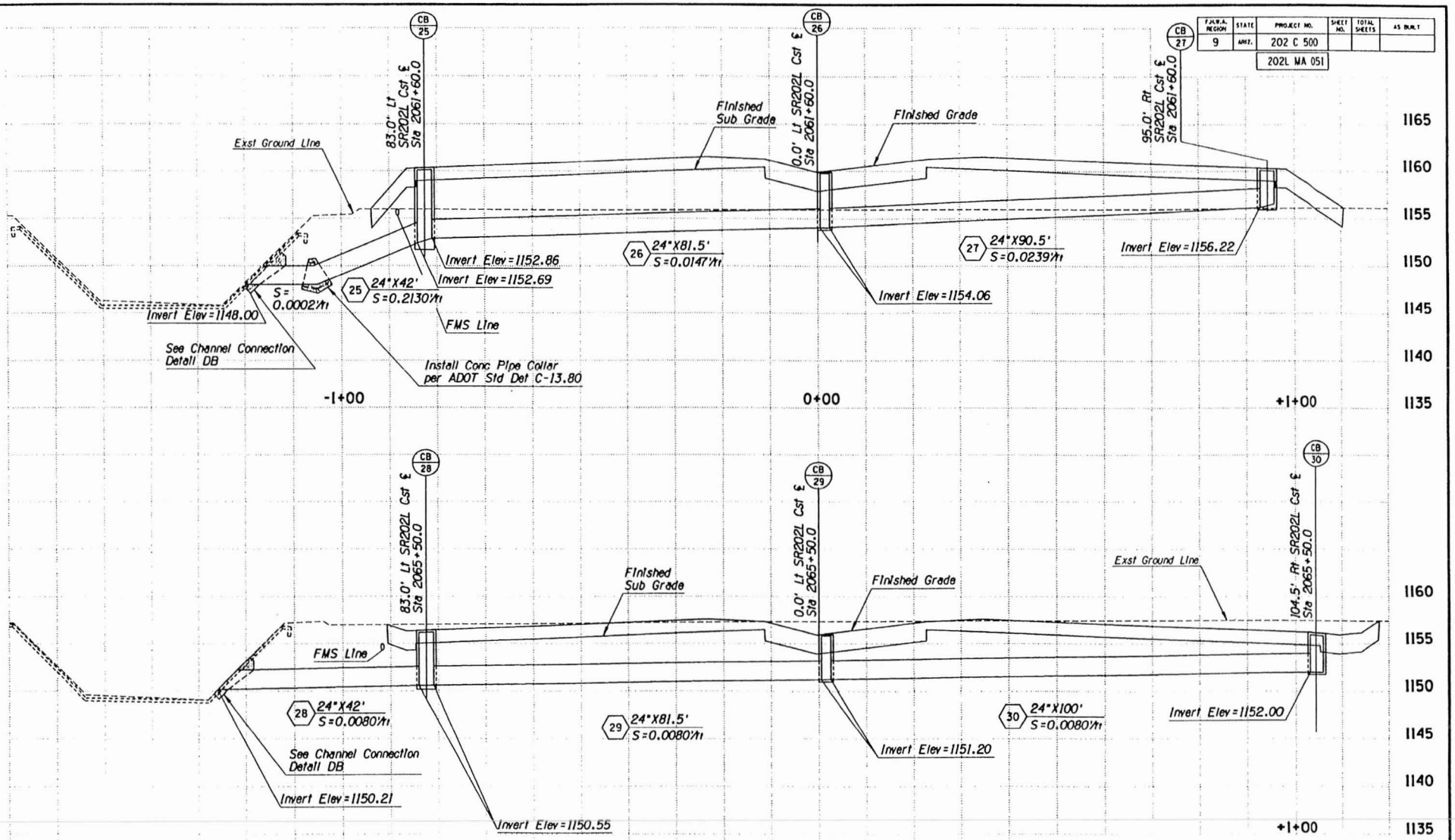
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DRAINAGE
PROFILE SHEET

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 25118 JEROME J. ZOYNE ARIZONA, U.S.A.

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE RO[redacted]

DWG NO. D-2.06

TRACS NO. H5416 01C

20[redacted]00

___ OF ___

263-1100

FILE: c:\wndm\56-kyrene\pd508806.dgn
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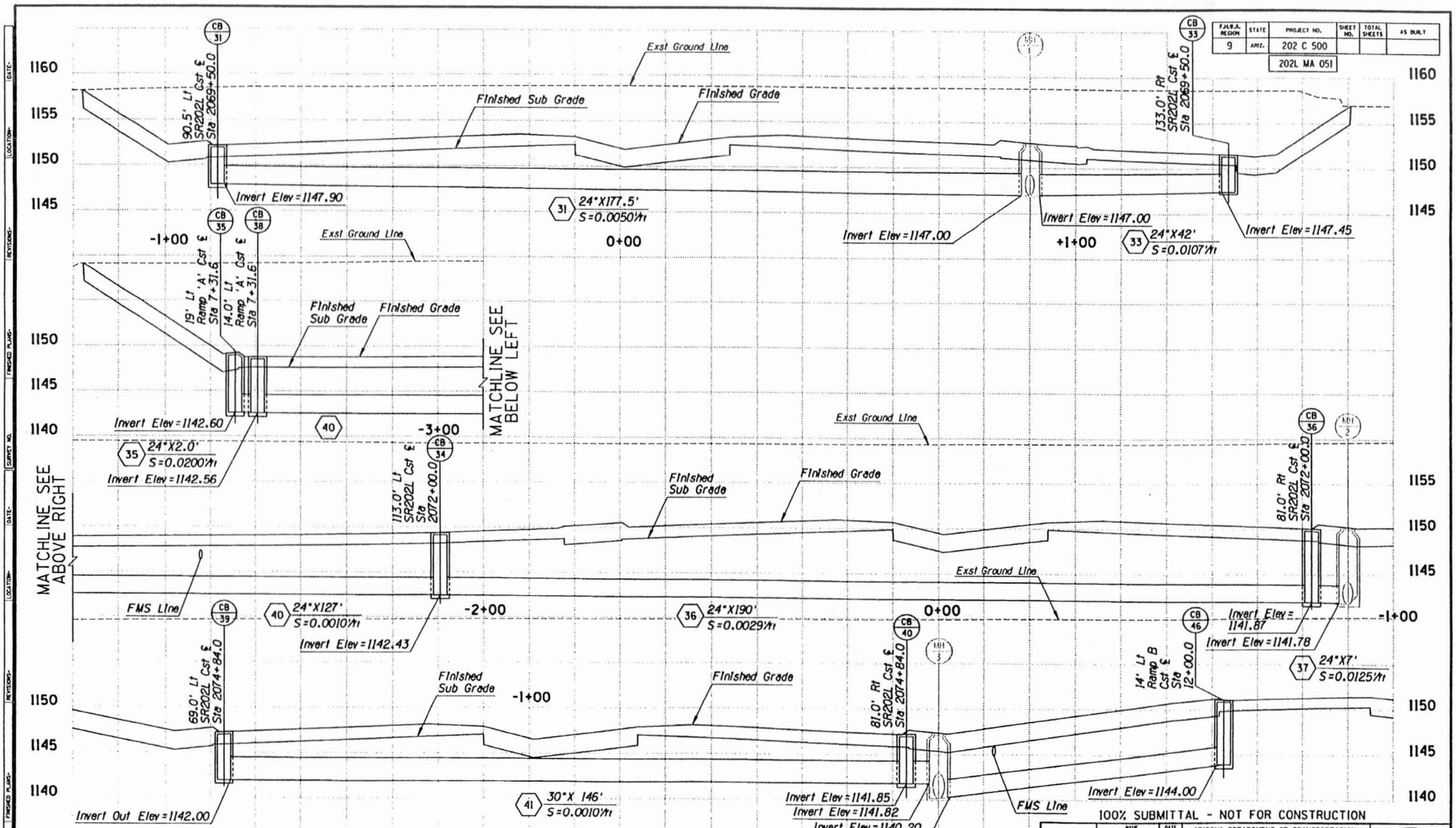

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DRAINAGE PROFILE SHEET

ROUTE 202L | LOCATION 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C | 202 C 500

DWG NO. D-2.07 ___ OF ___

263-1100

FILE: c:\windm\56-kyrene\pd508807.dgn
DATE: 31-Aug-00 16:10

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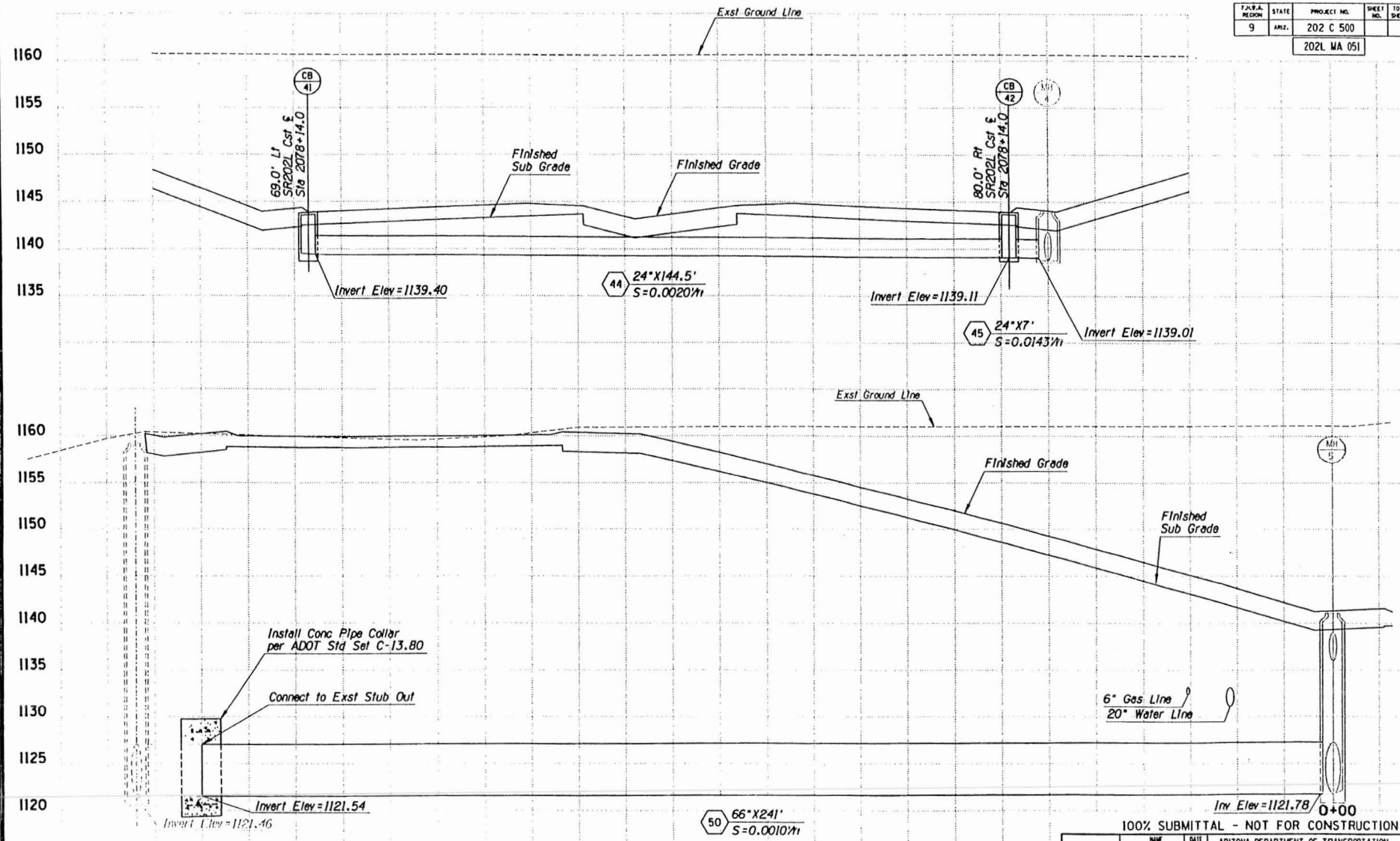

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	LJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DRAINAGE PROFILE SHEET

263-1100

ROUTE	LOCATION
202L	56TH STREET - KYRENE ROA

TRACS NO. H5416 01C | 202 C 500

DWG NO. D-2.08

___ OF ___

FILE: C:\MNDW\56-KYRENE\PD508808.DGN
DATE: 01-Sep-00 07:46

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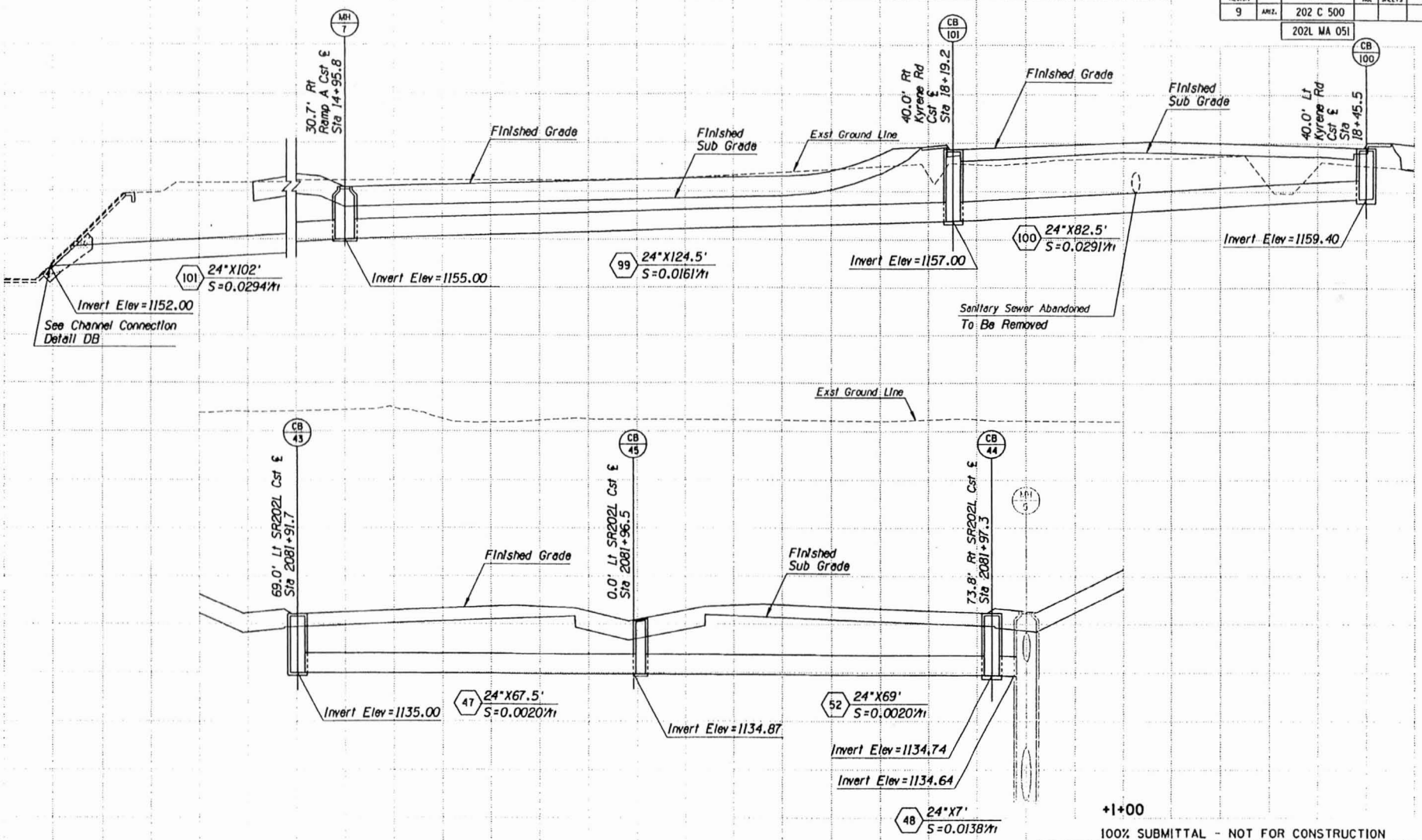

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DRAINAGE PROFILE SHEET

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 25118 JEROME J. ZOYNE ARIZONA, U.S.A.

ROUTE	LOCATION	
202L	56TH STREET - KYRENE ROAD	
TRACS NO. H5416 01C		202 C 500

DWG NO. D-2.09

___ OF ___

263-1100

FILE: c:\#from\56-kyrene\pd508809.dgn
DATE: 01-Sep-00 08:42

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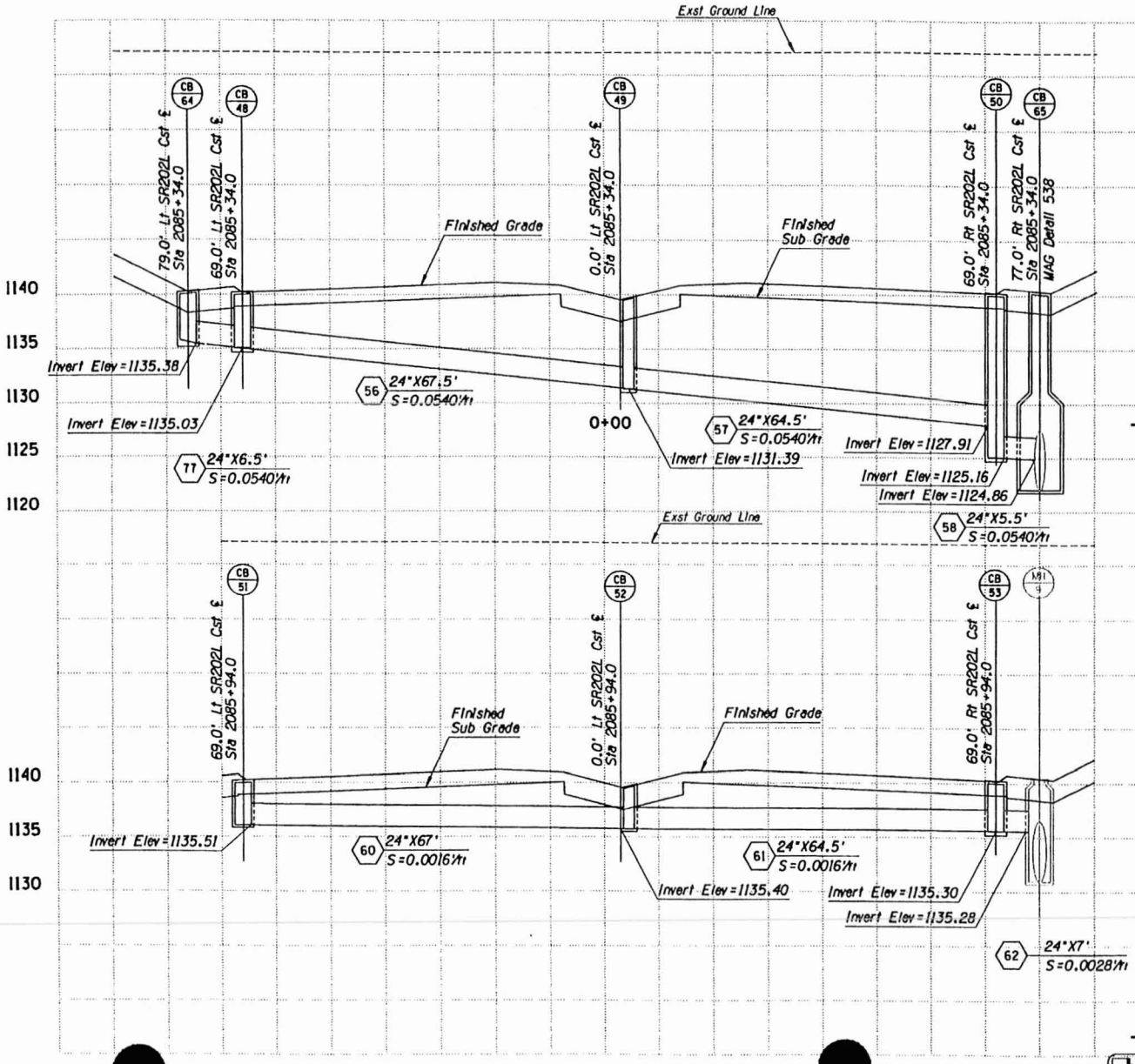

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DRAINAGE
PROFILE SHEET

263-1100

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C | 202 C 500

DWG NO. D-2.10
___ OF ___

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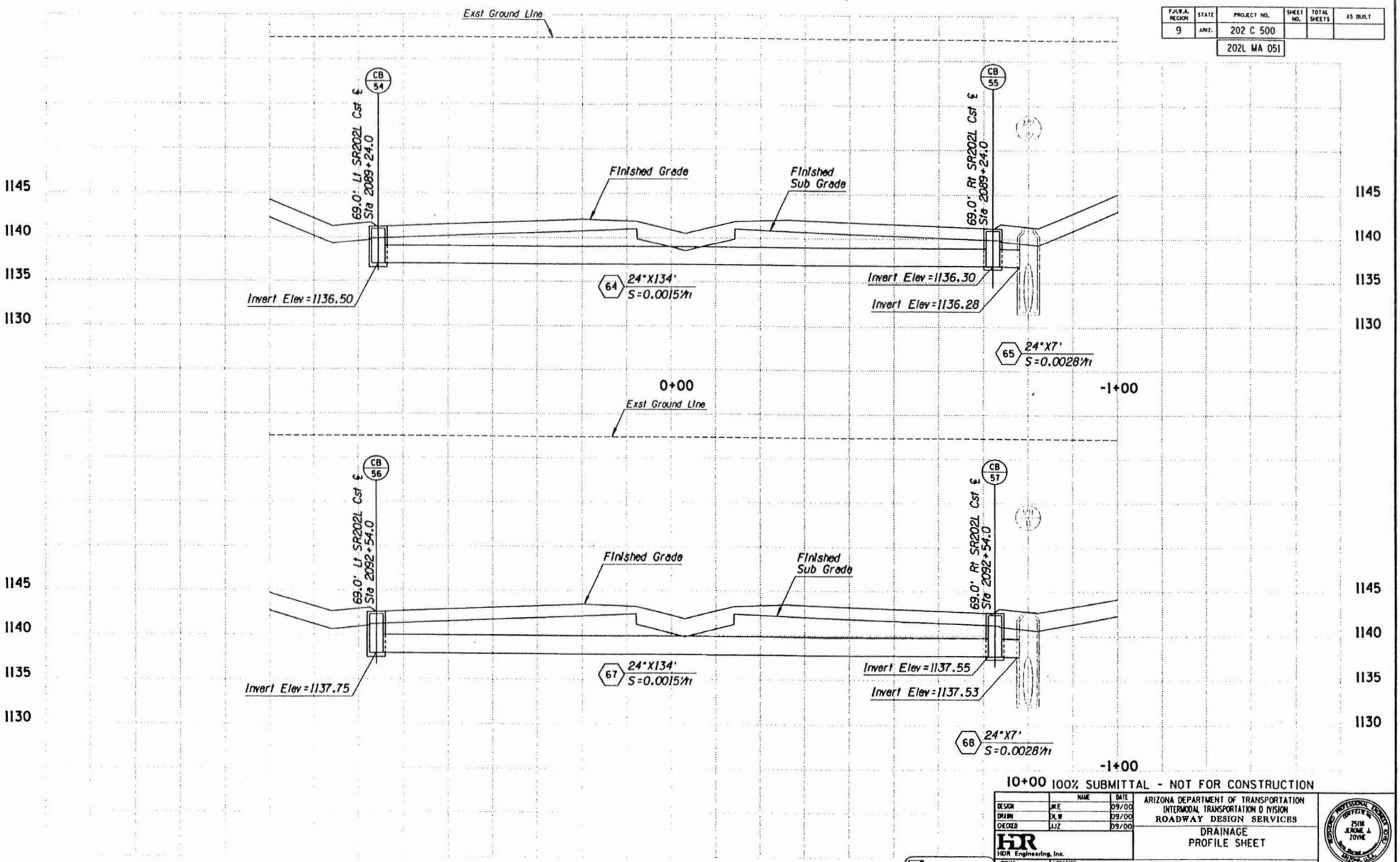
9	ARIZ.	202 C 500			
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DRAINAGE PROFILE SHEET

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C | 202 C 500

DWG NO. D-2.11

___ OF ___

263-1100

FILE: c:\windm\56-kyrene\pd508814.dgn
DATE: 01-Sep-00 07:48

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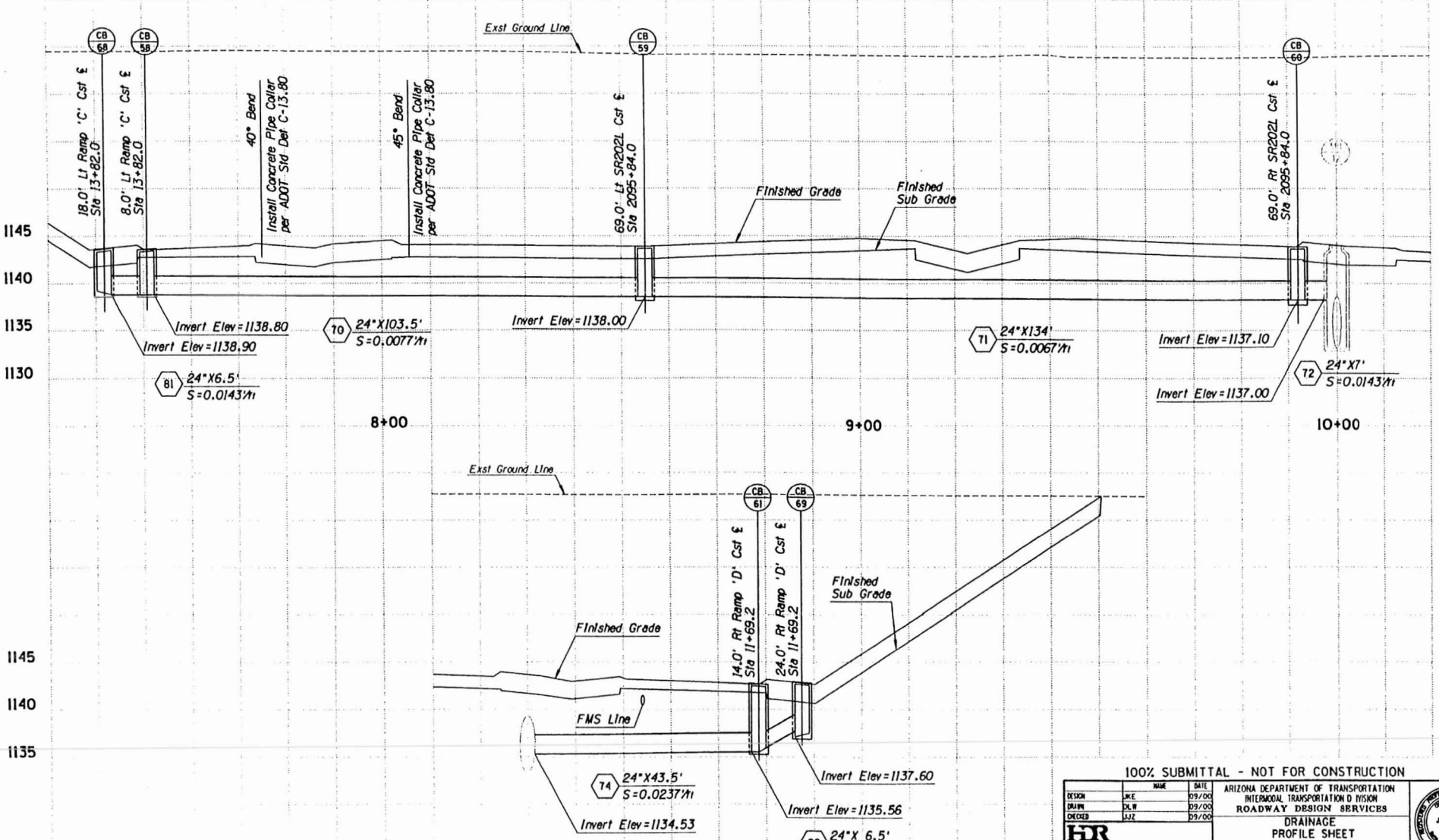
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DRAINAGE
PROFILE SHEET

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE RO

TRACS NO. H5416 01C

202 C 500

DWG NO. D-2.12

___ OF ___

263-1100

FILE: c:\windm\58-kyrene\pd508811.dgn
DATE: 01-Sep-00 07:50

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F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
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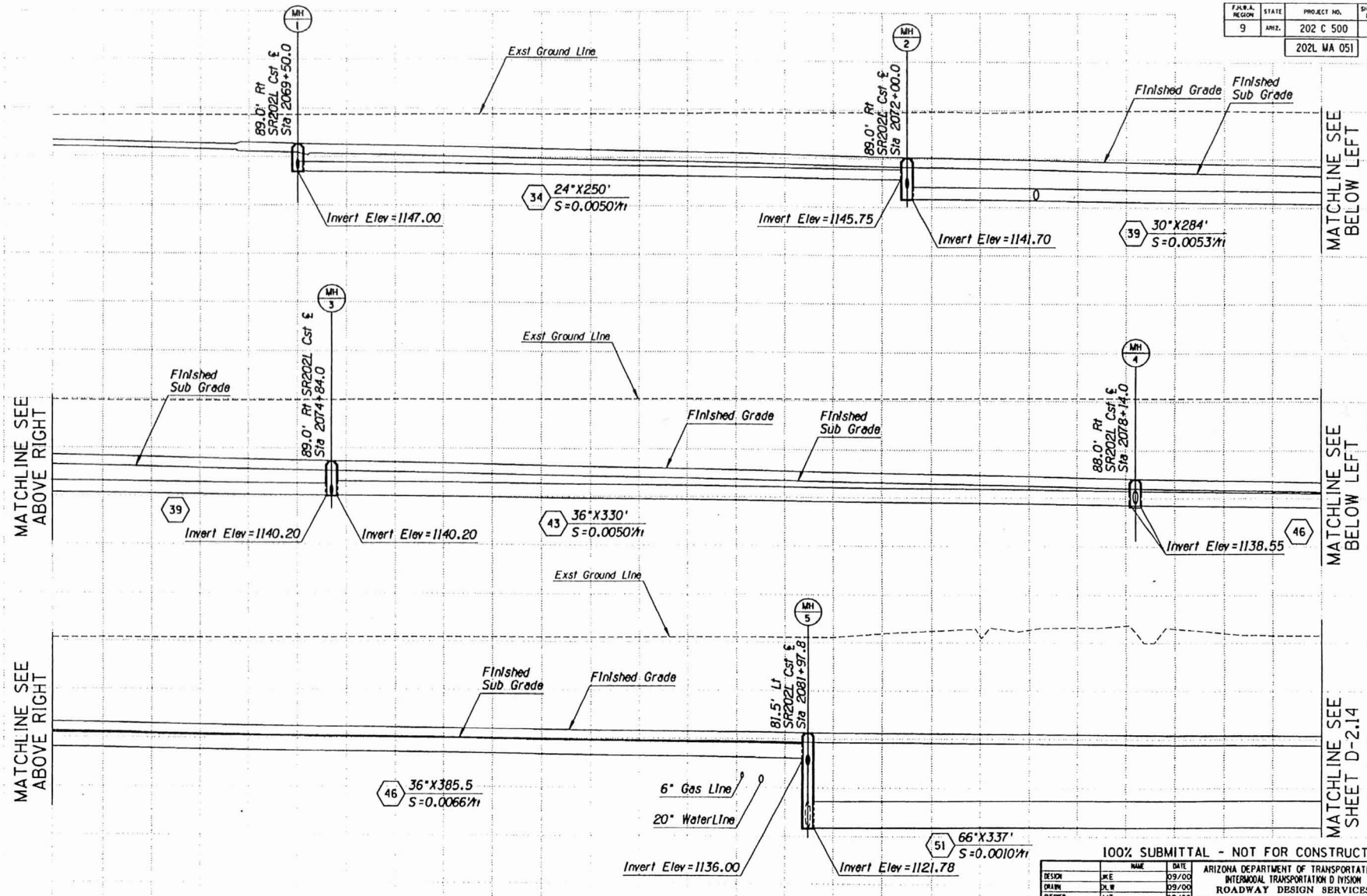

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DRAINAGE PROFILE SHEET

ROUTE 202L | LOCATION 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C | 202 C 500

DWG NO. D-2.13 ___ OF ___

263-1100

FILE: c:\windm\56-kyrene\pd508812.dgn
DATE: 01-Sep-00 07:52

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F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
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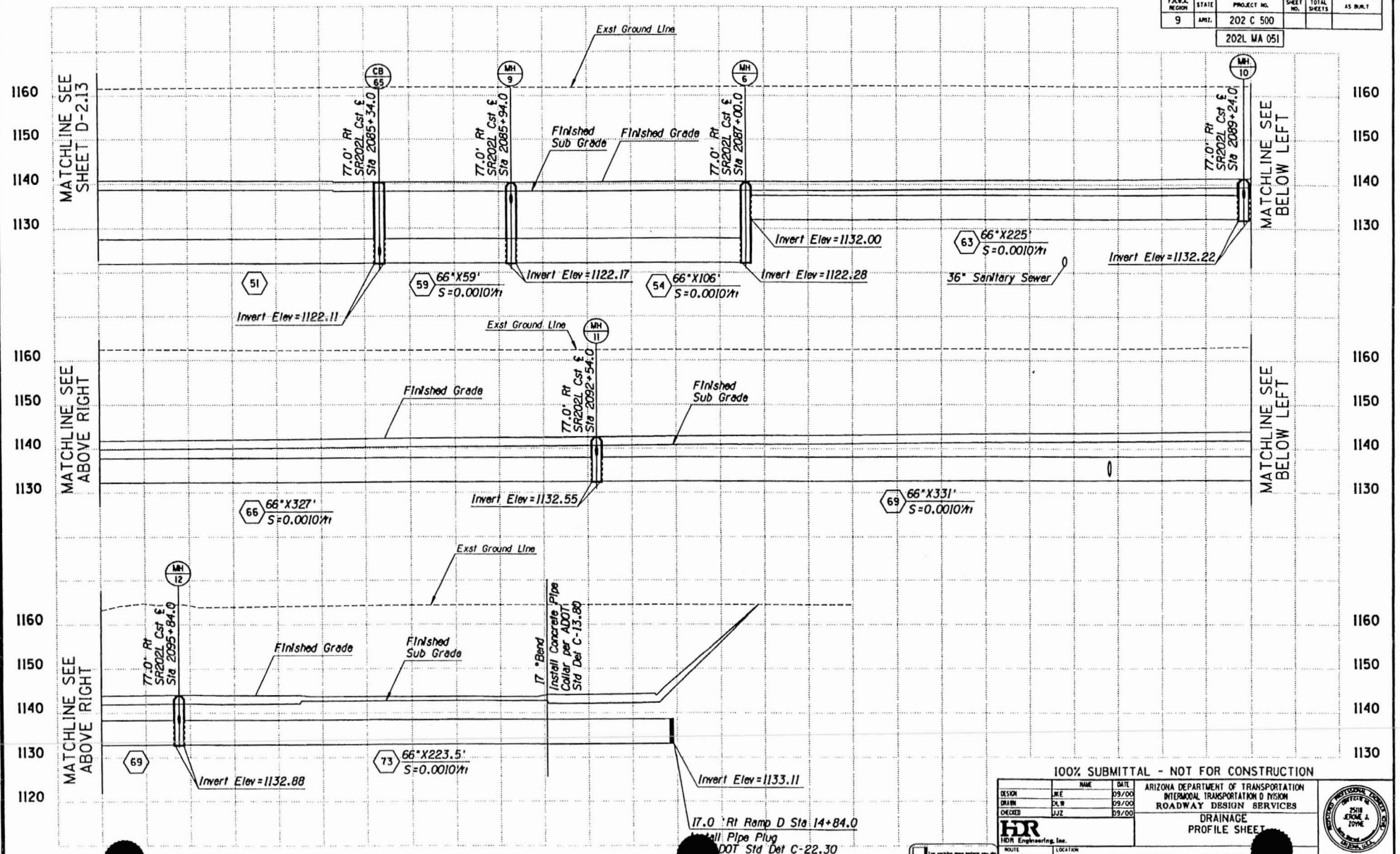
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DRAINAGE PROFILE SHEET

ROUTE 202L | LOCATION 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C | 202 C 500

DWG NO. D-2.14

___ OF ___

263-1100

FILE: c:\wndm\56-kyrene\pd508813.dgn
DATE: 01-Sep-00 08:07

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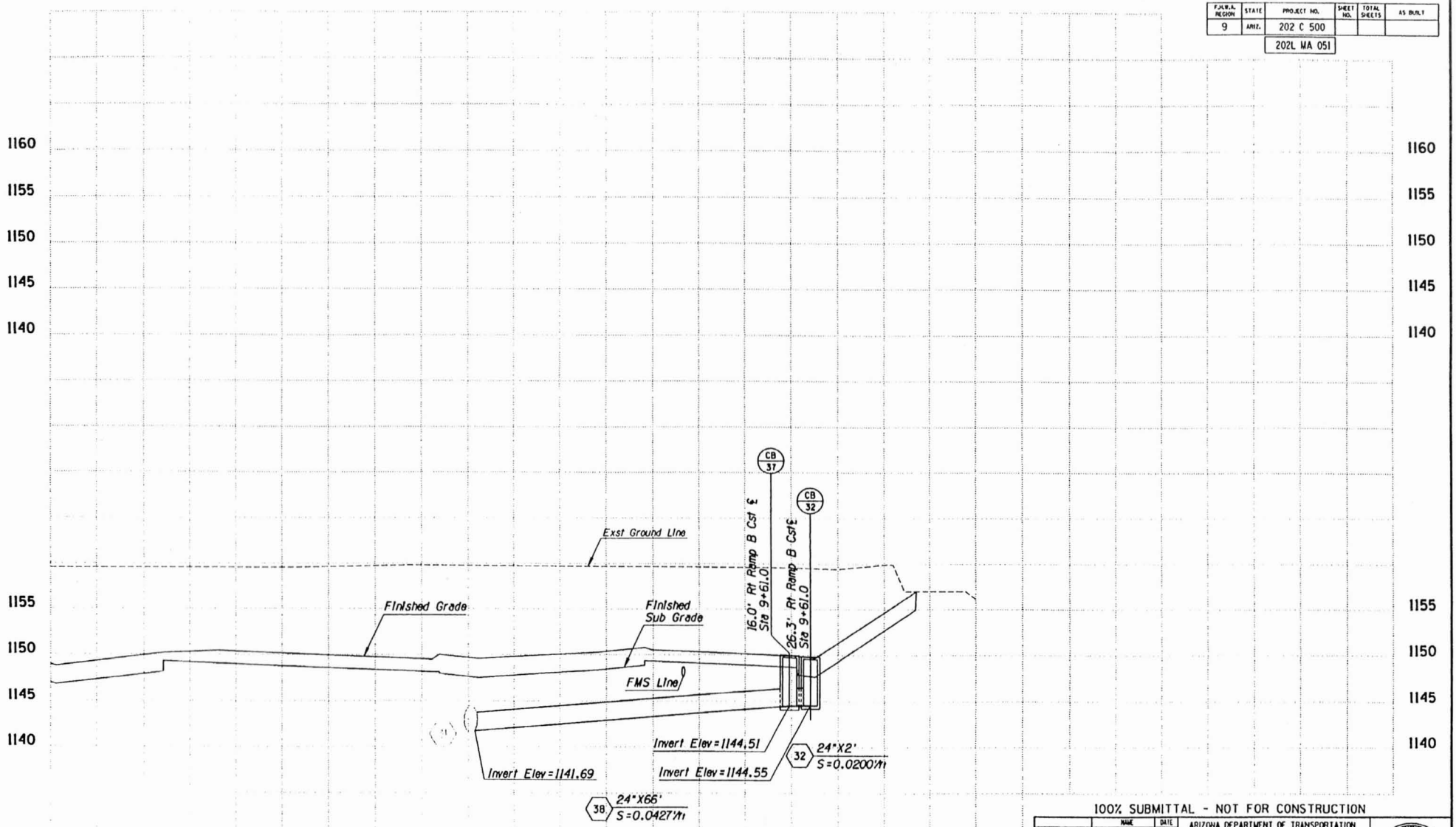
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLN	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DRAINAGE
PROFILE SHEET

ARIZONA PROFESSIONAL ENGINEER CERTIFICATE NO. 25118 JEROME J. ZOYNE

263-1100

ROUTE	LOCATION	
202L	56TH STREET - KYRENE ROAD	
TRACS NO. H5416 01C		202 C 500

DWG NO. D-2.15

___ OF ___

FILE: c:\windm\56-kyrene\pd508815.dgn
DATE: 01-Sep-00 08:09

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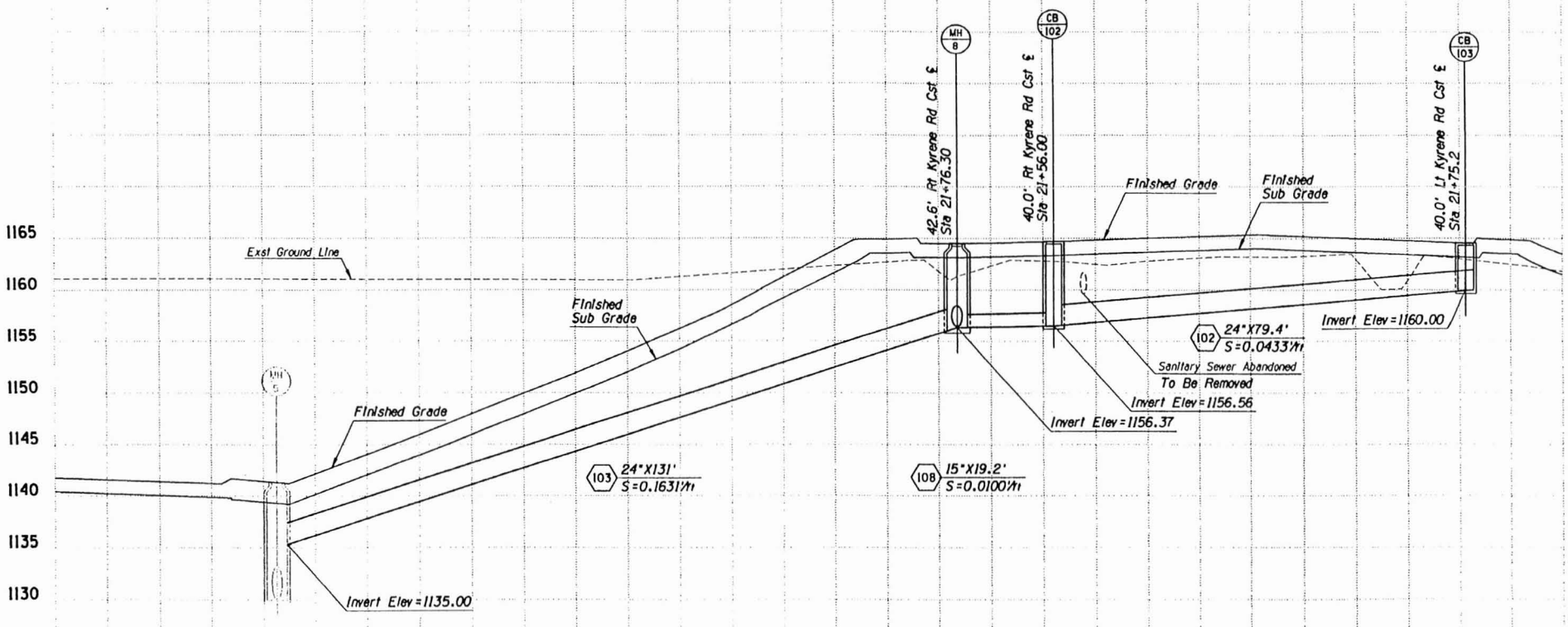
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DRAINAGE PROFILE SHEET

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE RO

TRACS NO. H5416 01C

202-C-500

DWG NO. D-2.16

___ OF ___

263-1100

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F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
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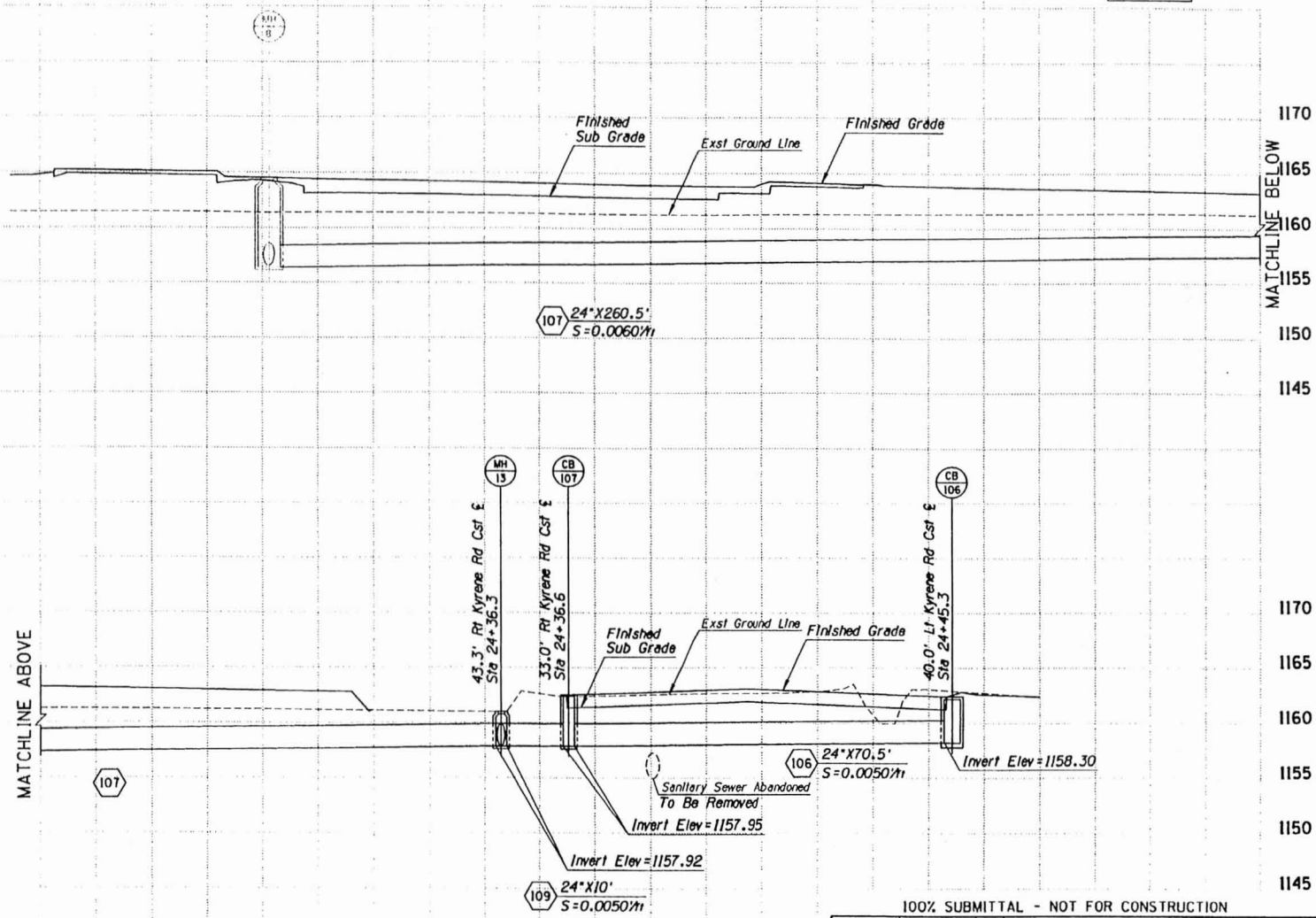
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DRAINAGE
PROFILE SHEET

263-1100

ROUTE	LOCATION	
202L	56TH STREET - KYRENE ROAD	
TRACS NO. H5416 01C		202 C 500

DWG NO. D-2.17

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F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
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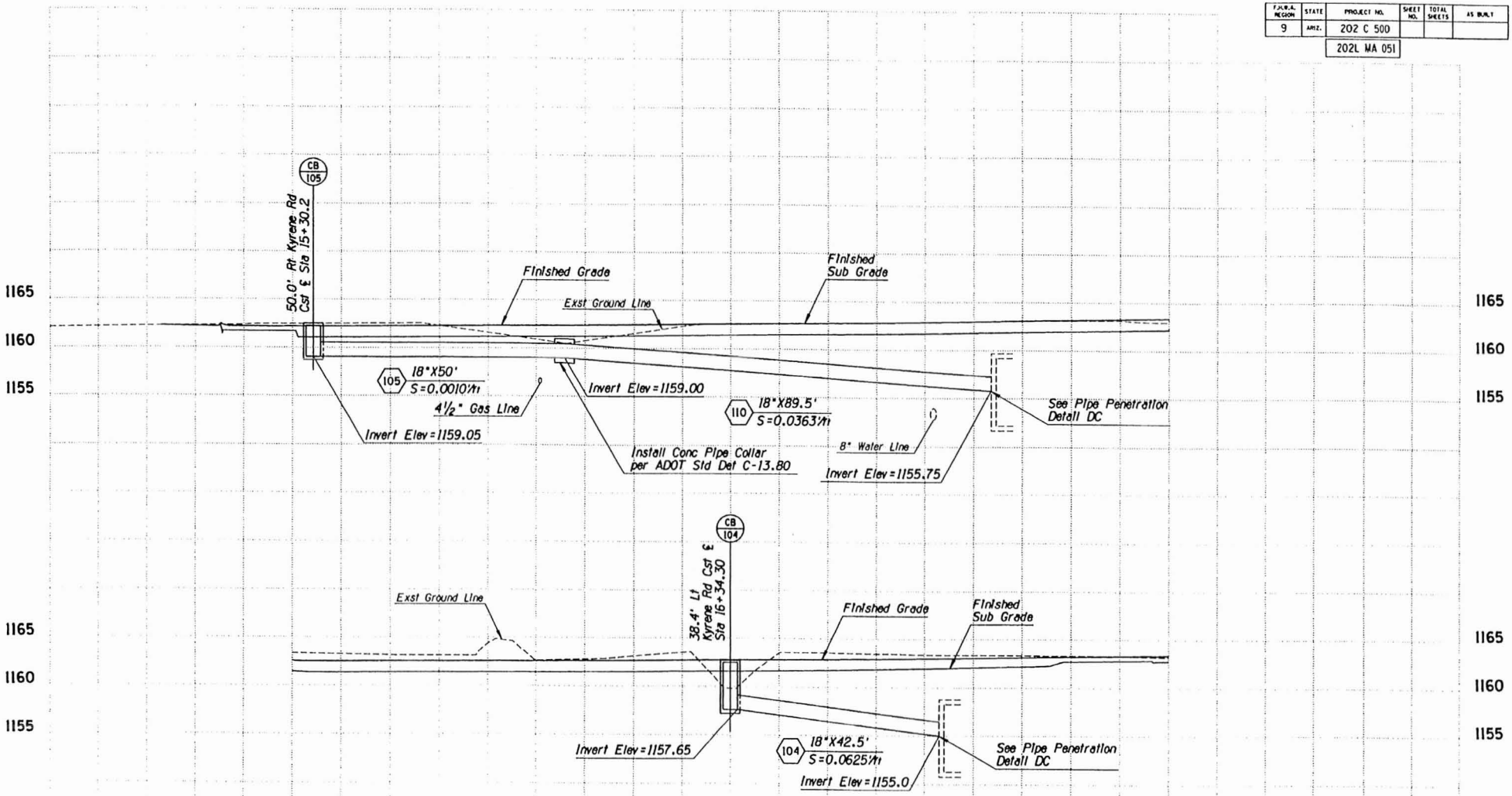
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	XLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DRAINAGE PROFILE SHEET

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE RO

TRACS NO. H5416 01C | 202 C 500

DWG NO. D-2.18

___ OF ___

263-1100

FILE: c:\windm\56-kyrene\pd508818.dgn
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F.A.P.N. NUMBER	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
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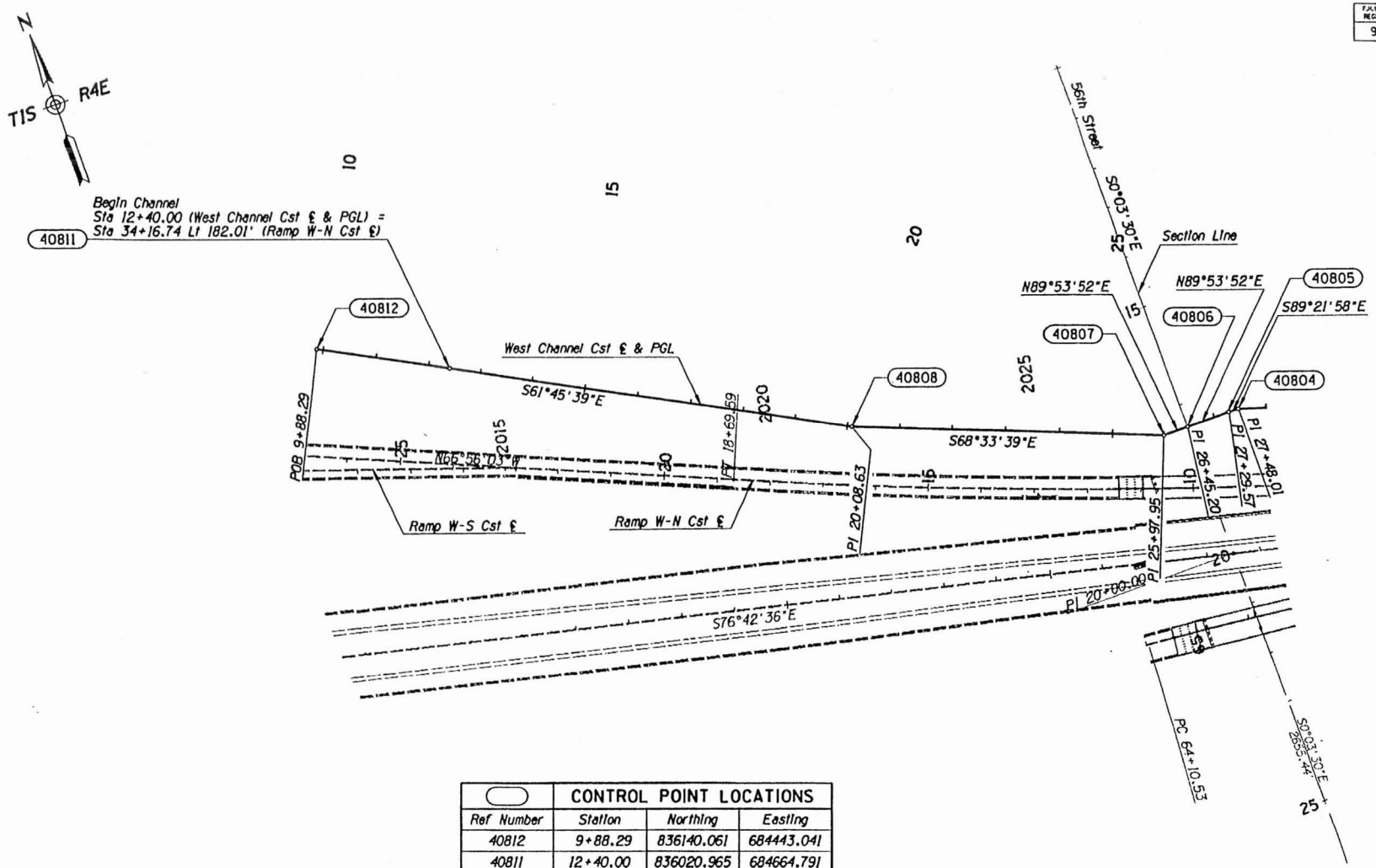
		202L MA 051			



	CONTROL POINT LOCATIONS			
Ref Number	Station	Northing	Easting	
40812	9+88.29	836140.061	684443.041	
40811	12+40.00	836020.965	684664.791	
40810	———	———	———	Point Deleted
40809	———	———	———	Point Deleted
40808	20+08.63	835657.287	685341.939	
40807	25+97.95	835441.882	685890.480	
40806	26+45.20	835441.966	685937.728	
40805	27+29.57	835442.117	686022.103	
40804	27+48.01	835441.913	686040.544	

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	NAME	DATE
DESIGN	JJZ	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SANTAN WEST CHANNEL
GEOMETRIC LAYOUT
Sta 9+78.99 to Sta 28+00

REGISTERED PROFESSIONAL ENGINEER (CIVIL) 25318 JEROME J. ZOYNE ARIZONA, U.S.A.

263-1100

ROUTE	LOCATION	
202L	56TH STREET - KYRENE ROAD	
TRACS NO. H5416 01C		202 C 500

DWG NO. D-3.01

___ OF ___

FILE: c:\windm\56-kyrene\dg508801.dgn
DATE: 31-Aug-00 09:56

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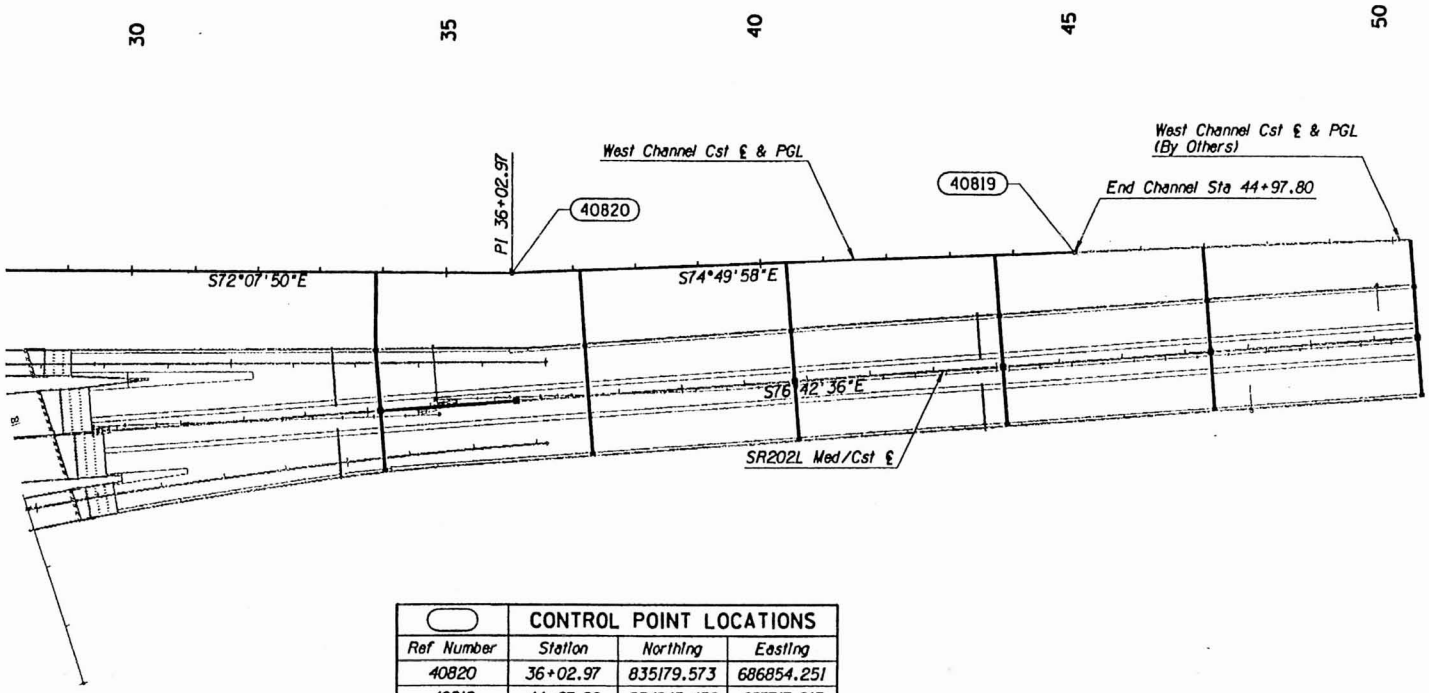
		202L MA 051			



	CONTROL POINT LOCATIONS		
Ref Number	Station	Northing	Easting
40820	36+02.97	835179.573	686854.251
40819	44+97.80	834945.450	687717.915

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JJZ	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SANTAN WEST CHANNEL
GEOMETRIC LAYOUT
Sta 28+00 to Sta 50+00

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE R[redacted]

TRACS NO. H5416 01C | 202[redacted]500

DWG NO. D-3.02
___ OF ___

263-1100

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DATE: 31-Aug-00 09:57

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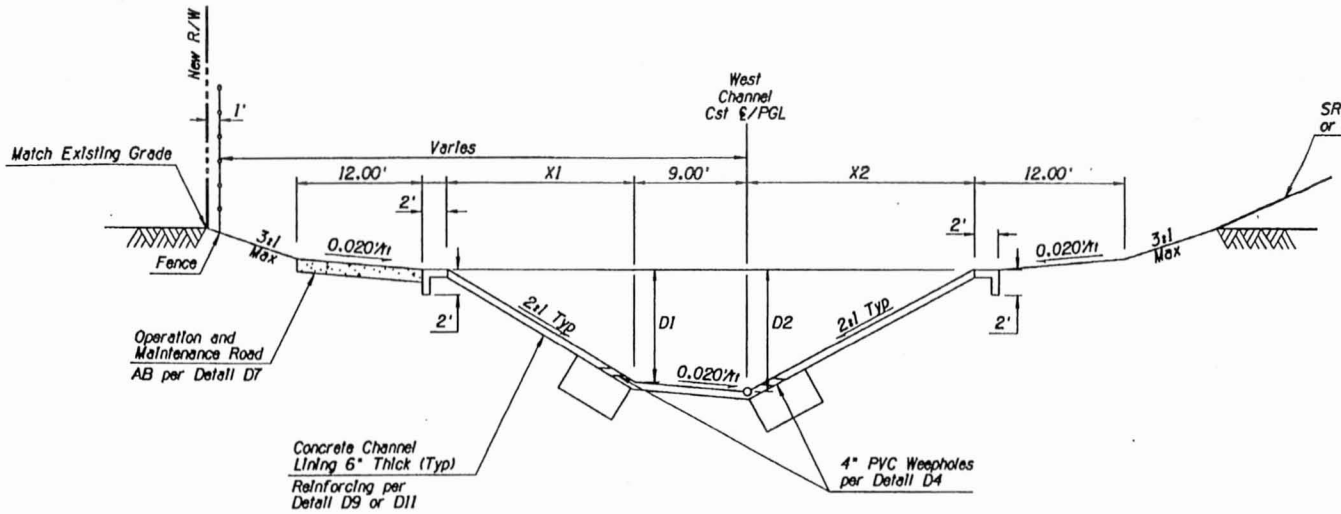
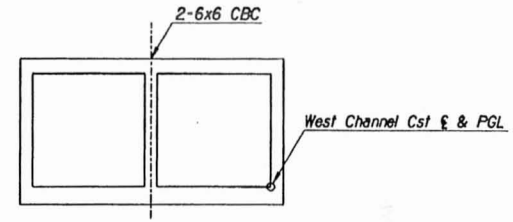
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			





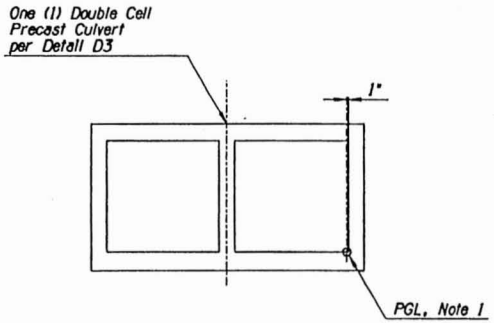
TYPICAL CULVERT SECTION

Sta 20+08.63 to 26+99.57

TYPICAL CHANNEL SECTION

Station	X1 (Ft)	X2 (Ft)	D1 (Ft)	D2 (Ft)	
Sta 12+40.00 to 18+08.63	13.00	13.36	6.50	6.68	
Sta 18+08.63 to 19+33.63	Varies	13.36	6.50	6.68	- See Detail D2
Sta 19+33.63 to 19+83.63	13.00	13.36	6.50	6.68	
Sta 27+48.01 to 28+60.00	15.00	15.36	7.50	7.68	
Sta 28+60.00 to 29+85.00	Varies	15.36	7.50	7.68	- See Detail D2
Sta 29+85.00 to 34+32.82	15.00	15.36	7.50	7.68	
Sta 34+32.82 to 40+33.81	14.50	14.86	7.25	7.43	
Sta 40+33.81 to 43+29.81	15.00	15.36	7.50	7.68	
Sta 43+29.81 to 43+33.81	Varies	Varies	Varies	Varies	
Sta 43+33.81 to 44+97.80	16.50	16.86	8.25	8.43	

Note:
PGL=Profile Grade Line



TYPICAL UPRR PRECAST CULVERT SECTION

Sta 26+99.57 to 27+29.57

UPRR Notes:

1. West Channel Cst ℄ & PGL Offset 1" for One (1) Double Cell Culvert

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JJZ	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SANTAN WEST CHANNEL
TYPICAL CHANNEL SECTIONS

ARIZONA REGISTERED PROFESSIONAL ENGINEER (CIVIL) 25118 JEROME J. ZOYNE

263-1100

ROUTE	LOCATION	
202L	56TH STREET - KYRENE ROAD	
TRACS NO. H5416 01C		202 C 500

DWG NO. D-3.03

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FILE: c:\windm\56-kyrene\ly508809.dgn
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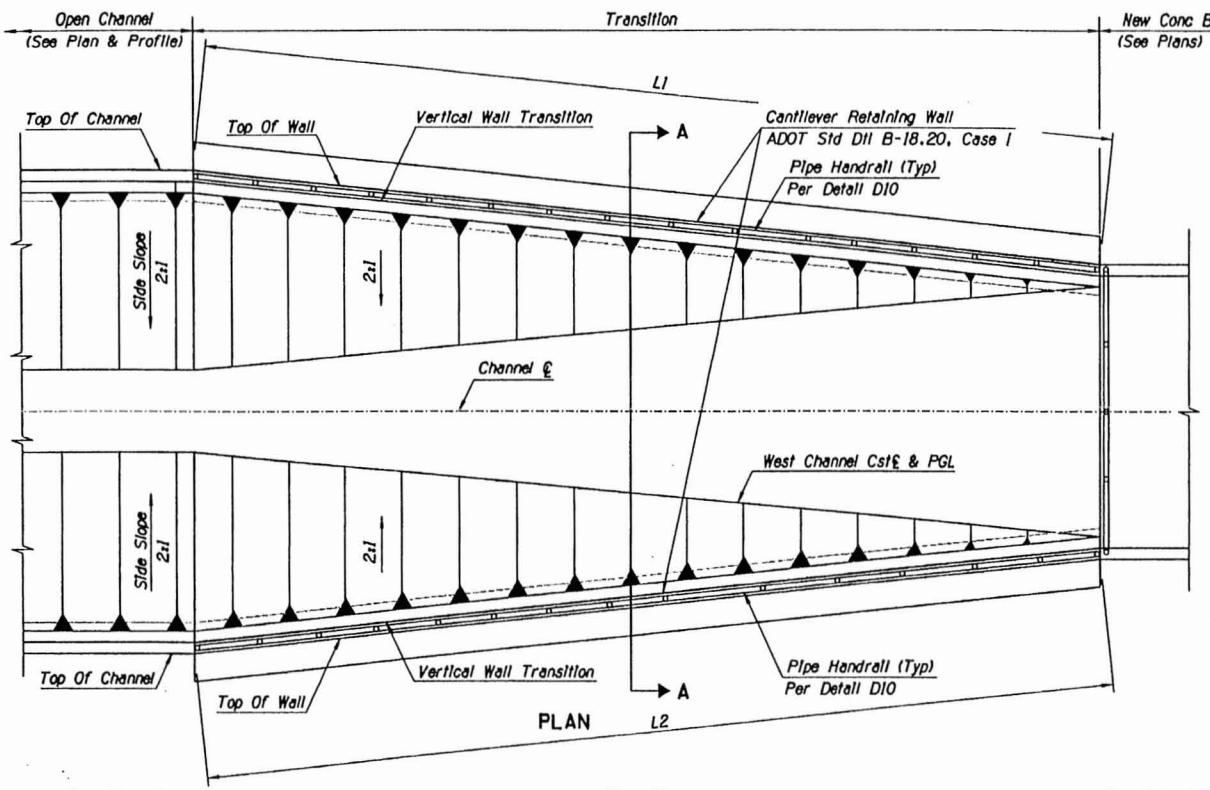
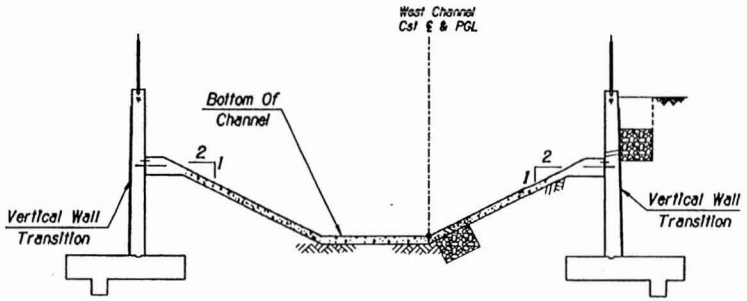
		202L MA 051			



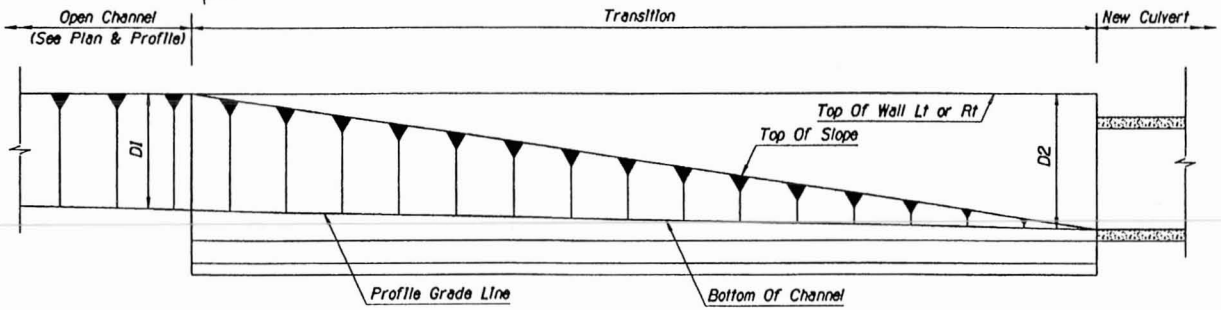
PLAN

Dimension Table					
West Channel Cst ℄ Station		Depth (ft)		Wall Length (ft)	
From	To	D1	D2	L1*	L2*
19+83.63	20+08.63	6.68	11.16	32.17	29.99
27+48.01	27+29.57	7.68	7.68	20.02	30.30

*Location of L1 and L2 Also Shown on Dwgs D-3.15 and D-3.16



SECTION A-A



ELEVATION
N.T.S.

DETAIL D1

SHEET 1 OF 3
VERTICAL WALL TRANSITION

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JJZ	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

VERTICAL WALL TRANSITION
DETAIL D1

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE R[redacted]

TRACS NO. H5416 01C

2[redacted]500

DWG NO. D-3.04

___ OF ___

263-1100

FILE: c:\windm\56-kyrene\dd508803.dgn
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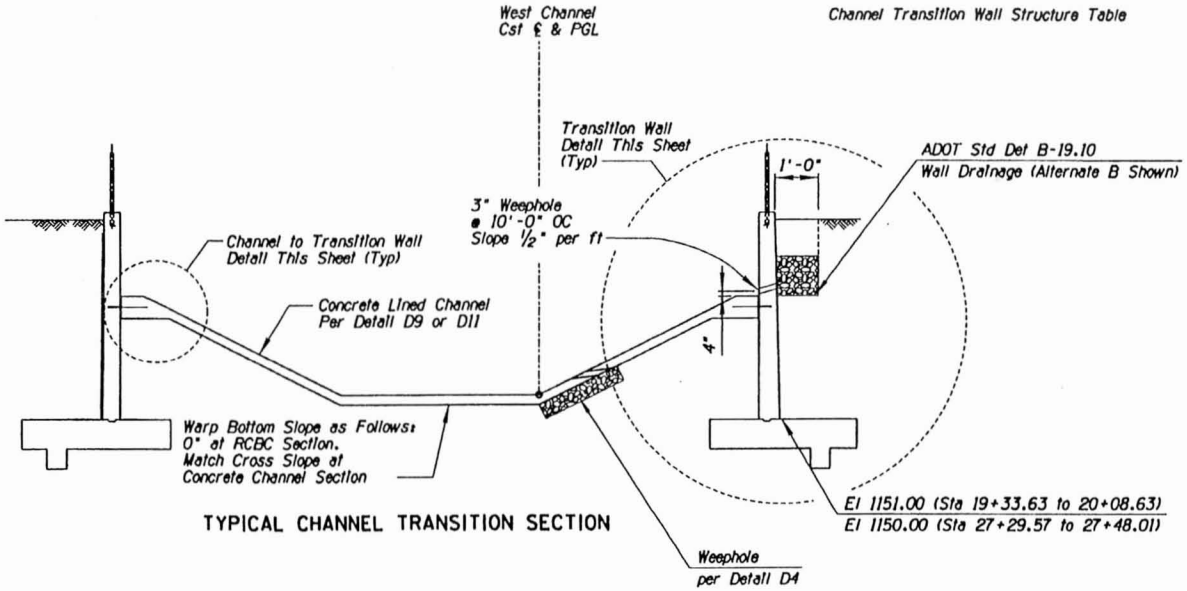
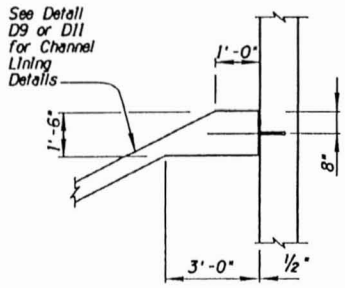
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			

Channel Location	Sta 1	Sta 2	Wall Length (Total)	Wall Height H	Reinf Steel	Class S Conc F'c=3 Ksi	Structural Excavation	Structural Back Fill
			ft (0)	ft-in	lb	CY	CY	CY
West Chnl Cst ℄	19+83.63	20+08.63	62	12-0	4030	50	387	255
West Chnl Cst ℄	27+29.57	27+48.01	50	9-0	2250	31	243	154

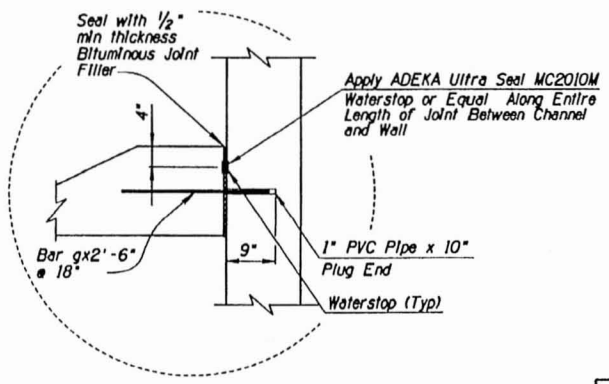
Channel Transition Wall Structure Table



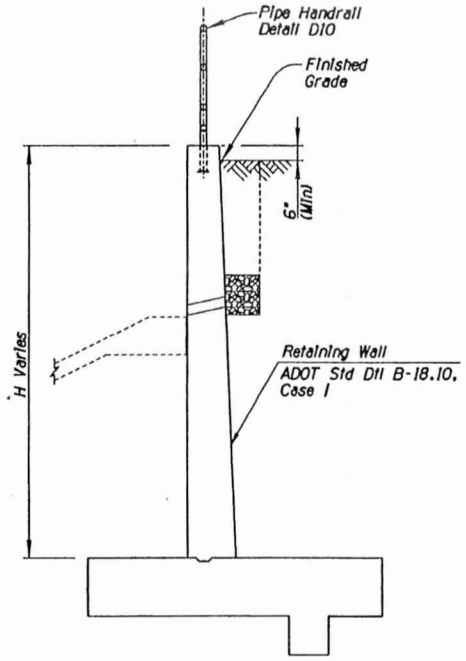
TYPICAL CHANNEL TRANSITION SECTION



CHANNEL TO TRANSITION WALL CONNECTION DETAIL



WATERSTOP DETAIL



TRANSITION WALL DETAIL

DETAIL D1

SHEET 2 OF 3
VERTICAL WALL TRANSITION

Note:
1. Channel Lining Between the Retaining Walls Is Included In Item 9201001 Concrete Lined Channel.

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	NAME	DATE
DESIGN	JJZ	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

VERTICAL WALL TRANSITION
DETAIL D1

ROUTE 202L | LOCATION 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C | 202 C 500

DWG NO. D-3.05

___ OF ___

263-1100

FILE: c:\windm\56-kyrene\dd508808.dgn
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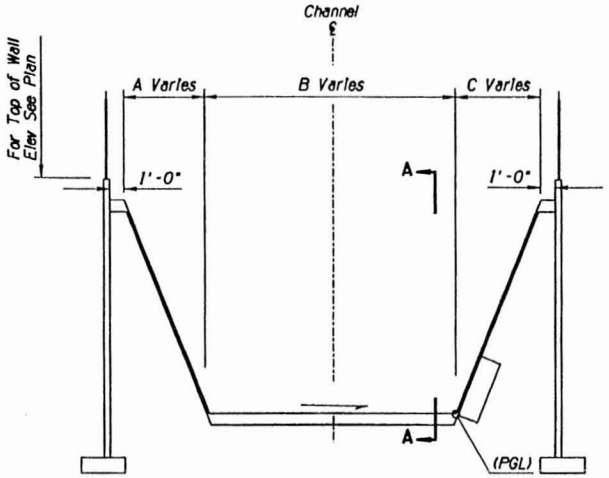
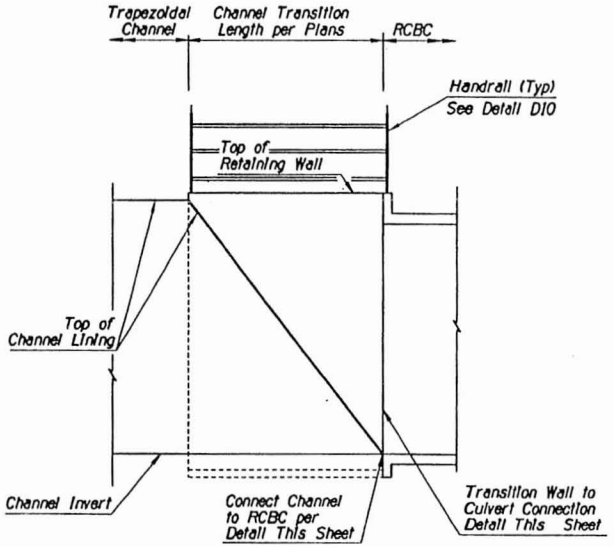
		202L MA 051			

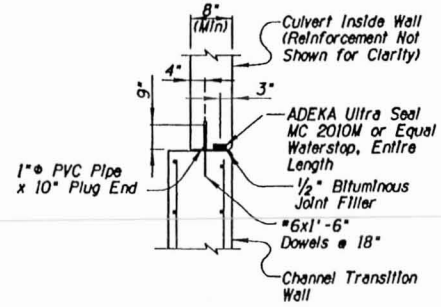


Location	From Sta	To Sta	A	B	C
West Channel Cst ℄	19+83.63	20+08.63	13'0" to 0"	9'0" to 12'8"	13'4" to 0"
West Channel Cst ℄	27+29.57	27+48.01	0" to 15'0"	12'10" to 9'0"	15'4" to 0"

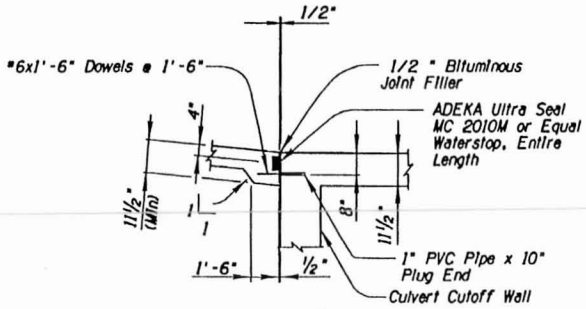
CONCRETE LINED CHANNEL TO CULVERT TRANSITION
See Station Limits in Table
NTS



Section A-A



TRANSITION WALL TO CULVERT CONNECTION DETAIL



CHANNEL TO CULVERT ① CONNECTION DETAIL

(See Sheet D-3 [illegible] Channel to UPRR Precast Box C[illegible] Connection Detail)

DETAIL D1

CHANNEL TRANSITION WALL DETAILS SHEET 3 OF 3

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JJZ	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

VERTICAL WALL TRANSITION DETAIL D1

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE RO[illegible]

TRACS NO. H5416 01C | 202-[illegible]-000

DIG NO. D-3.06

___ OF ___

CALL ARIZONA TOLL FREE 263-1100 Not blue staking CALL BEFORE

FILE: c:\windm\56-kyrene\dd508809.dgn
DATE: 31-Aug-00 10:56

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F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
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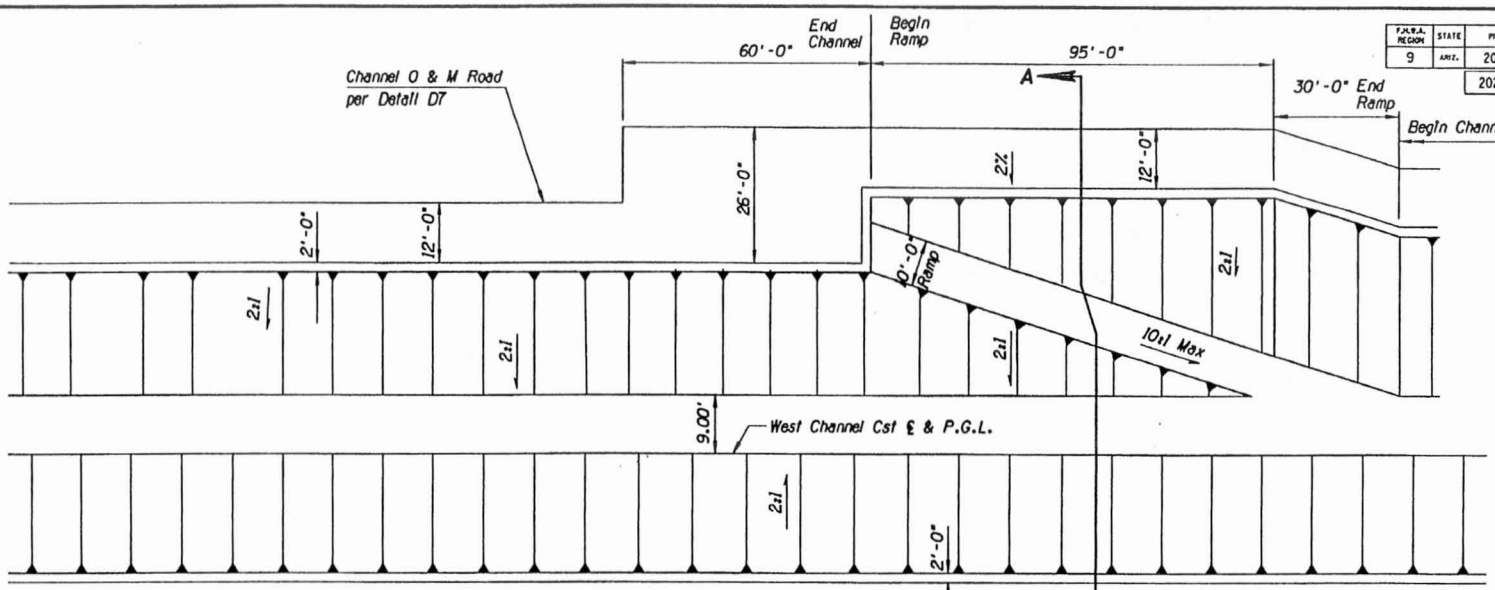
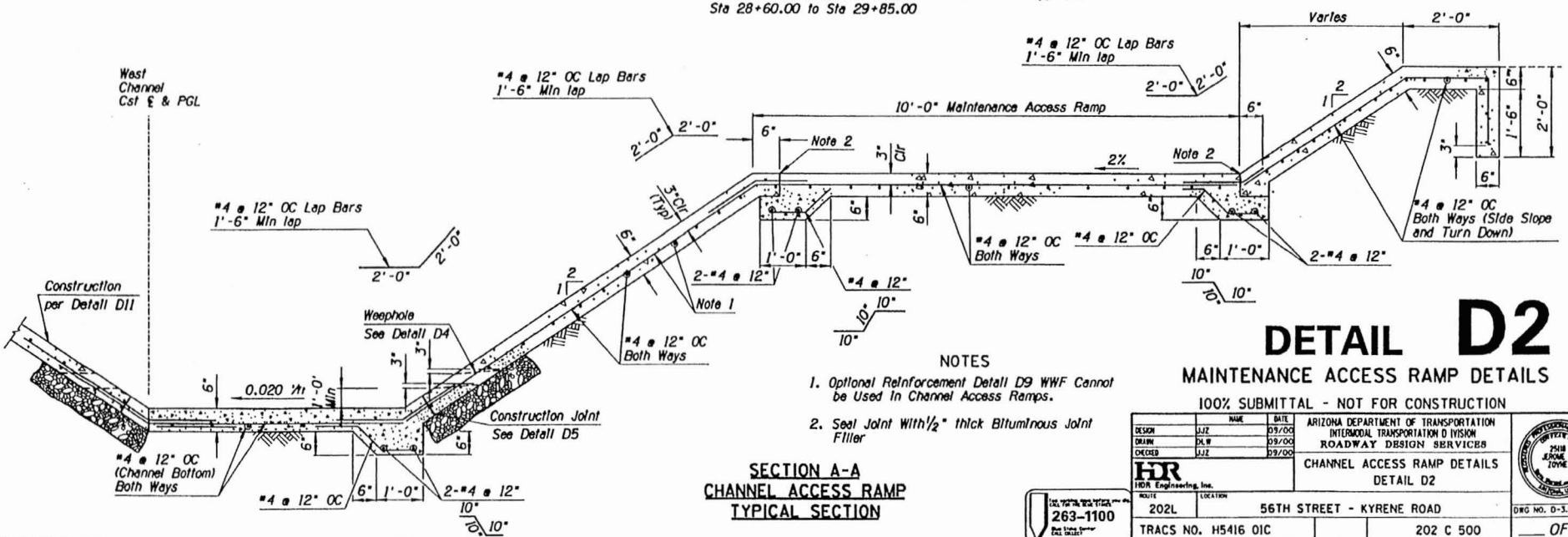
		202L MA 051			



PLAN

Sta 18+08.63 to Sta 19+33.63
Sta 28+60.00 to Sta 29+85.00



SECTION A-A
CHANNEL ACCESS RAMP
TYPICAL SECTION

NOTES

1. Optional Reinforcement Detail D9 WWF Cannot be Used In Channel Access Ramps.
2. Seal Joint With 1/2" thick Bituminous Joint Filler

DETAIL D2

MAINTENANCE ACCESS RAMP DETAILS

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JJZ	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

CHANNEL ACCESS RAMP DETAILS
DETAIL D2

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD

DWG NO. D-3.07

TRACS NO. H5416 01C | 202 C 500 | ___ OF ___

263-1100

FILE: c:\=mdm\56-kyrene\dd5068810.dgn
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F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
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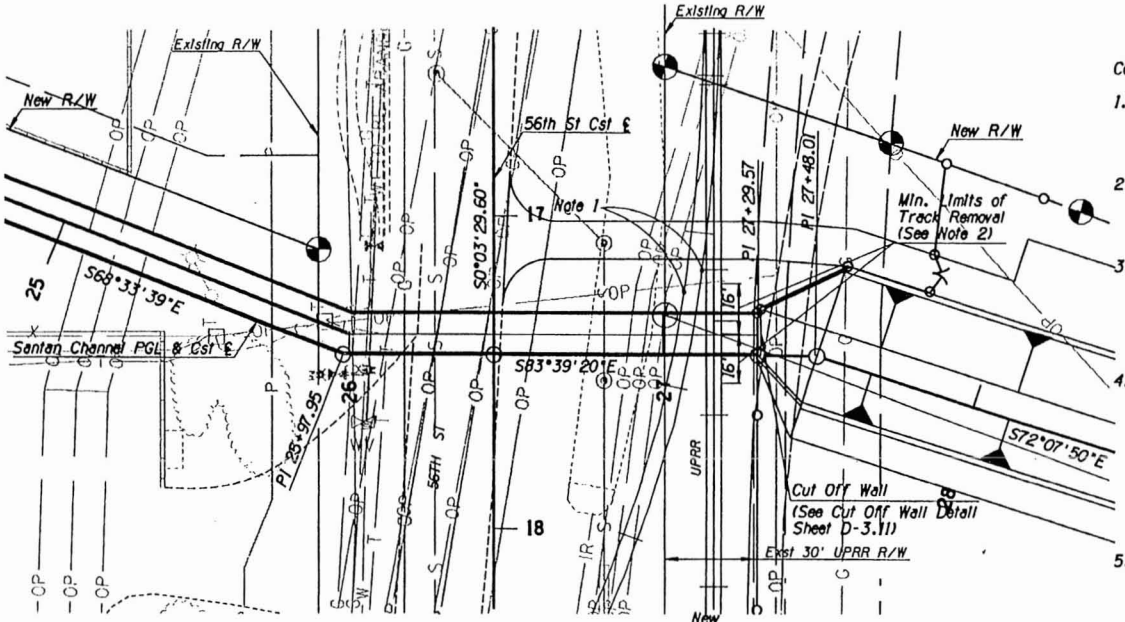
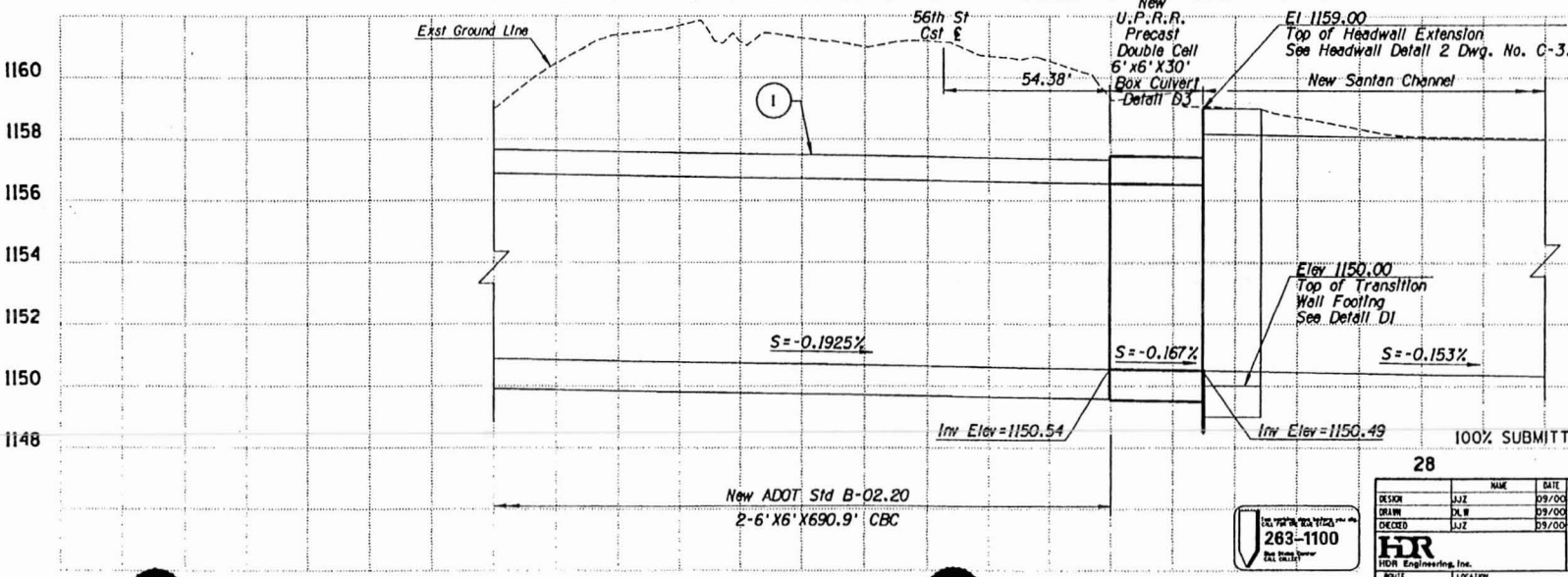
		202L MA 051			



Construction Notes:

1. Existing Spur Track to be Removed and Discarded by Union Pacific Railway Company (UPRR). (Spur to be Abandoned for Loop 202L Const.)
2. Existing Main Track to be Removed by UPRR Prior to Culvert Installation. (Min. 16' Either Side of Culvert ℄ as Shown)
3. Track Operations to be Suspended by UPRR for 72-Hour Period During Culvert Installation, From Noon Friday to Noon Monday. Contact Gary Houk, UPRR MTM at Least 60 Days In Advance to Schedule Operations.
4. Sequence of Operations:
   - Friday Noon - 3:00 pm UPRR to Remove Track. Contractor to Stand By and Assist UPRR Forces as Requested by UPRR.
   - Friday 3:00 pm to Monday 7:00am Contractor to Install Culvert, Backfill and Ballast.
   - Monday 7:00 am - Noon UPRR to Replace Track.
   - Monday Noon - Train Operations Resume.
5. Contractor Shall Use Extreme Caution and Appropriate Safety Measures When Working Near High Voltage Overhead Electric Lines. All Work Shall be Done In Accordance With the Overhead Power Safety Law.



DETAIL D3

Sheet 1 of 4

1-Double Cell 6X6 UPRR Precast Box Culvert

100% SUBMITTAL - NOT FOR CONSTRUCTION

263-1100

	NAME	DATE
DESIGN	JJZ	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

UPRR PRECAST BOX CULVERT
Sta 26+99.57 to 27+29.57
PLAN AND PROFILE

ROUTE	LOCATION
202L	56TH STREET - KYRENE RO

TRACS NO. H5416 01C | 202 00

DWG NO. D-3.08

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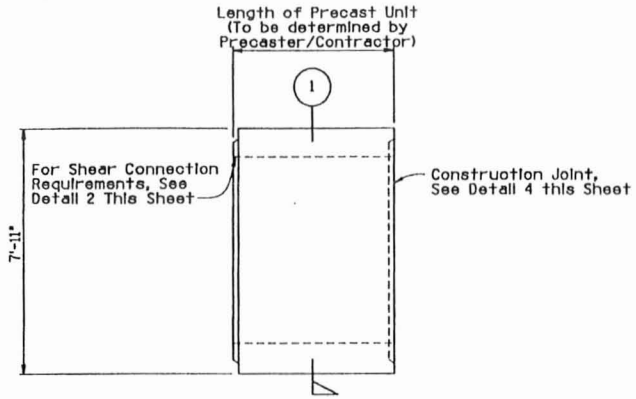
FILE: c:\windm\56-kyrene\dd508801.dgn
DATE: 30-Aug-00 15:04

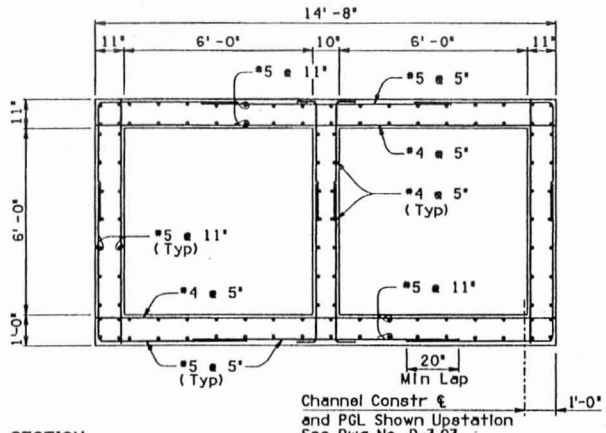
cccccSYSTIME:ccccc cccccDGNcSPECIFICATIONccccc

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



ELEVATION - PRECAST CONCRETE BOX CULVERT

Scale: 1/2" = 1'-0"

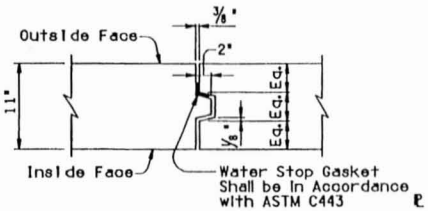


SECTION 1

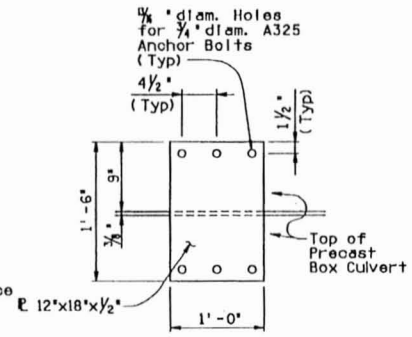
Scale: 1/2" = 1'-0"

GENERAL NOTES:

1. Design and construction per current AREMA Specifications (Chapter 8, Part 16) and U.P.R.R. Engineering Standards. Design live load - Cooper E-80 with 40% impact.
2. Reinforcing steel shall conform to requirements of ASTM A615, Grade 60.
3. Minimum 28 day concrete compressive strength shall be 4000 psi.
4. Minimum cover for concrete shall be 2" except for transverse bars in bottom of bottom slab requiring 3" of cover. Terminate typical box culvert longitudinal reinforcement 2" clear of joint.
5. Longitudinal bars shall be full length (no laps).
6. Bottom of box culvert to bear on subgrade of 12" compacted crushed stone and undisturbed native soil material with a minimum allowable bearing pressure of 3000 psf. Contractor to verify existing soil Bearing Pressure. See detail 3 this sheet.
7. Maximum design fill height is 3'-0".
8. For precast to cast-in-place box culvert transition details, see sheet 3 of 4.
9. For precast box culvert to channel transition details see sheet 4 of 4.
10. The Contractor shall be responsible for the design of any lifting devices necessary for handling and placing the precast units. The Contractor shall submit lifting device design and details to the Engineer for review and approval prior to proceeding with the work. The design and details shall be sealed by an Arizona registered Engineer, Civil or Structural Branch.
11. Any deviation from the project plans requires approval of Engineer prior to proceeding with the work.



Top Slab & Ext. Walls

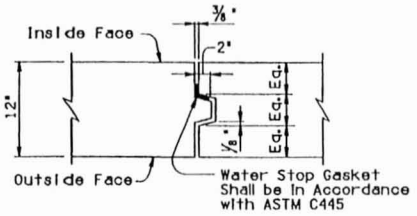


Notes:

1. Threaded inserts shall be installed in precast units for the shear connectors plates and anchor bolts. Threaded insert minimum capacity of 2400 lbs. Shear connections shall be installed in top of culvert between precast sections.
2. Shear connectors to be installed by the Contractor in the field.
3. Galvanized steel plate to have yield stress of 36 ksi (min).
4. Reinforcement and gasket not shown for clarity.
5. After installation, coat joint shear connectors with 12-14 mils of coal tar epoxy.
6. Maximum edge distance of joint shear connectors to be 36" with a minimum of 4 shear connectors per unit.

SHEAR CONNECTOR DETAIL 2

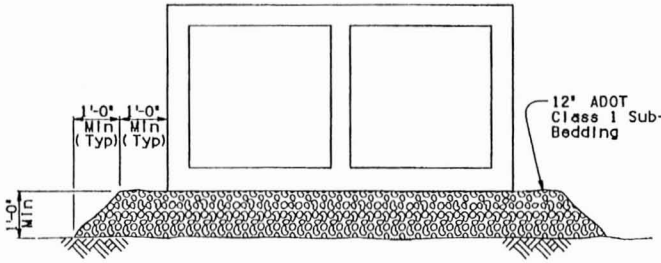
Scale: 1 1/2" = 1'-0"



Bottom Slab

JOINT DETAILS 4

Scale: 1 1/2" = 1'-0"



BEDDING DETAIL 3

No Scale

DETAIL D3

Sheet 2 of 4

1-Double Cell 6X6 UPRR
Precast Box Culvert

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE	ARIZONA DEPARTMENT OF TRANSPORTATION INTERMODAL TRANSPORTATION DIVISION ROADWAY DESIGN SERVICES
DESIGN	RMP	09/00	
DRAWN	TRK	09/00	
CHECKED	RT	09/00	
HDR Engineering, Inc.			U.P.R.R. PRECAST BOX CULVERT STA 26+99.57 TO 27+29.57
ROUTE 202L	LOCATION 56TH STREET - KYRENE ROAD		DWG NO. D-3.09
TRACS NO. H5416 01C		202 C 500	OF

263-1100

FILE: c:\windm\56-kyrene\bx508801.dgn
DATE: 14-Jun-00 11:20

ooooSYSTIMEoooooo oooooDGNoSPECIFICATIONoooooo

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
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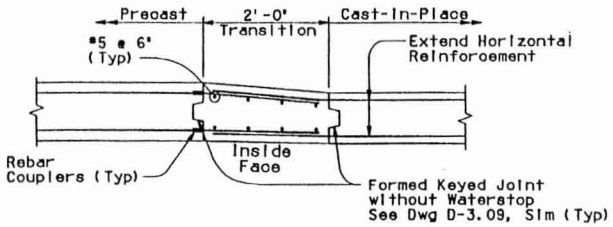
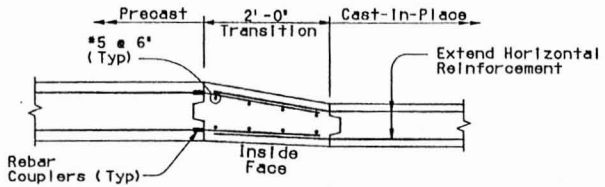
		202L MA 051			



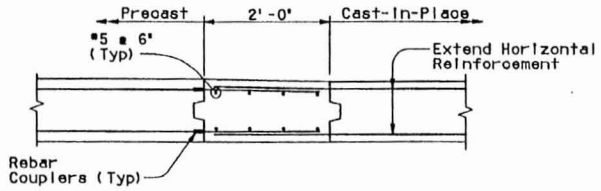
Section at Top Slab



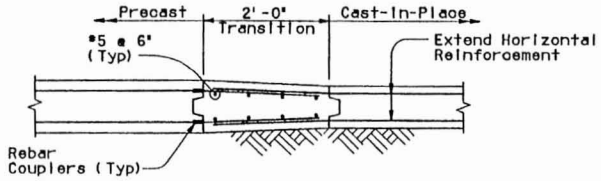
Section at Exterior Walls

NOTES:

1. Threaded Inserts may be used in lieu of #5 dowel reinforcement.
2. Provide a minimum 1'-0" lap splice with dowel reinforcement.
3. All mechanical splices (Couplers) shall be able to exceed 125% of the reinforcement specified yield strength.
4. Extend ADOT Standard box culvert horizontal reinforcement into 2'-0" cast-in-place concrete transition. Modify ADOT Standard B-02.20 horizontal reinforcement.



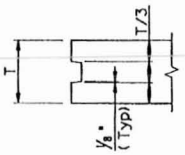
Section at Bottom Slab



Section at Interior Walls

NOTE:
Box culvert reinforcement not shown for clarity.

CAST-IN-PLACE CONCRETE TRANSITION DETAILS
NTS (Closure Pour)



TRANSITION CONSTRUCTION JOINT DETAIL
NTS

DETAIL D3

Sheet 3 of 4

1-Double Cell 6X6 UPRR
Precast Box Culvert

100% SUBMITTAL - NOT FOR CONSTRUCTION

263-1100

	NAME	DATE
DESIGN	RNP	09/00
DRAWN	TRK	09/00
CHECKED	RT	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

U.P.R.R. PERCAST BOX CULVERT
STA 26+99.57 TO 27+[illegible]

Registered Professional Engineer (Civil) CERTIFICATE NO. 32837 RONALD M. PIERCE Date Signed ARIZONA, U.S.A.

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD

DWG NO. D-3.10

TRACS NO. H5416 01C | 202 C 500 | ___ OF ___

FILE: c:\wndm\56-kyrene\bx508803.dgn
DATE: 14-Jun-00 11:20

SYSTIME DGNSPECIFICATION

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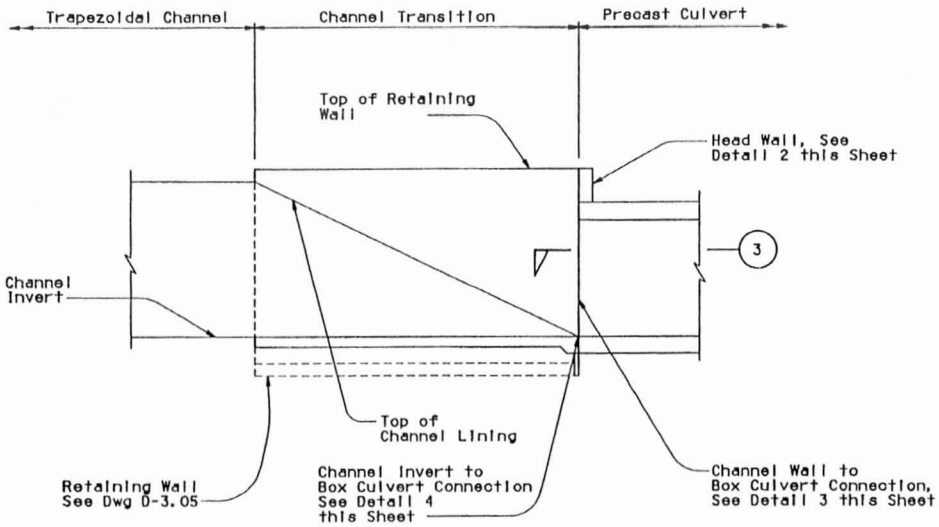
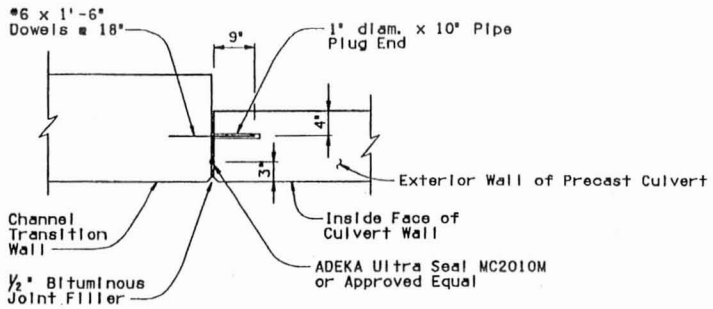
		202L MA 051			

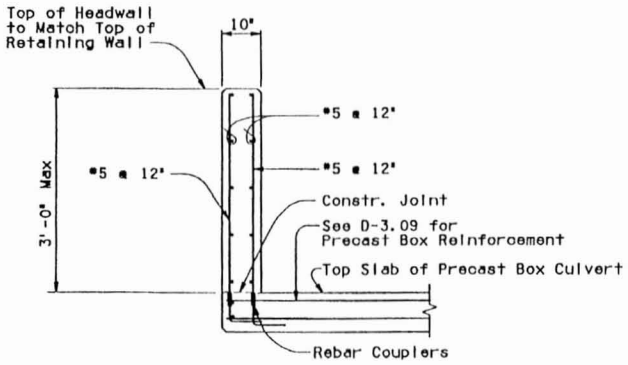


SECTION (1)
No Scale



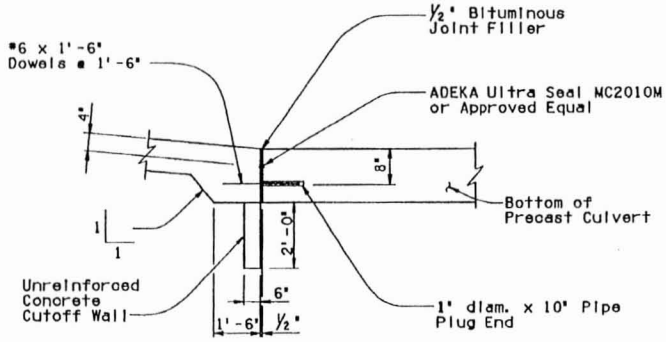
Note:
Wall reinforcement not shown for clarity

CHANNEL WALL TO CULVERT CONNECTION DETAIL (3)
Scale: ½"=1'-0"



Note:
Box Culvert transverse reinforcement not shown for clarity

CAST-IN-PLACE CONCRETE HEADWALL DETAIL (2)
Scale: ¼"=1'-0"



CHANNEL INVERT TO CULVERT CONNECTION DETAIL (4)
Scale: ½"=1'-0"

DETAIL D3

Sheet 4 of 4

1-Double Cell 6X6 UPRR Precast Box Culvert

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	RMP	09/00
DRAWN	TRK	09/00
CHECKED	RT	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

U.P.R.R. PRECAST BOX CULVERT
STA 26+99.57 TO 27+29.57

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD

DWG NO. D-3.11

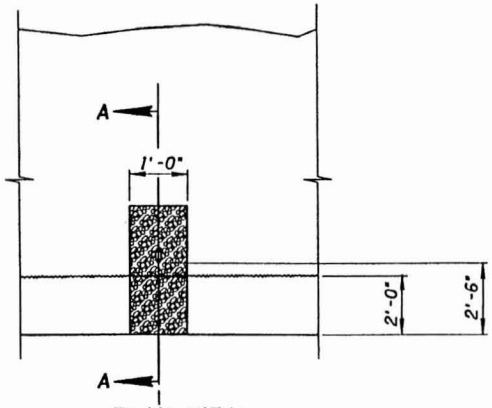
TRACS NO. H5416 01C | 202 C 500 | OF

263-1100

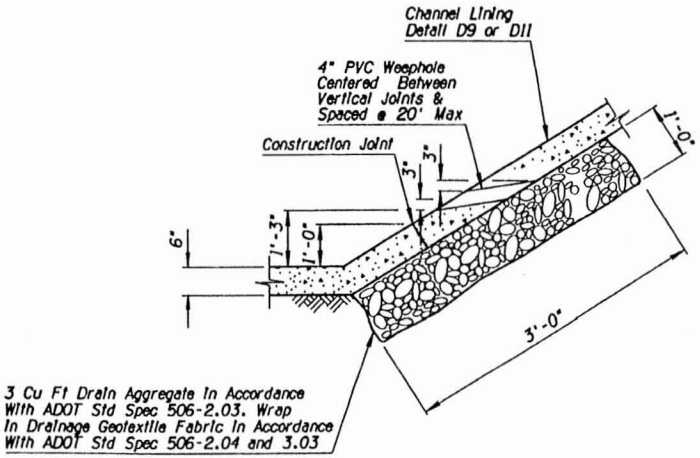
FILE: c:\windm\56-kyrene\bx508802.dgn
DATE: 14-Jun-00 11:31

ooooSYSTIMEoooooo oooooDGNoSPECIFICATIONoooooo

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



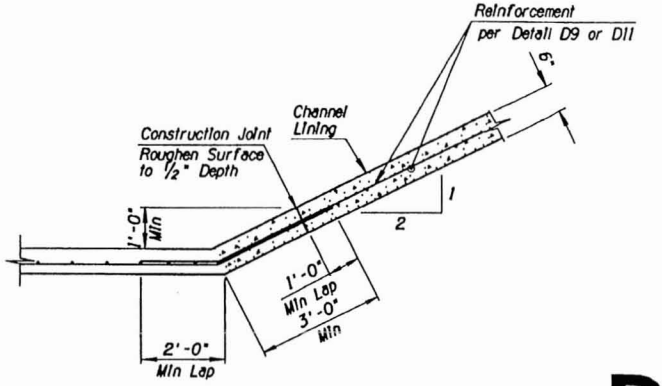
PLAN VIEW



SECTION A - A

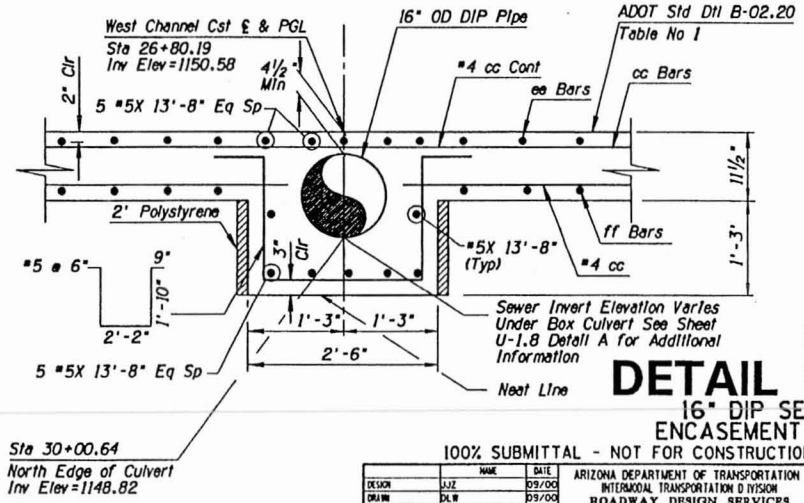
DETAIL D4

WEEPHOLE DETAIL



DETAIL D5

CHANNEL CONSTRUCTION JOINT DETAIL



DETAIL D6

16" DIP SEWER
ENCASEMENT DETAIL

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JJZ	09/00
DRAWN	DLW	09/00
CHECKED		09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DETAIL SHEET
DETAILS D4, D5 & D6

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE R

TRACS NO. H5416 01C

202 C 500

DWG NO. D-3.12

___ OF ___

263-1100

FILE: C:\WINDM\56-KYRENE\DD508806.DGN
DATE: 31-Aug-00 07:46

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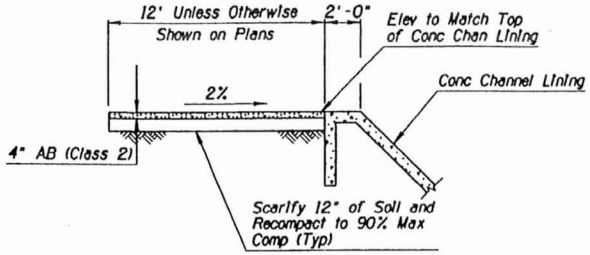
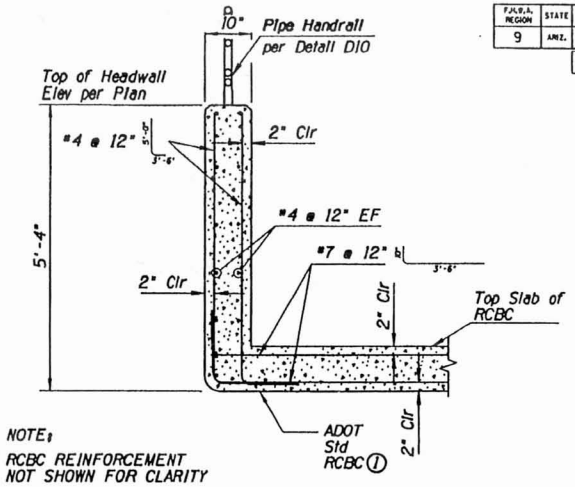
		202L MA 051			



DETAIL D7

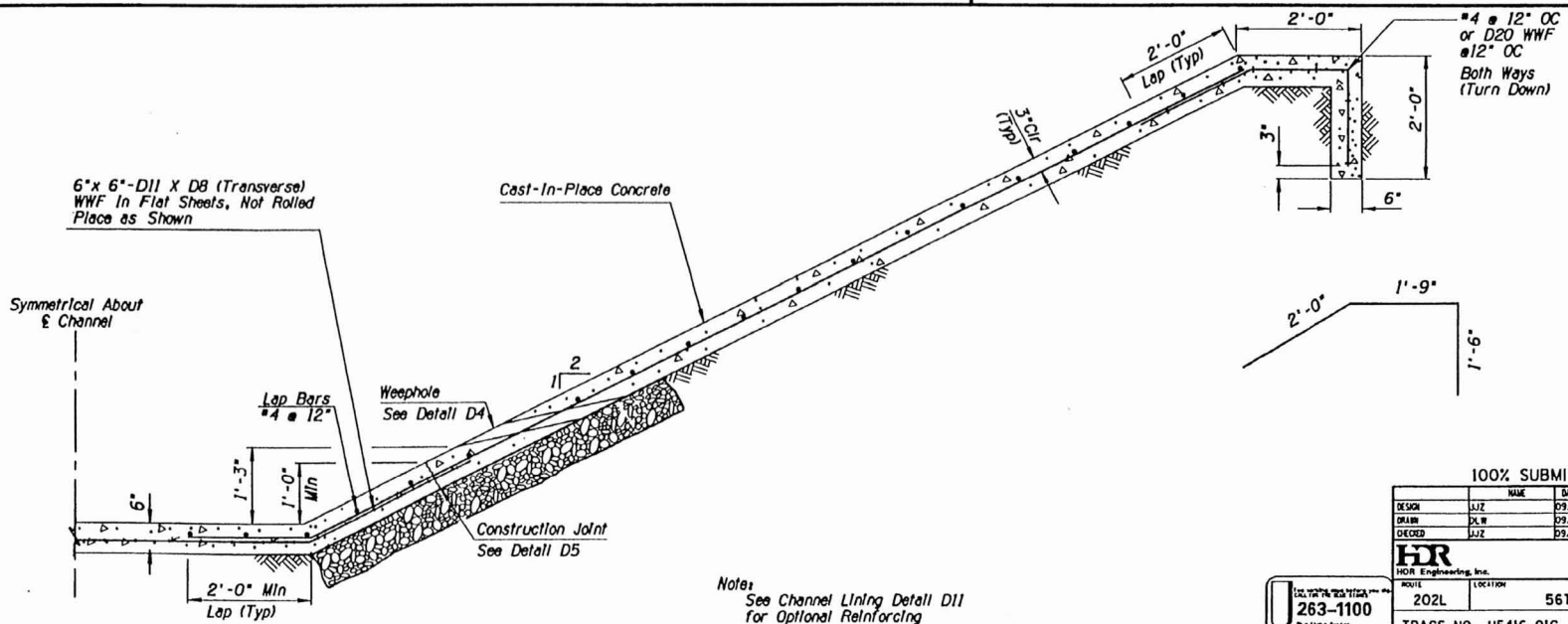
CHANNEL OPERATION & MAINTENANCE (O & M) ROAD



NOTE:
RCBC REINFORCEMENT NOT SHOWN FOR CLARITY

DETAIL D8

SPECIAL HEADWALL EXTENSION



Construction Notes:

1. Longitudinal Construction Joints Shall Not Be Placed In the Bottom Slab. Longitudinal Construction Joints May Be In the Side Slope If Placed a Minimum of One (1) Foot Above The Bottom Slab As Shown.
2. Concrete Channel Lining Shall be Finished to a Light Broomed Texture. Wood Trowel Finish Is Not Permitted.
3. Concrete Shall be Class "S", f'_c = 3000 psi.
4. Reinforcing Steel Shall Conform to ASTM A497, Grade 60.

Note:
See Channel Lining Detail D11 for Optional Reinforcing

DETAIL D9

CHANNEL LINING W/ WWF REINFORCEMENT

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JJZ	09/00
DRAWN	JLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DETAIL SHEET
DETAILS D7, D8, & D9

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C

202 C 500

DWG NO. D-3.13

___ OF ___

CALL TWO WORK DAYS BEFORE YOU DIG
263-1100
Blue Stake Center
CALL BEFORE!

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 25118
JEROME J. ZOYNE
ARIZONA, U.S.A.

FILE: c:\windm\56-kyrene\dd508807.dgn
DATE: 31-Aug-00 08:11

ccccSYSTIMEccccc ccccDGNcSPECIFICATIONcccc

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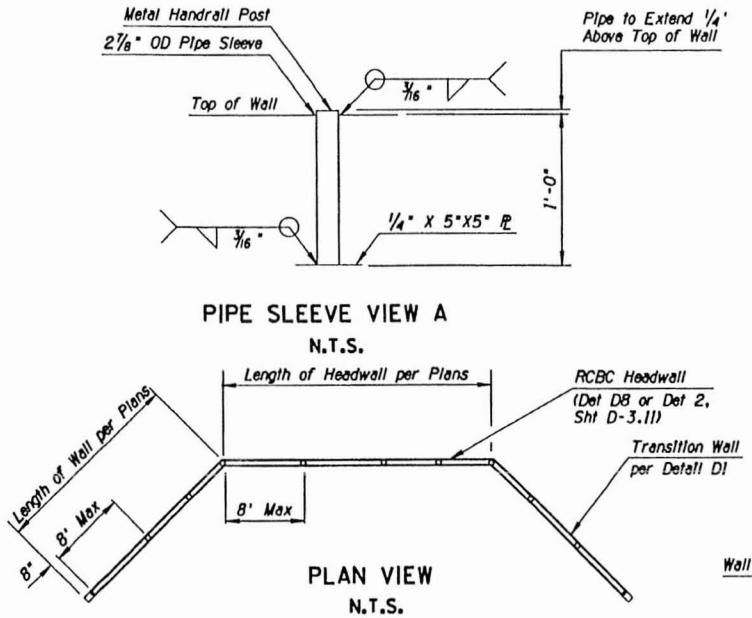
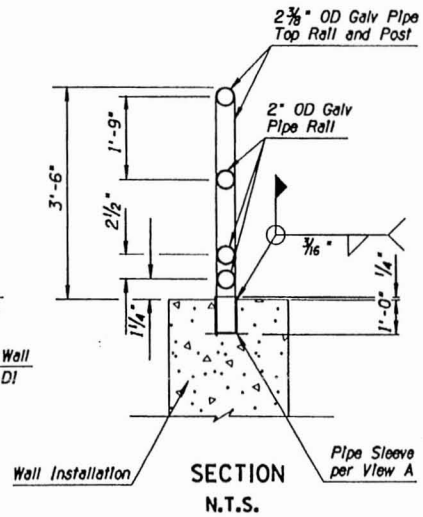
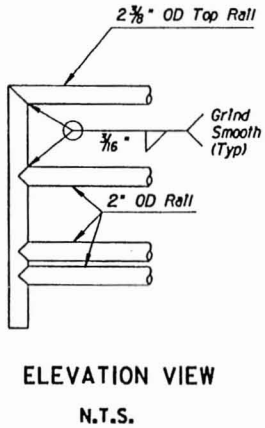
		202L MA 051			





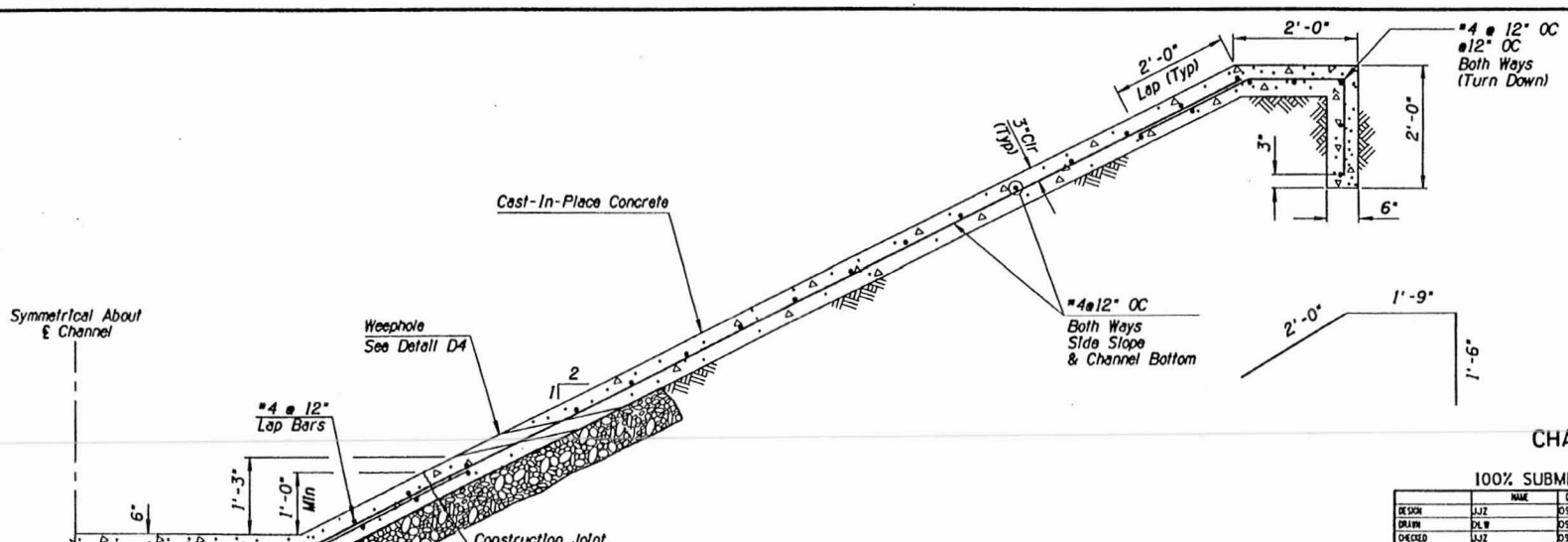


NOTES:

1. Pipe handrail shall be continuous between wall ends and expansion joints and discontinuous through expansion joints.
2. All miscellaneous steel shall be ASTM A-36.
3. All pipe shall be ASTM A-53 Grade B.
4. All galvanizing to be in accordance with ASTM A-123. All galvanizing that has been damaged in handling, transporting or welding shall be repaired by the application of a paste compound of an approved zinc solder and flux.

DETAIL D10

PIPE HANDRAIL



Construction Notes:

1. Longitudinal Construction Joints Shall Not Be Placed In the Bottom Slab. Longitudinal Construction Joints May Be In the Side Slope If Placed a Minimum of One (1) Foot Above The Bottom Slab As Shown.
2. Concrete Channel Lining Shall be Finished to a Light Broomed Texture. Wood Trowel Finish Is Not Permitted.
3. Concrete Shall be Class "S", f'_c = 3000 psi.
4. Reinforcing Steel Shall Conform to ASTM A615, Grade 60.

DETAIL D11

CHANNEL LINING W/REINFORCMENT

Note: See Channel Lining Detail [redacted] for Optional Reinforcing

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JJZ	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DETAIL SHEET
DETAILS D7, D8, [redacted]

ROUTE 202L | LOCATION 56TH STREET - KYRENE RO[redacted]

TRACS NO. H5416 01C | 202 C 500

DWG NO. D-3.14

___ OF ___

263-1100

FILE: c:\windm\56-kyrene\dd508811.dgn
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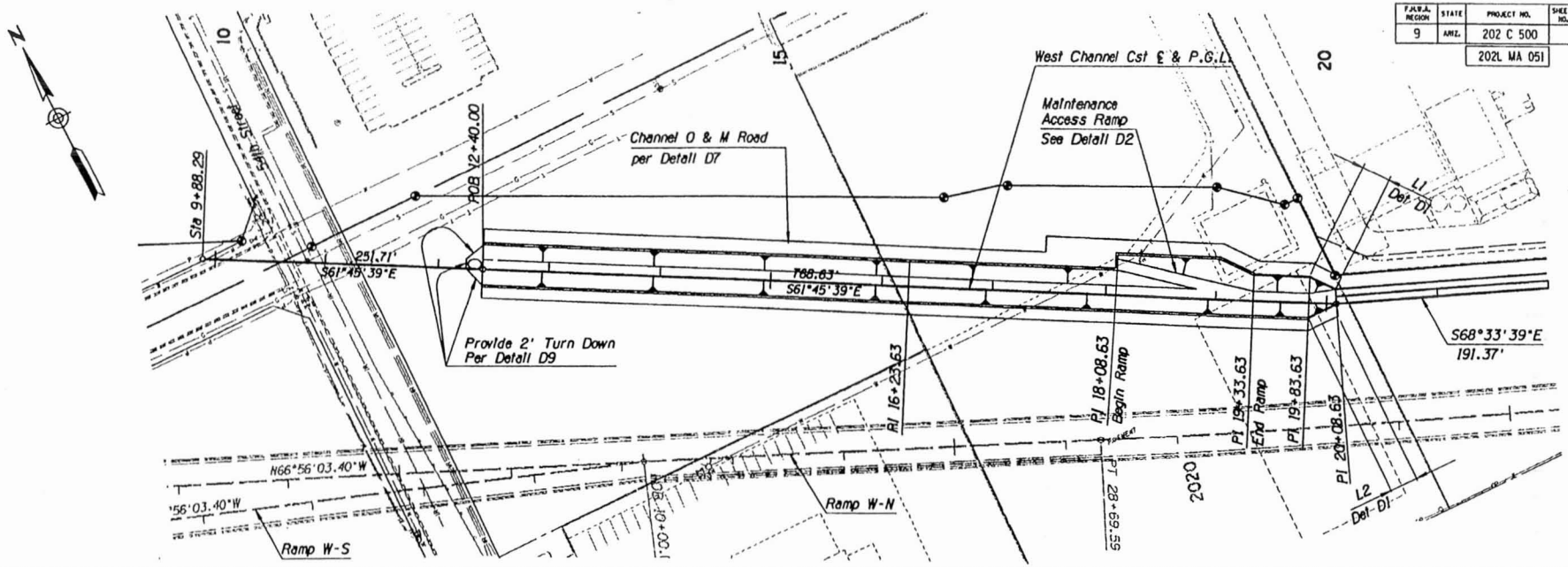

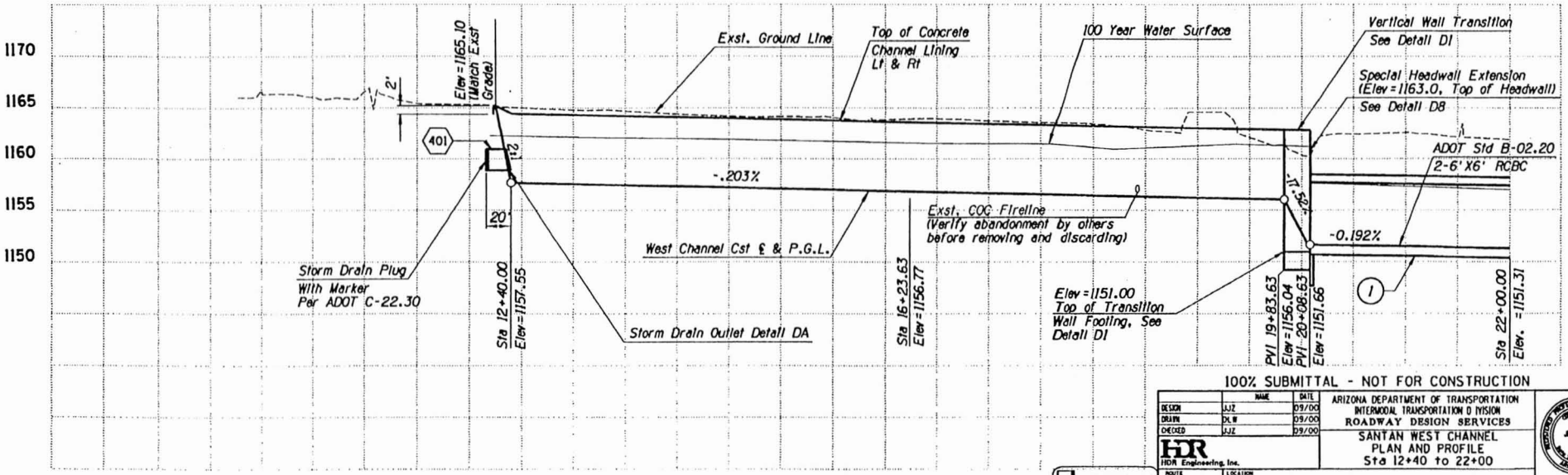

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JJZ	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SANTAN WEST CHANNEL
PLAN AND PROFILE
Sta 12+40 to 22+00

ROUTE 202L | LOCATION 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C | 202 C 500

DWG NO. D-3.15

___ OF ___

263-1100

FILE: c:\winem\56-kyrene\pp508851.dgn
DATE: 31-Aug-00 08:33

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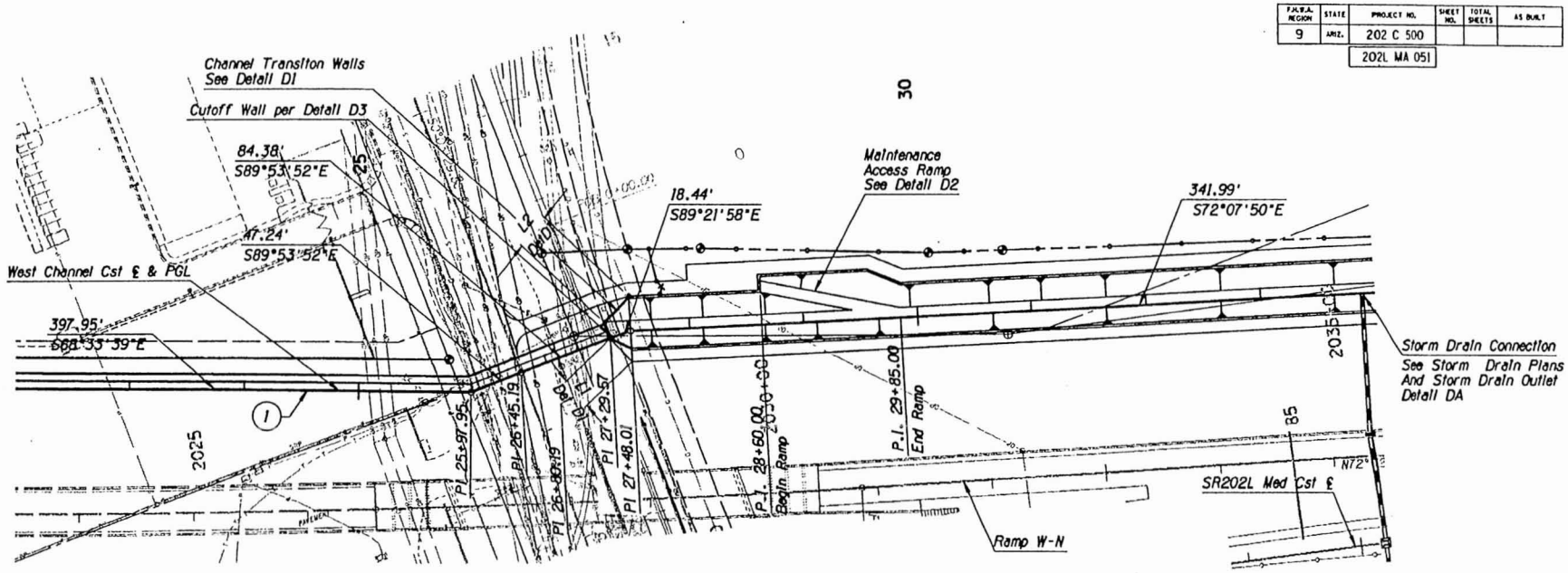
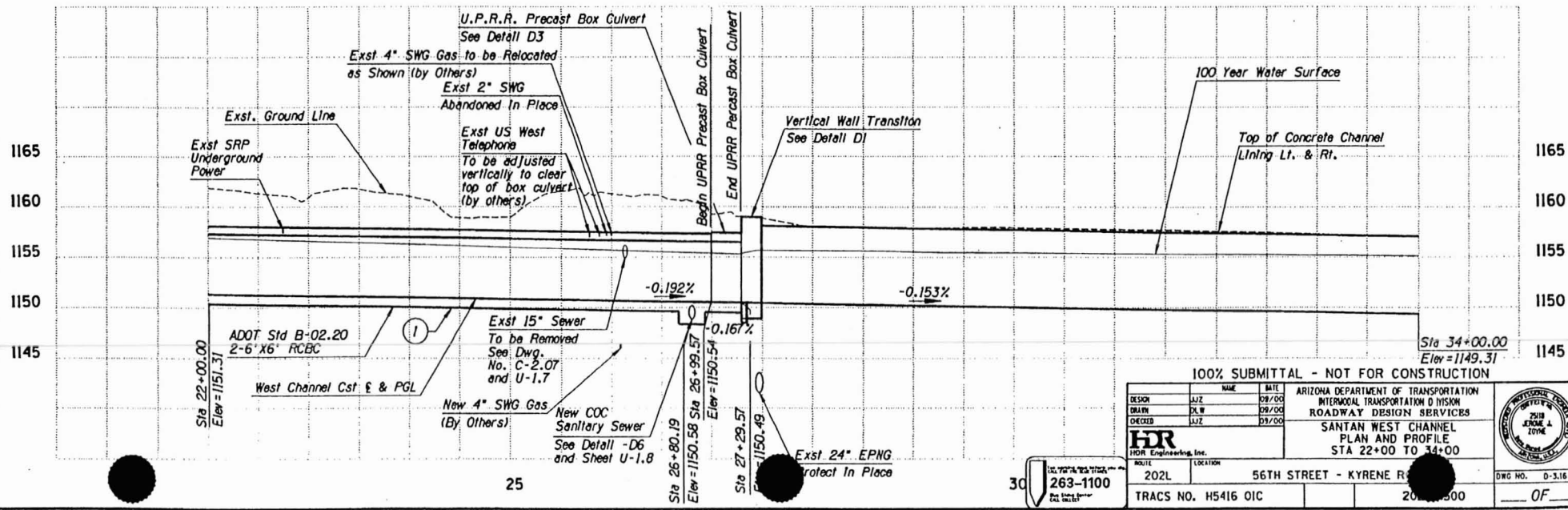
		202L MA 051			





100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JJZ	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SANTAN WEST CHANNEL
PLAN AND PROFILE
STA 22+00 TO 34+00

ROUTE	LOCATION
202L	56TH STREET - KYRENE R

TRACS NO. H5416 01C

DWG NO. D-3.16

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263-1100

FILE: c:\windm\56-kyrene\pp508852.dgn
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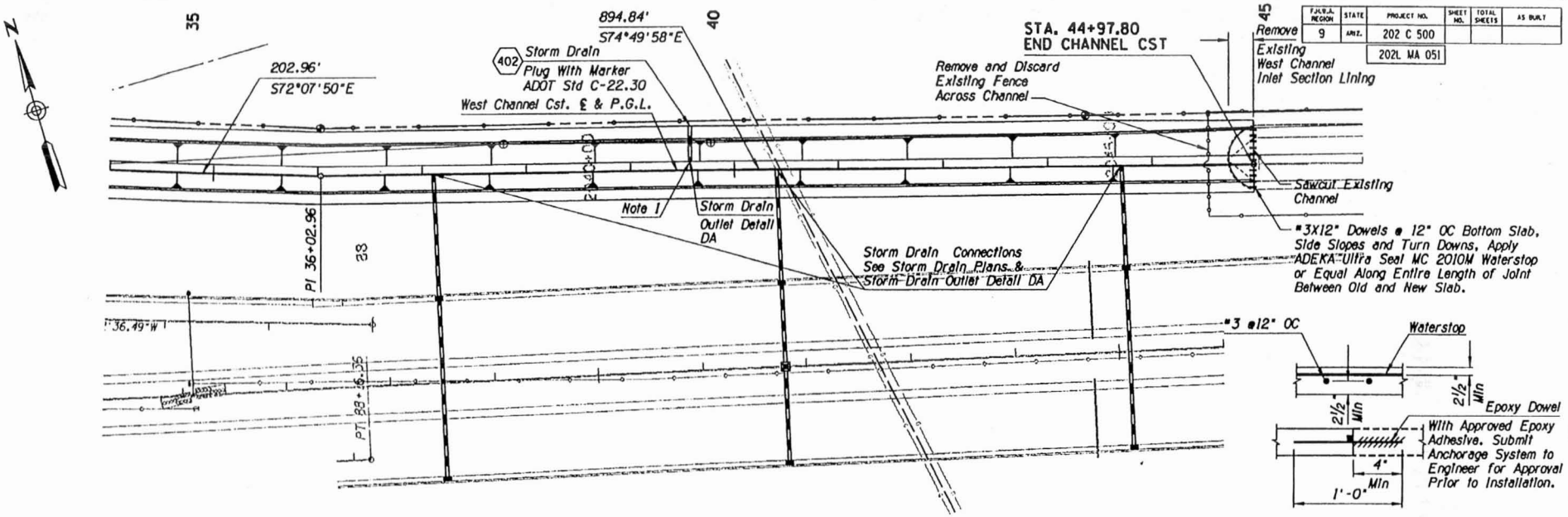
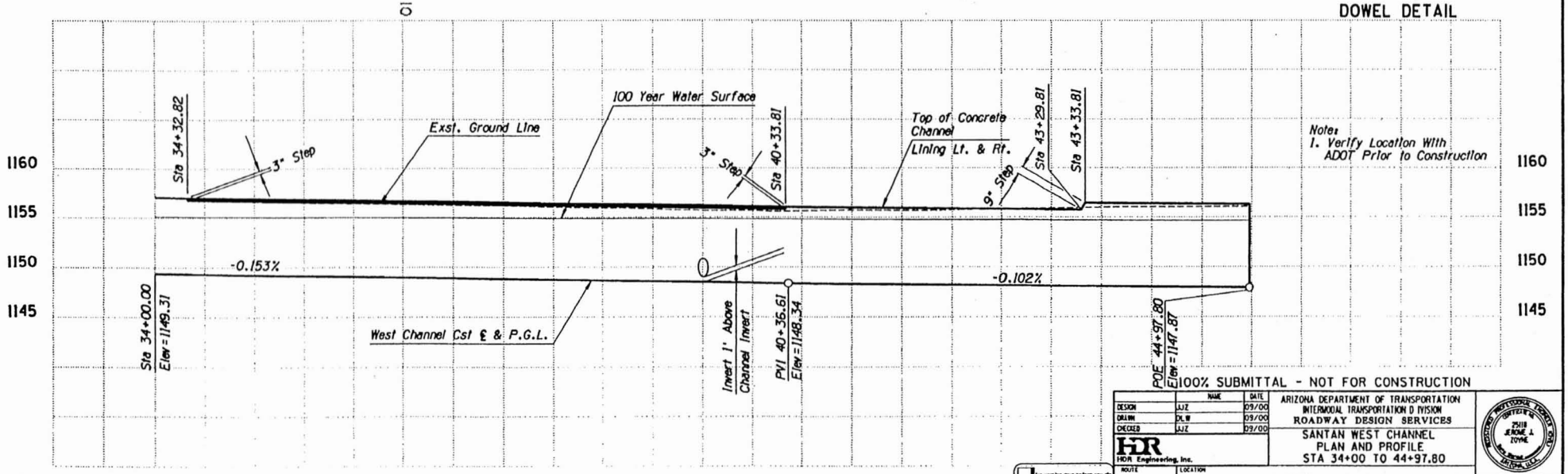
		202L MA 051			



DOWEL DETAIL



Note:
1. Verify Location With ADOT Prior to Construction

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JJZ	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SANTAN WEST CHANNEL
PLAN AND PROFILE
STA 34+00 TO 44+97.80

ROUTE 202L | LOCATION 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C | 202 C 500

DWG NO. D-3.17 ___ OF ___

263-1100

FILE: c:\windm\56-kyrene\pp508853.dgn
DATE: 31-Aug-00 09:09

cccccSYSTIMEccccc cccccDGNcSPECIFICATIONccccc

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			

PART 1 - To be completed by the Landscape Architect or Design Engineer

I. PROJECT DESCRIPTION

A. Owner Name and Address:

Arizona Department of Transportation
206 South 17th Avenue
Phoenix, Arizona 85007-3213

B. Project TRACS Number: H 5416 OIC

C. Project Location: SR202 56th St - Kyrene Rd

City: Chandler County: Maricopa

Latitude: 33°17'00"N Longitude: 112°57'30"W

D. Project Description: Project includes new raised and depressed freeway. Off-site drainage is to be intercepted in the Santan Channel north of the freeway and conveyed to a local pump station.

II. HYDROLOGIC INFORMATION

A. Project Size:

Length (MI) 1.34

Area (Ac) 95

B. Area to be Graded (Ac): 62

C. Runoff Coefficient:

Existing 0.71

Developed 0.76

D. Receiving Water(s): Santan Channel, Gila River

III. PRESERVATION OF EXISTING VEGETATION

A. In accordance with the specifications, existing vegetation will be preserved. Clearing limits shall be confined to areas that require grading. Existing vegetation outside the boundaries of the cleared area shall be protected from damage by construction activities. Existing trees within the area to be cleared shall be preserved and protected, wherever possible.

IV. SOIL STABILIZATION MEASURES

A. All disturbed soil, which will not be paved, riprapped or otherwise covered to prevent erosion, will be revegetated and/or landscaped in accordance with the project plans and specifications.

B. Scheduling of the revegetation effort can be found on PART 2 of this sheet under SCHEDULE OF MAJOR ACTIVITIES.

V. MEASURES TO CONTROL EROSION AND SEDIMENT

A. Permanent Erosion and Sediment Controls: (Refer to Project Plans SWPPP Site Plan and Specifications)

- ___ Crown Ditch/Dike
- ___ Rock Outlet Protection
- ___ Rock Riprap Channel Lining
- ___ Sediment Basin
- X Embankment Curb
- ___ Spillways and Downdrains
- ___ Minibenching
- ___ Others Describe: ___

B. Temporary Erosion and Sediment Controls: (Refer to the Following SWPPP Site Plan and Specifications)

- ___ Erosion Control Mattings
- ___ Temporary Diversion Dikes
- ___ Check Dams
- ___ Rock Inlet/Outlet Protection
- X Straw Bale Barriers
- ___ Silt Fence
- ___ Wattles (Excelsior/Straw)
- X Excelsior Logs
- ___ Others Describe: ___

VI. MAINTENANCE AND INSPECTIONS

A. Frequency of Inspections:

X Monthly and within 24 hours after a rainfall of 0.5 in. (12.7mm) or more (areas with less than 20" (508mm) or more mean annual rainfall).

___ Weekly and within 24 hours after a rainfall of 0.5 in. (12.7mm) or more (areas with 20" (508mm) mean annual rainfall).

NOTE: RAINFALL GAUGE TO BE KEPT ON-SITE TO DETERMINE DEPTH OF RAINFALL

B. Inspection Procedure:

ADOT's NPDES Inspection checklist will be completed by the ADOT resident engineer, or his representative, and will be kept on file. If repairs are necessary, they shall be initiated within 24 hours of the inspection report.

VII. CERTIFICATION OF COMPLIANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS

A. This Storm Water Pollution Plan has been prepared in accordance with ADOT's EROSION AND POLLUTION CONTROL MANUAL FOR HIGHWAY DESIGN AND CONSTRUCTION, published by ADOT, Highways Division.

X No other Federal, State or Local Regulations Apply.

PART 2 - To be completed by ADOT & CONTRACTOR

I. SCHEDULE OF MAJOR ACTIVITIES

A. Project Schedule: ___

Start Date: ___

End Date: ___

B. Construction Sequencing Schedule: (Attach Additional Sheets)

Date	Construction Activity

II. INVENTORY OF POLLUTANTS

A. The materials or substances checked below are expected to be onsite during construction:

- ___ Concrete
- ___ Paints
- ___ Herbicides
- ___ Fuel
- ___ Asphalt
- ___ Fertilizer
- ___ Wood
- ___ Oil
- ___ Others, List: ___

III. POLLUTION CONTROL MEASURES

A. Other Best Management Practices:

- ___ Solid Waste Management
- ___ Equipment Maintenance Procedures
- ___ Designated Washout Areas
- ___ Stabilized Construction Entrance
- ___ Protected Chemical and Material
- ___ Storage Area
- ___ Other, Describe: ___

IV. SPILL PREVENTION AND RESPONSE

A. Spill Prevention:
The procedures outlined in the Best Management Practices listed under Pollution Control Measures will be followed to prevent and contain spills of hazardous material. These preventative action include BMP's on equipment maintenance and proper handling, storage and disposal of chemicals and materials. All manufacturer's recommendations for usage, clean-up and disposal shall be followed.

B. Spill Response:
In the event of any accidental spill of chemicals or hazardous materials, contact the ADOT Hazardous Materials Specialist at ADOT's Health and Safety Section (Ph. # (602)255-7744 or Pager # (602)223-8323). If a reportable quantity is discharged in the storm water, ADOT shall contact the National Response Center and document the spill to the EPA. ADOT's Hazardous Materials Specialist shall provide instructions.

V. POLLUTION PREVENTION PLAN CERTIFICATION

A. I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

B. ADOT Resident Engineer

Signature: ___

Date: ___

Name: ___

Title: ___

ADOT District: ___

C. MUNICIPALITY (For local Government Project)

Signature: ___

Date: ___

Name: ___

Title: ___

Municipality: ___

VI. OTHER REQUIREMENTS

A. A copy of the General Permit is attached in accordance to Part IV, Section D, Subpart 1(h) of the NPDES General Permit for Storm Water Discharges From Construction Activities.

B. A copy of the page from the environmental clearance for the project that discusses endangered or threatened species is attached in accordance to Part IV, Section D, Subpart 1(i) of the NPDES General Permit for Storm Water Discharges From Construction Activities.

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE	ARIZONA DEPARTMENT OF TRANSPORTATION INTERMODAL TRANSPORTATION DIVISION ROADWAY DESIGN SERVICES
DESIGN	JKE	09/00	
DRAWN	JKE	09/00	
CHECKED	JJZ	09/00	

HDR Engineering, Inc.

STORMWATER POLLUTION PREVENTION PLAN

ROUTE 202L LOCATION 56TH STREET - KYRENE R[illegible]

TRACS NO. H5416 OIC 202[illegible]00

DWG NO. E-1.01

___ OF ___

FILE: c:\windm\56-kyrene\ec508801.dgn
DATE: 31-Aug-00 10:10

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F.A.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			

TYPE INSTALLATION / QUANTITIES

Station	Plan Reference	Rock Berms Left	Rock Berms Right	Rock Berms Spacing (ft)	Rock Berms Height (ft)	Check Dams Left	Check Dams Right	Check Dams Spacing (ft)	Check Dams Depth (ft)	Cut & Fill Transitions Left	Cut & Fill Transitions Right	Straw Bales ◒ Left	Straw Bales ◒ Right	Straw Bales ◒ (Center)	Sediment Logs Left	Sediment Logs Right	Sediment Logs (Center)	Rock Mulch & Riprap Treatment End Sections Left	End Sections Right	Headwalls Left	Headwalls Right	Rock Berm CY	Check Dam CY	Cut & Fill Transitions CY	Straw Bales (Ea)	Sediment Logs (Ea)	Headwalls CY	REMARKS
SR202L Sta 2035+20.0														X	X	X								8	4			CB1,CB2,CB3 See Detail E1&E2
SR202L Sta 2038+50.0															X	X									4			CB4,CB6 See Detail E1
SR202L Sta 2041+80.0														X	X	X								8	4			CB7,CB8,CB9 See Detail E1&E2
SR202L Sta 2045+10.0															X	X									4			CB10,CB12 See Detail E1
SR202L Sta 2048+40.0														X	X	X								8	4			CB13,CB14,CB15 See Detail E1&E2
SR202L Sta 2051+70.0															X	X									4			CB16,CB18 See Detail E1
SR202L Sta 2055+00.0														X	X	X								8	4			CB19,CB20,CB21 See Detail E1&E2
SR202L Sta 2058+30.0															X	X									4			CB22,CB24 See Detail E1
SR202L Sta 2061+60.0														X	X	X								8	4			CB25,CB26,CB27 See Detail E1&E2
SR202L Sta 2065+50.0														X	X	X								8	4			CB28,CB29,CB30 See Detail E1&E2
SR202L Sta 2069+50.0															X	X									4			CB31,CB33 See Detail E1
SR202L Sta 2072+00.0															X	X									4			CB34,CB36 See Detail E1
SR202L Sta 2074+84.0															X	X									4			CB39,CB40 See Detail E1
SR202L Sta 2078+14.0															X	X									4			CB41,CB42 See Detail E1
SR202L Sta 2081+91.7														X	X	X								8	4			CB43,CB44,CB45 See Detail E1&E2
SR202L Sta 2085+34.0												X	X	X	X	X								24	8			CB48,CB49,CB50,CB64,CB65 See Detail E1&E2
SR202L Sta 2085+94.0														X	X	X								8	8			CB51,CB52,CB53 See Detail E1&E2
SR202L Sta 2089+24.0															X	X									4			CB54,CB55 See Detail E1
SR202L Sta 2092+54.0															X	X									4			CB56,CB57 See Detail E1
SR202L Sta 2095+84.0															X	X									4			CB59,CB60 See Detail E1
Ramp A Sta 7+31.6												X			X									8	6			CB35,CB38 See Detail E1&E2
Ramp B Sta 9+61.0													X			X								8	6			CB32,CB37 See Detail E1&E2
Ramp B Sta 12+00.0															X										2			CB46 See Detail E1
Ramp C Sta 13+82.0												X			X									8	6			CB58,CB68 See Detail E1&E2
Ramp D Sta 11+69.2													X			X								8	6			CB61,CB69 See Detail E1&E2
Kyrene Rd Sta 15+30.2																X									4			CB105 See Detail E1
Kyrene Rd Sta 16+34.3															X										2			CB104 See Detail E1
Kyrene Rd Sta 18+19.2																X									2			CB101 See Detail E1
Kyrene Rd Sta 18+45.5															X										2			CB100 See Detail E1
Kyrene Rd Sta 21+56.0																X									2			CB102 See Detail E1
Kyrene Rd Sta 21+75.2															X										2			CB103 See Detail E1
Kyrene Rd Sta 24+36.6																X									2			CB107 See Detail E1
Kyrene Rd Sta 24+45.3															X										2			CB106 See Detail E1

STB - Straw Bales
SB - Sand Bags
RM Rock Mulch

RM / E-3 Reference Letter RB Correspond To The Type Of Installation In Squares On PLAN SHEETS.

NOTES:
The Placement of all Erosion Control Devices Listed Above Will Be Subject To Change.

◒ Placement of Straw Bales to be Determined by the Field Engineer. And May Be Adjusted By The Field Engineer.

■ Maximum Height Of Twelve (12") Inches Unless otherwise specified.

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
TRAFFIC DESIGN SERVICES

EROSION CONTROL
SUMMARY SHEET

ROUTE	LOCATION	
202L	56TH STREET - KYRENE ROAD	
TRACS NO. H5416 01C		202 C 500

DWG NO. E-1.02
___ OF ___

602-263-1100

FILE: c:\windm\56-kyrene\es508801.dgn
DATE: 31-Aug-00 10:12

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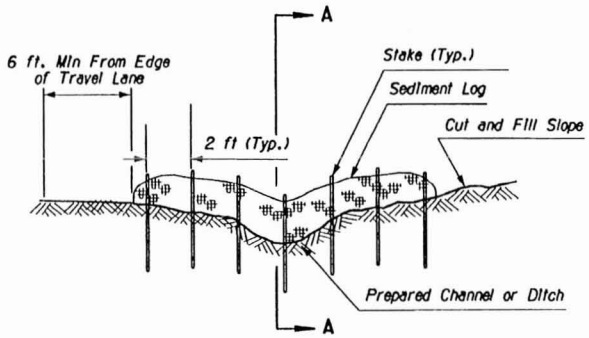
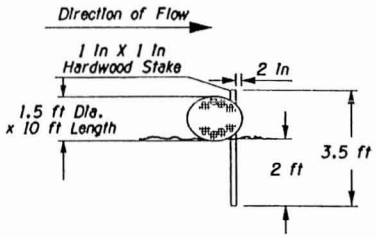
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



SEDIMENT LOGS SECTION



SECTION A-A

NOTES

Sediment logs shall be located at roadway edge catch basins as indicated in plans or as directed by the Engineer.

Stake with 1 In X 3.5 ft min. hardwood stakes on 2 ft centers. The stake shall be placed through the downstream side only 2 In max. into the log. It is only necessary for the stakes to grab 1 or 2 In of the netting. Do not drive the stakes through the center of the log. The stakes must be driven into the ground 2 ft.

Make sure no gaps exist between the soil and the sediment logs.

Repair any rills or gullies promptly.

In rock conditions the Engineer will evaluate the placement of erosion control.

DETAIL E1

SEDIMENT LOGS

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JKE	09/00
DRAWN	DLW	09/00
CHECKED	JJZ	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SEDIMENT LOGS
DETAIL E1

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE RO

TRACS NO. H5416 01C

202 00

DWG NO. E-1.03

___ OF ___

263-1100

FILE: C:\MNDW\56-KYRENE\E0508803.DGN
DATE: 01-Sep-00 09:52

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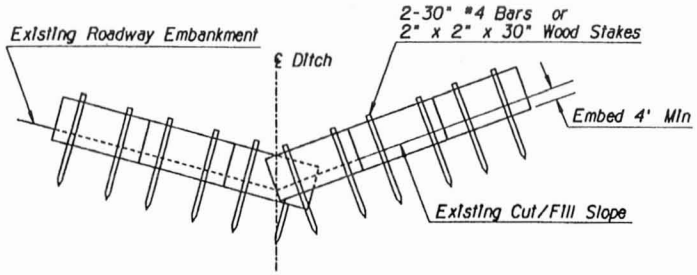
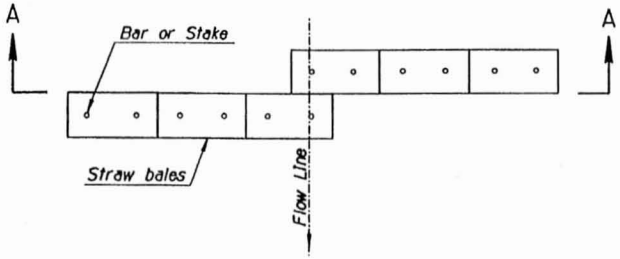
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			

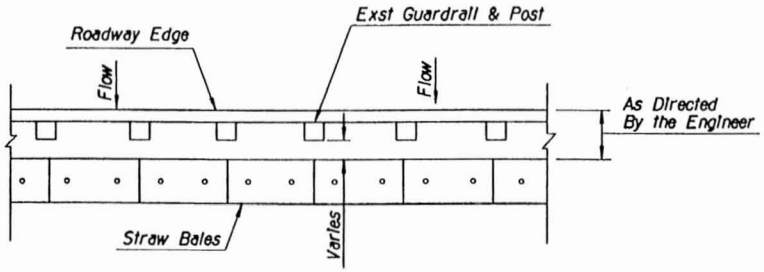


SECTION A-A



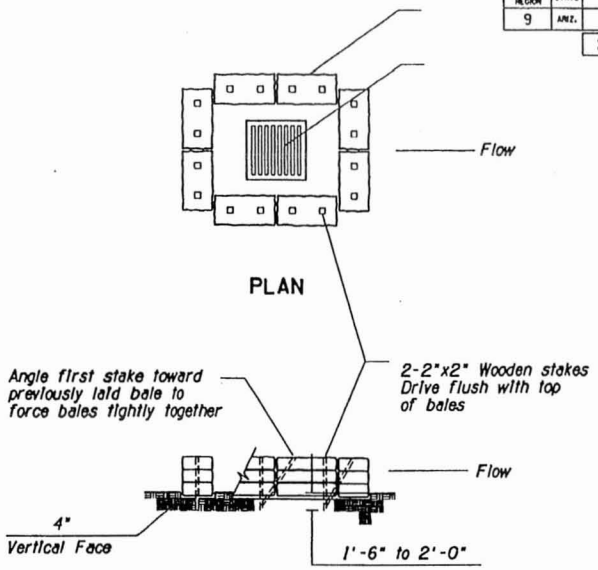
PLAN VIEW

STRAW BALES IN DITCH



PLAN VIEW

STRAW BALES AT ROADWAY EDGE



STRAW BALE BARRIER AT AREA INLETS

GENERAL NOTES:

Straw Bales Shall be Placed at all Area Inlet Catch Basins as Indicated in the Plans or as Directed by the Engineer.

Bales Shall Be Placed Together as Shown and at Right Angles to the Direction of Flow. They Should Be Placed Far Enough up the Ditch to Prevent Erosion Around Ends.

Stakes Shall Be Battered in the Opposite Direction.

All Erosion Control Materials are to be Available On Site For Immediate Installation Prior to any Ground Disturbing Activities.

DETAIL E2

STRAW BALE DETAILS

100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN	JJZ	09/00
DRAWN	DLW	09/00
CHECKED	JKE	09/00

HDR Engineering, Inc.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SWPPP
DETAIL E2

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C | 202 C 500

DWG NO. E-1.04

___ OF ___

263-1100

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DATE: 01-Sep-00 09:53

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APPENDIX B - Off-Site Hydrologic Model

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN   1998               *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   09MAY99  TIME  12:20:32  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X       X     X        XX
X     X  X       X               X
XXXXXXX  XXXX    X        XXXXX  X
X     X  X       X               X
X     X  X       X     X         X
X     X  XXXXXXX   XXXXX        XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID        FN: SEVRDS3A.DAT  May 1999        ADAPTED FROM SVRD05~2.DAT  (HDR 5/98)
  2           ID        This model has one revision from the previous model. The previous model
  3           ID        is separated into two models for the routing of the Basin B complex.
  4           ID        The outflow hydrograph from the Basin B routing is the inflow for the
  5           ID        SEVRDS3B.DAT model downstream of the basin complex to the Gila Floodway.
  6           ID        ***********************************************************************
  7           ID        FN: SVRD05~2.DAT  May 1998        ADAPTED FROM SEVRDS.DAT (HDR 4/97)
  8           ID        This model has two revisions from the previous model.
  9           ID        1. Revised BASIN B and Outlet Channel routings to accomodate P-MIP
 10           ID           project overflows from the Gila Drain as described below.
 11           ID        2. Revised Basin 15 from detention to retention so that flows will not
 12           ID           bypassed to the SEVRDS Channel during the event. See more below.
 13           ID        ***********************************************************************
 14           ID        HISTORY THIS MODEL:   This model is a modification of ALT2c.DAT
 15           ID        developed by HDR for the Alternative Study for SEVRDS by HDR in
 16           ID        June 1995. SMF48TH.DAT(PRICE5) on the West side of I-10 was included.
 17           ID        GILA1B.DAT(Gila Drain Floodway Model) was also included in this model.
 18           ID        ALT2c was a composite of HEC1 models from Price GEC Gila Drain Alternati
 19           ID        Drainage Report,HDR,Feb 1993(Price/Santan/Gila Drain GILADRY.DAT model),
 20           ID        South Mountain Freeway Concept Drainage Report, HDR, Feb 1993,(Segment V
 21           ID        PRICE5.DAT model modified to SMF48th.DAT described below), and Gila
 22           ID        Drain Floodway Master Plan Report, Feb 1993(GILA1B.DAT model).  The
 23           ID        original model was developed for the Price Freeway drainage system as
 24           ID        reported in "Hydrology Study: Price Expressway", ADOT Contract 88-24,
 25           ID        Dec. 1989.  The model criteria is provided in that report.  The basic
 26           ID        model has not changed since 1989. The model continues to be the model
 27           ID        record because the model was used to design the upper part of the
 28           ID        SEVRDS/Santan Channel system on Price Freeway for the Galveston to Frye
 29           ID        Interim Project which included construction of Basin G and the outlet to
 30           ID        the Santan Channel.
 31           ID        ***********************************************************************
 32           ID        BASIN B DESIGN. Basin B was configured as a bypass basin in 1993. With
 33           ID        the formation of SEVRDS, the Basin was reconfigured as a multi-celled
 34           ID        basin with first flush containment cell, a treatment cell and a large
 35           ID        retention cell to capture flows above 800 cfs.("Initial Drainage Report
 36           ID        Santan Freeway:56th St to Price Rd and Gila Drain Floodway to Basin B,"
 37           ID        Wood Patel & Assoc., Sept. 12, 1996.)
 38           ID        HDR prepared a detailed design of the Basin B complex in Feb. 1997.
 39           ID        The size of Basin B was increased from 385(9/96) to 450 af to limit bypa
 40           ID        flows to 900 cfs. This operation maximized the available storage on-site
 41           ID        and required moving the outlet channel to the west side of the Gila
 42           ID        Drain.  This most recent model further optimized storage on site in
 43           ID        in Basin B to limit bypass flows to 800 cfs to allow Gila Drain
 44           ID        flows of up to 150 cfs to enter the outfall channel at the GRIC boundary
 45           ID
 46           ID        Basin B site has three basins: 1.First flush equalization/sedimentation
 47           ID        basin stores first 39 ac-ft of inflow into system.  2. A two-celled Watr
 48           ID        Quality Basin treats the first-flush post-event. This basin is not
 49           ID        included in the model. 3. An off-line retention basin, Basin B, has a
 50           ID        capacity of 450 ac-ft.  Operation: The first flush is conveyed in the
 51           ID        Forebay Channel to Eq. Basin. Additional flow up to 804 cfs is bypassed
 52           ID        thru 3-10x4 control RCB to Outfall Chan.  At about 600 cfs, flow begins
 53           ID        to spill over Basin B weir.  At 100-yr peak of 2895 cfs, 804 cfs is
 54           ID        discharging to RCB and 2091 cfs is overflowing 1000' weir into Basin B
 55           ID        ***********************************************************************
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  56          ID        SMF48th.DAT Model of the area west of I-10 was significantly
  57          ID        changed in Feb. 1996 for the 48th St. ID study for Phoenix, including
  58          ID        the reconfiguration of Basin 15 as a retention basin as mentioned above.
  59          ID        A future connection of the 48th St.-Basin 15 to SEVRDS would be a pipe
  60          ID        to dewater Basin 15 post-event.  Basin 15 will not increase design
  61          ID        discharge of the SEVRDS Channel during the event.
  62          ID        ***********************************************************************
  63          ID
  64          ID
  65          ID        INITIAL ABSTRACTION USED TO REPRESENT DEVELOPMENT RETENTION PROVIDED
  66          ID        100 YEAR - 24 HOUR STORM
  67          ID        DMJM - PHOENIX
  68          ID        FILENAME: SEVRDS3A.DAT
  69          IT      5                    1000
  70          IO      5
  71          IN     12                     310
              *DIAGRAM

  72          KK    bash
  73          KM        OFFSITE INFLOW INTO BASIN H AT PRICE AND PECOS INTERCHANGE FROM E
  74          BA    6.76
  75          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
  76          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
  77          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
  78          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
  79          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.01    0.04    0.10
  80          QI    0.39    0.64    0.98    1.43    2.00    2.72    3.65    4.88    6.57
  81          QI   17.35   40.17   84.15  157.71  255.02  413.77  498.78  738.94  766.73
  82          QI  651.16  578.19  513.98  461.77  419.16  385.17  357.03  332.76  310.86
  83          QI  273.04  257.39  243.47  230.94  219.41  208.60  198.28  188.77  180.16
  84          QI  266.57  267.73  269.41  275.07  284.98  292.73  296.44  298.71  300.62
  85          QI  305.48  308.84  312.78  317.34  322.46  327.76  332.81  337.94  343.13
  86          QI  352.29  356.32  360.03  363.42  366.42  368.99  371.12  372.80  374.07
  87          QI  375.45  375.48  374.63  372.22  368.09  362.92  357.28  351.35  345.22
  88          QI  333.55  328.09  322.75  317.35  311.81  306.05  300.07  293.86  287.41
  89          QI  273.87  266.79  259.39  251.92  244.89  238.17  231.52  225.00  218.58
  90          QI  206.10  200.05  194.15  188.41  182.85  177.47  172.30  167.36  162.81
  91          QI  156.68  155.31  154.12  152.82  151.49  150.11  148.70  147.25  145.78
  92          QI  142.82  141.38  139.94  138.43  136.93  135.42  133.94  132.46  131.00
  93          QI  128.13  126.72  125.34  123.98  122.65  121.34  120.07  118.96  118.33
  94          QI  118.07  118.01  117.94  117.88  117.82  117.76  117.70  117.64  117.57
  95          QI  117.44  117.38  117.32  117.25  117.19  117.12  117.05  116.99  116.92
  96          QI  116.79  116.72  116.65  116.58  116.51  116.44  116.37  116.30  116.23
  97          QI  116.09  116.02  115.95  115.88  115.81  115.74  115.67  115.60  115.53
  98          QI  115.38  115.31  115.24  115.17  115.09  114.99  114.83  114.61  114.38
  99          QI  113.91  113.68  113.45  113.22  112.99   57.77   57.54   57.32   57.09
 100          QI   56.65   56.43   56.21   55.99   55.77   55.56   55.34   55.12   54.91
 101          QI   54.49   54.28   54.07   53.86   53.65   53.44   53.24   53.03   52.83
 102          QI   52.43   52.23   52.03   51.83   51.63   51.43   51.24   51.04   50.85
 103          QI   50.45   50.24   50.02   49.79   49.55   49.31   49.06   48.80   48.54
 104          QI   48.00   47.72   47.44   47.16   46.88   46.59   46.30   46.01   45.73
              *
 105          IN     12                     310
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 106          KK  CHNDLR
 107          KM        Pumped outflow from Chandler Basins (Galveston, Arrowhead and Denv
 108          BA   0.001
 109          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 110          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 111          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 112          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 113          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 114          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 115          QI    0.00    0.00    0.00    0.00    0.00   100.0   100.0   100.0   100.0
 116          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.
 117          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 118          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 119          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 120          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 121          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 122          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 123          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 124          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 125          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 126          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 127          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 128          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 129          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 130          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 131          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 132          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 133          QI   100.0   100.0   100.0   100.0   100.0    0.00    0.00    0.00    0.00
 134          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 135          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 136          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 137          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 138          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 139          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
              *

 140          KK  cchand
 141          KM        Combine flow from regional basins with offsite flows at old basin
 142          HC       2
              *
 143          IN       5                        300

 144          KK  interchange inflow
 145          KM        ONSITE DRAINAGE/STORAGE ANALYSIS -50 YEAR 24 HOUR STORM
 146          KM        USE OUTFLOW HYDROGRAPH FROM THE PRICE/SANTAN INTERCHANGE
 147          BA    0.16
 148          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 149          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 150          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 151          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 152          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 153          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 154          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 155          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 156          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
 157          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.
 158          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.
 159          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.
 160          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.
 161          QI     0.00     0.00     0.00     0.00     0.00     0.00    40.00    40.00    40.00     0.
 162          QI     0.00     0.00     0.00    40.00   120.00   120.00   200.00   200.00   200.00   200.
 163          QI   200.00   200.00   200.00   200.00   200.00   200.00     0.00     0.00     0.00     0.
 164          QI     0.00     0.00    40.00    40.00    40.00     0.00     0.00     0.00     0.00     0.
 165          QI     0.00     0.00     0.00     0.00    40.00    40.00    40.00     0.00     0.00     0.
 166          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.
 167          QI    40.00    40.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.
 168          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.
 169          QI     0.00    40.00    40.00     0.00     0.00     0.00     0.00     0.00     0.00     0.
 170          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.
 171          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.
 172          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.
 173          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.
 174          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.
 175          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.
 176          QI     0.00     0.00     0.00    40.00    40.00     0.00     0.00     0.00     0.00     0.
 177          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.
              *

 178          KK   addTI
 179          KM        Combine onsite p.s. outflow to offsite runoff from east
 180          HC       2
 181          IN      12                      310

 182          KK    basg
 183          KM        INFLOW INTO PRICE BASIN G FROM EAST
 184          BA    4.37
 185          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.
 186          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.
 187          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.
 188          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.
 189          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.
 190          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.01     0.04     0.17     0.
 191          QI     4.27    23.63    65.05   129.91   189.65   223.82   228.38   209.70   175.27   397.
 192          QI   954.28   905.32   843.40   750.42   650.70   561.76   486.59   424.50   372.86   329.
 193          QI   293.55   262.86   236.31   213.14   192.75   174.77   159.23   145.96   134.73   125.
 194          QI   116.85   109.70   103.63    98.58    94.39    90.95    88.07    85.64    83.62    82.
 195          QI    80.98    80.17    79.47    78.77    78.01    77.18    76.25    75.24    74.12    72.
 196          QI    71.75    70.55    69.36    68.18    67.03    65.90    64.80    63.73    62.69    61.
 197          QI    60.70    59.62    58.31    56.55    54.32    51.67    48.71    45.61    42.47    39.
 198          QI    35.68    32.14    28.66    25.32    22.21    19.38    16.87    14.65    12.72    11.
 199          QI     9.58     8.32     7.25     6.33     5.55     4.90     4.32     3.81     3.37     2.
 200          QI     2.60     2.32     2.07     1.85     1.66     1.48     1.33     1.20     1.08     0.
 201          QI     0.88     0.80     0.72     0.65     0.59     0.54     0.49     0.45     0.41     0.
 202          QI     0.34     0.31     0.28     0.26     0.24     0.22     0.20     0.19     0.17     0.
 203          QI     0.14     0.13     0.12     0.11     0.11     0.10     0.09     0.08     0.08     0.
 204          QI     0.07     0.06     0.06     0.05     0.05     0.05     0.04     0.04     0.04     0.
 205          QI     0.03     0.03     0.03     0.03     0.02     0.02     0.02     0.02     0.02     0.
 206          QI     0.02     0.02     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.
 207          QI     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.01     0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 208          QI    0.01    0.01    0.01    0.00    0.00    0.00    0.00    0.00    0.00    0.
 209          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
 210          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
 211          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
 212          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
 213          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
 214          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
 215          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
              *

 216          KK   rbasg
 217          KM        ROUTE OFFSITE FLOW INTO FROM EAST OF REGIONAL BASIN G
 218          KM        72 INCH GRAVITY LINE OUTFLOW TO Price/Pecos TI down WFR
 219          RS       1    ELEV     0.0
 220          SV     0.0    19.1    75.2    98.2   161.2
 221          SE    1174    1176    1179    1180    1183
 222          SQ     0.0      45     155     180     245
              *
              *

 223          KK  rtbasg  90-inch to 96-inch basin G drain
 224          RK    6301  .00060    .012            circ     7.5
              *

 225          KK  cinterchange
 226          KM        COMBINE ONSITE and offsite FLOWS TO TI and from Basin G.
 227          KM        Combined discharge to outfall to Santan collector channel to west.
 228          HC       2

 229          KK  MCSWL2
 230          KM        CHANDLER - AGRICULTURAL (PART SECTION 36)
 231          KM        COMPUTE RUNOFF HYDROGRAPH FOR AGRICULTURAL AREA
 232          PH       1   18.38    0.71    1.39    2.44    2.66    2.81    3.11    3.33    3.70
 233          BA  0.1550
 234          LS     1.5      83
 235          UD    0.88

 236          KK   cbash
 237          KM        COMBINE BASIN H OUTFLOW WITH LOCAL DRAINAGE AREA
 238          HC       2

 239          KK     RT1
 240          KM        ROUTE MCSWL2 HYDROGRAPH TO MCSWL3 CONFLUENCE
 241          RK    1600  .00200   0.016            TRAP     0.0    25.0

 242          KK  MCSWL3
 243          KM        CHANDLER - AGRICULTURAL  (PART SECTION 36)
 244          KM        COMPUTE RUNOFF HYDROGRAPH FOR AGRICULTURAL AREA
 245          BA  0.1700
 246          LS     1.5      83
 247          UD    0.91
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 248          KK   COMB1
 249          KM        COMBINE MCSWL3 - AT HALF-MILE POINT OF SECTION 36
 250          KM        THIS COMBINE FOR INFO. ONLY, SHOULD BE XX CFS AT THIS POINT
 251          HC       2

 252          KK  SECT25
 253          KM       CHANDLER
 254          KM       COMPUTE RUNOFF FOR SECTION 25
 255          PH       1   18.38    0.71    1.39    2.44    2.66    2.81    3.11    3.33    3.70
 256          BA    1.00
 257          LS    1.81      84
 258          UD    0.91

 259          KK     RT1
 260          KM       ROUTE SECTION 25 HYDROGRAPH TO OUTLET-A(OLD) - SW CORNER SECT. 36
 261          RK    4400  0.0011   0.016            TRAP     0.0    25.0

 262          KK  SECT36
 263          KM       CHANDLER
 264          KM       COMPUTE RUNOFF HYDROGRAPH FOR remainder of SECTION 36
 265          KM       This area reduced 0.32 to account for areas MCSLW2 and MCSLW3, areas
 266          KM       calculated separately in original analysis - now included in flow logic.
 267          BA    0.51
 268          LS    1.95      84
 269          UD    0.94

 270          KK  SECT36
 271          KM       COMBINE RT1 - SECT36 HYDROGRAPHS TO GIVE HYDROGRAPH AT SW COR SECT. 36
 272          HC       3
 273          IN       5                    300

 274          KK  mcclintock
 275          KM        ONSITE DRAINAGE/STORAGE ANALYSIS 50 YEAR 24 HOUR STORM
 276          KM        USE PUMP STATION 'OUTFLOW' HYDROGRAPH FROM MCCLIN4.DAT ONSITE FILE
 277          KM        PUMP STATION DESIGN Q IS 200 CFS.
 278          BA    0.11
 279          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 280          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 281          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 282          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 283          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 284          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 285          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 286          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 287          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 288          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 289          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 290          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 291          QI    0.00    0.00    0.00    0.00    0.00    0.00   40.00    0.00    0.00    0.00
 292          QI    0.00    0.00    0.00    0.00   40.00    0.00    0.00    0.00    0.00    0.00
 293          QI   40.00   40.00    0.00  120.00    0.00  200.00  200.00  200.00  200.00  200.00
 294          QI  200.00  200.00    0.00    0.00  120.00    0.00    0.00    0.00   40.00    0.00
 295          QI    0.00    0.00   40.00    0.00    0.00    0.00    0.00   40.00    0.00    0.00
 296          QI    0.00    0.00   40.00    0.00    0.00    0.00    0.00    0.00    0.00   40.00
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 297          QI    0.00    0.00    0.00    0.00    0.00   40.00    0.00    0.00    0.00    0.00
 298          QI    0.00    0.00    0.00   40.00    0.00    0.00    0.00    0.00    0.00    0.00
 299          QI    0.00    0.00   40.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 300          QI    0.00    0.00   40.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 301          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 302          QI   40.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 303          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 304          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 305          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00   40.00    0.00
 306          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 307          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 308          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00

 309          KK   cmcln
 310          HC       2

 311          KK  RT2536
 312          KM       ROUTE TO MID-SECTION POINT OF SECT. 35
 313          RK    2600    .008    .016            TRAP     9.5       2

 314          KK  RUSWL1
 315          KM        CHANDLER - COMMERCIAL (PART SECTION 35)
 316          KM        COMPUTE RUNOFF HYDROGRAPH FOR COMMERCIAL AREA
 317          BA  0.2145
 318          LS     3.0      92
 319          UD    0.45

 320          KK     RT1
 321          KM        ROUTE RUSWL1 HYDROGRAPH TO RUSWL3 CONFLUENCE
 322          RK    1200  .00330   0.016            TRAP     0.0    25.0

 323          KK  RUSWL2
 324          KM        CHANDLER - RESIDENTIAL - 0.16 (OLD) PART SECTION 35
 325          KM        COMPUTE RUNOFF HYDROGRAPH FOR RESIDENTIAL AREA
 326          BA  0.0933
 327          LS     2.9      84
 328          UD    0.51

 329          KK     RT2
 330          KM        ROUTE RUSWL2 HYDROGRAPH TO RUSWL3 CONFLUENCE
 331          RK    1800  .00330   0.016            TRAP     0.0    25.0

 332          KK  RUSWL3
 333          KM        CHANDLER - AGRICULTURAL  (PART SECTION 35)
 334          KM        COMPUTE RUNOFF HYDROGRAPH FOR AGRICULTURAL AREA
 335          BA  0.0990
 336          LS     1.5      83
 337          UD    0.57

 338          KK   COMB1
 339          HC       4
```

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 340          KK     RT3
 341          KM        ROUTE COMB1 HYDROGRAPH TO SW COR. SECT. 35 (PLUS 1000 FT. WEST)
 342          RK    3600  .00800   0.016            TRAP     9.5     2.0

 343          KK  RUSWL4
 344          KM        CHANDLER - RESIDENTIAL - 0.16 (PART SECTION 34 AND 35)
 345          KM        COMPUTE RUNOFF HYDROGRAPH FOR RESIDENTIAL AREA
 346          BA   .1638
 347          LS    2.90      84
 348          UD    0.48

 349          KK  RUSWL5
 350          KM        CHANDLER - OPEN FIELD  (PART SECTION 34 AND 35)
 351          KM        COMPUTE RUNOFF HYDROGRAPH FOR OPEN FIELD
 352          BA  0.0890
 353          LS    1.00      83
 354          UD    0.39

 355          KK     RT4
 356          KM        ROUTE RUSWL5 HYDROGRAPH TO OUTLET
 357          RK    1000  .00330   0.016            TRAP     0.0    25.0

 358          KK  RUSWL6
 359          KM        CHANDLER - RESIDENTIAL - 0.16  (PART SECTION 34 AND 35)
 360          KM        COMPUTE RUNOFF HYDROGRAPH FOR RESIDENTIAL AREA
 361          BA  0.1464
 362          LS     2.9      84
 363          UD    0.34

 364          KK   COMB2
 365          HC       3

 366          KK     RT5
 367          KM        ROUTE COMB2 HYDROGRAPH TO OUTLET
 368          RK    1400  .00330   0.016            TRAP     0.0    25.0

 369          KK  RUSWL7
 370          KM        CHANDLER - RESIDENTIAL - 0.16  (PART SECTION 34 AND 35)
 371          KM        COMPUTE RUNOFF HYDROGRAPH FOR RESIDENTIAL AREA
 372          BA   .1281
 373          LS    2.90      84
 374          UD    0.34

 375          KK  RUSWL8
 376          KM        CHANDLER - PARK/SCHOOL (PART SECTION 34 AND 35)
 377          KM        COMPUTE RUNOFF HYDROGRAPH FOR PARK/SCHOOL
 378          BA  0.0628
 379          LS       0      64
 380          UD    0.22
```

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  381         KK  RUSWL9
  382         KM        CHANDLER - AGRICULTURAL  (PART SECTION 34 AND 35)
  383         KM        COMPUTE RUNOFF HYDROGRAPH FOR AGRICULTURAL AREA
  384         BA  0.0961
  385         LS    1.5      83
  386         UD   0.23

  387         KK   SW34
  388         HC      5

  389         KK   RT35
  390         KM        ROUTE TO BOTTOM OF SECTION 34
  391         RK   4000   .0013    .016            TRAP      10     2.0

  392         KK   SECT9
  393         KM       TEMPE (TO OLD OUTLET B)
  394         KM       COMPUTE RUNOFF FOR SECTION 9
  395         BA   0.33
  396         LS   1.94      83
  397         UD   0.44

  398         KK  SECT10   OUTLET 3
  399         KM       TEMPE
  400         KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 10 - OUTLET 3
  401         BA   0.03
  402         LS   1.50      83
  403         UD   0.92

  404         KK  SECT10   OUTLET 2
  405         KM       TEMPE
  406         KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 10 - OUTLET 2
  407         BA   0.19
  408         LS   2.25      88
  409         UD   0.53

  410         KK    RT1
  411         KM       ROUTE SECTION 10 OUTLET 2 HYDROGRAPH TO KYRENE/ELLIOT INTERSECTION
  412         RK   2100  0.0010   0.016            TRAP     0.0    25.0

  413         KK   COMB1
  414         KM       COMBINE SECT9 * SECT10-3 * RT1 TO GIVE HYDROGRAPH AT KYRENE/ELLIOT
  415         HC       3

  416         KK    RT2
  417         KM       ROUTE COMB1 HYDROGRAPH TO KYRENE/WARNER INTERSECTION
  418         RK   5280  0.0004   0.016            TRAP     0.0    25.0

  419         KK  SECT16   OUTLET 1
  420         KM       TEMPE
  421         KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 16 - OUTLET 1
  422         BA   0.14
  423         LS   1.54      83
  424         UD   0.41
```

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 425          KK  SECT15   OUTLET 2
 426          KM       TEMPE
 427          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 15 - OUTLET 2
 428          BA    0.31
 429          LS    1.45      83
 430          UD    0.98

 431          KK   COMB2
 432          KM       COMBINE RT2 * SECT16-1 * SECT15-2 TO GIVE HYDROGRAPH AT KYRENE/WARNER
 433          HC       3

 434          KK     RT3
 435          KM       ROUTE COMB2 HYDROGRAPH TO KYRENE/RAY INTERSECTION
 436          RK    5280  0.0020   0.016            TRAP     0.0    25.0

 437          KK  SECT21   OUTLET 1
 438          KM       TEMPE
 439          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 21 - OUTLET 1
 440          BA    0.42
 441          LS    1.41      83
 442          UD    0.61

 443          KK  SECT22   OUTLET 1
 444          KM       TEMPE
 445          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 22 - OUTLET 1
 446          BA    0.82
 447          LS    2.26      83
 448          UD    0.38

 449          KK   COMB3
 450          KM       COMBINE RT3 * SECT21-1 * SECT22-1 TO GIVE HYDROGRAPH AT KYRENE/RAY
 451          HC       3

 452          KK     RT4
 453          KM       ROUTE COMB3 HYDROGRAPH TO KYRENE/CHANDLER INTERSECTION
 454          RK    5280  0.0019   0.016            TRAP     0.0    25.0

 455          KK  SECT12
 456          KM       TEMPE
 457          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 12
 458          BA    0.50
 459          LS    3.00      83
 460          UD    0.58

 461          KK     RT5
 462          KM       ROUTE SECT12 HYDROGRAPH TO SECT11 CONFLUENCE
 463          RK    2600  0.0006   0.016            TRAP     0.0    25.0

 464          KK  SECT11
 465          KM       TEMPE
 466          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 11
 467          BA    0.51
 468          LS    2.41      86
 469          UD    0.71
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  470         KK   COMB4
  471         KM       COMBINE SECT12 * SECT11 HYDROGRAPHS
  472         HC       2

  473         KK     RT6
  474         KM       ROUTE COMB4 HYDROGRAPH TO RURAL/ELLIOT INTERSECTION
  475         RK    2600  0.0006   0.016            TRAP     0.0    25.0

  476         KK  SECT10   OUTLET 1
  477         KM       TEMPE
  478         KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 10 - OUTLET 1
  479         BA    0.50
  480         LS    2.41      84
  481         UD    0.36

  482         KK   COMB5
  483         KM       COMBINE SECT10-1 * RT6 HYDROGRAPHS
  484         HC       2

  485         KK     RT7
  486         KM       ROUTE COMB5 HYDROGRAPH TO RURAL/WARNER INTERSECTION
  487         RK    5280  0.0006   0.016            TRAP     0.0    25.0

  488         KK  SECT13
  489         KM       TEMPE
  490         KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 13
  491         BA    1.00
  492         LS    2.72      88
  493         UD    0.32

  494         KK     RT8
  495         KM       ROUTE SECT13 HYDROGRAPH TO RURAL/WARNER INTERSECTION
  496         RK    5280  0.0009   0.016            TRAP     0.0    25.0

  497         KK  SECT14
  498         KM       TEMPE
  499         KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 14
  500         BA    1.00
  501         LS    2.83    75.7
  502         UD    0.75

  503         KK  SECT15   OUTLET 1
  504         KM       TEMPE
  505         KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 15 - OUTLET 1
  506         BA    0.69
  507         LS    2.18      81
  508         UD    0.82

  509         KK   COMB6
  510         KM       COMBINE RT7 * RT8 * SECT14 * SECT15-1 TO GIVE HYDROGRAPH AT
  511         KM       RURAL/CHANDLER INTERSECTION
  512         HC       4
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 513          KK     RT9
 514          KM       ROUTE COMB6 HYDROGRAPH TO RURAL/CHANDLER INTERSECTION
 515          RK    5280  0.0006   0.016            TRAP     0.0    25.0

 516          KK  SECT24
 517          KM       TEMPE
 518          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 24
 519          BA    1.00
 520          LS    2.77      83
 521          UD    0.60

 522          KK    RT10
 523          KM       ROUTE SECT24 HYDROGRAPH TO SECT23 CONFLUENCE
 524          RK    5280  0.0011   0.016            TRAP     0.0    25.0

 525          KK  SECT23
 526          KM       TEMPE
 527          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 23
 528          BA    1.00
 529          LS    2.97      83
 530          UD    0.78

 531          KK  SECT22   OUTLET 2
 532          KM       TEMPE
 533          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 22 - OUTLET 2
 534          BA    0.13
 535          LS    1.45      83
 536          UD    0.33

 537          KK   COMB7
 538          KM       COMBINE RT9 * RT10 * SECT22-2 * SECT23 TO GIVE HYDROGRAPH AT
 539          KM       RURAL/RAY INTERSECTION
 540          HC       4

 541          KK    RT11
 542          KM       ROUTE COMB7 HYDROGRAPH TO RURAL/CHANDLER INTERSECTION
 543          RK    5280  0.0009   0.016            TRAP     0.0    25.0

 544          KK  SECT26
 545          KM       CHANDLER
 546          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 26
 547          BA    1.00
 548          LS    1.82      85
 549          UD    0.96

 550          KK   COMB8
 551          KM       COMBINE RT11 * SECT26
 552          HC       2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 553          KK    RT12
 554          KM       ROUTE COMB8 HYDROGRAPH TO KYRENE/CHANDLER INTERSECTION
 555          RK    5280  0.0009   0.016            TRAP     0.0    25.0

 556          KK  SECT28   OUTLET 1
 557          KM       CHANDLER
 558          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 28 - OUTLET 1
 559          BA    0.69
 560          LS    2.51      85
 561          UD    0.35

 562          KK  SECT27
 563          KM       CHANDLER
 564          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 27
 565          BA    1.00
 566          LS    2.18      88
 567          UD    1.38

 568          KK   COMB9
 569          KM       COMBINE SECT27 * RT13 * RT12 * RT4 TO GIVE HYDROGRAPH AT
 570          KM       KYRENE/CHANDLER INTERSECTION
 571          HC       4

 572          KK    RT13
 573          KM       ROUTE COMB9 HYDROGRAPH TO KYRENE/SOUTHWEST LOOP INTERSECTION
 574          RK    4000  0.0006   0.016            TRAP     0.0    25.0

 575          KK  SECT34
 576          KM       CHANDLER
 577          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 34
 578          BA    0.67
 579          LS    2.04      83
 580          UD    1.05

 581          KK   COMBB
 582          KM        COMBINE HYDROGRAPHS AT SW CORNER SECTION 34 (INCL. 35,36,25)
 583          HC       3

 584          KK  SECT33   OUTLET 2
 585          KM       CHANDLER
 586          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 33 - OUTLET 2
 587          BA    0.26
 588          LS    1.53      86
 589          UD    0.54
              *
              * IN     5                    300
              * ***************************************************************************
              *        Note: Kyrene Pump Station removed from routing.  Pump Station pumps
              *        directly to Equalization Basin.
              * ***************************************************************************
              * KKkyrene
              * KM       ONSITE DRAINAGE/STORAGE ANALYSIS 50 YEAR 24 HOUR STORM
              * KM       USE PUMP STATION 'INFLOW' HYDROGRAPH FROM KYRENE2.DAT ONSITE FILE
              * KM       PUMP STATION DESIGN Q IS 200 CFS.
              * BA  0.11
              * QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
              * QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
              * QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
              * QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
              * QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
              * QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
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* QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0
* QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
* QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
* QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
* QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
* QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00     1.0     1.0     1
* QI  1.00    1.00    1.00    1.00    1.00    1.00    2.00    2.00    2.00    2.
* QI  2.00    3.00    3.00    3.00    4.00    4.00    4.00    5.00    5.00    6.
* QI  9.00   14.00   22.00   34.00   54.00   94.00  159.00  209.00  216.00  188.
* QI150.00  116.00   88.00   65.00   47.00   35.00   26.00   20.00   17.00   14.
* QI 12.00   11.00   11.00   10.00    9.00    9.00    8.00    8.00    8.00    7.
* QI  7.00    7.00    6.00    6.00    6.00    6.00    6.00    5.00    5.00    5.
* QI  5.00    5.00    5.00    5.00    4.00    4.00    4.00    4.00    4.00    4.
* QI  3.00    3.00    3.00    3.00    3.00    3.00    3.00    3.00    3.00    3.
* QI  3.00    3.00    3.00    3.00    3.00    3.00    3.00    3.00    3.00    2.
* QI  2.00    2.00    2.00    2.00    2.00    2.00    2.00    2.00    2.00    2.
* QI  2.00    1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.
* QI  1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.
* QI  1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.
* QI  1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.
* QI  1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.00    0.00    0.
* QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
* QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
* QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
*
* KK ckyre
* HC     2
*
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 590          KK   COMBB
 591          KM        COMBINE HYDROGRAPHS AT BASIN B FROM AREAS TO THE EAST
 592          HC       2

 593          KK  SECT16   OUTLET 3
 594          KM       TEMPE
 595          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 16 - OUTLET 3
 596          BA    0.23
 597          LS    3.00      88
 598          UD    0.39

 599          KK     RT1
 600          KM       ROUTE SECTION 16 OUTLET 3 HYDROGRAPH TO 56TH/RAY INTERSECTION
 601          RK    5280  0.0010   0.016            TRAP     0.0    25.0

 602          KK  SECT20
 603          KM       TEMPE
 604          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 20
 605          BA    0.29
 606          LS    1.10      83
 607          UD    0.28

 608          KK   COMB1
 609          KM       COMBINE SECT10 * RT1 TO GIVE HYDROGRAPH AT 56TH/RAY INTERSECTION
 610          HC       2

 611          KK     RT2
 612          KM       ROUTE COMB1 HYDROGRAPH TO 56TH/CHANDLER INTERSECTION
 613          RK    5280  0.0010   0.016            TRAP     0.0    25.0

 614          KK  SECT29
 615          KM       CHANDLER
 616          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 29
 617          BA    0.50
 618          LS    2.12      85
 619          UD    0.62

 620          KK   COMB2
 621          KM       COMBINE SECT29 * RT2 TO GIVE HYDROGRAPH AT 56TH/CHANDLER INTERSECTION
 622          HC       2

 623          KK     RT3
 624          KM       ROUTE COMB2 HYDROGRAPH TO OUTLET-C AT 56TH/SOUTHWEST LOOP INTERSECTION
 625          RK    3600  0.0010   0.016            TRAP     0.0    25.0

 626          KK  SECT16   OUTLET 2
 627          KM       TEMPE
 628          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 16 - OUTLET 2
 629          BA    0.50
 630          LS    1.52      83
 631          UD    0.54
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 632          KK     RT4
 633          KM       ROUTE SECT16 - OUTLET 2 HYDROGRAPH TO RAY/SO.PAC RR INTERSECTION
 634          RK    5400  0.0010   0.016            TRAP     0.0    25.0

 635          KK  SECT21   OUTLET 2
 636          KM       TEMPE
 637          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 21 - OUTLET 2
 638          BA    0.59
 639          LS    1.60      83
 640          UD    0.60

 641          KK   COMB3
 642          KM       COMBINE SECT21-2 * RT4 * HYDROGRAPHS AT RAY/SO.PAC. RR INTERSECTION
 643          HC       2

 644          KK     RT5
 645          KM       ROUTE COMB3 HYDROGRAPH TO CHANDLER/SO.PAC. RR INTERSECTION
 646          RK    5500  0.0010   0.016            TRAP     0.0    25.0

 647          KK  SECT28   OUTLET 2
 648          KM       CHANDLER
 649          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 28 - OUTLET 2
 650          BA    0.30
 651          LS    1.97      85
 652          UD    0.58

 653          KK   COMB4
 654          KM       COMBINE SECT28-2 * RT5 HYDROGRAPHS AT CHANDLER/SO.PAC. RR INTERSECTION
 655          HC       2

 656          KK     RT6
 657          KM       ROUTE COMB4 HYDROGRAPH TO SOUTHWEST LOOP/SO.PAC. RR INTERSECTION
 658          RK    3700  0.0010   0.016            TRAP     0.0    25.0

 659          KK  SECT32
 660          KM       CHANDLER
 661          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 32
 662          BA    0.33
 663          LS    1.50      83
 664          UD    0.60

 665          KK  OUTLTC
 666          KM       COMBINE RT6 * SECT32 * RT3 TO GIVE HYDOGRAPH AT OUTLET-C AT
 667          KM       SOUTHWEST LOOP/SO.PAC. RR INTERSECTION
 668          HC       3

 669          KK  SECT33   OUTLET 1
 670          KM       CHANDLER
 671          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 33 - OUTLET 1
 672          BA    0.53
 673          LS    2.22      82
 674          UD    0.18
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

675           KK   WCHAN
676           KM       COMBINE SECT33-1 AND OLD OUTLET C AREA
677           HC       2
              *
              *
              *

678           KK    INBB
679           KM       COMBINE ALL HYDROGRAPHS INFLOW TO BASIN B FOREBAY
680           HC       2
              * ***************************************************************************
              *       HYDROLOGIC ROUTING OF BASIN B PERFORMED USING SPREADSHEET.
              *       SEE DRAINGE REPORT FOR SANTAN CHANNEL PHASE 3.
              * ***************************************************************************
681           ZZ
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SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 INE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

 NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  72        bash
              .
              .
 106          .      CHNDLR
              .          .
              .          .
 140      cchand............
              .
              .
 144          .      interc
              .          .
              .          .
 178       addTI............
              .
              .
 182          .        basg
              .          V
              .          V
 216          .       rbasg
              .          V
              .          V
 223          .      rtbasg
              .          .
              .          .
 225      cinter............
              .
              .
 229          .      MCSWL2
              .          .
              .          .
 236       cbash............
             V
             V
 239         RT1
              .
              .
 242          .      MCSWL3
              .          .
              .          .
 248       COMB1............
              .
              .
 252          .      SECT25
              .          V
              .          V
 259          .         RT1
              .          .
              .          .
 262          .          .      SECT36
              .          .          .
              .          .          .
 270      SECT36........................
              .
              .
 274          .      mcclin
              .          .
              .          .
 309       cmcln............
             V
```

```
            V
311     RT2536
            .
            .
            .       RUSWL1
            .           V
            .           V
320         .         RT1
            .           .
            .           .
323         .           .       RUSWL2
            .           .           V
            .           .           V
329         .           .         RT2
            .           .           .
            .           .           .
332         .           .           .       RUSWL3
            .           .           .           .
            .           .           .           .
338     COMB1.................................
            V
            V
340       RT3
            .
            .
343         .       RUSWL4
            .           .
            .           .
349         .           .       RUSWL5
            .           .           V
            .           .           V
            .           .         RT4
            .           .           .
            .           .           .
358         .           .           .       RUSWL6
            .           .           .           .
            .           .           .           .
364         .       COMB2.......................
            .           V
            .           V
366         .         RT5
            .           .
            .           .
369         .           .       RUSWL7
            .           .           .
            .           .           .
375         .           .           .       RUSWL8
            .           .           .           .
            .           .           .           .
381         .           .           .           .       RUSWL9
            .           .           .           .           .
            .           .           .           .           .
387     SW34.............................................
            V
            V
389     RT35
            .
            .
392         .       SECT9
            .           .
            .           .
98          .           .       SECT10
            .           .           .
            .           .           .
404         .           .           .       SECT10
            .           .           .           V
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                 .          .          .          V
410              .          .          .        RT1
                 .          .          .          .
                 .          .          .          .
 3               .      COMB1.......................
                 .          V
                 .          V
416              .        RT2
                 .          .
                 .          .
419              .          .     SECT16
                 .          .          .
                 .          .          .
425              .          .          .     SECT15
                 .          .          .          .
                 .          .          .          .
431              .      COMB2.......................
                 .          V
                 .          V
434              .        RT3
                 .          .
                 .          .
437              .          .     SECT21
                 .          .          .
                 .          .          .
443              .          .          .     SECT22
                 .          .          .          .
                 .          .          .          .
449              .      COMB3.......................
                 .          V
                 .          V
452              .        RT4
                 .          .
                 .          .
455              .          .     SECT12
                 .          .          V
                 .          .          V
461              .          .        RT5
                 .          .          .
                 .          .          .
464              .          .          .     SECT11
                 .          .          .          .
                 .          .          .          .
470              .          .      COMB4............
                 .          .          V
                 .          .          V
473              .          .        RT6
                 .          .          .
                 .          .          .
476              .          .          .     SECT10
                 .          .          .          .
                 .          .          .          .
482              .          .      COMB5............
                 .          .          V
                 .          .          V
485              .          .        RT7
                 .          .          .
                 .          .          .
488              .          .          .     SECT13
                 .          .          .          V
                 .          .          .          V
494              .          .          .        RT8
                 .          .          .          .
                 .          .          .          .
497              .          .          .          .     SECT14
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                                                  .
503                                               .     SECT15
                                                  .       .
                                                  .       .
509                          COMB6.................................
                               V
                               V
513                           RT9
                                .
                                .
516                                     SECT24
                                            V
                                            V
522                                       RT10
                                            .
                                            .
525                                         .     SECT23
                                            .       .
                                            .       .
531                                         .       .     SECT22
                                            .       .       .
                                            .       .       .
537                          COMB7.................................
                               V
                               V
541                           RT11
                                .
                                .
544                                     SECT26
                                            .
                                            .
550                          COMB8............
                               V
                               V
553                           RT12
                                .
                                .
556                                     SECT28
                                            .
                                            .
562                                         .     SECT27
                                            .       .
                                            .       .
568                     COMB9.................................
                          V
                          V
572                      RT13
                            .
                            .
575                          SECT34
                                .
                                .
581                 COMBB.......................
                        .
                        .
584                 SECT33
                        .
                        .
590                 COMBB............
                        .
                        .
593                 SECT16
                          V
                          V
599                      RT1
                            .
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                .          .
602             .          .      SECT20
                .          .          .
                .          .          .
 08             .      COMB1............
                .          V
                .          V
611             .        RT2
                .          .
                .          .
614             .          .      SECT29
                .          .          .
                .          .          .
620             .      COMB2............
                .          V
                .          V
623             .        RT3
                .          .
                .          .
626             .          .      SECT16
                .          .          V
                .          .          V
632             .          .        RT4
                .          .          .
                .          .          .
635             .          .          .      SECT21
                .          .          .          .
                .          .          .          .
641             .          .      COMB3............
                .          .          V
                .          .          V
644             .          .        RT5
                .          .          .
                .          .          .
647             .          .          .      SECT28
                .          .          .          .
                .          .          .          .
653             .          .      COMB4............
                .          .          V
                .          .          V
656             .          .        RT6
                .          .          .
                .          .          .
659             .          .          .      SECT32
                .          .          .          .
                .          .          .          .
665             .     OUTLTC........................
                .          .
                .          .
669             .          .      SECT33
                .          .          .
                .          .          .
675             .      WCHAN............
                .          .
                .          .
678          INBB............
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(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN   1998               *
*           VERSION 4.1                *
*                                      *
* RUN DATE   09MAY99  TIME  12:20:32   *
*                                      *
****************************************
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****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*          (916) 756-1104              *
*                                      *
****************************************
```

FN: SEVRDS3A.DAT May 1999 ADAPTED FROM SVRD05~2.DAT (HDR 5/98)
This model has one revision from the previous model. The previous model is separated into two models for the routing of the Basin B complex. The outflow hydrograph from the Basin B routing is the inflow for the SEVRDS3B.DAT model downstream of the basin complex to the Gila Floodway.
****
FN: SVRD05~2.DAT May 1998 ADAPTED FROM SEVRDS.DAT (HDR 4/97)
This model has two revisions from the previous model.

1. Revised BASIN B and Outlet Channel routings to accomodate P-MIP project overflows from the Gila Drain as described below.
2. Revised Basin 15 from detention to retention so that flows will not bypassed to the SEVRDS Channel during the event. See more below.

****
HISTORY THIS MODEL: This model is a modification of ALT2c.DAT developed by HDR for the Alternative Study for SEVRDS by HDR in June 1995. SMF48TH.DAT(PRICE5) on the West side of I-10 was included. GILA1B.DAT(Gila Drain Floodway Model) was also included in this model. ALT2c was a composite of HEC1 models from Price GEC Gila Drain Alternati Drainage Report,HDR,Feb 1993(Price/Santan/Gila Drain GILADRY.DAT model), South Mountain Freeway Concept Drainage Report, HDR, Feb 1993,(Segment V PRICE5.DAT model modified to SMF48th.DAT described below), and Gila Drain Floodway Master Plan Report, Feb 1993(GILA1B.DAT model). The original model was developed for the Price Freeway drainage system as reported in "Hydrology Study: Price Expressway", ADOT Contract 88-24, Dec. 1989. The model criteria is provided in that report. The basic model has not changed since 1989. The model continues to be the model record because the model was used to design the upper part of the SEVRDS/Santan Channel system on Price Freeway for the Galveston to Frye Interim Project which included construction of Basin G and the outlet to the Santan Channel.
****
BASIN B DESIGN. Basin B was configured as a bypass basin in 1993. With the formation of SEVRDS, the Basin was reconfigured as a multi-celled basin with first flush containment cell, a treatment cell and a large retention cell to capture flows above 800 cfs.("Initial Drainage Report Santan Freeway:56th St to Price Rd and Gila Drain Floodway to Basin B," Wood Patel & Assoc., Sept. 12, 1996.)
HDR prepared a detailed design of the Basin B complex in Feb. 1997. The size of Basin B was increased from 385(9/96) to 450 af to limit bypa flows to 900 cfs. This operation maximized the available storage on-site and required moving the outlet channel to the west side of the Gila Drain. This most recent model further optimized storage on site in in Basin B to limit bypass flows to 800 cfs to allow Gila Drain flows of up to 150 cfs to enter the outfall channel at the GRIC boundary

Basin B site has three basins: 1.First flush equalization/sedimentation basin stores first 39 ac-ft of inflow into system. 2. A two-celled Watr Quality Basin treats the first-flush post-event. This basin is not included in the model. 3. An off-line retention basin, Basin B, has a capacity of 450 ac-ft. Operation: The first flush is conveyed in the Forebay Channel to Eq. Basin. Additional flow up to 804 cfs is bypassed thru 3-10x4 control RCB to Outfall Chan. At about 600 cfs, flow begins

to spill over Basin B weir. At 100-yr peak of 2895 cfs, 804 cfs is discharging to RCB and 2091 cfs is overflowing 1000' weir into Basin B
****
SMF48th.DAT Model of the area west of I-10 was significantly changed in Feb. 1996 for the 48th St. ID study for Phoenix, including the reconfiguration of Basin 15 as a retention basin as mentioned above. A future connection of the 48th St.-Basin 15 to SEVRDS would be a pipe to dewater Basin 15 post-event. Basin 15 will not increase design discharge of the SEVRDS Channel during the event.
****

INITIAL ABSTRACTION USED TO REPRESENT DEVELOPMENT RETENTION PROVIDED
100 YEAR - 24 HOUR STORM
DMJM - PHOENIX
FILENAME: SEVRDS3A.DAT

```
70 IO        OUTPUT CONTROL VARIABLES
                  IPRNT          5  PRINT CONTROL
                  IPLOT          0  PLOT CONTROL
                  QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT        HYDROGRAPH TIME DATA
                   NMIN          5  MINUTES IN COMPUTATION INTERVAL
                  IDATE     1    0  STARTING DATE
                  ITIME       0000  STARTING TIME
                     NQ       1000  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE     4    0  ENDING DATE
                 NDTIME       1115  ENDING TIME
                  ICENT         19  CENTURY MARK

            COMPUTATION INTERVAL     .08 HOURS
                 TOTAL TIME BASE   83.25 HOURS

      ENGLISH UNITS
          DRAINAGE AREA          SQUARE MILES
          PRECIPITATION DEPTH    INCHES
          LENGTH, ELEVATION      FEET
          FLOW                   CUBIC FEET PER SECOND
          STORAGE VOLUME         ACRE-FEET
          SURFACE AREA           ACRES
          TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	bash	764.	13.58	327.	255.	126.	6.76		
HYDROGRAPH AT	CHNDLR	100.	13.00	90.	90.	45.	.00		
2 COMBINED AT	cchand	864.	13.58	417.	344.	171.	6.76		
HYDROGRAPH AT	interc	200.	12.17	38.	10.	3.	.16		
2 COMBINED AT	addTI	904.	13.58	428.	350.	174.	6.92		
HYDROGRAPH AT	basg	954.	14.00	337.	109.	36.	4.37		
ROUTED TO	rbasg	190.	16.83	180.	105.	36.	4.37	1180.46	16.83
ROUTED TO	rtbasg	190.	16.92	180.	105.	36.	4.37		
2 COMBINED AT	cinter	938.	13.58	569.	454.	211.	11.29		
HYDROGRAPH AT	MCSWL2	48.	13.17	15.	4.	1.	.16		
2 COMBINED AT	cbash	975.	13.58	581.	459.	212.	11.45		
ROUTED TO	RT1	969.	13.58	581.	458.	212.	11.45		
HYDROGRAPH AT	MCSWL3	52.	13.17	17.	5.	2.	.17		
2 COMBINED AT	COMB1	1011.	13.58	595.	463.	214.	11.62		
HYDROGRAPH AT	SECT25	222.	13.25	77.	24.	8.	1.00		
ROUTED TO	RT1	222.	13.50	77.	24.	8.	1.00		
HYDROGRAPH AT	SECT36	92.	13.33	34.	11.	4.	.51		
3 COMBINED AT	SECT36	1315.	13.58	704.	498.	225.	13.13		
HYDROGRAPH AT	mcclin	200.	12.08	29.	8.	3.	.11		
2 COMBINED AT	cmcln	1332.	13.50	711.	504.	228.	13.24		
ROUTED TO	RT2536	1319.	13.58	711.	504.	228.	13.24		
HYDROGRAPH AT	RUSWL1	5.	14.75	4.	1.	0.	.21		
ROUTED TO	RT1	5.	14.83	4.	1.	0.	.21		
HYDROGRAPH AT	RUSWL2	2.	14.33	1.	0.	0.	.09		
ROUTED TO	RT2	2.	14.58	1.	0.	0.	.09		
HYDROGRAPH AT	RUSWL3	42.	12.83	10.	3.	1.	.10		
4 COMBINED AT	COMB1	1338.	13.58	722.	509.	229.	13.64		
ROUTED TO	RT3	1334.	13.58	722.	509.	229.	13.64		
HYDROGRAPH AT	RUSWL4	3.	14.33	2.	1.	0.	.16		

HYDROGRAPH AT	RUSWL5	74.	12.50	12.	4.	1.	.09
ROUTED TO	RT4	73.	12.58	12.	4.	1.	.09
HYDROGRAPH AT	RUSWL6	3.	14.00	2.	1.	0.	.15
3 COMBINED AT	COMB2	73.	12.58	16.	5.	2.	.40
ROUTED TO	RT5	72.	12.67	16.	5.	2.	.40
HYDROGRAPH AT	RUSWL7	2.	14.00	2.	1.	0.	.13
HYDROGRAPH AT	RUSWL8	32.	12.33	4.	1.	0.	.06
HYDROGRAPH AT	RUSWL9	64.	12.42	10.	3.	1.	.10
5 COMBINED AT	SW34	1365.	13.58	748.	519.	233.	14.33
ROUTED TO	RT35	1345.	13.67	748.	519.	233.	14.33
HYDROGRAPH AT	SECT9	94.	12.75	22.	7.	2.	.33
HYDROGRAPH AT	SECT10	9.	13.17	3.	1.	0.	.03
HYDROGRAPH AT	SECT10	37.	12.92	11.	4.	1.	.19
ROUTED TO	RT1	37.	13.08	11.	4.	1.	.19
3 COMBINED AT	COMB1	122.	12.83	35.	11.	4.	.55
ROUTED TO	RT2	121.	13.42	35.	11.	4.	.55
HYDROGRAPH AT	SECT16	69.	12.67	13.	4.	1.	.14
HYDROGRAPH AT	SECT15	94.	13.25	31.	9.	3.	.31
3 COMBINED AT	COMB2	231.	13.42	78.	24.	8.	1.00
ROUTED TO	RT3	229.	13.67	77.	24.	8.	1.00
HYDROGRAPH AT	SECT21	186.	12.83	44.	13.	4.	.42
HYDROGRAPH AT	SECT22	143.	12.75	37.	12.	4.	.82
3 COMBINED AT	COMB3	421.	12.92	157.	49.	16.	2.24
ROUTED TO	RT4	417.	13.08	156.	49.	16.	2.24
HYDROGRAPH AT	SECT12	6.	15.08	5.	2.	1.	.50
ROUTED TO	RT5	6.	15.58	4.	2.	1.	.50
HYDROGRAPH AT	SECT11	51.	13.25	21.	7.	2.	.51
2 COMBINED AT	COMB4	51.	13.25	24.	9.	3.	1.01
ROUTED TO	RT6	51.	13.50	24.	9.	3.	1.01
HYDROGRAPH AT	SECT10	65.	12.75	19.	6.	2.	.50
2 COMBINED AT	COMB5	84.	13.33	42.	15.	5.	1.51
ROUTED TO	RT7	84.	13.92	41.	15.	5.	1.51
HYDROGRAPH AT	SECT13	54.	12.92	26.	10.	3.	1.00

ROUTED TO	RT8	54.	13.42	26.	10.	3.	1.00
HYDROGRAPH AT	SECT14	15.	14.50	10.	4.	1.	1.00
HYDROGRAPH AT	SECT15	81.	13.25	31.	10.	3.	.69
4 COMBINED AT	COMB6	207.	13.67	104.	39.	13.	4.20
ROUTED TO	RT9	207.	14.08	104.	39.	13.	4.20
HYDROGRAPH AT	SECT24	27.	13.75	17.	7.	2.	1.00
ROUTED TO	RT10	27.	14.33	17.	7.	2.	1.00
HYDROGRAPH AT	SECT23	14.	15.17	10.	4.	1.	1.00
HYDROGRAPH AT	SECT22	79.	12.50	13.	4.	1.	.13
4 COMBINED AT	COMB7	251.	14.17	134.	54.	18.	6.33
ROUTED TO	RT11	251.	14.42	134.	54.	18.	6.33
HYDROGRAPH AT	SECT26	221.	13.33	79.	24.	8.	1.00
2 COMBINED AT	COMB8	365.	14.25	207.	79.	26.	7.33
ROUTED TO	RT12	364.	14.50	206.	79.	26.	7.33
HYDROGRAPH AT	SECT28	71.	12.83	23.	8.	3.	.69
HYDROGRAPH AT	SECT27	119.	13.92	60.	20.	7.	1.00
4 COMBINED AT	COMB9	761.	13.33	439.	156.	52.	11.26
ROUTED TO	RT13	758.	13.50	437.	155.	52.	11.26
HYDROGRAPH AT	SECT34	93.	13.50	39.	12.	4.	.67
3 COMBINED AT	COMBB	2179.	13.58	1217.	687.	289.	26.26
HYDROGRAPH AT	SECT33	126.	12.75	28.	8.	3.	.26
2 COMBINED AT	COMBB	2221.	13.58	1240.	695.	291.	26.52
HYDROGRAPH AT	SECT16	4.	14.83	3.	1.	0.	.23
ROUTED TO	RT1	4.	15.83	3.	1.	0.	.23
HYDROGRAPH AT	SECT20	267.	12.42	38.	11.	4.	.29
2 COMBINED AT	COMB1	267.	12.42	40.	12.	4.	.52
ROUTED TO	RT2	264.	12.75	39.	12.	4.	.52
HYDROGRAPH AT	SECT29	95.	13.00	29.	9.	3.	.50
2 COMBINED AT	COMB2	342.	12.75	68.	21.	7.	1.02
ROUTED TO	RT3	332.	13.00	68.	21.	7.	1.02
HYDROGRAPH AT	SECT16	215.	12.75	49.	14.	5.	.50
ROUTED TO	RT4	212.	13.08	48.	14.	5.	.50
HYDROGRAPH AT	SECT21	217.	12.83	53.	16.	5.	.59

2 COMBINED AT	COMB3	405.	13.00	101.	30.	10.	1.09
ROUTED TO	RT5	397.	13.33	100.	30.	10.	1.09
HYDROGRAPH AT	SECT28	76.	12.92	21.	6.	2.	.30
2 COMBINED AT	COMB4	452.	13.25	120.	37.	12.	1.39
ROUTED TO	RT6	443.	13.42	119.	37.	12.	1.39
HYDROGRAPH AT	SECT32	135.	12.83	32.	10.	3.	.33
3 COMBINED AT	OUTLTC	719.	13.42	217.	68.	23.	2.74
HYDROGRAPH AT	SECT33	126.	12.50	24.	8.	3.	.53
2 COMBINED AT	WCHAN	749.	13.42	241.	75.	25.	3.27
2 COMBINED AT	INBB	2886.	13.58	1478.	770.	316.	29.79

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
rtbasg	MANE	3.00	189.98	1016.00	.93	5.00	189.97	1015.00	.93

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2162E+03 EXCESS= .0000E+00 OUTFLOW= .2162E+03 BASIN STORAGE= .4429E-02 PERCENT ERROR= .0

RT1	MANE	1.45	969.64	815.29	2.07	5.00	969.02	815.00	2.07

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1262E+04 EXCESS= .0000E+00 OUTFLOW= .1262E+04 BASIN STORAGE= .4085E+00 PERCENT ERROR= -.1

RT1	MANE	4.87	222.35	809.68	.88	5.00	222.20	810.00	.88

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4703E+02 EXCESS= .0000E+00 OUTFLOW= .4699E+02 BASIN STORAGE= .1506E-05 PERCENT ERROR= .1

RT2536	MANE	.67	1331.28	811.42	1.92	5.00	1319.15	815.00	1.92

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1355E+04 EXCESS= .0000E+00 OUTFLOW= .1355E+04 BASIN STORAGE= .2990E+00 PERCENT ERROR= .0

RT1	MANE	3.06	5.36	890.68	.26	5.00	5.36	890.00	.26

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2950E+01 EXCESS= .0000E+00 OUTFLOW= .2951E+01 BASIN STORAGE= .1935E-08 PERCENT ERROR= .0

RT2	MANE	4.50	1.78	874.14	.20	5.00	1.78	875.00	.20

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9822E+00 EXCESS= .0000E+00 OUTFLOW= .9823E+00 BASIN STORAGE= .6775E-08 PERCENT ERROR= .0

RT3	MANE	.99	1334.70	815.50	1.88	5.00	1333.57	815.00	1.88

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1365E+04 EXCESS= .0000E+00 OUTFLOW= .1365E+04 BASIN STORAGE= .4185E+00 PERCENT ERROR= .0

RT4	MANE	1.37	73.73	753.45	1.47	5.00	73.39	755.00	1.47

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6979E+01 EXCESS= .0000E+00 OUTFLOW= .6982E+01 BASIN STORAGE= .9618E-09 PERCENT ERROR= .0

RT5	MANE	1.83	73.08	759.13	.48	5.00	72.50	760.00	.48

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1024E+02 EXCESS= .0000E+00 OUTFLOW= .1024E+02 BASIN STORAGE= .9098E-08 PERCENT ERROR= .0

RT35	MANE	1.93	1360.69	818.86	1.81	5.00	1345.27	820.00	1.81

```
CONTINUITY SUMMARY (AC-FT) - INFLOW= .1384E+04 EXCESS= .0000E+00 OUTFLOW= .1384E+04 BASIN STORAGE= .8813E+00 PERCENT ERROR=   -.1

          RT1  MANE        5.00     36.77    786.27      .69      5.00     36.62    785.00        .69

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6956E+01 EXCESS= .0000E+00 OUTFLOW= .6954E+01 BASIN STORAGE= .1052E-06 PERCENT ERROR=    .0

          RT2  MANE        4.93    121.84    808.21      .75      5.00    121.13    805.00        .75

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2200E+02 EXCESS= .0000E+00 OUTFLOW= .2200E+02 BASIN STORAGE= .1486E-04 PERCENT ERROR=    .0

          RT3  MANE        4.63    230.25    818.71      .91      5.00    228.81    820.00        .91

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4828E+02 EXCESS= .0000E+00 OUTFLOW= .4830E+02 BASIN STORAGE= .2292E-04 PERCENT ERROR=   -.1

          RT4  MANE        5.00    419.26    783.77      .82      5.00    417.10    785.00        .82

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9772E+02 EXCESS= .0000E+00 OUTFLOW= .9760E+02 BASIN STORAGE= .4090E-04 PERCENT ERROR=    .1

          RT5  MANE        5.00      6.32    934.56      .14      5.00      6.32    935.00        .14

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3839E+01 EXCESS= .0000E+00 OUTFLOW= .3840E+01 BASIN STORAGE= .3322E-06 PERCENT ERROR=

          RT6  MANE        5.00     51.30    809.64      .33      5.00     51.26    810.00        .33

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1787E+02 EXCESS= .0000E+00 OUTFLOW= .1786E+02 BASIN STORAGE= .1710E-05 PERCENT ERROR=    .1

          RT7  MANE        5.00     84.04    834.55      .38      5.00     83.94    835.00        .38

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3039E+02 EXCESS= .0000E+00 OUTFLOW= .3038E+02 BASIN STORAGE= .2638E-04 PERCENT ERROR=    .0

          RT8  MANE        5.00     53.94    805.24      .36      5.00     53.82    805.00        .36

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1908E+02 EXCESS= .0000E+00 OUTFLOW= .1919E+02 BASIN STORAGE= .2429E-05 PERCENT ERROR=   -.6

          RT9  MANE        4.97    206.80    843.86      .35      5.00    206.75    845.00        .35

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7804E+02 EXCESS= .0000E+00 OUTFLOW= .7802E+02 BASIN STORAGE= .8735E-04 PERCENT ERROR=    .0

         RT10  MANE        4.91     27.28    863.89      .25      5.00     27.28    860.00        .25

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1329E+02 EXCESS= .0000E+00 OUTFLOW= .1329E+02 BASIN STORAGE= .1912E-05 PERCENT ERROR=    .0

         RT11  MANE        4.92    250.88    868.68      .32      5.00    250.68    865.00        .32
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CONTINUITY SUMMARY (AC-FT) - INFLOW= .1074E+03 EXCESS= .0000E+00 OUTFLOW= .1076E+03 BASIN STORAGE= .1700E-03 PERCENT ERROR=   -.2

          RT12  MANE        5.00    363.79    866.99      .40      5.00    363.70    870.00        .40

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1561E+03 EXCESS= .0000E+00 OUTFLOW= .1560E+03 BASIN STORAGE= .2962E-03 PERCENT ERROR=    .0

          RT13  MANE        5.00    757.89    809.76      .51      5.00    757.59    810.00        .51

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3087E+03 EXCESS= .0000E+00 OUTFLOW= .3085E+03 BASIN STORAGE= .3493E-03 PERCENT ERROR=    .1

           RT1  MANE        5.00      4.13    948.98      .19      5.00      4.13    950.00        .19

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2376E+01 EXCESS= .0000E+00 OUTFLOW= .2376E+01 BASIN STORAGE= .1754E-05 PERCENT ERROR=    .0

           RT2  MANE        3.85    263.74    765.08      .86      5.00    263.68    765.00        .86

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2387E+02 EXCESS= .0000E+00 OUTFLOW= .2393E+02 BASIN STORAGE= .1525E-04 PERCENT ERROR=   -.2

           RT3  MANE        3.80    336.66    775.86      .78      5.00    332.07    780.00        .78

INUITY SUMMARY (AC-FT) - INFLOW= .4230E+02 EXCESS= .0000E+00 OUTFLOW= .4258E+02 BASIN STORAGE= .2116E-04 PERCENT ERROR=   -.7

           RT4  MANE        5.00    213.46    786.95     1.07      5.00    211.74    785.00       1.06

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2834E+02 EXCESS= .0000E+00 OUTFLOW= .2840E+02 BASIN STORAGE= .3142E-05 PERCENT ERROR=   -.2

           RT5  MANE        5.00    403.35    797.39     1.03      5.00    397.35    800.00       1.03

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5995E+02 EXCESS= .0000E+00 OUTFLOW= .5991E+02 BASIN STORAGE= .1825E-04 PERCENT ERROR=    .1

           RT6  MANE        4.75    450.11    806.98      .98      5.00    443.39    805.00        .98

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7263E+02 EXCESS= .0000E+00 OUTFLOW= .7253E+02 BASIN STORAGE= .2258E-04 PERCENT ERROR=    .1


*** NORMAL END OF HEC-1 ***
```

APPENDIX C - On-Site Hydraulic Analyses

Job No.	No.

Computation

HDR

Project	SR202L 56th Street to Kyrene	Computed JKE	Date 3/16/00
Subject	IDF Curve	Checked	Date
Task	ZONE 8	Sheet 1	Of 2

PART A RAINFALL DEPTHS

	Depth (in)	Depth (mm)
P 2yr,6hr	1.15	29.21
P 2yr,24hr	1.35	34.29
P 100yr,6hr	3.1	78.74
P 100yr,24 hr	3.6	91.44

PART B

	in	mm
2yr,1hr	0.912	23.160
100yr,1hr	2.509	63.742
2yr,2hr	0.993	25.223
2yr,3hr	1.047	26.603
2yr,12hr	1.250	31.750
100yr,2hr	2.711	68.856
100yr,3hr	2.845	72.276
100yr,12hr	3.350	85.090

PART C

	ZONE 6		ZONE 8	
	in	mm	in	mm
2yr,5min	0.319	8.106	0.310	7.875
2yr,10min	0.492	12.507	0.465	11.812
2yr,15min	0.593	15.054	0.565	14.359
2yr,30min	0.757	19.223	0.748	18.992
100yr,5min	0.803	20.397	0.753	19.123
100yr,10min	1.255	31.871	1.154	29.321
100yr,15min	1.556	39.520	1.481	37.608
100yr,30min	2.033	51.631	2.008	50.994

PART D

Frequency	x	y
5yr	0.674	0.278
10yr	0.496	0.449
25yr	0.293	0.669
50yr	0.146	0.835
500yr	-0.337	1.381

Job No.	No.

Computation

HDR

Project	SR202L 56th Street to Kyrene	Computed JKE	Date 3/16/0
Subject	IDF Curve	Checked	Date
Task	ZONE 8	Sheet 2	Of 2

PART E

ZONE 8

RAINFALL DEPTH IN INCHES

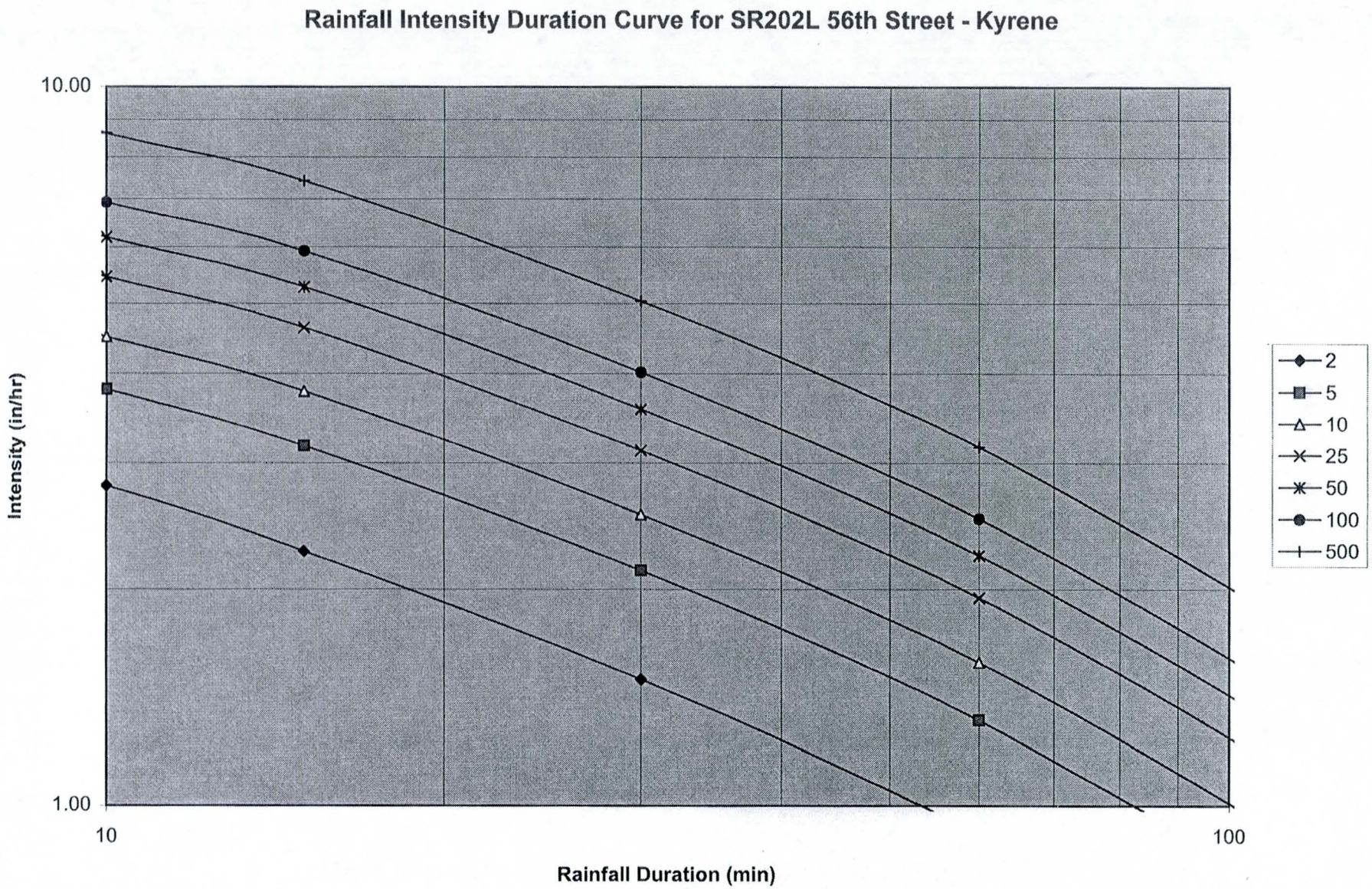
Frequency

	2	5	10	25	50	100	500
5	0.31	0.42	0.49	0.59	0.67	0.75	0.94
10	0.47	0.63	0.75	0.91	1.03	1.15	1.44
15	0.57	0.79	0.95	1.16	1.32	1.48	1.85
30	0.75	1.06	1.27	1.56	1.79	2.01	2.52
60	0.91	1.31	1.58	1.95	2.23	2.51	3.16
120	0.99	1.42	1.71	2.10	2.41	2.71	3.41
180	1.05	1.50	1.80	2.21	2.53	2.85	3.58
360	1.15	1.64	1.96	2.41	2.76	3.10	3.89
720	1.25	1.77	2.12	2.61	2.98	3.35	4.21
1440	1.35	1.91	2.29	2.80	3.20	3.60	4.52

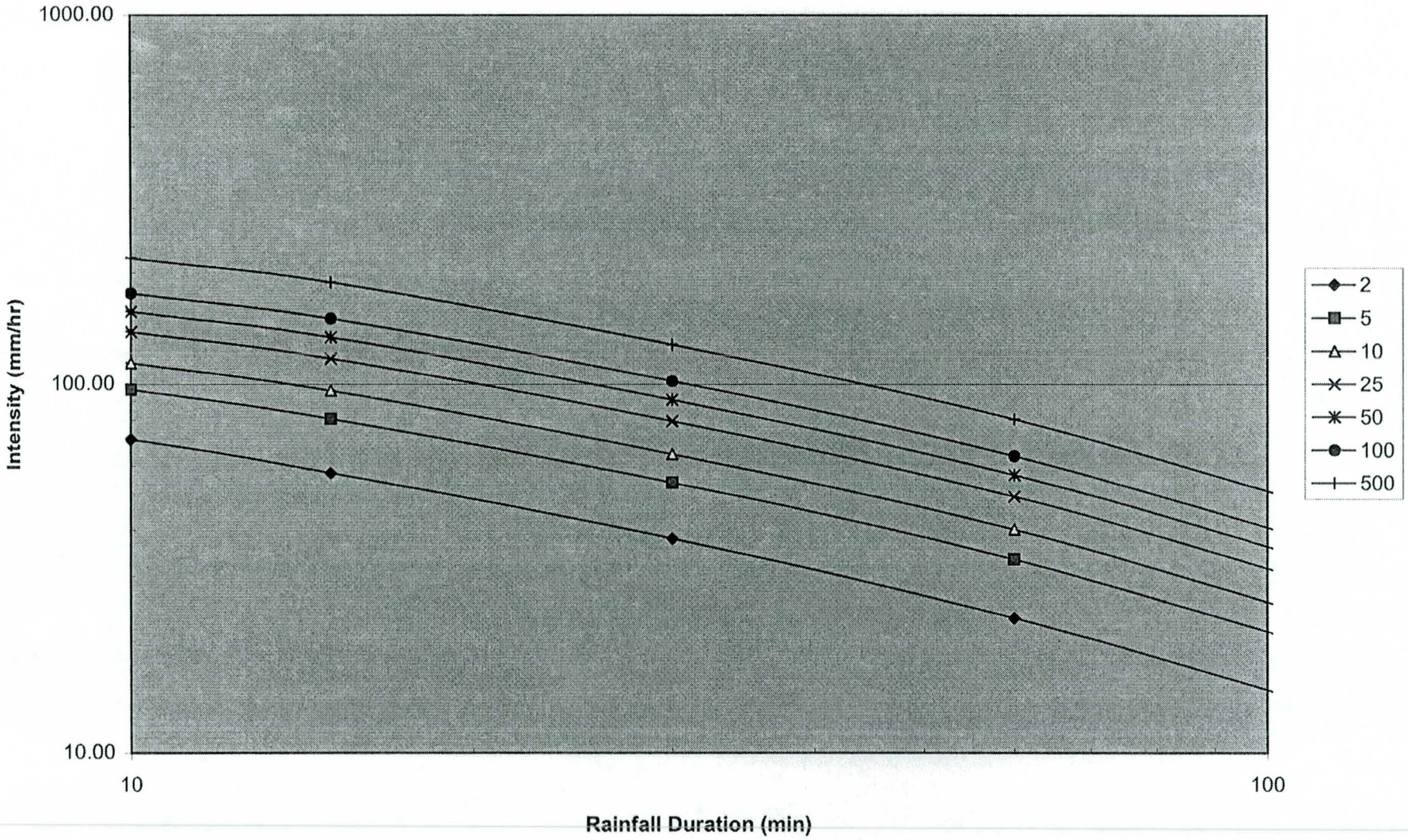
RAINFALL DEPTH IN MILLIMETERS

Frequency

	2	5	10	25	50	100	500
5	7.87	10.62	12.49	15.10	17.12	19.12	23.75
10	11.81	16.11	19.02	23.08	26.21	29.32	36.51
15	14.36	20.13	24.01	29.37	33.50	37.61	47.10
30	18.99	26.98	32.32	39.68	45.35	50.99	64.02
60	23.16	33.33	40.11	49.43	56.61	63.74	80.22
120	25.22	36.14	43.43	53.46	61.18	68.86	86.59
180	26.60	38.02	45.65	56.15	64.23	72.28	90.85
360	29.21	41.58	49.84	61.24	70.01	78.74	98.90
720	31.75	45.05	53.95	66.23	75.69	85.09	106.81
1440	34.29	48.53	58.06	71.22	81.36	91.44	114.72


Rainfall Intensity Duration Curve for SR202L 56th Street - Kyrene
10.00
1.00
Intensity (in/hr)
10
100
Rainfall Duration (min)
2
5
10
25
50
100
500

Rainfall Intensity Duration Curve for SR202L 56th Street - Kyrene



Job No.

Computation

HDR

Project	SR202L- 56th Street -Kyrene	Computed	JKE	Date	8/15/00
Subject	Onsite Drainage	Checked		Date	
Task	100% Drainage Areas	Sheet	1	Of	1

Area #	Area (sq.ft)	Area(Ac)	C
1	68711.6	1.577	0.95
2	30275.9	0.695	0.77
3	47992.8	1.102	0.95
4	29308.1	0.673	0.95
5	Not Used	#VALUE!	-
6	31463	0.722	0.95
7	27278.5	0.626	0.95
8	35002.53	0.804	0.77
9	31318.8	0.719	0.95
10	27099.1	0.622	0.95
11	38751.1	0.890	0.77
12	31707.2	0.728	0.95
13	27626	0.634	0.95
14	Not Used	#VALUE!	-
15	31542.6	0.724	0.95
16	27432	0.630	0.95
17	38166.6	0.876	0.78
18	31501.3	0.723	0.95
19	27634	0.634	0.95
20	Not Used	#VALUE!	-
21	31605	0.726	0.95
22	27628.4	0.634	0.95
23	43576	1.000	0.77
24	31395	0.721	0.95
25	27356.5	0.628	0.95
26	Not Used	#VALUE!	-
27	30985	0.711	0.95
28	32315.7	0.742	0.95
29	16601.3	0.381	0.77
30	37605.6	0.863	0.95
31	47096.5	1.081	0.88
32	44415.4	1.020	0.91
33	96674.33	2.219	0.77
34	12029.84	0.276	0.81
35	32563	0.748	0.87
36	31379.99	0.720	0.89
37	43869.2	1.007	0.70
38	32333.73	0.742	0.88
39	39185.4	0.900	0.85

Area #	Area (sq.ft)	Area(Ac)	C
40	17020	0.391	0.95
41	65015.8	1.493	0.83
42	60723.32	1.394	0.80
43	43769.2	1.005	0.83
44	54658.4	1.255	0.82
45	42128.8	0.967	0.73
46	62108.9	1.426	0.80
47	67558.5	1.551	0.81
48	56432.4	1.296	0.80
49	49616.75	1.139	0.81
50	166672.96	3.826	0.80
51	110940.8	2.547	0.81
52	52186.88	1.198	0.81
53	42902.37	0.985	0.83
54	40533.8	0.931	0.84
55	56746.2	1.303	0.79
56	35697.88	0.820	0.86
57	33533.56	0.770	0.87
58	13459.7	0.309	0.90
59	18604.11	0.427	0.91
Kyrene Road			
100	9332	0.214	0.95
101	9757.26	0.224	0.95
102	7948.18	0.182	0.95
103	8405.7	0.193	0.95
104	6564.3	0.151	0.95
105	29195.4	0.670	0.95
106	10420.7	0.239	0.95
107	8532	0.196	0.95

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 1 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.58 ac
0.64 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.270 km	0.168 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	363.36 m	1192.11 ft
Downstream Elevation	=	361.67 m	1186.57 ft
Watercourse slope (S)	=	6.25 m/km	32.98 ft/mi
Calculated Tc	=	0.12 hr	0.12 hr
		7.05 min	7.01 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.192 cms

English
Q=ciA

Q= 6.74 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 1 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.58 ac
0.64 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.270 km	0.168 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	363.36 m	1192.11 ft	
Downstream Elevation	=	361.67 m	1186.57 ft	
Watercourse slope (S)	=	6.25 m/km	32.98 ft/mi	
Calculated Tc	=	0.10 hr	0.10 hr	
		6.24 min	6.21 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric	English
Q=ciA/360	Q=ciA
Q= 0.265 cms	Q= 9.29 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 2 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.695 ac
0.28 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.137 km	0.085 mi
Resistance Coefficient (Kb)	=	0.08	0.08
Upstream Elevation	=	362.76 m	1190.15 ft
Downstream Elevation	=	361.65 m	1186.5 ft
Watercourse slope (S)	=	8.13 m/km	42.94 ft/mi
Calculated Tc	=	0.16 hr	0.16 hr
		9.50 min	9.45 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	26
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	74
C =	0.765		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.068 cms Q= 2.39 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 2 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.695 ac
0.28 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.137 km	0.085 mi	
Resistance Coefficient (Kb)	=	0.08	0.08	Table 2.1
Upstream Elevation	=	362.76 m	1190.15 ft	
Downstream Elevation	=	361.65 m	1186.5 ft	
Watercourse slope (S)	=	8.13 m/km	42.94 ft/mi	
Calculated Tc	=	0.14 hr	0.14 hr	
		8.41 min	8.36 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	26
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	74
C =	0.765		

Discharge Calculation

Metric	English
Q=ciA/360	Q=ciA
Q= 0.094 cms	Q= 3.29 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 3 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.1 ac
0.45 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.166 km	0.103 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	363.05 m	1191.1 ft
Downstream Elevation	=	361.75 m	1186.84 ft
Watercourse slope (S)	=	7.83 m/km	41.36 ft/mi
Calculated Tc	=	0.09 hr	0.09 hr
		5.14 min	5.12 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.134 cms Q= 4.69 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 3 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.1 ac
0.45 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.166 km	0.103 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	363.05 m	1191.1 ft	
Downstream Elevation	=	361.75 m	1186.84 ft	
Watercourse slope (S)	=	7.83 m/km	41.36 ft/mi	
Calculated Tc	=	0.08 hr	0.08 hr	
		4.55 min	4.53 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.185 cms Q= 6.47 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 4 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.67 ac
0.27 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.129 km	0.08 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	362.30 m	1188.64 ft
Downstream Elevation	=	360.75 m	1183.56 ft
Watercourse slope (S)	=	12.03 m/km	63.50 ft/mi
Calculated Tc	=	0.07 hr	0.07 hr
		3.97 min	3.95 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.082 cms Q= 2.86 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 4 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.67 ac
0.27 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.129 km	0.08 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	362.30 m	1188.64 ft	
Downstream Elevation	=	360.75 m	1183.56 ft	
Watercourse slope (S)	=	12.03 m/km	63.50 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.51 min	3.49 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.113 cms Q= 3.94 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 6 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.72 ac
0.29 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.126 km	0.078 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	362.37 m	1188.88 ft
Downstream Elevation	=	360.75 m	1183.56 ft
Watercourse slope (S)	=	12.92 m/km	68.21 ft/mi
Calculated Tc	=	0.06 hr	0.06 hr
		3.83 min	3.81 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric	English
Q=ciA/360	Q=ciA
Q= 0.088 cms	Q= 3.07 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 6 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.72 ac
0.29 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.126 km	0.078 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	362.37 m	1188.88 ft	
Downstream Elevation	=	360.75 m	1183.56 ft	
Watercourse slope (S)	=	12.92 m/km	68.21 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.39 min	3.38 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95	Rational Coefficient -Desert D-30%	

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.121 cms Q= 4.23 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 7 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.63 ac
0.25 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.122 km	0.076 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	361.28 m	1185.31 ft
Downstream Elevation	=	359.73 m	1180.23 ft
Watercourse slope (S)	=	12.66 m/km	66.84 ft/mi
Calculated Tc	=	0.06 hr	0.06 hr
		3.81 min	3.79 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.077 cms Q= 2.69 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 7 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.63 ac
0.26 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.122 km	0.076 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	361.28 m	1185.31 ft	
Downstream Elevation	=	359.73 m	1180.23 ft	
Watercourse slope (S)	=	12.66 m/km	66.84 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.37 min	3.35 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.106 cms Q= 3.70 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 8 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.804 ac
0.33 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.146 km	0.091 mi
Resistance Coefficient (Kb)	=	0.08	0.08
Upstream Elevation	=	361.42 m	1185.77 ft
Downstream Elevation	=	359.63 m	1179.9 ft
Watercourse slope (S)	=	12.22 m/km	64.51 ft/mi
Calculated Tc	=	0.14 hr	0.14 hr
		8.66 min	8.62 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	29
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	71
C =	0.7725		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.080 cms Q= 2.79 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 8 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.804 ac
0.33 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.146 km	0.091 mi	
Resistance Coefficient (Kb)	=	0.08	0.08	Table 2.1
Upstream Elevation	=	361.42 m	1185.77 ft	
Downstream Elevation	=	359.63 m	1179.9 ft	
Watercourse slope (S)	=	12.22 m/km	64.51 ft/mi	
Calculated Tc	=	0.13 hr	0.13 hr	
		7.67 min	7.63 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	29
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	71
C =	0.7725		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.110 cms

English
Q=ciA

Q= 3.84 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 9 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.72 ac
0.29 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.129 km	0.08 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	361.36 m	1185.55 ft
Downstream Elevation	=	359.73 m	1180.23 ft
Watercourse slope (S)	=	12.60 m/km	66.50 ft/mi
Calculated Tc	=	0.07 hr	0.06 hr
		3.91 min	3.89 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.088 cms Q= 3.07 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 9 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.72 ac
0.29 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.129 km	0.08 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	361.36 m	1185.55 ft	
Downstream Elevation	=	359.73 m	1180.23 ft	
Watercourse slope (S)	=	12.60 m/km	66.50 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.46 min	3.45 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.121 cms Q= 4.23 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 10 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.62 ac
0.25 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.124 km	0.077 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	360.27 m	1181.98 ft
Downstream Elevation	=	358.72 m	1176.9 ft
Watercourse slope (S)	=	12.50 m/km	65.97 ft/mi
Calculated Tc	=	0.06 hr	0.06 hr
		3.85 min	3.83 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.076 cms Q= 2.64 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 10 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.62 ac
0.25 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.124 km	0.077 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	360.27 m	1181.98 ft	
Downstream Elevation	=	358.72 m	1176.9 ft	
Watercourse slope (S)	=	12.50 m/km	65.97 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.41 min	3.39 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.104 cms Q= 3.65 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 11 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.89 ac
0.36 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	11 min	11 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	108 mm/hr	4.3 in/hr
Watercourse length (L)	=	0.212 km	0.132 mi
Resistance Coefficient (Kb)	=	0.08	0.08
Upstream Elevation	=	360.05 m	1181.28 ft
Downstream Elevation	=	357.60 m	1173.23 ft
Watercourse slope (S)	=	11.55 m/km	60.98 ft/mi
Calculated Tc	=	0.18 hr	0.18 hr
		10.84 min	10.74 min

Determine Rainfall Intensity

Tc= 11.00 min i = 108 mm/hr *** Tc< 10 min use 10 min as minimum
4.3 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	28
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	72
C =	0.77		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.083 cms Q= 2.95 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 11 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.89 ac
0.36 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.212 km	0.132 mi	
Resistance Coefficient (Kb)	=	0.08	0.08	Table 2.1
Upstream Elevation	=	360.05 m	1181.28 ft	
Downstream Elevation	=	357.60 m	1173.23 ft	
Watercourse slope (S)	=	11.55 m/km	60.98 ft/mi	
Calculated Tc	=	0.16 hr	0.16 hr	
		9.40 min	9.35 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	28
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	72
C =	0.77		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.121 cms Q= 4.24 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 12 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.72 ac
0.29 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.129 km	0.08 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	360.34 m	1182.22 ft
Downstream Elevation	=	358.72 m	1176.9 ft
Watercourse slope (S)	=	12.60 m/km	66.50 ft/mi
Calculated Tc	=	0.07 hr	0.06 hr
		3.91 min	3.89 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.088 cms Q= 3.07 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 12 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.72 ac
0.29 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.129 km	0.08 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	360.34 m	1182.22 ft	
Downstream Elevation	=	358.72 m	1176.9 ft	
Watercourse slope (S)	=	12.60 m/km	66.50 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.46 min	3.45 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.121 cms Q= 4.23 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 13 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.63 ac
0.25 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.124 km	0.077 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	359.27 m	1178.7 ft
Downstream Elevation	=	357.70 m	1173.56 ft
Watercourse slope (S)	=	12.64 m/km	66.75 ft/mi
Calculated Tc	=	0.06 hr	0.06 hr
		3.83 min	3.81 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.077 cms Q= 2.69 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 13 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.63 ac
0.26 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.124 km	0.077 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	359.27 m	1178.7 ft	
Downstream Elevation	=	357.70 m	1173.56 ft	
Watercourse slope (S)	=	12.64 m/km	66.75 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.39 min	3.38 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.106 cms

English
Q=ciA

Q= 3.70 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 15 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.72 ac
0.29 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.129 km	0.08 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	359.34 m	1178.94 ft
Downstream Elevation	=	357.70 m	1173.56 ft
Watercourse slope (S)	=	12.74 m/km	67.25 ft/mi
Calculated Tc	=	0.06 hr	0.06 hr
		3.90 min	3.88 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.088 cms Q= 3.07 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 15 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.72 ac
0.29 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.129 km	0.08 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	359.34 m	1178.94 ft	
Downstream Elevation	=	357.70 m	1173.56 ft	
Watercourse slope (S)	=	12.74 m/km	67.25 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.45 min	3.43 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.121 cms Q= 4.23 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 16 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.63 ac
0.25 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.124 km	0.077 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	358.25 m	1175.37 ft
Downstream Elevation	=	356.69 m	1170.23 ft
Watercourse slope (S)	=	12.64 m/km	66.75 ft/mi
Calculated Tc	=	0.06 hr	0.06 hr
		3.83 min	3.81 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.077 cms Q= 2.69 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 16 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.63 ac
0.26 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.124 km	0.077 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	358.25 m	1175.37 ft	
Downstream Elevation	=	356.69 m	1170.23 ft	
Watercourse slope (S)	=	12.64 m/km	66.75 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.39 min	3.38 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.106 cms Q= 3.70 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 17 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.88 ac
0.36 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	11 min	11 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	108 mm/hr	4.3 in/hr
Watercourse length (L)	=	0.212 km	0.132 mi
Resistance Coefficient (Kb)	=	0.08	0.08
Upstream Elevation	=	358.02 m	1174.6 ft
Downstream Elevation	=	355.57 m	1166.56 ft
Watercourse slope (S)	=	11.54 m/km	60.91 ft/mi
Calculated Tc	=	0.18 hr	0.18 hr
		10.84 min	10.74 min

Determine Rainfall Intensity

Tc= 11.00 min i = 108 mm/hr *** Tc< 10 min use 10 min as minimum
4.3 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	30
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	70
C =	0.775		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.083 cms Q= 2.93 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 17 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.88 ac
0.36 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.212 km	0.132 mi	
Resistance Coefficient (Kb)	=	0.08	0.08	Table 2.1
Upstream Elevation	=	358.02 m	1174.6 ft	
Downstream Elevation	=	355.57 m	1166.56 ft	
Watercourse slope (S)	=	11.54 m/km	60.91 ft/mi	
Calculated Tc	=	0.16 hr	0.16 hr	
		9.40 min	9.35 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	30
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	70
C =	0.775		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.121 cms

English
Q=ciA

Q= 4.22 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 18 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.72 ac
0.29 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.129 km	0.08 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	358.32 m	1175.59 ft
Downstream Elevation	=	356.69 m	1170.23 ft
Watercourse slope (S)	=	12.69 m/km	67.00 ft/mi
Calculated Tc	=	0.07 hr	0.06 hr
		3.90 min	3.88 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.088 cms Q= 3.07 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 18 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.72 ac
0.29 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.129 km	0.08 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	358.32 m	1175.59 ft	
Downstream Elevation	=	356.69 m	1170.23 ft	
Watercourse slope (S)	=	12.69 m/km	67.00 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.46 min	3.44 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.121 cms Q= 4.23 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 19 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.63 ac
0.25 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.124 km	0.077 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	357.23 m	1172.02 ft
Downstream Elevation	=	355.67 m	1166.89 ft
Watercourse slope (S)	=	12.62 m/km	66.62 ft/mi
Calculated Tc	=	0.06 hr	0.06 hr
		3.84 min	3.82 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.077 cms Q= 2.69 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 19 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.63 ac
0.26 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.124 km	0.077 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	357.23 m	1172.02 ft	
Downstream Elevation	=	355.67 m	1166.89 ft	
Watercourse slope (S)	=	12.62 m/km	66.62 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.40 min	3.38 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.106 cms Q= 3.70 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 21 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.72 ac
0.29 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.129 km	0.08 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	357.30 m	1172.26 ft
Downstream Elevation	=	355.67 m	1166.89 ft
Watercourse slope (S)	=	12.71 m/km	67.12 ft/mi
Calculated Tc	=	0.07 hr	0.06 hr
		3.90 min	3.88 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.088 cms Q= 3.07 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 21 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.72 ac
0.29 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.129 km	0.08 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	357.30 m	1172.26 ft	
Downstream Elevation	=	355.67 m	1166.89 ft	
Watercourse slope (S)	=	12.71 m/km	67.12 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.45 min	3.44 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.121 cms Q= 4.23 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 22 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.63 ac
0.25 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.126 km	0.078 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	355.77 m	1167.23 ft
Downstream Elevation	=	354.76 m	1163.9 ft
Watercourse slope (S)	=	8.09 m/km	42.69 ft/mi
Calculated Tc	=	0.07 hr	0.07 hr
		4.43 min	4.41 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.077 cms Q= 2.69 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 22 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.63 ac
0.26 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.126 km	0.078 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	355.77 m	1167.23 ft	
Downstream Elevation	=	354.76 m	1163.9 ft	
Watercourse slope (S)	=	8.09 m/km	42.69 ft/mi	
Calculated Tc	=	0.07 hr	0.07 hr	
		3.92 min	3.90 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.106 cms Q= 3.70 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 23 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1 ac
0.40 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	11 min	11 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	108 mm/hr	4.3 in/hr
Watercourse length (L)	=	0.212 km	0.132 mi
Resistance Coefficient (Kb)	=	0.08	0.08
Upstream Elevation	=	355.99 m	1167.93 ft
Downstream Elevation	=	353.53 m	1159.89 ft
Watercourse slope (S)	=	11.54 m/km	60.91 ft/mi
Calculated Tc	=	0.18 hr	0.18 hr
		10.84 min	10.74 min

Determine Rainfall Intensity

Tc= 11.00 min i = 108 mm/hr *** Tc< 10 min use 10 min as minimum
4.3 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	29
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	71
C =	0.7725		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.094 cms Q= 3.32 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 23 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1 ac
0.40 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.212 km	0.132 mi	
Resistance Coefficient (Kb)	=	0.08	0.08	Table 2.1
Upstream Elevation	=	355.99 m	1167.93 ft	
Downstream Elevation	=	353.53 m	1159.89 ft	
Watercourse slope (S)	=	11.54 m/km	60.91 ft/mi	
Calculated Tc	=	0.16 hr	0.16 hr	
		9.40 min	9.35 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	29
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	71
C =	0.7725		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.137 cms

English
Q=ciA

Q= 4.78 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 24 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.72 ac
0.29 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.130 km	0.081 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	355.71 m	1167.03 ft
Downstream Elevation	=	354.65 m	1163.56 ft
Watercourse slope (S)	=	8.11 m/km	42.84 ft/mi
Calculated Tc	=	0.08 hr	0.07 hr
		4.51 min	4.49 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.088 cms Q= 3.07 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 24 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.72 ac
0.29 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.130 km	0.081 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	355.71 m	1167.03 ft	
Downstream Elevation	=	354.65 m	1163.56 ft	
Watercourse slope (S)	=	8.11 m/km	42.84 ft/mi	
Calculated Tc	=	0.07 hr	0.07 hr	
		3.99 min	3.97 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.121 cms Q= 4.23 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 25 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.63 ac
0.25 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.127 km	0.079 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	355.20 m	1165.37 ft
Downstream Elevation	=	353.64 m	1160.22 ft
Watercourse slope (S)	=	12.35 m/km	65.19 ft/mi
Calculated Tc	=	0.07 hr	0.06 hr
		3.91 min	3.89 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.077 cms Q= 2.69 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 25 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.63 ac
0.26 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.127 km	0.079 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	355.20 m	1165.37 ft	
Downstream Elevation	=	353.64 m	1160.22 ft	
Watercourse slope (S)	=	12.35 m/km	65.19 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.46 min	3.44 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.106 cms Q= 3.70 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 27 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.71 ac
0.29 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.129 km	0.08 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	355.28 m	1165.61 ft
Downstream Elevation	=	353.64 m	1160.22 ft
Watercourse slope (S)	=	12.76 m/km	67.37 ft/mi
Calculated Tc	=	0.06 hr	0.06 hr
		3.90 min	3.88 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.087 cms Q= 3.03 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 27 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.71 ac
0.29 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.129 km	0.08 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	355.28 m	1165.61 ft	
Downstream Elevation	=	353.64 m	1160.22 ft	
Watercourse slope (S)	=	12.76 m/km	67.37 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.45 min	3.43 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.119 cms Q= 4.18 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 28 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.74 ac
0.30 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.146 km	0.091 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	354.19 m	1162.04 ft
Downstream Elevation	=	352.43 m	1156.28 ft
Watercourse slope (S)	=	11.99 m/km	63.30 ft/mi
Calculated Tc	=	0.07 hr	0.07 hr
		4.24 min	4.22 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.090 cms Q= 3.16 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 28 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.74 ac
0.30 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.146 km	0.091 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	354.19 m	1162.04 ft	
Downstream Elevation	=	352.43 m	1156.28 ft	
Watercourse slope (S)	=	11.99 m/km	63.30 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.75 min	3.73 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.124 cms Q= 4.35 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 29 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.38 ac
0.15 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.129 km	0.08 mi
Resistance Coefficient (Kb)	=	0.08	0.08
Upstream Elevation	=	353.95 m	1161.26 ft
Downstream Elevation	=	352.33 m	1155.95 ft
Watercourse slope (S)	=	12.57 m/km	66.37 ft/mi
Calculated Tc	=	0.13 hr	0.13 hr
		8.05 min	8.01 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	27
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	73
C =	0.7675		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.037 cms Q= 1.31 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 29 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.38 ac
0.15 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.129 km	0.08 mi	
Resistance Coefficient (Kb)	=	0.08	0.08	Table 2.1
Upstream Elevation	=	353.95 m	1161.26 ft	
Downstream Elevation	=	352.33 m	1155.95 ft	
Watercourse slope (S)	=	12.57 m/km	66.37 ft/mi	
Calculated Tc	=	0.12 hr	0.12 hr	
		7.13 min	7.09 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	27
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	73
C =	0.7675		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.052 cms Q= 1.81 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 30 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.86 ac
0.35 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.146 km	0.091 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	354.26 m	1162.26 ft
Downstream Elevation	=	352.35 m	1156 ft
Watercourse slope (S)	=	13.03 m/km	68.79 ft/mi
Calculated Tc	=	0.07 hr	0.07 hr
		4.13 min	4.11 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.105 cms Q= 3.67 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 30 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.86 ac
0.35 hc

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.146 km	0.091 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	354.26 m	1162.26 ft	
Downstream Elevation	=	352.35 m	1156 ft	
Watercourse slope (S)	=	13.03 m/km	68.79 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.66 min	3.64 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric		English	
Q=ciA/360		Q=ciA	
Q= 0.144	cms	Q= 5.06	cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 31 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.08 ac
0.44 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.151 km	0.094 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	352.99 m	1158.1 ft	
Downstream Elevation	=	351.12 m	1151.98 ft	
Watercourse slope (S)	=	12.33 m/km	65.11 ft/mi	
Calculated Tc	=	0.09 hr	0.09 hr	
		5.42 min	5.39 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	73
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	27
C =	0.8825		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.169 cms Q= 5.90 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 31 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.08 ac
0.44 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.151 km	0.094 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	352.99 m	1158.1 ft
Downstream Elevation	=	351.12 m	1151.98 ft
Watercourse slope (S)	=	12.33 m/km	65.11 ft/mi
Calculated Tc	=	0.09 hr	0.09 hr
		5.19 min	5.16 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	73
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	27
C =	0.8825		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.189 cms Q= 6.60 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 32 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.02 ac
0.41 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.153 km	0.095 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	352.75 m	1157.32 ft	
Downstream Elevation	=	350.97 m	1151.49 ft	
Watercourse slope (S)	=	11.62 m/km	61.37 ft/mi	
Calculated Tc	=	0.09 hr	0.09 hr	
		5.55 min	5.52 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	84
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	16
C =	0.91		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.164 cms Q= 5.75 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 32 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.02 ac
0.41 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.153 km	0.095 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	352.75 m	1157.32 ft
Downstream Elevation	=	350.97 m	1151.49 ft
Watercourse slope (S)	=	11.62 m/km	61.37 ft/mi
Calculated Tc.	=	0.09 hr	0.09 hr
		5.32 min	5.29 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	84
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	16
C =	0.91		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.184 cms

English
Q=ciA

Q= 6.43 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 33 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 2.22 ac
0.90 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	17 min	17 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	125 mm/hr	4.9 in/hr	Figure 2-2
Watercourse length (L)	=	0.531 km	0.33 mi	
Resistance Coefficient (Kb)	=	0.08	0.08	Table 2.1
Upstream Elevation	=	352.75 m	1157.32 ft	
Downstream Elevation	=	347.57 m	1140.32 ft	
Watercourse slope (S)	=	9.76 m/km	51.52 ft/mi	
Calculated Tc	=	0.28 hr	0.28 hr	
		17.08 min	17.02 min	

Determine Rainfall Intensity

Tc= 17.00 min i = 125 mm/hr *** Tc< 10 min use 10 min as minimum
4.9 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	27
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	73
C =	0.7675		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.240 cms Q= 8.35 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 33 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 2.22 ac
0.90 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	16 min	16 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	147 mm/hr	5.6 in/hr
Watercourse length (L)	=	0.531 km	0.33 mi
Resistance Coefficient (Kb)	=	0.08	0.08
Upstream Elevation	=	352.75 m	1157.32 ft
Downstream Elevation	=	347.57 m	1140.32 ft
Watercourse slope (S)	=	9.76 m/km	51.52 ft/mi
Calculated Tc	=	0.27 hr	0.27 hr
		16.06 min	16.18 min

Determine Rainfall Intensity

Tc= 16.00 min i = 147 mm/hr *** Tc< 10 min use 10 min as minimum
5.6 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	27
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	73
C =	0.7675		

Discharge Calculation

Metric		English	
Q=ciA/360		Q=ciA	
Q= 0.282	cms	Q= 9.54	cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 34 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.28 ac
0.11 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.064 km	0.04 mi	
Resistance Coefficient (Kb)	=	0.08	0.08	Table 2.1
Upstream Elevation	=	347.90 m	1141.39 ft	
Downstream Elevation	=	347.33 m	1139.52 ft	
Watercourse slope (S)	=	8.85 m/km	46.75 ft/mi	
Calculated Tc	=	0.09 hr	0.09 hr	
		5.62 min	5.59 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	42
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	58
C =	0.805		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.040 cms Q= 1.40 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 34 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.28 ac
0.11 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.064 km	0.04 mi
Resistance Coefficient (Kb)	=	0.08	0.08
Upstream Elevation	=	347.90 m	1141.39 ft
Downstream Elevation	=	347.33 m	1139.52 ft
Watercourse slope (S)	=	8.85 m/km	46.75 ft/mi
Calculated Tc	=	0.09 hr	0.09 hr
		5.38 min	5.35 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	42
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	58
C =	0.805		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.045 cms

English
Q=ciA

Q= 1.56 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 35 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.75 ac
0.30 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.103 km	0.064 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	351.74 m	1154 ft	
Downstream Elevation	=	350.07 m	1148.52 ft	
Watercourse slope (S)	=	16.22 m/km	85.63 ft/mi	
Calculated Tc	=	0.07 hr	0.07 hr	
		4.11 min	4.09 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	66
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	34
C =	0.865		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.115 cms Q= 4.02 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 35 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.75 ac
0.30 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.103 km	0.064 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	351.74 m	1154 ft
Downstream Elevation	=	350.07 m	1148.52 ft
Watercourse slope (S)	=	16.22 m/km	85.63 ft/mi
Calculated Tc	=	0.07 hr	0.07 hr
		3.94 min	3.91 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	66
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	34
C =	0.865		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.128 cms

English
Q=ciA

Q= 4.50 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 36 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.72 ac
0.29 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.111 km	0.069 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	351.89 m	1154.48 ft	
Downstream Elevation	=	350.48 m	1149.88 ft	
Watercourse slope (S)	=	12.63 m/km	66.67 ft/mi	
Calculated Tc	=	0.08 hr	0.08 hr	
		4.61 min	4.58 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	75
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	25
C =	0.8875		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.113 cms Q= 3.96 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 36 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.72 ac
0.29 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.111 km	0.069 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	351.89 m	1154.48 ft
Downstream Elevation	=	350.48 m	1149.88 ft
Watercourse slope (S)	=	12.63 m/km	66.67 ft/mi
Calculated Tc	=	0.07 hr	0.07 hr
		4.42 min	4.39 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	75
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	25
C =	0.8875		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.126 cms

English
Q=ciA

Q= 4.43 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 37 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.01 ac
0.41 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.209 km	0.13 mi	
Resistance Coefficient (Kb)	=	0.08	0.08	Table 2.1
Upstream Elevation	=	352.35 m	1156 ft	
Downstream Elevation	=	350.40 m	1149.61 ft	
Watercourse slope (S)	=	9.31 m/km	49.15 ft/mi	
Calculated Tc	=	0.17 hr	0.17 hr	
		9.97 min	9.92 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	0
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	100
C =	0.7		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.125 cms Q= 4.38 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 37 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.01 ac
0.41 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.209 km	0.13 mi
Resistance Coefficient (Kb)	=	0.08	0.08
Upstream Elevation	=	352.35 m	1156 ft
Downstream Elevation	=	350.40 m	1149.61 ft
Watercourse slope (S)	=	9.31 m/km	49.15 ft/mi
Calculated Tc	=	0.16 hr	0.16 hr
		9.55 min	9.50 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	0
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	100
C =	0.7		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.140 cms Q= 4.90 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 38 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.74 ac
0.30 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.122 km	0.076 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	351.13 m	1152.01 ft	
Downstream Elevation	=	349.61 m	1147.01 ft	
Watercourse slope (S)	=	12.46 m/km	65.79 ft/mi	
Calculated Tc	=	0.08 hr	0.08 hr	
		4.86 min	4.83 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	73
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	27
C =	0.8825		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.115 cms Q= 4.04 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 38 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.74 ac
0.30 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.122 km	0.076 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	351.13 m	1152.01 ft
Downstream Elevation	=	349.61 m	1147.01 ft
Watercourse slope (S)	=	12.46 m/km	65.79 ft/mi
Calculated Tc	=	0.08 hr	0.08 hr
		4.65 min	4.63 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	73
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	27
C =	0.8825		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.129 cms

English
Q=ciA

Q= 4.53 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 39 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.9 ac
0.36 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.111 km	0.069 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	350.99 m	1151.55 ft	
Downstream Elevation	=	349.61 m	1147.01 ft	
Watercourse slope (S)	=	12.46 m/km	65.80 ft/mi	
Calculated Tc	=	0.08 hr	0.08 hr	
		4.63 min	4.60 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	58
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	42
C =	0.845		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.134 cms Q= 4.71 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 39 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.9 ac
0.36 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.111 km	0.069 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	350.99 m	1151.55 ft
Downstream Elevation	=	349.61 m	1147.01 ft
Watercourse slope (S)	=	12.46 m/km	65.80 ft/mi
Calculated Tc	=	0.07 hr	0.07 hr
		4.43 min	4.41 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	58
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	42
C =	0.845		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.150 cms

English
Q=ciA

Q= 5.27 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 40 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.39 ac
0.16 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.097 km	0.06 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	351.10 m	1151.89 ft	
Downstream Elevation	=	350.48 m	1149.87 ft	
Watercourse slope (S)	=	6.38 m/km	33.67 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.70 min	3.68 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.066 cms Q= 2.29 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 40 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.39 ac
0.16 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.097 km	0.06 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	351.10 m	1151.89 ft
Downstream Elevation	=	350.48 m	1149.87 ft
Watercourse slope (S)	=	6.38 m/km	33.67 ft/mi
Calculated Tc	=	0.06 hr	0.06 hr
		3.55 min	3.53 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.073 cms

English
Q=ciA

Q= 2.57 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 41 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.49 ac
0.60 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.322 km	0.2 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	355.10 m	1165.04 ft	
Downstream Elevation	=	350.08 m	1148.56 ft	
Watercourse slope (S)	=	15.61 m/km	82.40 ft/mi	
Calculated Tc	=	0.12 hr	0.12 hr	
		7.35 min	7.31 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	50
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	50
C =	0.825		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.217 cms Q= 7.61 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 41 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.49 ac
0.60 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.322 km	0.2 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	355.10 m	1165.04 ft
Downstream Elevation	=	350.08 m	1148.56 ft
Watercourse slope (S)	=	15.61 m/km	82.40 ft/mi
Calculated Tc	=	0.12 hr	0.12 hr
		7.04 min	7.00 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	50
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	50
C =	0.825		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.243 cms

English
Q=ciA

Q= 8.52 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 42 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.4 ac
0.57 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	19 min	19 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	120 mm/hr	4.6 in/hr	Figure 2-2
Watercourse length (L)	=	0.402 km	0.25 mi	
Resistance Coefficient (Kb)	=	0.08	0.08	Table 2.1
Upstream Elevation	=	349.34 m	1146.13 ft	
Downstream Elevation	=	347.33 m	1139.54 ft	
Watercourse slope (S)	=	4.99 m/km	26.36 ft/mi	
Calculated Tc	=	0.31 hr	0.31 hr	
		18.59 min	18.68 min	

Determine Rainfall Intensity

Tc= 19.00 min i = 120 mm/hr *** Tc< 10 min use 10 min as minimum
4.6 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	40
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	60
C =	0.8		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.151 cms Q= 5.15 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 42 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.4 ac
0.57 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	18 min	18 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	130 mm/hr	5.1 in/hr
Watercourse length (L)	=	0.402 km	0.25 mi
Resistance Coefficient (Kb)	=	0.08	0.08
Upstream Elevation	=	349.34 m	1146.13 ft
Downstream Elevation	=	347.33 m	1139.54 ft
Watercourse slope (S)	=	4.99 m/km	26.36 ft/mi
Calculated Tc	=	0.30 hr	0.30 hr
		18.03 min	17.96 min

Determine Rainfall Intensity

Tc= 18.00 min i = 130 mm/hr *** Tc< 10 min use 10 min as minimum
5.1 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	40
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	60
C =	0.8		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.164 cms

English
Q=ciA

Q= 5.71 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 43 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.01 ac
0.41 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.121 km	0.075 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	350.11 m	1148.64 ft	
Downstream Elevation	=	348.62 m	1143.76 ft	
Watercourse slope (S)	=	12.32 m/km	65.07 ft/mi	
Calculated Tc	=	0.08 hr	0.08 hr	
		4.84 min	4.82 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	53
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	47
C =	0.8325		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.149 cms Q= 5.20 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 43 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.01 ac
0.41 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.121 km	0.075 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	350.11 m	1148.64 ft
Downstream Elevation	=	348.59 m	1143.67 ft
Watercourse slope (S)	=	12.55 m/km	66.27 ft/mi
Calculated Tc	=	0.08 hr	0.08 hr
		4.61 min	4.59 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	53
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	47
C =	0.8325		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.166 cms

English
Q=ciA

Q= 5.83 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 44 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.26 ac
0.51 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.127 km	0.079 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	350.52 m	1150 ft	
Downstream Elevation	=	348.59 m	1143.67 ft	
Watercourse slope (S)	=	15.18 m/km	80.13 ft/mi	
Calculated Tc	=	0.08 hr	0.08 hr	
		4.66 min	4.63 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	48
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	52
C =	0.82		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.183 cms

English
Q=ciA

Q= 6.40 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 44 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.26 ac
0.51 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.127 km	0.079 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	350.52 m	1150 ft
Downstream Elevation	=	348.59 m	1143.67 ft
Watercourse slope (S)	=	15.18 m/km	80.13 ft/mi
Calculated Tc	=	0.07 hr	0.07 hr
		4.46 min	4.44 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	48
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	52
C =	0.82		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.204 cms Q= 7.16 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 45 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.97 ac
0.39 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.257 km	0.16 mi	
Resistance Coefficient (Kb)	=	0.08	0.08	Table 2.1
Upstream Elevation	=	354.26 m	1162.27 ft	
Downstream Elevation	=	350.76 m	1150.78 ft	
Watercourse slope (S)	=	13.60 m/km	71.81 ft/mi	
Calculated Tc	=	0.16 hr	0.16 hr	
		9.84 min	9.78 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	10
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	90
C =	0.725		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.124 cms Q= 4.35 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 45 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.97 ac
0.39 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.257 km	0.16 mi
Resistance Coefficient (Kb)	=	0.08	0.08
Upstream Elevation	=	354.26 m	1162.27 ft
Downstream Elevation	=	350.76 m	1150.78 ft
Watercourse slope (S)	=	13.60 m/km	71.81 ft/mi
Calculated Tc	=	0.16 hr	0.16 hr
		9.42 min	9.37 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	10
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	90
C =	0.725		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.139 cms

English
Q=ciA

Q= 4.87 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 46 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.42 ac
0.57 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.138 km	0.086 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	352.14 m	1155.33 ft	
Downstream Elevation	=	347.73 m	1140.84 ft	
Watercourse slope (S)	=	31.91 m/km	168.49 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.86 min	3.84 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	41
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	59
C =	0.8025		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.202 cms Q= 7.05 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 46 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.42 ac
0.57 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.145 km	0.09 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	352.14 m	1155.33 ft
Downstream Elevation	=	347.73 m	1140.84 ft
Watercourse slope (S)	=	30.49 m/km	161.00 ft/mi
Calculated Tc	=	0.06 hr	0.06 hr
		3.84 min	3.82 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	41
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	59
C =	0.8025		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.225 cms

English
Q=ciA

Q= 7.90 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 47 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.56 ac
0.63 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.145 km	0.09 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	352.01 m	1154.89 ft	
Downstream Elevation	=	347.72 m	1140.81 ft	
Watercourse slope (S)	=	29.63 m/km	156.44 ft/mi	
Calculated Tc	=	0.07 hr	0.07 hr	
		4.04 min	4.02 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	42
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	58
C =	0.805		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.222 cms Q= 7.77 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 47 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.56 ac
0.63 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.145 km	0.09 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	352.01 m	1154.89 ft
Downstream Elevation	=	347.72 m	1140.81 ft
Watercourse slope (S)	=	29.63 m/km	156.44 ft/mi
Calculated Tc	=	0.06 hr	0.06 hr
		3.87 min	3.85 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	42
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	58
C =	0.805		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.248 cms

English
Q=ciA

Q= 8.70 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 48 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.296 ac
0.52 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.137 km	0.085 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	354.44 m	1162.85 ft	
Downstream Elevation	=	347.48 m	1140.01 ft	
Watercourse slope (S)	=	50.89 m/km	268.71 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.32 min	3.30 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	39
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	61
C =	0.7975		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.183 cms Q= 6.40 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 48 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.296 ac
0.52 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.137 km	0.085 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	354.44 m	1162.85 ft
Downstream Elevation	=	347.48 m	1140.01 ft
Watercourse slope (S)	=	50.89 m/km	268.71 ft/mi
Calculated Tc	=	0.05 hr	0.05 hr
		3.18 min	3.16 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	39
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	61
C =	0.7975		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.204 cms Q= 7.16 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 49 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.139 ac
0.46 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.121 km	0.075 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	348.05 m	1141.88 ft	
Downstream Elevation	=	347.48 m	1140.03 ft	
Watercourse slope (S)	=	4.67 m/km	24.67 ft/mi	
Calculated Tc	=	0.11 hr	0.11 hr	
		6.54 min	6.51 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	45
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	55
C =	0.8125		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.164 cms Q= 5.73 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 49 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.139 ac
0.46 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.121 km	0.075 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	348.05 m	1141.88 ft
Downstream Elevation	=	347.48 m	1140.03 ft
Watercourse slope (S)	=	4.67 m/km	24.67 ft/mi
Calculated Tc	=	0.10 hr	0.10 hr
		6.27 min	6.23 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	45
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	55
C =	0.8125		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.183 cms Q= 6.41 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 50 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 3.83 ac
1.55 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.426 km	0.265 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	355.17 m	1165.24 ft	
Downstream Elevation	=	348.49 m	1143.34 ft	
Watercourse slope (S)	=	15.65 m/km	82.64 ft/mi	
Calculated Tc	=	0.14 hr	0.14 hr	
		8.45 min	8.41 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	41
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	59
C =	0.8025		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.544 cms Q= 19.03 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 50 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 3.83 ac
1.55 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.426 km	0.265 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	355.17 m	1165.24 ft
Downstream Elevation	=	348.49 m	1143.34 ft
Watercourse slope (S)	=	15.65 m/km	82.64 ft/mi
Calculated Tc	=	0.13 hr	0.13 hr
		8.10 min	8.05 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	41
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	59
C =	0.8025		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.608 cms

English
Q=ciA

Q= 21.30 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 51 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 2.55 ac
1.03 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.354 km	0.22 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	355.15 m	1165.18 ft	
Downstream Elevation	=	348.21 m	1142.43 ft	
Watercourse slope (S)	=	19.59 m/km	103.41 ft/mi	
Calculated Tc	=	0.12 hr	0.12 hr	
		7.18 min	7.14 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	45
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	55
C =	0.8125		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.366 cms Q= 12.82 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 51 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 2.55 ac
1.03 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.354 km	0.22 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	355.15 m	1165.18 ft
Downstream Elevation	=	348.21 m	1142.43 ft
Watercourse slope (S)	=	19.59 m/km	103.41 ft/mi
Calculated Tc	=	0.11 hr	0.11 hr
		6.88 min	6.84 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	45
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	55
C =	0.8125		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.410 cms Q= 14.36 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 52 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.19 ac
0.48 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.121 km	0.075 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	348.05 m	1141.88 ft	
Downstream Elevation	=	347.48 m	1140.03 ft	
Watercourse slope (S)	=	4.67 m/km	24.67 ft/mi	
Calculated Tc	=	0.11 hr	0.11 hr	
		6.54 min	6.51 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	43
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	57
C =	0.8075		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.170 cms Q= 5.95 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 52 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.19 ac
0.48 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.121 km	0.075 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	348.05 m	1141.88 ft
Downstream Elevation	=	347.48 m	1140.03 ft
Watercourse slope (S)	=	4.67 m/km	24.67 ft/mi
Calculated Tc	=	0.10 hr	0.10 hr
		6.27 min	6.23 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	43
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	57
C =	0.8075		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.190 cms

English
Q=ciA

Q= 6.66 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 53 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.99 ac
0.40 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.121 km	0.075 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	348.45 m	1143.21 ft	
Downstream Elevation	=	347.78 m	1141 ft	
Watercourse slope (S)	=	5.58 m/km	29.47 ft/mi	
Calculated Tc	=	0.10 hr	0.10 hr	
		6.19 min	6.16 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	52
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	48
C =	0.83		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.145 cms Q= 5.09 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 53 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.99 ac
0.40 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.121 km	0.075 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	348.45 m	1143.21 ft
Downstream Elevation	=	347.78 m	1141 ft
Watercourse slope (S)	=	5.58 m/km	29.47 ft/mi
Calculated Tc	=	0.10 hr	0.10 hr
		5.93 min	5.90 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	52
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	48
C =	0.83		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.163 cms

English
Q=ciA

Q= 5.69 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 54 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.94 ac
0.38 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.121 km	0.075 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	348.45 m	1143.21 ft	
Downstream Elevation	=	347.78 m	1141 ft	
Watercourse slope (S)	=	5.58 m/km	29.47 ft/mi	
Calculated Tc	=	0.10 hr	0.10 hr	
		6.19 min	6.16 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	56
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	44
C =	0.84		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.140 cms

English
Q=ciA

Q= 4.89 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 54 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.94 ac
0.38 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.121 km	0.075 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	348.45 m	1143.21 ft
Downstream Elevation	=	347.78 m	1141 ft
Watercourse slope (S)	=	5.58 m/km	29.47 ft/mi
Calculated Tc	=	0.10 hr	0.10 hr
		5.93 min	5.90 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	56
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	44
C =	0.84		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.156 cms

English
Q=ciA

Q= 5.47 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 55 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.3 ac
0.53 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.156 km	0.097 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	354.48 m	1163 ft	
Downstream Elevation	=	347.48 m	1140.01 ft	
Watercourse slope (S)	=	44.89 m/km	237.01 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.69 min	3.67 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	35
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	65
C =	0.7875		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.181 cms Q= 6.34 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 55 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 1.3 ac
0.53 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.156 km	0.097 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	354.48 m	1163 ft
Downstream Elevation	=	347.48 m	1140.01 ft
Watercourse slope (S)	=	44.89 m/km	237.01 ft/mi
Calculated Tc	=	0.06 hr	0.06 hr
		3.53 min	3.51 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	35
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	65
C =	0.7875		

Discharge Calculation

Metric		English	
Q=ciA/360		Q=ciA	
Q= 0.203	cms	Q= 7.09	cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 56 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.82 ac
0.33 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.121 km	0.075 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	348.85 m	1144.53 ft	
Downstream Elevation	=	348.18 m	1142.33 ft	
Watercourse slope (S)	=	5.56 m/km	29.33 ft/mi	
Calculated Tc	=	0.10 hr	0.10 hr	
		6.20 min	6.17 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	63
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	37
C =	0.8575		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.124 cms Q= 4.35 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 56 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.82 ac
0.33 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.121 km	0.075 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	348.85 m	1144.53 ft
Downstream Elevation	=	348.18 m	1142.33 ft
Watercourse slope (S)	=	5.56 m/km	29.33 ft/mi
Calculated Tc	=	0.10 hr	0.10 hr
		5.94 min	5.91 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	63
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	37
C =	0.8575		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.139 cms

English
Q=ciA

Q= 4.87 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 57 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.77 ac
0.31 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.121 km	0.075 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	349.08 m	1145.26 ft	
Downstream Elevation	=	348.18 m	1142.33 ft	
Watercourse slope (S)	=	7.40 m/km	39.07 ft/mi	
Calculated Tc	=	0.09 hr	0.09 hr	
		5.67 min	5.64 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	66
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	34
C =	0.865		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.118 cms Q= 4.12 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 57 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.77 ac
0.31 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.121 km	0.075 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	349.08 m	1145.26 ft
Downstream Elevation	=	348.18 m	1142.33 ft
Watercourse slope (S)	=	7.40 m/km	39.07 ft/mi
Calculated Tc	=	0.09 hr	0.09 hr
		5.43 min	5.40 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	66
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	34
C =	0.865		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.132 cms

English
Q=ciA

Q= 4.62 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 58 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.31 ac
0.13 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.064 km	0.04 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	349.28 m	1145.93 ft	
Downstream Elevation	=	348.58 m	1143.65 ft	
Watercourse slope (S)	=	10.80 m/km	57.00 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.68 min	3.66 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	80
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	20
C =	0.9		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.049 cms Q= 1.73 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 58 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.31 ac
0.13 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.064 km	0.04 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	349.28 m	1145.93 ft
Downstream Elevation	=	348.58 m	1143.65 ft
Watercourse slope (S)	=	10.80 m/km	57.00 ft/mi
Calculated Tc	=	0.06 hr	0.06 hr
		3.53 min	3.51 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	80
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	20
C =	0.9		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.055 cms Q= 1.93 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 59 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.42 ac
0.17 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.080 km	0.05 mi	
Resistance Coefficient (Kb)	=	0.04	0.04	Table 2.1
Upstream Elevation	=	349.36 m	1146.18 ft	
Downstream Elevation	=	348.58 m	1143.65 ft	
Watercourse slope (S)	=	9.58 m/km	50.60 ft/mi	
Calculated Tc	=	0.07 hr	0.07 hr	
		4.27 min	4.25 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	84
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	16
C =	0.91		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.068 cms Q= 2.37 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 59 100 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.42 ac
0.17 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	63.740 mm	2.51 in
Rainfall intensity (i)	=	175.93 mm/hr	6.93 in/hr
Watercourse length (L)	=	0.080 km	0.05 mi
Resistance Coefficient (Kb)	=	0.04	0.04
Upstream Elevation	=	349.36 m	1146.18 ft
Downstream Elevation	=	348.58 m	1143.65 ft
Watercourse slope (S)	=	9.58 m/km	50.60 ft/mi
Calculated Tc	=	0.07 hr	0.07 hr
		4.10 min	4.07 min

Determine Rainfall Intensity

Tc= 10.00 min i = 175.93 mm/hr *** Tc< 10 min use 10 min as minimum
6.93 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	84
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	16
C =	0.91		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.076 cms

English
Q=ciA

Q= 2.65 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 100 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.21 ac
0.09 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.063 km	0.039 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	355.19 m	1165.31 ft
Downstream Elevation	=	354.92 m	1164.42 ft
Watercourse slope (S)	=	4.32 m/km	22.82 ft/mi
Calculated Tc	=	0.06 hr	0.06 hr
		3.81 min	3.79 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.026 cms Q= 0.90 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 100 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.21 ac
0.09 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.063 km	0.039 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	355.19 m	1165.31 ft	
Downstream Elevation	=	354.92 m	1164.42 ft	
Watercourse slope (S)	=	4.32 m/km	22.82 ft/mi	
Calculated Tc	=	0.06 hr	0.06 hr	
		3.37 min	3.35 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.035 cms

English
Q=ciA

Q= 1.23 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 101 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.22 ac
0.09 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.064 km	0.04 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	355.37 m	1165.91 ft
Downstream Elevation	=	354.88 m	1164.31 ft
Watercourse slope (S)	=	7.58 m/km	40.00 ft/mi
Calculated Tc	=	0.05 hr	0.05 hr
		3.24 min	3.22 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.027 cms Q= 0.94 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 101 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.22 ac
0.09 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.064 km	0.04 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	355.37 m	1165.91 ft	
Downstream Elevation	=	354.88 m	1164.31 ft	
Watercourse slope (S)	=	7.58 m/km	40.00 ft/mi	
Calculated Tc	=	0.05 hr	0.05 hr	
		2.87 min	2.85 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.037 cms Q= 1.29 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 102 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.18 ac
0.07 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.056 km	0.035 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	355.37 m	1165.91 ft
Downstream Elevation	=	354.96 m	1164.56 ft
Watercourse slope (S)	=	7.31 m/km	38.57 ft/mi
Calculated Tc	=	0.05 hr	0.05 hr
		3.06 min	3.05 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric		English	
Q=ciA/360		Q=ciA	
Q= 0.022	cms	Q= 0.77	cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 102 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.18 ac
0.07 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.056 km	0.035 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	355.37 m	1165.91 ft	
Downstream Elevation	=	354.96 m	1164.56 ft	
Watercourse slope (S)	=	7.31 m/km	38.57 ft/mi	
Calculated Tc	=	0.05 hr	0.04 hr	
		2.71 min	2.70 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.030 cms Q= 1.06 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 103 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.19 ac
0.08 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.060 km	0.037 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	355.37 m	1165.91 ft
Downstream Elevation	=	354.92 m	1164.43 ft
Watercourse slope (S)	=	7.58 m/km	40.00 ft/mi
Calculated Tc	=	0.05 hr	0.05 hr
		3.11 min	3.10 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.023 cms Q= 0.81 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 103 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.19 ac
0.08 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.060 km	0.037 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	355.37 m	1165.91 ft	
Downstream Elevation	=	354.92 m	1164.43 ft	
Watercourse slope (S)	=	7.58 m/km	40.00 ft/mi	
Calculated Tc	=	0.05 hr	0.05 hr	
		2.76 min	2.74 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.032 cms Q= 1.12 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 104 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.15 ac
0.06 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.061 km	0.038 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	355.05 m	1164.85 ft
Downstream Elevation	=	354.30 m	1162.4 ft
Watercourse slope (S)	=	12.21 m/km	64.47 ft/mi
Calculated Tc	=	0.05 hr	0.05 hr
		2.72 min	2.71 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.018 cms Q= 0.64 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 104 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.15 ac
0.06 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.061 km	0.038 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	355.05 m	1164.85 ft	
Downstream Elevation	=	354.30 m	1162.4 ft	
Watercourse slope (S)	=	12.21 m/km	64.47 ft/mi	
Calculated Tc	=	0.04 hr	0.04 hr	
		2.41 min	2.40 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.025 cms Q= 0.88 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 105 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.67 ac
0.27 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.113 km	0.07 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	354.98 m	1164.64 ft
Downstream Elevation	=	354.30 m	1162.4 ft
Watercourse slope (S)	=	6.06 m/km	32.00 ft/mi
Calculated Tc	=	0.08 hr	0.08 hr
		4.59 min	4.57 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.082 cms Q= 2.86 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 105 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.67 ac
0.27 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.113 km	0.07 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	354.98 m	1164.64 ft	
Downstream Elevation	=	354.30 m	1162.4 ft	
Watercourse slope (S)	=	6.06 m/km	32.00 ft/mi	
Calculated Tc	=	0.07 hr	0.07 hr	
		4.06 min	4.04 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.113 cms Q= 3.94 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 106 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.24 ac
0.10 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.087 km	0.054 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	355.04 m	1164.84 ft
Downstream Elevation	=	354.27 m	1162.31 ft
Watercourse slope (S)	=	8.87 m/km	46.85 ft/mi
Calculated Tc	=	0.06 hr	0.06 hr
		3.58 min	3.56 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.029 cms

English
Q=ciA

Q= 1.02 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 106 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.24 ac
0.10 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.087 km	0.054 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	355.04 m	1164.84 ft	
Downstream Elevation	=	354.27 m	1162.31 ft	
Watercourse slope (S)	=	8.87 m/km	46.85 ft/mi	
Calculated Tc	=	0.05 hr	0.05 hr	
		3.17 min	3.16 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.040 cms Q= 1.41 cfs

Job No. 00173-317-044

Computation

HDR

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 107 10 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.2 ac
0.08 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH
Assumed Tc for rainfall intensity	=	10 min	10 min
1-hour precipitation volume	=	40.110 mm	1.58 in
Rainfall intensity (i)	=	114.14 mm/hr	4.49 in/hr
Watercourse length (L)	=	0.089 km	0.055 mi
Resistance Coefficient (Kb)	=	0.02	0.02
Upstream Elevation	=	355.10 m	1165.01 ft
Downstream Elevation	=	354.28 m	1162.35 ft
Watercourse slope (S)	=	9.16 m/km	48.36 ft/mi
Calculated Tc	=	0.06 hr	0.06 hr
		3.58 min	3.56 min

Determine Rainfall Intensity

Tc= 10.00 min i = 114.14 mm/hr *** Tc< 10 min use 10 min as minimum
4.49 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

Q= 0.024 cms

English
Q=ciA

Q= 0.85 cfs

Job No. 00173-317-044

HDR

Computation

Project	SR202L 56th Street-Kyrene	Computed	JKE	Date	5/15/00
Subject	Hydraulic Analysis with Rational Method	Checked		Date	
Task	DRAINAGE AREA 107 50 YEAR DESIGN STORM FREQUENCY				

Drainage Area 0.2 ac
0.08 ha

Rational Equation Parameters

Time of Concentration

Tc=18.44*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38) Tc=11.4*(L^0.5)*(Kb^0.52)*(S^-0.31)*(i^-0.38)

		METRIC	ENGLISH	
Assumed Tc for rainfall intensity	=	10 min	10 min	
1-hour precipitation volume	=	56.610 mm	2.23 in	
Rainfall intensity (i)	=	157.25 mm/hr	6.19 in/hr	Figure 2-2
Watercourse length (L)	=	0.089 km	0.055 mi	
Resistance Coefficient (Kb)	=	0.02	0.02	Table 2.1
Upstream Elevation	=	355.10 m	1165.01 ft	
Downstream Elevation	=	354.28 m	1162.35 ft	
Watercourse slope (S)	=	9.16 m/km	48.36 ft/mi	
Calculated Tc	=	0.05 hr	0.05 hr	
		3.17 min	3.15 min	

Determine Rainfall Intensity

Tc= 10.00 min i = 157.25 mm/hr *** Tc< 10 min use 10 min as minimum
6.19 in/hr

Rainfall Runoff Coefficient

			% area
C =	0.95	From Figure 2-3 Rational Coefficient -Developed Pavement	100
C =	0.70	Rational Coefficient -Unpaved Moderate Urban 40% Impervious	0
C =	0.95		

Discharge Calculation

Metric
Q=ciA/360

English
Q=ciA

Q= 0.034 cms Q= 1.18 cfs

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB01
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	6.74	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.47	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.52	
Intercepted Flow	3.50	cfs
Bypass Flow	3.24	cfs
Spread	10.74	ft
Depth	0.40	ft
Flow Area	1.6	ft²
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.28	ft/s
Splash Over Velocity	7.55	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.50	
Active Grate Length	1.74	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB01-50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	9.29	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.43	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.44	
Intercepted Flow	4.13	cfs
Bypass Flow	5.16	cfs
Spread	12.85	ft
Depth	0.44	ft
Flow Area	2.1	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.48	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.43	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Ditch Inlet In Sag

Project Description	
Worksheet	Ditch Inlet - CB2
Type	Ditch Inlet In Sag
Solve For	Spread

Input Data		
Discharge	2.39	cfs
Left Side Slope	8.00	H : V
Right Side Slope	16.70	H : V
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.00	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	7.31	ft
Depth	0.21	ft
Wetted Perimeter	7.33	ft
Top Width	7.31	ft
Open Grate Area	2.7	ft^2
Active Grate Weir Length	8.00	ft

Worksheet
Worksheet for Ditch Inlet In Sag

Project Description	
Worksheet	Ditch Inlet - CB2-50yr
Type	Ditch Inlet In Sag
Solve For	Spread

Input Data		
Discharge	3.29	cfs
Left Side Slope	8.00	H : V
Right Side Slope	16.70	H : V
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.00	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	8.57	ft
Depth	0.27	ft
Wetted Perimeter	8.59	ft
Top Width	8.57	ft
Open Grate Area	2.7	ft^2
Active Grate Weir Length	8.00	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB03
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	4.69	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.62	
Intercepted Flow	2.93	cfs
Bypass Flow	1.76	cfs
Spread	8.51	ft
Depth	0.36	ft
Flow Area	1.1	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.09	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.04	
Grate Flow Ratio	0.61	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB03 50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	6.47	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.53	
Intercepted Flow	3.43	cfs
Bypass Flow	3.04	cfs
Spread	10.48	ft
Depth	0.40	ft
Flow Area	1.5	ft²
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.26	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.51	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB04
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	6.10	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.55	
Intercepted Flow	3.33	cfs
Bypass Flow	2.77	cfs
Spread	10.11	ft
Depth	0.39	ft
Flow Area	1.4	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.22	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.53	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB04-50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	9.10	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.45	
Intercepted Flow	4.08	cfs
Bypass Flow	5.02	cfs
Spread	12.71	ft
Depth	0.44	ft
Flow Area	2.0	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.47	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.43	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB06
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	4.83	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.61	
Intercepted Flow	2.97	cfs
Bypass Flow	1.86	cfs
Spread	8.69	ft
Depth	0.36	ft
Flow Area	1.2	ft²
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.10	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.04	
Grate Flow Ratio	0.60	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB06-50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	7.27	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.50	
Intercepted Flow	3.63	cfs
Bypass Flow	3.64	cfs
Spread	11.22	ft
Depth	0.41	ft
Flow Area	1.7	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.32	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.48	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB07
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	5.13	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.60	
Intercepted Flow	3.06	cfs
Bypass Flow	2.07	cfs
Spread	9.05	ft
Depth	0.37	ft
Flow Area	1.2	ft²
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.13	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.58	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB07-50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	8.72	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.46	
Intercepted Flow	3.99	cfs
Bypass Flow	4.73	cfs
Spread	12.42	ft
Depth	0.44	ft
Flow Area	2.0	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.44	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.44	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Ditch Inlet In Sag

Project Description	
Worksheet	Ditch Inlet - CB8
Type	Ditch Inlet In Sag
Solve For	Spread

Input Data		
Discharge	2.79	cfs
Left Side Slope	8.00	H : V
Right Side Slope	16.70	H : V
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.00	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	7.88	ft
Depth	0.24	ft
Wetted Perimeter	7.90	ft
Top Width	7.88	ft
Open Grate Area	2.7	ft^2
Active Grate Weir Length	8.00	ft

Worksheet
Worksheet for Ditch Inlet In Sag

Project Description	
Worksheet	Ditch Inlet - CB8-50yr
Type	Ditch Inlet In Sag
Solve For	Spread

Input Data		
Discharge	3.84	cfs
Left Side Slope	8.00	H : V
Right Side Slope	16.70	H : V
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.00	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	9.28	ft
Depth	0.29	ft
Wetted Perimeter	9.31	ft
Top Width	9.28	ft
Open Grate Area	2.7	ft^2
Active Grate Weir Length	8.00	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB09
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	4.93	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.61	
Intercepted Flow	3.00	cfs
Bypass Flow	1.93	cfs
Spread	8.81	ft
Depth	0.36	ft
Flow Area	1.2	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.11	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.04	
Grate Flow Ratio	0.59	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB09-50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	7.87	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.48	
Intercepted Flow	3.78	cfs
Bypass Flow	4.09	cfs
Spread	11.74	ft
Depth	0.42	ft
Flow Area	1.8	ft²
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.37	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.46	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB10
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	4.71	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.62	
Intercepted Flow	2.93	cfs
Bypass Flow	1.78	cfs
Spread	8.54	ft
Depth	0.36	ft
Flow Area	1.2	ft²
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.09	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.04	
Grate Flow Ratio	0.61	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB10-50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	8.38	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.47	
Intercepted Flow	3.91	cfs
Bypass Flow	4.47	cfs
Spread	12.15	ft
Depth	0.43	ft
Flow Area	1.9	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.41	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.45	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB12
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	5.00	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.60	
Intercepted Flow	3.02	cfs
Bypass Flow	1.98	cfs
Spread	8.89	ft
Depth	0.37	ft
Flow Area	1.2	ft²
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.12	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.59	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB12 50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	8.32	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.47	
Intercepted Flow	3.90	cfs
Bypass Flow	4.42	cfs
Spread	12.11	ft
Depth	0.43	ft
Flow Area	1.9	ft²
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.41	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.45	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB13
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	4.47	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.64	
Intercepted Flow	2.86	cfs
Bypass Flow	1.61	cfs
Spread	8.23	ft
Depth	0.35	ft
Flow Area	1.1	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.07	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.04	
Grate Flow Ratio	0.63	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB13- 50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	8.17	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.47	
Intercepted Flow	3.86	cfs
Bypass Flow	4.31	cfs
Spread	11.99	ft
Depth	0.43	ft
Flow Area	1.9	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.40	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.46	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Ditch Inlet In Sag

Project Description	
Worksheet	Ditch Inlet - CB14
Type	Ditch Inlet In Sag
Solve For	Spread

Input Data		
Discharge	2.95	cfs
Left Side Slope	8.00	H : V
Right Side Slope	16.70	H : V
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.00	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	8.11	ft
Depth	0.25	ft
Wetted Perimeter	8.13	ft
Top Width	8.11	ft
Open Grate Area	2.7	ft^2
Active Grate Weir Length	8.00	ft

Worksheet
Worksheet for Ditch Inlet In Sag

Project Description	
Worksheet	Ditch Inlet - CB14-50yr
Type	Ditch Inlet In Sag
Solve For	Spread

Input Data		
Discharge	4.24	cfs
Left Side Slope	8.00	H : V
Right Side Slope	16.70	H : V
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.00	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	9.78	ft
Depth	0.31	ft
Wetted Perimeter	9.81	ft
Top Width	9.78	ft
Open Grate Area	2.7	ft^2
Active Grate Weir Length	8.00	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB15
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	5.05	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.60	
Intercepted Flow	3.03	cfs
Bypass Flow	2.02	cfs
Spread	8.95	ft
Depth	0.37	ft
Flow Area	1.2	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.13	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.59	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB15-50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	8.65	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.46	
Intercepted Flow	3.97	cfs
Bypass Flow	4.68	cfs
Spread	12.37	ft
Depth	0.43	ft
Flow Area	2.0	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.43	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.44	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB16
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	4.30	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.65	
Intercepted Flow	2.81	cfs
Bypass Flow	1.49	cfs
Spread	8.00	ft
Depth	0.35	ft
Flow Area	1.1	ft²
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.05	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.04	
Grate Flow Ratio	0.64	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB16-50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	8.01	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.48	
Intercepted Flow	3.82	cfs
Bypass Flow	4.19	cfs
Spread	11.85	ft
Depth	0.42	ft
Flow Area	1.8	ft²
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.38	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.46	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB18
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	5.09	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.60	
Intercepted Flow	3.05	cfs
Bypass Flow	2.04	cfs
Spread	9.00	ft
Depth	0.37	ft
Flow Area	1.2	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.13	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.58	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB18-50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	8.91	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.45	
Intercepted Flow	4.04	cfs
Bypass Flow	4.87	cfs
Spread	12.57	ft
Depth	0.44	ft
Flow Area	2.0	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.45	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.44	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB19
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	4.18	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.66	
Intercepted Flow	2.77	cfs
Bypass Flow	1.41	cfs
Spread	7.84	ft
Depth	0.34	ft
Flow Area	1.0	ft²
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.03	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.04	
Grate Flow Ratio	0.65	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB19-50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	7.89	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.48	
Intercepted Flow	3.79	cfs
Bypass Flow	4.10	cfs
Spread	11.76	ft
Depth	0.42	ft
Flow Area	1.8	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.37	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.46	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Ditch Inlet In Sag

Project Description	
Worksheet	Ditch Inlet - CB20
Type	Ditch Inlet In Sag
Solve For	Spread

Input Data		
Discharge	2.93	cfs
Left Side Slope	8.00	H : V
Right Side Slope	16.70	H : V
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.00	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	8.08	ft
Depth	0.25	ft
Wetted Perimeter	8.10	ft
Top Width	8.08	ft
Open Grate Area	2.7	ft^2
Active Grate Weir Length	8.00	ft

Worksheet
Worksheet for Ditch Inlet In Sag

Project Description	
Worksheet	Ditch Inlet - CB20-50yr
Type	Ditch Inlet In Sag
Solve For	Spread

Input Data		
Discharge	4.22	cfs
Left Side Slope	8.00	H : V
Right Side Slope	16.70	H : V
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.00	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	9.75	ft
Depth	0.31	ft
Wetted Perimeter	9.78	ft
Top Width	9.75	ft
Open Grate Area	2.7	ft^2
Active Grate Weir Length	8.00	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB21
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	5.11	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.60	
Intercepted Flow	3.05	cfs
Bypass Flow	2.06	cfs
Spread	9.03	ft
Depth	0.37	ft
Flow Area	1.2	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.13	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.58	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB21-50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	9.10	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.45	
Intercepted Flow	4.08	cfs
Bypass Flow	5.02	cfs
Spread	12.71	ft
Depth	0.44	ft
Flow Area	2.0	ft²
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.47	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.43	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB22
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	4.10	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.67	
Intercepted Flow	2.75	cfs
Bypass Flow	1.35	cfs
Spread	7.72	ft
Depth	0.34	ft
Flow Area	1.0	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.03	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.04	
Grate Flow Ratio	0.66	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB22-50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	7.80	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.48	
Intercepted Flow	3.77	cfs
Bypass Flow	4.03	cfs
Spread	11.68	ft
Depth	0.42	ft
Flow Area	1.8	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.37	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.47	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB24
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	5.13	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.60	
Intercepted Flow	3.06	cfs
Bypass Flow	2.07	cfs
Spread	9.05	ft
Depth	0.37	ft
Flow Area	1.2	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.13	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.58	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB24-50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	9.25	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.45	
Intercepted Flow	4.12	cfs
Bypass Flow	5.13	cfs
Spread	12.82	ft
Depth	0.44	ft
Flow Area	2.1	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.48	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.43	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB25
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	4.04	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.68	
Intercepted Flow	2.73	cfs
Bypass Flow	1.31	cfs
Spread	7.64	ft
Depth	0.34	ft
Flow Area	1.0	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.02	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.04	
Grate Flow Ratio	0.66	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB25-50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	7.73	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.49	
Intercepted Flow	3.75	cfs
Bypass Flow	3.98	cfs
Spread	11.62	ft
Depth	0.42	ft
Flow Area	1.8	ft²
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.36	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.47	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Ditch Inlet In Sag

Project Description	
Worksheet	Ditch Inlet - CB26
Type	Ditch Inlet In Sag
Solve For	Spread

Input Data		
Discharge	3.32	cfs
Left Side Slope	8.00	H : V
Right Side Slope	16.70	H : V
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.00	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	8.61	ft
Depth	0.27	ft
Wetted Perimeter	8.63	ft
Top Width	8.61	ft
Open Grate Area	2.7	ft^2
Active Grate Weir Length	8.00	ft

Worksheet
Worksheet for Ditch Inlet In Sag

Project Description	
Worksheet	Ditch Inlet - CB26-50yr
Type	Ditch Inlet In Sag
Solve For	Spread

Input Data		
Discharge	4.78	cfs
Left Side Slope	8.00	H : V
Right Side Slope	16.70	H : V
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.00	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	10.42	ft
Depth	0.34	ft
Wetted Perimeter	10.45	ft
Top Width	10.42	ft
Open Grate Area	2.7	ft^2
Active Grate Weir Length	8.00	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB27
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	5.10	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.60	
Intercepted Flow	3.05	cfs
Bypass Flow	2.05	cfs
Spread	9.01	ft
Depth	0.37	ft
Flow Area	1.2	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.13	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.58	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB27-50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	9.31	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.44	
Intercepted Flow	4.13	cfs
Bypass Flow	5.18	cfs
Spread	12.86	ft
Depth	0.44	ft
Flow Area	2.1	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.48	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.43	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - 28 50yr
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	8.33	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.46	
Intercepted Flow	3.86	cfs
Bypass Flow	4.47	cfs
Spread	12.11	ft
Depth	0.43	ft
Flow Area	1.9	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.41	ft/s
Splash Over Velocity	6.99	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.02	
Grate Flow Ratio	0.45	
Active Grate Length	1.50	ft

Worksheet
Worksheet for Ditch Inlet In Sag

Project Description	
Worksheet	Ditch Inlet - CB29-50yr
Type	Ditch Inlet In Sag
Solve For	Spread

Input Data		
Discharge	1.81	cfs
Left Side Slope	8.00	H : V
Right Side Slope	16.70	H : V
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.00	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	6.41	ft
Depth	0.18	ft
Wetted Perimeter	6.43	ft
Top Width	6.41	ft
Open Grate Area	2.7	ft^2
Active Grate Weir Length	8.00	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - 30 50yr
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	10.24	cfs
Slope	0.010104	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.42	
Intercepted Flow	4.30	cfs
Bypass Flow	5.94	cfs
Spread	13.52	ft
Depth	0.46	ft
Flow Area	2.3	ft²
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.55	ft/s
Splash Over Velocity	6.99	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.02	
Grate Flow Ratio	0.41	
Active Grate Length	1.50	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	C-15.91 Grate Inlet - CB31-50yr
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	10.37	cfs
Slope	0.010104	ft/ft
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.93	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.57	
Intercepted Flow	5.87	cfs
Bypass Flow	4.50	cfs
Spread	14.10	ft
Depth	0.45	ft
Flow Area	2.3	ft^2
Gutter Depression	2.0	in
Total Depression	2.0	in
Velocity	4.45	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.55	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Irregular Channel

Project Description	
Worksheet	Irregular Channel - CB32
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.011472	ft/ft
Discharge	4.38	cfs

Options	
Current Roughness Method	mproved Lotter's Method
Open Channel Weighting Method	mproved Lotter's Method
Closed Channel Weighting Metho	Horton's Method

Results		
Mannings Coefficient	0.030	
Water Surface Elevation	0.21	ft
Elevation Range	-0.20 to 2.67	
Flow Area	2.1	ft²
Wetted Perimeter	8.61	ft
Top Width	8.39	ft
Actual Depth	0.41	ft
Critical Elevation	0.15	ft
Critical Slope	0.022551	ft/ft
Velocity	2.08	ft/s
Velocity Head	0.07	ft
Specific Energy	0.27	ft
Froude Number	0.73	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+15	0.030

Natural Channel Points

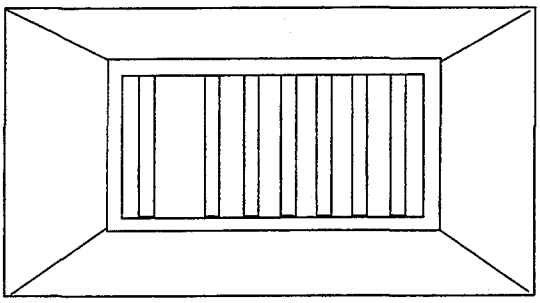
Station (ft)	Elevation (ft)
0+00	2.67
0+00	0.00
0+04	-0.20
0+09	0.23
0+12	1.23
0+15	2.23

Job No.	00173-317-044

Computation

HDR

Project	Santan	Computed	JKE	Date	6/00
Subject	Catch Basin Analysis	Checked		Date	
Task	CB 32 ON37	Sheet	1	Of	1



7 - 5/8 x 2 1/2 in Bars @ 3in C to C

Grate	
Area (sq.ft)	5.108
Length (ft)	2.554
Width (ft)	2.000
P=2(L+W) (ft)	9.108
Ae=A*50% (sq. ft)	2.554
Pe=P*50% (ft)	4.554

50% clogging factor

Cw = 3

Co= 0.67

Q50= 4.38 cfs

L=3-2(0.223) = 2.554 ft

A of Bars=(7*.208*.052) = 0.075712 sq ft

Nearest Low Pavement Elevation

Location 235+20
Elevation (Ep) 0 ft

Elevation of Grate

Eg 0 ft

Max Allowable Depth of Water

Dmax= 2.67 ft

Actual Depth of Water

Weir
d=((Qi)/((Cw)*(Pe)))^(2/3)

Orifice
d=((Qi)/((Co)*(Ae)*((2g)^.5)))^2

50 Year Flow
d= 0.47 ft

d= 0.33 ft

0.47< 2.67 Good

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - 33 50yr
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	11.69	cfs
Slope	0.011472	ft/ft
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.00	ft
Grate Length	3.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.41	
Intercepted Flow	4.74	cfs
Bypass Flow	6.95	cfs
Spread	14.01	ft
Depth	0.47	ft
Flow Area	2.4	ft^2
Gutter Depression	2.3	in
Total Depression	2.3	in
Velocity	4.90	ft/s
Splash Over Velocity	6.99	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.02	
Grate Flow Ratio	0.39	
Active Grate Length	1.50	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	C-15.91 Grate Inlet - CB34-50yr
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	8.52	cfs
Slope	0.011292	ft/ft
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.93	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.62	
Intercepted Flow	5.31	cfs
Bypass Flow	3.21	cfs
Spread	12.44	ft
Depth	0.42	ft
Flow Area	1.9	ft^2
Gutter Depression	2.0	in
Total Depression	2.0	in
Velocity	4.51	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.61	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Triangular Channel

Project Description	
Worksheet	Triangular Channel - 2
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Mannings Coefficient	0.030	
Slope	0.020668	ft/ft
Depth	0.25	ft
Left Side Slope	3.00	H : V
Right Side Slope	20.00	H : V

Results		
Discharge	1.27	cfs
Flow Area	0.7	ft²
Wetted Perimeter	5.80	ft
Top Width	5.75	ft
Critical Depth	0.24	ft
Critical Slope	0.026958	ft/ft
Velocity	1.77	ft/s
Velocity Head	0.05	ft
Specific Energy	0.30	ft
Froude Number	0.88	
Flow Type	Subcritical	

For CR [illegible]

Worksheet
Worksheet for Ditch Inlet In Sag

Project Description	
Worksheet	Ditch Inlet - CB35-50yr
Type	Ditch Inlet In Sag
Solve For	Spread

Input Data		
Discharge	1.27	cfs
Left Side Slope	3.00	H : V
Right Side Slope	20.00	H : V
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.00	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	5.24	ft
Depth	0.14	ft
Wetted Perimeter	5.27	ft
Top Width	5.24	ft
Open Grate Area	2.7	ft^2
Active Grate Weir Length	8.00	ft

additional [illegible]

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	C-15.91 Grate Inlet - CB36-50yr
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	3.96	cfs
Slope	0.010104	ft/ft
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.93	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.81	
Intercepted Flow	3.22	cfs
Bypass Flow	0.74	cfs
Spread	8.28	ft
Depth	0.34	ft
Flow Area	1.0	ft^2
Gutter Depression	2.0	in
Total Depression	2.0	in
Velocity	3.86	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.04	
Grate Flow Ratio	0.80	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Slot Inlet In Sag

Project Description	
Worksheet	Slot Inlet - CB37 50yr
Type	Slot Inlet In Sag
Solve For	Spread

Input Data		
Discharge	10.84	cfs
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Slot Width	0.15	ft
Slot Length	40.00	ft
Local Depression	1.0	in
Local Depression Width	4.00	ft

Results		
Spread	2.76	ft
Depth	0.23	ft
Gutter Depression	2.3	in
Total Depression	3.3	in
Open Slot Area	6.0	ft^2
Active Slot Weir Length	40.30	ft

[illegible] 30' [illegible]

CB [illegible] for clogging [illegible]

Worksheet
Worksheet for Grate Inlet In Sag

Project Description	
Worksheet	Sump-CB37-50yr
Type	Grate Inlet In Sag
Solve For	Spread

Input Data		
Discharge	10.84	cfs
Gutter Width	4.50	ft
Gutter Cross Slope	0.061700	ft/ft
Road Cross Slope	0.020000	ft/ft
Grate Width	2.00	ft
Grate Length	3.00	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	30.88	ft
Depth	0.81	ft
Gutter Depression	2.3	in
Total Depression	2.3	in
Open Grate Area	2.7	ft^2
Active Grate Weir Length	5.00	ft

Worksheet
Worksheet for Grate Inlet In Sag

Project Description	
Worksheet	Sump-CB38-50yr
Type	Grate Inlet In Sag
Solve For	Spread

Input Data		
Discharge	9.55	cfs
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Grate Width	2.93	ft
Grate Length	3.44	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	22.99	ft
Depth	0.63	ft
Gutter Depression	2.0	in
Total Depression	2.0	in
Open Grate Area	4.5	ft^2
Active Grate Weir Length	6.37	ft

Worksheet
Worksheet for Slot Inlet In Sag

Project Description	
Worksheet	Slot Inlet - CB38 50yr
Type	Slot Inlet In Sag
Solve For	Spread

Input Data		
Discharge	9.55	cfs
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Slot Width	0.15	ft
Slot Length	40.00	ft
Local Depression	1.0	in
Local Depression Width	4.00	ft

Results		
Spread	2.51	ft
Depth	0.21	ft
Gutter Depression	2.0	in
Total Depression	3.0	in
Open Slot Area	6.0	ft^2
Active Slot Weir Length	40.30	ft

Use 10.80 - 10.95 [illegible] accounting for [illegible]

Use 20' [illegible] drain [illegible] side

Change [illegible]

Worksheet
Worksheet for Grate Inlet In Sag

Project Description	
Worksheet	Sump-CB38-50yr
Type	Grate Inlet In Sag
Solve For	Spread

Input Data		
Discharge	7.82	cfs
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Grate Width	2.93	ft
Grate Length	3.44	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	19.06	ft
Depth	0.55	ft
Gutter Depression	2.0	in
Total Depression	2.0	in
Open Grate Area	4.5	ft^2
Active Grate Weir Length	6.37	ft

Use 10.00 [illegible] = 7.82 cfs accounting for additional C.B.

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	C-15.91 Grate Inlet - CB39-50yr
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	4.04	cfs
Slope	0.010104	ft/ft
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.93	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.81	
Intercepted Flow	3.26	cfs
Bypass Flow	0.78	cfs
Spread	8.39	ft
Depth	0.34	ft
Flow Area	1.0	ft²
Gutter Depression	2.0	in
Total Depression	2.0	in
Velocity	3.87	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.04	
Grate Flow Ratio	0.80	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	C-15.91 Grate Inlet - CB40-50yr
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	5.45	cfs
Slope	0.010104	ft/ft
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.93	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.72	
Intercepted Flow	3.95	cfs
Bypass Flow	1.50	cfs
Spread	10.07	ft
Depth	0.37	ft
Flow Area	1.4	ft^2
Gutter Depression	2.0	in
Total Depression	2.0	in
Velocity	4.02	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.04	
Grate Flow Ratio	0.71	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	C-15.91 Grate Inlet - CB41-50yr
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	5.98	cfs
Slope	0.010104	ft/ft
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.93	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.70	
Intercepted Flow	4.19	cfs
Bypass Flow	1.79	cfs
Spread	10.61	ft
Depth	0.38	ft
Flow Area	1.5	ft^2
Gutter Depression	2.0	in
Total Depression	2.0	in
Velocity	4.08	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.04	
Grate Flow Ratio	0.69	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	C-15.91 Grate Inlet - CB42-50yr
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	7.90	cfs
Slope	0.010104	ft/ft
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.93	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.63	
Intercepted Flow	4.97	cfs
Bypass Flow	2.93	cfs
Spread	12.32	ft
Depth	0.42	ft
Flow Area	1.9	ft²
Gutter Depression	2.0	in
Total Depression	2.0	in
Velocity	4.25	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.62	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	C-15.91 Grate Inlet - CB43-50yr
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	8.84	cfs
Slope	0.010104	ft/ft
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.93	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.60	
Intercepted Flow	5.33	cfs
Bypass Flow	3.51	cfs
Spread	13.04	ft
Depth	0.43	ft
Flow Area	2.0	ft²
Gutter Depression	2.0	in
Total Depression	2.0	in
Velocity	4.33	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.59	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	C-15.91 Grate Inlet - CB44-50yr
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	10.70	cfs
Slope	0.010104	ft/ft
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.93	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.56	
Intercepted Flow	5.98	cfs
Bypass Flow	4.72	cfs
Spread	14.31	ft
Depth	0.46	ft
Flow Area	2.4	ft^2
Gutter Depression	2.0	in
Total Depression	2.0	in
Velocity	4.48	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.55	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Ditch Inlet In Sag

Project Description	
Worksheet	Ditch Inlet - CB45-50yr
Type	Ditch Inlet In Sag
Solve For	Spread

Input Data		
Discharge	8.35	cfs
Left Side Slope	8.00	H : V
Right Side Slope	8.00	H : V
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.00	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	9.91	ft
Depth	0.49	ft
Wetted Perimeter	9.98	ft
Top Width	9.91	ft
Open Grate Area	2.7	ft^2
Active Grate Weir Length	8.00	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	C-15.91 Grate Inlet - CB46-50yr
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	4.35	cfs
Slope	0.018217	ft/ft
Gutter Width	4.00	ft
Gutter Cross Slope	0.033850	ft/ft
Road Cross Slope	0.015000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.93	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.63	
Intercepted Flow	2.75	cfs
Bypass Flow	1.60	cfs
Spread	11.01	ft
Depth	0.24	ft
Flow Area	1.1	ft^2
Gutter Depression	0.9	in
Total Depression	0.9	in
Velocity	4.11	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.62	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Triangular Channel

Project Description	
Worksheet	Triangular Channel - 1
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Mannings Coefficient	0.030	
Slope	0.010104	ft/ft
Depth	0.50	ft
Left Side Slope	4.00	H : V
Right Side Slope	20.00	H : V

Results		
Discharge	5.90	cfs
Flow Area	3.0	ft²
Wetted Perimeter	12.07	ft
Top Width	12.00	ft
Critical Depth	0.43	ft
Critical Slope	0.022038	ft/ft
Velocity	1.97	ft/s
Velocity Head	0.06	ft
Specific Energy	0.56	ft
Froude Number	0.69	
Flow Type	Subcritical	

Worksheet
Worksheet for Grate Inlet In Sag

Project Description	
Worksheet	Sump-CB48-50yr
Type	Grate Inlet In Sag
Solve For	Spread

Input Data		
Discharge	4.09	cfs
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Grate Width	2.93	ft
Grate Length	3.44	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	9.39	ft
Depth	0.36	ft
Gutter Depression	2.0	in
Total Depression	2.0	in
Open Grate Area	4.5	ft^2
Active Grate Weir Length	6.37	ft

Worksheet
Worksheet for Slot Inlet In Sag

Project Description	
Worksheet	Slot Inlet - CB48 50yr
Type	Slot Inlet In Sag
Solve For	Spread

Input Data		
Discharge	4.09	cfs
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Slot Width	0.15	ft
Slot Length	20.00	ft
Local Depression	1.0	in
Local Depression Width	4.00	ft

Results		
Spread	2.25	ft
Depth	0.19	ft
Gutter Depression	2.0	in
Total Depression	3.0	in
Open Slot Area	3.0	ft^2
Active Slot Weir Length	20.30	ft

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Worksheet
Worksheet for Ditch Inlet In Sag

Project Description	
Worksheet	Ditch Inlet - CB49-50yr
Type	Ditch Inlet In Sag
Solve For	Spread

Input Data		
Discharge	1.40	cfs
Left Side Slope	8.00	H : V
Right Side Slope	8.00	H : V
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.00	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	4.41	ft
Depth	0.15	ft
Wetted Perimeter	4.43	ft
Top Width	4.41	ft
Open Grate Area	2.7	ft^2
Active Grate Weir Length	8.00	ft

Worksheet
Worksheet for Grate Inlet In Sag

Project Description	
Worksheet	Sump-CB50-50yr
Type	Grate Inlet In Sag
Solve For	Spread

Input Data		
Discharge	5.39	cfs
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Grate Width	2.93	ft
Grate Length	3.44	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	13.00	ft
Depth	0.43	ft
Gutter Depression	2.0	in
Total Depression	2.0	in
Open Grate Area	4.5	ft^2
Active Grate Weir Length	6.37	ft

[illegible] 11.39 - .96 [illegible] accounting for [illegible]

Worksheet
Worksheet for Slot Inlet In Sag

Project Description	
Worksheet	Slot Inlet - CB50 50yr
Type	Slot Inlet In Sag
Solve For	Spread

Input Data		
Discharge	5.39	cfs
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Slot Width	0.15	ft
Slot Length	20.00	ft
Local Depression	1.0	in
Local Depression Width	4.00	ft

Results		
Spread	2.71	ft
Depth	0.23	ft
Gutter Depression	2.0	in
Total Depression	3.0	in
Open Slot Area	3.0	ft^2
Active Slot Weir Length	20.30	ft

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Worksheet
Worksheet for Slot Inlet In Sag

Project Description	
Worksheet	Slot Inlet - CB51 50yr
Type	Slot Inlet In Sag
Solve For	Spread

Input Data		
Discharge	8.91	cfs
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Slot Width	0.15	ft
Slot Length	20.00	ft
Local Depression	1.0	in
Local Depression Width	4.00	ft

Results		
Spread	3.78	ft
Depth	0.32	ft
Gutter Depression	2.0	in
Total Depression	3.0	in
Open Slot Area	3.0	ft^2
Active Slot Weir Length	20.30	ft

Use 20' Bathtub or
CB 51 accounts for 50% clogging

Worksheet
Worksheet for Grate Inlet In Sag

Project Description	
Worksheet	Sump-CB51-50yr
Type	Grate Inlet In Sag
Solve For	Spread

Input Data		
Discharge	8.91	cfs
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Grate Width	2.93	ft
Grate Length	3.44	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	21.56	ft
Depth	0.60	ft
Gutter Depression	2.0	in
Total Depression	2.0	in
Open Grate Area	4.5	ft^2
Active Grate Weir Length	6.37	ft

Worksheet
Worksheet for Ditch Inlet In Sag

Project Description	
Worksheet	Ditch Inlet - CB52-50yr
Type	Ditch Inlet In Sag
Solve For	Spread

Input Data		
Discharge	5.15	cfs
Left Side Slope	8.00	H : V
Right Side Slope	8.00	H : V
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.00	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	7.73	ft
Depth	0.36	ft
Wetted Perimeter	7.78	ft
Top Width	7.73	ft
Open Grate Area	2.7	ft^2
Active Grate Weir Length	8.00	ft

Worksheet
Worksheet for Slot Inlet In Sag

Project Description	
Worksheet	Slot Inlet - CB53 50yr
Type	Slot Inlet In Sag
Solve For	Spread

Input Data		
Discharge	8.42	cfs
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Slot Width	0.15	ft
Slot Length	20.00	ft
Local Depression	1.0	in
Local Depression Width	4.00	ft

Results		
Spread	3.64	ft
Depth	0.30	ft
Gutter Depression	2.0	in
Total Depression	3.0	in
Open Slot Area	3.0	ft^2
Active Slot Weir Length	20.30	ft

Use 20 out of CB

CB 53 accounts for 50% clogging

Worksheet
Worksheet for Grate Inlet In Sag

Project Description	
Worksheet	Sump-CB53-50yr
Type	Grate Inlet In Sag
Solve For	Spread

Input Data		
Discharge	8.42	cfs
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Grate Width	2.93	ft
Grate Length	3.44	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	20.45	ft
Depth	0.58	ft
Gutter Depression	2.0	in
Total Depression	2.0	in
Open Grate Area	4.5	ft^2
Active Grate Weir Length	6.37	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	C-15.91 Grate Inlet - CB54-50yr
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	6.90	cfs
Slope	0.004018	ft/ft
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.93	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.57	
Intercepted Flow	3.94	cfs
Bypass Flow	2.96	cfs
Spread	14.47	ft
Depth	0.46	ft
Flow Area	2.4	ft^2
Gutter Depression	2.0	in
Total Depression	2.0	in
Velocity	2.84	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.07	
Grate Flow Ratio	0.54	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	C-15.91 Grate Inlet - CB55-50yr
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	6.39	cfs
Slope	0.004018	ft/ft
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.93	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.59	
Intercepted Flow	3.75	cfs
Bypass Flow	2.64	cfs
Spread	13.94	ft
Depth	0.45	ft
Flow Area	2.3	ft²
Gutter Depression	2.0	in
Total Depression	2.0	in
Velocity	2.80	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.07	
Grate Flow Ratio	0.56	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	C-15.91 Grate Inlet - CB56-50yr
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	4.53	cfs
Slope	0.004018	ft/ft
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.93	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.67	
Intercepted Flow	3.02	cfs
Bypass Flow	1.51	cfs
Spread	11.72	ft
Depth	0.40	ft
Flow Area	1.7	ft^2
Gutter Depression	2.0	in
Total Depression	2.0	in
Velocity	2.64	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.07	
Grate Flow Ratio	0.64	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	C-15.91 Grate Inlet - CB57-50yr
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	4.51	cfs
Slope	0.004018	ft/ft
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.93	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.67	
Intercepted Flow	3.01	cfs
Bypass Flow	1.50	cfs
Spread	11.69	ft
Depth	0.40	ft
Flow Area	1.7	ft²
Gutter Depression	2.0	in
Total Depression	2.0	in
Velocity	2.64	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.07	
Grate Flow Ratio	0.64	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Slot Inlet In Sag

Project Description	
Worksheet	Slot Inlet - CB58 50yr
Type	Slot Inlet In Sag
Solve For	Spread

Input Data		
Discharge	13.67	cfs
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Slot Width	0.15	ft
Slot Length	40.00	ft
Local Depression	1.0	in
Local Depression Width	4.00	ft

Results		
Spread	3.19	ft
Depth	0.27	ft
Gutter Depression	2.0	in
Total Depression	3.0	in
Open Slot Area	6.0	ft^2
Active Slot Weir Length	40.30	ft

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Worksheet
Worksheet for Grate Inlet In Sag

Project Description	
Worksheet	Sump-CB58-50yr
Type	Grate Inlet In Sag
Solve For	Spread

Input Data		
Discharge	13.67	cfs
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Grate Width	2.93	ft
Grate Length	3.44	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	31.49	ft
Depth	0.80	ft
Gutter Depression	2.0	in
Total Depression	2.0	in
Open Grate Area	4.5	ft^2
Active Grate Weir Length	6.37	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	C-15.91 Grate Inlet - CB59-50yr
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	1.84	cfs
Slope	0.004018	ft/ft
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.93	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.90	
Intercepted Flow	1.66	cfs
Bypass Flow	0.18	cfs
Spread	6.65	ft
Depth	0.30	ft
Flow Area	0.8	ft²
Gutter Depression	2.0	in
Total Depression	2.0	in
Velocity	2.35	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.09	
Grate Flow Ratio	0.89	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	C-15.91 Grate Inlet - CB60-50yr
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	2.37	cfs
Slope	0.004018	ft/ft
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	2.93	ft
Grate Length	3.44	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.84	
Intercepted Flow	1.98	cfs
Bypass Flow	0.39	cfs
Spread	7.99	ft
Depth	0.33	ft
Flow Area	1.0	ft^2
Gutter Depression	2.0	in
Total Depression	2.0	in
Velocity	2.42	ft/s
Splash Over Velocity	7.51	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.09	
Grate Flow Ratio	0.82	
Active Grate Length	1.72	ft

Worksheet
Worksheet for Slot Inlet In Sag

Project Description	
Worksheet	Slot Inlet - CB61 50yr
Type	Slot Inlet In Sag
Solve For	Spread

Input Data		
Discharge	8.74	cfs
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Slot Width	0.15	ft
Slot Length	40.00	ft
Local Depression	1.0	in
Local Depression Width	4.00	ft

Results		
Spread	2.36	ft
Depth	0.20	ft
Gutter Depression	2.0	in
Total Depression	3.0	in
Open Slot Area	6.0	ft^2
Active Slot Weir Length	40.30	ft

Use 14.04 [illegible] for [illegible]

Worksheet
Worksheet for Grate Inlet In Sag

Project Description	
Worksheet	Sump-CB61-50yr
Type	Grate Inlet In Sag
Solve For	Spread

Input Data		
Discharge	8.74	cfs
Gutter Width	4.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Grate Width	2.93	ft
Grate Length	3.44	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	21.18	ft
Depth	0.59	ft
Gutter Depression	2.0	in
Total Depression	2.0	in
Open Grate Area	4.5	ft^2
Active Grate Weir Length	6.37	ft

Worksheet
Worksheet for Ditch Inlet In Sag

Project Description	
Worksheet	Ditch Inlet - CB64-50yr
Type	Ditch Inlet In Sag
Solve For	Spread

Input Data		
Discharge	5.90	cfs
Left Side Slope	4.00	H : V
Right Side Slope	20.00	H : V
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.00	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	11.42	ft
Depth	0.39	ft
Wetted Perimeter	11.48	ft
Top Width	11.42	ft
Open Grate Area	2.7	ft^2
Active Grate Weir Length	8.00	ft

Worksheet
Worksheet for Ditch Inlet In Sag

Project Description	
Worksheet	Ditch Inlet - CB65-50yr
Type	Ditch Inlet In Sag
Solve For	Spread

Input Data		
Discharge	5.90	cfs
Left Side Slope	4.00	H : V
Right Side Slope	20.00	H : V
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.00	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	11.42	ft
Depth	0.39	ft
Wetted Perimeter	11.48	ft
Top Width	11.42	ft
Open Grate Area	2.7	ft^2
Active Grate Weir Length	8.00	ft

Worksheet
Worksheet for Ditch Inlet In Sag

Project Description	
Worksheet	Ditch Inlet - CB68-50yr
Type	Ditch Inlet In Sag
Solve For	Spread

Input Data		
Discharge	5.90	cfs
Left Side Slope	3.00	H : V
Right Side Slope	20.00	H : V
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.00	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	11.03	ft
Depth	0.39	ft
Wetted Perimeter	11.10	ft
Top Width	11.03	ft
Open Grate Area	2.7	ft^2
Active Grate Weir Length	8.00	ft

Worksheet
Worksheet for Ditch Inlet In Sag

Project Description	
Worksheet	Ditch Inlet - CB69-50yr
Type	Ditch Inlet In Sag
Solve For	Spread

Input Data		
Discharge	5.90	cfs
Left Side Slope	3.00	H : V
Right Side Slope	20.00	H : V
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.00	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Results		
Spread	11.03	ft
Depth	0.39	ft
Wetted Perimeter	11.10	ft
Top Width	11.03	ft
Open Grate Area	2.7	ft^2
Active Grate Weir Length	8.00	ft

Additional CB for Pump [illegible]

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB100
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.90	cfs
Slope	0.011250	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.067700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	1.50	ft
Grate Length	2.98	ft
Grate Type	-50 mm x 100 mm (P-1-7/8"-4")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.76	
Intercepted Flow	0.68	cfs
Bypass Flow	0.22	cfs
Spread	4.83	ft
Depth	0.19	ft
Flow Area	0.3	ft^2
Gutter Depression	1.1	in
Total Depression	1.1	in
Velocity	2.73	ft/s
Splash Over Velocity	3.60	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.05	
Grate Flow Ratio	0.74	
Active Grate Length	1.49	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB100 50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	1.23	cfs
Slope	0.011250	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.067700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	1.50	ft
Grate Length	2.98	ft
Grate Type	-50 mm x 100 mm (P-1-7/8"-4")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.67	
Intercepted Flow	0.83	cfs
Bypass Flow	0.40	cfs
Spread	5.80	ft
Depth	0.21	ft
Flow Area	0.4	ft^2
Gutter Depression	1.1	in
Total Depression	1.1	in
Velocity	2.85	ft/s
Splash Over Velocity	3.60	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.05	
Grate Flow Ratio	0.66	
Active Grate Length	1.49	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB101
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.94	cfs
Slope	0.011250	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.067700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	1.50	ft
Grate Length	2.98	ft
Grate Type	-50 mm x 100 mm (P-1-7/8"-4")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.75	
Intercepted Flow	0.70	cfs
Bypass Flow	0.24	cfs
Spread	4.96	ft
Depth	0.19	ft
Flow Area	0.3	ft^2
Gutter Depression	1.1	in
Total Depression	1.1	in
Velocity	2.75	ft/s
Splash Over Velocity	3.60	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.05	
Grate Flow Ratio	0.73	
Active Grate Length	1.49	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB101-50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	1.29	cfs
Slope	0.012125	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.067700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	1.50	ft
Grate Length	2.98	ft
Grate Type	-50 mm x 100 mm (P-1-7/8"-4")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.67	
Intercepted Flow	0.86	cfs
Bypass Flow	0.43	cfs
Spread	5.83	ft
Depth	0.21	ft
Flow Area	0.4	ft²
Gutter Depression	1.1	in
Total Depression	1.1	in
Velocity	2.96	ft/s
Splash Over Velocity	3.60	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.05	
Grate Flow Ratio	0.65	
Active Grate Length	1.49	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB102-50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	1.06	cfs
Slope	0.010275	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.067700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	1.50	ft
Grate Length	2.98	ft
Grate Type	-50 mm x 100 mm (P-1-7/8"-4")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.70	
Intercepted Flow	0.74	cfs
Bypass Flow	0.32	cfs
Spread	5.47	ft
Depth	0.20	ft
Flow Area	0.4	ft^2
Gutter Depression	1.1	in
Total Depression	1.1	in
Velocity	2.68	ft/s
Splash Over Velocity	3.60	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.05	
Grate Flow Ratio	0.69	
Active Grate Length	1.49	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB102
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.77	cfs
Slope	0.010275	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.067700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	1.50	ft
Grate Length	2.98	ft
Grate Type	-50 mm x 100 mm (P-1-7/8"-4")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.79	
Intercepted Flow	0.61	cfs
Bypass Flow	0.16	cfs
Spread	4.51	ft
Depth	0.19	ft
Flow Area	0.3	ft²
Gutter Depression	1.1	in
Total Depression	1.1	in
Velocity	2.58	ft/s
Splash Over Velocity	3.60	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.06	
Grate Flow Ratio	0.78	
Active Grate Length	1.49	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB103
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.81	cfs
Slope	0.010275	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.067700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	1.50	ft
Grate Length	2.98	ft
Grate Type	-50 mm x 100 mm (P-1-7/8"-4")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.78	
Intercepted Flow	0.63	cfs
Bypass Flow	0.18	cfs
Spread	4.66	ft
Depth	0.19	ft
Flow Area	0.3	ft^2
Gutter Depression	1.1	in
Total Depression	1.1	in
Velocity	2.60	ft/s
Splash Over Velocity	3.60	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.06	
Grate Flow Ratio	0.76	
Active Grate Length	1.49	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB103-50yr Check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	1.12	cfs
Slope	0.010275	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.067700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	1.50	ft
Grate Length	2.98	ft
Grate Type	-50 mm x 100 mm (P-1-7/8"-4")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.69	
Intercepted Flow	0.77	cfs
Bypass Flow	0.35	cfs
Spread	5.65	ft
Depth	0.21	ft
Flow Area	0.4	ft²
Gutter Depression	1.1	in
Total Depression	1.1	in
Velocity	2.70	ft/s
Splash Over Velocity	3.60	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.05	
Grate Flow Ratio	0.67	
Active Grate Length	1.49	ft

Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	C-15.10 CB104
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.64	cfs
Local Depression	0.0	in
Local Depression Width	0.00	ft
Slope	0.011250	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.067700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Curb Opening Length	2.78	ft
Grate Width	1.50	ft
Grate Length	2.78	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	xclude None

Results		
Efficiency	0.85	
Intercepted Flow	0.55	cfs
Bypass Flow	0.09	cfs
Spread	3.84	ft
Depth	0.17	ft
Flow Area	0.2	ft²
Gutter Depression	1.1	in
Total Depression	1.1	in
Velocity	2.63	ft/s
Splash Over Velocity	6.72	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.05	
Grate Flow Ratio	0.85	
Equivalent Cross Slope	N/A	ft/ft
Active Grate Length	1.39	ft
Length Factor	0.00	
Total Interception Length	0.00	ft

Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	C-15.10 CB104-50yr
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.88	cfs
Local Depression	0.0	in
Local Depression Width	0.00	ft
Slope	0.011250	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.067700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Curb Opening Length	2.78	ft
Grate Width	1.50	ft
Grate Length	2.78	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	xclude None

Results		
Efficiency	0.76	
Intercepted Flow	0.67	cfs
Bypass Flow	0.21	cfs
Spread	4.77	ft
Depth	0.19	ft
Flow Area	0.3	ft^2
Gutter Depression	1.1	in
Total Depression	1.1	in
Velocity	2.73	ft/s
Splash Over Velocity	6.72	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.04	
Grate Flow Ratio	0.75	
Equivalent Cross Slope	N/A	ft/ft
Active Grate Length	1.39	ft
Length Factor	0.00	
Total Interception Length	0.00	ft

Worksheet
Worksheet for Slot Inlet In Sag

Project Description	
Worksheet	Slot Inlet - CB105
Type	Slot Inlet In Sag
Solve For	Spread

Input Data		
Discharge	2.86	cfs
Gutter Width	2.00	ft
Gutter Cross Slope	0.058700	ft/ft
Road Cross Slope	0.020000	ft/ft
Slot Width	0.15	ft
Slot Length	20.00	ft
Local Depression	1.0	in
Local Depression Width	4.00	ft

Results		
Spread	1.86	ft
Depth	0.15	ft
Gutter Depression	0.9	in
Total Depression	1.9	in
Open Slot Area	3.0	ft^2
Active Slot Weir Length	20.30	ft

Worksheet
Worksheet for Combination Inlet In Sag

Project Description	
Worksheet	C15.10 CB105
Type	Combination Inlet In Sag
Solve For	Spread

Input Data		
Discharge	2.86	cfs
Local Depression	0.0	in
Local Depression Width	0.00	ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.058000	ft/ft
Road Cross Slope	0.020000	ft/ft
Curb Opening Length	2.78	ft
Opening Height	0.50	ft
Curb Throat Type	Horizontal	
Grate Width	1.50	ft
Grate Length	2.78	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both

Results		
Spread	9.79	ft
Throat Incline Angle	90.00	degrees
Depth	0.27	ft
Gutter Depression	0.9	in
Total Depression	0.9	in
Open Grate Area	1.9	ft^2
Active Grate Weir Length	4.28	ft

Worksheet
Worksheet for Slot Inlet In Sag

Project Description	
Worksheet	Slot Inlet - CB105-50 yr check
Type	Slot Inlet In Sag
Solve For	Spread

Input Data		
Discharge	3.94	cfs
Gutter Width	2.00	ft
Gutter Cross Slope	0.058700	ft/ft
Road Cross Slope	0.020000	ft/ft
Slot Width	0.15	ft
Slot Length	20.00	ft
Local Depression	1.0	in
Local Depression Width	4.00	ft

Results		
Spread	2.30	ft
Depth	0.18	ft
Gutter Depression	0.9	in
Total Depression	1.9	in
Open Slot Area	3.0	ft^2
Active Slot Weir Length	20.30	ft

Worksheet
Worksheet for Combination Inlet In Sag

Project Description	
Worksheet	C15.10 CB105-50yr
Type	Combination Inlet In Sag
Solve For	Spread

Input Data		
Discharge	3.94	cfs
Local Depression	0.0	in
Local Depression Width	0.00	ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.058000	ft/ft
Road Cross Slope	0.020000	ft/ft
Curb Opening Length	2.78	ft
Opening Height	0.50	ft
Curb Throat Type	Horizontal	
Grate Width	1.50	ft
Grate Length	2.78	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both

Results		
Spread	13.03	ft
Throat Incline Angle	90.00	degrees
Depth	0.34	ft
Gutter Depression	0.9	in
Total Depression	0.9	in
Open Grate Area	1.9	ft^2
Active Grate Weir Length	4.28	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB106
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	1.02	cfs
Slope	0.024560	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.058700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	1.50	ft
Grate Length	2.98	ft
Grate Type	-50 mm x 100 mm (P-1-7/8"-4")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.69	
Intercepted Flow	0.70	cfs
Bypass Flow	0.32	cfs
Spread	5.00	ft
Depth	0.16	ft
Flow Area	0.3	ft²
Gutter Depression	0.7	in
Total Depression	0.7	in
Velocity	3.47	ft/s
Splash Over Velocity	3.60	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.68	
Active Grate Length	1.49	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB106-50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	1.41	cfs
Slope	0.024560	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.058700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	1.50	ft
Grate Length	2.98	ft
Grate Type	-50 mm x 100 mm (P-1-7/8"-4")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.61	
Intercepted Flow	0.87	cfs
Bypass Flow	0.54	cfs
Spread	5.82	ft
Depth	0.17	ft
Flow Area	0.4	ft^2
Gutter Depression	0.7	in
Total Depression	0.7	in
Velocity	3.69	ft/s
Splash Over Velocity	3.60	ft/s
Frontal Flow Factor	0.99	
Side Flow Factor	0.03	
Grate Flow Ratio	0.61	
Active Grate Length	1.49	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB107
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.85	cfs
Slope	0.024560	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.058700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	1.50	ft
Grate Length	2.98	ft
Grate Type	-50 mm x 100 mm (P-1-7/8"-4")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.73	
Intercepted Flow	0.62	cfs
Bypass Flow	0.23	cfs
Spread	4.57	ft
Depth	0.15	ft
Flow Area	0.3	ft^2
Gutter Depression	0.7	in
Total Depression	0.7	in
Velocity	3.36	ft/s
Splash Over Velocity	3.60	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.04	
Grate Flow Ratio	0.72	
Active Grate Length	1.49	ft

Worksheet
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	Grate Inlet - CB107 50yr check
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	1.18	cfs
Slope	0.024560	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.058700	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Grate Width	1.50	ft
Grate Length	2.98	ft
Grate Type	-50 mm x 100 mm (P-1-7/8"-4")	
Clogging	50.0	%

Options	
Grate Flow Option	xclude None

Results		
Efficiency	0.66	
Intercepted Flow	0.77	cfs
Bypass Flow	0.41	cfs
Spread	5.36	ft
Depth	0.17	ft
Flow Area	0.3	ft^2
Gutter Depression	0.7	in
Total Depression	0.7	in
Velocity	3.56	ft/s
Splash Over Velocity	3.60	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.03	
Grate Flow Ratio	0.64	
Active Grate Length	1.49	ft

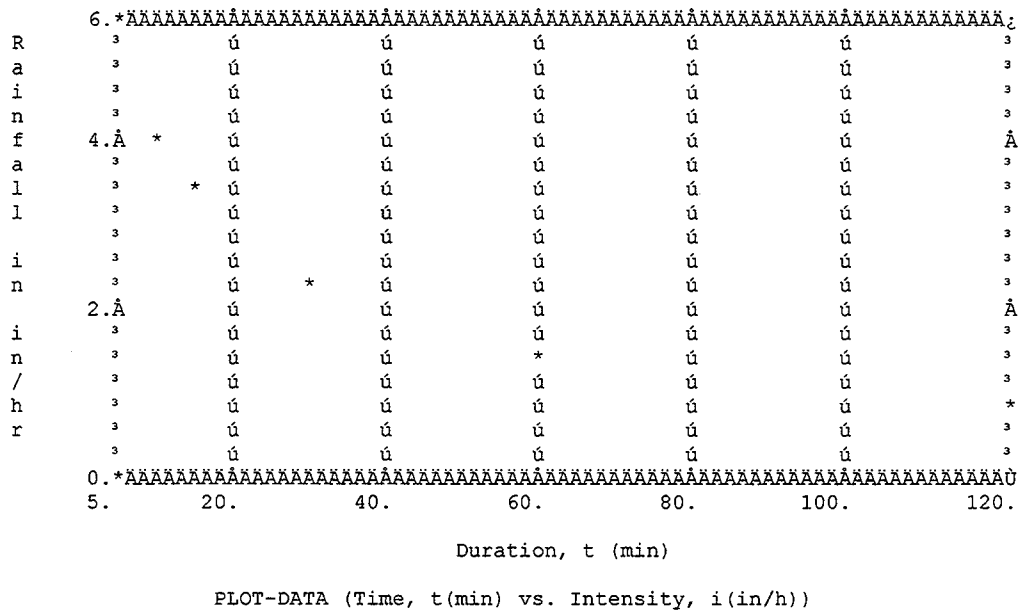
```
JOB Santan Freeway System #2 Elevated Section East of I-10.
SWI 2
REM SITE SPECIFIC RDDF FOR 10 YEAR
RAI 5 5.90 10 4.49 15 3.78 30 2.54 60 1.58 120 0.85
REM ASSUMES A PAVEMENT SECTION OF 18 INCHES
PDA .013 24 3.50 1.5 3 .0001
HGL 1
REM CREST AT 2030+81
NEW CBS AT 2035+20
STO 1.102 .95 10
PIP 93 1186.84 1186.56 1182.84 1180.73 -24
PNC 25 26 3 180 0
PIP 98 1186.56 1186.57 1180.73 1180.52 -24
PNC 26 27 3 180 0
STO 1.577 .95 10
PIP 122 1186.57 1155 1180.36 1150.4 -24
PNC 27 28 0 180 2
NEW CBS AT 2038+50
STO 0.722 .95 10
PIP 174 1183.56 1183.56 1179.56 1177.20 -24
PNC 30 31 3 180 0
STO 0.673 .95 10
PIP 117.5 1183.56 1155.0 1176.5 1149.0 -24
PNC 31 32 0 180 2
NEW CBS AT 2041+80
STO 0.719 .95 10
PIP 90.5 1180.23 1179.90 1176.23 1174.00 -24
PNC 33 34 3 180 0
PIP 81.5 1179.90 1180.23 1174.0 1173.66 -24
PNC 34 35 3 180 0
STO 0.626 .95 10
PIP 107.5 1180.23 1155 1173.59 1150.0 -24
PNC 35 36 0 180 2
NEW CBS AT 2045+10
STO .728 .95 10
PIP 174 1176.9 1176.90 1172.90 1170.53 -24
PNC 38 39  3 180 0
STO 0.622 .95 10
PIP 96 1176.9 1154 1170.36 1149.0 -24
PNC 39 40 0 180 2
NEW CBS AT 2048+40
STO 0.724 .95 10
PIP 90.5 1173.56 1173.23 1169.56 1167.40 -24
PNC 41 42 3 180 0
PIP 81.5 1173.23 1173.56 1167.4 1167.2 -24
PNC 42 43 3 180 0
STO 0.634 .95 10
PIP 85 1173.56 1154.0 1167.03 1149.0 -24
PNC 43 44 0 180 2
NEW CBS AT 2051+70
STO 0.723 .95 10
PIP 174 1170.23 1170.23 1166.23 1163.86 -24
PNC 46 47 3 180 0
STO 0.630 .95 10
PIP 74 1170.23 1154.0 1163.69 1148.40 -24
PNC 47 48 0 180 2
NEW CBS AT 2055+00
STO 0.726 .95 10
PIP 90.5 1166.89 1166.56 1162.89 1160.73 -24
PNC 49 50 3 180 0
PIP 81.5 1166.56 1166.89 1160.73 1160.53 -24
PNC 50 51 3 180 0
STO 0.634 .95 10
PIP 66.5 1166.89 1153.0 1160.36 1148.50 -24
PNC 51 52 0 180 2
NEW CBS AT 2058+30
STO 0.721 .95 10
PIP 174 1163.56 1163.56 1159.56 1157.29 -24
PNC 54 55 3 180 0
STO 0.634 .95 10
PIP 53 1163.56 1153.0 1157.19 1147.50 -24
PNC 55 56 0 180 2
NEW CBS AT 2061+60
STO 0.711 .95 10
PIP 80.5 1160.22 1159.89 1156.22 1154.06 -24
PNC 57 58 3 180 0
PIP 81.5 1159.89 1160.22 1154.06 1152.86 -24
PNC 58 59 3 180 0
STO 0.628 .95 10
PIP 42 1160.22 1152.0 1152.69 1148.00 -24
PNC 59 60 0 180 2
NEW CBS AT 2065+50
STO 0.863 .95 10
PIP 100 1156.00 1155.95 1152.0 1151.2 -24
```

```
PNC 61 62 3 180 0
PIP 81.5 1155.95 1156.28 1151.20 1150.55 -24
PNC 62 63 3 180 0
STO 0.742 .95 10
PIP 42 1156.28 1152. 1150.55 1150.21 -24
PNC 63 64 0 180 2
END
    o
```

Santan Freeway System #2 Elevated Section East of I-10.

```
+++ Commands Read From File sant.hda
  JOB
  SWI 2
  REM SITE SPECIFIC RDDF FOR 10 YEAR
  RAI 5 5.90 10 4.49 15 3.78 30 2.54 60 1.58 120 0.85
```

IDF CURVE



PLOT-DATA (Time, t(min) vs. Intensity, i(in/h))

t	i	t	i	t	i	t	i	t	i
5.	5.90	60.	1.58	0.	.00	0.	.00	0.	.00
10.	4.49	120.	.85	0.	.00	0.	.00	0.	.00
15.	3.78	0.	.00	0.	.00	0.	.00	0.	.00
30.	2.54	0.	.00	0.	.00	0.	.00	0.	.00

```
  REM ASSUMES A PAVEMENT SECTION OF 18 INCHES
  PDA .013 24 3.50 1.5 3 .0001
  HGL 1
  REM CREST AT 2030+81
  NEW CBS AT 2035+20
```

Santan Freeway System #2 Elevated Section East of I-10.

```
  STO 1.102 .95 10
  PIP 93 1186.84 1186.56 1182.84 1180.73 -24
+++ Tc =  10.0 min
+++ CA =   1.0
+++ Link #  1,  Flow depth =    .52 ft, Critical depth =    .76 ft
  PNC 25 26 3 180 0
  PIP 98 1186.56 1186.57 1180.73 1180.52 -24
+++ Tc =  10.2 min
+++ CA =   1.0
+++ Link #  2,  Flow depth =    .94 ft, Critical depth =    .76 ft
  PNC 26 27 3 180 0
  STO 1.577 .95 10
  PIP 122 1186.57 1155 1180.36 1150.4 -24
+++ Tc =  10.7 min
+++ CA =   2.5
+++ Link #  3,  Flow depth =    .44 ft, Critical depth =   1.20 ft
  PNC 27 28 0 180 2
  NEW CBS AT 2038+50
  STO 0.722 .95 10
  PIP 174 1183.56 1183.56 1179.56 1177.20 -24
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link #  4,  Flow depth =    .48 ft, Critical depth =    .61 ft
  PNC 30 31 3 180 0
  STO 0.673 .95 10
  PIP 117.5 1183.56 1155.0 1176.5 1149.0 -24
+++ Tc =  10.5 min
+++ CA =   1.3
+++ Link #  5,  Flow depth =    .32 ft, Critical depth =    .85 ft
  PNC 31 32 0 180 2
  NEW CBS AT 2041+80
  STO 0.719 .95 10
  PIP 90.5 1180.23 1179.90 1176.23 1174.00 -24
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link #  6,  Flow depth =    .40 ft, Critical depth =    .61 ft
  PNC 33 34 3 180 0
  PIP 81.5 1179.90 1180.23 1174.0 1173.66 -24
+++ Tc =  10.2 min
+++ CA =    .7
+++ Link #  7,  Flow depth =    .64 ft, Critical depth =    .61 ft
  PNC 34 35 3 180 0
  STO 0.626 .95 10
  PIP 107.5 1180.23 1155 1173.59 1150.0 -24
+++ Tc =  10.6 min
+++ CA =   1.3
+++ Link #  8,  Flow depth =    .32 ft, Critical depth =    .84 ft
  PNC 35 36 0 180 2
  NEW CBS AT 2045+10
```

Santan Freeway System #2 Elevated Section East of I-10.

```
  STO .728 .95 10
  PIP 174 1176.9 1176.90 1172.90 1170.53 -24
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link #  9,  Flow depth =    .48 ft, Critical depth =    .61 ft
  PNC 38 39  3 180 0
  STO 0.622 .95 10
  PIP 96 1176.9 1154 1170.36 1149.0 -24
+++ Tc =  10.5 min
+++ CA =   1.3
+++ Link # 10,  Flow depth =    .32 ft, Critical depth =    .84 ft
  PNC 39 40 0 180 2
  NEW CBS AT 2048+40
  STO 0.724 .95 10
  PIP 90.5 1173.56 1173.23 1169.56 1167.40 -24
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link # 11,  Flow depth =    .42 ft, Critical depth =    .61 ft
  PNC 41 42 3 180 0
  PIP 81.5 1173.23 1173.56 1167.4 1167.2 -24
+++ Tc =  10.2 min
+++ CA =    .7
+++ Link # 12,  Flow depth =    .72 ft, Critical depth =    .61 ft
  PNC 42 43 3 180 0
  STO 0.634 .95 10
  PIP 85 1173.56 1154.0 1167.03 1149.0 -24
+++ Tc =  10.7 min
+++ CA =   1.3
+++ Link # 13,  Flow depth =    .32 ft, Critical depth =    .84 ft
  PNC 43 44 0 180 2
  NEW CBS AT 2051+70
  STO 0.723 .95 10
  PIP 174 1170.23 1170.23 1166.23 1163.86 -24
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link # 14,  Flow depth =    .48 ft, Critical depth =    .61 ft
  PNC 46 47 3 180 0
  STO 0.630 .95 10
  PIP 74 1170.23 1154.0 1163.69 1148.40 -24
+++ Tc =  10.5 min
+++ CA =   1.3
+++ Link # 15,  Flow depth =    .32 ft, Critical depth =    .84 ft
  PNC 47 48 0 180 2
  NEW CBS AT 2055+00
  STO 0.726 .95 10
  PIP 90.5 1166.89 1166.56 1162.89 1160.73 -24
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link # 16,  Flow depth =    .42 ft, Critical depth =    .61 ft
```

Santan Freeway System #2 Elevated Section East of I-10.

```
  PNC 49 50 3 180 0
  PIP 81.5 1166.56 1166.89 1160.73 1160.53 -24
+++ Tc =  10.2 min
+++ CA =    .7
+++ Link # 17,  Flow depth =    .72 ft, Critical depth =    .61 ft
  PNC 50 51 3 180 0
  STO 0.634 .95 10
  PIP 66.5 1166.89 1153.0 1160.36 1148.50 -24
+++ Tc =  10.7 min
+++ CA =   1.3
+++ Link # 18,  Flow depth =    .34 ft, Critical depth =    .84 ft
  PNC 51 52 0 180 2
  NEW CBS AT 2058+30
  STO 0.721 .95 10
  PIP 174 1163.56 1163.56 1159.56 1157.29 -24
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link # 19,  Flow depth =    .48 ft, Critical depth =    .61 ft
  PNC 54 55 3 180 0
  STO 0.634 .95 10
  PIP 53 1163.56 1153.0 1157.19 1147.50 -24
+++ Tc =  10.5 min
+++ CA =   1.3
+++ Link # 20,  Flow depth =    .34 ft, Critical depth =    .84 ft
  PNC 55 56 0 180 2
  NEW CBS AT 2061+60
  STO 0.711 .95 10
  PIP 80.5 1160.22 1159.89 1156.22 1154.06 -24
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link # 21,  Flow depth =    .40 ft, Critical depth =    .61 ft
  PNC 57 58 3 180 0
  PIP 81.5 1159.89 1160.22 1154.06 1152.86 -24
+++ Tc =  10.2 min
+++ CA =    .7
+++ Link # 22,  Flow depth =    .46 ft, Critical depth =    .60 ft
  PNC 58 59 3 180 0
  STO 0.628 .95 10
  PIP 42 1160.22 1152.0 1152.69 1148.00 -24
+++ Tc =  10.4 min
+++ CA =   1.3
+++ Link # 23,  Flow depth =    .38 ft, Critical depth =    .84 ft
  PNC 59 60 0 180 2
  NEW CBS AT 2065+50
  STO 0.863 .95 10
  PIP 100 1156.00 1155.95 1152.0 1151.2 -24
+++ Tc =  10.0 min
+++ CA =    .8
+++ Link # 24,  Flow depth =    .58 ft, Critical depth =    .67 ft
```

Santan Freeway System #2 Elevated Section East of I-10.

```
  PNC 61 62 3 180 0
  PIP 81.5 1155.95 1156.28 1151.20 1150.55 -24
+++ Tc =  10.3 min
+++ CA =    .8
+++ Link # 25,  Flow depth =    .58 ft, Critical depth =    .67 ft
  PNC 62 63 3 180 0
  STO 0.742 .95 10
  PIP 42 1156.28 1152. 1150.55 1150.21 -24
+++ Tc =  10.6 min
+++ CA =   1.5
+++ Link # 26,  Flow depth =    .80 ft, Critical depth =    .92 ft
  PNC 63 64 0 180 2
  END
   o
 END OF INPUT DATA.
```

Santan Freeway System #2 Elevated Section East of I-10.

*** CBS AT 2035+20 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
1	93	24	1182.84	.02269	4.0	1.8	7.6	4.70	14		
			1180.73		5.8	3.7	10.8	34.08			
2	98	24	1180.73	.00214	5.8	3.7	3.2	4.67	45		
			1180.52		6.0	3.9	3.3	10.47			
3	122	24	1180.36	.24557	6.2	4.0	22.8	11.17	10		
			1150.40		4.6	2.4	35.7	112.11			

Length = 313. ft Total length = 313. ft

*** CBS AT 2038+50 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
4	174	24	1179.56	.01356	4.0	1.8	5.6	3.08	12		
			1177.20		6.4	4.2	8.4	26.35			
5	118	24	1176.50	.23404	7.1	4.9	18.5	5.85	5		
			1149.00		6.0	3.8	34.8	109.44			

Length = 292. ft Total length = 292. ft

Santan Freeway System #2 Elevated Section East of I-10.

*** CBS AT 2041+80 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
6	91	24	1176.23	.02464	4.0	1.8	6.9	3.07	9		
			1174.00		5.9	3.7	11.3	35.51			
7	82	24	1174.00	.00417	5.9	3.7	3.7	3.05	21		
			1173.66		6.6	4.4	4.7	14.61			
8	108	24	1173.59	.21944	6.6	4.5	17.8	5.63	5		
			1150.00		5.0	2.8	33.7	105.97			

Length = 280. ft Total length = 280. ft

*** CBS AT 2045+10 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
9	174	24	1172.90	.01362	4.0	1.8	5.6	3.11	12		
			1170.53		6.4	4.2	8.4	26.40			
10	96	24	1170.36	.22250	6.5	4.4	18.0	5.66	5		
			1149.00		5.0	2.8	34.0	106.71			

Length = 270. ft Total length = 270. ft

Santan Freeway System #2 Elevated Section East of I-10.

*** CBS AT 2048+40 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
11	91	24	1169.56	.02387	4.0	1.8	6.9	3.09	9		
			1167.40		5.8	3.7	11.1	34.95			
12	82	24	1167.40	.00245	5.8	3.7	3.0	3.07	27		
			1167.20		6.4	4.2	3.6	11.21			
13	85	24	1167.03	.21212	6.5	4.4	17.8	5.67	5		
			1149.00		5.0	2.8	33.2	104.19			

Length = 257. ft Total length = 257. ft

*** CBS AT 2051+70 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
14	174	24	1166.23	.01362	4.0	1.8	5.6	3.08	12		
			1163.86		6.4	4.2	8.4	26.40			
15	74	24	1163.69	.20662	6.5	4.4	17.5	5.68	6		
			1148.40		5.6	3.4	32.7	102.83			

Length = 248. ft Total length = 248. ft

Santan Freeway System #2 Elevated Section East of I-10.

*** CBS AT 2055+00 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
16	91	24	1162.89	.02387	4.0	1.8	6.9	3.10	9		
			1160.73		5.8	3.7	11.1	34.95			
17	82	24	1160.73	.00245	5.8	3.7	3.0	3.08	27		
			1160.53		6.4	4.2	3.6	11.21			
18	67	24	1160.36	.17835	6.5	4.4	16.7	5.68	6		
			1148.50		4.5	2.3	30.4	95.54			

Length = 239. ft Total length = 239. ft

*** CBS AT 2058+30 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
19	174	24	1159.56	.01305	4.0	1.8	5.5	3.08	12		
			1157.29		6.3	4.1	8.2	25.84			
20	53	24	1157.19	.18283	6.4	4.2	16.8	5.68	6		
			1147.50		5.5	3.3	30.8	96.73			

Length = 227. ft Total length = 227. ft

Santan Freeway System #2 Elevated Section East of I-10.

*** CBS AT 2061+60 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
21	81	24	1156.22	.02683	4.0	1.8	7.1	3.03	8		
			1154.06		5.8	3.7	11.8	37.06			
22	82	24	1154.06	.01472	5.8	3.7	5.7	3.01	11		
			1152.86		7.4	5.2	8.7	27.45			
23	42	24	1152.69	.11167	7.5	5.4	14.1	5.63	7		
			1148.00		4.0	1.8	24.1	75.60			

Length = 204. ft Total length = 204. ft

*** CBS AT 2065+50 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
24	100	24	1152.00	.00800	4.0	1.8	4.9	3.68	18		
			1151.20		4.8	2.6	6.4	20.23			
25	82	24	1151.20	.00797	4.8	2.6	4.9	3.64	18		
			1150.55		5.7	3.6	6.4	20.20			
26	42	24	1150.55	.00810	5.7	3.6	5.8	6.71	33		
			1150.21		1.8	-.4	6.5	20.36			

Length = 224. ft Total length = 224. ft

Santan Freeway System #2 Elevated Section East of I-10.

Hydraulic Gradeline Computations

Link #	Down-stream Node #	Hydraulic Gradeline Elevation	Crown Elev.	Possible Surcharge	Ground Elev.	Super-crit.?	Manhole Depth	Loss Coef
1	26	1181.25	1182.73	N	1186.56	Y	.00	.00
2	27	1181.46	1182.52	N	1186.57	N	.00	.00
3	28	1150.84	1152.40	N	1155.00	Y	.00	.00
4	31	1177.68	1179.20	N	1183.56	Y	.00	.00
5	32	1149.32	1151.00	N	1155.00	Y	.00	.00
6	34	1174.40	1176.00	N	1179.90	Y	.00	.00
7	35	1174.30	1175.66	N	1180.23	N	.00	.00
8	36	1150.32	1152.00	N	1155.00	Y	.00	.00
9	39	1171.01	1172.53	N	1176.90	Y	.00	.00
10	40	1149.32	1151.00	N	1154.00	Y	.00	.00
11	42	1167.82	1169.40	N	1173.23	Y	.00	.00
12	43	1167.92	1169.20	N	1173.56	N	.00	.00
13	44	1149.32	1151.00	N	1154.00	Y	.00	.00
14	47	1164.34	1165.86	N	1170.23	Y	.00	.00
15	48	1148.72	1150.40	N	1154.00	Y	.00	.00
16	50	1161.15	1162.73	N	1166.56	Y	.00	.00
17	51	1161.25	1162.53	N	1166.89	N	.00	.00
18	52	1148.84	1150.50	N	1153.00	Y	.00	.00
19	55	1157.77	1159.29	N	1163.56	Y	.00	.00
20	56	1147.84	1149.50	N	1153.00	Y	.00	.00
21	58	1154.46	1156.06	N	1159.89	Y	.00	.00
22	59	1153.32	1154.86	N	1160.22	Y	.00	.00
23	60	1148.38	1150.00	N	1152.00	Y	.00	.00
24	62	1151.87	1153.20	N	1155.95	Y	.95	.01
25	63	1151.22	1152.55	N	1156.28	Y	1.37	.55
26	64	1151.01	1152.21	N	1152.00	Y	.80	.00

Link #	Terminal Node #	Hydraulic Gradeline Elevation	Ground Elevation	Loss Coef.
24	61	1153.14	1156.00	1.50

NORMAL END OF HYDRA

```
JOB SR202L - PUMPSTA @ KYRENE, EAST SIDE + WEST SIDE AND KYRENE ROAD
SWI 2
REM Data in English Units
REM SITE SPECIFIC RDDF FOR 50 YEAR
RAI 5 8.09 10 6.19 15 5.28 30 3.57 60 2.23 120 1.2
REM ASSUMES A PAVEMENT SECTION OF 18 INCHES
PDA .012 24 3.75 1.5 3 .0001
HGL 1
NEW DMJM DA 160 to 131
STO 22.8 1 33.1
PIP 1 1144.18 1144.18
PNC 44 48 1 180 0
HOL 15
NEW DAs 130, 129
STO 1.297 .841 10
PIP 182 1144.18 1144.18
PNC 46 47 3 180 0
STO 1.300 .841 10
PIP 8 1144.18 1144.43
PNC 47 48 3 90 0
REC 15
PIP 112.5 1144.43 1144.18 1133.22 1133.11 -66
PNC 48 70 0 180 1
PIP 223.5 1144.12 1143.90 1133.11 1132.88 -66
PNC 70 52 4 192 0
HOL 16
NEW DA 50,58,59
STO 3.83 .8125 10
PIP 103.5 1143.34 1143.65 1138.80 1138.0 -24
PNC 49 50 3 90 0
STO .309 .9 10
PIP 134 1143.65 1143.65 1138.0 1137.10 -24
PNC 50 51 3 180 0
STO .427 .91 10
PIP 7 1143.65 1143.90 1137.10 1137. -24
PNC 51 52 4 90 0
REC 16
PIP 99 1143.9 1143. 1132.88 1132.78 -66
PNC 52 54 0 180 1
HOL 50
NEW DA 51
STO 2.54 .8125 10
PIP 43.5 1142.43 1143. 1135.56 1134.53 -24
PNC 53 54 0 90 1
REC 50
PIP 232 1143. 1142.33 1132.78 1132.55 -66
PNC 54 57 4 180 0
HOL 18
NEW DA 56,57
STO .82 .8587 10
PIP 134 1142.33 1142.33 1137.75 1137.55 -24
PNC 55 56 3 180 0
STO .767 .865 10
PIP 7 1142.33 1142.57 1137.55 1137.53 -24
PNC 56 57 4 90 0
REC 18
PIP 327.1 1142.33 1141.26 1132.55 1132.22 -66
PNC 57 60 4 180 0
HOL 19
NEW DAs 53, 54
STO .99 .83 10
PIP 134 1141.0 1141.0 1136.5 1136.30 -24
PNC 58 59 3 180 0
STO 0.93 .84 10
PIP 7 1141.0 1141.26 1136.3 1136.28 -24
PNC 59 60 4 90 0
REC 19
PIP 225 1141.26 1141.00 1132.22 1132.00 -66
PNC 60 90 4 180 0
PIP 106 1141 1140.29 1122.28 1122.17 -66
PNC 90 64 4 180 0
HOL 20
NEW DAs 52, 49
STO 1.20 .8075 10
PIP 67.5 1140.03 1139.54 1135.51 1135.4 -24
PNC 61 62 3 180 0
PIP 64.5 1139.54 1140.03 1135.4 1135.3 -24
PNC 62 63 3 180 0
STO 1.14 .8125 10
PIP 7 1140.03 1140.29 1135.3 1135.28 -24
PNC 63 64 4 90 0
REC 20
PIP 59. 1140.29 1140.27 1122.17 1122.11 -66
PNC 64 68 4 180 0
```

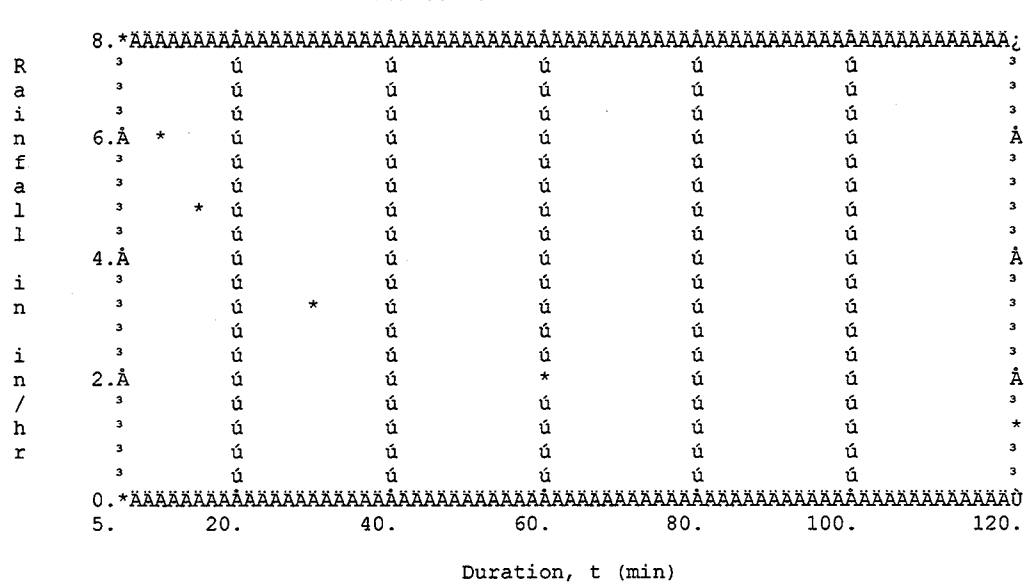
```
HOL 21
NEW DA 55,48
STO 1.30 .7875 10
PIP 67.5 1140.01 1139.52 1135.03 1131.39 -24
PNC 65 66 3 180 0
PIP 64.5 1139.52 1140.01 1131.39 1127.91 -24
PNC 66 67 3 180 0
STO 1.30 .7975 10
PIP 7 1140.01 1140.27 1125.16 1124.86 -24
PNC 67 68 3 90 0
REC 21
PIP 337 1140.27 1141.07 1122.11 1121.78 -66
PNC 68 111 4 90 0
REM FLOWS FROM WEST AND KYRENE ROAD
STO 12.6 1 13.4
PIP 260 1141.69 1160.75 1121.78 1121.46 -66
PNC 111 102 4 156 0
PIP 186.2 1160.75 1155.87 1121.46 1120.38 -66
PNC 102 103 4 180 0
PIP 47.7 1155.87 1155.8 1120.38 1119.10 -66
PNC 103 105 0 180 2
END
```

o

SR202L - PUMPSTA @ KYRENE, EAST SIDE + WEST SIDE AND KYRENE ROAD

```
+++ Commands Read From File total.hda
  JOB
  SWI 2
  REM Data in English Units
  REM SITE SPECIFIC RDDF FOR 50 YEAR
  RAI 5 8.09 10 6.19 15 5.28 30 3.57 60 2.23 120 1.2
```

IDF CURVE



PLOT-DATA (Time, t(min) vs. Intensity, i(in/h))

t	i	t	i	t	i	t	i	t	i
5.	8.09	60.	2.23	0.	.00	0.	.00	0.	.00
10.	6.19	120.	1.20	0.	.00	0.	.00	0.	.00
15.	5.28	0.	.00	0.	.00	0.	.00	0.	.00
30.	3.57	0.	.00	0.	.00	0.	.00	0.	.00

```
  REM ASSUMES A PAVEMENT SECTION OF 18 INCHES
  PDA .012 24 3.75 1.5 3 .0001
  HGL 1
  NEW DMJM DA 160 to 131
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE + WEST SIDE AND KYRENE ROAD

```
  STO 22.8 1 33.1
  PIP 1 1144.18 1144.18
+++ Tc =  33.1 min
+++ CA =  22.8
+++ Link #  1,  Flow depth =   1.44 ft, Critical depth =   2.24 ft
  PNC 44 48 1 180 0
  HOL 15
  NEW DAs 130, 129
  STO 1.297 .841 10
  PIP 182 1144.18 1144.18
+++ Tc =  10.0 min
+++ CA =   1.1
+++ Link #  2,  Flow depth =   1.20 ft, Critical depth =    .92 ft
  PNC 46 47 3 180 0
  STO 1.300 .841 10
  PIP 8 1144.18 1144.43
+++ Tc =  10.9 min
+++ CA =   2.2
+++ Link #  3,  Flow depth =    .98 ft, Critical depth =   1.31 ft
  PNC 47 48 3 90 0
  REC 15
  PIP 112.5 1144.43 1144.18 1133.22 1133.11 -66
+++ Tc =  33.1 min
+++ CA =  25.0
+++ Link #  4,  Flow depth =   3.57 ft, Critical depth =   2.55 ft
  PNC 48 70 0 180 1
  PIP 223.5 1144.12 1143.90 1133.11 1132.88 -66
+++ Tc =  33.5 min
+++ CA =  25.0
+++ Link #  5,  Flow depth =   3.52 ft, Critical depth =   2.54 ft
  PNC 70 52 4 192 0
  HOL 16
  NEW DA 50,58,59
  STO 3.83 .8125 10
  PIP 103.5 1143.34 1143.65 1138.80 1138.0 -24
+++ Tc =  10.0 min
+++ CA =   3.1
+++ Link #  6,  Flow depth =   1.48 ft, Critical depth =   1.58 ft
  PNC 49 50 3 90 0
  STO .309 .9 10
  PIP 134 1143.65 1143.65 1138.0 1137.10 -24
+++ Tc =  10.2 min
+++ CA =   3.4
+++ Link #  7,  Flow depth =   2.00 ft, Critical depth =   2.00 ft
  PNC 50 51 3 180 0
  STO .427 .91 10
  PIP 7 1143.65 1143.90 1137.10 1137. -24
+++ Tc =  10.6 min
+++ CA =   3.8
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE + WEST SIDE AND KYRENE ROAD

```
+++ Link #  8,  Flow depth =   1.34 ft, Critical depth =   1.71 ft
  PNC 51 52 4 90 0
  REC 16
  PIP 99 1143.9 1143. 1132.88 1132.78 -66
+++ Tc =  34.2 min
+++ CA =  28.8
+++ Link #  9,  Flow depth =   3.90 ft, Critical depth =   2.73 ft
  PNC 52 54 0 180 1
  HOL 50
  NEW DA 51
  STO 2.54 .8125 10
  PIP 43.5 1142.43 1143. 1135.56 1134.53 -24
+++ Tc =  10.0 min
+++ CA =   2.1
+++ Link # 10,  Flow depth =    .82 ft, Critical depth =   1.29 ft
  PNC 53 54 0 90 1
  REC 50
  PIP 232 1143. 1142.33 1132.78 1132.55 -66
+++ Tc =  34.5 min
+++ CA =  30.8
+++ Link # 11,  Flow depth =   4.12 ft, Critical depth =   2.82 ft
  PNC 54 57 4 180 0
  HOL 18
  NEW DA 56,57
  STO .82 .8587 10
  PIP 134 1142.33 1142.33 1137.75 1137.55 -24
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link # 12,  Flow depth =    .96 ft, Critical depth =    .73 ft
  PNC 55 56 3 180 0
  STO .767 .865 10
  PIP 7 1142.33 1142.57 1137.55 1137.53 -24
+++ Tc =  10.8 min
+++ CA =   1.4
+++ Link # 13,  Flow depth =   1.16 ft, Critical depth =   1.03 ft
  PNC 56 57 4 90 0
  REC 18
  PIP 327.1 1142.33 1141.26 1132.55 1132.22 -66
+++ Tc =  35.2 min
+++ CA =  32.2
+++ Link # 14,  Flow depth =   4.23 ft, Critical depth =   2.87 ft
  PNC 57 60 4 180 0
  HOL 19
  NEW DAs 53, 54
  STO .99 .83 10
  PIP 134 1141.0 1141.0 1136.5 1136.30 -24
+++ Tc =  10.0 min
+++ CA =    .8
+++ Link # 15,  Flow depth =   1.06 ft, Critical depth =    .80 ft
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE + WEST SIDE AND KYRENE ROAD

```
  PNC 58 59 3 180 0
  STO 0.93 .84 10
  PIP 7 1141.0 1141.26 1136.3 1136.28 -24
+++ Tc =  10.7 min
+++ CA =   1.6
+++ Link # 16,  Flow depth =   1.28 ft, Critical depth =   1.12 ft
  PNC 59 60 4 90 0
  REC 19
  PIP 225 1141.26 1141.00 1132.22 1132.00 -66
+++ Tc =  36.1 min
+++ CA =  33.8
+++ Link # 17,  Flow depth =   4.45 ft, Critical depth =   2.93 ft
  PNC 60 90 4 180 0
  PIP 106 1141 1140.29 1122.28 1122.17 -66
+++ Tc =  36.8 min
+++ CA =  33.8
+++ Link # 18,  Flow depth =   4.29 ft, Critical depth =   2.91 ft
  PNC 90 64 4 180 0
  HOL 20
  NEW DAs 52, 49
  STO 1.20 .8075 10
  PIP 67.5 1140.03 1139.54 1135.51 1135.4 -24
+++ Tc =  10.0 min
+++ CA =   1.0
+++ Link # 19,  Flow depth =   1.14 ft, Critical depth =    .87 ft
  PNC 61 62 3 180 0
  PIP 64.5 1139.54 1140.03 1135.4 1135.3 -24
+++ Tc =  10.3 min
+++ CA =   1.0
+++ Link # 20,  Flow depth =   1.14 ft, Critical depth =    .86 ft
  PNC 62 63 3 180 0
  STO 1.14 .8125 10
  PIP 7 1140.03 1140.29 1135.3 1135.28 -24
+++ Tc =  10.7 min
+++ CA =   1.9
+++ Link # 21,  Flow depth =   1.46 ft, Critical depth =   1.22 ft
  PNC 63 64 4 90 0
  REC 20
  PIP 59. 1140.29 1140.27 1122.17 1122.11 -66
+++ Tc =  37.2 min
+++ CA =  35.7
+++ Link # 22,  Flow depth =   5.50 ft, Critical depth =   5.50 ft
  PNC 64 68 4 180 0
  HOL 21
  NEW DA 55,48
  STO 1.30 .7875 10
  PIP 67.5 1140.01 1139.52 1135.03 1131.39 -24
+++ Tc =  10.0 min
+++ CA =   1.0
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE + WEST SIDE AND KYRENE ROAD

```
+++ Link # 23,  Flow depth =    .46 ft, Critical depth =    .89 ft
  PNC 65 66 3 180 0
  PIP 64.5 1139.52 1140.01 1131.39 1127.91 -24
+++ Tc =  10.1 min
+++ CA =   1.0
+++ Link # 24,  Flow depth =    .46 ft, Critical depth =    .89 ft
  PNC 66 67 3 180 0
  STO 1.30 .7975 10
  PIP 7 1140.01 1140.27 1125.16 1124.86 -24
+++ Tc =  10.2 min
+++ CA =   2.1
+++ Link # 25,  Flow depth =    .70 ft, Critical depth =   1.28 ft
  PNC 67 68 3 90 0
  REC 21
  PIP 337 1140.27 1141.07 1122.11 1121.78 -66
+++ Tc =  37.4 min
+++ CA =  37.8
+++ Link # 26,  Flow depth =   5.50 ft, Critical depth =   5.50 ft
  PNC 68 111 4 90 0
  REM FLOWS FROM WEST AND KYRENE ROAD
  STO 12.6 1 13.4
  PIP 260 1141.69 1160.75 1121.78 1121.46 -66
+++ Tc =  38.4 min
+++ CA =  50.4
+++ Link # 27,  Flow depth =   5.50 ft, Critical depth =   5.50 ft
  PNC 111 102 4 156 0
  PIP 186.2 1160.75 1155.87 1121.46 1120.38 -66
+++ Tc =  39.1 min
+++ CA =  50.4
+++ Link # 28,  Flow depth =   3.02 ft, Critical depth =   3.52 ft
  PNC 102 103 4 180 0
  PIP 47.7 1155.87 1155.8 1120.38 1119.10 -66
+++ Tc =  39.3 min
+++ CA =  50.4
+++ Link # 29,  Flow depth =   1.98 ft, Critical depth =   3.52 ft
  PNC 103 105 0 180 2
  END
 END OF INPUT DATA.
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE + WEST SIDE AND KYRENE ROAD

*** DMJM DA 160 to 131 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
1	1	27	1140.24	.10010	3.9	1.5	29.2	78.24	0.
			1140.14		4.0		26.7	106.15	

Length = 1. ft Total length = 1. ft
Cost = 0. Total Cost = 0.

*** DAs 130, 129 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
2	182	24	1140.43	.00175	3.8	1.6	3.5	6.75	0.
			1140.11		4.1		3.3	10.25	
3	8	24	1140.11	.01260	4.1	1.9	8.7	13.17	0.
			1140.01		4.4		8.8	27.51	

Length = 190. ft Total length = 190. ft
Cost = 0. Total Cost = 0.

*** DAs 130, 129 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
4	113	66	1133.22	.00098	11.2	5.3	5.3	85.73	75		
			1133.11		11.1	5.1	4.8	113.75			

Length = 303. ft Total length = 304. ft

SR202L - PUMPSTA @ KYRENE, EAST SIDE + WEST SIDE AND KYRENE ROAD

*** DAs 130, 129 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
5	224	66	1133.11	.00103	11.0	5.1	5.4	85.33	73		
			1132.88		11.0	5.1	4.9	116.70			

Length = 526. ft Total length = 527. ft

*** DA 50,58,59 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
6	104	24	1138.80	.00773	4.5	2.4	7.8	19.26	89		
			1138.00		5.7	3.5	6.9	21.55			
7	134	24	1138.00	.00672	5.7	3.5	6.6	20.85	104	.76	24
			1137.10		6.6	4.4	6.4	20.09			
8	7	24	1137.10	.01428	6.6	4.4	10.3	23.00	79		
			1137.00		6.9	4.7	9.3	29.29			
9	99	66	1132.88	.00101	11.0	5.1	5.5	97.35	84		
			1132.78		10.2	4.3	4.9	115.68			

Length = 344. ft Total length = 871. ft

SR202L - PUMPSTA @ KYRENE, EAST SIDE + WEST SIDE AND KYRENE ROAD

*** DA 51 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
10	44	24	1135.56	.02368	6.9	4.7	10.8	12.77	34		
			1134.53		8.5	6.3	12.0	37.71			
11	232	66	1132.78	.00099	10.2	4.3	5.5	103.92	91		
			1132.55		9.8	3.8	4.8	114.51			

Length = 276. ft Total length = 1146. ft

*** DA 56,57 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
12	134	24	1137.75	.00149	4.6	2.4	2.9	4.36	46		
			1137.55		4.8	2.6	3.0	9.47			
13	7	24	1137.55	.00286	4.8	2.6	4.4	8.28	63		
			1137.53		5.0	2.9	4.2	13.11			
14	327	66	1132.55	.00101	9.8	3.8	5.5	107.51	93		
			1132.22		9.0	3.1	4.9	115.56			

Length = 468. ft Total length = 1614. ft

SR202L - PUMPSTA @ KYRENE, EAST SIDE + WEST SIDE AND KYRENE ROAD

*** DAs 53, 54 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
15	134	24	1136.50	.00149	4.5	2.3	3.1	5.09	54		
			1136.30		4.7	2.5	3.0	9.47			
16	7	24	1136.30	.00288	4.7	2.5	4.6	9.71	74		
			1136.28		5.0	2.8	4.2	13.15			
17	225	66	1132.22	.00098	9.0	3.1	5.5	111.37	98		
			1132.00		9.0	3.0	4.8	113.75			
18	106	66	1122.28	.00104	18.7	12.8	5.6	110.33	94		
			1122.17		18.1	12.2	4.9	117.18			

Length = 472. ft Total length = 2086. ft

*** DAs 52, 49 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
19	68	24	1135.51	.00163	4.5	2.4	3.3	6.00	61		
			1135.40		4.1	2.0	3.1	9.89			
20	65	24	1135.40	.00155	4.1	2.0	3.2	5.94	62		
			1135.30		4.7	2.6	3.1	9.65			
21	7	24	1135.30	.00288	4.7	2.6	4.7	11.50	87		
			1135.28		5.0	2.8	4.2	13.15			
22	59	66	1122.17	.00102	18.1	12.2	4.9	116.02	100	.07	24
			1122.11		18.2	12.2	4.9	115.95			

Length = 198. ft Total length = 2284. ft

Length = 198. ft Total length = 2284. ft

SR202L - PUMPSTA @ KYRENE, EAST SIDE + WEST SIDE AND KYRENE ROAD

*** DA 55,48

Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
23	68	24	1135.03	.05393	5.0	2.8	12.0	6.34	11		
			1131.39		8.1	6.0	18.1	56.91			
24	65	24	1131.39	.05395	8.1	6.0	11.9	6.32	11		
			1127.91		12.1	9.9	18.1	56.93			
25	7	24	1125.16	.04285	14.8	12.7	13.4	12.69	25		
			1124.86		15.4	13.2	16.1	50.73			
26	337	66	1122.11	.00098	18.2	12.2	5.2	122.38	107	8.52	27
			1121.78		19.3	13.3	4.8	113.85			
27	260	66	1121.78	.00123	19.9	14.0	6.8	160.77	126	33.18	42
			1121.46		39.3	33.3	5.4	127.59			
28	186	66	1121.46	.00580	39.3	33.3	12.1	159.33	58		
			1120.38		35.5	29.5	11.7	277.07			
29	48	66	1120.38	.02683	35.5	29.5	21.2	158.75	27		
			1119.10		36.7	30.7	25.1	595.94			

Length = 970. ft Total length = 3254. ft

SR202L - PUMPSTA @ KYRENE, EAST SIDE + WEST SIDE AND KYRENE ROAD

Hydraulic Gradeline Computations

Link #	Down-stream Node #	Hydraulic Gradeline Elevation	Crown Elev.	Possible Surcharge	Ground Elev.	Super-crit.?	Manhole Depth	Loss Coef
1	48	1142.38	1142.39	N	1144.43	Y	6.47	.04
2	47	1142.72	1142.11	Y	1144.18	N	2.61	.86
3	48	1141.32	1142.01	N	1144.43	Y	6.47	.04
4	70	1139.21	1138.61	Y	1144.12	N	6.10	.03
5	52	1138.71	1138.38	Y	1143.90	N	5.86	.17
6	50	1139.57	1140.00	N	1143.65	Y	3.79	2.50
7	51	1140.79	1139.10	Y	1143.65	N/A	3.69	.46
8	52	1138.71	1139.00	N	1143.90	Y	5.86	1.85
9	54	1138.21	1138.28	N	1143.00	N	5.48	.08
10	54	1135.82	1136.53	N	1143.00	Y	5.48	1.51
11	57	1137.69	1138.05	N	1142.33	N	5.18	.05
12	56	1139.04	1139.55	N	1142.33	N	1.49	.61
13	57	1138.69	1139.53	N	1142.33	N	5.18	.02
14	60	1137.14	1137.72	N	1141.26	N	4.96	.05
15	59	1137.94	1138.30	N	1141.00	N	1.64	.63
16	60	1137.56	1138.28	N	1141.26	N	4.96	.02
17	90	1136.45	1137.50	N	1141.00	N	7.55	.12
18	64	1129.26	1127.67	Y	1140.29	N	7.11	.09
19	62	1137.34	1137.40	N	1139.54	N	1.94	.05
20	63	1137.15	1137.30	N	1140.03	N	1.85	.66
21	64	1136.74	1137.28	N	1140.29	N	7.11	.04
22	68	1128.87	1127.61	Y	1140.27	N/A	6.78	.07
23	66	1132.28	1133.39	N	1139.52	Y	2.80	.06
24	67	1128.80	1129.91	N	1140.01	Y	6.11	1.33
25	68	1126.14	1126.86	N	1140.27	Y	6.78	1.72
26	111	1128.38	1127.28	Y	1141.69	N/A	6.29	1.55
27	102	1126.96	1126.96	N	1160.75	N/A	5.37	.04
28	103	1123.90	1125.88	N	1155.87	Y	20.42	.26
29	105	1133.11	1124.60	Y	1155.80	Y	14.01	.00

Link #	Terminal Node #	Hydraulic Gradeline Elevation	Ground Elevation	Loss Coef.
1	44	1162.40	1144.18	1.50
2	46	1143.06	1144.18	1.50
6	49	1141.68	1143.34	1.50
10	53	1139.12	1142.43	1.50
12	55	1139.26	1142.33	1.50

SR202L - PUMPSTA @ KYRENE, EAST SIDE + WEST SIDE AND KYRENE ROAD

Link #	Terminal Node #	Hydraulic Gradeline Elevation	Ground Elevation	Loss Coef.
15	58	1138.16	1141.00	1.50
19	61	1137.60	1140.03	1.50
23	65	1138.83	1140.01	1.50

NORMAL END OF HYDRA

```
JOB SR202L - PUMPSTA @ KYRENE, WEST SIDE
SWI 2
REM Data in English Units
REM SITE SPECIFIC RDDF FOR 50 YEAR
RAI 5 8.09 10 6.19 15 5.28 30 3.57 60 2.23 120 1.2
REM ASSUMES A PAVEMENT SECTION OF 18 INCHES
PDA .012 24 4 2 3 .0001
HGL 1
NEW DA 32
STO 1.020 .91 10
PIP 42 1151.49 1152.66 1147.45 1147.00 -24
PNC 72 73 4 90 0
HOL 27
NEW DA 31
STO 1.081 .8825 10
PIP 177.5 1151.98 1152.66 1147.9 1147.00 -24
PNC 71 73 4 90 0
REC 27
PIP 250 1152.66 1150.14 1147. 1145.75 -24
PNC 73 76 4 180 0
HOL 30
NEW DA 41,35,36
STO 1.493 .825 10
PIP 127 1148.56 1148.52 1142.56 1142.43 -24
PNC 80 74 3 90 0
STO .748 .865 10
PIP 190 1148.52 1149.88 1142.43 1141.87 -24
PNC 74 75 3 180 0
STO .720 .8875 10
PIP 7 1149.88  1150.14 1141.87 1141.78 -24
PNC 75 76 4 90 0
REC 30
PIP 52.8 1150.14 1149.58 1141.70 1141.43 -30
PNC 76 79 0 180 1
HOL 31
NEW DA 37,40 - RAMP B
STO 1.007 .7 10
PIP 2 1149.61 1149.87 1144.55 1144.51 -24
PNC 77 78 3 180 0
STO .391 .95 10
PIP 66 1149.87 1149.58 1144.51 1141.69 -24
PNC 78 79 0 90 1
REC 31
PIP 231.2 1149.58 1147.27 1141.43 1140.20 -30
PNC 79 83 4 180 0
HOL 32
NEW DAs 38,39
STO .742 .8825 10
PIP 146 1147.01 1147.01 1142.00 1141.85 -30
PNC 81 82 3 180 0
STO 0.900 .845 10
PIP 7 1147.01 1147.27 1141.85 1141.82 -30
PNC 82 83 4 90 0
HOL 33
NEW DA 45
STO .967 .725 10
PIP 62.5 1150.87 1147.27 1144.0 1140.2 -24
PNC 60 83 4 90 0
REC 32
REC 33
PIP 330 1147.27 1143.93 1140.2 1138.55 -36
PNC 83 88 4 180 0
HOL 34
NEW DA 43 44
STO 1.005 .8325 10
PIP 144.5 1143.67 1143.67 1139.40 1139.11 -24
PNC 86 87 3 180 0
STO 1.255 .82 10
PIP 7 1143.67 1143.93 1139.11 1139.01 -24
PNC 87 88 4 90 0
REC 34
PIP 385.5 1143.93 1141.07 1138.55 1136. -36
PNC 88 95 4 90 0
HOL 35
NEW DA 46,47
STO 1.426 .8025 10
PIP 67.5 1140.84 1140.32 1135.0 1134.87 -24
PNC 92 93 3 180 0
PIP 69 1140.32 1140.81 1134.87 1134.74 -24
PNC 93 94 3 180 0
STO 1.551 .805 10
PIP 7 1140.81 1141.07 1134.74 1134.64 -24
PNC 94 95 4 180 0
REC 35
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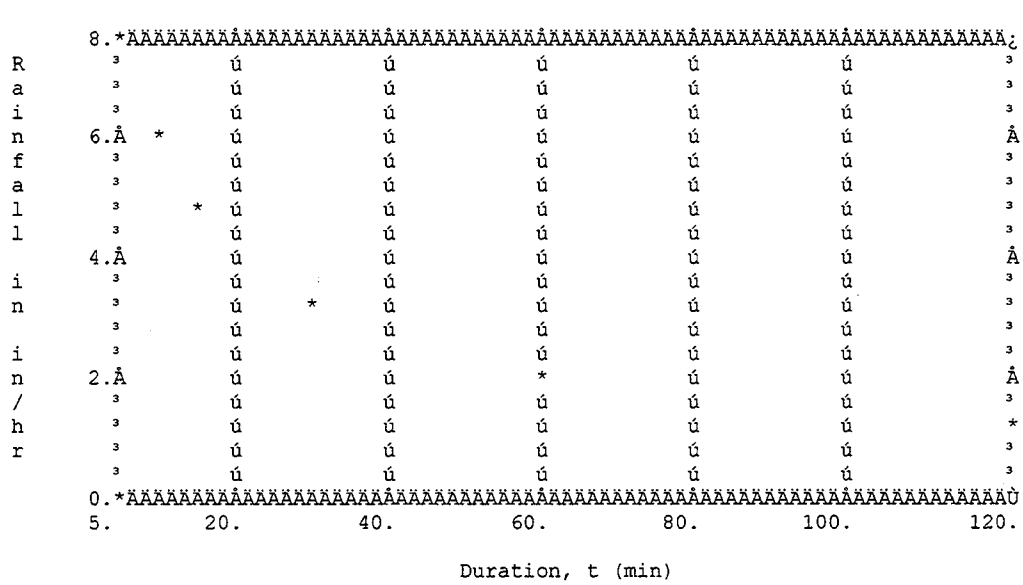
PIP 1  1141.07 1141.69 1121.87 1121.86 -66
PNC 95 96 4 120 0
HOL 36
NEW DA 106,107
STO .239 .95 10
PIP 70.5 1162.31 1162.35 1158.3 1157.95 -24
PNC 97 98 3 180 0
STO .196 .95 10
PIP 10 1162.35 1160.5 1157.95 1157.92 -24
PNC 98 10 4 90 0
PIP 260.5 1160.5 1164.56 1157.92 1156.37 -24
PNC 10 101 4 55 0
HOL 40
NEW DA 102,103
STO .193 .95 10
PIP 79.5 1164.43 1164.56 1160 1156.56 -24
PNC 99 100 3 90 0
STO .182 .95 10
PIP 19 1164.56 1164.47 1156.56 1156.37 -15
PNC 100 101 4 35 0
REC 40
PIP 131 1164.47 1141.07 1156.37 1135 -24
PNC 101 96 4 255 0
REC 36
PIP 1  1141.07 1141.69 1121.86 1121.85 -66
PNC 96 111 1 180 2
NEW DA 100,101,
STO .214 .95 10
PIP 82.5 1164.42 1164.31 1159.4 1157 -24
PNC 89 90 3 160 0
STO .224 .95 10
PIP 124.5 1164.31 1160.25 1157 1155.0 -24
PNC 90 91 4 90 0
PIP 102 1160.25 1157 1155.0 1152.0 -24
PNC 91 110 0 90 2
NEW DA 104
STO .151 .95 10
PIP 42.5 1162.65 1162.70 1157.65 1155.0 -24
PNC 1 2 0 90 2
NEW DA 105
STO .670 .95 10
PIP 50 1162.4 1162.6 1159.05 1159 -24
PNC 3 4 0 180 1
PIP 89.5 1162.6 1163.0 1159 1155.75 -24
PNC 4 5 0 90 2
END
```

SR202L - PUMPSTA @ KYRENE, WEST SIDE

```
+++ Commands Read From File westky.hda
  JOB
  SWI 2
  REM Data in English Units
  REM SITE SPECIFIC RDDF FOR 50 YEAR
  RAI 5 8.09 10 6.19 15 5.28 30 3.57 60 2.23 120 1.2
```

IDF CURVE



PLOT-DATA (Time, t(min) vs. Intensity, i(in/h))

t	i	t	i	t	i	t	i	t	i
5.	8.09	60.	2.23	0.	.00	0.	.00	0.	.00
10.	6.19	120.	1.20	0.	.00	0.	.00	0.	.00
15.	5.28	0.	.00	0.	.00	0.	.00	0.	.00
30.	3.57	0.	.00	0.	.00	0.	.00	0.	.00

```
  REM ASSUMES A PAVEMENT SECTION OF 18 INCHES
  PDA .012 24 4 2 3 .0001
  HGL 1
  NEW DA 32
```

SR202L - PUMPSTA @ KYRENE, WEST SIDE

```
  STO 1.020 .91 10
  PIP 42 1151.49 1152.66 1147.45 1147.00 -24
+++ Tc =  10.0 min
+++ CA =    .9
+++ Link #  1,  Flow depth =    .66 ft, Critical depth =    .85 ft
  PNC 72 73 4 90 0
  HOL 27
  NEW DA 31
  STO 1.081 .8825 10
  PIP 177.5 1151.98 1152.66 1147.9 1147.00 -24
+++ Tc =  10.0 min
+++ CA =   1.0
+++ Link #  2,  Flow depth =    .82 ft, Critical depth =    .86 ft
  PNC 71 73 4 90 0
  REC 27
  PIP 250 1152.66 1150.14 1147. 1145.75 -24
+++ Tc =  10.6 min
+++ CA =   1.9
+++ Link #  3,  Flow depth =   1.20 ft, Critical depth =   1.21 ft
  PNC 73 76 4 180 0
  HOL 30
  NEW DA 41,35,36
  STO 1.493 .825 10
  PIP 127 1148.56 1148.52 1142.56 1142.43 -24
+++ Tc =  10.0 min
+++ CA =   1.2
+++ Link #  4,  Flow depth =   1.60 ft, Critical depth =    .98 ft
  PNC 80 74 3 90 0
  STO .748 .865 10
  PIP 190 1148.52 1149.88 1142.43 1141.87 -24
+++ Tc =  10.7 min
+++ CA =   1.9
+++ Link #  5,  Flow depth =   1.44 ft, Critical depth =   1.21 ft
  PNC 74 75 3 180 0
  STO .720 .8875 10
  PIP 7 1149.88  1150.14 1141.87 1141.78 -24
+++ Tc =  11.4 min
+++ CA =   2.5
+++ Link #  6,  Flow depth =   1.06 ft, Critical depth =   1.39 ft
  PNC 75 76 4 90 0
  REC 30
  PIP 52.8 1150.14 1149.58 1141.70 1141.43 -30
+++ Tc =  11.4 min
+++ CA =   4.4
+++ Link #  7,  Flow depth =   1.75 ft, Critical depth =   1.74 ft
  PNC 76 79 0 180 1
  HOL 31
  NEW DA 37,40 - RAMP B
  STO 1.007 .7 10
```

SR202L - PUMPSTA @ KYRENE, WEST SIDE

```
  PIP 2 1149.61 1149.87 1144.55 1144.51 -24
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link #  8,  Flow depth =    .48 ft, Critical depth =    .73 ft
  PNC 77 78 3 180 0
  STO .391 .95 10
  PIP 66 1149.87 1149.58 1144.51 1141.69 -24
+++ Tc =  10.0 min
+++ CA =   1.1
+++ Link #  9,  Flow depth =    .50 ft, Critical depth =    .91 ft
  PNC 78 79 0 90 1
  REC 31
  PIP 231.2 1149.58 1147.27 1141.43 1140.20 -30
+++ Tc =  11.5 min
+++ CA =   5.5
+++ Link # 10,  Flow depth =   2.05 ft, Critical depth =   1.94 ft
  PNC 79 83 4 180 0
  HOL 32
  NEW DAs 38,39
  STO .742 .8825 10
  PIP 146 1147.01 1147.01 1142.00 1141.85 -30
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link # 11,  Flow depth =    .93 ft, Critical depth =    .66 ft
  PNC 81 82 3 180 0
  STO 0.900 .845 10
  PIP 7 1147.01 1147.27 1141.85 1141.82 -30
+++ Tc =  11.0 min
+++ CA =   1.4
+++ Link # 12,  Flow depth =    .95 ft, Critical depth =    .97 ft
  PNC 82 83 4 90 0
  HOL 33
  NEW DA 45
  STO .967 .725 10
  PIP 62.5 1150.87 1147.27 1144.0 1140.2 -24
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link # 13,  Flow depth =    .38 ft, Critical depth =    .73 ft
  PNC 60 83 4 90 0
  REC 32
  REC 33
  PIP 330 1147.27 1143.93 1140.2 1138.55 -36
+++ Tc =  12.1 min
+++ CA =   7.6
+++ Link # 14,  Flow depth =   2.16 ft, Critical depth =   2.17 ft
  PNC 83 88 4 180 0
  HOL 34
  NEW DA 43 44
  STO 1.005 .8325 10
```

SR202L - PUMPSTA @ KYRENE, WEST SIDE

```
  PIP 144.5 1143.67 1143.67 1139.40 1139.11 -24
+++ Tc =  10.0 min
+++ CA =    .8
+++ Link # 15,  Flow depth =    .98 ft, Critical depth =    .80 ft
  PNC 86 87 3 180 0
  STO 1.255 .82 10
  PIP 7 1143.67 1143.93 1139.11 1139.01 -24
+++ Tc =  10.7 min
+++ CA =   1.9
+++ Link # 16,  Flow depth =    .88 ft, Critical depth =   1.21 ft
  PNC 87 88 4 90 0
  REC 34
  PIP 385.5 1143.93 1141.07 1138.55 1136. -36
+++ Tc =  12.7 min
+++ CA =   9.5
+++ Link # 17,  Flow depth =   2.28 ft, Critical depth =   2.38 ft
  PNC 88 95 4 90 0
  HOL 35
  NEW DA 46,47
  STO 1.426 .8025 10
  PIP 67.5 1140.84 1140.32 1135.0 1134.87 -24
+++ Tc =  10.0 min
+++ CA =   1.1
+++ Link # 18,  Flow depth =   1.20 ft, Critical depth =    .95 ft
  PNC 92 93 3 180 0
  PIP 69 1140.32 1140.81 1134.87 1134.74 -24
+++ Tc =  10.3 min
+++ CA =   1.1
+++ Link # 19,  Flow depth =   1.20 ft, Critical depth =    .94 ft
  PNC 93 94 3 180 0
  STO 1.551 .805 10
  PIP 7 1140.81 1141.07 1134.74 1134.64 -24
+++ Tc =  10.6 min
+++ CA =   2.4
+++ Link # 20,  Flow depth =   1.00 ft, Critical depth =   1.38 ft
  PNC 94 95 4 180 0
  REC 35
  PIP 1  1141.07 1141.69 1121.87 1121.86 -66
+++ Tc =  13.4 min
+++ CA =  11.9
+++ Link # 21,  Flow depth =   1.59 ft, Critical depth =   2.23 ft
  PNC 95 96 4 120 0
  HOL 36
  NEW DA 106,107
  STO .239 .95 10
  PIP 70.5 1162.31 1162.35 1158.3 1157.95 -24
+++ Tc =  10.0 min
+++ CA =    .2
+++ Link # 22,  Flow depth =    .40 ft, Critical depth =    .41 ft
```

SR202L - PUMPSTA @ KYRENE, WEST SIDE

```
  PNC 97 98 3 180 0
  STO .196 .95 10
  PIP 10 1162.35 1160.5 1157.95 1157.92 -24
+++ Tc =  10.4 min
+++ CA =    .4
+++ Link # 23,  Flow depth =    .60 ft, Critical depth =    .55 ft
  PNC 98 10 4 90 0
  PIP 260.5 1160.5 1164.56 1157.92 1156.37 -24
+++ Tc =  10.4 min
+++ CA =    .4
+++ Link # 24,  Flow depth =    .50 ft, Critical depth =    .55 ft
  PNC 10 101 4 55 0
  HOL 40
  NEW DA 102,103
  STO .193 .95 10
  PIP 79.5 1164.43 1164.56 1160 1156.56 -24
+++ Tc =  10.0 min
+++ CA =    .2
+++ Link # 25,  Flow depth =    .22 ft, Critical depth =    .37 ft
  PNC 99 100 3 90 0
  STO .182 .95 10
  PIP 19 1164.56 1164.47 1156.56 1156.37 -15
+++ Tc =  10.2 min
+++ CA =    .4
+++ Link # 26,  Flow depth =    .49 ft, Critical depth =    .59 ft
  PNC 100 101 4 35 0
  REC 40
  PIP 131 1164.47 1141.07 1156.37 1135 -24
+++ Tc =  11.4 min
+++ CA =    .8
+++ Link # 27,  Flow depth =    .30 ft, Critical depth =    .75 ft
  PNC 101 96 4 255 0
  REC 36
  PIP 1  1141.07 1141.69 1121.86 1121.85 -66
+++ Tc =  13.4 min
+++ CA =  12.6
+++ Link # 28,  Flow depth =   1.65 ft, Critical depth =   2.29 ft
  PNC 96 111 1 180 2
  NEW DA 100,101,
  STO .214 .95 10
  PIP 82.5 1164.42 1164.31 1159.4 1157 -24
+++ Tc =  10.0 min
+++ CA =    .2
+++ Link # 29,  Flow depth =    .24 ft, Critical depth =    .39 ft
  PNC 89 90 3 160 0
  STO .224 .95 10
  PIP 124.5 1164.31 1160.25 1157 1155.0 -24
+++ Tc =  10.2 min
+++ CA =    .4
```

SR202L - PUMPSTA @ KYRENE, WEST SIDE

```
+++ Link # 30,  Flow depth =    .40 ft, Critical depth =    .56 ft
  PNC 90 91 4 90 0
  PIP 102 1160.25 1157 1155.0 1152.0 -24
+++ Tc =  10.6 min
+++ CA =    .4
+++ Link # 31,  Flow depth =    .34 ft, Critical depth =    .55 ft
  PNC 91 110 0 90 2
  NEW DA 104
  STO .151 .95 10
  PIP 42.5 1162.65 1162.70 1157.65 1155.0 -24
+++ Tc =  10.0 min
+++ CA =    .1
+++ Link # 32,  Flow depth =    .18 ft, Critical depth =    .32 ft
  PNC 1 2 0 90 2
  NEW DA 105
  STO .670 .95 10
  PIP 50 1162.4 1162.6 1159.05 1159 -24
+++ Tc =  10.0 min
+++ CA =    .6
+++ Link # 33,  Flow depth =   1.02 ft, Critical depth =    .70 ft
  PNC 3 4 0 180 1
  PIP 89.5 1162.6 1163.0 1159 1155.75 -24
+++ Tc =  10.3 min
+++ CA =    .6
+++ Link # 34,  Flow depth =    .40 ft, Critical depth =    .69 ft
  PNC 4 5 0 90 2
  END
 END OF INPUT DATA.
```

SR202L - PUMPSTA @ KYRENE, WEST SIDE

*** DA 32 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
1	42	24	1147.45	.01072	4.0	1.9	6.5	5.75	23		
			1147.00		5.7	3.5	8.1	25.37			

Length = 42. ft Total length = 42. ft

*** DA 31 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
2	178	24	1147.90	.00507	4.1	1.9	5.0	5.91	34		
			1147.00		5.7	3.5	5.6	17.45			
3	250	24	1147.00	.00500	5.7	3.5	5.9	11.45	66		
			1145.75		4.4	2.2	5.5	17.33			

Length = 428. ft Total length = 470. ft

*** DA 41,35,36 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
4	127	24	1142.56	.00102	6.0	3.8	2.8	7.62	97		
			1142.43		6.1	3.9	2.5	7.84			

Length = 127. ft Total length = 127. ft

SR202L - PUMPSTA @ KYRENE, WEST SIDE

*** DA 41,35,36 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
5	190	24	1142.43	.00295	6.1	3.9	4.8	11.37	85		
			1141.87		8.0	5.8	4.2	13.31			
6	7	24	1141.87	.01287	8.0	5.8	9.0	14.94	54		
			1141.78		8.4	6.2	8.8	27.80			
7	53	30	1141.70	.00511	8.4	5.7	7.2	26.10	82		
			1141.43		8.1	5.4	6.5	31.77			

Length = 377. ft Total length = 846. ft

*** DA 37,40 - RAMP B Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
8	2	24	1144.55	.02002	5.1	2.9	7.5	4.36	13		
			1144.51		5.4	3.2	11.0	34.68			
9	66	24	1144.51	.04273	5.4	3.2	11.2	6.66	13		
			1141.69		7.9	5.7	16.1	50.66			
10	231	30	1141.43	.00532	8.1	5.4	7.5	32.36	100		
			1140.20		7.1	4.4	6.6	32.41			

Length = 299. ft Total length = 1146. ft

SR202L - PUMPSTA @ KYRENE, WEST SIDE

*** DAs 38,39 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
11	146	30	1142.00	.00103	5.0	2.3	2.5	4.05	28		
			1141.85		5.2	2.5	2.9	14.24			
12	7	30	1141.85	.00429	5.2	2.5	5.1	8.51	29		
			1141.82		5.4	2.7	5.9	29.10			

Length = 153. ft Total length = 153. ft

*** DA 45 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
13	63	24	1144.00	.06080	6.9	4.7	11.2	4.34	7		
			1140.20		7.1	4.9	19.2	60.43			
14	330	36	1140.20	.00500	7.1	3.8	8.1	44.16	86		
			1138.55		5.4	2.1	7.2	51.09			

Length = 393. ft Total length = 1691. ft

SR202L - PUMPSTA @ KYRENE, WEST SIDE

*** DA 43 44 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
15	145	24	1139.40	.00201	4.3	2.1	3.4	5.18	47		
			1139.11		4.6	2.4	3.5	10.98			
16	7	24	1139.11	.01428	4.6	2.4	8.7	11.31	39		
			1139.01		4.9	2.8	9.3	29.29			
17	386	36	1138.55	.00661	5.4	2.1	9.4	53.84	92		
			1136.00		5.1	1.8	8.3	58.77			

Length = 537. ft Total length = 2228. ft

*** DA 46,47 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
18	68	24	1135.00	.00193	5.8	3.7	3.7	7.08	66		
			1134.87		5.5	3.3	3.4	10.76			
19	69	24	1134.87	.00188	5.5	3.3	3.6	7.02	66		
			1134.74		6.1	3.9	3.4	10.64			
20	7	24	1134.74	.01428	6.1	3.9	9.3	14.54	50		
			1134.64		6.4	4.3	9.3	29.29			
21	1	66	1121.87	.00989	19.2	13.2	11.6	66.00	18		
			1121.86		19.8	13.9	15.2	361.74			

Length = 145. ft Total length = 2373. ft

SR202L - PUMPSTA @ KYRENE, WEST SIDE

*** DA 106,107 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
22	71	24	1158.30	.00496	4.0	1.8	3.3	1.41	8		
			1157.95		4.4	2.2	5.5	17.27			
23	10	24	1157.95	.00300	4.4	2.2	3.3	2.53	19		
			1157.92		2.6	.4	4.3	13.43			
24	261	24	1157.92	.00595	2.6	.4	4.2	2.53	13		
			1156.37		8.2	6.0	6.0	18.90			

Length = 341. ft Total length = 341. ft

*** DA 102,103 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
25	80	24	1160.00	.04327	4.4	2.3	6.6	1.13	2		
			1156.56		8.0	5.8	16.2	50.98			
26	19	15	1156.56	.01000	8.0	6.6	5.0	2.19	31		
			1156.37		8.1	6.7	5.7	7.00			
27	131	24	1156.37	.16313	8.1	5.9	16.0	4.56	5		
			1135.00		6.1	3.9	31.5	98.98			
28	1	66	1121.86	.01001	19.2	13.3	11.8	70.28	19		
			1121.85		19.8	13.9	15.3	363.97			

Length = 231. ft Total length = 2944. ft

SR202L - PUMPSTA @ KYRENE, WEST SIDE

*** DA 100,101, Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
29	83	24	1159.40	.02909	5.0	2.9	5.9	1.26	3		
			1157.00		7.3	5.1	13.3	41.80			
30	125	24	1157.00	.01606	7.3	5.1	6.0	2.56	8		
			1155.00		5.3	3.1	9.9	31.06			
31	102	24	1155.00	.02941	5.3	3.1	7.4	2.53	6		
			1152.00		5.0	2.8	13.4	42.03			

Length = 309. ft Total length = 309. ft

*** DA 104 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
32	43	24	1157.65	.06235	5.0	2.8	7.0	.89	1		
			1155.00		7.7	5.5	19.5	61.20			

Length = 43. ft Total length = 43. ft

SR202L - PUMPSTA @ KYRENE, WEST SIDE

*** DA 105 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
33	50	24	1159.05	.00100	3.3	1.2	2.5	3.94	51		
			1159.00		3.6	1.4	2.5	7.75			
34	90	24	1159.00	.03631	3.6	1.4	9.0	3.90	8		
			1155.75		7.3	5.1	14.9	46.70			

Length = 140. ft Total length = 140. ft

SR202L - PUMPSTA @ KYRENE, WEST SIDE

Hydraulic Gradeline Computations

Link #	Down-stream Node #	Hydraulic Gradeline Elevation	Crown Elev.	Possible Surcharge	Ground Elev.	Super-crit.?	Manhole Depth	Loss Coef
1	73	1147.66	1149.00	N	1152.66	Y	.00	.00
2	73	1147.82	1149.00	N	1152.66	Y	.00	.00
3	76	1146.95	1147.75	N	1150.14	Y	.00	.00
4	74	1144.03	1144.43	N	1148.52	N	.00	.00
5	75	1143.31	1143.87	N	1149.88	N	.00	.00
6	76	1142.84	1143.78	N	1150.14	Y	.00	.00
7	79	1143.18	1143.93	N	1149.58	N	.00	.00
8	78	1144.99	1146.51	N	1149.87	Y	.00	.00
9	79	1142.19	1143.69	N	1149.58	Y	.00	.00
10	83	1142.25	1142.70	N	1147.27	N	.00	.00
11	82	1142.78	1144.35	N	1147.01	N	.00	.00
12	83	1142.77	1144.32	N	1147.27	Y	.00	.00
13	83	1140.58	1142.20	N	1147.27	Y	.00	.00
14	88	1140.71	1141.55	N	1143.93	Y	.00	.00
15	87	1140.09	1141.11	N	1143.67	N	.00	.00
16	88	1139.89	1141.01	N	1143.93	Y	.00	.00
17	95	1138.28	1139.00	N	1141.07	Y	.00	.00
18	93	1136.07	1136.87	N	1140.32	N	.00	.00
19	94	1135.94	1136.74	N	1140.81	N	.00	.00
20	95	1135.64	1136.64	N	1141.07	Y	.00	.00
21	96	1123.46	1127.36	N	1141.07	Y	.00	.00
22	98	1158.35	1159.95	N	1162.35	Y	.00	.00
23	10	1158.52	1159.92	N	1160.50	N	.00	.00
24	101	1156.87	1158.37	N	1164.47	Y	.00	.00
25	100	1156.78	1158.56	N	1164.56	Y	.00	.00
26	101	1156.86	1157.62	N	1164.47	Y	.00	.00
27	96	1135.30	1137.00	N	1141.07	Y	.00	.00
28	111	1123.50	1127.35	N	1141.69	Y	.00	.00
29	90	1157.24	1159.00	N	1164.31	Y	.00	.00
30	91	1155.40	1157.00	N	1160.25	Y	.00	.00
31	110	1152.34	1154.00	N	1157.00	Y	.00	.00
32	2	1155.18	1157.00	N	1162.70	Y	.00	.00
33	4	1160.69	1161.00	N	1162.60	N	1.69	.54
34	5	1156.15	1157.75	N	1163.00	Y	.40	.00

Link #	Terminal Node #	Hydraulic Gradeline Elevation	Ground Elevation	Loss Coef.
33	3	1161.02	1162.40	1.50

SR202L - PUMPSTA @ KYRENE, WEST SIDE

Link #	Terminal Node #	Hydraulic Gradeline Elevation	Ground Elevation	Loss Coef.

NORMAL END OF HYDRA

DMUM DATA
Drainage Areas 160-130

```
JOB SR202L - PUMPSTA @ KYRENE, EAST SIDE
SWI 2
REM Data in English Units
REM SITE SPECIFIC RDDF FOR 50 YEAR
RAI 5 8.09 10 6.19 15 5.28 30 3.57 60 2.23 120 1.2
REM ASSUMES A PAVEMENT SECTION OF 18 INCHES
PDA .012 24 3.75 1.5 3 .0001
HGL 1
REM CREST AT 2153+21
NEW DAs 160, 159
STO 0.912 .898 10
PIP 138 1164.69 1164.69
PNC 1 2 3 180 0
STO 0.912 .898 10
PIP 8 1164.69 1164.94
PNC 2 3 3 90 0
PIP 330 1165.20 1163.87 1159.99 1159.33 -24
PNC 3 6 3 180 0
HOL 1
NEW DAs 158, 157
STO 0.659 .898 10
PIP 138 1163.36 1163.36
PNC 4 5 3 180 0
STO 0.659 .898 10
PIP 8 1163.36 1163.61
PNC 5 6 3 90 0
REC 1
PIP 330 1163.61 1162.29 1158.84 1158.08 -30
PNC 6 9 3 180 0
HOL 2
NEW DAs 156, 155
STO 0.686 .891 10
PIP 138 1162.04 1162.04
PNC 7 8 3 180 0
STO 0.686 .891 10
PIP 8 1162.24 1162.29
PNC 8 9 3 90 0
REC 2
PIP 330 1162.29 1160.96 1156.56 1156.00 -36
PNC 9 12 3 180 0
HOL 3
NEW DAs 154, 153
STO 0.758 .873 10
PIP 138 1160.71 1160.71
PNC 10 11 3 180 0
STO 0.758 .873 10
PIP 8 1160.71 1160.96
PNC 11 12 3 90 0
REC 3
PIP 330 1160.96 1159.64 1155.48 1154.89 -36
PNC 12 15 3 180 0
HOL 4
NEW DAs 152, 151
STO 0.807 .862 10
PIP 138 1159.39 1159.39
PNC 13 14 3 180 0
STO 0.807 .862 10
PIP 8 1159.39 1159.64
PNC 14 15 3 90 0
REC 4
PIP 330 1159.64 1158.31 1153.35 1153.02 -42
PNC 15 18 3 180 0
HOL 5
NEW DAs 150, 149
STO 0.811 .861 10
PIP 138 1158.06 1158.06
PNC 16 17 3 180 0
STO 0.811 .861 10
PIP 8 1158.06 1158.31
PNC 17 18 3 90 0
REC 5
PIP 330 1158.31 1156.98 1151.38 1151.15 -48
PNC 18 21 3 180 0
HOL 6
NEW DAs 148, 147
STO 0.826 .858 10
PIP 138 1156.73 1156.73
PNC 19 20 3 180 0
STO 0.826 .858 10
PIP 8 1156.73 1156.98
PNC 20 21 3 90 0
REC 6
PIP 330 1156.98 1155.66 1149.52 1149.29 -54
PNC 21 24 3 180 0
```

```
HOL 7
NEW DAs 146, 145
STO 0.848 .854 10
PIP 138 1155.41 1155.21
PNC 22 23 3 180 0
STO 0.848 .854 10
PIP 8 1155.41 1155.66
PNC 23 24 3 90 0
REC 7
PIP 330 1155.66 1154.33 1148.19 1147.96 -54
PNC 24 27 3 180 0
HOL 8
NEW DAs 144, 143
STO 0.867 .851 10
PIP 150 1154.08 1154.08
PNC 25 26 3 180 0
STO 0.958 .824 10
PIP 8 1154.08 1154.33
PNC 26 27 3 90 0
REC 8
PIP 330 1154.33 1153.01 1146.87 1146.64 -54
PNC 27 30 3 180 0
HOL 9
NEW DAs 142, 141
STO 0.883 .848 10
PIP 150 1152.76 1152.76
PNC 28 29 3 180 0
STO 0.973 .858 10
PIP 8 1152.76 1153.01
PNC 29 30 3 90 0
REC 9
PIP 330 1153.01 1151.68 1144.35 1144.22 -66
PNC 30 33 3 180 0
HOL 10
NEW DAs 140, 139
STO 0.890 .847 10
PIP 150 1151.43 1151.43
PNC 31 32 3 180 0
STO 0.981 .856 10
PIP 8 1151.43 1151.68
PNC 32 33 3 90 0
REC 10
PIP 330 1151.68 1150.35 1143.02 1142.89 -66
PNC 33 36 3 180 0
HOL 11
NEW DAs 138, 137
STO 0.924 .841 10
PIP 150 1150.10 1150.10
PNC 34 35 3 180 0
STO 1.015 .841 10
PIP 8 1150.10 1150.35
PNC 35 36 3 90 0
REC 11
PIP 330 1150.35 1149.03 1141.70 1141.57 -66
PNC 36 39 3 180 0
HOL 12
NEW DAs 136, 135
STO 0.996 .831 10
PIP 150 1148.78 1148.78
PNC 37 38 3 180 0
STO 1.087 .831 10
PIP 8 1148.78 1149.03
PNC 38 39 3 90 0
REC 12
PIP 330 1149.03 1147.46 1140.13 1140.00 -66
PNC 39 42 3 180 0
HOL 13
NEW DAs 134, 133
STO 1.053 .824 10
PIP 154 1147.45 1147.21
PNC 40 41 3 180 0
STO 1.160 .830 10
PIP 8 1147.21 1147.46
PNC 41 42 3 90 0
REC 13
PIP 330 1147.46 1145.98 1138.65 1138.52 -66
PNC 42 45 3 180 0
HOL 14
NEW DAs 132, 131
STO 1.042 .825 10
PIP 177 1145.93 1145.73
PNC 43 44 3 180 0
STO 1.190 .841 10
PIP 8 1145.73 1145.98
```

```
PNC 44 45 3 90 0
REC 14
PIP 330 1145.98 1144.43 1136.56 1136.43 -66
PNC 45 48 3 180 0
HOL 15
NEW DAs 130, 129
STO 1.297 .841 10
PIP 182 1144.18 1144.18
PNC 46 47 3 180 0
STO 1.300 .841 10
PIP 8 1144.18 1144.43
PNC 47 48 3 90 0
REC 15
PIP 112.5 1144.43 1144.18 1133.22 1133.11 -66
PNC 48 70 0 180 1
PIP 223.6 1144.12 1143.90 1133.11 1132.88 -66
PNC 70 52 0 192 2
END
```

o

SR202L - PUMPSTA @ KYRENE, EAST SIDE

```
+++ Commands Read From File east.hda
  JOB
  SWI 2
  REM Data in English Units
  REM SITE SPECIFIC RDDF FOR 50 YEAR
  RAI 5 8.09 10 6.19 15 5.28 30 3.57 60 2.23 120 1.2
```

IDF CURVE

```
      8.*ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ¿
R       ³        ú         ú         ú         ú         ú         ³
a       ³        ú         ú         ú         ú         ú         ³
i       ³        ú         ú         ú         ú         ú         ³
n     6.Å  *     ú         ú         ú         ú         ú         Å
f       ³        ú         ú         ú         ú         ú         ³
a       ³        ú         ú         ú         ú         ú         ³
l       ³     *  ú         ú         ú         ú         ú         ³
l       ³        ú         ú         ú         ú         ú         ³
      4.Å        ú         ú         ú         ú         ú         Å
i       ³        ú         ú         ú         ú         ú         ³
n       ³        ú      *  ú         ú         ú         ú         ³
        ³        ú         ú         ú         ú         ú         ³
i       ³        ú         ú         ú         ú         ú         ³
n     2.Å        ú         ú         *         ú         ú         Å
/       ³        ú         ú         ú         ú         ú         ³
h       ³        ú         ú         ú         ú         ú         *
r       ³        ú         ú         ú         ú         ú         ³
        ³        ú         ú         ú         ú         ú         ³
      0.*ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÙ
      5.       20.        40.        60.        80.       100.       120.
```

Duration, t (min)

PLOT-DATA (Time, t(min) vs. Intensity, i(in/h))

t	i	t	i	t	i	t	i	t	i
5.	8.09	60.	2.23	0.	.00	0.	.00	0.	.00
10.	6.19	120.	1.20	0.	.00	0.	.00	0.	.00
15.	5.28	0.	.00	0.	.00	0.	.00	0.	.00
30.	3.57	0.	.00	0.	.00	0.	.00	0.	.00

```
  REM ASSUMES A PAVEMENT SECTION OF 18 INCHES
  PDA .012 24 3.75 1.5 3 .0001
  HGL 1
  REM CREST AT 2153+21
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE

```
  NEW DAs 160, 159
  STO 0.912 .898 10
  PIP 138 1164.69 1164.69
+++ Tc =  10.0 min
+++ CA =    .8
+++ Link #  1,  Flow depth =   1.04 ft, Critical depth =    .79 ft
  PNC 1 2 3 180 0
  STO 0.912 .898 10
  PIP 8 1164.69 1164.94
+++ Tc =  10.7 min
+++ CA =   1.6
+++ Link #  2,  Flow depth =    .84 ft, Critical depth =   1.13 ft
  PNC 2 3 3 90 0
  PIP 330 1165.20 1163.87 1159.99 1159.33 -24
+++ Tc =  10.8 min
+++ CA =   1.6
+++ Link #  3,  Flow depth =   1.50 ft, Critical depth =   1.13 ft
  PNC 3 6 3 180 0
  HOL 1
  NEW DAs 158, 157
  STO 0.659 .898 10
  PIP 138 1163.36 1163.36
+++ Tc =  10.0 min
+++ CA =    .6
+++ Link #  4,  Flow depth =    .86 ft, Critical depth =    .67 ft
  PNC 4 5 3 180 0
  STO 0.659 .898 10
  PIP 8 1163.36 1163.61
+++ Tc =  10.8 min
+++ CA =   1.2
+++ Link #  5,  Flow depth =    .70 ft, Critical depth =    .95 ft
  PNC 5 6 3 90 0
  REC 1
  PIP 330 1163.61 1162.29 1158.84 1158.08 -30
+++ Tc =  12.2 min
+++ CA =   2.8
+++ Link #  6,  Flow depth =   1.65 ft, Critical depth =   1.37 ft
  PNC 6 9 3 180 0
  HOL 2
  NEW DAs 156, 155
  STO 0.686 .891 10
  PIP 138 1162.04 1162.04
+++ Tc =  10.0 min
+++ CA =    .6
+++ Link #  7,  Flow depth =    .88 ft, Critical depth =    .68 ft
  PNC 7 8 3 180 0
  STO 0.686 .891 10
  PIP 8 1162.24 1162.29
+++ Tc =  10.8 min
+++ CA =   1.2
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE

```
+++ Link #  8,  Flow depth =    .72 ft, Critical depth =    .97 ft
  PNC 8 9 3 90 0
  REC 2
  PIP 330 1162.29 1160.96 1156.56 1156.00 -36
+++ Tc =  13.3 min
+++ CA =   4.0
+++ Link #  9,  Flow depth =   1.98 ft, Critical depth =   1.53 ft
  PNC 9 12 3 180 0
  HOL 3
  NEW DAs 154, 153
  STO 0.758 .873 10
  PIP 138 1160.71 1160.71
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link # 10,  Flow depth =    .92 ft, Critical depth =    .71 ft
  PNC 10 11 3 180 0
  STO 0.758 .873 10
  PIP 8 1160.71 1160.96
+++ Tc =  10.8 min
+++ CA =   1.3
+++ Link # 11,  Flow depth =    .74 ft, Critical depth =   1.01 ft
  PNC 11 12 3 90 0
  REC 3
  PIP 330 1160.96 1159.64 1155.48 1154.89 -36
+++ Tc =  14.5 min
+++ CA =   5.4
+++ Link # 12,  Flow depth =   2.34 ft, Critical depth =   1.74 ft
  PNC 12 15 3 180 0
  HOL 4
  NEW DAs 152, 151
  STO 0.807 .862 10
  PIP 138 1159.39 1159.39
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link # 13,  Flow depth =    .94 ft, Critical depth =    .73 ft
  PNC 13 14 3 180 0
  STO 0.807 .862 10
  PIP 8 1159.39 1159.64
+++ Tc =  10.8 min
+++ CA =   1.4
+++ Link # 14,  Flow depth =    .76 ft, Critical depth =   1.04 ft
  PNC 14 15 3 90 0
  REC 4
  PIP 330 1159.64 1158.31 1153.35 1153.02 -42
+++ Tc =  15.6 min
+++ CA =   6.8
+++ Link # 15,  Flow depth =   3.50 ft, Critical depth =   3.50 ft
  PNC 15 18 3 180 0
  HOL 5
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE

```
  NEW DAs 150, 149
  STO 0.811 .861 10
  PIP 138 1158.06 1158.06
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link # 16,  Flow depth =    .94 ft, Critical depth =    .73 ft
  PNC 16 17 3 180 0
  STO 0.811 .861 10
  PIP 8 1158.06 1158.31
+++ Tc =  10.8 min
+++ CA =   1.4
+++ Link # 17,  Flow depth =    .78 ft, Critical depth =   1.04 ft
  PNC 17 18 3 90 0
  REC 5
  PIP 330 1158.31 1156.98 1151.38 1151.15 -48
+++ Tc =  17.1 min
+++ CA =   8.2
+++ Link # 18,  Flow depth =   4.00 ft, Critical depth =   4.00 ft
  PNC 18 21 3 180 0
  HOL 6
  NEW DAs 148, 147
  STO 0.826 .858 10
  PIP 138 1156.73 1156.73
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link # 19,  Flow depth =    .96 ft, Critical depth =    .74 ft
  PNC 19 20 3 180 0
  STO 0.826 .858 10
  PIP 8 1156.73 1156.98
+++ Tc =  10.8 min
+++ CA =   1.4
+++ Link # 20,  Flow depth =    .78 ft, Critical depth =   1.05 ft
  PNC 20 21 3 90 0
  REC 6
  PIP 330 1156.98 1155.66 1149.52 1149.29 -54
+++ Tc =  18.8 min
+++ CA =   9.6
+++ Link # 21,  Flow depth =   3.15 ft, Critical depth =   1.97 ft
  PNC 21 24 3 180 0
  HOL 7
  NEW DAs 146, 145
  STO 0.848 .854 10
  PIP 138 1155.41 1155.21
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link # 22,  Flow depth =    .88 ft, Critical depth =    .75 ft
  PNC 22 23 3 180 0
  STO 0.848 .854 10
  PIP 8 1155.41 1155.66
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE

```
+++ Tc =  10.7 min
+++ CA =   1.4
+++ Link # 23,  Flow depth =    .78 ft, Critical depth =   1.06 ft
  PNC 23 24 3 90 0
  REC 7
  PIP 330 1155.66 1154.33 1148.19 1147.96 -54
+++ Tc =  20.2 min
+++ CA =  11.0
+++ Link # 24,  Flow depth =   3.42 ft, Critical depth =   2.08 ft
  PNC 24 27 3 180 0
  HOL 8
  NEW DAs 144, 143
  STO 0.867 .851 10
  PIP 150 1154.08 1154.08
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link # 25,  Flow depth =    .90 ft, Critical depth =    .75 ft
  PNC 25 26 3 180 0
  STO 0.958 .824 10
  PIP 8 1154.08 1154.33
+++ Tc =  10.7 min
+++ CA =   1.5
+++ Link # 26,  Flow depth =    .80 ft, Critical depth =   1.09 ft
  PNC 26 27 3 90 0
  REC 8
  PIP 330 1154.33 1153.01 1146.87 1146.64 -54
+++ Tc =  21.6 min
+++ CA =  12.5
+++ Link # 27,  Flow depth =   4.50 ft, Critical depth =   4.50 ft
  PNC 27 30 3 180 0
  HOL 9
  NEW DAs 142, 141
  STO 0.883 .848 10
  PIP 150 1152.76 1152.76
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link # 28,  Flow depth =    .90 ft, Critical depth =    .76 ft
  PNC 28 29 3 180 0
  STO 0.973 .858 10
  PIP 8 1152.76 1153.01
+++ Tc =  10.7 min
+++ CA =   1.6
+++ Link # 29,  Flow depth =    .82 ft, Critical depth =   1.11 ft
  PNC 29 30 3 90 0
  REC 9
  PIP 330 1153.01 1151.68 1144.35 1144.22 -66
+++ Tc =  23.1 min
+++ CA =  14.1
+++ Link # 30,  Flow depth =   3.90 ft, Critical depth =   2.15 ft
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE

```
  PNC 30 33 3 180 0
  HOL 10
  NEW DAs 140, 139
  STO 0.890 .847 10
  PIP 150 1151.43 1151.43
+++ Tc =  10.0 min
+++ CA =    .8
+++ Link # 31,  Flow depth =    .90 ft, Critical depth =    .76 ft
  PNC 31 32 3 180 0
  STO 0.981 .856 10
  PIP 8 1151.43 1151.68
+++ Tc =  10.7 min
+++ CA =   1.6
+++ Link # 32,  Flow depth =    .82 ft, Critical depth =   1.11 ft
  PNC 32 33 3 90 0
  REC 10
  PIP 330 1151.68 1150.35 1143.02 1142.89 -66
+++ Tc =  24.7 min
+++ CA =  15.7
+++ Link # 33,  Flow depth =   4.12 ft, Critical depth =   2.22 ft
  PNC 33 36 3 180 0
  HOL 11
  NEW DAs 138, 137
  STO 0.924 .841 10
  PIP 150 1150.10 1150.10
+++ Tc =  10.0 min
+++ CA =    .8
+++ Link # 34,  Flow depth =    .92 ft, Critical depth =    .77 ft
  PNC 34 35 3 180 0
  STO 1.015 .841 10
  PIP 8 1150.10 1150.35
+++ Tc =  10.7 min
+++ CA =   1.6
+++ Link # 35,  Flow depth =    .84 ft, Critical depth =   1.13 ft
  PNC 35 36 3 90 0
  REC 11
  PIP 330 1150.35 1149.03 1141.70 1141.57 -66
+++ Tc =  26.3 min
+++ CA =  17.4
+++ Link # 36,  Flow depth =   4.34 ft, Critical depth =   2.28 ft
  PNC 36 39 3 180 0
  HOL 12
  NEW DAs 136, 135
  STO 0.996 .831 10
  PIP 150 1148.78 1148.78
+++ Tc =  10.0 min
+++ CA =    .8
+++ Link # 37,  Flow depth =    .96 ft, Critical depth =    .80 ft
  PNC 37 38 3 180 0
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE

```
  STO 1.087 .831 10
  PIP 8 1148.78 1149.03
+++ Tc =  10.7 min
+++ CA =   1.7
+++ Link # 38,  Flow depth =    .86 ft, Critical depth =   1.16 ft
  PNC 38 39 3 90 0
  REC 12
  PIP 330 1149.03 1147.46 1140.13 1140.00 -66
+++ Tc =  27.9 min
+++ CA =  19.1
+++ Link # 39,  Flow depth =   5.50 ft, Critical depth =   5.50 ft
  PNC 39 42 3 180 0
  HOL 13
  NEW DAs 134, 133
  STO 1.053 .824 10
  PIP 154 1147.45 1147.21
+++ Tc =  10.0 min
+++ CA =    .9
+++ Link # 40,  Flow depth =   1.08 ft, Critical depth =    .82 ft
  PNC 40 41 3 180 0
  STO 1.160 .830 10
  PIP 8 1147.21 1147.46
+++ Tc =  10.8 min
+++ CA =   1.8
+++ Link # 41,  Flow depth =    .90 ft, Critical depth =   1.19 ft
  PNC 41 42 3 90 0
  REC 13
  PIP 330 1147.46 1145.98 1138.65 1138.52 -66
+++ Tc =  29.7 min
+++ CA =  20.9
+++ Link # 42,  Flow depth =   5.50 ft, Critical depth =   5.50 ft
  PNC 42 45 3 180 0
  HOL 14
  NEW DAs 132, 131
  STO 1.042 .825 10
  PIP 177 1145.93 1145.73
+++ Tc =  10.0 min
+++ CA =    .9
+++ Link # 43,  Flow depth =   1.04 ft, Critical depth =    .82 ft
  PNC 43 44 3 180 0
  STO 1.190 .841 10
  PIP 8 1145.73 1145.98
+++ Tc =  10.9 min
+++ CA =   1.9
+++ Link # 44,  Flow depth =    .90 ft, Critical depth =   1.20 ft
  PNC 44 45 3 90 0
  REC 14
  PIP 330 1145.98 1144.43 1136.56 1136.43 -66
+++ Tc =  31.4 min
+++ CA =  22.8
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE

```
+++ Link # 45,  Flow depth =   5.50 ft, Critical depth =   5.50 ft
  PNC 45 48 3 180 0
  HOL 15
  NEW DAs 130, 129
  STO 1.297 .841 10
  PIP 182 1144.18 1144.18
+++ Tc =  10.0 min
+++ CA =   1.1
+++ Link # 46,  Flow depth =   1.20 ft, Critical depth =    .92 ft
  PNC 46 47 3 180 0
  STO 1.300 .841 10
  PIP 8 1144.18 1144.43
+++ Tc =  10.9 min
+++ CA =   2.2
+++ Link # 47,  Flow depth =    .98 ft, Critical depth =   1.31 ft
  PNC 47 48 3 90 0
  REC 15
  PIP 112.5 1144.43 1144.18 1133.22 1133.11 -66
+++ Tc =  33.1 min
+++ CA =  25.0
+++ Link # 48,  Flow depth =   3.57 ft, Critical depth =   2.55 ft
  PNC 48 70 0 180 1
  PIP 223.6 1144.12 1143.90 1133.11 1132.88 -66
+++ Tc =  33.4 min
+++ CA =  25.0
+++ Link # 49,  Flow depth =   3.52 ft, Critical depth =   2.54 ft
  PNC 70 52 0 192 2
  END
 END OF INPUT DATA.
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE

*** DAs 160, 159 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
1	138	24	1160.94	.00155	3.8	1.6	3.1	5.07	0.
			1160.73		4.0		3.1	9.65	
2	8	24	1160.73	.01260	4.0	1.8	8.0	9.92	0.
			1160.63		4.3		8.8	27.51	

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

*** DAs 160, 159 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
3	330	24	1159.99	.00200	5.2	3.0	3.9	9.91	90		
			1159.33		4.5	2.4	3.5	10.96			

Length = 476. ft Total length = 476. ft

*** DAs 158, 157 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
4	138	24	1159.61	.00155	3.8	1.6	2.9	3.66	0.
			1159.40		4.0		3.1	9.65	
5	8	24	1159.40	.01260	4.0	1.8	7.4	7.15	0.
			1159.30		4.3		8.8	27.51	

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

SR202L - PUMPSTA @ KYRENE, EAST SIDE

*** DAs 158, 157 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
6	330	30	1158.84	.00230	4.8	2.1	4.8	16.36	77		
			1158.08		4.2	1.5	4.3	21.33			

Length = 476. ft Total length = 952. ft

*** DAs 156, 155 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
7	138	24	1158.29	.00155	3.8	1.6	2.9	3.78	0.
			1158.08		4.0		3.1	9.65	
8	8	24	1158.08	.01260	4.2	2.0	7.4	7.39	0.
			1157.98		4.3		8.8	27.51	

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

*** DAs 156, 155 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
9	330	36	1156.56	.00170	5.7	2.5	4.6	22.60	76		
			1156.00		5.0	1.7	4.2	29.77			

Length = 476. ft Total length = 1428. ft

Length = 476. ft Total length = 1428. ft

SR202L - PUMPSTA @ KYRENE, EAST SIDE

*** DAs 154, 153 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
10	138	24	1156.96	.00155	3.8	1.6	2.9	4.10	0.
			1156.75		4.0		3.1	9.65	
11	8	24	1156.75	.01260	4.0	1.8	7.6	8.00	0.
			1156.65		4.3		8.8	27.51	

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

*** DAs 154, 153 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
12	330	36	1155.48	.00179	5.5	2.2	4.9	28.84	94		
			1154.89		4.8	1.5	4.3	30.55			

Length = 476. ft Total length = 1904. ft

*** DAs 152, 151 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
13	138	24	1155.64	.00155	3.8	1.6	3.0	4.31	0.
			1155.43		4.0		3.1	9.65	
14	8	24	1155.43	.01260	4.0	1.8	7.7	8.42	0.
			1155.33		4.3		8.8	27.51	

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

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*** DAs 152, 151 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
15	330	42	1153.35	.00100	6.3	2.5	3.7	35.22	102	.75	24
			1153.02		5.3	1.5	3.6	34.47			

Length = 476. ft Total length = 2380. ft

*** DAs 150, 149 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
16	138	24	1154.31	.00155	3.8	1.6	3.0	4.32	0.
			1154.10		4.0		3.1	9.65	
17	8	24	1154.10	.01260	4.0	1.8	7.7	8.45	0.
			1154.00		4.3		8.8	27.51	

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

*** DAs 150, 149 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
18	330	48	1151.38	.00070	6.9	2.6	3.3	41.10	100	.02	24
			1151.15		5.8	1.5	3.3	41.08			

Length = 476. ft Total length = 2856. ft

Length = 476. ft Total length = 2856. ft

SR202L - PUMPSTA @ KYRENE, EAST SIDE

*** DAs 148, 147 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
19	138	24	1152.98	.00155	3.8	1.6	3.0	4.39	0.
			1152.77		4.0		3.1	9.65	
20	8	24	1152.77	.01260	4.0	1.8	7.7	8.58	0.
			1152.67		4.3		8.8	27.51	

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

*** DAs 148, 147 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
21	330	54	1149.52	.00070	7.5	2.6	3.9	46.41	82		
			1149.29		6.4	1.5	3.5	56.25			

Length = 476. ft Total length = 3332. ft

*** DAs 146, 145 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
22	138	24	1151.66	.00217	3.8	1.6	3.4	4.48	0.
			1151.36		3.8		3.6	11.43	
23	8	24	1151.36	.01260	4.1	1.9	7.8	8.79	0.
			1151.26		4.4		8.8	27.51	

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

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*** DAs 146, 145 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
24	330	54	1148.19	.00070	7.5	2.6	4.0	51.68	92		
			1147.96		6.4	1.5	3.5	56.22			

Length = 476. ft Total length = 3808. ft

*** DAs 144, 143 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
25	150	24	1150.33	.00210	3.8	1.6	3.4	4.57	0.
			1150.02		4.1		3.6	11.23	
26	8	24	1150.02	.01260	4.1	1.9	7.9	9.25	0.
			1149.91		4.4		8.8	27.51	

Length = 158. ft Total length = 158. ft
Cost = 0. Total Cost = 0.

*** DAs 144, 143 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
27	330	54	1146.87	.00070	7.5	2.6	3.6	56.88	101	.64	24
			1146.64		6.4	1.5	3.5	56.24			

Length = 488. ft Total length = 4296. ft

Length = 488. ft Total length = 4296. ft

SR202L - PUMPSTA @ KYRENE, EAST SIDE

*** DAs 142, 141 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
28	150	24	1149.01	.00210	3.8	1.6	3.4	4.63	0.
			1148.70		4.1		3.6	11.23	
29	8	24	1148.70	.01260	4.1	1.9	8.0	9.59	0.
			1148.59		4.4		8.8	27.51	

Length = 158. ft Total length = 158. ft
Cost = 0. Total Cost = 0.

*** DAs 142, 141 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
30	330	66	1144.35	.00039	8.7	2.7	3.4	61.58	85		
			1144.22		7.5	1.5	3.0	72.24			

Length = 488. ft Total length = 4784. ft

*** DAs 140, 139 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
31	150	24	1147.68	.00210	3.8	1.6	3.4	4.67	0.
			1147.37		4.1		3.6	11.23	
32	8	24	1147.37	.01260	4.1	1.9	8.0	9.65	0.
			1147.26		4.4		8.8	27.51	

Length = 158. ft Total length = 158. ft
Cost = 0. Total Cost = 0.

Length = 158. ft Total length = 158. ft
Cost = 0. Total Cost = 0.

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*** DAs 140, 139 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
33	330	66	1143.02	.00039	8.7	2.7	3.4	65.63	91		
			1142.89		7.5	1.5	3.0	72.21			

Length = 488. ft Total length = 5272. ft

*** DAs 138, 137 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
34	150	24	1146.35	.00210	3.8	1.6	3.4	4.81	0.
			1146.04		4.1		3.6	11.23	
35	8	24	1146.04	.01260	4.1	1.9	8.0	9.88	0.
			1145.93		4.4		8.8	27.51	

Length = 158. ft Total length = 158. ft
Cost = 0. Total Cost = 0.

*** DAs 138, 137 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
36	330	66	1141.70	.00039	8.7	2.7	3.5	69.28	96		
			1141.57		7.5	1.5	3.0	72.21			

Length = 488. ft Total length = 5760. ft

Length = 488. ft Total length = 5760. ft

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*** DAs 136, 135 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
37	150	24	1145.03	.00210	3.8	1.6	3.5	5.12	0.
			1144.71		4.1		3.6	11.23	
38	8	24	1144.71	.01260	4.1	1.9	8.1	10.49	0.
			1144.61		4.4		8.8	27.51	

Length = 158. ft Total length = 158. ft
Cost = 0. Total Cost = 0.

*** DAs 136, 135 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
39	330	66	1140.13	.00039	8.9	2.9	3.1	72.73	101	.52	24
			1140.00		7.5	1.5	3.0	72.21			

Length = 488. ft Total length = 6248. ft

*** DAs 134, 133 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
40	154	24	1143.70	.00156	3.8	1.6	3.2	5.37	0.
			1143.46		3.8		3.1	9.68	
41	8	24	1143.46	.01260	3.8	1.6	8.3	11.06	0.
			1143.36		4.1		8.8	27.51	

Length = 162. ft Total length = 162. ft
Cost = 0. Total Cost = 0.

Length = 162. ft Total length = 162. ft
Cost = 0. Total Cost = 0.

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*** DAs 134, 133 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
42	330	66	1138.65	.00039	8.8	2.9	3.2	75.42	104	3.21	24
			1138.52		7.5	1.5	3.0	72.21			

Length = 492. ft Total length = 6740. ft

*** DAs 132, 131 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
43	177	24	1142.18	.00170	3.8	1.6	3.2	5.32	0.
			1141.88		3.8		3.2	10.09	
44	8	24	1141.88	.01260	3.8	1.7	8.3	11.21	0.
			1141.78		4.2		8.8	27.51	

Length = 185. ft Total length = 185. ft
Cost = 0. Total Cost = 0.

*** DAs 132, 131 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
45	330	66	1136.56	.00039	9.4	3.5	3.4	79.87	111	7.66	30
			1136.43		8.0	2.0	3.0	72.21			

Length = 515. ft Total length = 7255. ft

Length = 515. ft Total length = 7255. ft

SR202L - PUMPSTA @ KYRENE, EAST SIDE

*** DAs 130, 129 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
46	182	24	1140.43	.00175	3.8	1.6	3.5	6.75	0.
			1140.11		4.1		3.3	10.25	
47	8	24	1140.11	.01260	4.1	1.9	8.7	13.17	0.
			1140.01		4.4		8.8	27.51	

Length = 190. ft Total length = 190. ft
Cost = 0. Total Cost = 0.

*** DAs 130, 129 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
48	113	66	1133.22	.00098	11.2	5.3	5.3	85.71	75		
			1133.11		11.1	5.1	4.8	113.75			
49	224	66	1133.11	.00103	11.0	5.1	5.4	85.31	73		
			1132.88		11.0	5.1	4.9	116.67			

Length = 526. ft Total length = 7781. ft

SR202L - PUMPSTA @ KYRENE, EAST SIDE

Hydraulic Gradeline Computations

Link #	Down-stream Node #	Hydraulic Gradeline Elevation	Crown Elev.	Possible Surcharge	Ground Elev.	Super-crit.?	Manhole Depth	Loss Coef
1	2	1162.91	1162.73	Y	1164.69	N	2.18	.83
2	3	1161.75	1162.63	N	1165.20	Y	1.76	.05
3	6	1160.85	1161.33	N	1163.61	N	2.01	.44
4	5	1161.19	1161.40	N	1163.36	N	1.79	.78
5	6	1160.25	1161.30	N	1163.61	Y	2.01	2.06
6	9	1159.73	1160.58	N	1162.29	N	2.32	.02
7	8	1159.90	1160.08	N	1162.24	N	1.83	.79
8	9	1158.94	1159.98	N	1162.29	Y	2.32	.02
9	12	1158.20	1159.00	N	1160.96	N	2.72	.24
10	11	1158.66	1158.75	N	1160.71	N	1.92	.80
11	12	1157.65	1158.65	N	1160.96	Y	2.72	1.68
12	15	1157.23	1157.89	N	1159.64	N	3.73	.31
13	14	1157.41	1157.43	N	1159.39	N	1.98	.80
14	15	1156.36	1157.33	N	1159.64	Y	3.73	2.08
15	18	1156.52	1156.52	N	1158.31	N/A	4.18	.02
16	17	1156.08	1156.10	N	1158.06	N	1.98	.80
17	18	1155.03	1156.00	N	1158.31	Y	4.18	2.17
18	21	1155.15	1155.15	N	1156.98	N/A	3.41	.01
19	20	1154.77	1154.77	Y	1156.73	N	2.00	.81
20	21	1153.71	1154.67	N	1156.98	Y	3.41	.01
21	24	1152.44	1153.79	N	1155.66	N	3.70	.12
22	23	1153.39	1153.36	Y	1155.41	N	2.03	.78
23	24	1152.32	1153.26	N	1155.66	Y	3.70	.01
24	27	1151.57	1152.46	N	1154.33	N	4.72	.13
25	26	1152.12	1152.02	Y	1154.08	N	2.11	.81
26	27	1151.00	1151.91	N	1154.33	Y	4.72	1.82
27	30	1151.14	1151.14	N	1153.01	N/A	4.10	.01
28	29	1150.85	1150.70	Y	1152.76	N	2.16	.82
29	30	1149.70	1150.59	N	1153.01	Y	4.10	.01
30	33	1148.13	1149.72	N	1151.68	N	4.32	.07
31	32	1149.53	1149.37	Y	1151.43	N	2.16	.82
32	33	1148.38	1149.26	N	1151.68	Y	4.32	.01
33	36	1147.02	1148.39	N	1150.35	N	4.54	.06
34	35	1148.22	1148.04	Y	1150.10	N	2.19	.82
35	36	1147.06	1147.93	N	1150.35	Y	4.54	.01
36	39	1145.91	1147.07	N	1149.03	N	5.66	.08
37	38	1146.99	1146.71	Y	1148.78	N	2.27	.83
38	39	1145.78	1146.61	N	1149.03	Y	5.66	2.04
39	42	1145.50	1145.50	N	1147.46	N/A	5.67	.02
40	41	1145.80	1145.46	Y	1147.21	N	2.34	.86
41	42	1144.55	1145.36	N	1147.46	Y	5.67	.02

SR202L - PUMPSTA @ KYRENE, EAST SIDE

Hydraulic Gradeline Computations

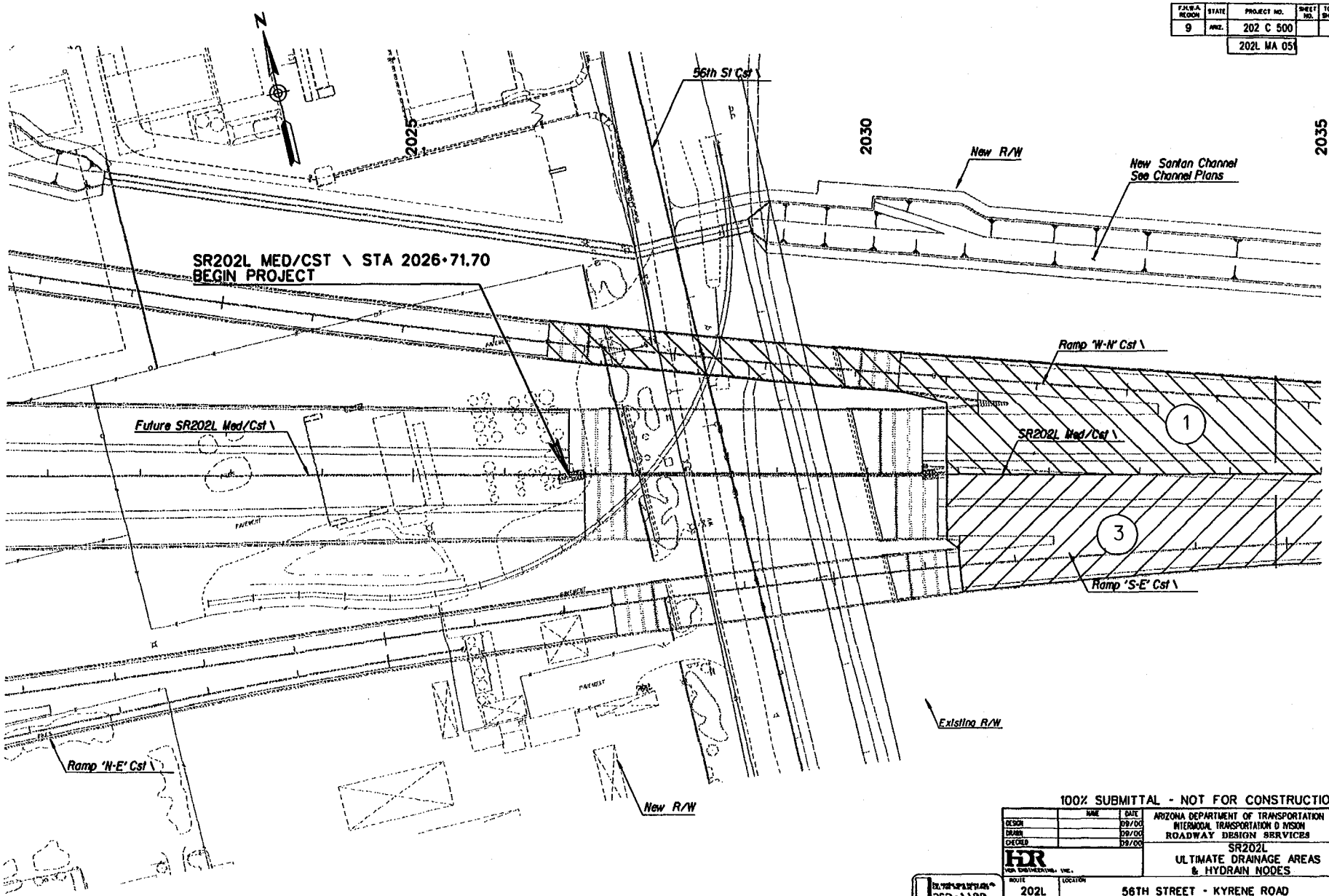
Link #	Down-stream Node #	Hydraulic Gradeline Elevation	Crown Elev.	Possible Surcharge	Ground Elev.	Super-crit.?	Manhole Depth	Loss Coef
42	45	1144.02	1144.02	N	1145.98	N/A	5.69	.02
43	44	1144.24	1143.88	Y	1145.73	N	2.36	.87
44	45	1142.98	1143.78	N	1145.98	Y	5.69	.02
45	48	1141.93	1141.93	N	1144.43	N/A	4.35	.02
46	47	1142.72	1142.11	Y	1144.18	N	2.61	.86
47	48	1141.32	1142.01	N	1144.43	Y	4.35	.02
48	70	1137.08	1138.61	N	1144.12	N	3.97	.01
49	52	1136.40	1138.38	N	1143.90	N	3.52	.00

Link #	Terminal Node #	Hydraulic Gradeline Elevation	Ground Elevation	Loss Coef.
1	1	1163.17	1164.69	1.50
4	4	1161.39	1163.36	1.50
7	7	1160.11	1162.04	1.50
10	10	1158.88	1160.71	1.50
13	13	1157.63	1159.39	1.50
16	16	1156.30	1158.06	1.50
19	19	1155.01	1156.73	1.50
22	22	1153.71	1155.41	1.50
25	25	1152.43	1154.08	1.50
28	28	1151.17	1152.76	1.50
31	31	1149.84	1151.43	1.50
34	34	1148.54	1150.10	1.50
37	37	1147.32	1148.78	1.50
40	40	1146.07	1147.45	1.50
43	43	1144.54	1145.93	1.50
46	46	1143.06	1144.18	1.50

NORMAL END OF HYDRA

APPENDIX D - Pavement Basin Drainage Area Maps

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN		09/00
DRAWN		09/00
CHECKED		09/00

HDR ENGINEERING, INC.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SR202L
ULTIMATE DRAINAGE AREAS
& HYDRAIN NODES

ROUTE 202L | LOCATION 56TH STREET - KYRENE ROAD

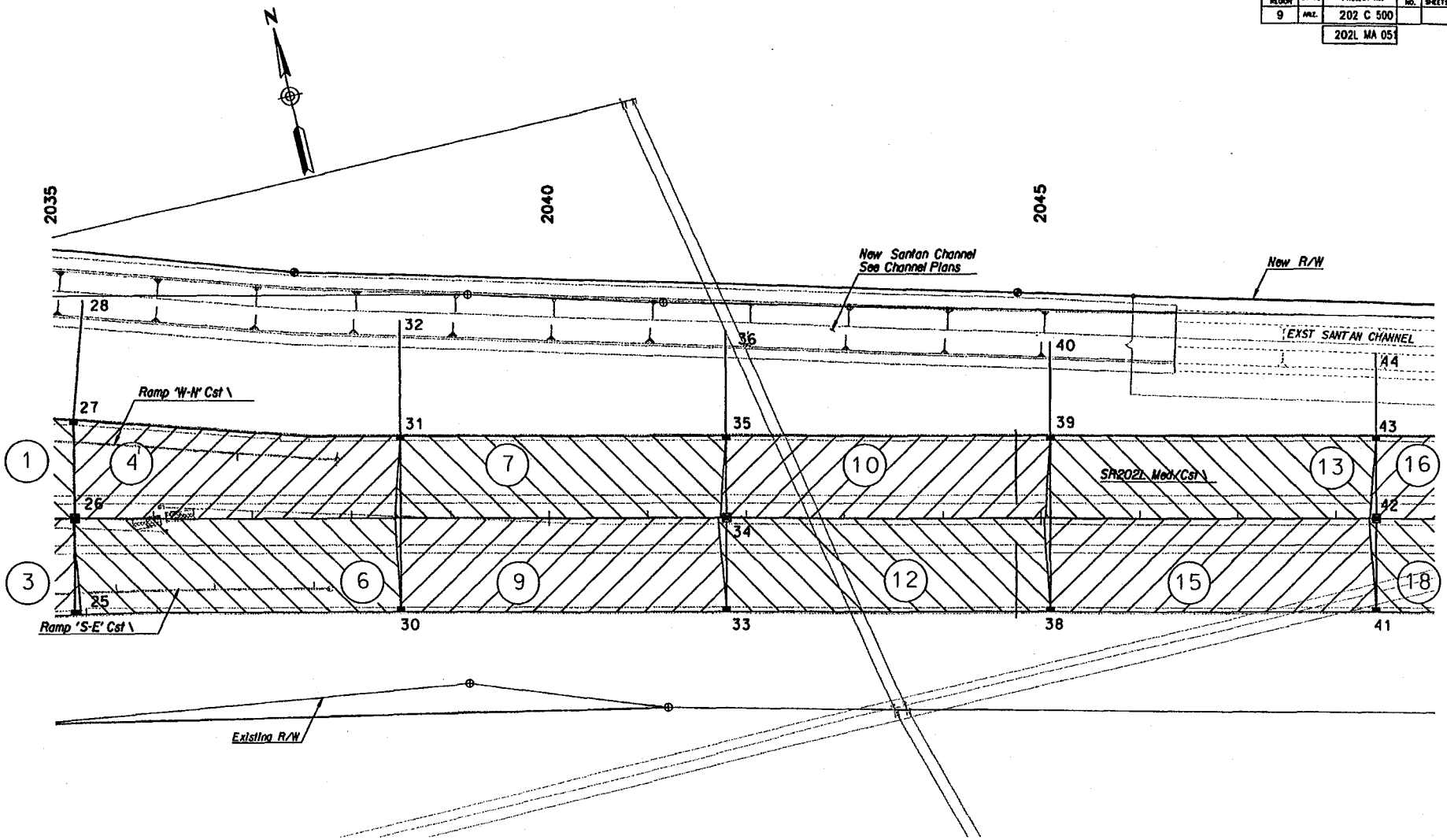
TRACS NO. H5416 01C | 202 C 500

DWG NO. 1 OF 12

263-1180

SYSTIME 00 SPECIFICATION

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE	
DESIGN		09/00	ARIZONA DEPARTMENT OF TRANSPORTATION INTERMODAL TRANSPORTATION DIVISION ROADWAY DESIGN SERVICES
DRAWN		09/00	
CHECKED		09/00	SR202L ULTIMATE DRAINAGE AREAS & HYDRAIN NODES

HDR ENGINEERING, INC.

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD

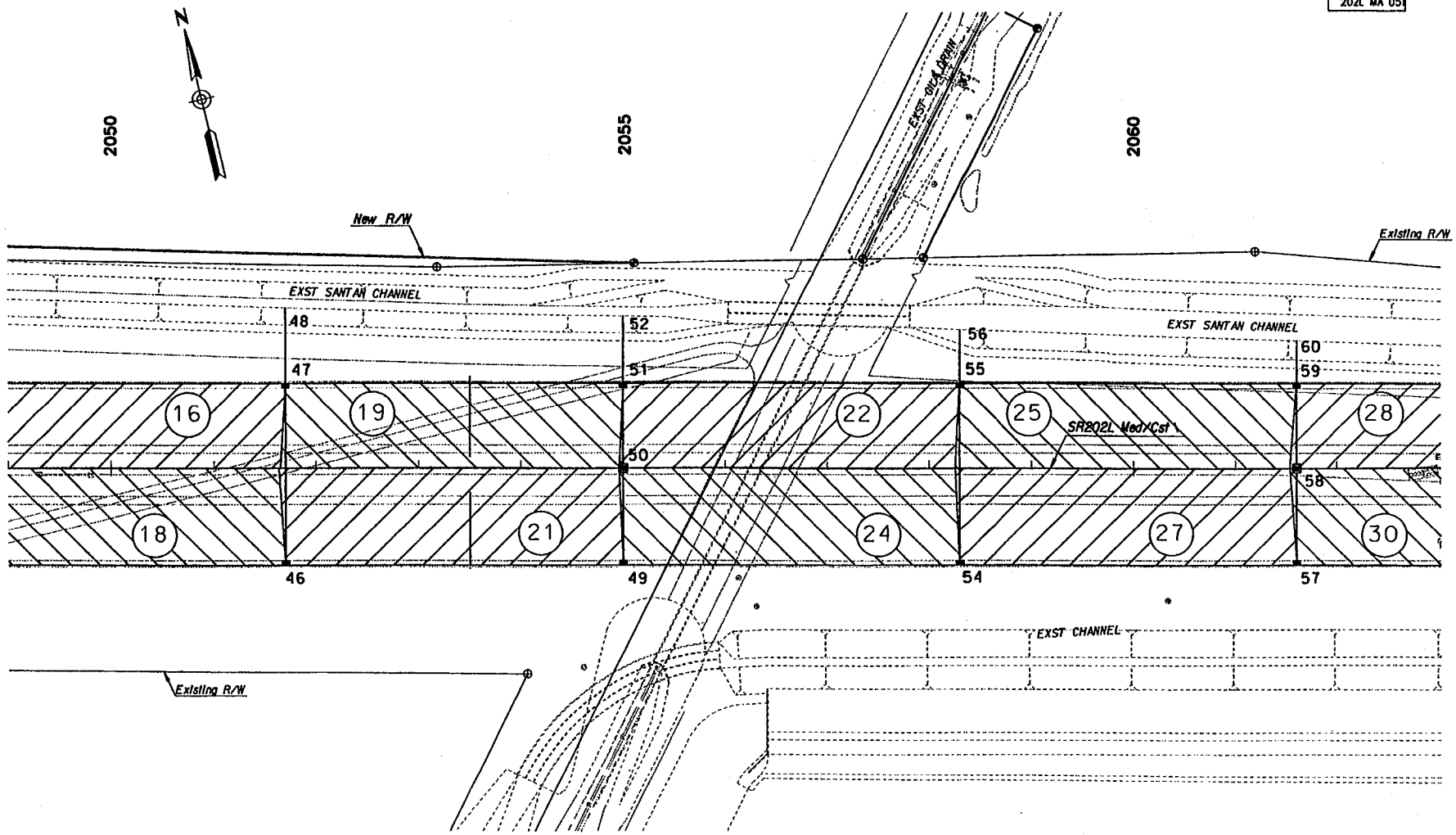
TRACS NO. H5416 01C | 202 C 500

DWG NO. 2 OF 12

ULTRAMAR 283-1100

SYSTIME UNSPECIFICATION

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN		09/00
DRAWN		09/00
CHECKED		09/00

HDR ENGINEERING, INC.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SR202L
ULTIMATE DRAINAGE AREAS
& HYDRAIN NODES

ROUTE 202L | LOCATION 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C | 202 C 500

DWG NO. 3 OF 12

ARIZONA BLUE STAKE, INC. 283-1100

SYSTIME UNSPECIFICATION

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
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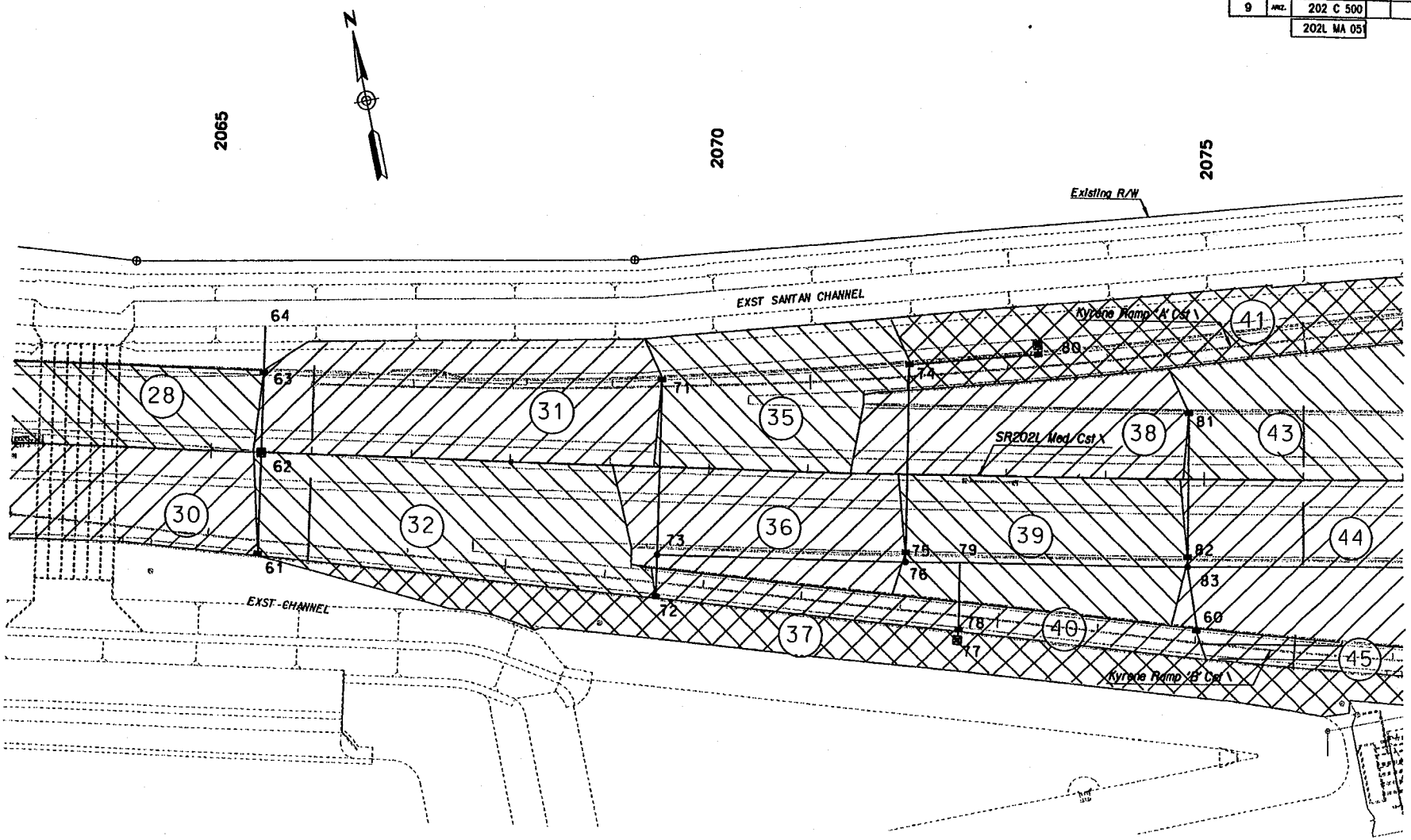
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN		09/00
DRAWN		09/00
CHECKED		09/00

HDR VON TOBEL ENGINEERING, INC.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SR202L
ULTIMATE DRAINAGE AREAS
& HYDRAIN NODES

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD

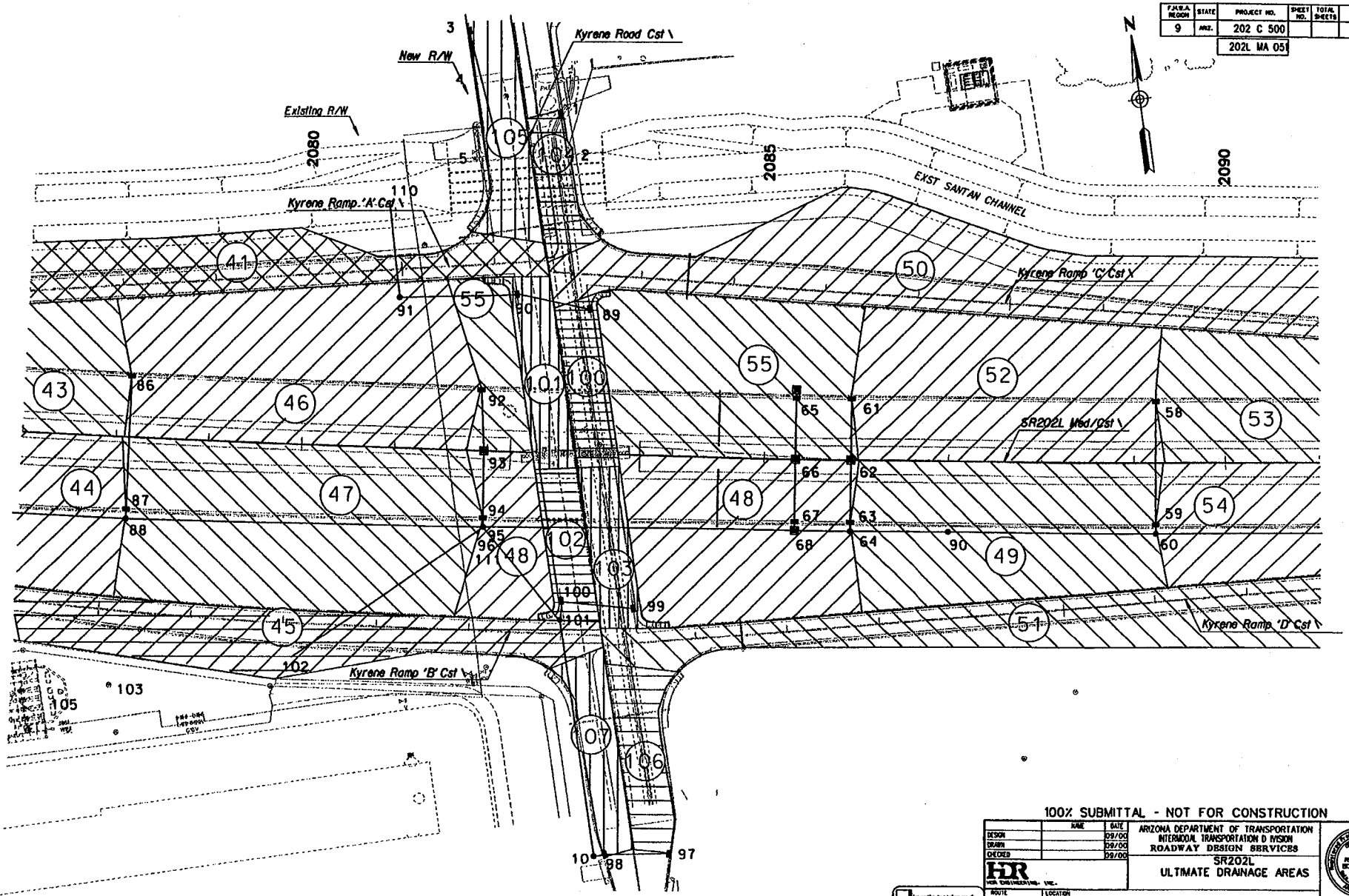
TRACS NO. H5416 01C | 202 C 500

DWG NO. 4 OF 12

283-1100

SYSTIME UNSPECIFICATION

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN		09/00
DRAWN		09/00
CHECKED		09/00

HDR ENGINEERING, INC.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SR202L
ULTIMATE DRAINAGE AREAS

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD

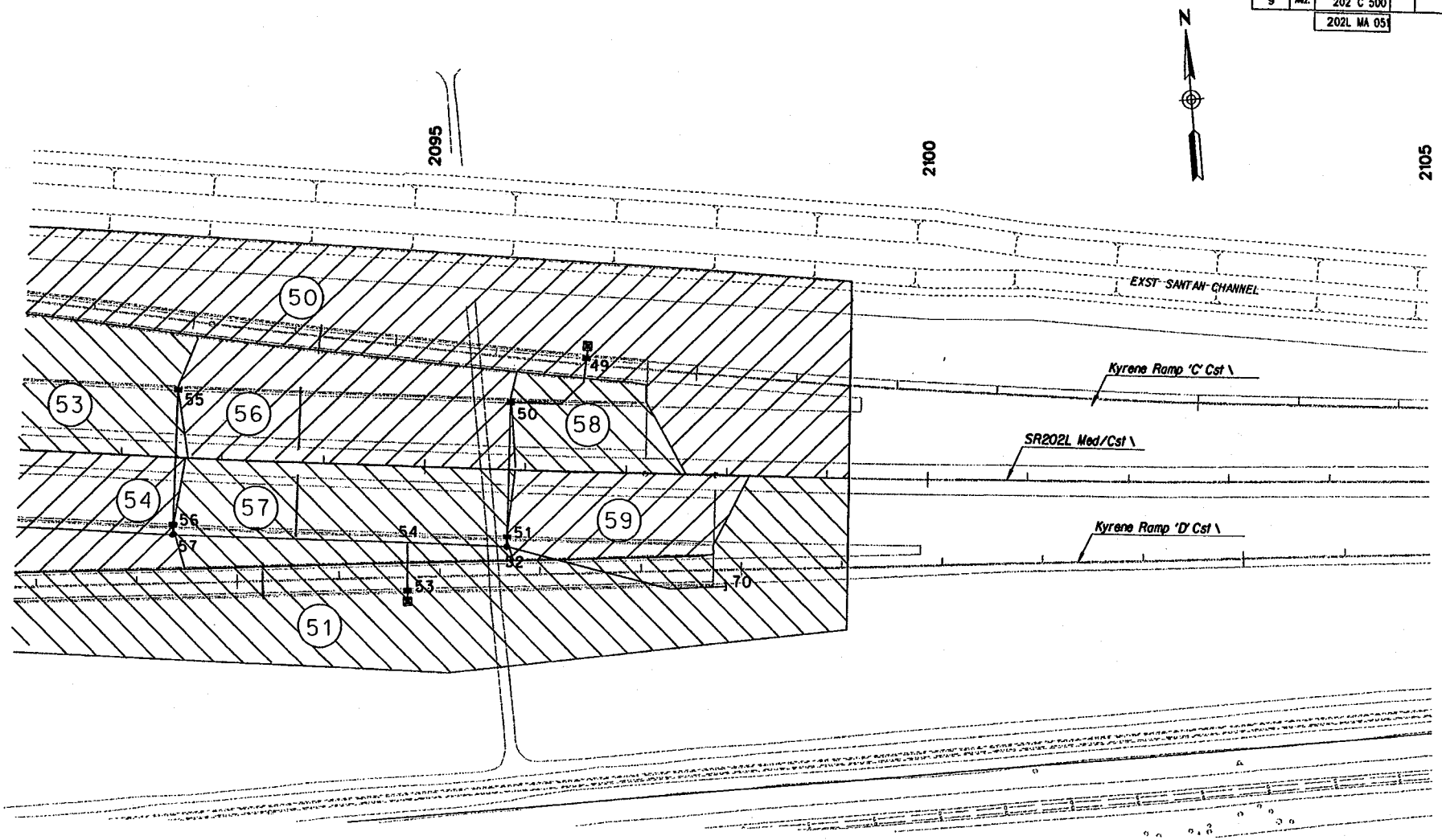
TRACS NO. H5416 01C | 202 C 500

DWG NO. 5 OF 12

283-1180

SYSTIME SYSTIME DGNSPECIFICATION

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN		09/00
DRAWN		09/00
CHECKED		09/00

HDR VON DRIEHEERING, INC.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

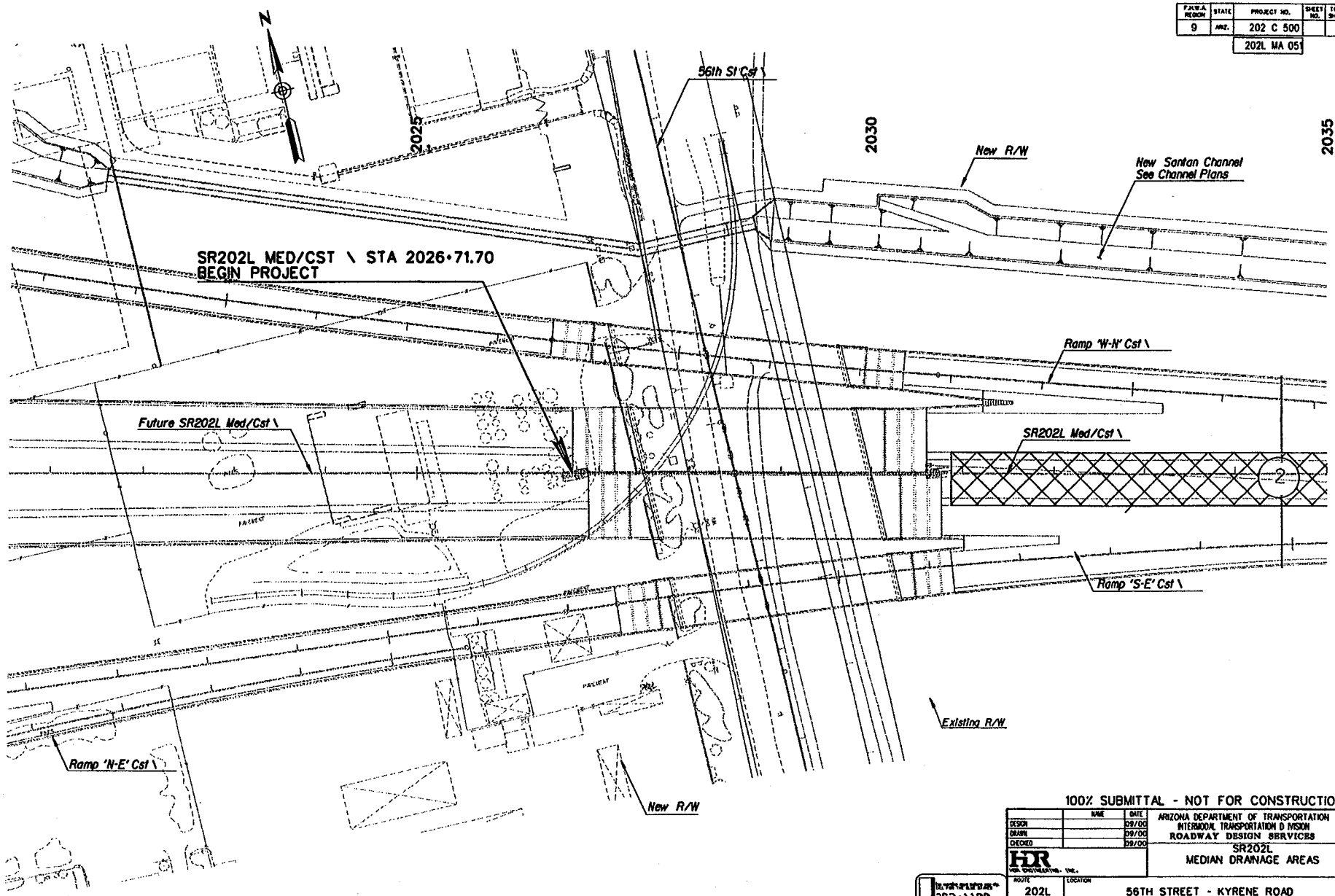
SR202L
ULTIMATE DRAINAGE AREAS
& HYDRAIN NODES

ROUTE	LOCATION
202L	56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C | 202 C 500 | DWG NO. 6 OF 12

263-1180

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE	ARIZONA DEPARTMENT OF TRANSPORTATION INTERMODAL TRANSPORTATION DIVISION ROADWAY DESIGN SERVICES
DESIGN		09/00	
DRAWN		09/00	
CHECKED		09/00	

HDR

SR202L
MEDIAN DRAINAGE AREAS

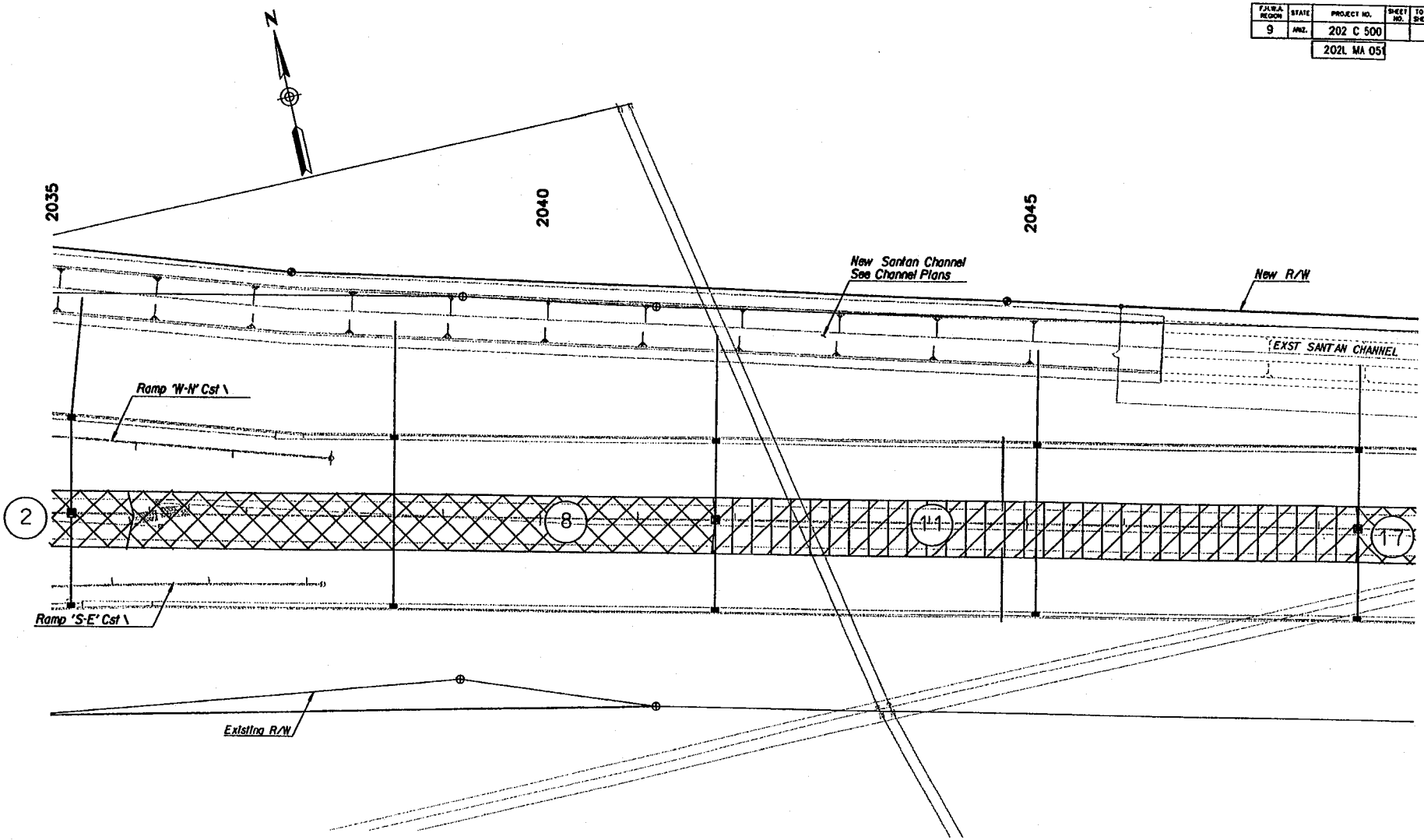
ROUTE	LOCATION	
202L	56TH STREET - KYRENE ROAD	
TRACS NO. H5416 01C		202 C 500

DWG NO. 7 OF 12

283-1188

SYSTIME SYSTIME 00 SPECIFICATION

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN		09/00
DRAWN		09/00
CHECKED		09/00

HDR VON TOBEL WILLIAMS, INC.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SR202L
MEDIAN DRAINAGE AREAS

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C

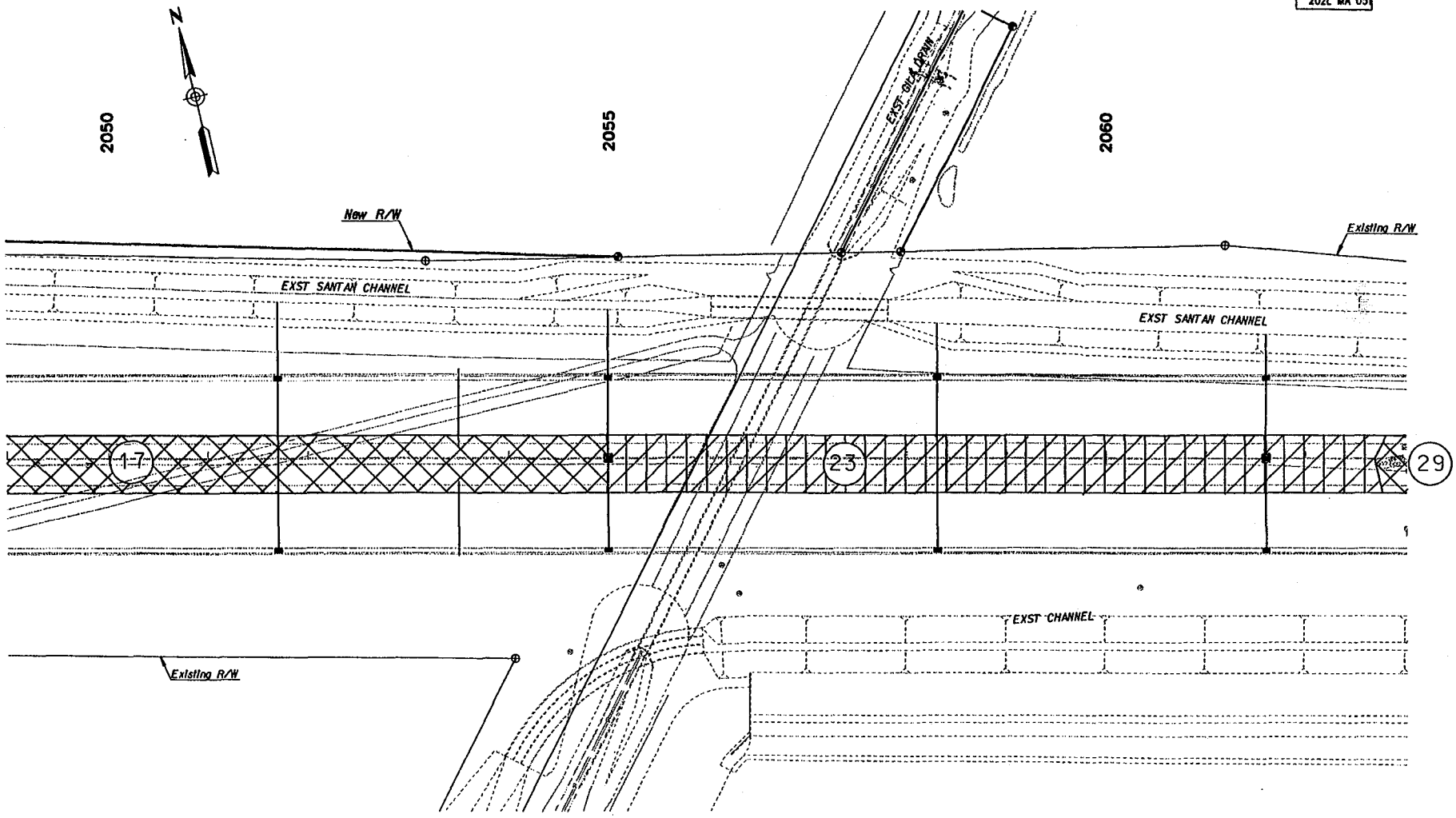
202 C 500

DWG NO. 8 OF 12

UNDERGROUND SERVICE ALERT 263-1100

SYSTIPE UNSPECIFICATION

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN		09/00
DRAWN		09/00
CHECKED		09/00

HDR VON GERICHTEN, INC.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SR202L
MEDIAN DRAINAGE AREAS

ROUTE 202L | LOCATION 56TH STREET - KYRENE ROAD

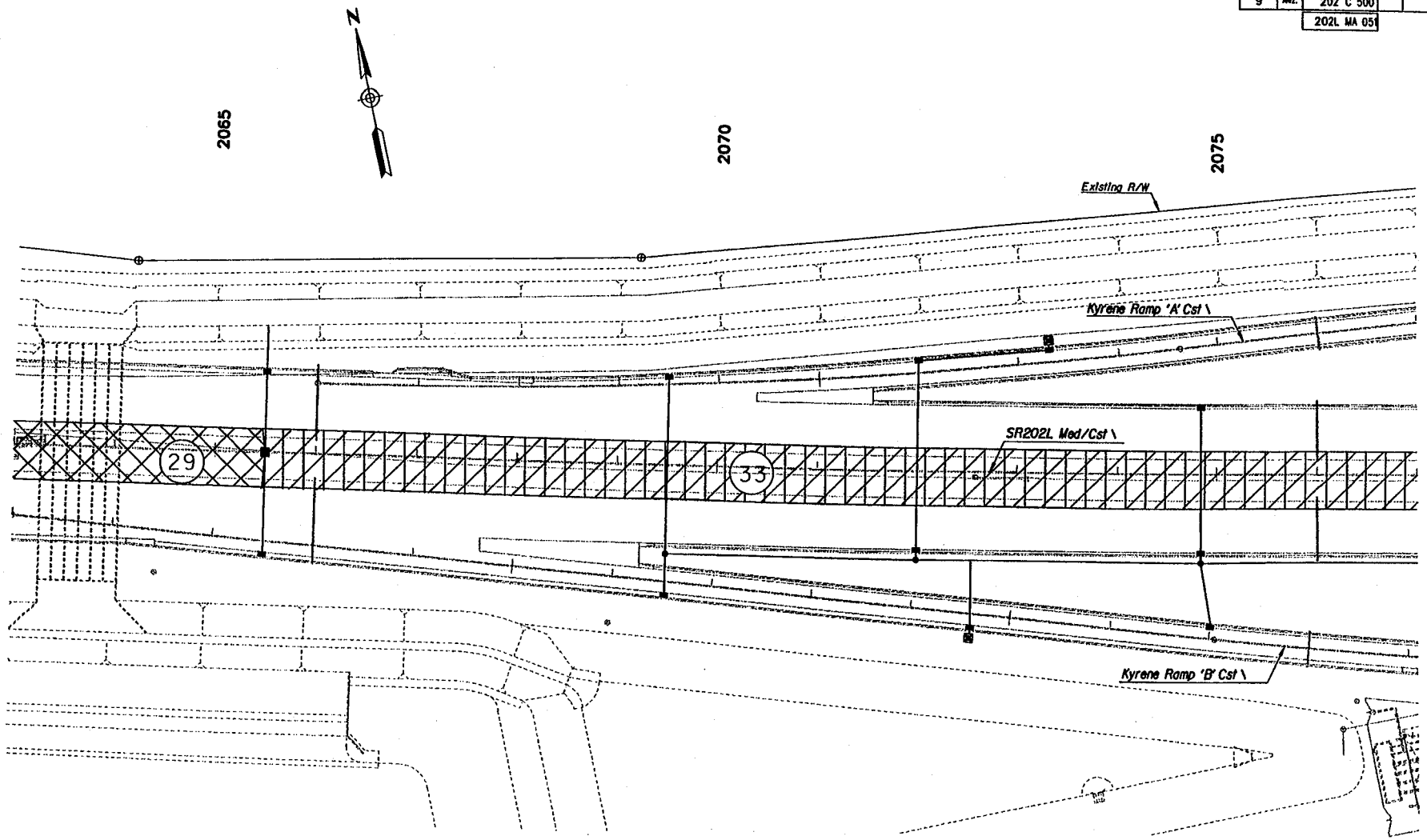
TRACS NO. H5416 01C | 202 C 500

DWG NO. 9 OF 12

CALL 263-1100 BEFORE YOU DIG

SYSTIME SPECIFICATION

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	202 C 500			
		202L MA 051			



100% SUBMITTAL - NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN		09/00
DRAWN		09/00
CHECKED		09/00

HDR VON GERICHTEN, INC.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SR202L
MEDIAN DRAINAGE AREAS

ROUTE	LOCATION
202L	56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C | 202 C 500

DWG NO. 10 OF 12

DATE- | LOCATION- | REVISIONS- | FINISHED PLANS- | SURVEY NO.

SYSTIME SPECIFICATION

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
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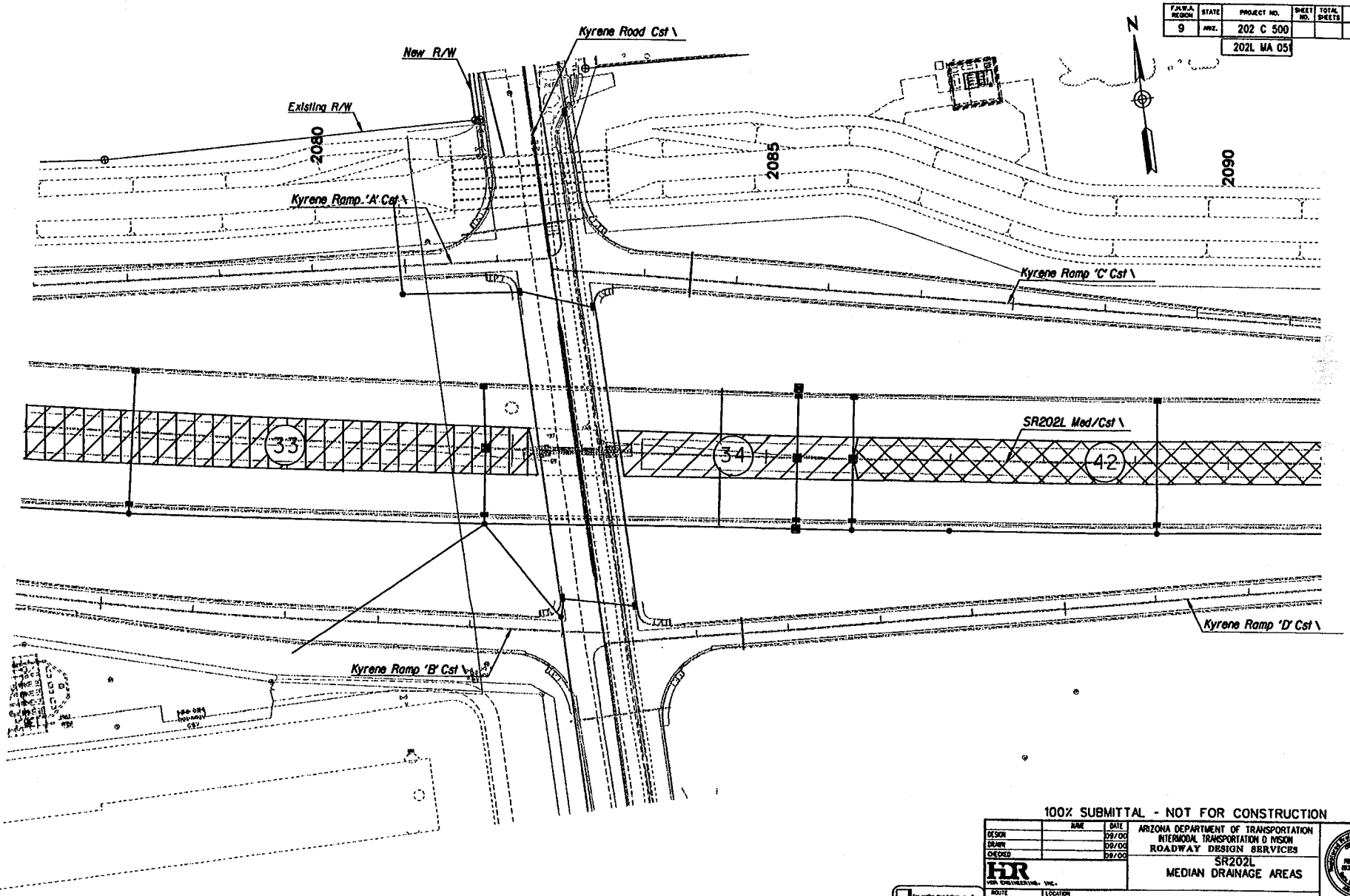

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	NAME	DATE
DESIGN		09/00
DRAWN		09/00
CHECKED		09/00

HDR ENGINEERING, INC.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SR202L
MEDIAN DRAINAGE AREAS

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C

202 C 500

DWG NO. 11 OF 12

BLUESTAKE 263-1180

SYSTIME SYSTIME DLNoSPECIFICATIONoo

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
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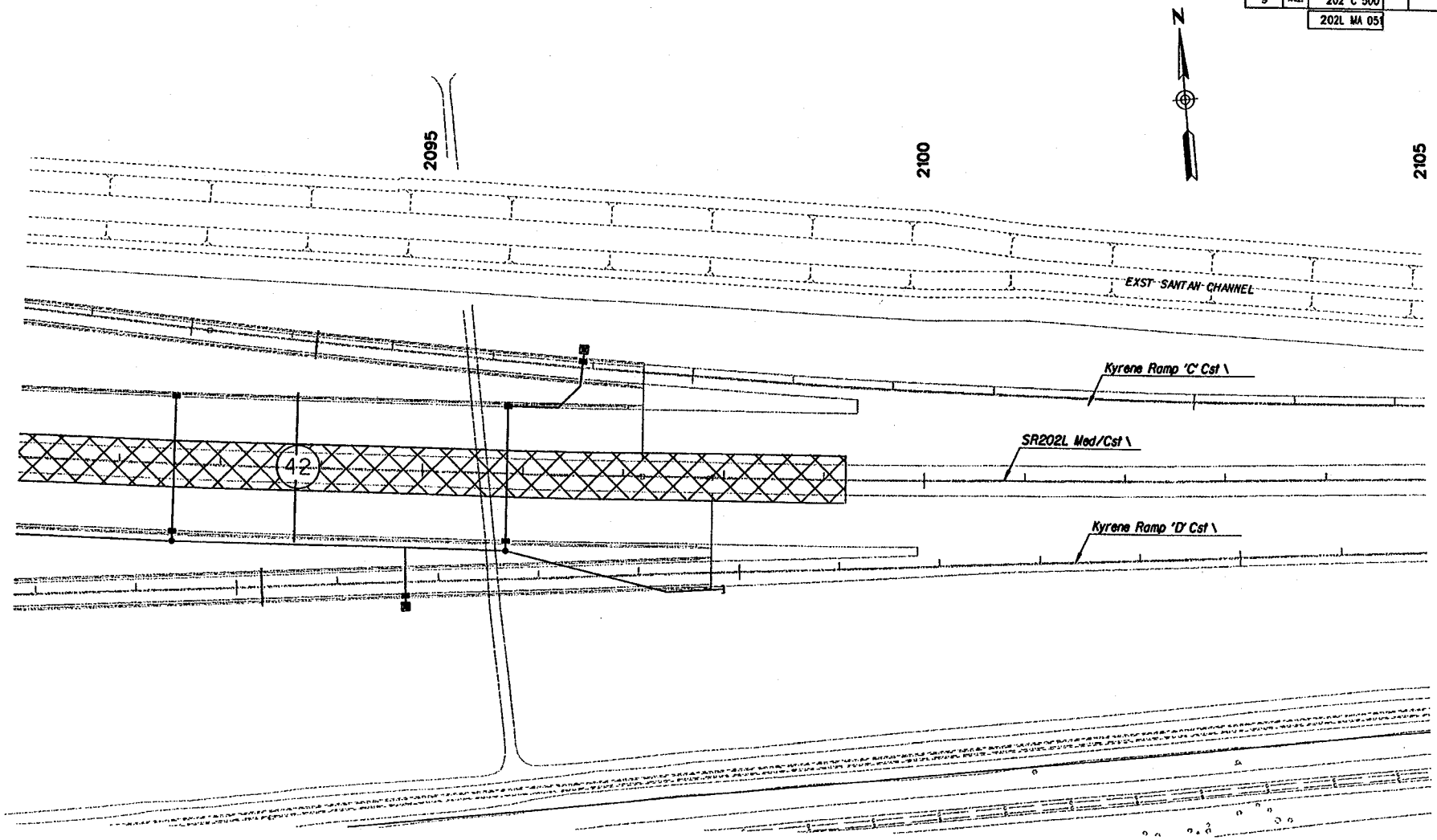

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	NAME	DATE
DESIGN		09/00
DRAWN		09/00
CHECKED		09/00

HDR ENGINEERING, INC.

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

SR202L
MEDIAN DRAINAGE AREAS

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD

TRACS NO. H5416 01C

202 C 500

DWG NO. 12 OF 12

ARIZONA BLUE STAKE, INC. 263-1100

APPENDIX E - Off-Site Hydraulic Analyses

WEST CHANNEL		
HES-RAS River Sta	**Construction C_L & PGL**	
62+30.00	10+03.81	
62+00.00	10+33.82	
60+00.00	12+33.82	
	12+40	End West Channel
58+00.00	14+33.81	
56+00.00	16+33.81	
54+00.00	18+33.81	
	19+34.72	
	20+08.63	End 2-6'x6' Box Culvert
52+00.00	20+33.81	
50+00.00	22+33.81	
48+16.00	24+17.81	
47+66.00	24+67.81	
47+01.00	25+32.81	
46+87.00	25+46.81	
46+86.00	25+47.81	
45+07.00	27+26.81	
	27+29.57	Begin 2-6'x6' Box Culvert
44+97.00	27+36.81	
44+85.00	27+48.01	
44+22.00	28+11.81	
43+72.00	28+61.82	
42+00.00	30+33.82	
40+00.00	32+33.82	
38+00.00	34+33.82	
36+00.00	36+33.82	
34+00.00	38+33.82	
32+00.00	40+33.82	
30+00.00	42+33.81	
28+00.00	44+33.81	
	44+97.00	Begin West Channel (connect to existing West Channel in Santan Channel Phase III)
26+00.00	46+33.82	
24+00.00	48+33.82	
22+00.00	50+33.82	
20+00.00	52+33.81	
18+35.33	53+98.48	
17+72.05	54+61.76	
17+16.05	55+17.76	
16+50.05	55+83.76	
15+94.05	56+39.76	
15+31.00	57+02.81	
14+00.00	58+33.81	
12+00.00	60+33.81	
10+39.00	61+94.81	
10+00.00	62+33.81	

HEC-RAS September 1998 Version 2.2
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

```
X     X  XXXXXX    XXXX        XXXX        XX      XXXX
X     X  X        X    X      X   X      X  X:   X
X     X  X        X           X   X     X    X   X
XXXXXXX  XXXX     X       XXX XXXX      XXXXXX    XXXX
X     X  X        X            X  X     X    X        X
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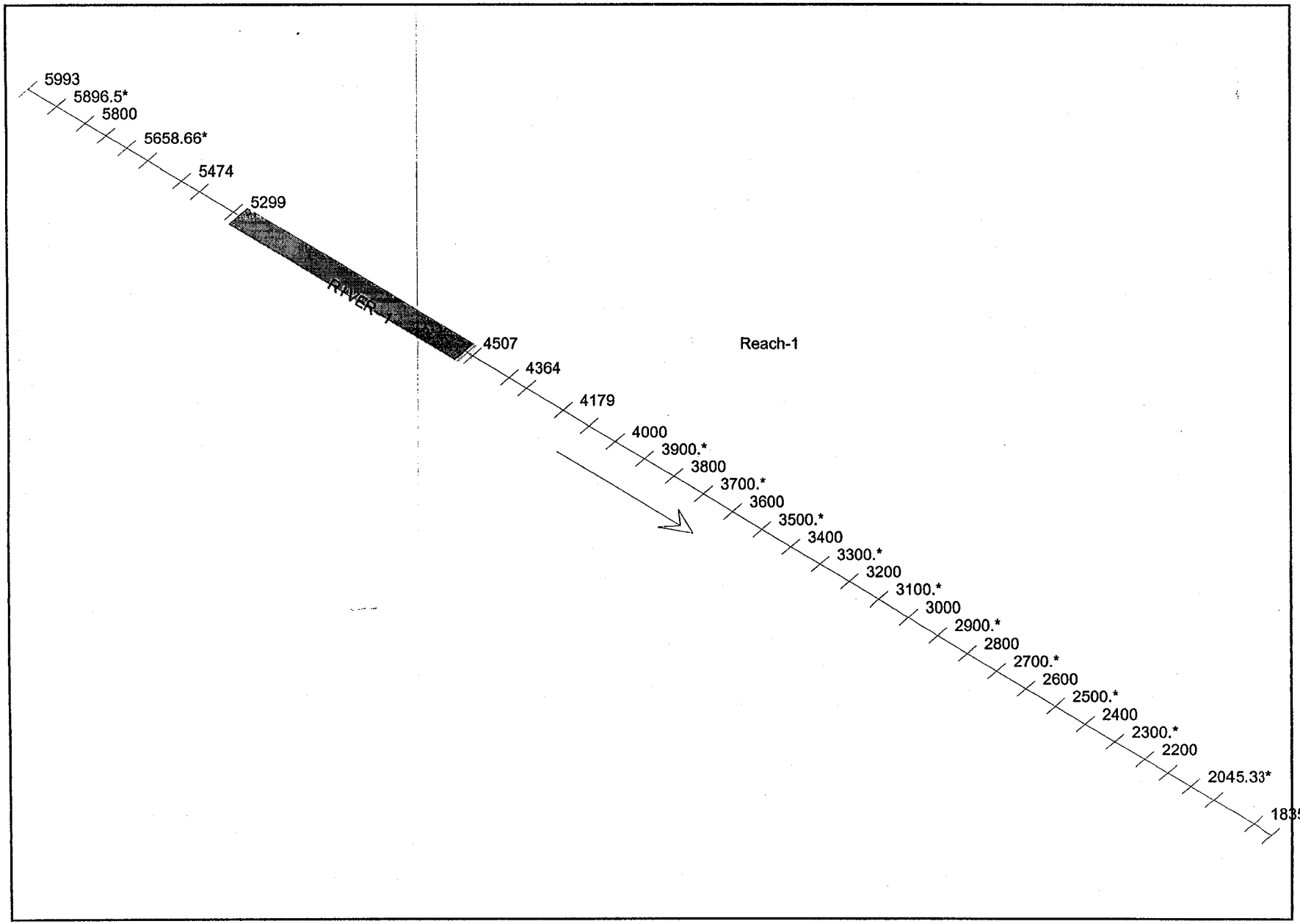
PROJECT DATA
Project Title: SANTAN CHANNELS NEW
Project File : W_CHANH.prj
Run Date and Time: 3/22/00 9:13:00 AM

Project in English units

Project Description:
West Channel 12+40 to 44+95 (Santan Fwy ,56th to Kyrene)

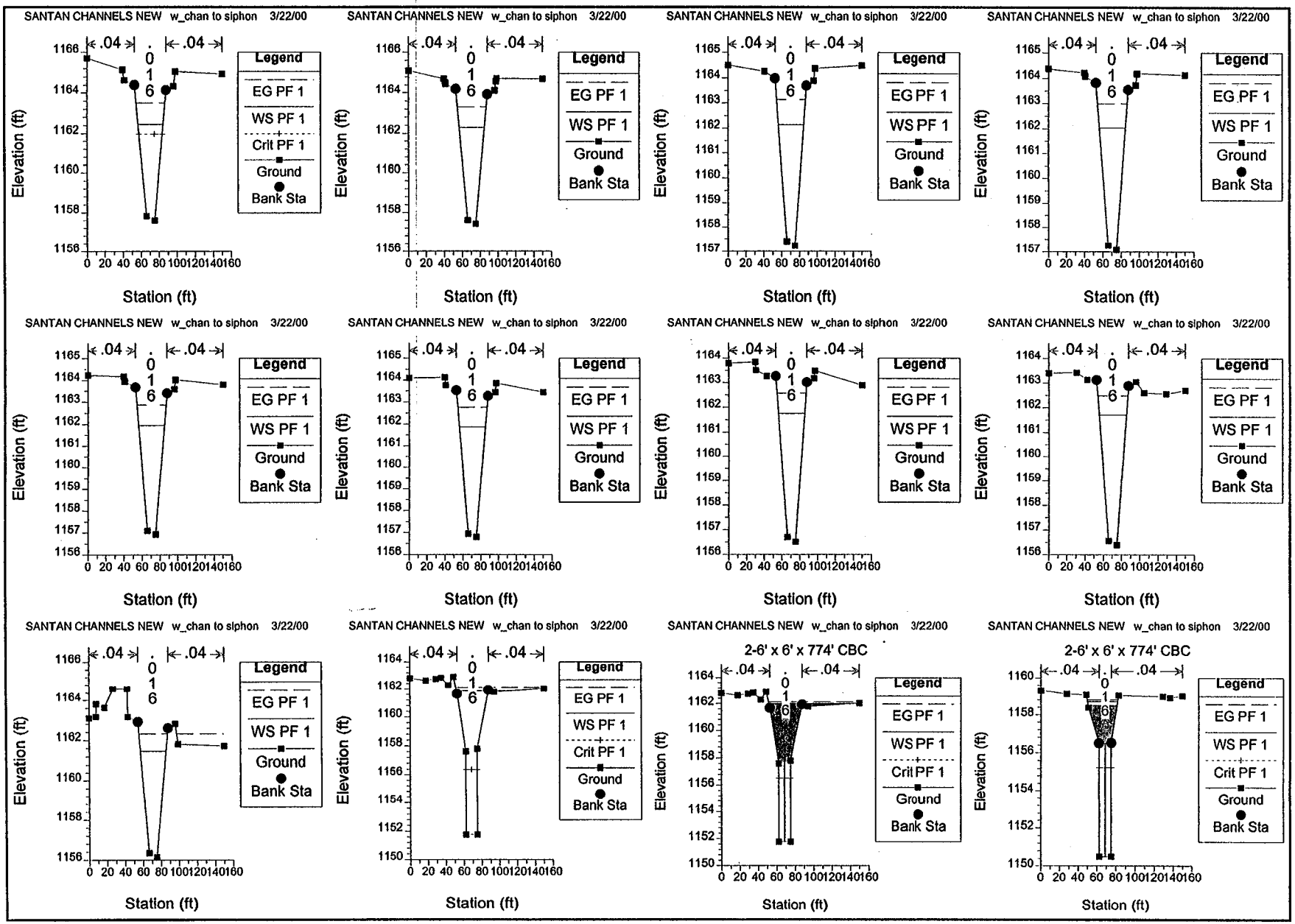
HDR Engineering,
Inc
2141 E. Highland Avenue, Suite 250
Phoenix, AZ 85016
602 508-6600


5993
5896.5*
5800
5658.66*
5474
5299
RIVER 1
4507
Reach-1
4364
4179
4000
3900.*
3800
3700.*
3600
3500.*
3400
3300.*
3200
3100.*
3000
2900.*
2800
2700.*
2600
2500.*
2400
2300.*
2200
2045.33*
1835

HEC-RAS Plan: w_chan River: RIVER-1 Reach: Reach-1

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	5993	719.00	1157.60	1162.46	1161.97	1163.51	0.001884	8.21	87.62	27.92	0.82
Reach-1	5896.5*	719.00	1157.42	1162.29		1163.32	0.001833	8.12	88.56	28.09	0.81
Reach-1	5800	719.00	1157.23	1162.15		1163.13	0.001746	7.97	90.21	28.37	0.79
Reach-1	5729.33*	719.00	1157.09	1162.04		1163.00	0.001685	7.87	91.39	28.54	0.77
Reach-1	5658.66*	719.00	1156.94	1161.96		1162.88	0.001594	7.71	93.29	28.80	0.75
Reach-1	5588	719.00	1156.80	1161.87		1162.76	0.001519	7.57	94.95	29.03	0.74
Reach-1	5474	719.00	1156.52	1161.76		1162.57	0.001339	7.23	99.43	29.60	0.70
Reach-1	5414	719.00	1156.40	1161.71		1162.48	0.001264	7.08	101.57	29.90	0.68
Reach-1	5299	719.00	1156.14	1161.46		1162.32	0.001411	7.42	96.88	28.69	0.71
Reach-1	5281	719.00	1151.77	1161.87	1156.38	1162.13	0.000345	4.10	176.41	56.55	0.32
Reach-1	5280	Culvert									
Reach-1	4507	719.00	1150.50	1155.13	1155.13	1157.44	0.004636	12.22	58.84	12.79	1.00
Reach-1	4489	750.00	1150.47	1153.90	1154.95	1157.22	0.008959	14.64	51.24	22.36	1.70
Reach-1	4364	750.00	1150.26	1155.67	1154.68	1156.46	0.001256	7.14	105.00	30.31	0.68
Reach-1	4304*	750.00	1150.16	1155.61		1156.38	0.001220	7.07	106.14	30.46	0.67
Reach-1	4179*	750.00	1149.95	1155.48		1156.23	0.001160	6.93	108.23	30.80	0.65
Reach-1	4089.5*	750.00	1149.80	1155.40		1156.12	0.001100	6.80	110.37	31.08	0.64
Reach-1	4000	750.00	1149.66	1155.32		1156.01	0.001044	6.66	112.55	31.37	0.62
Reach-1	3900*	750.00	1149.49	1155.25		1155.90	0.000976	6.50	115.34	31.71	0.60
Reach-1	3800	750.00	1149.33	1155.17		1155.80	0.000916	6.35	118.06	32.04	0.58
Reach-1	3700*	750.00	1149.17	1155.11		1155.70	0.000852	6.18	121.27	32.43	0.56
Reach-1	3600	750.00	1149.00	1155.05		1155.61	0.000791	6.02	124.65	32.84	0.54
Reach-1	3500*	750.00	1148.83	1154.99		1155.53	0.000737	5.86	127.98	33.25	0.53
Reach-1	3400	750.00	1148.67	1154.94		1155.45	0.000686	5.70	131.48	33.71	0.51
Reach-1	3300*	750.00	1148.49	1154.90		1155.37	0.000625	5.51	136.05	34.21	0.49
Reach-1	3200	750.00	1148.30	1154.86		1155.30	0.000565	5.31	141.17	34.75	0.46
Reach-1	3100*	750.00	1148.20	1154.81		1155.24	0.000546	5.25	142.99	34.96	0.46
Reach-1	3000	750.00	1148.10	1154.77		1155.19	0.000526	5.17	144.93	35.18	0.45
Reach-1	2900*	750.00	1148.00	1154.73		1155.13	0.000507	5.10	147.01	35.44	0.44
Reach-1	2800	750.00	1147.90	1154.68		1155.08	0.000489	5.03	149.02	35.65	0.43
Reach-1	2700*	750.00	1147.80	1154.64		1155.03	0.000470	4.96	151.16	35.89	0.43
Reach-1	2600	750.00	1147.70	1154.60		1154.98	0.000452	4.89	153.38	36.14	0.42
Reach-1	2500*	750.00	1147.62	1154.57		1154.93	0.000437	4.83	155.39	36.38	0.41
Reach-1	2400	750.00	1147.54	1154.53		1154.88	0.000421	4.76	157.53	36.65	0.40
Reach-1	2300*	750.00	1147.44	1154.50		1154.84	0.000404	4.69	159.96	36.91	0.40
Reach-1	2200	750.00	1147.34	1154.47		1154.80	0.000388	4.62	162.47	37.18	0.39

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	2122.66*	750.00	1147.26	1154.44		1154.76	0.000375	4.56	164.51	37.39	0.38
Reach-1	2045.33*	750.00	1147.18	1154.42		1154.73	0.000362	4.50	166.65	37.62	0.38
Reach-1	1968	750.00	1147.10	1154.40		1154.70	0.000350	4.44	168.78	37.84	0.37
Reach-1	1835	750.00	1146.96	1154.34		1154.66	0.000358	4.48	167.54	37.83	0.37
Reach-1	1772	750.00	1145.80	1154.36	1149.21	1154.62	0.000348	4.08	183.92	34.31	0.31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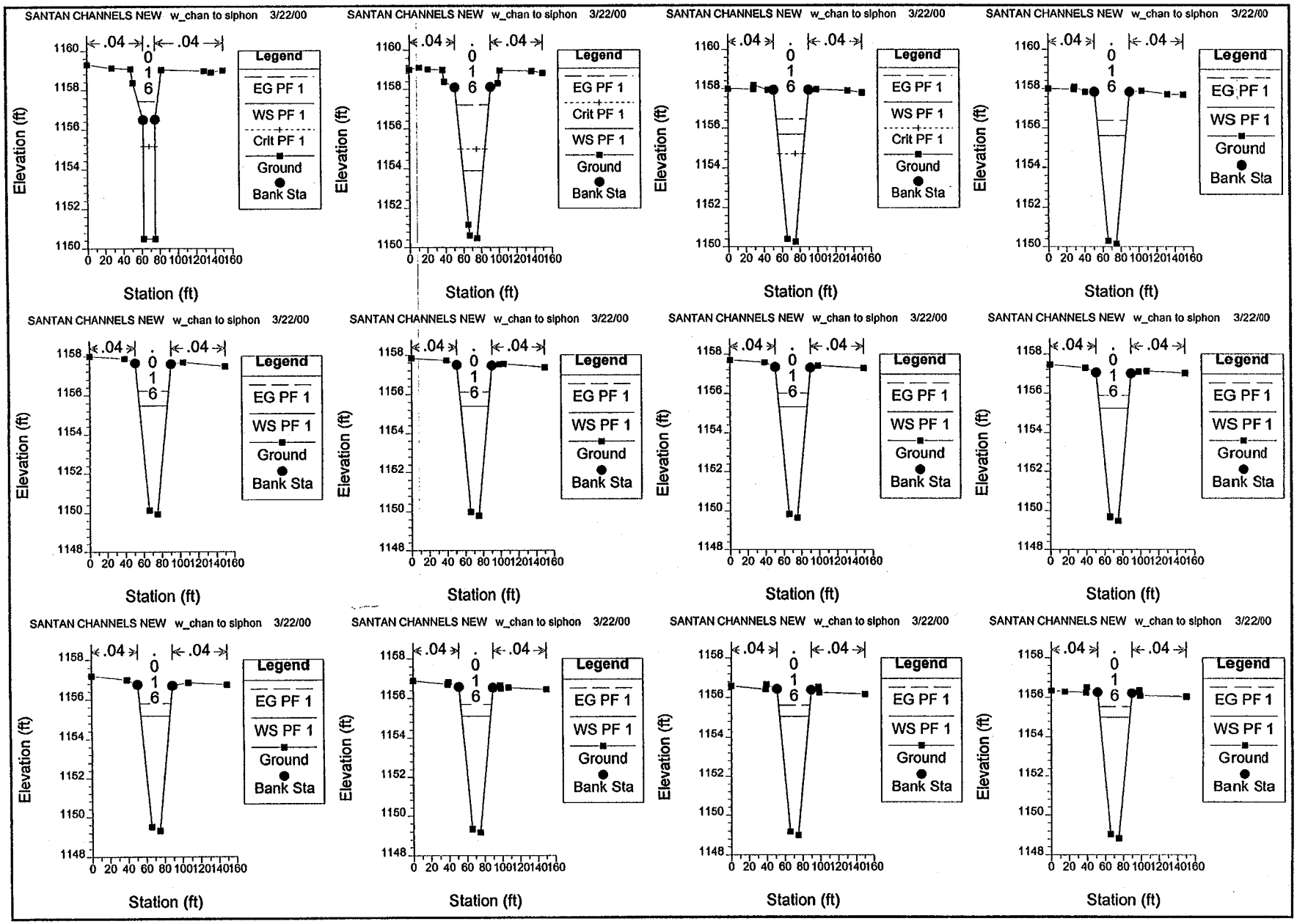
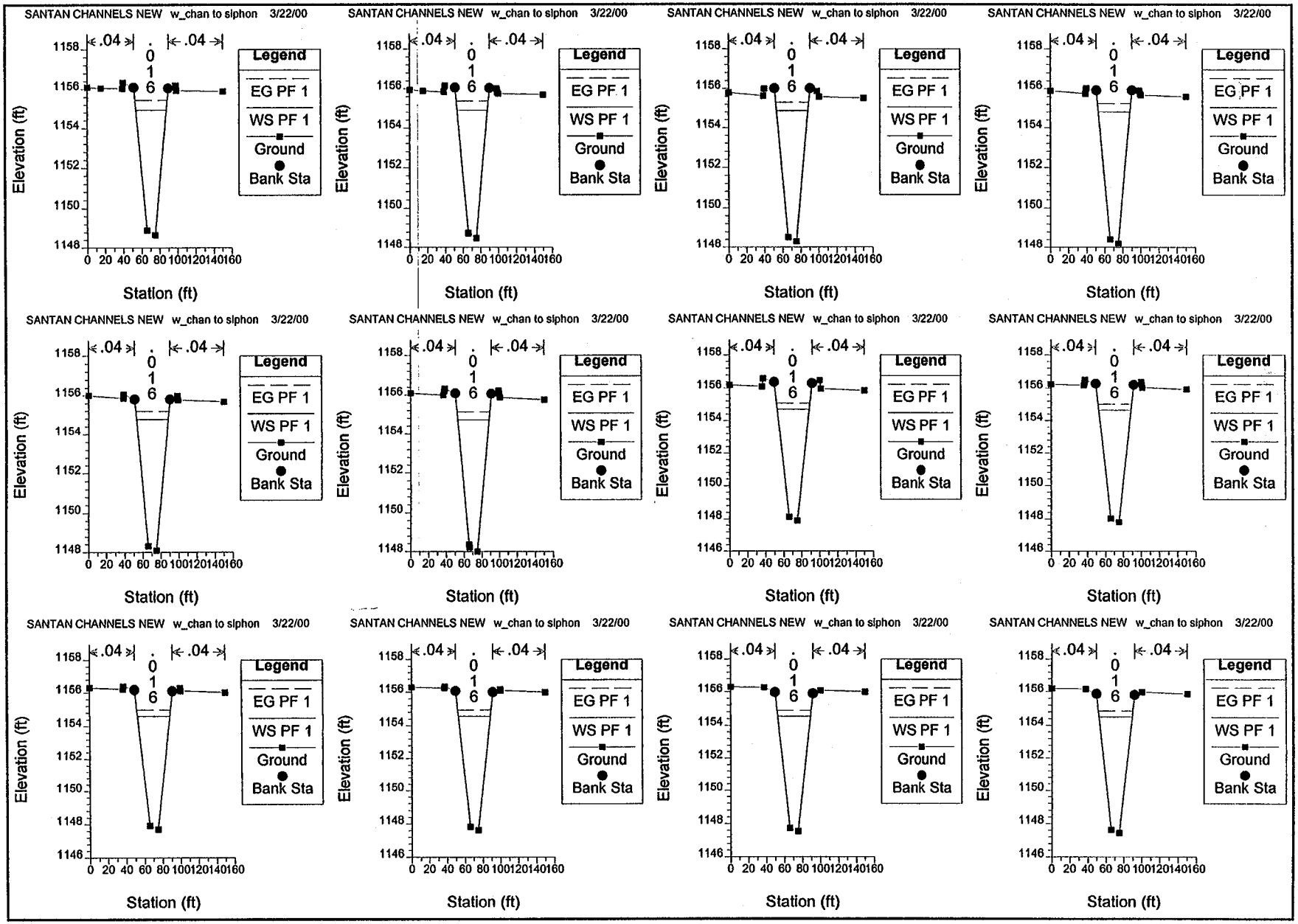
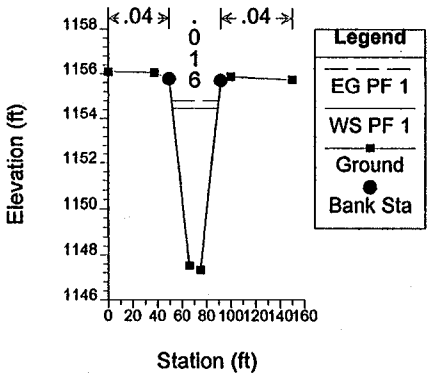
Elevation (ft)
Station (ft)
.04
.04
0
1
6
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
2-6' x 6' x 774' CBC

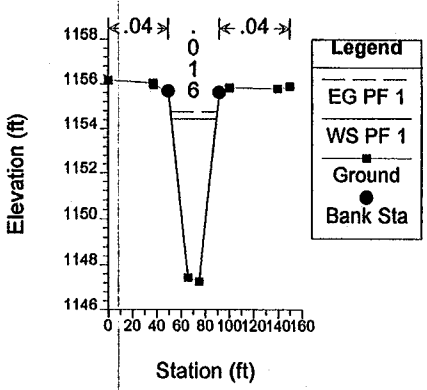

SANTAN CHANNELS NEW w_chan to siphon 3/22/00
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
.04
.016


SANTAN CHANNELS NEW w_chan to siphon 3/22/00
.04
.016
.04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

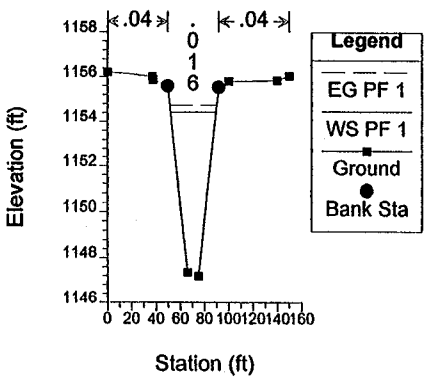
SANTAN CHANNELS NEW w_chan to siphon 3/22/00



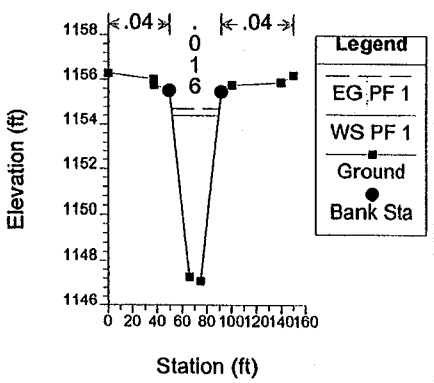
SANTAN CHANNELS NEW w_chan to siphon 3/22/00



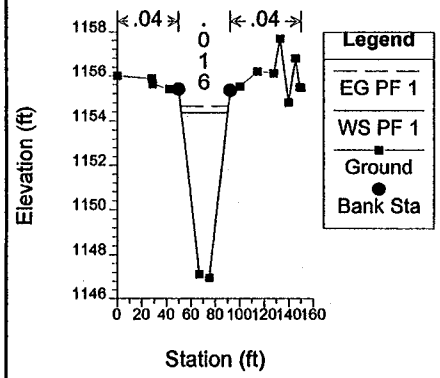
SANTAN CHANNELS NEW w_chan to siphon 3/22/00



SANTAN CHANNELS NEW w_chan to siphon 3/22/00



SANTAN CHANNELS NEW w_chan to siphon 3/22/00



PLAN DATA

Plan Title: w_chan to siphon
Plan File : e:\00173317DR\Hecras\W_CHANH.p06

Geometry Title: w_chan to siphon
Geometry File : e:\00173317DR\Hecras\W_CHANH.g11

Flow Title : w_chan to siphon
Flow File : e:\00173317DR\Hecras\W_CHANH.f01

Plan Summary Information:

Number of:	Cross Sections	= 40	Mulitple Openings	=	0
	Culverts	= 1	Inline Weirs	=	0
	Bridges	= 0			

Computational Information

Water surface calculation tolerance	=	0.01
Critical depth calculaton tolerance	=	0.01
Maximum number of interations	=	40
Maximum difference tolerance	=	0.3
Flow tolerance factor	=	0.001

Computation Options

Critical depth computed only where necessary	
Conveyance Calculation Method:	At breaks in n values only
Friction Slope Method:	Average Conveyance
Computational Flow Regime:	Mixed Flow

FLOW DATA

Flow Title: w_chan to siphon
Flow File : e:\00173317DR\Hecras\W_CHANH.f01

Flow Data (cfs)

River	Reach	RS	PF 1
RIVER-1	Reach-1	5993	719
RIVER-1	Reach-1	4489	750

Boundary Conditions

```
  River            Reach            Profile                          Upstre
am
Downstream


  RIVER-1          Reach-1          PF 1                            Normal S
 = .002        Known WS
= 1154.36
```

GEOMETRY DATA

Geometry Title: w_chan to siphon
Geometry File : e:\00173317DR\Hecras\W_CHANH.g11

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5993

INPUT
Description:
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1165.7	39.32	1165.14	41.36	1164.63	52.84	1164.466	1157.83	
75	1157.6	88	1164.15	96.09	1164.34	98.26	1165.06	150	1164.94

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	52.84	.016	88	.04

```
Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Cont
r.   Expan.
         52.84      88              96.5    96.5    96.5              .1
       .3
```

CROSS SECTION OUTPUT Profile #PF 1

```
  E.G. Elev (ft)            1163.51   Element                    Left O
```

```
B    Channel   Right
OB
  Vel Head (ft)                 1.05   Wt. n-Val.
       0.016
  W.S. Elev (ft)             1162.46   Reach Len. (ft)              96.5
0      96.50
96.50
  Crit W.S. (ft)             1161.97   Flow Area (sq ft)
       87.62
  E.G. Slope (ft/ft)        0.001884   Area (sq ft)
       87.62
  Q Total (cfs)               719.00   Flow (cfs)
      719.00
  Top Width (ft)               27.92   Top Width (ft)
       27.92
  Vel Total (ft/s)              8.21   Avg. Vel. (ft/s)
        8.21
  Max Chl Dpth (ft)             4.86   Hydr. Depth (ft)
        3.14
  Conv. Total (cfs)          16562.9   Conv. (cfs)
    16562.9
  Length Wtd. (ft)             96.50   Wetted Per. (ft)
       30.17
  Min Ch El (ft)             1157.60   Shear (lb/sq ft)
        0.34
  Alpha                         1.00   Stream Power (lb/ft s)
        2.80
  Frctn Loss (ft)               0.18   Cum Volume (acre-ft)          0.0
0      12.21
0.01
  C & E Loss (ft)               0.01   Cum SA (acres)                0.0
1       3.03
0.19
```

```
CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 5896.5*

INPUT
Description:
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1165.1   39.32  1164.7    40.7 1164.53   41.36 1164.44   52.
84 1164.19
      66 1157.62      75 1157.42      88 1163.93      96 1164.11   96.
09 1164.13
```

```
   97.44 1164.58   98.26 1164.72     150 1164.71

Manning's n Values          num=        4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   52.84    .016      88     .04     150     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         52.84      88             96.5    96.5    96.5             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)              1163.32   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                  1.02   Wt. n-Val.
       0.016
  W.S. Elev (ft)              1162.29   Reach Len. (ft)              96.5
0      96.50
96.50
  Crit W.S. (ft)                        Flow Area (sq ft)
       88.56
  E.G. Slope (ft/ft)         0.001833   Area (sq ft)
       88.56
  Q Total (cfs)                719.00   Flow (cfs)
      719.00
  Top Width (ft)               28.09   Top Width (ft)
       28.09
  Vel Total (ft/s)              8.12   Avg. Vel. (ft/s)
        8.12
  Max Chl Dpth (ft)             4.87   Hydr. Depth (ft)
        3.15
  Conv. Total (cfs)          16794.0   Conv. (cfs)
    16794.0
  Length Wtd. (ft)             96.50   Wetted Per. (ft)
       30.35
  Min Ch El (ft)             1157.42   Shear (lb/sq ft)
        0.33
  Alpha                         1.00   Stream Power (lb/ft s)
        2.71
  Frctn Loss (ft)               0.17   Cum Volume (acre-ft)          0.0
0      12.02
0.01
  C & E Loss (ft)               0.01   Cum SA (acres)                0.0
1       2.97
0.19
```

```
CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 5800

INPUT
Description:
Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1164.5    40.7 1164.26   52.84 1163.98      66 1157.41
75 1157.23
      88  1163.7      96 1163.89   97.44 1164.37     150 1164.49

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   52.84    .016      88     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         52.84      88            70.63   70.63   70.63             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)             1163.13   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                 0.99   Wt. n-Val.
       0.016
  W.S. Elev (ft)             1162.15   Reach Len. (ft)              70.6
3      70.63
70.63
  Crit W.S. (ft)                       Flow Area (sq ft)
       90.21
  E.G. Slope (ft/ft)        0.001746   Area (sq ft)
       90.21
  Q Total (cfs)               719.00   Flow (cfs)
      719.00
  Top Width (ft)               28.37   Top Width (ft)
       28.37
  Vel Total (ft/s)              7.97   Avg. Vel. (ft/s)
        7.97
  Max Chl Dpth (ft)             4.92   Hydr. Depth (ft)
        3.18
  Conv. Total (cfs)          17208.9   Conv. (cfs)
```

```
     17208.9
  Length Wtd. (ft)              70.63   Wetted Per. (ft)
       30.64
  Min Ch El (ft)              1157.23   Shear (lb/sq ft)
        0.32
  Alpha                          1.00   Stream Power (lb/ft s)
        2.56
  Frctn Loss (ft)                0.12   Cum Volume (acre-ft)          0.0
0       11.82
0.01
  C & E Loss (ft)                0.01   Cum SA (acres)                0.0
1        2.91
0.19


CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 5729.33*

INPUT
Description:
Station Elevation Data     num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0 1164.37   39.76 1164.22    40.7 1164.11   40.84 1164.09   52.
84 1163.83
      66 1157.26      75 1157.09      88 1163.56      96 1163.74   96.
03 1163.75
   97.32 1164.17   97.44  1164.2     150 1164.14

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   52.84    .016      88     .04     150     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         52.84      88            70.63   70.63   70.63             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)              1163.00   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                  0.96   Wt. n-Val.
       0.016
  W.S. Elev (ft)              1162.04   Reach Len. (ft)              70.6
```

```
3       70.63
70.63
  Crit W.S. (ft)                          Flow Area (sq ft)
       91.39
  E.G. Slope (ft/ft)          0.001685    Area (sq ft)
       91.39
  Q Total (cfs)                 719.00    Flow (cfs)
      719.00
  Top Width (ft)                 28.54    Top Width (ft)
       28.54
  Vel Total (ft/s)                7.87    Avg. Vel. (ft/s)
        7.87
  Max Chl Dpth (ft)               4.95    Hydr. Depth (ft)
        3.20
  Conv. Total (cfs)           17515.4     Conv. (cfs)
    17515.4
  Length Wtd. (ft)               70.63    Wetted Per. (ft)
       30.83
  Min Ch El (ft)              1157.09     Shear (lb/sq ft)
        0.31
  Alpha                           1.00    Stream Power (lb/ft s)
        2.45
  Frctn Loss (ft)                 0.12    Cum Volume (acre-ft)          0.0
0       11.67
0.01
  C & E Loss (ft)                 0.01    Cum SA (acres)                0.0
1        2.86
0.19


CROSS SECTION            RIVER: RIVER-1
REACH: Reach-1              RS: 5658.66*

INPUT
Description:
Station Elevation Data     num=       13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0 1164.23   39.76 1164.17    40.7 1163.96   40.84 1163.93   52.
84 1163.67
      66  1157.1      75 1156.94      88 1163.41      96 1163.59   96.
03 1163.59
   97.32 1164.02   97.44 1164.03     150 1163.79

Manning's n Values         num=        4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   52.84    .016      88     .04     150     .04
```

```
Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Cont
r.    Expan.
          52.84       88             70.63   70.63    70.63              .1
        .3

CROSS SECTION OUTPUT     Profile #PF 1


  E.G. Elev (ft)              1162.88   Element                      Left O
B     Channel    Right
OB
  Vel Head (ft)                  0.92   Wt. n-Val.
       0.016
  W.S. Elev (ft)              1161.96   Reach Len. (ft)                70.6
3       70.63
70.63
  Crit W.S. (ft)                        Flow Area (sq ft)
       93.29
  E.G. Slope (ft/ft)         0.001594   Area (sq ft)
       93.29
  Q Total (cfs)                719.00   Flow (cfs)
      719.00
  Top Width (ft)                28.80   Top Width (ft)
       28.80
  Vel Total (ft/s)               7.71   Avg. Vel. (ft/s)
        7.71
  Max Chl Dpth (ft)              5.02   Hydr. Depth (ft)
        3.24
  Conv. Total (cfs)          18010.5    Conv. (cfs)
    18010.5
  Length Wtd. (ft)              70.63   Wetted Per. (ft)
       31.13
  Min Ch El (ft)             1156.94    Shear (lb/sq ft)
        0.30
  Alpha                          1.00   Stream Power (lb/ft s)
        2.30
  Frctn Loss (ft)                0.11   Cum Volume (acre-ft)           0.0
0       11.52
0.01
  C & E Loss (ft)                0.01   Cum SA (acres)                 0.0
1        2.81
0.19


CROSS SECTION            RIVER: RIVER-1
REACH: Reach-1              RS: 5588
```

```
INPUT
Description:
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1164.1   39.76 1164.12   40.84 1163.76   52.84 1163.52
66 1156.95
      75  1156.8      88 1163.27   96.03 1163.44   97.32 1163.86     1
50 1163.44

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   52.84    .016      88     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         52.84      88           114.01  114.01  114.01             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)            1162.76   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                0.89   Wt. n-Val.
       0.016
  W.S. Elev (ft)            1161.87   Reach Len. (ft)             114.0
1     114.01
114.01
  Crit W.S. (ft)                      Flow Area (sq ft)
       94.95
  E.G. Slope (ft/ft)       0.001519   Area (sq ft)
       94.95
  Q Total (cfs)              719.00   Flow (cfs)
      719.00
  Top Width (ft)              29.03   Top Width (ft)
       29.03
  Vel Total (ft/s)             7.57   Avg. Vel. (ft/s)
        7.57
  Max Chl Dpth (ft)            5.07   Hydr. Depth (ft)
        3.27
  Conv. Total (cfs)         18446.0   Conv. (cfs)
     18446.0
  Length Wtd. (ft)           114.01   Wetted Per. (ft)
       31.38
  Min Ch El (ft)            1156.80   Shear (lb/sq ft)
```

```
        0.29
  Alpha                          1.00   Stream Power (lb/ft s)
        2.17
  Frctn Loss (ft)                0.16   Cum Volume (acre-ft)          0.0
0       11.37
0.01
  C & E Loss (ft)                0.02   Cum SA (acres)                0.0
1        2.77
0.19


CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 5474

INPUT
Description:
Station Elevation Data     num=       11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1163.8   29.85 1163.85   30.85 1163.52   42.86 1163.27   52.
86 1163.27
      66  1156.7      75 1156.52      88 1163.02      96 1163.18   96.
93 1163.49
     150  1162.9

Manning's n Values         num=        3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   52.86    .016      88     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         52.86      88               60      60      60             .1
       .3


CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)            1162.57   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                0.81   Wt. n-Val.
       0.016
  W.S. Elev (ft)            1161.76   Reach Len. (ft)              60.0
0      60.00
60.00
  Crit W.S. (ft)                      Flow Area (sq ft)
       99.43
```

```
  E.G. Slope (ft/ft)        0.001339   Area (sq ft)
       99.43
  Q Total (cfs)               719.00   Flow (cfs)
      719.00
  Top Width (ft)               29.60   Top Width (ft)
       29.60
  Vel Total (ft/s)              7.23   Avg. Vel. (ft/s)
        7.23
  Max Chl Dpth (ft)             5.24   Hydr. Depth (ft)
        3.36
  Conv. Total (cfs)          19648.6   Conv. (cfs)
     19648.6
  Length Wtd. (ft)             60.00   Wetted Per. (ft)
       32.04
  Min Ch El (ft)             1156.52   Shear (lb/sq ft)
        0.26
  Alpha                         1.00   Stream Power (lb/ft s)
        1.88
  Frctn Loss (ft)               0.08   Cum Volume (acre-ft)          0.0
0       11.11
0.01
  C & E Loss (ft)               0.01   Cum SA (acres)                0.0
1        2.69
0.19


CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 5414

INPUT
Description:
Station Elevation Data     num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1163.4    30.7 1163.43   42.86 1163.14   52.86 1163.14
66 1156.57
      75  1156.4      88 1162.89      96 1163.05  104.74  1162.6  128.
85 1162.56
     150  1162.7

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   52.86    .016      88     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         52.86      88             115     115     115              .1
```

.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1162.48	Element	Left O
B Channel Right OB			
Vel Head (ft)	0.78	Wt. n-Val.	
0.016			
W.S. Elev (ft)	1161.71	Reach Len. (ft)	115.0
0 115.00 115.00			
Crit W.S. (ft)		Flow Area (sq ft)	
101.57			
E.G. Slope (ft/ft)	0.001264	Area (sq ft)	
101.57			
Q Total (cfs)	719.00	Flow (cfs)	
719.00			
Top Width (ft)	29.90	Top Width (ft)	
29.90			
Vel Total (ft/s)	7.08	Avg. Vel. (ft/s)	
7.08			
Max Chl Dpth (ft)	5.31	Hydr. Depth (ft)	
3.40			
Conv. Total (cfs)	20219.9	Conv. (cfs)	
20219.9			
Length Wtd. (ft)	115.00	Wetted Per. (ft)	
32.37			
Min Ch El (ft)	1156.40	Shear (lb/sq ft)	
0.25			
Alpha	1.00	Stream Power (lb/ft s)	
1.75			
Frctn Loss (ft)	0.15	Cum Volume (acre-ft)	0.0
0 10.98 0.01			
C & E Loss (ft)	0.01	Cum SA (acres)	0.0
1 2.65 0.19			

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 5299

INPUT
Description:
Station Elevation Data num= 14

```
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1163.1    7.47 1163.17    7.91 1163.82   17.29 1163.64   26.
46  1164.6
   42.28  1164.6   42.89 1163.16   54.32 1162.91   66.62 1156.34
75 1156.14
      88  1162.6      96  1162.8   98.95 1161.82     150 1161.73

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   54.32    .016      88     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         54.32      88            18.44   18.44   18.44             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)            1162.32   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                0.86   Wt. n-Val.
       0.016
  W.S. Elev (ft)            1161.46   Reach Len. (ft)              18.4
4      18.44
18.44
  Crit W.S. (ft)                      Flow Area (sq ft)
       96.88
  E.G. Slope (ft/ft)       0.001411   Area (sq ft)
       96.88
  Q Total (cfs)              719.00   Flow (cfs)
      719.00
  Top Width (ft)              28.69   Top Width (ft)
       28.69
  Vel Total (ft/s)             7.42   Avg. Vel. (ft/s)
        7.42
  Max Chl Dpth (ft)            5.32   Hydr. Depth (ft)
        3.38
  Conv. Total (cfs)         19141.8   Conv. (cfs)
     19141.8
  Length Wtd. (ft)            18.44   Wetted Per. (ft)
       31.22
  Min Ch El (ft)            1156.14   Shear (lb/sq ft)
        0.27
  Alpha                        1.00   Stream Power (lb/ft s)
        2.03
```

```
  Frctn Loss (ft)                0.01   Cum Volume (acre-ft)          0.0
0       10.71
0.01
  C & E Loss (ft)                0.18   Cum SA (acres)                0.0
1        2.57
0.19


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).
This may indicate the
need for
         additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstre
am conveyance) is less
         than 0.7 or greater than 1.4.  This may indicate the need for
 additional cross
sections.

CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 5281

INPUT
Description:
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1162.8   17.72 1162.64   28.97 1162.75   34.57 1162.84   42.
81 1162.31
   48.79  1162.9   52.83 1161.66   62.24 1157.62   62.27 1151.77
75 1151.77
   75.05  1157.8   87.73 1161.93   94.13 1161.79     150 1162.04

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   52.83    .016   87.73     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         52.83   87.73           773.62  773.62  773.62             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)            1162.13   Element                   Left O
B    Channel   Right
OB
```

Vel Head (ft)	0.26	Wt. n-Val.	0.04
0 0.016			
0.040			
W.S. Elev (ft)	1161.87	Reach Len. (ft)	773.6
2 773.62			
773.62			
Crit W.S. (ft)	1156.38	Flow Area (sq ft)	0.0
7 175.51			
0.83			
E.G. Slope (ft/ft)	0.000345	Area (sq ft)	0.0
7 175.51			
0.83			
Q Total (cfs)	719.00	Flow (cfs)	0.0
1 718.92			
0.07			
Top Width (ft)	56.55	Top Width (ft)	0.6
8 34.71			
21.16			
Vel Total (ft/s)	4.08	Avg. Vel. (ft/s)	0.1
5 4.10			
0.08			
Max Chl Dpth (ft)	10.10	Hydr. Depth (ft)	0.1
0 5.06			
0.04			
Conv. Total (cfs)	38695.4	Conv. (cfs)	0.
6 38691.3			
3.6			
Length Wtd. (ft)	773.62	Wetted Per. (ft)	0.7
1 47.99			
21.16			
Min Ch El (ft)	1151.77	Shear (lb/sq ft)	0.0
0 0.08			
0.00			
Alpha	1.01	Stream Power (lb/ft s)	0.0
0 0.32			
0.00			
Frctn Loss (ft)		Cum Volume (acre-ft)	0.0
0 10.66			
0.01			
C & E Loss (ft)		Cum SA (acres)	0.0
1 2.56			
0.19			

CULVERT RIVER: RIVER-1
REACH: Reach-1 RS: 5280

```
INPUT
Description: 2-6' x 6' x 774' CBC
Distance from Upstream XS =       1
Deck/Roadway Width        =     765
Weir Coefficient          =     2.6
Bridge Deck/Roadway Skew  =
Upstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0    1162    1150     150    1162    1150

Upstream Bridge Cross Section Data
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1162.8   17.72 1162.64   28.97 1162.75   34.57 1162.84   42.
81 1162.31
   48.79  1162.9   52.83 1161.66   62.24 1157.62   62.27 1151.77
75 1151.77
   75.05  1157.8   87.73 1161.93   94.13 1161.79     150 1162.04

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   52.83    .016   87.73     .04

Bank Sta: Left   Right    Coeff Contr.   Expan.
         52.83   87.73             .1       .3

Downstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0  1158.5    1150     150  1158.5    1150

Downstream Bridge Cross Section Data
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1159.3   27.64 1159.12   48.55 1159.07   50.82 1158.37   62.
29  1156.5
   62.35  1150.5      75  1150.5   75.12 1156.52    82.7 1159.04  129.
29 1158.97
  136.73  1158.9     150    1159

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   62.29    .016   75.12     .04

Bank Sta: Left   Right    Coeff Contr.   Expan.
```

```
        62.29   75.12              .1        .3

Upstream Embankment side slope                =       4 horiz. to 1.0 ve
rtical
Downstream Embankment side slope              =       4 horiz. to 1.0 ve
rtical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins           =
Energy head used in spillway design           =
Spillway height used in design                =
Weir crest shape                              = Broad Crested

Number of Culverts =  1

Culvert Name      Shape      Rise    Span
Culvert #1            Box       6       6
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    n Value   Entrance Loss Coef   Exit Los
s Coef
                  1   776.4       .014                    .5
     1
Number of Barrels =  2
Upstream   Elevation =  1151.77
Centerline Stations
    Sta.    Sta.
   65.27   71.94
Downstream Elevation =  1150.49
Centerline Stations
    Sta.    Sta.
   65.27   71.94

CULVERT_OUTPUT    Profile #PF 1
Culvert ID : Culvert #1

  Culv Q (cfs)            707.25   Culv Vel In (ft/s)        9.82
  # Barrels                    2   Culv Vel Out (ft/s)      12.38
  Q Barrel (cfs)          353.62   Culv Inv El Up (ft)    1151.77
  E.G. US. (ft)          1162.13   Culv Inv El Dn (ft)    1150.49
  W.S. US. (ft)          1161.87   Culv Frctn Ls (ft)        3.75
  Delta EG (ft)             4.68   Culv Ext Lss (ft)         0.19
  Delta WS (ft)             6.74   Culv Ent Lss (ft)         0.75
  E.G. IC (ft)           1160.27   Q Weir (cfs)             11.75
  E.G. OC (ft)           1162.13   Weir Sta Lft (ft)        51.30
  Culvert Control         Outlet   Weir Sta Rgt (ft)       150.00
  Culv WS In (ft)        1157.77   Weir Submerg              0.00
  Culv WS Out (ft)       1155.25   Weir Max Depth (ft)       0.13
```

```
Culv Nml Depth (ft)        6.00   Weir Avg Depth (ft)        0.13
Culv Crt Depth (ft)        4.76   Wr Flw Area (sq ft)       12.62
Culv Ful Lngh (ft)       632.34   Min Top Rd (ft)         1162.00
```

Note: The normal depth exceeds the height of the culvert. The program assumes that the normal
depth is equal to the height of the culvert.

```
CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 4507

INPUT
Description:
Station Elevation Data    num=     12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  1159.3   27.64 1159.12   48.55 1159.07   50.82 1158.37   62.29  1156.5
   62.35  1150.5      75  1150.5   75.12 1156.52    82.7 1159.04  129.29 1158.97
  136.73  1158.9     150    1159

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   62.29    .016   75.12     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         62.29   75.12             18.44   18.44   18.44              .1       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)            1157.44   Element                    Left OB    Channel   Right OB
  Vel Head (ft)                2.32   Wt. n-Val.                   0.016
  W.S. Elev (ft)            1155.13   Reach Len. (ft)              18.44      18.44     18.44
  Crit W.S. (ft)            1155.13   Flow Area (sq ft)            58.84
  E.G. Slope (ft/ft)       0.004636   Area (sq ft)                 58.84
```

Q Total (cfs)	719.00	Flow (cfs)
719.00		
Top Width (ft)	12.79	Top Width (ft)
12.79		
Vel Total (ft/s)	12.22	Avg. Vel. (ft/s)
12.22		
Max Chl Dpth (ft)	4.63	Hydr. Depth (ft)
4.60		
Conv. Total (cfs)	10559.9	Conv. (cfs)
10559.9		
Length Wtd. (ft)	18.44	Wetted Per. (ft)
21.90		
Min Ch El (ft)	1150.50	Shear (lb/sq ft)
0.78		
Alpha	1.00	Stream Power (lb/ft s)
9.50		
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)
8.58		
C & E Loss (ft)	0.44	Cum SA (acres)
2.14		

Warning: The energy equation could not be balanced within the specifie d number of
iterations. The
program selected the water surface that had the least amount of error between
computed
and assumed values.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the
need for
additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstre am conveyance) is less
than 0.7 or greater than 1.4. This may indicate the need for additional cross
sections.
Warning: During the standard step iterations, when the assumed water s urface was set equal
to
critical depth, the calculated water surface came back below critical depth. This
indicates
that there is not a valid subcritical answer. The program de faulted to critical
depth.

```
CROSS SECTION            RIVER: RIVER-1
REACH: Reach-1              RS: 4489

INPUT
Description:
Station Elevation Data     num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0    1159   10.95 1159.11    20.7 1159.02   37.16 1158.99   38.
98 1158.39
   50.98  1158.1   65.54 1151.19   66.98 1150.62   75.01 1150.47   91.
05 1158.12
    99.4  1158.3  101.43 1158.96  137.45 1158.92     150 1158.82

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   50.98    .016   91.05     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         50.98   91.05              125     125     125             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)             1157.22   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                 3.33   Wt. n-Val.
       0.016
  W.S. Elev (ft)             1153.90   Reach Len. (ft)             125.0
0     125.00
125.00
  Crit W.S. (ft)             1154.95   Flow Area (sq ft)
       51.24
  E.G. Slope (ft/ft)        0.008959   Area (sq ft)
       51.24
  Q Total (cfs)               750.00   Flow (cfs)
      750.00
  Top Width (ft)               22.36   Top Width (ft)
       22.36
  Vel Total (ft/s)             14.64   Avg. Vel. (ft/s)
       14.64
  Max Chl Dpth (ft)             3.43   Hydr. Depth (ft)
        2.29
  Conv. Total (cfs)           7923.8   Conv. (cfs)
```

```
     7923.8
  Length Wtd. (ft)            125.00   Wetted Per. (ft)
      23.85
  Min Ch El (ft)             1150.47   Shear (lb/sq ft)
       1.20
  Alpha                         1.00   Stream Power (lb/ft s)
      17.59
  Frctn Loss (ft)               0.12   Cum Volume (acre-ft)
       8.55
  C & E Loss (ft)               0.10   Cum SA (acres)
       2.13


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).
This may indicate the
need for
         additional cross sections.

CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 4364

INPUT
Description:
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0    1158   28.39 1157.99   28.99 1158.18    44.9 1157.94
51 1157.94
      66  1150.4      75 1150.26   90.36 1157.94   98.77 1157.97  133.
66 1157.91
     150  1157.8

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04      51    .016   90.36     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
            51   90.36               60      60      60             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)             1156.46   Element                    Left O
B    Channel   Right
OB
```

```
  Vel Head (ft)                 0.79   Wt. n-Val.
       0.016
  W.S. Elev (ft)            1155.67   Reach Len. (ft)              60.0
0      60.00
60.00
  Crit W.S. (ft)            1154.68   Flow Area (sq ft)
      105.00
  E.G. Slope (ft/ft)       0.001256   Area (sq ft)
      105.00
  Q Total (cfs)              750.00   Flow (cfs)
      750.00
  Top Width (ft)              30.31   Top Width (ft)
       30.31
  Vel Total (ft/s)             7.14   Avg. Vel. (ft/s)
        7.14
  Max Chl Dpth (ft)            5.41   Hydr. Depth (ft)
        3.46
  Conv. Total (cfs)         21163.7   Conv. (cfs)
     21163.7
  Length Wtd. (ft)            60.00   Wetted Per. (ft)
       32.84
  Min Ch El (ft)            1150.26   Shear (lb/sq ft)
        0.25
  Alpha                        1.00   Stream Power (lb/ft s)
        1.79
  Frctn Loss (ft)              0.07   Cum Volume (acre-ft)
        8.33
  C & E Loss (ft)              0.01   Cum SA (acres)
        2.05


Note:    Hydraulic jump has occurred between this cross section and th
e previous upstream
section.

CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 4304

INPUT
Description:
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0    1158   28.36 1157.97   28.99 1158.09      41 1157.84
51 1157.84
      66  1150.3      75 1150.16   90.36 1157.84  103.67  1157.9  132.
19 1157.72
```

```
     150  1157.7

Manning's n Values          num=        3
     Sta   n Val      Sta   n Val      Sta   n Val
       0     .04       51    .016    90.36     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
            51   90.36              125     125     125             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)              1156.38   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                  0.78   Wt. n-Val.
       0.016
  W.S. Elev (ft)              1155.61   Reach Len. (ft)             125.0
0     125.00
125.00
  Crit W.S. (ft)                        Flow Area (sq ft)
      106.14
  E.G. Slope (ft/ft)         0.001220   Area (sq ft)
      106.14
  Q Total (cfs)                750.00   Flow (cfs)
      750.00
  Top Width (ft)                30.46   Top Width (ft)
       30.46
  Vel Total (ft/s)               7.07   Avg. Vel. (ft/s)
        7.07
  Max Chl Dpth (ft)              5.45   Hydr. Depth (ft)
        3.48
  Conv. Total (cfs)           21475.8   Conv. (cfs)
     21475.8
  Length Wtd. (ft)             125.00   Wetted Per. (ft)
       33.01
  Min Ch El (ft)              1150.16   Shear (lb/sq ft)
        0.24
  Alpha                          1.00   Stream Power (lb/ft s)
        1.73
  Frctn Loss (ft)                0.15   Cum Volume (acre-ft)
        8.18
  C & E Loss (ft)                0.01   Cum SA (acres)
        2.01
```

```
CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 4179

INPUT
Description:
Station Elevation Data     num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0    1158   38.98 1157.88   50.98 1157.64      66 1150.14
75 1149.95
   90.36  1157.6   103.7 1157.68     150 1157.46

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   50.98    .016   90.36     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         50.98   90.36             89.3    89.3    89.3             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)             1156.23   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                 0.75   Wt. n-Val.
       0.016
  W.S. Elev (ft)             1155.48   Reach Len. (ft)              89.3
0      89.30
89.30
  Crit W.S. (ft)                       Flow Area (sq ft)
      108.23
  E.G. Slope (ft/ft)        0.001160   Area (sq ft)
      108.23
  Q Total (cfs)               750.00   Flow (cfs)
      750.00
  Top Width (ft)               30.80   Top Width (ft)
       30.80
  Vel Total (ft/s)              6.93   Avg. Vel. (ft/s)
        6.93
  Max Chl Dpth (ft)             5.53   Hydr. Depth (ft)
        3.51
  Conv. Total (cfs)          22022.9   Conv. (cfs)
     22022.9
  Length Wtd. (ft)             89.30   Wetted Per. (ft)
```

```
      33.37
  Min Ch El (ft)              1149.95   Shear (lb/sq ft)
       0.23
  Alpha                          1.00   Stream Power (lb/ft s)
       1.63
  Frctn Loss (ft)                0.10   Cum Volume (acre-ft)
       7.88
  C & E Loss (ft)                0.01   Cum SA (acres)
       1.92


CROSS SECTION            RIVER: RIVER-1
REACH: Reach-1              RS: 4089.5*

INPUT
Description:
Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0 1157.85   38.98 1157.73   50.98 1157.49      66 1149.99
75  1149.8
   90.36 1157.45   98.65 1157.53   103.7 1157.54     150 1157.36

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   50.98    .016   90.36     .04     150     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         50.98   90.36             89.3    89.3    89.3             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)              1156.12   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                  0.72   Wt. n-Val.
       0.016
  W.S. Elev (ft)              1155.40   Reach Len. (ft)              89.3
0      89.30
89.30
  Crit W.S. (ft)                        Flow Area (sq ft)
      110.37
  E.G. Slope (ft/ft)        0.001100   Area (sq ft)
      110.37
```

```
Q Total (cfs)                750.00   Flow (cfs)
    750.00
Top Width (ft)                31.08   Top Width (ft)
     31.08
Vel Total (ft/s)               6.80   Avg. Vel. (ft/s)
      6.80
Max Chl Dpth (ft)              5.60   Hydr. Depth (ft)
      3.55
Conv. Total (cfs)           22613.7   Conv. (cfs)
   22613.7
Length Wtd. (ft)              89.30   Wetted Per. (ft)
     33.68
Min Ch El (ft)              1149.80   Shear (lb/sq ft)
      0.23
Alpha                          1.00   Stream Power (lb/ft s)
      1.53
Frctn Loss (ft)                0.10   Cum Volume (acre-ft)
      7.65
C & E Loss (ft)                0.01   Cum SA (acres)
      1.86


CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 4000

INPUT
Description:
Station Elevation Data     num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1157.7   38.98 1157.58   50.98 1157.34      66 1149.84
75 1149.66
   90.36  1157.3   98.65 1157.41     150 1157.27

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   50.98    .016   90.36     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         50.98   90.36              100     100     100             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)            1156.01   Element                    Left O
```

```
B    Channel   Right
OB
  Vel Head (ft)                 0.69   Wt. n-Val.
       0.016
  W.S. Elev (ft)             1155.32   Reach Len. (ft)            100.0
0     100.00
100.00
  Crit W.S. (ft)                       Flow Area (sq ft)
      112.55
  E.G. Slope (ft/ft)        0.001044   Area (sq ft)
      112.55
  Q Total (cfs)               750.00   Flow (cfs)
      750.00
  Top Width (ft)               31.37   Top Width (ft)
       31.37
  Vel Total (ft/s)              6.66   Avg. Vel. (ft/s)
        6.66
  Max Chl Dpth (ft)             5.66   Hydr. Depth (ft)
        3.59
  Conv. Total (cfs)          23216.5   Conv. (cfs)
     23216.5
  Length Wtd. (ft)            100.00   Wetted Per. (ft)
       34.00
  Min Ch El (ft)             1149.66   Shear (lb/sq ft)
        0.22
  Alpha                         1.00   Stream Power (lb/ft s)
        1.44
  Frctn Loss (ft)               0.10   Cum Volume (acre-ft)
        7.42
  C & E Loss (ft)               0.01   Cum SA (acres)
        1.80
```

```
CROSS SECTION            RIVER: RIVER-1
REACH: Reach-1              RS: 3900.*

INPUT
Description:
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0 1157.45   39.17 1157.29   39.29 1157.29   51.23 1157.05    65
.9 1149.72
   66.09 1149.67      75 1149.49   90.06    1157   98.39 1157.09  107.
41 1157.12
     150 1157.01
```

```
Manning's n Values          num=        4
     Sta   n Val      Sta    n Val      Sta    n Val      Sta    n Val
       0     .04    51.23     .016    90.06     .04      150     .04

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Cont
r.   Expan.
         51.23    90.06               100      100      100              .1
       .3

CROSS SECTION OUTPUT     Profile #PF 1


  E.G. Elev (ft)              1155.90   Element                     Left O
B    Channel    Right
OB
  Vel Head (ft)                  0.66   Wt. n-Val.
       0.016
  W.S. Elev (ft)              1155.25   Reach Len. (ft)              100.0
0     100.00
100.00
  Crit W.S. (ft)                        Flow Area (sq ft)
      115.34
  E.G. Slope (ft/ft)         0.000976   Area (sq ft)
      115.34
  Q Total (cfs)                750.00   Flow (cfs)
      750.00
  Top Width (ft)                31.71   Top Width (ft)
       31.71
  Vel Total (ft/s)               6.50   Avg. Vel. (ft/s)
        6.50
  Max Chl Dpth (ft)              5.76   Hydr. Depth (ft)
        3.64
  Conv. Total (cfs)           24009.0   Conv. (cfs)
     24009.0
  Length Wtd. (ft)             100.00   Wetted Per. (ft)
       34.37
  Min Ch El (ft)              1149.49   Shear (lb/sq ft)
        0.20
  Alpha                          1.00   Stream Power (lb/ft s)
        1.33
  Frctn Loss (ft)                0.09   Cum Volume (acre-ft)
        7.16
  C & E Loss (ft)                0.01   Cum SA (acres)
        1.72


CROSS SECTION            RIVER: RIVER-1
```

```
REACH: Reach-1              RS: 3800

INPUT
Description:
Station Elevation Data     num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1157.2   39.48    1157   51.48 1156.76      66 1149.51
75 1149.33
   89.75  1156.7  107.19 1156.86     150 1156.75

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   51.48    .016   89.75     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         51.48   89.75              100     100     100             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)            1155.80   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                0.63   Wt. n-Val.
       0.016
  W.S. Elev (ft)            1155.17   Reach Len. (ft) --         100.0
0     100.00
100.00
  Crit W.S. (ft)                      Flow Area (sq ft)
      118.06
  E.G. Slope (ft/ft)       0.000916   Area (sq ft)
      118.06
  Q Total (cfs)              750.00   Flow (cfs)
      750.00
  Top Width (ft)              32.04   Top Width (ft)
       32.04
  Vel Total (ft/s)             6.35   Avg. Vel. (ft/s)
        6.35
  Max Chl Dpth (ft)            5.84   Hydr. Depth (ft)
        3.69
  Conv. Total (cfs)         24778.3   Conv. (cfs)
     24778.3
  Length Wtd. (ft)           100.00   Wetted Per. (ft)
       34.75
  Min Ch El (ft)            1149.33   Shear (lb/sq ft)
```

```
        0.19
  Alpha                          1.00   Stream Power (lb/ft s)
        1.23
  Frctn Loss (ft)                0.09   Cum Volume (acre-ft)
        6.89
  C & E Loss (ft)                0.01   Cum SA (acres)
        1.65


CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 3700.*

INPUT
Description:
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1156.9   38.74 1156.72   39.48 1156.83   51.48 1156.59
66 1149.34
      75 1149.17   89.75 1156.54   97.75 1156.66   98.61 1156.52  107.
19 1156.55
     150 1156.46

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   51.48    .016   89.75     .04     150     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         51.48   89.75              100     100     100             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)             1155.70   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                 0.59   Wt. n-Val.
       0.016
  W.S. Elev (ft)             1155.11   Reach Len. (ft)             100.0
0     100.00
100.00
  Crit W.S. (ft)                       Flow Area (sq ft)
      121.27
  E.G. Slope (ft/ft)        0.000852   Area (sq ft)
      121.27
```

```
Q Total (cfs)                750.00   Flow (cfs)
    750.00
Top Width (ft)                32.43   Top Width (ft)
     32.43
Vel Total (ft/s)               6.18   Avg. Vel. (ft/s)
      6.18
Max Chl Dpth (ft)              5.94   Hydr. Depth (ft)
      3.74
Conv. Total (cfs)          25690.2    Conv. (cfs)
   25690.2
Length Wtd. (ft)             100.00   Wetted Per. (ft)
     35.20
Min Ch El (ft)             1149.17    Shear (lb/sq ft)
      0.18
Alpha                          1.00   Stream Power (lb/ft s)
      1.13
Frctn Loss (ft)                0.08   Cum Volume (acre-ft)
      6.62
C & E Loss (ft)                0.01   Cum SA (acres)
      1.58


CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 3600

INPUT
Description:
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1156.6   38.74 1156.43   39.48 1156.67   51.48 1156.43
66 1149.18
      75    1149   89.75 1156.38   97.75 1156.54   98.61 1156.25     1
50 1156.17

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   51.48    .016   89.75     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         51.48   89.75              100     100     100             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1
```

```
  E.G. Elev (ft)              1155.61   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                  0.56   Wt. n-Val.
       0.016
  W.S. Elev (ft)              1155.05   Reach Len. (ft)             100.0
0     100.00
100.00
  Crit W.S. (ft)                        Flow Area (sq ft)
      124.65
  E.G. Slope (ft/ft)         0.000791   Area (sq ft)
      124.65
  Q Total (cfs)                750.00   Flow (cfs)
      750.00
  Top Width (ft)                32.84   Top Width (ft)
       32.84
  Vel Total (ft/s)               6.02   Avg. Vel. (ft/s)
        6.02
  Max Chl Dpth (ft)              6.05   Hydr. Depth (ft)
        3.80
  Conv. Total (cfs)          26667.8   Conv. (cfs)
     26667.8
  Length Wtd. (ft)             100.00   Wetted Per. (ft)
       35.65
  Min Ch El (ft)              1149.00   Shear (lb/sq ft)
        0.17
  Alpha                          1.00   Stream Power (lb/ft s)
        1.04
  Frctn Loss (ft)                0.08   Cum Volume (acre-ft)
        6.34
  C & E Loss (ft)                0.01   Cum SA (acres)
        1.50


CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 3500.*

INPUT
Description:
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0 1156.35   14.97  1156.3   38.55 1156.24   38.74 1156.27   39.
48 1156.51
   51.48 1156.27      66 1149.04      75 1148.83   89.75 1156.22   97.
75 1156.37
    98.6 1156.09   98.61 1156.09     150 1156.04
```

```
Manning's n Values          num=        4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   51.48    .016   89.75     .04     150     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         51.48   89.75              100     100     100             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)            1155.53   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                0.53   Wt. n-Val.
       0.016
  W.S. Elev (ft)            1154.99   Reach Len. (ft)             100.0
0     100.00
100.00
  Crit W.S. (ft)                      Flow Area (sq ft)
      127.98
  E.G. Slope (ft/ft)       0.000737   Area (sq ft)
      127.98
  Q Total (cfs)              750.00   Flow (cfs)
      750.00
  Top Width (ft)              33.25   Top Width (ft)
       33.25
  Vel Total (ft/s)             5.86   Avg. Vel. (ft/s)
        5.86
  Max Chl Dpth (ft)            6.16   Hydr. Depth (ft)
        3.85
  Conv. Total (cfs)         27627.0   Conv. (cfs)
     27627.0
  Length Wtd. (ft)           100.00   Wetted Per. (ft)
       36.11
  Min Ch El (ft)            1148.83   Shear (lb/sq ft)
        0.16
  Alpha                        1.00   Stream Power (lb/ft s)
        0.96
  Frctn Loss (ft)              0.07   Cum Volume (acre-ft)
        6.05
  C & E Loss (ft)              0.01   Cum SA (acres)
        1.43
```

```
CROSS SECTION            RIVER: RIVER-1
REACH: Reach-1              RS: 3400

INPUT
Description:
Station Elevation Data     num=       11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1156.1   14.97 1156.06   38.55 1156.04   39.48 1156.34   51.
48  1156.1
      66  1148.9      75 1148.67   89.75 1156.05   97.75  1156.2    98
.6 1155.93
     150  1155.9

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   51.48    .016   89.75     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         51.48   89.75              100     100     100             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)            1155.45   Element                   Left O
B    Channel   Right
OB
  Vel Head (ft)                0.51   Wt. n-Val.
       0.016
  W.S. Elev (ft)            1154.94   Reach Len. (ft)            100.0
0     100.00
100.00
  Crit W.S. (ft)                      Flow Area (sq ft)
      131.48
  E.G. Slope (ft/ft)       0.000686   Area (sq ft)
      131.48
  Q Total (cfs)              750.00   Flow (cfs)
      750.00
  Top Width (ft)              33.71   Top Width (ft)
       33.71
  Vel Total (ft/s)             5.70   Avg. Vel. (ft/s)
        5.70
  Max Chl Dpth (ft)            6.27   Hydr. Depth (ft)
        3.90
  Conv. Total (cfs)         28635.4   Conv. (cfs)
     28635.4
```

```
  Length Wtd. (ft)            100.00   Wetted Per. (ft)
       36.61
  Min Ch El (ft)             1148.67   Shear (lb/sq ft)
        0.15
  Alpha                         1.00   Stream Power (lb/ft s)
        0.88
  Frctn Loss (ft)               0.07   Cum Volume (acre-ft)
        5.75
  C & E Loss (ft)               0.01   Cum SA (acres)
        1.35


CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 3300.*

INPUT
Description:
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0 1155.95    14.9  1155.9   38.37 1155.84   38.53 1155.87   39.
29 1156.11
   39.67 1156.17   51.24 1156.06   65.91 1148.76   66.09 1148.71
75 1148.49
   90.06 1156.04   97.48 1156.03   98.01 1156.01   98.86 1155.82    99
.9 1155.76
     150 1155.71

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   51.24    .016   90.06     .04     150     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         51.24   90.06              100     100     100             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)             1155.37   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                 0.47   Wt. n-Val.
        0.016
  W.S. Elev (ft)             1154.90   Reach Len. (ft)             100.0
0     100.00
```

```
100.00
  Crit W.S. (ft)                          Flow Area (sq ft)
      136.05
  E.G. Slope (ft/ft)          0.000625    Area (sq ft)
      136.05
  Q Total (cfs)                 750.00    Flow (cfs)
      750.00
  Top Width (ft)                 34.21    Top Width (ft)
       34.21
  Vel Total (ft/s)                5.51    Avg. Vel. (ft/s)
        5.51
  Max Chl Dpth (ft)               6.41    Hydr. Depth (ft)
        3.98
  Conv. Total (cfs)           30004.0     Conv. (cfs)
     30004.0
  Length Wtd. (ft)               100.00   Wetted Per. (ft)
       37.18
  Min Ch El (ft)              1148.49     Shear (lb/sq ft)
        0.14
  Alpha                           1.00    Stream Power (lb/ft s)
        0.79
  Frctn Loss (ft)                 0.06    Cum Volume (acre-ft)
        5.44
  C & E Loss (ft)                 0.01    Cum SA (acres)
        1.27


CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 3200

INPUT
Description:
Station Elevation Data     num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev      S
ta    Elev
       0  1155.8   38.35 1155.64   39.48 1156.01   50.99 1156.02
66 1148.52
      75  1148.3   90.36 1156.02   97.75 1155.88  100.15 1155.59      1
50 1155.52

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   50.99    .016   90.36     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
        50.99   90.36              100     100     100              .1
```

.3

CROSS SECTION OUTPUT Profile #PF 1

```
  E.G. Elev (ft)              1155.30   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                  0.44   Wt. n-Val.
       0.016
  W.S. Elev (ft)              1154.86   Reach Len. (ft)             100.0
0     100.00
100.00
  Crit W.S. (ft)                        Flow Area (sq ft)
      141.17
  E.G. Slope (ft/ft)         0.000565   Area (sq ft)
      141.17
  Q Total (cfs)                750.00   Flow (cfs)
      750.00
  Top Width (ft)                34.75   Top Width (ft)
       34.75
  Vel Total (ft/s)               5.31   Avg. Vel. (ft/s)
        5.31
  Max Chl Dpth (ft)              6.56   Hydr. Depth (ft)
        4.06
  Conv. Total (cfs)          31555.5   Conv. (cfs)
     31555.5
  Length Wtd. (ft)             100.00   Wetted Per. (ft)
       37.81
  Min Ch El (ft)              1148.30   Shear (lb/sq ft)
        0.13
  Alpha                          1.00   Stream Power (lb/ft s)
        0.70
  Frctn Loss (ft)                0.06   Cum Volume (acre-ft)
        5.12
  C & E Loss (ft)                0.00   Cum SA (acres)
        1.19
```

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 3100.*

INPUT
Description:
Station Elevation Data num= 14

```
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
```

```
       0  1155.9   38.35 1155.75   38.37 1155.75   38.98 1155.95   39.
48 1156.03
   50.99 1155.92      66 1148.42      75  1148.2   90.36 1155.92   97.
75 1155.92
   98.36 1155.89   98.97 1155.76  100.15 1155.68     150  1155.6

Manning's n Values          num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   50.99    .016   90.36     .04     150     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         50.99   90.36              100     100     100             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)              1155.24   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                  0.43   Wt. n-Val.
       0.016
  W.S. Elev (ft)              1154.81   Reach Len. (ft)             100.0
0     100.00
100.00
  Crit W.S. (ft)                        Flow Area (sq ft)
      142.99
  E.G. Slope (ft/ft)         0.000546   Area (sq ft)
      142.99
  Q Total (cfs)                750.00   Flow (cfs)
      750.00
  Top Width (ft)                34.96   Top Width (ft)
       34.96
  Vel Total (ft/s)               5.25   Avg. Vel. (ft/s)
        5.25
  Max Chl Dpth (ft)              6.61   Hydr. Depth (ft)
        4.09
  Conv. Total (cfs)          32105.4   Conv. (cfs)
     32105.4
  Length Wtd. (ft)             100.00   Wetted Per. (ft)
       38.04
  Min Ch El (ft)              1148.20   Shear (lb/sq ft)
        0.13
  Alpha                          1.00   Stream Power (lb/ft s)
        0.67
  Frctn Loss (ft)                0.05   Cum Volume (acre-ft)
        4.80
```

```
  C & E Loss (ft)                0.00   Cum SA (acres)
       1.11


CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 3000

INPUT
Description:
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0    1156   38.37 1155.86   38.98 1156.06   50.98 1155.82
66 1148.32
      75  1148.1   90.36 1155.82   98.36 1155.98   98.97 1155.78     1
50 1155.68

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   50.98    .016   90.36     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         50.98   90.36              100     100     100             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)            1155.19   Element                   Left O
B    Channel   Right
OB
  Vel Head (ft)                0.42   Wt. n-Val.
       0.016
  W.S. Elev (ft)            1154.77   Reach Len. (ft)            100.0
0     100.00
100.00
  Crit W.S. (ft)                      Flow Area (sq ft)
      144.93
  E.G. Slope (ft/ft)       0.000526   Area (sq ft)
      144.93
  Q Total (cfs)              750.00   Flow (cfs)
      750.00
  Top Width (ft)              35.18   Top Width (ft)
       35.18
  Vel Total (ft/s)             5.17   Avg. Vel. (ft/s)
        5.17
```

```
  Max Chl Dpth (ft)              6.67   Hydr. Depth (ft)
        4.12
  Conv. Total (cfs)          32689.5   Conv. (cfs)
     32689.5
  Length Wtd. (ft)            100.00   Wetted Per. (ft)
       38.29
  Min Ch El (ft)             1148.10   Shear (lb/sq ft)
        0.12
  Alpha                         1.00   Stream Power (lb/ft s)
        0.64
  Frctn Loss (ft)               0.05   Cum Volume (acre-ft)
        4.47
  C & E Loss (ft)               0.00   Cum SA (acres)
        1.03


CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 2900.*

INPUT
Description:
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1156.1   36.51 1155.99   37.81  1156.2   38.05 1156.28   38.
41 1156.33
   50.23 1156.09   65.72 1148.36   66.26 1148.21      75    1148   91.
06 1156.06
   98.96 1156.22   99.15 1156.19   99.56 1156.06  100.72 1155.87     1
50 1155.77

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   50.23    .016   91.06     .04     150     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         50.23   91.06              100     100     100             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)             1155.13   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                 0.40   Wt. n-Val.
```

```
        0.016
  W.S. Elev (ft)              1154.73   Reach Len. (ft)              100.0
0     100.00
100.00
  Crit W.S. (ft)                        Flow Area (sq ft)
      147.01
  E.G. Slope (ft/ft)        0.000507    Area (sq ft)
      147.01
  Q Total (cfs)               750.00    Flow (cfs)
      750.00
  Top Width (ft)               35.44    Top Width (ft)
       35.44
  Vel Total (ft/s)              5.10    Avg. Vel. (ft/s)
        5.10
  Max Chl Dpth (ft)             6.73    Hydr. Depth (ft)
        4.15
  Conv. Total (cfs)          33323.2    Conv. (cfs)
     33323.2
  Length Wtd. (ft)            100.00    Wetted Per. (ft)
       38.55
  Min Ch El (ft)             1148.00    Shear (lb/sq ft)
        0.12
  Alpha                         1.00    Stream Power (lb/ft s)
        0.62
  Frctn Loss (ft)               0.05    Cum Volume (acre-ft)
        4.13
  C & E Loss (ft)               0.00    Cum SA (acres)
        0.95


CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 2800

INPUT
Description:
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1156.2   35.96 1156.11   37.48 1156.61   49.48 1156.37
66 1148.12
      75  1147.9   91.75 1156.31   99.75 1156.47   101.3 1155.96     1
50 1155.86

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   49.48    .016   91.75     .04
```

```
Bank Sta: Left    Right    Lengths: Left Channel    Right      Coeff Cont
r.   Expan.
         49.48    91.75              100      100      100              .1
       .3

CROSS SECTION OUTPUT     Profile #PF 1


  E.G. Elev (ft)              1155.08   Element                     Left O
B    Channel    Right
OB                                       .
  Vel Head (ft)                  0.39   Wt. n-Val.
       0.016
  W.S. Elev (ft)              1154.68   Reach Len. (ft)              100.0
0     100.00
100.00
  Crit W.S. (ft)                        Flow Area (sq ft)
      149.02
  E.G. Slope (ft/ft)         0.000489   Area (sq ft)
      149.02
  Q Total (cfs)               750.00   Flow (cfs)
      750.00
  Top Width (ft)               35.65   Top Width (ft)
       35.65
  Vel Total (ft/s)              5.03   Avg. Vel. (ft/s)
        5.03
  Max Chl Dpth (ft)             6.78   Hydr. Depth (ft)
        4.18
  Conv. Total (cfs)          33933.4   Conv. (cfs)
     33933.4
  Length Wtd. (ft)            100.00   Wetted Per. (ft)
       38.81
  Min Ch El (ft)             1147.90   Shear (lb/sq ft)
        0.12
  Alpha                         1.00   Stream Power (lb/ft s)
        0.59
  Frctn Loss (ft)               0.05   Cum Volume (acre-ft)
        3.79
  C & E Loss (ft)               0.00   Cum SA (acres)
        0.87


CROSS SECTION            RIVER: RIVER-1
REACH: Reach-1              RS: 2700.*

INPUT
Description:
```

```
Station Elevation Data     num=       12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0 1156.25   35.96 1156.17   36.91 1156.32   37.48 1156.51   49.
48 1156.27
      66 1148.02      75  1147.8   91.75 1156.21   99.75 1156.37  100.
28  1156.2
   101.3 1156.03     150 1155.94

Manning's n Values         num=        4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   49.48    .016   91.75     .04     150     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         49.48   91.75              100     100     100             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)            1155.03   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                0.38   Wt. n-Val.
       0.016
  W.S. Elev (ft)            1154.64   Reach Len. (ft)             100.0
0     100.00
100.00
  Crit W.S. (ft)                      Flow Area (sq ft)
      151.16
  E.G. Slope (ft/ft)       0.000470   Area (sq ft)
      151.16
  Q Total (cfs)              750.00   Flow (cfs)
      750.00
  Top Width (ft)              35.89   Top Width (ft)
       35.89
  Vel Total (ft/s)             4.96   Avg. Vel. (ft/s)
        4.96
  Max Chl Dpth (ft)            6.84   Hydr. Depth (ft)
        4.21
  Conv. Total (cfs)         34590.9   Conv. (cfs)
     34590.9
  Length Wtd. (ft)           100.00   Wetted Per. (ft)
       39.08
  Min Ch El (ft)            1147.80   Shear (lb/sq ft)
        0.11
  Alpha                        1.00   Stream Power (lb/ft s)
```

```
        0.56
  Frctn Loss (ft)                0.05   Cum Volume (acre-ft)
        3.45
  C & E Loss (ft)                0.00   Cum SA (acres)
        0.79


CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 2600

INPUT
Description:
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1156.3   36.91 1156.22   37.48 1156.41   49.48 1156.17
66 1147.92
      75  1147.7   91.75 1156.11   99.75 1156.27  100.28  1156.1     1
50 1156.02

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   49.48    .016   91.75     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         49.48   91.75              100     100     100             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)            1154.98   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                0.37   Wt. n-Val.
       0.016
  W.S. Elev (ft)            1154.60   Reach Len. (ft)             100.0
0     100.00
100.00
  Crit W.S. (ft)                      Flow Area (sq ft)
      153.38
  E.G. Slope (ft/ft)       0.000452   Area (sq ft)
      153.38
  Q Total (cfs)              750.00   Flow (cfs)
      750.00
  Top Width (ft)              36.14   Top Width (ft)
```

```
      36.14
  Vel Total (ft/s)              4.89   Avg. Vel. (ft/s)
       4.89
  Max Chl Dpth (ft)             6.91   Hydr. Depth (ft)
       4.24
  Conv. Total (cfs)          35276.8   Conv. (cfs)
     35276.8
  Length Wtd. (ft)            100.00   Wetted Per. (ft)
      39.35
  Min Ch El (ft)             1147.70   Shear (lb/sq ft)
       0.11
  Alpha                         1.00   Stream Power (lb/ft s)
       0.54
  Frctn Loss (ft)               0.04   Cum Volume (acre-ft)
       3.10
  C & E Loss (ft)               0.00   Cum SA (acres)
       0.70


CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 2500.*

INPUT
Description:
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1156.3   36.91 1156.25   37.28 1156.31   37.48 1156.34   49.
48 1156.07
      66 1147.82      75 1147.62   91.75 1156.01   99.75 1156.17   99.
78 1156.17
  100.28 1156.09     150 1156.01

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   49.48    .016   91.75     .04     150     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
        49.48   91.75              100     100     100             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)            1154.93   Element                    Left O
B    Channel   Right
```

```
OB
  Vel Head (ft)                 0.36   Wt. n-Val.
       0.016
  W.S. Elev (ft)             1154.57   Reach Len. (ft)              100.0
0     100.00
100.00
  Crit W.S. (ft)                       Flow Area (sq ft)
      155.39
  E.G. Slope (ft/ft)        0.000437   Area (sq ft)
      155.39
  Q Total (cfs)               750.00   Flow (cfs)
      750.00
  Top Width (ft)               36.38   Top Width (ft)
       36.38
  Vel Total (ft/s)              4.83   Avg. Vel. (ft/s)
        4.83
  Max Chl Dpth (ft)             6.95   Hydr. Depth (ft)
        4.27
  Conv. Total (cfs)          35889.9   Conv. (cfs)
     35889.9
  Length Wtd. (ft)            100.00   Wetted Per. (ft)
       39.62
  Min Ch El (ft)             1147.62   Shear (lb/sq ft)
        0.11
  Alpha                         1.00   Stream Power (lb/ft s)
        0.52
  Frctn Loss (ft)               0.04   Cum Volume (acre-ft)
        2.74
  C & E Loss (ft)               0.00   Cum SA (acres)
        0.62


CROSS SECTION            RIVER: RIVER-1
REACH: Reach-1             RS: 2400

INPUT
Description:
Station Elevation Data    num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1156.3   37.28 1156.27   49.48 1155.97      66 1147.72
75 1147.54
   91.75  1155.9   99.78 1156.08     150    1156

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   49.48    .016   91.75     .04
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         49.48   91.75              100     100     100             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)             1154.88   Element                   Left O
B    Channel   Right
OB
  Vel Head (ft)                 0.35   Wt. n-Val.
       0.016
  W.S. Elev (ft)             1154.53   Reach Len. (ft)             100.0
0     100.00
100.00
  Crit W.S. (ft)                       Flow Area (sq ft)
      157.53
  E.G. Slope (ft/ft)        0.000421   Area (sq ft)
      157.53
  Q Total (cfs)               750.00   Flow (cfs)
      750.00
  Top Width (ft)               36.65   Top Width (ft)
       36.65
  Vel Total (ft/s)              4.76   Avg. Vel. (ft/s)
        4.76
  Max Chl Dpth (ft)             6.99   Hydr. Depth (ft)
        4.30
  Conv. Total (cfs)         36542.3    Conv. (cfs)
     36542.3
  Length Wtd. (ft)            100.00   Wetted Per. (ft)
       39.90
  Min Ch El (ft)             1147.54   Shear (lb/sq ft)
        0.10
  Alpha                         1.00   Stream Power (lb/ft s)
        0.49
  Frctn Loss (ft)               0.04   Cum Volume (acre-ft)
        2.38
  C & E Loss (ft)               0.00   Cum SA (acres)
        0.54


CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 2300.*

INPUT
```

```
Description:
Station Elevation Data     num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1156.2   37.28 1156.17   37.31 1156.16   49.48 1155.87
66 1147.62
      75 1147.44   91.75  1155.8   99.78 1155.98     150 1155.88

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   49.48    .016   91.75     .04     150     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         49.48   91.75              100     100     100             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)             1154.84   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                 0.34   Wt. n-Val.
       0.016
  W.S. Elev (ft)             1154.50   Reach Len. (ft)             100.0
0     100.00
100.00
  Crit W.S. (ft)                       Flow Area (sq ft)
      159.96
  E.G. Slope (ft/ft)        0.000404   Area (sq ft)
      159.96
  Q Total (cfs)               750.00   Flow (cfs)
      750.00
  Top Width (ft)               36.91   Top Width (ft)
       36.91
  Vel Total (ft/s)              4.69   Avg. Vel. (ft/s)
        4.69
  Max Chl Dpth (ft)             7.06   Hydr. Depth (ft)
        4.33
  Conv. Total (cfs)          37304.1   Conv. (cfs)
     37304.1
  Length Wtd. (ft)            100.00   Wetted Per. (ft)
       40.20
  Min Ch El (ft)             1147.44   Shear (lb/sq ft)
        0.10
  Alpha                         1.00   Stream Power (lb/ft s)
        0.47
```

```
  Frctn Loss (ft)                0.04   Cum Volume (acre-ft)
        2.02
  C & E Loss (ft)                0.00   Cum SA (acres)
        0.45


CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 2200

INPUT
Description:
Station Elevation Data    num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1156.1   37.31 1156.06   49.48 1155.77      66 1147.52
75 1147.34
   91.75  1155.7   99.78 1155.88     150 1155.75

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   49.48    .016   91.75     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         49.48   91.75            77.39   77.39   77.39             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)            1154.80   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                0.33   Wt. n-Val.
       0.016
  W.S. Elev (ft)            1154.47   Reach Len. (ft)              77.3
9      77.39
77.39
  Crit W.S. (ft)                      Flow Area (sq ft)
      162.47
  E.G. Slope (ft/ft)       0.000388   Area (sq ft)
      162.47
  Q Total (cfs)              750.00   Flow (cfs)
      750.00
  Top Width (ft)              37.18   Top Width (ft)
       37.18
  Vel Total (ft/s)             4.62   Avg. Vel. (ft/s)
```

```
      4.62
  Max Chl Dpth (ft)              7.13   Hydr. Depth (ft)
      4.37
  Conv. Total (cfs)          38093.5    Conv. (cfs)
   38093.5
  Length Wtd. (ft)              77.39   Wetted Per. (ft)
     40.50
  Min Ch El (ft)             1147.34    Shear (lb/sq ft)
      0.10
  Alpha                          1.00   Stream Power (lb/ft s)
      0.45
  Frctn Loss (ft)                0.03   Cum Volume (acre-ft)
      1.65
  C & E Loss (ft)                0.00   Cum SA (acres)
      0.37


CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 2122.66*

INPUT
Description:
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0 1156.17    36.7 1156.05   37.31 1155.98   37.48 1155.96   49.
48 1155.69
      66 1147.44      75 1147.26   91.75 1155.63   99.78 1155.84  100.
17 1155.85
  139.78 1155.81     150 1155.91

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   49.48    .016   91.75     .04     150     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
        49.48   91.75            77.39   77.39   77.39             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)            1154.76   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                0.32   Wt. n-Val.
```

```
        0.016
  W.S. Elev (ft)              1154.44   Reach Len. (ft)              77.3
9       77.39
77.39
  Crit W.S. (ft)                        Flow Area (sq ft)
      164.51
  E.G. Slope (ft/ft)        0.000375    Area (sq ft)
      164.51
  Q Total (cfs)               750.00    Flow (cfs)
      750.00
  Top Width (ft)               37.39    Top Width (ft)
       37.39
  Vel Total (ft/s)              4.56    Avg. Vel. (ft/s)
        4.56
  Max Chl Dpth (ft)             7.18    Hydr. Depth (ft)
        4.40
  Conv. Total (cfs)          38741.4    Conv. (cfs)
     38741.4
  Length Wtd. (ft)             77.39    Wetted Per. (ft)
       40.74
  Min Ch El (ft)             1147.26    Shear (lb/sq ft)
        0.09
  Alpha                         1.00    Stream Power (lb/ft s)
        0.43
  Frctn Loss (ft)               0.03    Cum Volume (acre-ft)
        1.36
  C & E Loss (ft)               0.00    Cum SA (acres)
        0.30


CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 2045.33*

INPUT
Description:
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0 1156.23    36.7 1156.04   37.31  1155.9   37.48 1155.87   49.
48 1155.61
      66 1147.36      75 1147.18   91.75 1155.55   99.78  1155.8  100.
17 1155.81
  139.78 1155.85     150 1156.06

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   49.48    .016   91.75     .04     150     .04
```

```
Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Cont
r.    Expan.
          49.48    91.75              77.39   77.39    77.39              .1
        .3

CROSS SECTION OUTPUT     Profile #PF 1


  E.G. Elev (ft)              1154.73   Element                      Left O
B    Channel    Right
OB
  Vel Head (ft)                  0.31   Wt. n-Val.
       0.016
  W.S. Elev (ft)              1154.42   Reach Len. (ft)                77.3
9      77.39
77.39
  Crit W.S. (ft)                        Flow Area (sq ft)
      166.65
  E.G. Slope (ft/ft)         0.000362   Area (sq ft)
      166.65
  Q Total (cfs)               750.00    Flow (cfs)
      750.00
  Top Width (ft)               37.62    Top Width (ft)
       37.62
  Vel Total (ft/s)              4.50    Avg. Vel. (ft/s)
        4.50
  Max Chl Dpth (ft)             7.24    Hydr. Depth (ft)
        4.43
  Conv. Total (cfs)          39422.7    Conv. (cfs)
     39422.7
  Length Wtd. (ft)             77.39    Wetted Per. (ft)
       40.99
  Min Ch El (ft)             1147.18    Shear (lb/sq ft)
        0.09
  Alpha                         1.00    Stream Power (lb/ft s)
        0.41
  Frctn Loss (ft)               0.03    Cum Volume (acre-ft)
        1.06
  C & E Loss (ft)               0.00    Cum SA (acres)
        0.23


CROSS SECTION            RIVER: RIVER-1
REACH: Reach-1              RS: 1968

INPUT
```

```
Description:
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0  1156.3    36.7 1156.03   37.48 1155.77   49.48 1155.53
66 1147.28
      75  1147.1   91.75 1155.48  100.17 1155.78  139.78 1155.89     1
50 1156.22

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   49.48    .016   91.75     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         49.48   91.75           132.84  132.84  132.84             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)            1154.70   Element                   Left O
B    Channel   Right
OB
  Vel Head (ft)                0.31   Wt. n-Val.
       0.016
  W.S. Elev (ft)            1154.40   Reach Len. (ft)            132.8
4     132.84
132.84
  Crit W.S. (ft)                      Flow Area (sq ft)
      168.78
  E.G. Slope (ft/ft)       0.000350   Area (sq ft)
      168.78
  Q Total (cfs)              750.00   Flow (cfs)
      750.00
  Top Width (ft)              37.84   Top Width (ft)
       37.84
  Vel Total (ft/s)             4.44   Avg. Vel. (ft/s)
        4.44
  Max Chl Dpth (ft)            7.30   Hydr. Depth (ft)
        4.46
  Conv. Total (cfs)         40105.7   Conv. (cfs)
     40105.7
  Length Wtd. (ft)            132.84   Wetted Per. (ft)
       41.24
  Min Ch El (ft)            1147.10   Shear (lb/sq ft)
        0.09
  Alpha                        1.00   Stream Power (lb/ft s)
```

```
        0.40
  Frctn Loss (ft)                0.05   Cum Volume (acre-ft)
        0.77
  C & E Loss (ft)                0.00   Cum SA (acres)
        0.17


CROSS SECTION           RIVER: RIVER-1
REACH: Reach-1             RS: 1835

INPUT
Description:
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     S
ta    Elev
       0    1156   27.93 1155.89   28.72 1155.63   42.51  1155.4   49.
75  1155.4
   66.99 1147.11      75 1146.96   91.79 1155.35    99.9 1155.53  114.
33  1156.2
  127.76 1156.14  132.96  1157.7  139.63 1154.82  145.56 1156.82  148.
74  1155.5
     150 1155.48

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   49.75    .016   91.79     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         49.75   91.79            62.95   62.95   62.95             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)             1154.66   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                 0.31   Wt. n-Val.
       0.016
  W.S. Elev (ft)             1154.34   Reach Len. (ft)              62.9
5      62.95
62.95
  Crit W.S. (ft)                       Flow Area (sq ft)
      167.54
  E.G. Slope (ft/ft)        0.000358   Area (sq ft)
      167.54
```

Q Total (cfs)	750.00	Flow (cfs)	750.00
Top Width (ft)	37.83	Top Width (ft)	37.83
Vel Total (ft/s)	4.48	Avg. Vel. (ft/s)	4.48
Max Chl Dpth (ft)	7.38	Hydr. Depth (ft)	4.43
Conv. Total (cfs)	39623.4	Conv. (cfs)	39623.4
Length Wtd. (ft)	62.95	Wetted Per. (ft)	41.23
Min Ch El (ft)	1146.96	Shear (lb/sq ft)	0.09
Alpha	1.00	Stream Power (lb/ft s)	0.41
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	0.25
C & E Loss (ft)	0.02	Cum SA (acres)	0.05

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 1772

INPUT
Description:

BEGIN
STUDY

Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1156.2	9.35	1156.13	26.17	1155.88	40.14	1155.83	42.05	1155.47

```
   42.17  1154.1   54.05 1153.87   54.08  1145.8      75  1145.8   75.
02 1154.13
   82.97  1155.4   84.91 1156.01  104.69 1156.91  108.96 1157.58  112.
06 1155.78
  114.35  1155.1  118.48 1157.45  123.67 1157.91  129.69 1155.97     1
37 1155.86
     150  1156.4

Manning's n Values          num=        3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   40.14    .016   84.91     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Cont
r.   Expan.
         40.14   84.91                 0       0       0             .1
       .3

CROSS SECTION OUTPUT    Profile #PF 1


  E.G. Elev (ft)              1154.62   Element                    Left O
B    Channel   Right
OB
  Vel Head (ft)                  0.26   Wt. n-Val.
       0.016
  W.S. Elev (ft)              1154.36   Reach Len. (ft)

  Crit W.S. (ft)              1149.21   Flow Area (sq ft)
      183.92
  E.G. Slope (ft/ft)         0.000348   Area (sq ft)
      183.92
  Q Total (cfs)                750.00   Flow (cfs)
      750.00
  Top Width (ft)                34.31   Top Width (ft)
       34.31
  Vel Total (ft/s)               4.08   Avg. Vel. (ft/s)
        4.08
  Max Chl Dpth (ft)              8.56   Hydr. Depth (ft)
        5.36
  Conv. Total (cfs)          40209.5   Conv. (cfs)
     40209.5
  Length Wtd. (ft)                     Wetted Per. (ft)
       50.92
  Min Ch El (ft)              1145.80   Shear (lb/sq ft)
        0.08
  Alpha                          1.00   Stream Power (lb/ft s)
        0.32
  Frctn Loss (ft)                      Cum Volume (acre-ft)
```

C & E Loss (ft) Cum SA (acres)

SUMMARY OF MANNING'S N VALUES

River:RIVER-1

Reach	River Sta.	n1	n2	n3	n4
Reach-1	5993	.04	.016	.04	
Reach-1	5896.5*	.04	.016	.04	
.04					
Reach-1	5800	.04	.016	.04	
Reach-1	5729.33*	.04	.016	.04	
.04					
Reach-1	5658.66*	.04	.016	.04	
.04					
Reach-1	5588	.04	.016	.04	
Reach-1	5474	.04	.016	.04	
Reach-1	5414	.04	.016	.04	
Reach-1	5299	.04	.016	.04	
Reach-1	5281	.04	.016	.04	
Reach-1	5280	Culvert			
Reach-1	4507	.04	.016	.04	
Reach-1	4489	.04	.016	.04	
Reach-1	4364	.04	.016	.04	
Reach-1	4304	.04	.016	.04	

Reach-1	4179	.04	.016	.04
Reach-1	4089.5*	.04	.016	.04
.04				
Reach-1	4000	.04	.016	.04
Reach-1	3900.*	.04	.016	.04
.04				
Reach-1	3800	.04	.016	.04
Reach-1	3700.*	.04	.016	.04
.04				
Reach-1	3600	.04	.016	.04
Reach-1	3500.*	.04	.016	.04
.04				
Reach-1	3400	.04	.016	.04
Reach-1	3300.*	.04	.016	.04
.04				
Reach-1	3200	.04	.016	.04
Reach-1	3100.*	.04	.016	.04
.04				
Reach-1	3000	.04	.016	.04
Reach-1	2900.*	.04	.016	.04
.04				
Reach-1	2800	.04	.016	.04
Reach-1	2700.*	.04	.016	.04
.04				
Reach-1	2600	.04	.016	.04
Reach-1	2500.*	.04	.016	.04
.04				
Reach-1	2400	.04	.016	.04
Reach-1	2300.*	.04	.016	.04
.04				
Reach-1	2200	.04	.016	.04
Reach-1	2122.66*	.04	.016	.04
.04				
Reach-1	2045.33*	.04	.016	.04
.04				
Reach-1	1968	.04	.016	.04

Reach-1	1835	.04	.016	.04
Reach-1	1772	.04	.016	.04

SUMMARY OF REACH LENGTHS

River: RIVER-1

Reach	River Sta.	Left	Channel	Right
Reach-1	5993	96.5	96.5	96.5
Reach-1	5896.5*	96.5	96.5	96.5
Reach-1	5800	70.63	70.63	70.63
Reach-1	5729.33*	70.63	70.63	70.63
Reach-1	5658.66*	70.63	70.63	70.63
Reach-1	5588	114.01	114.01	114.01
Reach-1	5474	60	60	60
Reach-1	5414	115	115	115
Reach-1	5299	18.44	18.44	18.44
Reach-1	5281	773.62	773.62	773.62
Reach-1	5280	Culvert		
Reach-1	4507	18.44	18.44	18.44
Reach-1	4489	125	125	125
Reach-1	4364	60	60	60
Reach-1	4304	125	125	125
Reach-1	4179	89.3	89.3	89.3
Reach-1	4089.5*	89.3	89.3	89.3
Reach-1	4000	100	100	100
Reach-1	3900.*	100	100	100
Reach-1	3800	100	100	100
Reach-1	3700.*	100	100	100
Reach-1	3600	100	100	100
Reach-1	3500.*	100	100	100
Reach-1	3400	100	100	100
Reach-1	3300.*	100	100	100
Reach-1	3200	100	100	100
Reach-1	3100.*	100	100	100
Reach-1	3000	100	100	100
Reach-1	2900.*	100	100	100
Reach-1	2800	100	100	100
Reach-1	2700.*	100	100	100
Reach-1	2600	100	100	100

Reach-1	2500.*	100	100	100
Reach-1	2400	100	100	100
Reach-1	2300.*	100	100	100
Reach-1	2200	77.39	77.39	77.39
Reach-1	2122.66*	77.39	77.39	77.39
Reach-1	2045.33*	77.39	77.39	77.39
Reach-1	1968	132.84	132.84	132.84
Reach-1	1835	62.95	62.95	62.95
Reach-1	1772	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RIVER-1

Reach	River Sta.	Contr.	Expan.
Reach-1	5993	.1	.3
Reach-1	5896.5*	.1	.3
Reach-1	5800	.1	.3
Reach-1	5729.33*	.1	.3
Reach-1	5658.66*	.1	.3
Reach-1	5588	.1	.3
Reach-1	5474	.1	.3
Reach-1	5414	.1	.3
Reach-1	5299	.1	.3
Reach-1	5281	.1	.3
Reach-1	5280	Culvert	
Reach-1	4507	.1	.3
Reach-1	4489	.1	.3
Reach-1	4364	.1	.3
Reach-1	4304	.1	.3
Reach-1	4179	.1	.3
Reach-1	4089.5*	.1	.3
Reach-1	4000	.1	.3
Reach-1	3900.*	.1	.3
Reach-1	3800	.1	.3
Reach-1	3700.*	.1	.3
Reach-1	3600	.1	.3
Reach-1	3500.*	.1	.3
Reach-1	3400	.1	.3
Reach-1	3300.*	.1	.3
Reach-1	3200	.1	.3
Reach-1	3100.*	.1	.3
Reach-1	3000	.1	.3

Reach-1	2900.*	.1	.3
Reach-1	2800	.1	.3
Reach-1	2700.*	.1	.3
Reach-1	2600	.1	.3
Reach-1	2500.*	.1	.3
Reach-1	2400	.1	.3
Reach-1	2300.*	.1	.3
Reach-1	2200	.1	.3
Reach-1	2122.66*	.1	.3
Reach-1	2045.33*	.1	.3
Reach-1	1968	.1	.3
Reach-1	1835	.1	.3
Reach-1	1772	.1	.3

Profile Output Table - Standard Table 1

```
  Reach          River Sta          Q Total   Min Ch El   W.S. Elev   Crit
W.S.  E.G. Elev  E.G.
Slope    Vel Chnl   Flow Area   Top Width   Froude # Chl
                                   (cfs)        (ft)        (ft)
(ft)        (ft)
(ft/ft)      (ft/s)     (sq ft)       (ft)


  Reach-1        5993                719.00     1157.60     1162.46     116
1.97    1163.51
0.001884        8.21       87.62       27.92           0.82
  Reach-1        5896.5*             719.00     1157.42     1162.29
        1163.32
0.001833        8.12       88.56       28.09           0.81
  Reach-1        5800                719.00     1157.23     1162.15
        1163.13
0.001746        7.97       90.21       28.37           0.79
  Reach-1        5729.33*            719.00     1157.09     1162.04
        1163.00
0.001685        7.87       91.39       28.54           0.77
  Reach-1        5658.66*            719.00     1156.94     1161.96
        1162.88
0.001594        7.71       93.29       28.80           0.75
  Reach-1        5588                719.00     1156.80     1161.87
        1162.76
0.001519        7.57       94.95       29.03           0.74
  Reach-1        5474                719.00     1156.52     1161.76
        1162.57
```

```
0.001339        7.23       99.43       29.60          0.70
  Reach-1        5414                719.00     1156.40     1161.71
        1162.48
0.001264        7.08      101.57       29.90          0.68
  Reach-1        5299                719.00     1156.14     1161.46
        1162.32
0.001411        7.42       96.88       28.69          0.71
  Reach-1        5281                719.00     1151.77     1161.87     115
6.38    1162.13
0.000345        4.10      176.41       56.55          0.32
  Reach-1        5280               Culvert


  Reach-1        4507                719.00     1150.50     1155.13     115
5.13    1157.44
0.004636       12.22       58.84       12.79          1.00
  Reach-1        4489                750.00     1150.47     1153.90     115
4.95    1157.22
0.008959       14.64       51.24       22.36          1.70
  Reach-1        4364                750.00     1150.26     1155.67     115
4.68    1156.46
0.001256        7.14      105.00       30.31          0.68
  Reach-1        4304                750.00     1150.16     1155.61
        1156.38
0.001220        7.07      106.14       30.46          0.67
  Reach-1        4179                750.00     1149.95     1155.48
        1156.23
0.001160        6.93      108.23       30.80          0.65
  Reach-1        4089.5*             750.00     1149.80     1155.40
        1156.12
0.001100        6.80      110.37       31.08          0.64
  Reach-1        4000                750.00     1149.66     1155.32
        1156.01
0.001044        6.66      112.55       31.37          0.62
  Reach-1        3900.*              750.00     1149.49     1155.25
        1155.90
0.000976        6.50      115.34       31.71          0.60
  Reach-1        3800                750.00     1149.33     1155.17
        1155.80
0.000916        6.35      118.06       32.04          0.58
  Reach-1        3700.*              750.00     1149.17     1155.11
        1155.70
0.000852        6.18      121.27       32.43          0.56
  Reach-1        3600                750.00     1149.00     1155.05
        1155.61
0.000791        6.02      124.65       32.84          0.54
  Reach-1        3500.*              750.00     1148.83     1154.99
        1155.53
```

```
0.000737        5.86      127.98       33.25           0.53
  Reach-1        3400                 750.00     1148.67     1154.94
        1155.45
0.000686        5.70      131.48       33.71           0.51
  Reach-1        3300.*               750.00     1148.49     1154.90
        1155.37
0.000625        5.51      136.05       34.21           0.49
  Reach-1        3200                 750.00     1148.30     1154.86
        1155.30
0.000565        5.31      141.17       34.75           0.46
  Reach-1        3100.*               750.00     1148.20     1154.81
        1155.24
0.000546        5.25      142.99       34.96           0.46
  Reach-1        3000                 750.00     1148.10     1154.77
        1155.19
0.000526        5.17      144.93       35.18           0.45
  Reach-1        2900.*               750.00     1148.00     1154.73
        1155.13
0.000507        5.10      147.01       35.44           0.44
  Reach-1        2800                 750.00     1147.90     1154.68
        1155.08
0.000489        5.03      149.02       35.65           0.43
  Reach-1        2700.*               750.00     1147.80     1154.64
        1155.03
0.000470        4.96      151.16       35.89           0.43
  Reach-1        2600                 750.00     1147.70     1154.60
        1154.98
0.000452        4.89      153.38       36.14           0.42
  Reach-1        2500.*               750.00     1147.62     1154.57
        1154.93
0.000437        4.83      155.39       36.38           0.41
  Reach-1        2400                 750.00     1147.54     1154.53
        1154.88
0.000421        4.76      157.53       36.65           0.40
  Reach-1        2300.*               750.00     1147.44     1154.50
        1154.84
0.000404        4.69      159.96       36.91           0.40
  Reach-1        2200                 750.00     1147.34     1154.47
        1154.80
0.000388        4.62      162.47       37.18           0.39
  Reach-1        2122.66*             750.00     1147.26     1154.44
        1154.76
0.000375        4.56      164.51       37.39           0.38
  Reach-1        2045.33*             750.00     1147.18     1154.42
        1154.73
0.000362        4.50      166.65       37.62           0.38
  Reach-1        1968                 750.00     1147.10     1154.40
        1154.70
```

```
0.000350        4.44      168.78       37.84           0.37
  Reach-1        1835                 750.00     1146.96     1154.34
        1154.66
0.000358        4.48      167.54       37.83           0.37
  Reach-1        1772                 750.00     1145.80     1154.36     114
9.21     1154.62
0.000348        4.08      183.92       34.31           0.31
```

Profile Output Table - Standard Table 2

```
  Reach          River Sta        E.G. Elev  W.S. Elev   Vel Head  Frctn
 Loss  C & E Loss
Q Left   Q Channel     Q Right   Top Width
                                     (ft)        (ft)        (ft)
 (ft)         (ft)
(cfs)       (cfs)       (cfs)        (ft)


  Reach-1        5993                1163.51    1162.46        1.05
 0.18         0.01
719.00                   27.92
  Reach-1        5896.5*             1163.32    1162.29        1.02
 0.17         0.01
719.00                   28.09
  Reach-1        5800                1163.13    1162.15        0.99
 0.12         0.01
719.00                   28.37
  Reach-1        5729.33*            1163.00    1162.04        0.96
 0.12         0.01
719.00                   28.54
  Reach-1        5658.66*            1162.88    1161.96        0.92
 0.11         0.01
719.00                   28.80
  Reach-1        5588                1162.76    1161.87        0.89
 0.16         0.02
719.00                   29.03
  Reach-1        5474                1162.57    1161.76        0.81
 0.08         0.01
719.00                   29.60
  Reach-1        5414                1162.48    1161.71        0.78
 0.15         0.01
719.00                   29.90
  Reach-1        5299                1162.32    1161.46        0.86
 0.01         0.18
```

```
719.00                    28.69
  Reach-1       5281                1162.13    1161.87        0.26

0.01     718.92        0.07       56.55
  Reach-1       5280                Culvert

  Reach-1       4507                1157.44    1155.13        2.32
 0.04        0.44
719.00                    12.79
  Reach-1       4489                1157.22    1153.90        3.33
 0.12        0.10
750.00                    22.36
  Reach-1       4364                1156.46    1155.67        0.79
 0.07        0.01
750.00                    30.31
  Reach-1       4304                1156.38    1155.61        0.78
 0.15        0.01
750.00                    30.46
  Reach-1       4179                1156.23    1155.48        0.75
 0.10        0.01
750.00                    30.80
  Reach-1       4089.5*             1156.12    1155.40        0.72
 0.10        0.01
750.00                    31.08
  Reach-1       4000                1156.01    1155.32        0.69
 0.10        0.01
750.00                    31.37
  Reach-1       3900.*              1155.90    1155.25        0.66
 0.09        0.01
750.00                    31.71
  Reach-1       3800                1155.80    1155.17        0.63
 0.09        0.01
750.00                    32.04
  Reach-1       3700.*              1155.70    1155.11        0.59
 0.08        0.01
750.00                    32.43
  Reach-1       3600                1155.61    1155.05        0.56
 0.08        0.01
750.00                    32.84
  Reach-1       3500.*              1155.53    1154.99        0.53
 0.07        0.01
750.00                    33.25
  Reach-1       3400                1155.45    1154.94        0.51
 0.07        0.01
750.00                    33.71
  Reach-1       3300.*              1155.37    1154.90        0.47
 0.06        0.01
750.00                    34.21
```

```
  Reach-1        3200                1155.30    1154.86        0.44
 0.06        0.00
750.00                  34.75
  Reach-1        3100.*              1155.24    1154.81        0.43
 0.05        0.00
750.00                  34.96
  Reach-1        3000                1155.19    1154.77        0.42
 0.05        0.00
750.00                  35.18
  Reach-1        2900.*              1155.13    1154.73        0.40
 0.05        0.00
750.00                  35.44
  Reach-1        2800                1155.08    1154.68        0.39
 0.05        0.00
750.00                  35.65
  Reach-1        2700.*              1155.03    1154.64        0.38
 0.05        0.00
750.00                  35.89
  Reach-1        2600                1154.98    1154.60        0.37
 0.04        0.00
750.00                  36.14
  Reach-1        2500.*              1154.93    1154.57        0.36
 0.04        0.00
750.00                  36.38
  Reach-1        2400                1154.88    1154.53        0.35
 0.04        0.00
750.00                  36.65
  Reach-1        2300.*              1154.84    1154.50        0.34
 0.04        0.00
750.00                  36.91
  Reach-1        2200                1154.80    1154.47        0.33
 0.03        0.00
750.00                  37.18
  Reach-1        2122.66*            1154.76    1154.44        0.32
 0.03        0.00
750.00                  37.39
  Reach-1        2045.33*            1154.73    1154.42        0.31
 0.03        0.00
750.00                  37.62
  Reach-1        1968                1154.70    1154.40        0.31
 0.05        0.00
750.00                  37.84
  Reach-1        1835                1154.66    1154.34        0.31
 0.02        0.02
750.00                  37.83
  Reach-1        1772                1154.62    1154.36        0.26

750.00                  34.31
```

Profile Output Table - Four XS Culvert

```
  Reach          River Sta       E.G. Elev  W.S. Elev   Vel Head  Frctn
 Loss  C & E Loss
Q Left  Q Channel    Q Right  Top Width
                                   (ft)        (ft)        (ft)
 (ft)        (ft)
(cfs)      (cfs)      (cfs)       (ft)


  Reach-1        5299                1162.32    1161.46        0.86
 0.01        0.18
719.00                  28.69
  Reach-1        5281                1162.13    1161.87        0.26

0.01     718.92       0.07      56.55
  Reach-1        5280                Culvert

  Reach-1        4507                1157.44    1155.13        2.32
 0.04        0.44
719.00                  12.79
  Reach-1        4489                1157.22    1153.90        3.33
 0.12        0.10
750.00                  22.36
```

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : w_chan

River: RIVER-1 Reach: Reach-1 RS: 5299 Profile: PF 1
Warning:The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate
the need for additional cross sections.
Warning:The conveyance ratio (upstream conveyance divided by down stream conveyance) is
less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: RIVER-1 Reach: Reach-1 RS: 5280 Profile: PF 1 Culv : Culvert #1
Note: The normal depth exceeds the height of the culvert. The

program assumes that
the normal depth is equal to the height
of the culvert.

River: RIVER-1 Reach: Reach-1 RS: 4507 Profile: PF 1

Warning:The energy equation could not be balanced within the spec
ified number of
iterations. The program selected the water
surface that had the least amount of error between comput
ed and assumed values.

Warning:The velocity head has changed by more than 0.5 ft (0.15 m
). This may indicate
the need for additional cross sections.

Warning:The conveyance ratio (upstream conveyance divided by down
stream conveyance) is
less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

Warning:During the standard step iterations, when the assumed wat
er surface was set
equal to critical depth, the calculated
water surface came back below critical depth. This indic
ates that there is not
a valid subcritical answer. The
program defaulted to critical depth.

River: RIVER-1 Reach: Reach-1 RS: 4489 Profile: PF 1

Warning:The velocity head has changed by more than 0.5 ft (0.15 m
). This may indicate
the need for additional cross sections.

River: RIVER-1 Reach: Reach-1 RS: 4364 Profile: PF 1

Note: Hydraulic jump has occurred between this cross section an
d the previous
upstream section.