Palm Valley Phase 5
Bullard Wash Channel
Goodyear, Arizona

Letter of Map Revision
(LOMR)

Firm Panel No's. 04012C2060F & 04012C1595G

Date 3-23-05
FEMA Case #

Prepared For:
SunCor Development
14130 W McDowell Road
Suite A-107
Goodyear, AZ 85338

Prepared By:
Engineering and Environmental Consultants Inc.
3003 N Central Ave
Suite 600
Phoenix, Arizona 85012

Registered Professional Engineer (Civil)
CERTIFICATE NO
35920
MICHAEL J.
ROBERTS
Date signed 3/24/05
ARIZONA U.S.A.

EEC # 304013

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Back Pockets

Registered Professional Engineer (Civil)
CERTIFICATE NO
35920
MICHAEL J.
ROBERTS
Date signed 5/9/05
ARIZONA U.S.A.

INTRODUCTION

This submittal is intended to document the hydrologic and hydraulic designs for the Palm Valley Phase 5 Bullard Wash channel. Palm Valley Phase 5 is a master planned residential community located within the City of Goodyear, Maricopa County, Arizona and is within Sections 19 and a portion Section 20 of Township 2 North, Range 1 West. Refer to Figure 1 for the Vicinity and Location Map. This area is contained on FEMA FIRM Panels 04013C2060F and 04013C1595G.

Palm Valley Phase 5 encompasses approximately 684 acres of currently undeveloped agricultural row crops. The topography generally slopes northwest to southeast at approximately 0.5%. The major concentration point for this area is the existing box culvert at Bullard Wash under Indian School Road, west of Wigwam Boulevard and the pipe culverts at Camelback Road.

The Bullard Wash channel is generally located along the east 1/16 section line of Section 20, T2N, R1W, and runs from Camelback Road to Indian School Road which is approximately 1.1 miles. The new channel contains the 100year-24hour storm flood flows with at least 1 foot of freeboard.

The Maricopa County Flood Control District has recently delineated Bullard Wash between Camelback Road and Indian School Road as a Flood Hazard Zone AE. This delineation was prepared using the hydrologic results from their Loop303 White Tanks ADMS update. The Palm Valley Phase 5 design used the same HEC-1 model, modified to reflect developed conditions within Phase 5, to determine the peak flows within Bullard Wash.

The photographs on the following page show the new channel at the upstream and downstream ends. The channel is currently being landscaped that includes trees, shrubs and turf.

Since the flood flows are contained within a channel that has been dedicated as a drainage easement, floodway encroachment will not be allowed. Refer to Final Plat for Palm Valley Phase 5, Maricopa County Recorder Number 715-35 and Assessor Parcel No. 508-13-590.

Photo: 1.0
Bullard Wash Channel, looking south from Camelback Road. HEC-RAS cross section 1.909.

Photo: 2.0
Bullard Wash Channel looking at the Indian School Road culverts. HEC-RAS cross sections 1.013. (Straw bales are temporary sediment control items and will be removed when channel is landscaped.)

Photo:2.1
Bullard Wash Channel looking north from Indian School Road culverts at shotcrete drop section. HEC-RAS cross Section 1.016 thru 1.114.

FEDERAL EMERGENCY MANAGEMENT AGENCY **REVISION REQUESTER AND COMMUNITY OFFICIAL**	O.M.B No. 3067-0148 Expires April 30, 2001

Public reporting burden for this form is estimated to average 2.13 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

1. REQUESTED RESPONSE FROM FEMA

This request is for a:

☐ CLOMR A letter from FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision, or proposed hydrology changes (See 44 CFR Ch. 1, Parts 60,65 & 72).

☒ LOMR A letter from FEMA officially revising the current NFIP map to show the changes to floodplains, floodway or flood elevations. LOMRs typically decrease flood hazards. (See 44 CFR Ch. 1 Parts 60 & 65.)

☐ Other Describe: _____

2. OVERVIEW

1. The basis for this revision request is (are): (check all that apply)

☒ Physical Change ☐ Improved Methodology/Data ☐ Floodway Revision

☐ Other Describe: _____

Note: A photograph is not required, but is very helpful during review.

2. Flooding Source: CP241, CP 253 from Loop 303 ADMS Update by the Flood Control District of Maricopa County.

3. Project Name/Identifier: Palm Valley Phase 5 Bullard Wash LOMR

4. FEMA zone designations affected: AE
(example: A, AH, AO, A1-A30, A99, AE, V, V1-V30, VE, B, C, D, X)

5. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
Ex: 480301 480287	Katy, City Harris County	TX TX	480301 48201C	0005D 0220G	02/08/83 09/28/90
040046	Goodyear, Maricopa County	AZ	04013C	1595F	07/19/01
040046	Goodyear, Maricopa County	AZ	04013C	2060	07/19/01

6. The area of revision encompasses the following types of flooding and structures. Check all that apply.

Types of Flooding	Structures
☒ Riverine	☒ Channelization
☐ Coastal	☐ Levee/Floodwall
☐ Alluvial fan	☐ Bridge/Culvert
☐ Shallow Flooding (e.g. Zones AO and AH)	☐ Dam
☐ Lakes	☐ Fill
☐ Other (describe)	☐ Other (describe)

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

4. ENCROACHMENT INFORMATION

1. Does the State have jurisdiction over the floodway or its adoption by communities participating in the NFIP?
   ☐ Yes ☒ No

/es, attach a copy of a letter notifying the appropriate State agency of the floodway revision and documentation of the approval of the revised floodway by the appropriate State agency.

2. Does the development in the floodway cause the 1% annual chance (base) elevation to increase at any location by more than 0.000 feet? ☐ Yes ☒ No ☐ N/A

3. Does the cumulative effect of all development that has occurred since the effective SFHA was originally identified cause the base flood elevation to increase at any location by more than one foot (or other increase limit if community or state has adopted more stringent criteria - even if a floodway has not been delineated by FEMA)? ☐ Yes ☒ No

If the answer to either items is Yes, please attach documentation that all requirements of Section 65.12 of the NFIP regulations have been met, regarding evaluation of alternatives, notice to individual legal property owners, concurrence of CEO, and certification that no insurable structures are impacted.

5. MAINTENANCE RESPONSIBILITY

The community is willing to assume responsibility for ☐ performing ☒ overseeing compliance with the maintenance and operation plans of the Bullard Wash Channel (Name) flood control structure. If not performed promptly by an owner other than the community, the community will provide the necessary services without cost to the Federal government.

Operation and maintenance plans are attached. ☐ **Yes** ☒ **No** ☐ **N/A**

6. REVIEW FEE

The review fee for the appropriate request category has been included. ☒ Yes Fee amount: $_____

OR

This request is based on a federally sponsored flood-control project where 50 percent or more of the project's cost is federally sponsored, or the request is based on detailed hydrologic and hydraulic studies conducted by Federal, State, or local agencies to replace approximate studies conducted by FEMA and shown on the effective FIRM; thus the project is fee exempt.
☐ Yes

Please see Instructions for Fee Amounts

7. SIGNATURE

Note: **I understand that my signature indicates that all information submitted in support of this request is correct**

Thomas W Hill

Signature of Revision Requester

Thomas Hill
Printed Name and Title of Revision Requester

SunCor Development
Company Name

Telephone No.: 602-390-2375 Date: 2-1-05

Note: **Signature indicates that the community understands, from the revision requester, the impacts of the revision on flooding conditions in the community.**

David J Ramirez

Signature of Community Official

DAVID J RAMIREZ, CITY ENGINEER
Printed Name and Title of Community Official

Goodyear Arizona
Community Name

Telephone No.: 623-882-7954 Date: 5-11-05

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is in accordance with 44 CFR Ch. 1, Sect 65.2

Signature

Michael J. Roberts
Printed Name and Title of Revision Requester

Registr No. 35920 Expires (Date) 3/31/2007 State AZ

Type of License/Expertise: Civil

Check which forms have been included with this request

Form Name and (Number)	Required if ......
☒ **Hydrologic** (3)	new or revised discharges
☒ **Hydraulic** (4)	new or revised water-surface elevations
☒ **Mapping** (5)	floodplain/floodway changes
☒ **Channelization** (6)	channel is modified
☒ **Bridge/Culvert** (7)	addition/revision of bridge/culvert
☐ **Levee/Floodwall** (8)	addition/revision of levee/floodwall
☐ **Coastal** (9)	new or revised coastal elevations
☐ **Coastal Structures** (10)	addition/revision of coastal structure
☐ **Dam** (11)	addition/revision of dam
☐ **Alluvial Fan** (12)	structures proposed on alluvial fan

FEDERAL EMERGENCY MANAGEMENT AGENCY **HYDROLOGIC ANALYSIS**	O.M.B No. 3067-0148 Expires April 30, 2001

Note: Fill out one form for each flooding source studied

Community Name: City of Goodyear Arizona, Maricopa County

Flooding Source: CP241, CP253E, CP253N, 1CP241

Project Name/Identifier: Palm VAlley Phase 5 Bullard Wash Channel

1. REASON FOR NEW HYDROLOGIC ANALYSIS

☐ No existing analysis ☐ Improved data ☒ Changed physical condition of watershed

☐ Alternative methodology ☐ Proposed Conditions (CLOMR) ☐ Other

For the reason stated above, please attach a detailed explanation. If a computer program/model was used in revising the hydrologic analysis, **please provide a diskette with the input files** for the same flood recurrence intervals contained in the FIS for that stream; and at least for the 1% annual chance (base) flood where no detailed study exists.

Explanation provided: ☒ Yes ☐ No **Diskettes provided:** ☒ Yes ☐ No

2. METHODOLOGY FOR NEW ANALYSIS

Indicate Method	Required Data	Data Included
☐ Statistical Analysis of Gage Records	Form 3 - Attachment A	☐ Yes ☐ No
☐ Regional Regression Equations	Form 3 - Attachment C	☐ Yes ☐ No
☒ Precipitation/Runoff Model	Form 3 - Attachment D	☒ Yes ☐ No
☐ Other	Back-up computations and supporting data	☐ Yes ☐ No

3. APPROVAL OF ANALYSIS

The hydrologic analysis has already been approved by a local, state, or Federal Agency. ☒ Yes ☐ No ☐ Not Required

If Yes, attach evidence of approval. ☒ **Approval attached.** If No, attach explanation. ☐ **Explanation attached.**

4. COMPARISON OF BASE FLOOD DISCHARGES

Location:	Drainage Area (SqMi)	FIS(cfs)	Revised (cfs)
CP253I/CP253 (LOMR/FIS)	84.5	2640	2640
CP241	78.75	2376	2376

Note: When revised discharges are not significantly different than the FIS discharges, FEMA may require a confidence limits analysis (see attachment B) at a later date to complete the review.

If only a portion of a detailed study area was revised please attach an explanation describing the transition from the proposed discharges to the effective discharges. ☒ **Explanation included** ☐ **Explanation Not Required**

5. HISTORICAL FLOODING INFORMATION

If historical data are available for the flooding source please provide: Location, peak discharges/water-surface elevations and dates, and source of information. ☐ **Data Attached** ☒ **Data Not Available**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

ATTACHMENT D: PRECIPITATION/RUNOFF MODEL

		FIS:		Revised:	
1.	Method or model used:	HEC-1		Used Same HEC-1 Model as Existing FIS, Only revised portions that pertain to this project.	
	Version:	v4.1			
	Date:	1998			
2.	Source of rainfall depth:	Noaa Atlas 2		"	
3.	Source of rainfall distribution:	SCS Type II		"	
4.	Rainfall duration:	24 hr		"	
5.	Areal adjustment to precipitation (%):	Varies See Model		"	
6.	Maximum overland flow length	1 mile		"	
7.	Hydrograph development method:	S Graph		"	
8.	Loss rate method:	Green Ampt		"	
	Source of soils information:	NRCS Soil Surveys		"	
	Source of land use information:	Existing Zoning		"	
9.	Channel routing method:	Normal Depth		"	
10.	Reservoir routing:	☒ Yes	☐ No	" ☐ Yes	☐ No
11.	Baseflow considerations:	☐ Yes	☒ No	" ☐ Yes	☐ No

If Yes, explain below how baseflow was determined:

______

12.	Snowmelt considerations:	☐ Yes	☒ No	☐ Yes	☐ No
13.	Model calibration: **If Yes, explain below how calibration was performed**	☐ Yes	☒ No	☐ Yes	☐ No

______

14.	Future land use condition: **If Yes, explain why below**	☒ Yes	☐ No	☐ Yes	☐ No

The parcel withiin the developmen are currently being graded and built therefore the future conditions will be existing within a very short time.

15. **Attach precipitation/runoff model, hydrologic model schematic, curve number calculations, time of concentration calculations, and supporting maps, delineating the watershed boundary and drainage area divides.**

Information and Maps provided? ☐ Yes ☒ No

NOTE: FEMA policy is to base flooding on existing conditions.

FEDERAL EMERGENCY MANAGEMENT AGENCY **RIVERINE HYDRAULIC ANALYSIS**	O.M.B No. 3067-0148 Expires April 30, 2001

Note: Fill out one form for each flooding source studied

Community Name: City of Goodyear, Arizona Maricopa County

Flooding Source: CP241

Project Name/Identifier: Palm Valley Phase 5, Bullard Wash LOMR

1. REACH TO BE REVISED

Describe the limits of the revision OR submit a copy of the FIRM with the revision area clearly highlighted.
Copy of FIRM(s) attached depicting area of the revision (highlighted, or circled)? ☒ Yes

Downstream Limit: _____

Upstream Limit: _____

2. MODELS SUBMITTED

Requirements: for areas which have detailed flooding:	**for areas which do not have detailed flooding**:
Full input and output listings along with files on diskette for each of the models listed below (items 1-4) and a summary of the source of input parameters used in the models must be provided. The summary must include a description of any changes made from model to model (e.g., Duplicate Effective model to Corrected Effective model). At a minimum, the Duplicate Effective (item 1) and the Revised or Post-Project Conditions (item 4) models must be submitted. See instructions for directions on when other models may be required.	Only the 100-year (Base) flood profile is required. A hydraulic model is not required for areas which do not have detailed flooding; however, BFEs may not be added to the revised FIRM. If a hydraulic model is developed for the area, items 3 and 4 described below must be submitted.

If hydraulic models are not developed, hydraulic analyses (including all calculations) for existing or pre-project conditions and revised or post-project conditions must be submitted.

1. Duplicate Effective Model ☐ **Natural** **File Name** _____ ☐ **Floodway** **File Name** _____

Copies of the hydraulic analysis used in the effective FIS, referred to as the effective models (10-, 50-, 100-, and 500-year multi-profile runs and the floodway run) must be obtained and then reproduced on the requester's equipment to produce the Duplicate Effective model. This is required to assure that the effective models input data has been transferred correctly to the requester's equipment and to assure that the revised data will be integrated into the effective data to provide a continuous FIS model upstream and downstream of the revised reach.

2. Corrected Effective Model ☐ **Natural** **File Name** _____ ☐ **Floodway** **File Name** _____

The Corrected Effective model is the model that corrects any errors that occur in the Duplicate Effective model, adds any additional cross sections to the Duplicate Effective model, or incorporates more detailed topographic information than that used in the currently effective model. The Corrected Effective model must not reflect any man-made physical changes since the date of the effective model. An error could be a technical error in the modeling procedures, or any construction in the floodplain that occurred prior to the date of the effective model but was not incorporated into the effective model.

3. Existing or Pre-Project Conditions Model ☐ **Natural** **File Name** _____ ☐ **Floodway** **File Name** _____

The Duplicate Effective model or Corrective Effective model is modified to produce the Existing or Pre-Project Conditions model to reflect any modifications that have occurred within the floodplain since the date of the Effective model but prior to the construction of the project for which the revision is being requested. If no modification has occurred since the date of the effective model, then this model would be identical to the Corrected Effective model or Duplicate Effective model.

4. Revised or Post-Project Conditions Model ☐ **Natural** **File Name** _____ ☐ **Floodway** **File Name** _____

The Existing or Pre-Project Conditions model (or Duplicate Effective model or Corrected Effective model, as appropriate) is revised to reflect revised or post-project conditions. This model must incorporate any physical changes to the floodplain since the effective model was produced as well as the effects of the project. When the request is for the proposed project this model must reflect proposed conditions.

5. Other – Please attach a sheet describing all other models submitted along with the file names. ☐ **Natural** ☐ **Floodway**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

3. STARTING WATER-SURFACE ELEVATIONS

Explain how they were determined. Explanation Attached? ☒ Yes ☐ No

NOTE: If the effective study is an approximate study, the slope/area method is recommended.
For detailed analysis studies, using a known water-surface elevation is recommended.

4. RESULTS (from the model used to revise the 100-year water surface elevations)

If the results indicate any of the following, attach an explanation - to this form, or to the hydraulic model printout- as to the reasonableness of the situation.

☒ Supercritical depth ☐ Critical Depth ☐ Drawdowns ☐ Negative Floodway Surcharges

☐ Floodway Surcharges Greater Than Maximum Allowed by Community/State

☐ Water surface elevations higher than the end points of cross sections.

☐ Floodway discharge is different than the Natural 100-year (base) flood discharge.

☐ Project causes 100-year floodplain or floodway elevations to increase (state if increases are located off the requester's property)

Explanation attached with Form ☐ **Explanation provided on attached printout** ☒

If Hydraulic model used is HEC-2, has it been checked with FEMA'S CHECK-2 computer program? ☐ **Yes** ☒ **No**
(see instructions for information on how to obtain CHECK-2)

5. REVISED FIRM/FBFM AND FLOOD PROFILES

1. Profile Transition

a. 100-Year Water-Surface Elevations - indicate the difference in water surface elevations where the project 100-year elevations tie into the existing 100-year water surface elevations at each end of the project.

Downstream End 0.964 within 1.0 (feet) Upstream End 2.13 within 1.0' (feet)
Cross-Section # *Cross-Section #*

b. Floodway Elevations - indicate the difference in water surface elevations where the project floodway elevations tie into the existing floodway water surface elevations at each end of the project.

Downstream End 0.964 within 1.0 (feet) Upstream End 2.13 within 1.0 (feet)
Cross-Section # *Cross-Section #*

c. Floodway widths - indicate the difference in floodway widths where the project floodway widths tie into the existing floodway width at each end of the project.

Downstream End 0.964 within 10 (feet) Upstream End 2.13 within 100 (feet)
Cross-Section # *Cross-Section #*

2. Profile Checklist (check box if information has been provided on profile)

The following information (unless in parentheses) must be included at the same scale as the existing profiles for this project:

☒ Stream Name ☒ Community Name ☐ Corporate Limits labeled ☐ Study limits labeled

☐ Confluences labeled ☒ Channel Stationing ☒ Streambed profiled ☒ Cross Sections labeled

☒ Horizontal/Vertical Scales indicated ☒ 100-year elevs profiled*

☒ Road Crossings ☐ Labeled ☐ Low Chord Elevations ☒ Top of Road Elevations

*All recurrence intervals in the effective study must also be profiled.

Floodway Data Table

Attach a Floodway Data Table for each cross section listed in the published Floodway Data table in the FIS report.

Floodway Data Table Attached ☐ **Yes** ☒ **Not Required**

FEDERAL EMERGENCY MANAGEMENT AGENCY **RIVERINE / COASTAL MAPPING**	O.M.B No. 3067-0148 Expires April 30, 2001

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1.5 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Note: Fill out one form for each flooding source studied

Community Name: City of Goodyear Arizona, Maricopa County

Flooding Source: Cp241

Project Name/Identifier: Palm Valley Phase 5, Bullard Wash Channel

This is a ☒ Manual ☐ Digital submission. *Digital map submissions may be used to update digital FIRMs (DFIRMs). For updating DFIRMs, these submissions must be coordinated with FEMA Headquarters as far in advance as possible.*

1. MAPPING CHANGES

1. A topographic workmap must be submitted showing the following information (check N/A when not applicable):

a. Revised approximate 100-year floodplain boundaries (Zone A)	☐ Yes	☒ No	☐ N/A
b. Revised detailed 100- and 500-year floodplain boundaries.	☒ Yes	☐ No	☐ N/A
c. Revised floodway boundaries	☒ Yes	☐ No	☐ N/A
d. Location and alignment of all cross sections with stationing control indicated.	☒ Yes	☐ No	☐ N/A
e. Stream alignments, road alignments and dam alignments.	☒ Yes	☐ No	☐ N/A
f. Current community boundaries.	☒ Yes	☐ No	☐ N/A
g. Effective 100- year floodplain and floodway boundaries from FIRM/FBFM reduced or enlarged to the scale of the topographic workmap	☒ Yes	☐ No	☐ N/A
h. Tie-ins between the effective and revised 100-, 500-year and floodway boundaries	☒ Yes	☐ No	☐ N/A
i. The requester's property boundaries and community easements	☒ Yes	☐ No	☐ N/A
j. The signed certification of a registered professional engineer	☒ Yes	☐ No	☐ N/A
k. Location and description of reference marks	☒ Yes	☐ No	☐ N/A
l. Vertical datum (example: NGVD, NAVD)	☒ Yes	☐ No	☐ N/A
m. Coastal zone designations tie into adjacent areas not being revised	☐ Yes	☒ No	☐ N/A
n. Location and alignment of all coastal transects used to revise the coastal analyze	☐ Yes	☒ No	☐ N/A
o. V-zone has been delineated to extend landward to the heel of the primary frontal dune	☐ Yes	☒ No	☐ N/A

If any items are marked No or N/A please attach an explanation.

2. What is the source and date of the updated topographic information (example: orthophoto maps, July 1985; filed survey, May 1979, beach profile, June 1987 etc.)? Field Survey, 2003

3. What is the scale and contour interval of the following workmaps?

Effective FIS	Scale 1"=200'	Contour Interval 2'
Revision Request	Scale 1"=40'	Contour Interval 2'

NOTE: Revised topographic information must be of equal or greater detail than effective.

4. Attach an annotated FIRM/FBFM at the scale of the effective FIRM/FBFM showing the revised 100- and 500-year floodplain and the floodway boundaries and how they tie into those shown on the effective FIRM/FBFM downstream and upstream of the revisions or adjacent to the area of revision for coastal studies. **FIRM/FBFM attached?** ☒ **Yes** ☐ **No**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

2. EARTH FILL PLACEMENT

1. The fill is: ☒ Existing ☐ Proposed

2. Has fill been/will be placed in the regulatory floodway? ☒ Yes ☐ No
If Yes, please attach completed Riverine Hydraulic Analysis Form (Form 4).

3. Has fill been/will be placed in floodway fringe (*area between the floodway and 100-year floodplain boundaries*)? ☒ Yes ☐ No

If Yes, then complete A, B, C, and D below.

a. Are fill slopes for granular materials steeper than one vertical on one-and-one-half horizontal? ☐ Yes ☒ No

If Yes, justify steeper slopes _____

b. Is adequate erosion protection provided for fill slopes exposed to moving flood waters? (*Slopes exposed to flows with velocities of up to 5 feet per second (fps) during the 100-year flood must, at a minimum, be protected by a cover of grass, vines, weeds, or similar vegetation; slopes exposed to flows with velocities greater than 5 fps during the 100-year flood must, at a minimum, be protected by stone or rock riprap.)*

☐ Yes ☒ No

If No, describe erosion protection provided _____

c. Has all fill placed in revised 100-year floodplain been compacted to 95 percent of the maximum density obtainable with the Standard Proctor Test Method or acceptable equivalent method? ☒ Yes ☐ No

d. Can structures conceivably be constructed on the fill at any time in the future? ☒ Yes ☐ No

If Yes, attach certification of fill compaction (item 3c. above) by the community's NFIP permit official, a registered professional engineer, or an accredited soils engineer in accordance with Subparagraph 65.5(a)(6) of the NFIP regulations.

Fill certification attached ☐ **Yes** ☒ **No**

4. Has fill been/will be placed in a V zone? ☐ Yes ☒ No

If Yes, is the fill protected from erosion by a flood control structure such as a revetment or seawall?

☐ Yes ☐ No

If Yes, attach the Coastal Structures Form (Form 10).

FEDERAL EMERGENCY MANAGEMENT AGENCY **CHANNELIZATION**	O.M.B. Burden No. 3067-0148 Expires April 30, 2001

PUBLIC BURDEN DISCLOSURE NOTICE

Community Name: City of Goodyear Arizona, Maricopa County

Flooding Source: CP241, CP253E, CP253N, 1CP241

Project Name/Identifier: Palm Valley Phase 5, Bullard Wash Channel

1. REACH TO BE REVISED

Describe the limits of the revision **OR** submit a copy of the FIRM with the revision area clearly highlighted.
Copy of FIRM(s) attached depicting area of the revision (highlighted, or circled)? ☒ Yes

Downstream Limit: Indian School Road---See Attached Annotated Firms

Upstream Limit: Camelback Road

2. CHANNEL DESCRIPTION

Attach the following information about the channel (check box if information has been provided):

☒ Description of the inlet and outlet

☒ Description of the shape of the channel *(both cross sectional and planimetric configuration)* and its lining *(channel bottom and sides)*:

3. ACCESSORY STRUCTURES

The channelization includes:

☐ Levees *(Attach Levee/Floodwall System Analysis Form - Form 8)*
☒ Drop structures
☐ Superelevated sections
☐ Transitions in cross sectional geometry
☐ Debris basin/detention basin
☐ Energy dissipater
☐ Other (Describe):

4. DRAWING CHECKLIST

Attach the plans of the channelization certified by a registered professional engineer. The plan detail and information should include (check box if information has been provided):

☒ Channel alignment and locations of inlet, outlet, and accessory structures

☒ Channel lining

☒ Typical cross sections and profiles of channel banks and invert

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

5. HYDRAULIC CONSIDERATIONS

1. The channel was designed to carry 2770 (cfs) and/or the 100-year flood.

2. The design elevation in the channel based on:

   ☒ Subcritical flow

   ☐ Critical flow

   ☐ Supercritical flow

   ☐ Energy grade line

3. **If there is the potential for a hydraulic jump at the following locations, check the box(es) that apply and attach an explanation of how the hydraulic jump is controlled without affecting the stability of the channel.**

Inlet to channel?	☐ Yes
Outlet of channel?	☐ Yes
At Drop Structures?	☒ Yes
At Transitions?	☐ Yes
Other locations?	☐ Yes

Explanation Attached? ☒ **Yes** ☐ **No** ☐ **N/A**

6. SEDIMENT TRANSPORT CONSIDERATIONS

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the 100-year (base flood) water-surface elevations; and/or based on the stream geomorphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including sewer and deposition) to affect the base flood water-surface elevations, then provide the following information **(Check the box if provided):**

☐ Estimated sediment load

☐ Method used to estimate sediment transport

☐ Method used to estimate scour and/or deposition

☐ Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport

FEDERAL EMERGENCY MANAGEMENT AGENCY **BRIDGE/CULVERT**	O.M.B. Burden No. 3067-0148 Expires April 30, 2001

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Community Name: City of Goodyear, Arizona Maricopa County

Flooding Source: CP241

Project Name/Identifier: Palm Valley Phase 5, Bullard Wash LOMR

1. IDENTIFIER

1. Name of structure (roadway, railroad, etc.): Camelback Road Culverts

2. Location of bridge/culvert along flooding source (in terms of stream distance or cross-section identifier):

   Cross Section 2.09

3. This revision reflects (check one of the following):

   ☒ New bridge/culvert not modeled in the FIS

   ☐ Modified bridge/culvert previously modeled in the FIS

   ☐ New analysis of bridge/culvert previously modeled in the FIS

4. Hydraulic model used to analyze the structure *(e.g., HEC-2 with special bridge routine, WSPRO, HY8)*

   HEC-RAS

   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structure(s). *(Attach justification)*

   Justification attached ☐ **Yes** ☐ **No** ☒ **N/A**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

2. DRAWING CHECKLIST

Attach plans of the structure(s) certified by a registered professional engineer. The plan detail and information should include the following (check the boxes if the information has been provided):

- ☒ Dimensions (height, width, span, radius, length)
- ☒ Shape (culverts only)
- ☒ Material
- ☒ Beveling or Rounding
- ☒ Wing Wall Angle
- ☒ Low Chord Elevations - Upstream and Downstream
- ☒ Top of Road Elevations - Upstream and Downstream
- ☒ Structure Invert Elevations - Upstream and Downstream
- ☒ Stream Invert Elevations - Upstream and Downstream
- ☒ Skew Angle
- ☒ Cross-Section Locations
- ☒ Distances Between Cross Sections
- ☐ Erosion Protection

3. SEDIMENT TRANSPORT CONSIDERATIONS

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the 100-year (base flood) water-surface elevations; and/or based on the stream geomorphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including sewer and deposition) to affect the base flood elevations, then provide the following information **(Check the box if provided):**

- ☐ Estimated sediment load
- ☐ Method used to estimate sediment transport
- ☐ Method used to estimate scour and/or deposition
- ☐ Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport

OFFSITE DRAINAGE REPORT

for

PALM VALLEY

PHASE 5

August 2004

APPROVED
BY _______ DATE 9/22/04
CITY OF GOODYEAR
FOR CITY ENGINEER

Prepared for:
SunCor Development
1616 North Litchfield Road
Goodyear, Arizona 85338
Contact: Tom Hill
Phone: (623) 390-2375

Prepared by:
Engineering & Environmental Consultants, Inc.
3003 North Central Avenue, Suite 600
Phoenix, Arizona 85012
Contact: Mike Roberts
Phone: (602) 248-7702

Registered Professional Engineer (Civil)
CERTIFICATE NO
35920
MICHAEL J.
ROBERTS
Date Signed 8.31.04
ARIZONA U.S.A.

TABLE OF CONTENTS

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ROBERTS
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ARIZONA, U.S.A.

1.0 Introduction

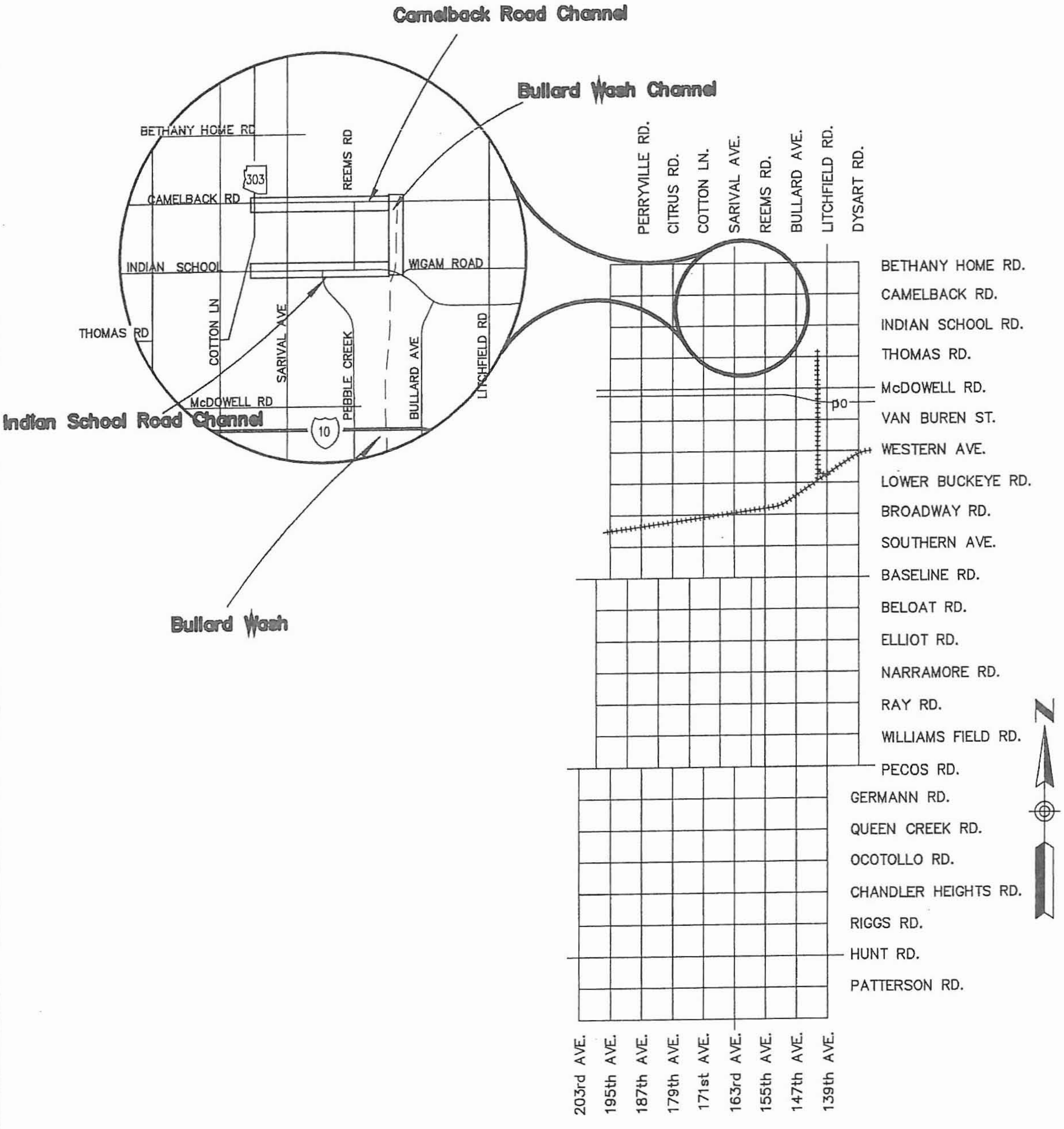
This report is intended to document the hydrologic and hydraulic designs for the Palm Valley Phase 5 perimeter channels; the Bullard Wash channel the Indian School Road channel and the Camel Back Road channel. Palm Valley Phase 5 is a master planned residential community and is located within the City of Goodyear, Maricopa County, Arizona and is within Sections 19 and a portion Section 20, Township 2 North, Range 1 West. Refer to Figure 1 for the Vicinity and Location Map.

Palm Valley Phase 5 encompasses approximately 684 acres of currently undeveloped agricultural row crops. The topography generally slopes northwest to southeast at approximately 0.5%. The major concentration point for this area is the existing box culvert at Bullard Wash under Indian School Road, west of Wigwam Boulevard.

The proposed Camelback Road channel is located along the south side of Camelback Road from the Loop 303 east to the Bullard Wash channel and is approximately 2.2 miles long. The proposed Bullard Wash channel is generally located along the east 1/16 section line of Section 20, T2N, R1W, and runs from Camelback Road to Indian School Road and is approximately 1.1 miles long. The proposed Indian School Road channel is located along the north side of Indian School Road and runs from approximately ½ mile east of the Loop 303 to the existing box culverts at Indian School Road and is approximately 1.8 miles long.

1.1 Existing Floodplain

The southern portion of the Bullard Wash channel and the eastern portion of the Indian School Road channel lie within a Federal Emergency Management Association (FEMA) Flood Hazard Zone AE , as shown on FIRM Panel Number 04013C2060 F, Revised July 19, 2001. Refer To Figure 1A for a portion of the Flood Insurance Rate Map (FIRM). It should be noted that the peak discharge for the existing flood plain has been reduced due to recent drainage improvements in the upstream watershed. More specifically, new improvements to the Dysart Drain channel, within the offsite drainage area, will prevent flood flows from overtopping the channel and flowing south into Bullard wash.



VICINITY MAP

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FIGURE NO. 1

eec
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Phoenix, Arizona 85012-2905
TEL:(602)248-7702 FAX:(602)248-7851

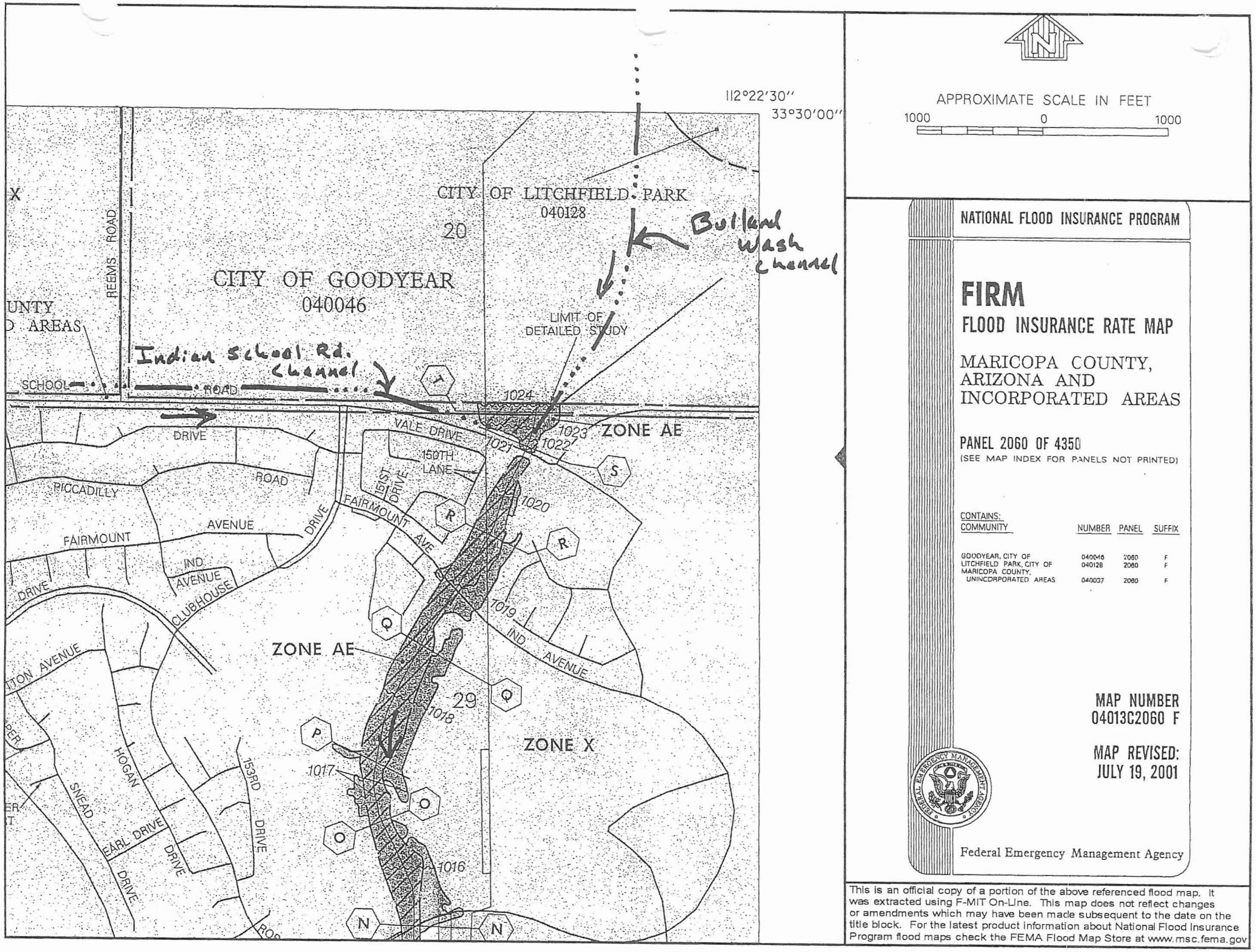

FIGURE 1A

3 of 19

2.0 Hydrologic Analysis

The drainage concept for the Palm Valley Phase 5 project area was originally developed in the Palm Valley Master Drainage Report prepared by the WLB Group Inc. for SunCor Development. However, since that report was completed, the Flood Control District of Maricopa County (FCD) updated the White Tanks/Aqua Fria Area Drainage Master Plan (ADMP) now called the Loop 303 Corridor White Tanks ADMP. Along with the FCD changes, SunCor Development has revised the land-use plan for this area. Peak discharges are determined using Army Corps of Engineers HEC-1 v4.01 software.

The ADMP model revisions included: modifying the “xksat” parameters for all subbasins, incorporating improvements to the Dysart Drain channel and revising the hydrologic characteristics for those subbasins that have had land use changes since the original ADMP was completed. In addition to these changes, the FCD used this HEC-1 model to develop a drainage plan for the future Loop 303 freeway. The Loop 303 drainage plan is to capture the stormwater runoff that concentrates along the west side of the road and convey it to the south in a series of new channels and retention basins.

SunCor Development has revised its land use plan due to changes in the Luke Air Force base’s noise contour lines. The proposed development follows the noise contours from the northeast at Camelback Road to the southwest at Indian School Road. At this time, the area north of the noise contour will remain as agricultural until SunCor Development creates a land use plan that is acceptable to the City (see Exhibit 2). If future Land Use differs, the modified areas will need to be analyzed to determine if stormwater retention volumes need to be revised.

Peak discharges were estimated using the Army Corp of Engineers HEC-1, v4.01 software. The FCD’s HEC-1 model, L303m7K.dat, was used as the base model for the existing and developed conditions HEC-1 model for Palm Valley Phase 5. The unit hydrographs were developed using the FCD’s Drainage Design Menu System software.

It should be noted that, the FCD’s future drainage plan for the Loop 303, diverts and reroutes a portion of the offsite runoff away from Palm Valley Phase 5. Especially those inflows into the Indian School Road channel and Camelback Road channel that originate west of the Loop 303. It is anticipated that portions Palm Valley Phase 5 will begin construction next year, which will be well ahead of the Loop 303 improvements. A significant portion of the offsite flow impacting Palm Valley is generated from the watershed due north of the site, which will not be affected by the Loop 303 improvements. Therefore, Phase 5 will need to be protected from this offsite runoff from the north, even after the FCD improvements. The flood protection provided by from the proposed FCD improvements were <u>not</u> included the drainage design for Phase 5.

Consequently, at some point in the future after the Loop 303 improvements, the Camelback Road and Indian School Road channels will be somewhat oversized. Refer to Figure 2 for the offsite drainage area map.

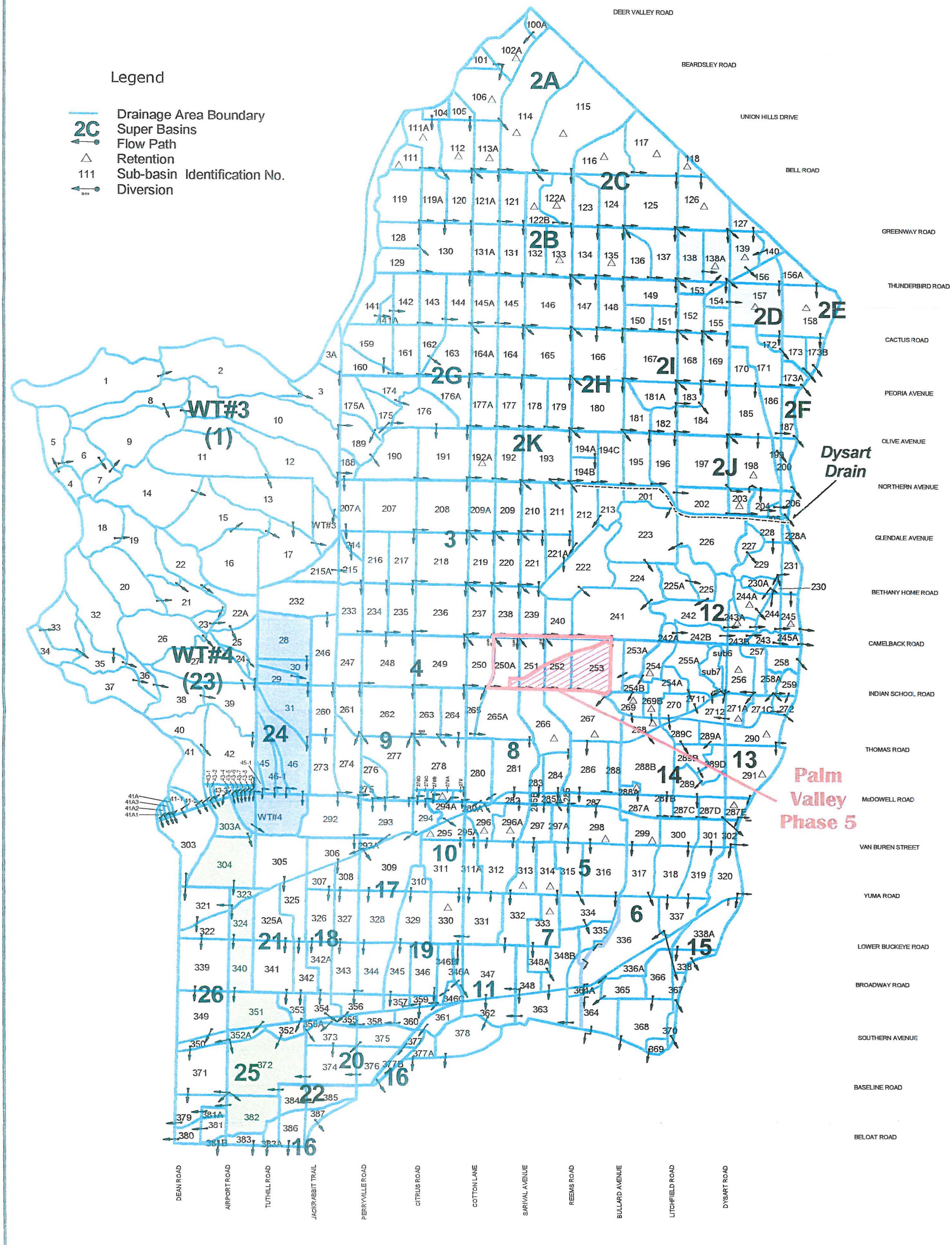

Figure No. 2
Existing Conditions Drainage Area Map

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3003 N. Central Ave, Suite 600
Phoenix, Arizona 85012

2.1 Developed Conditions Model

The revisions to the existing conditions FCD HEC-1 model, used to reflect developed conditions within the Phase 5 site include:

1. Combining and routing the stormwater runoff that spills over Camelback Road and diverting it to Bullard Wash.

2. Revising the existing conditions subbasins within Phase 5 to reflect developed conditions.

3. Revising the HEC-1 channel routes for the Bullard Wash Channel, Indian School Road Channel and the Camelback Road Channel to reflect the proposed improvements.

<u>HEC-1 model parameters for the revised subbasins</u>:

- 100-year, 24-hour, S-Graph for the unit hydrograph.
- Point rainfall depth 4.03 inches.
- Green and Ampt rainfall loss method.
- Normal Depth for hydrograph routing.

The following table are the Green and Ampt rainfall loss parameters used to model the revised onsite subbasins.

Table 2.1

Land Use	Dtheta Conditions	% Veg Cover	Rtimp	Ia	Kn
OPEN	NORMAL	10	0	0.1	0.02
V.L.D.R	NORMAL	30	5	0.3	0.05
L.D.R.	NORMAL	50	15	0.3	0.05
M.D.R.	NORMAL	50	30	0.25	0.05
M.F.R.	NORMAL	50	45	0.25	0.05
Ind	NORMAL	60	55	0.15	0.03
Comm	NORMAL	75	80	0.1	0.02
Park	NORMAL	90	0	0.2	0.1
RowCrop	WET	85	0	0.5	0.1

V.L.D.R.-very low density residential, L.D.R-low density residential, M.D.R.-medium density residential, M.F.R.-multi-family residential, Ind.- industrial, Comm- commercial.

Descriptions:

Land use - Type of proposed development.
Dtheta - Soil Moisture condition.
% Veg Cover - % of vegetative cover (excluding impervious areas).
Rtimp - % of impervious area.
Ia - Initial rainfall abstraction (inches)
Kn - Basin flow roughness characteristic.

HEC-1 subbasins 250A, 251, 252, and 253 are the existing conditions subbasins that have been modified to account for the proposed development. Proposed Land Uses were obtained from the Palm Valley Phase 5 Land Use plan and are shown on the Onsite Drainage Area Map (Exhibit No. 2). Those areas within subbasins 250A, 251, 252, and 253 that are not within Phase 5 will remain as agricultural.

Along with accounting for the new land uses, onsite stormwater detention/retention for the 100 year-6 hour storm was input for each onsite drainage basin. The volumes were calculated using the FCD's Rational Method coefficients with the flowing equation:

$V_r = CIA$ (ac-ft)

V_r – Volume required
I – 100 yr.-6hr. Rainfall Depth (in/12)
C – Runoff coefficient
A – Contributing Drainage Area (ac)

The new detention basins were modeled as storage routes within HEC-1. The out flows were then routed to the nearest offsite channel and then combined with the offsite flows. Refer to Appendix 1 for the detention/retention volume and outlet capacity calculations. Keogh Engineering will prepare specific onsite drainage reports for each parcel which will include the detention basin volumes configurations and basin drainage systems.

Since the HEC-1 model output is very large (2.5 MB or 500 pages) it was not printed out for this report. It has been copied onto a compact disk and is attached to the back cover of this report. Table 2.2 is a summary of the peak discharges that impact the Phase 5 site. Refer to Appendix 1 for Table 2.2.

The existing and proposed conditions peak discharge at Bullard Wash and Indian School Road is 2640 cfs. Under existing conditions, floodwaters tend to sheet flow across the agricultural fields, which results in longer travel times and corresponding lower peak discharges. Channeling the flows along Camelback Road results in shorter travel times, hence higher peak discharges. Moreover, the original design flow for the culverts at Indian School Road, as well as the downstream Pebble Creek golf course channel, was 4,120 cfs. In addition, the new channels currently being designed and constructed by the Flood Control District downstream of I-10 are designed for 3200 cfs, which is also greater than the 2640 cfs predicted with this study. To make sure that the proposed condition peak discharges, with the Phase 5 channels in place, do not rise above the 3200 cfs threshold, the HEC-1 model included Bullard Wash and its tributaries down to its outfall into the Gila River.

In order to maintain existing conditions peak flow at the Bullard Wash Indian School Road culvert, an offline weir and storage basin along the west bank of Bullard Wash is to be added. The weir will capture 280 cfs from the peak of inflow hydrograph within Bullard Wash. A new park will act as the detention basin and will need to store 15 acre-feet of runoff. Keogh Engineering is currently designing the park basin and weir section. It should be noted that the weir is designed to capture runoff from the peak of the 100 year event, therefore the park will only be impacted by Bullard Wash flows during the 100 year storm.

Table 2.2

Retention Volume Summary

Basin ID	Volume Required	Min. Drain Rate
	(ac-ft)	CFS
250B	7.0	2.3
251B	6.1	2.0
251C	3.1	1.0
252B	23.7	8.0
252C	4.2	1.4
253B	8.8	3.0
253C	18.1	6.1
253D	6.1	2.0
253E	6.1	2.0
253F	11.8	4.0
253G	6.2	2.1
253H	3.7	1.2
253J	12.6	4.2
253K	2.0	0.7

Note : Keogh Engineering has prepared a separate drainage report for each parcel which includes the onsite retetion volumes and outlet flows.

3.0 Hydraulic Design

The proposed drainage structures were designed using the 100-year, 24-hour peak discharges from the HEC-1 model. Three HEC-RAS models were developed to design the proposed channels and culverts for Phase 5.

The channels will be constructed within new drainage easements, which are to be dedicated by the property owners.

The following HEC RAS parameters were used in the hydraulic design.

Manning's "n": 0.030 for the Landscaped channels.
0.022 for Shotcrete bank protected sections of the channels.
0.04 for overbank areas.

Expansion/Contraction Coefficients: 0.1/0.3 normal channel section, 0.5/1.0 at the culvert sections.

Culvert Analysis: HEC RAS, v3.0.1, software set to the highest loss equations at the culverts.

The channels have been designed using the FCD Drainage Design Manual Volume II recommendations. The flow in the channels have Froude numbers below 0.8. with one exception, at the drop structure in Bullard Wash. The drop structure will be shotcrete lined for erosion protection.

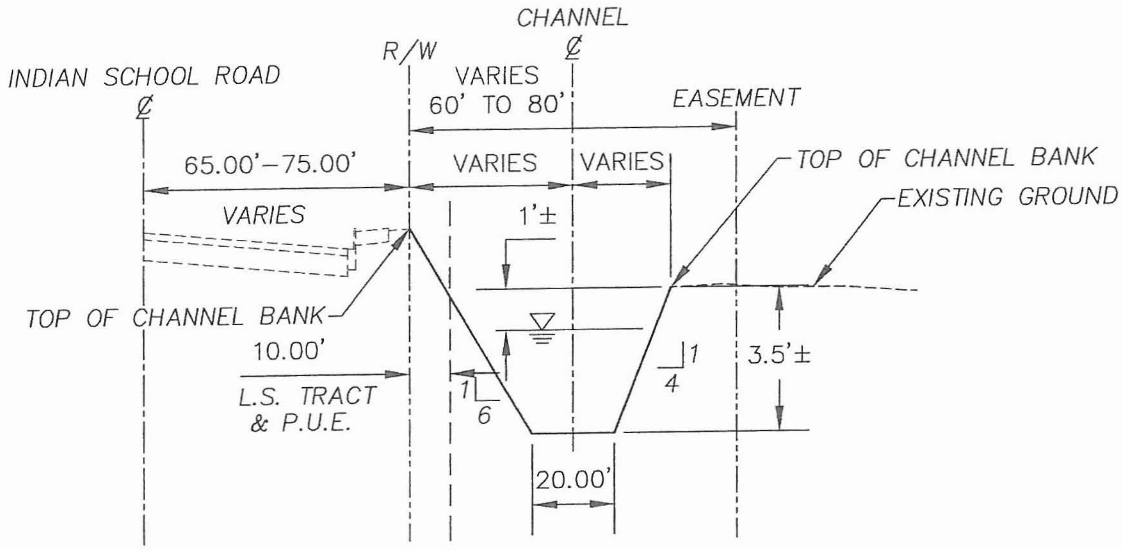
Channel velocities are generally between 3 fps and 6 fps. Section 3.1 through 3.3 are brief descriptions of the specific channel and culvert design. Refer to Exhibits 2 thru 5 for the HEC-RAS cross section locations and Appendix 2 for the HEC-RAS model output reports.

3.1 Indian School Road Channel

The Indian School Road channel will convey the 100 year-24 hour peak flow that concentrates along the north side of Indian School Road. With the new Camelback Road channel in place, the flood flows along Indian School Road are reduced from 1500cfs down to approximately 350cfs. Therefore, the Camelback Road channel will need to be constructed prior to the occupancy of the Phase 5 units. The majority of the remaining peak discharge comes from west of the Loop 303.

In addition, the peak flows along Indian School were also reduced by an offline retention basin north of the LDN road. This basin will capture all but 40 cfs of the peak flows. The remaining 40cfs is conveyed along Pebble Creek Parkway, within a roadside channel, and outfalls into the Indian School Road channel. This reduced the flows to approximately 270cfs for the 100year-24 hour event.

There will be six box culvert crossings. They are at Sarival Road, Pebble Creek Parkway, 155th Ave, Reems Road and Clubhouse Drive and the new park entrance. The typical channel section will be trapezoidal with 6H:1V side slopes along the south Right of Way line and 4H:1V side slopes along the north channel bank. The bottom width is fairly constant at 20 feet. The south top of channel bank generally follows the new right of way line for Indian School Road. Longitudinal channel slopes vary from 0.30 % to 0.39%. Figure 3.1 is a typical section of the Indian School Road Channel.



INDIAN SCHOOL ROAD CHANNEL
TYPICAL SECTIONS

NTS

FIGURE NO. 3.1

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3.2 Bullard Wash Channel

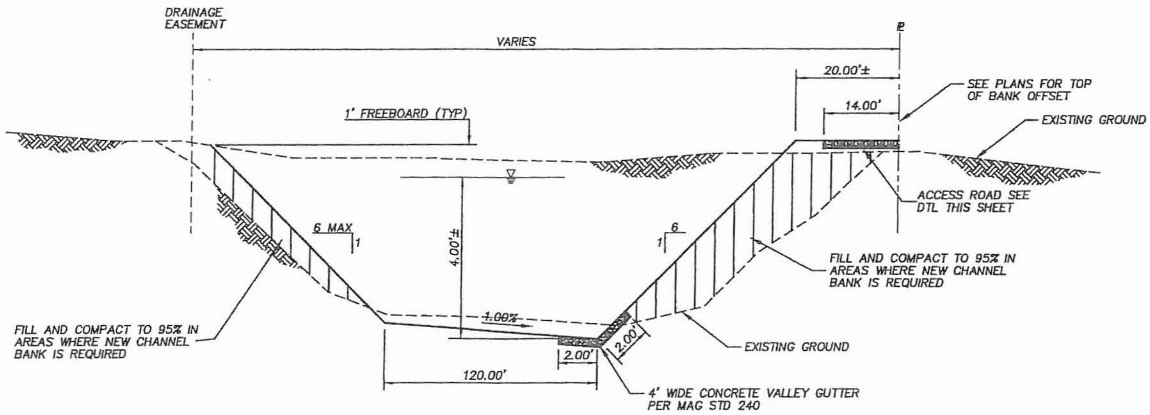
The Bullard Wash channel will convey the 100 yr- 24 hr flood flows within the channel banks. The peak flow in the channel is approximately 2,780 cfs. The typical channel section will be trapezoidal with 6H:1V side slopes along both sides. The channel bottom is sloped at 1.0% towards the east bank, as requested by the City. Longitudinal channel slopes vary from 0.29% to 0.38%.

The bottom width varies between 120 feet and 140 feet. The bottom width is 140 feet from Camelback Road south to the dog leg at channel station 26+00 then tapers into 120 feet wide bottom width to the culverts at Indian School Road. The overall channel top width varies between 160 feet to 200 feet.

An lateral weir will capture 280cfs during peak of the flows within Bullard Wash. It will discharge into an offline retention basin within the proposed park at the south end of the channel. The weir is designed by Keogh Engineering and will have a 120 foot bottom width with 6:1 side slopes and will be bank protected by either shotcrete or reinforced turf. The flow remaining in the channel after the weir is 2,495 cfs.

At the downstream end of the channel, there is a proposed shotcrete drop structure. The structure has a 100 foot bottom width and 6H:1V side slopes. The drop is approximately 5 feet and will have approximately 19% slope. Erosion protection will be 6" thick shotcrete reinforced lining starting at the Indian School Road culverts upstream to 10 feet beyond the top of the Bullard Wash drop structure. The Indian School Road channel's flow line will connect into the bottom of the drop structure. Refer to Appendix 2 for the drop structure hydraulic design calculations.

A 24 inch diameter drain pipe is to be installed in the west bank of the channel. This pipe will convey irrigation tail water that flows into the channel at the north end. The tail water originates from the farm fields north of Camelback Road. Currently, there is an earthen ditch that carries this flow from Camelback Road into the existing tail water pipe at Indian School Road. Figure 3.2 is a typical section of the Bullard Wash channel. The City will maintain this drainage tract as a linear park and will be responsible for the maintenance.

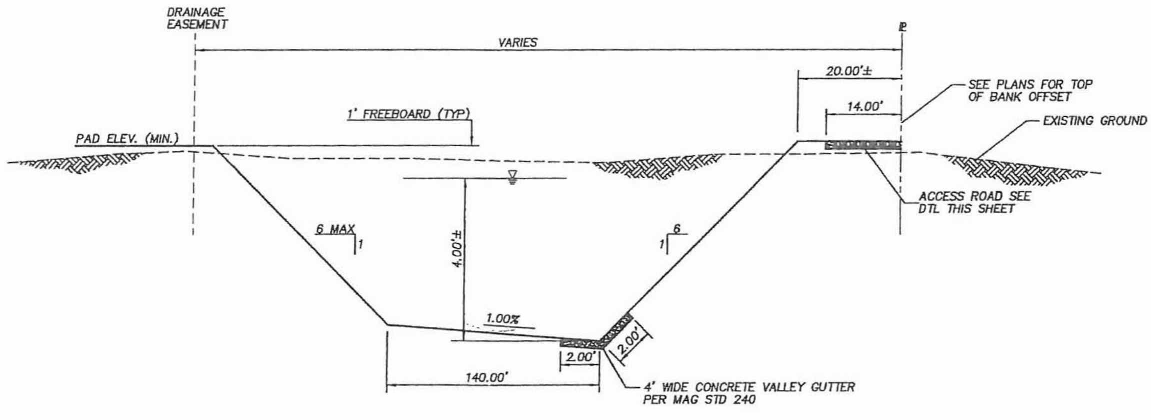


SECTION 1

STA 12+00 TO STA 26+00

TYPICAL CHANNEL SECTION

NTS



SECTION 2

STA 27+00 TO STA 62+00

TYPICAL CHANNEL SECTION

NTS

BULLARD WASH TYPICAL SECTIONS

NTS

FIGURE NO. 3.2

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3.3 Camelback Road Channel

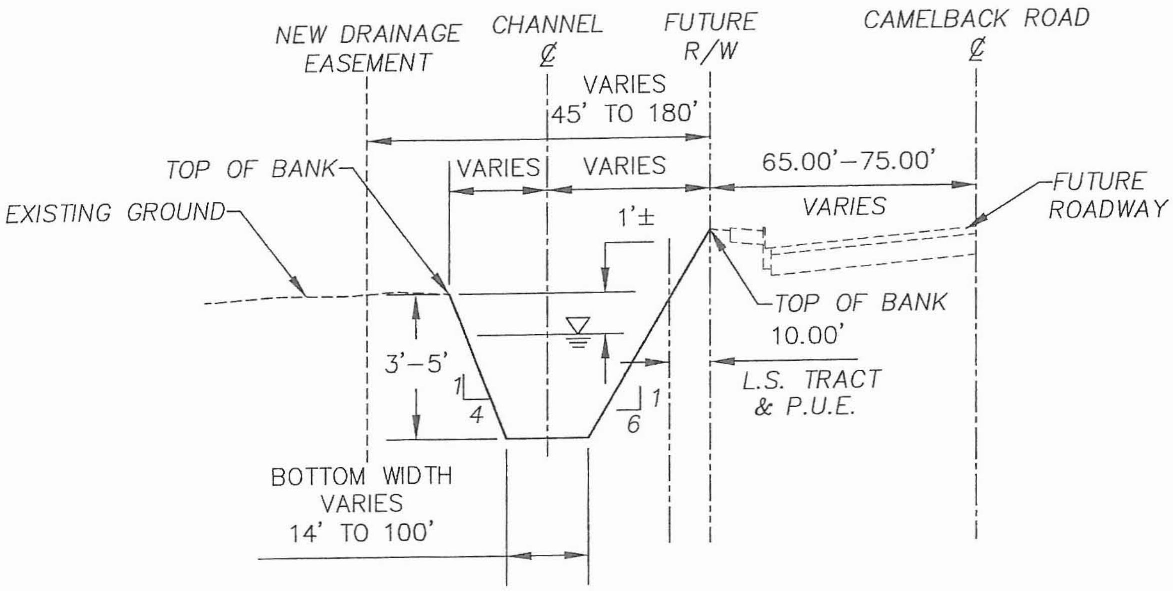
The Camelback Road channel will convey the 100-year, 24-hour peak flows that overtop Camelback Road between the Loop 303 and Bullard Wash The channel will follow the south side of the future 65 foot Right of Way line for Camelback Road. There is one culvert crossings anticipated for this channel at this time. The design flows vary between 200 cfs at the Loop 303 to 1742 cfs flowing into Bullard Wash.

The typical channel section will be trapezoidal and will have 6H:1V side slopes along its north side and 4H:1V along the south channel bank. The new Right of Way for Camelback Road is assumed to be 65 feet in the future. Turn lanes and roadway tapers are assumed to be similar to those used in the new Indian School Road designed by Keogh Engineering. Figure 3.3 is a typical section of the Camelback Road channel.

At this time, there is one planned culvert crossing onto Camelback Road. It is at Club House Drive. The other crossings, Sarival Road and Reems Road are intended to be dip sections that will only be used the local farmer. When this area develop, in the future, the crossings will be designed with box culverts.

Sarival Road and Reems Road are to be abandoned therefore culvert crossings were not designed at this time. The channel does however have dip sections crossing that will allow the local farmer to use these as access points to the farm fields south of the channel. In the future, when the channel crossings are built, the channel flows will have to be re-analyzed due to the FCD's plan to divert flows from the west. The diversion will probably reduce the peak discharges by several hundred cfs. If the crossings are built prior to the FCD improvements then the flows in this report will govern the culvert design.

Table 3.1 is a summary of the proposed structures and refers to Appendix 2 for the HEC-RAS models and summary tables. See exhibit 1A for Bullard Wash channel and exhibit 1B for Indian School Road channel.



CAMELBACK ROAD CHANNEL
TYPICAL SECTIONS

NTS

FIGURE NO. 3.3

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Table 3.1
New Structure Summary

Location	Structure	Design Discharge (cfs)
Indian School Road Channel		
Sarival Road & Indian School Road, Station 43+50	2-10' x 3' Box Culverts W/ Headwalls	270
155th Avenue & Indian School	2-10' x 4'Box Culverts W/ Headwalls	270
Pebble Creek Parkway & Indian School Road, Station 60+00	2-10' x 3' Box Culverts W/ Headwalls	270
Reems Road & Indian School Road, Station 95+50	2-8' x 4'Box Culverts W/ Headwalls	270
Park Entrance & Ind. School Road	2-8' x 4'Box Culverts W/ Headwalls	270
Clubhouse Drive & Indian School Road, Station 113+50	2-10' x 4' Box Culverts W/ Headwalls	270
Existing Culverts At Indian School Road and Bullard Wash	*10-10' x 5' Box Culverts W/ Headwalls*	4,000
Bullard Wash Channel		
Bullard Wash at Camelback Road Box Culverts	8-10' x 4' x 134 Box Culverts	2375
Camelback Road Channel		
Camelback Road & 152nd Avenue	8 - 10' x 4' Box Culverts W/Headwalls	1742

4.0 Conclusions

1. The proposed channels and culverts adjacent to Palm Valley Phase 5 will convey the 100 year- 24 hour flows.

2 The estimated developed condition peak discharge at the outfall point from Phase 5, which is the box culvert Bullard Wash at Indian School Road, is less than or equal to the existing condition peak discharge.

4 The proposed channel banks have at least 1 foot of freeboard, therefore as long as the building pads and FFE are built at or above the channel banks they will be above 100-year, 24-hour water surface elevation.

5.0 References

1. *White Tanks/Agua Fria ADMS*, by the FCD, dated May, 1992.

2. *Palm Valley Master Drainage Study*, by The WLB Group, dated August, 1998.

3 *Engineering Design Standards and Policies Manual,* City of Goodyear, July 22, 1997.

3 *Drainage Design Manuals for Maricopa County Volumes I & II*, Flood Control District Maricopa County, Arizona.

4 *Loop 303 Corridor / White Tanks ADMP Update*, HEC-1 model L303M7K.dat, Dated 9-30-02, Flood Control District.

5 *Open Channel Hydraulics*, Ven Te Chow, Dated 1959.

Appendix 1.0

Palm Valley Phase 5
HEC-1 Summary Output

HEC-1 ID	Q_{100} cfs	Time min	Area mi^2
247	303	13.08	0.5
248	471	13.25	1
249	514	13.25	1
250	294	13.08	0.49
267	1412	12.42	1.19
1CP238	376	15.25	30.34
1CP239	1742	15.75	32.16
1CP241	2780	16.08	78.75
1CP251	25	13.42	0.55
1CP253	39	12.75	0.37
1D238	41	15.33	30.34
1D239	1276	15.92	31.76
1I248	903	13.67	15.08
1I249	484	13.25	18.54
1I250	326	16.33	26.83
1I253I	97	12.08	0.05
1I253J	35	13.67	0.68
1R237	269	14.25	27.84
1R237	373	15.33	30.34
1R239	1703	16.08	32.16
250A	159	12.33	0.44
250A1	68	12.08	0.11
250B	146	12	0.05
251A	199	12.08	0.31
251B	129	12.08	0.07
251C	0	0	0.03
252A	77	12.08	0.13
252B	275	12.25	0.19
252C	99	12.08	0.04
253A	251	12.33	0.25
253B	25	12.08	0.04
253C	260	12.17	0.17
253D	122	12	0.06
253E	139	12.17	0.08
253F	172	12.17	0.1
253G	155	12.08	0.08
253H	83	12	0.03
253I	96	12.08	0.04
253J	260	12.17	0.15
253K	54	12	0.02
253L	32	12	0.01
253M	85	12.17	0.16
253N	137	12.17	0.26
2D238	116	15.33	30.34
2D239	147	15.92	31.76
2I248	1156	13.58	15.58
2I250	427	16.25	28.33
2I253	236	12.42	79
2I253I	261	16.17	33.14
CP241	2376	12.92	78.7
CP248	1900	14	17.54
CP249	567	14.25	28.84
CP250	710	14.75	30.83
CP250A	267	14.83	30.94

Palm Valley Phase 5
HEC-1 Summary Output

HEC-1 ID	Q_{100} cfs	Time min	Area mi^2
CP250B	267	14.92	31.43
CP251A	199	12.08	0.52
CP251B	261	15.08	31.5
CP251C	261	15.25	32.05
CP252B	253	15.67	32.28
CP252C	258	15.42	32.09
CP253C	40	12.75	0.43
CP253E	2777	16.17	78.83
CP253F	39	13.08	0.53
CP253G	250	15.83	32.36
CP253H	244	16.08	32.41
CP253I	2640	16.33	84.5
CP253J	261	16.17	33.09
CP253K	248	15.92	32.38
CP253M	91	12.17	0.2
CP253N	2770	16.25	79
D234	706	13.17	14.08
D235	1079	13.75	16.04
D236	321	14.08	26.34
D236	400	14.08	26.34
D237	271	14.08	27.84
D237	232	14.08	27.84
D247	303	13.08	0.5
D248	180	14	17.54
D249	510	14.25	28.84
D250	274	14.75	30.83
DI261	0	0	0.5
DI262	1721	14	17.54
DI264	57	14.25	28.84
DI265	436	13.33	30.83
ICP238	287	14.42	30.34
R234	608	13.83	14.08
R235	994	14.17	16.04
R236	314	14.33	26.34
R236	327	16.33	26.34
R237	216	14.92	27.84
R241	2776	16.17	78.75
R247	275	13.5	0.5
R248	168	14.67	17.54
R249	495	14.67	28.84
R250	267	14.83	30.83
R250A	156	12.42	0.44
R250A1	267	14.92	30.94
R250B	261	15.08	31.43
R251A	25	13.42	0.52
R251B	255	15.25	31.5
R251C	257	15.42	32.05
R252A	26	12.75	0.13
R252B	248	15.83	32.28
R252C	245	15.67	32.09
R253A	236	12.5	0.25
R253B	11	12.42	0.04
R253C	35	13.08	0.43
R253D	2	16.83	0.06

Palm Valley Phase 5
HEC-1 Summary Output

HEC-1 ID	Q_{100} cfs	Time min	Area mi^2
R253E	2770	16.25	78.83
R253F	31	13.67	0.53
R253G	247	15.92	32.36
R253H	243	16.17	32.41
R253J	261	16.17	33.09
R253K	244	16.08	32.38
R253L	6	12.25	0.01
R253M	34	12.75	0.2
R253N	2763	16.42	79
RS250B	4	14.08	0.05
RS251A	37	12.5	0.52
RS251B	0	22.17	0.07
RS252B	8	12.17	0.19
RS252C	8	12.42	0.04
RS253C	6	12.08	0.17
RS253D	2	12	0.06
RS253E	4	12.75	0.08
RS253F	4	12.08	0.1
RS253G	4	12.83	0.08
RS253H	31	12.17	0.03
RS253J	4	12.08	0.15
RS253K	18	12.17	0.02
RS253L	21	12.08	0.01

partial HEC-1 Flow stream

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4730            .           .           .           .         226
                .           .           .           .           V
                .           .           .           .           V
4737            .           .           .           .       SR226
                .           .           .           .           V
                .           .           .           .           V
                .           .           .           .        R226
   3            .           .           .           .           .
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4749            .           .           .           .           .         201
                .           .           .           .           .           V
                .           .           .           .           .           V
4756            .           .           .           .           .        R201
                .           .           .           .           .           .
4762            .           .           .           .           .           .         223
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4770            .           .           .           .           .       1I223............
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4773            .           .           .           .       CP223............
                .           .           .           .           V
                .           .           .           .           V
4776            .           .           .           .        R223
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4782            .           .           .           .           .         224
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4789            .           .           .           .       CP224............
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4792            .           .           .           .        R224
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4798            .           .           .           .           .         241
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4806            .           .           .           .       1I241............
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   9            .           .           .       2I241............
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4812            .           .       CP241............
                .           .           .
                .           .           .
4817            .           .           .           .<-------  1D250A
4815            .           .           .        D237
                .           .           .           V
                .           .           .           V
4818            .           .           .       1R237
                .           .           .           .
                .           .           .           .
4827            .           .           .           .           .<-------  2D250A
4825            .           .           .           .       1D238
                .           .           .           .           .
                .           .           .           .           .
4828            .           .           .      ICP238............
                .           .           .           .
                .           .           .           .
4833            .           .           .           .           .<-------   1D251
4831            .           .           .           .       2D238
                .           .           .           .           .
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4834            .           .           .      1CP238............
                .           .           .           V
                .           .           .           V
4837            .           .           .       1R237
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4846            .           .           .           .           .<-------   2D251
4844            .           .           .           .       1D239
                .           .           .           .           .
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4849            .           .           .           .           .           .<-------   DI252
4847            .           .           .           .           .       2D239
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4850            .           .           .      1CP239........................
                .           .           .           V
                .           .           .           V
4853            .           .           .       1R239
                .           .           .           .
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4860            .           .      1CP241............
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— Inflow to Camelback Rd culvert @ Ballard Wash

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                .           .           V
                .           .           V
4864            .           .         R241
                .           .           .
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4870            .           .           .        253E
                .           .           .           V
                .           .           .           V
                .           .           .      RS253E
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4886            .           .      CP253E............
                .           .           V
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4889            .           .       R253E
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4895            .           .           .        253A
                .           .           .           V
                .           .           .           V
4902            .           .           .       R253A
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4908            .           .           .           .        253N
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4918            .           .           .       2I253............
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4921            .           .      CP253N............
                .           .           V
                .           .           V
4924            .           .       R253N
                .           .           .    DO253 Inflow to offline Basin
                .           .           .
4930            .           .           .         247
                .           .           .           .
                .           .           .           .
4942            .           .           .           .------->   DI261
4940            .           .           .        D247
                .           .     DI253 .           V
                .           .           .           V
4945            .           .           .        R247
                .           .           .           .
                .           .           .           .
4951            .           .           .           .         248
                .           .           .           .           .
                .           .           .           .           .
4964            .           .           .           .           .           .<-------    1D248
4962            .           .           .           .           .        D234
                .           .           .           .           .           V
                .           .           .           .           .           V
4965            .           .           .           .           .        R234
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4971            .           .           .           .       1I248............
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4974            .           .           .       2I248............
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                .           .           .           .
4979            .           .           .           .           .<-------    2D248
4977            .           .           .           .        D235
                .           .           .           .           V
                .           .           .           .           V
4980            .           .           .           .        R235
                .           .           .           .           .
                .           .           .           .           .
4986            .           .           .       CP248............
                .           .           .           .
                .           .           .           .
4991            .           .           .           .------->   DI262
4989            .           .           .        D248
                .           .           .           V
                .           .           .           V
4994            .           .           .        R248
                .           .           .           .
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5000            .           .           .           .         249
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5011            .           .           .       1I249............
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5016            .           .           .           .           .<-------    DI249
5014            .           .           .           .        D236
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5017            .           .           .           .        R236
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5023            .           .           .       CP249............
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5028            .           .           .           .------->   DI264
                .           .           .        D249
                .           .           .           V
                .           .           .           V
5031            .           .           .        R249
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5039            .           .           .           .           .<-------   1D250
5037            .           .           .           .        D236
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5040            .           .           .           .        R236
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5046            .           .           .           .           .         250
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5056            .           .           .           .       1I250............
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5061            .           .           .           .           .           .<-------   2D250
5059            .           .           .           .           .        D237
                .           .           .           .           .           V
                .           .           .           .           .           V
5062            .           .           .           .           .        R237
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5068            .           .           .           .       2I250............
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5071            .           .           .       CP250............
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5077            .           .           .           .------->   DI265
5074            .           .           .        D250
                .           .           .           V
                .           .           .           V
                .           .           .        R250
                .           .           .           .
                .           .           .           .
5086            .           .           .           .       250A1
                .           .           .           .           .
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5096            .           .           .      CP250A............
                .           .           .           V
                .           .           .           V
5099            .           .           .      R250A1
                .           .           .           .
                .           .           .           .
5105            .           .           .           .        250A
                .           .           .           .           V
                .           .           .           .           V
5117            .           .           .           .       R250A
                .           .           .           .           .
                .           .           .           .           .
5123            .           .           .           .           .        250B
                .           .           .           .           .           V
                .           .           .           .           .           V
5132            .           .           .           .           .      RS250B
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                .           .           .           .           .           .
5138            .           .           .      CP250B........................
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                .           .           .           V
5141            .           .           .       R250B
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5147            .           .           .           .        251B
                .           .           .           .           V
                .           .           .           .           V
5157            .           .           .           .      RS251B
                .           .           .           .           .
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   3            .           .           .      CP251B............
                .           .           .           V
                .           .           .           V
5166            .           .           .       R251B
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5172            .           .           .           .        252A
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5182      .     .     .         .     R252A
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5188      .     .     .         .         .        251A
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5198      .     .     .         .    CP251A............
          .     .     .         .         V
          .     .     .         .         V
5202      .     .     .         .    RS251A
          .     .     .         .         V
          .     .     .         .         V
5208      .     .     .         .     R251A
          .     .     .         .         .
          .     .     .         .         .
5214      .     .     .         .         .        251C
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          .     .     .         .         .           .
5223      .     .     .         .    1CP251............
          .     .     .         .         .
          .     .     .         .         .
5226      .     .     .    CP251C..........
          .     .     .         V
          .     .     .         V
5229      .     .     .     R251C
          .     .     .         .
          .     .     .         .
5235      .     .     .         .      252C
          .     .     .         .         V
          .     .     .         .         V
5244      .     .     .         .    RS252C
          .     .     .         .         .
          .     .     .         .         .
5250      .     .     .    CP252C..........
          .     .     .         V
          .     .     .         V
5253      .     .     .     R252C
          .     .     .         .
          .     .     .         .
5259      .     .     .         .      252B
          .     .     .         .         V
          .     .     .         .         V
5269      .     .     .         .    RS252B
          .     .     .         .         .
          .     .     .         .         .
5275      .     .     .    CP252B..........
          .     .     .         V
          .     .     .         V
5278      .     .     .     R252B
          .     .     .         .
          .     .     .         .
5284      .     .     .         .      253G
          .     .     .         .         V
          .     .     .         .         V
5293      .     .     .         .    RS253G
          .     .     .         .         .
          .     .     .         .         .
5299      .     .     .    CP253G..........
          .     .     .         V
          .     .     .         V
5302      .     .     .     R253G
          .     .     .         .
          .     .     .         .
5308      .     .     .         .      253K
          .     .     .         .         V
          .     .     .         .         V
5317      .     .     .         .    RS253K
          .     .     .         .         .
          .     .     .         .         .
5323      .     .     .    CP253K..........
          .     .     .         V
          .     .     .         V
5326      .     .     .     R253K
          .     .     .         .
          .     .     .         .
5332      .     .     .         .      253H
          .     .     .         .         V
          .     .     .         .         V
5341      .     .     .         .    RS253H
          .     .     .         .         .
          .     .     .         .         .
5347      .     .     .    CP253H..........
          .     .     .         V
          .     .     .         V
5350      .     .     .     R253H
          .     .     .         .
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5356      .     .     .         .      253D
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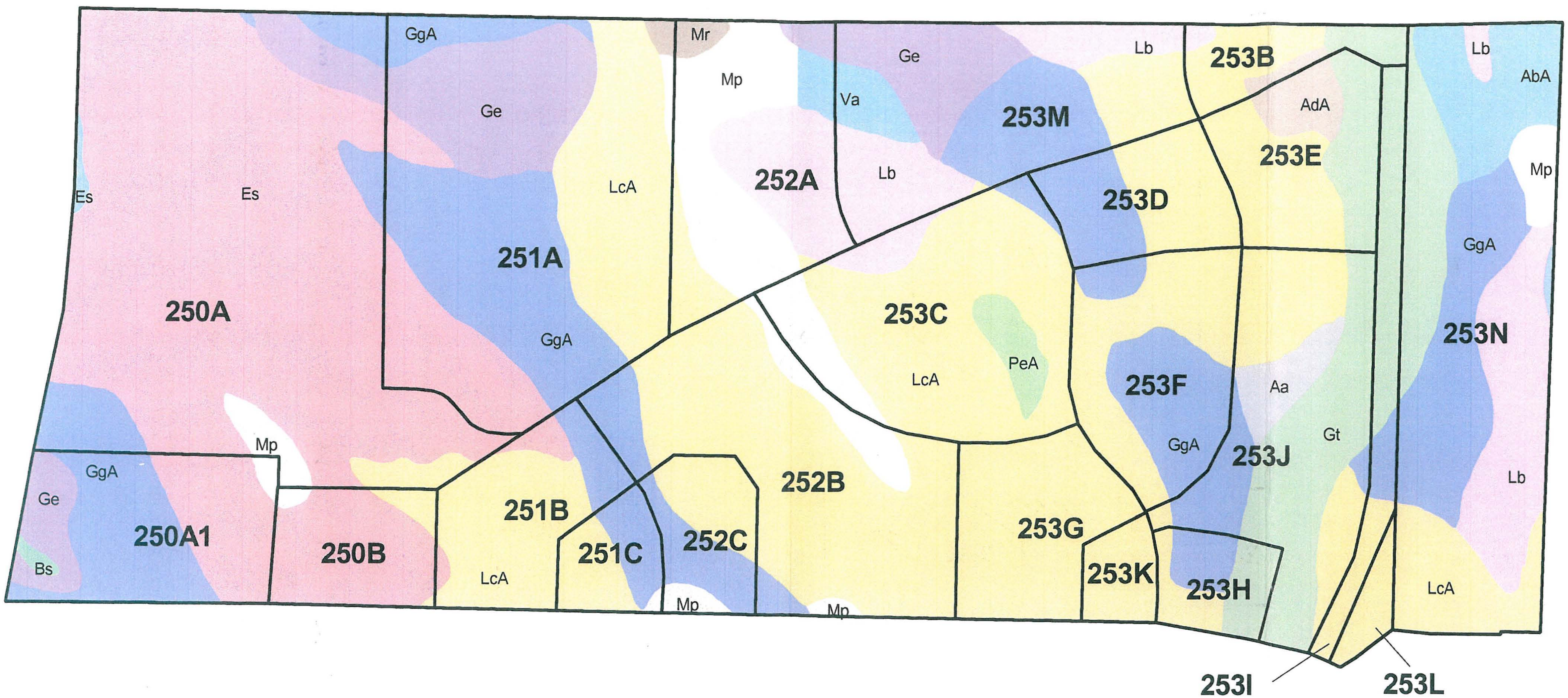

Figure No. 3
Palm Valley Phase 5
Soil Unit Map

Date: July, 2004

eec
Engineering and Environmental Consultants, Inc
3003 N. Central Ave, Suite 600
Phoenix, Arizona 85012

LOSS PARAMETERS FOR SUBBASIN: 250A

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock - Outcrop
ES	235.900	83.9	0.25	0
GE	10.700	3.8	0.26	0
GGA	20.900	7.4	0.25	0
LCA	5.700	2.0	0.25	0
MP	6.100	2.2	0.25	0
VA	1.700	0.6	0.39	0

TOTAL = 281.000 Acres XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
	OPEN		NORMAL	10	0	0.10	0.02	Min	
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
	L.D.R.		NORMAL	50	15	0.30	0.05	Low	
	M.D.R.		NORMAL	50	30	0.25	0.05	Low	
	M.F.R.		NORMAL	50	45	0.25	0.05	Low	
	Ind		NORMAL	60	55	0.15	0.03	Min	
	Comm		NORMAL	75	80	0.10	0.02	Min	
	Park		NORMAL	90	0	0.20	0.10	Hi	
281.000	RowCrop	100.	WET	85	0	0.50	0.10	Hi	0.09

281.00 = Total Area Avg. = 85 0% 0.500

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 0.0 %
WET = 100. %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.00

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.46

IMPERVIOUS AREA: URBAN @ 100 % effective = 0
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 0

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
250A	0.439	1.51	0.92	0.10	14.6	0.50	0.00	4.80	0.46	0	98

LOSS PARAMETERS FOR SUBBASIN: 250A1

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
BS	1.500	2.2	0.39	0
ES	23.200	33.4	0.25	0
GE	11.720	16.9	0.26	0
GGA	31.500	45.4	0.25	0
MP	1.530	2.2	0.25	0

TOTAL = 69.450 Acres XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
	OPEN		NORMAL	10	0	0.10	0.02	Min	
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
	L.D.R.		NORMAL	50	15	0.30	0.05	Low	
	M.D.R.		NORMAL	50	30	0.25	0.05	Low	
	M.F.R.		NORMAL	50	45	0.25	0.05	Low	
	Ind		NORMAL	60	55	0.15	0.03	Min	
	Comm		NORMAL	75	80	0.10	0.02	Min	
	Park		NORMAL	90	0	0.20	0.10	Hi	
69.450	RowCrop	100.	WET	85	0	0.50	0.10	Hi	0.10

69.450 = Total Area Avg. = 85 0% 0.500

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 0.0 %
WET = 100. %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.00

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.46

IMPERVIOUS AREA: URBAN @ 100 % effective = 0
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 0

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
250A1	0.108	0.61	0.30	0.10	19.7	0.50	0.00	4.80	0.46	0	43

LOSS PARAMETERS FOR SUBBASIN: 250B

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
ES	30.700	88.0	0.25	0
LCA	3.200	9.2	0.25	0
MP	1.000	2.9	0.25	0

TOTAL = 34.900 Acres XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
	OPEN		NORMAL	10	0	0.10	0.02	Min	
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
	L.D.R.		NORMAL	50	15	0.30	0.05	Low	
	M.D.R.		NORMAL	50	30	0.25	0.05	Low	
	M.F.R.		NORMAL	50	45	0.25	0.05	Low	
	Ind		NORMAL	60	55	0.15	0.03	Min	
34.900	Comm	100.	NORMAL	75	80	0.10	0.02	Min	0.03
	Park		NORMAL	90	0	0.20	0.10	Hi	
	RowCrop		WET	85	0	0.50	0.10	Hi	

34.900 = Total Area Avg. = 75 80% 0.100

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.43

IMPERVIOUS AREA: URBAN @ 100 % effective = 80
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 80

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
250B	0.055	0.40	0.33	0.02	22.5	0.10	0.25	4.80	0.43	80	7

LOSS PARAMETERS FOR SUBBASIN: 251A

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
ES	31.100	15.6	0.25	0
GE	41.920	21.0	0.26	0
GGA	69.400	34.7	0.25	0
LCA	54.200	27.1	0.25	0
MP	1.600	0.8	0.25	0
MR	1.650	0.8	0.05	0

TOTAL = 199.900 Acres XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
	OPEN		NORMAL	10	0	0.10	0.02	Min	
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
	L.D.R.		NORMAL	50	15	0.30	0.05	Low	
	M.D.R.		NORMAL	50	30	0.25	0.05	Low	
	M.F.R.		NORMAL	50	45	0.25	0.05	Low	
	Ind		NORMAL	60	55	0.15	0.03	Min	
	Comm		NORMAL	75	80	0.10	0.02	Min	
	Park		NORMAL	90	0	0.20	0.10	Hi	
199.900	RowCrop	100.	WET	85	0	0.50	0.10	Hi	0.09

199.90 = Total Area Avg. = 85 0% 0.500

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 0.0 %
WET = 100. %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.00

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.46

IMPERVIOUS AREA: URBAN @ 100 % effective = 0
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 0

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
251A	0.312	0.61	0.30	0.10	23.0	0.50	0.00	4.80	0.46	0	42

LOSS PARAMETERS FOR SUBBASIN: 251B

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
ES	4.100	8.8	0.25	0
GGA	7.100	15.2	0.25	0
LCA	35.600	76.1	0.25	0

TOTAL = 46.800 Acres XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
	OPEN		NORMAL	10	0	0.10	0.02	Min	
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
46.800	L.D.R.	100.	NORMAL	50	15	0.30	0.05	Low	0.06
	M.D.R.		NORMAL	50	30	0.25	0.05	Low	
	M.F.R.		NORMAL	50	45	0.25	0.05	Low	
	Ind		NORMAL	60	55	0.15	0.03	Min	
	Comm		NORMAL	75	80	0.10	0.02	Min	
	Park		NORMAL	90	0	0.20	0.10	Hi	
	RowCrop		WET	85	0	0.50	0.10	Hi	

46.800 = Total Area Avg. = 50 15% 0.300

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.36

IMPERVIOUS AREA: URBAN @ 100 % effective = 15
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 15

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
251B	0.073	0.38	0.17	0.05	13.2	0.30	0.25	4.80	0.36	15	16

LOSS PARAMETERS FOR SUBBASIN: 251C

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
GGA	8.700	44.8	0.25	0
LCA	10.100	52.1	0.25	0
MP	0.600	3.1	0.25	0

TOTAL = 19.400 Acres   XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35   PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
	OPEN		NORMAL	10	0	0.10	0.02	Min	
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
	L.D.R.		NORMAL	50	15	0.30	0.05	Low	
	M.D.R.		NORMAL	50	30	0.25	0.05	Low	
	M.F.R.		NORMAL	50	45	0.25	0.05	Low	
	Ind		NORMAL	60	55	0.15	0.03	Min	
19.400	Comm	100.	NORMAL	75	80	0.10	0.02	Min	0.03
	Park		NORMAL	90	0	0.20	0.10	Hi	
	RowCrop		WET	85	0	0.50	0.10	Hi	

19.400 = Total Area   Avg. = 75 80% 0.100

PERCENT OF SUBBASIN   DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.43

IMPERVIOUS AREA: URBAN @ 100 % effective = 80
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 80

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
251C	0.030	0.20	0.09	0.02	10.0	0.10	0.25	4.80	0.43	80	4

LOSS PARAMETERS FOR SUBBASIN: 252A

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
GE	2.880	3.4	0.26	0
LB	25.680	30.7	0.40	0
LCA	8.500	10.2	0.25	0
MP	39.600	47.3	0.25	0
MR	3.000	3.6	0.05	0
VA	4.030	4.8	0.39	0

TOTAL = 83.690 Acres XKSAT = 0.28 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.60
Normal = 0.25
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
	OPEN		NORMAL	10	0	0.10	0.02	Min	
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
	L.D.R.		NORMAL	50	15	0.30	0.05	Low	
	M.D.R.		NORMAL	50	30	0.25	0.05	Low	
	M.F.R.		NORMAL	50	45	0.25	0.05	Low	
	Ind		NORMAL	60	55	0.15	0.03	Min	
	Comm		NORMAL	75	80	0.10	0.02	Min	
	Park		NORMAL	90	0	0.20	0.10	Hi	
83.690	RowCrop	100.	WET	85	0	0.50	0.10	Hi	0.10

83.690 = Total Area Avg. = 85 0% 0.500

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 0.0 %
WET = 100. %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.00

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.51

IMPERVIOUS AREA: URBAN @ 100 % effective = 0
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 0

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
252A	0.131	0.66	0.33	0.10	18.2	0.50	0.00	4.60	0.51	0	47

LOSS PARAMETERS FOR SUBBASIN: 252B

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
GGA	10.900	9.2	0.25	0
LCA	96.500	81.4	0.25	0
MP	11.200	9.4	0.25	0

TOTAL = 118.600 Acres XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
	OPEN		NORMAL	10	0	0.10	0.02	Min	
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
	L.D.R.		NORMAL	50	15	0.30	0.05	Low	
118.600	M.D.R.	100.	NORMAL	50	30	0.25	0.05	Low	0.05
	M.F.R.		NORMAL	50	45	0.25	0.05	Low	
	Ind		NORMAL	60	55	0.15	0.03	Min	
	Comm		NORMAL	75	80	0.10	0.02	Min	
	Park		NORMAL	90	0	0.20	0.10	Hi	
	RowCrop		WET	85	0	0.50	0.10	Hi	

118.60 = Total Area Avg. = 50 30% 0.250

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.36

IMPERVIOUS AREA: URBAN @ 100 % effective = 30
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 30

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
252B	0.185	0.67	0.33	0.05	19.4	0.25	0.25	4.80	0.36	30	23

LOSS PARAMETERS FOR SUBBASIN: 252C
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Soil Survey Used Central County

XKSAT
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Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
GGA	11.900	42.2	0.25	0
LCA	13.500	47.9	0.25	0
MP	2.800	9.9	0.25	0

TOTAL = 28.200 Acres XKSAT = 0.25 %Rock = 0

DTHETA
========

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE
========

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
	OPEN		NORMAL	10	0	0.10	0.02	Min	
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
	L.D.R.		NORMAL	50	15	0.30	0.05	Low	
	M.D.R.		NORMAL	50	30	0.25	0.05	Low	
17.600	M.F.R.	62.4	NORMAL	50	45	0.25	0.05	Low	0.06
	Ind		NORMAL	60	55	0.15	0.03	Min	
10.600	Comm	37.6	NORMAL	75	80	0.10	0.02	Min	0.03
	Park		NORMAL	90	0	0.20	0.10	Hi	
	RowCrop		WET	85	0	0.50	0.10	Hi	
28.200 = Total Area			Avg. =	54	58%	0.190			

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.37

IMPERVIOUS AREA: URBAN @ 100 % effective = 58
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 58

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
252C	0.044	0.31	0.18	0.04	16.1	0.19	0.25	4.80	0.37	58	11

LOSS PARAMETERS FOR SUBBASIN: 253A

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
GE	5.700	16.9	0.26	0
GGA	23.000	68.1	0.25	0
LB	4.800	14.2	0.40	0
LCA	0.300	0.9	0.25	0

TOTAL = 33.800 Acres XKSAT = 0.27 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.65
Normal = 0.25
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
	OPEN		NORMAL	10	0	0.10	0.02	Min	
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
	L.D.R.		NORMAL	50	15	0.30	0.05	Low	
	M.D.R.		NORMAL	50	30	0.25	0.05	Low	
	M.F.R.		NORMAL	50	45	0.25	0.05	Low	
	Ind		NORMAL	60	55	0.15	0.03	Min	
	Comm		NORMAL	75	80	0.10	0.02	Min	
	Park		NORMAL	90	0	0.20	0.10	Hi	
33.800	RowCrop	100.	WET	85	0	0.50	0.10	Hi	0.11
33.800 = Total Area			Avg. =	85	0%	0.500			

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 0.0 %
WET = 100. %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.00

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.49

IMPERVIOUS AREA: URBAN @ 100 % effective = 0
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 0

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
253A	0.053	0.39	0.25	0.10	18.0	0.50	0.00	4.65	0.49	0	34

LOSS PARAMETERS FOR SUBBASIN: 253B

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
ADA	2.300	10.2	0.40	0
GT	5.100	22.6	0.04	0
LB	1.300	5.8	0.40	0
LCA	13.887	61.5	0.25	0

TOTAL = 22.590 Acres XKSAT = 0.18 %Rock = 0

DTHETA

Dry = 0.38 PSIF = 5.60
Normal = 0.25
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
	OPEN		NORMAL	10	0	0.10	0.02	Min	
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
	L.D.R.		NORMAL	50	15	0.30	0.05	Low	
	M.D.R.		NORMAL	50	30	0.25	0.05	Low	
	M.F.R.		NORMAL	50	45	0.25	0.05	Low	
	Ind		NORMAL	60	55	0.15	0.03	Min	
	Comm		NORMAL	75	80	0.10	0.02	Min	
	Park		NORMAL	90	0	0.20	0.10	Hi	
22.590	RowCrop	100.	WET	85	0	0.50	0.10	Hi	0.12
22.590 = Total Area			Avg. =	85	0%	0.500			

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 0.0 %
WET = 100. %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.00

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.33

IMPERVIOUS AREA: URBAN @ 100 % effective = 0
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 0

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
253B	0.035	0.34	0.16	0.10	5.9	0.50	0.00	5.60	0.33	0	34

LOSS PARAMETERS FOR SUBBASIN: 253C

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
GGA	2.500	2.3	0.25	0
LB	5.900	5.5	0.40	0
LCA	78.600	73.4	0.25	0
MP	11.500	10.7	0.25	0
PEA	8.600	8.0	0.37	0

TOTAL = 107.100 Acres XKSAT = 0.27 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.65
Normal = 0.25
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
13.270	OPEN	12.4	NORMAL	10	0	0.10	0.02	Min	0.03
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
70.730	L.D.R.	66.0	NORMAL	50	15	0.30	0.05	Low	0.05
23.100	M.D.R.	21.6	NORMAL	50	30	0.25	0.05	Low	0.06
	M.F.R.		NORMAL	50	45	0.25	0.05	Low	
	Ind		NORMAL	60	55	0.15	0.03	Min	
	Comm		NORMAL	75	80	0.10	0.02	Min	
	Park		NORMAL	90	0	0.20	0.10	Hi	
	RowCrop		WET	85	0	0.50	0.10	Hi	
107.10 = Total Area			Avg. =	44	16%	0.260			

PERCENT OF SUBBASIN
DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.37

IMPERVIOUS AREA: URBAN @ 100 % effective = 16
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 16

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
253C	0.167	0.610	0.049	18.0	0.26	0.25	4.65	0.37	16

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
253C	0.167	0.61	0.29	0.05	18.0	0.26	0.25	4.65	0.37	16	20

LOSS PARAMETERS FOR SUBBASIN: 253D

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
GGA	15.800	42.2	0.25	0
LCA	21.600	57.8	0.25	0

TOTAL = 37.400 Acres XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
	OPEN		NORMAL	10	0	0.10	0.02	Min	
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
37.400	L.D.R.	100.	NORMAL	50	15	0.30	0.05	Low	0.06
	M.D.R.		NORMAL	50	30	0.25	0.05	Low	
	M.F.R.		NORMAL	50	45	0.25	0.05	Low	
	Ind		NORMAL	60	55	0.15	0.03	Min	
	Comm		NORMAL	75	80	0.10	0.02	Min	
	Park		NORMAL	90	0	0.20	0.10	Hi	
	RowCrop		WET	85	0	0.50	0.10	Hi	

37.400 = Total Area Avg. = 50 15% 0.300

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.36

IMPERVIOUS AREA: URBAN @ 100 % effective = 15
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 15

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
253D	0.058	0.26	0.10	0.05	23.1	0.30	0.25	4.80	0.36	15	10

LOSS PARAMETERS FOR SUBBASIN: 253E

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
ADA	9.400	18.6	0.40	0
GT	15.300	30.3	0.04	0
LCA	25.800	51.1	0.25	0

TOTAL = 50.500 Acres XKSAT = 0.16 %Rock = 0

DTHETA

Dry = 0.39 PSIF = 5.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
	OPEN		NORMAL	10	0	0.10	0.02	Min	
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
50.500	L.D.R.	100.	NORMAL	50	15	0.30	0.05	Low	0.06
	M.D.R.		NORMAL	50	30	0.25	0.05	Low	
	M.F.R.		NORMAL	50	45	0.25	0.05	Low	
	Ind		NORMAL	60	55	0.15	0.03	Min	
	Comm		NORMAL	75	80	0.10	0.02	Min	
	Park		NORMAL	90	0	0.20	0.10	Hi	
	RowCrop		WET	85	0	0.50	0.10	Hi	

50.500 = Total Area Avg. = 50 15% 0.300

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.23

IMPERVIOUS AREA: URBAN @ 100 % effective = 15
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 15

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
253E	0.079	0.38	0.26	0.05	15.8	0.30	0.25	5.80	0.23	15	18

LOSS PARAMETERS FOR SUBBASIN: 253F

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
GGA	29.700	45.8	0.25	0
LCA	35.100	54.2	0.25	0

TOTAL = 64.800 Acres XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
	OPEN		NORMAL	10	0	0.10	0.02	Min	
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
29.100	L.D.R.	44.9	NORMAL	50	15	0.30	0.05	Low	0.06
35.700	M.D.R.	55.1	NORMAL	50	30	0.25	0.05	Low	0.06
	M.F.R.		NORMAL	50	45	0.25	0.05	Low	
	Ind		NORMAL	60	55	0.15	0.03	Min	
	Comm		NORMAL	75	80	0.10	0.02	Min	
	Park		NORMAL	90	0	0.20	0.10	Hi	
	RowCrop		WET	85	0	0.50	0.10	Hi	
64.800 = Total Area			Avg. =	50	23%	0.270			

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.36

IMPERVIOUS AREA: URBAN @ 100 % effective = 23
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 23

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
253F	0.101	0.43	0.25	0.05	18.6	0.27	0.25	4.80	0.36	23	18

LOSS PARAMETERS FOR SUBBASIN: 253G

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
LCA	48.500	100.	0.25	0

TOTAL = 48.500 Acres   XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35   PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
	OPEN		NORMAL	10	0	0.10	0.02	Min	
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
7.000	L.D.R.	14.4	NORMAL	50	15	0.30	0.05	Low	0.07
41.500	M.D.R.	85.6	NORMAL	50	30	0.25	0.05	Low	0.06
	M.F.R.		NORMAL	50	45	0.25	0.05	Low	
	Ind		NORMAL	60	55	0.15	0.03	Min	
	Comm		NORMAL	75	80	0.10	0.02	Min	
	Park		NORMAL	90	0	0.20	0.10	Hi	
	RowCrop		WET	85	0	0.50	0.10	Hi	
48.500 = Total Area			Avg. =	50	28%	0.260			

PERCENT OF SUBBASIN   DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.36

IMPERVIOUS AREA: URBAN @ 100 % effective = 28
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 28

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
253G	0.076	0.32	0.19	0.05	31.2	0.26	0.25	4.80	0.36	28	13

LOSS PARAMETERS FOR SUBBASIN: 253H

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
GGA	6.700	32.1	0.25	0
GT	7.700	36.8	0.04	0
LCA	6.500	31.1	0.25	0

TOTAL = 20.900 Acres XKSAT = 0.13 %Rock = 0

DTHETA

Dry = 0.38 PSIF = 6.40
Normal = 0.21
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
	OPEN		NORMAL	10	0	0.10	0.02	Min	
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
	L.D.R.		NORMAL	50	15	0.30	0.05	Low	
	M.D.R.		NORMAL	50	30	0.25	0.05	Low	
20.900	M.F.R.	100.	NORMAL	50	45	0.25	0.05	Low	0.06
	Ind		NORMAL	60	55	0.15	0.03	Min	
	Comm		NORMAL	75	80	0.10	0.02	Min	
	Park		NORMAL	90	0	0.20	0.10	Hi	
	RowCrop		WET	85	0	0.50	0.10	Hi	
20.900 = Total Area			Avg. =	50	45%	0.250			

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.21

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.19

IMPERVIOUS AREA: URBAN @ 100 % effective = 45
ROCK OUTCROP @ 100 % effective = 0
\------------------------
% EFFECTIVE IMP. = 45

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
253H	0.033	0.19	0.10	0.05	31.6	0.25	0.21	6.40	0.19	45	8

LOSS PARAMETERS FOR SUBBASIN: 253I

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
GGA	3.700	13.4	0.25	0
GT	16.900	61.2	0.04	0
LCA	7.000	25.4	0.25	0

TOTAL = 27.600 Acres XKSAT = 0.08 %Rock = 0

DTHETA

Dry = 0.32 PSIF = 7.60
Normal = 0.15
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
27.600	OPEN	100.	NORMAL	10	0	0.10	0.02	Min	0.03
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
	L.D.R.		NORMAL	50	15	0.30	0.05	Low	
	M.D.R.		NORMAL	50	30	0.25	0.05	Low	
	M.F.R.		NORMAL	50	45	0.25	0.05	Low	
	Ind		NORMAL	60	55	0.15	0.03	Min	
	Comm		NORMAL	75	80	0.10	0.02	Min	
	Park		NORMAL	90	0	0.20	0.10	Hi	
	RowCrop		WET	85	0	0.50	0.10	Hi	
27.600 = Total Area			Avg. =	10	0%	0.100			

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.15

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.08

IMPERVIOUS AREA: URBAN @ 100 % effective = 0
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 0

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
253I	0.043	1.09	0.58	0.02	20.2	0.10	0.15	7.60	0.08	0	14

LOSS PARAMETERS FOR SUBBASIN: 253J

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
AA	10.800	11.4	0.26	0
GGA	12.300	13.0	0.25	0
GT	42.800	45.2	0.04	0
LCA	28.900	30.5	0.25	0

TOTAL = 94.800 Acres XKSAT = 0.11 %Rock = 0

DTHETA

Dry = 0.36 PSIF = 6.80
Normal = 0.17
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
17.000	OPEN	17.9	NORMAL	10	0	0.10	0.02	Min	0.03
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
77.800	L.D.R.	82.1	NORMAL	50	15	0.30	0.05	Low	0.05
	M.D.R.		NORMAL	50	30	0.25	0.05	Low	
	M.F.R.		NORMAL	50	45	0.25	0.05	Low	
	Ind		NORMAL	60	55	0.15	0.03	Min	
	Comm		NORMAL	75	80	0.10	0.02	Min	
	Park		NORMAL	90	0	0.20	0.10	Hi	
	RowCrop		WET	85	0	0.50	0.10	Hi	

94.800 = Total Area Avg. = 42 12% 0.260

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.17

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.15

IMPERVIOUS AREA: URBAN @ 100 % effective = 12
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 12

INPUT VALUES FOR MCUHP1 PROGRAM

SUBBASIN	Area sq.mi.	Length mi.	Kb	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %
253J	0.148	0.640	0.048	19.0	0.26	0.17	6.80	0.15	12

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
253J	0.148	0.64	0.31	0.05	18.8	0.26	0.17	6.80	0.15	12	20

LOSS PARAMETERS FOR SUBBASIN: 253K

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
LCA	12.500	100.	0.25	0

TOTAL = 12.500 Acres XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
	OPEN		NORMAL	10	0	0.10	0.02	Min	
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
	L.D.R.		NORMAL	50	15	0.30	0.05	Low	
	M.D.R.		NORMAL	50	30	0.25	0.05	Low	
	M.F.R.		NORMAL	50	45	0.25	0.05	Low	
	Ind		NORMAL	60	55	0.15	0.03	Min	
12.500	Comm	100.	NORMAL	75	80	0.10	0.02	Min	0.03
	Park		NORMAL	90	0	0.20	0.10	Hi	
	RowCrop		WET	85	0	0.50	0.10	Hi	

12.500 = Total Area Avg. = 75 80% 0.100

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.43

IMPERVIOUS AREA: URBAN @ 100 % effective = 80
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 80

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
253K	0.020	0.17	0.08	0.02	29.4	0.10	0.25	4.80	0.43	80	3

LOSS PARAMETERS FOR SUBBASIN: 253L

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
LCA	7.700	100.	0.25	0

TOTAL = 7.700 Acres XKSAT = 0.25 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.80
Normal = 0.25
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
	OPEN		NORMAL	10	0	0.10	0.02	Min	
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
	L.D.R.		NORMAL	50	15	0.30	0.05	Low	
	M.D.R.		NORMAL	50	30	0.25	0.05	Low	
	M.F.R.		NORMAL	50	45	0.25	0.05	Low	
	Ind		NORMAL	60	55	0.15	0.03	Min	
7.700	Comm	100.	NORMAL	75	80	0.10	0.02	Min	0.03
	Park		NORMAL	90	0	0.20	0.10	Hi	
	RowCrop		WET	85	0	0.50	0.10	Hi	
7.700 = Total Area			Avg. =	75	80%	0.100			

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 100. %
WET = 0.0 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.25

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.43

IMPERVIOUS AREA: URBAN @ 100 % effective = 80
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 80

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
253L	0.012	0.27	0.12	0.02	3.7	0.10	0.25	4.80	0.43	80	6

LOSS PARAMETERS FOR SUBBASIN: 253M

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
GE	25.400	24.7	0.26	0
GGA	25.670	24.9	0.25	0
LB	29.560	28.7	0.40	0
LCA	14.330	13.9	0.25	0
VA	8.080	7.8	0.39	0

TOTAL = 103.000 Acres   XKSAT = 0.30 %Rock = 0

DTHETA

Dry = 0.35   PSIF = 4.50
Normal = 0.25
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
	OPEN		NORMAL	10	0	0.10	0.02	Min	
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
	L.D.R.		NORMAL	50	15	0.30	0.05	Low	
	M.D.R.		NORMAL	50	30	0.25	0.05	Low	
	M.F.R.		NORMAL	50	45	0.25	0.05	Low	
	Ind		NORMAL	60	55	0.15	0.03	Min	
	Comm		NORMAL	75	80	0.10	0.02	Min	
	Park		NORMAL	90	0	0.20	0.10	Hi	
103.000	RowCrop	100.	WET	85	0	0.50	0.10	Hi	0.10

103.00 = Total Area   Avg. = 85 0% 0.500

PERCENT OF SUBBASIN   DRY = 0.0 %
NORMAL = 0.0 %
WET = 100. %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.00

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.55

IMPERVIOUS AREA: URBAN @ 100 % effective = 0
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 0

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
253M	0.161	0.61	0.30	0.10	6.6	0.50	0.00	4.50	0.55	0	53

LOSS PARAMETERS FOR SUBBASIN: 253N

Soil Survey Used Central County

XKSAT

Map Unit	AREA Acres	% Area	XKSAT	% Rock Outcrop
ABA	29.500	17.5	0.38	0
GGA	42.100	25.0	0.25	0
GT	22.800	13.5	0.04	0
LB	41.800	24.8	0.40	0
LCA	25.300	15.0	0.25	0
MP	7.000	4.2	0.25	0

TOTAL = 168.500 Acres XKSAT = 0.24 %Rock = 0

DTHETA

Dry = 0.35 PSIF = 4.90
Normal = 0.25
Wet = 0.00

LAND USE

AREA Acres	LAND USE Type	% Area	DTHETA condition	%Veg. cover	RTIMP%	IA in.	Kn	Kb Type	Kb
	Desert		DRY	25	0	0.35	0.03	Low	
	OPEN		NORMAL	10	0	0.10	0.02	Min	
	V.L.D.R		NORMAL	30	5	0.30	0.05	Low	
	L.D.R.		NORMAL	50	15	0.30	0.05	Low	
	M.D.R.		NORMAL	50	30	0.25	0.05	Low	
	M.F.R.		NORMAL	50	45	0.25	0.05	Low	
	Ind		NORMAL	60	55	0.15	0.03	Min	
	Comm		NORMAL	75	80	0.10	0.02	Min	
	Park		NORMAL	90	0	0.20	0.10	Hi	
168.500	RowCrop	100.	WET	85	0	0.50	0.10	Hi	0.09

168.50 = Total Area Avg. = 85 0% 0.500

PERCENT OF SUBBASIN DRY = 0.0 %
NORMAL = 0.0 %
WET = 100. %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.00

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.44

IMPERVIOUS AREA: URBAN @ 100 % effective = 0
ROCK OUTCROP @ 100 % effective = 0

% EFFECTIVE IMP. = 0

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	Area sq. mi.	Length mi.	Lca	Kn	Slope ft/mi	IA in.	DTHETA	PSIF	XKSAT adj.	RTIMP %	Lag min.
253N	0.263	1.00	0.50	0.10	28.0	0.50	0.00	4.90	0.44	0	59

Table 2.2

Retention Volume Summary

Basin ID	Volume Required	Min. Drain Rate
	(ac-ft)	CFS
250B	7.0	2.3
251B	6.1	2.0
251C	3.1	1.0
252B	23.7	8.0
252C	4.2	1.4
253B	8.8	3.0
253C	18.1	6.1
253D	6.1	2.0
253E	6.1	2.0
253F	11.8	4.0
253G	6.2	2.1
253H	3.7	1.2
253J	12.6	4.2
253K	2.0	0.7

Note : Keogh Engineering has prepared a separate drainage report for each parcel which includes the onsite retetion volumes and outlet flows.

Palm Valley Phase 5
On-Site Storm Water Detention Volume
100-Year, 6-Hour Storm

Subbasin ID **250B**

Land Use	Area (ac)	C	C_w
Golf		0.35	0
Low Density		0.55	0
Med Density		0.65	0
High Density		0.7	0
Commercial	34.9	0.8	0.8
Industrial		0.88	0

Totals 34.90 0.80

Detention Volumes

$V_R = C_w \times I \times A$

V_r = $\boxed{6.98}$ ac-ft
Vr* = 5.58 ac-ft

C_w = Weighed Runoff Coefficient
I = Rainfall Depth (ft) 3.0 in
A = Contributing Drainage Area (ac)
V_R = Volume Required (ac-ft)

Average Drain Rate, D_R (cfs)
(to drain in 36 hrs)
D_R= Vr/(3600*36) = $\boxed{2.3}$ cfs

Palm Valley Phase 5
On-Site Storm Water Detention Volume
100-Year, 6-Hour Storm

Subbasin ID **251B**

Land Use	Area (ac)	C	C_w
Golf		0.35	0
Low Density	46.8	0.55	0.55
Med Density		0.65	0
High Density		0.7	0
Commercial		0.8	0
Industrial		0.88	0

Totals 46.80 0.55

Detention Volumes

$V_R = C_w \times I \times A$

V_r = $\boxed{6.4}$ ac-ft
Vr* = 5.15 ac-ft

C_w = Weighed Runoff Coefficient
I = Rainfall Depth (ft) 3.0 in
A = Contributing Drainage Area (ac)
V_R = Volume Required (ac-ft)

Average Drain Rate, D_R (cfs)
(to drain in 36 hrs)
D_R= Vr/(3600*36) = $\boxed{2.2}$ cfs

Palm Valley Phase 5
On-Site Storm Water Detention Volume
100-Year, 6-Hour Storm

Subbasin ID **251C**

Land Use	Area (ac)	C	C_w
Golf		0.35	0
Low Density		0.55	0
Med Density		0.65	0
High Density		0.7	0
Commercial	19.4	0.8	0.8
Industrial		0.88	0

Totals 19.40 0.80

Detention Volumes

$V_R = C_w \times I \times A$

V_r = $\boxed{3.9}$ ac-ft

C_w = Weighed Runoff Coefficient
I = Rainfall Depth (ft) 3.0 in
A = Contributing Drainage Area (ac)
V_R = Volume Required (ac-ft)

Average Drain Rate, D_R (cfs)
(to drain in 36 hrs)
D_R= Vr/(3600*36) = $\boxed{1.3}$ cfs

Palm Valley Phase 5
On-Site Storm Water Detention Volume
100-Year, 6-Hour Storm

Subbasin ID **252B**

Land Use	Area (ac)	C	C_w
Golf		0.35	0
Low Density		0.55	0
Med Density		0.65	0
High Density		0.7	0
Commercial	118.6	0.8	0.8
Industrial		0.88	0

Totals 118.60 0.80

Detention Volumes

$V_R = C_w \times I \times A$

V_r = $\boxed{23.72}$ ac-ft

C_w = Weighed Runoff Coefficient
I = Rainfall Depth (ft) 3.0 in
A = Contributing Drainage Area (ac)
V_R = Volume Required (ac-ft)

Average Drain Rate, D_R (cfs)
(to drain in 36 hrs)
D_R= Vr/(3600*36) = $\boxed{7.97}$ cfs

Palm Valley Phase 5
On-Site Storm Water Detention Volume
100-Year, 6-Hour Storm

Subbasin ID **252C**

Land Use	Area (ac)	C	C_w
Golf		0.35	0
Low Density		0.55	0
Med Density		0.65	0
High Density	17.6	0.7	0.43688
Commercial	10.6	0.8	0.30071
Industrial		0.88	0

Totals	28.20		0.74

Detention Volumes

$V_R = C_w \times I \times A$

V_r = $\boxed{5.20}$ ac-ft

C_w = Weighed Runoff Coefficient
I = Rainfall Depth (ft) 3.0 in
A = Contributing Drainage Area (ac)
V_R = Volume Required (ac-ft)

Average Drain Rate, D_R (cfs)
(to drain in 36 hrs)
D_R= Vr/(3600*36) = $\boxed{1.75}$ cfs

Palm Valley Phase 5
On-Site Storm Water Detention Volume
100-Year, 6-Hour Storm

Subbasin ID **253B**

Land Use	**Area (ac)**	**C**	C_w
Golf		0.35	0
Low Density		0.55	0
Med Density		0.65	0
High Density		0.7	0
Commercial	44.0	0.8	0.8
Industrial		0.88	0

Totals 44.00 0.80

Detention Volumes

$V_R = C_w \times I \times A$

$V_r =$ $\boxed{8.8}$ ac-ft

C_w = Weighed Runoff Coefficient
I = Rainfall Depth (ft) 3.0 in
A = Contributing Drainage Area (ac)
V_R = Volume Required (ac-ft)

Average Drain Rate, D_R (cfs)
(to drain in 36 hrs)
D_R= Vr/(3600*36) = $\boxed{2.96}$ cfs

Palm Valley Phase 5
On-Site Storm Water Detention Volume
100-Year, 6-Hour Storm

Subbasin ID **253C**

Land Use	Area (ac)	C	C_w
Golf	13.27	0.35	0.04337
Low Density	70.73	0.55	0.36323
Med Density	23.1	0.65	0.1402
High Density		0.7	0
Commercial		0.8	0
Industrial		0.88	0

Totals 107.10 0.55

Detention Volumes

$V_R = C_w \times I \times A$

V_r = 14.64025 ac-ft

C_w = Weighed Runoff Coefficient
I = Rainfall Depth (ft) 3.0 in
A = Contributing Drainage Area (ac)
V_R = Volume Required (ac-ft)

Average Drain Rate, D_R (cfs)
(to drain in 36 hrs)
D_R= Vr/(3600*36) = 4.92 cfs

Palm Valley Phase 5
On-Site Storm Water Detention Volume
100-Year, 6-Hour Storm

Subbasin ID **253D**

Land Use	Area (ac)	C	C_w
Golf		0.35	0
Low Density	37.4	0.55	0.55
Med Density		0.65	0
High Density		0.7	0
Commercial		0.8	0
Industrial		0.88	0

Totals 37.40 0.55

Detention Volumes

$V_R = C_w \times I \times A$

$V_r =$ $\boxed{5.1425}$ ac-ft

C_w = Weighed Runoff Coefficient
I = Rainfall Depth (ft) 3.0 in
A = Contributing Drainage Area (ac)
V_R = Volume Required (ac-ft)

Average Drain Rate, D_R (cfs)
(to drain in 36 hrs)
$D_R = Vr/(3600*36) =$ $\boxed{1.73}$ cfs

Palm Valley Phase 5
On-Site Storm Water Detention Volume
100-Year, 6-Hour Storm

Subbasin ID	253E

Land Use	Area (ac)	C	C_w
Golf		0.35	0
Low Density	50.5	0.55	0.55
Med Density		0.65	0
High Density		0.7	0
Commercial		0.8	0
Industrial		0.88	0

Totals 50.50 0.55

Detention Volumes

$V_R = C_w \times I \times A$

$V_r = \boxed{6.94375}$ ac-ft

C_w = Weighed Runoff Coefficient
I = Rainfall Depth (ft) 3.0 in
A = Contributing Drainage Area (ac)
V_R = Volume Required (ac-ft)

Average Drain Rate, D_R (cfs)
(to drain in 36 hrs)
D_R= Vr/(3600*36) = $\boxed{2.33}$ cfs

Palm Valley Phase 5
On-Site Storm Water Detention Volume
100-Year, 6-Hour Storm

Subbasin ID **253F**

Land Use	Area (ac)	C	C_w
Golf		0.35	0
Low Density	29.1	0.55	0.24699
Med Density	35.7	0.65	0.3581
High Density		0.7	0
Commercial		0.8	0
Industrial		0.88	0

Totals 64.80 0.61

Detention Volumes

$V_R = C_w \times I \times A$

V_r = 9.8025 ac-ft

C_w = Weighed Runoff Coefficient
I = Rainfall Depth (ft) 3.0 in
A = Contributing Drainage Area (ac)
V_R = Volume Required (ac-ft)

Average Drain Rate, D_R (cfs)
(to drain in 36 hrs)
D_R= Vr/(3600*36) = 3.29 cfs

Palm Valley Phase 5
On-Site Storm Water Detention Volume
100-Year, 6-Hour Storm

Subbasin ID **253G**

Land Use	**Area (ac)**	**C**	C_w
Golf		0.35	0
Low Density	7	0.55	0.07938
Med Density	41.5	0.65	0.55619
High Density		0.7	0
Commercial		0.8	0
Industrial		0.88	0

Totals 48.50 0.64

Detention Volumes

$V_R = C_w \times I \times A$

V_r = $\boxed{7.70625}$ ac-ft

C_w = Weighed Runoff Coefficient
I = Rainfall Depth (ft) 3.0 in
A = Contributing Drainage Area (ac)
V_R = Volume Required (ac-ft)

Average Drain Rate, D_R (cfs)
(to drain in 36 hrs)
D_R= Vr/(3600*36) = $\boxed{2.59}$ cfs

Palm Valley Phase 5
On-Site Storm Water Detention Volume
100-Year, 6-Hour Storm

Subbasin ID **253H**

Land Use	Area (ac)	C	C_w
Golf		0.35	0
Low Density		0.55	0
Med Density		0.65	0
High Density	20.9	0.7	0.7
Commercial		0.8	0
Industrial		0.88	0

Totals 20.90 0.70

Detention Volumes

$V_R = C_w \times I \times A$

$V_r =$ $\boxed{3.6575}$ ac-ft

C_w = Weighed Runoff Coefficient
I = Rainfall Depth (ft) 3.0 in
A = Contributing Drainage Area (ac)
V_R = Volume Required (ac-ft)

Average Drain Rate, D_R (cfs)
(to drain in 36 hrs)
D_R= Vr/(3600*36) = $\boxed{1.23}$ cfs

Palm Valley Phase 5
On-Site Storm Water Detention Volume
100-Year, 6-Hour Storm

Subbasin ID **253I**

Land Use	Area (ac)	C	C_w
Golf		0.35	0
Low Density		0.55	0
Med Density		0.65	0
High Density	27.6	0.7	0.7
Commercial		0.8	0
Industrial		0.88	0

Totals 27.60 0.70

Detention Volumes

$V_R = C_w \times I \times A$

V_r = $\boxed{4.83}$ ac-ft
3.86 ac-ft

C_w = Weighed Runoff Coefficient
I = Rainfall Depth (ft) 3.0 in
A = Contributing Drainage Area (ac)
V_R = Volume Required (ac-ft)

Average Drain Rate, D_R (cfs)
(to drain in 36 hrs)
D_R= Vr/(3600*36) = $\boxed{1.62}$ cfs

Palm Valley Phase 5
On-Site Storm Water Detention Volume
100-Year, 6-Hour Storm

Subbasin ID **253J**

Land Use	**Area (ac)**	**C**	**C_w**
Golf	17.0	0.35	0.06276
Low Density	77.8	0.55	0.45137
Med Density		0.65	0
High Density		0.7	0
Commercial		0.8	0
Industrial		0.88	0

Totals 94.80 0.51

Detention Volumes

$V_R = C_w \times I \times A$

V_r = $\boxed{12.185}$ ac-ft

C_w = Weighed Runoff Coefficient
I = Rainfall Depth (ft) 3.0 in
A = Contributing Drainage Area (ac)
V_R = Volume Required (ac-ft)

Average Drain Rate, D_R (cfs)
(to drain in 36 hrs)
D_R= Vr/(3600*36) = $\boxed{4.10}$ cfs

Palm Valley Phase 5
On-Site Storm Water Detention Volume
100-Year, 6-Hour Storm

Subbasin ID **253K**

Land Use	**Area (ac)**	**C**	C_w
Golf		0.35	0
Low Density		0.55	0
Med Density		0.65	0
High Density		0.7	0
Commercial	12.5	0.8	0.8
Industrial		0.88	0

Totals 12.50 0.80

Detention Volumes

$V_R = C_w \times I \times A$

V_r = $\boxed{2.5}$ ac-ft

C_w = Weighed Runoff Coefficient
I = Rainfall Depth (ft) 3.0 in
A = Contributing Drainage Area (ac)
V_R = Volume Required (ac-ft)

Average Drain Rate, D_R (cfs)

(to drain in 36 hrs)
D_R= Vr/(3600*36) = $\boxed{0.84}$ cfs

Palm Valley Phase 5
On-Site Storm Water Detention Volume
100-Year, 6-Hour Storm

Subbasin ID **253N**

Land Use	**Area (ac)**	**C**	**C_w**
Golf	48.0	0.35	0.10
Low Density		0.55	0.00
Med Density		0.65	0.00
High Density		0.7	0.00
Commercial	120.5	0.8	0.57
Industrial		0.88	0

Totals	168.50	0.67

Detention Volumes

$V_R = C_w \times I \times A$

V_r = 28.3 ac-ft

C_w = Weighed Runoff Coefficient
I = Rainfall Depth (ft) 3.0 in
A = Contributing Drainage Area (ac)
V_R = Volume Required (ac-ft)
Vr* = 80% of required retention
Average Drain Rate, D_R (cfs)
(to drain in 36 hrs)
D_R= Vr/(3600*36) = 9.51 cfs

Palm Valley Phase 5
On-Site Storm Water Detention Volume
100-Year, 6-Hour Storm

Subbasin ID **253L**

Land Use	**Area (ac)**	**C**	**C_w**
Golf		0.35	0
Low Density		0.55	0
Med Density		0.65	0
High Density		0.7	0
Commercial	7.7	0.8	0.8
Industrial		0.88	0

Totals 7.70 0.80

Detention Volumes

$V_R = C_w \times I \times A$

$V_r =$ $\boxed{1.54}$ ac-ft

C_w = Weighed Runoff Coefficient
I = Rainfall Depth (ft) 3.0 in
A = Contributing Drainage Area (ac)
V_R = Volume Required (ac-ft)

Average Drain Rate, D_R (cfs)
(to drain in 36 hrs)
D_R= Vr/(3600*36) = $\boxed{0.52}$ cfs

Table 2.2

Retention Volume Summary

Basin ID	Volume Required	Min. Drain Rate
	(ac-ft)	CFS
250B	7.0	2.3
251B	6.1	2.0
251C	3.1	1.0
252B	23.7	8.0
252C	4.2	1.4
253B	8.8	3.0
253C	18.1	6.1
253D	6.1	2.0
253E	6.1	2.0
253F	11.8	4.0
253G	6.2	2.1
253H	3.7	1.2
253J	12.6	4.2
253K	2.0	0.7

Note : Keogh Engineering has prepared a separate drainage report for each parcel which includes the onsite retetion volumes and outlet flows.

2.1 Indian School Road HEC-RAS Model

HEC-RAS Plan: Plan 08 River: Indian School Ch Reach: 1 Profile: PF 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)	
1	57	270.00	45.39	47.37	46.98	47.73	0.004509	5.24	58.80	39.45	0.66
	56	270.00	44.91	46.72		47.19	0.006444	5.90	51.68	37.21	0.77
	55	270.00	43.19	45.15	44.77	45.52	0.004677	5.30	58.22	39.55	0.67
1	54	270.00	41.59	43.88		44.12	0.002569	4.36	71.86	42.86	0.51
1	53	270.00	40.84	43.76	42.31	43.87	0.000812	2.88	109.77	52.19	0.30
1	52.5	Culvert									
1	52	270.00	40.40	42.60		42.81	0.002221	3.95	77.73	46.58	0.47
1	51	270.00	40.05	42.22		42.51	0.003209	4.70	66.12	41.06	0.56
1	50	270.00	39.74	41.87		42.17	0.003391	4.77	65.16	41.27	0.58
1	49	270.00	38.74	40.93		41.21	0.003047	4.61	67.66	41.87	0.55
1	48	270.00	37.23	39.43		39.71	0.002983	4.58	68.12	41.90	0.54
1	46	270.00	35.66	37.80	37.25	38.10	0.003427	4.81	64.27	40.13	0.58
1	45	270.00	33.89	36.21		36.45	0.002499	4.34	71.99	42.13	0.50
1	44	270.00	33.26	35.87		36.04	0.001555	3.70	85.67	45.73	0.40
1	43	270.00	32.95	35.79	34.43	35.91	0.000917	3.01	104.77	50.82	0.31
1	42.5	Culvert									
1	42	270.00	32.37	34.75		34.92	0.002421	3.52	83.34	47.05	0.40
1	41	270.00	32.00	34.31		34.55	0.002444	4.28	73.38	43.54	0.50
1	40	270.00	31.62	33.93		34.17	0.002484	4.31	72.56	42.81	0.50
1	39	270.00	30.62	32.95		33.19	0.002413	4.28	73.26	42.90	0.49
1	38	270.00	29.37	32.28		32.41	0.000993	3.19	100.90	49.25	0.33
1	37.75	270.00	28.24	32.20	29.84	32.26	0.000319	2.22	148.12	54.80	0.20
1	37.6	Culvert									
1	37.5	270.00	28.50	30.80		31.08	0.002731	4.51	68.29	39.29	0.52
1	37	270.00	28.11	30.43		30.67	0.002457	4.30	72.88	42.93	0.50
1	36	270.00	26.86	29.72		29.86	0.001068	3.26	98.30	48.70	0.34
1	35	270.00	26.35	29.58		29.69	0.000692	2.85	113.18	49.99	0.28
1	34	270.00	26.13	29.47	27.80	29.61	0.000855	3.23	94.65	36.70	0.31
1	33.5	Culvert									
1	33	270.00	25.67	27.93		28.27	0.004939	4.87	59.02	32.13	0.57
1	32	270.00	25.19	27.41		27.66	0.002798	4.45	70.52	43.64	0.53
1	31	270.00	24.90	27.11		27.37	0.002912	4.53	69.05	42.61	0.54
	30	270.00	24.27	26.49	25.85	26.76	0.002895	4.53	68.89	42.16	0.54
	29	270.00	23.08	25.22		25.52	0.003318	4.74	65.62	41.33	0.57
1	28	270.00	22.78	24.98		25.21	0.002648	4.31	74.04	47.45	0.51
1	27	270.00	21.59	24.24		24.41	0.001492	3.66	86.36	45.18	0.40
1	26	270.00	20.74	24.00	22.35	24.11	0.000700	2.88	111.09	48.07	0.28
1	25.5	Culvert									
1	25	270.00	20.31	22.78		22.96	0.002484	3.66	81.23	45.73	0.41
1	24	270.00	19.87	22.49		22.67	0.001548	3.71	85.27	45.01	0.40
1	23	270.00	19.51	22.31		22.49	0.001366	3.64	85.52	41.02	0.38
1	22	270.00	19.22	22.26		22.36	0.000814	2.96	109.59	52.21	0.30
1	21	270.00	18.64	22.16		22.23	0.000479	2.51	130.66	54.35	0.24
1	20	270.00	18.05	22.10		22.15	0.000267	2.06	161.96	59.91	0.18
1	19.7	270.00	17.76	22.09	19.33	22.12	0.000186	1.79	189.63	67.66	0.15
1	19.6	Culvert									
1	19.5	270.00	17.49	21.63		21.68	0.000230	1.94	173.35	63.65	0.17
1	19	270.00	17.17	21.62		21.65	0.000178	1.79	188.71	64.86	0.15
1	18	270.00	16.29	21.60	17.88	21.62	0.000085	1.39	248.06	73.43	0.11

PALM VALLEY PHASE 5

Indian School Road Channel

Freeboard (FB) Depth Calculation

FB = $0.25*(depth + V^2/2g)$

River Sta	Min Ch El	W.S. Elev	Vel Chnl	Channel Depth	**Free Board Calc.**	Min. Free Board Depth	Freeboard Elevation
	(ft)	(ft)	(ft/s)	(ft)	**(ft)**	(ft)	(ft)
57	45.39	47.37	5.24	1.98	**0.60**	1	48.37
56	44.91	46.72	5.9	1.81	**0.59**	1	47.72
55	43.19	45.15	5.3	1.96	**0.60**	1	46.15
54	41.59	43.88	4.36	2.29	**0.65**	1	44.88
53	40.84	43.76	2.88	2.92	**0.76**	1	44.76
52.5							
52	40.4	42.6	3.95	2.2	**0.61**	1	43.60
51	40.05	42.22	4.7	2.17	**0.63**	1	43.22
50	39.74	41.87	4.77	2.13	**0.62**	1	42.87
49	38.74	40.93	4.61	2.19	**0.63**	1	41.93
48	37.23	39.43	4.58	2.2	**0.63**	1	40.43
46	35.66	37.8	4.81	2.14	**0.62**	1	38.80
45	33.89	36.21	4.34	2.32	**0.65**	1	37.21
44	33.26	35.87	3.7	2.61	**0.71**	1	36.87
43	32.95	35.79	3.01	2.84	**0.75**	1	36.79
42.5							
42	32.37	34.75	3.52	2.38	**0.64**	1	35.75
41	32	34.31	4.28	2.31	**0.65**	1	35.31
40	31.62	33.93	4.31	2.31	**0.65**	1	34.93
39	30.62	32.95	4.28	2.33	**0.65**	1	33.95
38	29.37	32.28	3.19	2.91	**0.77**	1	33.28
37.75	28.24	32.2	2.22	3.96	**1.01**	1	33.20
37.6							
37.5	28.5	30.8	4.51	2.3	**0.65**	1	31.80
37	28.11	30.43	4.3	2.32	**0.65**	1	31.43
36	26.86	29.72	3.26	2.86	**0.76**	1	30.72
35	26.35	29.58	2.85	3.23	**0.84**	1	30.58
34	26.13	29.47	3.23	3.34	**0.88**	1	30.47
33.5							
33	25.67	27.93	4.87	2.26	**0.66**	1	28.93
32	25.19	27.41	4.45	2.22	**0.63**	1	28.41
31	24.9	27.11	4.53	2.21	**0.63**	1	28.11
30	24.27	26.49	4.53	2.22	**0.63**	1	27.49
29	23.08	25.22	4.74	2.14	**0.62**	1	26.22

PALM VALLEY PHASE 5

Indian School Road Channel

Freeboard (FB) Depth Calculation

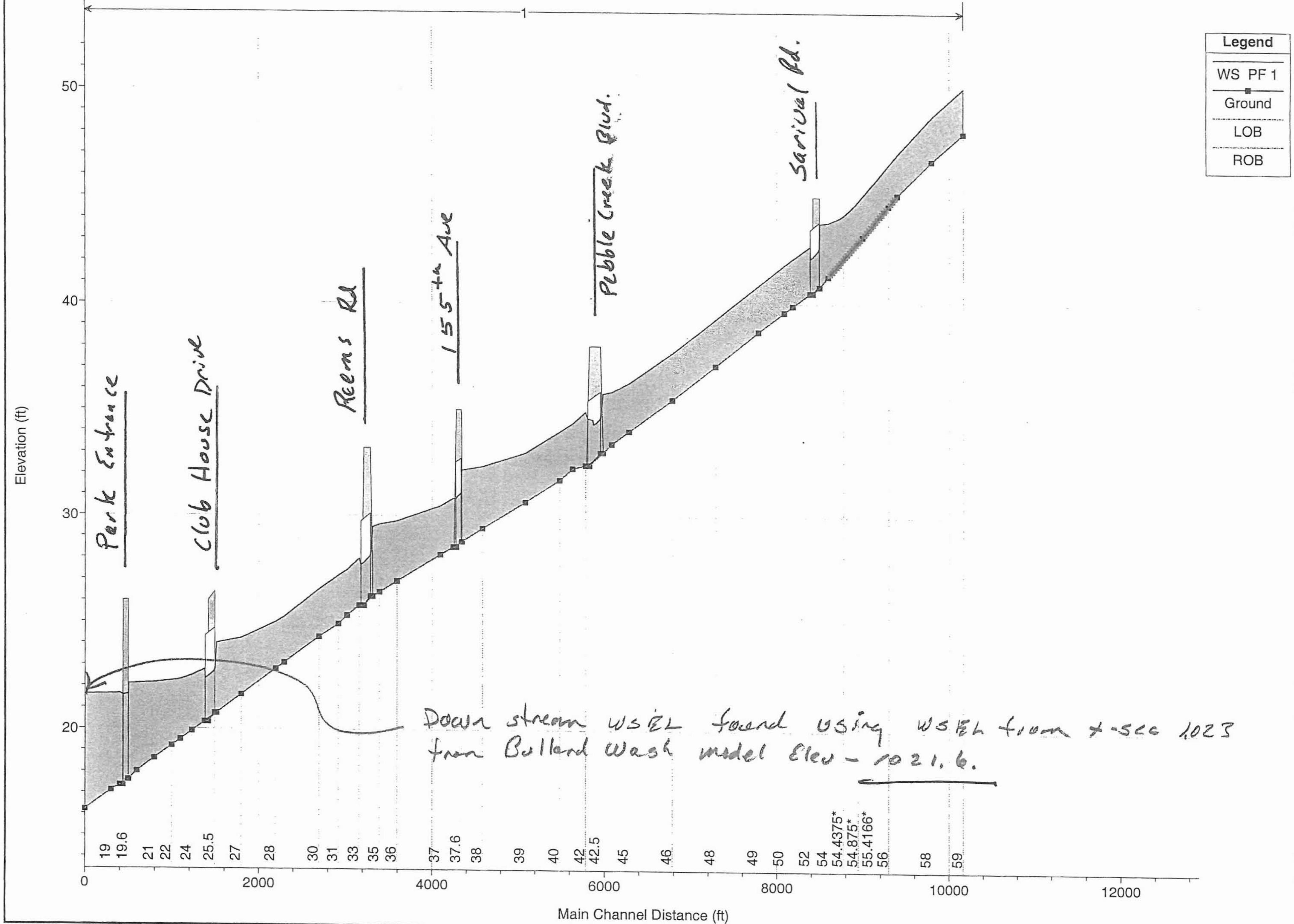
FB = 0.25*(depth + $V^2/2g$)

River Sta	Min Ch El	W.S. Elev	Vel Chnl	Channel Depth	**Free Board Calc.**	Min. Free Board Depth	Freeboard Elevation
	(ft)	(ft)	(ft/s)	(ft)	**(ft)**	(ft)	(ft)
28	22.78	24.98	4.31	2.2	**0.62**	1	25.98
27	21.59	24.24	3.66	2.65	**0.71**	1	25.24
26	20.74	24	2.88	3.26	**0.85**	1	25.00
25.5							
25	20.31	22.78	3.66	2.47	**0.67**	1	23.78
24	19.87	22.49	3.71	2.62	**0.71**	1	23.49
23	19.51	22.31	3.64	2.8	**0.75**	1	23.31
22	19.22	22.26	2.96	3.04	**0.79**	1	23.26
21	18.64	22.16	2.51	3.52	**0.90**	1	23.16
20	18.05	22.1	2.06	4.05	**1.03**	1.0	23.13
19.7	17.76	22.09	1.79	4.33	**1.09**	1.1	23.18
19.6							
19.5	17.49	21.63	1.94	4.14	**1.05**	1.0	22.68
19	17.17	21.62	1.79	4.45	**1.12**	1.1	22.74
18	16.29	21.6	1.39	5.31	**1.34**	1.3	22.94

Indian School Road
Cross Section vs Channel Station

River Sta	Sta
	ft
57	3339
56	3439
55	3739
54	4139
53	4299
52.5	
52	4429
51	4541
50	4641
49	4941
48	5441
46	5941
45	6503
44	6703
43	6803
42.5	
42	7003
41	7153
40	7303
39	7703
38	8203
37.75	8453
37.6	
37.5	8548
37	8705
36	9205
35	9405
34	9495
33.5	
33	9635
32	9795
31	9895
30	10107
29	10507
28	10607
27	11007
26	11294
25.5	
25	11429
24	11579
23	11704
22	11804
21	12004
20	12204
19.7	12304
19.6	
19.5	12399
19	12509
18	12809

Indian School Channel Plan: Plan 08



1 in Horiz. = 1500 ft 1 in Vert. = 6 ft

HEC-RAS Version 3.0.1 Mar 2001
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
 X     X  X       X    X       X  X     X    X         X
 X     X  XXXXXX   XXXX        X   X    X    X    XXXXX
```

PROJECT DATA
Project Title: Indian School Channel
Project File : 303004IndSch.prj
Run Date and Time: 9/2/2004 2:55:07 PM

Project in English units

Project Description:
Loop 303 to bullard Wash

PLAN DATA

Plan Title: Plan 08
Plan File : w:\303004\CD FILES\final Submittal\Ind Sch HEC-RAS\303004IndSch.p08

Geometry Title: Geom 01
Geometry File : w:\303004\CD FILES\final Submittal\Ind Sch HEC-RAS\303004IndSch.g01

Flow Title : Flow 01
Flow File : w:\303004\CD FILES\final Submittal\Ind Sch HEC-RAS\303004IndSch.f01

Plan Summary Information:

Number of:				
Cross Sections =	43	Mulitple Openings =	0
Culverts =	6	Inline Weirs =	0
Bridges =	0		

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculaton tolerance = 0.01
Maximum number of interations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Mixed Flow

FLOW DATA

Flow Title: Flow 01
Flow File : w:\303004\CD FILES\final Submittal\Ind Sch HEC-RAS\303004IndSch.f01

Flow Data (cfs)

River	Reach	RS	PF 1
Indian School	Ch1	57	270
Indian School	Ch1	46	270
Indian School	Ch1	37	270

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Indian School Ch1		PF 1	Normal S = .0047	Known WS = 21.6

```
GEOMETRY DATA

Geometry Title: Geom 01
Geometry File : w:\303004\CD FILES\final Submittal\Ind Sch HEC-RAS\303004IndSch.g01

CROSS SECTION          RIVER: Indian School Ch
REACH: 1                 RS: 57

INPUT
Description: STA 34
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev      Sta    Elev      Sta    Elev
       0   48.89      14   45.39       34   45.39       55   48.99

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val      Sta   n Val
       0     .03      14     .03       34     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
            14      34              100      100    100               .1       .3

CROSS SECTION          RIVER: Indian School Ch
REACH: 1                 RS: 56

INPUT
Description: STA 35
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev      Sta    Elev      Sta    Elev
       0   48.41      14   44.91       34   44.91       55   48.71

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val      Sta   n Val
       0     .03      14     .03       34     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
            14      34              300      300    300               .1       .3

CROSS SECTION          RIVER: Indian School Ch
REACH: 1                 RS: 55

INPUT
Description: STA 38
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev      Sta    Elev      Sta    Elev
       0   46.69      14   43.19       34   43.19       58   47.19

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val      Sta   n Val
       0     .03      14     .03       34     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
            14      34              400      400    400               .1       .3

CROSS SECTION          RIVER: Indian School Ch
REACH: 1                 RS: 54

INPUT
Description: STA 42
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev      Sta    Elev      Sta    Elev
       0   45.09      14   41.59       34   41.59       55   45.09

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val      Sta   n Val
       0     .03      14     .03       34     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
            14      34              160      160    160               .1       .3

CROSS SECTION          RIVER: Indian School Ch
REACH: 1                 RS: 53
```

```
INPUT
Description: STA 43
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   45.04      17   40.84      40   40.84      65   45.04

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03      17     .03      40     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            17      40               130     130     130              .1       .3

CULVERT                  RIVER: Indian School Ch
REACH: 1                    RS: 52.5

INPUT
Description: Sarival Ave  STA 43.5
Distance from Upstream XS =       1
Deck/Roadway Width        =      75
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0      45              65      45

Upstream Bridge Cross Section Data
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   45.04      17   40.84      40   40.84      65   45.04

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03      17     .03      40     .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
            17      40              .1       .3

Downstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0      45              65      45

Downstream Bridge Cross Section Data
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    44.4      16    40.4      40    40.4      65    44.4

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03      16     .03      40     .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
            16      40              .1       .3

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .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
Sarival Ave        Box         3      10
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    n Value   Entrance Loss Coef   Exit Loss Coef
                  5     105       .012                   .4               .3
Number of Barrels =  2
Upstream   Elevation =  40.84
Centerline Stations
    Sta.    Sta.
      23    33.6
Downstream Elevation =  40.48
```

Centerline Stations

Sta.	Sta.
23	33.6

CROSS SECTION RIVER: Indian School Ch
REACH: 1 RS: 52

INPUT
Description: STA 44
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	44.4	16	40.4	40	40.4	65	44.4

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	16	.03	40	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
16	40	112	112	112	.1	.3

CROSS SECTION RIVER: Indian School Ch
REACH: 1 RS: 51

INPUT
Description: STA 46
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	43.65	14	40.05	34	40.05	55	43.65

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	14	.03	34	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
14	34	100	100	100	.1	.3

CROSS SECTION RIVER: Indian School Ch
REACH: 1 RS: 50

INPUT
Description: STA 47
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	43.24	14	39.74	34	39.74	58	43.74

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	14	.03	34	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
14	34	300	300	300	.1	.3

CROSS SECTION RIVER: Indian School Ch
REACH: 1 RS: 49

INPUT
Description: STA 50
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	42.24	14	38.74	34	38.74	58	42.74

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	14	.03	34	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
14	34	500	500	500	.1	.3

CROSS SECTION RIVER: Indian School Ch
REACH: 1 RS: 48

INPUT
Description: STA 55
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	40.73	14	37.23	34	37.23	59	41.43

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

```
       0     .03       14     .03       34     .03

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
            14       34                500     500     500                 .1        .3

CROSS SECTION            RIVER: Indian School Ch
REACH: 1                    RS: 46

INPUT
Description: STA 60
Station Elevation Data      num=        4
     Sta     Elev      Sta     Elev     Sta     Elev       Sta     Elev
       0    39.16       14    35.66      34    35.66        60    40.46

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val     Sta    n Val
       0      .03       14      .03      34      .03

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
            14       34                562     562     562                 .1        .3

CROSS SECTION            RIVER: Indian School Ch
REACH: 1                    RS: 45

INPUT
Description: STA 65
Station Elevation Data      num=        4
     Sta     Elev      Sta     Elev     Sta     Elev       Sta     Elev
       0    37.89       14    33.89      34    33.89        60    38.19

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val     Sta    n Val
       0      .03       14      .03      34      .03

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
            14       34                200     200     200                 .1        .3

CROSS SECTION            RIVER: Indian School Ch
REACH: 1                    RS: 44

INPUT
Description: STA 67
Station Elevation Data      num=        4
     Sta     Elev      Sta     Elev     Sta     Elev       Sta     Elev
       0    36.76       14    33.26      34    33.26        61    37.86

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val     Sta    n Val
       0      .03       14      .03      34      .03

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
            14       34                100     100     100                 .1        .3

CROSS SECTION            RIVER: Indian School Ch
REACH: 1                    RS: 43

INPUT
Description: STA 68
Station Elevation Data      num=        4
     Sta     Elev      Sta     Elev     Sta     Elev       Sta     Elev
       0    37.95       20    32.95      43    32.95        72    37.95

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val     Sta    n Val
       0      .03       20      .03      43      .03

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
            20       43                200     200     200                 .1        .3

CULVERT                  RIVER: Indian School Ch
REACH: 1                    RS: 42.5

INPUT
Description: Pebble Creek STA 69
Distance from Upstream XS =        30
Deck/Roadway Width        =       125
Weir Coefficient          =       2.6
Upstream  Deck/Roadway Coordinates
    num=        2
```

```
      Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
       0     38                  72     38

 Upstream Bridge Cross Section Data
 Station Elevation Data     num=        4
      Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
        0    37.95       20    32.95      43    32.95       72    37.95

 Manning's n Values          num=        3
      Sta    n Val      Sta    n Val      Sta    n Val
        0      .03       20      .03       43      .03

 Bank Sta: Left    Right     Coeff Contr.    Expan.
             20       43                .1        .3

 Downstream  Deck/Roadway Coordinates
     num=        2
      Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
       0     38                  72     38

 Downstream Bridge Cross Section Data
 Station Elevation Data     num=        4
      Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
        0    36.97     18.5    32.37    41.5    32.37     69.5    36.97

 Manning's n Values          num=        3
      Sta    n Val      Sta    n Val      Sta    n Val
        0      .03     18.5     .037    41.5      .03

 Bank Sta: Left    Right     Coeff Contr.    Expan.
           18.5     41.5                .1        .3

 Upstream Embankment side slope              =       6 horiz. to 1.0 vertical
 Downstream Embankment side slope            =       6 horiz. to 1.0 vertical
 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
 Pebble Creek        Box        3      10
 FHWA Chart # 8 - flared wingwalls
 FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist  Length    n Value   Entrance Loss Coef   Exit Loss Coef
                  30     143      .012                   .4                .3
 Number of Barrels =  2
 Upstream   Elevation =  32.88
 Centerline Stations
     Sta.    Sta.
     26.6    37.3
 Downstream Elevation =  32.44
 Centerline Stations
     Sta.    Sta.
     24.6    35.3

 CROSS SECTION           RIVER: Indian School Ch
 REACH: 1                   RS: 42

 INPUT
 Description: STA 70
 Station Elevation Data     num=        4
      Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
        0    36.97     18.5    32.37    41.5    32.37     69.5    36.97

 Manning's n Values          num=        3
      Sta    n Val      Sta    n Val      Sta    n Val
        0      .03     18.5     .037    41.5      .03

 Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
           18.5     41.5               150     150      150                .1        .3

 CROSS SECTION           RIVER: Indian School Ch
 REACH: 1                   RS: 41

 INPUT
```

```
Description: STA 71.5
Station Elevation Data    num=        4
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0     35.5       14       32       34       32       60     36.2

Manning's n Values        num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .03       14      .03       34      .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            14      34              150     150     150               .1       .3

CROSS SECTION            RIVER: Indian School Ch
REACH: 1                     RS: 40

INPUT
Description: STA 73
Station Elevation Data    num=        4
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0    35.12       14    31.62       34    31.62       61    36.22

Manning's n Values        num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .03       14      .03       34      .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            14      34              400     400     400               .1       .3

CROSS SECTION            RIVER: Indian School Ch
REACH: 1                     RS: 39

INPUT
Description: STA 77
Station Elevation Data    num=        4
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0    34.12       14    30.62       34    30.62       62    35.42

Manning's n Values        num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .03       14      .03       34      .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            14      34              500     500     500               .1       .3

CROSS SECTION            RIVER: Indian School Ch
REACH: 1                     RS: 38

INPUT
Description: STA 82
Station Elevation Data    num=        4
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0    32.87       14    29.37       34    29.37       66    34.67

Manning's n Values        num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .03       14      .03       34      .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            14      34              250     250     250               .1       .3

CROSS SECTION            RIVER: Indian School Ch
REACH: 1                     RS: 37.75

INPUT
Description: STA 82
Station Elevation Data    num=        4
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0    32.37       14    28.24       34    28.24       66    34.17

Manning's n Values        num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .03       14      .03       34      .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            14      34               95      95      95               .1       .3

CULVERT                  RIVER: Indian School Ch
REACH: 1                     RS: 37.6
```

```
INPUT
Description:
Distance from Upstream XS =       5
Deck/Roadway Width        =      60
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0      35      20     150      35      20

Upstream Bridge Cross Section Data
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   32.37      14   28.24      34   28.24      66   34.17

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03      14     .03      34     .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
            14      34              .1       .3

Downstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0      35      20     150      35      20

Downstream Bridge Cross Section Data
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   32.88      14    28.5      34    28.5      66   34.68

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03      14     .03      34     .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
            14      34              .1       .3

Upstream Embankment side slope              =       4 horiz. to 1.0 vertical
Downstream Embankment side slope            =       4 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .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        4       8
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 Loss Coef
                 10      58       .015                   .5                1
Number of Barrels =  2
Upstream   Elevation =  28.71
Centerline Stations
    Sta.    Sta.
    18.6    27.2
Downstream Elevation =  28.55
Centerline Stations
    Sta.    Sta.
    18.6    27.2

CROSS SECTION          RIVER: Indian School Ch
REACH: 1                   RS: 37.5

INPUT
Description: STA 82
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   32.88      14    28.5      34    28.5      66   34.68

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03      14     .03      34     .03
```

```
Bank Sta: Left    Right     Lengths: Left Channel   Right     Coeff Contr.   Expan.
            14       34                 157     157     157                .1        .3

CROSS SECTION           RIVER: Indian School Ch
REACH: 1                     RS: 37

INPUT
Description: STA 87
Station Elevation Data     num=        4
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0    31.61       14    28.11       34    28.11       70    34.21

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .03       14      .03       34      .03

Bank Sta: Left    Right     Lengths: Left Channel   Right     Coeff Contr.   Expan.
            14       34                 500     500     500                .1        .3

CROSS SECTION           RIVER: Indian School Ch
REACH: 1                     RS: 36

INPUT
Description: STA 92
Station Elevation Data     num=        4
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0    30.36       14    26.86       34    26.86       75    33.66

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .03       14      .03       34      .03

Bank Sta: Left    Right     Lengths: Left Channel   Right     Coeff Contr.   Expan.
            14       34                 200     200     200                .1        .3

CROSS SECTION           RIVER: Indian School Ch
REACH: 1                     RS: 35

INPUT
Description: STA 94
Station Elevation Data     num=        4
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0    30.35       14    26.35       34    26.35       75    33.45

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .03       14      .03       34      .03

Bank Sta: Left    Right     Lengths: Left Channel   Right     Coeff Contr.   Expan.
            14       34                  90      90      90                .1        .3

CROSS SECTION           RIVER: Indian School Ch
REACH: 1                     RS: 34

INPUT
Description: STA 94.8
Station Elevation Data     num=        4
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0    33.13       14    26.13       34    26.13       55    33.13

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .03       14      .03       34      .03

Bank Sta: Left    Right     Lengths: Left Channel   Right     Coeff Contr.   Expan.
            14       34                 140     140     140                .1        .3

CULVERT                 RIVER: Indian School Ch
REACH: 1                     RS: 33.5

INPUT
Description: Reems Rd STA 95.5
Distance from Upstream XS =       25
Deck/Roadway Width        =       75
Weir Coefficient          =      2.6
Upstream  Deck/Roadway Coordinates
    num=        2
     Sta Hi Cord Lo Cord        Sta Hi Cord Lo Cord
       0    33.2                 80    33.2
```

```
Upstream Bridge Cross Section Data
Station Elevation Data    num=        4
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0    33.13       14    26.13       34    26.13       55    33.13

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .03       14      .03       34      .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
            14      34              .1       .3

Downstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
       0    33.2               75    33.2

Downstream Bridge Cross Section Data
Station Elevation Data    num=        4
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0     32.2       14    25.67       34    25.67       55     32.2

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .03       14     .037       34      .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
            14      34              .1       .3

Upstream Embankment side slope              =      4.2 horiz. to 1.0 vertical
Downstream Embankment side slope            =        4 horiz. to 1.0 vertical
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
Reems Rd           Box         4       8
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 Loss Coef
                 25     109       .012                   .4               .3
Number of Barrels =  2
Upstream   Elevation =  26.1
Centerline Stations
    Sta.    Sta.
    19.6    28.2
Downstream Elevation =  25.72
Centerline Stations
    Sta.    Sta.
      20    28.6

CROSS SECTION           RIVER: Indian School Ch
REACH: 1                   RS: 33

INPUT
Description: STA 96.35
Station Elevation Data    num=        4
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0     32.2       14    25.67       34    25.67       55     32.2

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .03       14     .037       34      .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            14      34              160     160     160              .1       .3

CROSS SECTION           RIVER: Indian School Ch
REACH: 1                   RS: 32

INPUT
Description: STA 97.75
Station Elevation Data    num=        4
```

```
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0    28.69       14    25.19       34    25.19       76    31.49

Manning's n Values          num=         3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .03       14      .03       34      .03

Bank Sta: Left    Right     Lengths: Left Channel    Right       Coeff Contr.    Expan.
            14       34               100      100      100                 .1        .3

CROSS SECTION             RIVER: Indian School Ch
REACH: 1                     RS: 31

INPUT
Description: STA 99.0
Station Elevation Data      num=         4
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0     28.4       14     24.9       34     24.9       74     31.3

Manning's n Values          num=         3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .03       14      .03       34      .03

Bank Sta: Left    Right     Lengths: Left Channel    Right       Coeff Contr.    Expan.
            14       34               212      212      212                 .1        .3

CROSS SECTION             RIVER: Indian School Ch
REACH: 1                     RS: 30

INPUT
Description: STA 101
Station Elevation Data      num=         4
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0    27.77       14    24.27       34    24.27       70    30.27

Manning's n Values          num=         3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .03       14      .03       34      .03

Bank Sta: Left    Right     Lengths: Left Channel    Right       Coeff Contr.    Expan.
            14       34               400      400      400                 .1        .3

CROSS SECTION             RIVER: Indian School Ch
REACH: 1                     RS: 29

INPUT
Description: STA 105
Station Elevation Data      num=         4
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0    26.58       14    23.08       34    23.08       68    28.78

Manning's n Values          num=         3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .03       14      .03       34      .03

Bank Sta: Left    Right     Lengths: Left Channel    Right       Coeff Contr.    Expan.
            14       34               100      100      100                 .1        .3

CROSS SECTION             RIVER: Indian School Ch
REACH: 1                     RS: 28

INPUT
Description: STA 106
Station Elevation Data      num=         4
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0    26.78       14    22.78       34    22.78       70    26.78

Manning's n Values          num=         3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .03       14      .03       34      .03

Bank Sta: Left    Right     Lengths: Left Channel    Right       Coeff Contr.    Expan.
            14       34               400      400      400                 .1        .3

CROSS SECTION             RIVER: Indian School Ch
REACH: 1                     RS: 27

INPUT
Description: STA 110
```

```
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   25.59      14   21.59      34   21.59      70   27.59

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03      14     .03      34     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right    Coeff Contr.   Expan.
            14      34              287     287     287            .1       .3

CROSS SECTION          RIVER: Indian School Ch
REACH: 1                   RS: 26

INPUT
Description: STA 112.87
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   25.21      14   20.74      34   20.74      65   26.41

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03      14     .03      34     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right    Coeff Contr.   Expan.
            14      34              135     135     135            .1       .3

CULVERT                RIVER: Indian School Ch
REACH: 1                   RS: 25.5

INPUT
Description: Club House Dr STA 113.5
Distance from Upstream XS =      20
Deck/Roadway Width        =      75
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0    26.4              75    26.4

Upstream Bridge Cross Section Data
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   25.21      14   20.74      34   20.74      65   26.41

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03      14     .03      34     .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
            14      34            .1       .3

Downstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0      26              75      26

Downstream Bridge Cross Section Data
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   24.78      14   20.31      34   20.31      68   24.98

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03      14    .037      34     .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
            14      34            .1       .3

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .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
Club House             Box     4       8
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 Loss Coef
                 20    109       .012                    .3               .1
Number of Barrels =  2
Upstream   Elevation =  20.7
Centerline Stations
    Sta.    Sta.
    18.6    27.2
Downstream Elevation =  20.35
Centerline Stations
    Sta.    Sta.
    18.6    27.2

CROSS SECTION           RIVER: Indian School Ch
REACH: 1                   RS: 25

INPUT
Description: STA 114.22
Station Elevation Data    num=       4
     Sta     Elev     Sta     Elev      Sta     Elev      Sta     Elev
       0    24.78      14    20.31       34    20.31       68    24.98

Manning's n Values          num=       3
     Sta    n Val     Sta    n Val      Sta    n Val
       0      .03      14     .037       34      .03

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.   Expan.
            14       34                150      150      150                .1       .3

CROSS SECTION           RIVER: Indian School Ch
REACH: 1                   RS: 24

INPUT
Description: STA 115.67
Station Elevation Data    num=       4
     Sta     Elev     Sta     Elev      Sta     Elev      Sta     Elev
       0    23.37      14    19.87       34    19.87       65    25.47

Manning's n Values          num=       3
     Sta    n Val     Sta    n Val      Sta    n Val
       0      .03      14      .03       34      .03

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.   Expan.
            14       34                125      125      125                .1       .3

CROSS SECTION           RIVER: Indian School Ch
REACH: 1                   RS: 23

INPUT
Description: STA 117
Station Elevation Data    num=       4
     Sta     Elev     Sta     Elev      Sta     Elev      Sta     Elev
       0    23.01      14    19.51       34    19.51       55    25.51

Manning's n Values          num=       3
     Sta    n Val     Sta    n Val      Sta    n Val
       0      .03      14      .03       34      .03

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.   Expan.
            14       34                100      100      100                .1       .3

CROSS SECTION           RIVER: Indian School Ch
REACH: 1                   RS: 22

INPUT
Description: STA 118
Station Elevation Data    num=       4
     Sta     Elev     Sta     Elev      Sta     Elev      Sta     Elev
       0    22.72      14    19.22       34    19.22       73    25.12

Manning's n Values          num=       3
     Sta    n Val     Sta    n Val      Sta    n Val
       0      .03      14      .03       34      .03

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.   Expan.
```

```
              14       34                200      200      200                .1        .3

CROSS SECTION           RIVER: Indian School Ch
REACH: 1                    RS: 21

INPUT
Description: STA 120
Station Elevation Data    num=        4
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0   22.64       14   18.64       34   18.64       71   24.54

Manning's n Values         num=        3
     Sta    n Val     Sta    n Val     Sta    n Val
       0     .03       14     .03       34     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
            14      34                200     200     200               .1        .3

CROSS SECTION           RIVER: Indian School Ch
REACH: 1                    RS: 20

INPUT
Description: STA 122
Station Elevation Data    num=        4
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0   22.65       18   18.05       38   18.05       73   23.95

Manning's n Values         num=        3
     Sta    n Val     Sta    n Val     Sta    n Val
       0     .03       18     .03       38     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
            18      38                100     100     100               .1        .3

CROSS SECTION           RIVER: Indian School Ch
REACH: 1                    RS: 19.7

INPUT
Description: STA 125
Station Elevation Data    num=        4
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0   22.76       20   17.76       40   17.76       80   23.46

Manning's n Values         num=        3
     Sta    n Val     Sta    n Val     Sta    n Val
       0     .03       20     .03       40     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
            20      40                 95      95      95               .1        .3

CULVERT                 RIVER: Indian School Ch
REACH: 1                    RS: 19.6

INPUT
Description:
Distance from Upstream XS =       5
Deck/Roadway Width        =      60
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       2
      Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
        0      26      12     200      26      12

Upstream Bridge Cross Section Data
Station Elevation Data    num=        4
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0   22.76       20   17.76       40   17.76       80   23.46

Manning's n Values         num=        3
     Sta    n Val     Sta    n Val     Sta    n Val
       0     .03       20     .03       40     .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
            20      40             .1        .3

Downstream  Deck/Roadway Coordinates
    num=       2
      Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
        0      26      12     200      26      12
```

```
Downstream Bridge Cross Section Data
Station Elevation Data    num=       4
     Sta     Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0    22.74       20   17.49       40   17.49       80   23.44

Manning's n Values         num=       3
     Sta    n Val      Sta   n Val      Sta   n Val
       0      .03       20     .03       40     .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
            20      40              .1        .3

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .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       4       8
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 Loss Coef
                  2      60      .015                   .5                1
Number of Barrels =  2
Upstream   Elevation =  17.6
Centerline Stations
    Sta.    Sta.
      23      32
Downstream Elevation =  17.55
Centerline Stations
    Sta.    Sta.
      23      32

CROSS SECTION           RIVER: Indian School Ch
REACH: 1                   RS: 19.5

INPUT
Description: STA 125
Station Elevation Data    num=       4
     Sta     Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0    22.74       20   17.49       40   17.49       80   23.44

Manning's n Values         num=       3
     Sta    n Val      Sta   n Val      Sta   n Val
       0      .03       20     .03       40     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            20      40              110     110     110              .1        .3

CROSS SECTION           RIVER: Indian School Ch
REACH: 1                   RS: 19

INPUT
Description: STA 125
Station Elevation Data    num=       4
     Sta     Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0    22.67       20   17.17       40   17.17       80   23.37

Manning's n Values         num=       3
     Sta    n Val      Sta   n Val      Sta   n Val
       0      .03       20     .03       40     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            20      40              300     300     300              .1        .3

CROSS SECTION           RIVER: Indian School Ch
REACH: 1                   RS: 18

INPUT
Description: STA 128
Station Elevation Data    num=       4
     Sta     Elev      Sta    Elev      Sta    Elev      Sta    Elev
```

0	22.69	26	16.29	46	16.29	85	22.79

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	26	.03	46	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
26	46	0	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Indian School Ch

Reach	River Sta.	n1	n2	n3
1	57	.03	.03	.03
1	56	.03	.03	.03
1	55	.03	.03	.03
1	54	.03	.03	.03
1	53	.03	.03	.03
1	52.5	Culvert		
1	52	.03	.03	.03
1	51	.03	.03	.03
1	50	.03	.03	.03
1	49	.03	.03	.03
1	48	.03	.03	.03
1	46	.03	.03	.03
1	45	.03	.03	.03
1	44	.03	.03	.03
1	43	.03	.03	.03
1	42.5	Culvert		
1	42	.03	.037	.03
1	41	.03	.03	.03
1	40	.03	.03	.03
1	39	.03	.03	.03
1	38	.03	.03	.03
1	37.75	.03	.03	.03
1	37.6	Culvert		
1	37.5	.03	.03	.03
1	37	.03	.03	.03
1	36	.03	.03	.03
1	35	.03	.03	.03
1	34	.03	.03	.03
1	33.5	Culvert		
1	33	.03	.037	.03
1	32	.03	.03	.03
1	31	.03	.03	.03
1	30	.03	.03	.03
1	29	.03	.03	.03
1	28	.03	.03	.03
1	27	.03	.03	.03
1	26	.03	.03	.03
1	25.5	Culvert		
1	25	.03	.037	.03
1	24	.03	.03	.03
1	23	.03	.03	.03
1	22	.03	.03	.03
1	21	.03	.03	.03
1	20	.03	.03	.03
1	19.7	.03	.03	.03
1	19.6	Culvert		
1	19.5	.03	.03	.03
1	19	.03	.03	.03
1	18	.03	.03	.03

SUMMARY OF REACH LENGTHS

River: Indian School Ch

Reach	River Sta.	Left	Channel	Right
1	57	100	100	100
1	56	300	300	300
1	55	400	400	400

1	54	160	160	160
1	53	130	130	130
1	52.5	Culvert		
1	52	112	112	112
1	51	100	100	100
1	50	300	300	300
1	49	500	500	500
1	48	500	500	500
1	46	562	562	562
1	45	200	200	200
1	44	100	100	100
1	43	200	200	200
1	42.5	Culvert		
1	42	150	150	150
1	41	150	150	150
1	40	400	400	400
1	39	500	500	500
1	38	250	250	250
1	37.75	95	95	95
1	37.6	Culvert		
1	37.5	157	157	157
1	37	500	500	500
1	36	200	200	200
1	35	90	90	90
1	34	140	140	140
1	33.5	Culvert		
1	33	160	160	160
1	32	100	100	100
1	31	212	212	212
1	30	400	400	400
1	29	100	100	100
1	28	400	400	400
1	27	287	287	287
1	26	135	135	135
1	25.5	Culvert		
1	25	150	150	150
1	24	125	125	125
1	23	100	100	100
1	22	200	200	200
1	21	200	200	200
1	20	100	100	100
1	19.7	95	95	95
1	19.6	Culvert		
1	19.5	110	110	110
1	19	300	300	300
1	18	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Indian School Ch

Reach	River Sta.	Contr.	Expan.
1	57	.1	.3
1	56	.1	.3
1	55	.1	.3
1	54	.1	.3
1	53	.1	.3
1	52.5	Culvert	
1	52	.1	.3
1	51	.1	.3
1	50	.1	.3
1	49	.1	.3
1	48	.1	.3
1	46	.1	.3
1	45	.1	.3
1	44	.1	.3
1	43	.1	.3
1	42.5	Culvert	
1	42	.1	.3
1	41	.1	.3
1	40	.1	.3
1	39	.1	.3
1	38	.1	.3
1	37.75	.1	.3
1	37.6	Culvert	

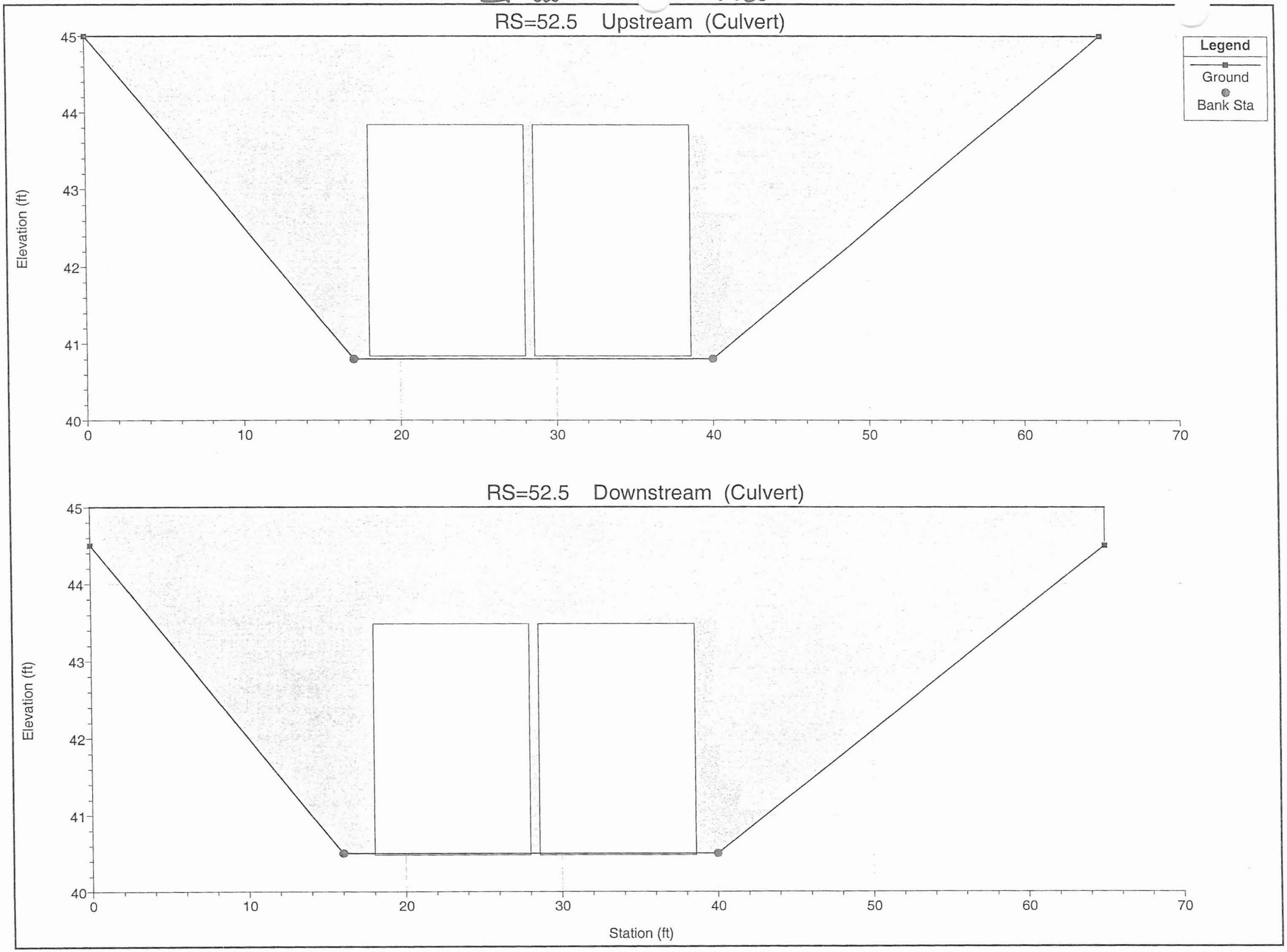
1	37.5	.1	.3
1	37	.1	.3
1	36	.1	.3
1	35	.1	.3
1	34	.1	.3
1	33.5	Culvert	
1	33	.1	.3
1	32	.1	.3
1	31	.1	.3
1	30	.1	.3
1	29	.1	.3
1	28	.1	.3
1	27	.1	.3
1	26	.1	.3
1	25.5	Culvert	
1	25	.1	.3
1	24	.1	.3
1	23	.1	.3
1	22	.1	.3
1	21	.1	.3
1	20	.1	.3
1	19.7	.1	.3
1	19.6	Culvert	
1	19.5	.1	.3
1	19	.1	.3
1	18	.1	.3

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : Plan 08

River: Indian School Ch Reach: 1 RS: 56 Profile: PF 1
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Indian School Ch Reach: 1 RS: 55 Profile: PF 1
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Indian School Ch Reach: 1 RS: 54 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
River: Indian School Ch Reach: 1 RS: 52.5 Profile: PF 1
Note: During the supercritical calculations a hydraulic jump occurred at the outlet of (leaving) the culvert.
River: Indian School Ch Reach: 1 RS: 52.5 Profile: PF 1 Culv: Sarival Ave
Note: During supercritical analysis, the culvert direct step method went to normal depth. The program then assumed normal depth at the outlet.
Note: The flow in the culvert is entirely supercritical.
River: Indian School Ch Reach: 1 RS: 49 Profile: PF 1
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Indian School Ch Reach: 1 RS: 48 Profile: PF 1
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Indian School Ch Reach: 1 RS: 46 Profile: PF 1
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Indian School Ch Reach: 1 RS: 42.5 Profile: PF 1
Note: During the supercritical calculations a hydraulic jump occurred at the outlet of (leaving) the culvert.
River: Indian School Ch Reach: 1 RS: 42.5 Profile: PF 1 Culv: Pebble Creek
Note: During supercritical analysis, the culvert direct step method went to normal depth. The program then assumed normal depth at the outlet.
Note: The flow in the culvert is entirely supercritical.
River: Indian School Ch Reach: 1 RS: 39 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
River: Indian School Ch Reach: 1 RS: 38 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7

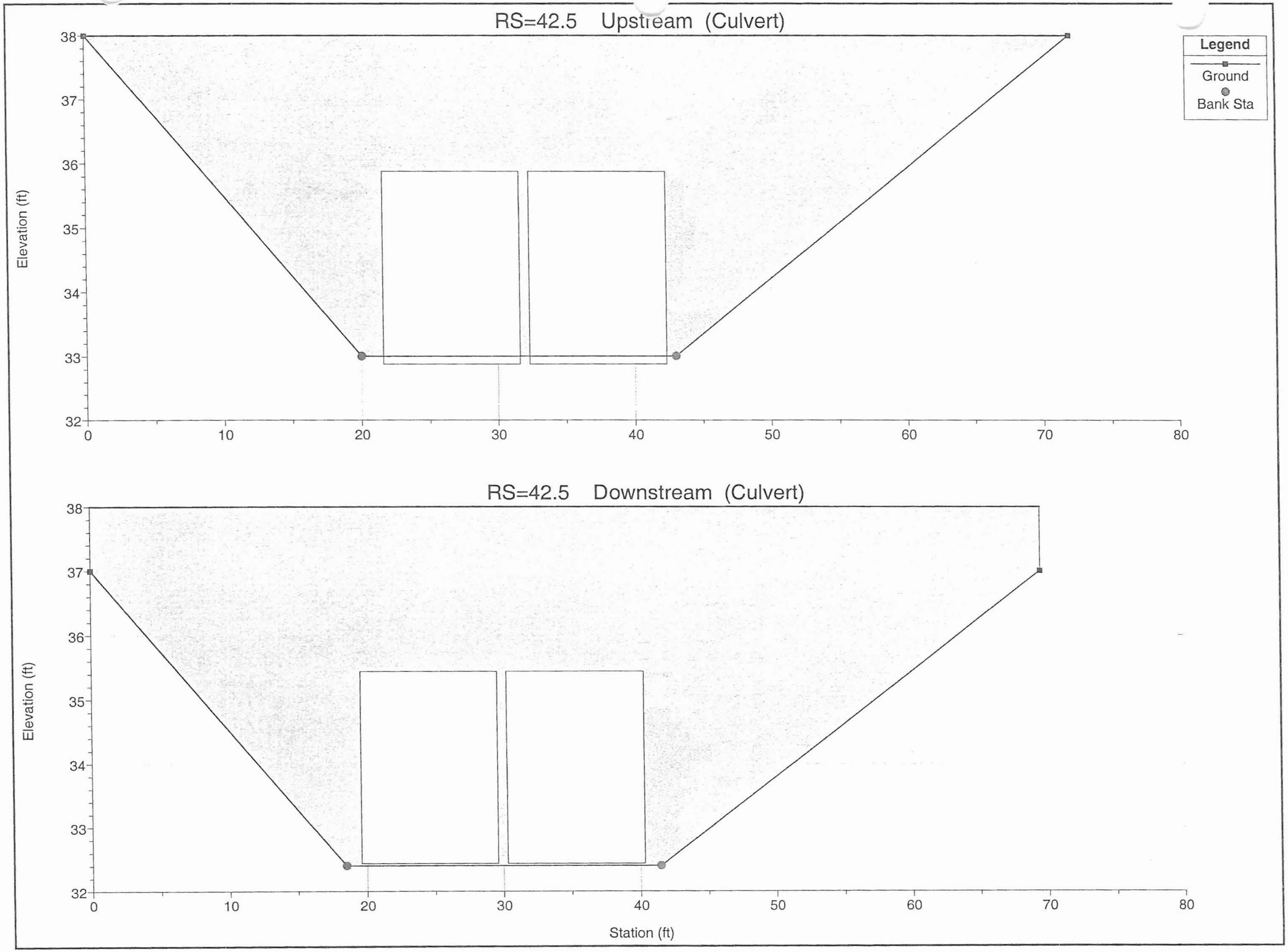
or greater than 1.4.
This may indicate the need for additional cross sections.
River: Indian School Ch Reach: 1 RS: 37 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Indian School Ch Reach: 1 RS: 33.5 Profile: PF 1
Note: During the supercritical calculations a hydraulic jump occurred at the outlet of (leaving) the culvert.
River: Indian School Ch Reach: 1 RS: 33.5 Profile: PF 1 Culv: Reems Rd
Note: During supercritical analysis, the culvert direct step method went to normal depth. The program then assumed normal
depth at the outlet.
Note: The flow in the culvert is entirely supercritical.
River: Indian School Ch Reach: 1 RS: 30 Profile: PF 1
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
River: Indian School Ch Reach: 1 RS: 27 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Indian School Ch Reach: 1 RS: 25.5 Profile: PF 1
Note: During the supercritical calculations a hydraulic jump occurred at the outlet of (leaving) the culvert.
River: Indian School Ch Reach: 1 RS: 25.5 Profile: PF 1 Culv: Club House
Note: During supercritical analysis, the culvert direct step method went to normal depth. The program then assumed normal
depth at the outlet.
Note: The flow in the culvert is entirely supercritical.
River: Indian School Ch Reach: 1 RS: 19 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

Ind. Sc Rd.

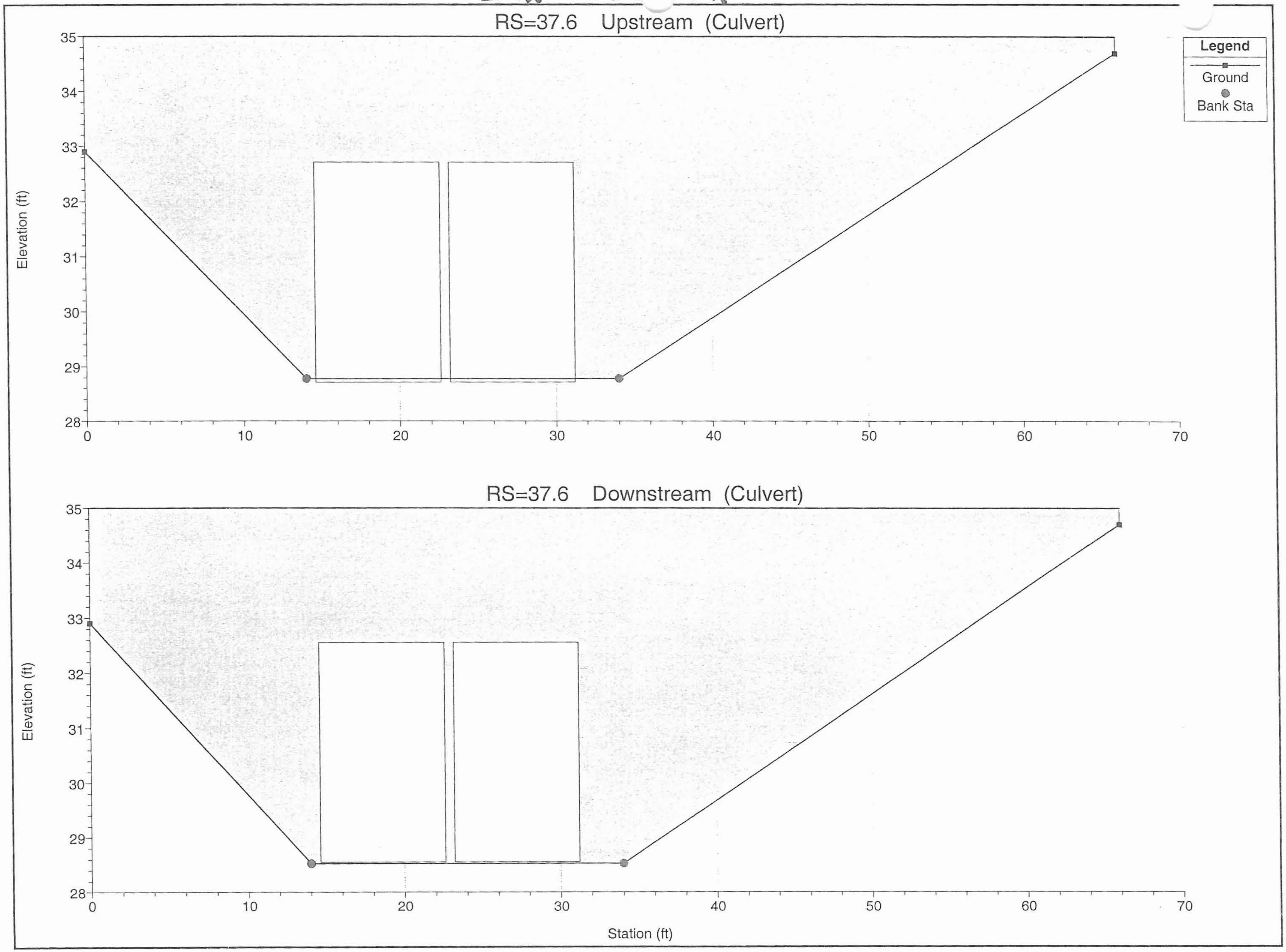


RS=52.5 Upstream (Culvert)
Legend
Ground
Bank Sta
Elevation (ft)
45
44
43
42
41
40
0
10
20
30
40
50
60
70
RS=52.5 Downstream (Culvert)
Elevation (ft)
45
44
43
42
41
40
0
10
20
30
40
50
60
70
Station (ft)

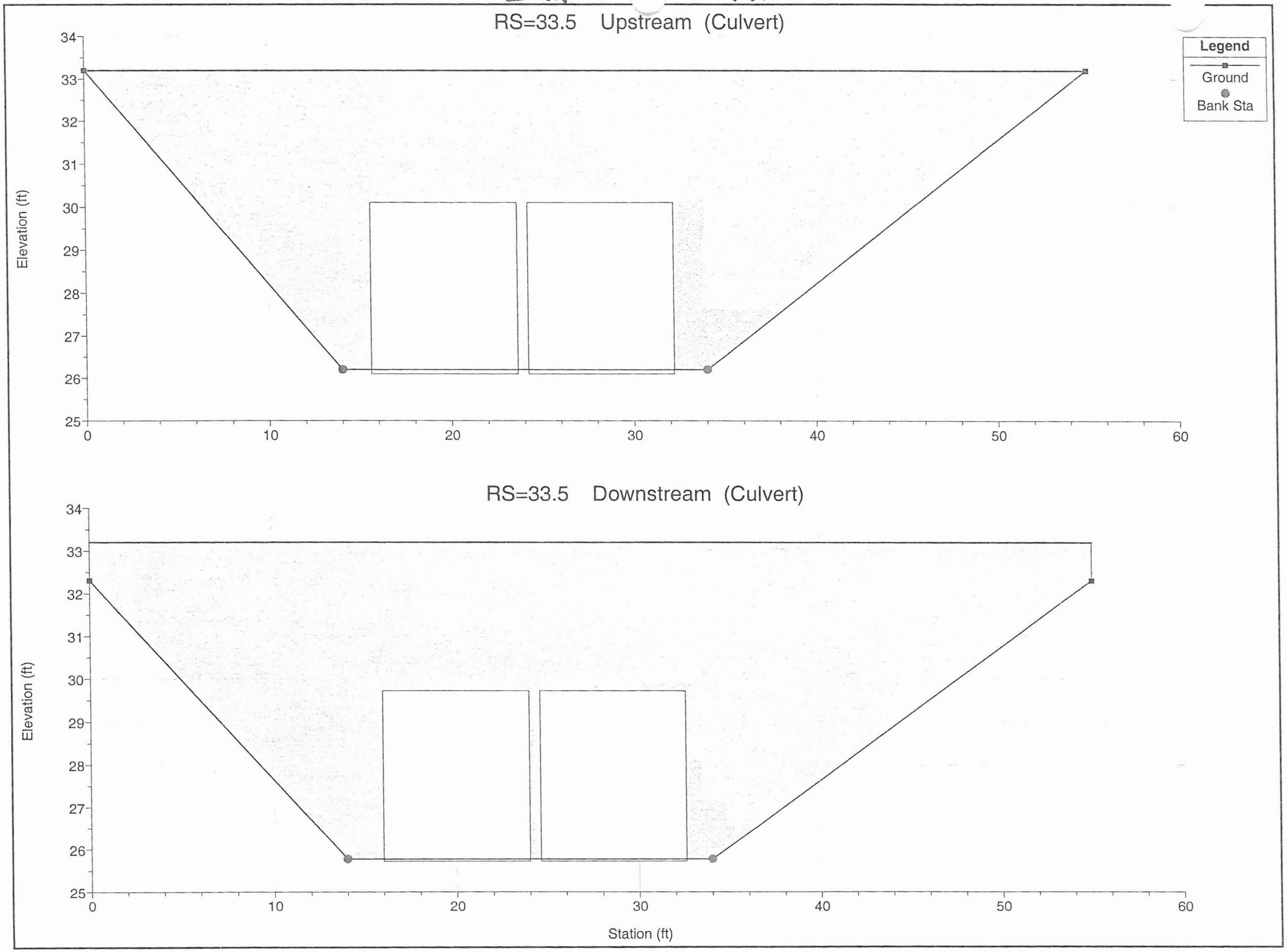
Ind. Sc Rd.


RS=42.5 Upstream (Culvert)
Legend
Ground
Bank Sta
Elevation (ft)
38
37
36
35
34
33
32
0
10
20
30
40
50
60
70
80
RS=42.5 Downstream (Culvert)
Elevation (ft)
38
37
36
35
34
33
32
0
10
20
30
40
50
60
70
80
Station (ft)

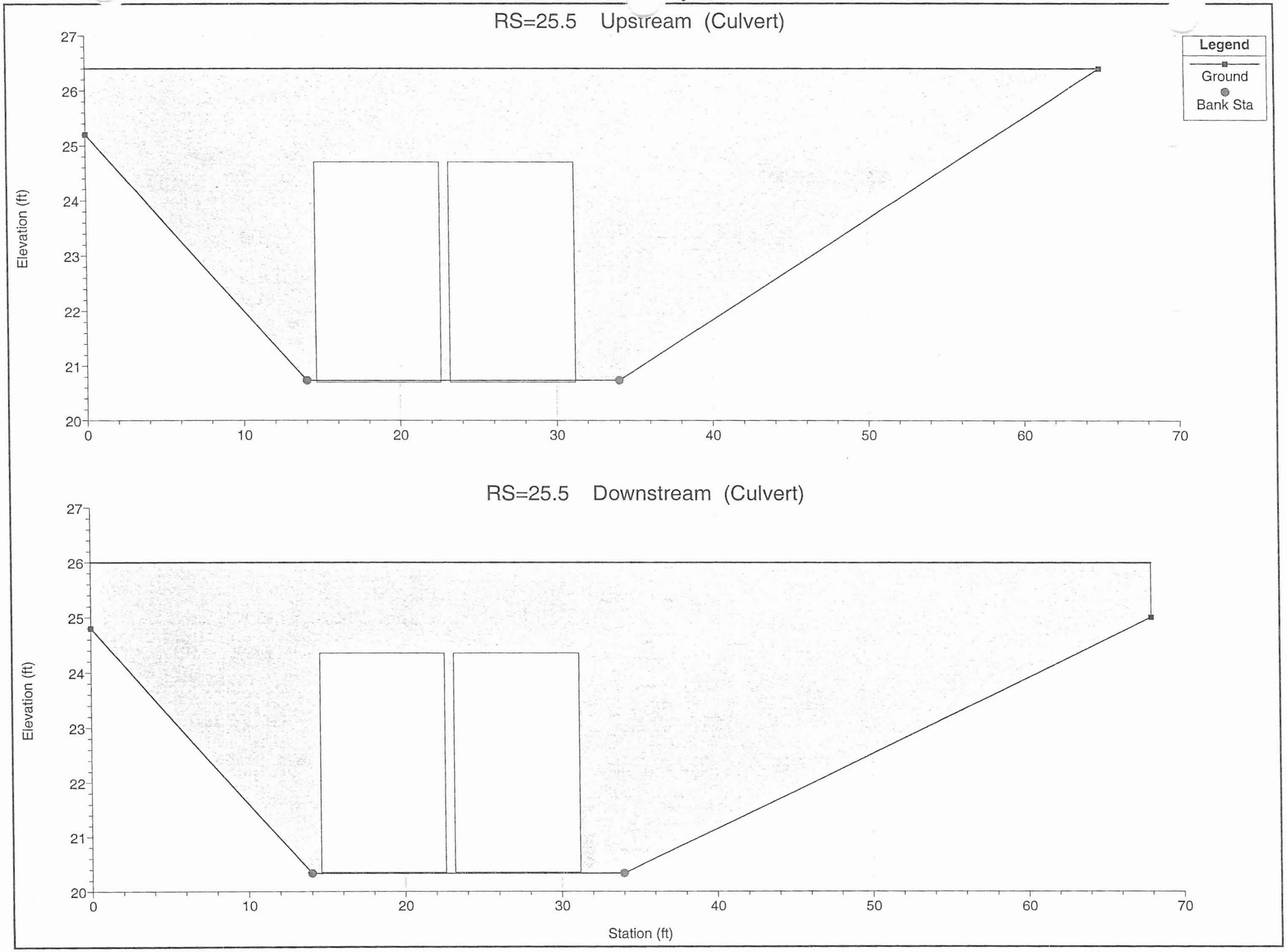
Ind. Sch Rd.


RS=37.6 Upstream (Culvert)
Legend
Ground
Bank Sta
Elevation (ft)
RS=37.6 Downstream (Culvert)
Elevation (ft)
Station (ft)

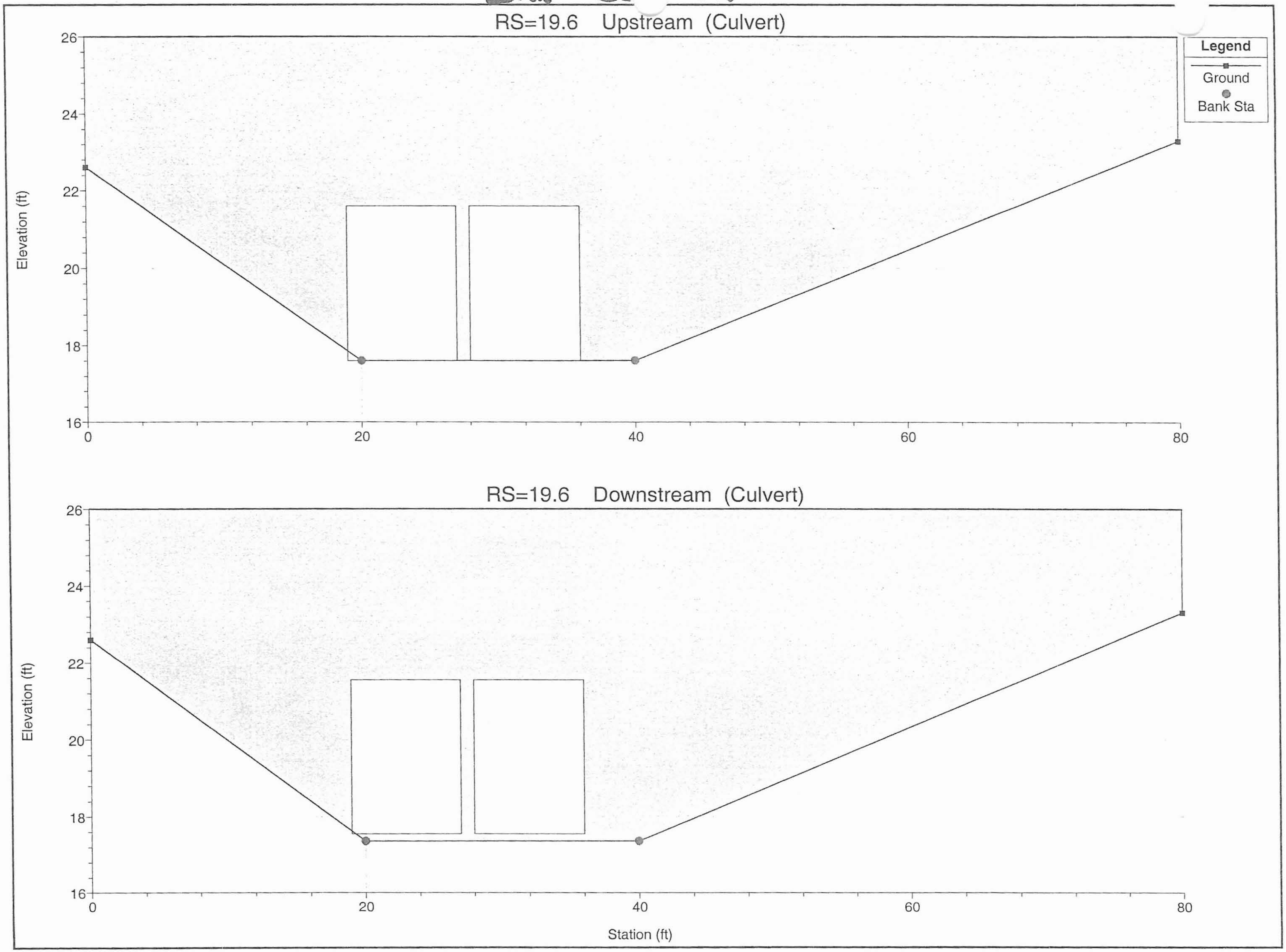
Ind. [illegible] Rd.


RS=33.5 Upstream (Culvert)
Legend
Ground
Bank Sta
Elevation (ft)
34
33
32
31
30
29
28
27
26
25
0
10
20
30
40
50
60
RS=33.5 Downstream (Culvert)
Elevation (ft)
Station (ft)

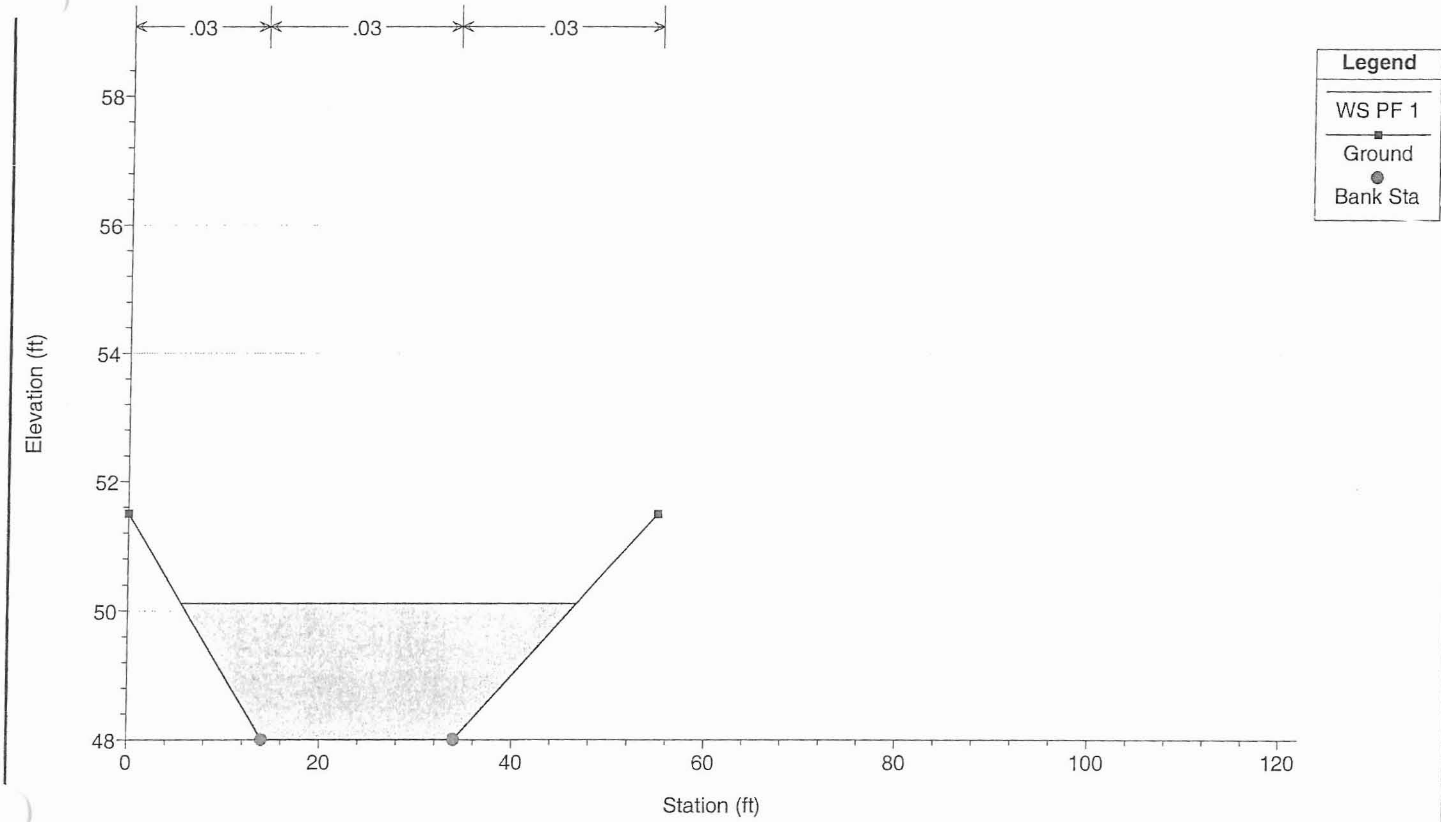
Ind. Sch Rd.


RS=25.5 Upstream (Culvert)
Legend
Ground
Bank Sta
Elevation (ft)
RS=25.5 Downstream (Culvert)
Elevation (ft)
Station (ft)

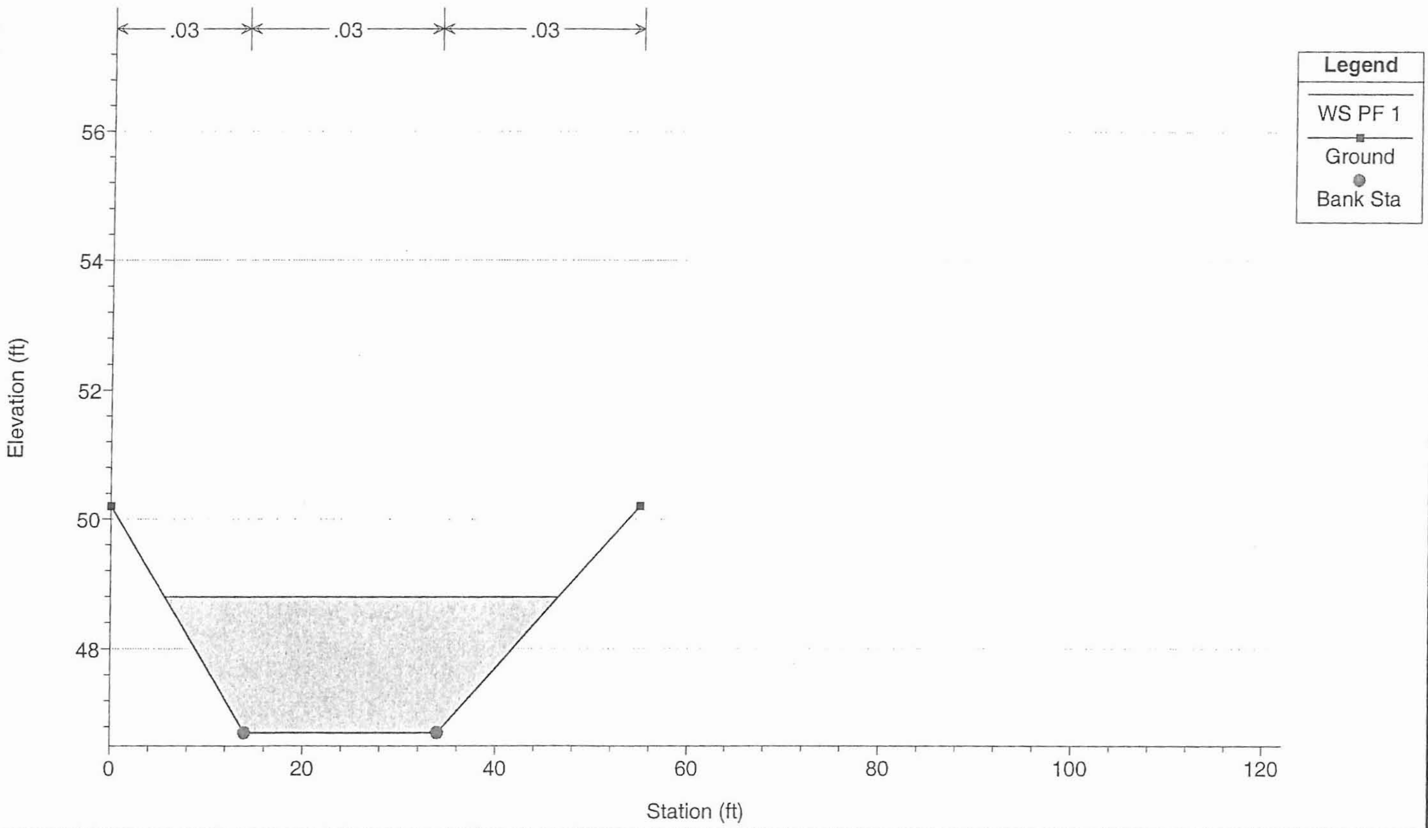
Ind. Sc' Rd.


RS=19.6 Upstream (Culvert)
Legend
Ground
Bank Sta
Elevation (ft)
26
24
22
20
18
16
0
20
40
60
80
RS=19.6 Downstream (Culvert)
Elevation (ft)
26
24
22
20
18
16
0
20
40
60
80
Station (ft)

Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 59 STA 26.3

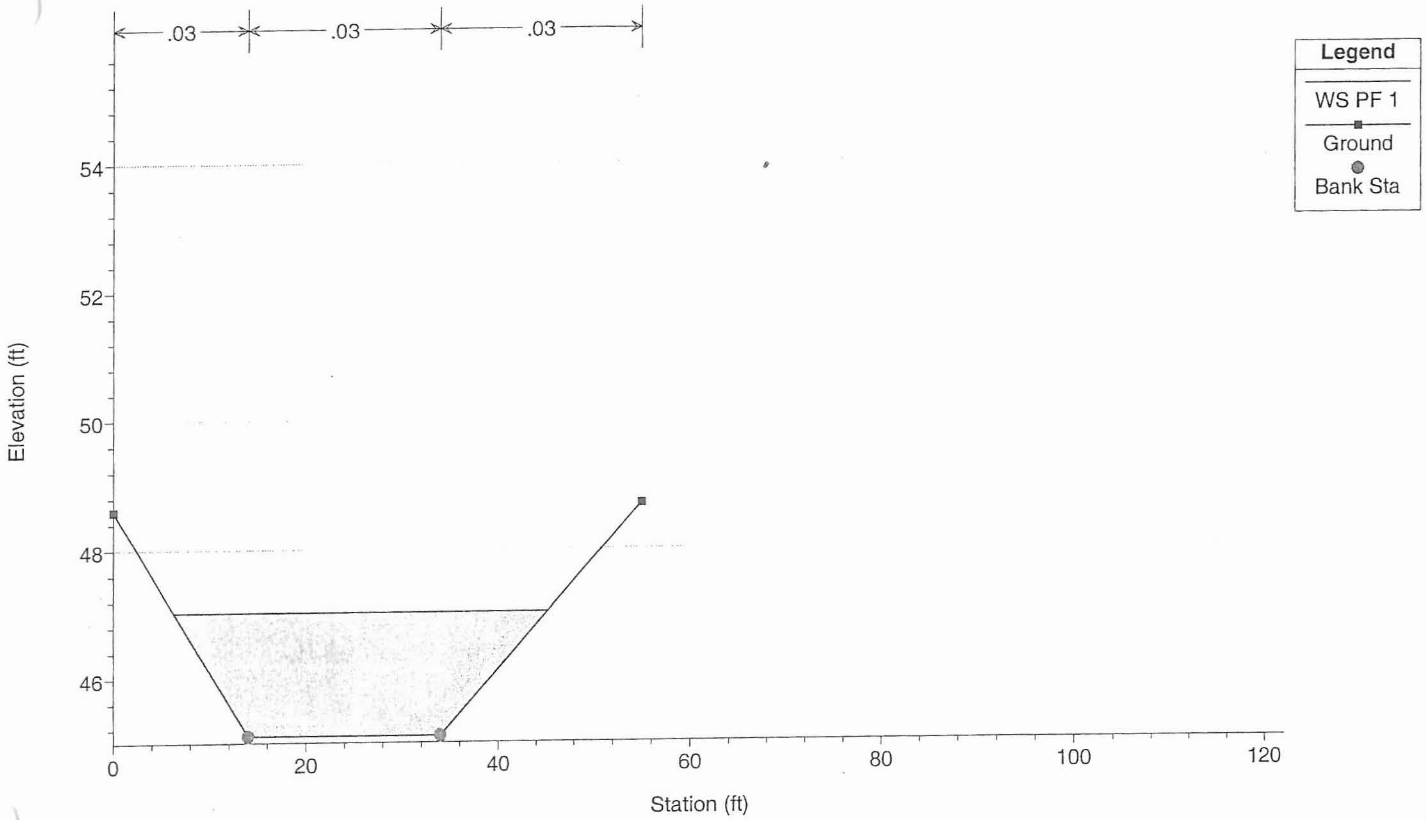


Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 58 STA 30

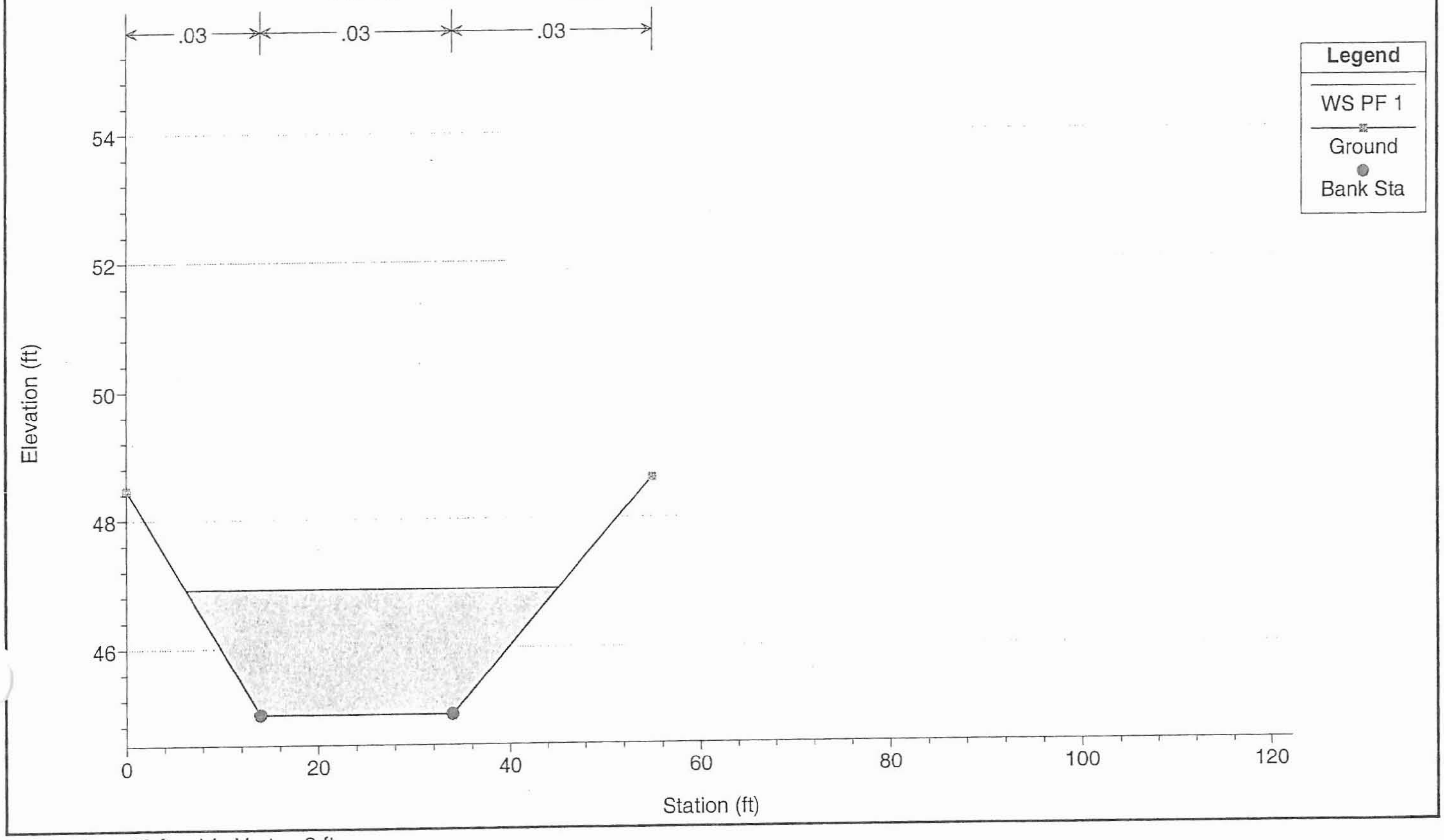


1 in Horiz. = 20 ft 1 in Vert. = 3 ft

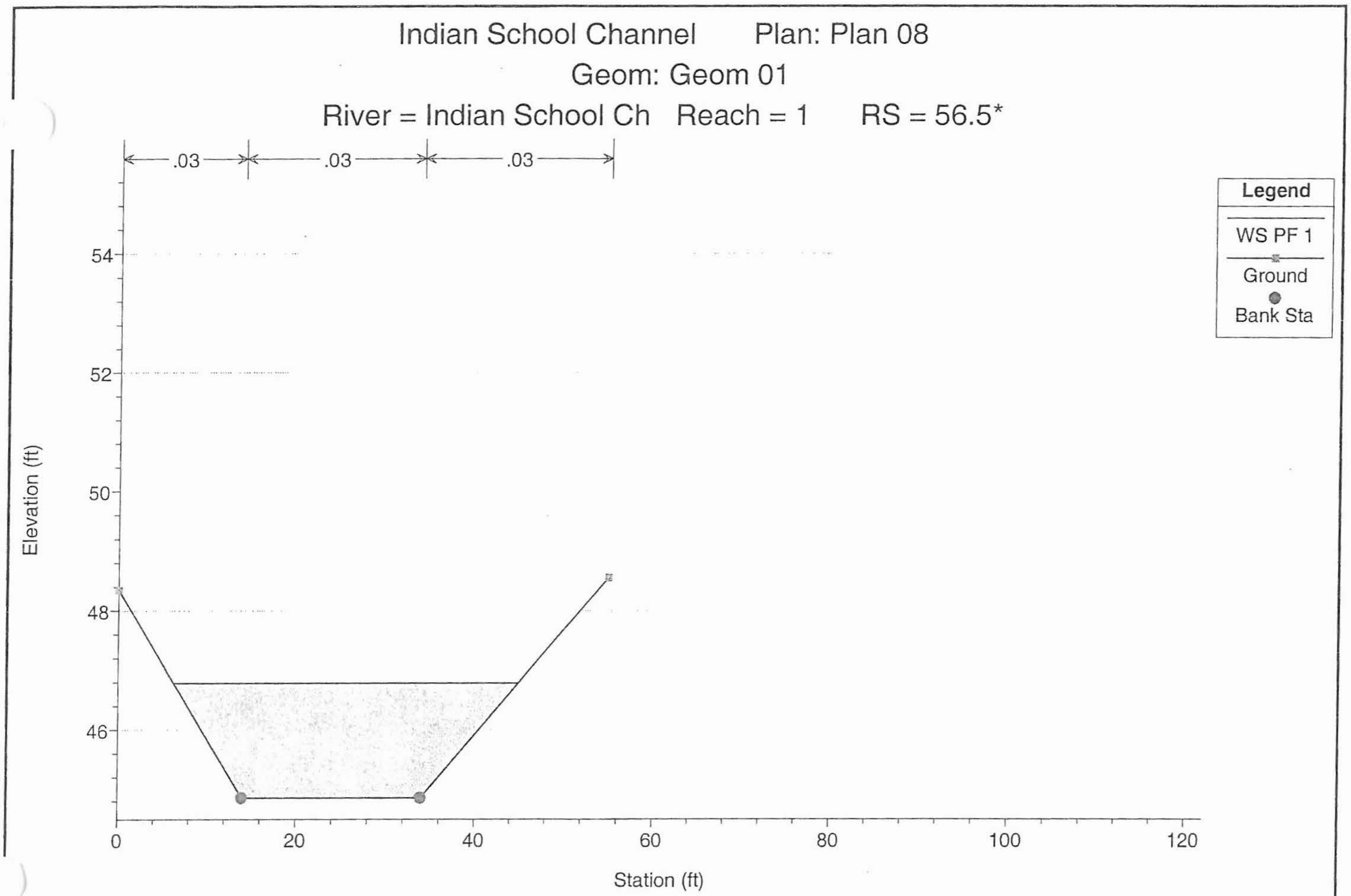
Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 57 STA 34

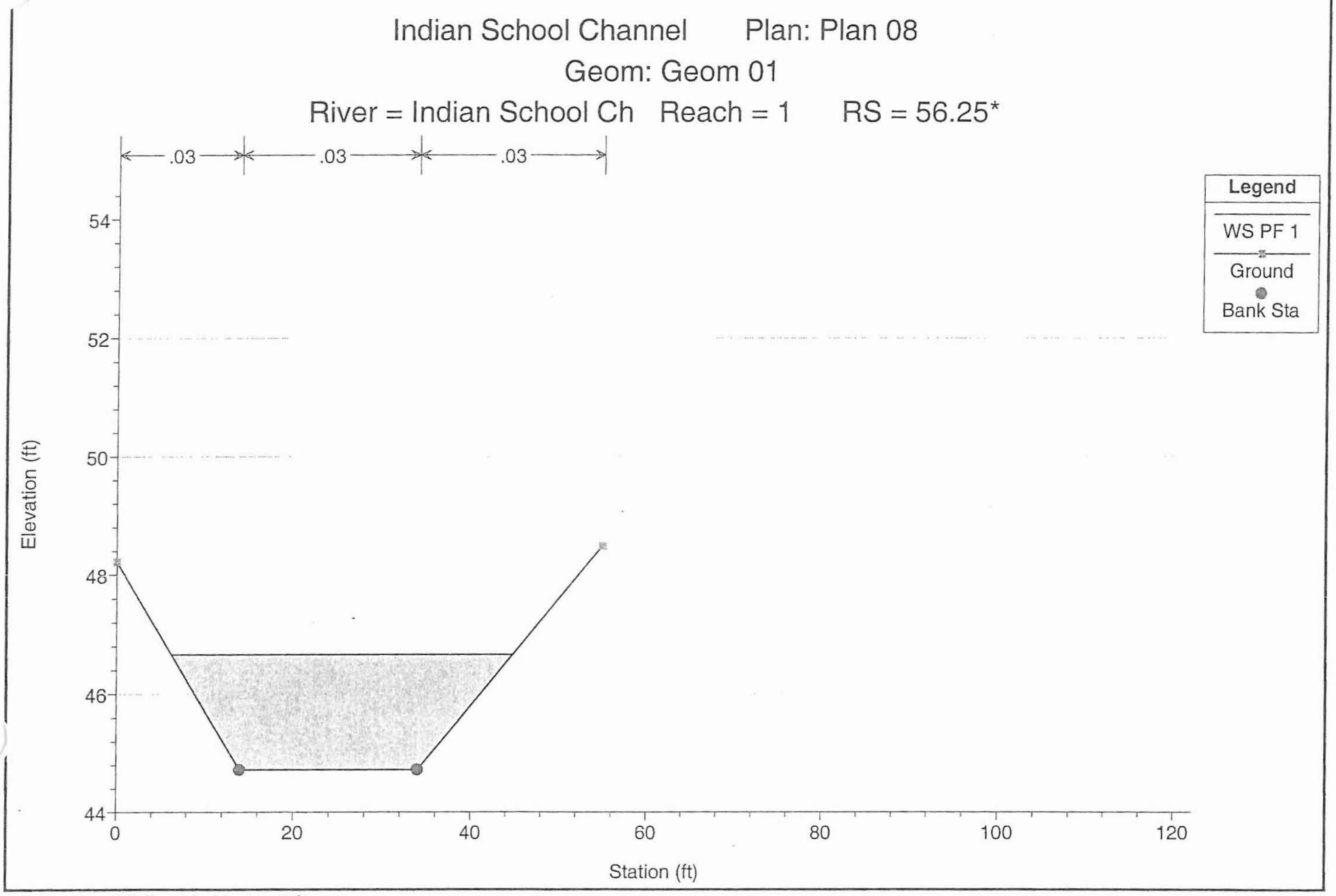


Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 56.75*

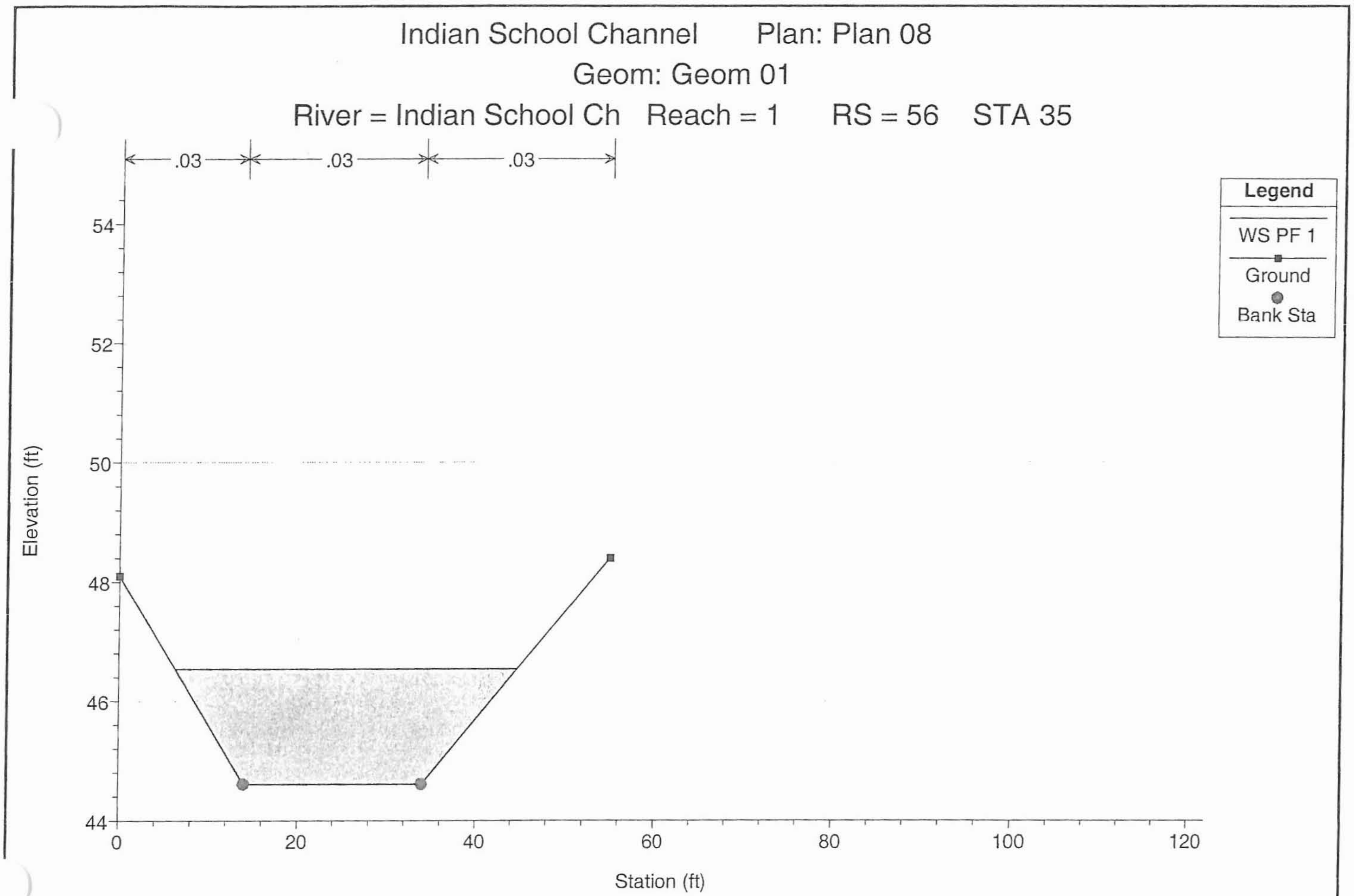


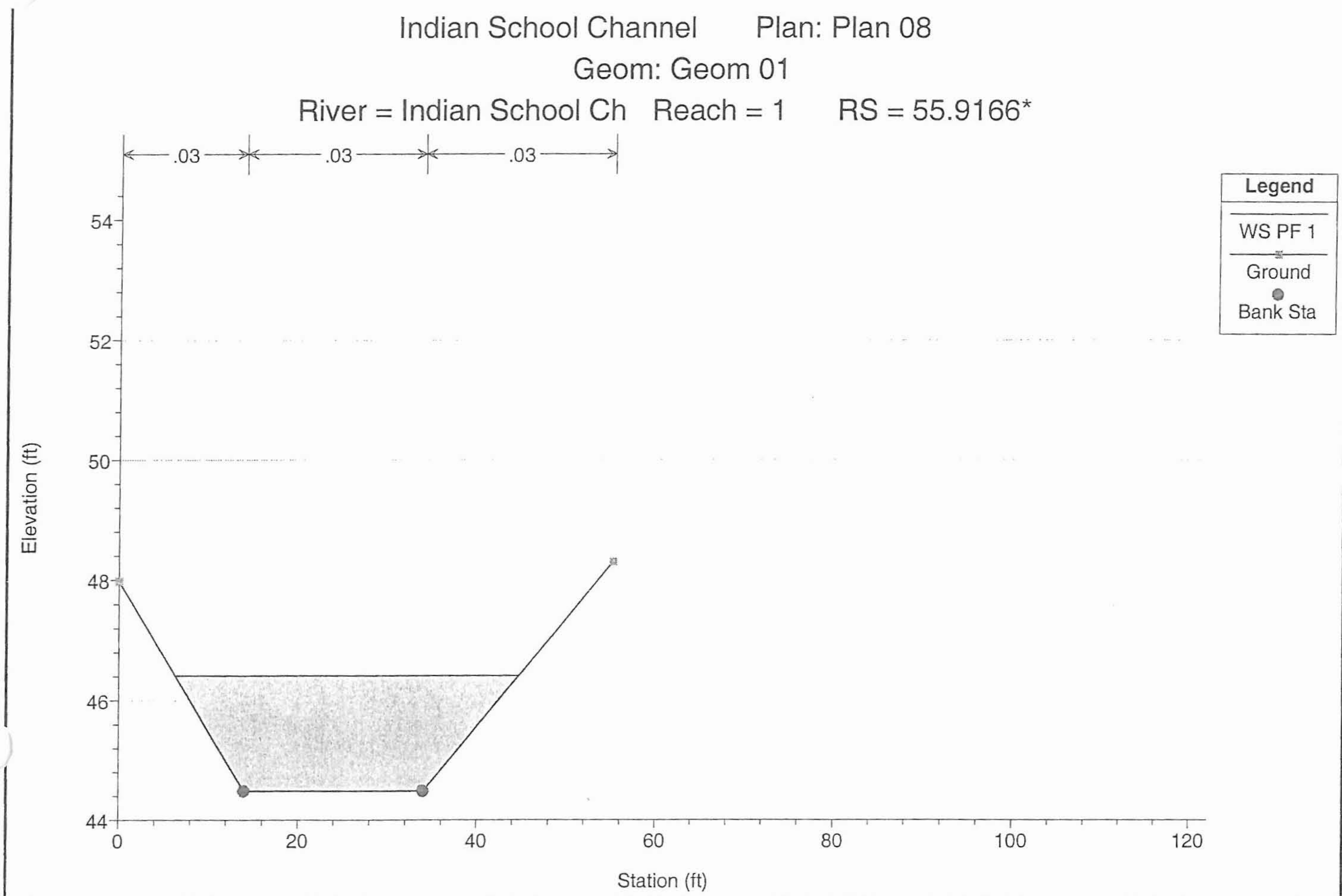
1 in Horiz. = 20 ft 1 in Vert. = 3 ft



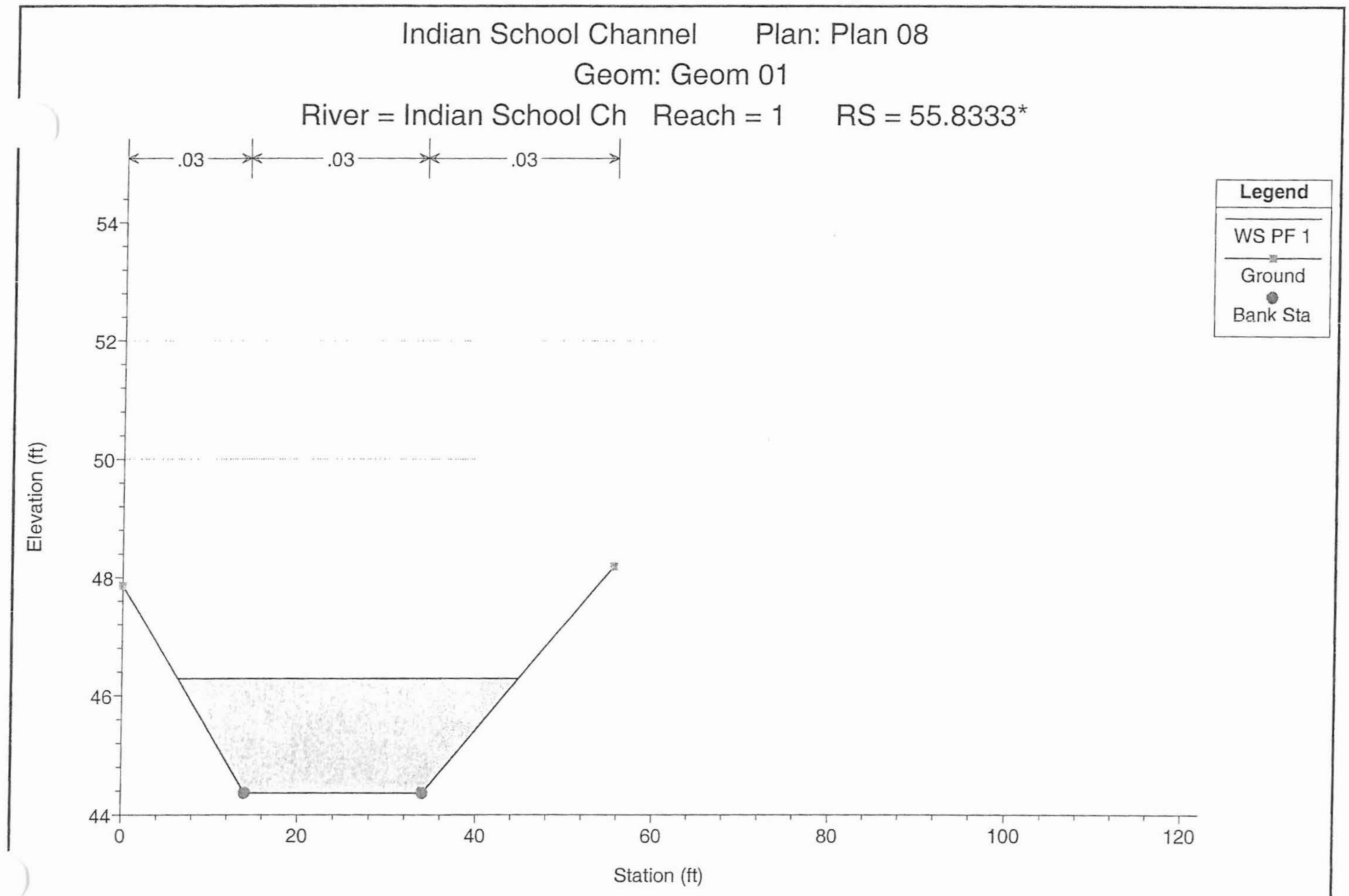


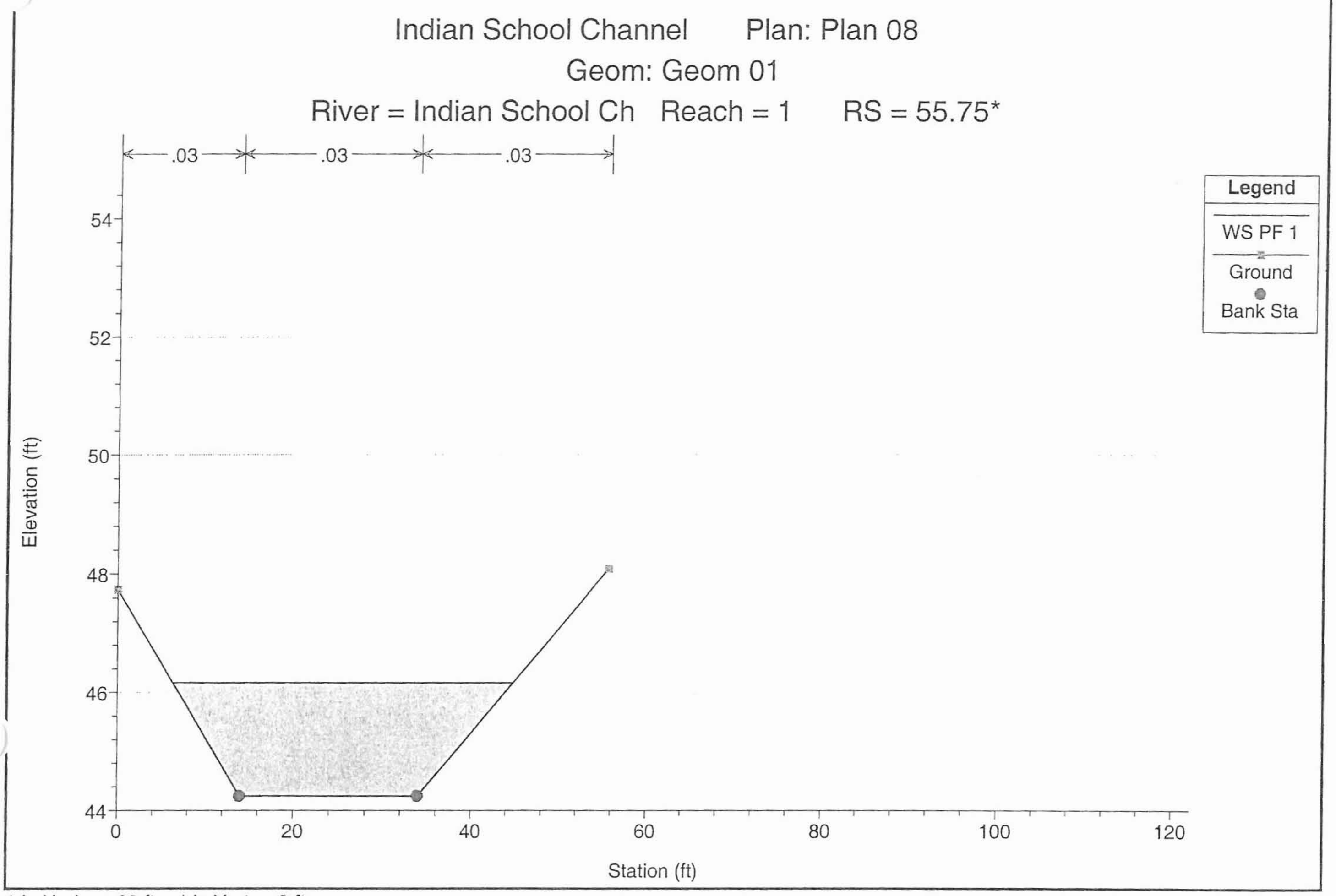
1 in Horiz. = 20 ft 1 in Vert. = 3 ft



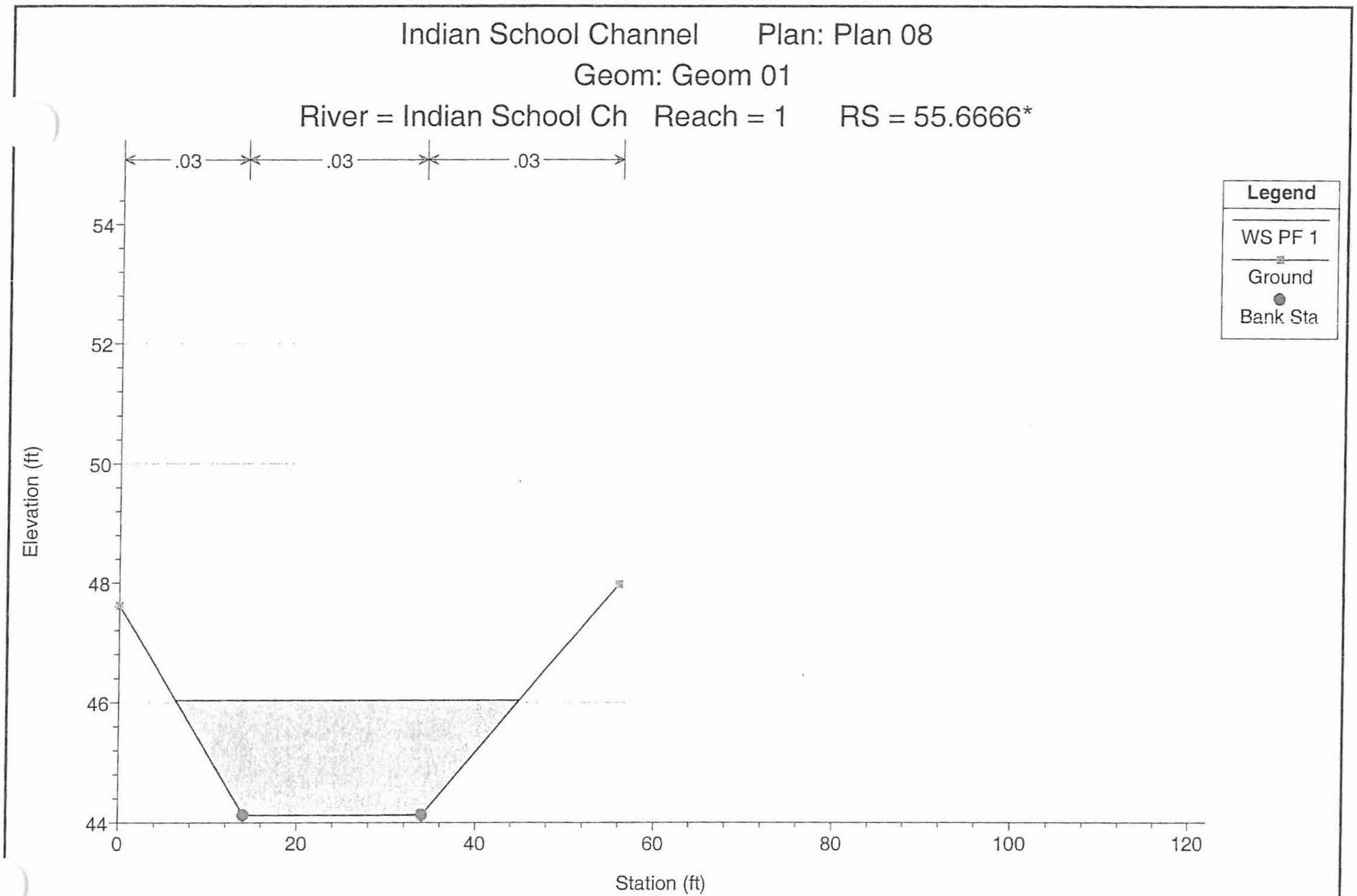


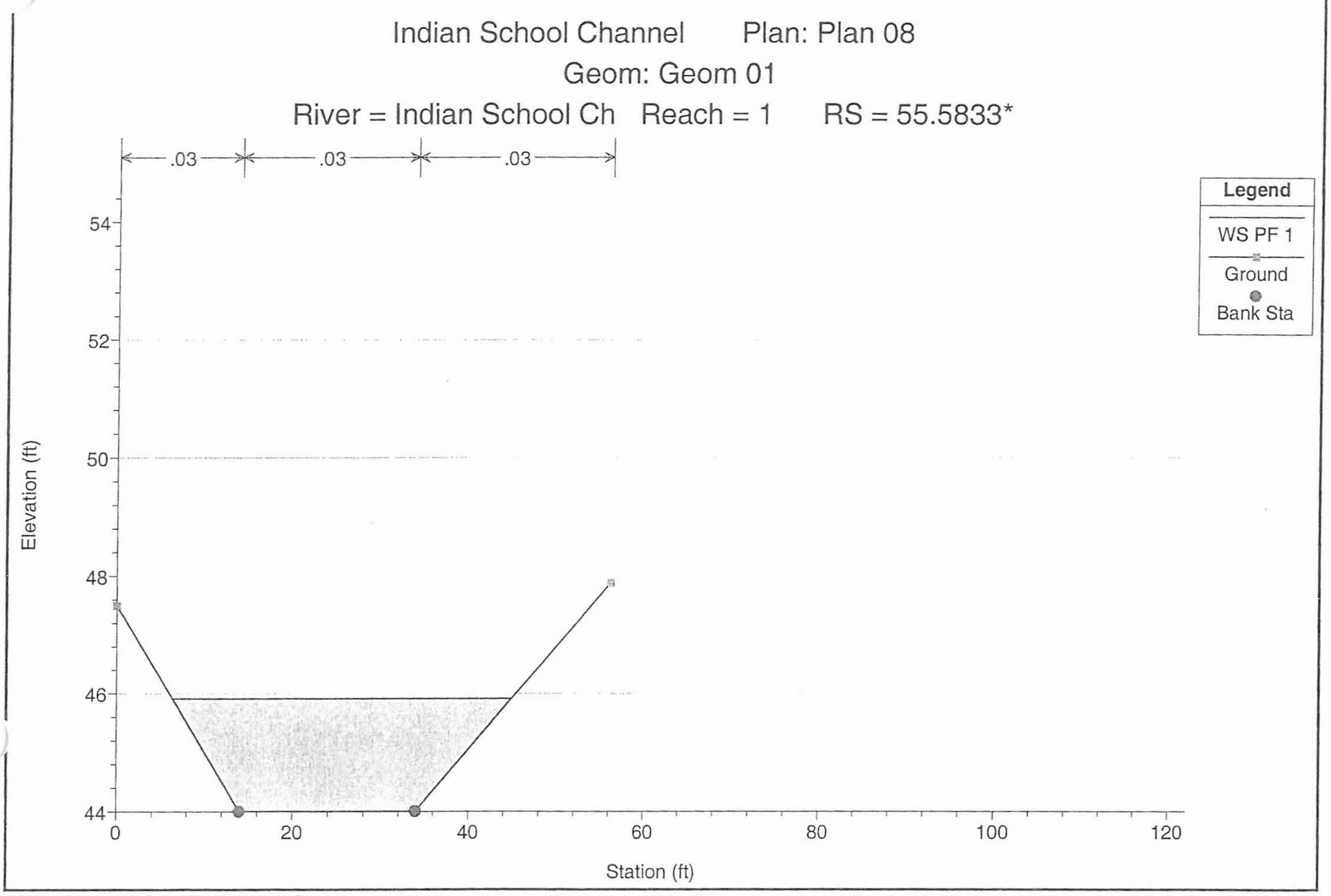
1 in Horiz. = 20 ft 1 in Vert. = 3 ft



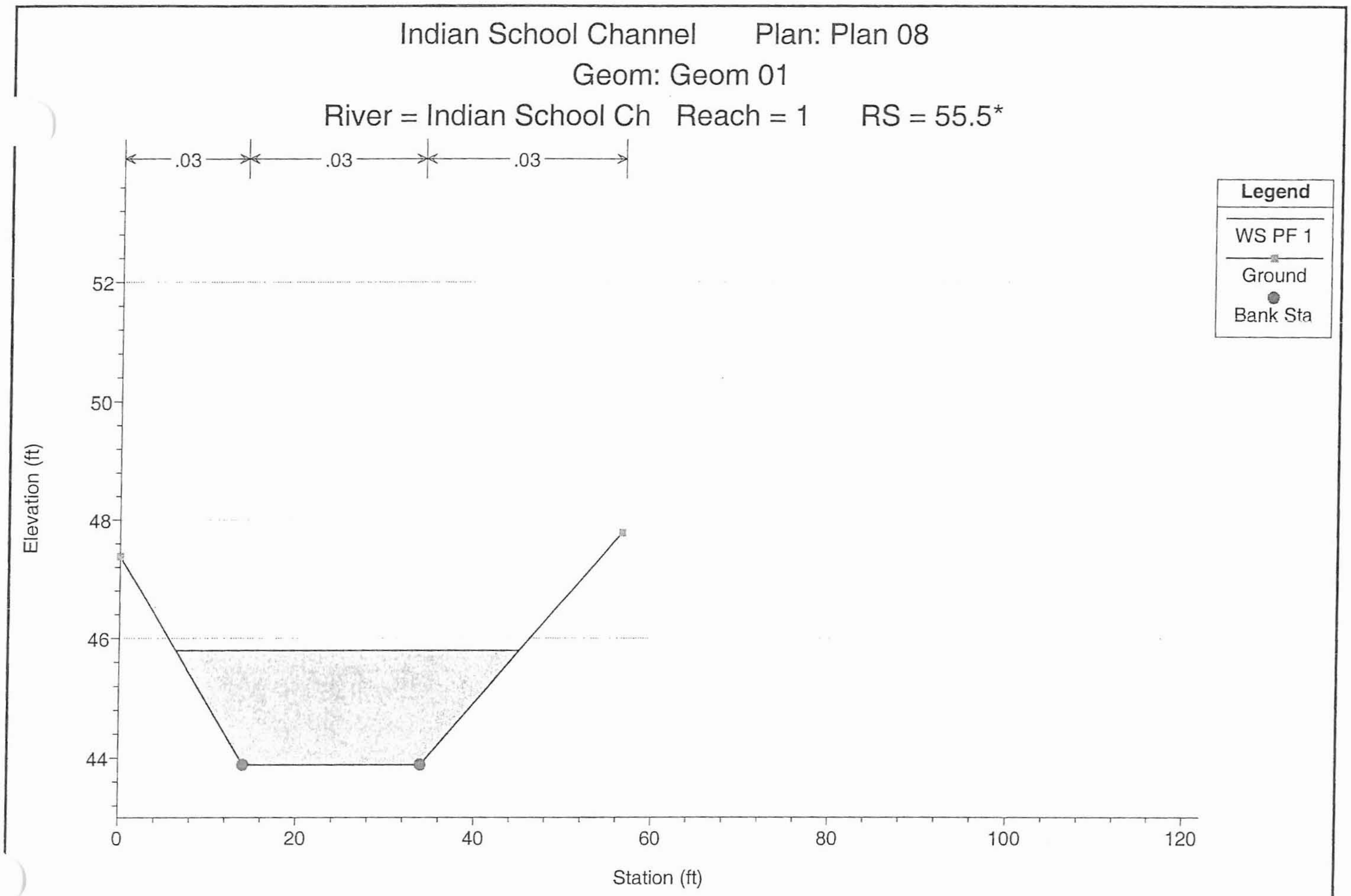


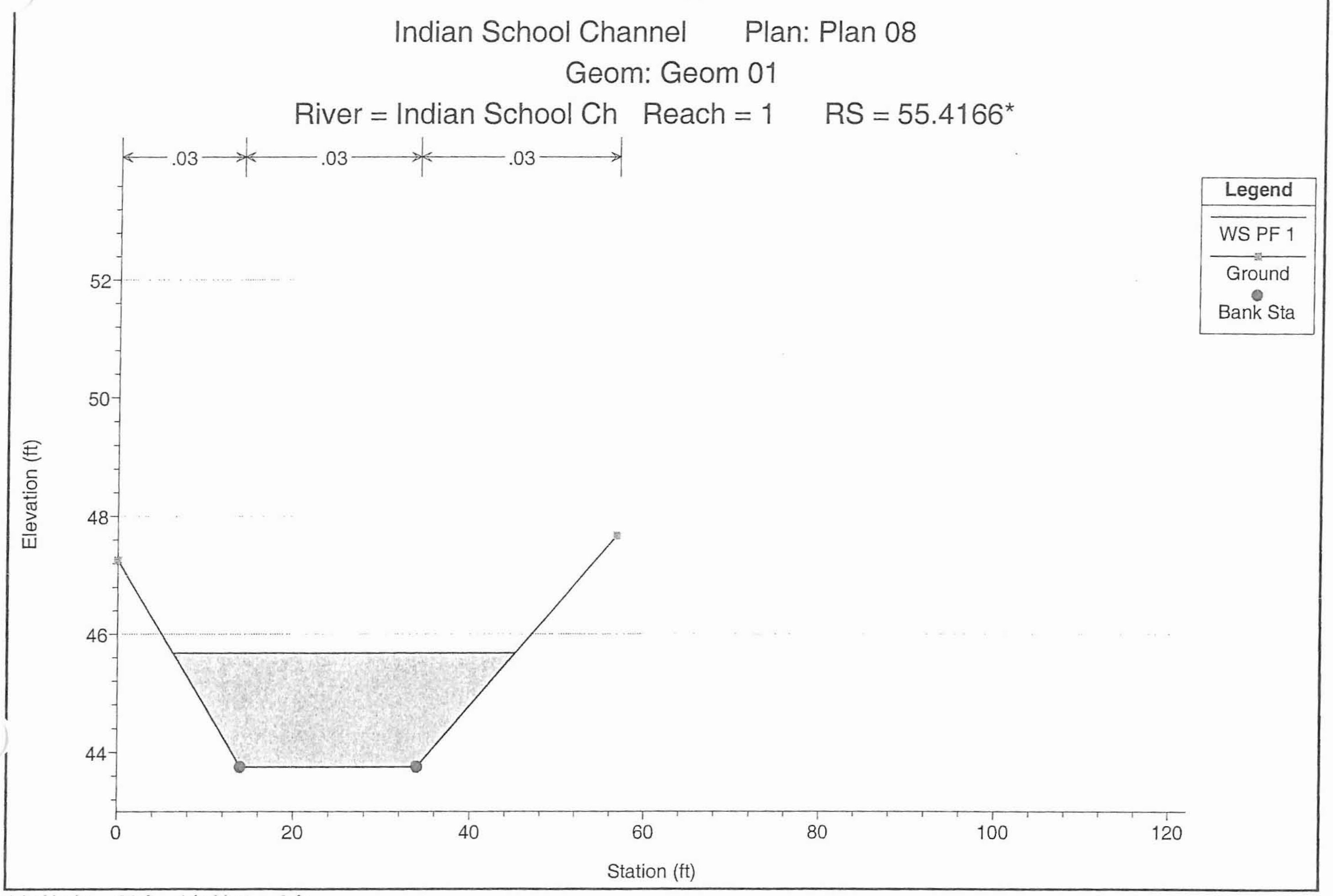
1 in Horiz. = 20 ft 1 in Vert. = 3 ft



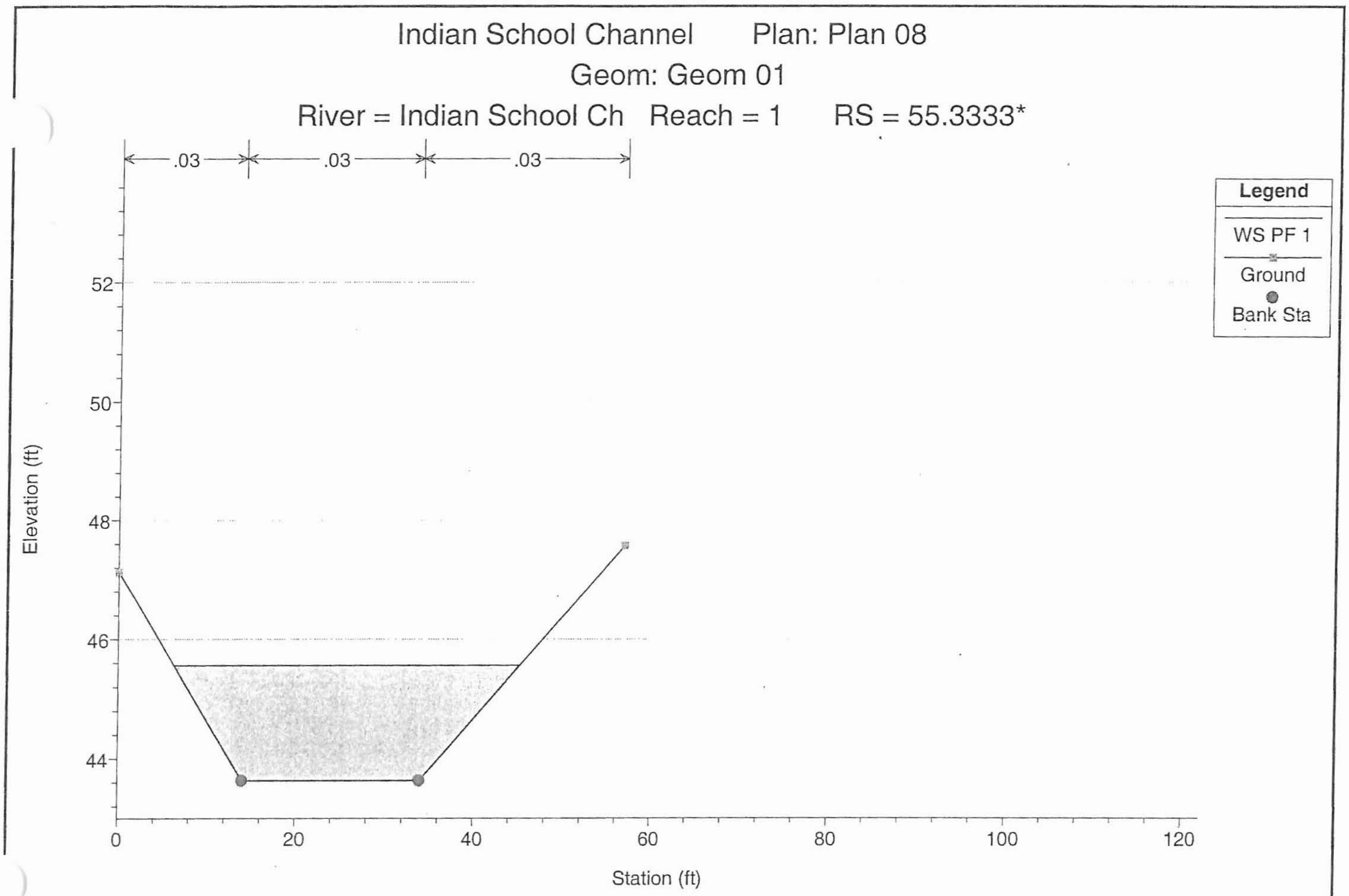


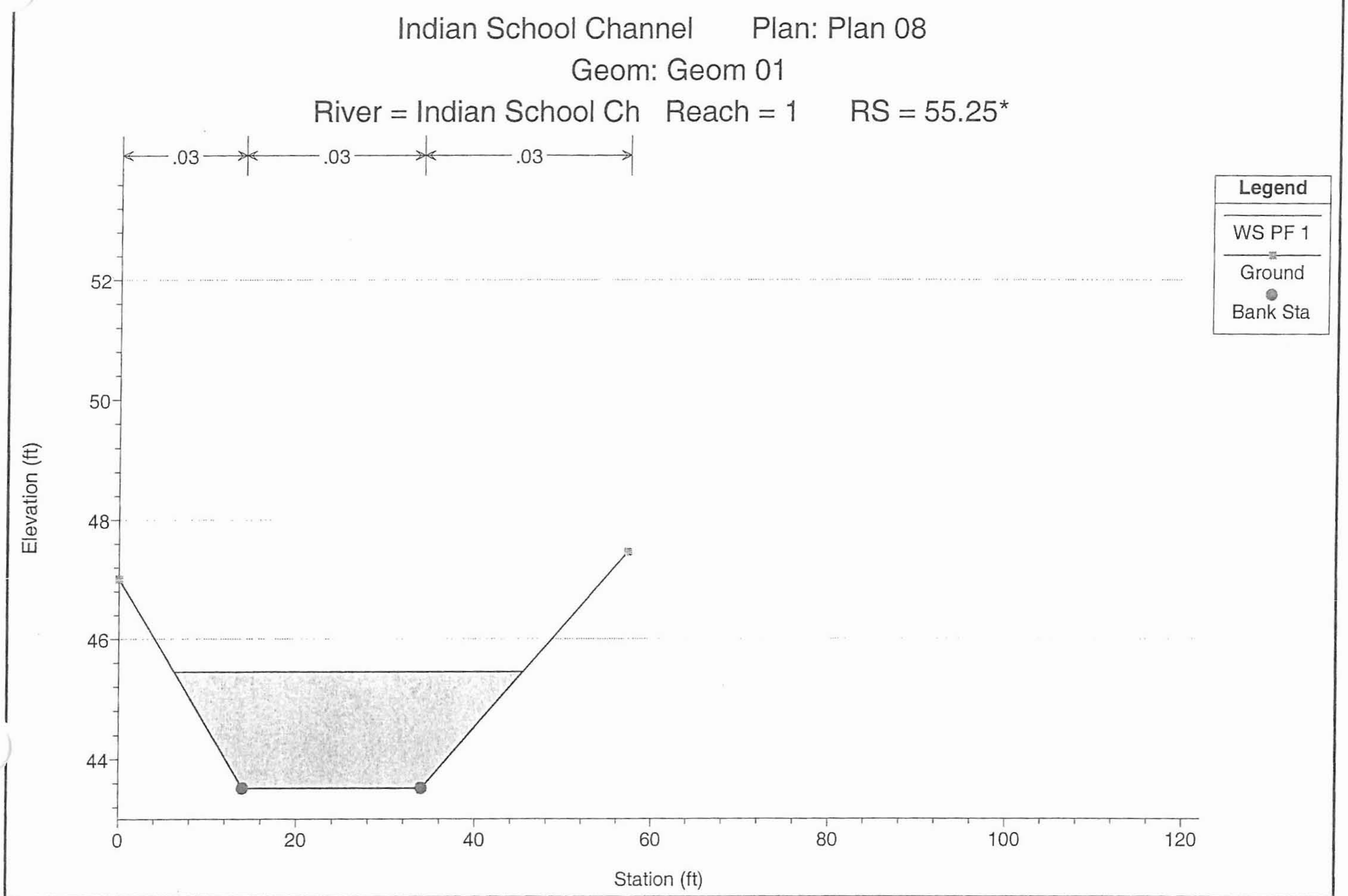
1 in Horiz. = 20 ft 1 in Vert. = 3 ft





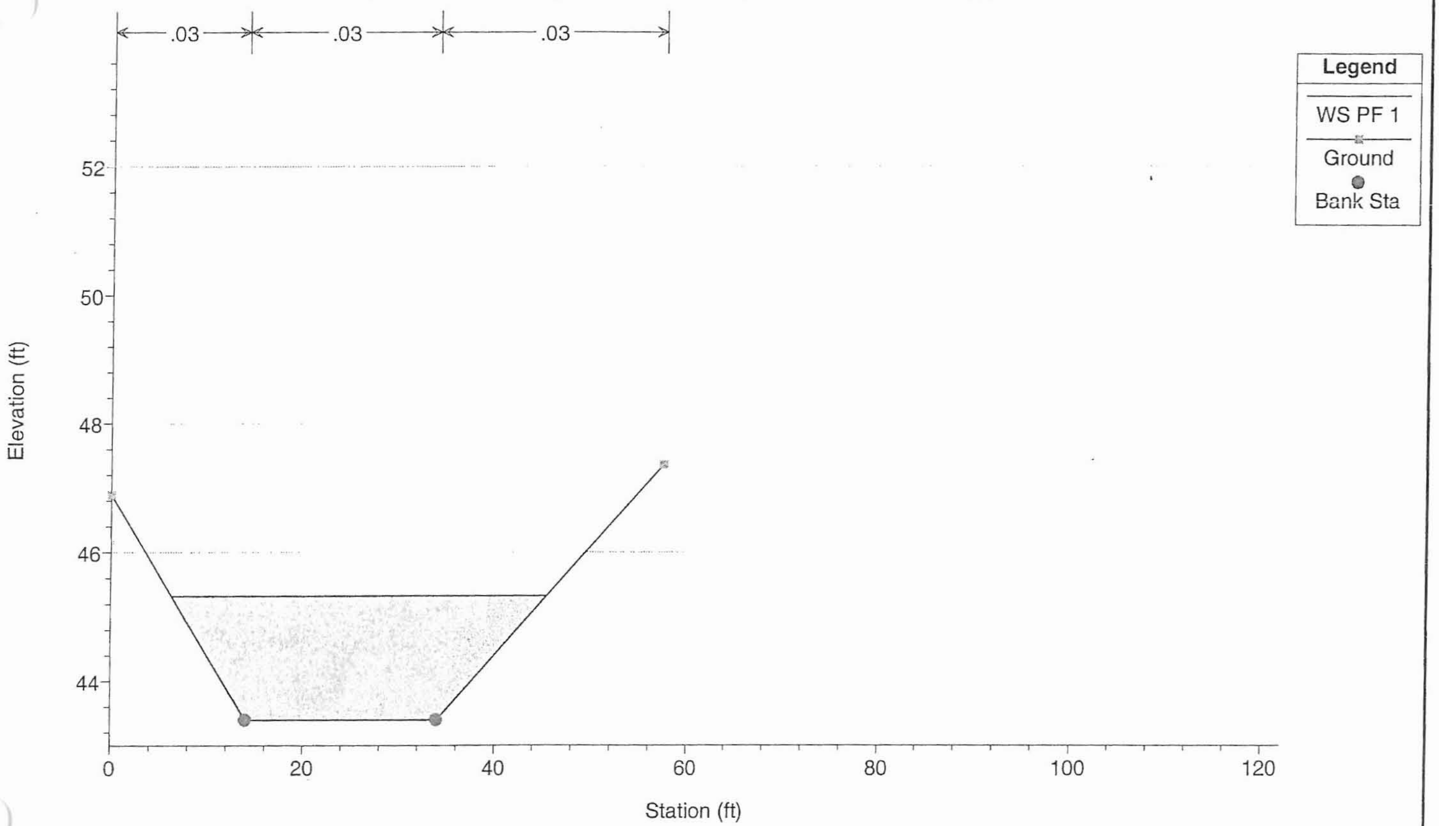
1 in Horiz. = 20 ft 1 in Vert. = 3 ft



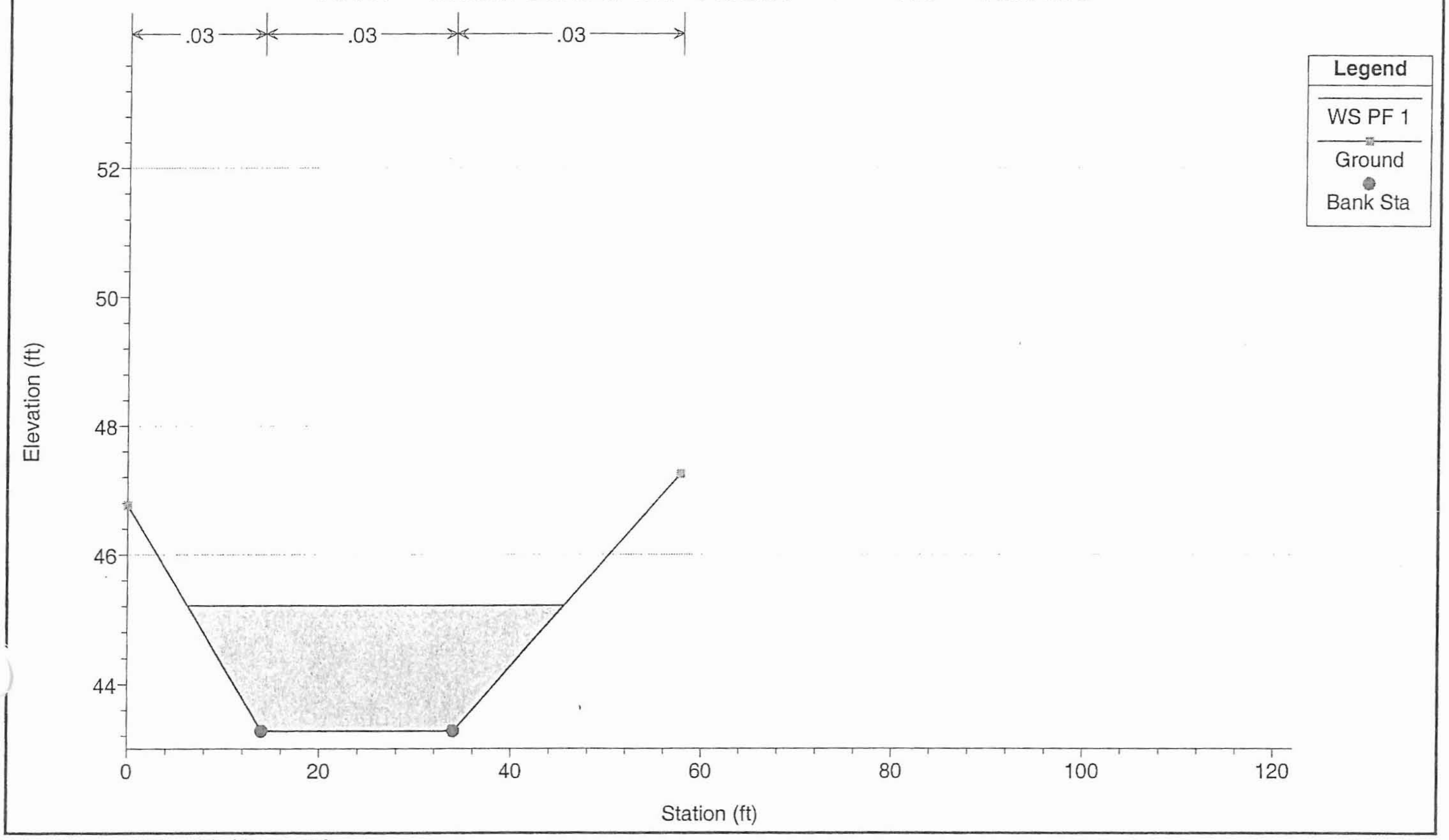


1 in Horiz. = 20 ft 1 in Vert. = 3 ft

Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 55.1666*

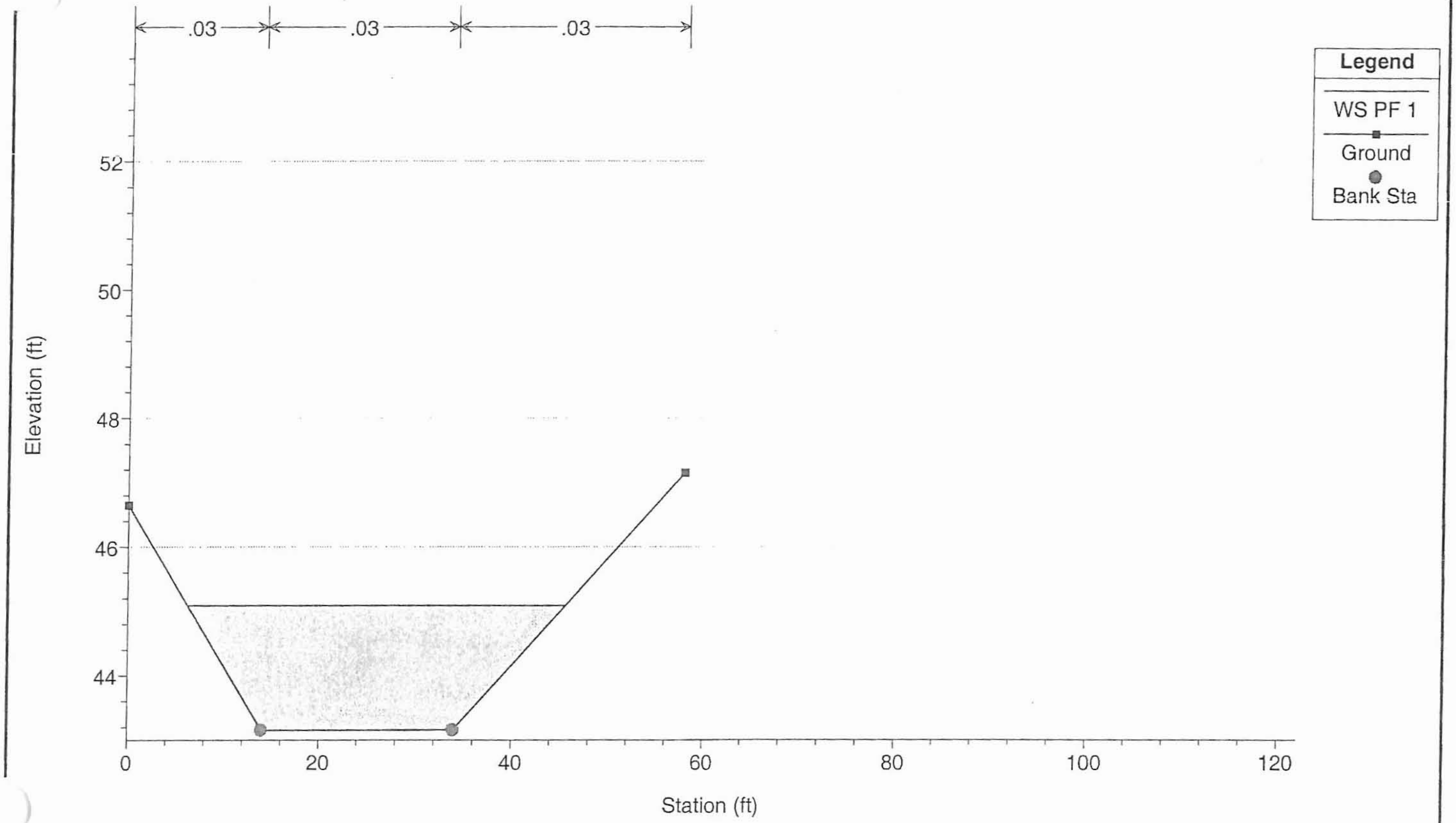


Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 55.0833*

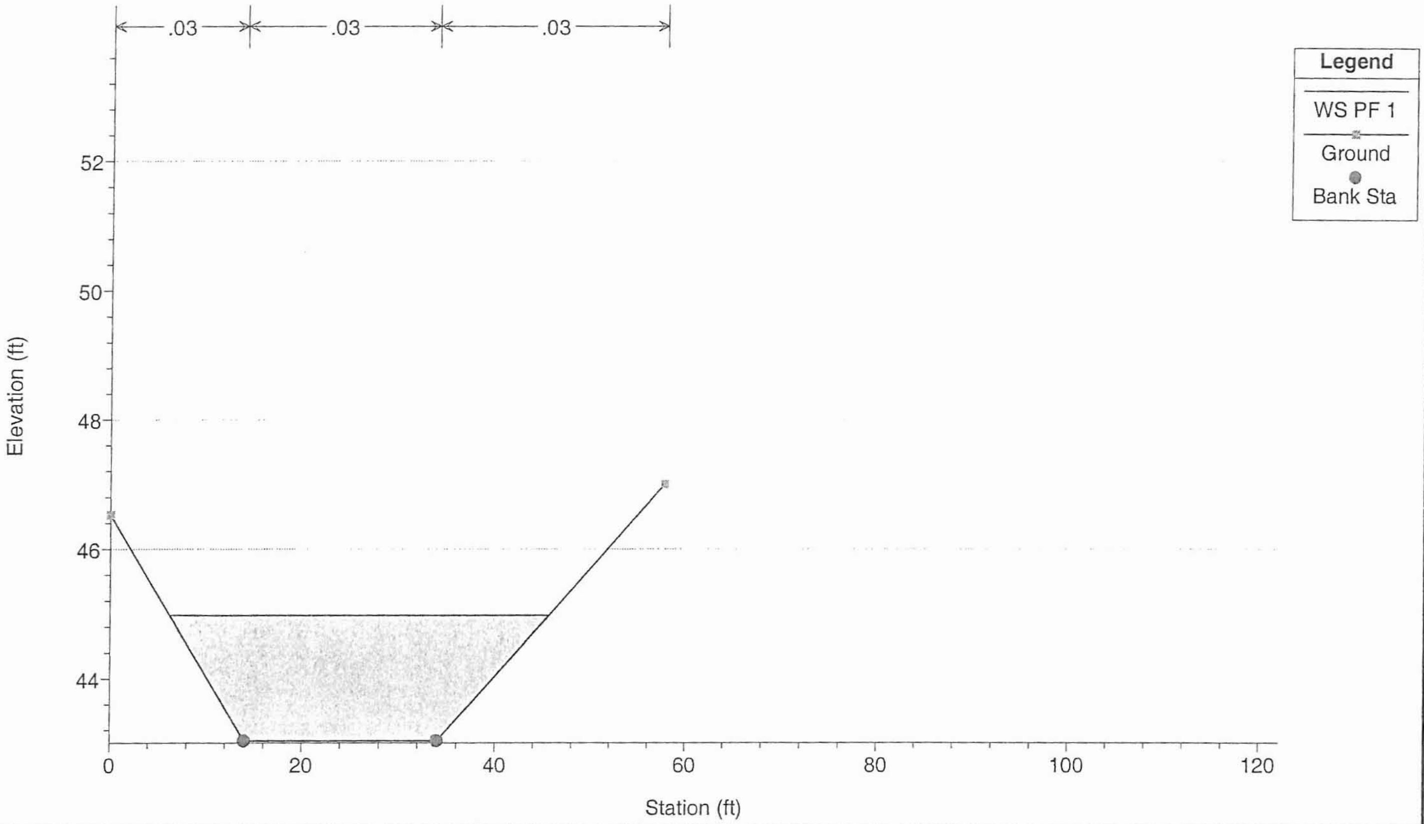


1 in Horiz. = 20 ft 1 in Vert. = 3 ft

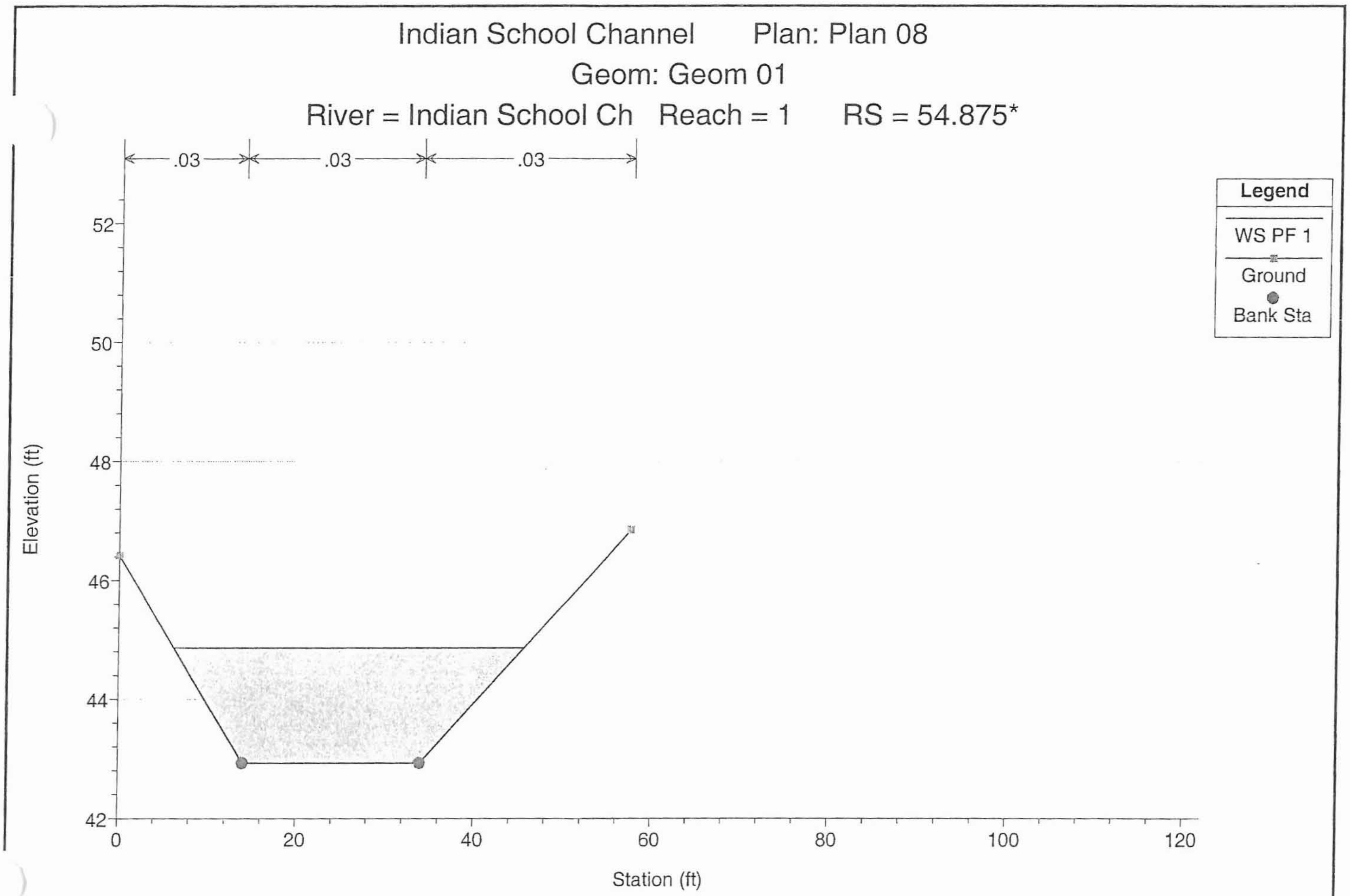
Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 55 STA 38

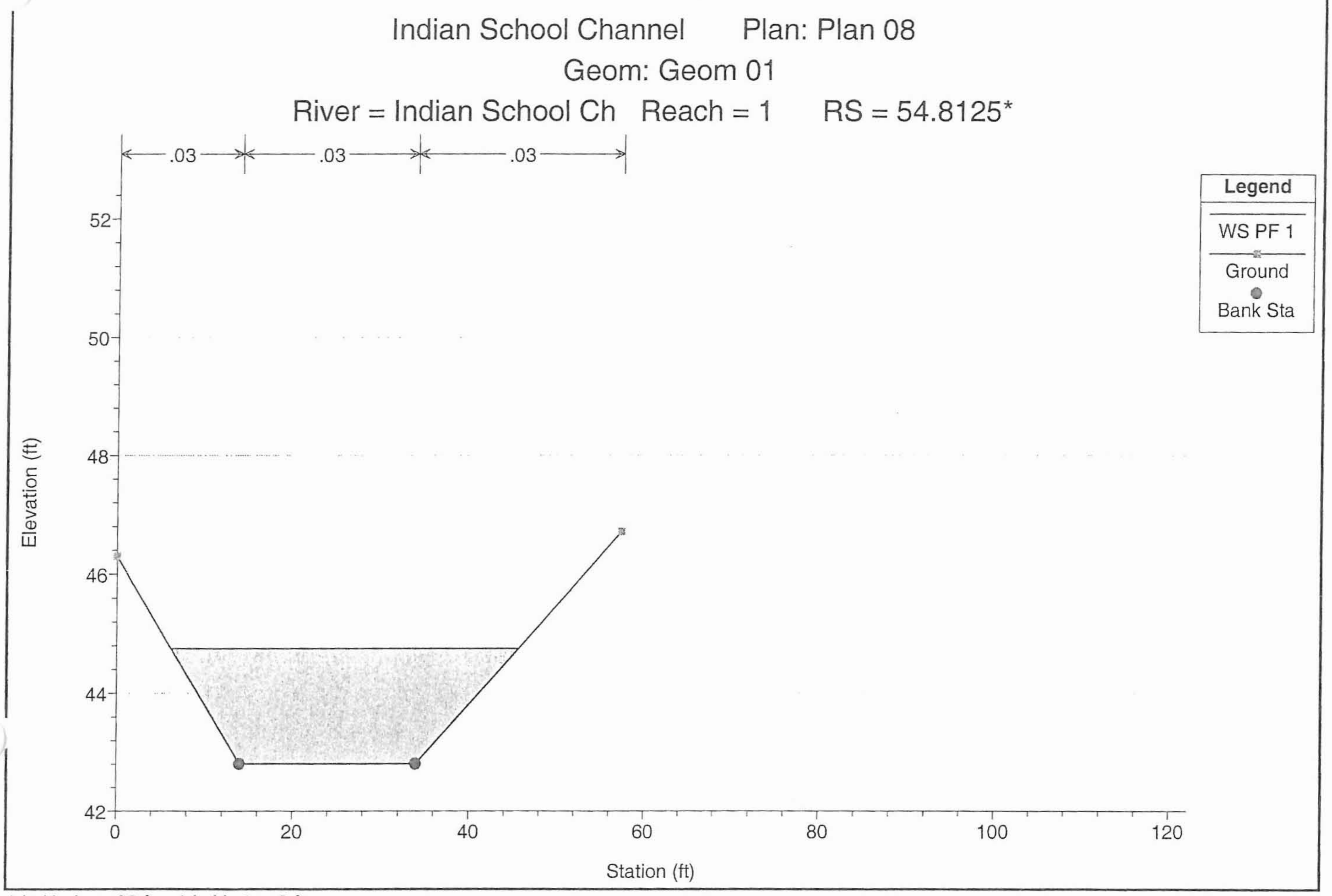


Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 54.9375*



1 in Horiz. = 20 ft 1 in Vert. = 3 ft



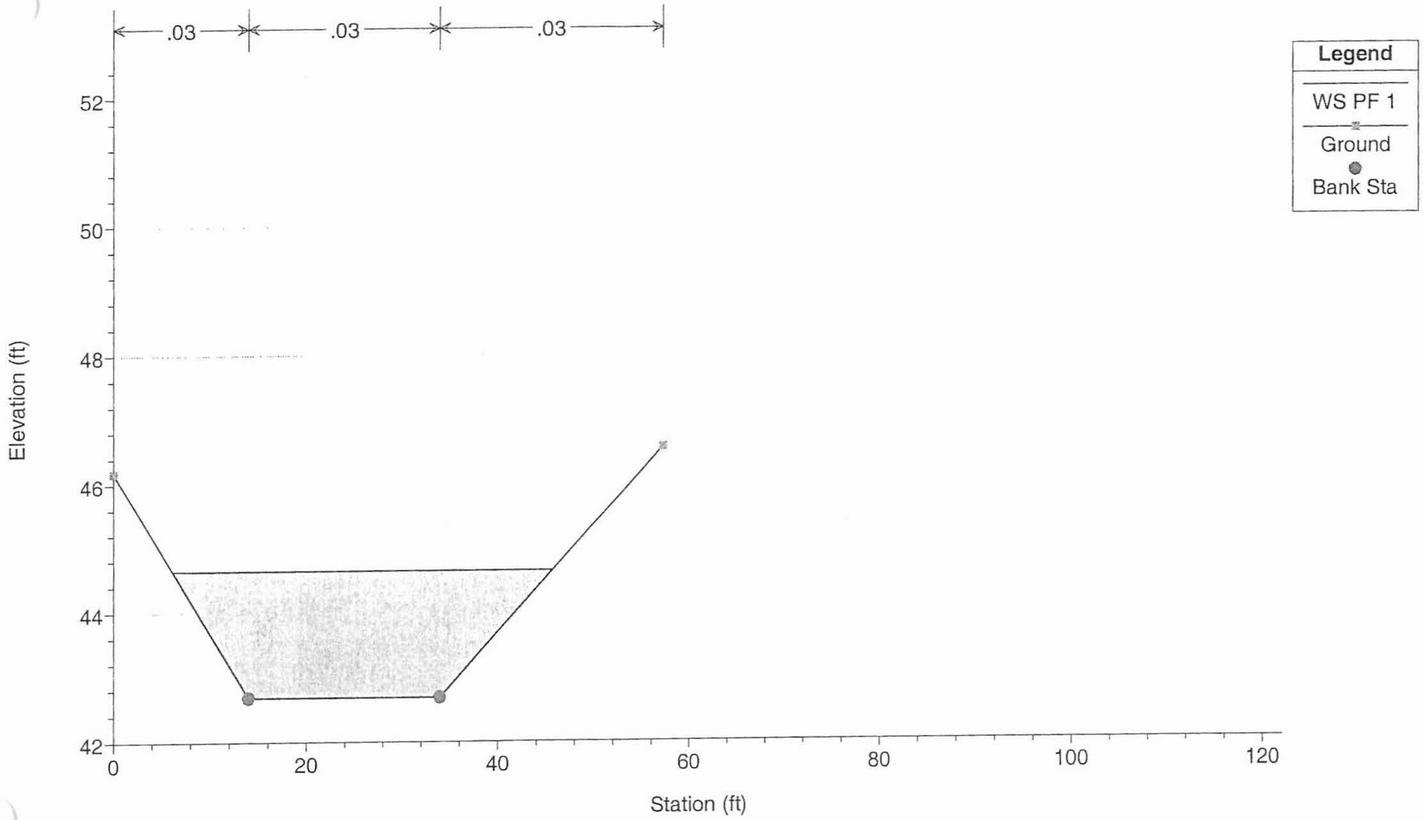


1 in Horiz. = 20 ft 1 in Vert. = 3 ft

Indian School Channel Plan: Plan 08

Geom: Geom 01

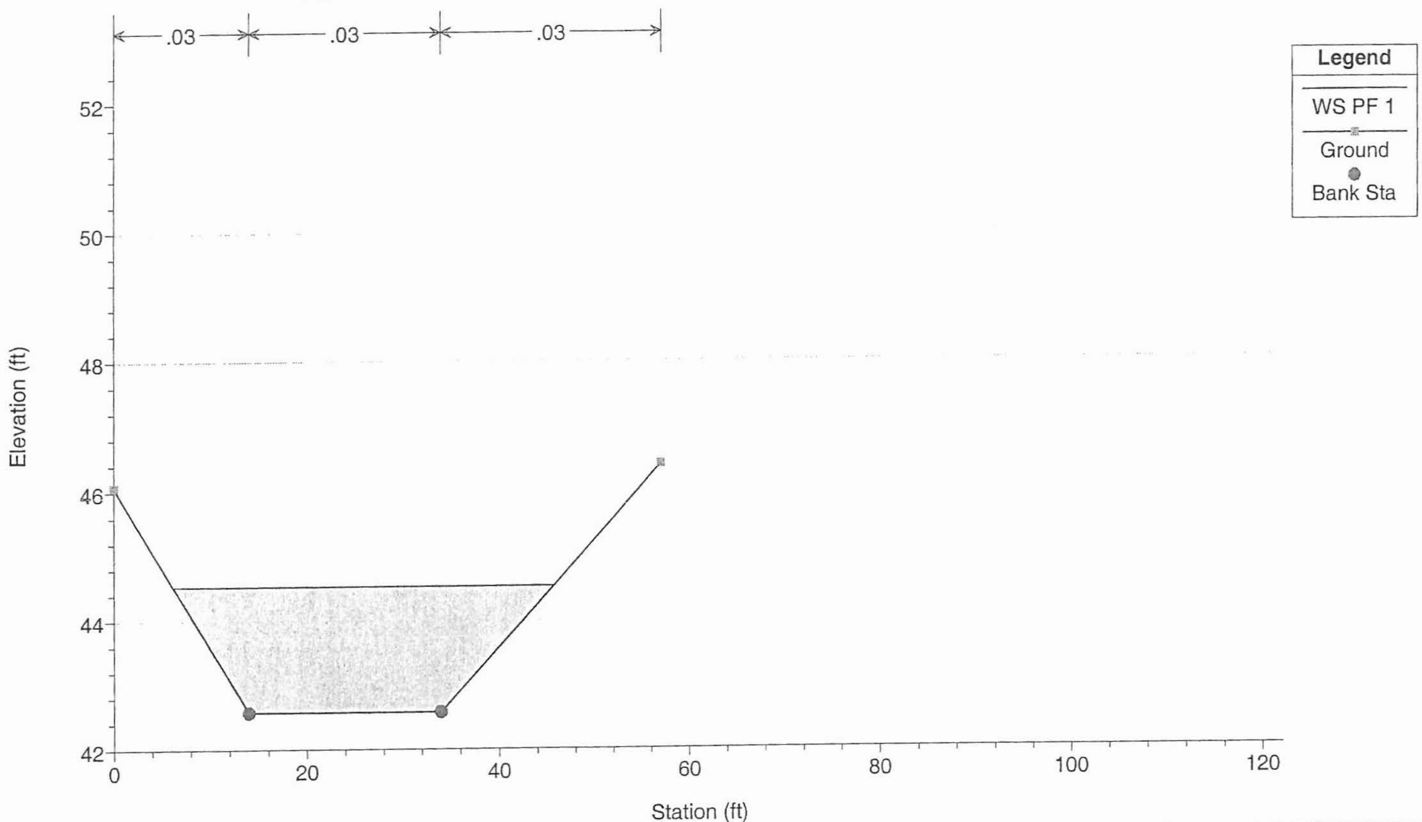
River = Indian School Ch Reach = 1 RS = 54.75*



Indian School Channel Plan: Plan 08

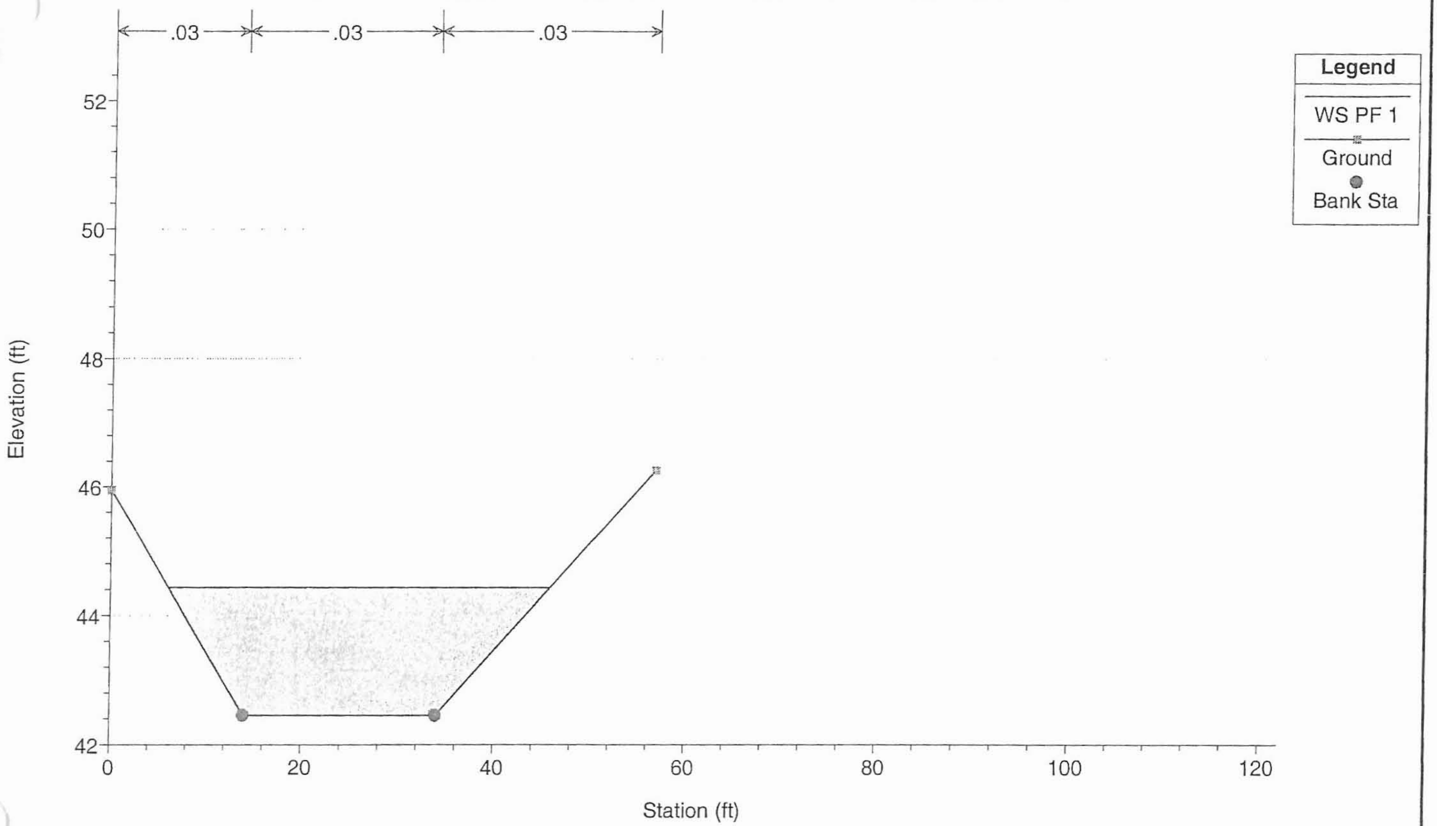
Geom: Geom 01

River = Indian School Ch Reach = 1 RS = 54.6875*

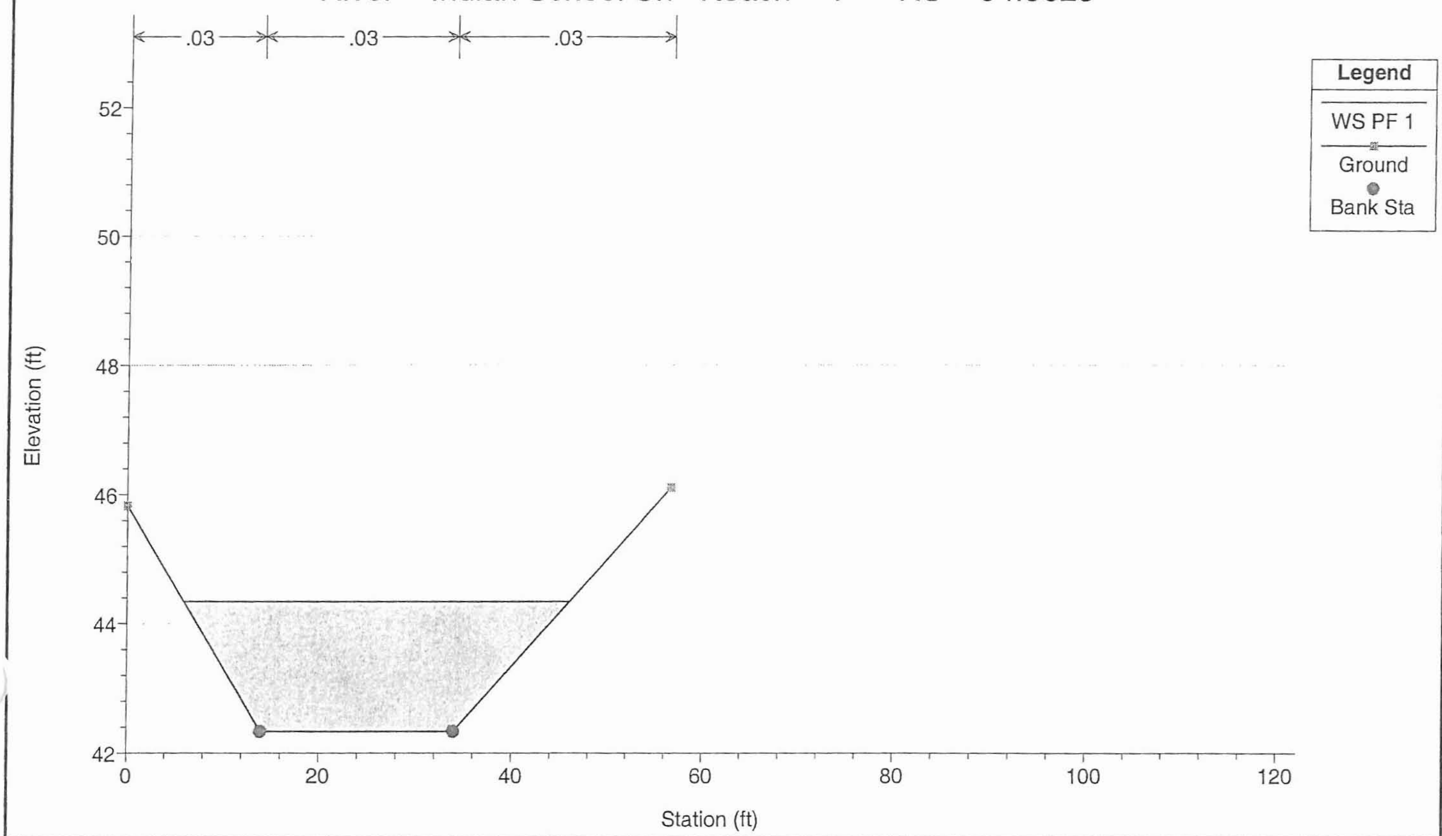


1 in Horiz. = 20 ft 1 in Vert. = 3 ft

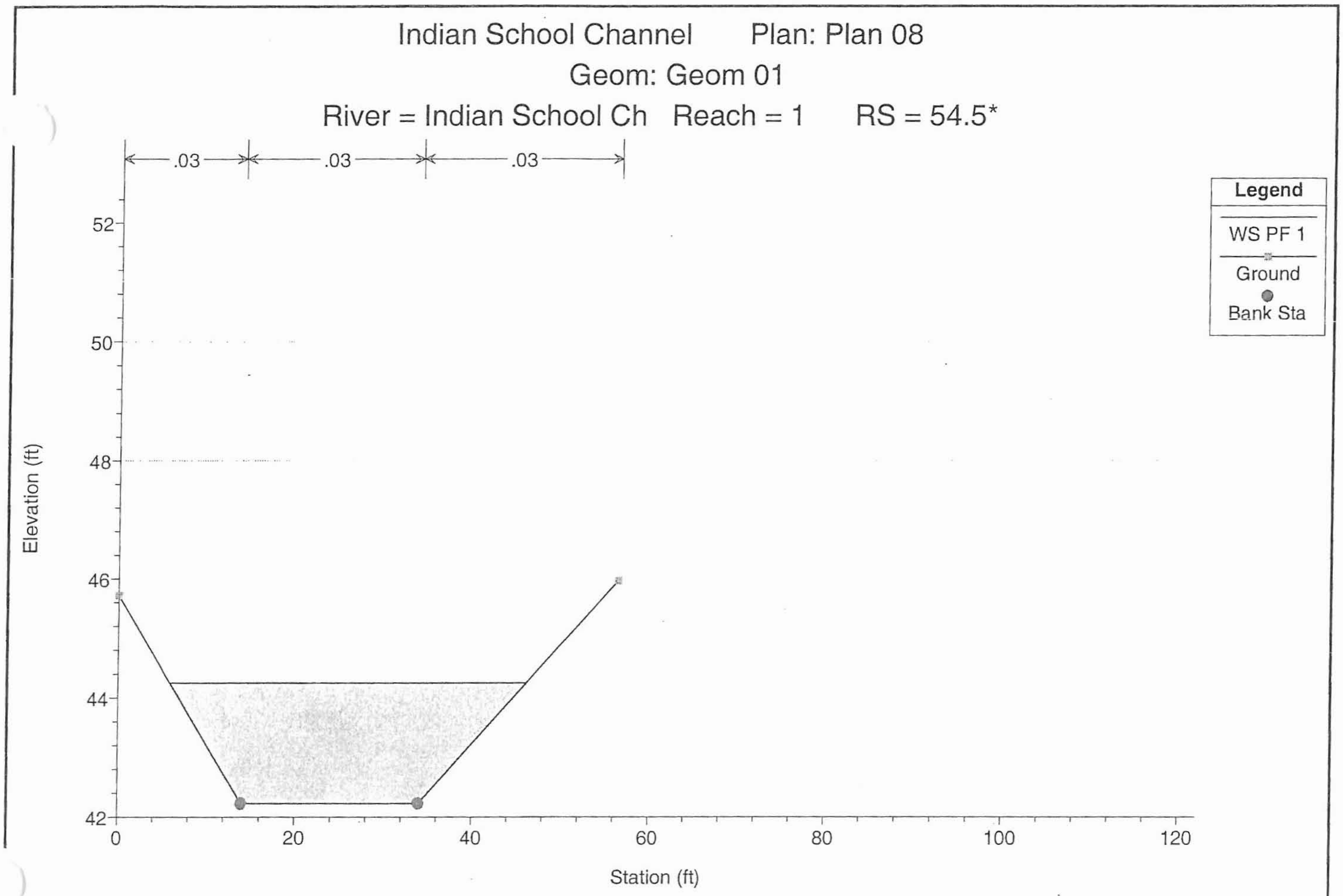
Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 54.625*

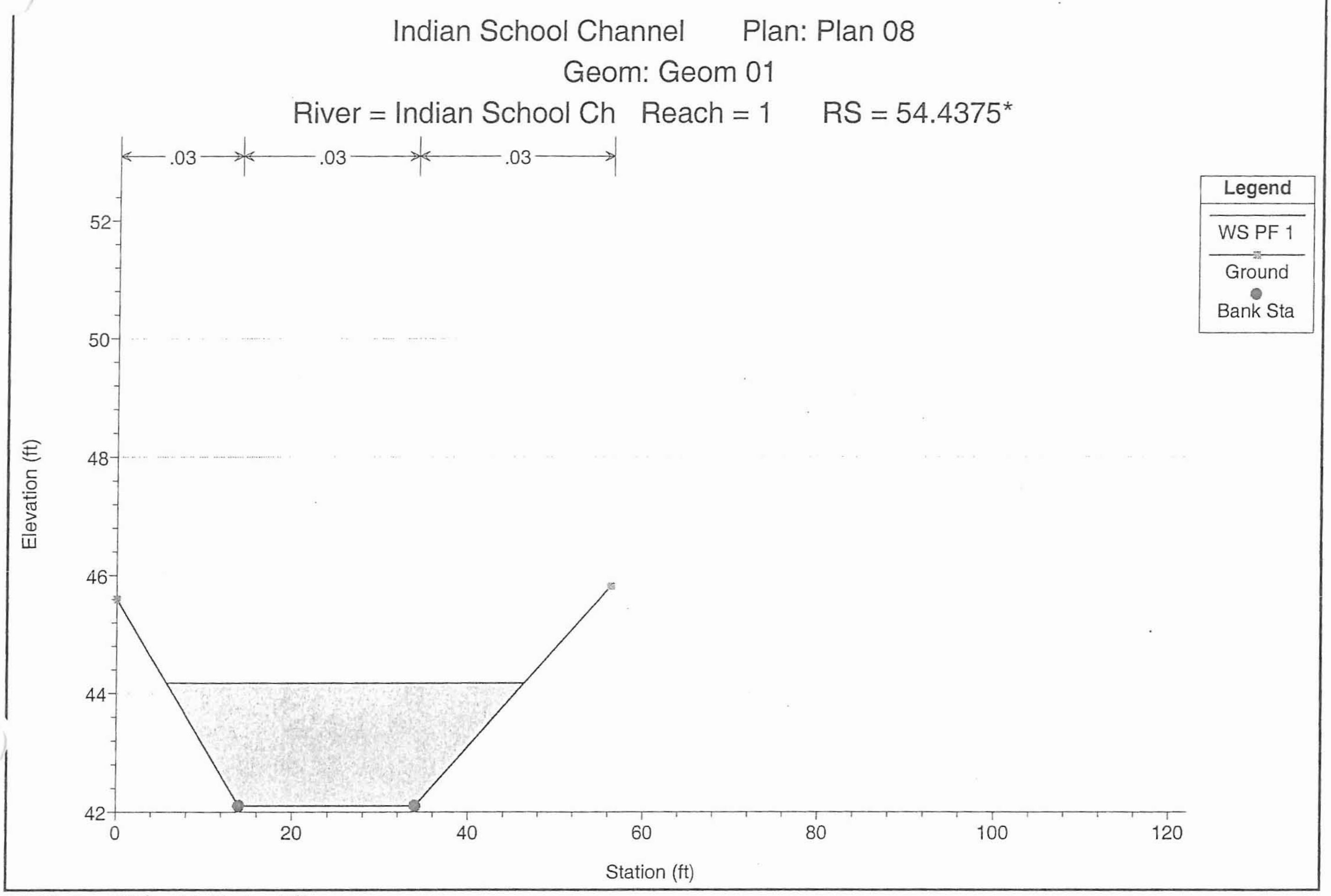


Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 54.5625*

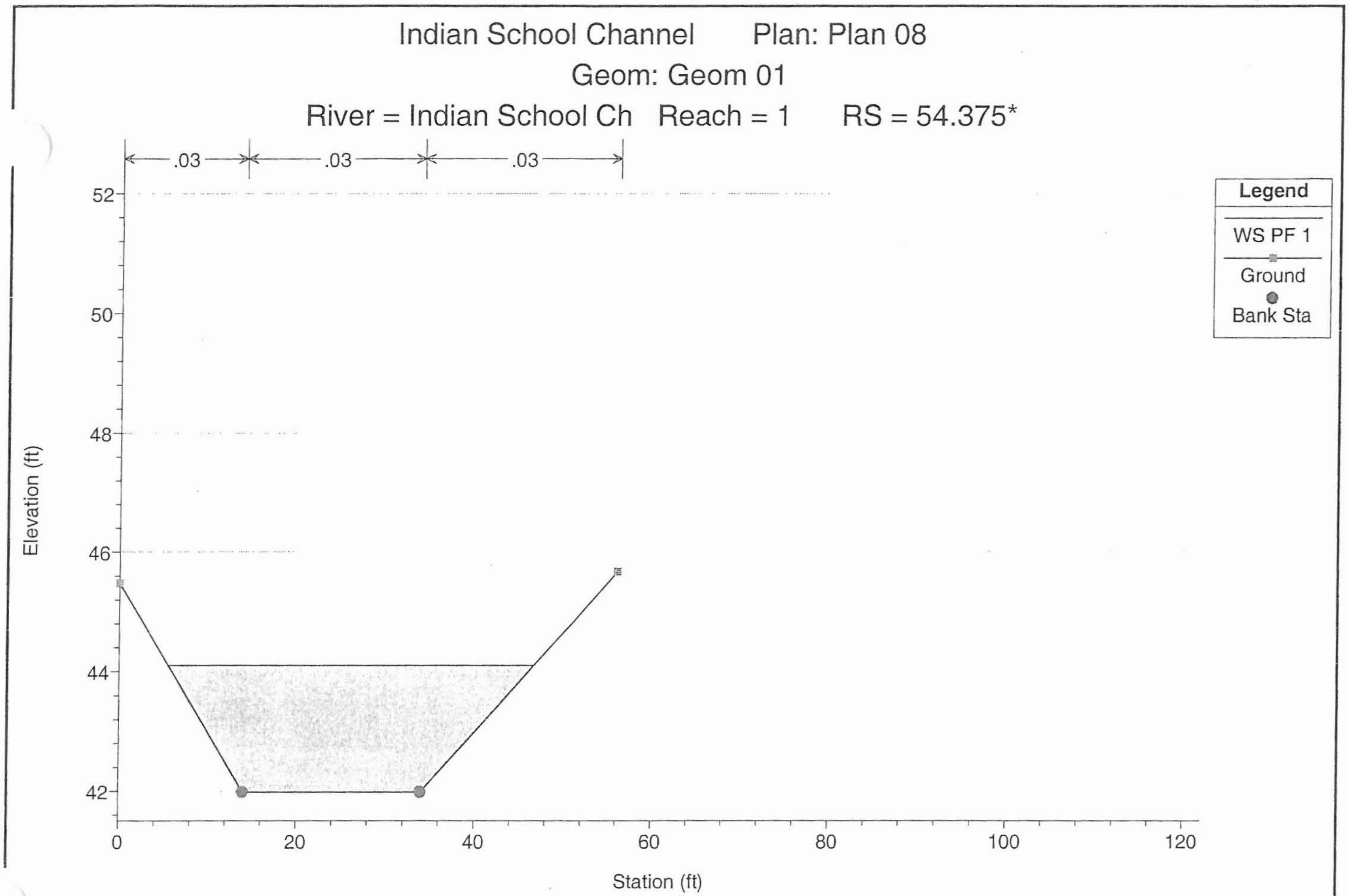


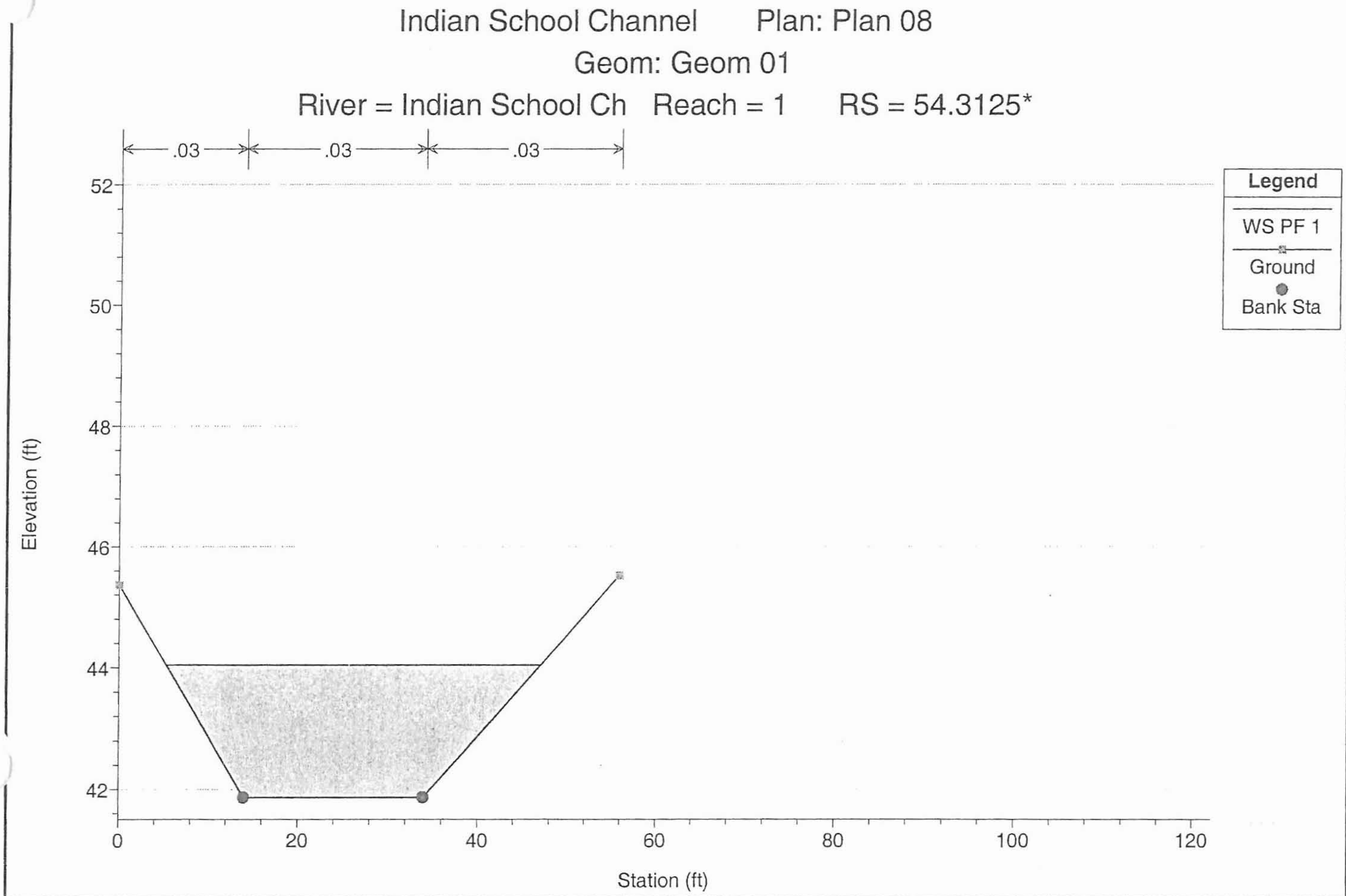
1 in Horiz. = 20 ft 1 in Vert. = 3 ft



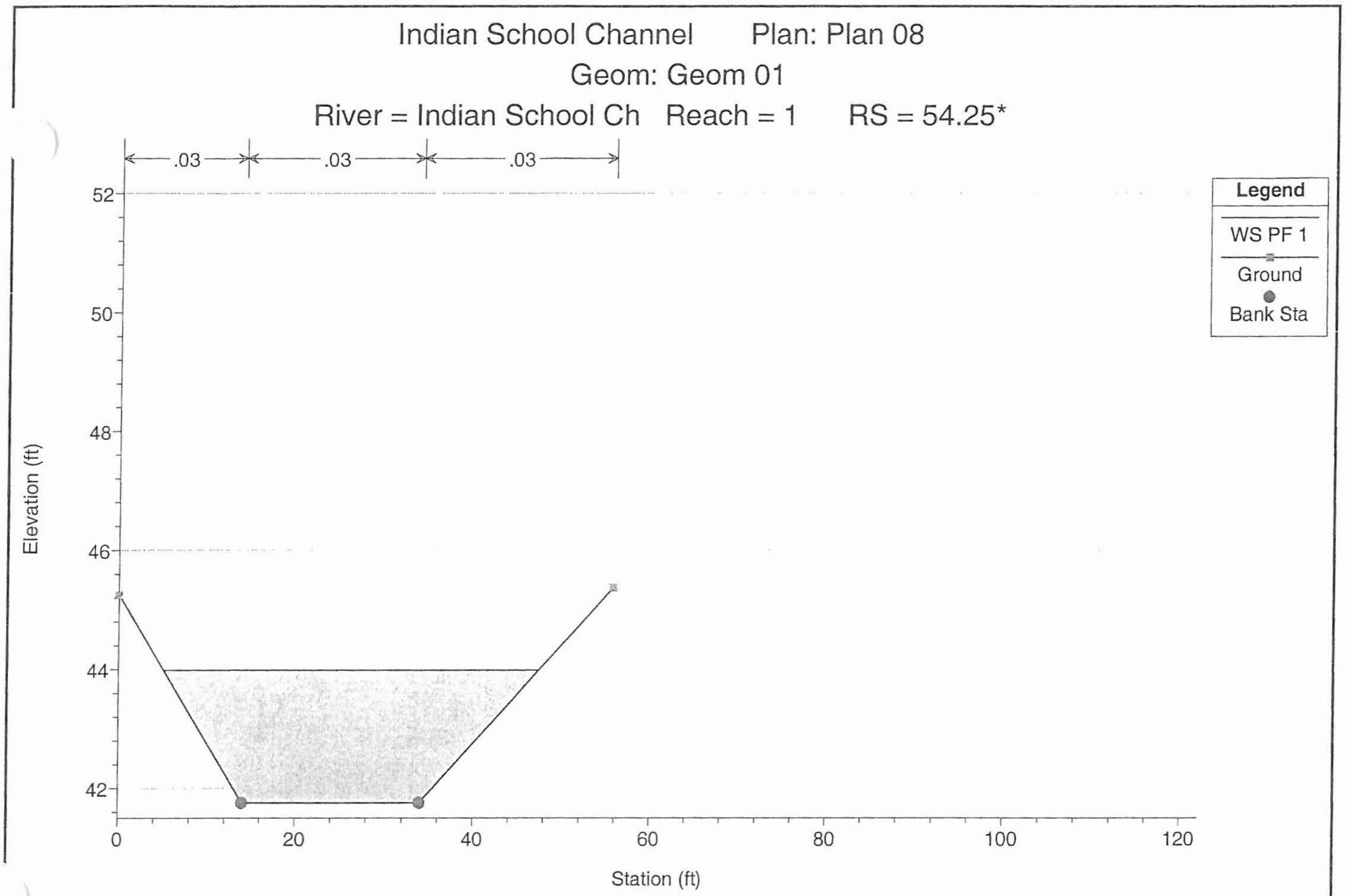


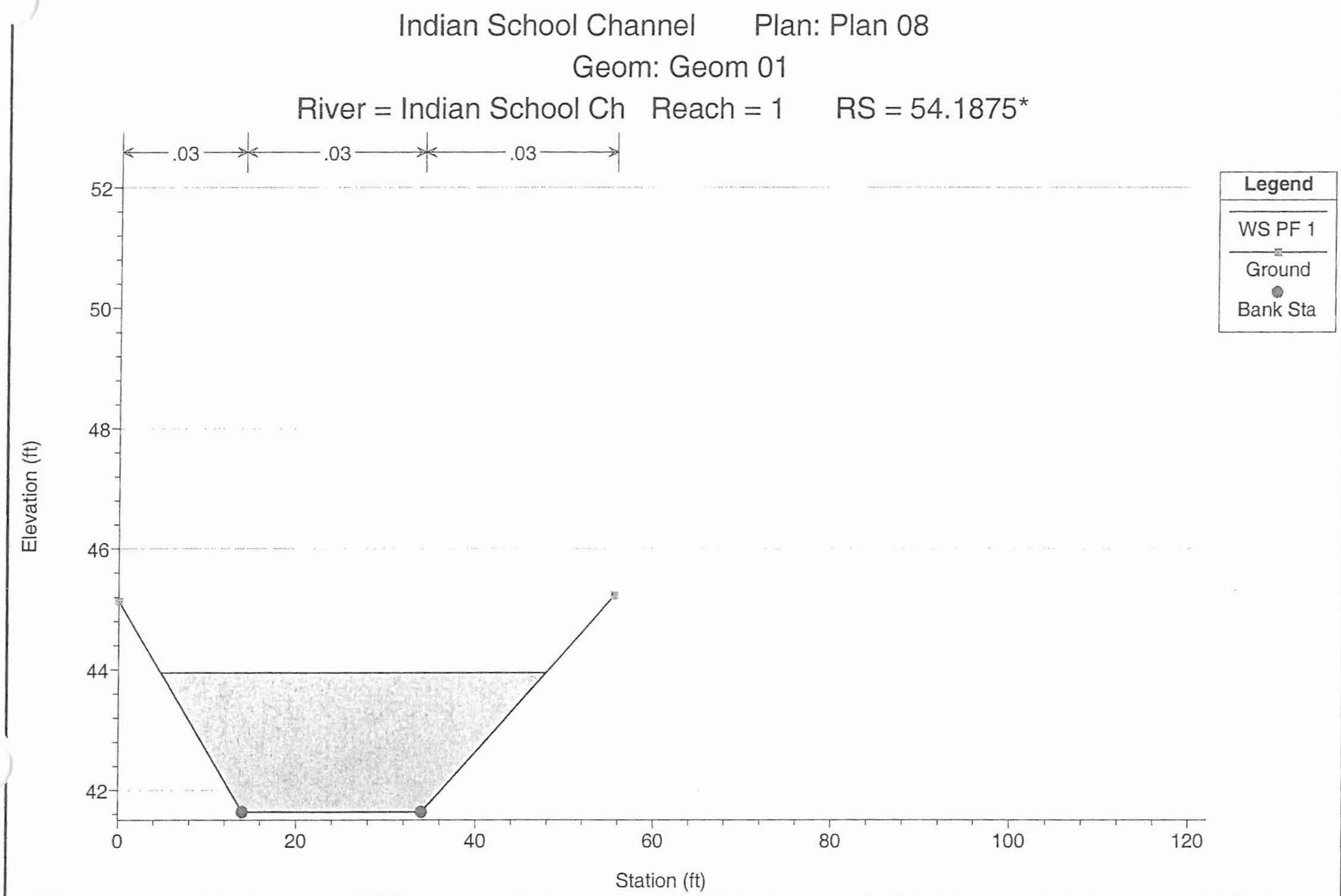
1 in Horiz. = 20 ft 1 in Vert. = 3 ft



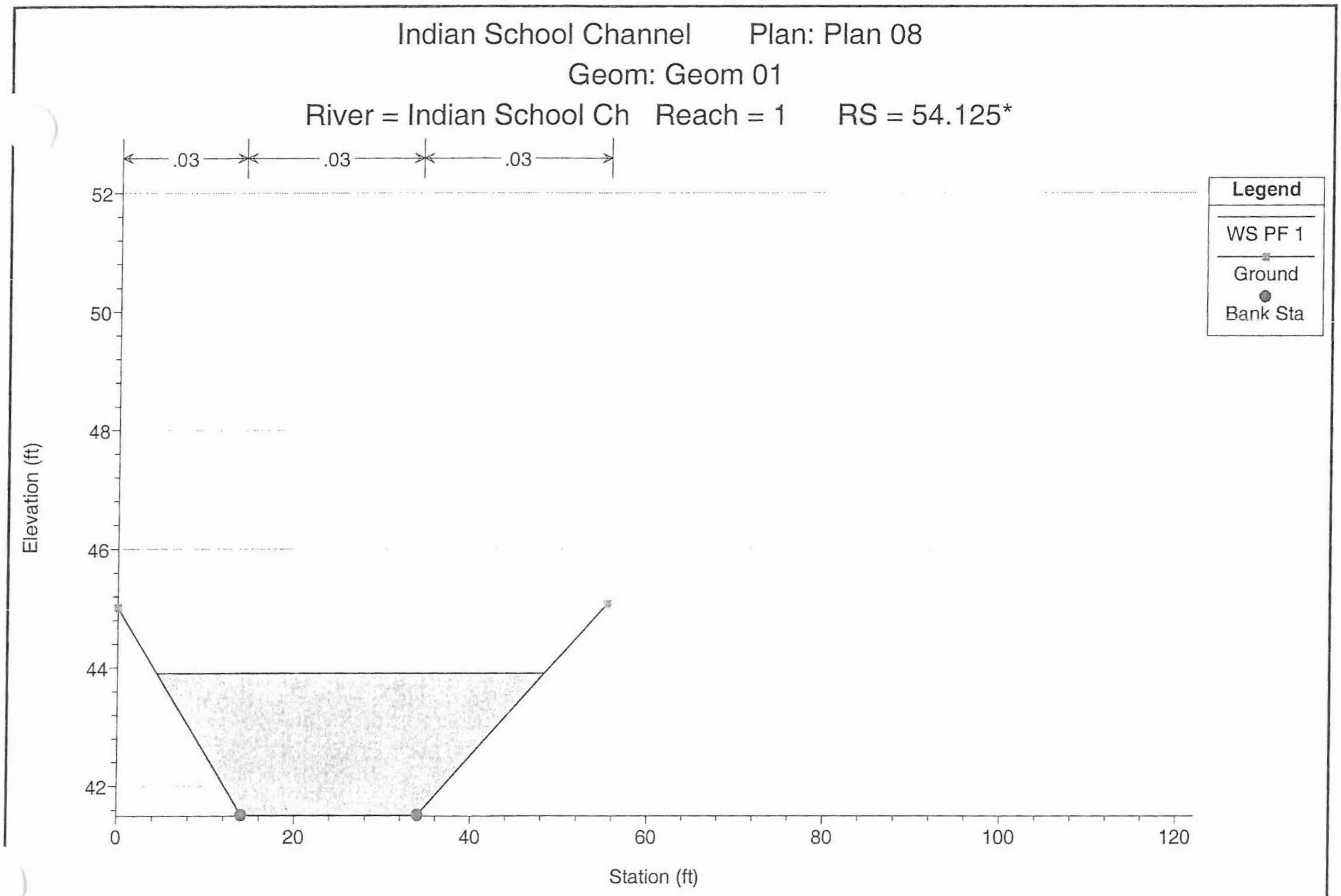


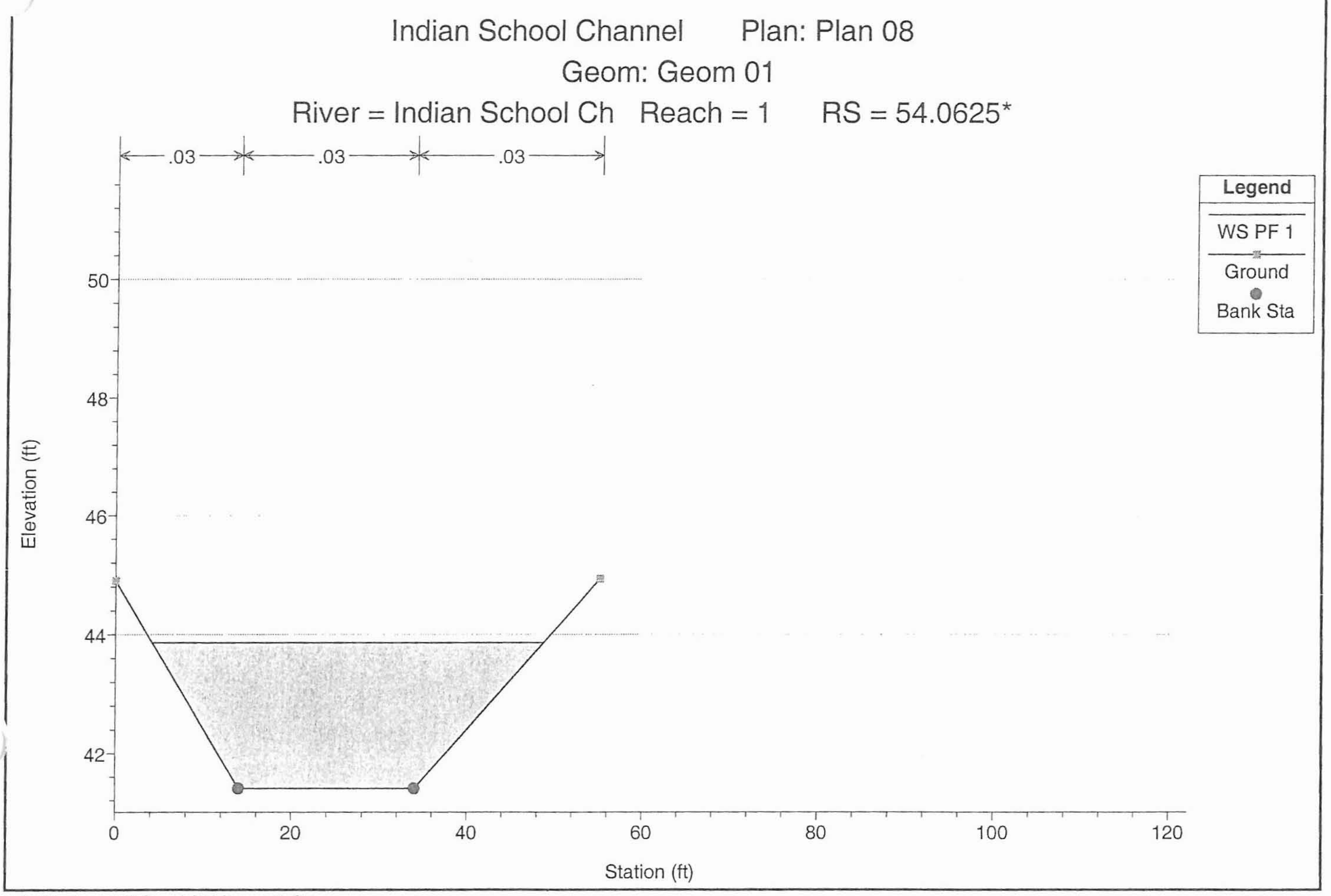
1 in Horiz. = 20 ft 1 in Vert. = 3 ft





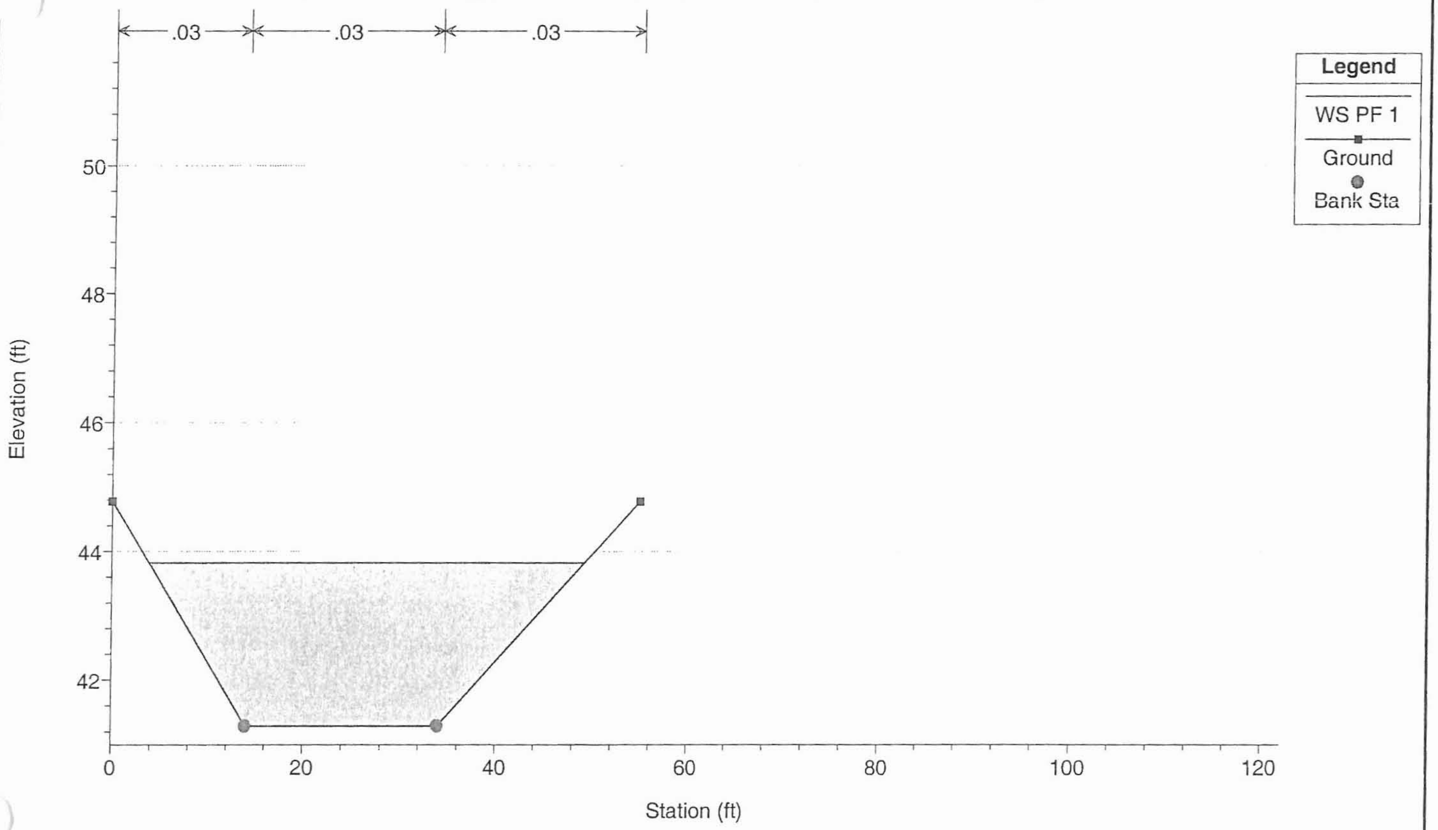
1 in Horiz. = 20 ft 1 in Vert. = 3 ft



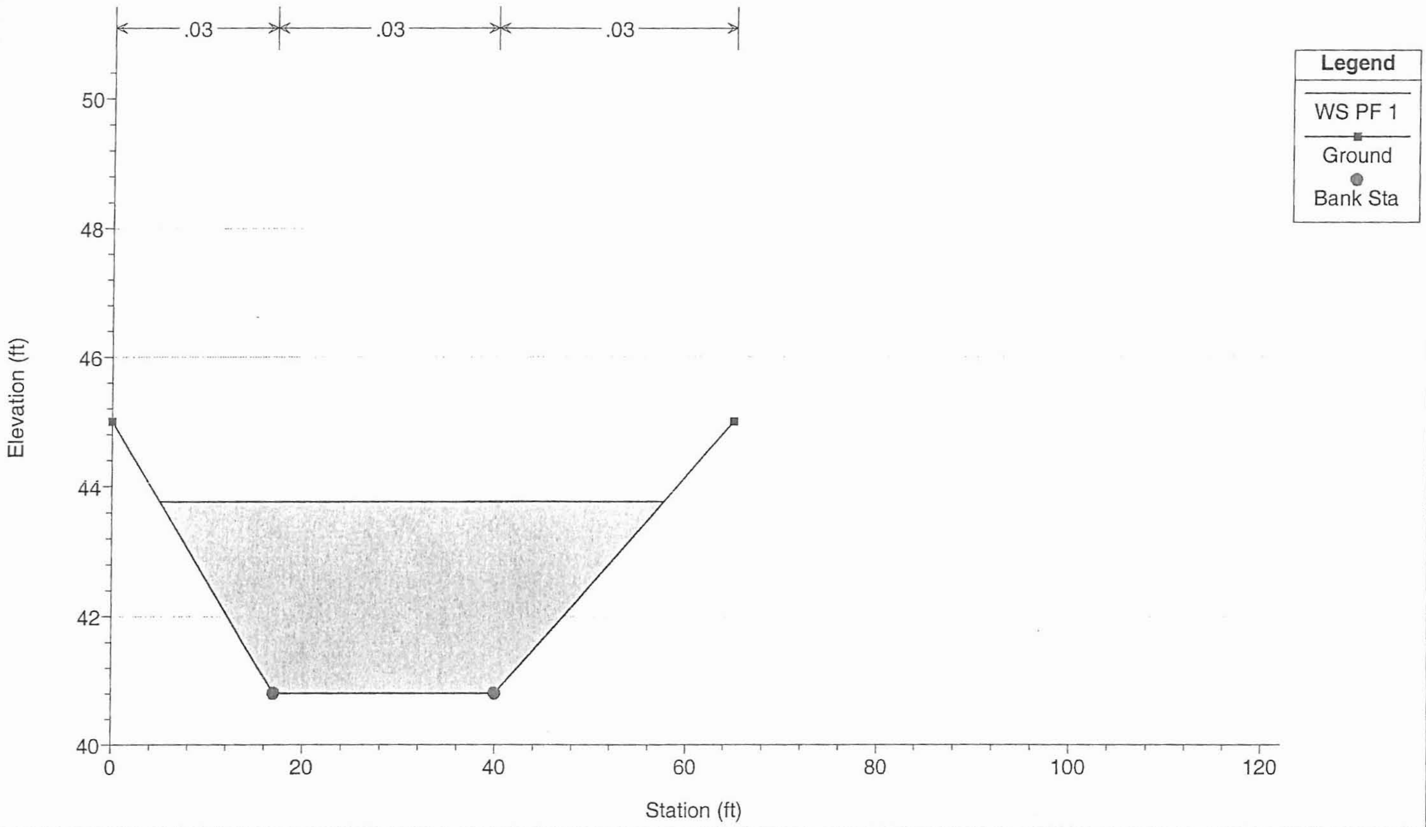


1 in Horiz. = 20 ft 1 in Vert. = 3 ft

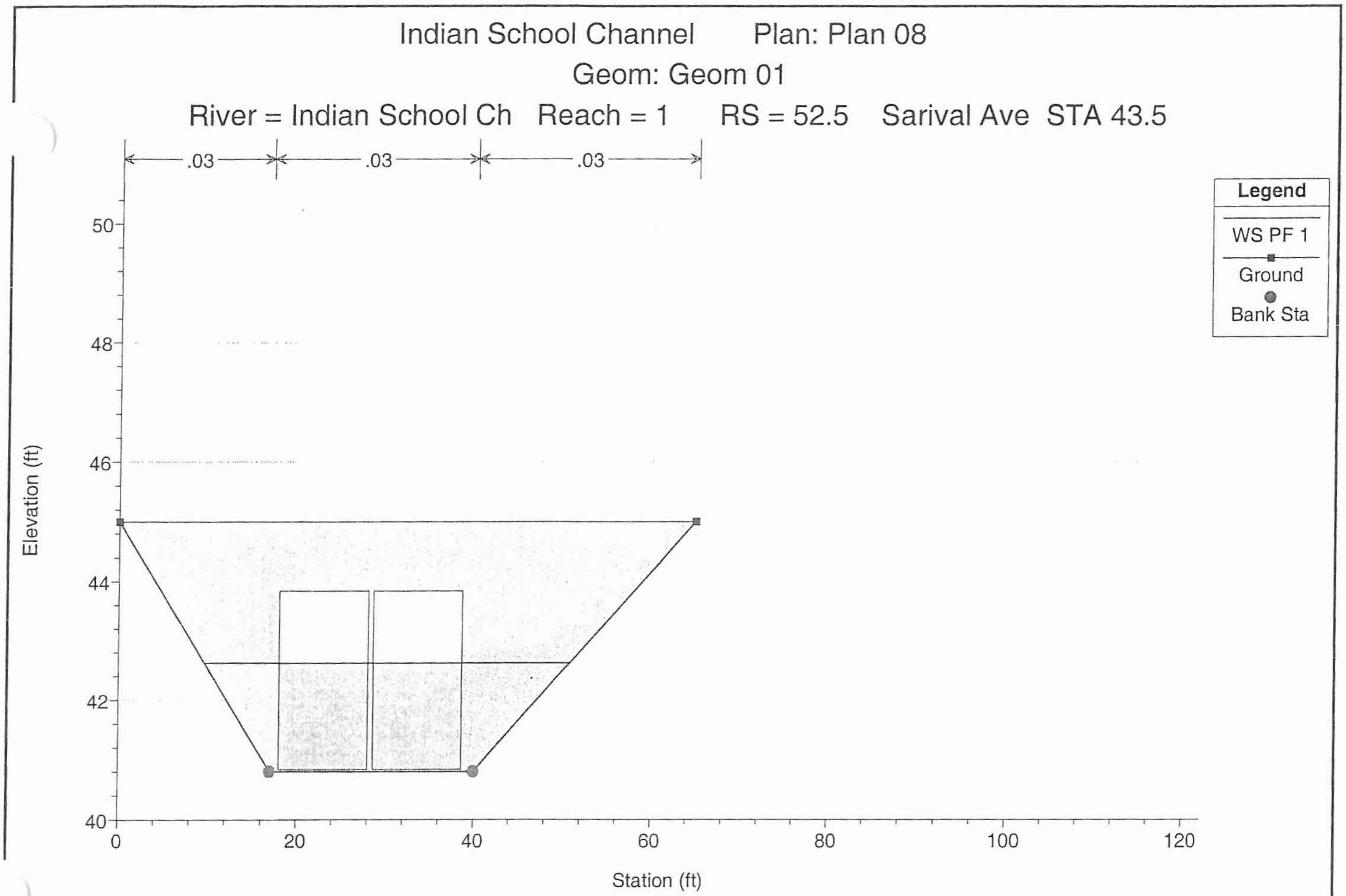
Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 54 STA 42

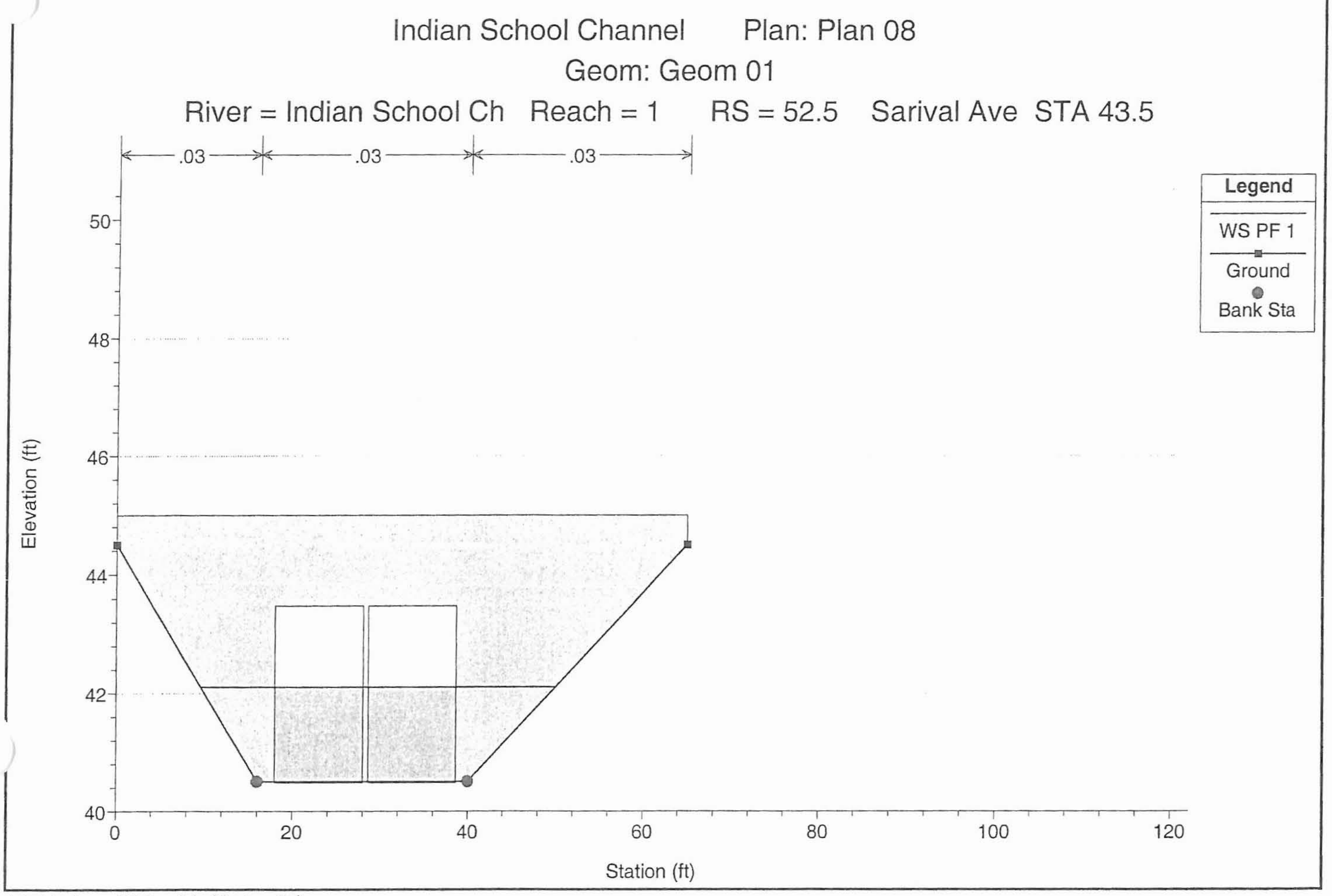


Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 53 STA 43



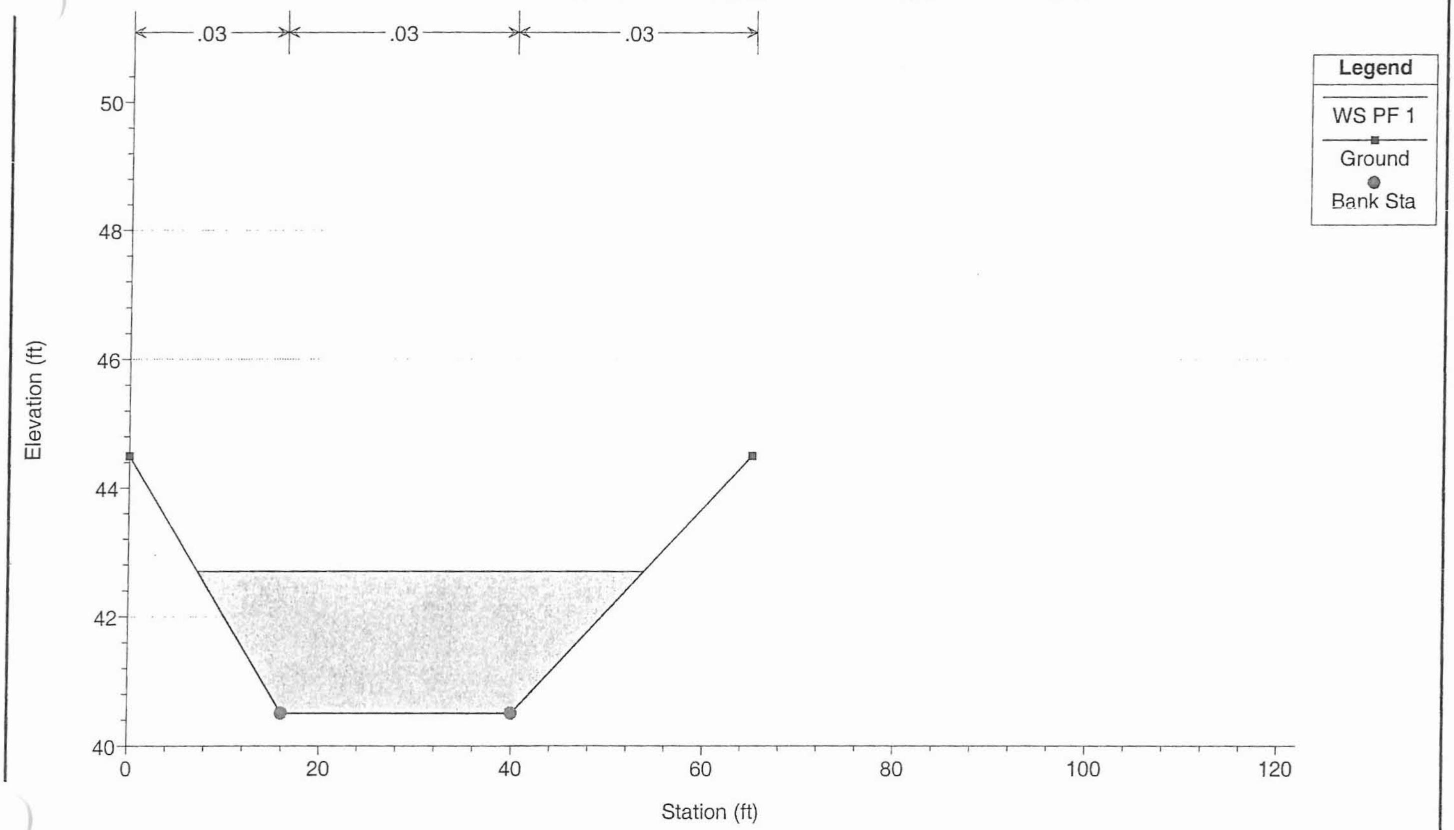
1 in Horiz. = 20 ft 1 in Vert. = 3 ft



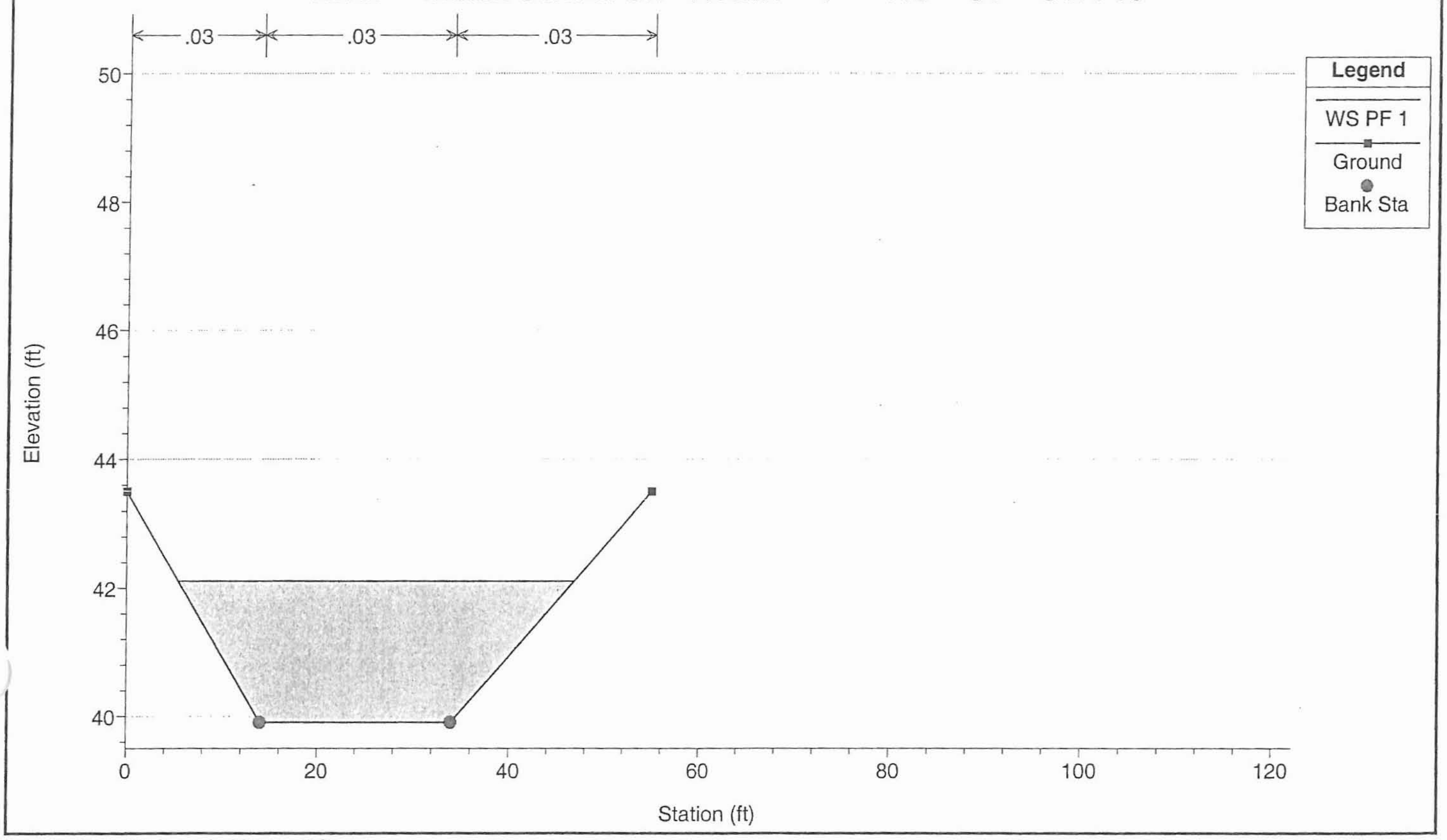


1 in Horiz. = 20 ft 1 in Vert. = 3 ft

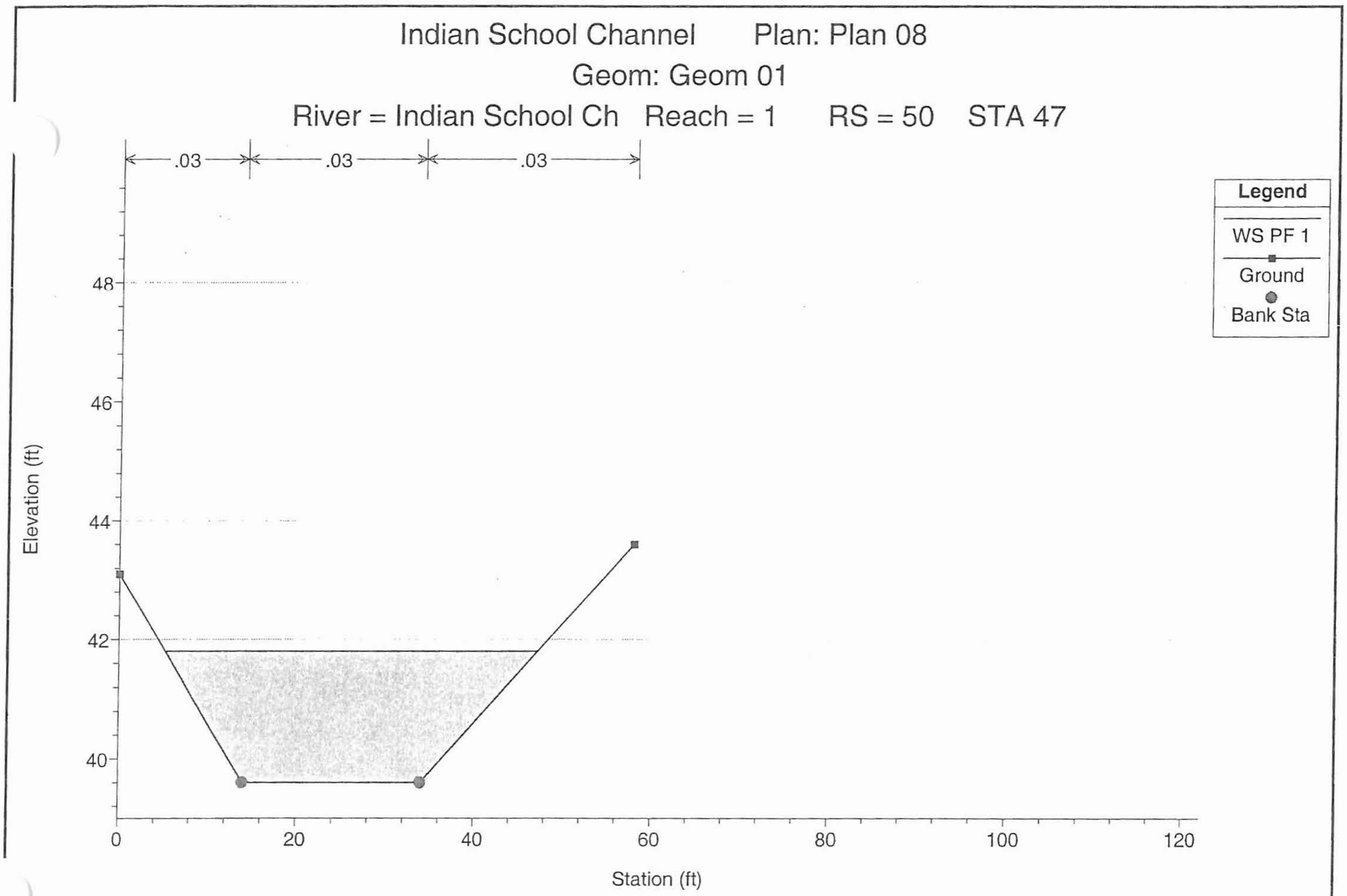
Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 52 STA 44

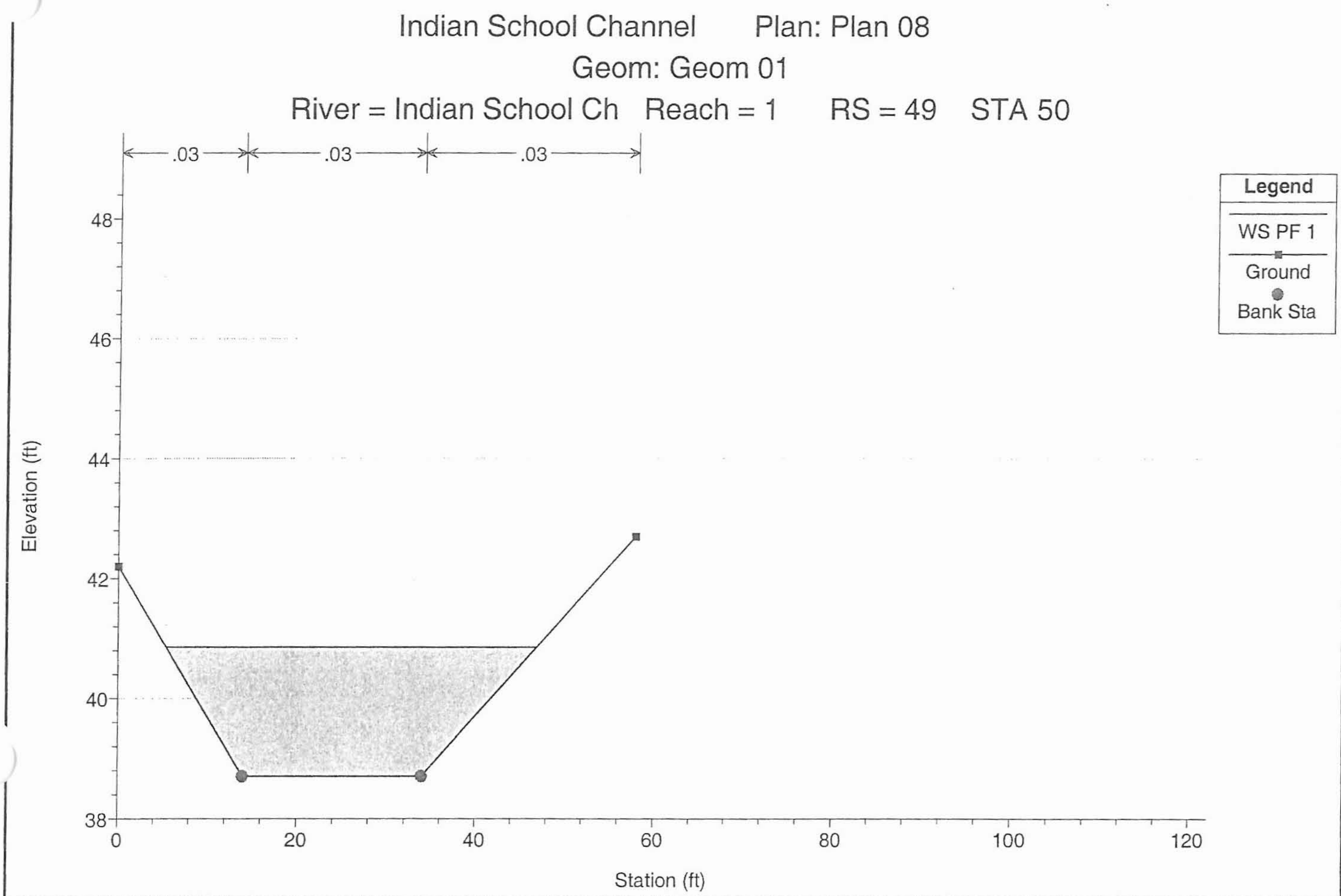


Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 51 STA 46

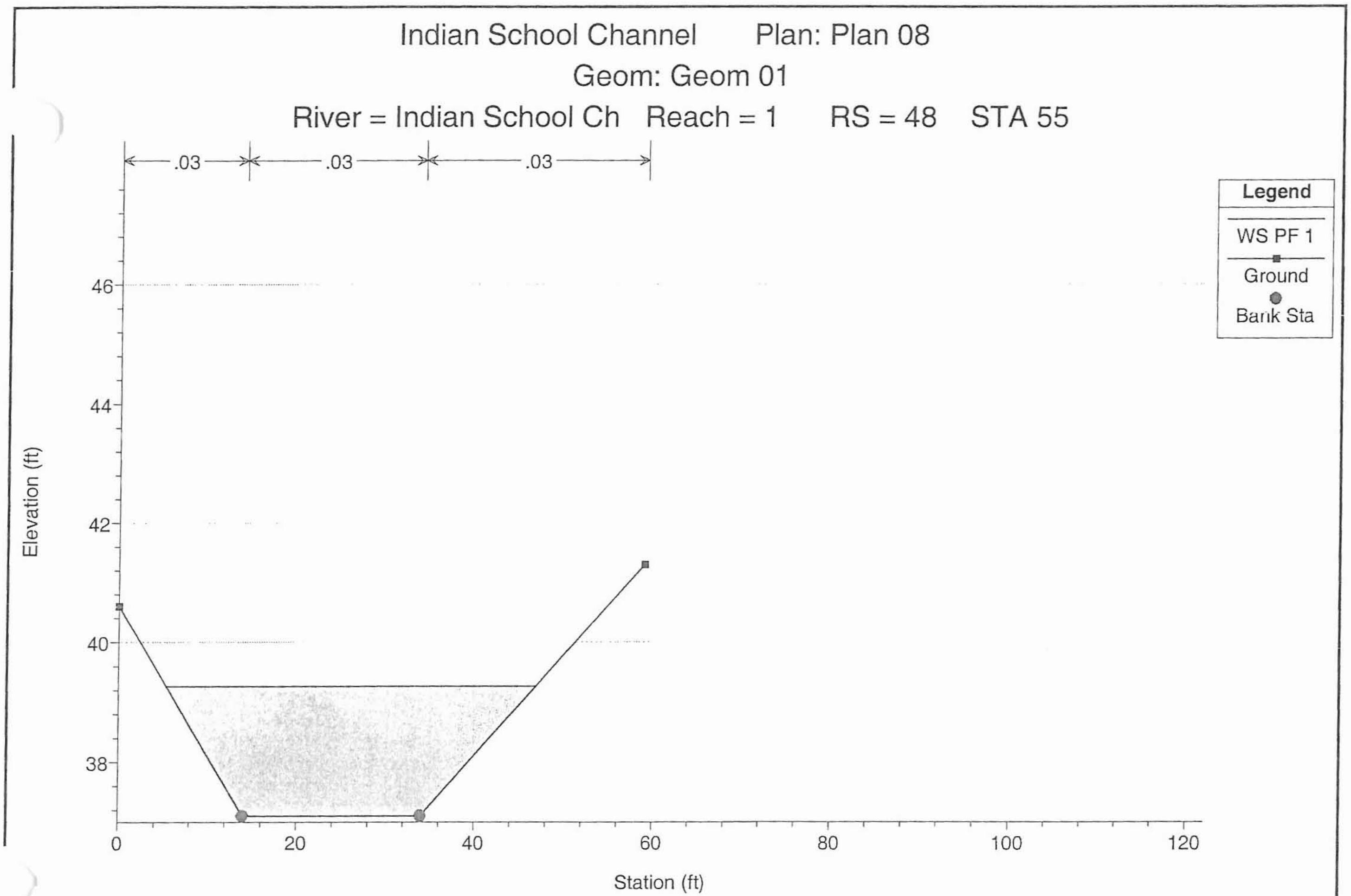


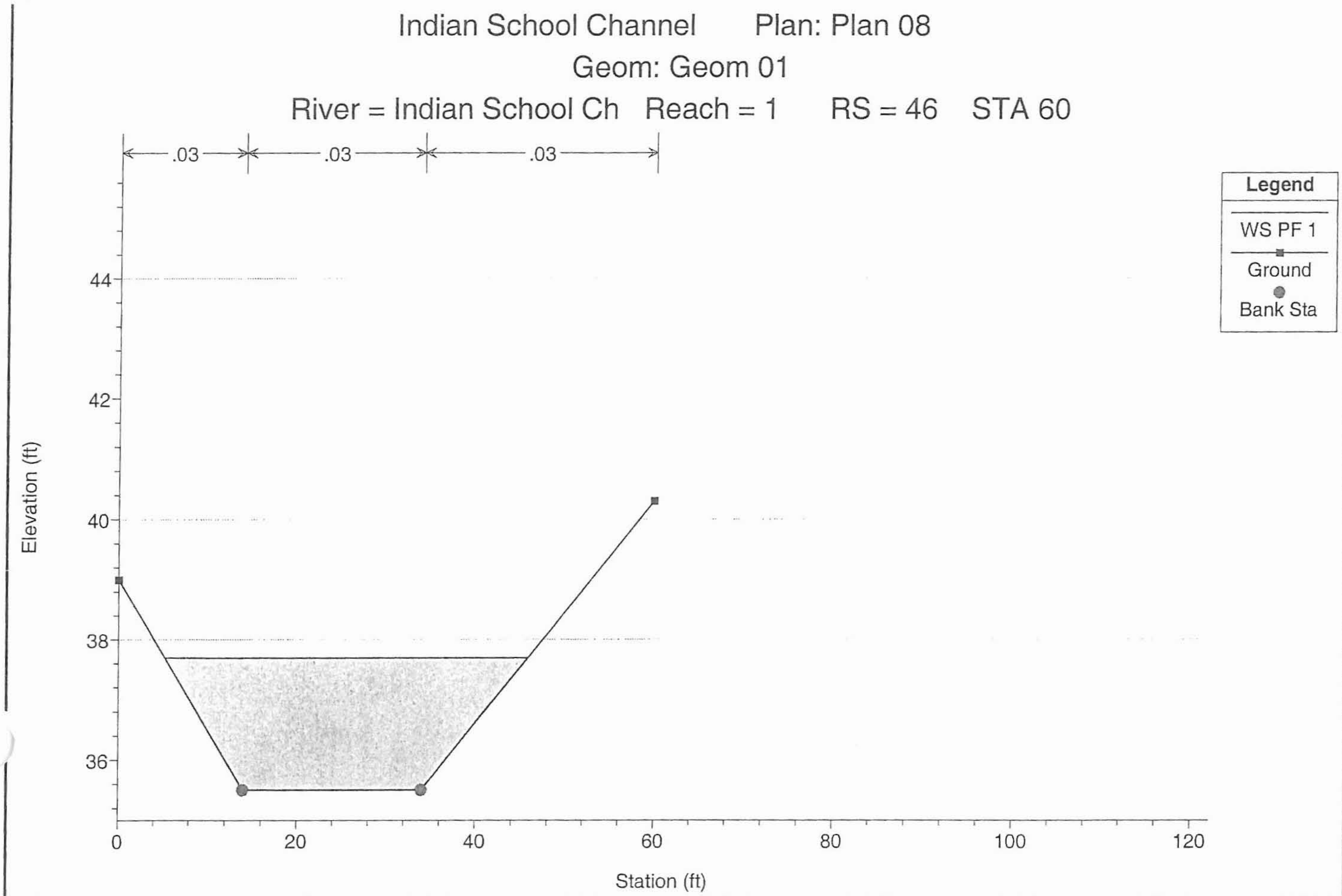
1 in Horiz. = 20 ft 1 in Vert. = 3 ft





1 in Horiz. = 20 ft 1 in Vert. = 3 ft



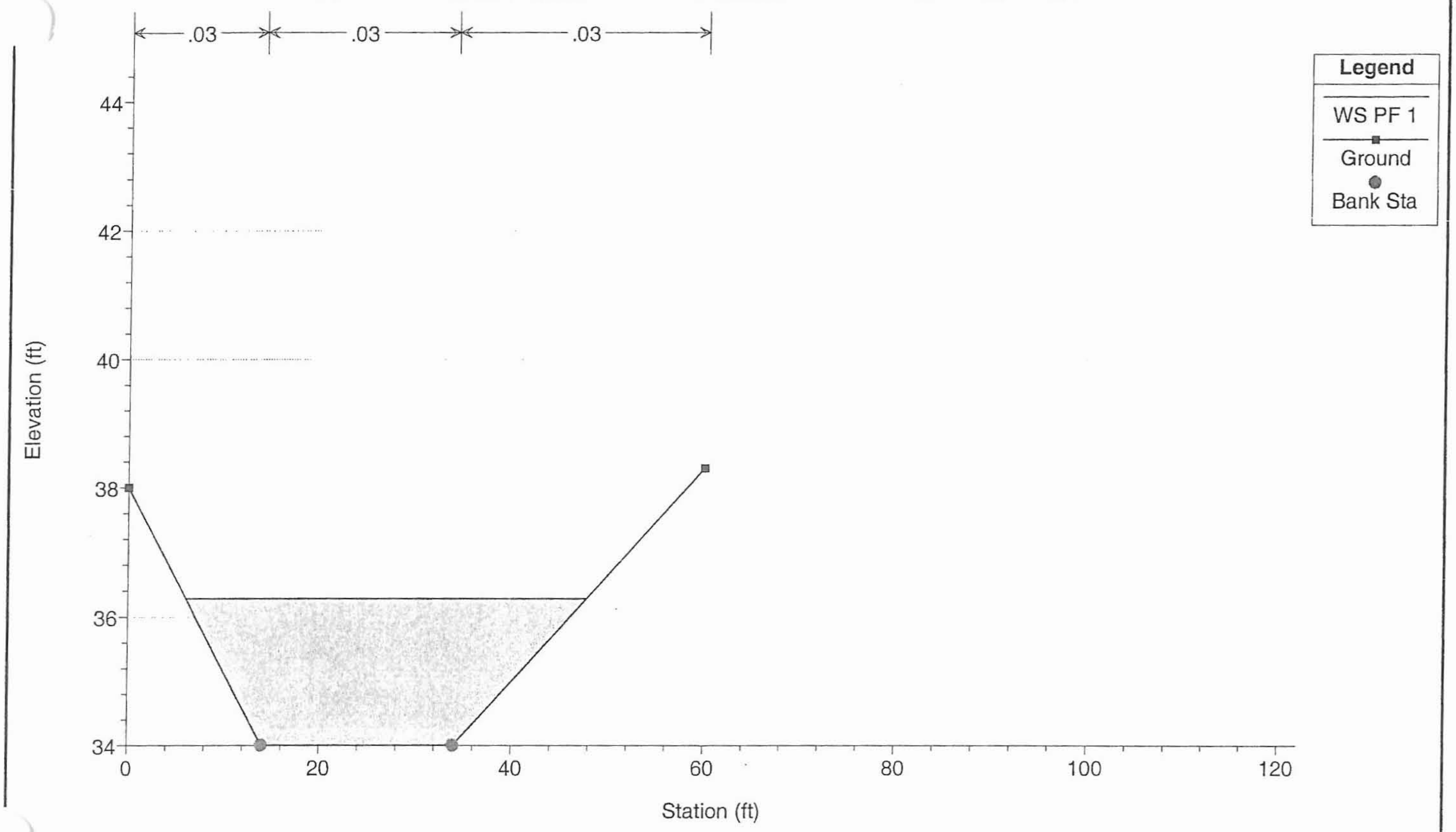


1 in Horiz. = 20 ft 1 in Vert. = 3 ft

Indian School Channel Plan: Plan 08

Geom: Geom 01

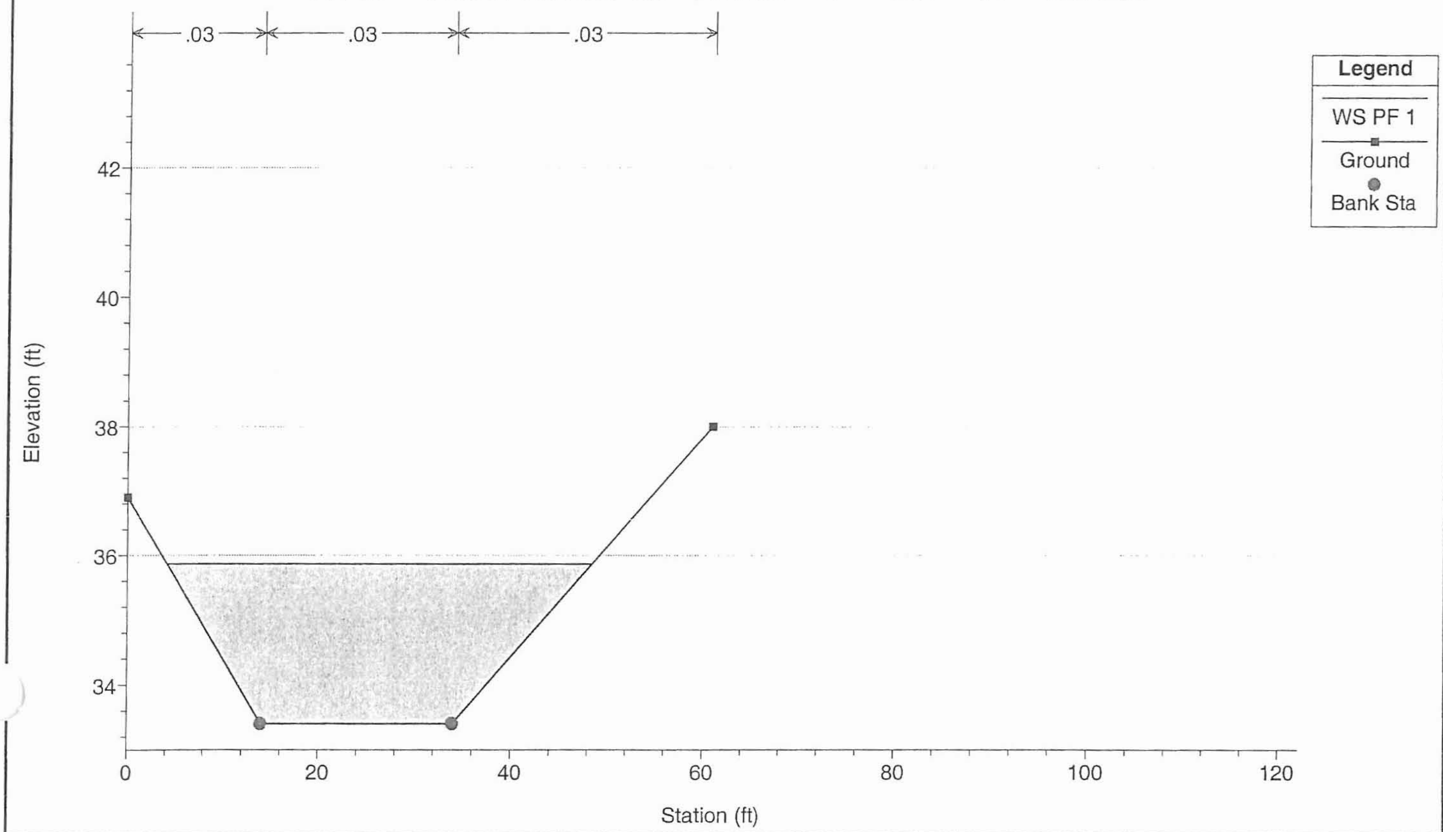
River = Indian School Ch Reach = 1 RS = 45 STA 65



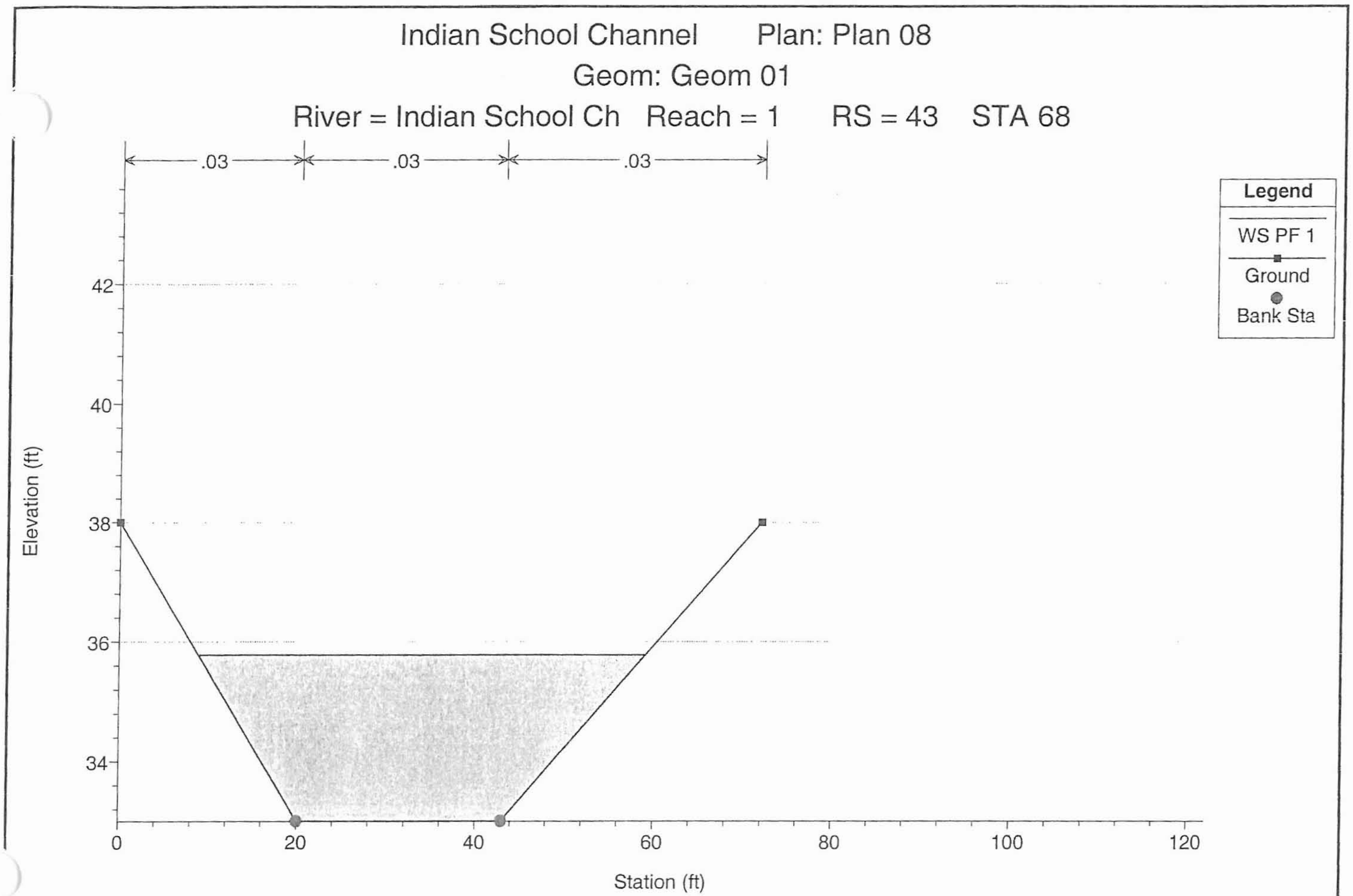
Indian School Channel Plan: Plan 08

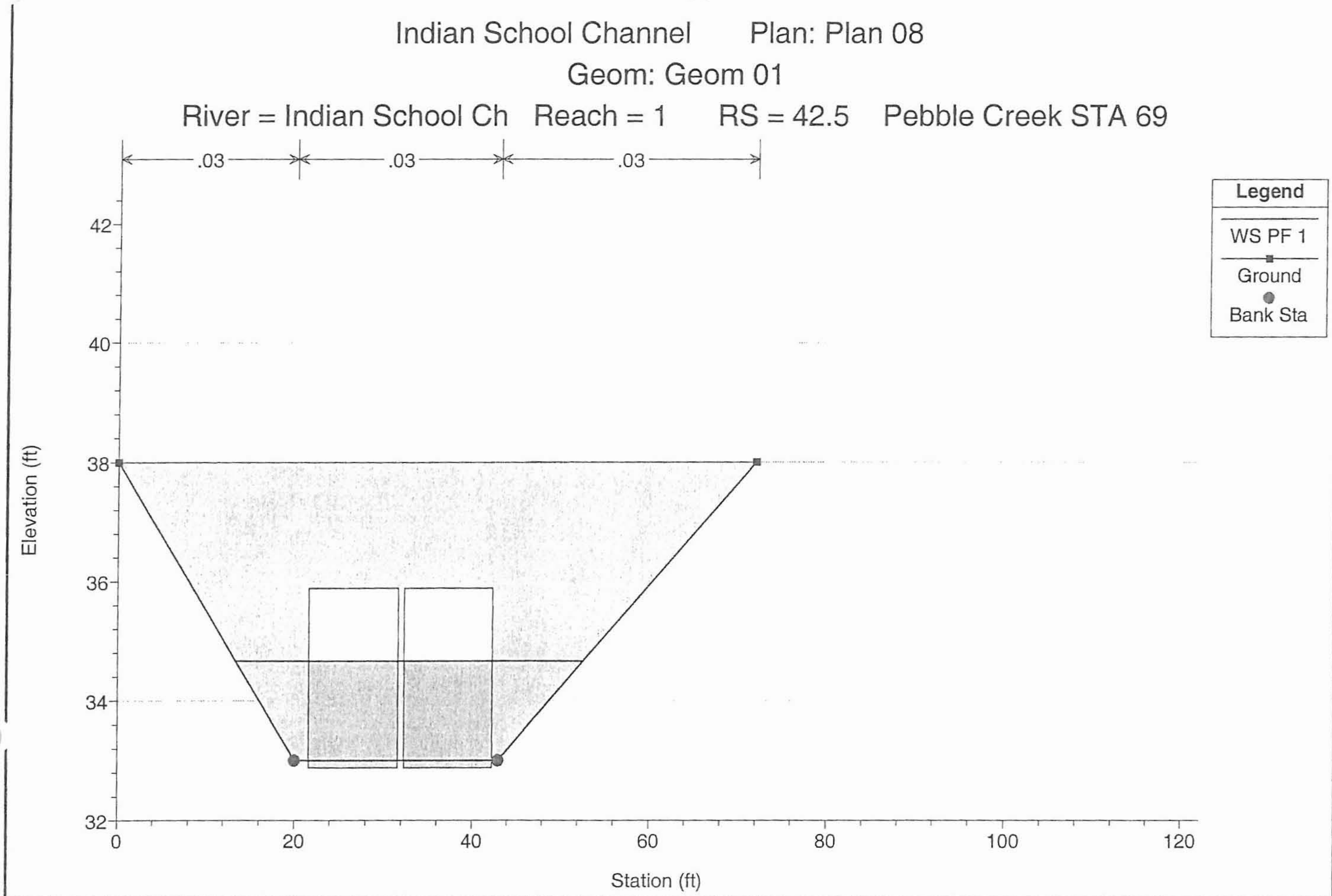
Geom: Geom 01

River = Indian School Ch Reach = 1 RS = 44 STA 67

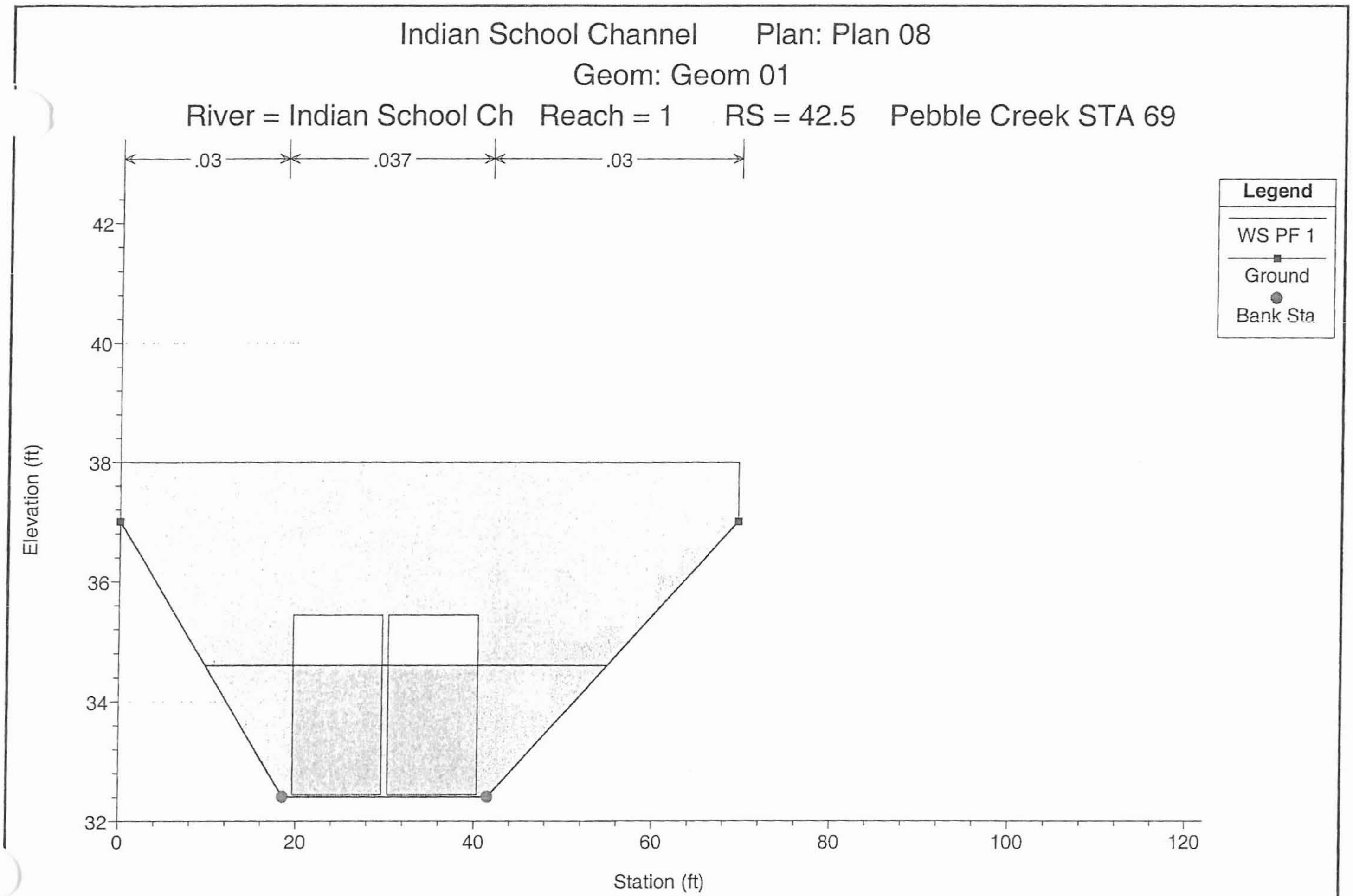


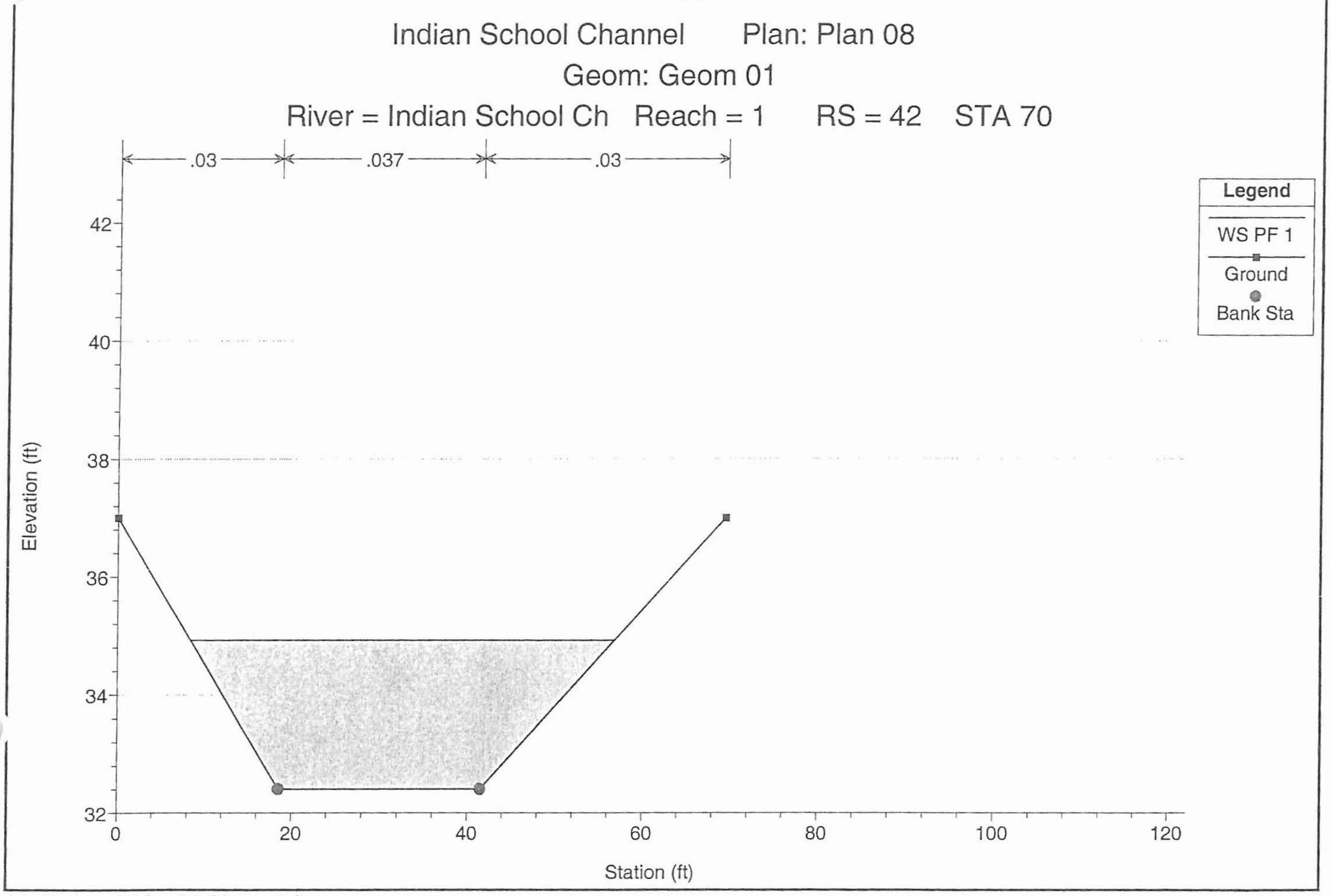
1 in Horiz. = 20 ft 1 in Vert. = 3 ft



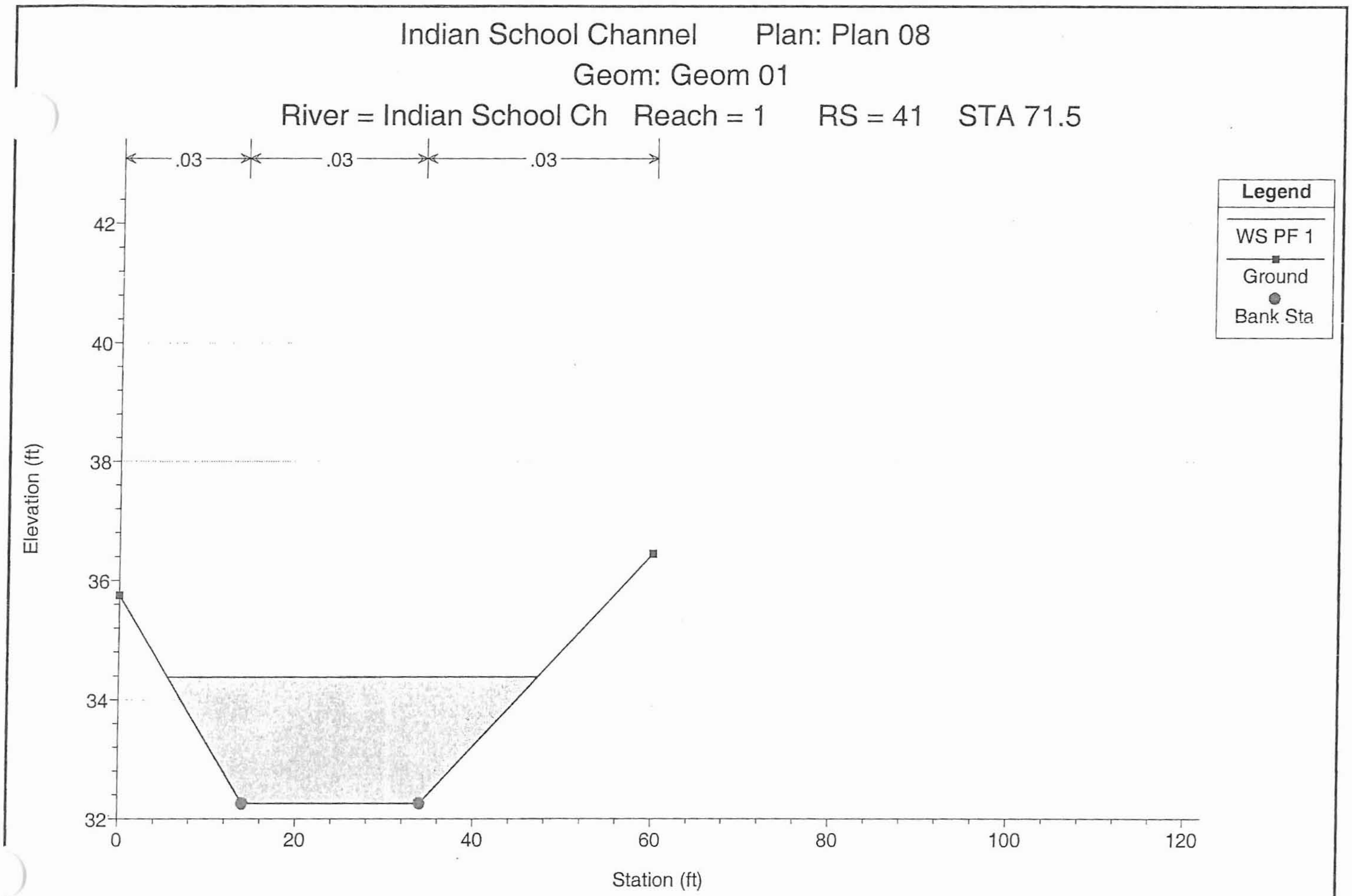


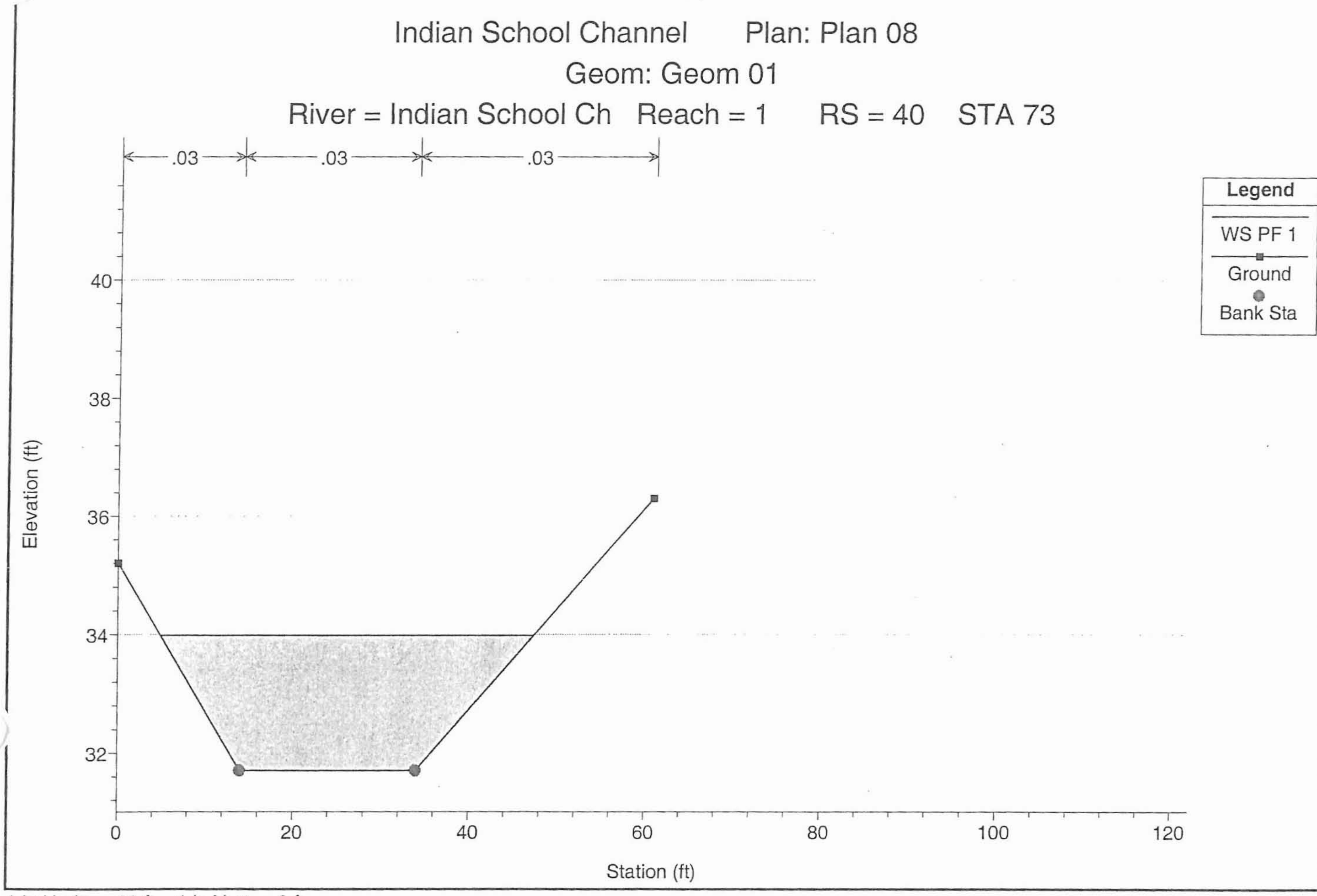
1 in Horiz. = 20 ft 1 in Vert. = 3 ft



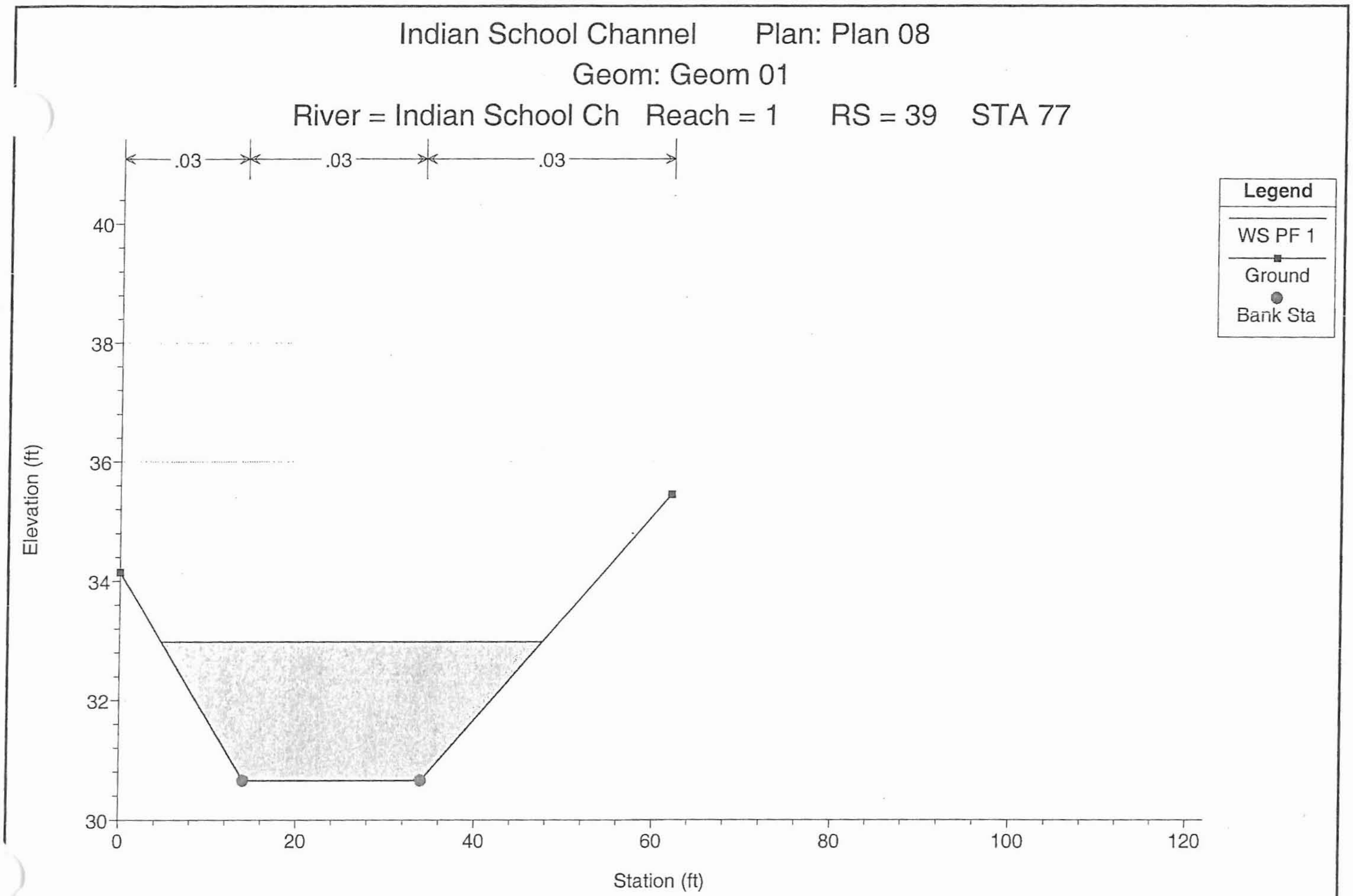


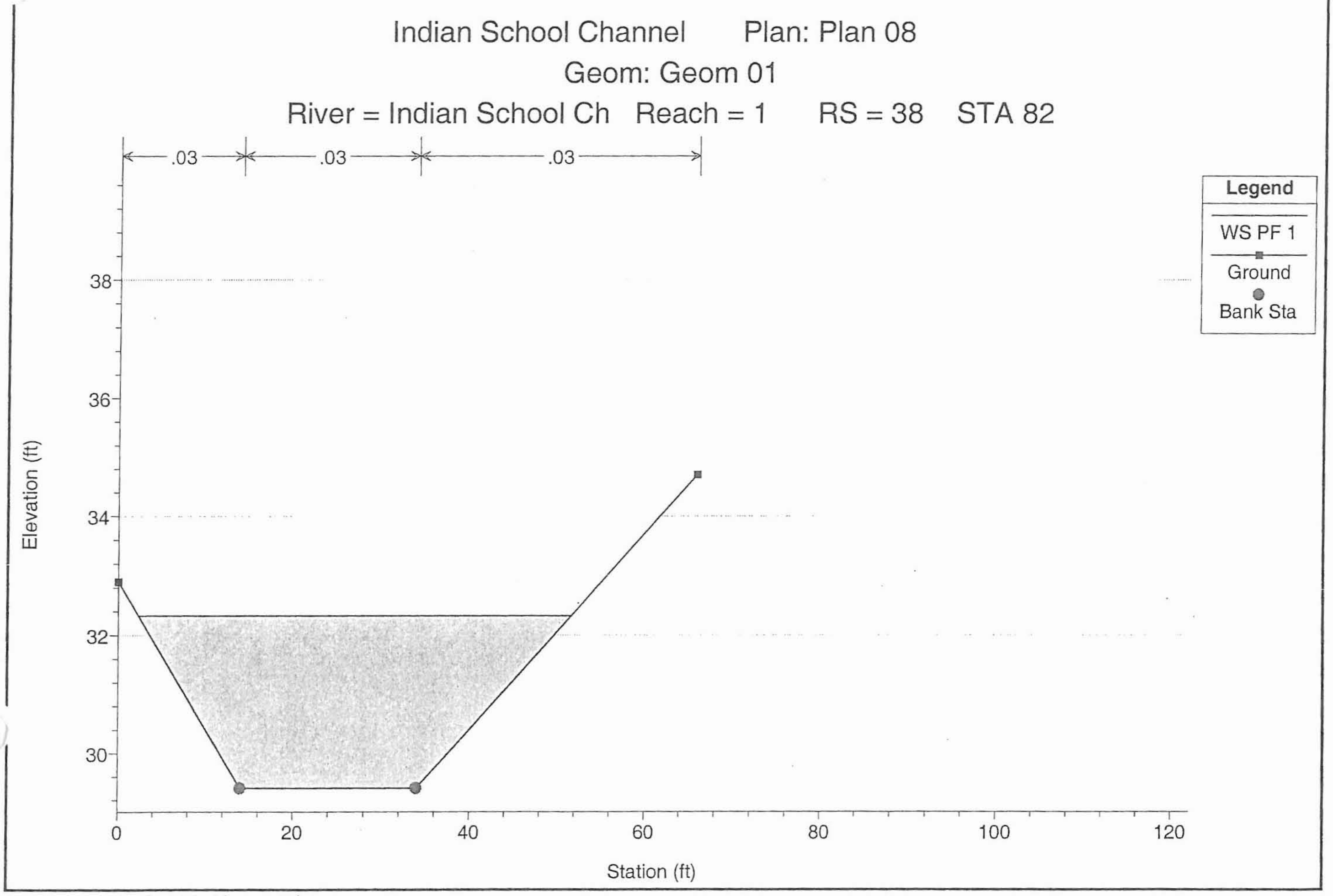
1 in Horiz. = 20 ft 1 in Vert. = 3 ft



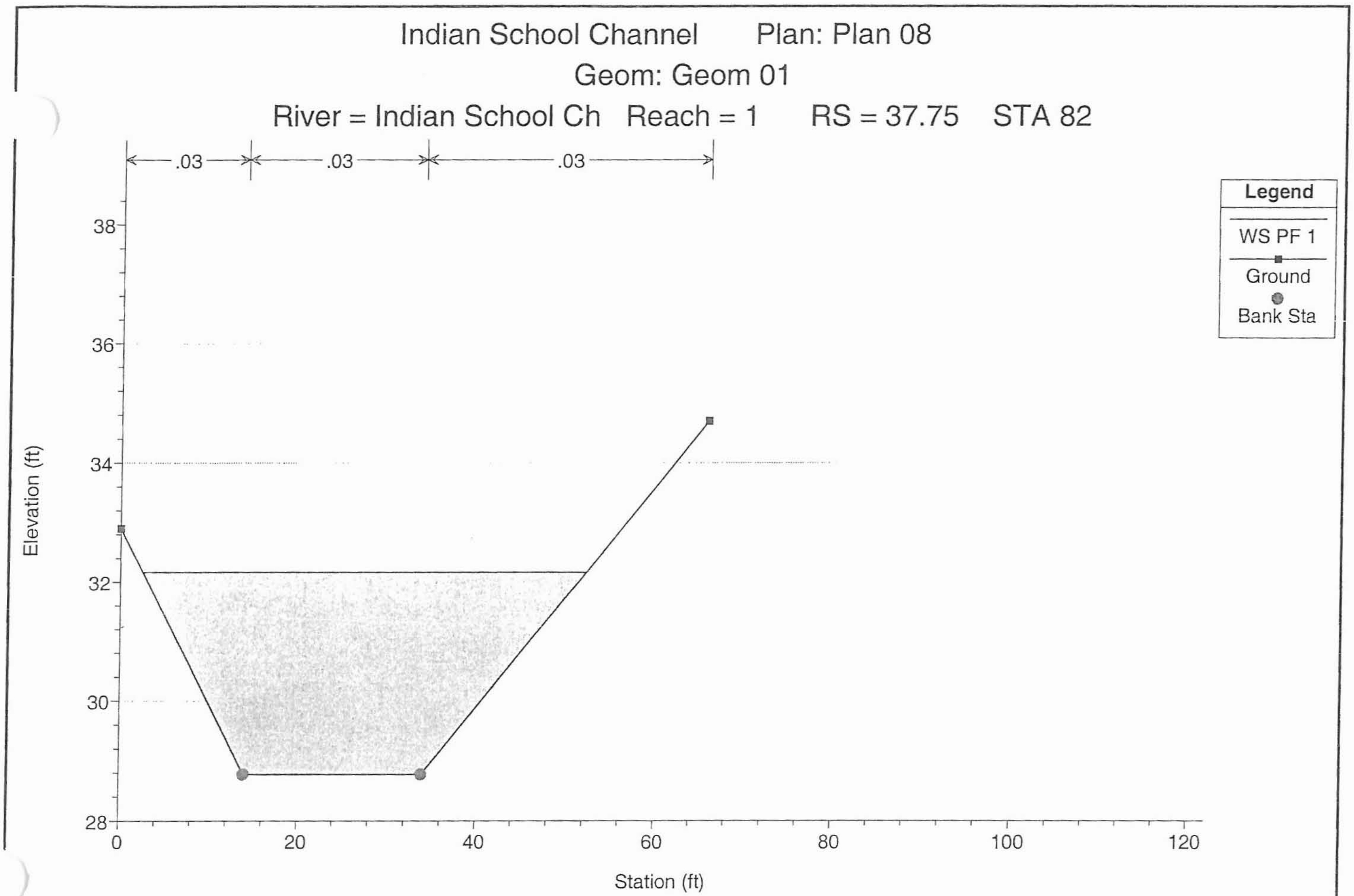


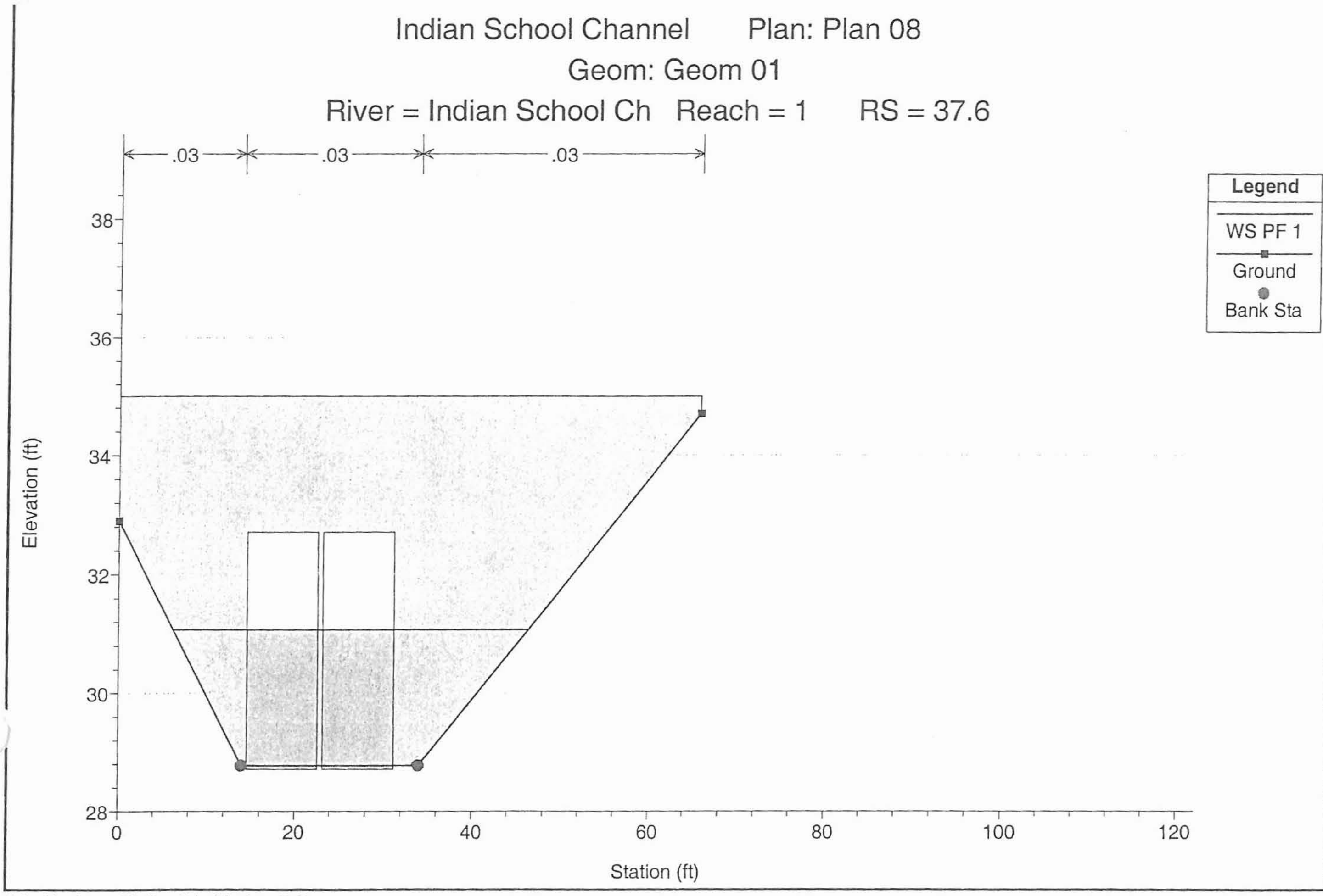
1 in Horiz. = 20 ft 1 in Vert. = 3 ft





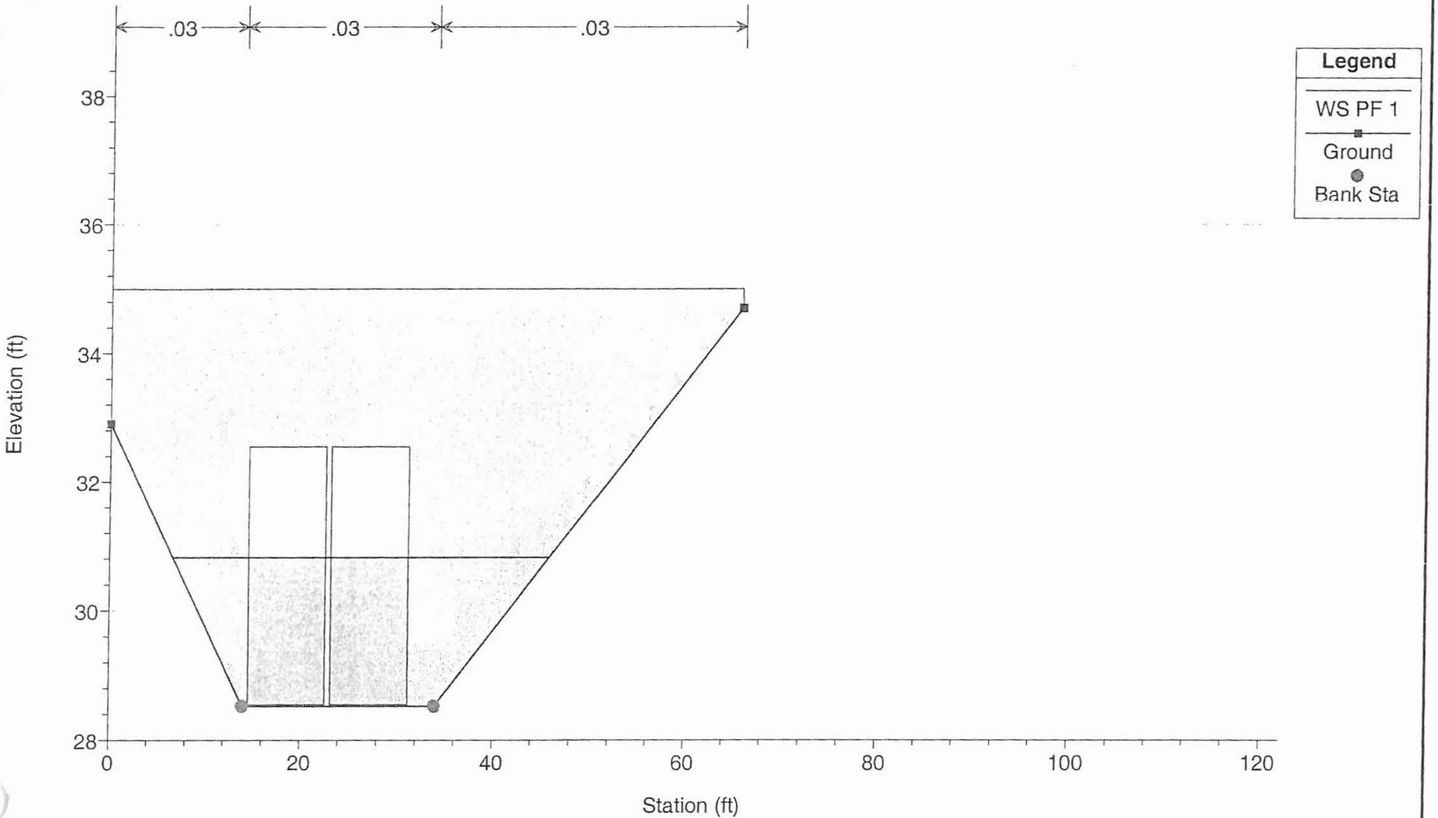
1 in Horiz. = 20 ft 1 in Vert. = 3 ft



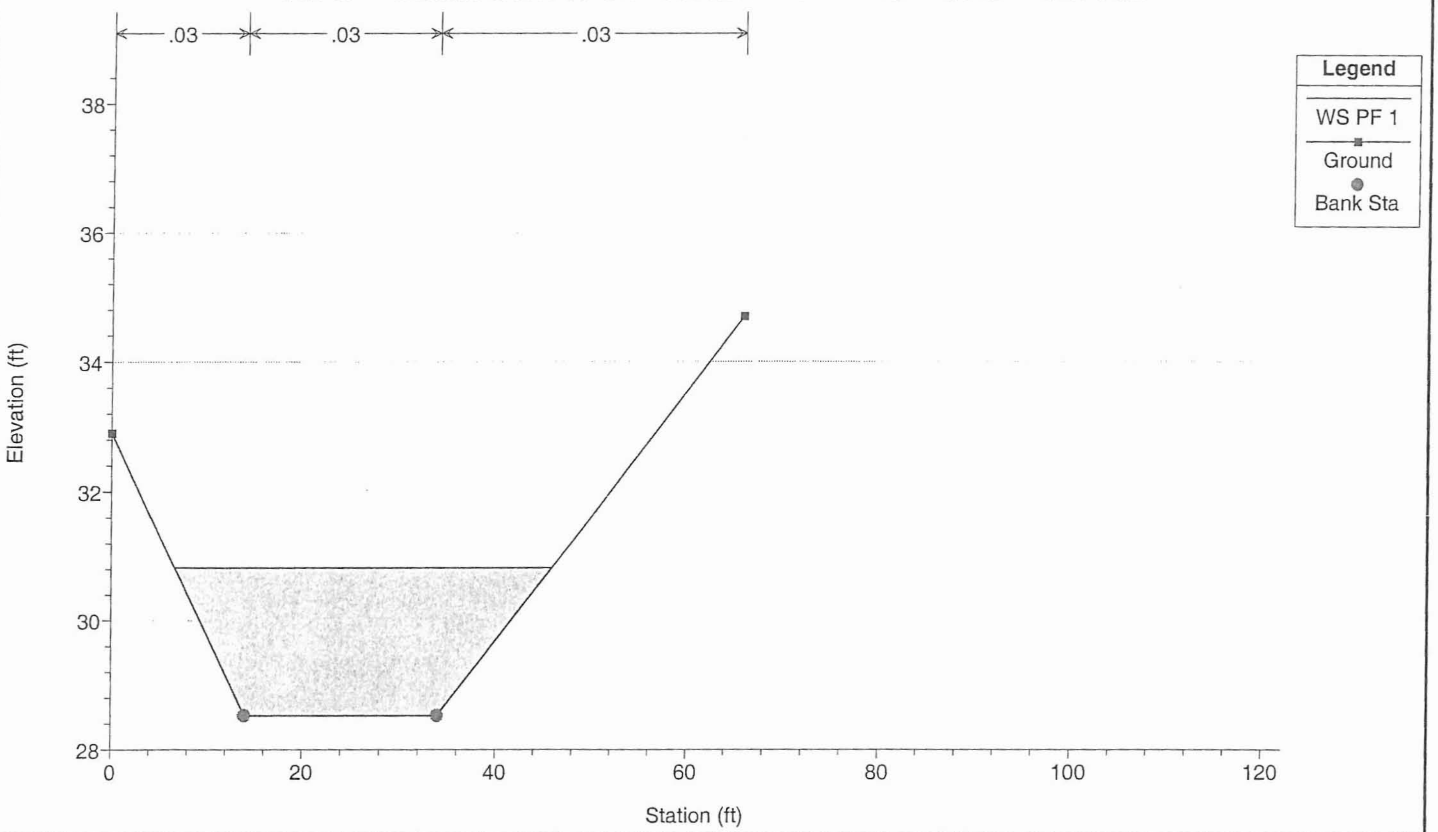


1 in Horiz. = 20 ft 1 in Vert. = 3 ft

Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 37.6

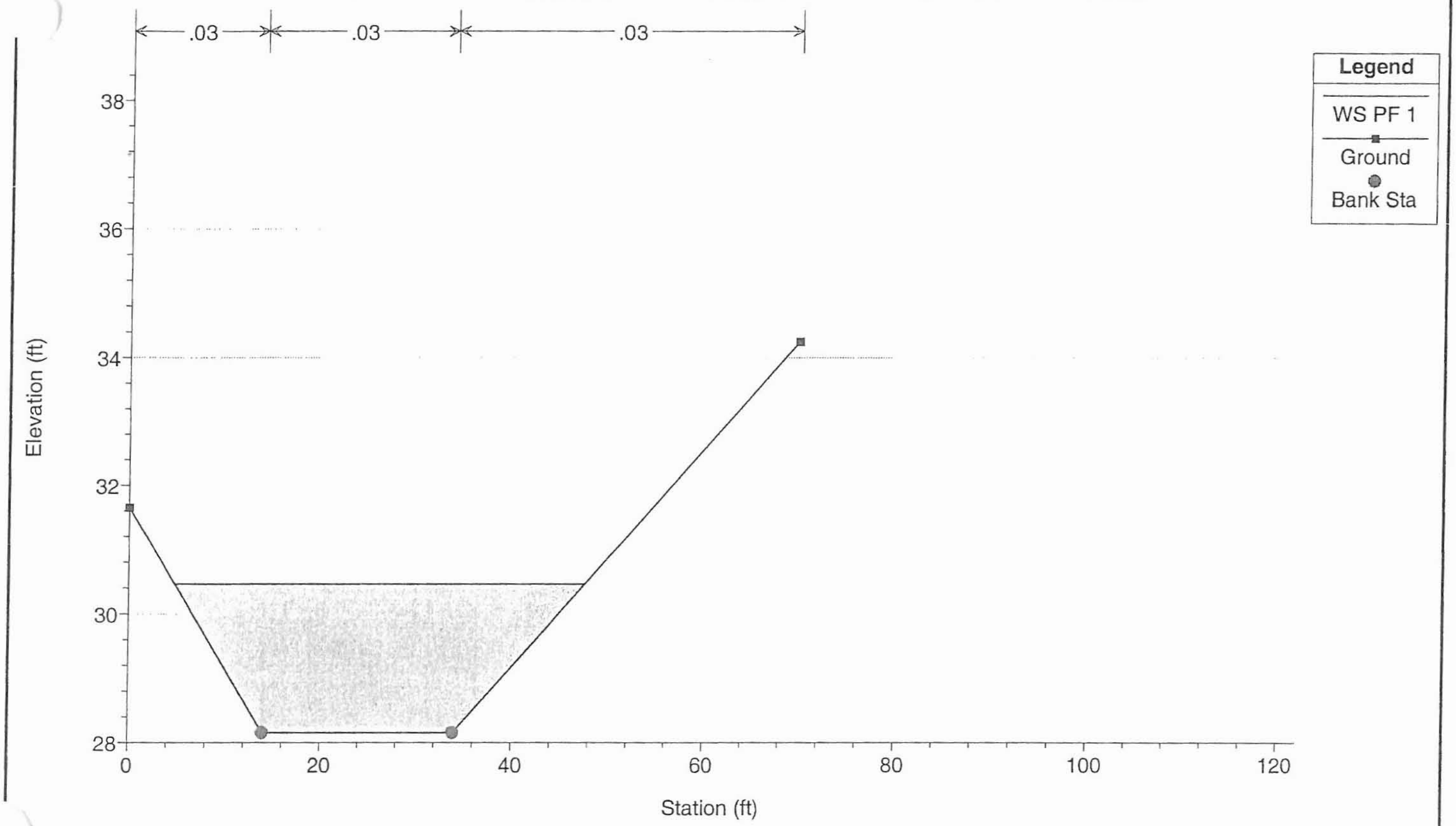


Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 37.5 STA 82

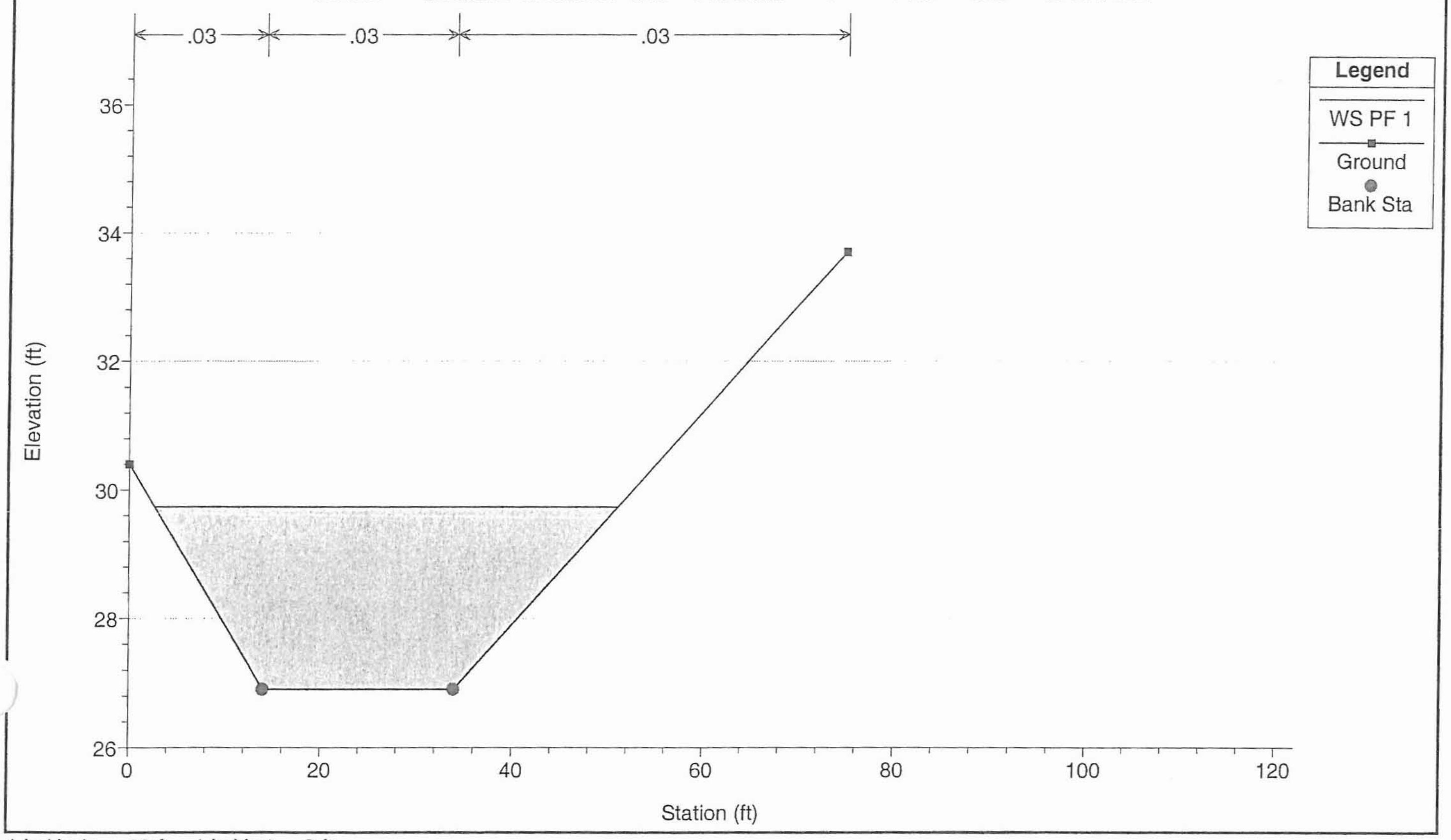


1 in Horiz. = 20 ft 1 in Vert. = 3 ft

Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 37 STA 87

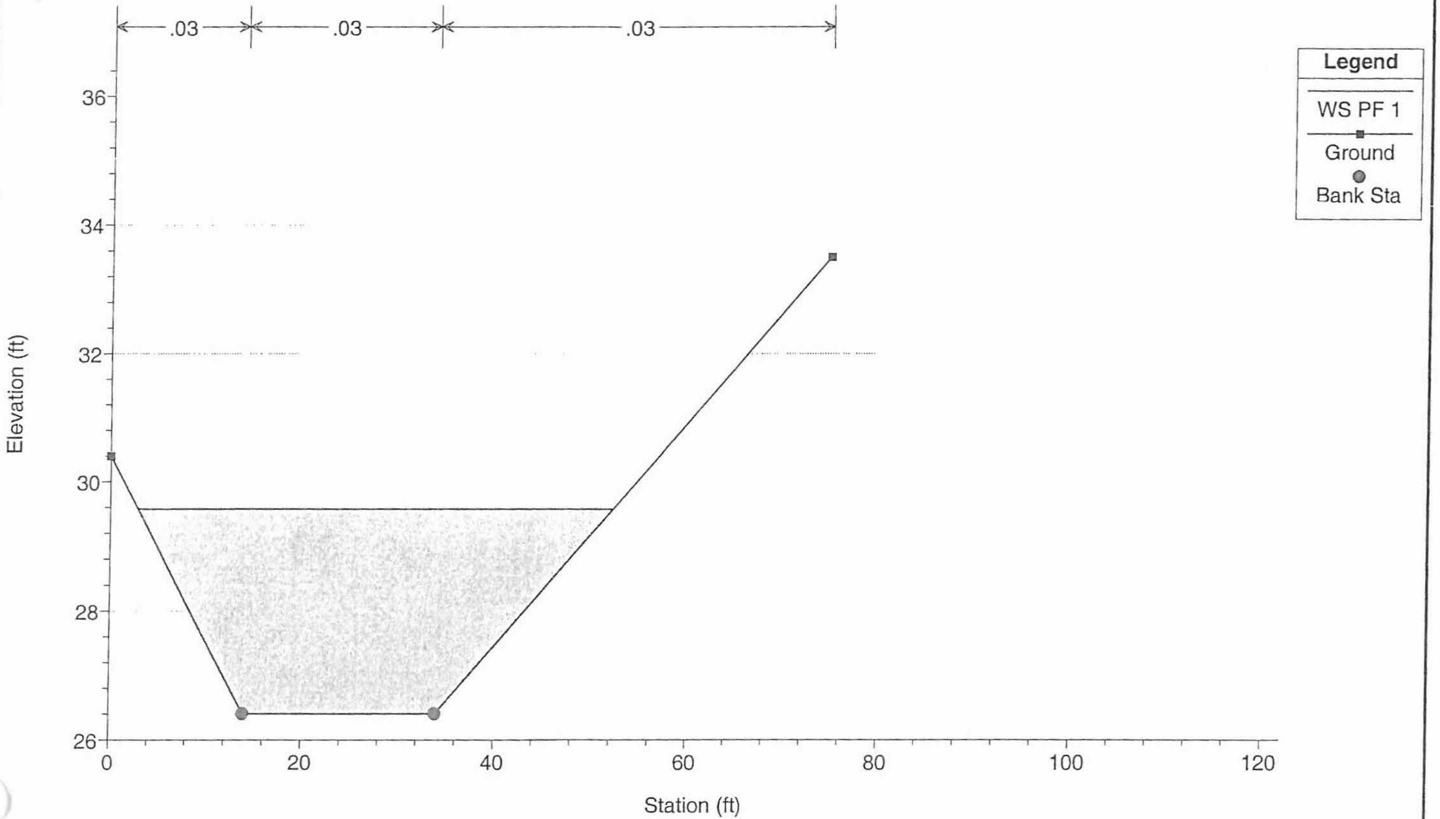


Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 36 STA 92

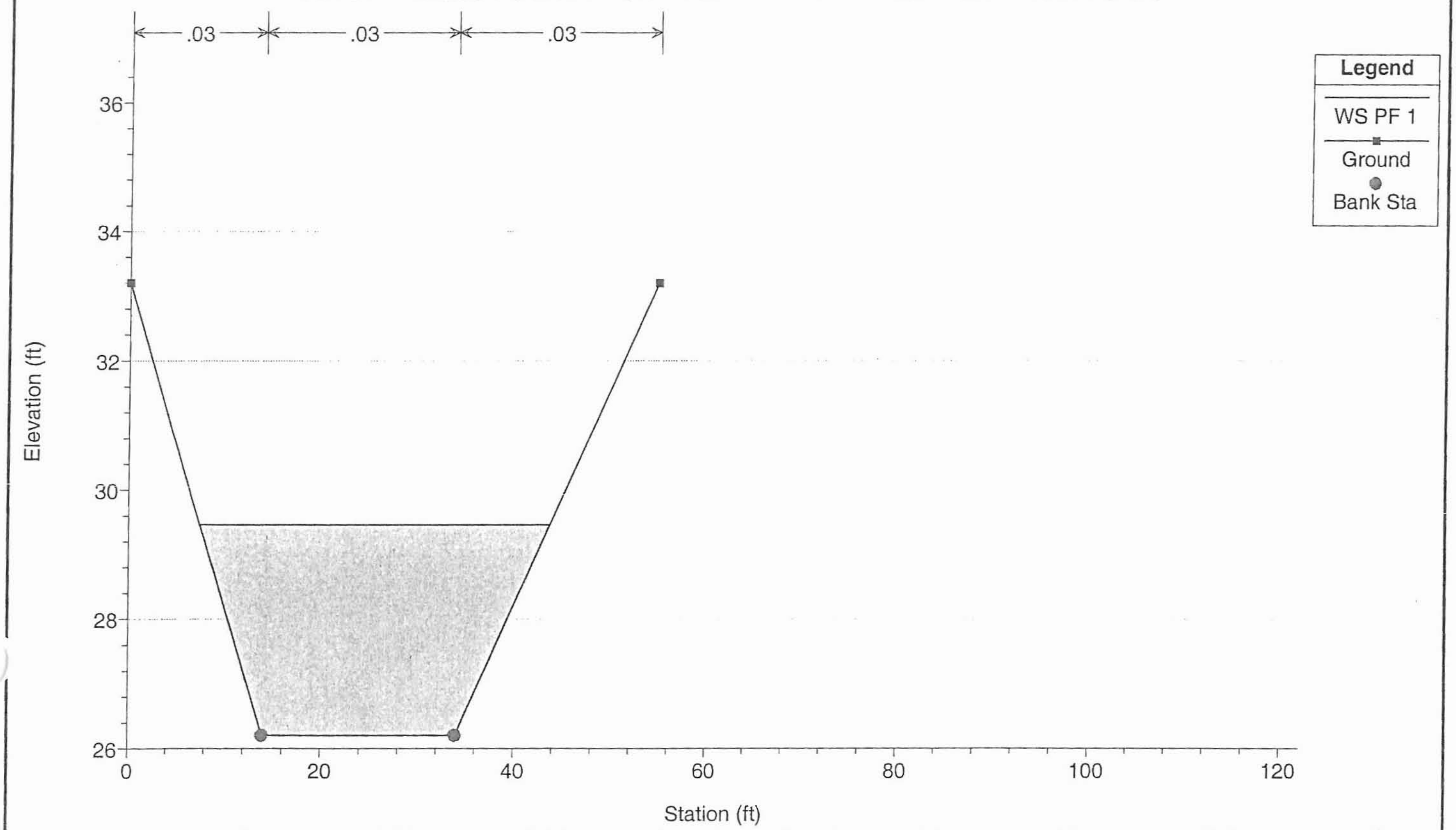


1 in Horiz. = 20 ft 1 in Vert. = 3 ft

Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 35 STA 94

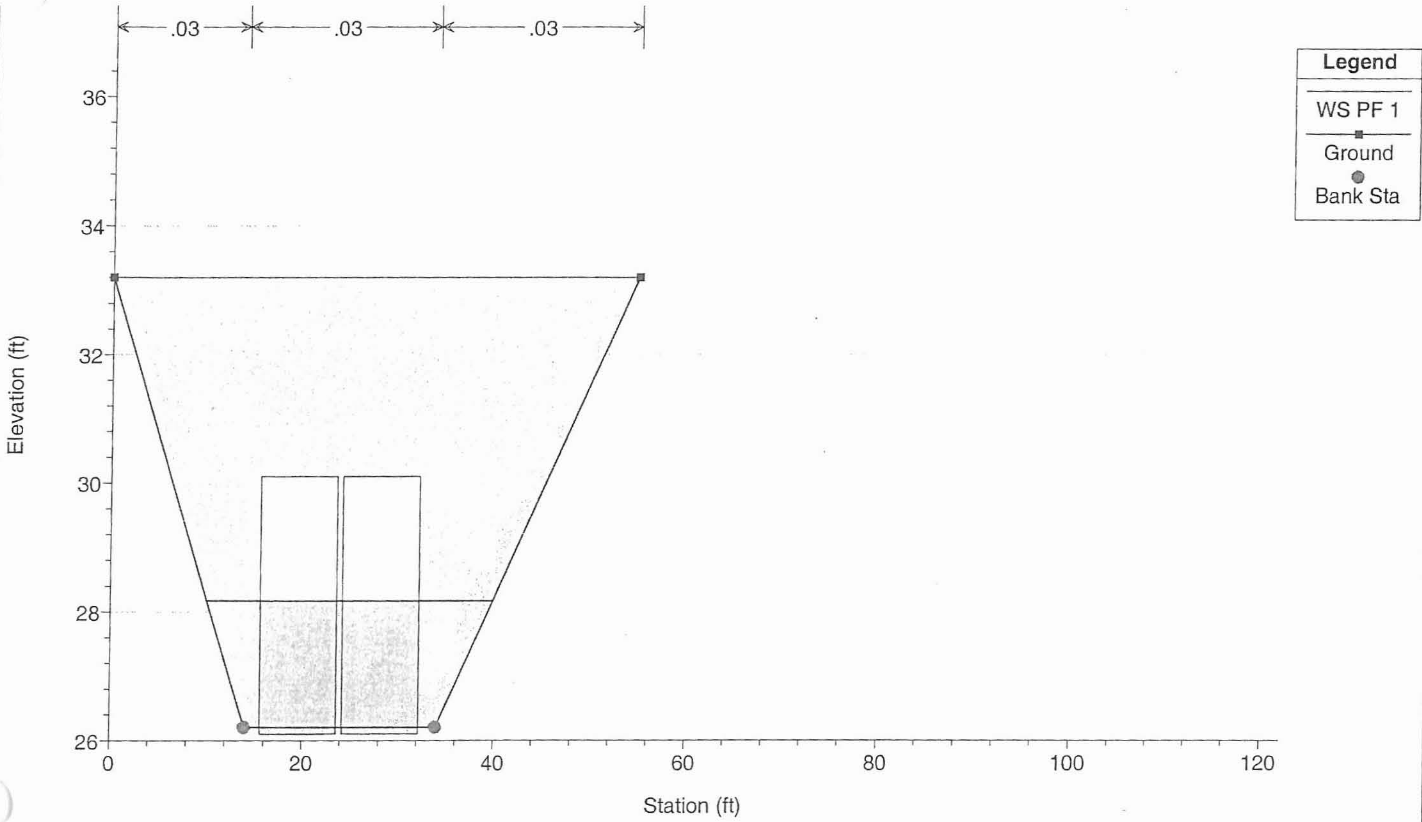


Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 34 STA 94.8

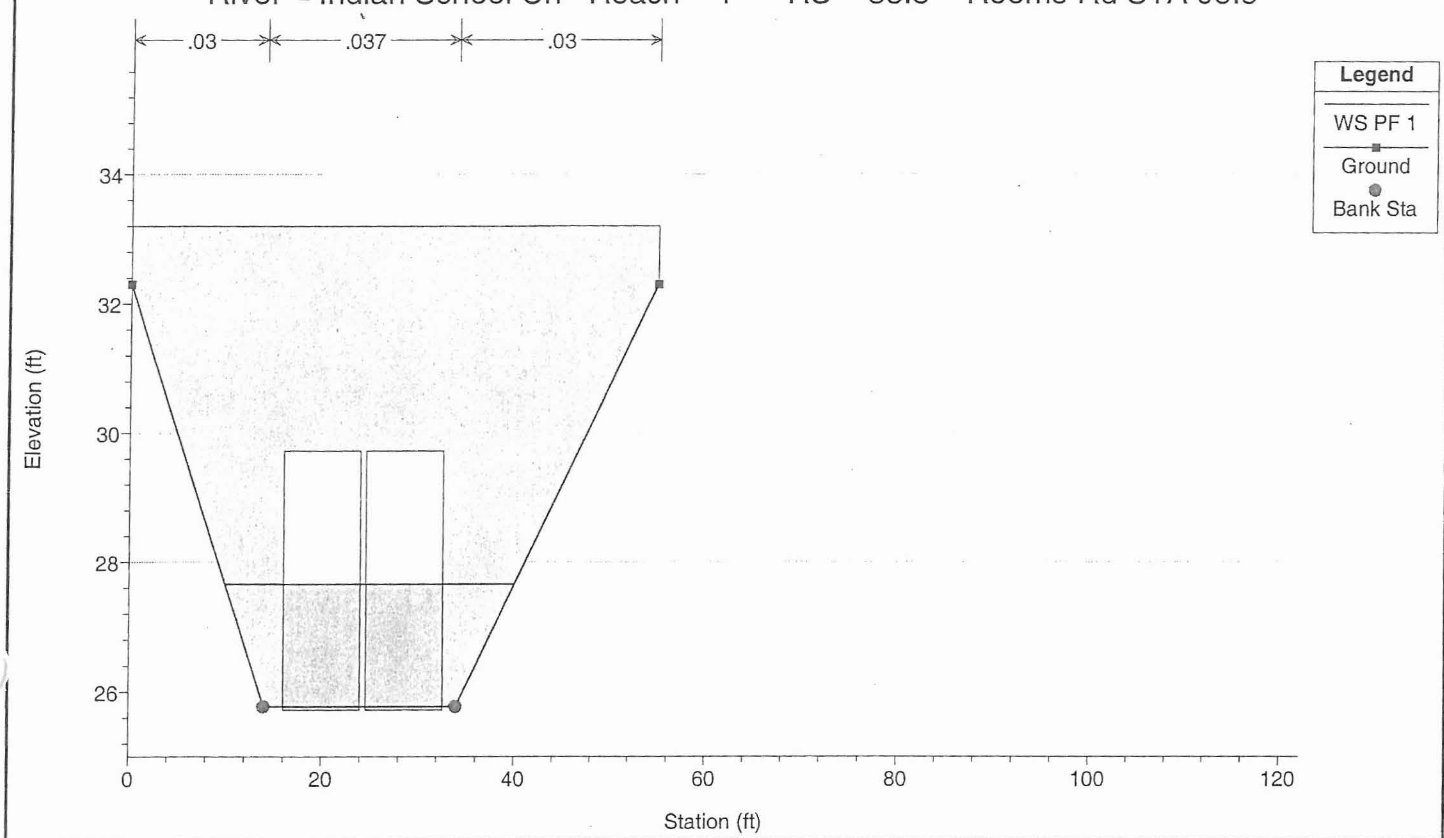


1 in Horiz. = 20 ft 1 in Vert. = 3 ft

Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 33.5 Reems Rd STA 95.5

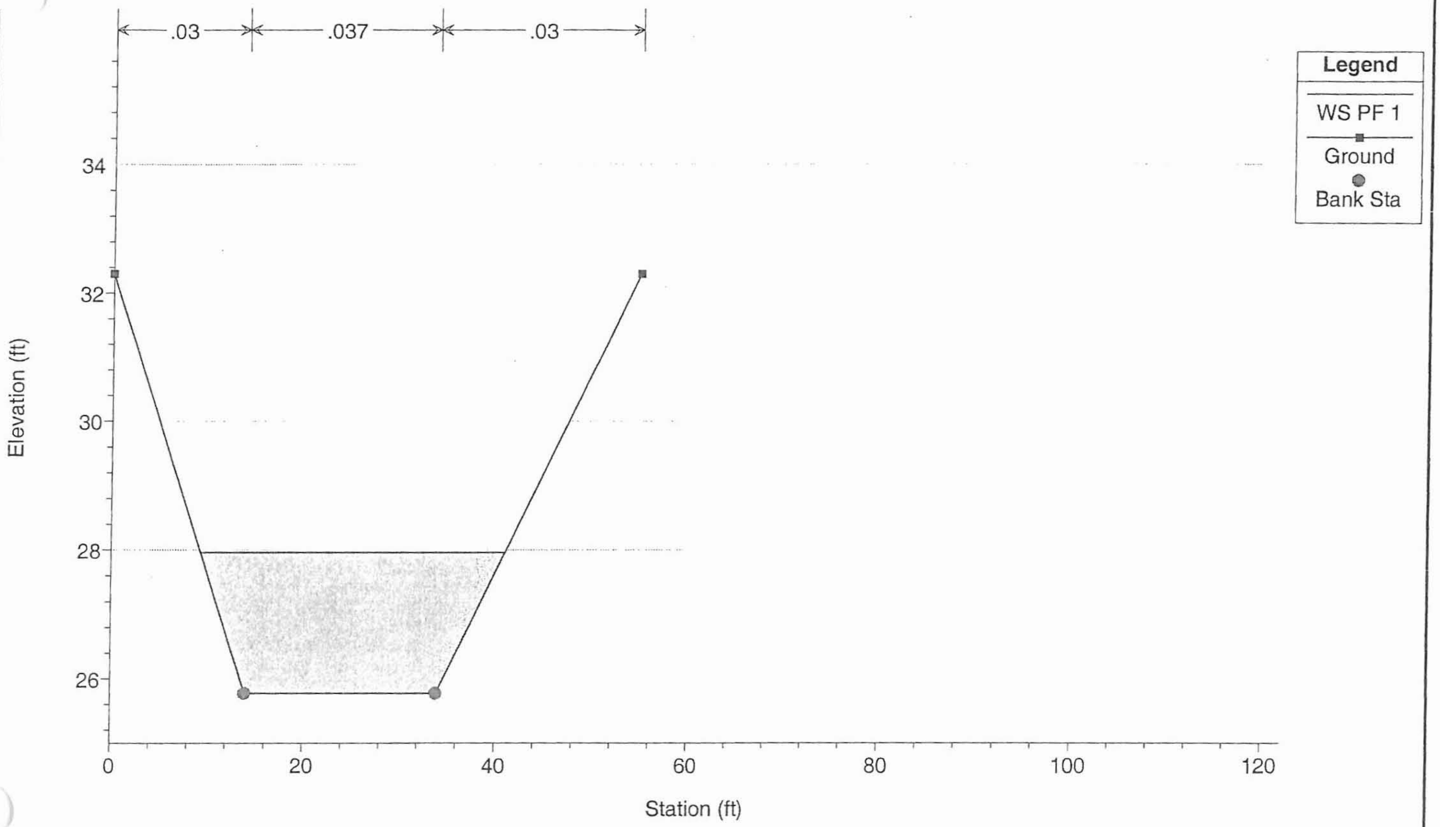


Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 33.5 Reems Rd STA 95.5

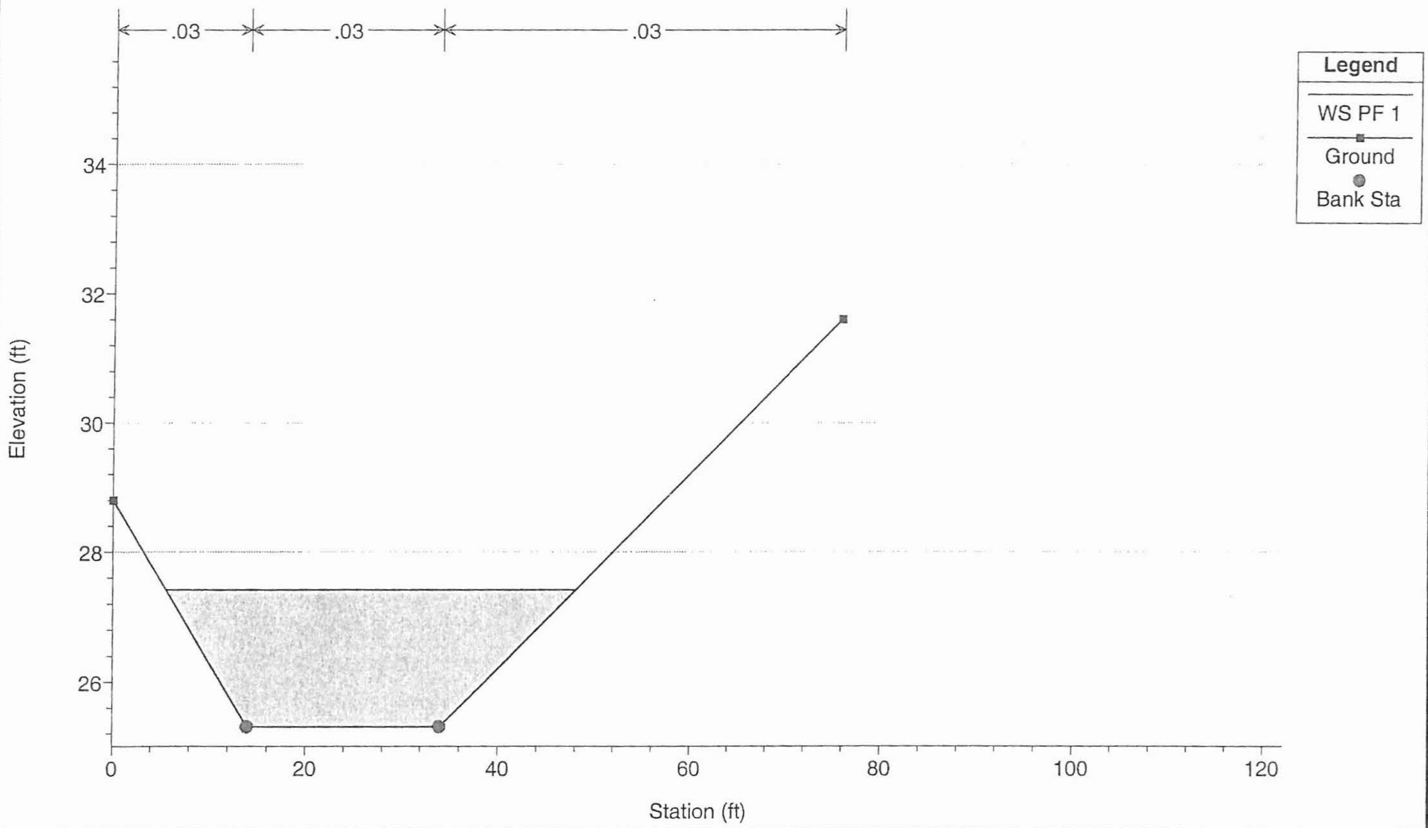


1 in Horiz. = 20 ft 1 in Vert. = 3 ft

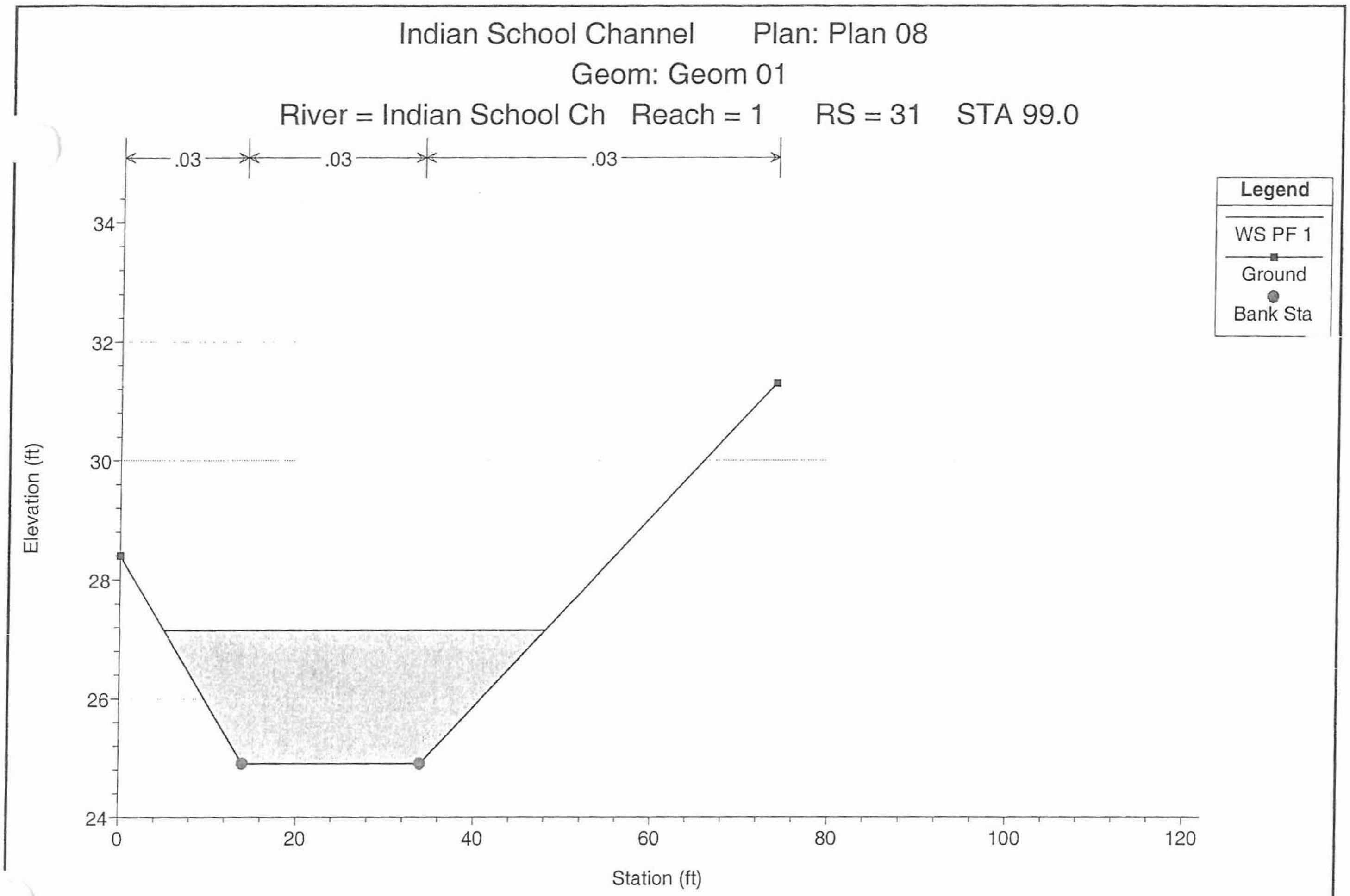
Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 33 STA 96.35

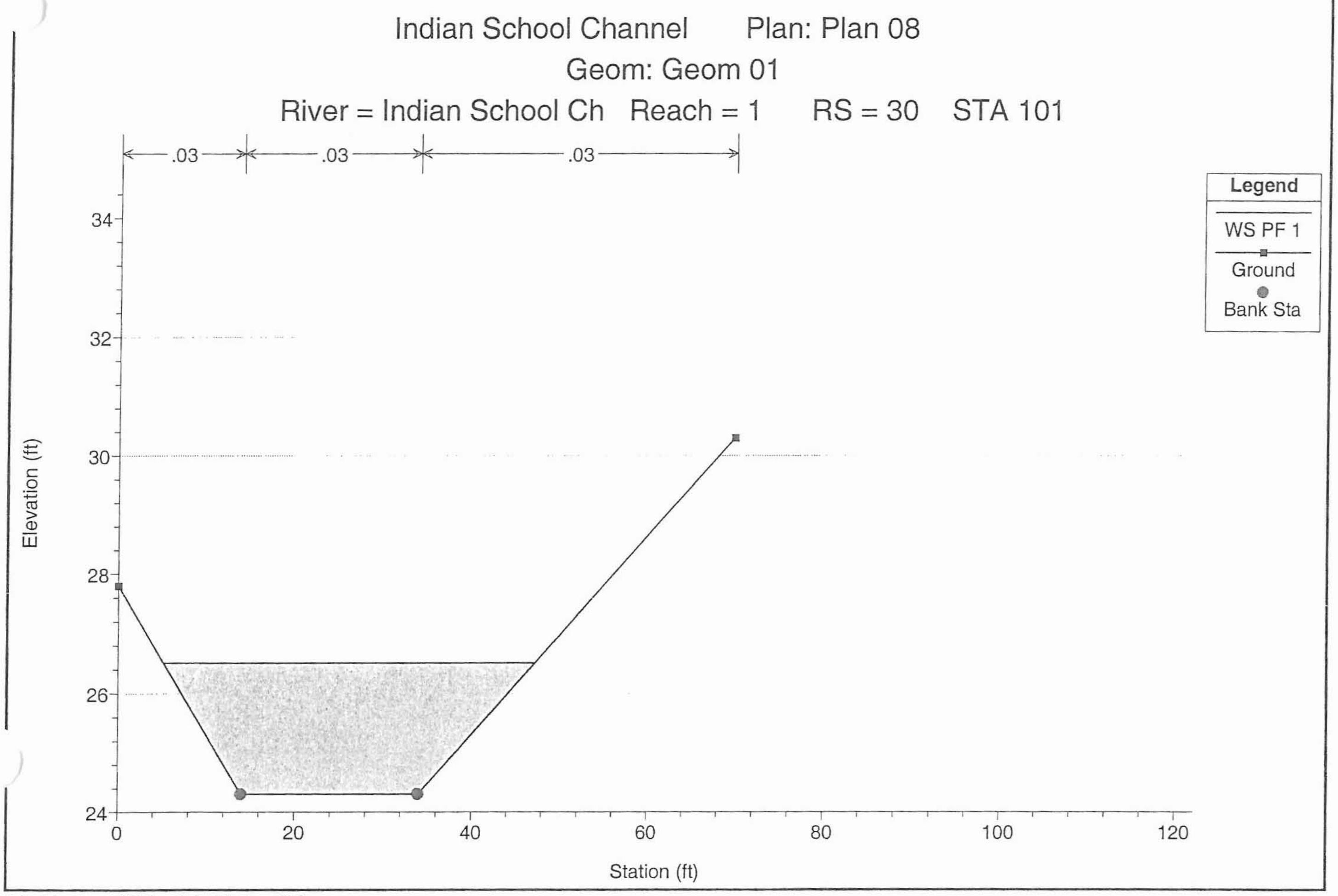


Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 32 STA 97.75



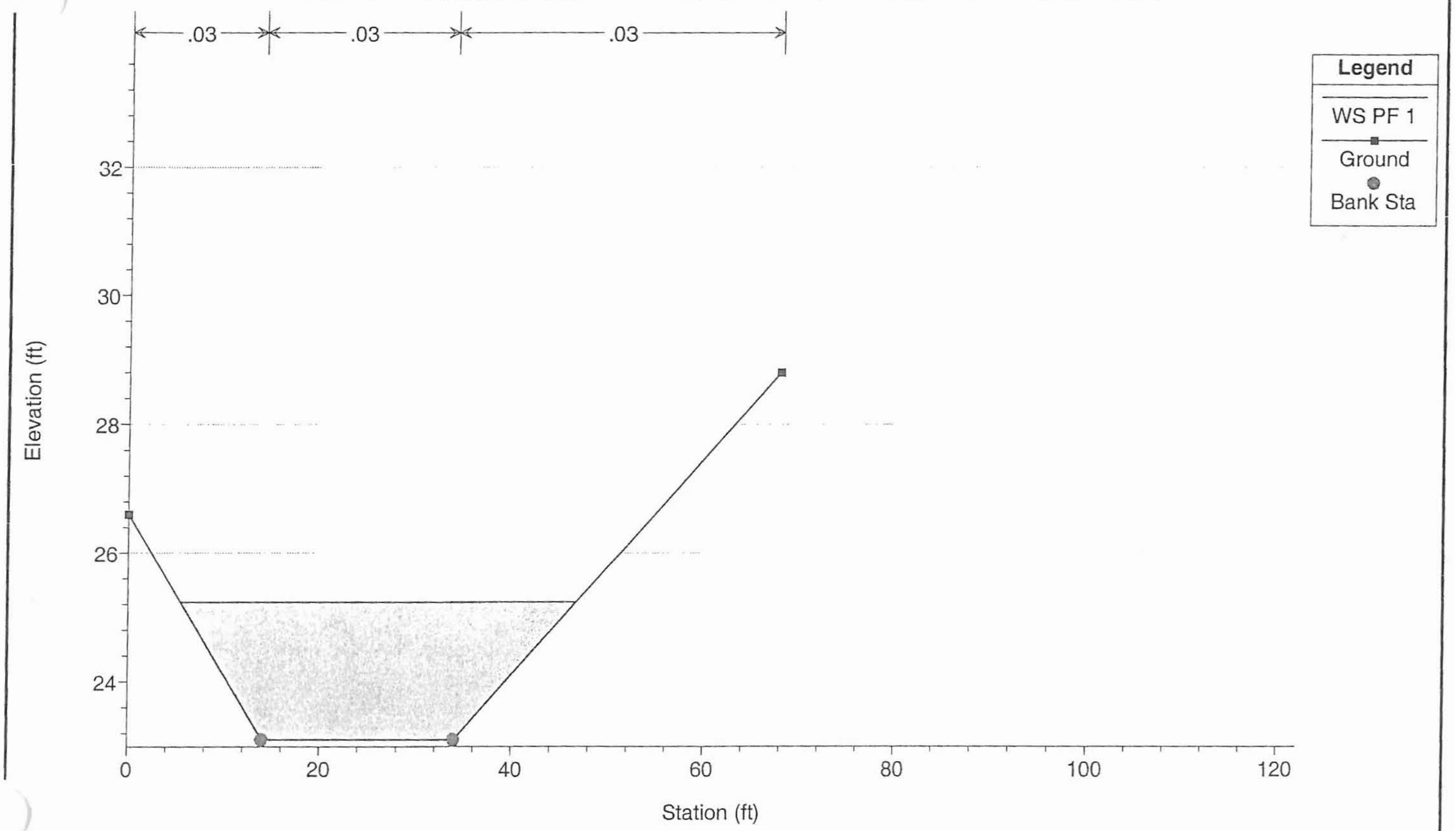
1 in Horiz. = 20 ft 1 in Vert. = 3 ft



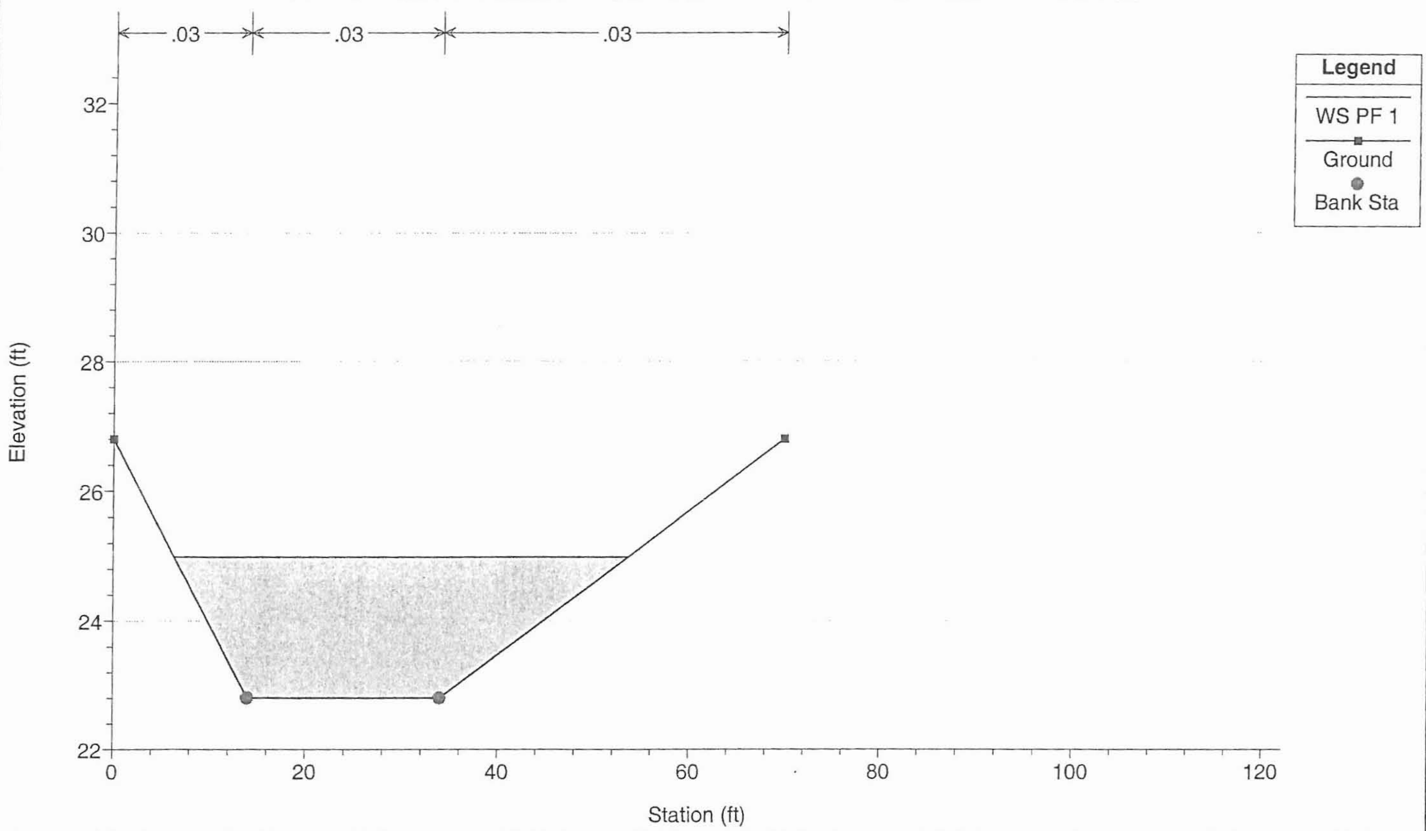


1 in Horiz. = 20 ft 1 in Vert. = 3 ft

Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 29 STA 105

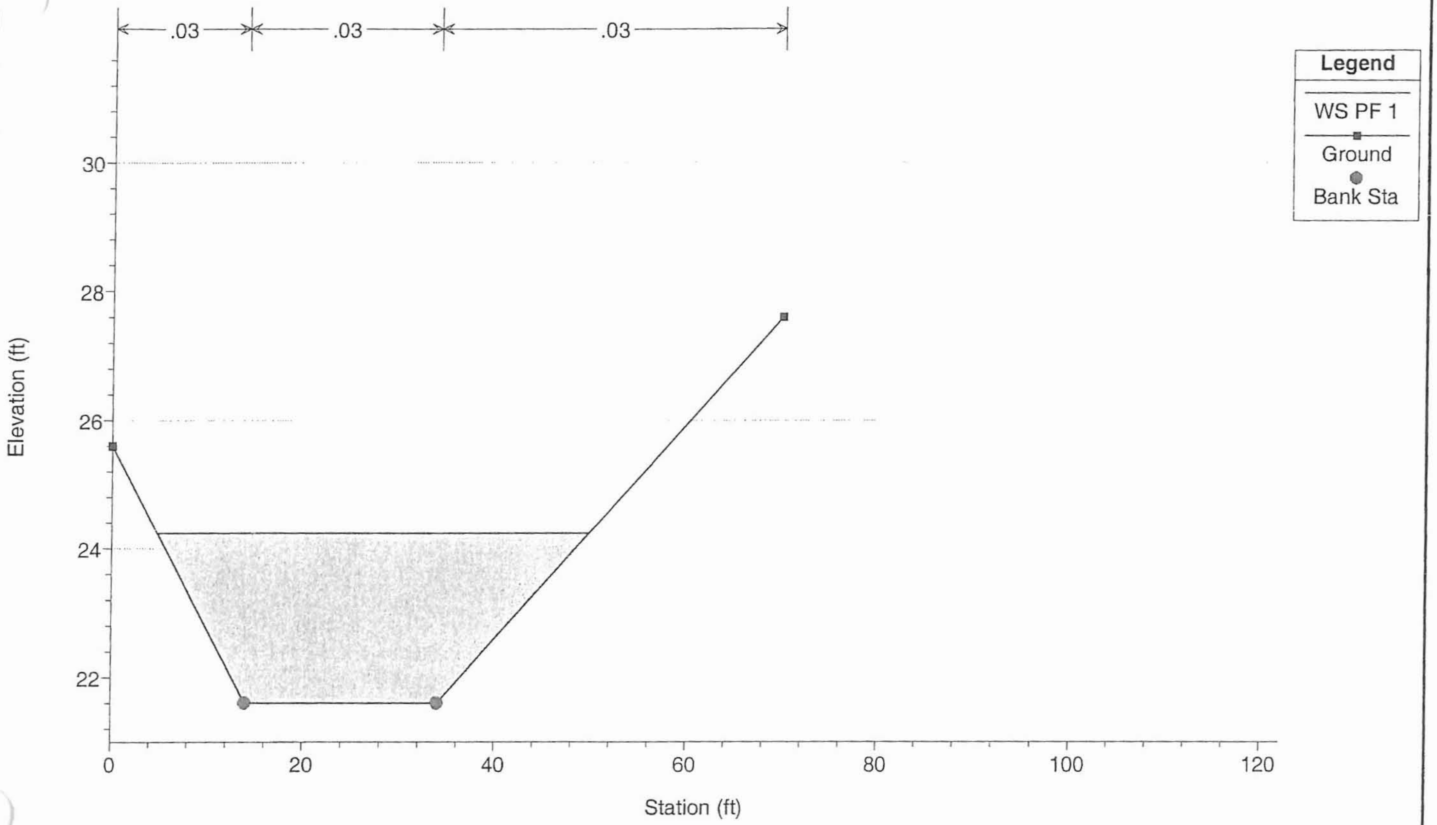


Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 28 STA 106

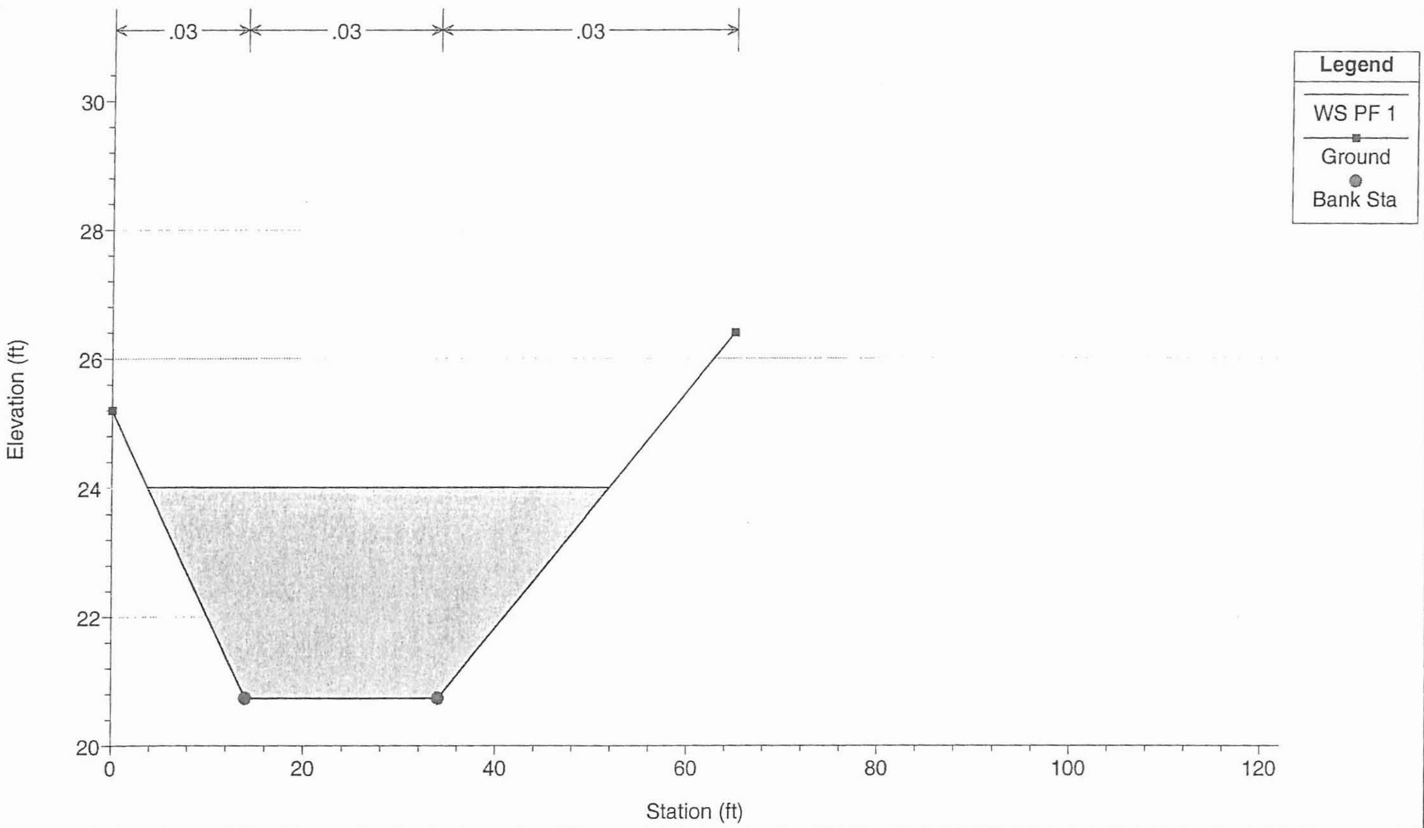


1 in Horiz. = 20 ft 1 in Vert. = 3 ft

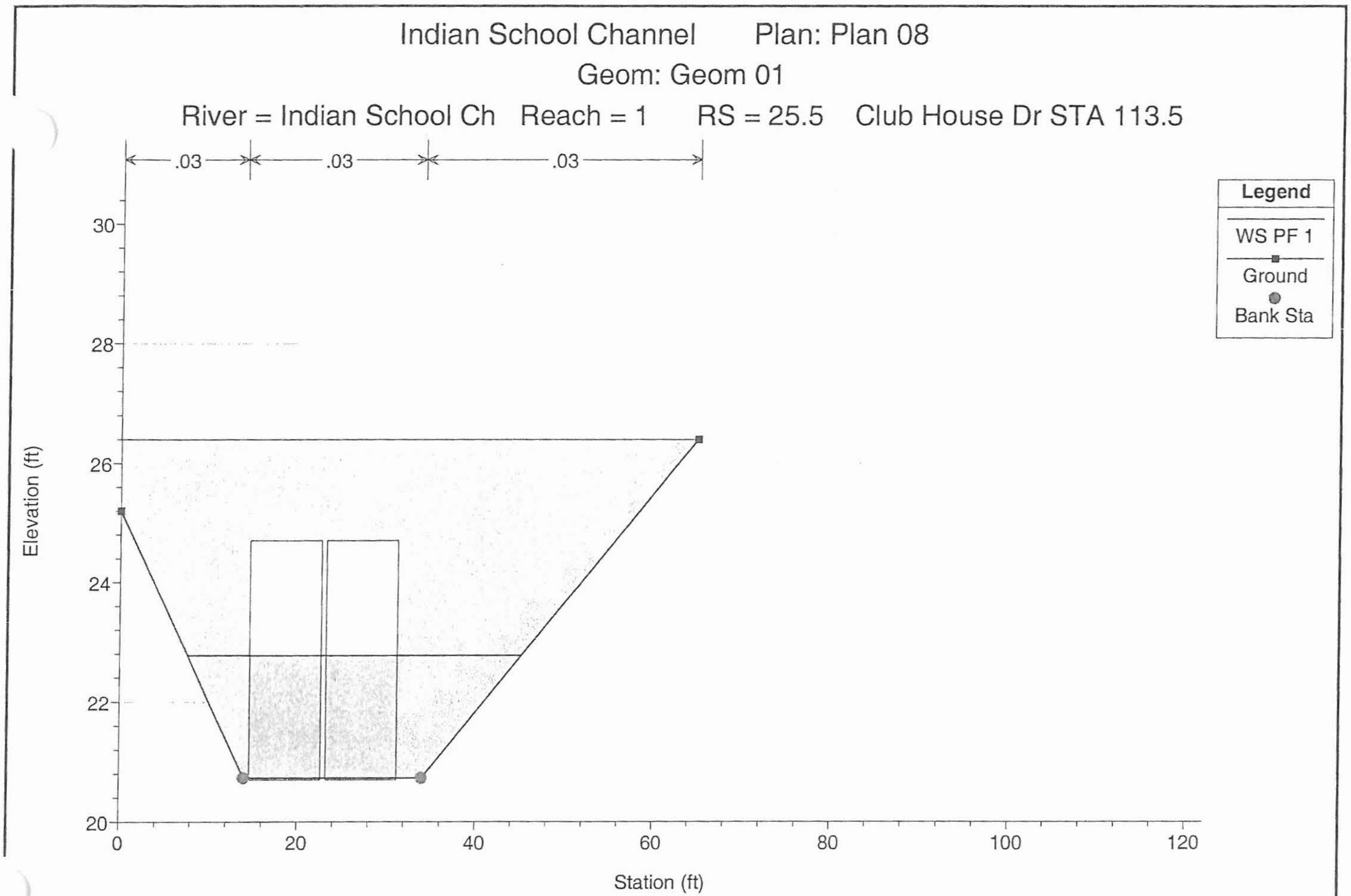
Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 27 STA 110

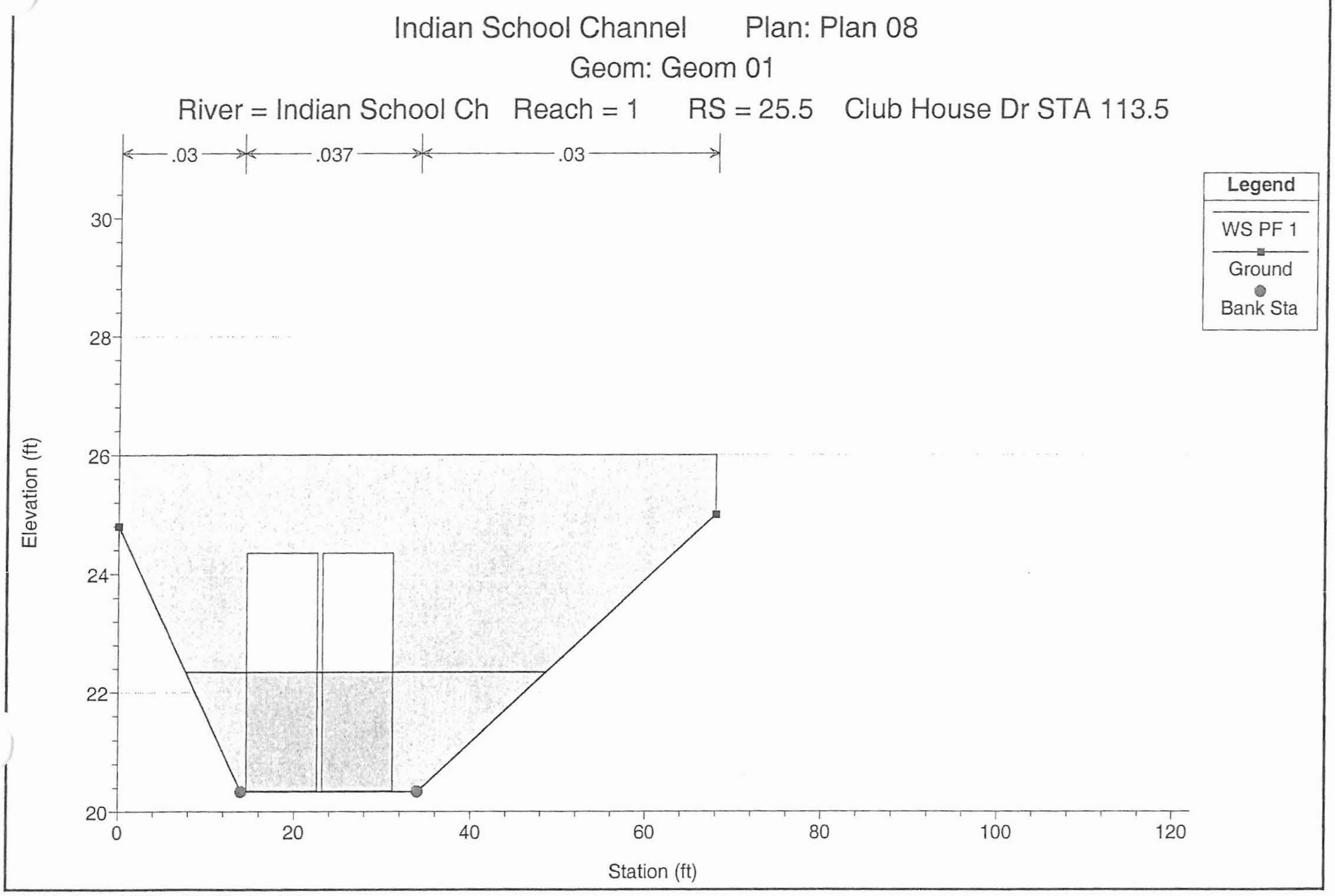


Indian School Channel Plan: Plan 08
Geom: Geom 01
River = Indian School Ch Reach = 1 RS = 26 STA 112.87

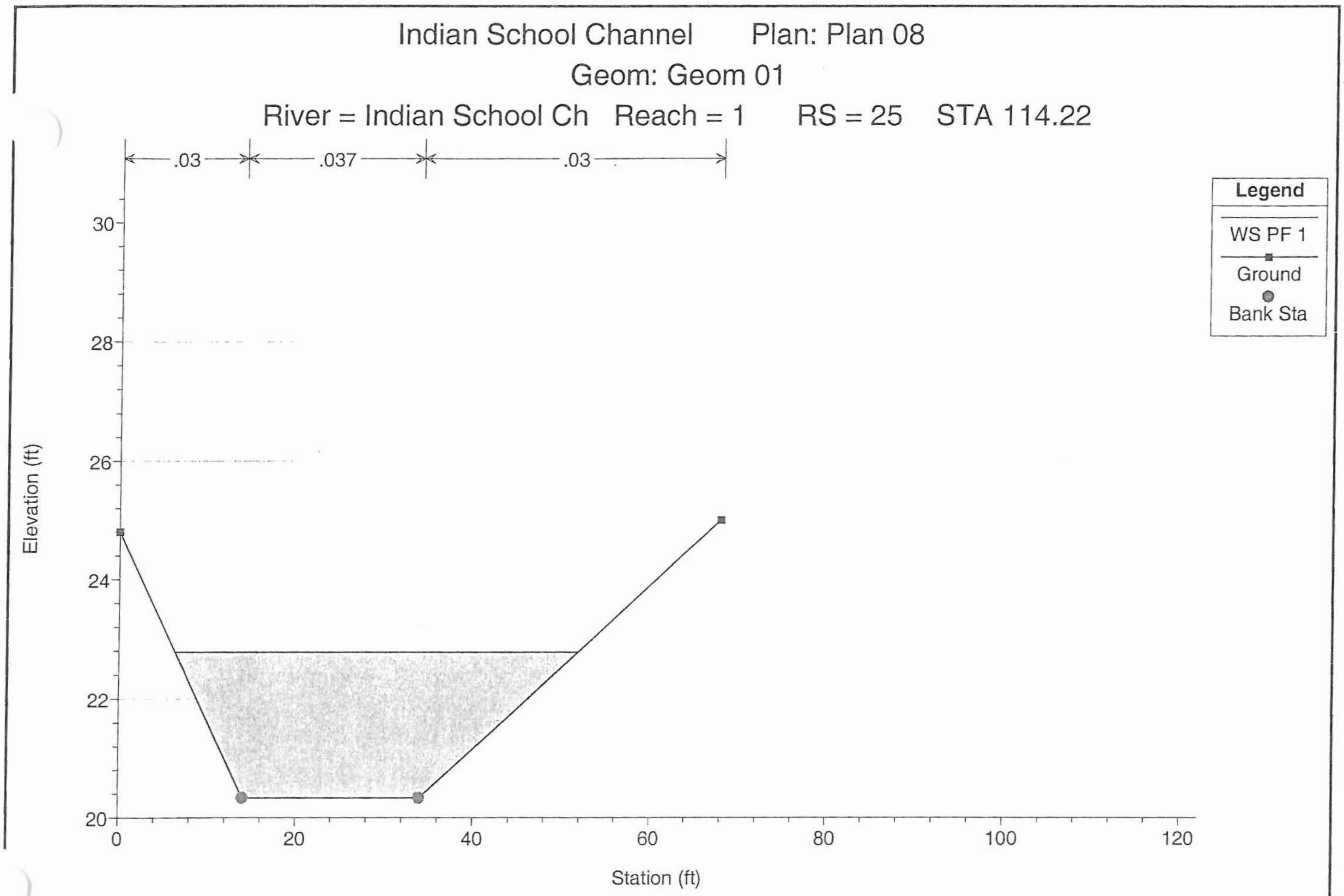


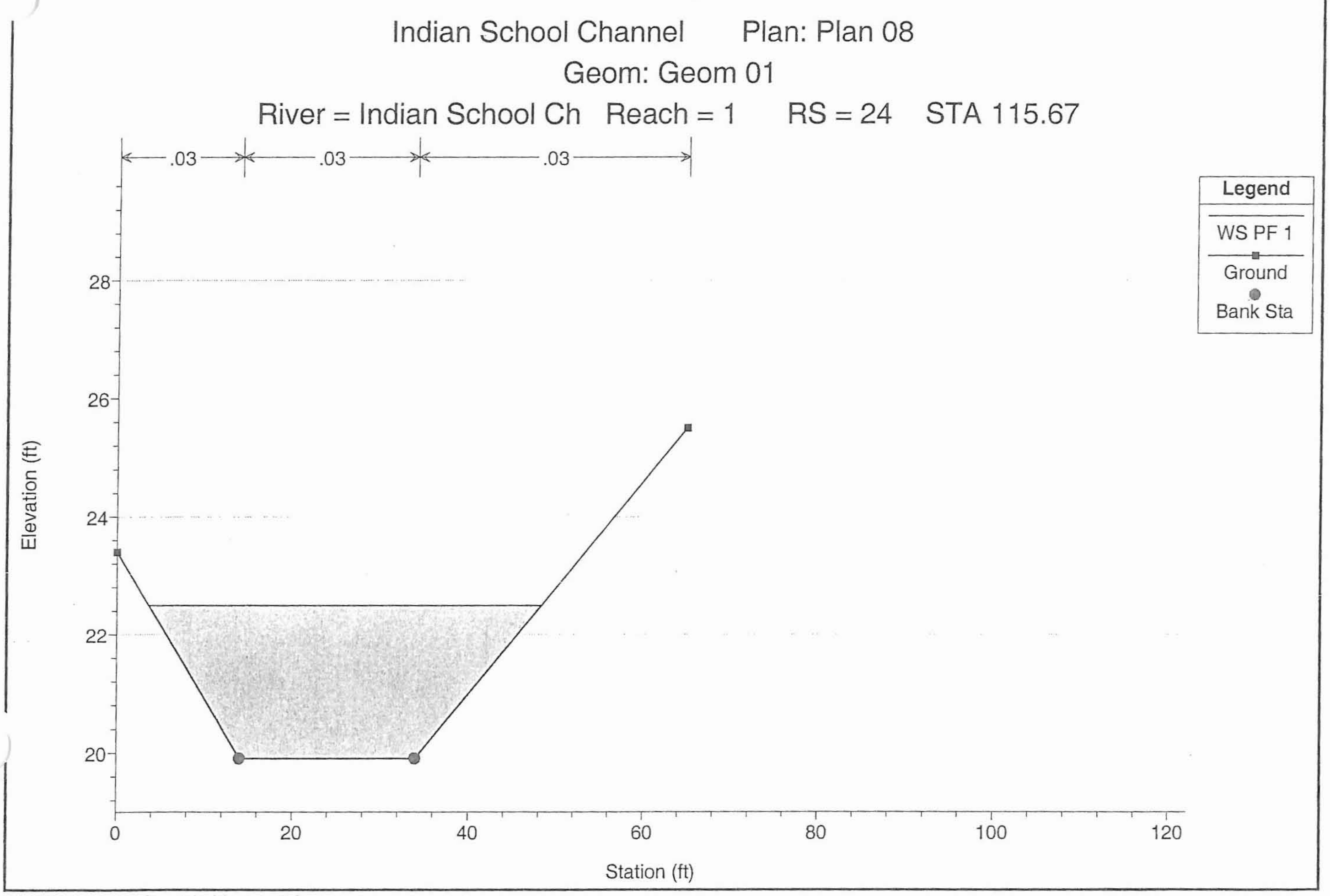
1 in Horiz. = 20 ft 1 in Vert. = 3 ft



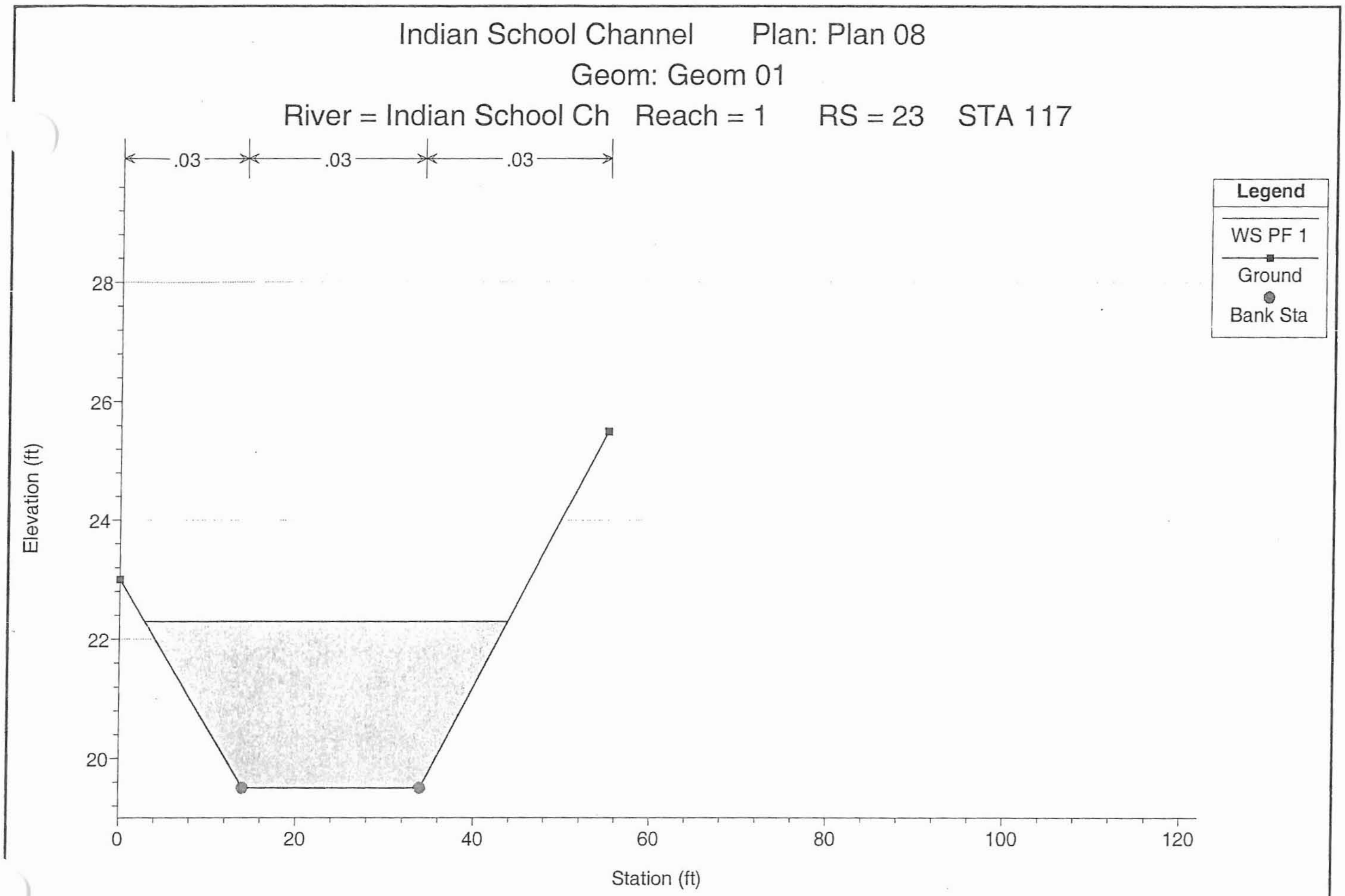


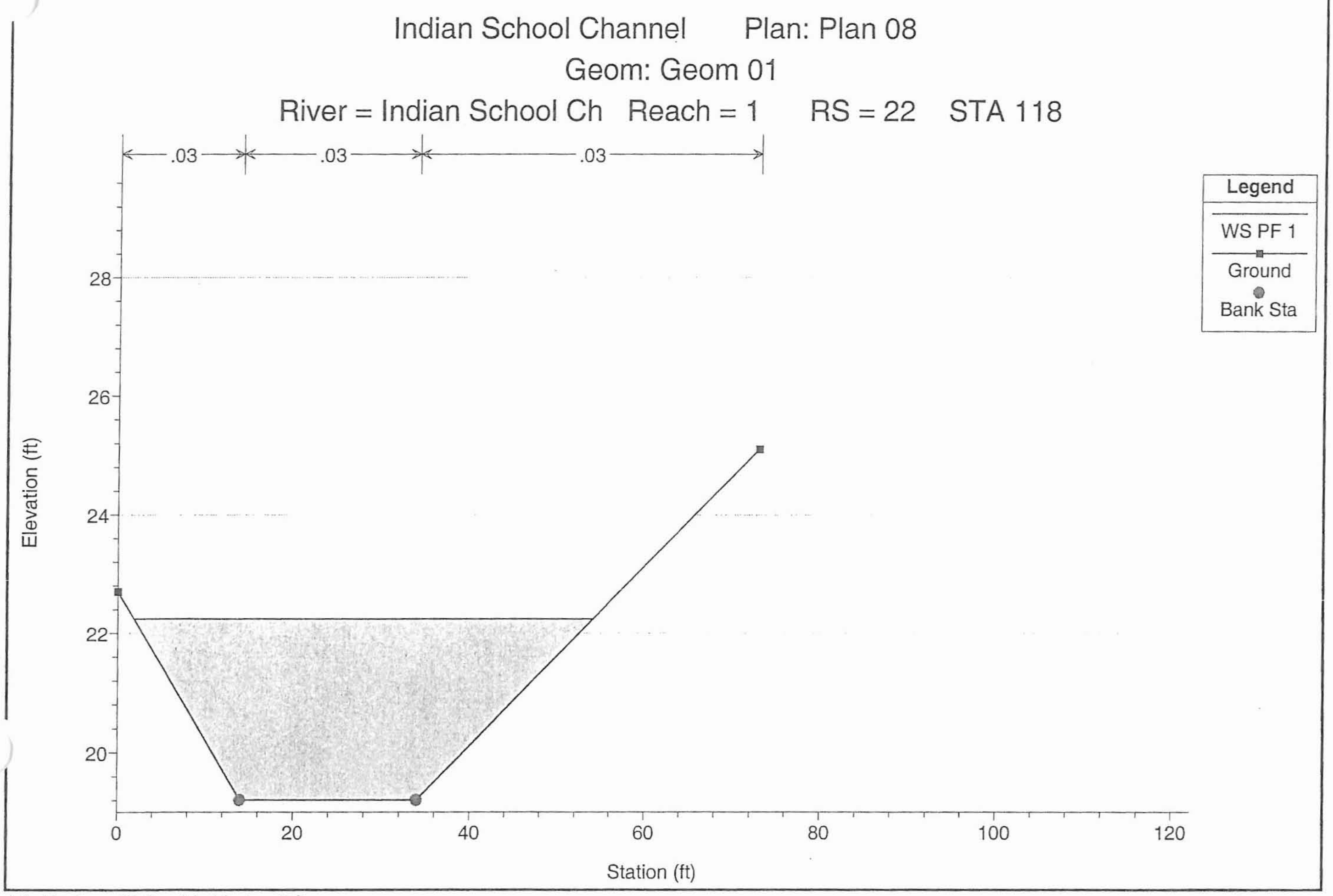
1 in Horiz. = 20 ft 1 in Vert. = 3 ft



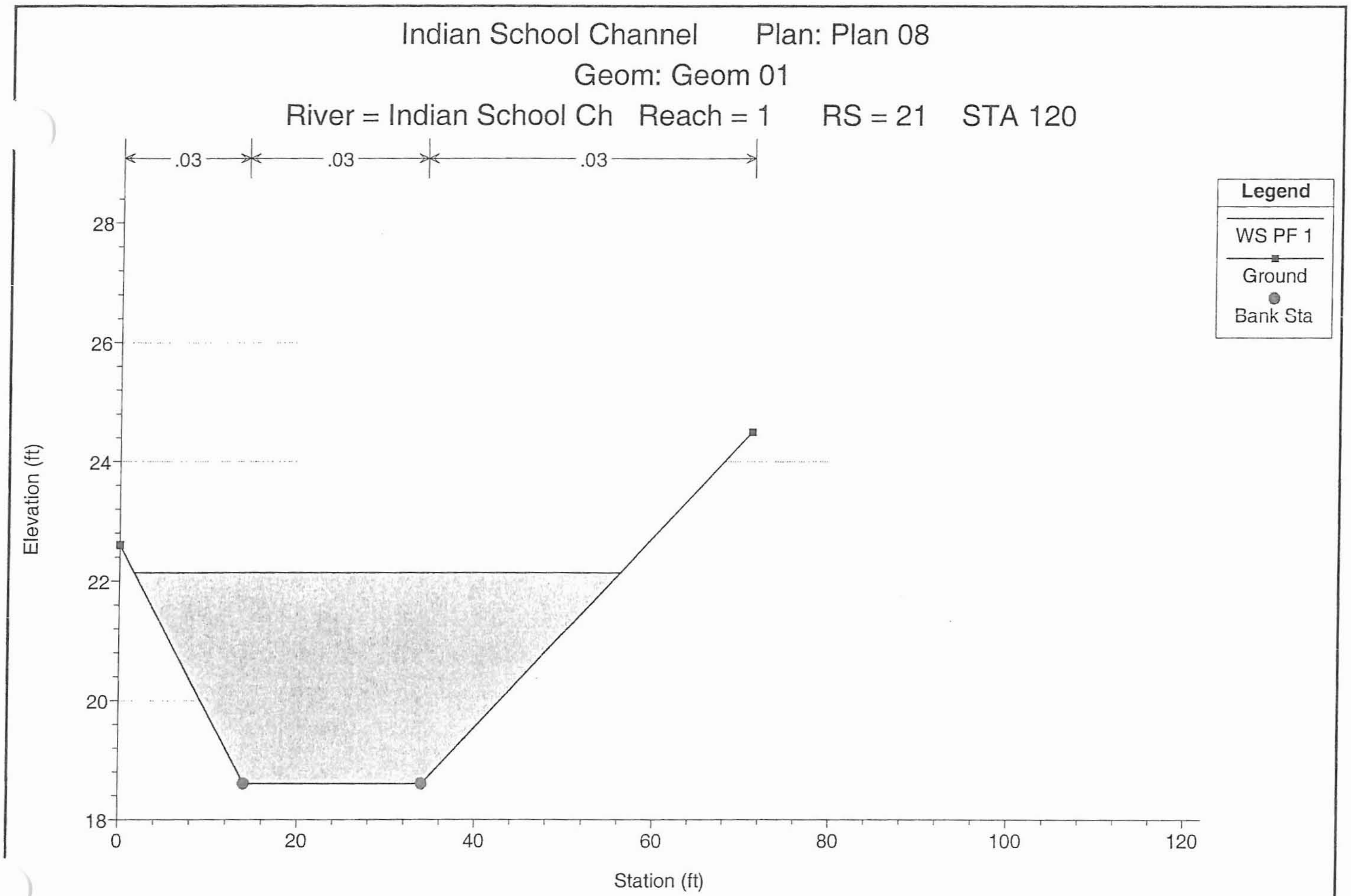


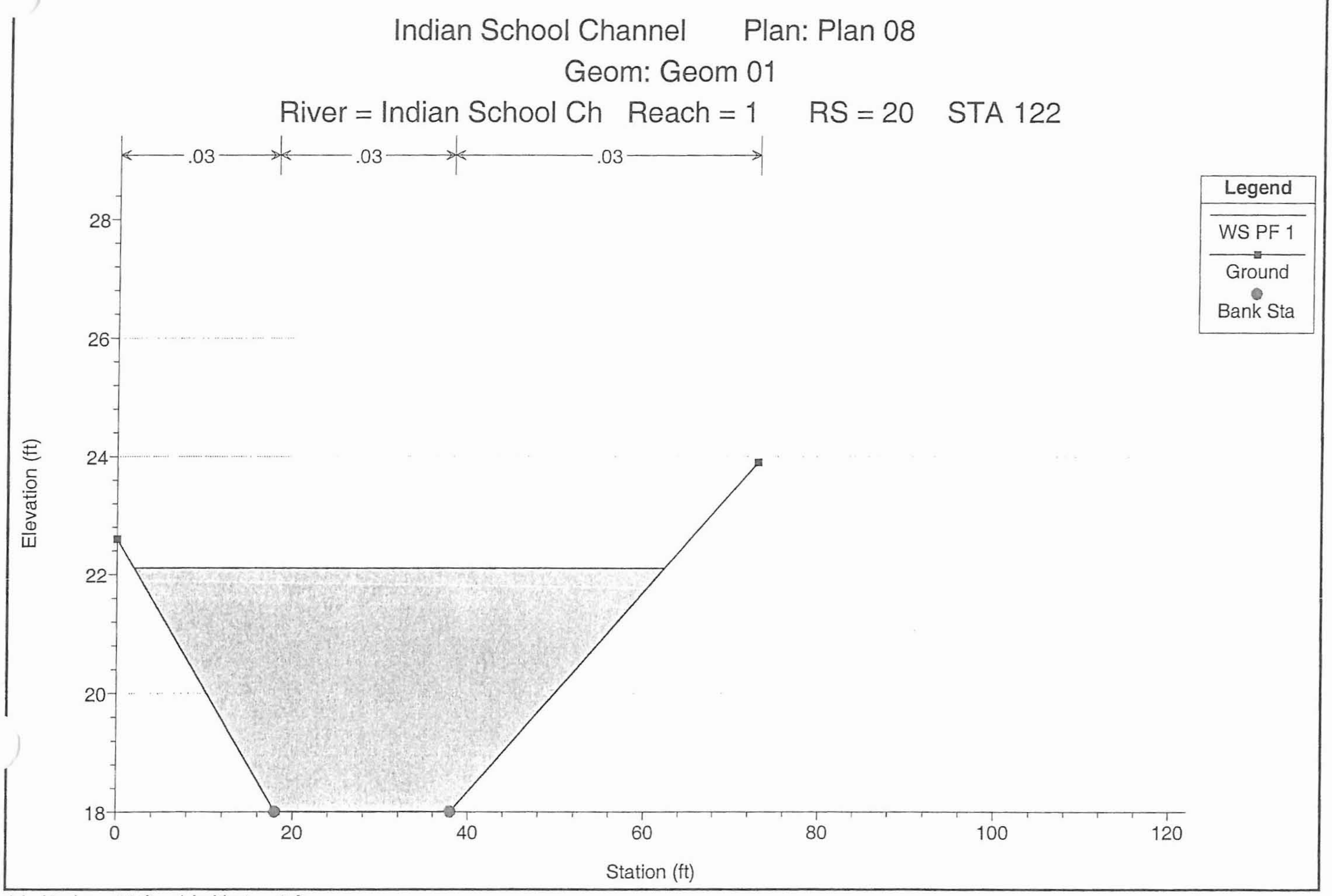
1 in Horiz. = 20 ft 1 in Vert. = 3 ft





1 in Horiz. = 20 ft 1 in Vert. = 3 ft





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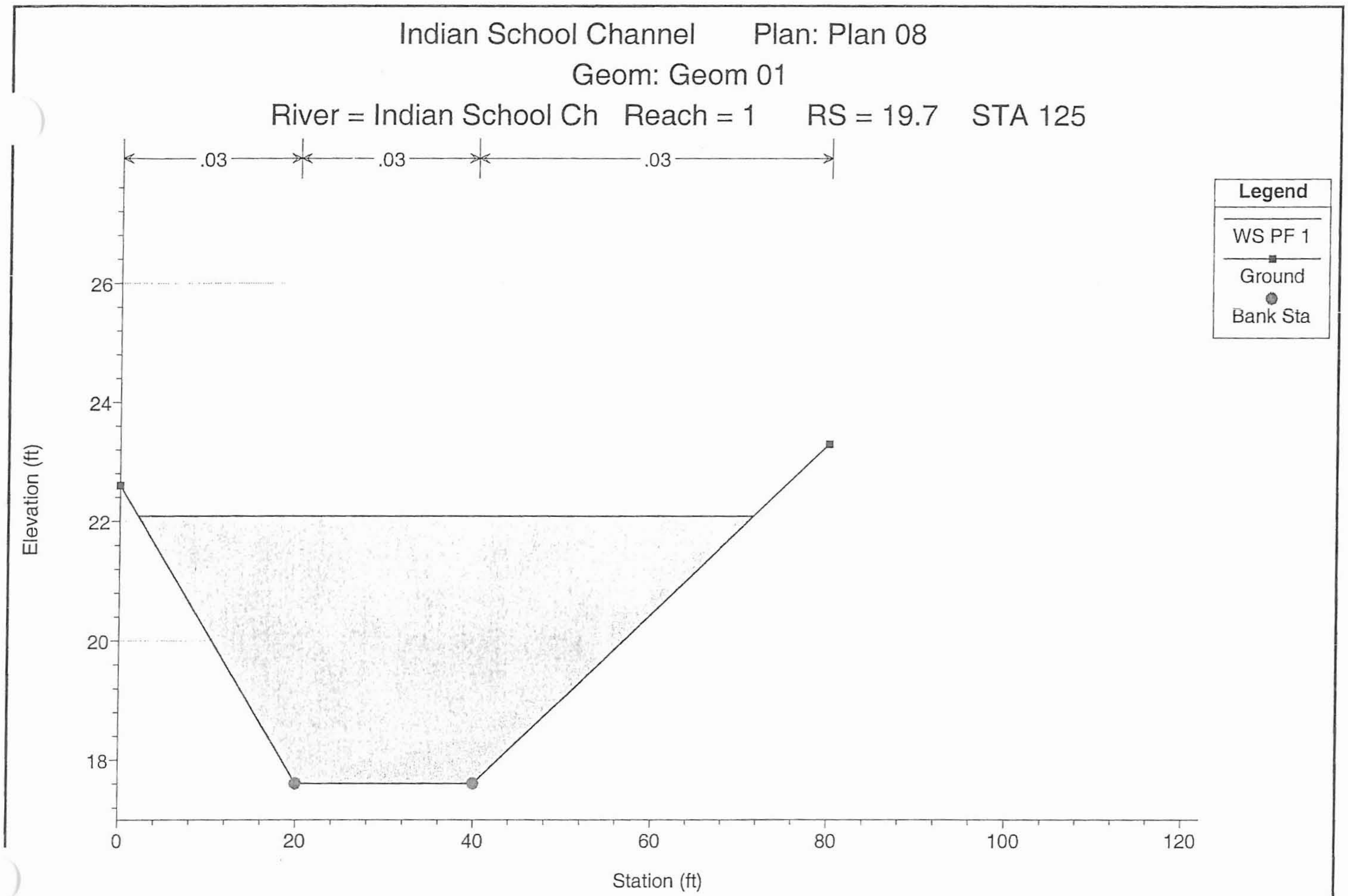
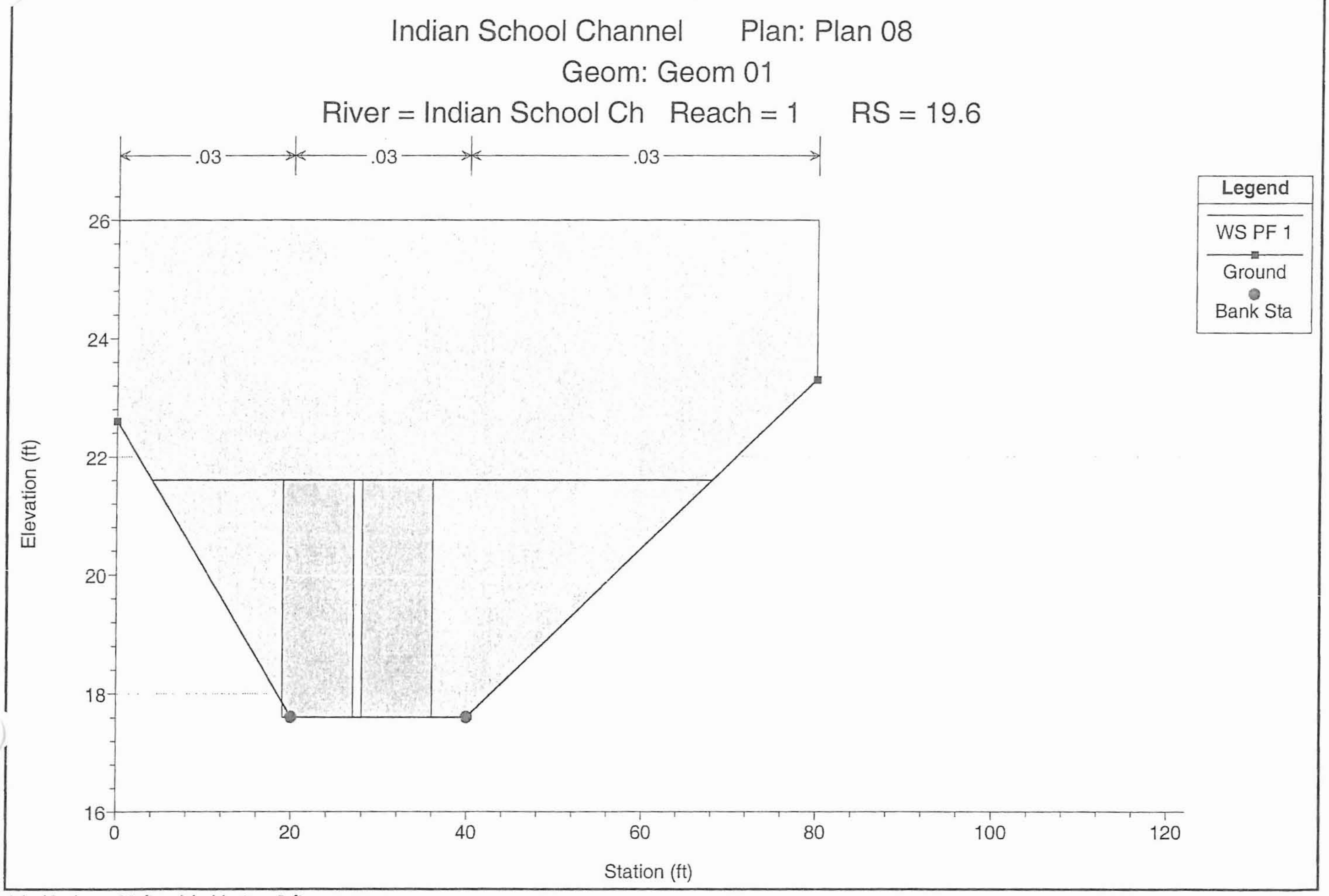
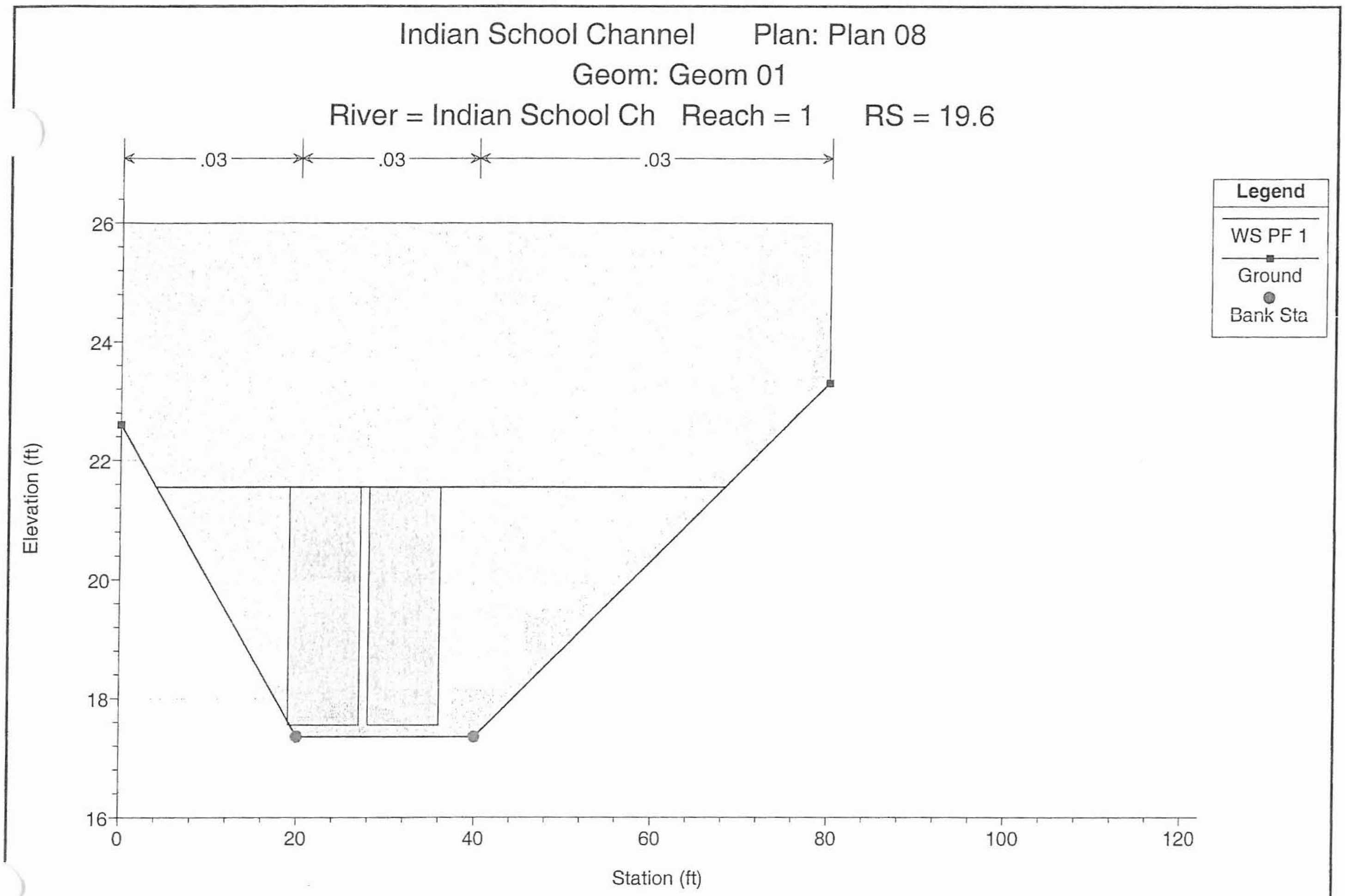
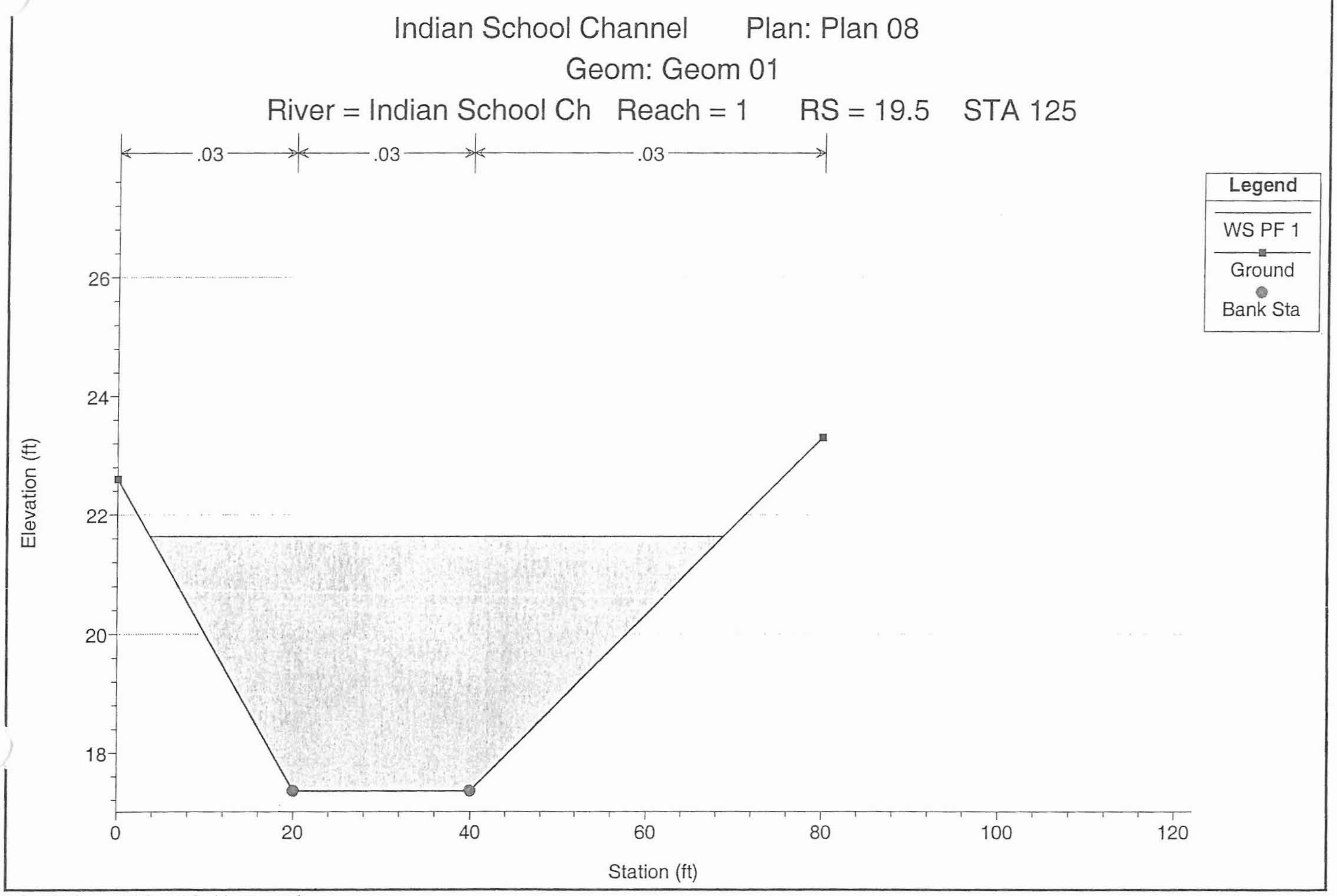




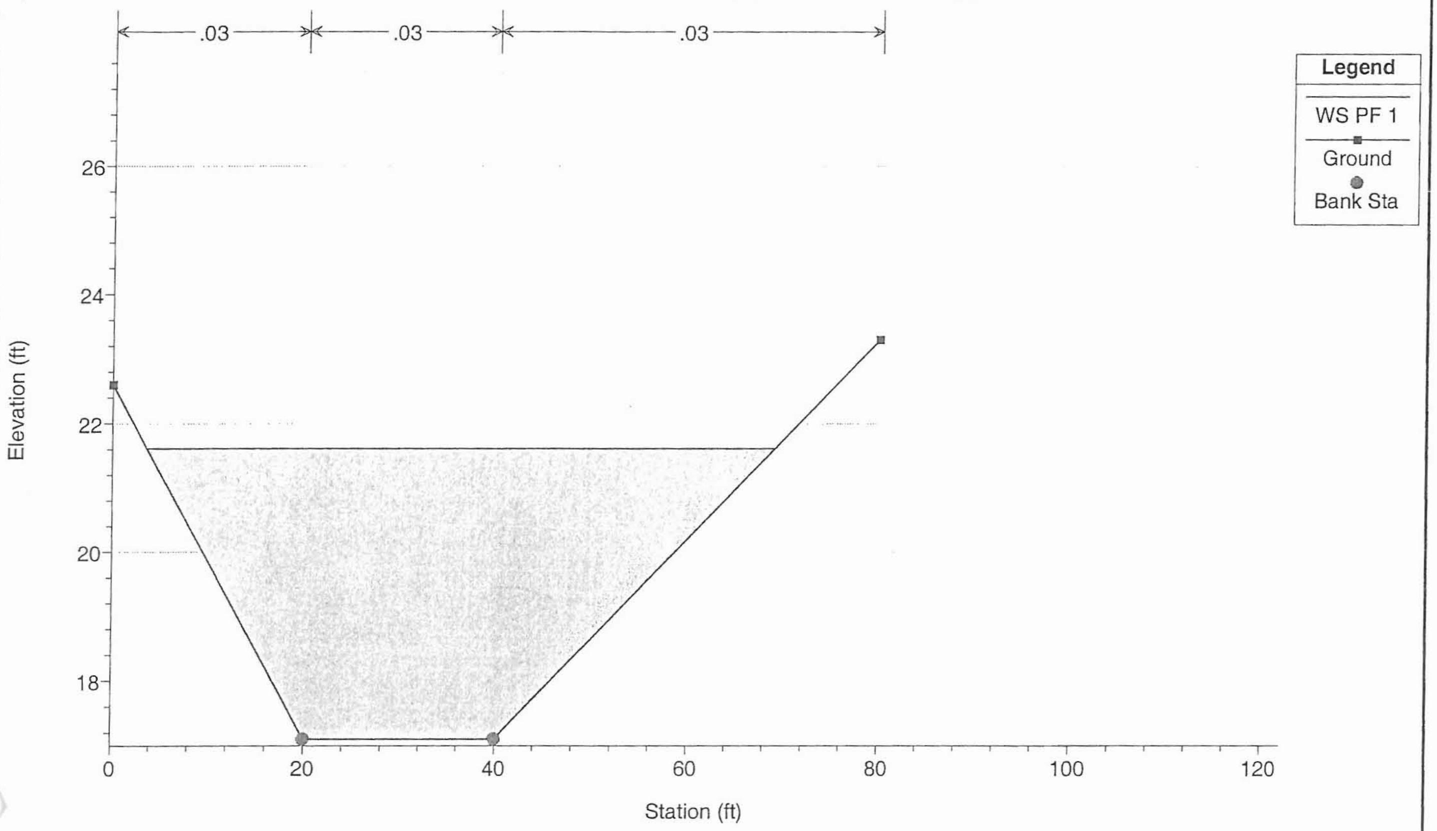
1 in Horiz. = 20 ft 1 in Vert. = 3 ft



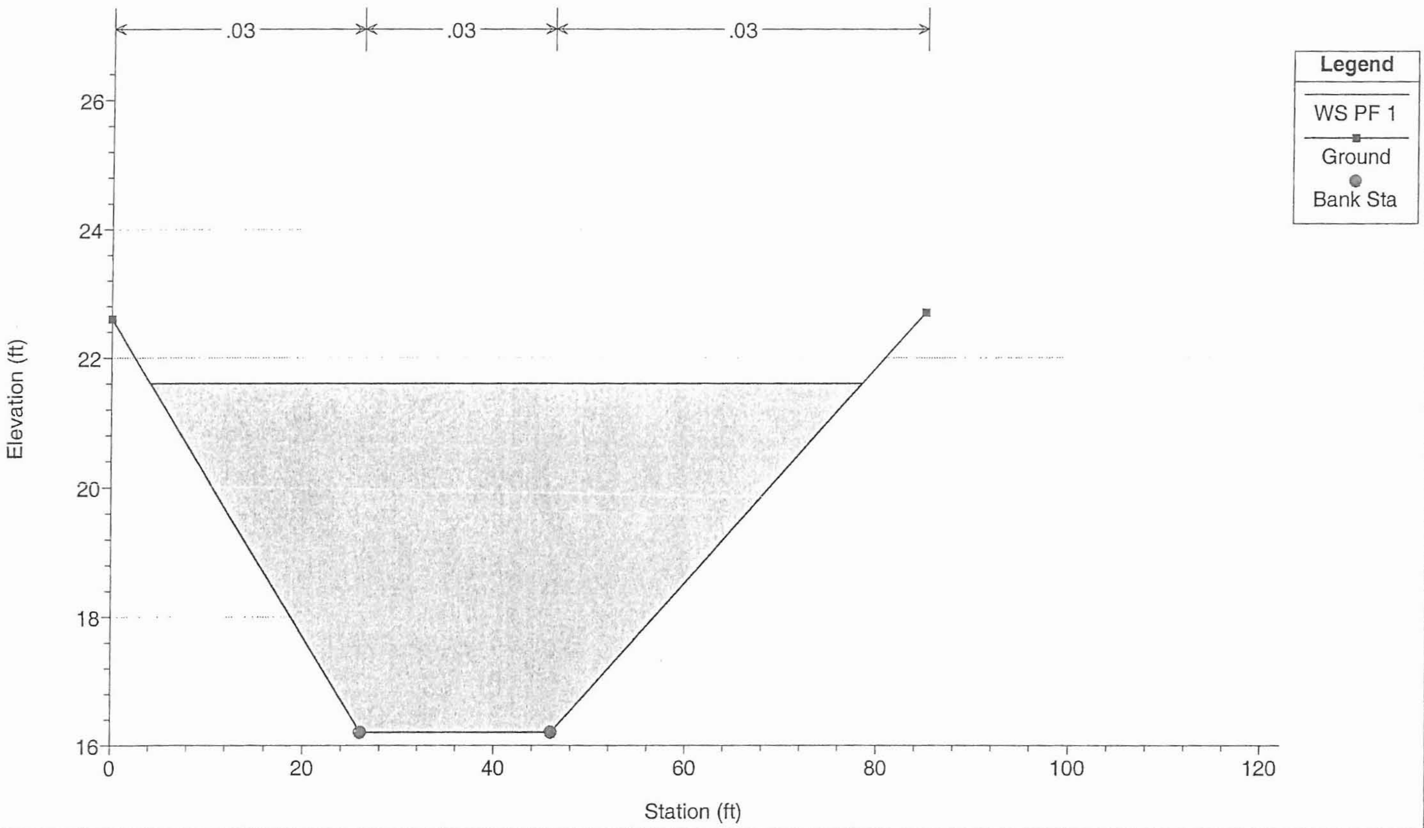


1 in Horiz. = 20 ft 1 in Vert. = 3 ft

Indian School Channel   Plan: Plan 08
Geom: Geom 01
River = Indian School Ch   Reach = 1   RS = 19   STA 125



Indian School Channel   Plan: Plan 08
Geom: Geom 01
River = Indian School Ch   Reach = 1   RS = 18   STA 128



1 in Horiz. = 20 ft   1 in Vert. = 3 ft

2.2 Bullard Wash
HEC-RAS Model

Bullard Wash channel

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 # C
	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
2.13	2385	1041.5	1047.05	1043.96	1047.21	0.00057	3.16	754.63	171.77	0.27
2.12	2385	1041	1047.03		1047.16	0.000433	2.91	820.94	172.34	0.23
2.1	2385	1040.8	1046.91	1043.55	1047.1	0.000607	3.54	672.85	134.35	0.28
2.09	Culvert									
2.08	2385	1039.95	1043.04		1043.96	0.006438	7.68	310.71	115.11	0.82
2.075	2385	1039.72	1042.91		1043.41	0.003378	5.68	420.08	151.15	0.6
2.023	2780	1038.28	1041.96		1042.49	0.0038	5.86	474.36	177.91	0.63
1.966	2780	1037.14	1040.82		1041.35	0.0038	5.86	474.38	177.91	0.63
1.909	2780	1036	1039.68		1040.21	0.0038	5.86	474.36	177.91	0.63
1.852	2780	1034.86	1038.54		1039.07	0.003799	5.86	474.41	177.92	0.63
1.795	2780	1033.72	1037.4		1037.93	0.003803	5.86	474.24	177.9	0.63
1.739	2780	1032.58	1036.26		1036.79	0.003789	5.85	474.83	177.95	0.63
1.727	2780	1032.34	1036.01		1036.55	0.003811	5.87	473.91	177.88	0.63
1.706	2780	1031.94	1035.61		1036.15	0.003813	5.87	473.85	177.87	0.63
1.682	2780	1031.44	1035.12		1035.65	0.003808	5.86	474.04	177.89	0.63
1.625	2780	1030.3	1033.98		1034.51	0.003761	5.83	476.45	178.48	0.63
1.568	2780	1029.15	1032.99		1033.46	0.003185	5.53	502.45	179.91	0.58
1.549	2780	1028.78	1032.7		1033.15	0.002901	5.37	518.12	181.13	0.56
1.511	2780	1028.2	1032.12		1032.57	0.002902	5.37	518.04	181.12	0.56
1.455	2780	1027.33	1031.25		1031.7	0.002906	5.37	517.84	181.11	0.56
1.398	2780	1026.46	1030.37		1030.82	0.002925	5.38	516.72	181.03	0.56
1.341	2780	1025.59	1029.46		1029.93	0.003054	5.46	509.48	180.5	0.57
1.32	2780	1025.3	1029.14		1029.62	0.003156	5.52	504.02	180.1	0.58
1.3	2780	1025.01	1028.82		1029.31	0.002922	5.63	494.11	161.61	0.57
1.284	2780	1024.72	1028.53		1029.02	0.002914	5.61	495.5	162.42	0.57
1.227	2780	1023.85	1027.64		1028.13	0.002968	5.64	492.53	162.23	0.57
1.17	2780	1022.98	1026.64		1027.18	0.003373	5.89	472.15	160.69	0.61
1.16	Lat Struct									
1.114	2500	1022.11	1025.86		1026.27	0.002498	5.14	486.09	161.74	0.52
1.057	2500	1021.42	1024.81	1024.03	1025.35	0.003774	5.86	426.73	159.26	0.63
1.036	2500	1020.95	1023.68	1023.68	1024.87	0.004426	8.77	284.9	119.83	1
1.032	2500	1016.09	1021.32	1018.78	1021.54	0.000396	3.79	659.44	159.83	0.33
1.023	2500	1015.88	1021.28		1021.47	0.000312	3.47	720.87	166.79	0.29
1.019	2644	1015.82	1021.24		1021.46	0.000383	3.78	698.8	165.62	0.32
1.016	2644	1015.76	1021.25		1021.45	0.000332	3.61	731.47	166.68	0.3
1.013	2644	1015.67	1021.23	1018.44	1021.44	0.00035	3.68	718.72	166	0.31
1	Culvert									
0.987	2644	1016.7	1020.54		1021.05	0.001312	5.7	464.24	150.15	0.57
0.976	2644	1016.2	1020.09		1020.8	0.004899	6.79	389.19	141.5	0.72
0.964	2644	1015.6	1019.7	1019.11	1020.5	0.005001	7.14	370.35	126.74	0.74

lowered Q

Revised: 3.23.05; Lowered Q @ x-sec 1.114 through 0.964 (To match HEC-1 model)

Also – modified Culvert @ x-sec 2.09 from 10'x7' to 10'x8' (per aproved plans by Keogh Eng.)

1.013	1015.67	1021.54	3.77	5.87	**1.5**	1.5	1023.1
1							
0.987	1016.7	1020.74	5.87	4.04	**1.1**	1.1	1021.9
0.976	1016.2	1020.29	6.94	4.09	**1.2**	1.2	1021.5
0.964	1015.6	1019.89	7.36	4.29	**1.3**	1.3	1021.2

PALM VALLEY PHASE 5

Bullard Wash Channel

Freeboard (FB) Depth Calculation

FB = 0.25*(depth + V^2/2g)

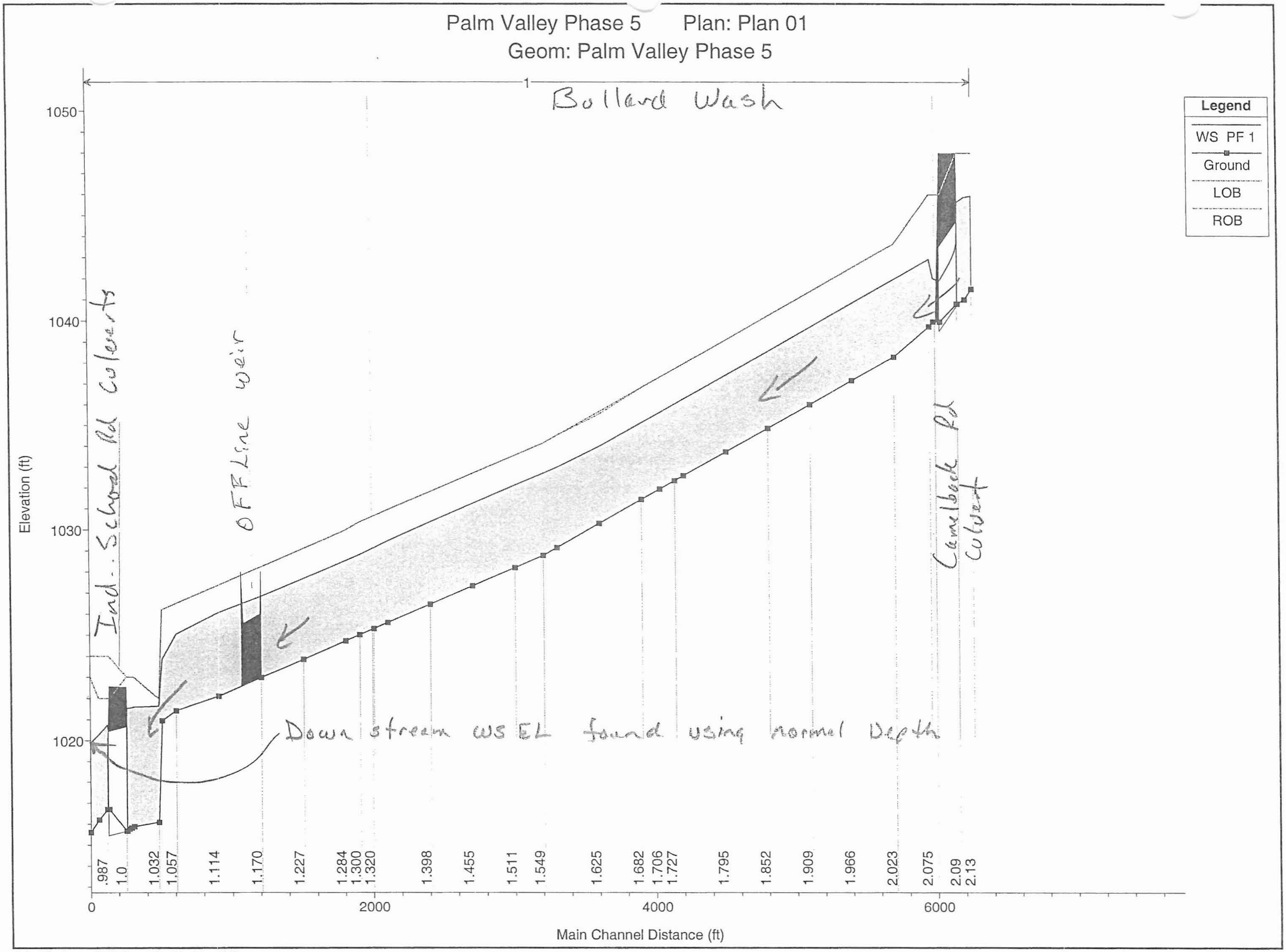
River Sta	Min Ch El	W.S. Elev	Vel Chnl	Channel Depth	**Free Board Calc.**	Min. Free Board Depth	Freeboard Elevation
	(ft)	(ft)	(ft/s)	(ft)	**(ft)**	(ft)	(ft)
2.13	1041.5	1045.94	4.18	4.44	**1.2**	1.2	1047.1
2.12	1041	1045.88	3.78	4.88	**1.3**	1.3	1047.2
2.1	1040.8	1045.65	4.68	4.85	**1.3**	1.3	1046.9
2.09							
2.08	1039.95	1042.01	12.08	2.06	**1.1**	1.1	1043.1
2.075	1039.72	1042.92	5.66	3.2	**0.9**	1.0	1043.9
2.023	1038.28	1041.96	5.86	3.68	**2.1**	2.1	1044.1
1.966	1037.14	1040.82	5.86	3.68	**1.1**	1.1	1041.9
1.909	1036	1039.68	5.86	3.68	**1.1**	1.1	1040.7
1.852	1034.86	1038.54	5.86	3.68	**1.1**	1.1	1039.6
1.795	1033.72	1037.4	5.86	3.68	**1.1**	1.1	1038.5
1.739	1032.58	1036.26	5.85	3.68	**1.1**	1.1	1037.3
1.727	1032.34	1036.02	5.86	3.68	**1.1**	1.1	1037.1
1.706	1031.94	1035.62	5.86	3.68	**1.1**	1.1	1036.7
1.682	1031.44	1035.12	5.86	3.68	**1.1**	1.1	1036.2
1.625	1030.3	1033.99	5.83	3.69	**1.1**	1.1	1035.0
1.568	1029.15	1032.98	5.55	3.83	**1.1**	1.1	1034.1
1.549	1028.78	1032.7	5.36	3.92	**1.1**	1.1	1033.8
1.511	1028.2	1032.13	5.36	3.93	**1.1**	1.1	1033.2
1.455	1027.33	1031.25	5.36	3.92	**1.1**	1.1	1032.3
1.398	1026.46	1030.37	5.39	3.91	**1.1**	1.1	1031.5
1.341	1025.59	1029.47	5.45	3.88	**1.1**	1.1	1030.6
1.32	1025.3	1029.14	5.51	3.84	**1.1**	1.1	1030.2
1.3	1025.01	1028.82	5.62	3.81	**1.1**	1.1	1029.9
1.284	1024.72	1028.53	5.6	3.81	**1.2**	1.2	1029.7
1.227	1023.85	1027.68	5.58	3.83	**1.2**	1.2	1028.8
1.17	1022.98	1026.84	5.52	3.86	**1.1**	1.1	1027.9
1.114	1022.11	1026.07	5.34	3.96	**1.1**	1.1	1027.2
1.057	1021.29	1025.05	5.99	3.76	**1.1**	1.1	1026.1
1.036	1020.95	1023.86	9.06	2.91	**1.0**	1.0	1024.9
1.032	1016.09	1021.64	3.91	5.55	**1.4**	1.4	1023.1
1.023	1015.88	1021.6	3.59	5.72	**1.5**	1.5	1023.1
1.019	1015.82	1021.56	3.86	5.74	**1.5**	1.5	1023.1
1.016	1015.76	1021.55	3.71	5.79	**1.5**	1.5	1023.1

Includes F.B. for curve channel

Includes FB for curve RT Bank only.

River Sta	Channel St Channel Sta	Length Chnl (ft)
2.13		50
2.12		50
2.1		173
2.09		
2.08		28
2.075		252
2.023	6435	300
1.966	6135	300
1.909	5835	300
1.852	5535	300
1.795	5235	300
1.739	4935	64
1.727	4871	105
1.706	4766	131
1.682	4635	300
1.625	4335	300
1.568	4035	100
1.549	3935	200
1.511	3735	300
1.455	3435	300
1.398	3135	300
1.341	2835	100
1.32	2735	100
1.3	2635	100
1.284	2535	300
1.227	2235	300
1.17	1935	300
1.16		
1.114	1635	300
1.057	1335	100
1.036	1235	25
1.032	1210	20
1.023	1190	65
1.019	1125	15
1.016	1110	14.5
1.013	1095.5	140
1		
0.987	955.5	60
0.976	895.5	60
0.964	835.5	

Weir



1 in Horiz. = 900 ft 1 in Vert. = 6 ft

HEC-RAS Version 3.1.2 April 2004
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X      X  XXXXXX   XXXX        XXXX       XX      XXXX
X      X  X       X    X       X   X     X  X    X
X      X  X       X            X   X    X    X   X
XXXXXXX   XXXX    X      XXX   XXXX     XXXXXX    XXXX
X      X  X       X            X  X     X    X        X
X      X  X       X    X       X   X    X    X        X
X      X  XXXXXX   XXXX        X    X   X    X   XXXXX
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PROJECT DATA
Project Title: Palm Valley Phase 5
Project File : bullardwoweir.prj
Run Date and Time: 3/24/2005 10:10:20 AM

Project in English units

Project Description:
Palm Valley Phase 5
Bullard Wash Channel- Indain School Road to Camelback
Road

Model By EEC
3003 N. Central Ave
Suite 600
Phoenix, AZ
85044

Contact: Mike Roberts

PLAN DATA

Plan Title: Plan 01
Plan File : w:\303004\CD FILES\FINAL_FINALSUBMITTAL\bullardwoweir.p01

Geometry Title: Palm Valley Phase 5
Geometry File : w:\303004\CD FILES\FINAL_FINALSUBMITTAL\bullardwoweir.g01

Flow Title : Flow 03
Flow File : w:\303004\CD FILES\FINAL_FINALSUBMITTAL\bullardwoweir.f03

Plan Summary Information:

Number of:	Cross Sections =	37	Multiple Openings =	0
	Culverts =	2	Inline Structures =	0
	Bridges =	0	Lateral Structures =	1

Computational Information
Water surface calculation tolerance = 0.01

Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Mixed Flow

FLOW DATA

Flow Title: Flow 03
Flow File : w:\303004\CD FILES\FINAL_FINALSUBMITTAL\bullardwoweir.f03

Flow Data (cfs)

River	Reach	RS	PF 1
Bullard Wash	1	2.13	2385
Bullard Wash	1	2.12	2385
Bullard Wash	1	2.10	2385
Bullard Wash	1	2.023	2780
Bullard Wash	1	1.114	2500
Bullard Wash	1	1.019	2644

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Bullard Wash	1	PF 1	Normal S = 0.0029	Normal S = 0.005

GEOMETRY DATA

Geometry Title: Palm Valley Phase 5
Geometry File : w:\303004\CD FILES\FINAL_FINALSUBMITTAL\bullardwoweir.g01

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 2.13

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
908	1048	950	1041.5	1000	1041.5	1050	1041.5	1092	1048

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

908	.035	908	.03	1092	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
908	1092	50	50	50	.5	1

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1047.21	Element			
Vel Head (ft)	0.16	Wt. n-Val.		0.030	
W.S. Elev (ft)	1047.05	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	1043.96	Flow Area (sq ft)		754.63	
E.G. Slope (ft/ft)	0.000570	Area (sq ft)		754.63	
Q Total (cfs)	2385.00	Flow (cfs)		2385.00	
Top Width (ft)	171.77	Top Width (ft)		171.77	
Vel Total (ft/s)	3.16	Avg. Vel. (ft/s)		3.16	
Max Chl Dpth (ft)	5.55	Hydr. Depth (ft)		4.39	
Conv. Total (cfs)	99930.1	Conv. (cfs)		99930.1	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		172.62	
Min Ch El (ft)	1041.50	Shear (lb/sq ft)		0.16	
Alpha	1.00	Stream Power (lb/ft s)		0.49	
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)		71.29	
C & E Loss (ft)	0.02	Cum SA (acres)		24.47	

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 2.12

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
908	1048	950	1041	1000	1041	1050	1041	1092	1048

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
908	.035	908	.03	1092	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
908	1092	50	50	50	.5	1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1047.16	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.13	Wt. n-Val.		0.030	
W.S. Elev (ft)	1047.03	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)		Flow Area (sq ft)		820.94	
E.G. Slope (ft/ft)	0.000433	Area (sq ft)		820.94	
Q Total (cfs)	2385.00	Flow (cfs)		2385.00	
Top Width (ft)	172.34	Top Width (ft)		172.34	
Vel Total (ft/s)	2.91	Avg. Vel. (ft/s)		2.91	
Max Chl Dpth (ft)	6.03	Hydr. Depth (ft)		4.76	
Conv. Total (cfs)	114671.6	Conv. (cfs)		114671.6	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		173.34	
Min Ch El (ft)	1041.00	Shear (lb/sq ft)		0.13	
Alpha	1.00	Stream Power (lb/ft s)		0.37	
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)		70.39	
C & E Loss (ft)	0.03	Cum SA (acres)		24.27	

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 2.10

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
929	1048	957	1040.8	1000	1040.8	1043	1040.8	1072	1048

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
929	.035	929	.03	1072	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
929	1072	173	173	173	.5	1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1047.10	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	Wt. n-Val.		0.030	
W.S. Elev (ft)	1046.91	Reach Len. (ft)	173.00	173.00	173.00
Crit W.S. (ft)	1043.55	Flow Area (sq ft)		672.85	

E.G. Slope (ft/ft)	0.000607	Area (sq ft)	672.85
Q Total (cfs)	2385.00	Flow (cfs)	2385.00
Top Width (ft)	134.35	Top Width (ft)	134.35
Vel Total (ft/s)	3.54	Avg. Vel. (ft/s)	3.54
Max Chl Dpth (ft)	6.11	Hydr. Depth (ft)	5.01
Conv. Total (cfs)	96827.2	Conv. (cfs)	96827.2
Length Wtd. (ft)	173.00	Wetted Per. (ft)	135.87
Min Ch El (ft)	1040.80	Shear (lb/sq ft)	0.19
Alpha	1.00	Stream Power (lb/ft s)	0.66
Frctn Loss (ft)		Cum Volume (acre-ft)	69.53
C & E Loss (ft)		Cum SA (acres)	24.09

CULVERT

RIVER: Bullard Wash
REACH: 1 RS: 2.09

INPUT
Description:
Distance from Upstream XS = 5
Deck/Roadway Width = 120
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
750	1048	1035	1100	1048	1035

Upstream Bridge Cross Section Data
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
929	1048	957	1040.8	1000	1040.8	1043	1040.8	1072	1048

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
929	.035	929	.03	1072	.035

Bank Sta: Left	Right	Coeff Contr.	Expan.
929	1072	.5	1

Downstream Deck/Roadway Coordinates
num= 2

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
750	1048	1035	1100	1048	1035

Downstream Bridge Cross Section Data
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
929	1046	957	1039.95	1000	1039.95	1043	1039.95	1072	1046

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
929	.035	929	.03	1072	.035

Bank Sta: Left	Right	Coeff Contr.	Expan.
929	1072	.5	1

Upstream Embankment side slope = 4 horiz. to 1.0 vertical
Downstream Embankment side slope = 4 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins = 1047
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	7	10

FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG

Culvert Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
5	125	.015	.015	0	.5	1

Number of Barrels = 6
Upstream Elevation = 1040.7
Centerline Stations

Sta.	Sta.	Sta.	Sta.	Sta.	Sta.
972.5	983.5	994.5	1005.5	1016.5	1027.5

Downstream Elevation = 1039.5
Centerline Stations

Sta.	Sta.	Sta.	Sta.	Sta.	Sta.
972.5	983.5	994.5	1005.5	1016.5	1027.5

CULVERT OUTPUT Profile #PF 1 Culv Group: Culvert #1

Q Culv Group (cfs)	2385.00	Culv Full Len (ft)	
# Barrels	6	Culv Vel US (ft/s)	10.86
Q Barrel (cfs)	397.50	Culv Vel DS (ft/s)	13.60
E.G. US. (ft)	1047.11	Culv Inv El Up (ft)	1040.70
W.S. US. (ft)	1046.91	Culv Inv El Dn (ft)	1039.50
E.G. DS (ft)	1043.96	Culv Frctn Ls (ft)	0.90
W.S. DS (ft)	1043.04	Culv Exit Loss (ft)	1.34
Delta EG (ft)	3.15	Culv Entr Loss (ft)	0.92
Delta WS (ft)	3.87	Q Weir (cfs)	
E.G. IC (ft)	1046.55	Weir Sta Lft (ft)	
E.G. OC (ft)	1047.11	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	1044.36	Weir Max Depth (ft)	
Culv WS Outlet (ft)	1042.42	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.78	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	3.66	Min El Weir Flow (ft)	1048.01

Note: During the supercritical calculations a hydraulic jump occurred at the outlet of (leaving) the culvert.
Note: The flow in the culvert is entirely supercritical.

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 2.080

INPUT
Description:

Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
929	1046	957	1039.95	1000	1039.95	1043	1039.95	1072	1046

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
929	.035	929	.03	1072	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
929	1072	28	28	28	.5	1

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1043.96	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.91	Wt. n-Val.		0.030	
W.S. Elev (ft)	1043.04	Reach Len. (ft)	28.00	28.00	28.00
Crit W.S. (ft)		Flow Area (sq ft)		310.71	
E.G. Slope (ft/ft)	0.006438	Area (sq ft)		310.71	
Q Total (cfs)	2385.00	Flow (cfs)		2385.00	
Top Width (ft)	115.11	Top Width (ft)		115.11	
Vel Total (ft/s)	7.68	Avg. Vel. (ft/s)		7.68	
Max Chl Dpth (ft)	3.09	Hydr. Depth (ft)		2.70	
Conv. Total (cfs)	29723.6	Conv. (cfs)		29723.6	
Length Wtd. (ft)	28.00	Wetted Per. (ft)		115.76	
Min Ch El (ft)	1039.95	Shear (lb/sq ft)		1.08	
Alpha	1.00	Stream Power (lb/ft s)		8.28	
Frctn Loss (ft)	0.13	Cum Volume (acre-ft)		67.58	
C & E Loss (ft)	0.41	Cum SA (acres)		23.60	

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 2.075

INPUT
Description:

Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
907	1046	944	1039.72	1000	1039.72	1056	1039.72	1096	1046

Manning's n Values		num=	3	
Sta	n Val	Sta	n Val	Sta	n Val
907	.035	907	.03	1096	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
907	1096	252	252	252	.5	1

CROSS SECTION OUTPUT Profile #PF 1

		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	1043.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.50	Wt. n-Val.		0.030	
W.S. Elev (ft)	1042.91	Reach Len. (ft)	252.00	252.00	252.00
Crit W.S. (ft)		Flow Area (sq ft)		420.08	
E.G. Slope (ft/ft)	0.003378	Area (sq ft)		420.08	
Q Total (cfs)	2385.00	Flow (cfs)		2385.00	
Top Width (ft)	151.15	Top Width (ft)		151.15	
Vel Total (ft/s)	5.68	Avg. Vel. (ft/s)		5.68	
Max Chl Dpth (ft)	3.19	Hydr. Depth (ft)		2.78	
Conv. Total (cfs)	41036.6	Conv. (cfs)		41036.6	
Length Wtd. (ft)	252.00	Wetted Per. (ft)		151.66	
Min Ch El (ft)	1039.72	Shear (lb/sq ft)		0.58	
Alpha	1.00	Stream Power (lb/ft s)		3.32	
Frctn Loss (ft)	0.91	Cum Volume (acre-ft)		67.34	
C & E Loss (ft)	0.02	Cum SA (acres)		23.51	

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 2.023

INPUT
Description:

Station Elevation Data		num=	5						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
900	1043.63	930	1039.68	1000	1038.98	1070	1038.28	1100	1043.63

Manning's n Values		num=	3		
Sta	n Val	Sta	n Val	Sta	n Val
900	.035	900	.03	1100	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
900	1100	300	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	1042.49	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.53	Wt. n-Val.		0.030	
W.S. Elev (ft)	1041.96	Reach Len. (ft)	300.00	300.00	300.00
Crit W.S. (ft)		Flow Area (sq ft)		474.36	
E.G. Slope (ft/ft)	0.003800	Area (sq ft)		474.36	
Q Total (cfs)	2780.00	Flow (cfs)		2780.00	
Top Width (ft)	177.91	Top Width (ft)		177.91	
Vel Total (ft/s)	5.86	Avg. Vel. (ft/s)		5.86	
Max Chl Dpth (ft)	3.68	Hydr. Depth (ft)		2.67	
Conv. Total (cfs)	45095.4	Conv. (cfs)		45095.4	
Length Wtd. (ft)	300.00	Wetted Per. (ft)		178.39	
Min Ch El (ft)	1038.28	Shear (lb/sq ft)		0.63	
Alpha	1.00	Stream Power (lb/ft s)		3.70	
Frctn Loss (ft)	1.14	Cum Volume (acre-ft)		64.76	
C & E Loss (ft)	0.00	Cum SA (acres)		22.56	

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.966

INPUT
Description:

Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
900	1042.49	930	1038.54	1000	1037.84	1070	1037.14	1100	1042.49

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
900	.035	900	.03	1100	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
900	1100	300	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft) 1041.35 Element Left OB Channel

Right OB

Vel Head (ft)	0.53	Wt. n-Val.		0.030
W.S. Elev (ft)	1040.82	Reach Len. (ft)	300.00	300.00

300.00

Crit W.S. (ft)		Flow Area (sq ft)	474.38
E.G. Slope (ft/ft)	0.003800	Area (sq ft)	474.38
Q Total (cfs)	2780.00	Flow (cfs)	2780.00
Top Width (ft)	177.91	Top Width (ft)	177.91
Vel Total (ft/s)	5.86	Avg. Vel. (ft/s)	5.86
Max Chl Dpth (ft)	3.68	Hydr. Depth (ft)	2.67
Conv. Total (cfs)	45098.6	Conv. (cfs)	45098.6
Length Wtd. (ft)	300.00	Wetted Per. (ft)	178.39
Min Ch El (ft)	1037.14	Shear (lb/sq ft)	0.63
Alpha	1.00	Stream Power (lb/ft s)	3.70
Frctn Loss (ft)	1.14	Cum Volume (acre-ft)	61.49
C & E Loss (ft)	0.00	Cum SA (acres)	21.34

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.909

INPUT
Description:

Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
900	1041.35	930	1037.4	1000	1036.7	1070	1036	1100	1041.35

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
900	.035	900	.03	1100	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
900	1100	300	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel
E.G. Elev (ft)	1040.21	Element		

Right OB

Vel Head (ft)	0.53	Wt. n-Val.		0.030
W.S. Elev (ft)	1039.68	Reach Len. (ft)	300.00	300.00

300.00

Crit W.S. (ft)		Flow Area (sq ft)	474.36
E.G. Slope (ft/ft)	0.003800	Area (sq ft)	474.36
Q Total (cfs)	2780.00	Flow (cfs)	2780.00
Top Width (ft)	177.91	Top Width (ft)	177.91
Vel Total (ft/s)	5.86	Avg. Vel. (ft/s)	5.86
Max Chl Dpth (ft)	3.68	Hydr. Depth (ft)	2.67
Conv. Total (cfs)	45095.4	Conv. (cfs)	45095.4
Length Wtd. (ft)	300.00	Wetted Per. (ft)	178.39
Min Ch El (ft)	1036.00	Shear (lb/sq ft)	0.63
Alpha	1.00	Stream Power (lb/ft s)	3.70
Frctn Loss (ft)	1.14	Cum Volume (acre-ft)	58.22
C & E Loss (ft)	0.00	Cum SA (acres)	20.11

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.852

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
900	1040.21	930	1036.26	1000	1035.56	1070	1034.86	1100	1040.21

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
900	.035	900	.03	1100	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
900	1100	300	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1039.07	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.53	Wt. n-Val.		0.030
W.S. Elev (ft)	1038.54	Reach Len. (ft)	300.00	300.00
300.00				
Crit W.S. (ft)		Flow Area (sq ft)		474.41
E.G. Slope (ft/ft)	0.003799	Area (sq ft)		474.41

Q Total (cfs)	2780.00	Flow (cfs)	2780.00
Top Width (ft)	177.92	Top Width (ft)	177.92
Vel Total (ft/s)	5.86	Avg. Vel. (ft/s)	5.86
Max Chl Dpth (ft)	3.68	Hydr. Depth (ft)	2.67
Conv. Total (cfs)	45103.6	Conv. (cfs)	45103.6
Length Wtd. (ft)	300.00	Wetted Per. (ft)	178.40
Min Ch El (ft)	1034.86	Shear (lb/sq ft)	0.63
Alpha	1.00	Stream Power (lb/ft s)	3.70
Frctn Loss (ft)	1.14	Cum Volume (acre-ft)	54.95
C & E Loss (ft)	0.00	Cum SA (acres)	18.89

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.795

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
900	1039.07	930	1035.12	1000	1034.42	1070	1033.72	1100	1039.07

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
900	.035	900	.03	1100	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
900	1100	300	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1037.93	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.53	Wt. n-Val.		0.030
W.S. Elev (ft)	1037.40	Reach Len. (ft)	300.00	300.00
300.00				
Crit W.S. (ft)		Flow Area (sq ft)		474.24
E.G. Slope (ft/ft)	0.003803	Area (sq ft)		474.24
Q Total (cfs)	2780.00	Flow (cfs)		2780.00
Top Width (ft)	177.90	Top Width (ft)		177.90

Vel Total (ft/s)	5.86	Avg. Vel. (ft/s)	5.86
Max Chl Dpth (ft)	3.68	Hydr. Depth (ft)	2.67
Conv. Total (cfs)	45078.3	Conv. (cfs)	45078.3
Length Wtd. (ft)	300.00	Wetted Per. (ft)	178.38
Min Ch El (ft)	1033.72	Shear (lb/sq ft)	0.63
Alpha	1.00	Stream Power (lb/ft s)	3.70
Frctn Loss (ft)	1.14	Cum Volume (acre-ft)	51.69
C & E Loss (ft)	0.00	Cum SA (acres)	17.66

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.739

INPUT
Description:

Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
900	1037.93	930	1033.98	1000	1033.28	1070	1032.58	1100	1037.93

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
900	.035	900	.03	1100	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
900	1100	64	64	64	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1036.79	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.53	Wt. n-Val.		0.030
W.S. Elev (ft)	1036.26	Reach Len. (ft)	64.00	64.00
64.00				
Crit W.S. (ft)		Flow Area (sq ft)		474.83
E.G. Slope (ft/ft)	0.003789	Area (sq ft)		474.83
Q Total (cfs)	2780.00	Flow (cfs)		2780.00
Top Width (ft)	177.95	Top Width (ft)		177.95
Vel Total (ft/s)	5.85	Avg. Vel. (ft/s)		5.85
Max Chl Dpth (ft)	3.68	Hydr. Depth (ft)		2.67

Conv. Total (cfs)	45163.7	Conv. (cfs)	45163.7
Length Wtd. (ft)	64.00	Wetted Per. (ft)	178.43
Min Ch El (ft)	1032.58	Shear (lb/sq ft)	0.63
Alpha	1.00	Stream Power (lb/ft s)	3.69
Frctn Loss (ft)	0.24	Cum Volume (acre-ft)	48.42
C & E Loss (ft)	0.00	Cum SA (acres)	16.43

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.727

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
900	1037.69	930	1033.74	1000	1033.04	1070	1032.34	1100	1037.69

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
900	.035	900	.03	1100	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
900	1100	105	105	105	.3	.5

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1036.55	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.53	Wt. n-Val.		0.030	
W.S. Elev (ft)	1036.01	Reach Len. (ft)	105.00	105.00	105.00
Crit W.S. (ft)		Flow Area (sq ft)		473.91	
E.G. Slope (ft/ft)	0.003811	Area (sq ft)		473.91	
Q Total (cfs)	2780.00	Flow (cfs)		2780.00	
Top Width (ft)	177.88	Top Width (ft)		177.88	
Vel Total (ft/s)	5.87	Avg. Vel. (ft/s)		5.87	
Max Chl Dpth (ft)	3.67	Hydr. Depth (ft)		2.66	
Conv. Total (cfs)	45030.8	Conv. (cfs)		45030.8	
Length Wtd. (ft)	105.00	Wetted Per. (ft)		178.36	
Min Ch El (ft)	1032.34	Shear (lb/sq ft)		0.63	
Alpha	1.00	Stream Power (lb/ft s)		3.71	

Frctn Loss (ft)	0.40	Cum Volume (acre-ft)	47.72
C & E Loss (ft)	0.00	Cum SA (acres)	16.17

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.706

INPUT
Description:

Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
900	1037.29	930	1033.34	1000	1032.64	1070	1031.94	1100	1037.29

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
900	.035	900	.03	1100	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
900	1100	131	131	131	.3	.5

CROSS SECTION OUTPUT Profile #PF 1

		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	1036.15	Wt. n-Val.		0.030	
Vel Head (ft)	0.53	Reach Len. (ft)	131.00	131.00	131.00
W.S. Elev (ft)	1035.61	Flow Area (sq ft)		473.85	
Crit W.S. (ft)		Area (sq ft)		473.85	
E.G. Slope (ft/ft)	0.003813	Flow (cfs)		2780.00	
Q Total (cfs)	2780.00	Top Width (ft)		177.87	
Top Width (ft)	177.87	Avg. Vel. (ft/s)		5.87	
Vel Total (ft/s)	5.87	Hydr. Depth (ft)		2.66	
Max Chl Dpth (ft)	3.67	Conv. (cfs)		45021.2	
Conv. Total (cfs)	45021.2	Wetted Per. (ft)		178.35	
Length Wtd. (ft)	131.00	Shear (lb/sq ft)		0.63	
Min Ch El (ft)	1031.94	Stream Power (lb/ft s)		3.71	
Alpha	1.00	Cum Volume (acre-ft)		46.58	
Frctn Loss (ft)	0.50	Cum SA (acres)		15.74	
C & E Loss (ft)	0.00				

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.682

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
900	1036.79	930	1032.84	1000	1032.14	1070	1031.44	1100	1036.79

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
900	.035	900	.03	1100	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
900	1100	300	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft) 1035.65 Element Left OB Channel
Right OB
Vel Head (ft) 0.53 Wt. n-Val. 0.030
W.S. Elev (ft) 1035.12 Reach Len. (ft) 300.00 300.00
300.00
Crit W.S. (ft) Flow Area (sq ft) 474.04
E.G. Slope (ft/ft) 0.003808 Area (sq ft) 474.04
Q Total (cfs) 2780.00 Flow (cfs) 2780.00
Top Width (ft) 177.89 Top Width (ft) 177.89
Vel Total (ft/s) 5.86 Avg. Vel. (ft/s) 5.86
Max Chl Dpth (ft) 3.68 Hydr. Depth (ft) 2.66
Conv. Total (cfs) 45049.7 Conv. (cfs) 45049.7
Length Wtd. (ft) 300.00 Wetted Per. (ft) 178.37
Min Ch El (ft) 1031.44 Shear (lb/sq ft) 0.63
Alpha 1.00 Stream Power (lb/ft s) 3.71
Frctn Loss (ft) 1.14 Cum Volume (acre-ft) 45.16
C & E Loss (ft) 0.00 Cum SA (acres) 15.21

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Bullard Wash

REACH: 1 RS: 1.625

INPUT
Description:

Station Elevation Data		num=	5						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
900	1035.65	930	1031.7	1000	1031	1070	1030.3	1100	1035.53

Manning's n Values		num=	3		
Sta	n Val	Sta	n Val	Sta	n Val
900	.035	900	.03	1100	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
900	1100	300	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	1034.51	Wt. n-Val.		0.030	
Vel Head (ft)	0.53	Reach Len. (ft)	300.00	300.00	300.00
W.S. Elev (ft)	1033.98	Flow Area (sq ft)		476.45	
Crit W.S. (ft)		Area (sq ft)		476.45	
E.G. Slope (ft/ft)	0.003761	Flow (cfs)		2780.00	
Q Total (cfs)	2780.00	Top Width (ft)		178.48	
Top Width (ft)	178.48	Avg. Vel. (ft/s)		5.83	
Vel Total (ft/s)	5.83	Hydr. Depth (ft)		2.67	
Max Chl Dpth (ft)	3.68	Conv. (cfs)		45333.3	
Conv. Total (cfs)	45333.3	Wetted Per. (ft)		178.95	
Length Wtd. (ft)	300.00	Shear (lb/sq ft)		0.63	
Min Ch El (ft)	1030.30	Stream Power (lb/ft s)		3.65	
Alpha	1.00	Cum Volume (acre-ft)		41.88	
Frctn Loss (ft)	1.04	Cum SA (acres)		13.98	
C & E Loss (ft)	0.02				

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.568

INPUT
Description:

Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
900	1034.51	930	1030.55	1000	1029.85	1070	1029.15	1100	1034.51

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
900	.035	900	.03	1100	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
900	1100	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1033.46	Element			
Vel Head (ft)	0.48	Wt. n-Val.		0.030	
W.S. Elev (ft)	1032.99	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		502.45	
E.G. Slope (ft/ft)	0.003185	Area (sq ft)		502.45	
Q Total (cfs)	2780.00	Flow (cfs)		2780.00	
Top Width (ft)	179.91	Top Width (ft)		179.91	
Vel Total (ft/s)	5.53	Avg. Vel. (ft/s)		5.53	
Max Chl Dpth (ft)	3.83	Hydr. Depth (ft)		2.79	
Conv. Total (cfs)	49262.0	Conv. (cfs)		49262.0	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		180.41	
Min Ch El (ft)	1029.15	Shear (lb/sq ft)		0.55	
Alpha	1.00	Stream Power (lb/ft s)		3.06	
Frctn Loss (ft)	0.30	Cum Volume (acre-ft)		38.51	
C & E Loss (ft)	0.01	Cum SA (acres)		12.75	

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.549

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
900	1034.13	930	1030.18	1000	1029.48	1070	1028.78	1100	1034.13

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
900	.035	900	.03	1100	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
900	1100	200	200	200	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1033.15	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.45	Wt. n-Val.		0.030	
W.S. Elev (ft)	1032.70	Reach Len. (ft)	200.00	200.00	200.00
Crit W.S. (ft)		Flow Area (sq ft)		518.12	
E.G. Slope (ft/ft)	0.002901	Area (sq ft)		518.12	
Q Total (cfs)	2780.00	Flow (cfs)		2780.00	
Top Width (ft)	181.13	Top Width (ft)		181.13	
Vel Total (ft/s)	5.37	Avg. Vel. (ft/s)		5.37	
Max Chl Dpth (ft)	3.92	Hydr. Depth (ft)		2.86	
Conv. Total (cfs)	51614.3	Conv. (cfs)		51614.3	
Length Wtd. (ft)	200.00	Wetted Per. (ft)		181.65	
Min Ch El (ft)	1028.78	Shear (lb/sq ft)		0.52	
Alpha	1.00	Stream Power (lb/ft s)		2.77	
Frctn Loss (ft)	0.58	Cum Volume (acre-ft)		37.34	
C & E Loss (ft)	0.00	Cum SA (acres)		12.33	

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.511

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
900	1033.55	930	1029.6	1000	1028.9	1070	1028.2	1100	1033.55

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
900	.035	900	.03	1100	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
900	1100	300	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1032.57	Element	Left OB	Channel	Right OB

Vel Head (ft)	0.45	Wt. n-Val.		0.030
W.S. Elev (ft)	1032.12	Reach Len. (ft)	300.00	300.00

300.00

Crit W.S. (ft)		Flow Area (sq ft)		518.04
E.G. Slope (ft/ft)	0.002902	Area (sq ft)		518.04
Q Total (cfs)	2780.00	Flow (cfs)		2780.00
Top Width (ft)	181.12	Top Width (ft)		181.12
Vel Total (ft/s)	5.37	Avg. Vel. (ft/s)		5.37
Max Chl Dpth (ft)	3.92	Hydr. Depth (ft)		2.86
Conv. Total (cfs)	51602.7	Conv. (cfs)		51602.7
Length Wtd. (ft)	300.00	Wetted Per. (ft)		181.64
Min Ch El (ft)	1028.20	Shear (lb/sq ft)		0.52
Alpha	1.00	Stream Power (lb/ft s)		2.77
Frctn Loss (ft)	0.87	Cum Volume (acre-ft)		34.96
C & E Loss (ft)	0.00	Cum SA (acres)		11.50

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.455

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
900	1032.68	930	1028.73	1000	1028.03	1070	1027.33	1100	1032.68

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
900	.035	900	.03	1100	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
900	1100	300	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1031.70	Element	Left OB	Channel

Right OB

Vel Head (ft)	0.45	Wt. n-Val.		0.030
W.S. Elev (ft)	1031.25	Reach Len. (ft)	300.00	300.00

300.00

Crit W.S. (ft)		Flow Area (sq ft)		517.84
E.G. Slope (ft/ft)	0.002906	Area (sq ft)		517.84

Q Total (cfs)	2780.00	Flow (cfs)	2780.00
Top Width (ft)	181.11	Top Width (ft)	181.11
Vel Total (ft/s)	5.37	Avg. Vel. (ft/s)	5.37
Max Chl Dpth (ft)	3.92	Hydr. Depth (ft)	2.86
Conv. Total (cfs)	51572.5	Conv. (cfs)	51572.5
Length Wtd. (ft)	300.00	Wetted Per. (ft)	181.63
Min Ch El (ft)	1027.33	Shear (lb/sq ft)	0.52
Alpha	1.00	Stream Power (lb/ft s)	2.78
Frctn Loss (ft)	0.87	Cum Volume (acre-ft)	31.39
C & E Loss (ft)	0.00	Cum SA (acres)	10.25

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.398

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
900	1031.81	930	1027.86	1000	1027.16	1070	1026.46	1100	1031.81

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
900	.035	900	.03	1100	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
900	1100	300	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1030.82	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.45	Wt. n-Val.		0.030
W.S. Elev (ft)	1030.37	Reach Len. (ft)	300.00	300.00
300.00				
Crit W.S. (ft)		Flow Area (sq ft)		516.72
E.G. Slope (ft/ft)	0.002925	Area (sq ft)		516.72
Q Total (cfs)	2780.00	Flow (cfs)		2780.00
Top Width (ft)	181.03	Top Width (ft)		181.03
Vel Total (ft/s)	5.38	Avg. Vel. (ft/s)		5.38
Max Chl Dpth (ft)	3.91	Hydr. Depth (ft)		2.85

Conv. Total (cfs)	51401.2	Conv. (cfs)	51401.2
Length Wtd. (ft)	300.00	Wetted Per. (ft)	181.54
Min Ch El (ft)	1026.46	Shear (lb/sq ft)	0.52
Alpha	1.00	Stream Power (lb/ft s)	2.80
Frctn Loss (ft)	0.90	Cum Volume (acre-ft)	27.83
C & E Loss (ft)	0.00	Cum SA (acres)	9.01

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.341

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
900	1030.94	930	1026.99	1000	1026.29	1070	1025.59	1100	1030.94

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
900	.035	900	.03	1100	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
900	1100	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1029.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.46	Wt. n-Val.		0.030	
W.S. Elev (ft)	1029.46	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		509.48	
E.G. Slope (ft/ft)	0.003054	Area (sq ft)		509.48	
Q Total (cfs)	2780.00	Flow (cfs)		2780.00	
Top Width (ft)	180.50	Top Width (ft)		180.50	
Vel Total (ft/s)	5.46	Avg. Vel. (ft/s)		5.46	
Max Chl Dpth (ft)	3.87	Hydr. Depth (ft)		2.82	
Conv. Total (cfs)	50305.8	Conv. (cfs)		50305.8	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		181.01	
Min Ch El (ft)	1025.59	Shear (lb/sq ft)		0.54	
Alpha	1.00	Stream Power (lb/ft s)		2.93	

Frctn Loss (ft)	0.31	Cum Volume (acre-ft)	24.30
C & E Loss (ft)	0.00	Cum SA (acres)	7.76

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.320

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
900	1030.65	930	1026.7	1000	1026	1070	1025.3	1100	1030.65

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
900	.035	900	.03	1100	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
900	1100	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	1029.62	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.47	Wt. n-Val.		0.030	
W.S. Elev (ft)	1029.14	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		504.02	
E.G. Slope (ft/ft)	0.003156	Area (sq ft)		504.02	
Q Total (cfs)	2780.00	Flow (cfs)		2780.00	
Top Width (ft)	180.10	Top Width (ft)		180.10	
Vel Total (ft/s)	5.52	Avg. Vel. (ft/s)		5.52	
Max Chl Dpth (ft)	3.84	Hydr. Depth (ft)		2.80	
Conv. Total (cfs)	49483.4	Conv. (cfs)		49483.4	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		180.61	
Min Ch El (ft)	1025.30	Shear (lb/sq ft)		0.55	
Alpha	1.00	Stream Power (lb/ft s)		3.03	
Frctn Loss (ft)	0.30	Cum Volume (acre-ft)		23.13	
C & E Loss (ft)	0.00	Cum SA (acres)		7.35	

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.300

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
910	1030.36	940	1025.61	1000	1025.31	1060	1025.01	1090	1030.36

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
910	.035	910	.03	1090	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
910	1090	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1029.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.49	Wt. n-Val.		0.030	
W.S. Elev (ft)	1028.82	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		494.11	
E.G. Slope (ft/ft)	0.002922	Area (sq ft)		494.11	
Q Total (cfs)	2780.00	Flow (cfs)		2780.00	
Top Width (ft)	161.61	Top Width (ft)		161.61	
Vel Total (ft/s)	5.63	Avg. Vel. (ft/s)		5.63	
Max Chl Dpth (ft)	3.81	Hydr. Depth (ft)		3.06	
Conv. Total (cfs)	51428.7	Conv. (cfs)		51428.7	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		162.21	
Min Ch El (ft)	1025.01	Shear (lb/sq ft)		0.56	
Alpha	1.00	Stream Power (lb/ft s)		3.13	
Frctn Loss (ft)	0.29	Cum Volume (acre-ft)		21.99	
C & E Loss (ft)	0.00	Cum SA (acres)		6.96	

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.284

INPUT
Description:
Station Elevation Data num= 5

```
     Sta     Elev       Sta     Elev      Sta     Elev       Sta     Elev       Sta     Elev
     9101029.979        940 1025.32      1000 1025.02       1060 1024.72       1090 1029.97

Manning's n Values            num=        3
     Sta    n Val       Sta    n Val      Sta    n Val
     910     .035       910      .03     1090     .035

Bank Sta: Left    Right      Lengths: Left Channel     Right       Coeff Contr.     Expan.
           910     1090                300     300      300                 .1          .3

CROSS SECTION OUTPUT   Profile #PF 1

  E.G. Elev (ft)              1029.02     Element                        Left OB     Channel
Right OB
  Vel Head (ft)                  0.49     Wt. n-Val.                                   0.030
  W.S. Elev (ft)              1028.53     Reach Len. (ft)                300.00      300.00
 300.00
  Crit W.S. (ft)                          Flow Area (sq ft)                          495.50
  E.G. Slope (ft/ft)         0.002914     Area (sq ft)                               495.50
  Q Total (cfs)               2780.00     Flow (cfs)                                2780.00
  Top Width (ft)               162.42     Top Width (ft)                             162.42
  Vel Total (ft/s)               5.61     Avg. Vel. (ft/s)                             5.61
  Max Chl Dpth (ft)              3.81     Hydr. Depth (ft)                             3.05
  Conv. Total (cfs)           51502.8     Conv. (cfs)                               51502.8
  Length Wtd. (ft)             300.00     Wetted Per. (ft)                           162.99
  Min Ch El (ft)              1024.72     Shear (lb/sq ft)                             0.55
  Alpha                          1.00     Stream Power (lb/ft s)                       3.10
  Frctn Loss (ft)                0.88     Cum Volume (acre-ft)                        20.85
  C & E Loss (ft)                0.00     Cum SA (acres)                               6.58


CROSS SECTION

RIVER: Bullard Wash
REACH: 1                      RS: 1.227

INPUT
Description:
Station Elevation Data        num=        5
     Sta     Elev       Sta     Elev      Sta     Elev       Sta     Elev       Sta     Elev
     910   1029.1       940 1024.45      1000 1024.15       1060 1023.85       1090   1029.1

Manning's n Values            num=        3
     Sta    n Val       Sta    n Val      Sta    n Val
     910     .035       910      .03     1090     .035

Bank Sta: Left    Right      Lengths: Left Channel     Right       Coeff Contr.     Expan.
```

910	1090	300	300	300		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

				Left OB	Channel	Right OB
E.G. Elev (ft)	1028.13	Element		Left OB	Channel	Right OB
Vel Head (ft)	0.49	Wt. n-Val.			0.030	
W.S. Elev (ft)	1027.64	Reach Len. (ft)		300.00	300.00	300.00
Crit W.S. (ft)		Flow Area (sq ft)			492.53	
E.G. Slope (ft/ft)	0.002968	Area (sq ft)			492.53	
Q Total (cfs)	2780.00	Flow (cfs)			2780.00	
Top Width (ft)	162.23	Top Width (ft)			162.23	
Vel Total (ft/s)	5.64	Avg. Vel. (ft/s)			5.64	
Max Chl Dpth (ft)	3.79	Hydr. Depth (ft)			3.04	
Conv. Total (cfs)	51029.5	Conv. (cfs)			51029.5	
Length Wtd. (ft)	300.00	Wetted Per. (ft)			162.80	
Min Ch El (ft)	1023.85	Shear (lb/sq ft)			0.56	
Alpha	1.00	Stream Power (lb/ft s)			3.16	
Frctn Loss (ft)	0.95	Cum Volume (acre-ft)			17.45	
C & E Loss (ft)	0.00	Cum SA (acres)			5.47	

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.170

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
910	1028.23	940	1023.58	1000	1023.28	1060	1022.98	1090	1028.23

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
910	.035	910	.03	1090	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
910	1090	300	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1027.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.54	Wt. n-Val.		0.030	

W.S. Elev (ft)	1026.64	Reach Len. (ft)	300.00	300.00
300.00				
Crit W.S. (ft)		Flow Area (sq ft)		472.15
E.G. Slope (ft/ft)	0.003373	Area (sq ft)		472.15
Q Total (cfs)	2780.00	Flow (cfs)		2780.00
Top Width (ft)	160.69	Top Width (ft)		160.69
Vel Total (ft/s)	5.89	Avg. Vel. (ft/s)		5.89
Max Chl Dpth (ft)	3.66	Hydr. Depth (ft)		2.94
Conv. Total (cfs)	47864.3	Conv. (cfs)		47864.3
Length Wtd. (ft)	300.00	Wetted Per. (ft)		161.25
Min Ch El (ft)	1022.98	Shear (lb/sq ft)		0.62
Alpha	1.00	Stream Power (lb/ft s)		3.63
Frctn Loss (ft)	0.87	Cum Volume (acre-ft)		14.13
C & E Loss (ft)	0.04	Cum SA (acres)		4.35

LATERAL STRUCTURE

RIVER: Bullard Wash
REACH: 1 RS: 1.160

INPUT
Description:
Lateral structure position = Right overbank
Distance from Upstream XS = 1
Deck/Roadway Width = 10
Weir Coefficient = 2.8
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1028	9	1026	125	1025.55	140	1028

Weir crest shape = Broad Crested

LATERAL STRUCTURE OUTPUT Profile #PF 1 Lat Struct

E.G. US. (ft)	1027.18	Weir Sta US (ft)	
W.S. US. (ft)	1026.64	Weir Sta DS (ft)	
E.G. DS (ft)	1027.18	Weir Max Depth (ft)	0.00
W.S. DS (ft)	1026.64	Weir Avg Depth (ft)	0.00
Q US (cfs)	2780.00	Weir Submerg	0.00
Q Leaving Total (cfs)	0.00	Min El Weir Flow (ft)	0.00
Q DS (cfs)	2500.00	Wr Top Wdth (ft)	0.00
Perc Q Leaving	0.00	Q Gate Group (cfs)	
Q Weir (cfs)	0.00	Gate Open Ht (ft)	
Q Gates (cfs)	0.00	Gate #Open	
Q Culv (cfs)	0.00	Gate Area (sq ft)	

```
Q Lat RC (cfs)              0.00    Gate Submerg
Weir Flow Area (sq ft)      0.00    Gate Invert (ft)
```

CROSS SECTION

RIVER: Bullard Wash
REACH: 1   RS: 1.114

INPUT
Description:

```
Station Elevation Data     num=       5
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
     910 1027.36      940 1022.71     1000 1022.41     1060 1022.11     1090 1027.36

Manning's n Values         num=       3
     Sta    n Val     Sta    n Val     Sta    n Val
     910    .035      910     .03     1090    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
           910    1090              300     300     300                .1       .3
```

CROSS SECTION OUTPUT Profile #PF 1

```
  E.G. Elev (ft)            1026.27    Element                    Left OB    Channel
Right OB
  Vel Head (ft)                0.41    Wt. n-Val.                              0.030
  W.S. Elev (ft)            1025.86    Reach Len. (ft)             300.00     300.00
 300.00
  Crit W.S. (ft)                       Flow Area (sq ft)                      486.09
  E.G. Slope (ft/ft)       0.002498    Area (sq ft)                           486.09
  Q Total (cfs)             2500.00    Flow (cfs)                            2500.00
  Top Width (ft)             161.74    Top Width (ft)                         161.74
  Vel Total (ft/s)             5.14    Avg. Vel. (ft/s)                         5.14
  Max Chl Dpth (ft)            3.75    Hydr. Depth (ft)                         3.01
  Conv. Total (cfs)         50022.0    Conv. (cfs)                           50022.0
  Length Wtd. (ft)           300.00    Wetted Per. (ft)                       162.31
  Min Ch El (ft)            1022.11    Shear (lb/sq ft)                         0.47
  Alpha                        1.00    Stream Power (lb/ft s)                   2.40
  Frctn Loss (ft)              0.91    Cum Volume (acre-ft)                    10.83
  C & E Loss (ft)              0.01    Cum SA (acres)                           3.24
```

CROSS SECTION

RIVER: Bullard Wash

REACH: 1 RS: 1.057

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
910	1026.49	940	1021.89	1000	1021.59	1033.06	1021.45	1040.32	1021.42
1049.19	1022.51	1066.13	1022.51	1069.35	1022.96	1090	1026.49		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
910	.035	910	.03	1090	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
910	1090	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1025.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.53	Wt. n-Val.		0.030	
W.S. Elev (ft)	1024.81	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	1024.03	Flow Area (sq ft)		426.73	
E.G. Slope (ft/ft)	0.003774	Area (sq ft)		426.73	
Q Total (cfs)	2500.00	Flow (cfs)		2500.00	
Top Width (ft)	159.26	Top Width (ft)		159.26	
Vel Total (ft/s)	5.86	Avg. Vel. (ft/s)		5.86	
Max Chl Dpth (ft)	3.39	Hydr. Depth (ft)		2.68	
Conv. Total (cfs)	40693.6	Conv. (cfs)		40693.6	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		159.74	
Min Ch El (ft)	1021.42	Shear (lb/sq ft)		0.63	
Alpha	1.00	Stream Power (lb/ft s)		3.69	
Frctn Loss (ft)	0.41	Cum Volume (acre-ft)		7.69	
C & E Loss (ft)	0.07	Cum SA (acres)		2.14	

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: Bullard Wash
REACH: 1 RS: 1.036

INPUT

Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
930	1026.2	950	1021.2	1000	1020.95	1050	1021.2	1070	1026.2

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
930	.035	930	.02	1070	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
930	1070	25	25	25	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1024.87	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.20	Wt. n-Val.		0.020	
W.S. Elev (ft)	1023.68	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)	1023.68	Flow Area (sq ft)		284.90	
E.G. Slope (ft/ft)	0.004426	Area (sq ft)		284.90	
Q Total (cfs)	2500.00	Flow (cfs)		2500.00	
Top Width (ft)	119.83	Top Width (ft)		119.83	
Vel Total (ft/s)	8.77	Avg. Vel. (ft/s)		8.77	
Max Chl Dpth (ft)	2.73	Hydr. Depth (ft)		2.38	
Conv. Total (cfs)	37579.3	Conv. (cfs)		37579.3	
Length Wtd. (ft)	25.00	Wetted Per. (ft)		120.44	
Min Ch El (ft)	1020.95	Shear (lb/sq ft)		0.65	
Alpha	1.00	Stream Power (lb/ft s)		5.74	
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)		6.87	
C & E Loss (ft)	0.29	Cum SA (acres)		1.82	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set

equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there is
not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.032

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
916	1022	950	1016.34	1000	1016.09	1050	1016.34	1084	1022

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
916	.035	916	.02	1084	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
916	1084	175	175	175	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	1021.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.22	Wt. n-Val.		0.020	
W.S. Elev (ft)	1021.32	Reach Len. (ft)	175.00	175.00	175.00
Crit W.S. (ft)	1018.78	Flow Area (sq ft)		659.44	
E.G. Slope (ft/ft)	0.000396	Area (sq ft)		659.44	
Q Total (cfs)	2500.00	Flow (cfs)		2500.00	
Top Width (ft)	159.83	Top Width (ft)		159.83	
Vel Total (ft/s)	3.79	Avg. Vel. (ft/s)		3.79	
Max Chl Dpth (ft)	5.23	Hydr. Depth (ft)		4.13	
Conv. Total (cfs)	125601.7	Conv. (cfs)		125601.7	
Length Wtd. (ft)	175.00	Wetted Per. (ft)		160.65	
Min Ch El (ft)	1016.09	Shear (lb/sq ft)		0.10	
Alpha	1.00	Stream Power (lb/ft s)		0.38	
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)		6.60	
C & E Loss (ft)	0.01	Cum SA (acres)		1.74	

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.023

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
906	1023	950	1015.88	1000	1015.88	1050	1015.88	1094	1023

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
906	.035	906	.02	1094	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
906	1094	20	20	20	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1021.47	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.		0.020	
W.S. Elev (ft)	1021.28	Reach Len. (ft)	20.00	20.00	20.00
Crit W.S. (ft)		Flow Area (sq ft)		720.87	
E.G. Slope (ft/ft)	0.000312	Area (sq ft)		720.87	
Q Total (cfs)	2500.00	Flow (cfs)		2500.00	
Top Width (ft)	166.79	Top Width (ft)		166.79	
Vel Total (ft/s)	3.47	Avg. Vel. (ft/s)		3.47	
Max Chl Dpth (ft)	5.40	Hydr. Depth (ft)		4.32	
Conv. Total (cfs)	141613.8	Conv. (cfs)		141613.8	
Length Wtd. (ft)	20.00	Wetted Per. (ft)		167.66	
Min Ch El (ft)	1015.88	Shear (lb/sq ft)		0.08	
Alpha	1.00	Stream Power (lb/ft s)		0.29	
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)		3.83	
C & E Loss (ft)	0.00	Cum SA (acres)		1.08	

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.019

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
906	1023	950	1016.07	1000	1015.82	1050	1016.07	1094	1023

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
906	.035	906	.02	1094	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
906	1094	15	15	15	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	1021.46	Wt. n-Val.		0.020	
Vel Head (ft)	0.22	Reach Len. (ft)	15.00	15.00	15.00
W.S. Elev (ft)	1021.24	Flow Area (sq ft)		698.80	
Crit W.S. (ft)		Area (sq ft)		698.80	
E.G. Slope (ft/ft)	0.000383	Flow (cfs)		2644.00	
Q Total (cfs)	2644.00	Top Width (ft)		165.62	
Top Width (ft)	165.62	Avg. Vel. (ft/s)		3.78	
Vel Total (ft/s)	3.78	Hydr. Depth (ft)		4.22	
Max Chl Dpth (ft)	5.42	Conv. (cfs)		135124.1	
Conv. Total (cfs)	135124.1	Wetted Per. (ft)		166.43	
Length Wtd. (ft)	15.00	Shear (lb/sq ft)		0.10	
Min Ch El (ft)	1015.82	Stream Power (lb/ft s)		0.38	
Alpha	1.00	Cum Volume (acre-ft)		3.50	
Frctn Loss (ft)	0.01	Cum SA (acres)		1.01	
C & E Loss (ft)	0.01				

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.016

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
906	1023	950	1015.76	1000	1015.76	1050	1015.76	1094	1023

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
906	.035	906	.02	1094	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
906	1094	14.5	14.5	14.5	.5	1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1021.45	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.20	Wt. n-Val.		0.020
W.S. Elev (ft)	1021.25	Reach Len. (ft)	14.50	14.50
14.50				
Crit W.S. (ft)		Flow Area (sq ft)		731.47
E.G. Slope (ft/ft)	0.000332	Area (sq ft)		731.47
Q Total (cfs)	2644.00	Flow (cfs)		2644.00
Top Width (ft)	166.68	Top Width (ft)		166.68
Vel Total (ft/s)	3.61	Avg. Vel. (ft/s)		3.61
Max Chl Dpth (ft)	5.49	Hydr. Depth (ft)		4.39
Conv. Total (cfs)	145150.6	Conv. (cfs)		145150.6
Length Wtd. (ft)	14.50	Wetted Per. (ft)		167.57
Min Ch El (ft)	1015.76	Shear (lb/sq ft)		0.09
Alpha	1.00	Stream Power (lb/ft s)		0.33
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)		3.25
C & E Loss (ft)	0.00	Cum SA (acres)		0.95

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: 1.013

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
906	1023	950	1015.92	1000	1015.67	1050	1015.92	1094	1023

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
906	.035	906	.02	1094	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
906	1094	140	140	140	.5	1

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1021.44	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.21	Wt. n-Val.		0.020
W.S. Elev (ft)	1021.23	Reach Len. (ft)	140.00	140.00

140.00

Crit W.S. (ft)	1018.44	Flow Area (sq ft)	718.72
E.G. Slope (ft/ft)	0.000350	Area (sq ft)	718.72
Q Total (cfs)	2644.00	Flow (cfs)	2644.00
Top Width (ft)	166.00	Top Width (ft)	166.00
Vel Total (ft/s)	3.68	Avg. Vel. (ft/s)	3.68
Max Chl Dpth (ft)	5.56	Hydr. Depth (ft)	4.33
Conv. Total (cfs)	141366.8	Conv. (cfs)	141366.8
Length Wtd. (ft)	140.00	Wetted Per. (ft)	166.85
Min Ch El (ft)	1015.67	Shear (lb/sq ft)	0.09
Alpha	1.00	Stream Power (lb/ft s)	0.35
Frctn Loss (ft)		Cum Volume (acre-ft)	3.01
C & E Loss (ft)		Cum SA (acres)	0.89

CULVERT

RIVER: Bullard Wash
REACH: 1 RS: 1.0

INPUT
Description:
Distance from Upstream XS = 5
Deck/Roadway Width = 122
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
894	1023.67	1015	935	1023.17	1015	1000	1022.94	1015
1072	1022.6	1015	1094	1022.53	1015			

Upstream Bridge Cross Section Data
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
906	1023	950	1015.92	1000	1015.67	1050	1015.92	1094	1023

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
906	.035	906	.02	1094	.035

Bank Sta: Left	Right	Coeff Contr.	Expan.
906	1094	.5	1

Downstream Deck/Roadway Coordinates
num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
894	1023.67	1015	935	1023.17	1015	1000	1022.94	1015
1072	1022.6	1015	1094	1022.53	1015			

Downstream Bridge Cross Section Data

Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
915	1022	938	1017	1000	1016.7	1060	1018	1088	1024

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
915	.035	915	.02	1088	.035

Bank Sta: Left	Right	Coeff Contr.	Expan.
915	1088	.5	1

```
Upstream Embankment side slope              =      4 horiz. to 1.0 vertical
Downstream Embankment side slope            =      4 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =    .95
Elevation at which weir flow begins         = 1022.53
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        5       10
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length   Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 5      128    .015     .015         0                   .5
    1
Number of Barrels =  10
Upstream   Elevation =  1015.67
Centerline Stations
```

Sta.	Sta.	Sta.	Sta.	Sta.	Sta.	Sta.	Sta.	Sta.	Sta.
950.5	961.5	972.5	983.5	994.5	1005.5	1016.5	1027.5	1038.5	1049.5

Downstream Elevation = 1015.44

Centerline Stations

Sta.	Sta.	Sta.	Sta.	Sta.	Sta.	Sta.	Sta.	Sta.	Sta.
950.5	961.5	972.5	983.5	994.5	1005.5	1016.5	1027.5	1038.5	1049.5

CULVERT OUTPUT Profile #PF 1 Culv Group: Culvert #1

Q Culv Group (cfs)	2644.00	Culv Full Len (ft)	128.00
# Barrels	10	Culv Vel US (ft/s)	5.29
Q Barrel (cfs)	264.40	Culv Vel DS (ft/s)	5.29
E.G. US. (ft)	1021.45	Culv Inv El Up (ft)	1015.67
W.S. US. (ft)	1021.23	Culv Inv El Dn (ft)	1015.44
E.G. DS (ft)	1021.05	Culv Frctn Ls (ft)	0.18
W.S. DS (ft)	1020.54	Culv Exit Loss (ft)	
Delta EG (ft)	0.40	Culv Entr Loss (ft)	0.22
Delta WS (ft)	0.69	Q Weir (cfs)	
E.G. IC (ft)	1020.16	Weir Sta Lft (ft)	
E.G. OC (ft)	1021.45	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	1020.67	Weir Max Depth (ft)	
Culv WS Outlet (ft)	1020.44	Weir Avg Depth (ft)	
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.79	Min El Weir Flow (ft)	1022.58

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: .987

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
915	1022	938	1017	1000	1016.7	1060	1018	1088	1024

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
915	.035	915	.02	1088	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
915	1088	63	60	61	.5	1

CROSS SECTION OUTPUT Profile #PF 1

		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	1021.05	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.50	Wt. n-Val.		0.020	
W.S. Elev (ft)	1020.54	Reach Len. (ft)	63.00	60.00	61.00
Crit W.S. (ft)		Flow Area (sq ft)		464.24	
E.G. Slope (ft/ft)	0.001312	Area (sq ft)		464.24	
Q Total (cfs)	2644.00	Flow (cfs)		2644.00	
Top Width (ft)	150.15	Top Width (ft)		150.15	
Vel Total (ft/s)	5.70	Avg. Vel. (ft/s)		5.70	
Max Chl Dpth (ft)	3.84	Hydr. Depth (ft)		3.09	
Conv. Total (cfs)	72985.6	Conv. (cfs)		72985.6	
Length Wtd. (ft)	60.00	Wetted Per. (ft)		150.81	
Min Ch El (ft)	1016.70	Shear (lb/sq ft)		0.25	
Alpha	1.00	Stream Power (lb/ft s)		1.44	
Frctn Loss (ft)	0.14	Cum Volume (acre-ft)		1.11	
C & E Loss (ft)	0.11	Cum SA (acres)		0.39	

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: .976

INPUT
Description:

Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
902	1022	953	1017	1000	1016.2	1041	1017	1091	1024

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
902	.035	902	.03	1091	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
902	1091	65	60	62	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel
E.G. Elev (ft)	1020.80	Element		
Right OB				
Vel Head (ft)	0.72	Wt. n-Val.		0.030
W.S. Elev (ft)	1020.09	Reach Len. (ft)	65.00	60.00
62.00				
Crit W.S. (ft)		Flow Area (sq ft)		389.19
E.G. Slope (ft/ft)	0.004899	Area (sq ft)		389.19
Q Total (cfs)	2644.00	Flow (cfs)		2644.00
Top Width (ft)	141.50	Top Width (ft)		141.50
Vel Total (ft/s)	6.79	Avg. Vel. (ft/s)		6.79
Max Chl Dpth (ft)	3.88	Hydr. Depth (ft)		2.75
Conv. Total (cfs)	37774.5	Conv. (cfs)		37774.5
Length Wtd. (ft)	60.00	Wetted Per. (ft)		141.88
Min Ch El (ft)	1016.20	Shear (lb/sq ft)		0.84
Alpha	1.00	Stream Power (lb/ft s)		5.70
Frctn Loss (ft)	0.30	Cum Volume (acre-ft)		0.52
C & E Loss (ft)	0.01	Cum SA (acres)		0.18

CROSS SECTION

RIVER: Bullard Wash
REACH: 1 RS: .964

INPUT
Description:

Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
925	1023	955	1017	1000	1015.6	1052	1017	1094	1024

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
925	.035	925	.03	1094	.035

Bank Sta: Left	Right	Coeff Contr.	Expan.
925	1094	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	1020.50				
Vel Head (ft)	0.79	Wt. n-Val.		0.030	
W.S. Elev (ft)	1019.70	Reach Len. (ft)			
Crit W.S. (ft)	1019.11	Flow Area (sq ft)		370.35	
E.G. Slope (ft/ft)	0.005001	Area (sq ft)		370.35	
Q Total (cfs)	2644.00	Flow (cfs)		2644.00	
Top Width (ft)	126.74	Top Width (ft)		126.74	
Vel Total (ft/s)	7.14	Avg. Vel. (ft/s)		7.14	
Max Chl Dpth (ft)	4.10	Hydr. Depth (ft)		2.92	
Conv. Total (cfs)	37388.2	Conv. (cfs)		37388.2	
Length Wtd. (ft)		Wetted Per. (ft)		127.27	
Min Ch El (ft)	1015.60	Shear (lb/sq ft)		0.91	
Alpha	1.00	Stream Power (lb/ft s)		6.49	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

SUMMARY OF MANNING'S N VALUES

River:Bullard Wash

Reach	River Sta.	n1	n2	n3
1	2.13	.035	.03	.035
1	2.12	.035	.03	.035
1	2.10	.035	.03	.035
1	2.09	Culvert		
1	2.080	.035	.03	.035
1	2.075	.035	.03	.035
1	2.023	.035	.03	.035
1	1.966	.035	.03	.035
1	1.909	.035	.03	.035
1	1.852	.035	.03	.035
1	1.795	.035	.03	.035
1	1.739	.035	.03	.035
1	1.727	.035	.03	.035

1	1.706	.035	.03	.035
1	1.682	.035	.03	.035
1	1.625	.035	.03	.035
1	1.568	.035	.03	.035
1	1.549	.035	.03	.035
1	1.511	.035	.03	.035
1	1.455	.035	.03	.035
1	1.398	.035	.03	.035
1	1.341	.035	.03	.035
1	1.320	.035	.03	.035
1	1.300	.035	.03	.035
1	1.284	.035	.03	.035
1	1.227	.035	.03	.035
1	1.170	.035	.03	.035
1	1.160	Lat Struct		
1	1.114	.035	.03	.035
1	1.057	.035	.03	.035
1	1.036	.035	.02	.035
1	1.032	.035	.02	.035
1	1.023	.035	.02	.035
1	1.019	.035	.02	.035
1	1.016	.035	.02	.035
1	1.013	.035	.02	.035
1	1.0	Culvert		
1	.987	.035	.02	.035
1	.976	.035	.03	.035
1	.964	.035	.03	.035

SUMMARY OF REACH LENGTHS

River: Bullard Wash

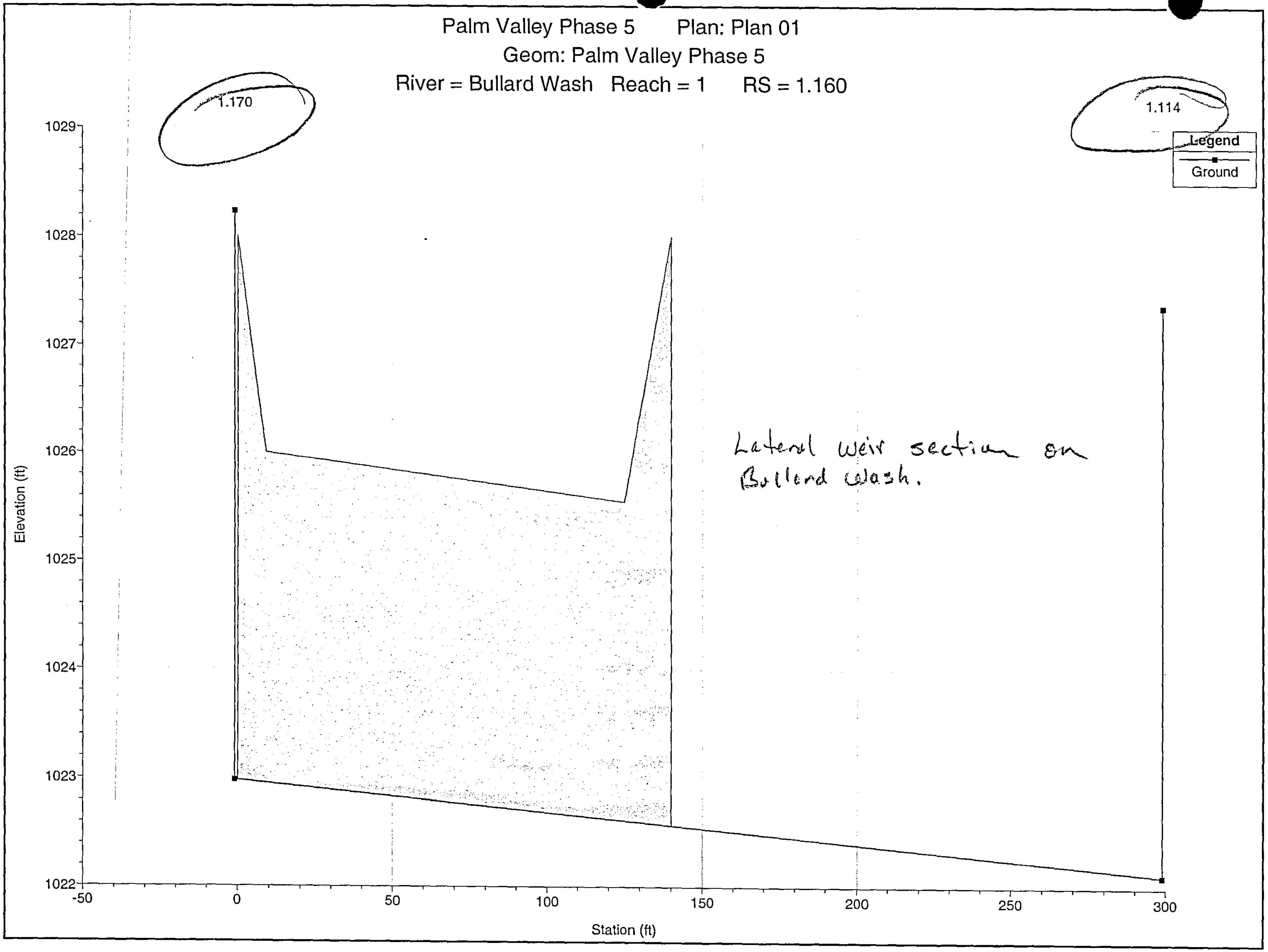
Reach	River Sta.	Left	Channel	Right
1	2.13	50	50	50
1	2.12	50	50	50
1	2.10	173	173	173
1	2.09	Culvert		
1	2.080	28	28	28
1	2.075	252	252	252
1	2.023	300	300	300
1	1.966	300	300	300
1	1.909	300	300	300
1	1.852	300	300	300
1	1.795	300	300	300
1	1.739	64	64	64
1	1.727	105	105	105
1	1.706	131	131	131
1	1.682	300	300	300
1	1.625	300	300	300
1	1.568	100	100	100
1	1.549	200	200	200
1	1.511	300	300	300
1	1.455	300	300	300
1	1.398	300	300	300
1	1.341	100	100	100
1	1.320	100	100	100
1	1.300	100	100	100
1	1.284	300	300	300
1	1.227	300	300	300

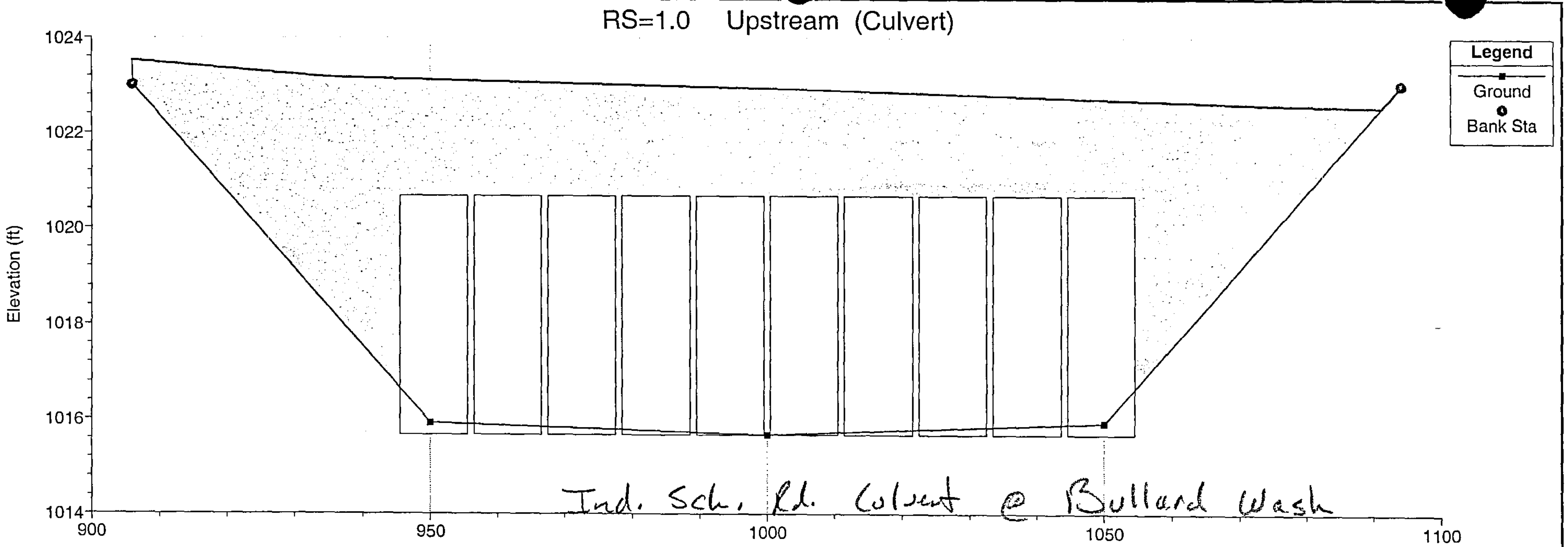
1	1.170	300	300	300
1	1.160	Lat Struct		
1	1.114	300	300	300
1	1.057	100	100	100
1	1.036	25	25	25
1	1.032	175	175	175
1	1.023	20	20	20
1	1.019	15	15	15
1	1.016	14.5	14.5	14.5
1	1.013	140	140	140
1	1.0	Culvert		
1	.987	63	60	61
1	.976	65	60	62
1	.964			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Bullard Wash

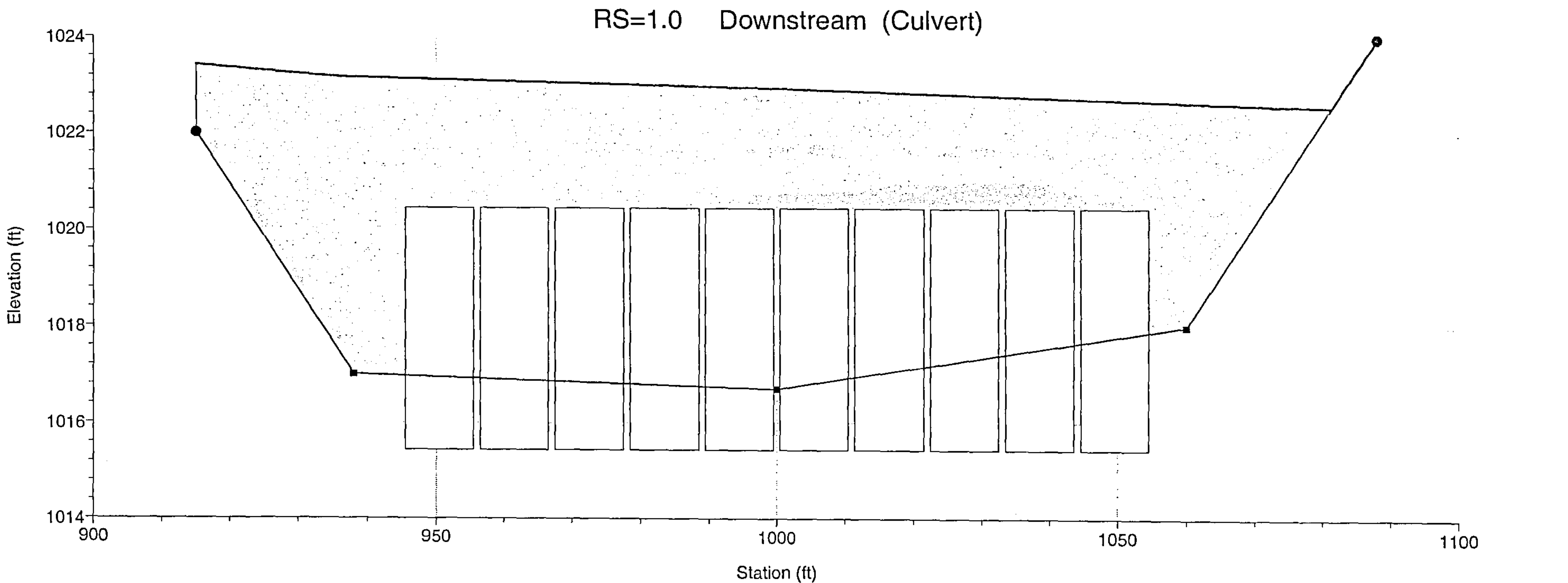
Reach	River Sta.	Contr.	Expan.
1	2.13	.5	1
1	2.12	.5	1
1	2.10	.5	1
1	2.09	Culvert	
1	2.080	.5	1
1	2.075	.5	1
1	2.023	.1	.3
1	1.966	.1	.3
1	1.909	.1	.3
1	1.852	.1	.3
1	1.795	.1	.3
1	1.739	.1	.3
1	1.727	.3	.5
1	1.706	.3	.5
1	1.682	.1	.3
1	1.625	.1	.3
1	1.568	.1	.3
1	1.549	.1	.3
1	1.511	.1	.3
1	1.455	.1	.3
1	1.398	.1	.3
1	1.341	.1	.3
1	1.320	.1	.3
1	1.300	.1	.3
1	1.284	.1	.3
1	1.227	.1	.3
1	1.170	.1	.3
1	1.160	Lat Struct	
1	1.114	.1	.3
1	1.057	.1	.3
1	1.036	.1	.3
1	1.032	.1	.3
1	1.023	.1	.3
1	1.019	.1	.3
1	1.016	.5	1
1	1.013	.5	1
1	1.0	Culvert	
1	.987	.5	1
1	.976	.1	.3

1	.964	.1	.3

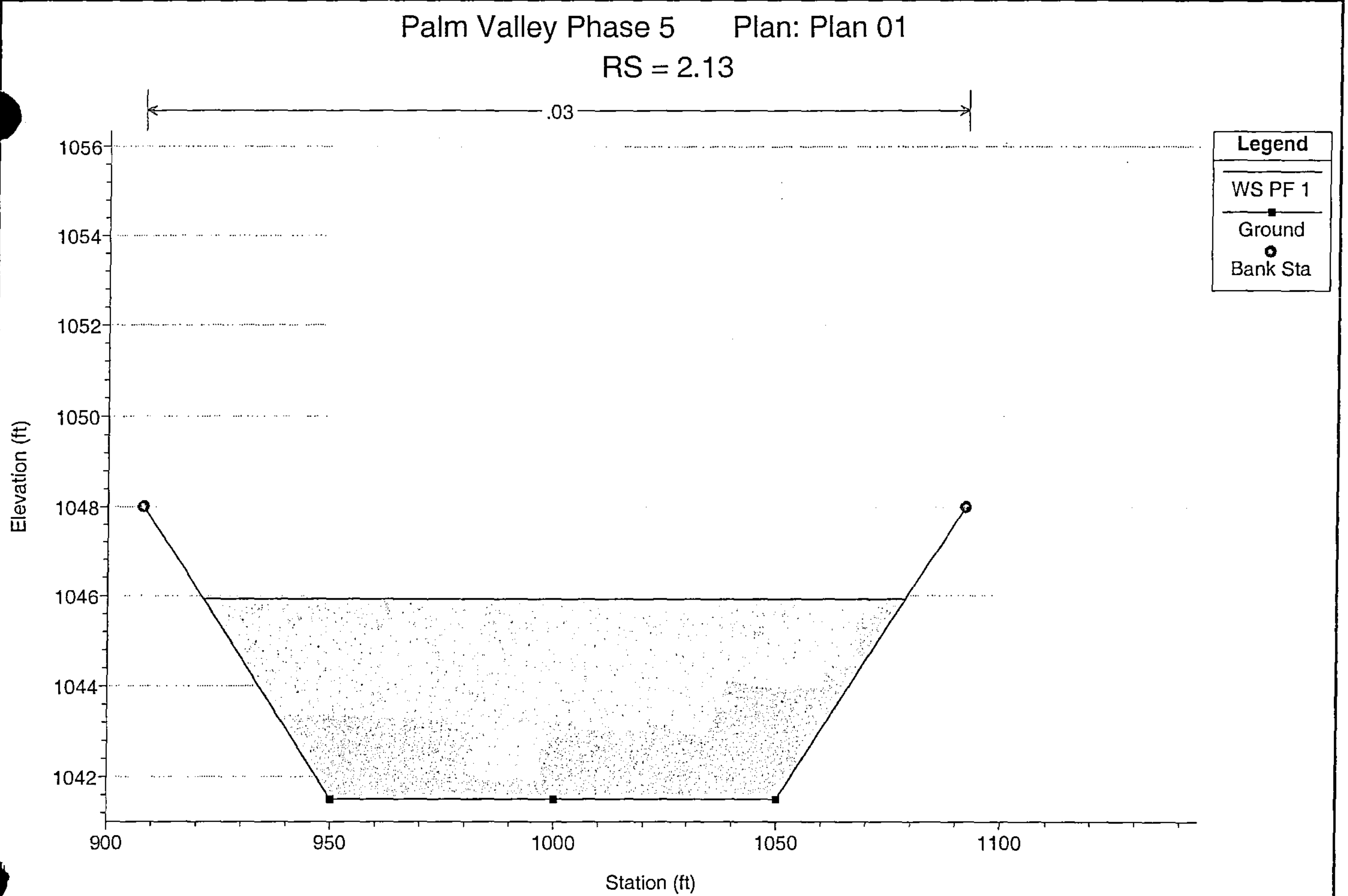

Palm Valley Phase 5 Plan: Plan 01
Geom: Palm Valley Phase 5
River = Bullard Wash Reach = 1 RS = 1.160
1.170
1.114
Legend
Ground
Elevation (ft)
1029
1028
1027
1026
1025
1024
1023
1022
-50
0
50
100
150
200
250
300
Station (ft)
Lateral weir section on Bullard Wash.

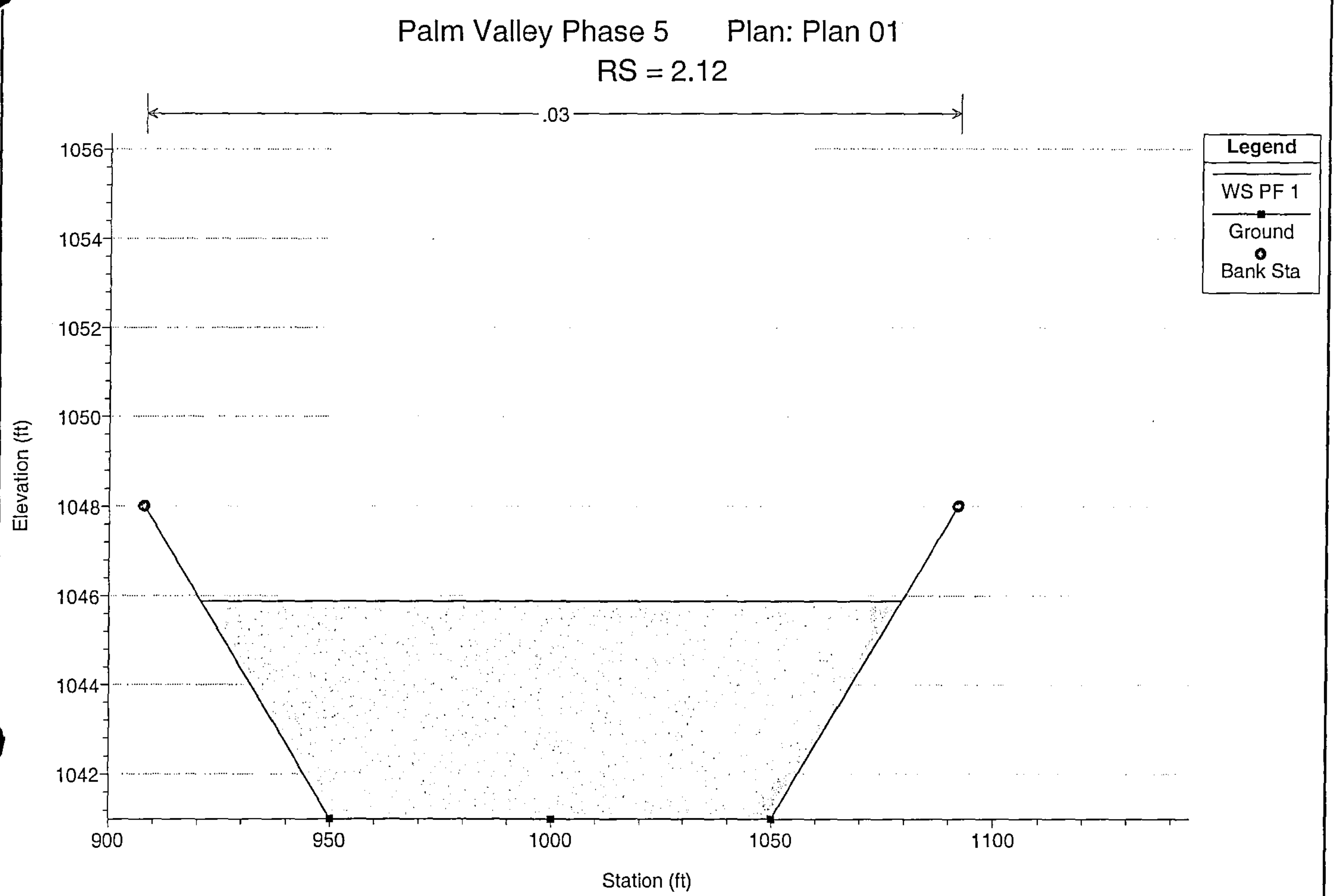


RS=1.0 Upstream (Culvert)
Legend
Ground
Bank Sta
Elevation (ft)
1024
1022
1020
1018
1016
1014
900
950
1000
1050
1100
Ind. Sch. Rd. Culvert @ Bullard Wash

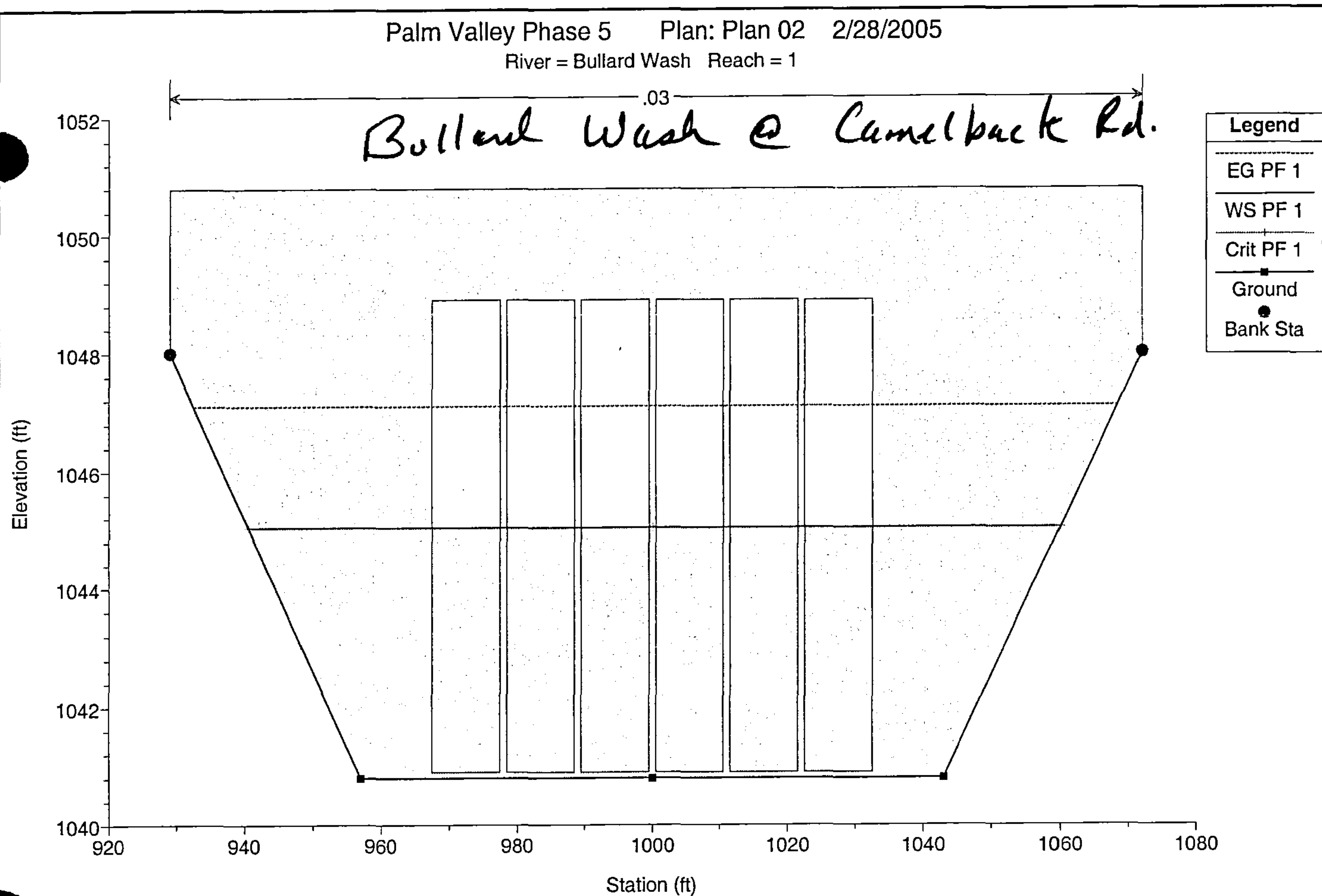


RS=1.0 Downstream (Culvert)
Elevation (ft)
1024
1022
1020
1018
1016
1014
900
950
1000
1050
1100
Station (ft)

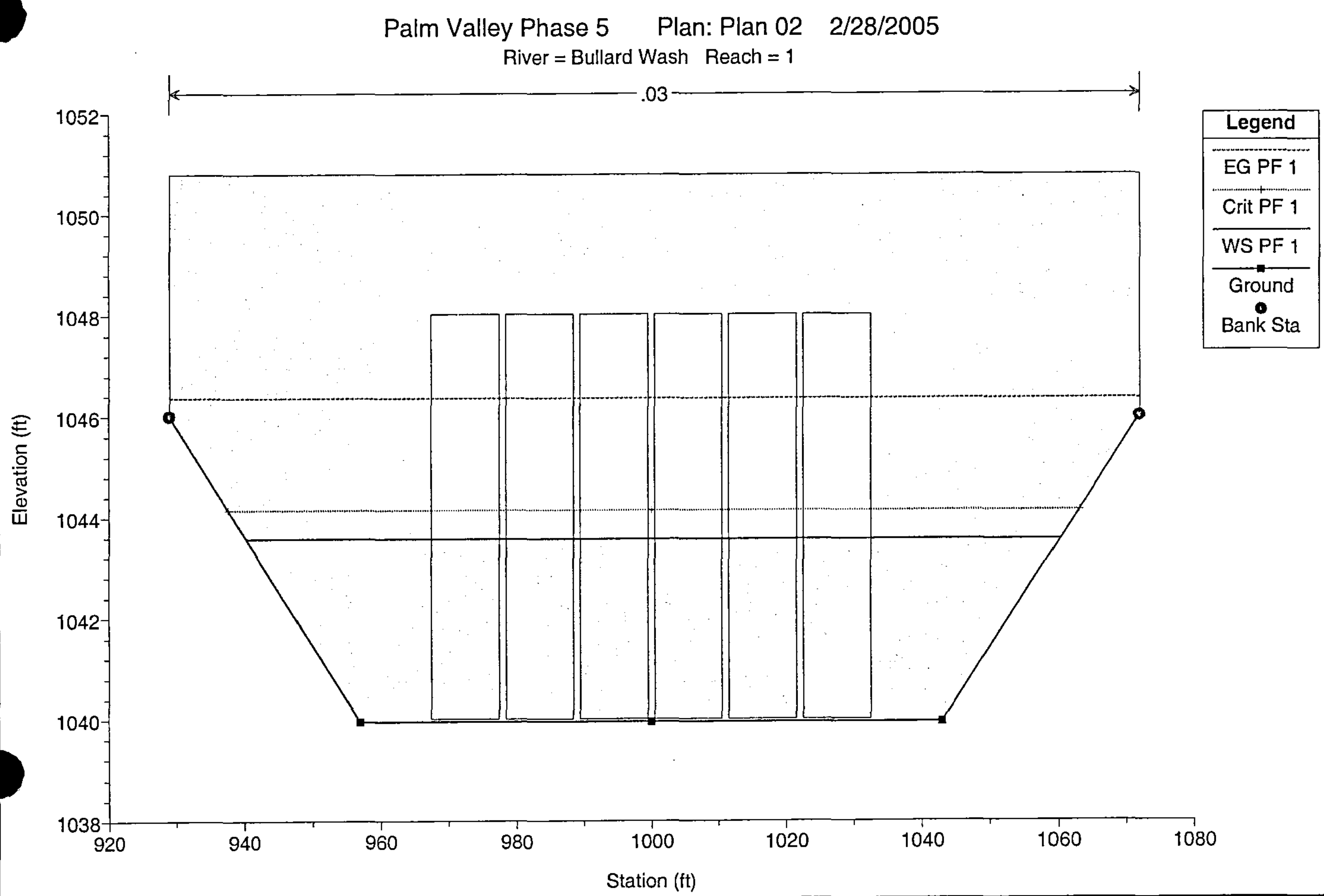




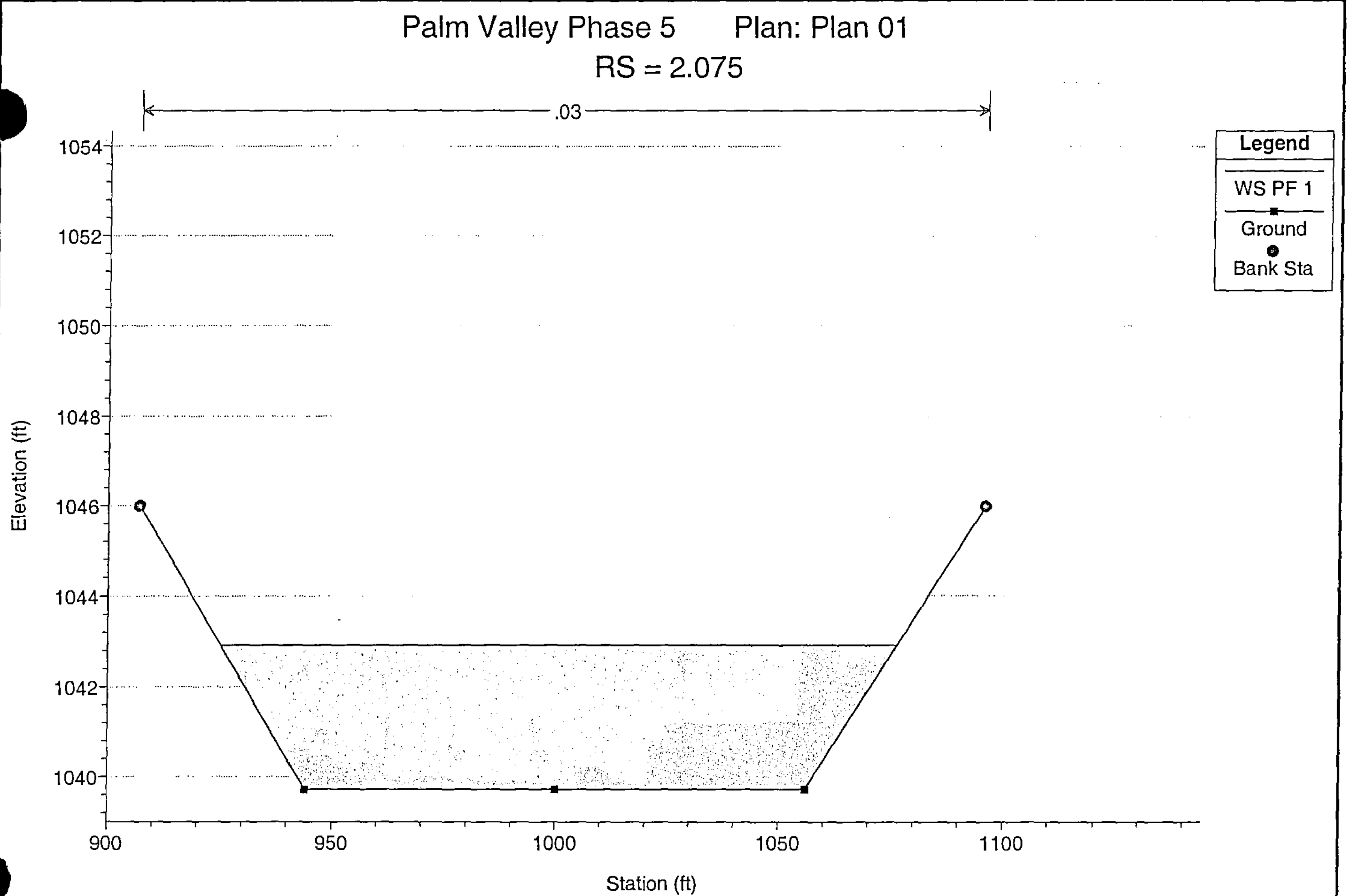
1 in Horiz. = 40 ft 1 in Vert. = 4 ft

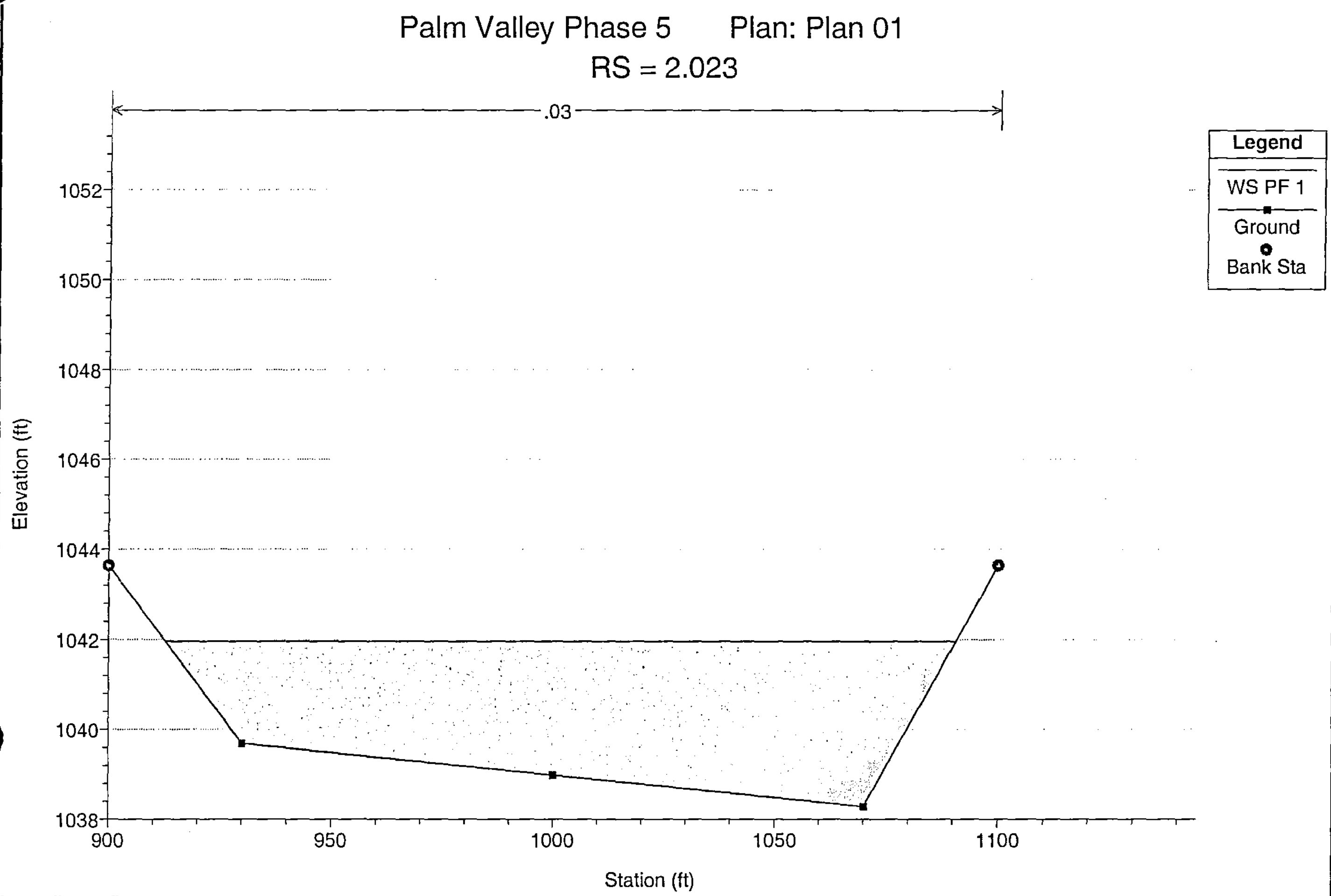


Palm Valley Phase 5 Plan: Plan 02 2/28/2005
River = Bullard Wash Reach = 1
.03
Bullard Wash @ Camelback Rd.
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
1052
1050
1048
1046
1044
1042
1040
Station (ft)
920
940
960
980
1000
1020
1040
1060
1080

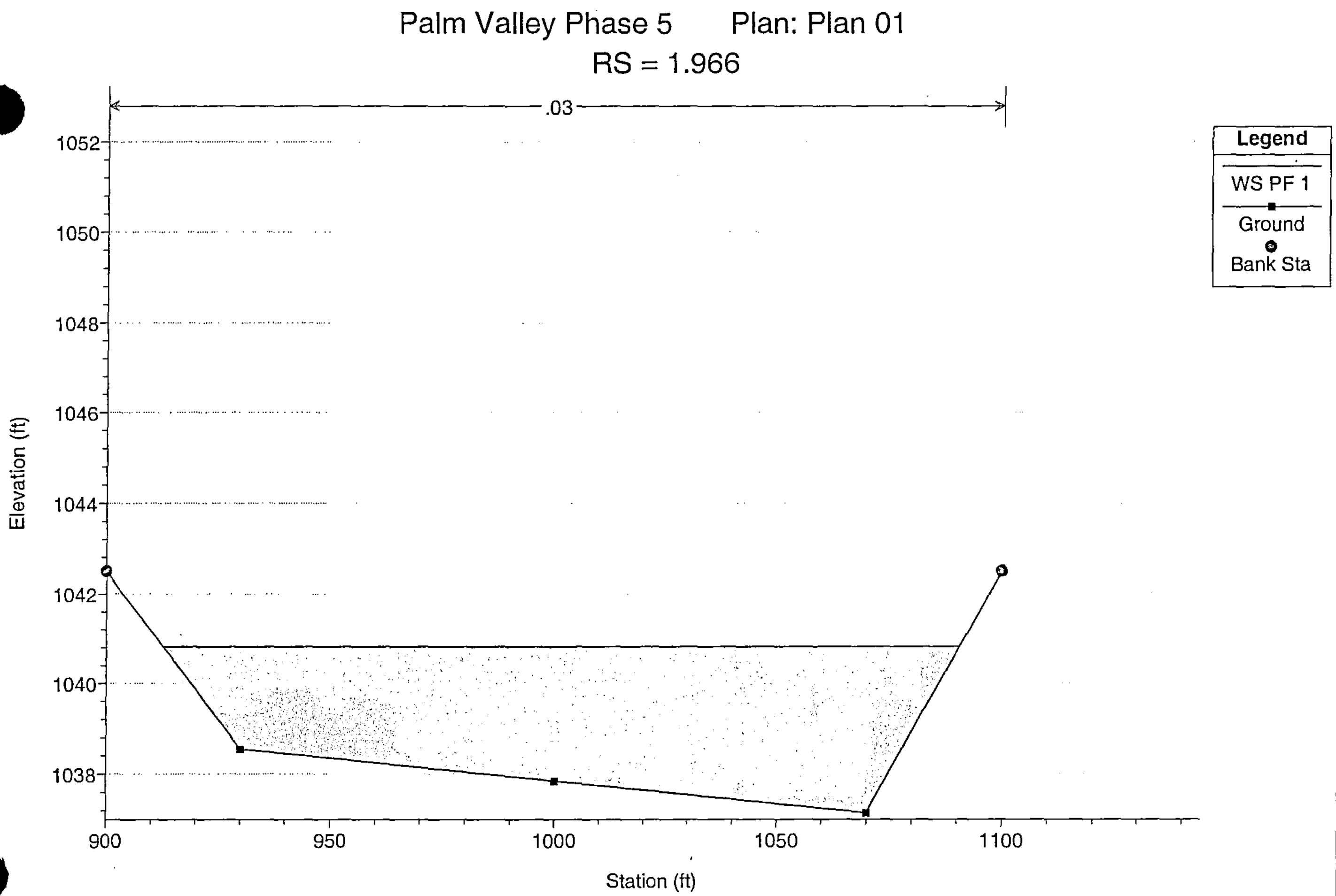


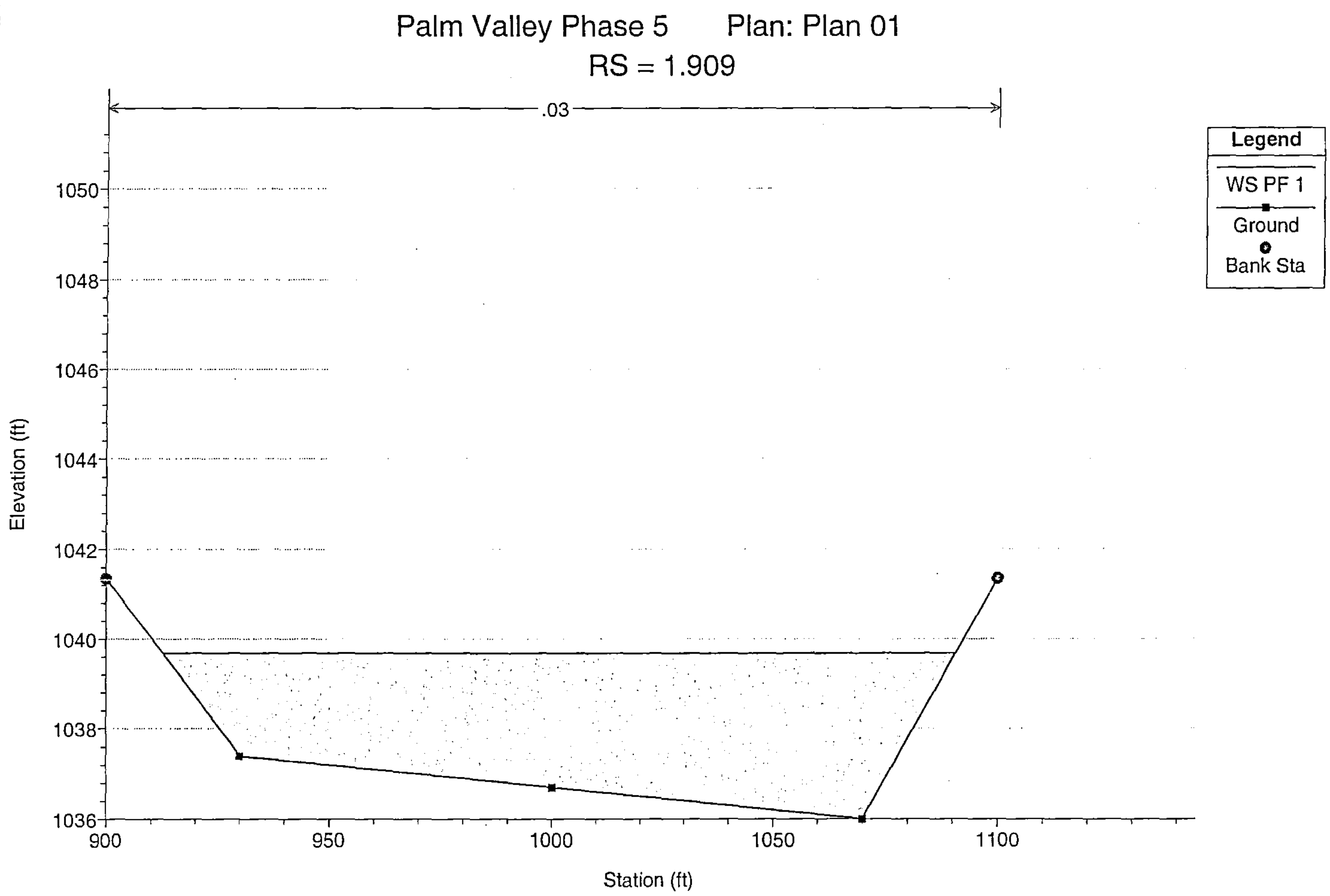
Palm Valley Phase 5 Plan: Plan 02 2/28/2005
River = Bullard Wash Reach = 1
.03
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1052
1050
1048
1046
1044
1042
1040
1038
Station (ft)
920
940
960
980
1000
1020
1040
1060
1080



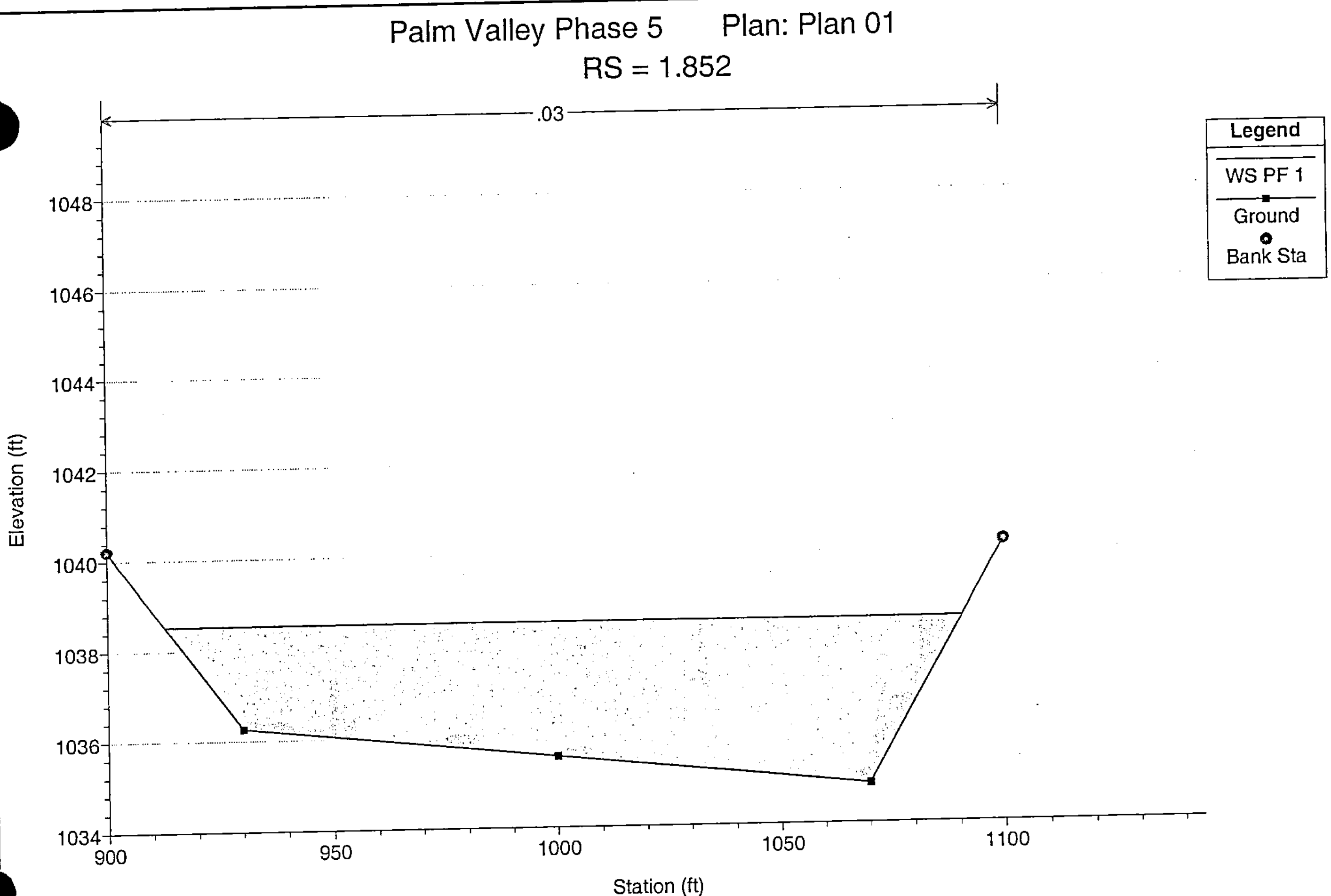


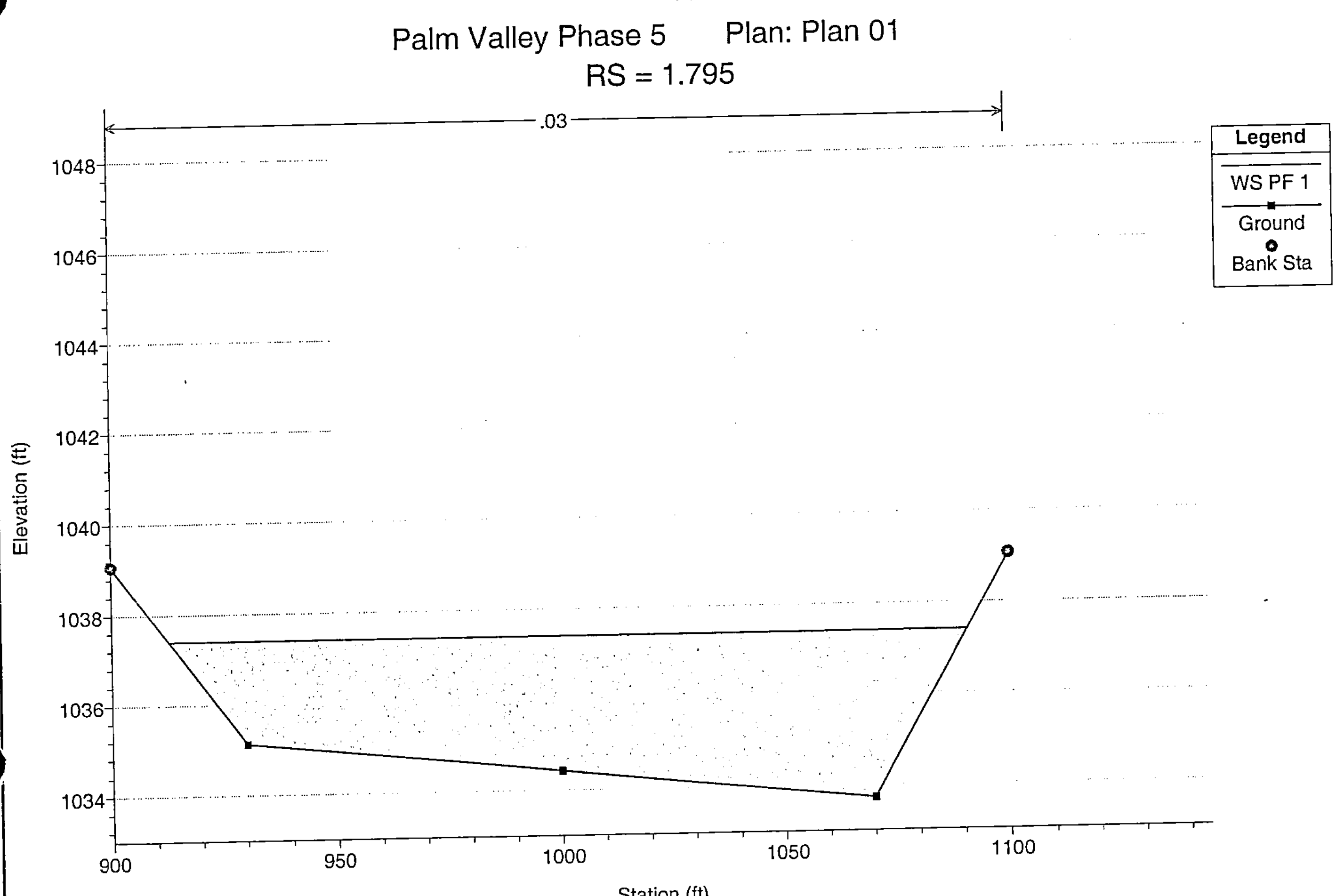
1 in Horiz. = 40 ft 1 in Vert. = 4 ft



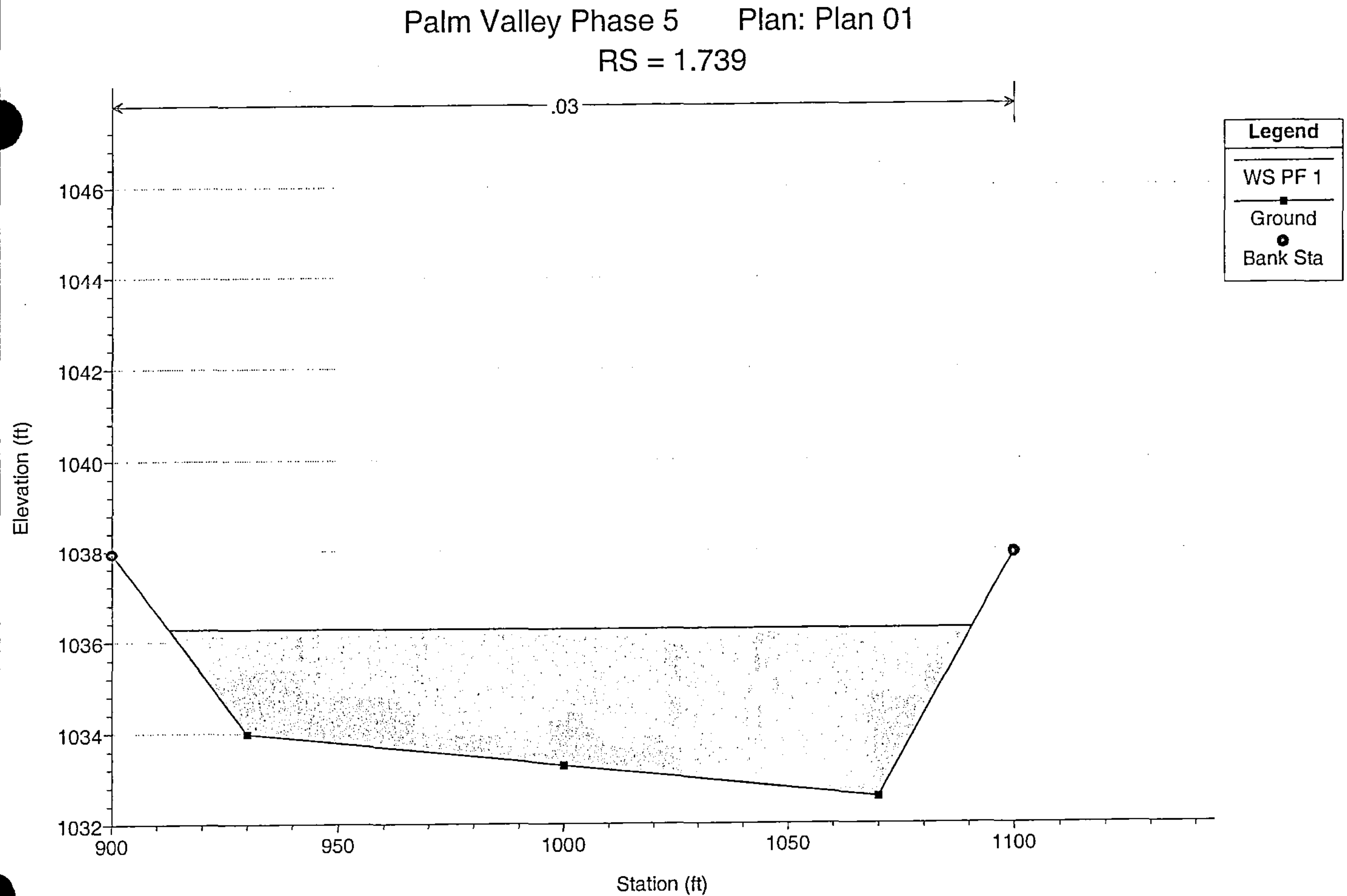


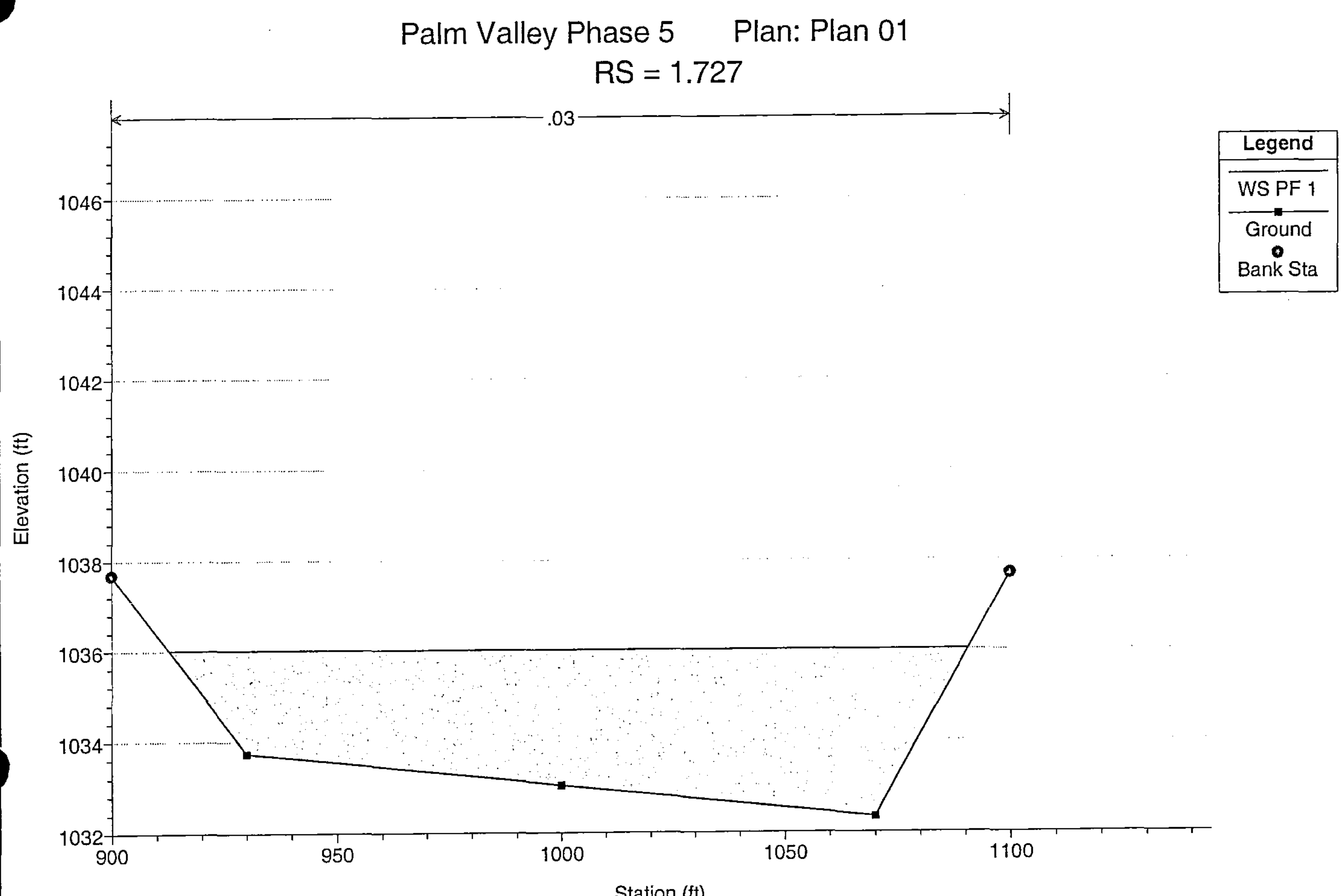
1 in Horiz. = 40 ft 1 in Vert. = 4 ft



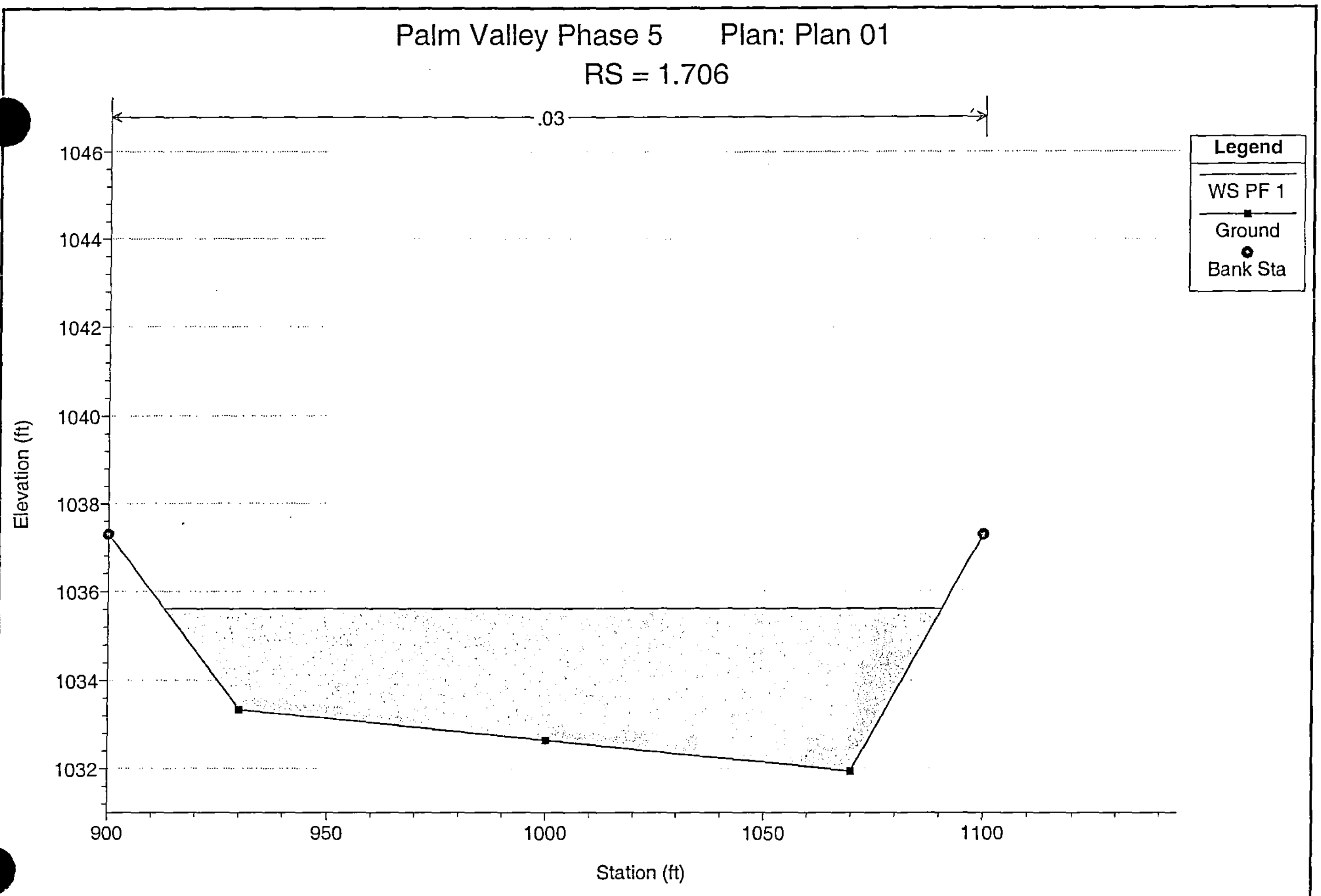


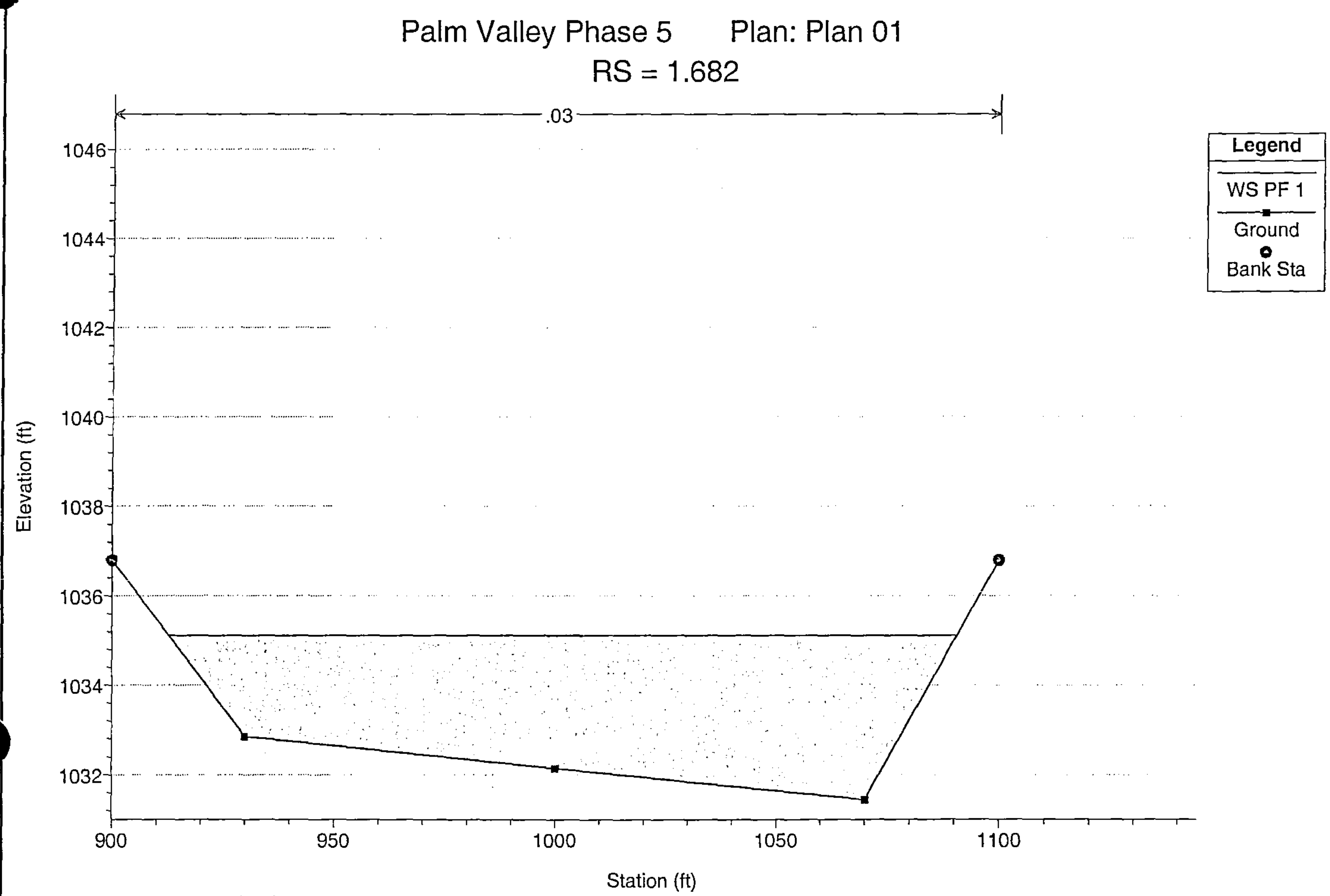
1 in Horiz. = 40 ft 1 in Vert. = 4 ft





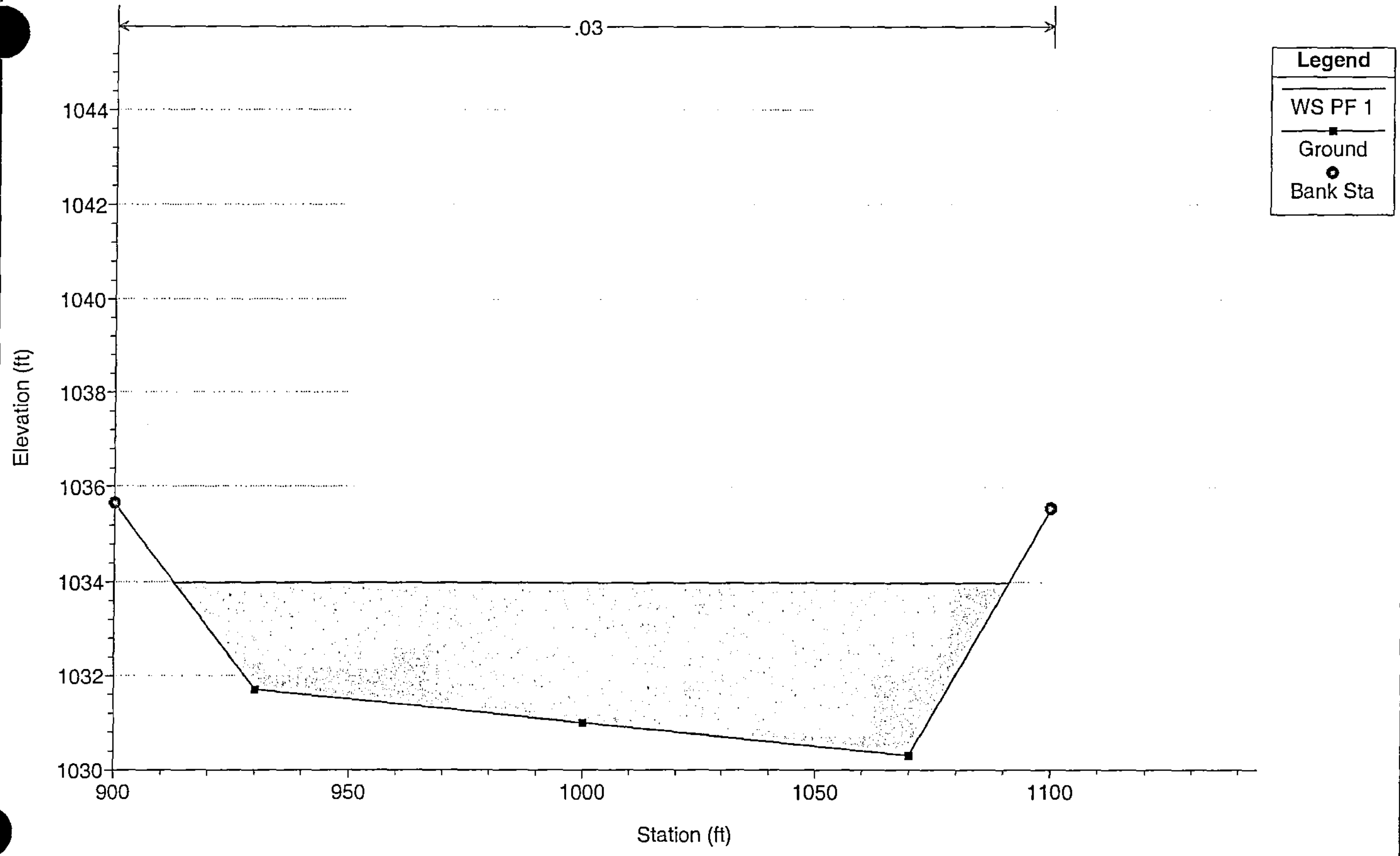
1 in Horiz. = 40 ft 1 in Vert. = 4 ft



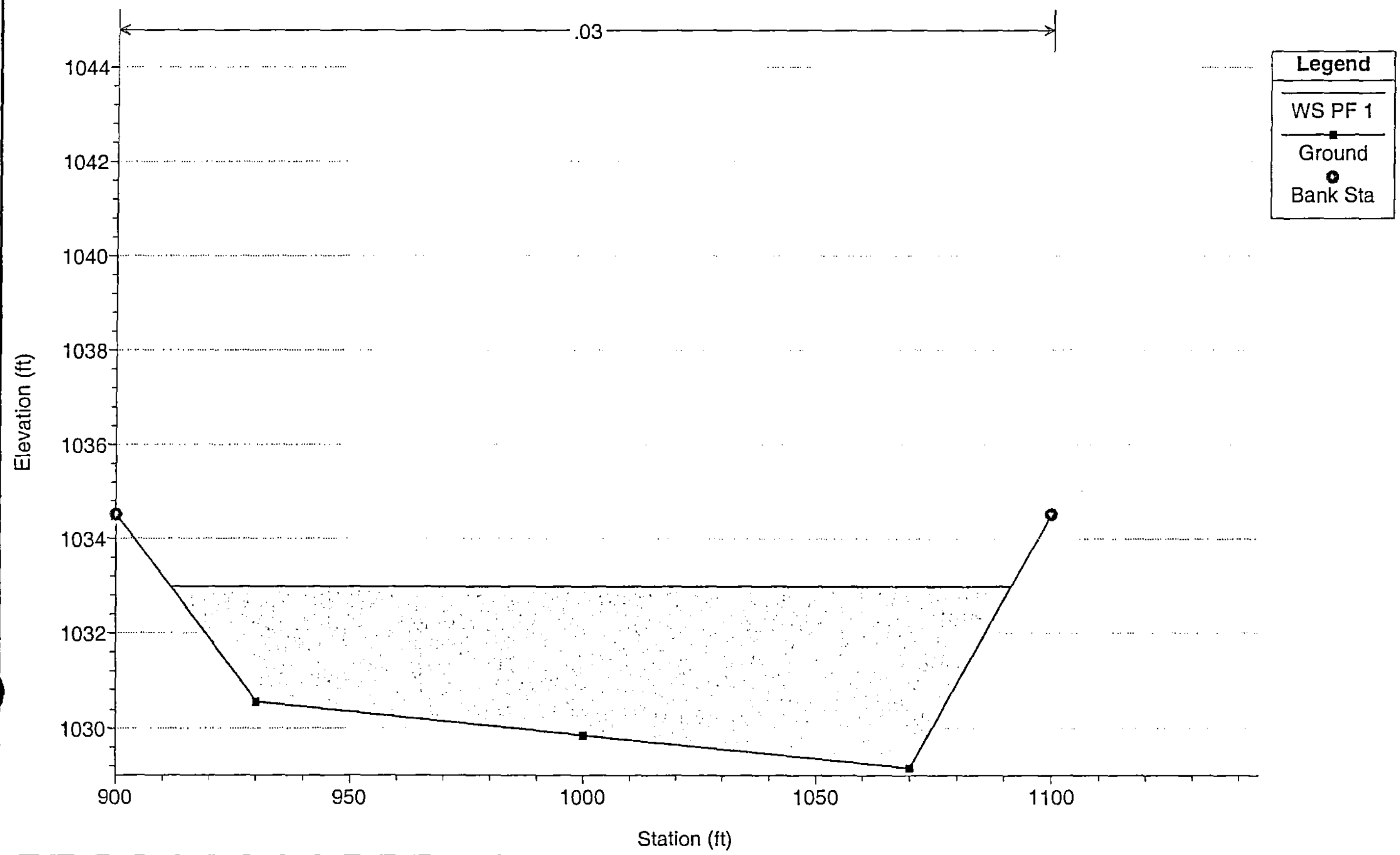


1 in Horiz. = 40 ft 1 in Vert. = 4 ft

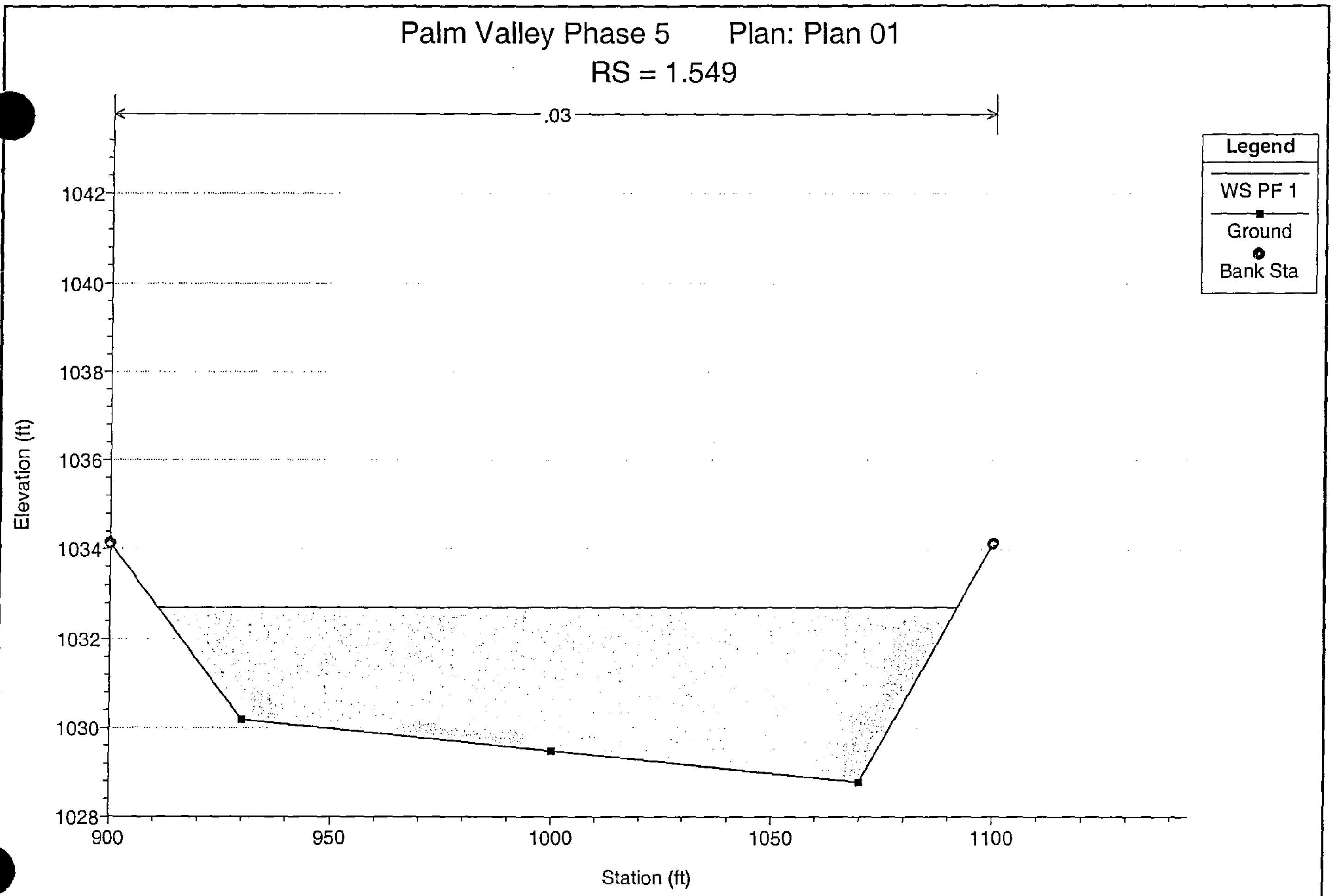
Palm Valley Phase 5 Plan: Plan 01
RS = 1.625

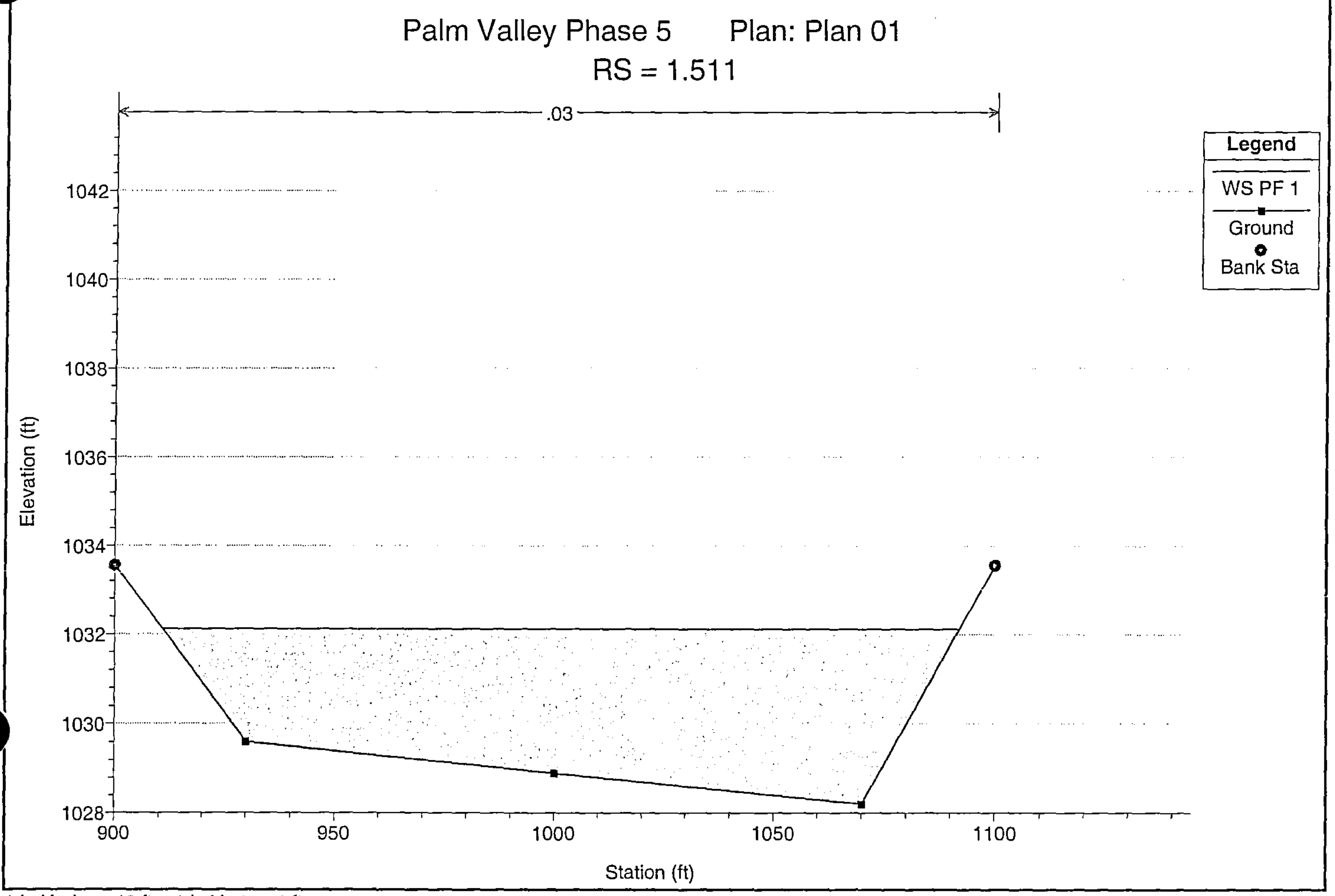


Palm Valley Phase 5 Plan: Plan 01
RS = 1.568

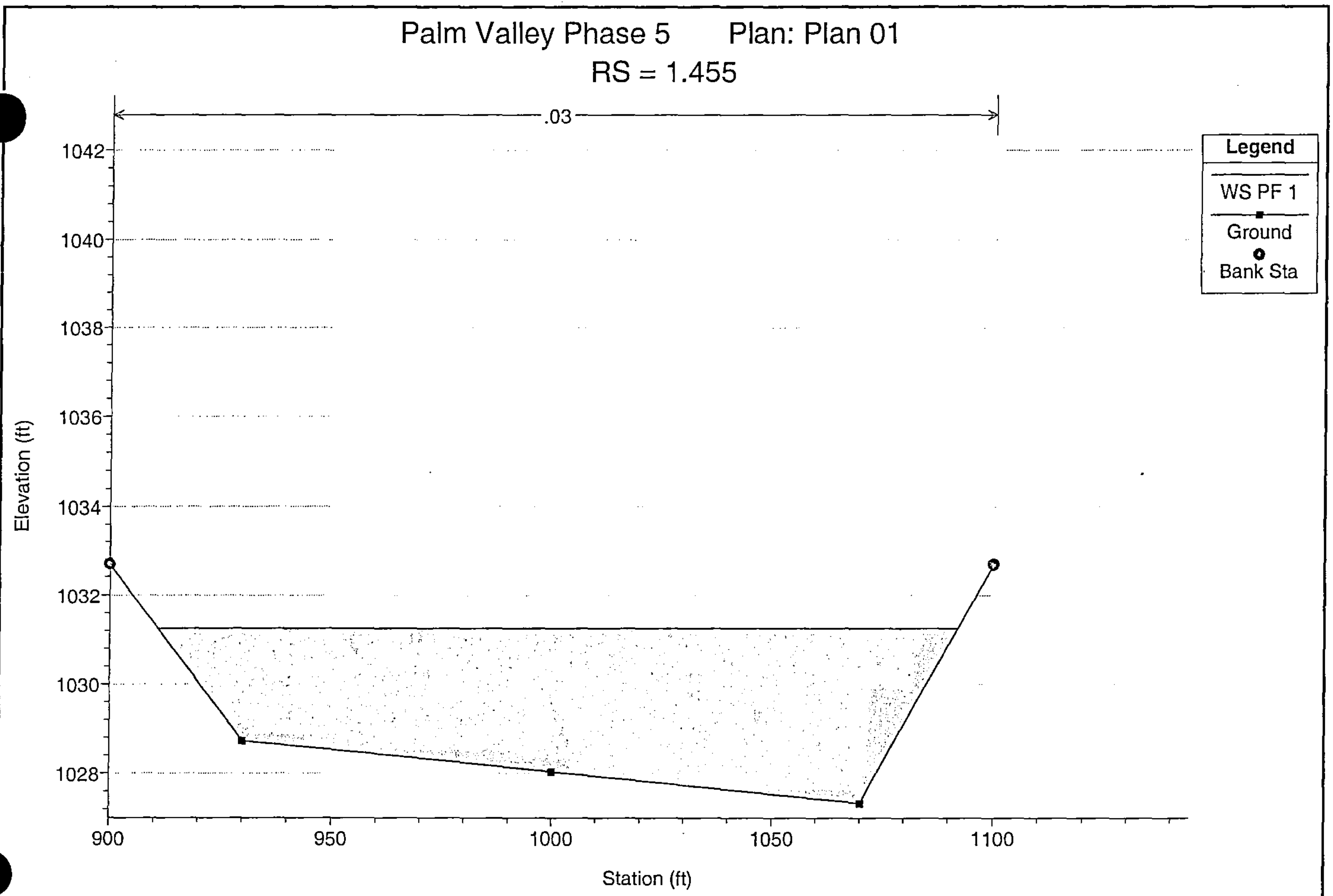


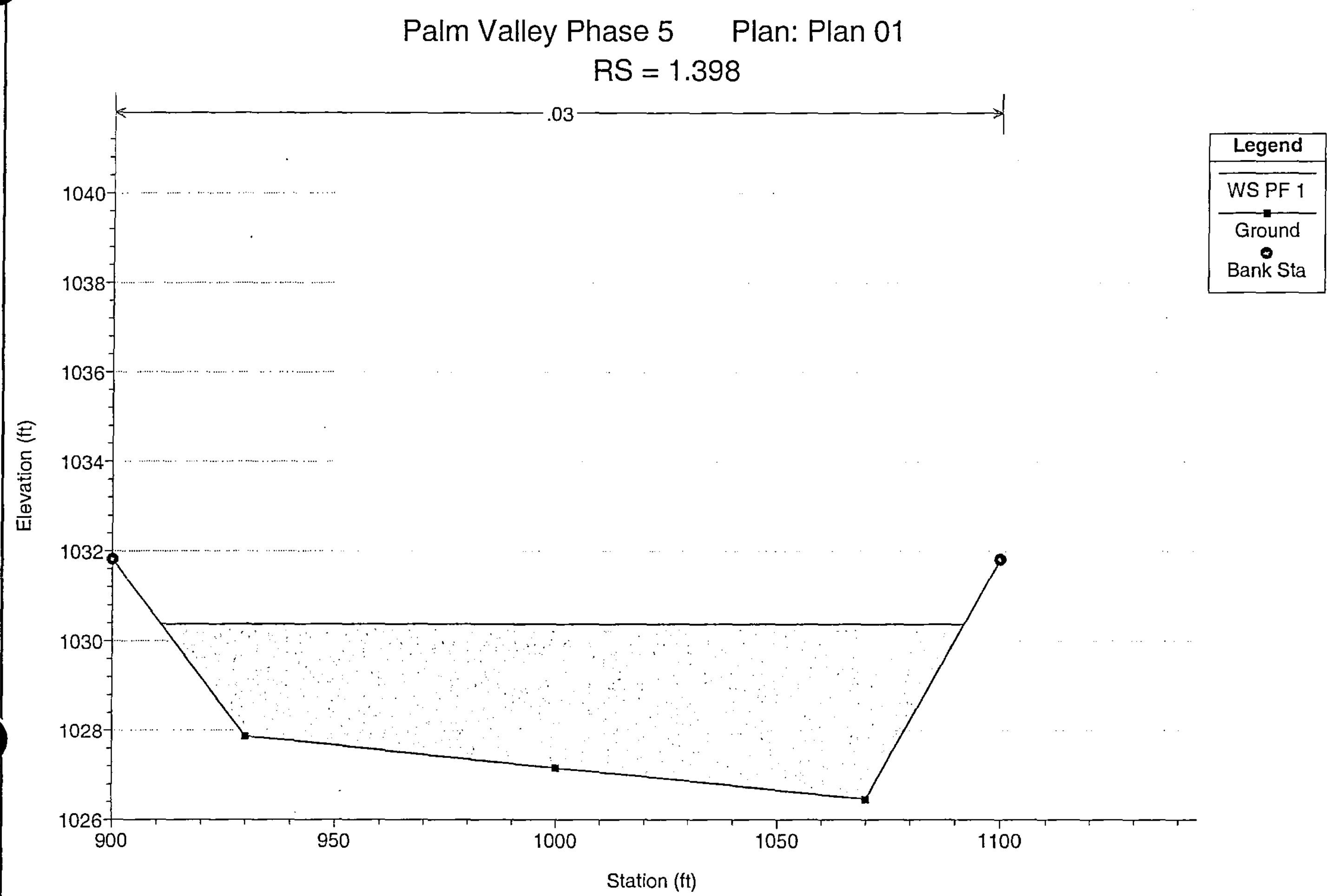
1 in Horiz. = 40 ft 1 in Vert. = 4 ft



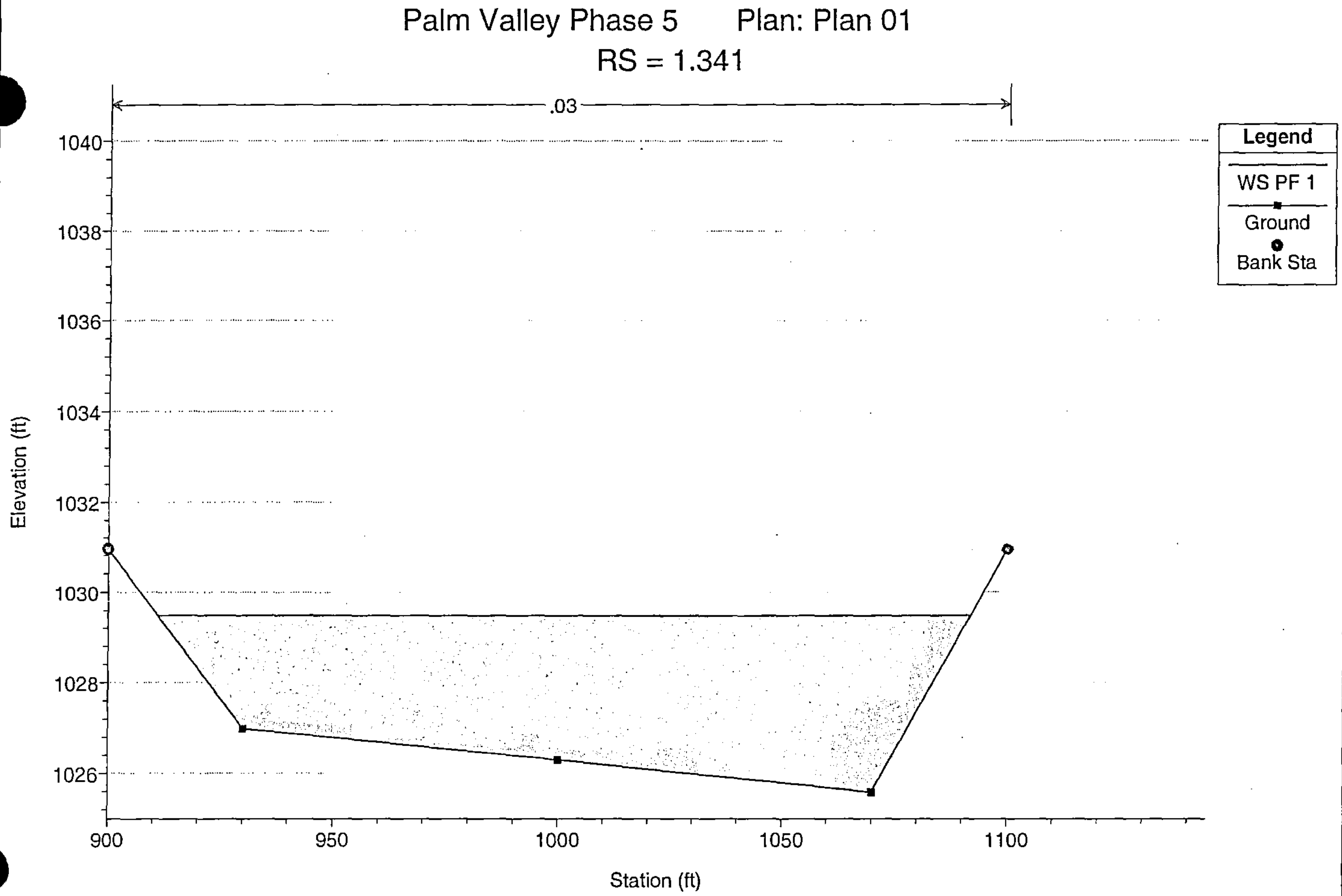


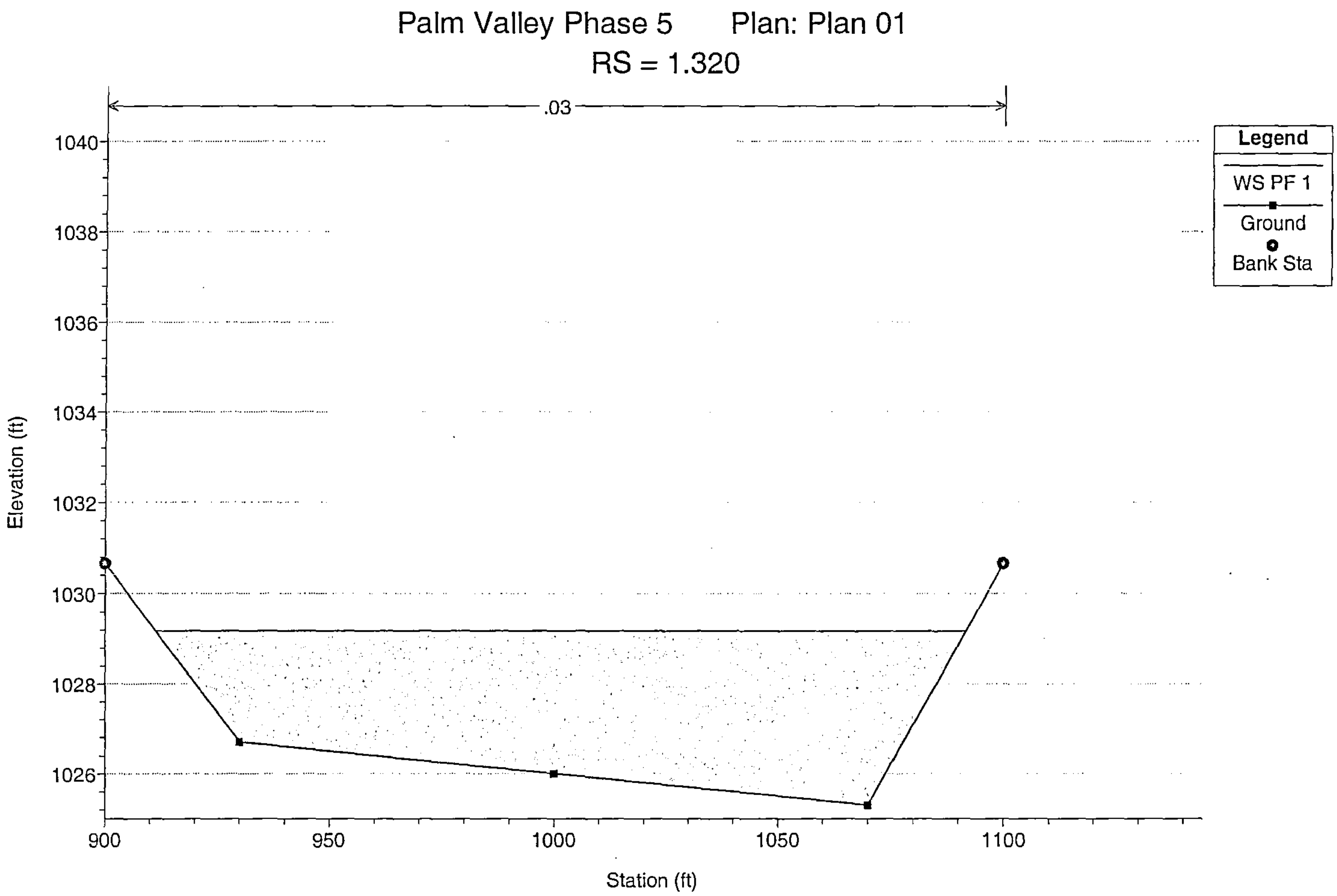
1 in Horiz. = 40 ft 1 in Vert. = 4 ft



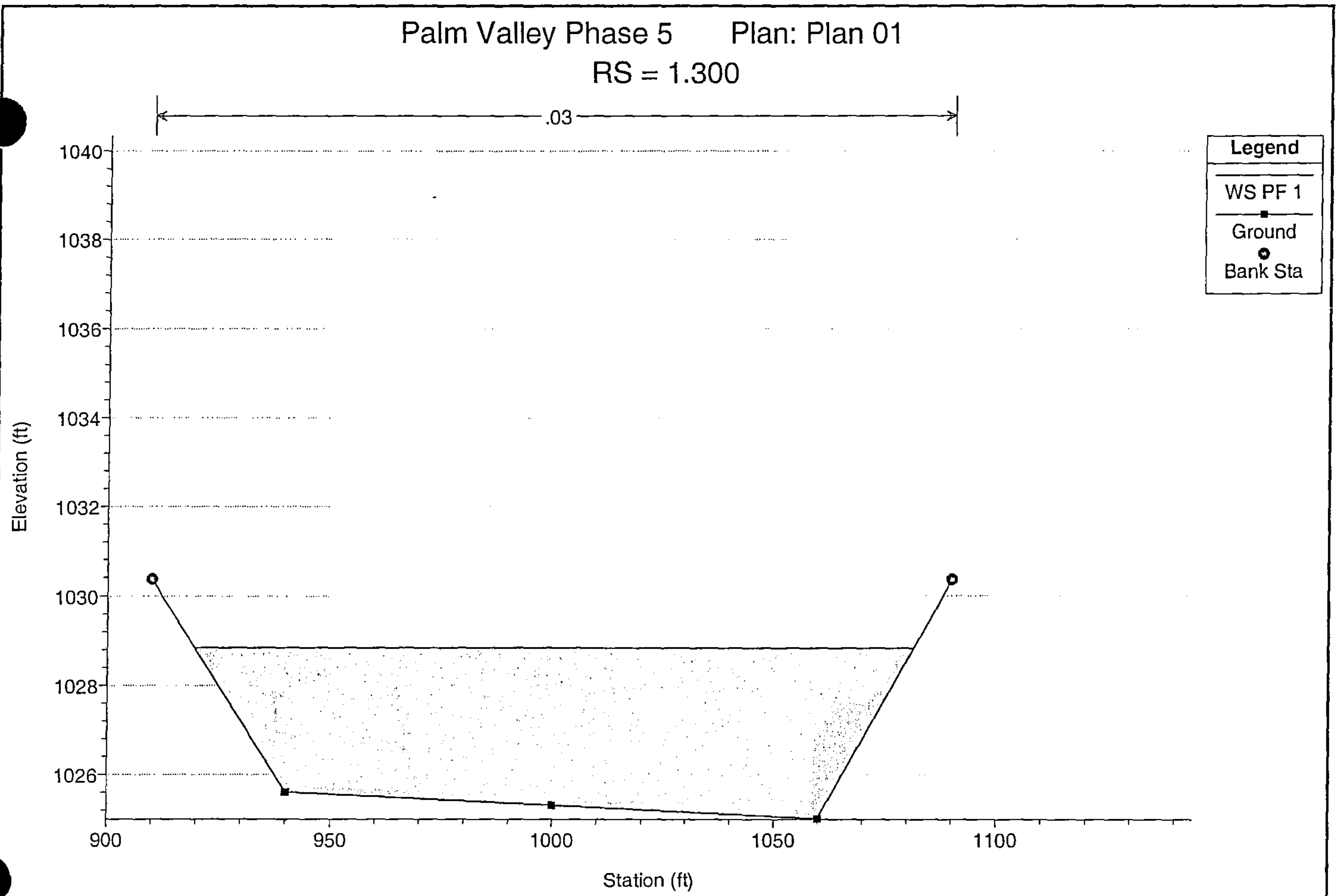


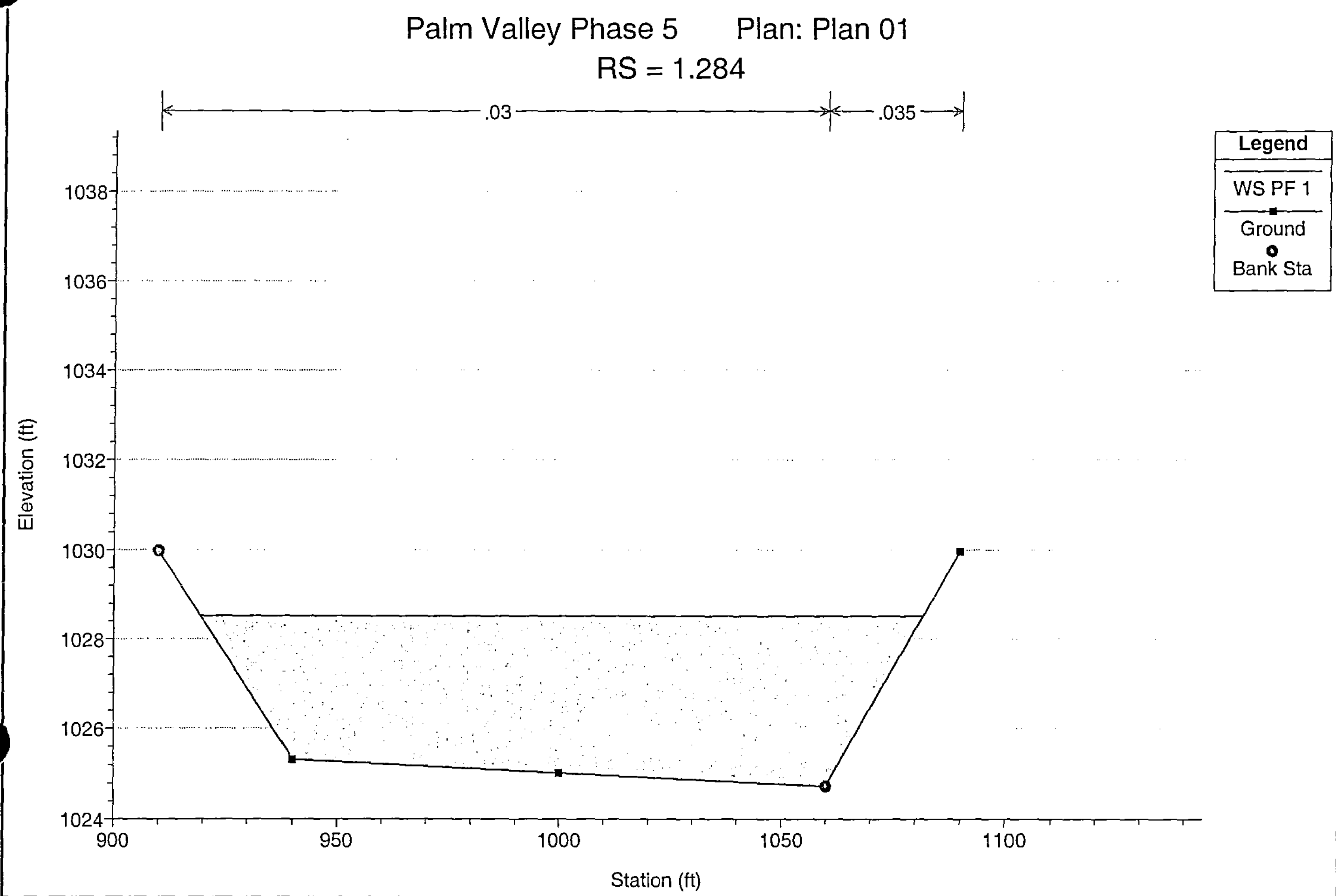
1 in Horiz. = 40 ft 1 in Vert. = 4 ft



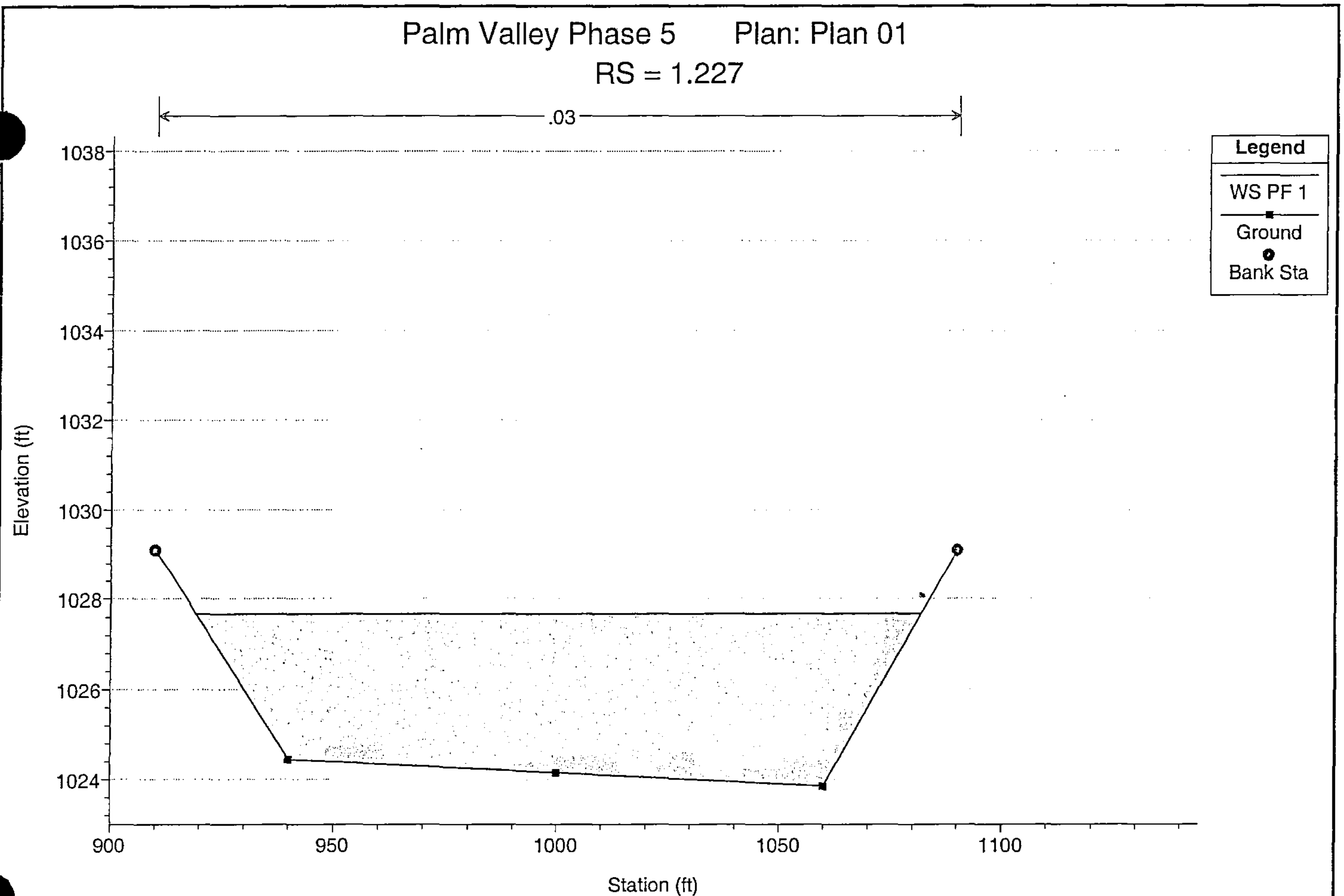


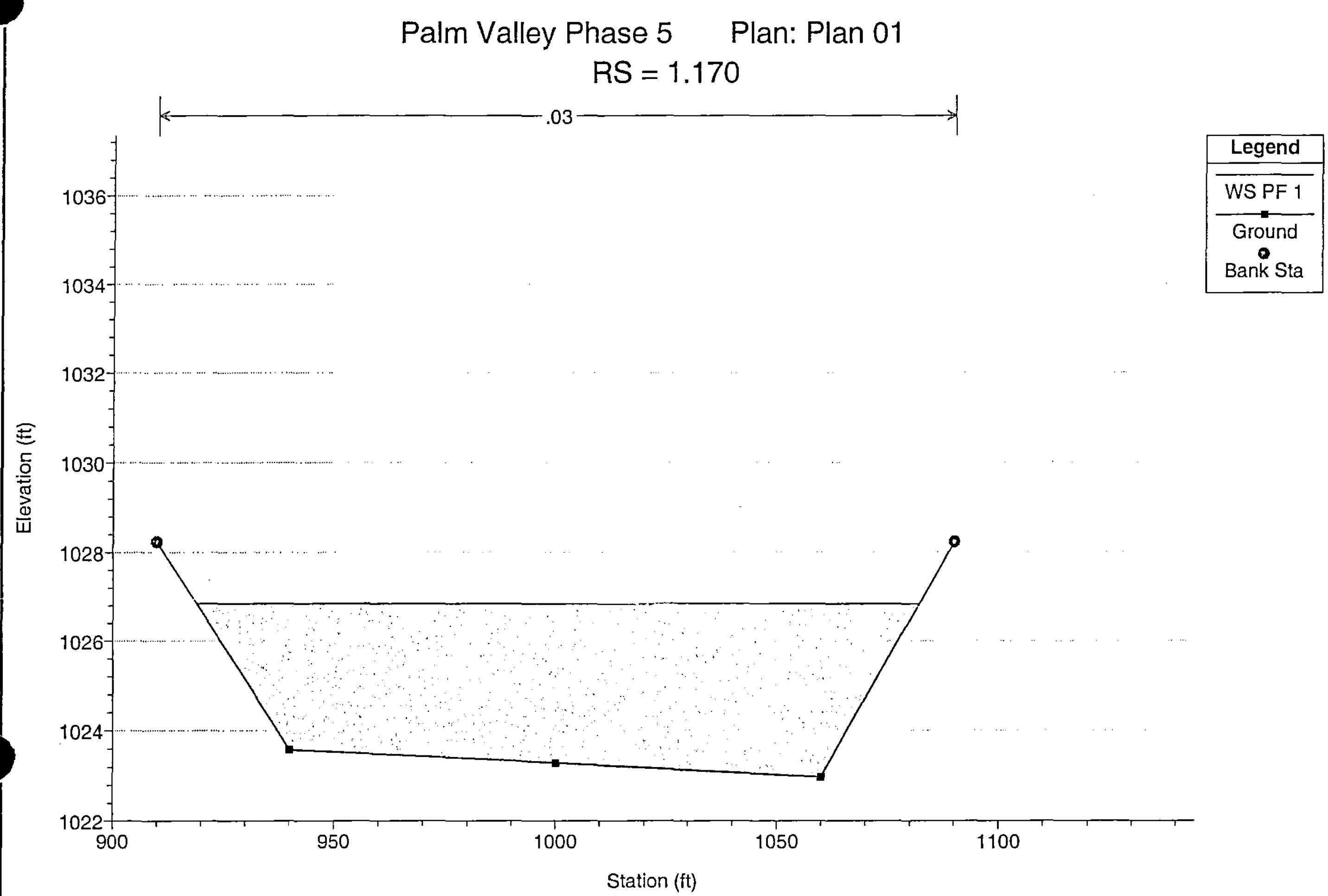
1 in Horiz. = 40 ft 1 in Vert. = 4 ft



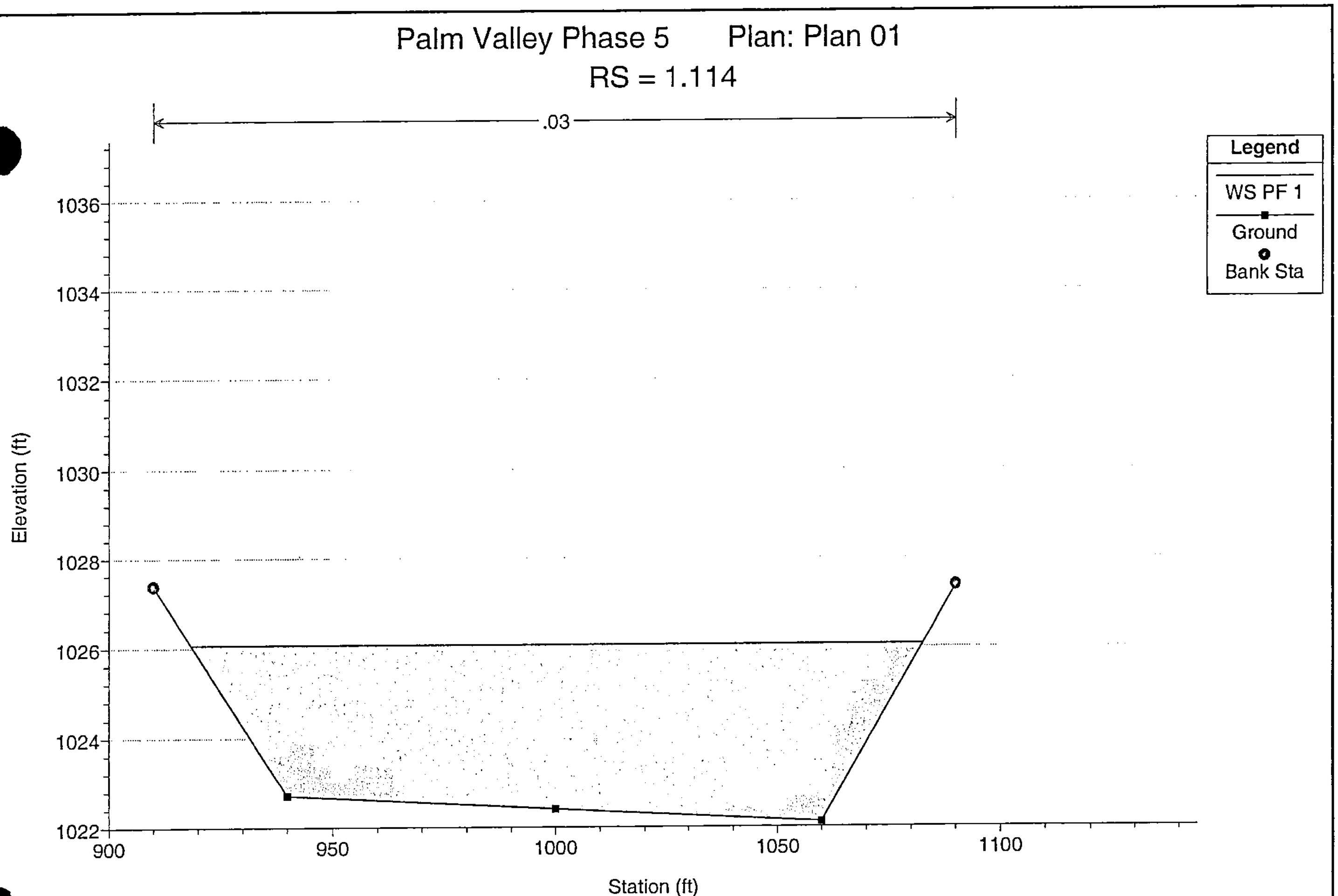


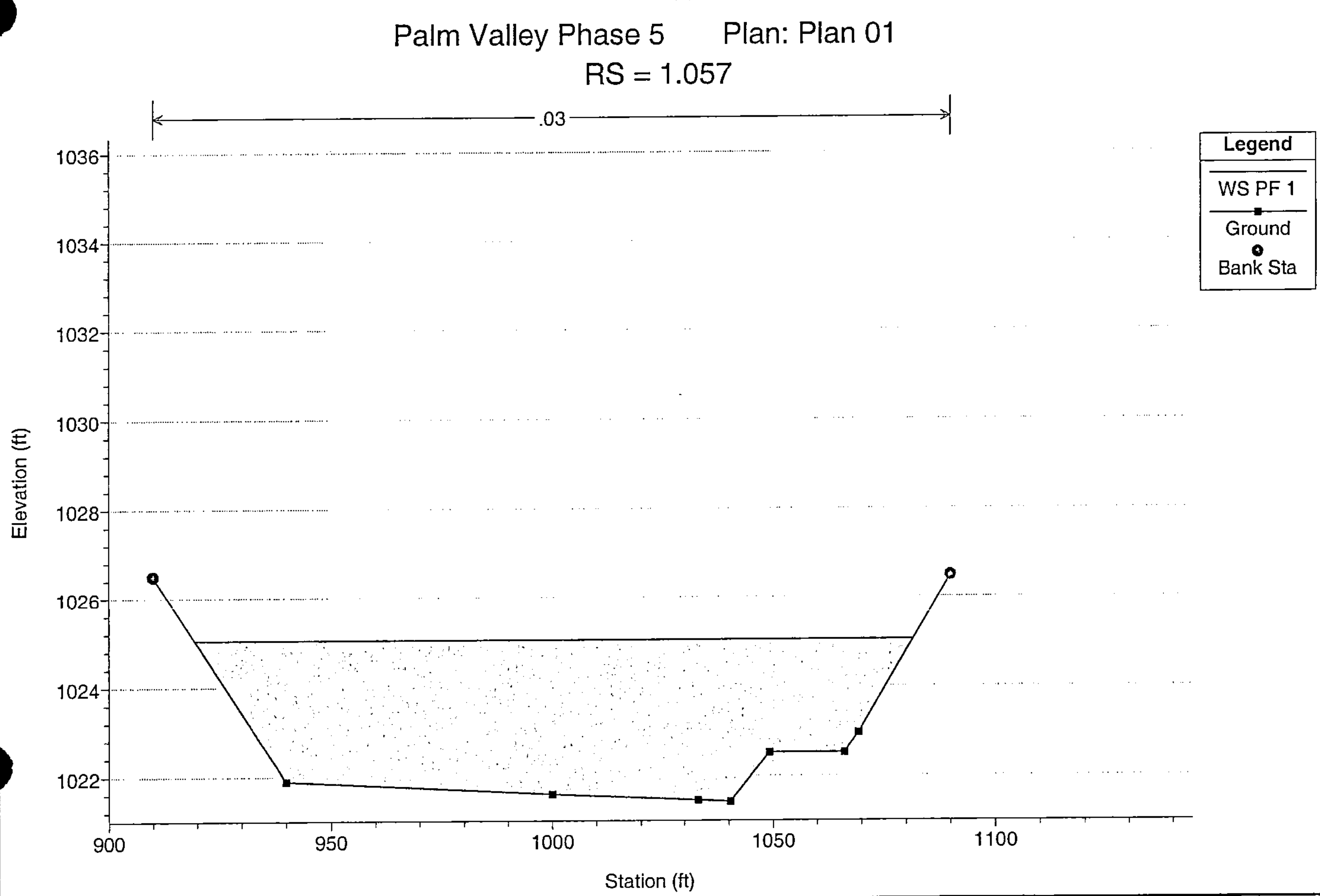
1 in Horiz. = 40 ft 1 in Vert. = 4 ft



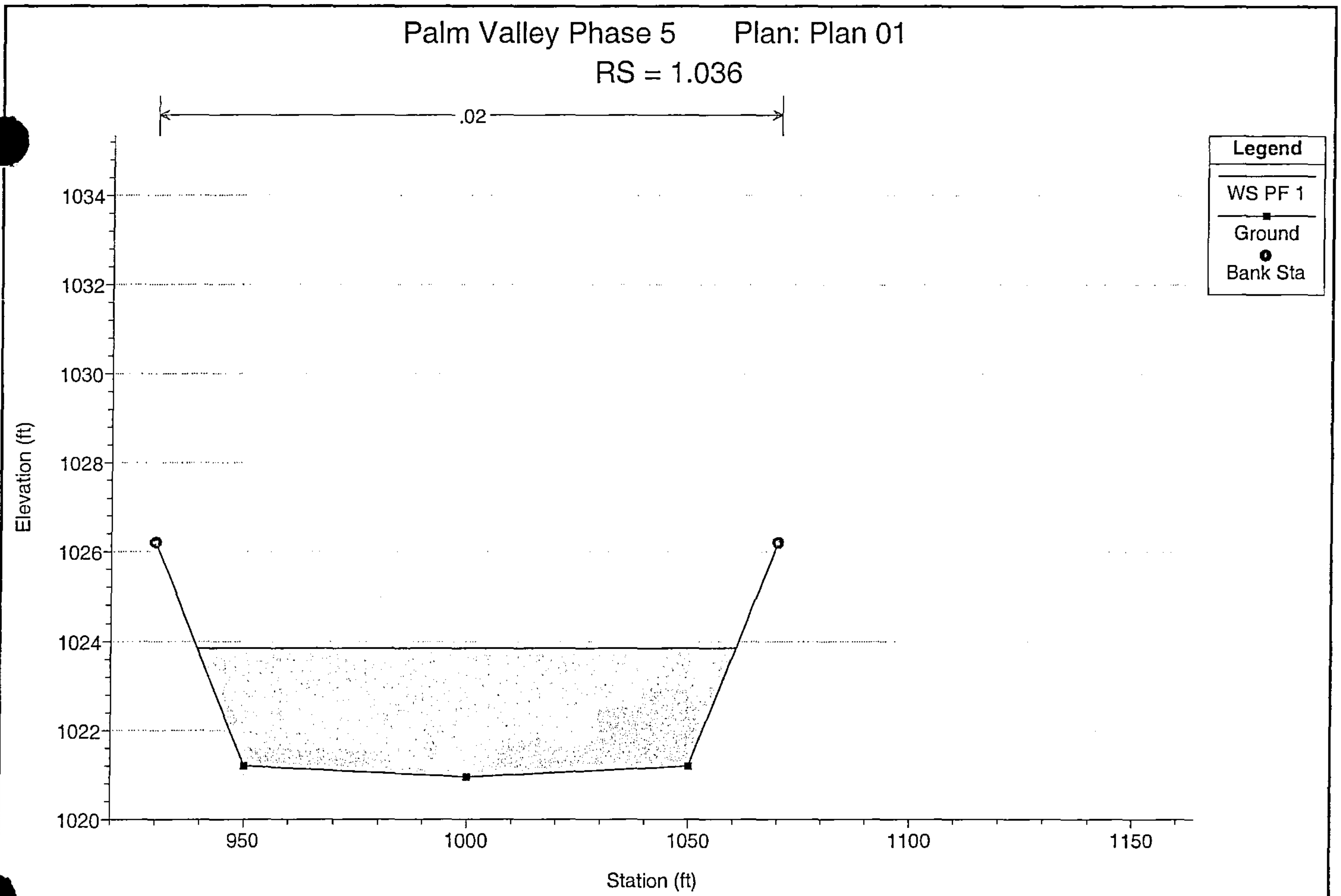


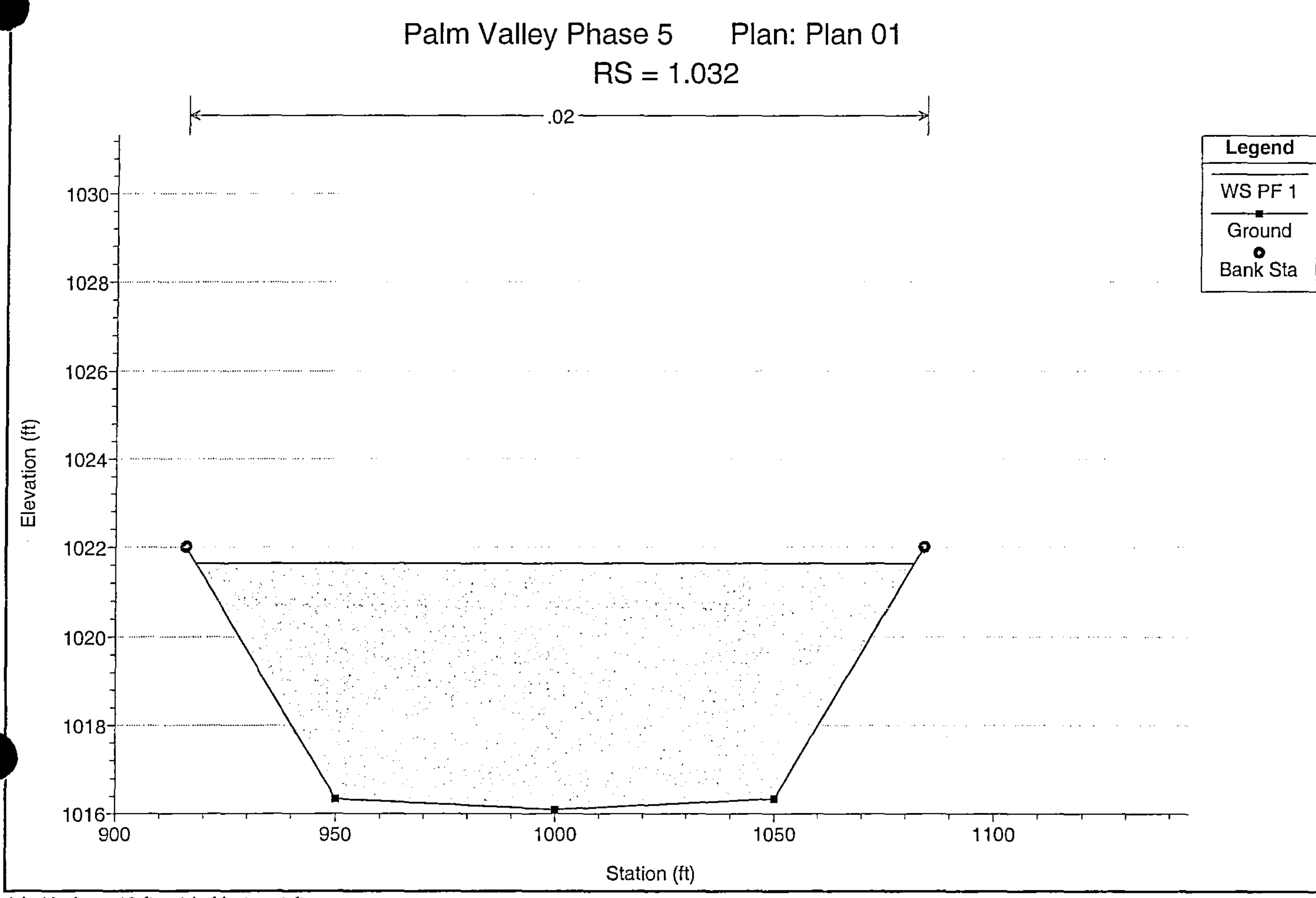
1 in Horiz. = 40 ft 1 in Vert. = 4 ft



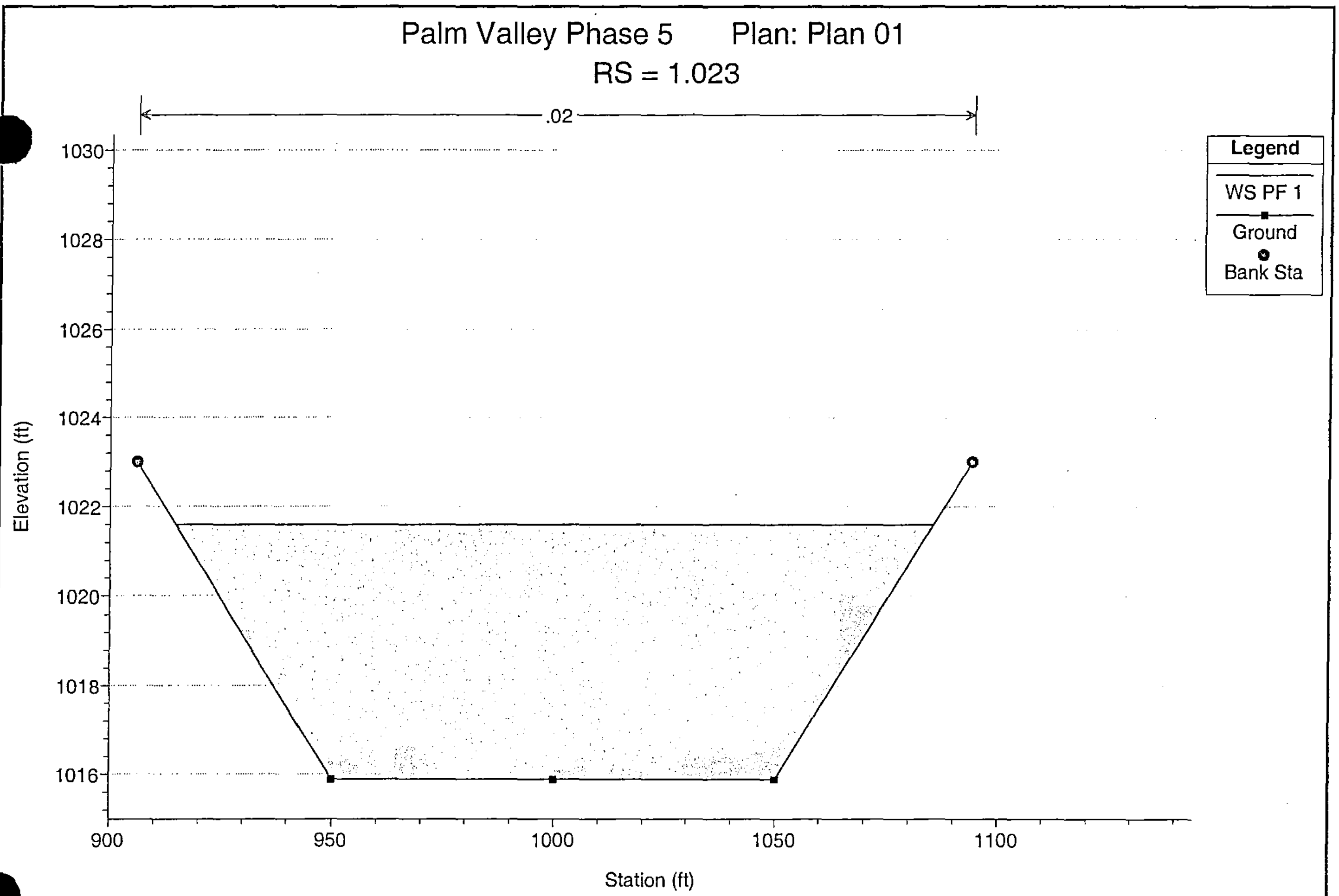


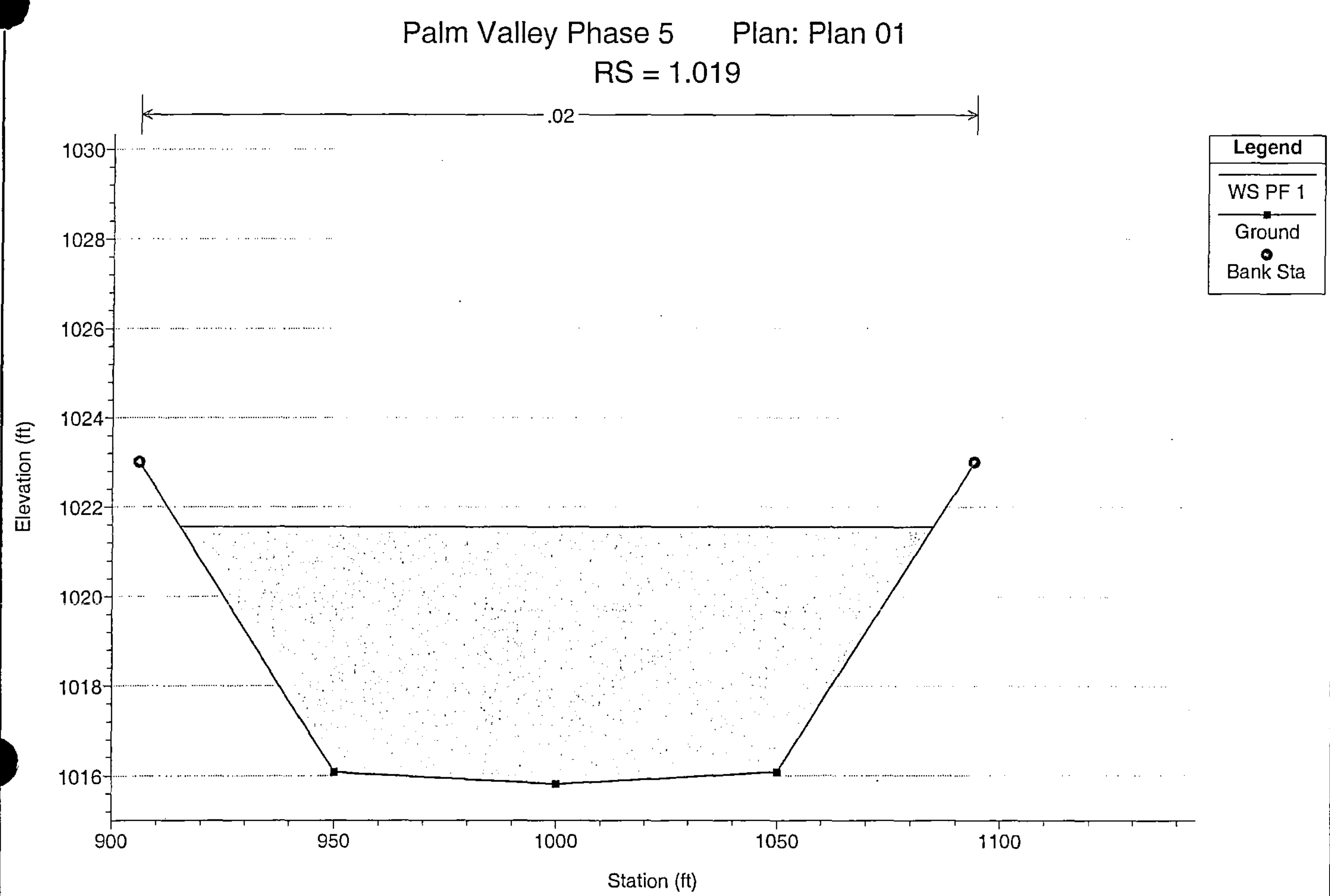
1 in Horiz. = 40 ft 1 in Vert. = 4 ft





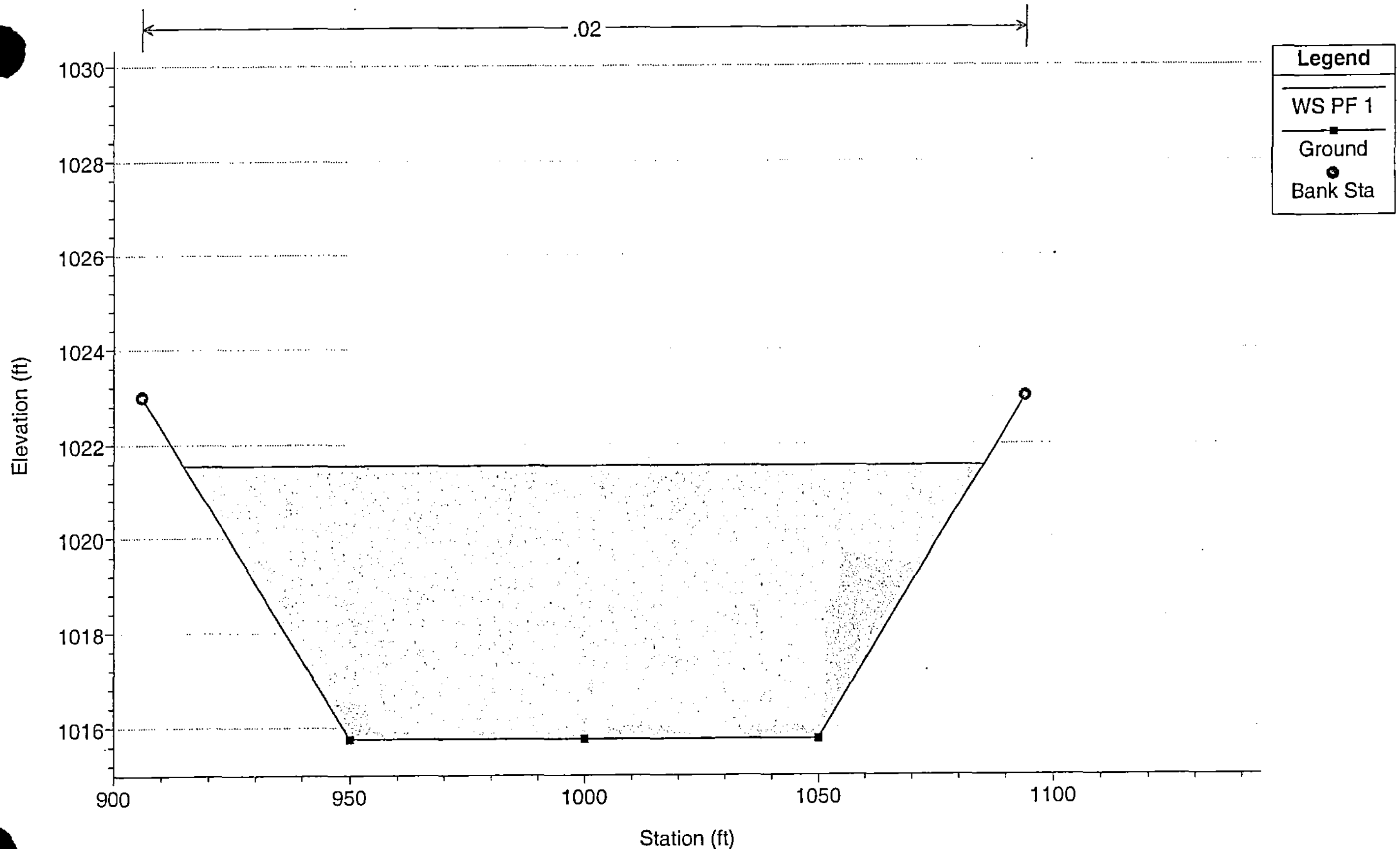
1 in Horiz. = 40 ft 1 in Vert. = 4 ft



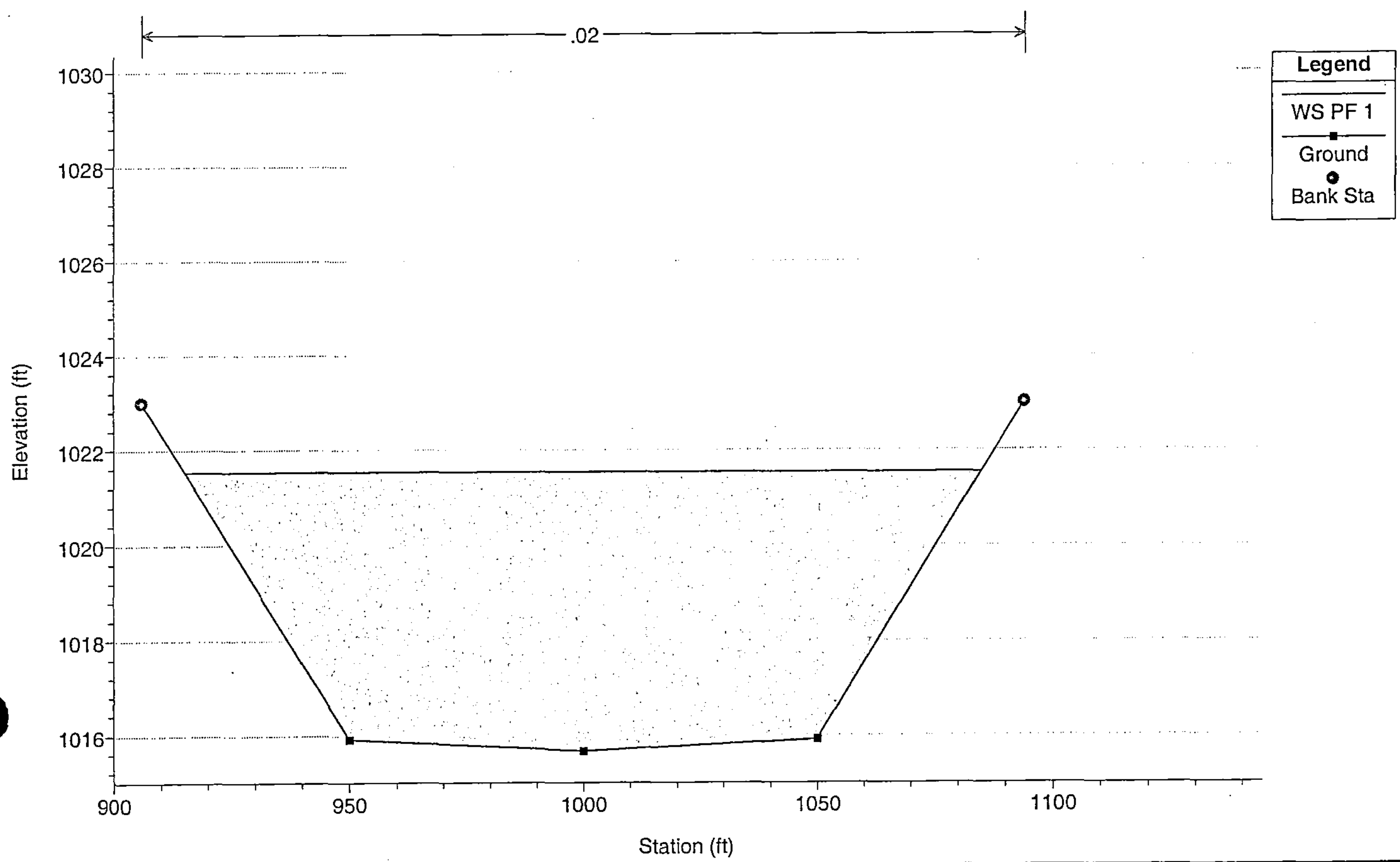


1 in Horiz. = 40 ft 1 in Vert. = 4 ft

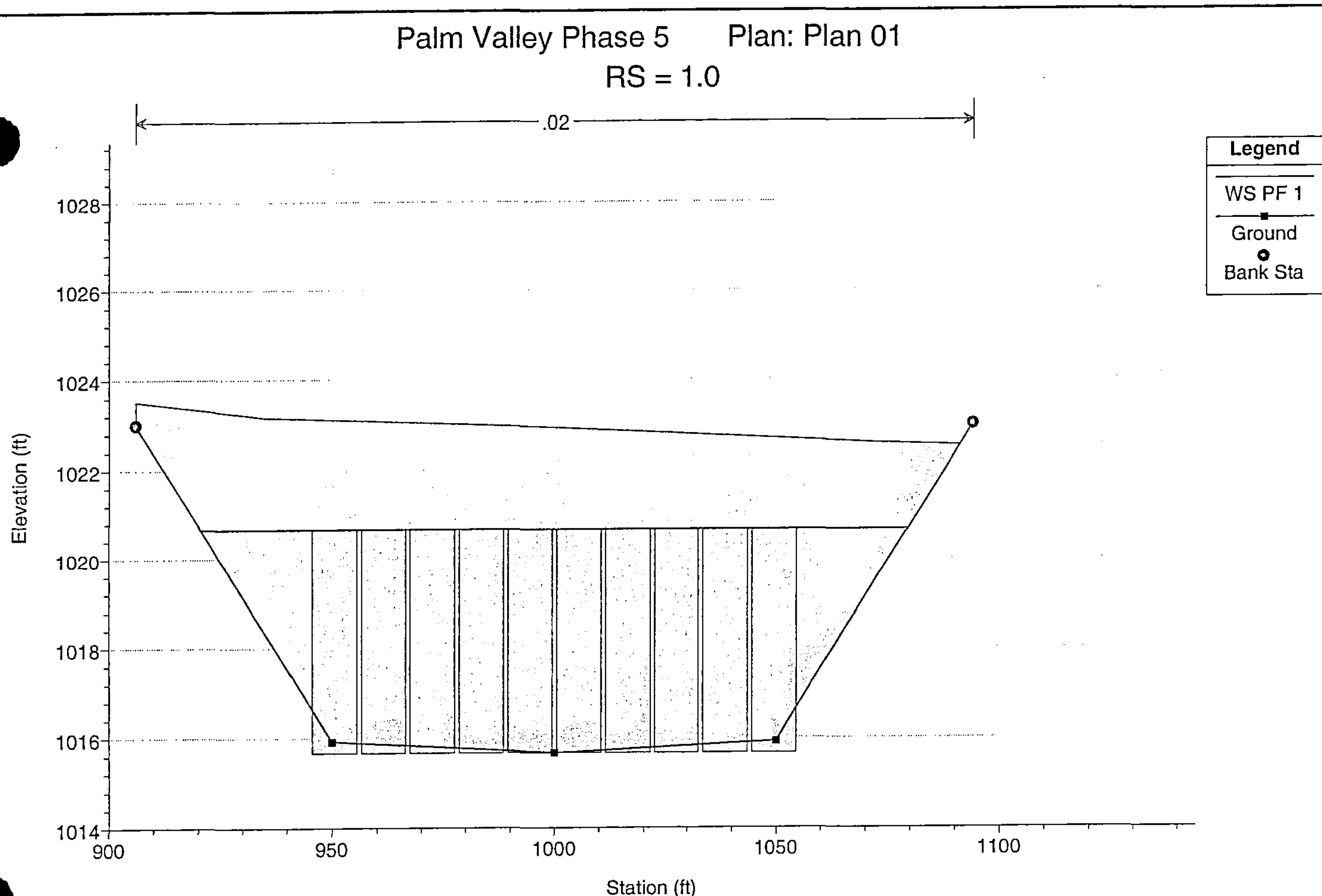
Palm Valley Phase 5 Plan: Plan 01
RS = 1.016

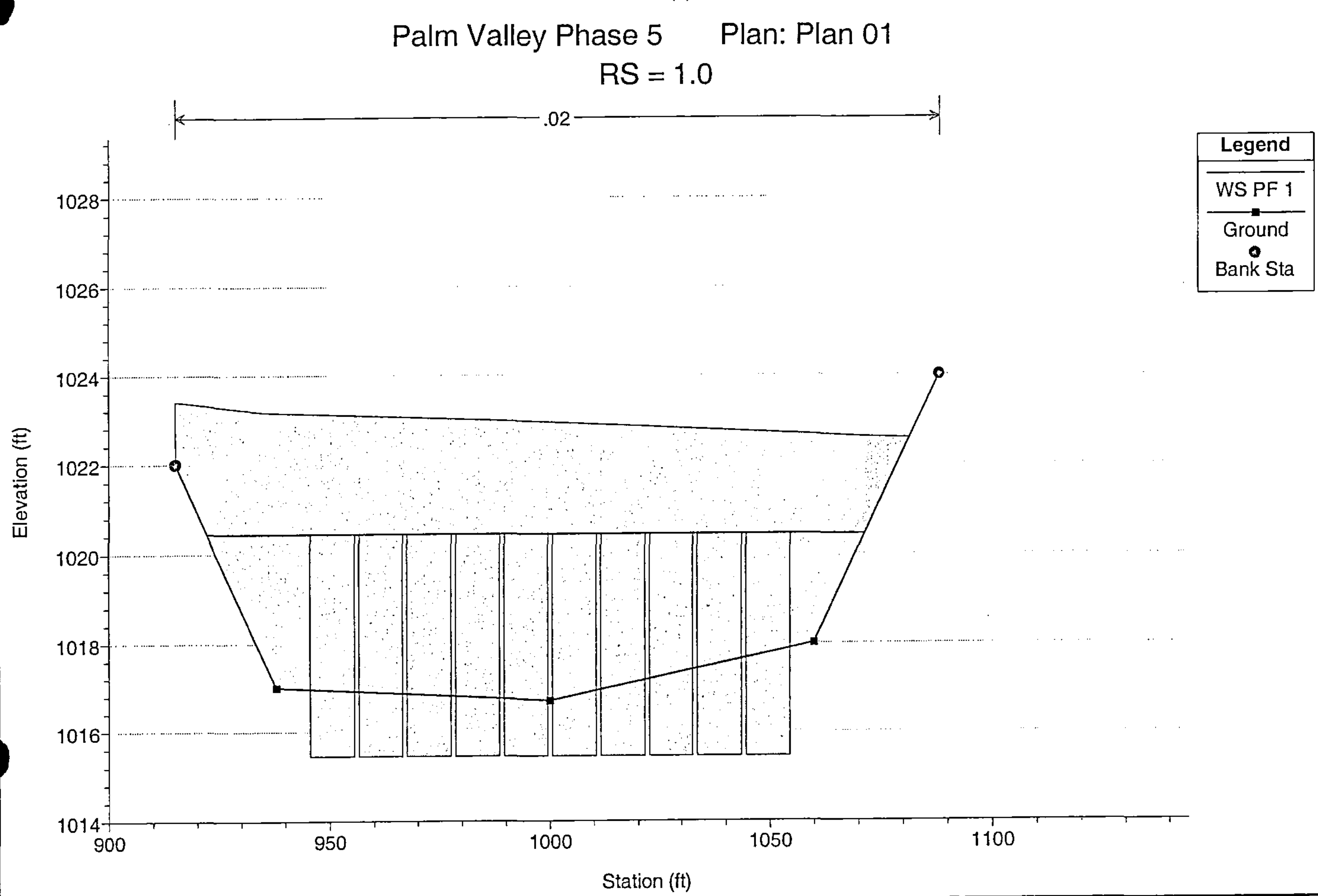


Palm Valley Phase 5 Plan: Plan 01
RS = 1.013



1 in Horiz. = 40 ft 1 in Vert. = 4 ft

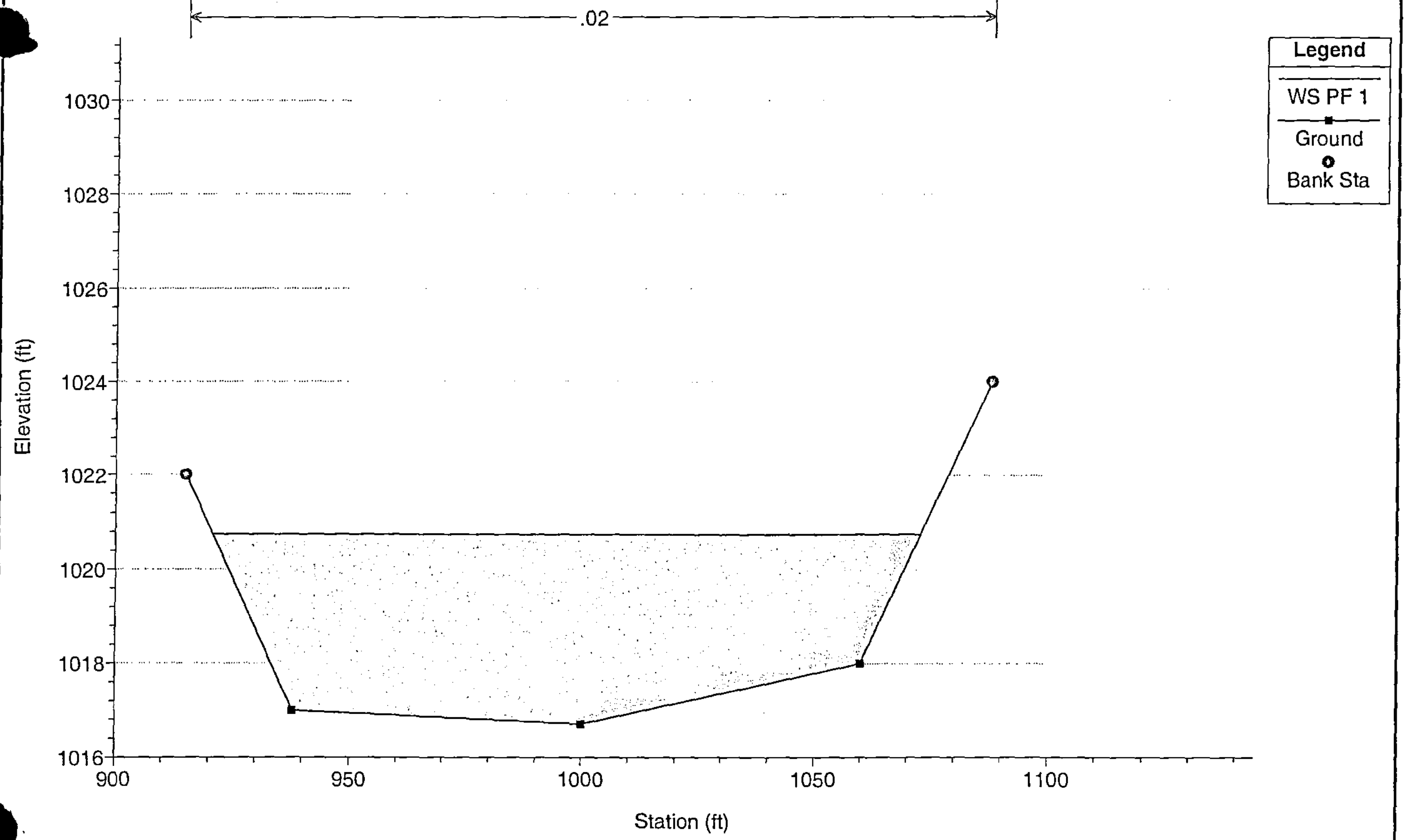




1 in Horiz. = 40 ft 1 in Vert. = 4 ft

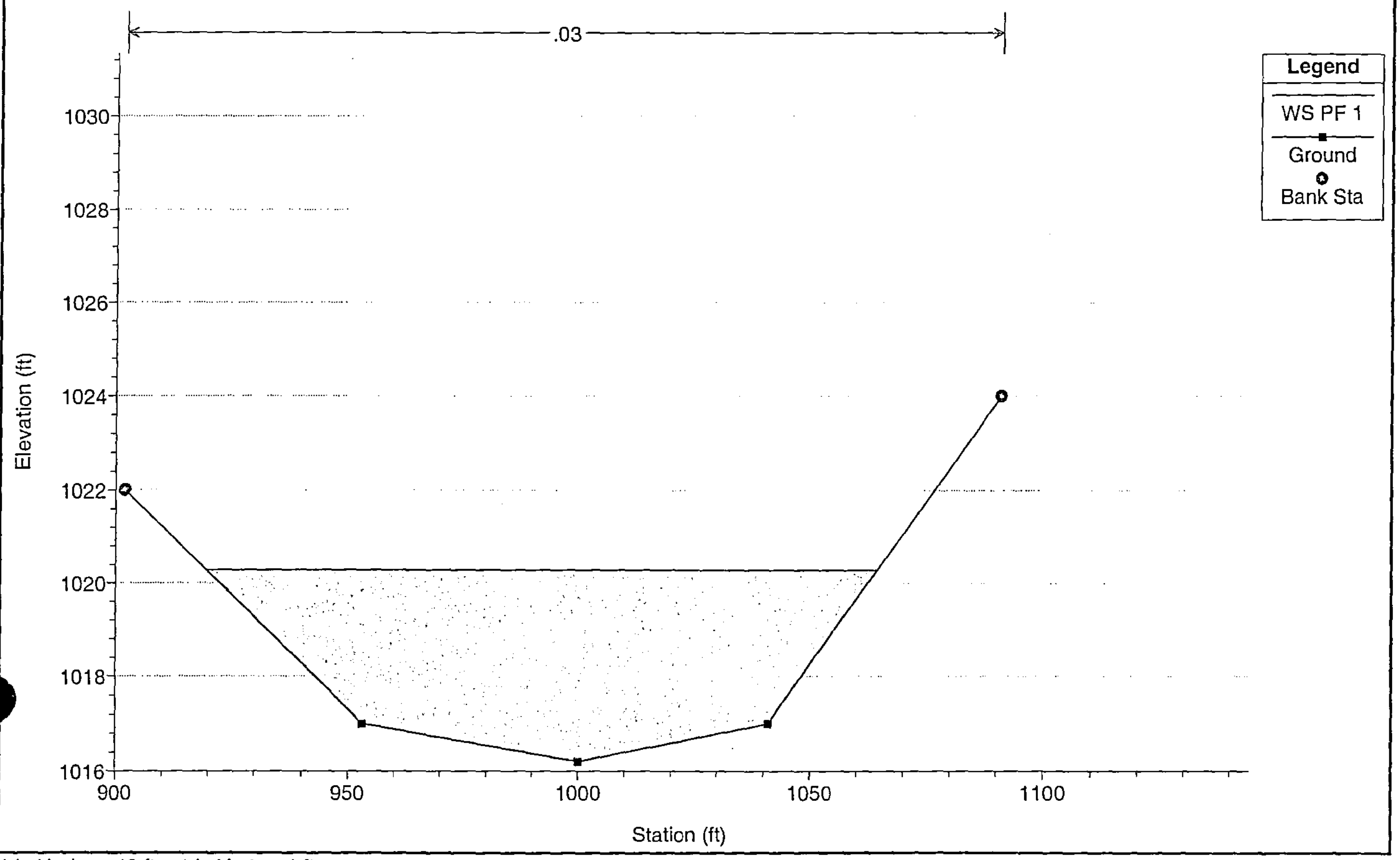
Palm Valley Phase 5 Plan: Plan 01

RS = .987



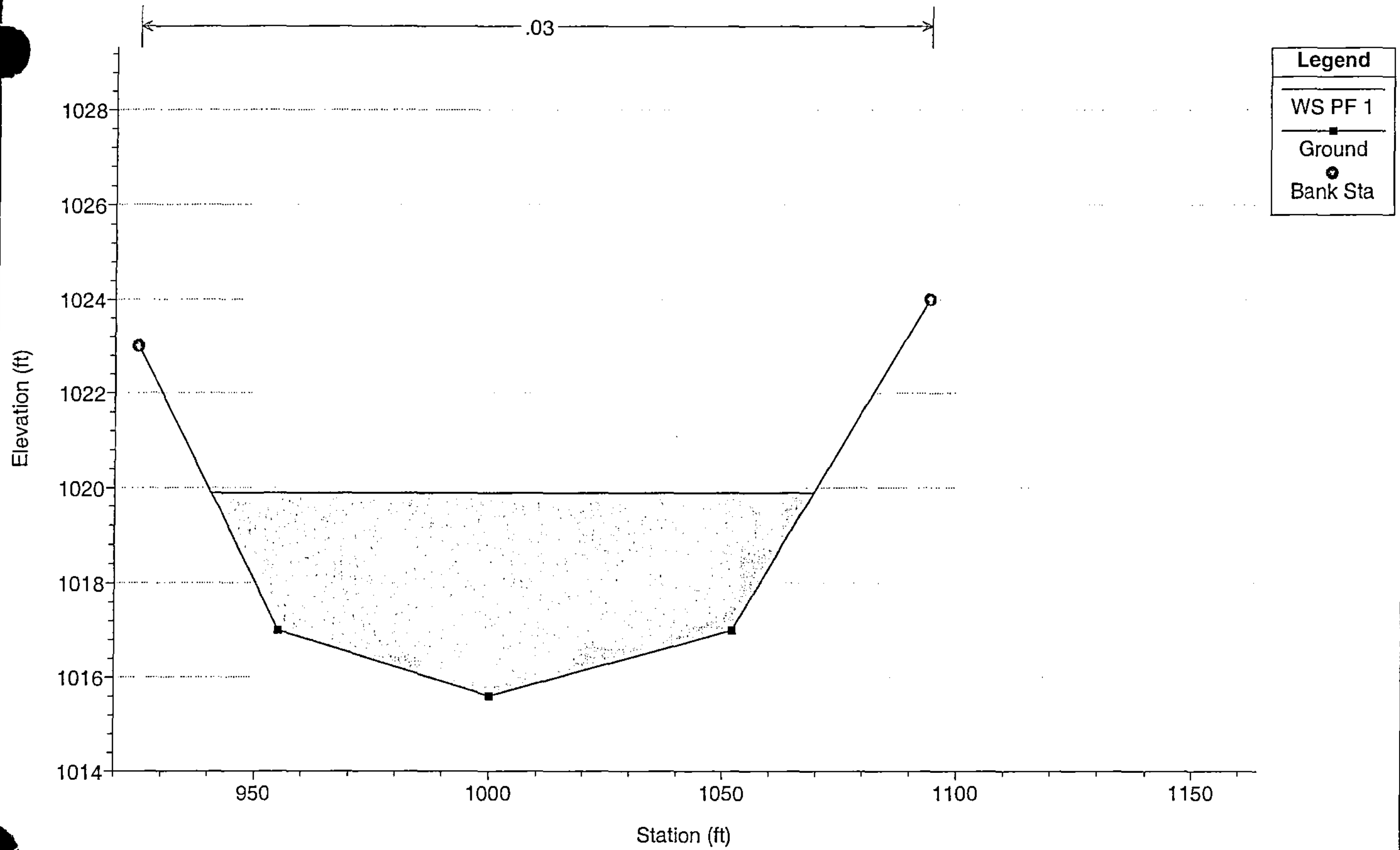
Palm Valley Phase 5 Plan: Plan 01

RS = .976



1 in Horiz. = 40 ft 1 in Vert. = 4 ft

Palm Valley Phase 5 Plan: Plan 01
RS = .964

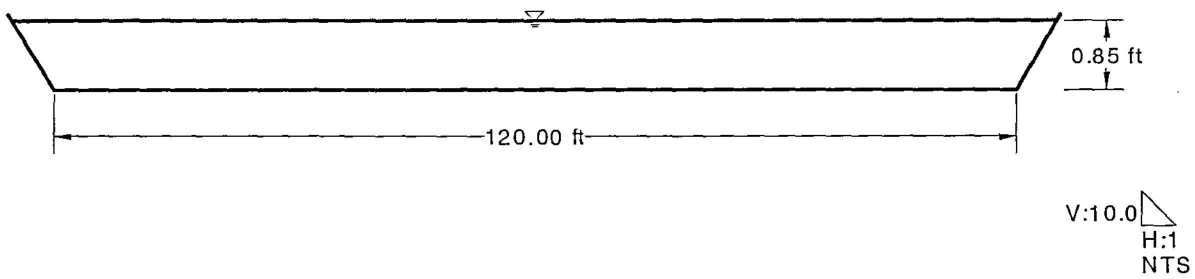


1 in Horiz. = 40 ft 1 in Vert. = 4 ft

Cross Section
Cross Section for Trapezoidal Channel

Project Description	
Worksheet	Trapezoidal Channel - 1
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.022	
Slope	0.194500	ft/ft
Depth	0.85	ft
Left Side Slope	6.00	H : V
Right Side Slope	6.00	H : V
Bottom Width	120.00	ft
Discharge	2,780.00	cfs



Project Title Palm Valley Phase 5 Project No. 303009 Date 7-27-04

Subject Drop structure Hydraulic Prepared By MJR Checked By ________ Page ________

Length of Jump.

using Fig 6.29 from FCD Hydraulic Design manual (Length of Hydraulic Jump in Rect. Channel)

Length using F_{r_1} @ 5 = 40 ft

Have 100 ft available.

also a Froude ~~#~~ between 4.5 and 9 produce steady. ∴ Jump will remain in shotcrete section of channel.

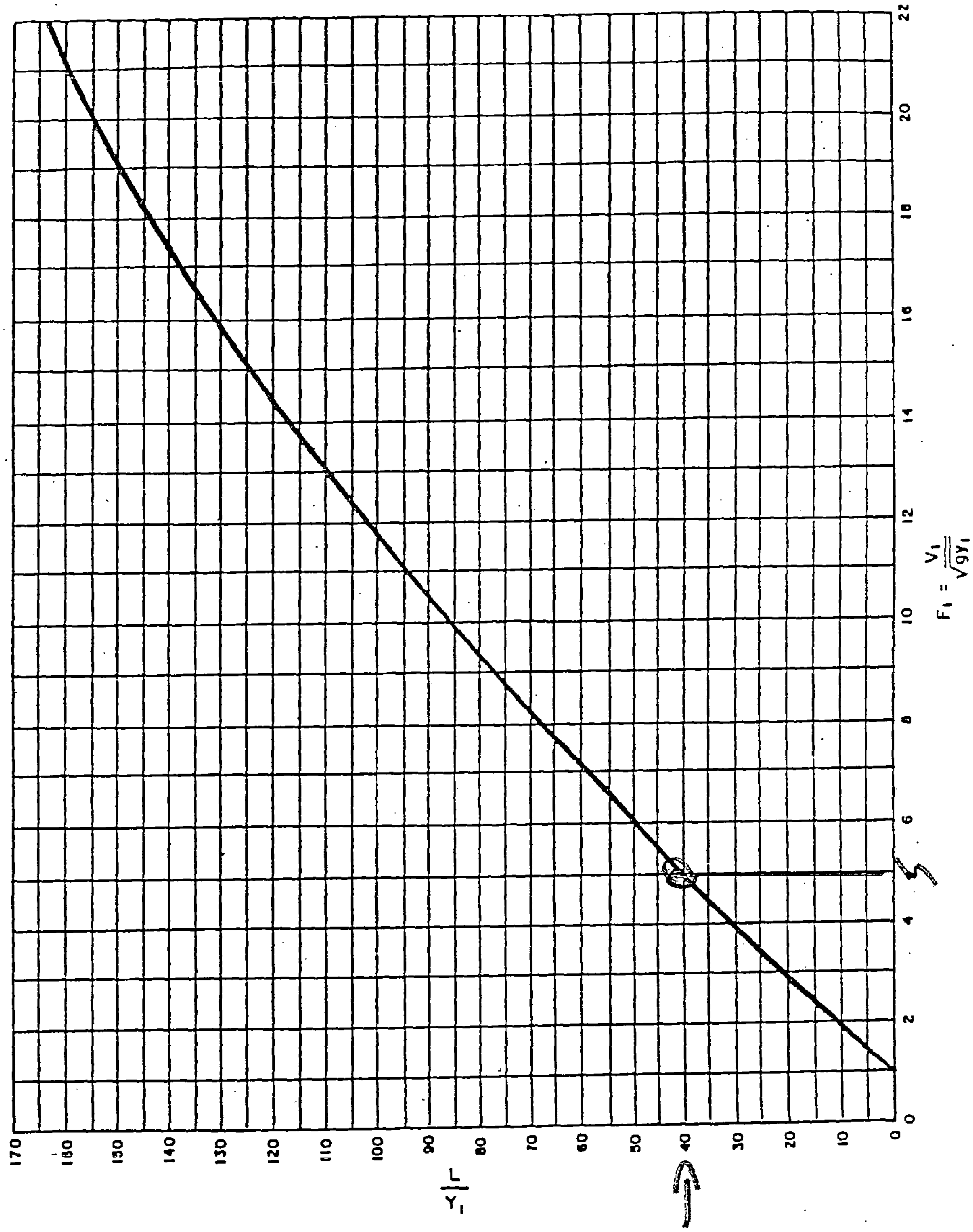


Figure 6.29
Length of a Hydraulic Jump for Rectangular Channels
(Simons, Li and Associates, Inc. 1989)

40'

Project Title Palm Valley Phase 5 Project No. 303004 Date 7.27.04

Subject Drop structure Jump Prepared By MJL Checked By ______ Page ______

Length of Hydraulic Jump.

Using Fig 7.6 from FCD Hydraulic Design manual.
with an $F_{r_1} \sim 5.0$ Length ~ 40 ft.

or using Fig 7.9 and assuming $t = 16$, $z = 1/2$
get a length of 90 ft. Chart does not have
$t = 21.5$ and $z = 0.167$ ft/ft. also in bold letters
"Do Not Extrapolate". (why $t = 16$ was used)

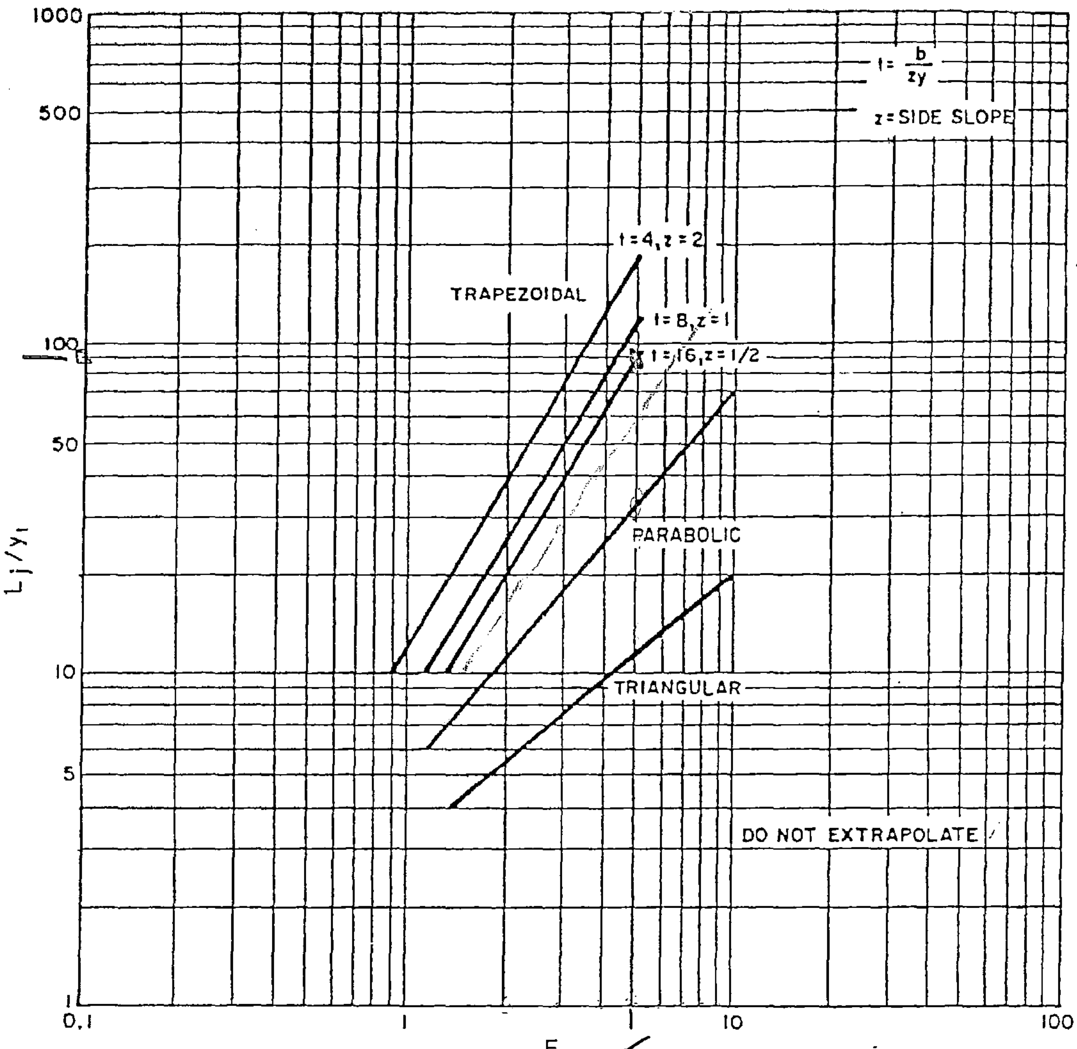
Can expect length of Jump to be between

40 ft & 90 ft ⇒ have 110 ft of lined
channel. Therefore, Hydraulic jump will occur
within lined channel section.

See attached Figures 7.6 & 7.9

FIGURE 7.9
LENGTH OF A HYDRAULIC JUMP FOR NON-RECTANGULAR CHANNELS
(USDOT, FHWA, HEC-14, 1983)

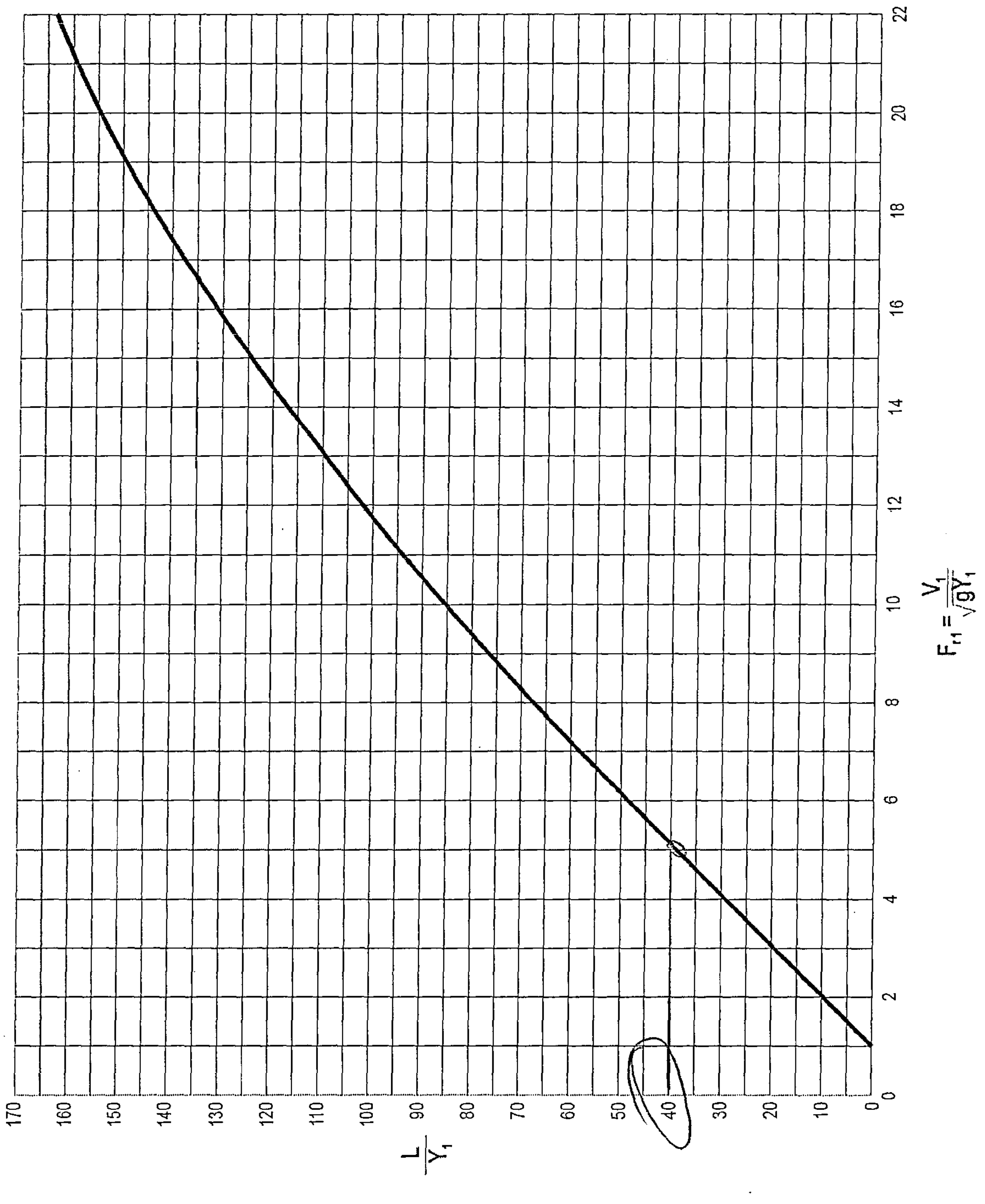
90



$t = \frac{110}{6(.85)} = 21.5$ } not on Graph ∴ use $t = 16$ $z = 1/2$

$z = 1V:6H = \frac{1}{6} = 0.167$ ft/ft

FIGURE 7.7
LENGTH OF HYDRAULIC JUMP FOR RECTANGULAR CHANNELS
(USDOT, FHWA, HEC-14, 1983)

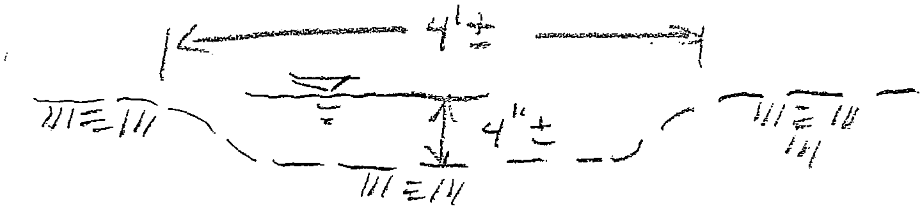


eec

Project Title Palm Valley Phase 5 Project No. 303007 Date 4.10.04

Subject Tailwater Pipe Flow Prepared By MJL Checked By ______ Page ______

Indian School Rd. ditch



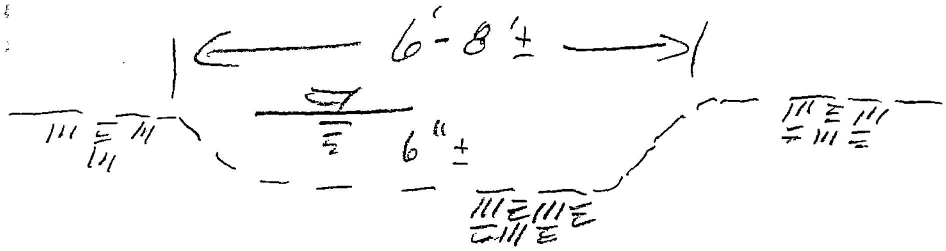
Typical slope ~ 0.3 %

Flow ~ 2 cfs 24" pipe cap. ~ 13 cfs

$\geq$ 2 cfs

$\therefore$ ok

Bollard wash ditch



Typical slope ~ 0.3 %

Flow 6.5 cfs 24" pipe cap ~ 13 cfs

$\therefore$ ok

Ind School Rd Tail water Ditch
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Trapezoidal Channel - 1
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Mannings Coefficient	0.030	
Slope	0.003000	ft/ft
Depth	0.33	ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	4.00	ft

Results		
Discharge	1.79	cfs
Flow Area	1.5	ft²
Wetted Perimeter	5.48	ft
Top Width	5.32	ft
Critical Depth	0.18	ft
Critical Slope	0.024489	ft/ft
Velocity	1.16	ft/s
Velocity Head	0.02	ft
Specific Energy	0.35	ft
Froude Number	0.38	
Flow Type	Subcritical	

Bullard Wash Tail Water flows
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Trapezoidal Channel - 2
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Mannings Coefficient	0.030	
Slope	0.002500	ft/ft
Depth	0.50	ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	8.00	ft

Results		
Discharge	6.44	cfs
Flow Area	4.5	ft²
Wetted Perimeter	10.24	ft
Top Width	10.00	ft
Critical Depth	0.27	ft
Critical Slope	0.021192	ft/ft
Velocity	1.43	ft/s
Velocity Head	0.03	ft
Specific Energy	0.53	ft
Froude Number	0.38	
Flow Type	Subcritical	

24 " Tailwater Pipe
Worksheet for Circular Channel

Tailwater pipe capacity
Assume flowing full

Project Description	
Worksheet	Circular Channel - 1
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.010	
Slope	0.001500	ft/ft
Diameter	24	in

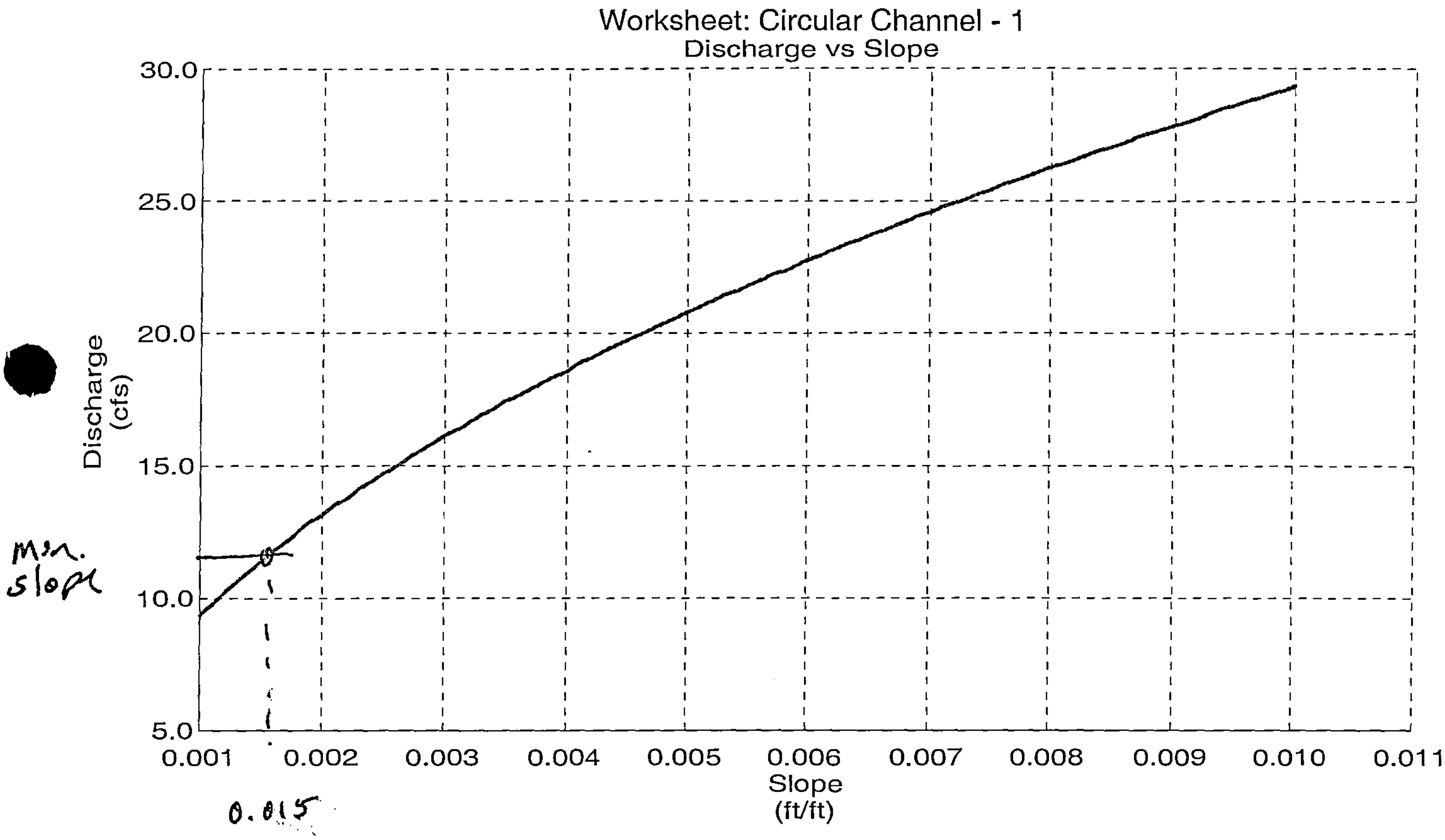
Results		
Depth	2.00	ft
Discharge	11.39	cfs
Flow Area	3.1	ft^2
Wetted Perimeter	6.28	ft
Top Width	0.00	ft
Critical Depth	1.21	ft
Percent Full	100.0	%
Critical Slope	0.003231	ft/ft
Velocity	3.63	ft/s
Velocity Head	0.20	ft
Specific Energy	2.20	ft
Froude Number	0.00	
Maximum Discharg	12.25	cfs
Discharge Full	11.39	cfs
Slope Full	0.001500	ft/ft
Flow Type	N/A	

Curve
Plotted Curves for Circular Channel

Project Description	
Worksheet	Circular Channel - 1
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

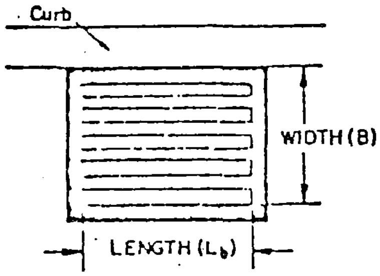
Input Data	
Mannings Coefficient	0.010
Diameter	24 in

Attribute	Minimum	Maximum	Increment
Slope (ft/ft)	0.001000	0.010000	0.000100

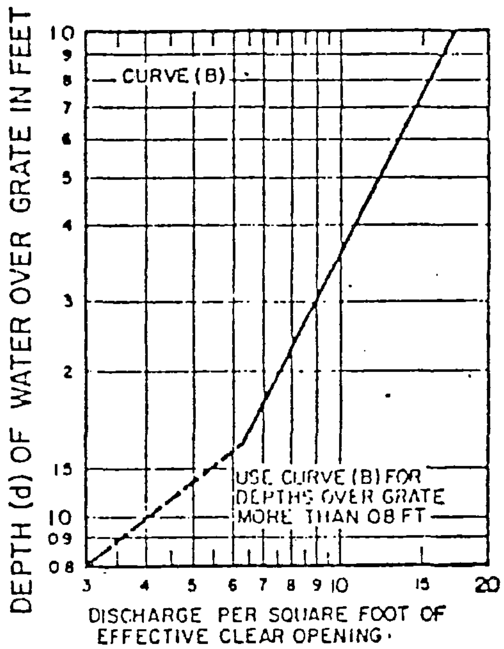


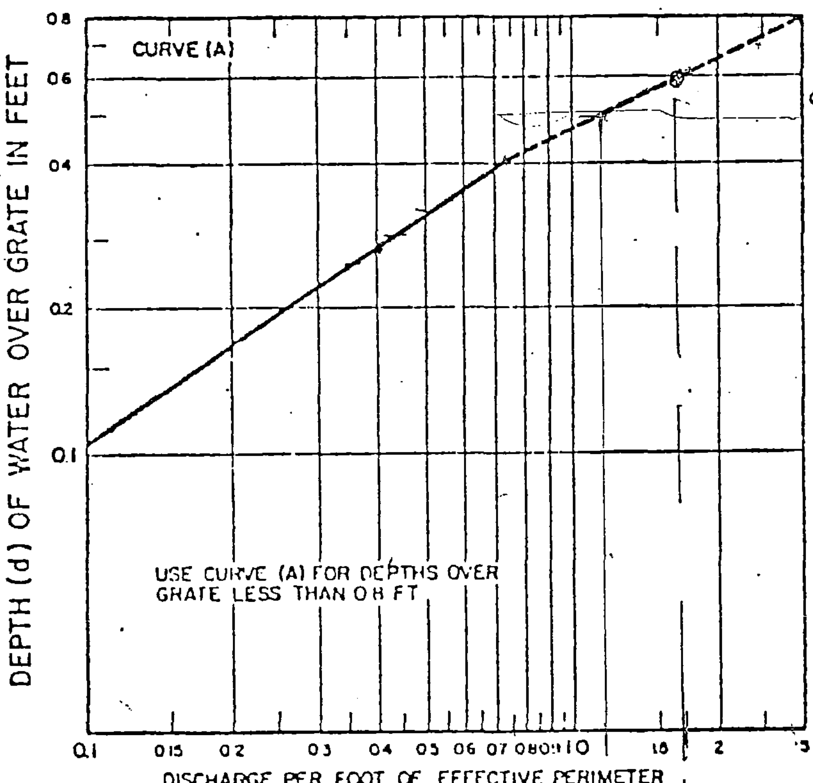
Palm Valley
Phase 5

Grate inlet Calculations
for Bollard Wash T.W. pipe Inlet Grate

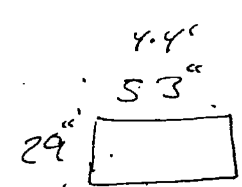


$P = 2B + L_b$
A = AREA OF CLEAR OPENING IN GRATE
TO ALLOW FOR CLOGGING DIVIDE P OR A BY 2 BEFORE OBTAINING d.
WITHOUT CURB $P = 2(B + L_b)$





GRATE TYPE	AREA	P
1	3.78	10.66
2	2.56	9.41



A = 10.6 □'
P = 4.4'
Depth ≈ 6"

weir flow

Q_p = 4.4 × 1.6 = 7.0 cfs
> actual ∴ ok
or

BUREAU OF PUBLIC ROADS
REV. AUG. 1968

HYDRAULIC CAPACITY OF GRATE
INLET IN SUMP

HEC-RAS Output for
Lateral Weir within Bullard Wash

River Sta	Q US	Q Leaving Total	Q Weir	Top Wdth	Weir Max Depth	Weir Avg Depth	Min El Weir Flow	E.G. US.	W.S. US.	E.G. DS	W.S. DS	Weir Submerg
	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1.16	2780	281.67	281.67	125.53	0.97	0.86	1025.55	1027.31	1026.84	1026.94	1026.48	0.76

See hand calculation on next page to confirm HEC-RAS model.

MJL

Project Title Palm Valley Phase 5 Project No. 302004 Date 8-30-04

Subject Weir Calculation Prepared By MJR Checked By ______ Page 1/1

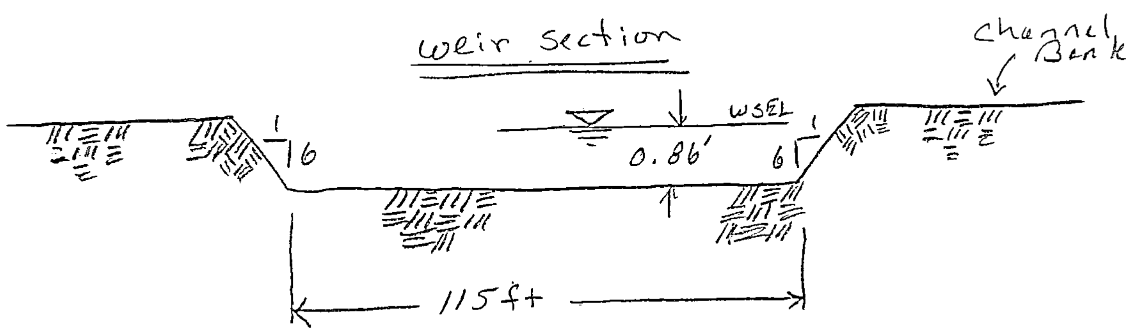
Hand Calculation to confirm HEC-RAS model

$Q = 280$ cfs

use $Q = CLH^{3/2}$ $C = 2.8$

from HEC-RAS model $L_{we} = 120$ ft $H = 0.89$ ft

weir section



$Q = 2.8(120)(0.89)^{3/2} = \underline{282 \text{ cfs}} \approx 280 \text{ cfs}$

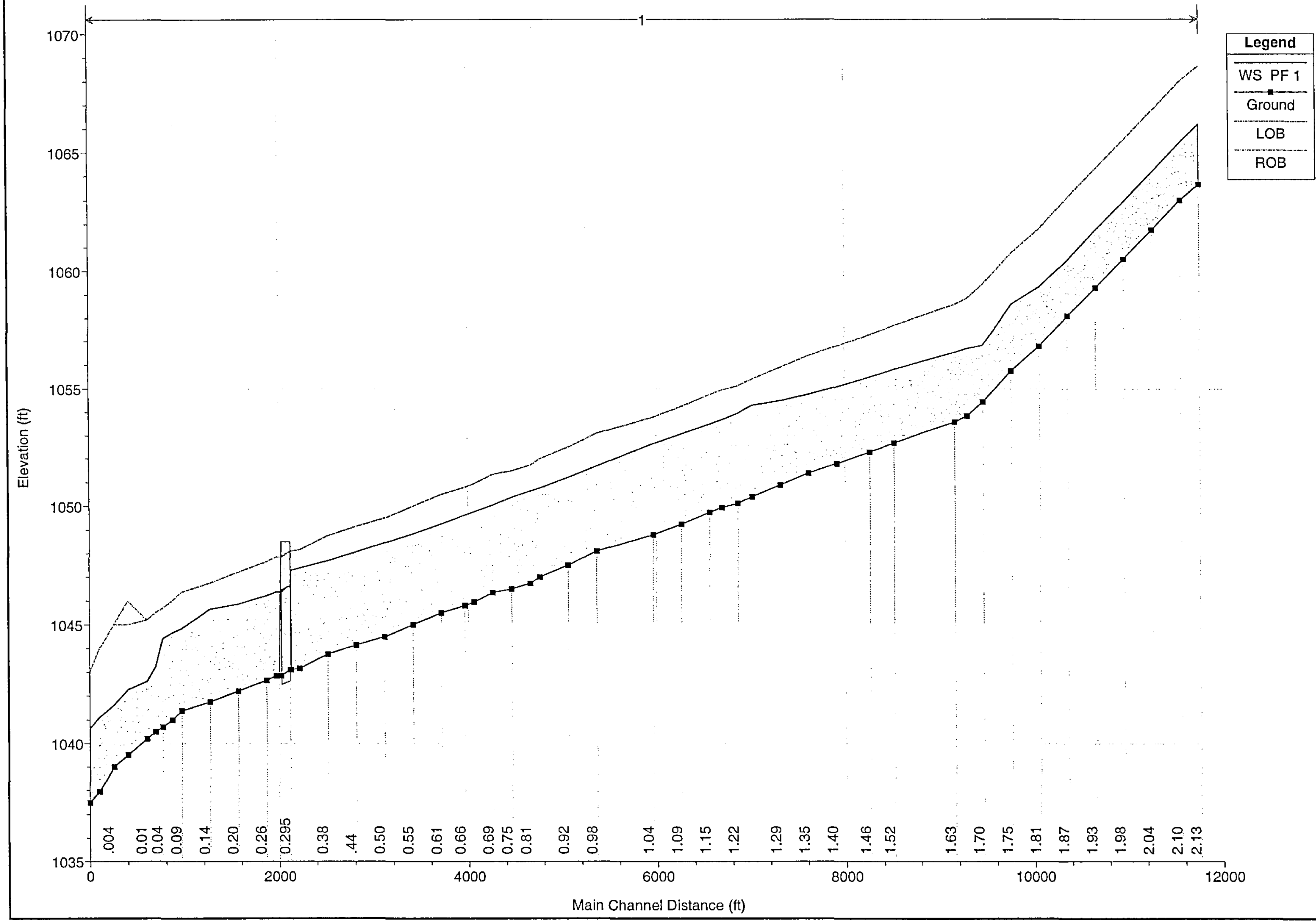
$\therefore$ OK

2.3 Camelback Road HEC-RAS Model

HEC-RAS Plan: Plan 01 River: Camalback Road C Reach: 1 Profile: PF 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)	
1	2.13	271.00	1063.65	1066.21	1065.47	1066.48	0.003319	4.20	64.48	35.45	0.55
[illegible]	2.10	271.00	1063.00	1065.41		1065.74	0.004158	4.56	59.47	34.30	0.61
[illegible]	2.04	271.00	1061.75	1064.16		1064.48	0.004190	4.57	59.31	34.26	0.61
1	1.98	271.00	1060.50	1062.94		1063.25	0.004013	4.50	60.23	34.48	0.60
1	1.93	271.00	1059.30	1061.75		1062.06	0.003890	4.45	60.91	34.63	0.59
1	1.87	271.00	1058.10	1060.46		1060.81	0.004498	4.69	57.82	33.91	0.63
1	1.81	271.00	1056.80	1059.35		1059.63	0.003359	4.22	64.21	35.39	0.55
1	1.75	271.00	1055.75	1058.61	1057.57	1058.81	0.002139	3.59	75.56	37.87	0.45
1	1.70	380.00	1054.45	1056.84		1057.49	0.008436	6.46	58.80	34.14	0.87
1	1.67	380.00	1053.85	1056.71		1056.85	0.001426	3.07	123.70	58.22	0.37
1	1.63	380.00	1053.60	1056.54		1056.68	0.001264	2.94	129.07	59.13	0.35
1	1.52	380.00	1052.70	1055.83		1055.94	0.000999	2.71	140.32	61.03	0.31
1	1.46	450.00	1052.30	1055.51		1055.66	0.001276	3.10	145.03	61.81	0.36
1	1.40	450.00	1051.80	1055.09		1055.23	0.001158	3.00	150.13	62.64	0.34
1	1.35	450.00	1051.40	1054.76		1054.89	0.001064	2.91	154.73	63.38	0.33
1	1.29	450.00	1050.90	1054.50		1054.61	0.000816	2.65	170.07	65.79	0.29
1	1.23	450.00	1050.40	1054.31		1054.39	0.000592	2.36	190.85	68.92	0.25
1	1.22	1750.00	1050.12	1053.96		1054.21	0.001384	3.98	439.70	137.82	0.39
1	1.17	1750.00	1049.95	1053.70		1053.96	0.001511	4.10	427.07	136.85	0.41
1	1.15	1750.00	1049.75	1053.50		1053.76	0.001506	4.09	427.56	136.89	0.41
1	1.09	1750.00	1049.25	1053.08		1053.32	0.001406	4.00	437.38	137.64	0.40
1	1.04	1750.00	1048.80	1052.67		1052.91	0.001352	3.95	443.20	138.08	0.39
1	0.98	1750.00	1048.10	1051.70		1051.99	0.001752	4.30	406.60	135.27	0.44
1	0.92	1750.00	1047.50	1051.22		1051.49	0.001555	4.14	422.99	136.54	0.41
1	0.86	1750.00	1047.00	1050.77		1051.03	0.001481	4.07	429.90	137.07	0.41
1	0.81	1750.00	1046.74	1050.65		1050.88	0.001303	3.90	448.65	138.50	0.38
1	0.75	1750.00	1046.50	1050.38		1050.62	0.001338	3.94	444.68	138.20	0.39
1	0.69	1750.00	1046.35	1050.06		1050.33	0.001573	4.15	421.39	136.41	0.42
1	0.68	1750.00	1045.95	1049.78		1050.02	0.001407	4.00	437.26	137.63	0.40
1	0.66	1750.00	1045.80	1049.64		1049.88	0.001393	3.99	438.76	137.75	0.39
1	0.61	1750.00	1045.50	1049.26		1049.52	0.001494	4.08	428.68	136.97	0.41
1	0.55	1750.00	1045.00	1048.84		1049.09	0.001389	3.98	439.21	137.78	0.39
[illegible]	0.50	1750.00	1044.50	1048.46		1048.69	0.001247	3.84	455.26	139.00	0.37
[illegible]	.44	1750.00	1044.15	1048.07		1048.31	0.001287	3.88	450.53	138.64	0.38
1	0.38	1750.00	1043.75	1047.69		1047.92	0.001264	3.86	453.21	138.85	0.38
1	0.32	1750.00	1043.15	1047.39		1047.58	0.000973	3.54	494.56	141.95	0.33
1	0.31	1750.00	1043.10	1047.29	1045.28	1047.49	0.001012	3.58	488.19	141.47	0.34
1	0.295	Culvert									
1	0.28	1750.00	1042.85	1046.38		1046.68	0.001891	4.41	396.45	134.47	0.45
1	0.26	1750.00	1042.65	1046.22		1046.49	0.001570	4.16	420.87	135.71	0.42
1	0.20	1750.00	1042.20	1045.87		1046.14	0.000882	4.21	415.57	135.96	0.42
1	0.14	1750.00	1041.75	1045.66		1045.90	0.000700	3.90	448.86	138.52	0.38
1	0.09	1750.00	1041.37	1044.84		1045.50	0.002343	6.52	268.55	94.72	0.68
1	0.08	1750.00	1041.00	1044.67		1045.25	0.001913	6.08	287.83	96.73	0.62
1	0.04	1750.00	1040.70	1044.44		1044.99	0.003319	5.94	294.75	97.44	0.60
1	0.03	1750.00	1040.50	1043.24	1043.24	1044.41	0.010108	8.67	201.94	87.40	1.00
1	0.01	1750.00	1040.20	1042.62	1042.18	1043.17	0.005546	5.95	294.33	143.51	0.73
1	0.005	1750.00	1039.50	1042.27		1042.45	0.001538	3.41	512.51	219.52	0.39
1	.004	2785.00	1039.00	1041.62		1042.03	0.003312	5.13	543.34	224.92	0.58
1	0.003	2785.00	1037.95	1041.12		1041.55	0.002934	5.29	526.00	189.17	0.56
1	.002	2785.00	1037.50	1040.64	1039.87	1041.19	0.003802	5.93	469.55	173.01	0.63

3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A



Camelback Road Channel

Freeboard (FB) Depth Calculation

$FB = 0.25*(depth + V^2/2g)$

River Sta	Min Ch El	W.S. Elev	Vel Chnl	Channel Depth	**Free Board Calc.**	Min. Free Board Depth
	(ft)	(ft)	(ft/s)	(ft)	**(ft)**	(ft)
2.13	1063.65	1066.21	4.2	2.56	**0.7**	1.0
2.1	1063	1065.41	4.56	2.41	**0.7**	1.0
2.04	1061.75	1064.16	4.57	2.41	**0.7**	1.0
1.98	1060.5	1062.94	4.5	2.44	**0.7**	1.0
1.93	1059.3	1061.75	4.45	2.45	**0.7**	1.0
1.87	1058.1	1060.46	4.69	2.36	**0.7**	1.0
1.81	1056.8	1059.35	4.22	2.55	**0.7**	1.0
1.75	1055.75	1058.61	3.59	2.86	**0.8**	1.0
1.7	1054.45	1056.84	6.46	2.39	**0.8**	1.0
1.67	1053.85	1056.71	3.07	2.86	**0.8**	1.0
1.63	1053.6	1056.54	2.94	2.94	**0.8**	1.0
1.52	1052.7	1055.83	2.71	3.13	**0.8**	1.0
1.46	1052.3	1055.51	3.1	3.21	**0.8**	1.0
1.4	1051.8	1055.09	3	3.29	**0.9**	1.0
1.35	1051.4	1054.76	2.91	3.36	**0.9**	1.0
1.29	1050.9	1054.5	2.65	3.6	**0.9**	1.0
1.23	1050.4	1054.31	2.36	3.91	**1.0**	1.0
1.22	1050.12	1053.96	3.98	3.84	**1.0**	1.0
1.17	1049.95	1053.7	4.1	3.75	**1.0**	1.0
1.15	1049.75	1053.5	4.09	3.75	**1.0**	1.0
1.09	1049.25	1053.08	4	3.83	**1.0**	1.0
1.04	1048.8	1052.67	3.95	3.87	**1.0**	1.0
0.98	1048.1	1051.7	4.3	3.6	**1.0**	1.0
0.92	1047.5	1051.22	4.14	3.72	**1.0**	1.0
0.86	1047	1050.77	4.07	3.77	**1.0**	1.0
0.81	1046.74	1050.65	3.9	3.91	**1.0**	1.0
0.75	1046.5	1050.38	3.94	3.88	**1.0**	1.0
0.69	1046.35	1050.06	4.15	3.71	**1.0**	1.0
0.68	1045.95	1049.78	4	3.83	**1.0**	1.0
0.66	1045.8	1049.64	3.99	3.84	**1.0**	1.0
0.61	1045.5	1049.26	4.08	3.76	**1.0**	1.0
0.55	1045	1048.84	3.98	3.84	**1.0**	1.0
0.5	1044.5	1048.46	3.84	3.96	**1.0**	1.0
0.44	1044.15	1048.07	3.88	3.92	**1.0**	1.0

0.38	1043.75	1047.69	3.86	3.94	**1.0**	1.0
0.32	1043.15	1047.39	3.54	4.24	**1.1**	
0.31	1043.1	1047.29	3.58	4.19	**1.1**	1.1
0.295				0	**0.0**	
0.28	1042.85	1046.38	4.41	3.53	**1.0**	1.0
0.26	1042.65	1046.22	4.16	3.57	**1.0**	1.0
0.2	1042.2	1045.87	4.21	3.67	**1.0**	1.0
0.14	1041.75	1045.66	3.9	3.91	**1.0**	1.0
0.09	1041.37	1044.84	6.52	3.47	**1.0**	1.0
0.04	1041	1044.67	6.08	3.67	**1.1**	1.1
0.03	1040.7	1044.44	5.94	3.74	**1.1**	1.1
0.01	1040.5	1043.24	8.67	2.74	**1.0**	1.0
0.005	1040.2	1042.62	5.95	2.42	**0.7**	1.0
0.004	1039.5	1042.27	3.41	2.77	**0.7**	1.0
0.003	1039	1041.62	5.13	2.62	**0.8**	1.0
0.002	1037.95	1041.12	5.29	3.17	**0.9**	1.0

Camelback Road
Channel
Palm Valley Phase V

River Sta	Channel Station
2.13	3714
2.1	3914
2.04	4214
1.98	4514
1.93	4814
1.87	5114
1.81	5414
1.75	5714
1.7	6014
1.67	6184
1.63	6314
1.52	6964
1.46	7214
1.4	7564
1.35	7864
1.29	8164
1.23	8464
1.22	8614
1.17	8784
1.15	8914
1.09	9214
1.04	9514
0.98	10114
0.92	10414
0.86	10714
0.81	10814
0.75	11014
0.69	11214
0.68	11414
0.66	11514
0.61	11764
0.55	12064
0.5	12364
0.44	12664
0.38	12964
0.32	13264
0.31	13354
0.295	
0.28	13514
0.26	13614
0.2	13914
0.14	14214
0.09	14514
0.08	14614
0.04	14714
0.03	14789
0.01	14879
0.005	15079
0.004	15229
0.003	15379
0.002	15479

HEC-RAS Version 3.0.1 Mar 2001
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
 X     X  X       X    X       X  X    X    X        X
 X     X  XXXXXX   XXXX        X   X   X    X   XXXXX
```

PROJECT DATA
Project Title: 3-19-04CB Road Ras
Project File : 303004CamelbackChannel.prj
Run Date and Time: 9/3/2004 11:09:29 AM

Project in English units

Project Description:
Palm Valley Phase V
Camelback Road Channel
EEC # 303004.03

9-2-04

PLAN DATA

Plan Title: Plan 01
Plan File : w:\303004\CD FILES\final Submittal\Camel HEC-RAS\303004CamelbackChannel.p01

Geometry Title: Camelback Channel Geo 1A
Geometry File : w:\303004\CD FILES\final Submittal\Camel HEC-RAS\303004CamelbackChannel.g01

Flow Title : Flow 02
Flow File : w:\303004\CD FILES\final Submittal\Camel HEC-RAS\303004CamelbackChannel.f02

```
Plan Summary Information:
Number of:  Cross Sections =   50    Mulitple Openings =   0
            Culverts       =    1    Inline Weirs      =   0
            Bridges        =    0
```

```
Computational Information
    Water surface calculation tolerance =  0.003
    Critical depth calculaton tolerance =  0.003
    Maximum number of interations       =  20
    Maximum difference tolerance        =  0.1
    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: Flow 02
Flow File : w:\303004\CD FILES\final Submittal\Camel HEC-RAS\303004CamelbackChannel.f02

Flow Data (cfs)

River	Reach	RS	PF 1
Camalback Road	C1	2.13	271
Camalback Road	C1	1.70	380

Camalback Road C1	1.46	450
Camalback Road C1	1.22	1750
Camalback Road C1	.004	2785

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Camalback Road C1		PF 1	Normal S = .004	Normal S = .0038

GEOMETRY DATA

Geometry Title: Camelback Channel Geo 1A
Geometry File : W:\303004\CD FILES\final Submittal\Camel HEC-RAS\303004CamelbackChannel.g01

CROSS SECTION RIVER: Camalback Road C
REACH: 1 RS: 2.13

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
72.5	1068.65	92.5	1063.65	100	1063.65	107.5	1063.65	127.5	1068.65

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
72.5	.045	72.5	.03	127.5	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
72.5	127.5	200	200	200	.1	.3

CROSS SECTION RIVER: Camalback Road C
REACH: 1 RS: 2.10

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
72.5	1068	92.5	1063	100	1063	107.5	1063	127.5	1068

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
72.5	.045	72.5	.03	127.5	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
72.5	127.5	300	300	300	.1	.3

CROSS SECTION RIVER: Camalback Road C
REACH: 1 RS: 2.04

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
72.5	1066.75	92.5	1061.75	100	1061.75	107.5	1061.75	127.5	1066.75

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
72.5	.045	72.5	.03	127.5	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
72.5	127.5	300	300	300	.1	.3

CROSS SECTION RIVER: Camalback Road C
REACH: 1 RS: 1.98

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
72.5	1065.5	92.5	1060.5	100	1060.5	107.5	1060.5	127.5	1065.5

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
72.5	.045	72.5	.03	127.5	.045

```
Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
          72.5    127.5              300      300    300                 .1        .3

CROSS SECTION              RIVER: Camalback Road C
REACH: 1                      RS: 1.93

INPUT
Description:
Station Elevation Data     num=          5
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
    72.5   1064.3     92.5   1059.3      100   1059.3    107.5   1059.3    127.5   1064.3

Manning's n Values         num=          3
     Sta    n Val      Sta    n Val      Sta    n Val
    72.5     .045     72.5      .03    127.5     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
          72.5    127.5              300      300    300                 .1        .3

CROSS SECTION              RIVER: Camalback Road C
REACH: 1                      RS: 1.87

INPUT
Description:
Station Elevation Data     num=          5
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
    72.5   1063.1     92.5   1058.1      100   1058.1    107.5   1058.1    127.5   1063.1

Manning's n Values         num=          3
     Sta    n Val      Sta    n Val      Sta    n Val
    72.5     .045     72.5      .03    127.5     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
          72.5    127.5              300      300    300                 .1        .3

CROSS SECTION              RIVER: Camalback Road C
REACH: 1                      RS: 1.81

INPUT
Description:
Station Elevation Data     num=          5
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
    72.5   1061.8     92.5   1056.8      100   1056.8    107.5   1056.8    127.5   1061.8

Manning's n Values         num=          3
     Sta    n Val      Sta    n Val      Sta    n Val
    72.5     .045     72.5      .03    127.5     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
          72.5    127.5              300      300    300                 .1        .3

CROSS SECTION              RIVER: Camalback Road C
REACH: 1                      RS: 1.75

INPUT
Description:
Station Elevation Data     num=          5
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
    72.5  1060.75     92.5  1055.75      100  1055.75    107.5  1055.75    127.5  1060.75

Manning's n Values         num=          3
     Sta    n Val      Sta    n Val      Sta    n Val
    72.5     .045     72.5      .03    127.5     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
          72.5    127.5              300      300    300                 .1        .3

CROSS SECTION              RIVER: Camalback Road C
REACH: 1                      RS: 1.70

INPUT
Description:
Station Elevation Data     num=          5
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
    72.5  1059.45     92.5  1054.45      100  1054.45    107.5  1054.45    127.5  1059.45

Manning's n Values         num=          3
     Sta    n Val      Sta    n Val      Sta    n Val
```

72.5	.045	72.5	.03	127.5	.045

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
72.5 127.5 170 170 170 .1 .3

CROSS SECTION RIVER: Camalback Road C
REACH: 1 RS: 1.67

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
55	1058.85	85	1053.93	100	1053.85	115	1053.93	135	1058.85

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
55	.045	55	.03	135	.045

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
55 135 130.02 130.02 130.02 .1 .3

CROSS SECTION RIVER: Camalback Road C
REACH: 1 RS: 1.63

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
55	1058.6	85	1053.67	100	1053.6	115	1053.67	135	1058.6

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
55	.045	55	.03	135	.045

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
55 135 650 650 650 .1 .3

CROSS SECTION RIVER: Camalback Road C
REACH: 1 RS: 1.52

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
55	1057.7	85	1052.77	100	1052.7	115	1052.77	135	1057.7

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
55	.045	55	.03	135	.045

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
55 135 250 250 250 .1 .3

CROSS SECTION RIVER: Camalback Road C
REACH: 1 RS: 1.46

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
55	1057.3	85	1052.37	100	1052.3	115	1052.37	135	1057.3

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
55	.045	55	.03	135	.045

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
55 135 350 350 350 .1 .3

CROSS SECTION RIVER: Camalback Road C
REACH: 1 RS: 1.40

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
55	1056.8	85	1051.87	100	1051.8	115	1051.87	135	1056.8

Manning's n Values num= 3

```
      Sta    n Val       Sta    n Val       Sta    n Val
       55     .045        55      .03       135     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
            55      135               300      300     300                 .1         .3

CROSS SECTION              RIVER: Camalback Road C
REACH: 1                         RS: 1.35

INPUT
Description:
Station Elevation Data      num=          5
     Sta     Elev       Sta      Elev       Sta     Elev       Sta     Elev       Sta     Elev
      55   1056.4        85   1051.47       100   1051.4       115  1051.47       135   1056.4

Manning's n Values          num=          3
     Sta    n Val       Sta    n Val       Sta    n Val
      55     .045        55      .03       135     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
            55      135               300      300     300                 .1         .3

CROSS SECTION              RIVER: Camalback Road C
REACH: 1                         RS: 1.29

INPUT
Description:
Station Elevation Data      num=          5
     Sta     Elev       Sta      Elev       Sta     Elev       Sta     Elev       Sta     Elev
      55   1055.9        85   1050.97       100   1050.9       115  1050.97       135   1055.9

Manning's n Values          num=          3
     Sta    n Val       Sta    n Val       Sta    n Val
      55     .045        55      .03       135     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
            55      135               300      300     300                 .1         .3

CROSS SECTION              RIVER: Camalback Road C
REACH: 1                         RS: 1.23

INPUT
Description:
Station Elevation Data      num=          5
     Sta     Elev       Sta      Elev       Sta     Elev       Sta     Elev       Sta     Elev
      55   1055.4        85   1050.47       100   1050.4       115  1050.47       135   1055.4

Manning's n Values          num=          3
     Sta    n Val       Sta    n Val       Sta    n Val
      55     .045        55      .03       135     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
            55      135               150      150     150                 .1         .3

CROSS SECTION              RIVER: Camalback Road C
REACH: 1                         RS: 1.22

INPUT
Description:
Station Elevation Data      num=          5
     Sta     Elev       Sta      Elev       Sta     Elev       Sta     Elev       Sta     Elev
      20  1055.12        50   1050.37       100  1050.12       150  1050.37       170  1055.12

Manning's n Values          num=          3
     Sta    n Val       Sta    n Val       Sta    n Val
      20     .045        20      .03       170     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
            20      170               170      170     170                 .1         .3

CROSS SECTION              RIVER: Camalback Road C
REACH: 1                         RS: 1.17

INPUT
Description:
Station Elevation Data      num=          5
     Sta     Elev       Sta      Elev       Sta     Elev       Sta     Elev       Sta     Elev
      20  1054.95        50    1050.2       100  1049.95       150   1050.2       170  1054.95
```

```
Manning's n Values            num=        3
      Sta    n Val       Sta    n Val      Sta    n Val
       20     .045        20     .03       170     .045

Bank Sta: Left    Right     Lengths: Left Channel   Right       Coeff Contr.    Expan.
            20      170              130.02  130.02  130.02              .1         .3

CROSS SECTION                  RIVER: Camalback Road C
REACH: 1                          RS: 1.15

INPUT
Description:
Station Elevation Data        num=        5
      Sta    Elev        Sta     Elev      Sta    Elev       Sta    Elev       Sta    Elev
       20 1054.75         50     1050      100 1049.75       150    1050       170 1054.75

Manning's n Values            num=        3
      Sta    n Val       Sta    n Val      Sta    n Val
       20     .045        20     .03       170     .045

Bank Sta: Left    Right     Lengths: Left Channel   Right       Coeff Contr.    Expan.
            20      170                300     300     300               .1         .3

CROSS SECTION                  RIVER: Camalback Road C
REACH: 1                          RS: 1.09

INPUT
Description:
Station Elevation Data        num=        5
      Sta    Elev        Sta     Elev      Sta    Elev       Sta    Elev       Sta    Elev
       20 1054.25         50   1049.5      100 1049.25       150  1049.5       170 1054.25

Manning's n Values            num=        3
      Sta    n Val       Sta    n Val      Sta    n Val
       20     .045        20     .03       170     .045

Bank Sta: Left    Right     Lengths: Left Channel   Right       Coeff Contr.    Expan.
            20      170                300     300     300               .1         .3

CROSS SECTION                  RIVER: Camalback Road C
REACH: 1                          RS: 1.04

INPUT
Description:
Station Elevation Data        num=        5
      Sta    Elev        Sta     Elev      Sta    Elev       Sta    Elev       Sta    Elev
       20  1053.8         50  1049.05      100  1048.8       150 1049.05       170  1053.8

Manning's n Values            num=        3
      Sta    n Val       Sta    n Val      Sta    n Val
       20     .045        20     .03       170     .045

Bank Sta: Left    Right     Lengths: Left Channel   Right       Coeff Contr.    Expan.
            20      170                600     600     600               .1         .3

CROSS SECTION                  RIVER: Camalback Road C
REACH: 1                          RS: 0.98

INPUT
Description:
Station Elevation Data        num=        5
      Sta    Elev        Sta     Elev      Sta    Elev       Sta    Elev       Sta    Elev
       20  1053.1         50  1048.35      100  1048.1       150 1048.35       170  1053.1

Manning's n Values            num=        3
      Sta    n Val       Sta    n Val      Sta    n Val
       20     .045        20     .03       170     .045

Bank Sta: Left    Right     Lengths: Left Channel   Right       Coeff Contr.    Expan.
            20      170                300     300     300               .1         .3

CROSS SECTION                  RIVER: Camalback Road C
REACH: 1                          RS: 0.92

INPUT
Description:
Station Elevation Data        num=        5
      Sta    Elev        Sta     Elev      Sta    Elev       Sta    Elev       Sta    Elev
       20  1052.5         50  1047.75      100  1047.5       150 1047.75       170  1052.5
```

```
Manning's n Values          num=        3
     Sta    n Val      Sta    n Val     Sta    n Val
      20     .045       20      .03     170     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right        Coeff Contr.    Expan.
            20      170              300     300      300                   .1        .3

CROSS SECTION               RIVER: Camalback Road C
REACH: 1                       RS: 0.86

INPUT
Description:
Station Elevation Data      num=        5
     Sta    Elev       Sta     Elev     Sta     Elev       Sta     Elev      Sta     Elev
      20    1052        50  1047.25     100     1047       150  1047.25      170     1052

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val     Sta    n Val
      20     .045       20      .03     170     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right        Coeff Contr.    Expan.
            20      170              100     100      100                   .1        .3

CROSS SECTION               RIVER: Camalback Road C
REACH: 1                       RS: 0.81

INPUT
Description:
Station Elevation Data      num=        5
     Sta    Elev       Sta     Elev     Sta     Elev       Sta     Elev      Sta     Elev
      20 1051.74        50  1046.99     100  1046.74       150  1046.99      170  1051.74

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val     Sta    n Val
      20     .045       20      .03     170     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right        Coeff Contr.    Expan.
            20      170              200     200      200                   .1        .3

CROSS SECTION               RIVER: Camalback Road C
REACH: 1                       RS: 0.75

INPUT
Description:
Station Elevation Data      num=        5
     Sta    Elev       Sta     Elev     Sta     Elev       Sta     Elev      Sta     Elev
      20  1051.5        50  1046.75     100   1046.5       150  1046.75      170   1051.5

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val     Sta    n Val
      20     .045       20      .03     170     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right        Coeff Contr.    Expan.
            20      170              200     200      200                   .1        .3

CROSS SECTION               RIVER: Camalback Road C
REACH: 1                       RS: 0.69

INPUT
Description:
Station Elevation Data      num=        5
     Sta    Elev       Sta     Elev     Sta     Elev       Sta     Elev      Sta     Elev
      20 1051.35        50   1046.6     100  1046.35       150   1046.6      170  1051.35

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val     Sta    n Val
      20     .045       20      .03     170     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right        Coeff Contr.    Expan.
            20      170              200     200      200                   .1        .3

CROSS SECTION               RIVER: Camalback Road C
REACH: 1                       RS: 0.68

INPUT
Description:
Station Elevation Data      num=        5
     Sta    Elev       Sta     Elev     Sta     Elev       Sta     Elev      Sta     Elev
```

```
      20 1050.95       50  1046.2      100 1045.95      150  1046.2      170 1050.95

Manning's n Values            num=         3
      Sta    n Val     Sta    n Val       Sta    n Val
       20     .045      20      .03       170     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right       Coeff Contr.     Expan.
            20     170                 100     100     100                 .1         .3

CROSS SECTION               RIVER: Camalback Road C
REACH: 1                       RS: 0.66

INPUT
Description:
Station Elevation Data        num=         5
      Sta     Elev       Sta     Elev      Sta      Elev       Sta     Elev      Sta     Elev
       20   1050.8        50  1046.05      100    1045.8       150  1046.05      170   1050.8

Manning's n Values            num=         3
      Sta    n Val     Sta    n Val       Sta    n Val
       20     .045      20      .03       170     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right       Coeff Contr.     Expan.
            20     170                 250     250     250                 .1         .3

CROSS SECTION               RIVER: Camalback Road C
REACH: 1                       RS: 0.61

INPUT
Description:
Station Elevation Data        num=         5
      Sta     Elev       Sta     Elev      Sta      Elev       Sta     Elev      Sta     Elev
       20   1050.5        50  1045.75      100    1045.5       150  1045.75      170   1050.5

Manning's n Values            num=         3
      Sta    n Val     Sta    n Val       Sta    n Val
       20     .045      20      .03       170     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right       Coeff Contr.     Expan.
            20     170                 300     300     300                 .1         .3

CROSS SECTION               RIVER: Camalback Road C
REACH: 1                       RS: 0.55

INPUT
Description:
Station Elevation Data        num=         5
      Sta     Elev       Sta     Elev      Sta      Elev       Sta     Elev      Sta     Elev
       20     1050        50  1045.25      100      1045       150  1045.25      170     1050

Manning's n Values            num=         3
      Sta    n Val     Sta    n Val       Sta    n Val
       20     .045      20      .03       170     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right       Coeff Contr.     Expan.
            20     170                 300     300     300                 .1         .3

CROSS SECTION               RIVER: Camalback Road C
REACH: 1                       RS: 0.50

INPUT
Description:
Station Elevation Data        num=         5
      Sta     Elev       Sta     Elev      Sta      Elev       Sta     Elev      Sta     Elev
       20   1049.5        50  1044.75      100    1044.5       150  1044.75      170   1049.5

Manning's n Values            num=         3
      Sta    n Val     Sta    n Val       Sta    n Val
       20     .045      20      .03       170     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right       Coeff Contr.     Expan.
            20     170                 300     300     300                 .1         .3

CROSS SECTION               RIVER: Camalback Road C
REACH: 1                       RS: .44

INPUT
Description:
Station Elevation Data        num=         5
```

```
     Sta     Elev       Sta     Elev       Sta     Elev       Sta     Elev       Sta     Elev
      20 1049.15         50   1044.4       100  1044.15       150   1044.4       170  1049.15

Manning's n Values            num=          3
     Sta     n Val      Sta     n Val      Sta     n Val
      20      .045       20       .03       170     .045

Bank Sta: Left     Right      Lengths: Left Channel     Right          Coeff Contr.     Expan.
            20       170                300       300     300                   .1         .3

CROSS SECTION                   RIVER: Camalback Road C
REACH: 1                           RS: 0.38

INPUT
Description:
Station Elevation Data        num=          5
     Sta     Elev       Sta     Elev       Sta     Elev       Sta     Elev       Sta     Elev
      20 1048.75         50     1044       100  1043.75       150     1044       170  1048.75

Manning's n Values            num=          3
     Sta     n Val      Sta     n Val      Sta     n Val
      20      .045       20       .03       170     .045

Bank Sta: Left     Right      Lengths: Left Channel     Right          Coeff Contr.     Expan.
            20       170                300       300     300                   .1         .3

CROSS SECTION                   RIVER: Camalback Road C
REACH: 1                           RS: 0.32

INPUT
Description:
Station Elevation Data        num=          5
     Sta     Elev       Sta     Elev       Sta     Elev       Sta     Elev       Sta     Elev
      20 1048.15         50   1043.4       100  1043.15       150   1043.4       170  1048.15

Manning's n Values            num=          3
     Sta     n Val      Sta     n Val      Sta     n Val
      20      .045       20       .03       170     .045

Bank Sta: Left     Right      Lengths: Left Channel     Right          Coeff Contr.     Expan.
            20       170                 90        90      90                   .1         .3

CROSS SECTION                   RIVER: Camalback Road C
REACH: 1                           RS: 0.31

INPUT
Description:
Station Elevation Data        num=          5
     Sta     Elev       Sta     Elev       Sta     Elev       Sta     Elev       Sta     Elev
      20   1048.1        50  1043.35       100   1043.1       150  1043.35       170   1048.1

Manning's n Values            num=          3
     Sta     n Val      Sta     n Val      Sta     n Val
      20      .045       20       .03       170     .045

Bank Sta: Left     Right      Lengths: Left Channel     Right          Coeff Contr.     Expan.
            20       170                160       160     160                   .1         .3

CULVERT                         RIVER: Camalback Road C
REACH: 1                           RS: 0.295

INPUT
Description:
Distance from Upstream XS =          10
Deck/Roadway Width        =          95
Weir Coefficient          =         2.6
Upstream  Deck/Roadway Coordinates
    num=         2
     Sta Hi Cord Lo Cord        Sta Hi Cord Lo Cord
       5  1048.5    1040        220  1048.5    1040

Upstream Bridge Cross Section Data
Station Elevation Data        num=          5
     Sta     Elev       Sta     Elev       Sta     Elev       Sta     Elev       Sta     Elev
      20   1048.1        50  1043.35       100   1043.1       150  1043.35       170   1048.1

Manning's n Values            num=          3
     Sta     n Val      Sta     n Val      Sta     n Val
      20      .045       20       .03       170     .045
```

```
Bank Sta: Left    Right     Coeff Contr.    Expan.
           20      170              .1         .3

Downstream  Deck/Roadway Coordinates
     num=        2
       Sta Hi Cord Lo Cord        Sta Hi Cord Lo Cord
         5  1048.5    1040        220  1048.5    1040

Downstream Bridge Cross Section Data
Station Elevation Data      num=        5
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
      20  1047.85       50   1043.1      100  1042.85      150   1043.1      170  1047.85

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
      20     .045       20      .03      170     .045

Bank Sta: Left    Right     Coeff Contr.    Expan.
           20      170              .3         .5

Upstream Embankment side slope                  =        4 horiz. to 1.0 vertical
Downstream Embankment side slope                =        4 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =         .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          4       10
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length     n Value   Entrance Loss Coef    Exit Loss Coef
                  5      95        .025                   .5                 1
Number of Barrels =  8
Upstream    Elevation =   1042.64
Centerline Stations
     Sta.     Sta.     Sta.     Sta.     Sta.     Sta.     Sta.     Sta.
     61.5     72.5     83.5     94.5    105.5    116.5    127.5    138.5
Downstream Elevation =   1042.47
Centerline Stations
     Sta.     Sta.     Sta.     Sta.     Sta.     Sta.     Sta.     Sta.
     61.5     72.5     83.5     94.5    105.5    116.5    127.5    138.5

CROSS SECTION              RIVER: Camalback Road C
REACH: 1                       RS: 0.28

INPUT
Description:
Station Elevation Data      num=        5
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
      20  1047.85       50   1043.1      100  1042.85      150   1043.1      170  1047.85

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
      20     .045       20      .03      170     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
           20      170                100     100      100              .3         .5

CROSS SECTION              RIVER: Camalback Road C
REACH: 1                       RS: 0.26

INPUT
Description:
Station Elevation Data      num=        5
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
      20  1047.65       50  1042.65      100  1042.65      150  1042.65      170  1047.65

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
      20     .045       20      .03      170     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
           20      170                300     300      300              .3         .5
```

```
CROSS SECTION              RIVER: Camalback Road C
REACH: 1                      RS: 0.20

INPUT
Description:
Station Elevation Data      num=          5
     Sta     Elev      Sta     Elev       Sta     Elev       Sta     Elev       Sta     Elev
      20   1047.2       50  1042.45       100   1042.2       150  1042.45       170   1047.2

Manning's n Values          num=          3
     Sta    n Val      Sta    n Val       Sta    n Val
      20     .045       20     .022       170     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right       Coeff Contr.    Expan.
            20      170               300     300      300                 .1        .3

CROSS SECTION              RIVER: Camalback Road C
REACH: 1                      RS: 0.14

INPUT
Description:
Station Elevation Data      num=          5
     Sta     Elev      Sta     Elev       Sta     Elev       Sta     Elev       Sta     Elev
      20  1046.75       50     1042       100  1041.75       150     1042       170  1046.75

Manning's n Values          num=          3
     Sta    n Val      Sta    n Val       Sta    n Val
      20     .045       20     .022       170     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right       Coeff Contr.    Expan.
            20      170               300     300      300                 .1        .3

CROSS SECTION              RIVER: Camalback Road C
REACH: 1                      RS: 0.09

INPUT
Description:
Station Elevation Data      num=          5
     Sta     Elev      Sta     Elev       Sta     Elev       Sta     Elev       Sta     Elev
      40  1046.37       70  1041.37       100  1041.37       130  1041.37       150  1046.37

Manning's n Values          num=          3
     Sta    n Val      Sta    n Val       Sta    n Val
      40     .045       40     .022       150     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right       Coeff Contr.    Expan.
            40      150               100     100      100                 .3        .5

CROSS SECTION              RIVER: Camalback Road C
REACH: 1                      RS: 0.08

INPUT
Description:
Station Elevation Data      num=          5
     Sta     Elev      Sta     Elev       Sta     Elev       Sta     Elev       Sta     Elev
      40     1046       70     1041       100     1041       130     1041       150     1046

Manning's n Values          num=          3
     Sta    n Val      Sta    n Val       Sta    n Val
      40     .045       40     .022       150     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right       Coeff Contr.    Expan.
            40      150               100     100      100                 .1        .3

CROSS SECTION              RIVER: Camalback Road C
REACH: 1                      RS: 0.04

INPUT
Description:
Station Elevation Data      num=          5
     Sta     Elev      Sta     Elev       Sta     Elev       Sta     Elev       Sta     Elev
      40   1045.7       70   1040.7       100   1040.7       130   1040.7       150   1045.7

Manning's n Values          num=          3
     Sta    n Val      Sta    n Val       Sta    n Val
      40     .045       40      .03       150     .045

Bank Sta: Left    Right     Lengths: Left Channel    Right       Coeff Contr.    Expan.
```

40	150	75	75	75		.3	.5

CROSS SECTION RIVER: Camalback Road C
REACH: 1 RS: 0.03

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
40	1045.5	70	1040.5	100	1040.5	130	1040.5	150	1045.5

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
40	.045	40	.03	150	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
40	150	90	90	90	.3	.5

CROSS SECTION RIVER: Camalback Road C
REACH: 1 RS: 0.01

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
40	1045.2	70	1040.2	100	1040.2	170	1040.2	230	1045.2

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
40	.045	40	.03	230	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
40	230	250	200	100	.3	.5

CROSS SECTION RIVER: Camalback Road C
REACH: 1 RS: 0.005

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
100	1045	140	1040	220	1039.5	330	1040	360	1046

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
100	.045	100	.03	360	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
100	360	190.02	150	55.02	.3	.5

CROSS SECTION RIVER: Camalback Road C
REACH: 1 RS: .004

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
100	1045	140	1039	190	1039	330	1039	370	1045

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
100	.045	100	.03	370	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
100	370	180	150	115.02	.3	.5

CROSS SECTION RIVER: Camalback Road C
REACH: 1 RS: 0.003

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
100	1044	125	1038.2	195	1037.95	283	1038.2	320	1044

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
100	.045	100	.03	320	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
100	320	100	100	100	.3	.5

CROSS SECTION RIVER: Camalback Road C
REACH: 1 RS: .002

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
100	1043	130	1037.75	200	1037.5	270	1037.75	300	1043

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
100	.045	100	.03	300	.045

Bank Sta: Left	Right	Coeff Contr.	Expan.
100	300	.3	.5

SUMMARY OF MANNING'S N VALUES

River:Camalback Road C

Reach	River Sta.	n1	n2	n3
1	2.13	.045	.03	.045
1	2.10	.045	.03	.045
1	2.04	.045	.03	.045
1	1.98	.045	.03	.045
1	1.93	.045	.03	.045
1	1.87	.045	.03	.045
1	1.81	.045	.03	.045
1	1.75	.045	.03	.045
1	1.70	.045	.03	.045
1	1.67	.045	.03	.045
1	1.63	.045	.03	.045
1	1.52	.045	.03	.045
1	1.46	.045	.03	.045
1	1.40	.045	.03	.045
1	1.35	.045	.03	.045
1	1.29	.045	.03	.045
1	1.23	.045	.03	.045
1	1.22	.045	.03	.045
1	1.17	.045	.03	.045
1	1.15	.045	.03	.045
1	1.09	.045	.03	.045
1	1.04	.045	.03	.045
1	0.98	.045	.03	.045
1	0.92	.045	.03	.045
1	0.86	.045	.03	.045
1	0.81	.045	.03	.045
1	0.75	.045	.03	.045
1	0.69	.045	.03	.045
1	0.68	.045	.03	.045
1	0.66	.045	.03	.045
1	0.61	.045	.03	.045
1	0.55	.045	.03	.045
1	0.50	.045	.03	.045
1	.44	.045	.03	.045
1	0.38	.045	.03	.045
1	0.32	.045	.03	.045
1	0.31	.045	.03	.045
1	0.295	Culvert		
1	0.28	.045	.03	.045
1	0.26	.045	.03	.045
1	0.20	.045	.022	.045
1	0.14	.045	.022	.045
1	0.09	.045	.022	.045
1	0.08	.045	.022	.045
1	0.04	.045	.03	.045
1	0.03	.045	.03	.045
1	0.01	.045	.03	.045
1	0.005	.045	.03	.045
1	.004	.045	.03	.045
1	0.003	.045	.03	.045
1	.002	.045	.03	.045

SUMMARY OF REACH LENGTHS

River: Camalback Road C

Reach	River Sta.	Left	Channel	Right
1	2.13	200	200	200
1	2.10	300	300	300
1	2.04	300	300	300
1	1.98	300	300	300
1	1.93	300	300	300
1	1.87	300	300	300
1	1.81	300	300	300
1	1.75	300	300	300
1	1.70	170	170	170
1	1.67	130.02	130.02	130.02
1	1.63	650	650	650
1	1.52	250	250	250
1	1.46	350	350	350
1	1.40	300	300	300
1	1.35	300	300	300
1	1.29	300	300	300
1	1.23	150	150	150
1	1.22	170	170	170
1	1.17	130.02	130.02	130.02
1	1.15	300	300	300
1	1.09	300	300	300
1	1.04	600	600	600
1	0.98	300	300	300
1	0.92	300	300	300
1	0.86	100	100	100
1	0.81	200	200	200
1	0.75	200	200	200
1	0.69	200	200	200
1	0.68	100	100	100
1	0.66	250	250	250
1	0.61	300	300	300
1	0.55	300	300	300
1	0.50	300	300	300
1	.44	300	300	300
1	0.38	300	300	300
1	0.32	90	90	90
1	0.31	160	160	160
1	0.295	Culvert		
1	0.28	100	100	100
1	0.26	300	300	300
1	0.20	300	300	300
1	0.14	300	300	300
1	0.09	100	100	100
1	0.08	100	100	100
1	0.04	75	75	75
1	0.03	90	90	90
1	0.01	250	200	100
1	0.005	190.02	150	55.02
1	.004	180	150	115.02
1	0.003	100	100	100
1	.002			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Camalback Road C

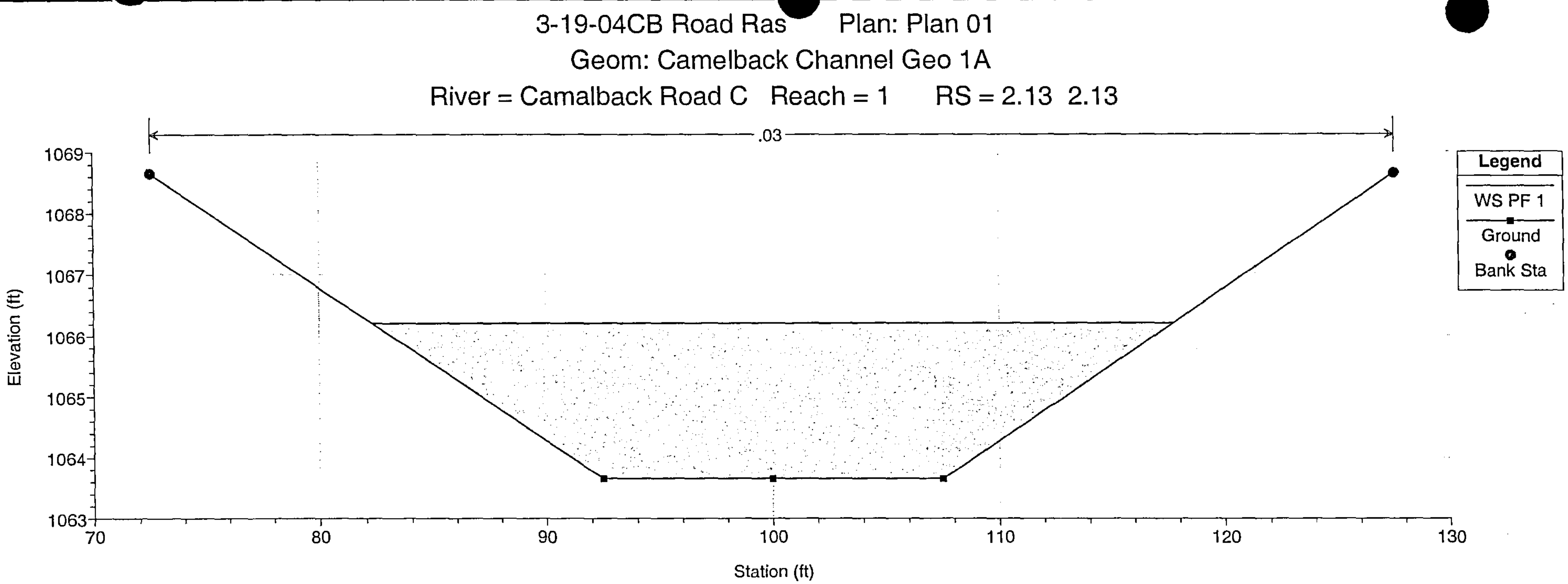
Reach	River Sta.	Contr.	Expan.
1	2.13	.1	.3
1	2.10	.1	.3
1	2.04	.1	.3
1	1.98	.1	.3
1	1.93	.1	.3
1	1.87	.1	.3
1	1.81	.1	.3
1	1.75	.1	.3
1	1.70	.1	.3

1	1.67	.1	.3
1	1.63	.1	.3
1	1.52	.1	.3
1	1.46	.1	.3
1	1.40	.1	.3
1	1.35	.1	.3
1	1.29	.1	.3
1	1.23	.1	.3
1	1.22	.1	.3
1	1.17	.1	.3
1	1.15	.1	.3
1	1.09	.1	.3
1	1.04	.1	.3
1	0.98	.1	.3
1	0.92	.1	.3
1	0.86	.1	.3
1	0.81	.1	.3
1	0.75	.1	.3
1	0.69	.1	.3
1	0.68	.1	.3
1	0.66	.1	.3
1	0.61	.1	.3
1	0.55	.1	.3
1	0.50	.1	.3
1	.44	.1	.3
1	0.38	.1	.3
1	0.32	.1	.3
1	0.31	.1	.3
1	0.295	Culvert	
1	0.28	.3	.5
1	0.26	.3	.5
1	0.20	.1	.3
1	0.14	.1	.3
1	0.09	.3	.5
1	0.08	.1	.3
1	0.04	.3	.5
1	0.03	.3	.5
1	0.01	.3	.5
1	0.005	.3	.5
1	.004	.3	.5
1	0.003	.3	.5
1	.002	.3	.5

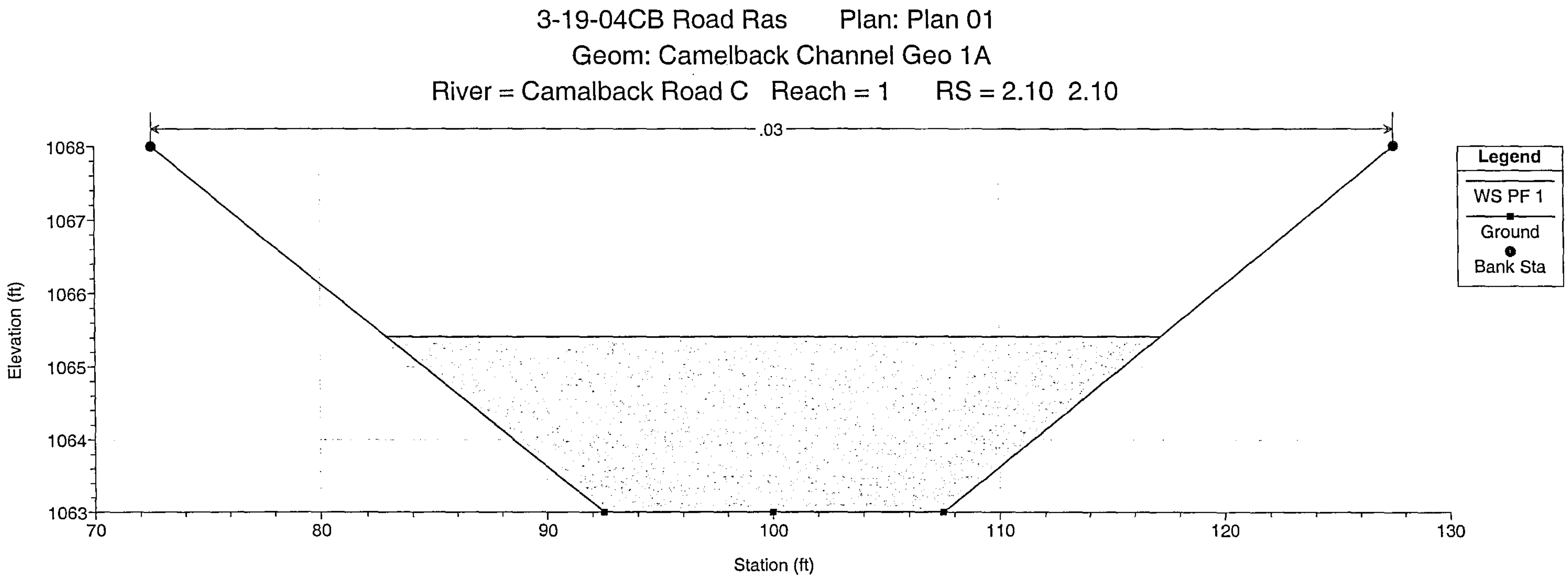
ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : Plan 01

River: Camalback Road C Reach: 1 RS: 2.10 Profile: PF 1
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Camalback Road C Reach: 1 RS: 2.04 Profile: PF 1
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Camalback Road C Reach: 1 RS: 1.98 Profile: PF 1
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Camalback Road C Reach: 1 RS: 1.93 Profile: PF 1
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Camalback Road C Reach: 1 RS: 1.87 Profile: PF 1
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Camalback Road C Reach: 1 RS: 1.75 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning:The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
River: Camalback Road C Reach: 1 RS: 1.70 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.

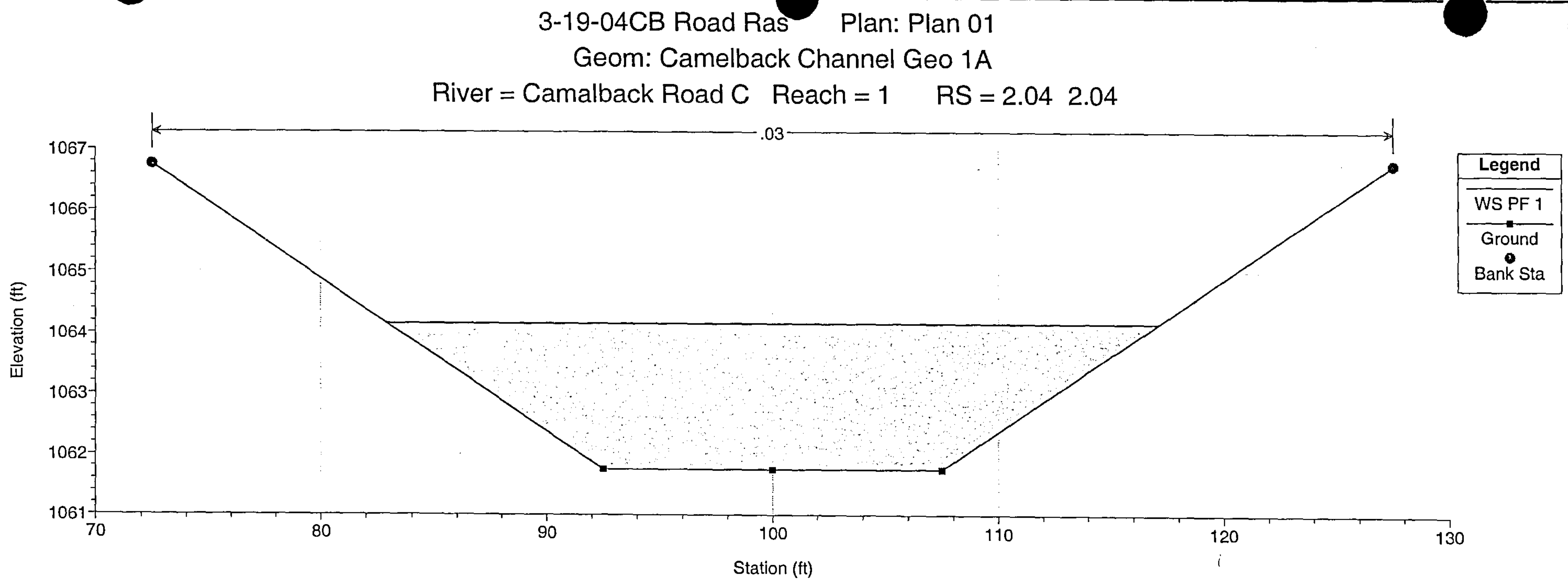
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Camalback Road C Reach: 1 RS: 1.23 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Camalback Road C Reach: 1 RS: 0.295 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: Camalback Road C Reach: 1 RS: 0.14 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Camalback Road C Reach: 1 RS: 0.04 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 downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
River: Camalback Road C Reach: 1 RS: 0.03 Profile: PF 1
Warning:The energy equation could not be balanced within the specified 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 energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning:During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.
River: Camalback Road C Reach: 1 RS: 0.01 Profile: PF 1
Warning:The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Hydraulic jump has occurred between this cross section and the previous upstream section.

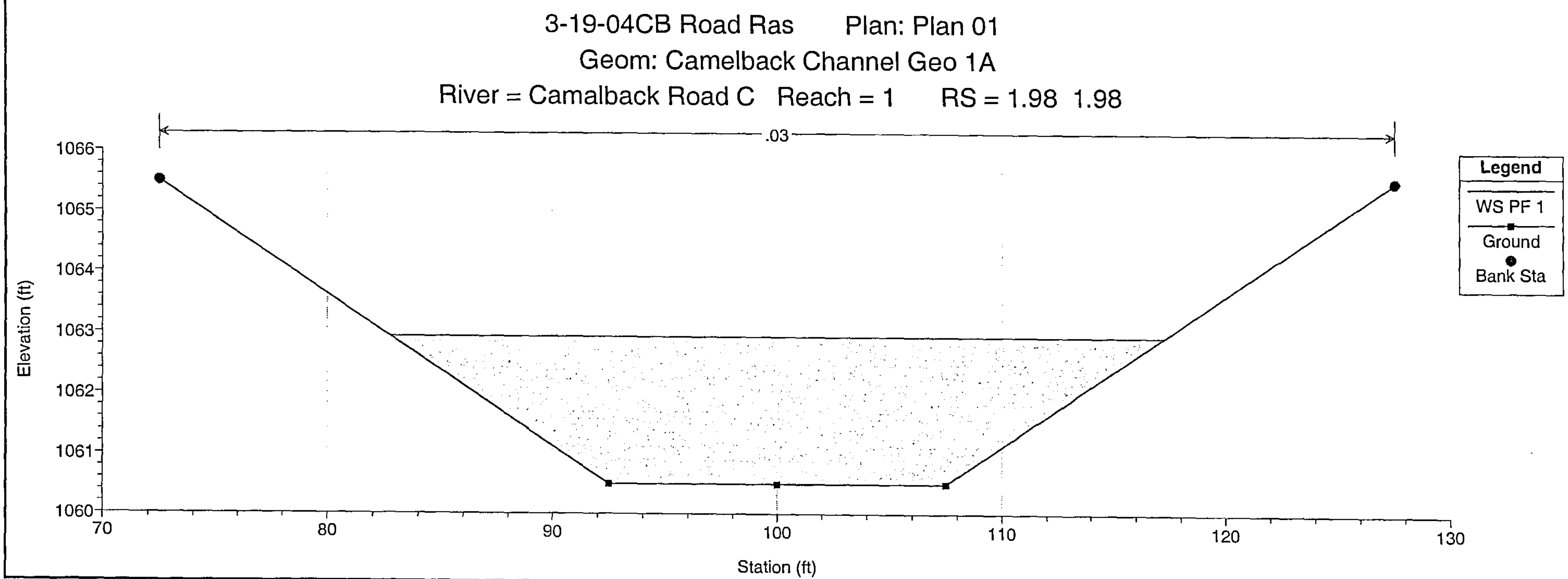


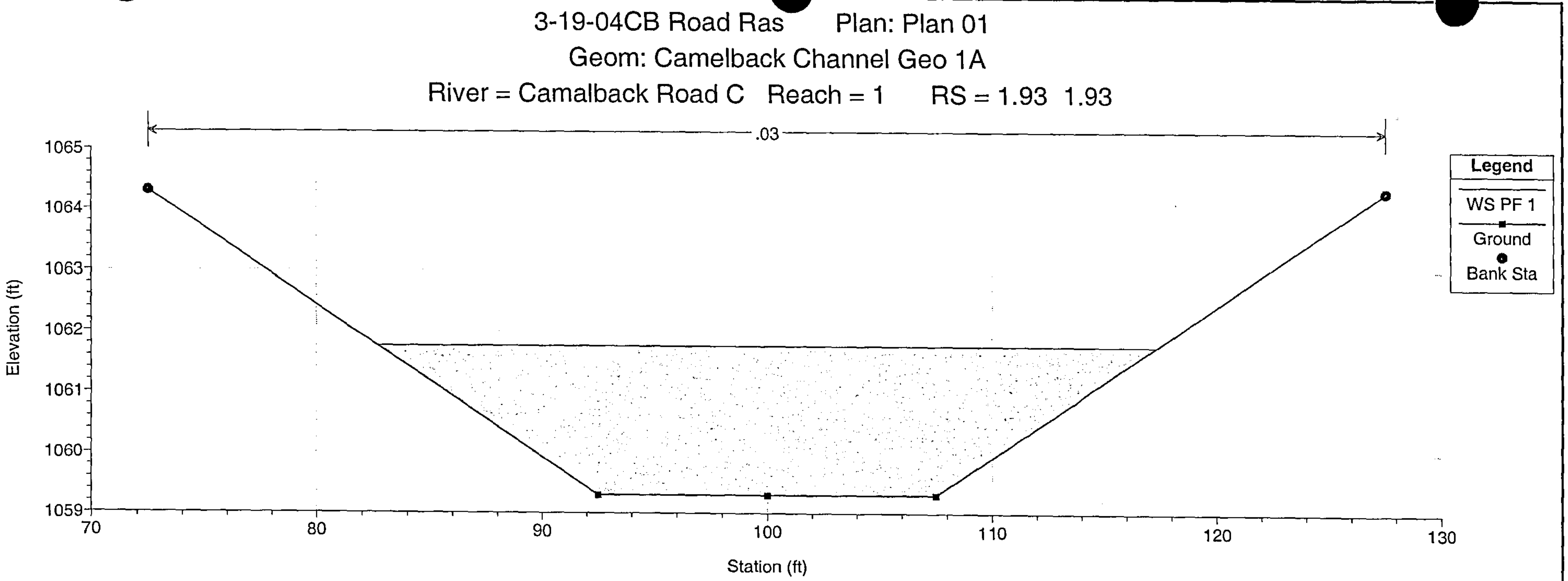
3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 2.13 2.13
.03
Elevation (ft)
1069
1068
1067
1066
1065
1064
1063
70
80
90
100
110
120
130
Station (ft)
Legend
WS PF 1
Ground
Bank Sta

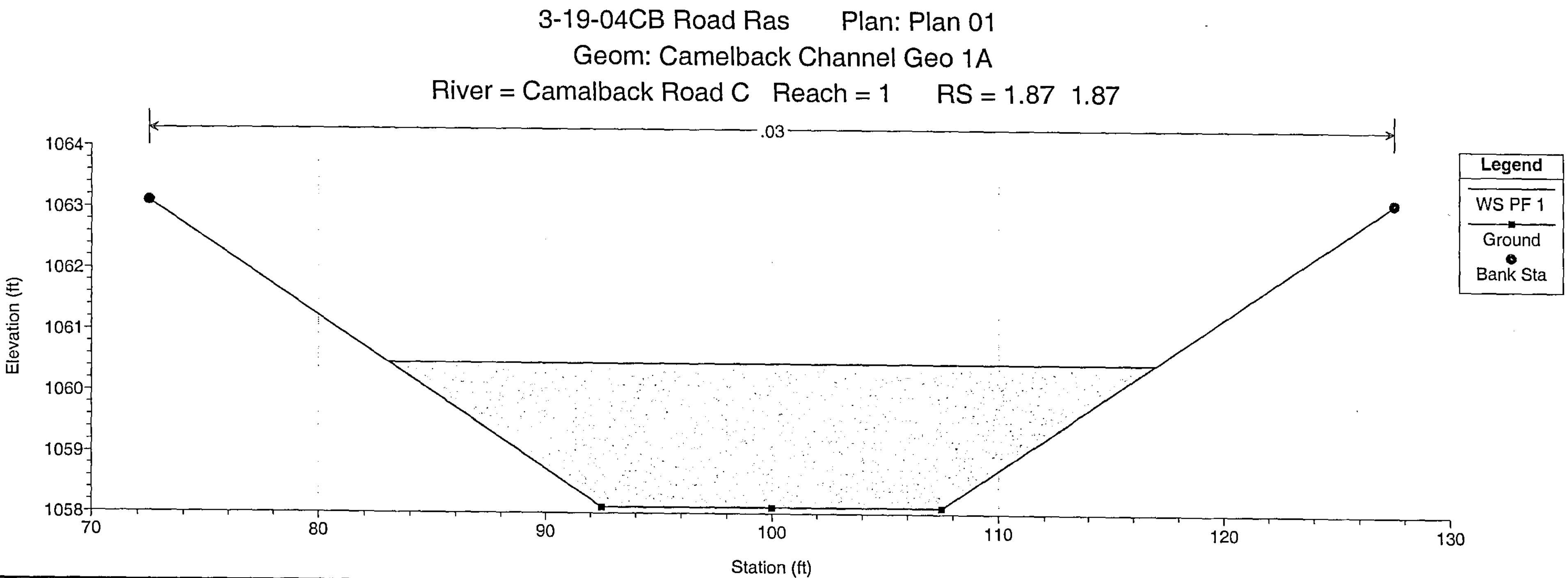


3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 2.10 2.10
.03
Elevation (ft)
1068
1067
1066
1065
1064
1063
70
80
90
100
110
120
130
Station (ft)
Legend
WS PF 1
Ground
Bank Sta

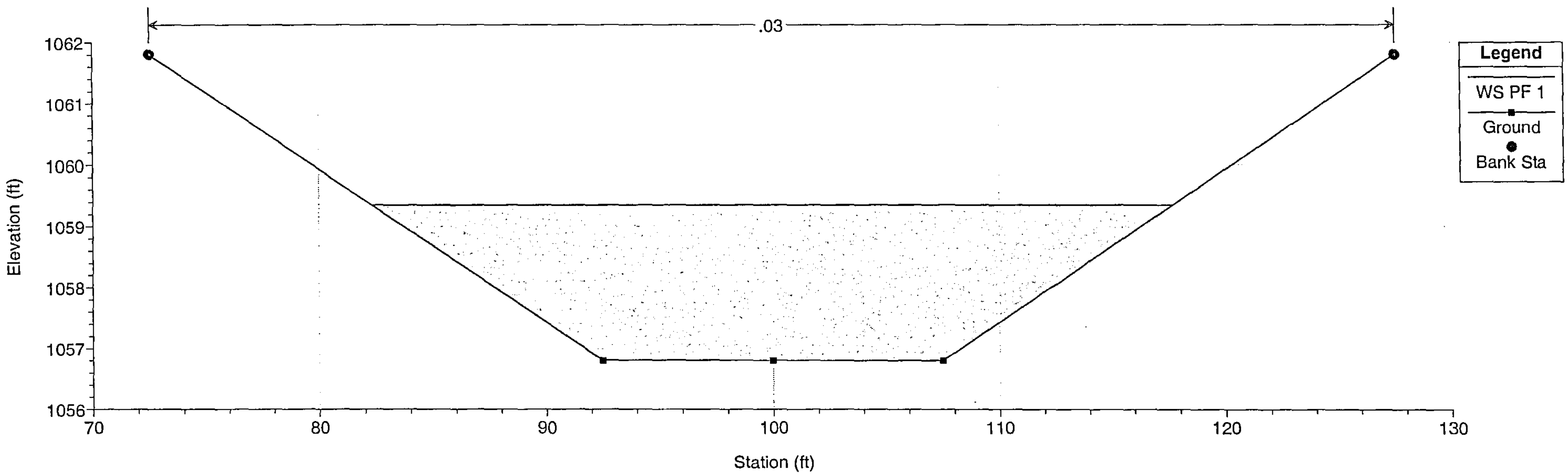

3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 2.04 2.04
.03
1067
1066
1065
1064
1063
1062
1061
Elevation (ft)
70
80
90
100
110
120
130
Station (ft)
Legend
WS PF 1
Ground
Bank Sta


3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 1.98 1.98
.03
1066
1065
1064
1063
1062
1061
1060
Elevation (ft)
70
80
90
100
110
120
130
Station (ft)
Legend
WS PF 1
Ground
Bank Sta

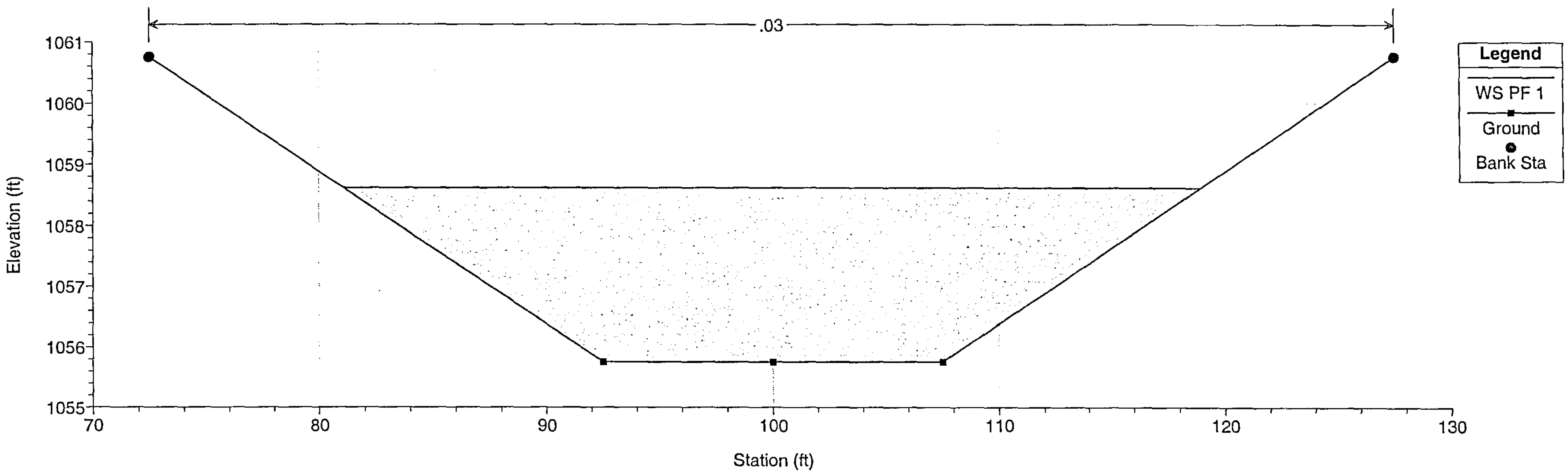

3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 1.93 1.93
.03
Elevation (ft)
1065
1064
1063
1062
1061
1060
1059
70
80
90
100
110
120
130
Station (ft)
Legend
WS PF 1
Ground
Bank Sta

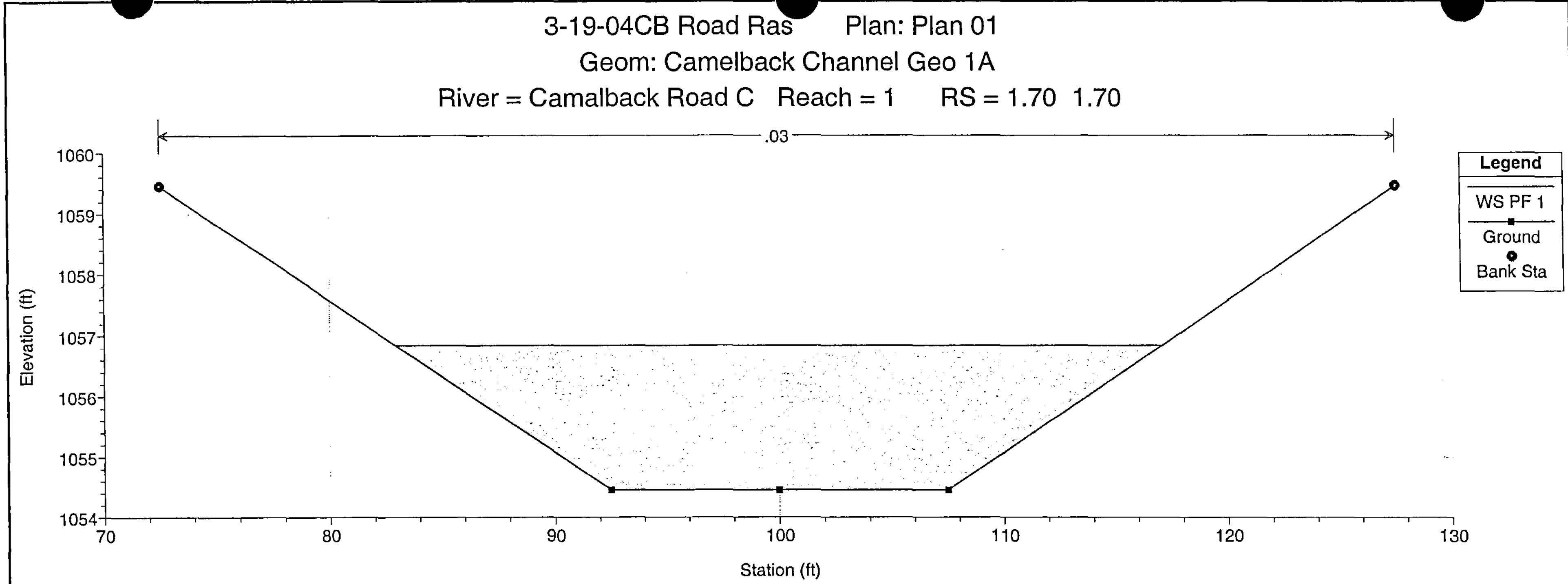

3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 1.87 1.87
.03
Elevation (ft)
1064
1063
1062
1061
1060
1059
1058
70
80
90
100
110
120
130
Station (ft)
Legend
WS PF 1
Ground
Bank Sta

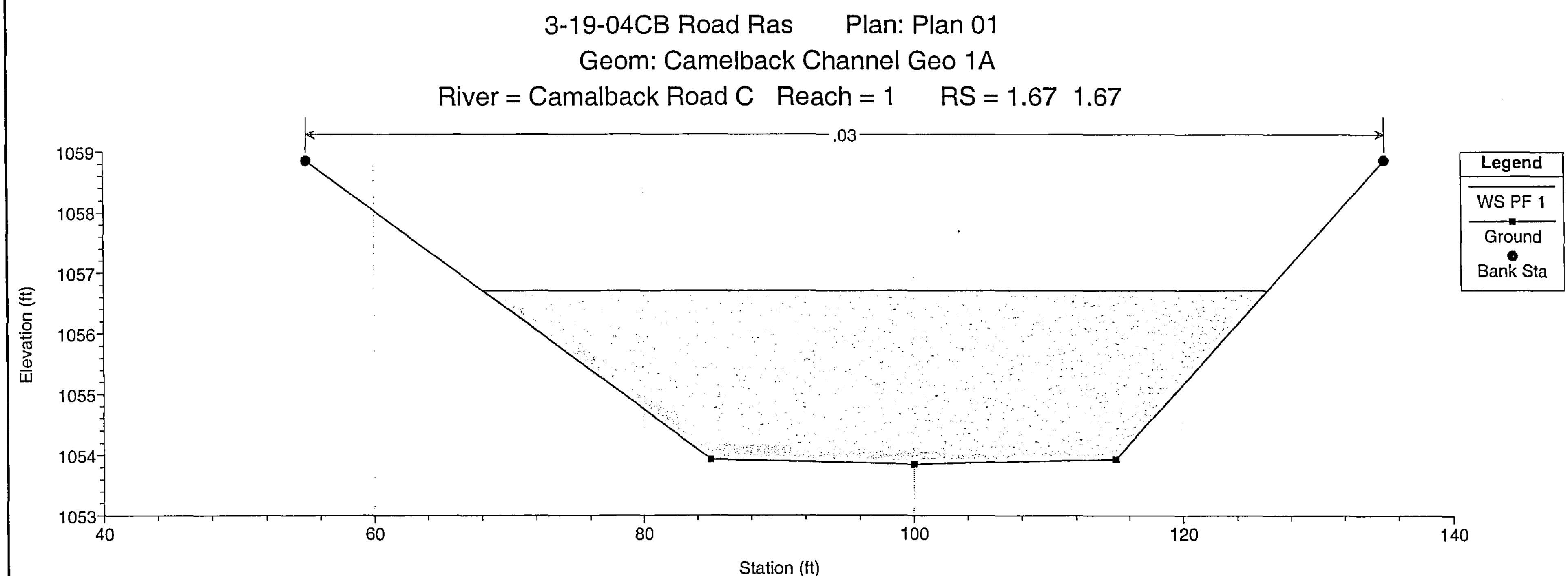
3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 1.81 1.81



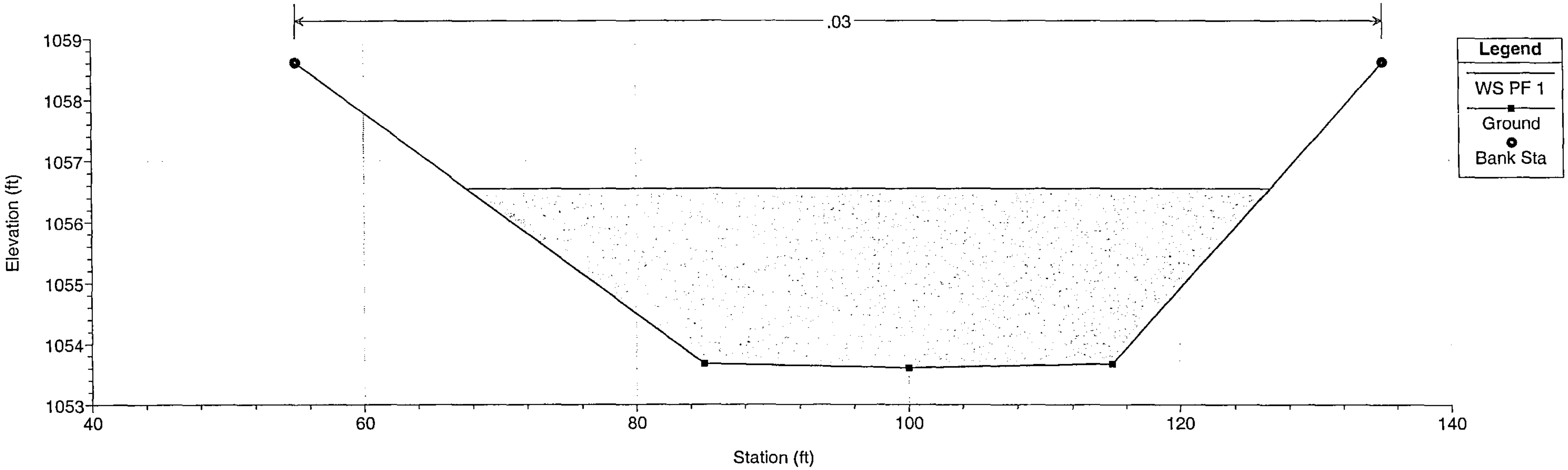
3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 1.75 1.75



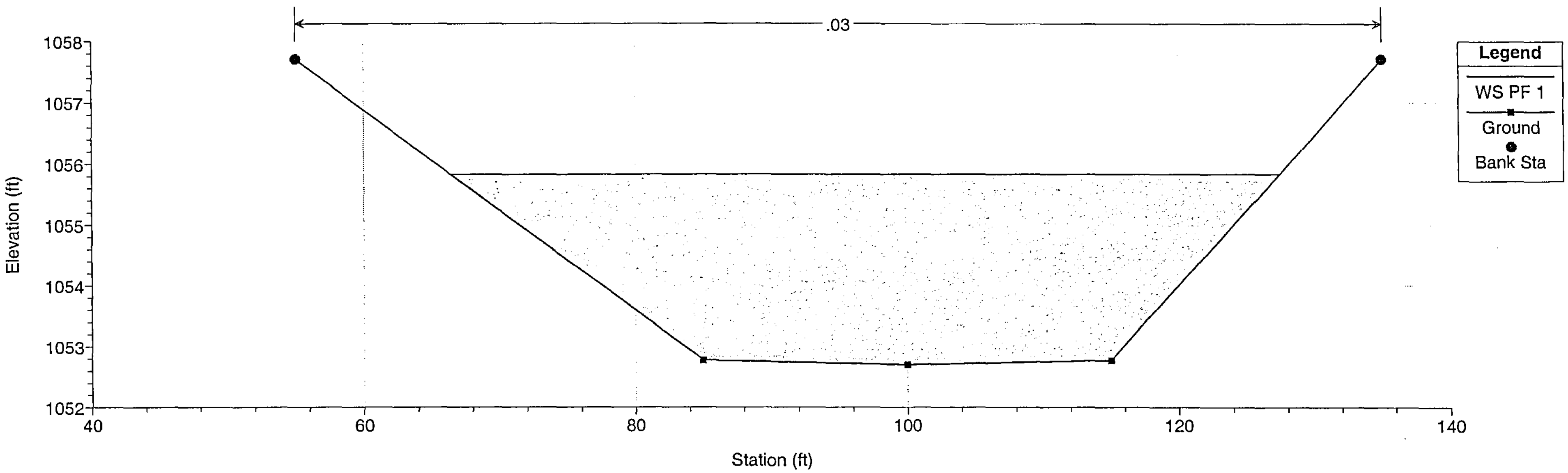

3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 1.70 1.70
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
1060
1059
1058
1057
1056
1055
1054
70
80
90
100
110
120
130
Station (ft)


3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 1.67 1.67
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
1059
1058
1057
1056
1055
1054
1053
40
60
80
100
120
140
Station (ft)

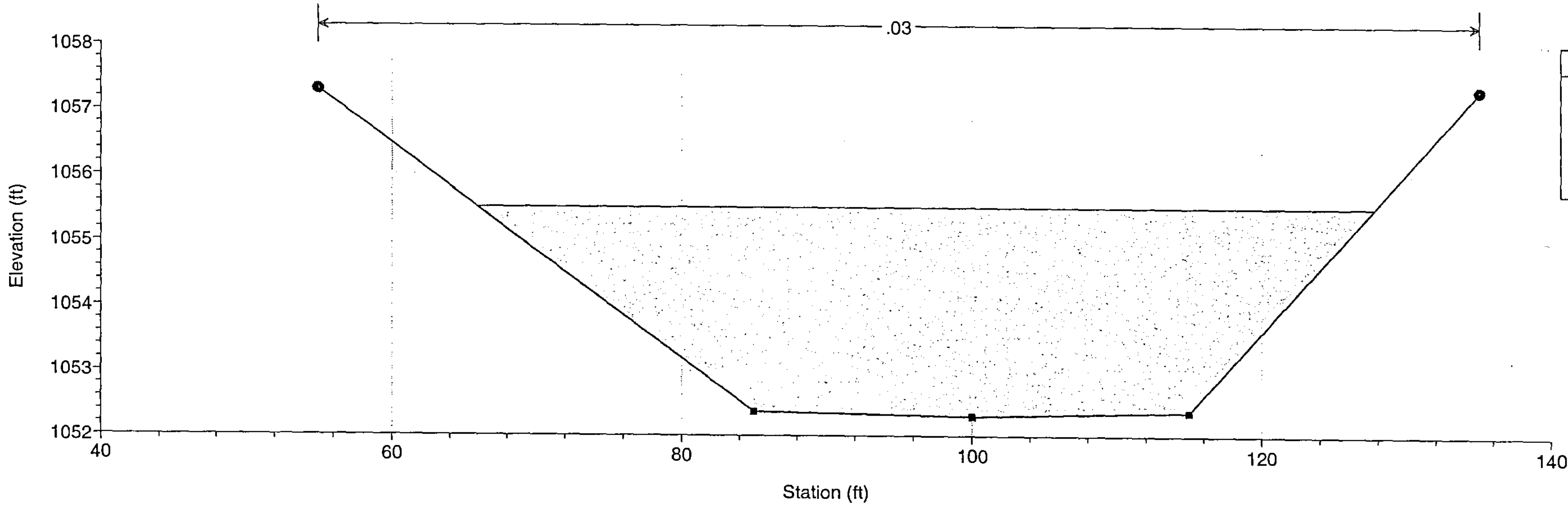
3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 1.63 1.63



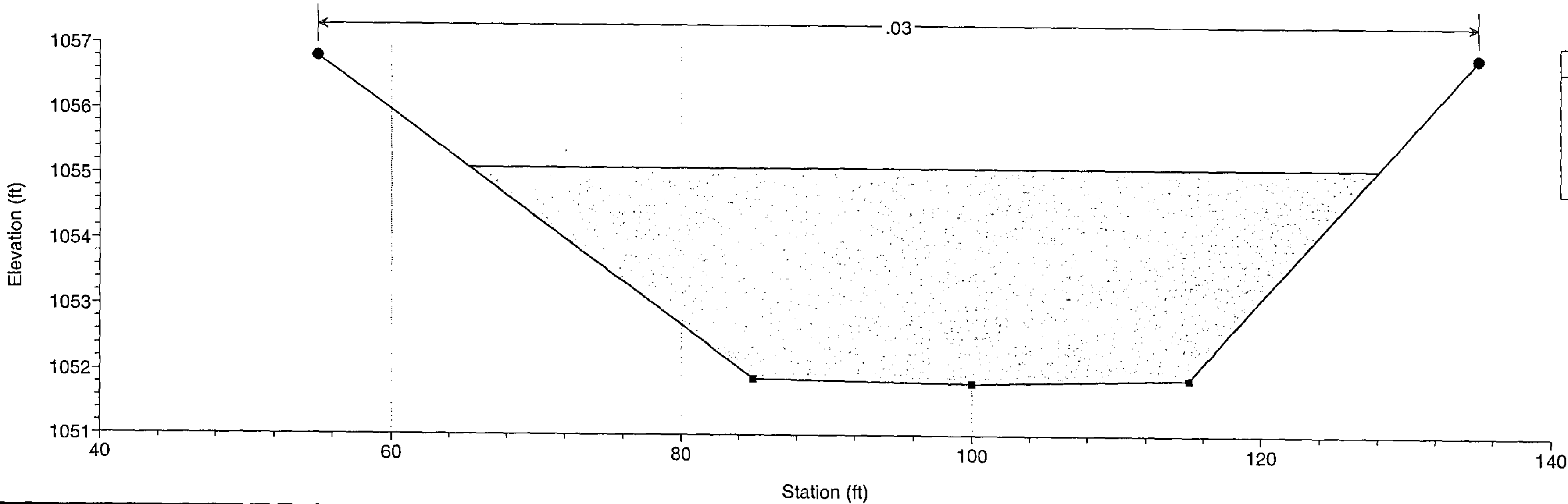
3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 1.52 1.52

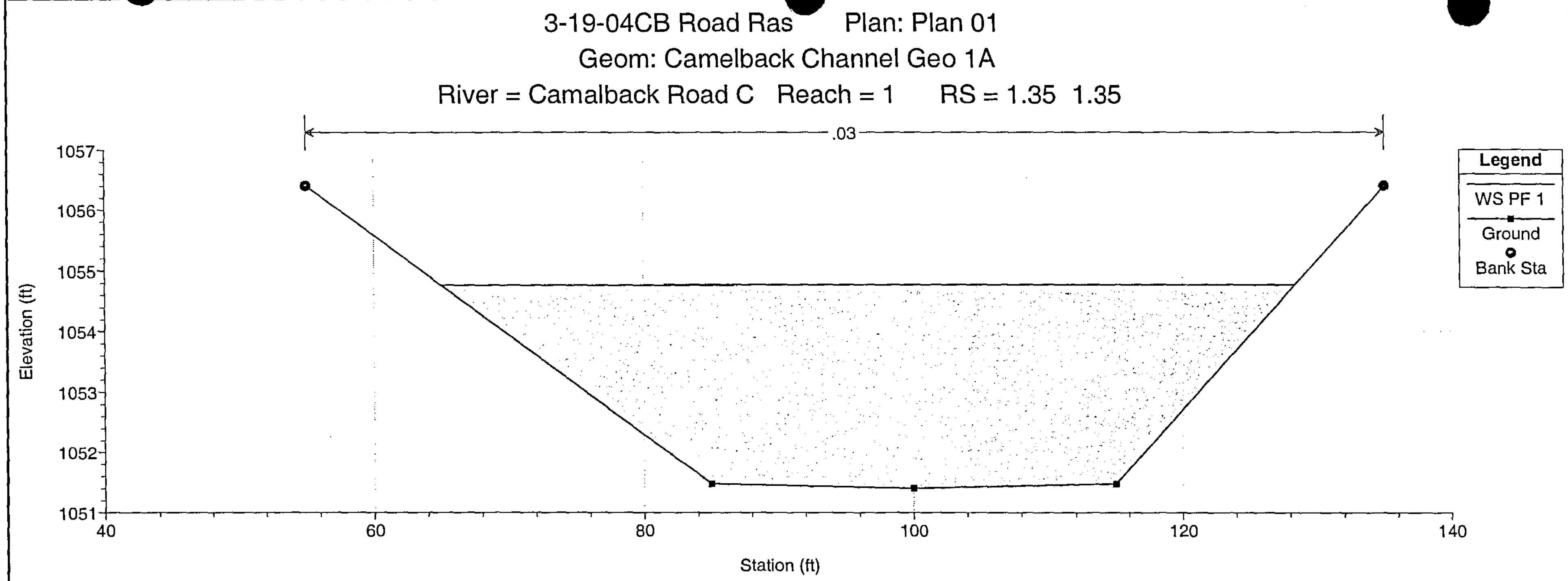


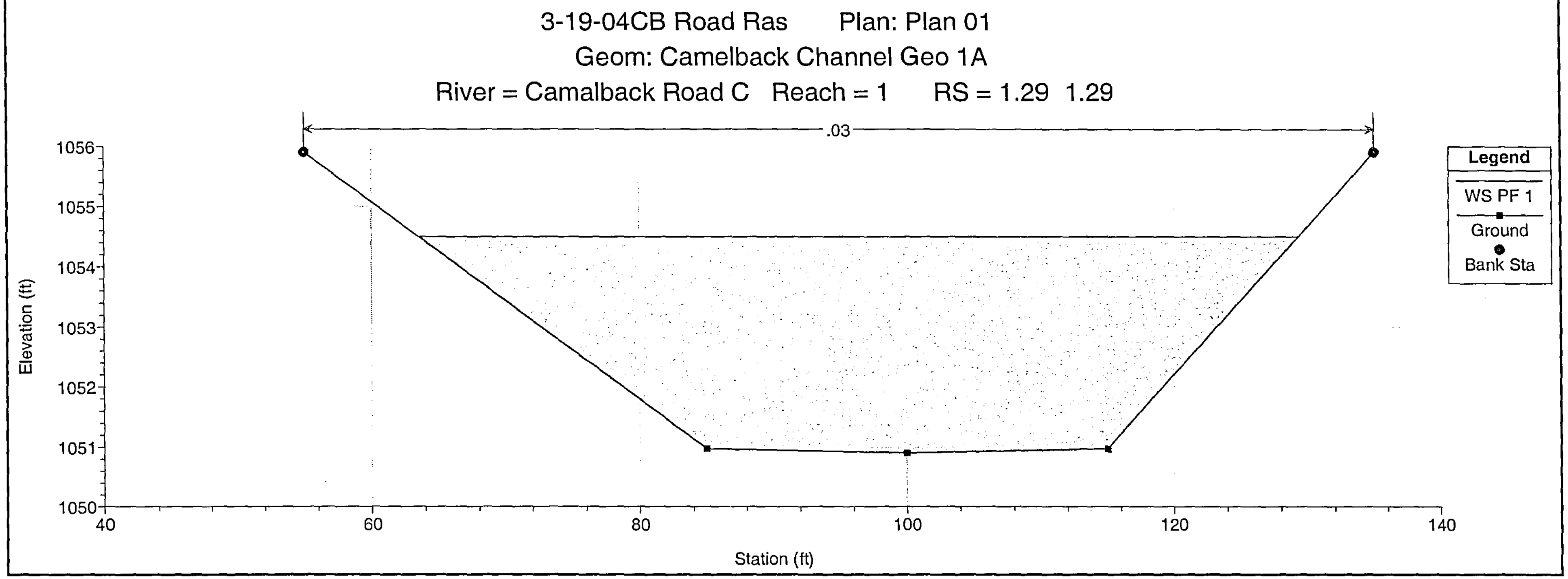
3-19-04CB Road Ras   Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C   Reach = 1   RS = 1.46 1.46

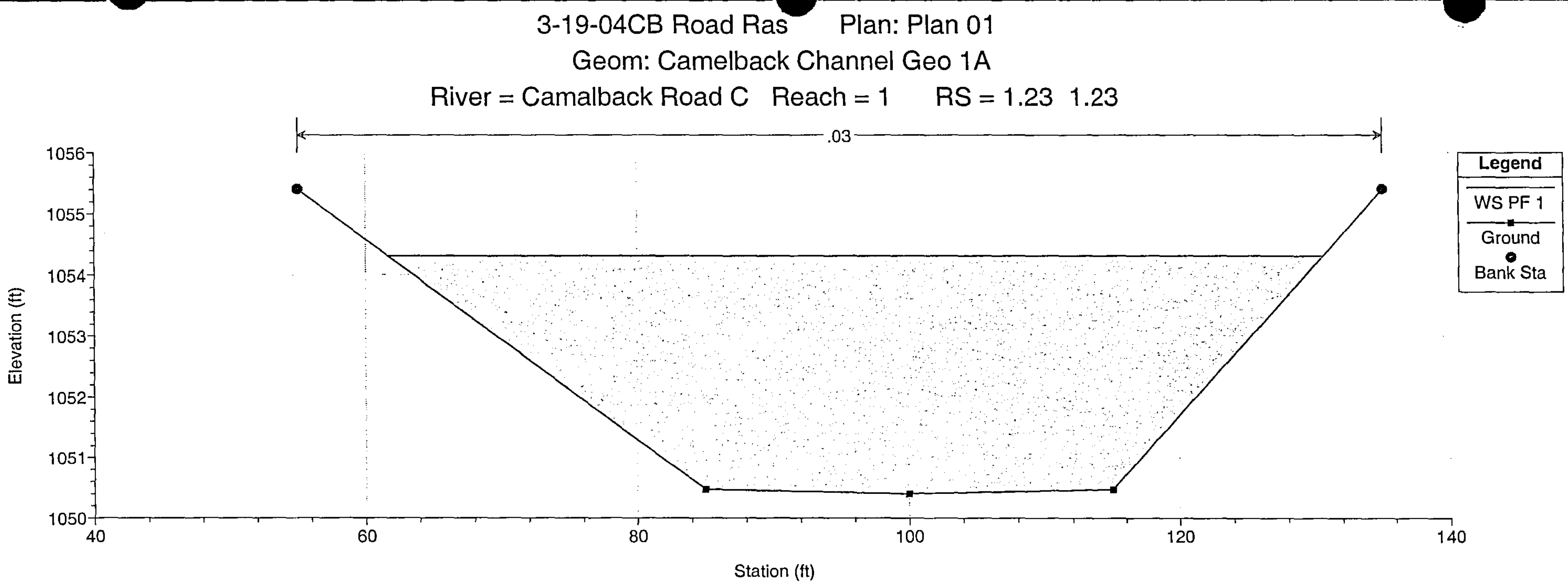


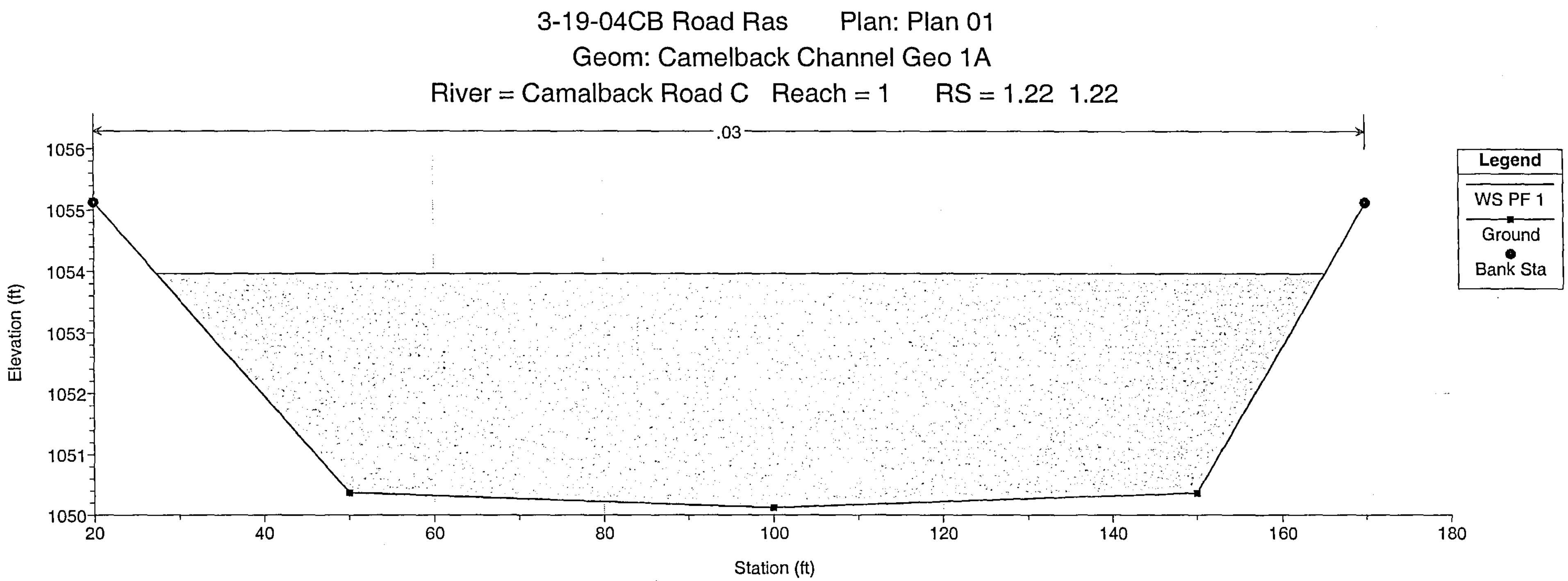
3-19-04CB Road Ras   Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C   Reach = 1   RS = 1.40 1.40



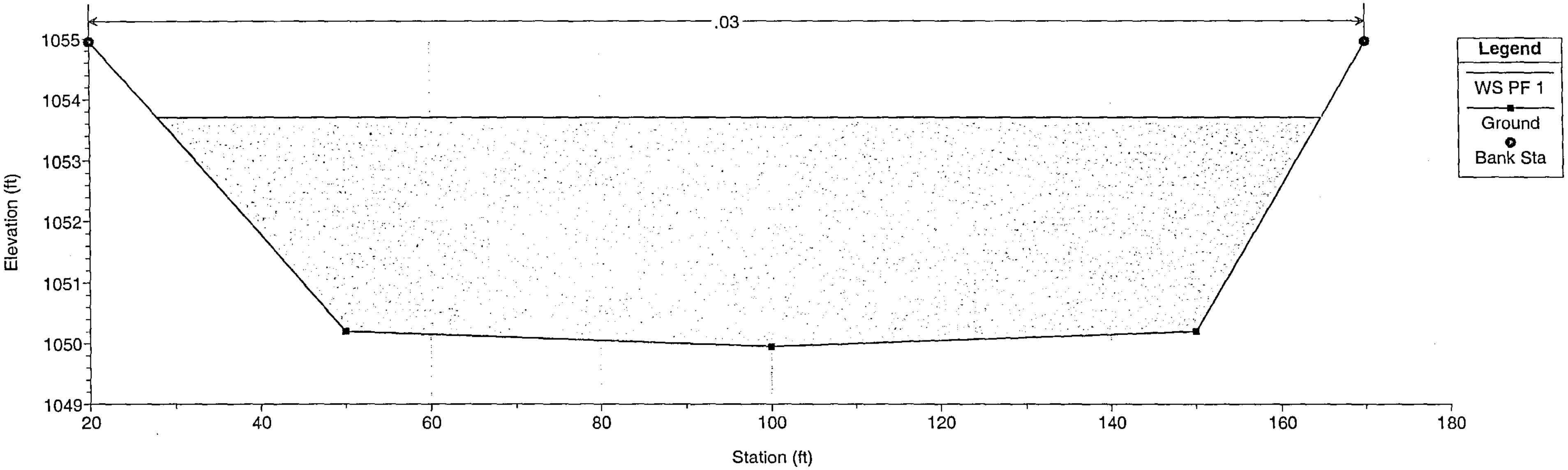

3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 1.35 1.35
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
1057
1056
1055
1054
1053
1052
1051
40
60
80
100
120
140
Station (ft)


3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 1.29 1.29
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
1056
1055
1054
1053
1052
1051
1050
40
60
80
100
120
140
Station (ft)

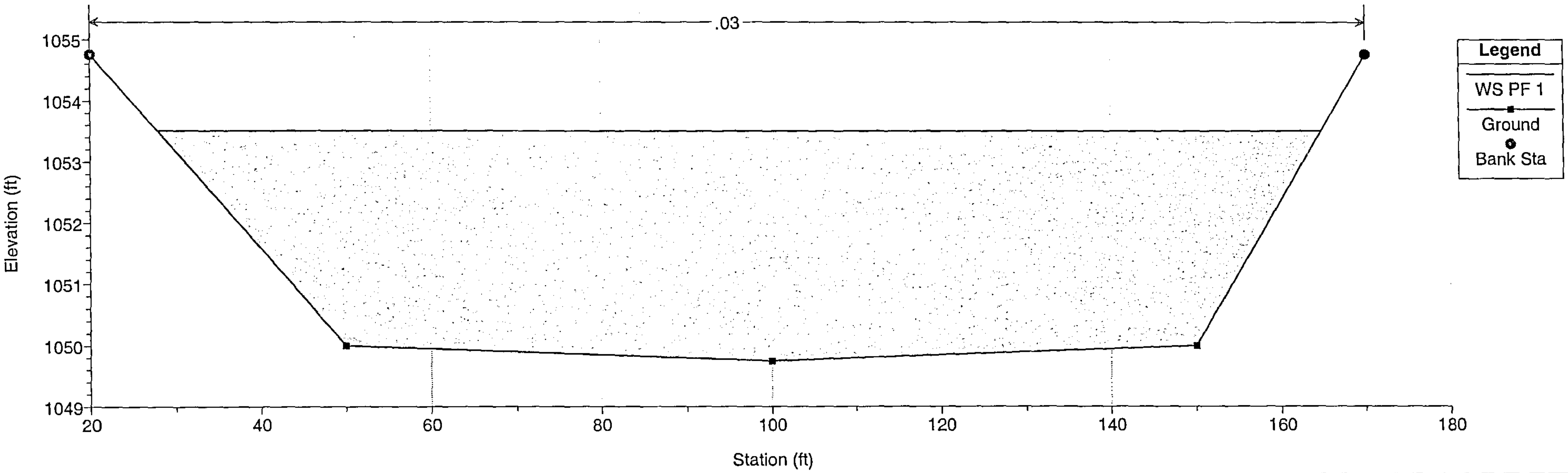

3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 1.23 1.23
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
1056
1055
1054
1053
1052
1051
1050
40
60
80
100
120
140
Station (ft)


3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 1.22 1.22
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
1056
1055
1054
1053
1052
1051
1050
20
40
60
80
100
120
140
160
180
Station (ft)

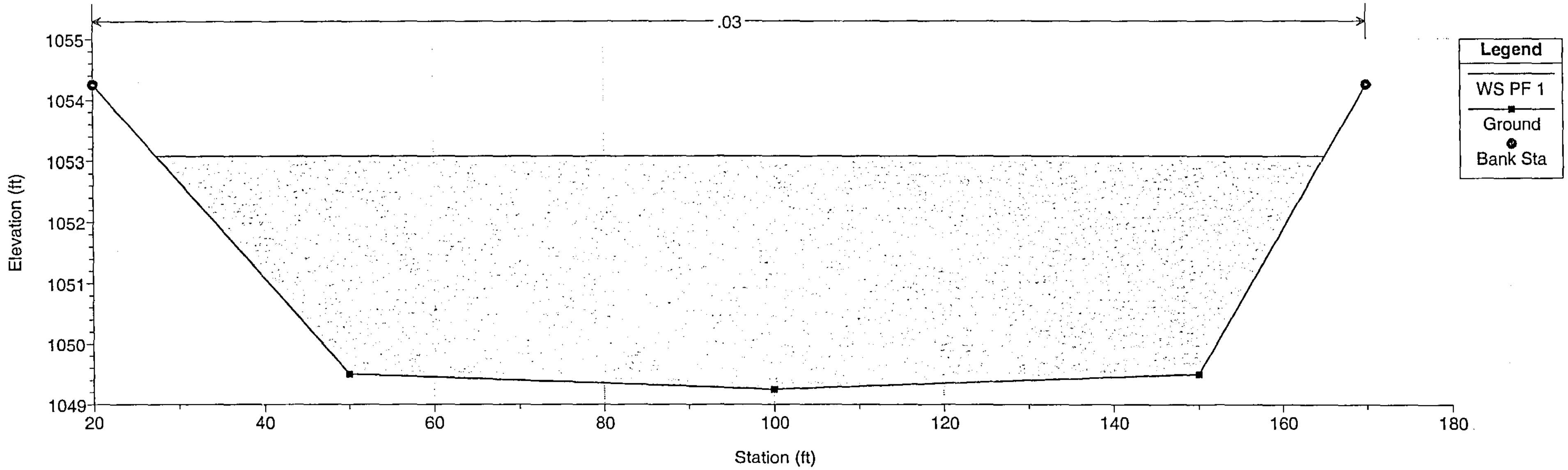
3-19-04CB Road Ras   Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C   Reach = 1   RS = 1.17 1.17



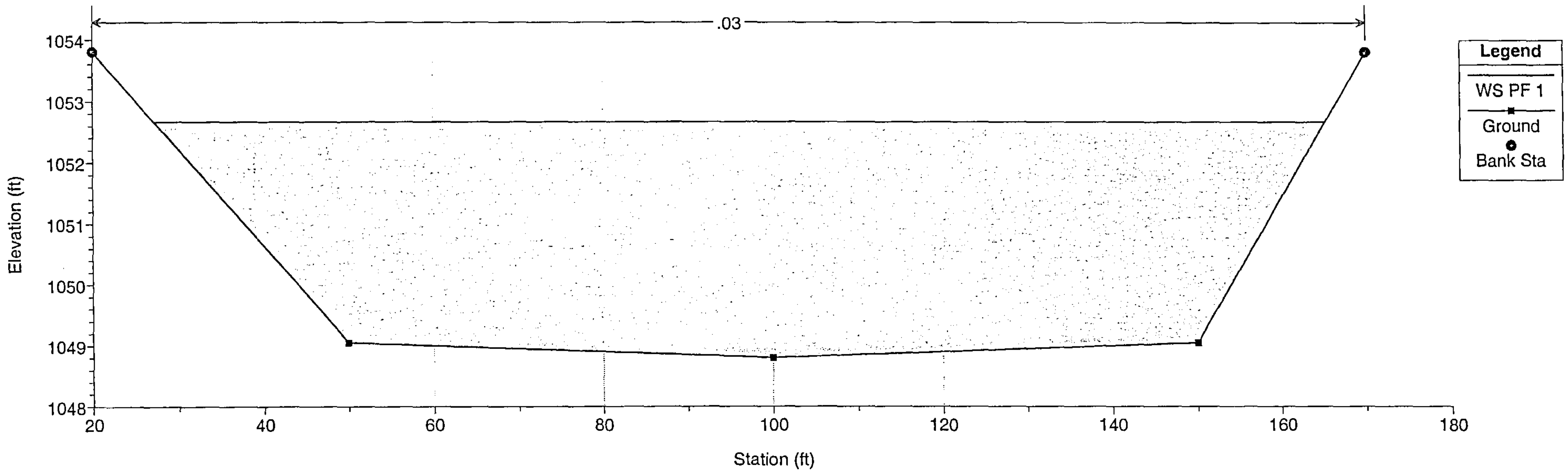
3-19-04CB Road Ras   Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C   Reach = 1   RS = 1.15 1.15



3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 1.09 1.09



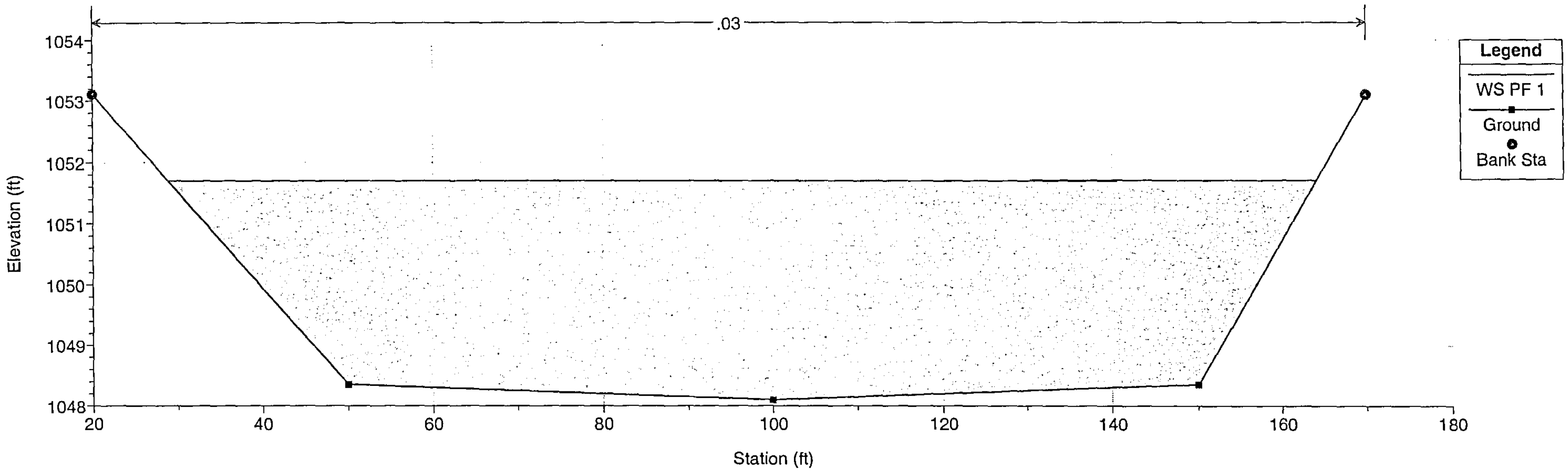
3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 1.04 1.04



3-19-04CB Road Ras   Plan: Plan 01

Geom: Camelback Channel Geo 1A

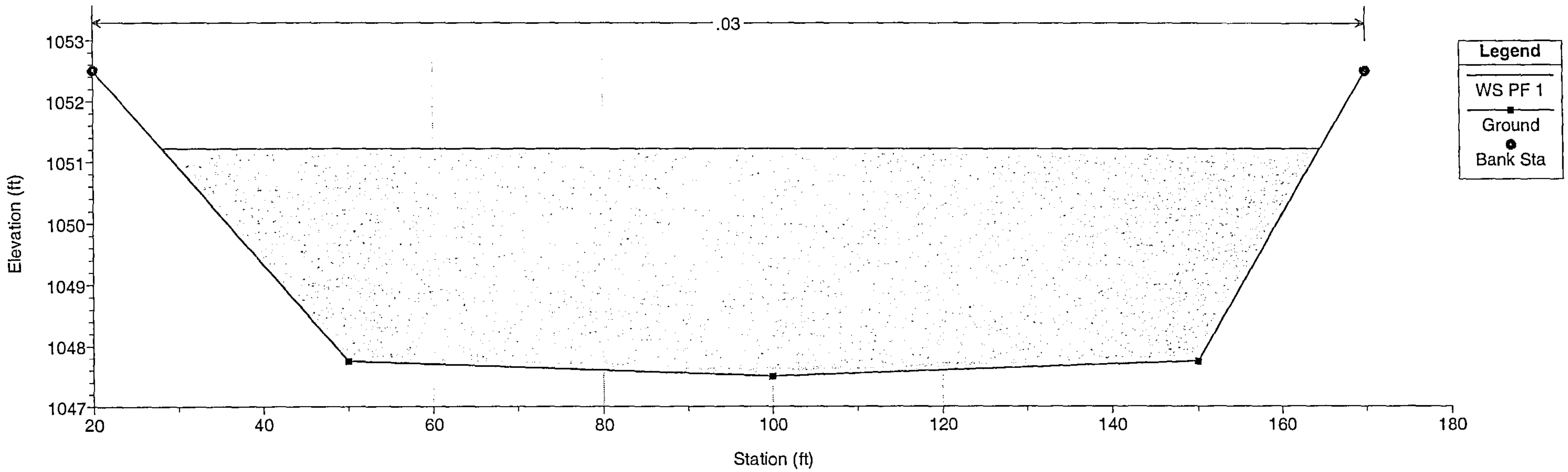
River = Camalback Road C   Reach = 1   RS = 0.98 0.98



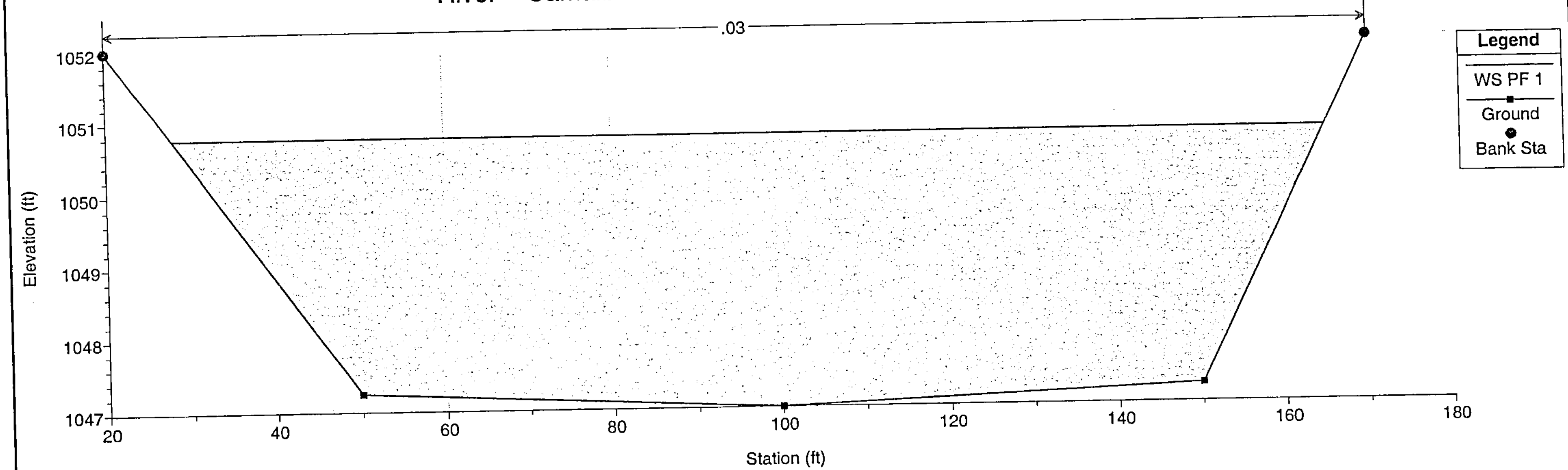
3-19-04CB Road Ras   Plan: Plan 01

Geom: Camelback Channel Geo 1A

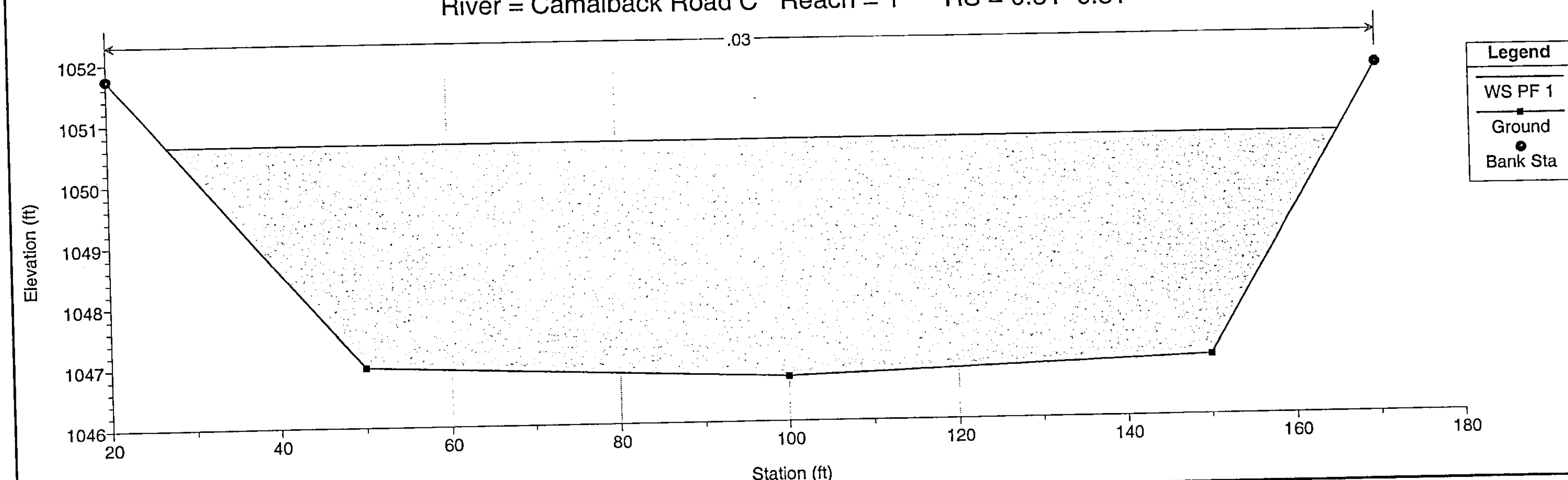
River = Camalback Road C   Reach = 1   RS = 0.92 0.92



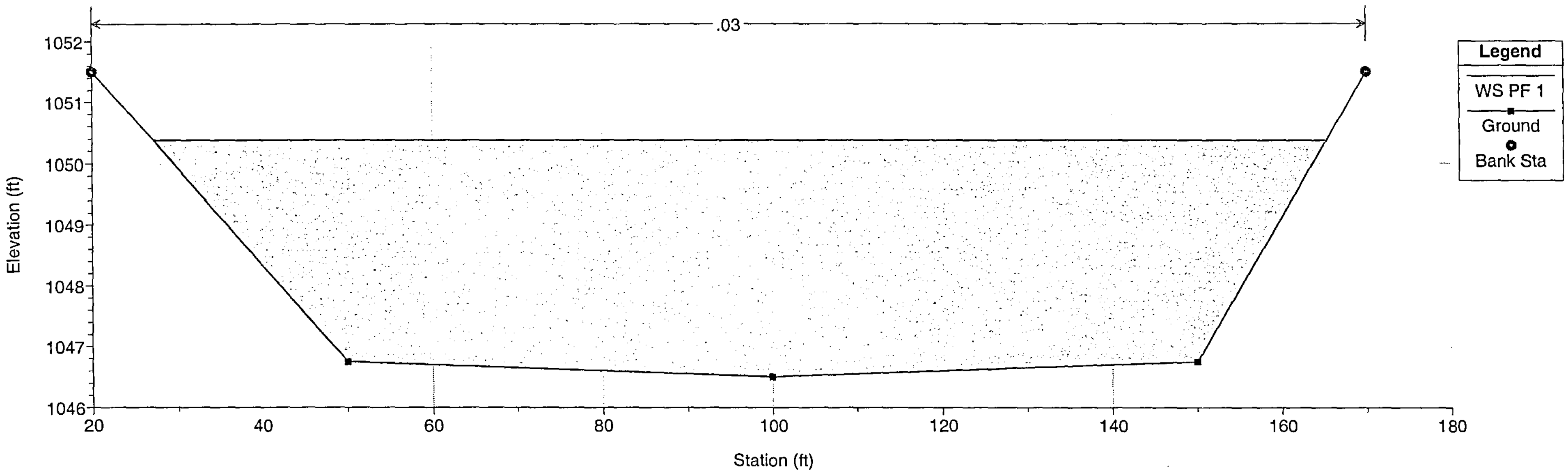
3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 0.86 0.86



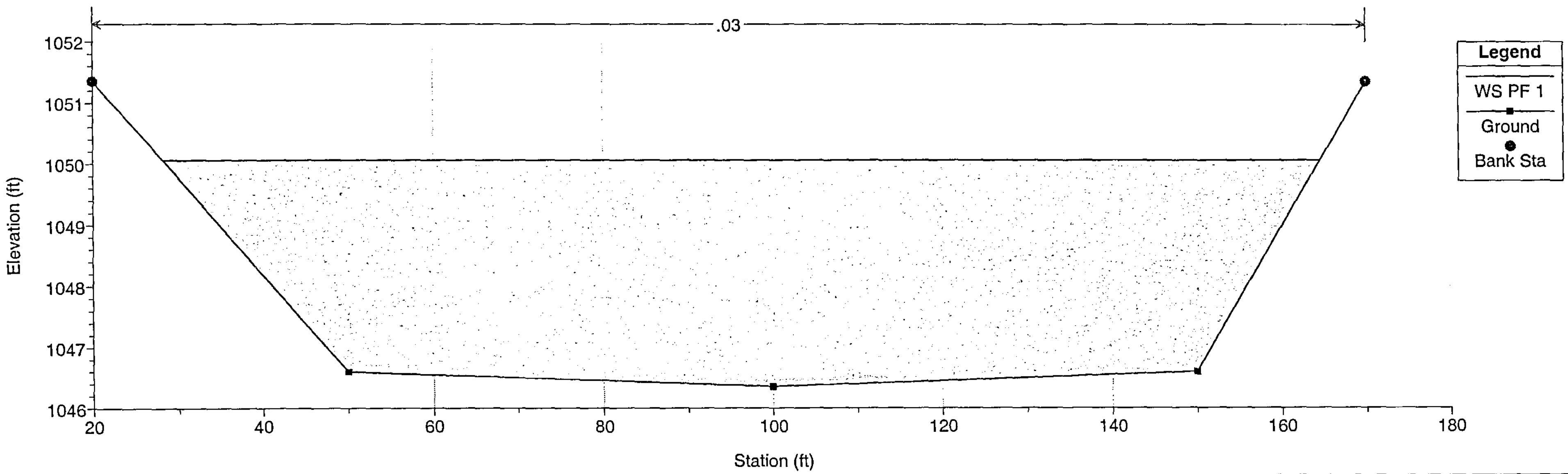
3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 0.81 0.81

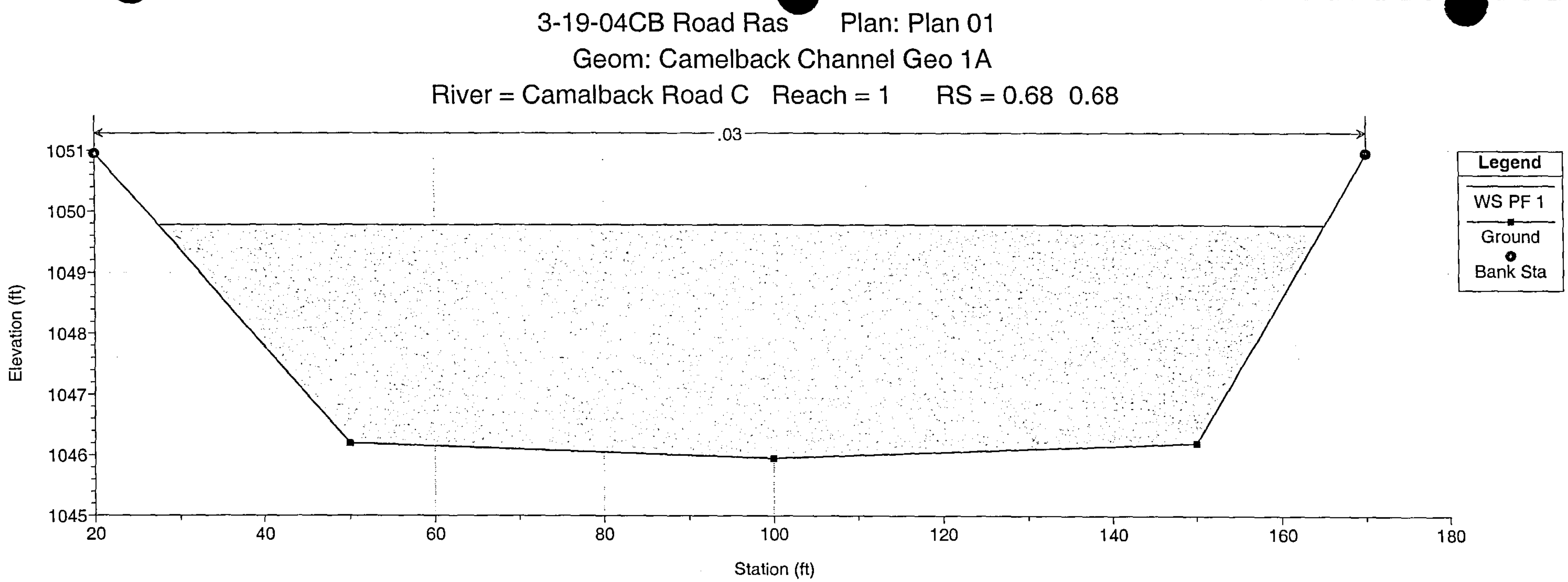


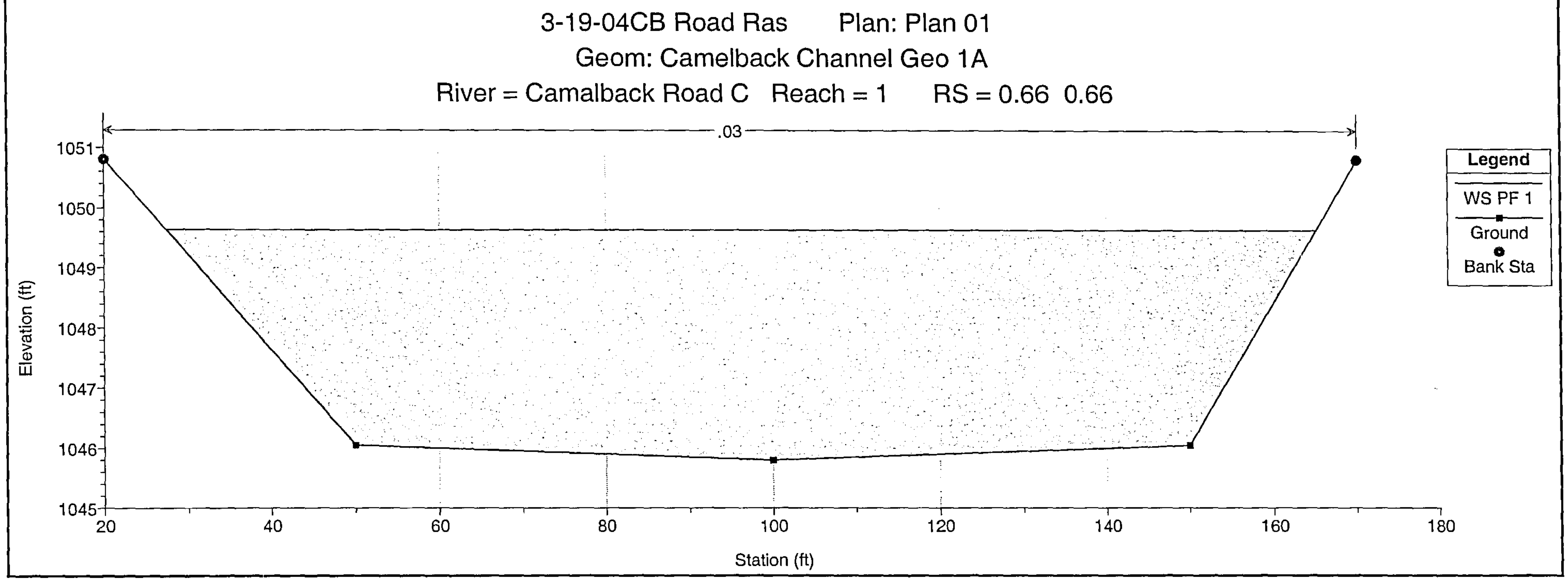
3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 0.75 0.75



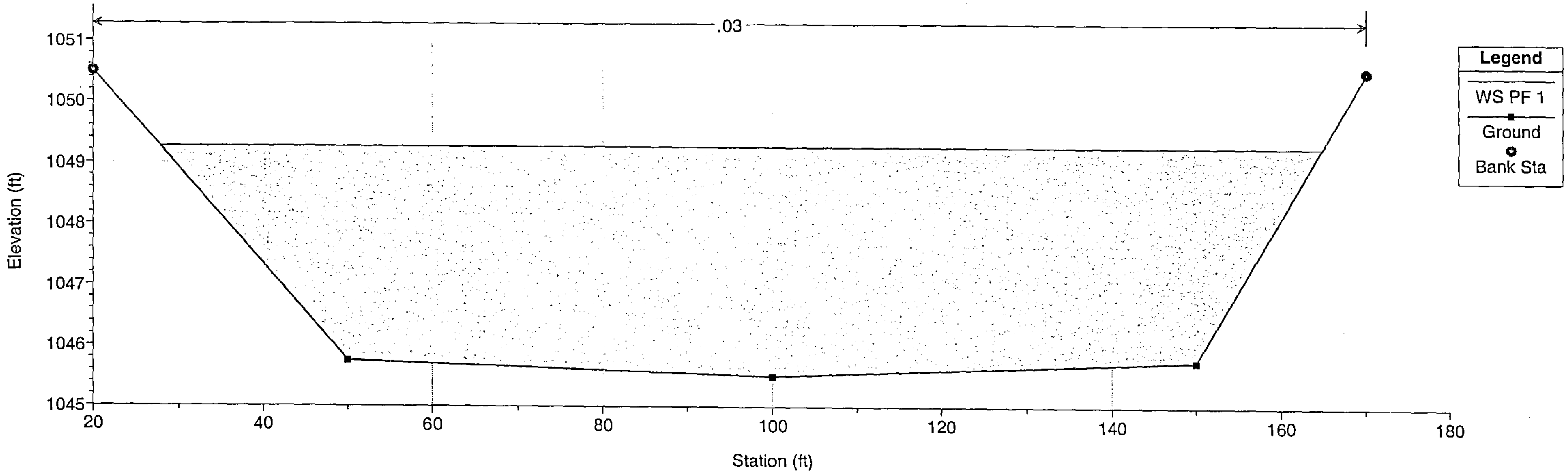
3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 0.69 0.69



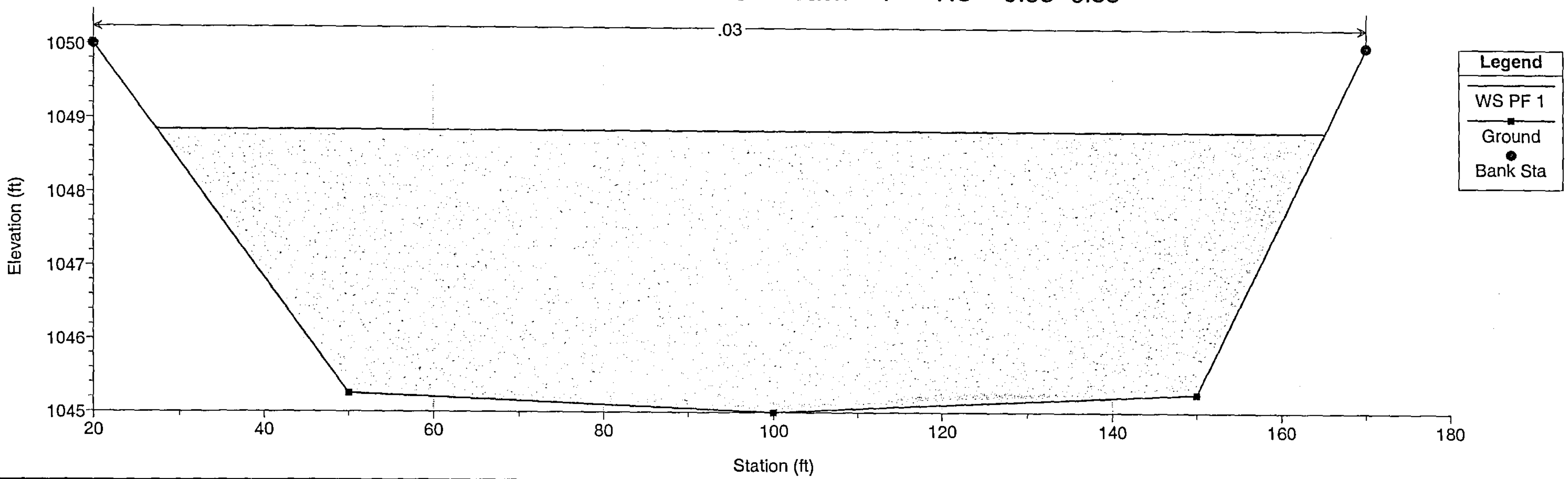

3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 0.68 0.68
.03
Elevation (ft)
1051
1050
1049
1048
1047
1046
1045
20
40
60
80
100
120
140
160
180
Station (ft)
Legend
WS PF 1
Ground
Bank Sta

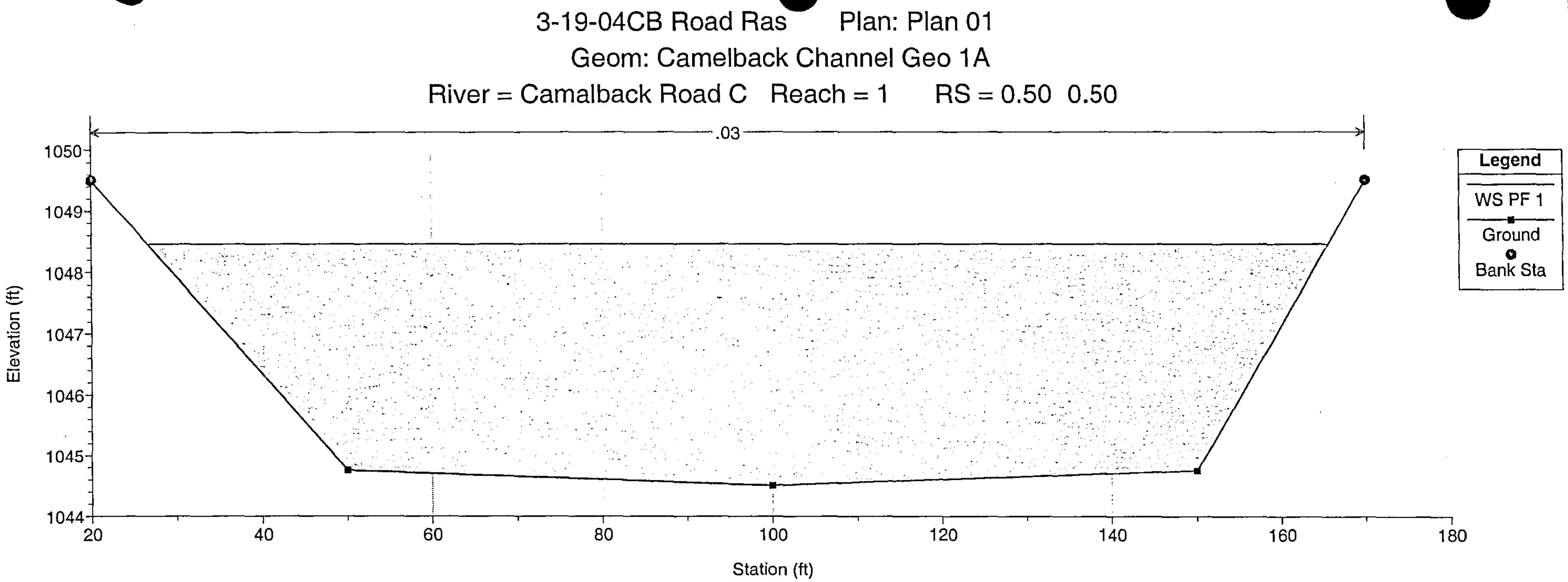

3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 0.66 0.66
.03
Elevation (ft)
1051
1050
1049
1048
1047
1046
1045
20
40
60
80
100
120
140
160
180
Station (ft)
Legend
WS PF 1
Ground
Bank Sta

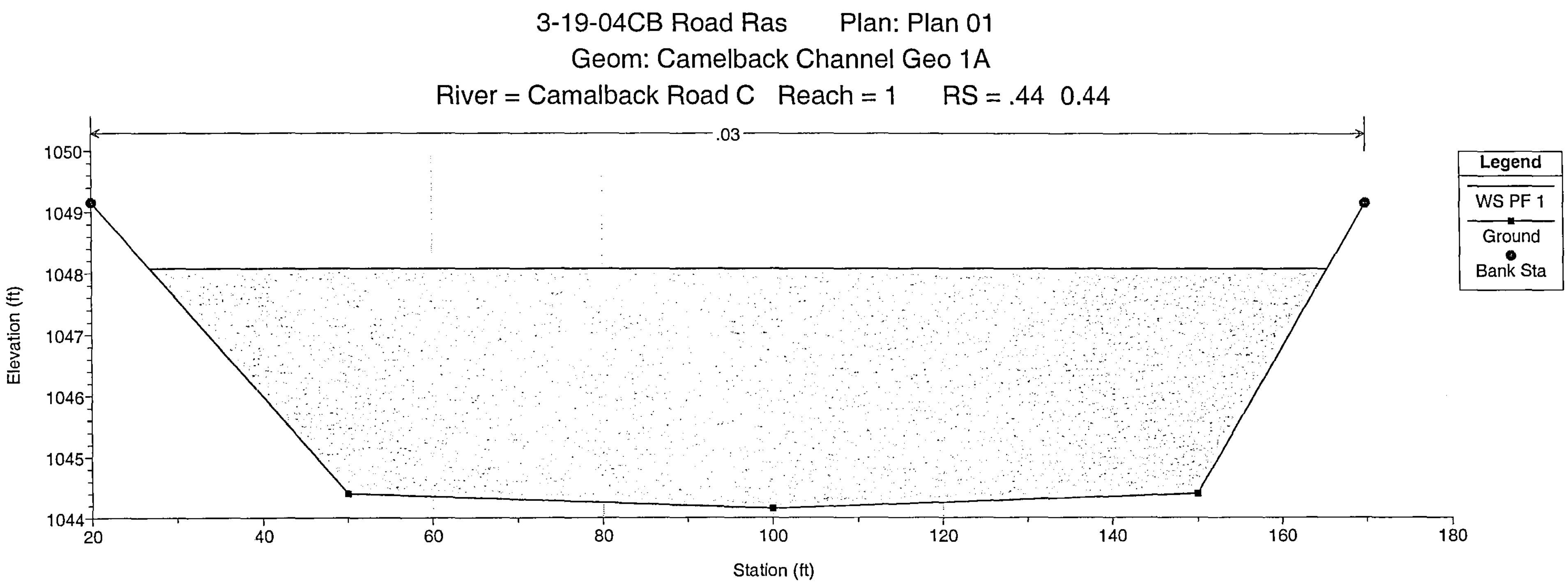
3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 0.61 0.61



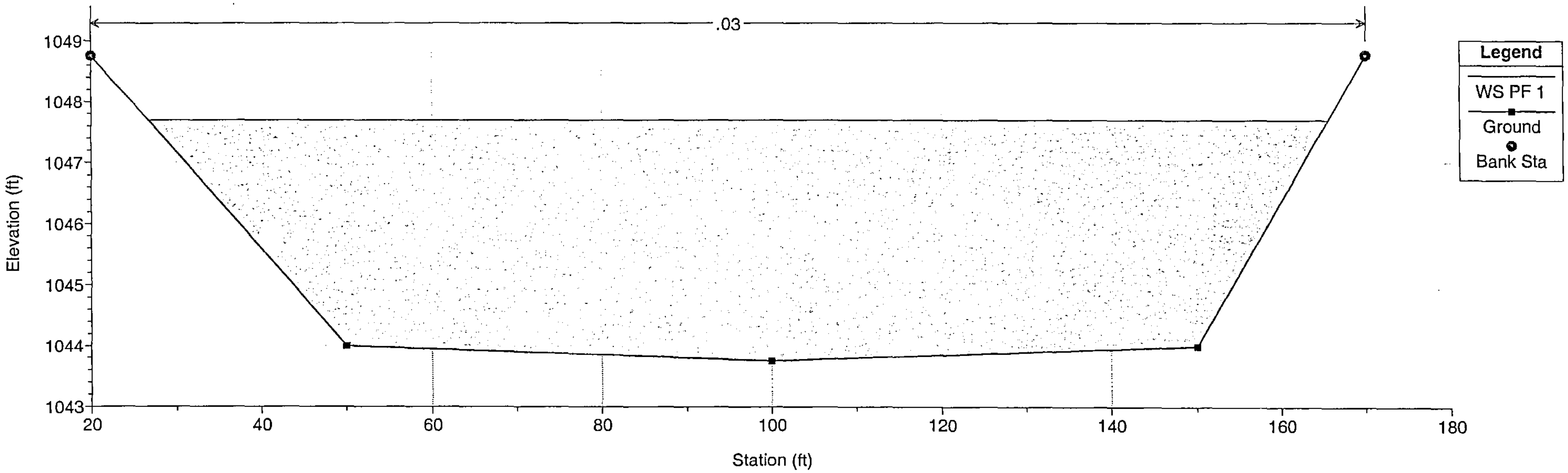
3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 0.55 0.55



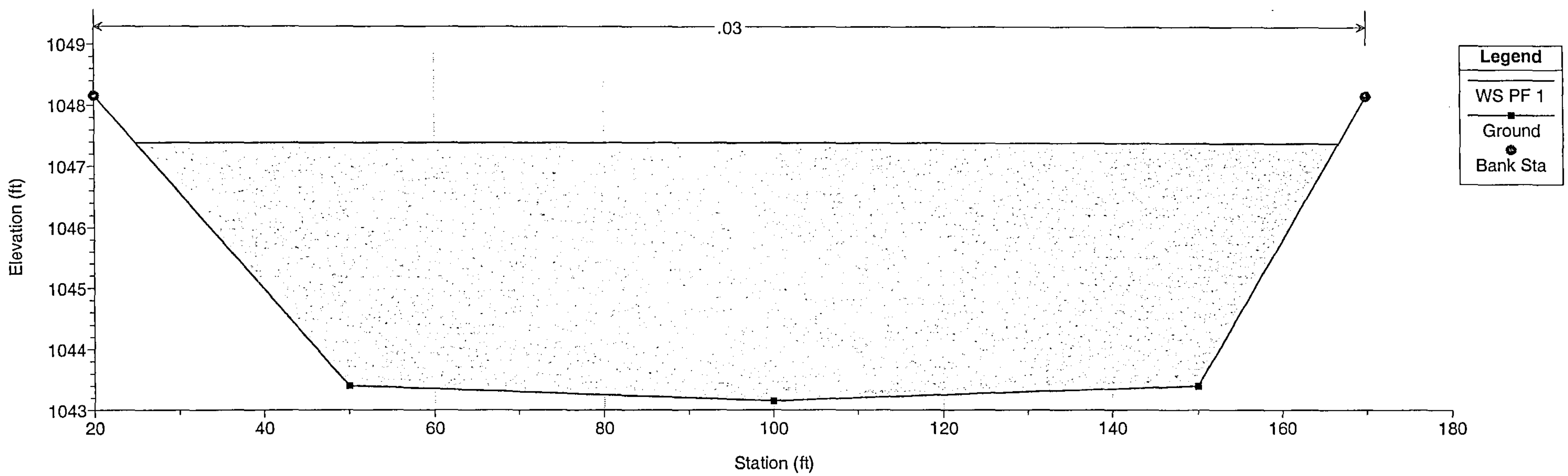

3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = 0.50 0.50
.03
Elevation (ft)
1050
1049
1048
1047
1046
1045
1044
20
40
60
80
100
120
140
160
180
Station (ft)
Legend
WS PF 1
Ground
Bank Sta


3-19-04CB Road Ras Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C Reach = 1 RS = .44 0.44
.03
Elevation (ft)
1050
1049
1048
1047
1046
1045
1044
20
40
60
80
100
120
140
160
180
Station (ft)
Legend
WS PF 1
Ground
Bank Sta

3-19-04CB Road Ras   Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C   Reach = 1   RS = 0.38 0.38



3-19-04CB Road Ras   Plan: Plan 01
Geom: Camelback Channel Geo 1A
River = Camalback Road C   Reach = 1   RS = 0.32 0.32

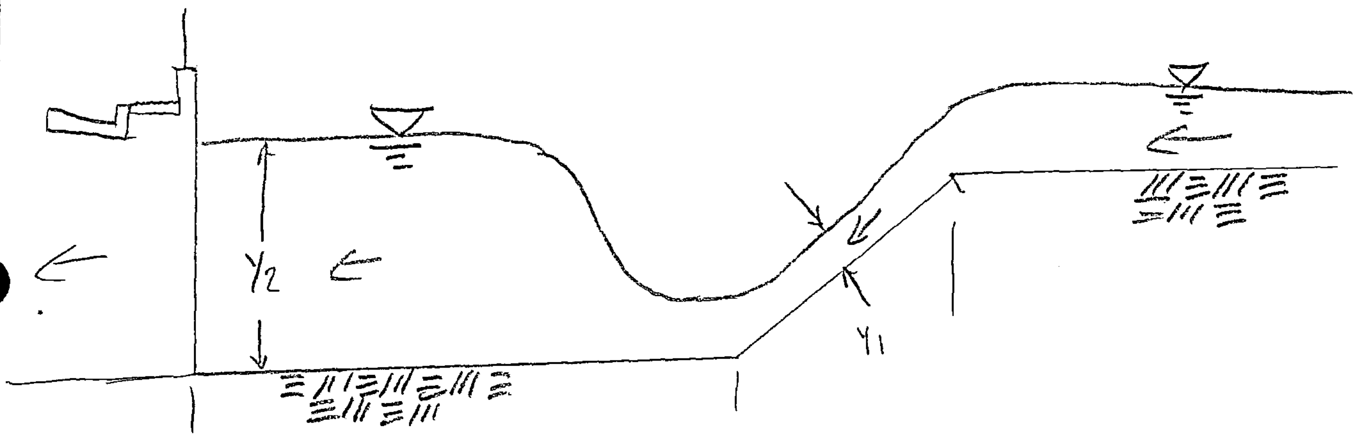


Project Title Palm Valley Phase 5 Project No. 303104 Date 7-27-09

Subject Drop Structure Hydraulic Prepared By MJK Checked By Page

Hydraulic Jump Height → worst case assume Drop is long enough for flow to reach normal Depth.

Refer to attached normal Depth calculation



Determine Jump Height

Eq. 7.2

$$\frac{Y_2}{Y_1} = \frac{1}{2}\left(\sqrt{1+8F_{r_1}^{2}} - 1\right)$$

$$Y_2 = \frac{1}{2}\left(\sqrt{1+8(5.1)^2} - 1\right)0.85$$

$\doteq$ 5.7 ft Check with HEC-RAS model ⟹ (X-sec 1.013 $\Delta H = 5.86$ ft)

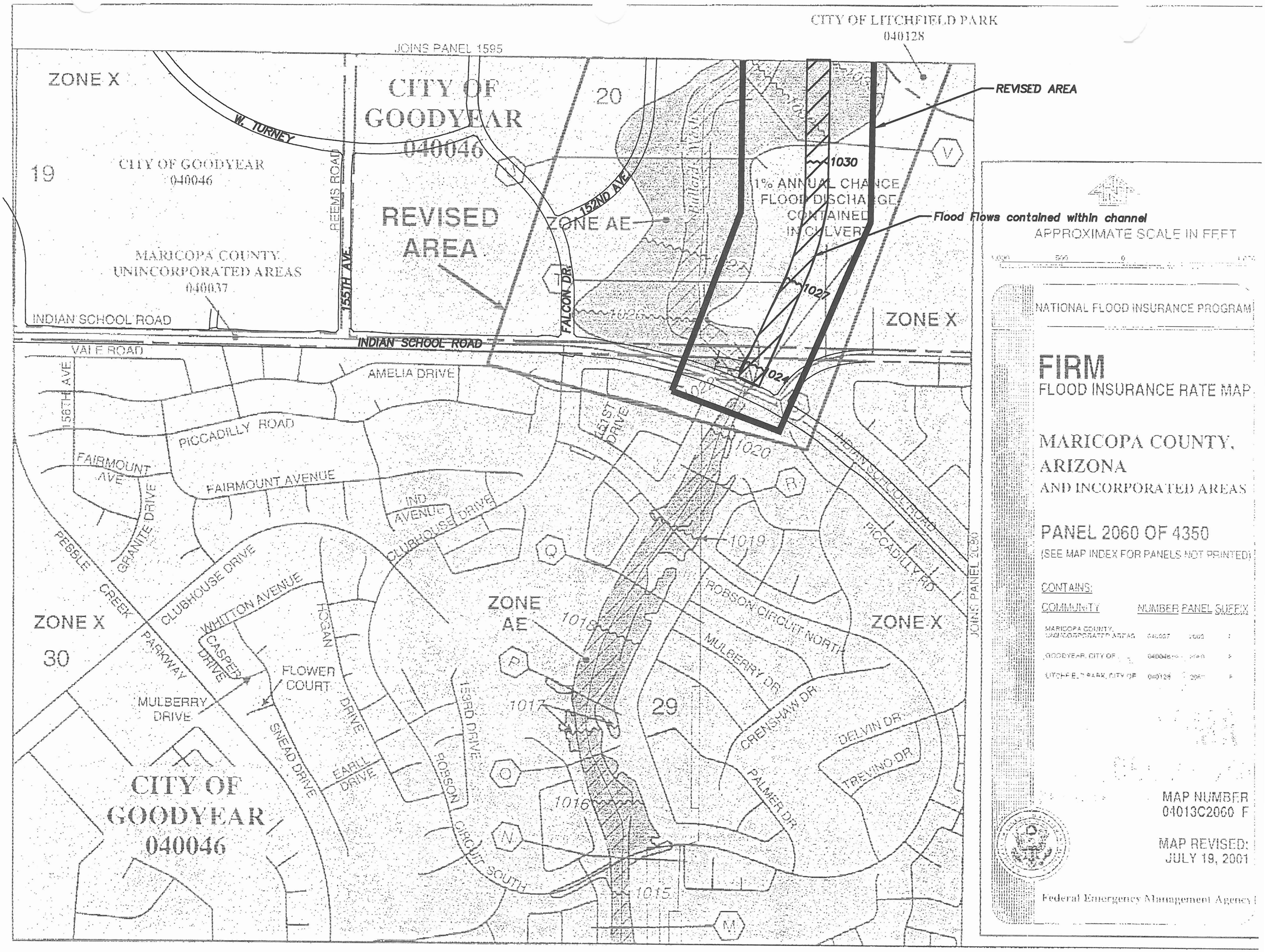
Very close → Assume HEC-RAS is calculating Δ WSEL correctly

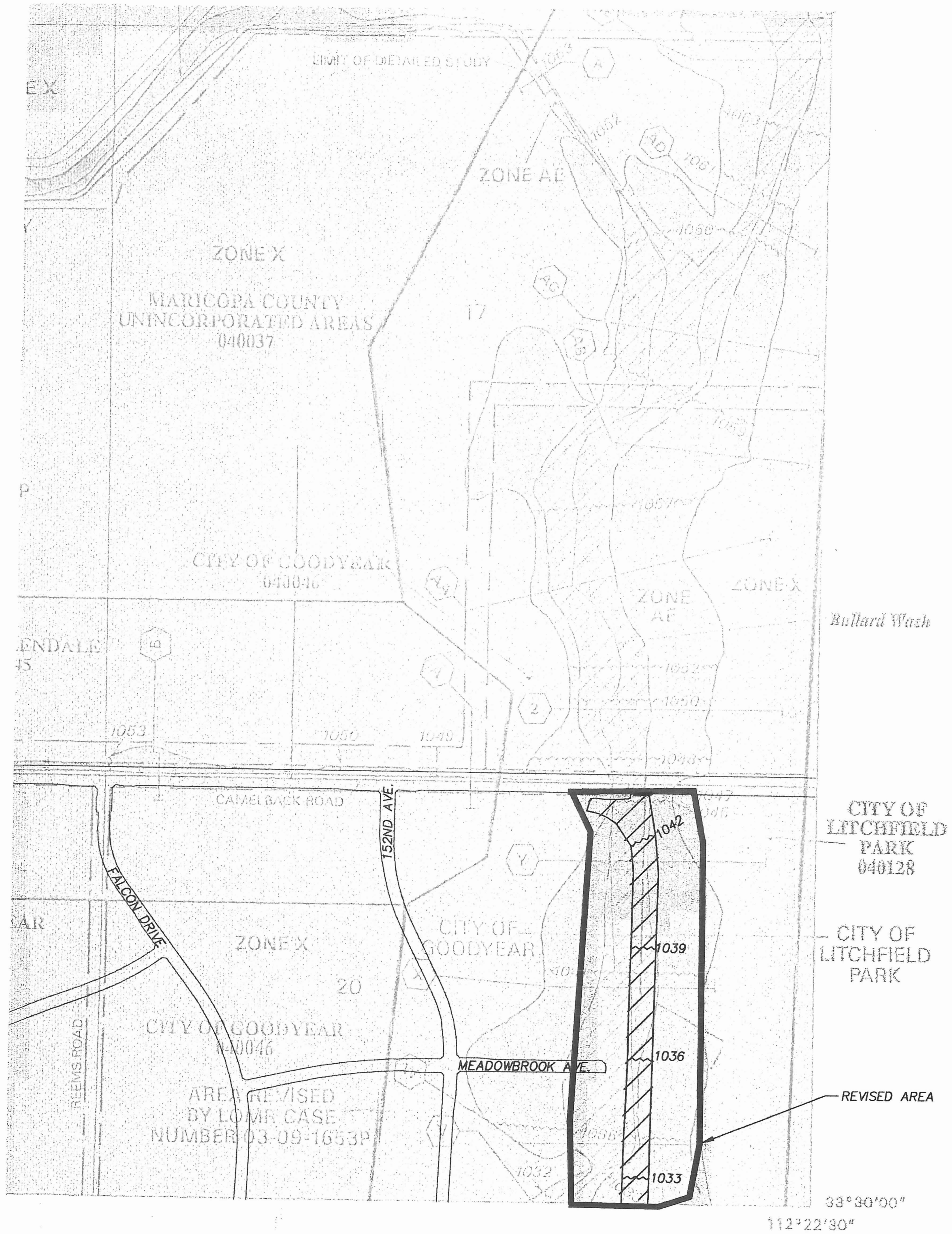
Drop Structure at Bullard and Ind. School Road
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Trapezoidal Channel - 1
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.022	
Slope	0.194500	ft/ft
Left Side Slope	6.00	H : V
Right Side Slope	6.00	H : V
Bottom Width	120.00	ft
Discharge	2,780.00	cfs

Results		
Depth	0.85	ft
Flow Area	106.7	ft^2
Wetted Perimeter	130.37	ft
Top Width	130.23	ft
Critical Depth	2.45	ft
Critical Slope	0.005436	ft/ft
Velocity	26.06	ft/s
Velocity Head	10.55	ft
Specific Energy	11.41	ft
Froude Number	5.08	
Flow Type	Supercritical	


CITY OF LITCHFIELD PARK
040128
JOINS PANEL 1595
REVISED AREA
Flood Flows contained within channel
ZONE X
CITY OF GOODYEAR
040046
20
19
CITY OF GOODYEAR
040046
MARICOPA COUNTY
UNINCORPORATED AREAS
040037
W. TURNEY
REEMS ROAD
155TH AVE.
REVISED
AREA
152ND AVE.
ZONE AE
FALCON DR.
1030
1% ANNUAL CHANCE
FLOOD DISCHARGE
CONTAINED
IN CULVERT
1027
1026
ZONE X
INDIAN SCHOOL ROAD
INDIAN SCHOOL ROAD
VALE ROAD
AMELIA DRIVE
156TH AVE
151ST DRIVE
1020
PICCADILLY ROAD
FAIRMOUNT AVE
FAIRMOUNT AVENUE
GRANITE DRIVE
IND AVENUE
CLUBHOUSE DRIVE
INDIAN SCHOOL ROAD
PICCADILLY RD
1019
PEBBLE CREEK PARKWAY
CLUBHOUSE DRIVE
WHITTON AVENUE
HOGAN DRIVE
ROBSON CIRCUIT NORTH
ZONE AE
1018
MULBERRY DR.
ZONE X
ZONE X
30
CASPER DRIVE
FLOWER COURT
MULBERRY DRIVE
1017
29
CRENSHAW DR.
DELVIN DR.
TREVINO DR.
153RD DRIVE
SNEAD DRIVE
EARLL DRIVE
ROBSON CIRCUIT SOUTH
PALMER DR.
1016
1015
CITY OF GOODYEAR
040046
JOINS PANEL 2080
APPROXIMATE SCALE IN FEET
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS
PANEL 2060 OF 4350
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
MAP NUMBER
04013C2060 F
MAP REVISED:
JULY 19, 2001
Federal Emergency Management Agency



MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

METERS 300 0 300 600

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1595G

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY,
ARIZONA
AND INCORPORATED AREAS

PANEL 1595 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
GLENDALE, CITY OF	040045	1595	G
MARICOPA COUNTY, UNINCORPORATED AREAS	040037	1595	G
LITCHFIELD PARK, CITY OF	040128	1595	G
GOODYEAR, CITY OF	040046	1595	G

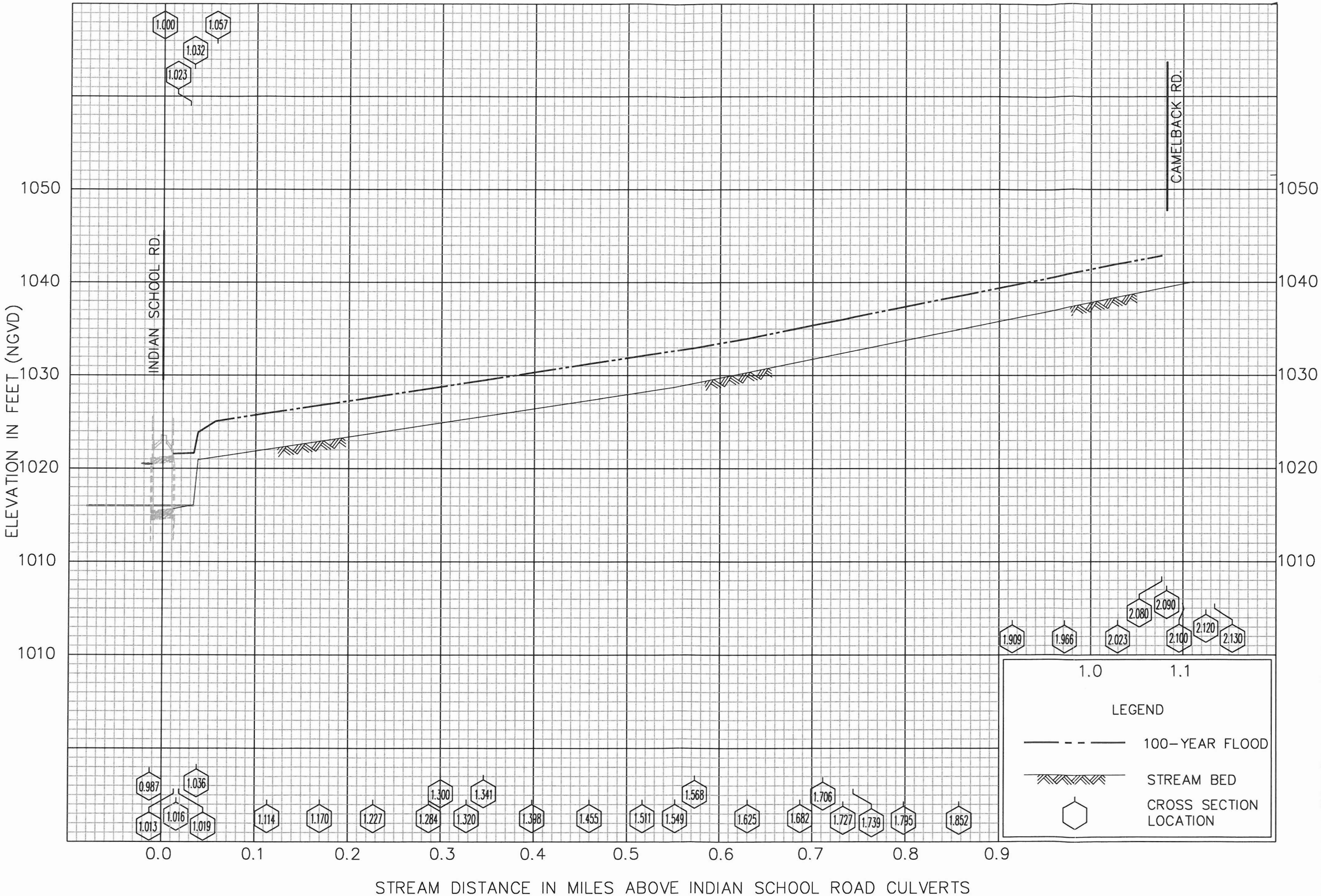
REVISED TO
REFLECT LOMR

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

MAP NUMBER
04013C1595G

MAP REVISED:
JULY 19, 2001

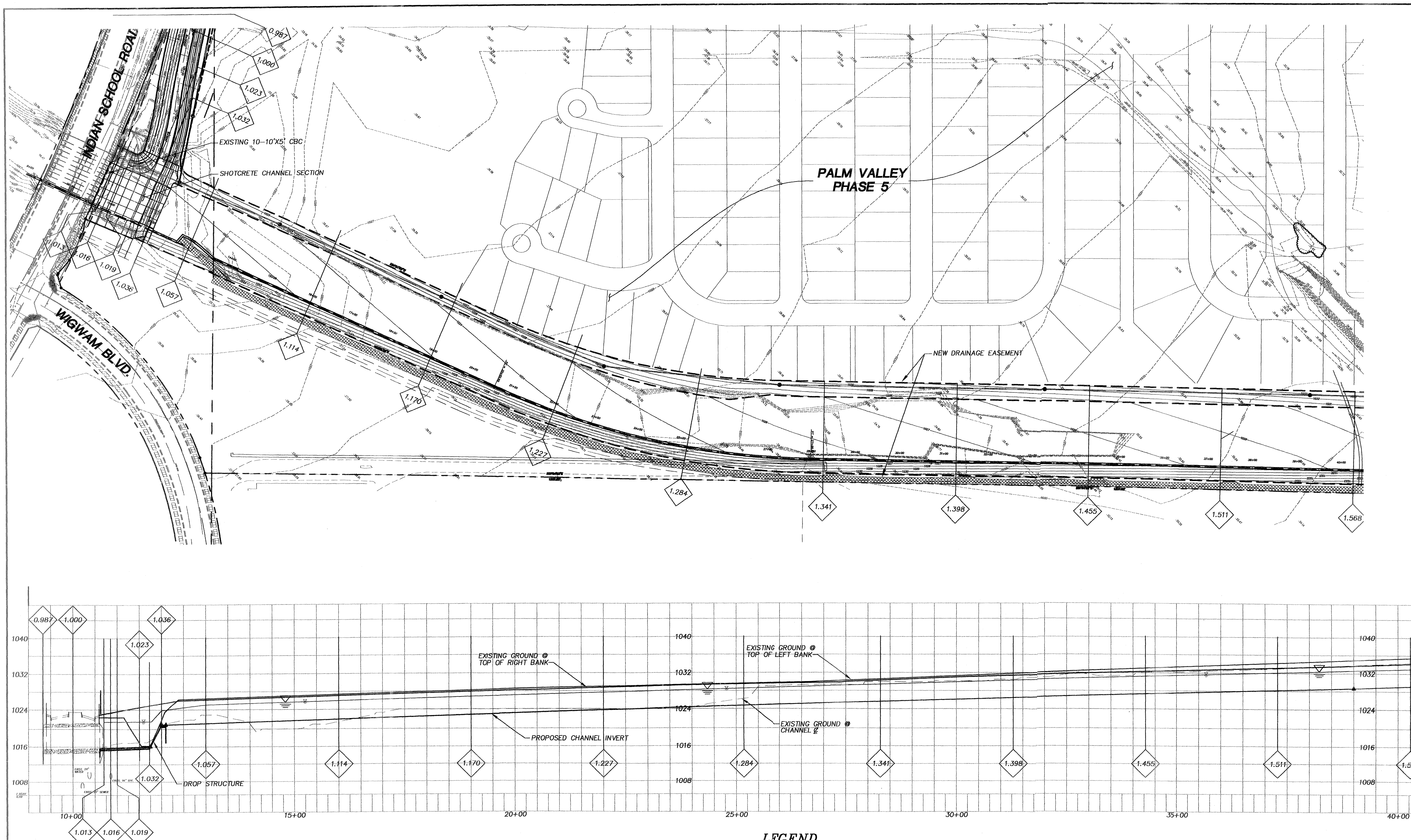
Federal Emergency Management Agency



FLOOD PROFILES

Bullard Wash Channel
Indian School Road to Camelback Road

FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF GOODYEAR, ARIZONA
MARICOPA COUNTY



LEGEND

- 1.341 HEC-RAS CROSS SECTION
- 100 YR-24 HR WATER SURFACE ELEVATION
- PROPOSED CONTOUR
- EXISTING CONTOUR
- NEW LOT LINE

NORTH

GRAPHIC SCALE

100' 0 50' 100' 200'

SCALE 1"=100' ft.

CONTOUR INTERVAL = 1ft.

BULLARD WASH CHANNEL

EXHIBIT 1A

REV.	DATE	DESCRIPTION	CK. BY

BULLARD WASH CHANNEL

INDIAN SCHOOL RD. TO CAMELBACK RD.

SHEET TITLE: HEC-RAS FLOOD PLAIN EXHIBIT

Engineering and Environmental Consultants, Inc.
3003 N. Central Avenue, Suite 600
Phoenix, Arizona 85012-2905
TEL:(602)248-7702 FAX:(602)248-7851

REGISTERED PROFESSIONAL ENGINEER — CERTIFICATE NO. 35920 MICHAEL J. ROBERTS — ARIZONA

DESIGN BY: MJR

DRAWN BY: AJA

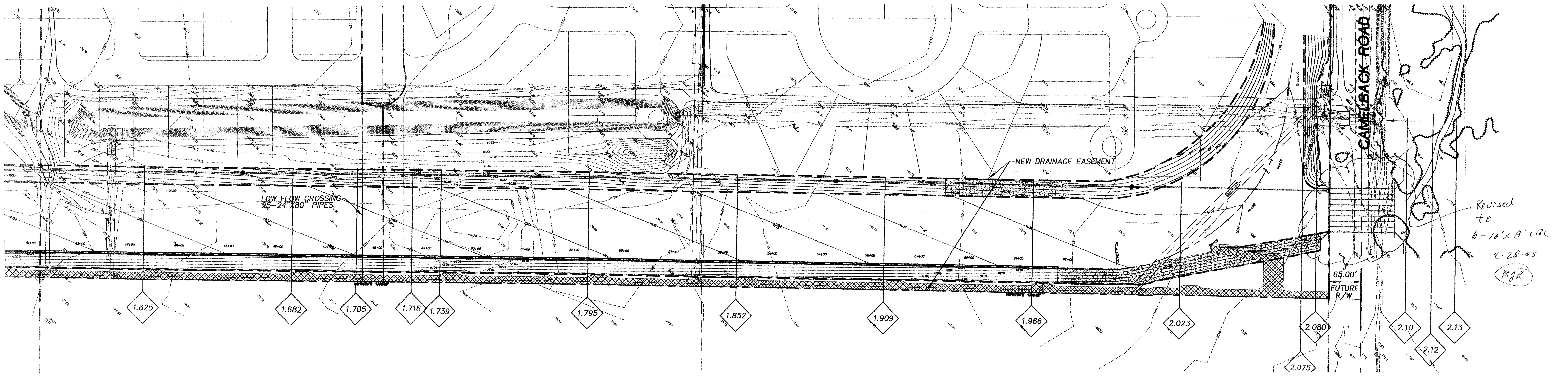
CHK'D BY: MJR

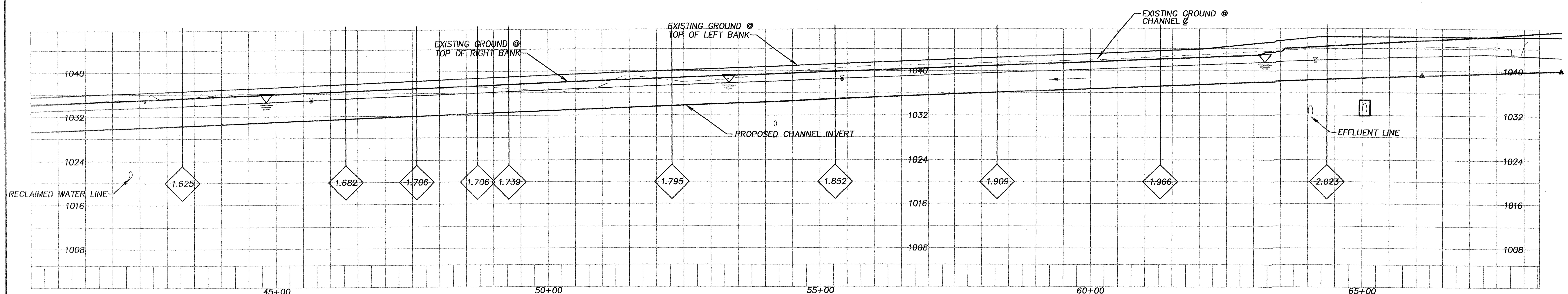
DATE: OCTOBER, 2003

SCALE: Hor. 1"=100' Vert. 1"=10'

DRAWING NO. 1 of 2

Camelback Rd
Existing Roadside Ditch
Camelback Rd Channel
Indian School Rd
Indian School Channel
Loop 303
167th Ave
Sarival Ave
Alsup Ave
Reems Rd
Clubhouse Drive
Pebble Creek Parkway
Bullard Wash
SECTION 24
SECTION 19
SECTION 20
Pebble Creek Phase II
Pebble Creek Phase I
Millenium High School
Bullard Wash Weir
D 0253 (280 cfs)
Existing Indian School Culverts 10 - 10' x 5' CBC
New Culvert
Existing Culvert
Legend
Concentration Point
Sub basin ID
Routing Reach
Storage Route
Basin Boundary
Land Use
Roads
Contours
Channel
2904 cfs = Q_{100}
Topographic Mapping from 1990 FCD Aerial Survey
Palm Valley Phase 5
Exhibit 2
Engineering and Environmental Consultants, Inc
3003 North Central Ave, Suite 600
Phoenix, Arizona 85012
Scale: 1' = 400'
N
Project Area Drainage Map
Revision Date: 8-27-04





NORTH

GRAPHIC SCALE

100' 0 50' 100' 200'

SCALE 1"=100' ft.

CONTOUR INTERVAL = 1ft.

BULLARD WASH CHANNEL

EXHIBIT 1A

REV.	DATE	DESCRIPTION	CK BY

BULLARD WASH CHANNEL
INDIAN SCHOOL RD. TO CAMELBACK RD.

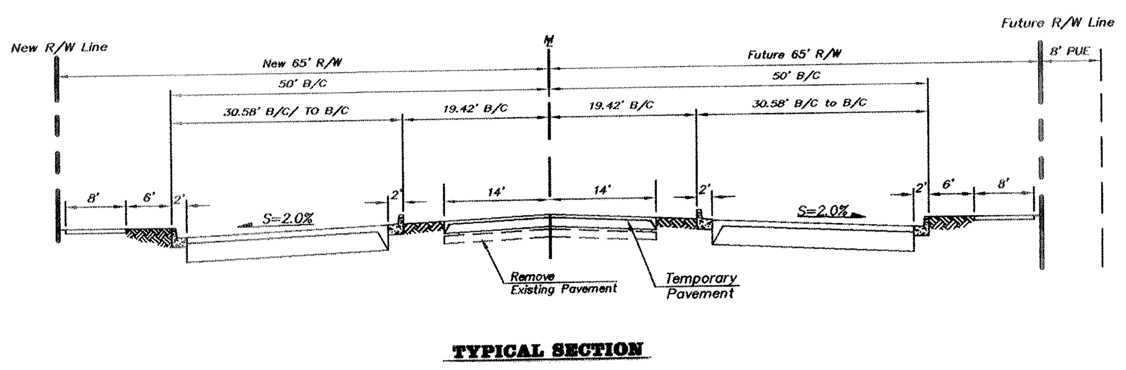
SHEET TITLE
HEC-RAS
FLOOD PLAIN EXHIBIT

EEC
Engineering and Environmental Consultants, Inc.
3003 N. Central Avenue, Suite 600
Phoenix, Arizona 85012-2905
TEL:(602)248-7702 FAX:(602)248-7851

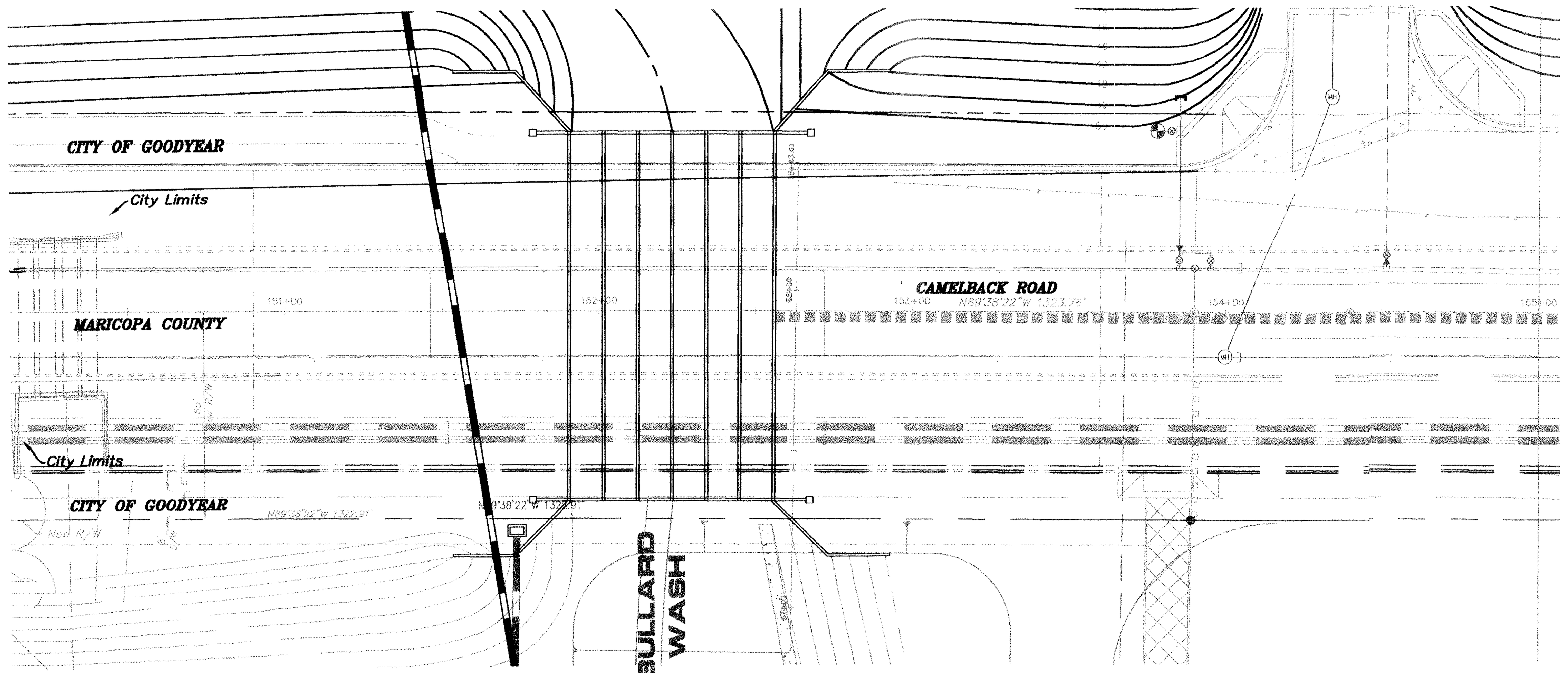
REGISTERED PROFESSIONAL ENGINEER
CERTIFICATE No. 35920
MICHAEL J. ROBERTS

DESIGN BY: MJR
DRAWN BY: AJA
CHK'D BY: MJR
DATE: OCTOBER, 2003
SCALE: Hor. 1"=100' Vert. 1"=10'
DRAWING NO.
2 of 2

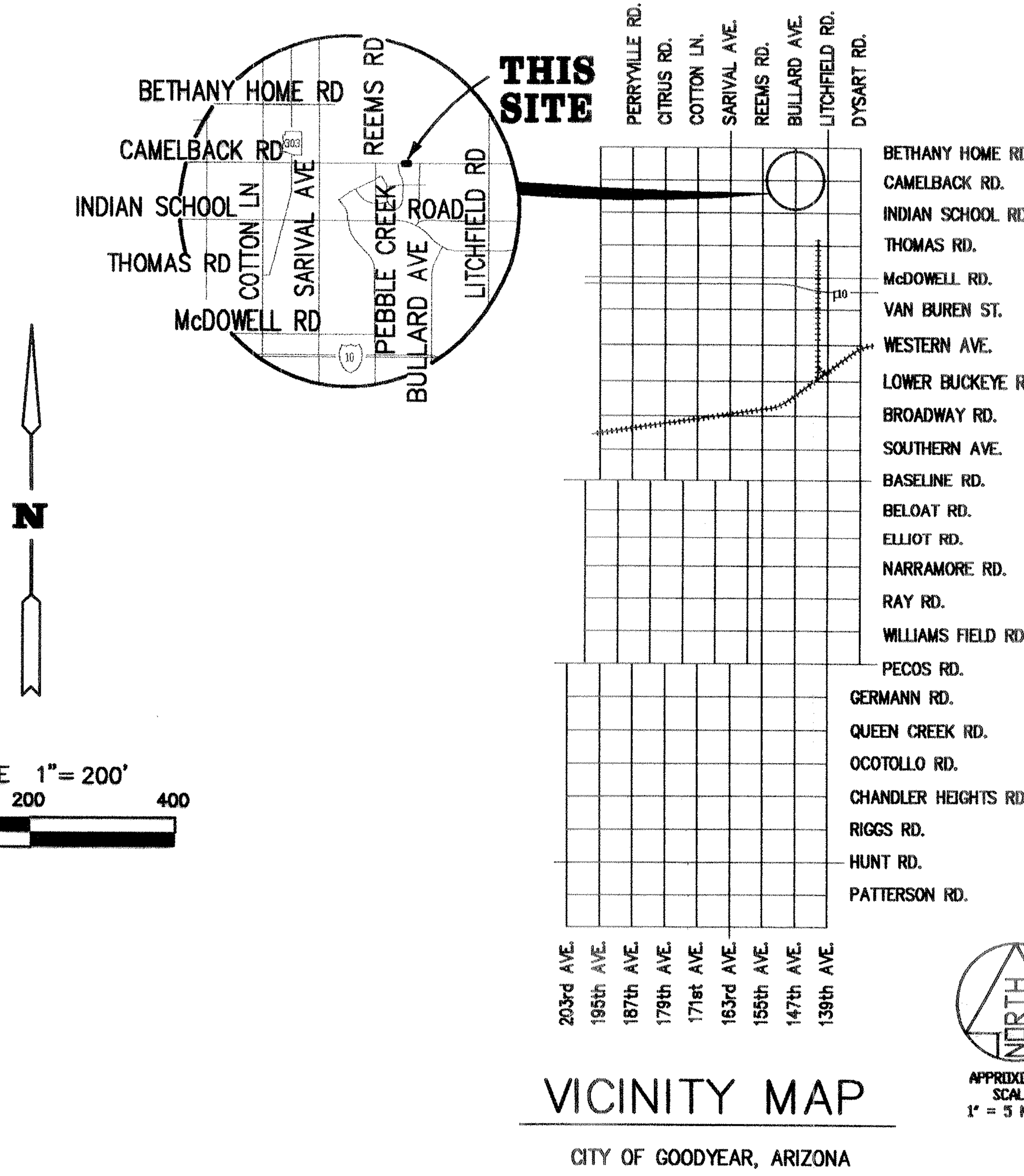
CAMELBACK ROAD-BULLARD WASH - BOX CULVERT PLANS



TYPICAL SECTION



KEY MAP



VICINITY MAP

CITY OF GOODYEAR, ARIZONA

MARICOPA COUNTY GENERAL NOTES

1. All construction shall conform to the latest Maricopa County Department of Transportation (MCDOT) Roadway Design Manual and M.A.G. Specifications and Maricopa County Special Provisions for Construction of Street Improvements.
2. Contractor to obtain necessary MCDOT permits prior to construction within county right-of-way.
3. The engineering design on these plans are only approved by Maricopa County Department of Transportation in scope and not in detail. Construction quantities on these plans are not verified by Maricopa County Department of Transportation. Approval of these plans are for permit purposes only and shall not prevent Maricopa County Department of Transportation from requiring correction of errors in the plans where such errors are subsequently found to be in violation of any law, ordinance, health, safety, or other design issues.
4. Contractor shall notify the MCDOT inspection department at least 24 hours in advance of any construction at (602) 506-8606.
5. An approved set of plans shall be on the site during construction and inspections.
6. Contractor performing construction or excavating operations is responsible for locating, relocating and/or protecting all utilities in conflict or within the clear zone, at no expense to Maricopa County.
7. All compaction and back fill within county right-of-way shall conform to the special provisions for construction of street improvements and installation of underground utilities. Backfill under any existing or proposed pavement, curb, gutter or within two feet (2') or less from the edge of pavement shall consist of aggregate base course (ABC) material.
8. All structures, such as manholes, valve box and covers, and monitoring wells must be marked with at least two reflective yellow flex post when structures are located outside the traveled way and within the right-of-way. ("applies only when there is no curb.")
9. All existing pavement marking, traffic signs and signal equipment that needs to be removed, replaced, relocated or repaired because of contractor's work, will be done by the contractor at his expense. All traffic signs that are removed shall be stockpiles on the project site and the contractor is to notify the inspector when all signs have been removed. All new street name signs shall be provided and installed by permittee at no expense to Maricopa County.
10. Pavement marking, signing and signal work will be inspected and will have to meet county standards before release of bond.
11. Asphalt mix design shall be submitted to MCDOT a minimum of 48 hours prior to placing any asphalt courses. (trench work excluded.)
12. Prior to conducting excavation operations, the contractor shall obtain from the Arizona State Historical Preservation Officer (SHPO) (602) 542-4009, recommendations regarding the need for cultural resources (archaeological) clearance. All discoveries of human remains, cultural artifacts, or paleontological remains shall be reported to the Arizona State Museum and MCDOT. Upon discovery, contractor shall cease operations in the vicinity of the find and protect the discovery are from further disturbance until the find can be professionally investigated by the Arizona State Museum and MCDOT.
13. Prior to moving or destroying protected native plant species, the contractor shall file a formal notice of intent with the Arizona Department of Agriculture Native Plants (602) 542-3292.
14. Except under emergency conditions, roads shall not be closed for construction activity unless prior approval is obtained from the Transportation Director or his representative.
15. All box culverts constructed in the public right-of-way shall comply with Arizona Department of Transportation (ADOT) latest design specifications and standards. Minimum clear height of box culvert shall be 4 feet.
16. Prior to installation of the base course and wearing surface, submit soil test(s) of sub-grade and revised pavement design/calculations to the Maricopa County Department of Transportation for review and approval.

rev. 03/20/2003

CITY OF GOODYEAR STANDARD NOTES FOR GRADING & DRAINAGE CONSTRUCTION

A. An on-site grading permit is required.
B. A separate permit is necessary for any off-site construction.
C. The City shall be notified 24 hours before any on-site construction begins. (623) 882-7979.
D. Finish floor elevations shall be a minimum of 14" above point of outfall. Carport elevations shall be 4" below finish floor elevation.
E. Staking pad and/or finished floor elevations are the responsibility of the developer or his engineer. In non-critical areas, the developer's engineer shall submit certifications of constructed building pad elevations prior to the City's acceptance of project. In a critical drainage area, certification of the finished building floor or stem wall elevation shall be submitted and approved prior to any vertical construction.
F. The grading contractor shall designate the location for wasting spoil materials and a letter from the owner giving permission for said disposal prior to starting on-site construction.
G. Grading and drainage plan approval includes: construction of drainage plan including, but not limited to, retention areas and/or other drainage facilities, surface grading, walls, curbs, asphalt pavement, and building floor elevations.
H. The contractor shall provide all retention basins at elevations as shown on the plans. Retention basins side slope shall not exceed 4:1 on private property or 6:1 adjacent to public right-of-way. Retention basins shall not exceed 3 foot depth on private property or 1.5 foot depth within 10 feet of public right-of-way.
I. The contractor is responsible for locating and confirming depth of al the existing utility lines within proposed retention basin areas. If the basin cannot be constructed per plans as a result of conflict with underground utilities, the contractor should contact the City and designer and request modification of the basin design.
J. This set of plans has been reviewed for compliance with City requirements prior to issuance of construction permits and shall be kept at the construction site. Such review shall not prevent the City from requiring correction of errors in plans which are found to be in violation of any law or ordinance.
K. You are hereby advised that no person shall use any mechanical equipment for land leveling or clearing, road construction, trenching, excavating, demolition or engage in any earthmoving activity without first obtaining a permit from Air Pollution Control, Maricopa County Department of Health Services 1001 N. Central Ave., Ste. 150, Phoenix, AZ 85004, Phone: (602) 506-6666. (This notice is issued pursuant to A.R.S. 36-779.07, Notice of Building Agencies.)
L. "As Built" drawings (one set mylars, 2 sets of prints), certified by the developer's engineer, shall be submitted and approved prior to issuance of a building "Certificate of Occupancy".

CITY OF GOODYEAR GENERAL NOTES FOR CONSTRUCTION

A. All construction shall conform with the latest MAG standard Details and Specifications
B. This set of plans has been reviewed for compliance with City requirements prior to issuance of construction permits. However, such review shall not prevent the City from requiring correction of errors in plans found to be in violation of any law or ordinance.
C. This City does not warrant any quantities shown on these plans.
D. The City approval is for general layout in the right-of-way only. This approval is valid for a period of one year. Construction permits shall be obtained during this period or the plans shall be resubmitted for review and approval.
E. An approved set of plans shall be available on the job site at all times.
F. The City shall be notified 24 hours prior to any construction work and inspections. (623) 882-7979. Construction work concealed without inspection by the City shall be subject to exposure at the contractors expense.
G. Right-of-way improvements shall not be accepted until "As-Built" plans have been submitted and approved by the City. (See as-built requirements)
H. The developer is responsible for the removal or relocation of all obstructions within the right-of-way prior to starting new construction.
I. The developer is responsible for arranging the relocation and associated costs of all utilities. A utility relocation schedule shall be submitted to the issuance of permits.
J. The developer is responsible for obtaining or dedicating all required rights-of-way and easements to the City prior to issuance of permits.
K. The contractor shall contact BLUE STAKE (602) 263-1100) at least 48 hours prior to construction. The contractor shall barricade construction sites at all times per the City of Phoenix
L. Traffic Barricade Manual. When required by the City, a traffic control plan shall be submitted for approval in advance of construction.
M. The contractor may request a fire hydrant meter for construction water from LPSCO. This meter should be ordered two working days prior to the start of construction. The unlawful removal of water from a fire hydrant is a violation of the municipal code, punishable by fine and/or imprisonment.
N. Private on-site water and sewer lines shall be constructed in accordance with the Uniform Plumbing Code, N.F.P.A. and the Uniform Fire Code as adopted by the City.

* Potable water is generally not available for construction propcses

CITY OF GOODYEAR GENERAL NOTES FOR STREET CONSTRUCTION

A. All construction shall be in accordance with current MAG specification and standard details.
B. Contractor shall obtain all necessary permits prior to construction.
C. City of Goodyear inspectors shall be notified 24 hours prior to starting each phase of construction, and each inspection requested (623-882-7979).
D. Any work performed without the approval of the City Engineer and any work/material not in conformance with the specifications is subject to removal and replacement at the contractor's expense.
E. Contractor will expose any lines being tied into to verify location.
F. Contractor shall have all existing underground utilities located (BLUE STAKE (602) 263-1100) and shall eliminate all conflicts prior to construction.
G. City of Goodyear is not liable for delays nor damages to utilities related to this construction; neither will the City participate in the cost of utility construction nor relocation.
H. As-Built drawings (one set mylars and two sets of prints), certified by the subdivider's engineer, shall be submitted to and accepted by the City Engineer before final acceptance of the work. (See as-built requirements.)
I. Contractor shall continuously reference location of all valves during construction.
J. All underground utilities located in the roadway shall be completed before paving.
K. Base course shall not be placed until subgrade has been approved by City Engineer.
L. Gutter shall be water tested for drainage in the presence of City Engineer.
M. Exact point of matching termination and overlay shall be determined in the field by the City Engineer.
N. Curb, gutter, sidewalk and pavement shall be swept clean of dirt and debris.
O. Contractor shall obtain an air pollution permit from the Maricopa County Air Pollution Control.
P. Contractor is to install a blue reflector at all fire hydrant locations. Reflector is to be glued to the finished paving at the specified location. (See Section 5.1 Potable Water System Design and Detail G-3212).

SHEET INDEX

1 Cover Sheet
2 A.D.O.T. Culvert Details
3 Sections "A" & "B" and Details
4 Section "C" and Details
5 Plan and Profile

OWNER/DEVELOPER

SunCor Development Company
14130 W. McDowell Rd., Suite A107
Goodyear, AZ 85338
Phone: (623) 935-0600
Attn: Tom Hill

UTILITY NOTE

Location on all utilities shown on these plans are based on information supplied to the engineer by the appropriate utility companies. Engineer does not guarantee that all utilities are shown or their locations. It is the responsibility of the contractor or owner to contact Blue Stake and any other involved agencies to locate all utilities prior to construction.

BENCHMARKS

Brass Cap in Flush @ Intersection of Pebble Creek Parkway and Indian School Road
City of Goodyear Datum= 1038.10

Brass Cap in Handhole @ Intersection of Sarival Avenue and Indian School Road
City of Goodyear Datum= 1045.15

Brass Cap in Flush @ Intersection of N. 155th Avenue and Indian School Road
City of Goodyear Datum= 1032.72

CERTIFICATION:

I HEREBY CERTIFY THAT THIS DESIGN IS BASED ON ACCURATE FIELD DATA WHICH HAS BEEN CHECKED IN THE FIELD WITHIN 60 DAYS PRIOR TO SUBMISSION FOR CITY APPROVAL.

BY:______________________ DATE________
Registered Professional Engineer

"AS BUILT" CERTIFICATION:

I CERTIFY THAT THE "AS-BUILT" INFORMATION SHOWN HEREON WAS OBTAINED UNDER MY DIRECT SUPERVISION AND IS CORRECT AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF.

NAME______________________ (SEAL)
REGISTRATION NO.______________ DATE________
REVD. BY:______________________
FIELD ENGINEERING

APPROVAL:

BY: See Approval Letter From Maricopa County DATE 3/2/2005
MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION

CITY OF GOODYEAR REVIEW AND RECOMMENDED APPROVAL			
FIRE DEPT.	—	GRADING & DRAINAGE	KJM
LANDSCAPING & PLANNING	—	WATER & SEWER	—
TRAFFIC	—	PAVING	—

APPROVED BY: Karl J. Mathiesen 3/4/05
~~PROJECT REVIEW SR. ENGINEER~~ DATE
PLANS EXAMINER

Two working days before you dig
CALL FOR THE BLUE STAKES
263-1100
Blue Stake Center
CALL COLLECT

SHEET 1 OF 5

Registered Professional Engineer (CIVIL)
CERTIFICATE NO. 11305
DENNIS FRANK KEOGH
Date Signed 3/2/05
ARIZONA, U.S.A.

PREPARED FOR
SunCor Development Company

CAMELBACK ROAD - BULLARD WASH CULVERT PLANS

DRAWN BY	DDS
CHECKED BY	DFK
FIELD WORK BY	GJ
DATE	Jan, 2005

KEI
Keogh Engineering, Inc.
1616 N. LITCHFIELD RD. · SUITE 120 · GOODYEAR, AZ 85338
PHONE (623) 535-7260 FAX (623) 535-7262

JOB NO. 19477
MAP NO. P-19477

BOX CULVERT PLANS - CAMELBACK ROAD-BULLARD WASH

HTF 05-292

Plot Date / Time: 03/03/05 07:52am Layout Name: Sheet 1 AutoCad Version: 16.0
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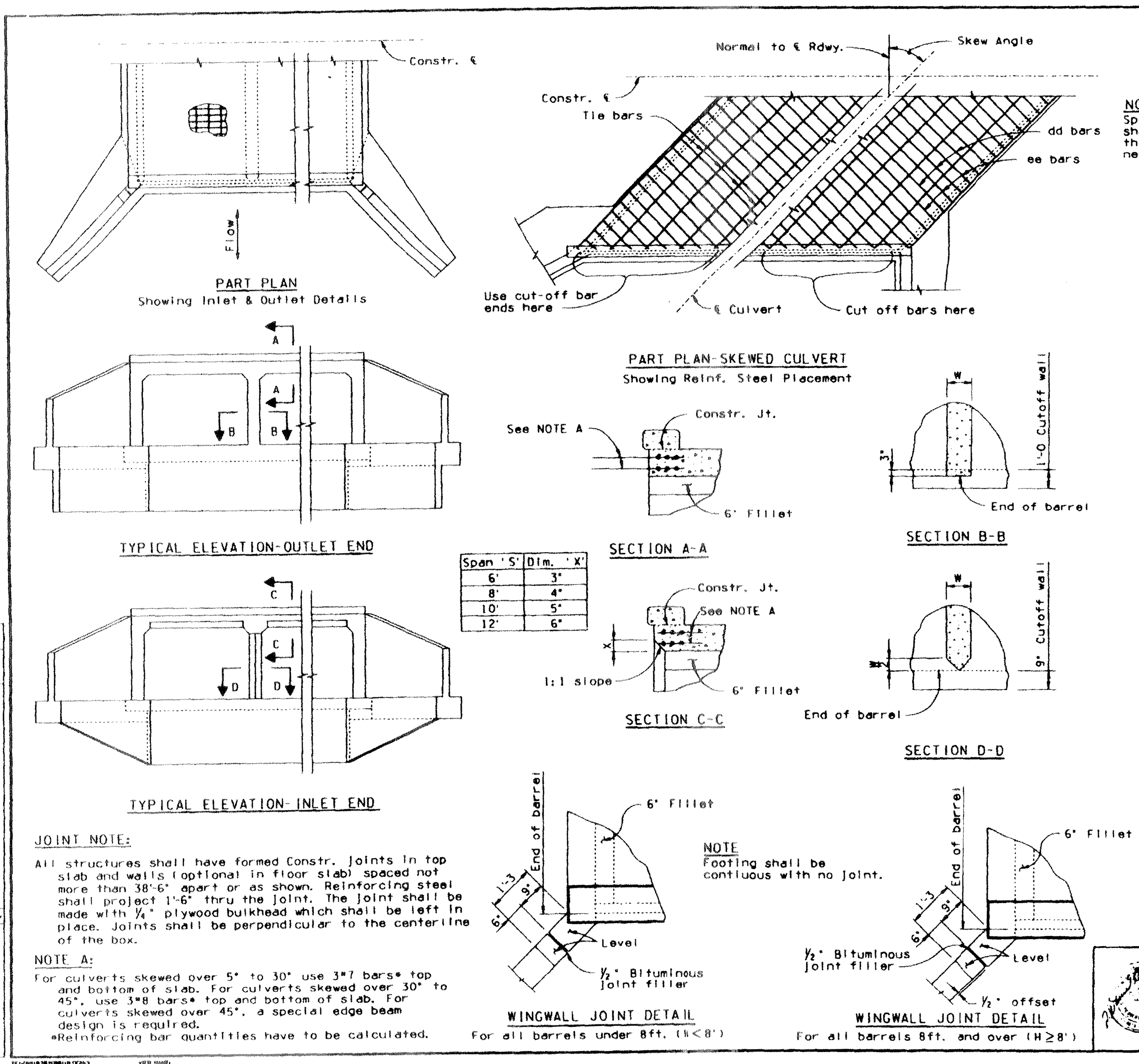


NOTE:
Specially designed sections shall be used along with the standard barrels when necessary.

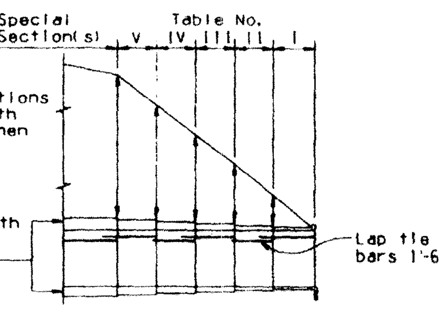


DIAGRAM SHOWING TABLES TO BE USED FOR VARIOUS FILL HEIGHTS

NOTE: Culvert barrels always begin and end with Table No. I.

JOINT NOTE:

All structures shall have formed Constr. Joints in top slab and walls (optional in floor slab) spaced not more than 38'-6" apart or as shown. Reinforcing steel shall project 1'-6" thru the joint. The joint shall be made with ¼" plywood bulkhead which shall be left in place. Joints shall be perpendicular to the centerline of the box.

NOTE A:

For culverts skewed over 5° to 30° use 3#7 bars* top and bottom of slab. For culverts skewed over 30° to 45°, use 3#8 bars* top and bottom of slab. For culverts skewed over 45°, a special edge beam design is required.
*Reinforcing bar quantities have to be calculated.

GENERAL NOTES:

Construction Specification - Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, latest Edition.

Design Specifications - AASHTO Standard Specifications for Highway Bridges, Edition of 1989 and 1990 Interim Specifications.

Loading Class - HS20-44 and/or Interstate Alternate Loading.

All concrete shall be Class "S" unless noted otherwise.

Reinforcing steel shall conform to ASTM Specification A615. Bar sizes #6 and smaller shall be designed as Grade 40 but may be furnished as Grade 40 or Grade 60. Bar sizes #7 and larger shall be designed and furnished as Grade 60.

All bend dimensions for reinforcing steel shall be out-to-out of bars. All placement dimensions for reinforcing steel shall be to center of bars unless noted otherwise.

All reinforcing steel shall have 2 inch clear cover unless noted otherwise.

Stresses:
Concrete .... f'c = 3000 psi
Grade 40 reinforcing steel .... fs = 20000 psi
Grade 60 reinforcing steel .... fs = 24000 psi

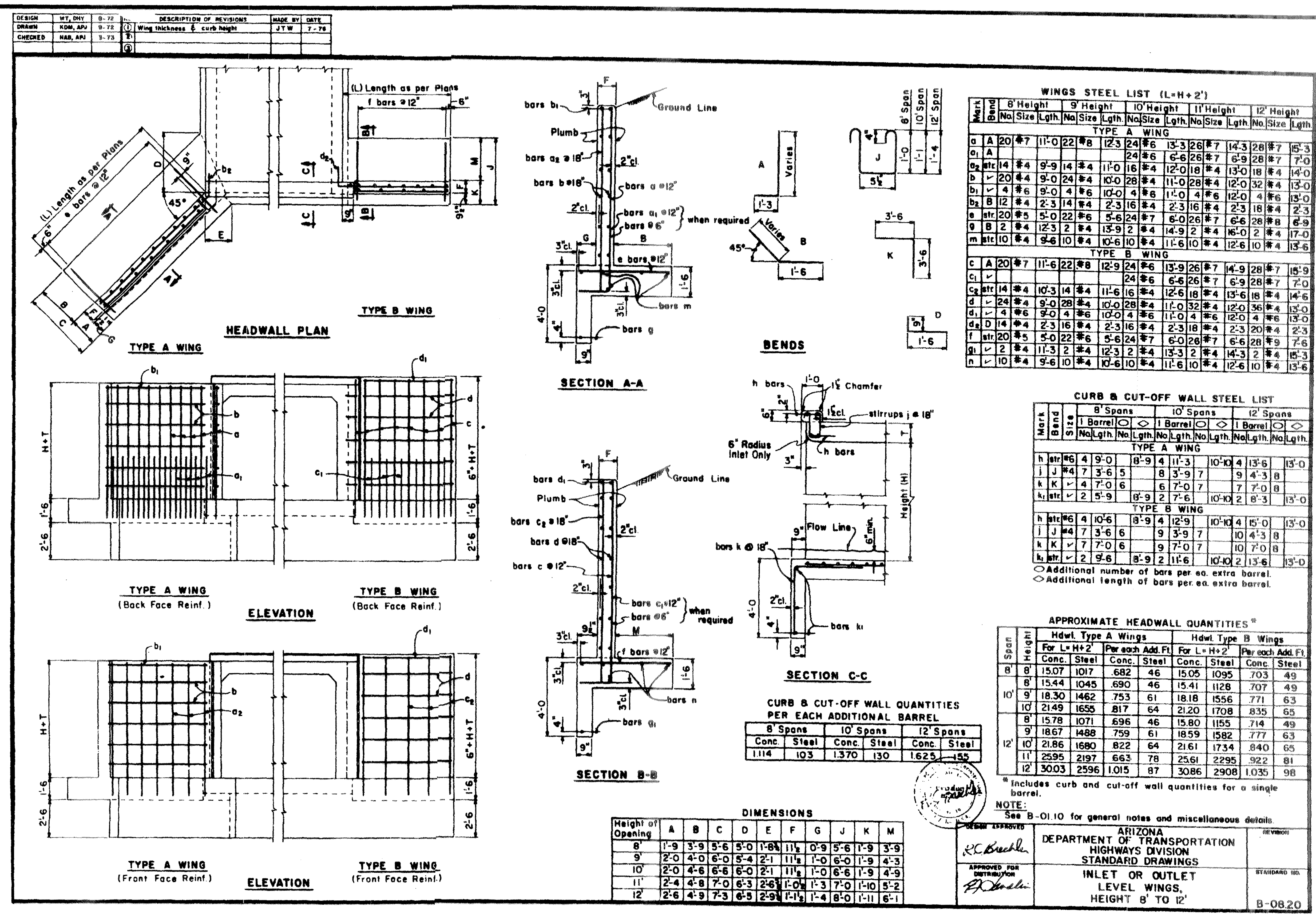
Chamfer all exposed corners ¾" as per Standard B-19.10 unless noted otherwise.

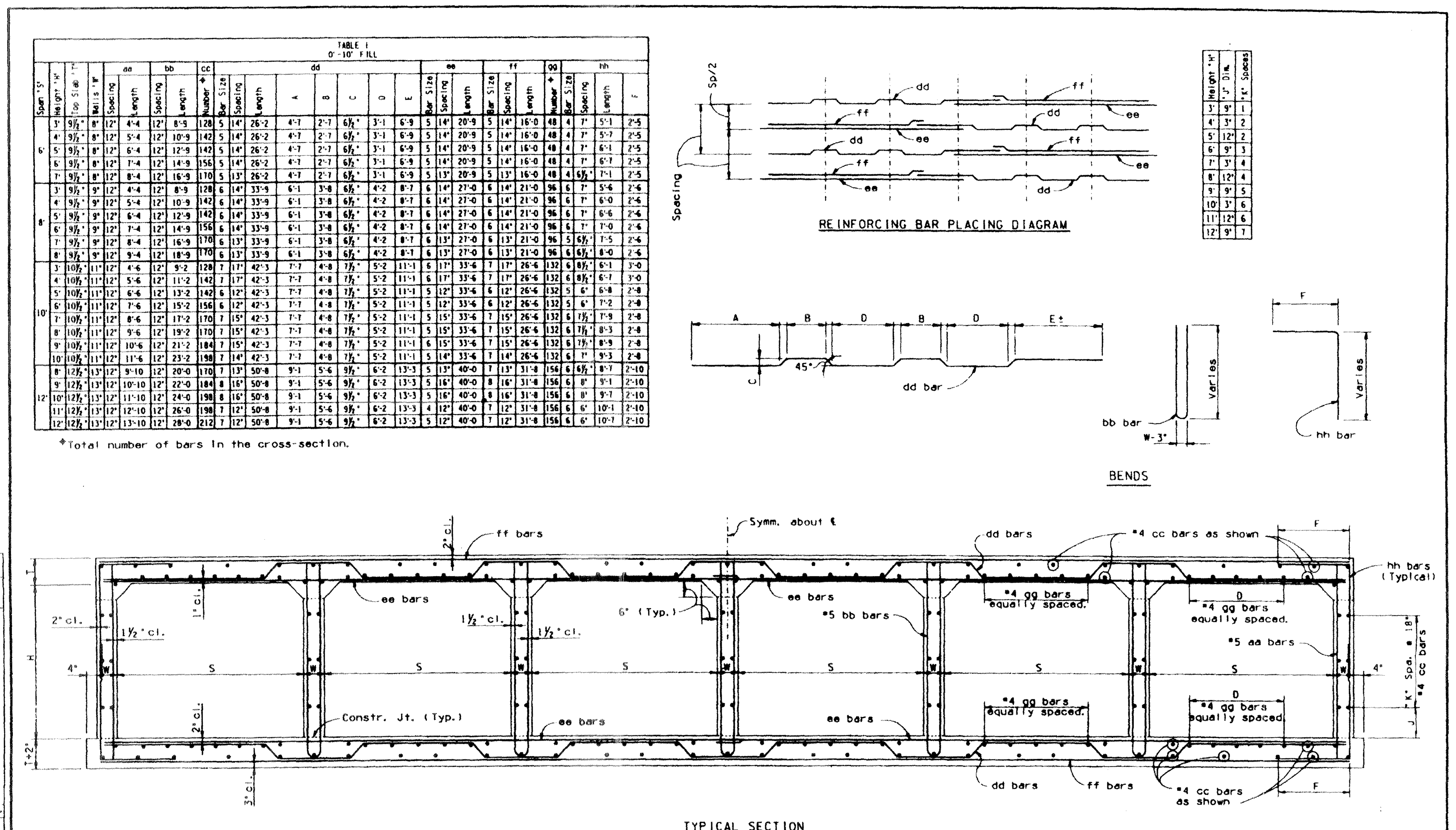
Dimensions shall not be scaled from drawings.

QUANTITY NOTE:

Total Box Culvert Quantities include Barrel Quantities and Headwall Quantities. Add Apron Quantity when apron is used.
Standard headwall quantities include wings, curb and cut-off wall.
Barrel Quantities are obtained by mutiplying length of box by quantities per linear foot of box.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS
MISCELLANEOUS DETAILS FOR STANDARD BOX CULVERTS
REVISION 4-92
STANDARD NO. B-01.10

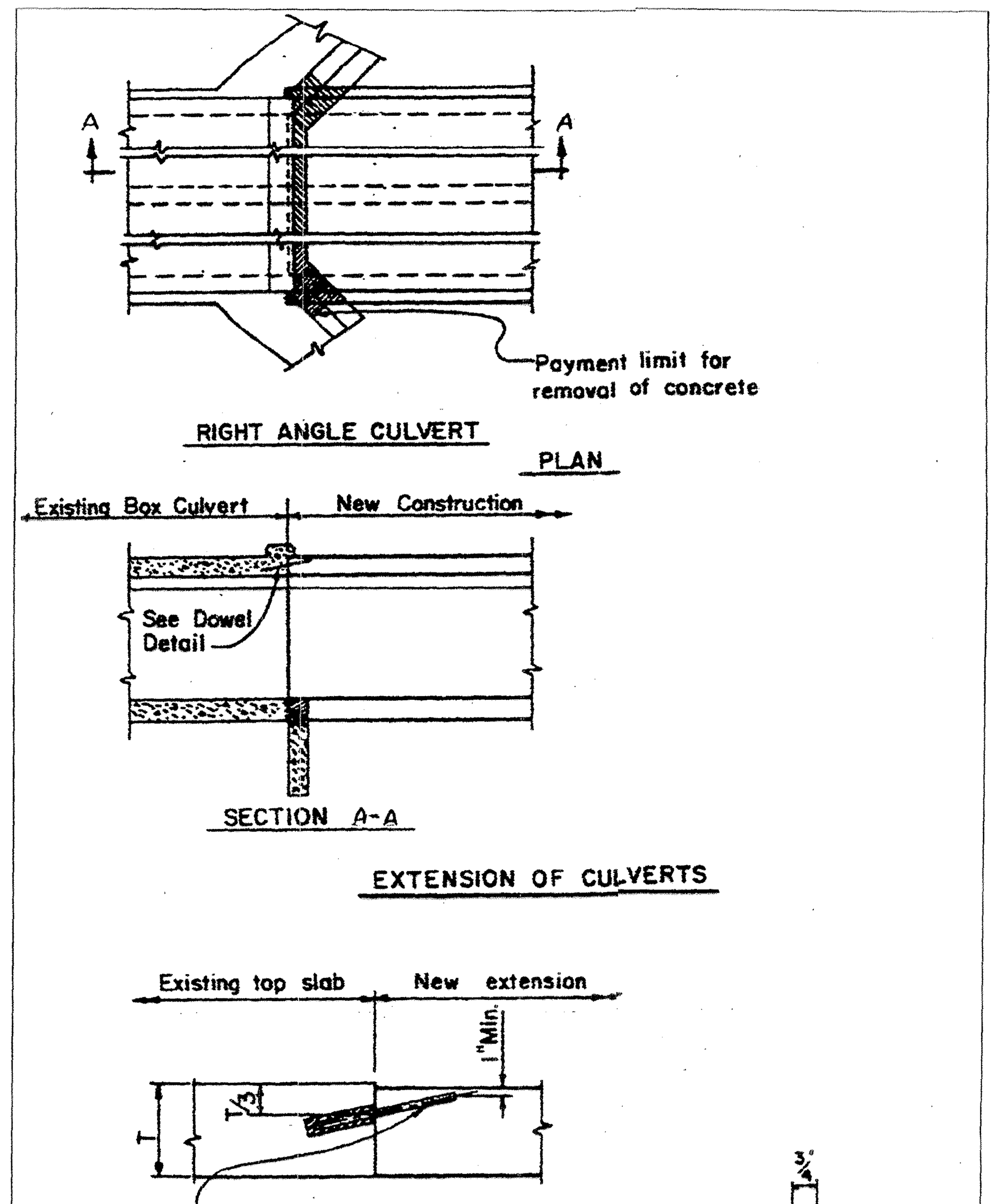




NOTE:
See B-02.65 for Tables II thru V.
See B-01.10 for General Notes and Miscellaneous Details.
See B-02.70 for Quantities.

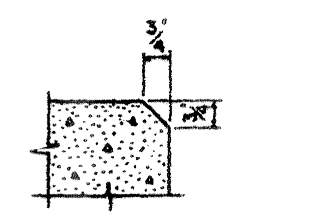
NOTE:
Reinforcing shown is for placement location only.
Use the appropiate table to determine the reinforcing requirements.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS
SIX BARREL BOX CULVERT
REVISION 4-92
STANDARD NO. B-02.60



Drill hole 8" deep with 1" ϕ hole for #6 x 1'-9 dowel @ 18". Epoxy dowel in hole with approved adhesive. Top slab only. Anchorage shall develop a tensile pullout strength of 13 kips.

DOWEL DETAIL



Chamfer all exposed corners thus unless otherwise noted.
This note applicable to all culvert sheets pertaining to the project.

ESTIMATED BOX CULVERT QUANTITIES

TOTAL	UNIT	DESCRIPTION
1	Ea.	Relocate Power Pole
517	SY	Remove Existing Pavement
1	Ea.	(6) 10'x 8' Concrete Box Culvert
212	LF	Remove Existing Arch Pipes and Headwalls
240	LF	Remove Existing 24" Abandoned Concrete Irrigation Pipes
1	Ea.	Catch Basin, Type H
1	Ea.	Catch Basin, Type G
1	Ea.	Remove Existing Catch Basin
245	LF	24" R.G.R.C.P., Cl. IV
46	LF	Remove Existing 24" HDPE Pipe
110	LF	Sawcut, Remove and Replace Pavement

These Quantities are meant as a guide for Permit purposes only. Contractor should verify Quantities and base his bid solely upon his own Estimates.

Two working days before you dig
CALL FOR THE BLUE STAKES
263-1100
Blue Stake Center
CALL COLLECT

SHEET 2 OF 5

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 11305
DENNIS FRANK KEOGH
3/2/05
ARIZONA, U.S.A.

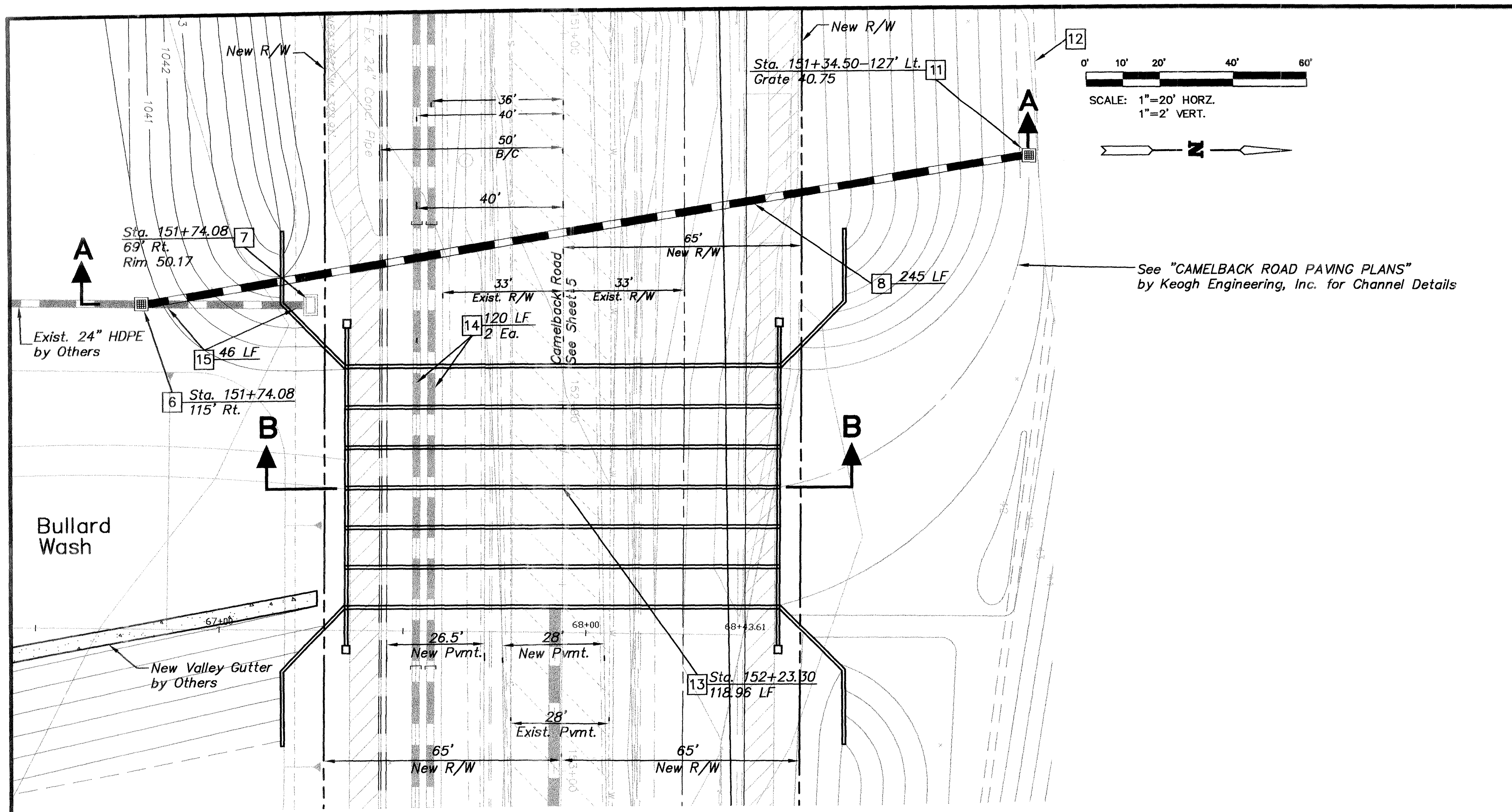
PREPARED FOR
SunCor Development Company

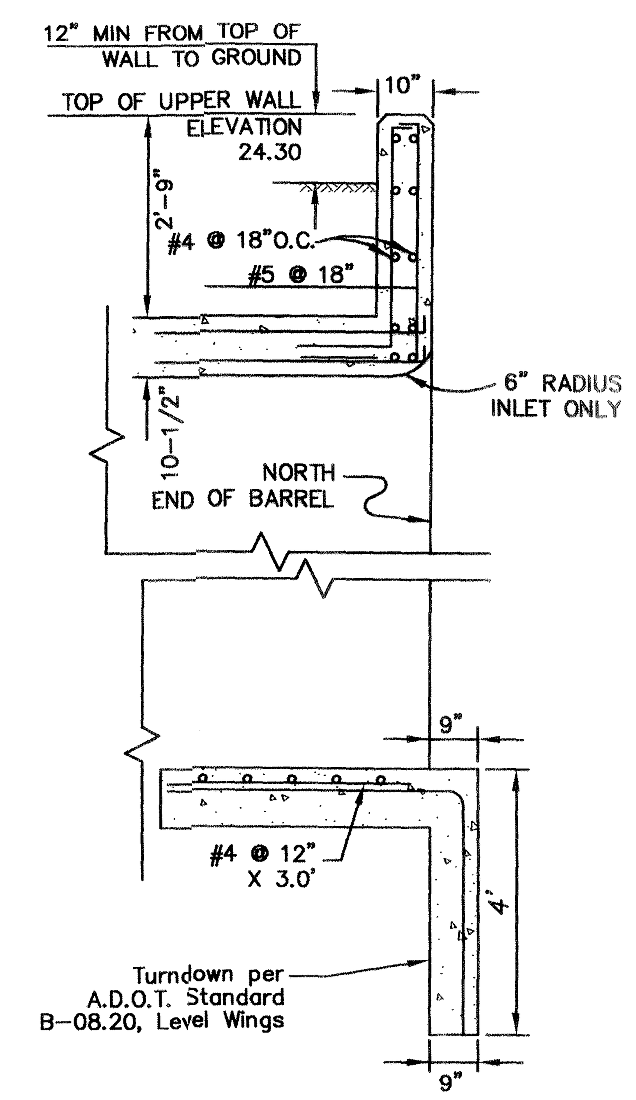
CAMELBACK ROAD - BULLARD WASH CULVERT PLANS

DRAWN BY	DDS
CHECKED BY	DFK
FIELD WORK BY	GJ
DATE	Jan, 2005

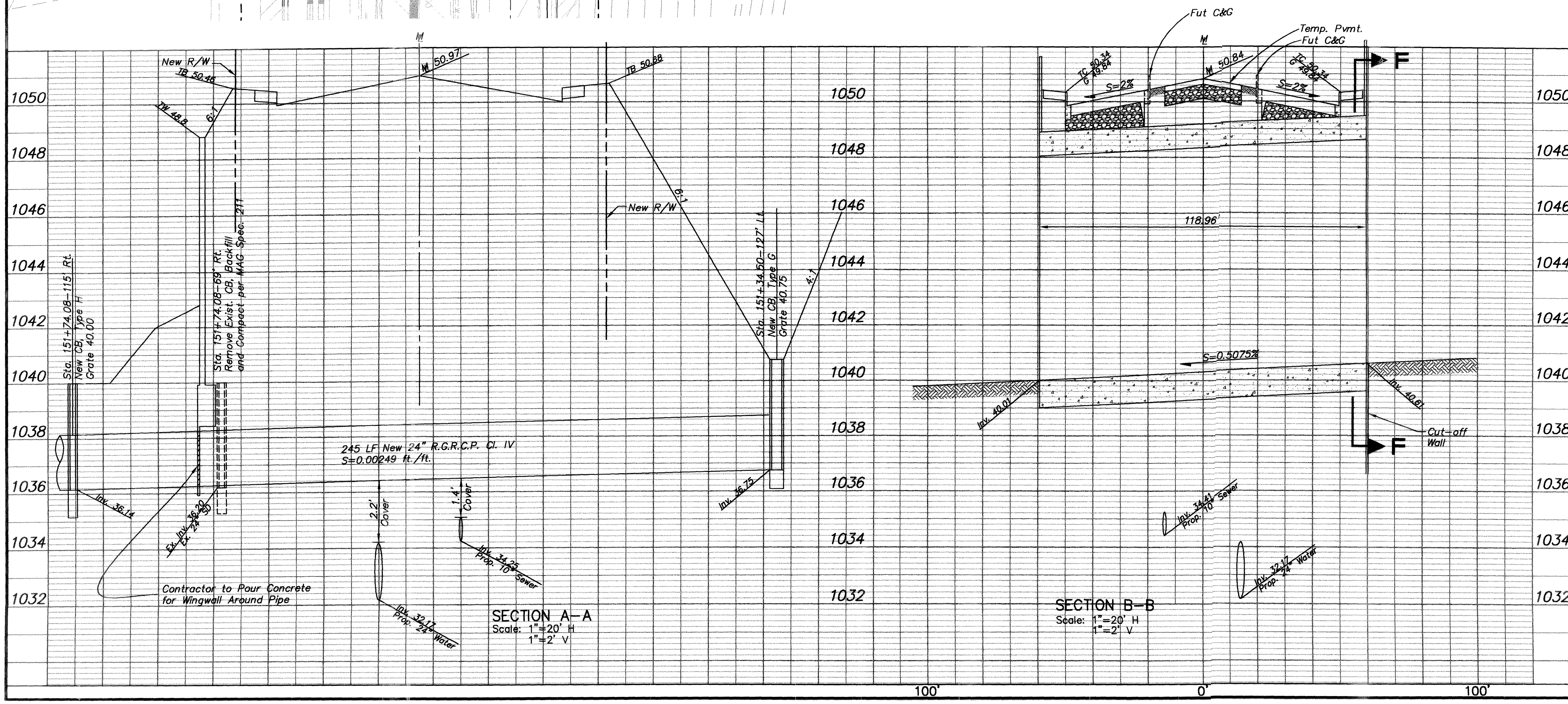
Keogh Engineering, Inc.
1616 N. LITCHFIELD RD. • SUITE 120 • GOODYEAR, AZ 85338
PHONE (623) 535-7260 FAX (623) 535-7262

JOB NO. 19477 MAP NO. P-19477





PARAPET WALL & APRON
SECTION F-F
N.T.S.



SECTION A-A
Scale: 1"=20' H
1"=2' V

SECTION B-B
Scale: 1"=20' H
1"=2' V

PAVING CONSTRUCTION NOTES

6 Construct Catch Basin, MAG Det. 538 & 539, Type H. Connect Existing 24" HDPE to New 24" R.G.R.C.P. Cl. IV

7 Remove Existing Catch Basin and Backfill and Compact per MAG Spec. 211

8 Install 24" R.G.R.C.P., Cl. IV

11 Construct Catch Basin – MAG Det. 537 and 539, Type G

12 Grade New 5' wide Flat Bottom Channel

13 Proposed (6) 10'x 8' C.B.C. See Sheet 2 for Details, L=118.96

14 Remove 120 LF Each of Two Abandoned 24" Concrete Irrigation Pipes as Shown on Plan. Plug Each End of Pipes Prior to Construction of New C.B.C. – MAG Det. 427

15 Remove Existing 46 LF HDPE. Backfill and Compact per MAG Spec. 211

Two working days before you dig
CALL FOR THE BLUE STAKES
263-1100
Blue Stake Center
CALL COLLECT

11305
DENNIS FRANK
KEOGH
ARIZONA, U.S.A.

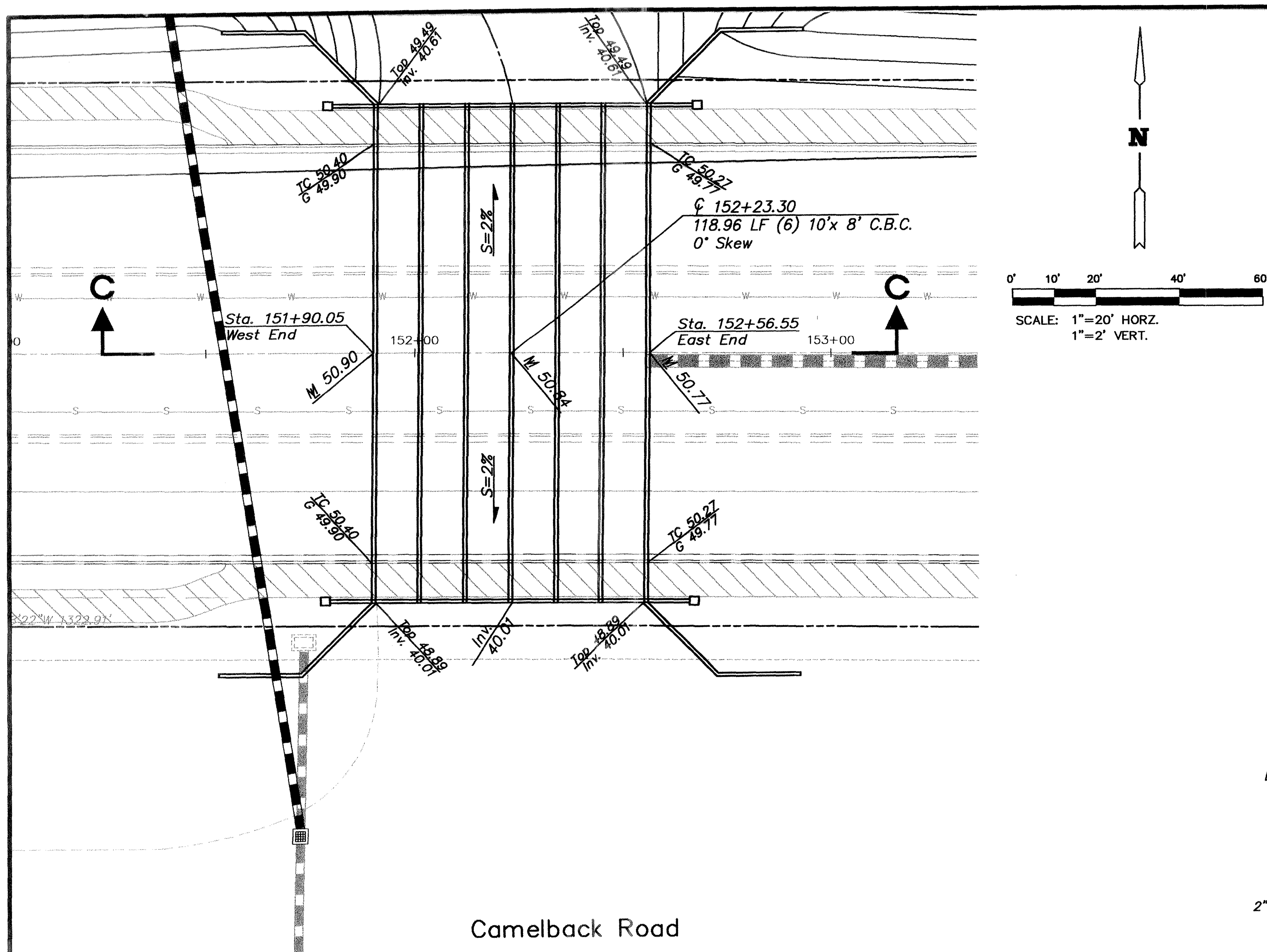
CAMELBACK ROAD – BULLARD WASH CULVERT PLANS

SHEET 3 of 5

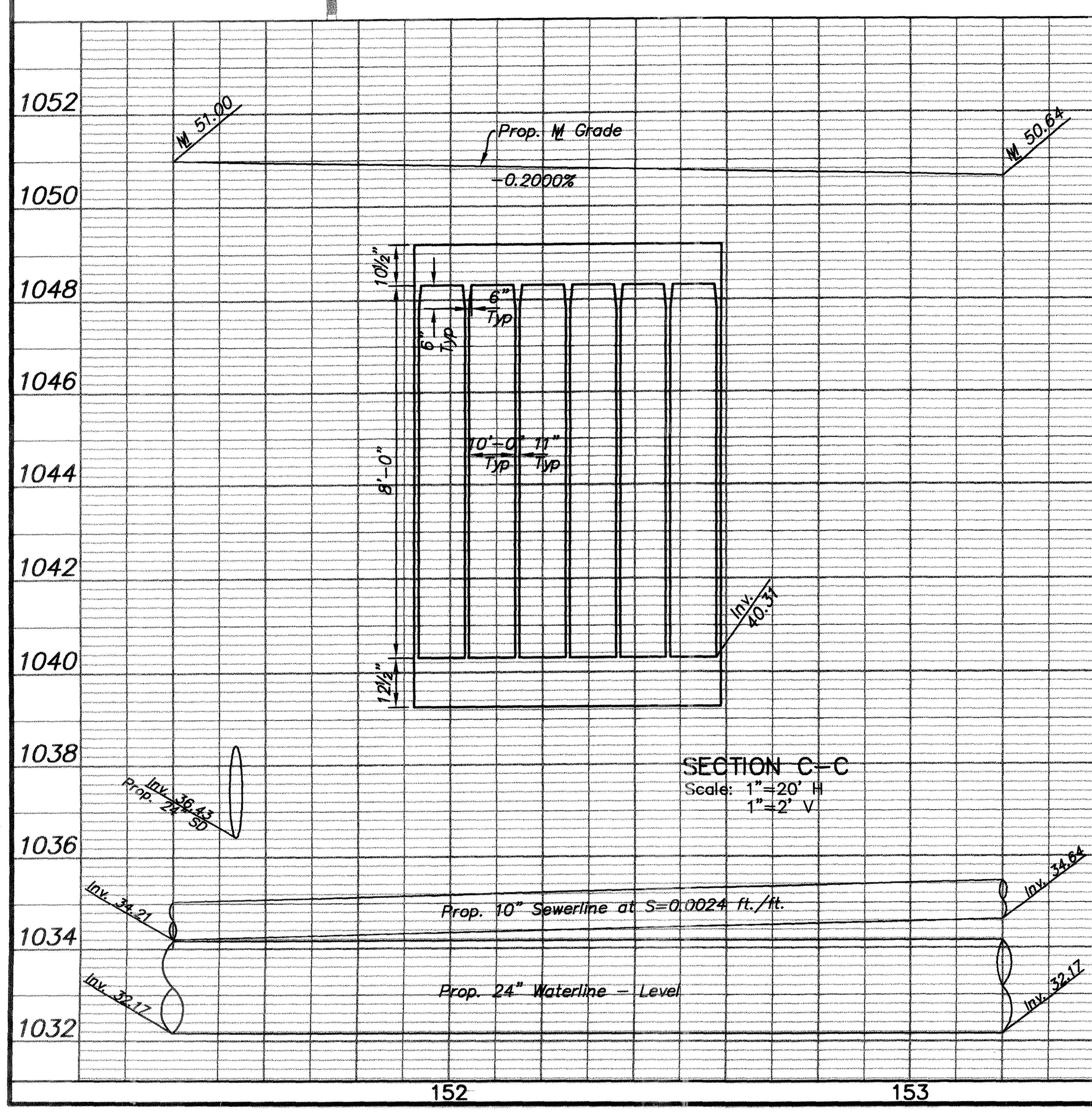
KEI Keogh Engineering, Inc.
1616 N. LITCHFIELD RD. • SUITE 120 • GOODYEAR, AZ 85338
PHONE (623) 535-7260 FAX (623) 535-7262

JOB NO. 19477 MAP NO. P-19477

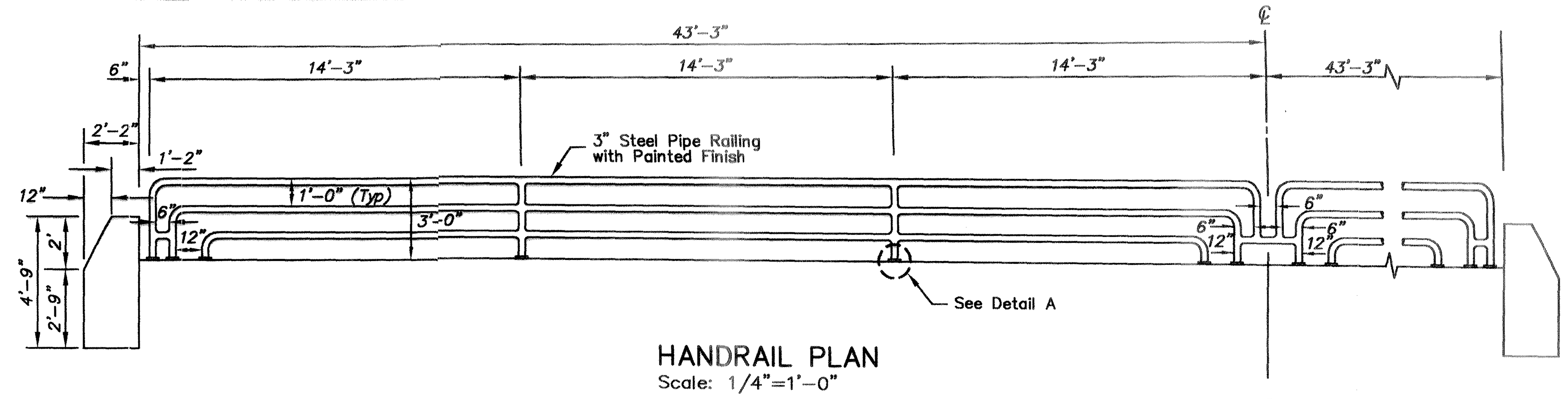
Plot Date / Time: 03/02/05 12:21pm Layout Name: Sheet 17 AutoCad Version: 16.0
Full File Path: L:\19477\Palm Valley Phase V-A\V-A Camelback Rd\BOX CULVERT PLANS\Boxculvert sheet3.dwg Login Name: DWAYNE



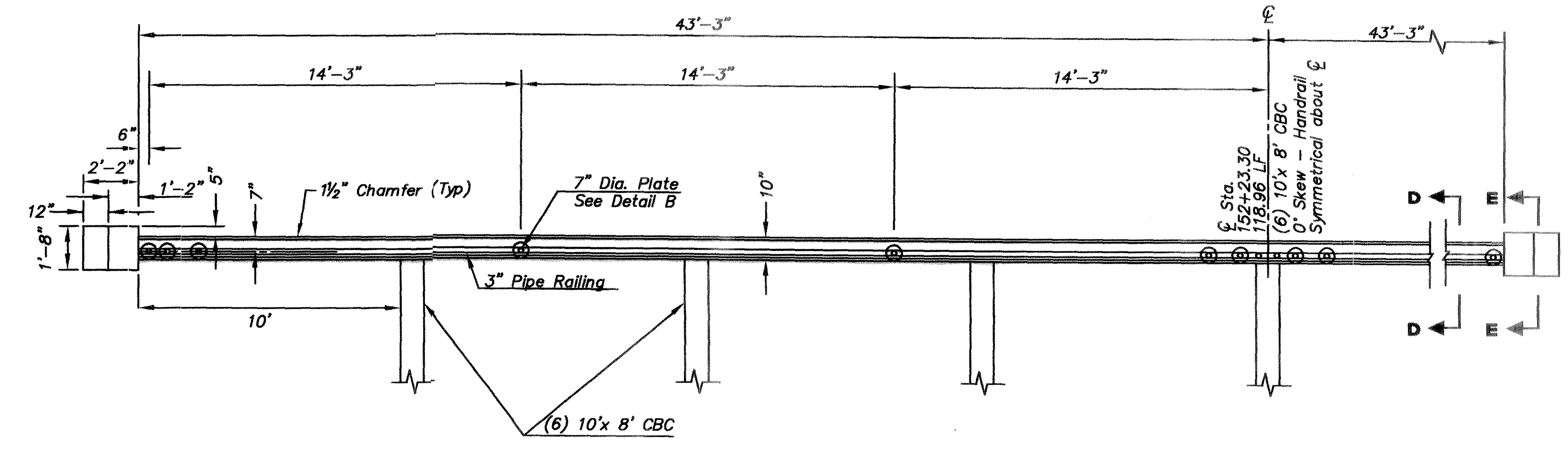
Camelback Road



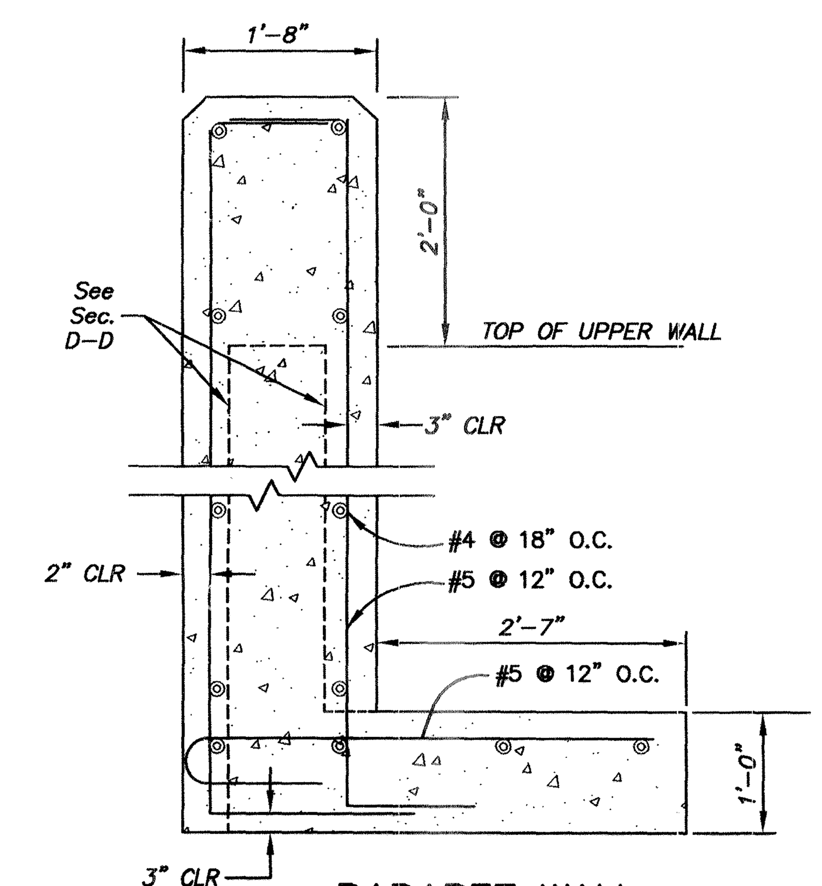
SECTION C–C
Scale: 1"=20' H
1"=2' V



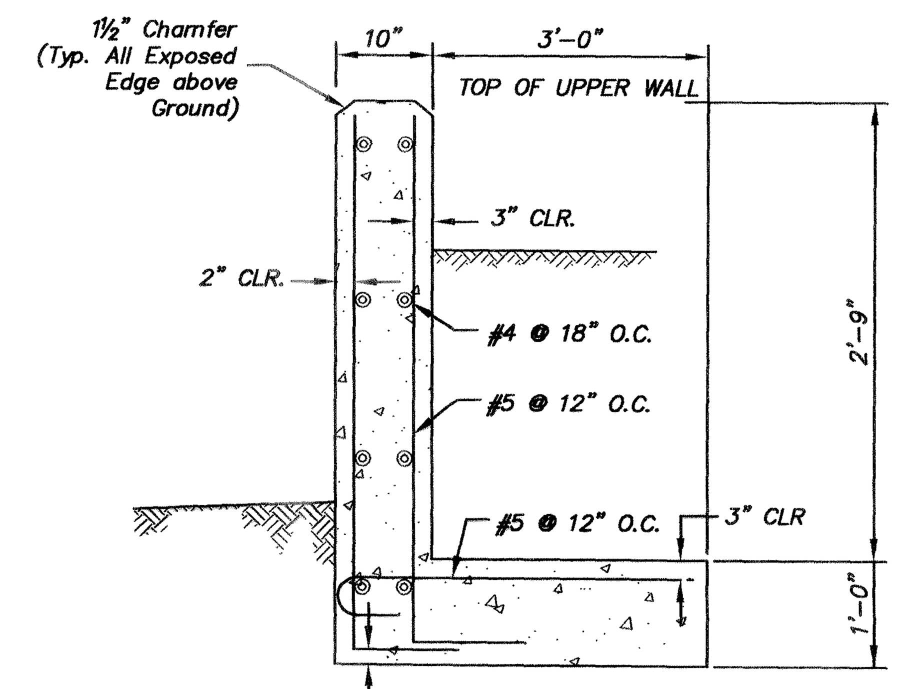
HANDRAIL PLAN
Scale: 1/4"=1'-0"



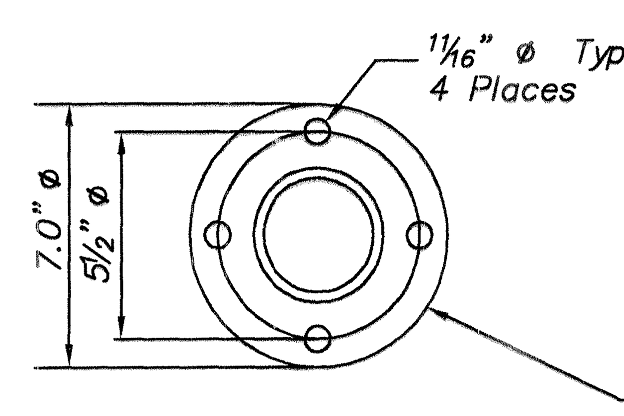
HANDRAIL SECTION
Scale: 1/4"=1'-0"



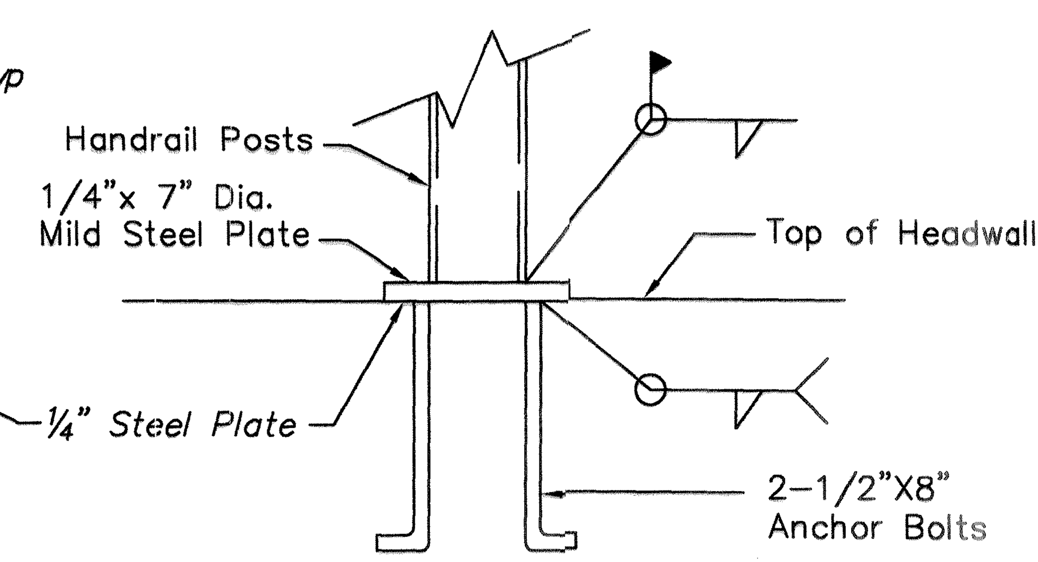
PARAPET WALL
SECTION E–E
N.T.S.



PARAPET WALL DETAIL
SECTION D–D
N.T.S.



DETAIL B
Scale: 1/4"=1'



ANCHOR PLATE DETAIL

DETAIL A
N.T.S.

NOTE:

HANDRAILING SHALL BE SCHEDULE 40 STEEL PIPE AND PAINTED WITH ONE COAT PRIMER AND 2 COATS GREEN COLORED PAINT.
SAMPLES SHALL BE SUBMITTED TO SUNCOR FOR APPROVAL.

Two working days before you dig CALL FOR THE BLUE STAKES 263-1100 Blue Stake Center CALL COLLECT

11305 DENNIS FRANK KEOGH ARIZONA, U.S.A.

CAMELBACK ROAD – BULLARD WASH CULVERT PLANS

SHEET 4 of 5

Keogh Engineering, Inc.
1616 N. LITCHFIELD RD. • SUITE 120 • GOODYEAR, AZ 85338
PHONE (623) 535-7260 FAX (623) 535-7262

JOB NO. 19477 MAP NO. P-19477

Plot Date / Time: 03/02/05 12:23pm Layout Name: Sheet 17 AutoCad Version: 16.0
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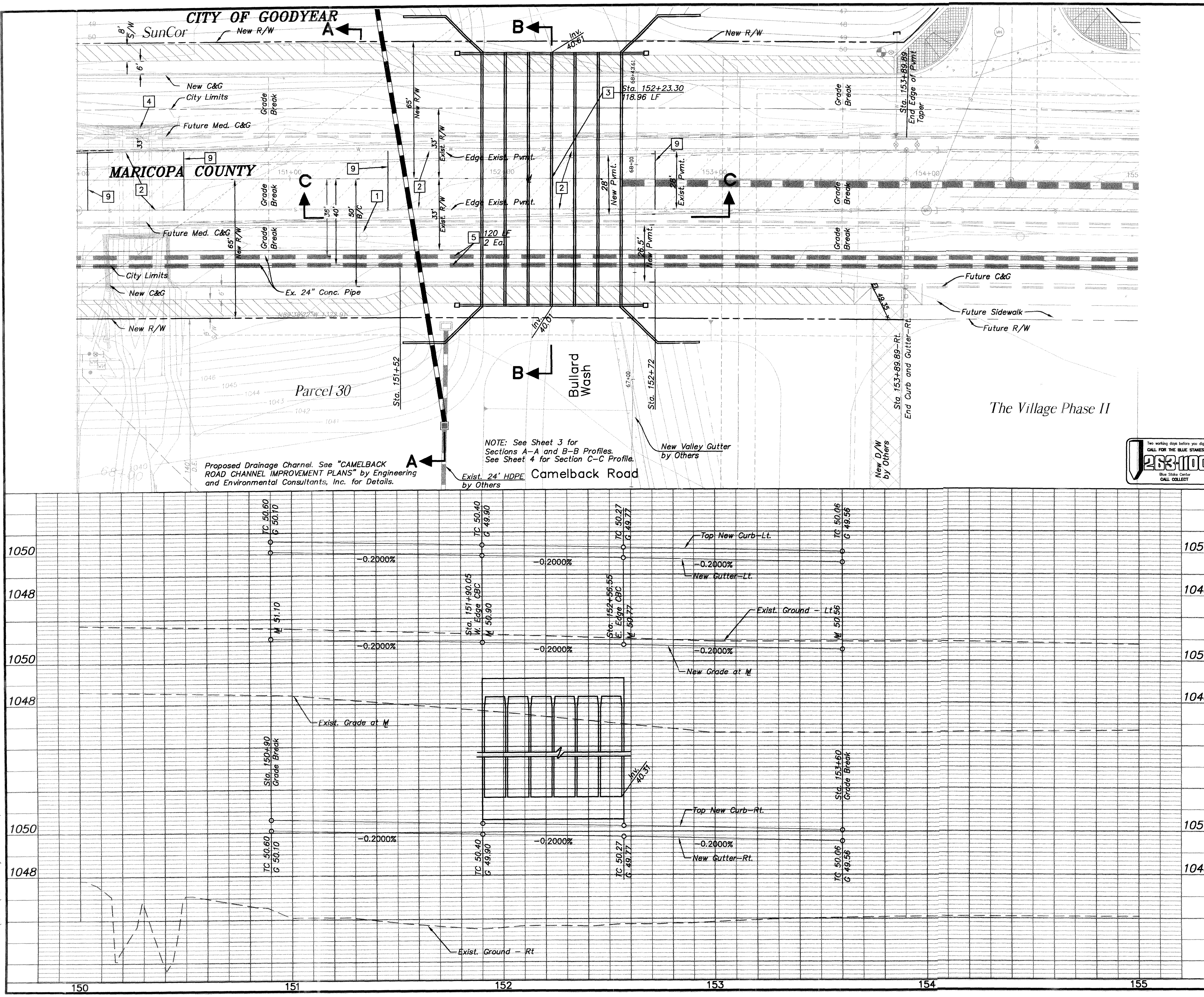


SCALE: 1"=20' HORZ.
1"=2' VERT.

N

PAVING CONSTRUCTION NOTES

1. Contractor to Coordinate with APS to Relocate Existing Power Poles
2. Remove Existing Pavement
3. Proposed (6) 10'x 8' C.B.C. See Sheet 2 for Details, L=118.96'
4. Remove Existing Arch Pipes and Headwalls after Completion of New (6) 10'x 8' CBC.
5. Remove 120 LF each of two Abandoned 24" Concrete Irrigation Pipes as shown on Plan. Plug each end of Pipes prior to Construction of New C.B.C. – MAG Det. 427
9. Sawcut, Remove and Replace Existing Pavement

Two working days before you dig CALL FOR THE BLUE STAKES 263-1100 Blue Stake Center CALL COLLECT

DENNIS FRANK KEOGH 11305 ARIZONA, USA

CAMELBACK ROAD – BULLARD WASH CULVERT PLANS

SHEET 5 of 5

KEI Keogh Engineering, Inc.
1616 N. LITCHFIELD RD. - SUITE 120 - GOODYEAR, AZ 85338
PHONE (623) 535-7260 FAX (623) 535-7262

JOB NO. 19477 MAP NO. P-19477

Plot Date / Time: 03/02/05 12:24pm Layout Name: Sheet 17 AutoCad Version: 16.0
Full File Path: L:\19477\Palm Valley Phase V-A\1-A Camelback Rd\BOX CULVERT PLANS\Boxculvert sheet5.dwg Login Name: DWAYNE

PALM VALLEY PHASE V
IMPROVEMENT PLANS
BULLARD WASH CHANNEL

CITY OF GOODYEAR GENERAL NOTES FOR CONSTRUCTION

A. ALL CONSTRUCTION SHALL CONFORM WITH THE LATEST MAG STANDARD DETAILS AND SPECIFICATIONS AND THE CITY'S SUPPLEMENT DETAILS AND SEC.

B. THIS SET OF PLANS HAS BEEN REVIEWED FOR COMPLIANCE WITH CITY REQUIREMENTS PRIOR TO ISSUANCE OF CONSTRUCTION PERMITS. HOWEVER, SUCH REVIEW SHALL NOT PREVENT THE CITY FROM REQUIRING CORRECTION OF ERRORS IN PLANS FOUND TO BE IN VIOLATION OF ANY LAW OR ORDINANCE.

C. THE CITY DOES NOT WARRANT ANY QUANTITIES SHOWN ON THESE PLANS.

D. THE CITY APPROVAL IS FOR GENERAL LAYOUT IN THE RIGHT-OF-WAY ONLY. THIS APPROVAL IS VALID FOR A PERIOD OF ONE YEAR. CONSTRUCTION PERMITS SHALL BE OBTAINED DURING THIS PERIOD OR THE PLANS SHALL BE RESUBMITTED FOR REVIEW AND APPROVAL.

E. AN APPROVED SET OF PLANS SHALL BE AVAILABLE ON THE SITE AT ALL TIMES.

F. THE CITY SHALL BE NOTIFIED 24 HOURS PRIOR TO ANY CONSTRUCTION WORK AND INSPECTIONS (623-932-1637). CONSTRUCTION WORK CONCEALED WITHOUT INSPECTION BY THE CITY SHALL BE SUBJECT TO EXPOSURE AT THE CONTRACTOR'S EXPENSE.

G. RIGHT-OF-WAY IMPROVEMENTS SHALL NOT BE ACCEPTED UNTIL "AS-BUILT" PLANS HAVE BEEN SUBMITTED AND APPROVED BY THE CITY. (SEE AS-BUILT REQUIREMENTS).

H. THE DEVELOPER IS RESPONSIBLE FOR THE REMOVAL OR RELOCATION OF ALL OBSTRUCTIONS WITHIN THE RIGHT-OF-WAY PRIOR TO STARTING NEW CONSTRUCTION.

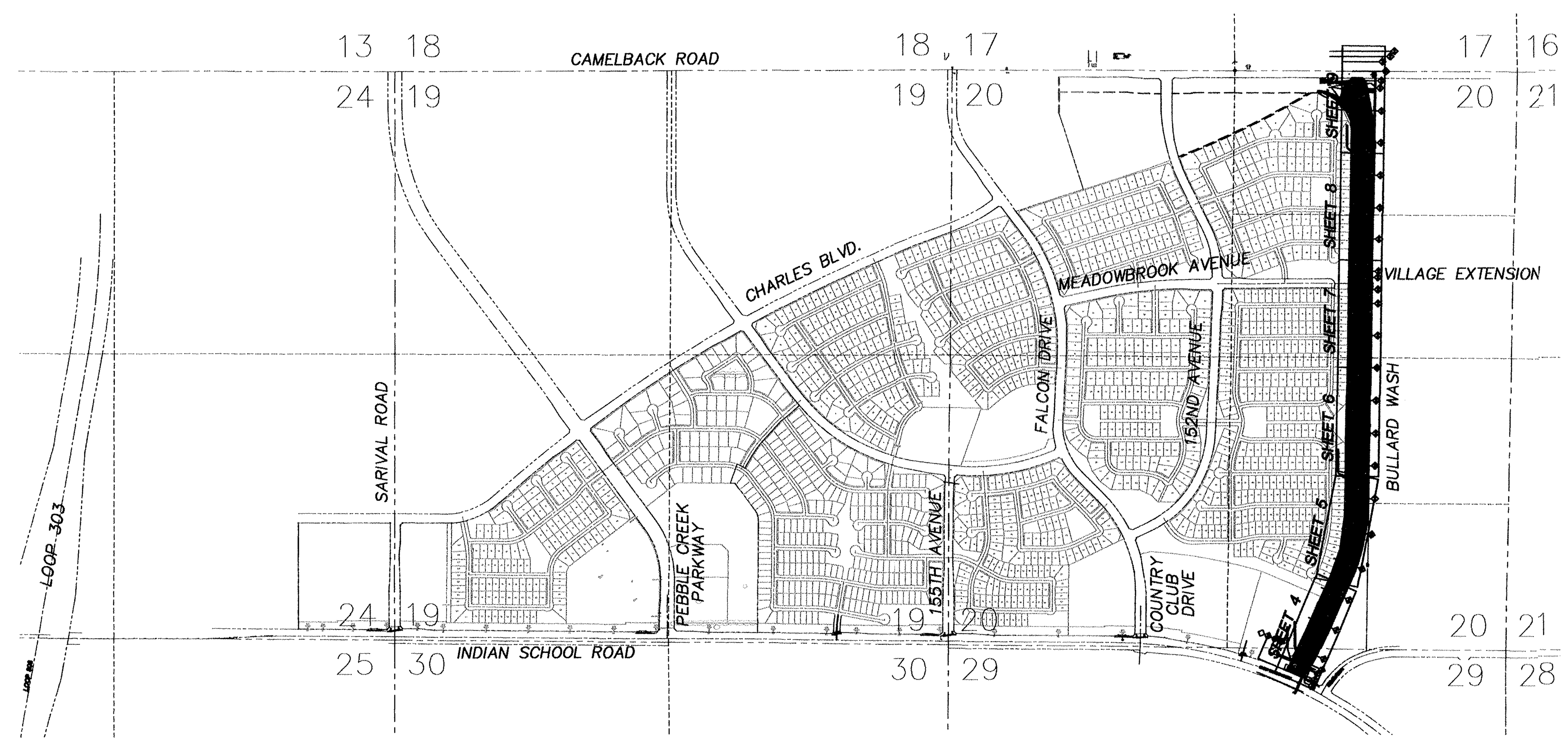
I. THE DEVELOPER IS RESPONSIBLE FOR ARRANGING THE RELOCATION AND ASSOCIATED COST OF ALL UTILITIES. A UTILITY RELOCATION SCHEDULE SHALL BE SUBMITTED PRIOR TO ISSUANCE OF PERMITS.

J. THE DEVELOPER IS RESPONSIBLE FOR OBTAINING OR DEDICATING ALL REQUIRED RIGHTS-OF-WAY AND EASEMENTS TO THE CITY PRIOR TO ISSUANCE OF PERMITS.

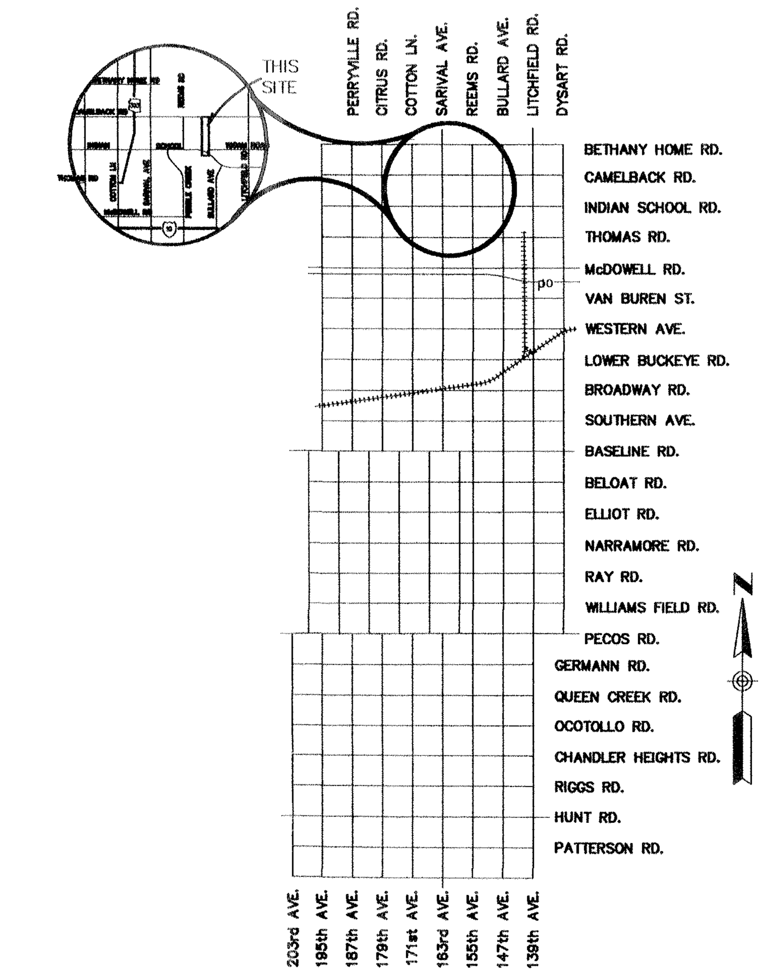
K. THE CONTRACTOR SHALL CONTACT BLUE STAKE (602-263-1100) AT LEAST 48 HOURS PRIOR TO CONSTRUCTION.

L. THE CONTRACTOR SHALL BARRICADE CONSTRUCTION SITES AT ALL TIMES PER THE CITY OF PHOENIX TRAFFIC BARRICADE MANUAL. WHEN REQUIRED BY THE CITY, A TRAFFIC CONTROL PLAN SHALL BE SUBMITTED FOR APPROVAL IN ADVANCE OF CONSTRUCTION.

M. PRIVATE ON-SITE WATER AND SEWER LINES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE UNIFORM PLUMBING CODE N.F.P.A. AND THE UNIFORM FIRE CODE AS ADOPTED BY THE CITY.



LOCATION MAP & SHEET INDEX
SCALE 1"=500'



VICINITY MAP
NTS

SHEET INDEX

1. COVER
2. DETAILS
3. DETAILS
4. BULLARD WASH CHANNEL, STA 10+00 TO STA 20+00
5. BULLARD WASH CHANNEL, STA 20+00 TO STA 30+00
6. BULLARD WASH CHANNEL, STA 30+00 TO STA 40+00
7. BULLARD WASH CHANNEL, STA 40+00 TO STA 50+00
8. BULLARD WASH CHANNEL, STA 50+00 TO STA 60+00
9. BULLARD WASH CHANNEL, STA 60+00 TO STA 70+00
10. CULVERT PLAN AND PROFILE DETAILS
11. CULVERT AND HEADWALL DETAILS
12. HEADWALL AND RAILING DETAILS

CITY OF GOODYEAR GRADING NOTES

A. AN ON-SITE GRADING PERMIT IS REQUIRED.

B. A SEPARATE PERMIT IS NECESSARY FOR ANY OFF-SITE CONSTRUCTION.

C. THE CITY SHALL BE NOTIFIED 24 HOURS BEFORE ANY ON-SITE CONSTRUCTION BEGINS. (623) 932-1637

D. FINISH FLOOR ELEVATIONS SHALL BE A MINIMUM OF 14" ABOVE POINT OF OUTFALL. CARPORT ELEVATIONS SHALL BE 4" BELOW FINISH FLOOR ELEVATIONS.

E. STAKING PAD AND/OR FINISHED FLOOR ELEVATIONS ARE THE RESPONSIBILITY OF THE DEVELOPER OR HIS ENGINEER. IN NON-CRITICAL AREAS, THE DEVELOPER'S ENGINEER SHALL SUBMIT CERTIFICATIONS OF CONSTRUCTED BUILDING PAD ELEVATIONS PRIOR TO THE CITY'S ACCEPTANCE OF PROJECT. IN A CRITICAL DRAINAGE AREA, CERTIFICATION OF FINISHED BUILDING FLOOR OR STEM WALL ELEVATION SHALL BE SUBMITTED AND APPROVED PRIOR TO ANY VERTICAL CONSTRUCTION.

F. THE GRADING CONTRACTOR SHALL DESIGNATE THE LOCATION FOR WASTING SPOIL MATERIALS AND A LETTER FROM THE OWNER GIVING PERMISSION FOR SAID DISPOSAL PRIOR TO STARTING ON-SITE CONSTRUCTION.

G. GRADING AND DRAINAGE PLAN APPROVAL INCLUDES: CONSTRUCTION OF DRAINAGE PLAN INCLUDING, BUT NOT LIMITED TO, RETENTION AREAS AND/OR OTHER DRAINAGE FACILITIES, SURFACE GRADING, WALLS, CURBS, ASPHALT PAVEMENT, AND BUILDING FLOOR ELEVATIONS.

H. THE CONTRACTOR SHALL PROVIDE ALL RETENTION BASINS AT ELEVATIONS AS SHOWN ON THE PLANS. RETENTION BASINS SIDE SLOPE SHALL NOT EXCEED 4:1 ON PRIVATE PROPERTY OR 6:1 ADJACENT TO PUBLIC RIGHT-OF-WAY. RETENTION BASINS SHALL NOT EXCEED 3 FOOT DEPTH ON PRIVATE PROPERTY OF 1.5 FOOT DEPTH WITHIN 10 FEET OF PUBLIC RIGHT-OF-WAY.

I. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING AD CONFIRMING DEPTH OF ALL THE EXISTING UTILITY LINES WITHIN PROPOSED RETENTION BASIN AREAS. IF THE BASIN CANNOT BE CONSTRUCTED PER PLANS AS A RESULT OF CONFLICT WITH UNDERGROUND UTILITIES, THE CONTRACTOR SHOULD CONTACT THE CITY AND DESIGNER AND REQUEST MODIFICATION OF THE BASIN DESIGN.

J. THIS SET OF PLANS HAS BEEN REVIEWED FOR COMPLIANCE WITH CITY REQUIREMENTS PRIOR TO ISSUANCE OF CONSTRUCTION PERMITS AND SHALL BE KEPT AT THE CONSTRUCTION SITE. HOWEVER, SUCH REVIEW SHALL NOT PREVENT THE CITY FROM REQUIRING CORRECTION OF ERRORS IN PLANS FOUND TO BE IN VIOLATION OF ANY LAW OR ORDINANCE.

K. YOU ARE HEARBY ADVISED THAT NO PERSON SHALL USE ANY MECHANICAL EQUIPMENT FOR LAND LEVELING OR CLEARING, ROAD CONSTRUCTION, TRENCHING, EXCAVATING, DEMOLITION, OR ENGAGE IN ANY EARTH MOVING ACTIVITY WITHOUT FIRST OBTAINING A PERMIT FROM AIR POLLUTION CONTROL, MARICOPA COUNTY DEPARTMENT OF HEALTH SERVICES 1001 N. CENTRAL AVE., STE 150, PHOENIX, AZ 85004, PHONE: (602)506-6666. (THIS NOTICE IS ISSUED PURSUANT TO A.R.S. 36-779.07, NOTICE OF BUILDING AGENCIES.)

L. "AS-BUILT" DRAWINGS (ONE SET MYLARS, 2 SET PRINTS), CERTIFIED BY THE DEVELOPER'S ENGINEER, SHALL BE SUBMITTED AND APPROVED PRIOR TO ISSUANCE OF A BUILDING "CERTIFICATE OF OCCUPANCY".

LIST OF QUANTITIES

24" DIA HDPE PIPE	5,512 L.F.
4' DIA MANHOLES (MAG DET 520 & 522)	11 EA.
CHANNEL EXCAVATION	127,500 C.Y.
SHOTCRETE	55,360 S.F.
VALLEY GUTTER	4,970 L.F.
CATCH BASIN	1 EA.
BOX CULVERT & HEADWALLS	134 L.F.
4" AB	3,360 S.Y.
CONCRETE CURB FLUSH	11,810 L.F.

CITY OF GOODYEAR REVIEW AND RECOMMENDED APPROVAL

FIRE DEPT.		GRADING & DRAINAGE	
LANDSCAPPING & PLANNING		WATER & SEWER	
TRAFFIC		PAVING	
TRAFFIC			
PROJECT REVIEW SR. ENGINEER		DATE	

"AS-BUILT CERTIFICATION"
I CERTIFY THAT THE "AS-BUILT" INFORMATION SHOWN HEREON WAS OBTAINED UNDER MY DIRECT SUPERVISION AND IS CORRECT AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF.

NAME______________________ (SEAL)
REGISTRATION NO.______________ DATE______
REVD. BY:______________________
FIELD ENGINEERING

CIVIL ENGINEER

ENGINEERING & ENVIRONMENTAL CONSULTANTS
3003 N. Central Ave. Suite 600
Phoenix, AZ. 85012
Contact: Michael Roberts
Phone: (602)248-7702
Fax: (602)248-7851

OWNER

SUNCOR DEVELOPMENT COMPANY
1616 N. Litchfield Rd., Suite 270
Phoenix, AZ 85338
Contact: Tom Hill
Phone: (602)935-0600

BENCHMARK

CHSELED SQUARE "□" ON NORTHWEST CORNER R.I.D. CANAL ABUTMENT AT THOMAS AND BULLARD ROADS. ELEVATION=1014.92 (FEMA AND C.O.G. DATUM)

BASIS OF BEARING

SOUTH LINE OF SECTION 20 T2N, R1W
BEARING BEING S89°21'41"E
FND BC IN HH AT THE INTERSECTION OF INDIAN SCHOOL RD. AND REEMS RD. AND AT THE INTERSECTION OF CLUB HOUSE DRIVE AND INDIAN SCHOOL RD.

UTILITY NOTE

LOCATION ON ALL UTILITIES SHOWN ON THESE PLANS ARE BASED ON INFORMATION SUPPLIED TO THE ENGINEER BY THE APPROPRIATE UTILITY COMPANIES. ENGINEER DOES NOT GUARANTEE THAT ALL UTILITIES ARE SHOWN OR THEIR LOCATIONS. IT IS THE RESPONSIBILITY OF THE CONTRACTOR OR OWNER TO CONTACT BLUE STAKE AND ANY OTHER INVOLVED AGENCIES TO LOCATE ALL UTILITIES PRIOR TO CONSTRUCTION.

"I HEREBY CERTIFY THAT THIS DESIGN IS BASED ON ACCURATE FIELD DATA WHICH HAS BEEN CHECKED IN THE FIELD PRIOR TO SUBMISSION FOR CITY APPROVAL."

BY______________________ DATE__________

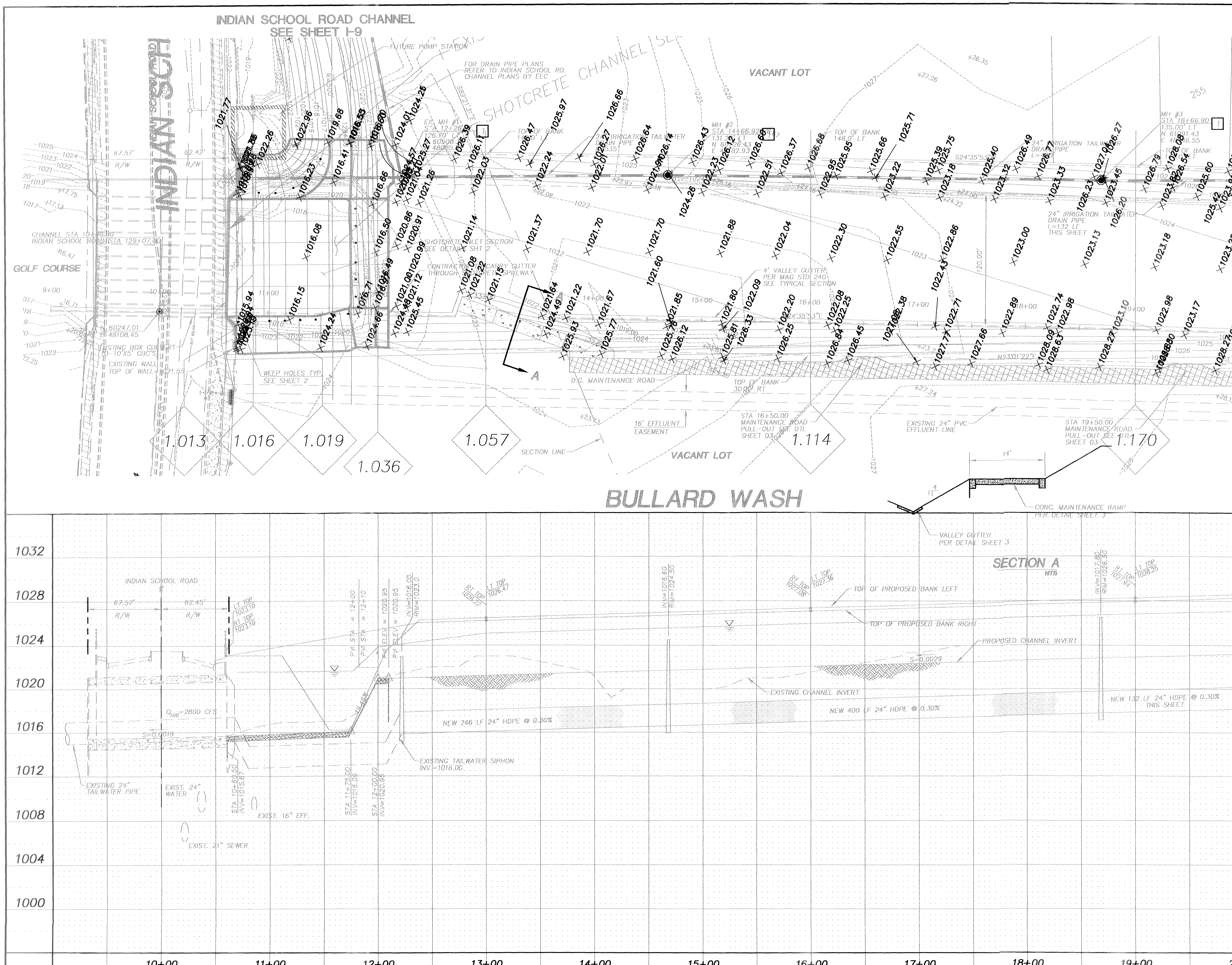
REV.	DATE	DESCRIPTION	CK. BY

PALM VALLEY PHASE V
BULLARD WASH CHANNEL
GRADING & DRAINAGE PLANS

SHEET TITLE: COVER SHEET

Engineering and Environmental Consultants, Inc.
3003 N. Central Avenue, Suite 600
Phoenix, Arizona 85012-2905
TEL:(602)248-7702 FAX:(602)248-7851

DESIGN BY: MJR
DRAWN BY: AJA
CHK'D BY: MTG
DATE: AUGUST, 2004
SCALE:
DRAWING NO.
1 of 12



CONSTRUCTION NOTES

NO.	DESCRIPTION
1	INSTALL MAG STD DTL 520 STORM DRAIN MANHOLE (MODIFIED FOR HDPE PIPE) MANHOLE SHAFT PER MAG STD DTL 522

REV.	DATE	DESCRIPTION	CK. BY

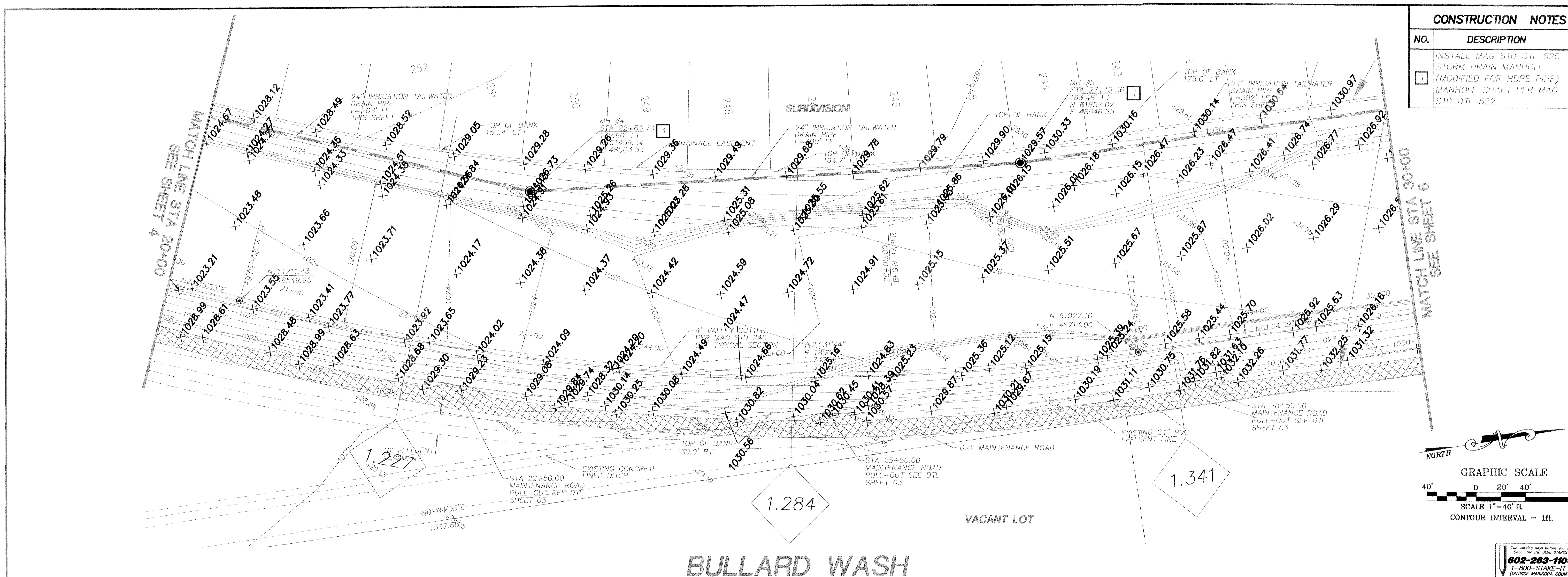
PALM VALLEY PHASE V
BULLARD WASH CHANNEL
GRADING & DRAINAGE PLANS

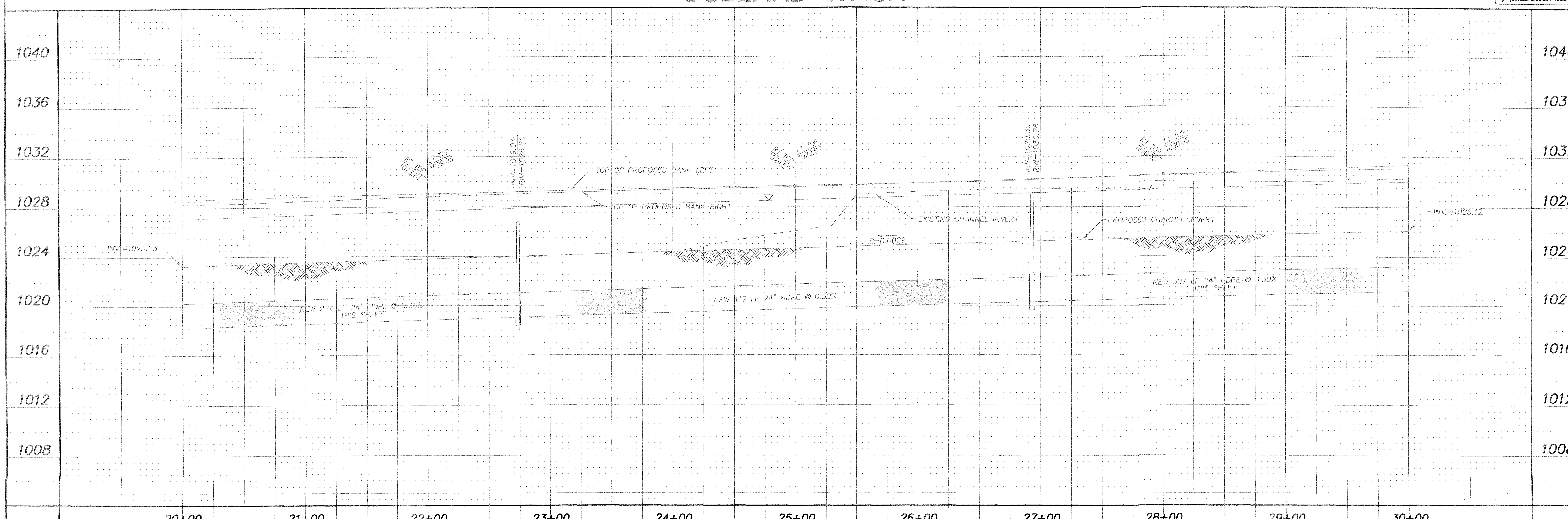
SHEET TITLE: CHANNEL PLAN & PROFILE

Engineering and Environmental Consultants, Inc.
3003 N. Central Avenue, Suite 600
Phoenix, Arizona 85012-2905
TEL:(602)248-7702 FAX:(602)248-7851

DESIGN BY: MJR
DRAWN BY: AJA
CHK'D BY: MTG
DATE: AUGUST, 2004
SCALE: Hor. 1"=40' Vert. 1"=4'

DRAWING NO. 4 of 12





CONSTRUCTION NOTES

NO.	DESCRIPTION
1	INSTALL MAG STD DTL 520 STORM DRAIN MANHOLE (MODIFIED FOR HDPE PIPE) MANHOLE SHAFT PER MAG STD DTL 522

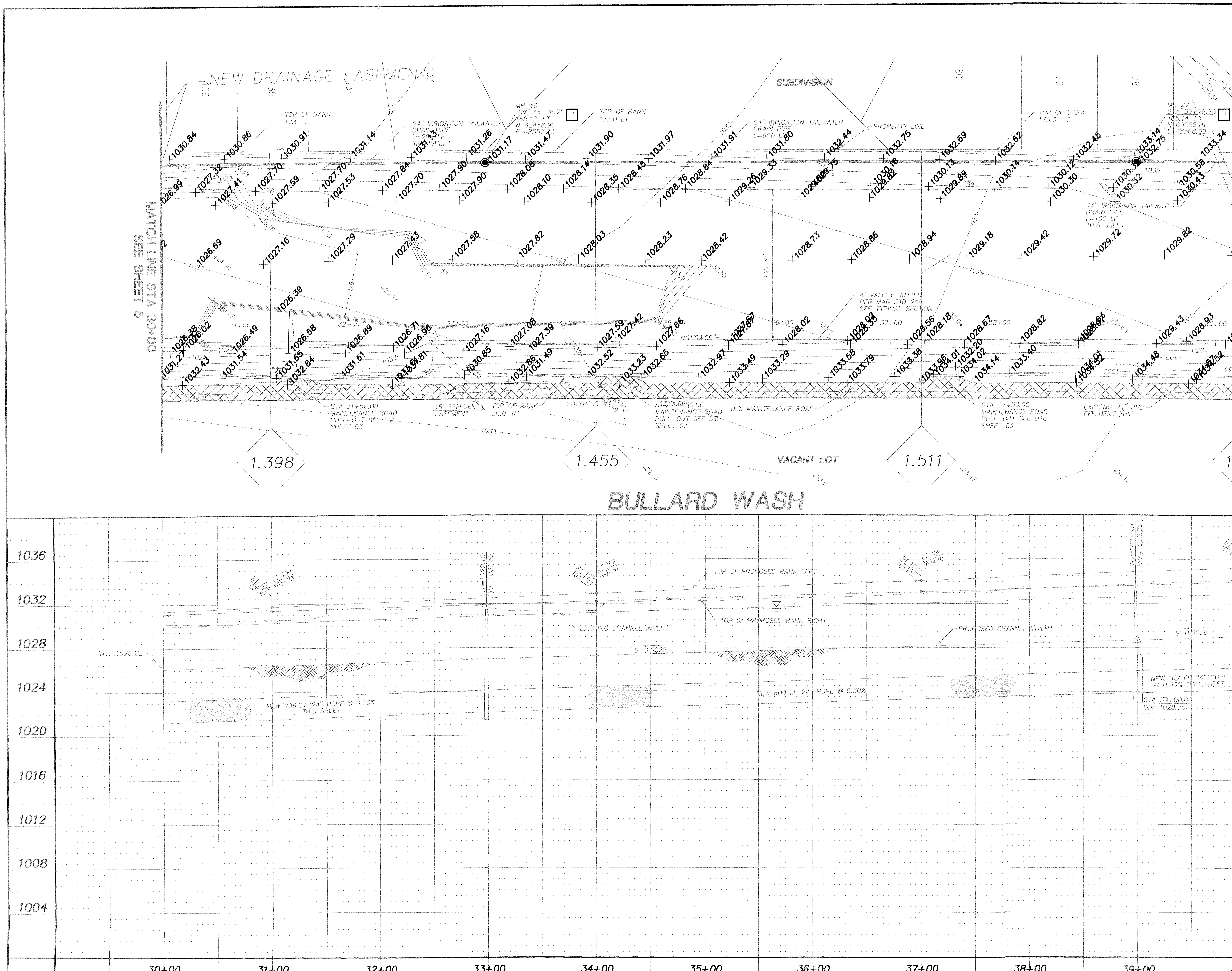
REV.	DATE	DESCRIPTION	CK. BY

PALM VALLEY PHASE V
BULLARD WASH CHANNEL
GRADING & DRAINAGE PLANS

SHEET TITLE: CHANNEL PLAN & PROFILE

Engineering and Environmental Consultants, Inc.
3003 N. Central Avenue, Suite 600
Phoenix, Arizona 85012-2905
TEL:(602)248-7702 FAX:(602)248-7851

DESIGN BY: MJR
DRAWN BY: AJA
CHK'D BY: MTC
DATE: AUGUST, 2004
SCALE: Hor. 1"=40' Vert. 1"=4'
DRAWING NO. 5 of 12



CONSTRUCTION NOTES

NO.	DESCRIPTION
1	INSTALL MAG STD DTL 520 STORM DRAIN MANHOLE (MODIFIED FOR HDPE PIPE) MANHOLE SHAFT PER MAG STD DTL 522

NORTH

GRAPHIC SCALE

40' 0 20' 40' 80'

SCALE 1"=40' ft.

CONTOUR INTERVAL = 1ft.

Two working days before you dig, CALL FOR THE BLUE STAKES
602-263-1100
1-800-STAKE-IT (OUTSIDE MARICOPA COUNTY)

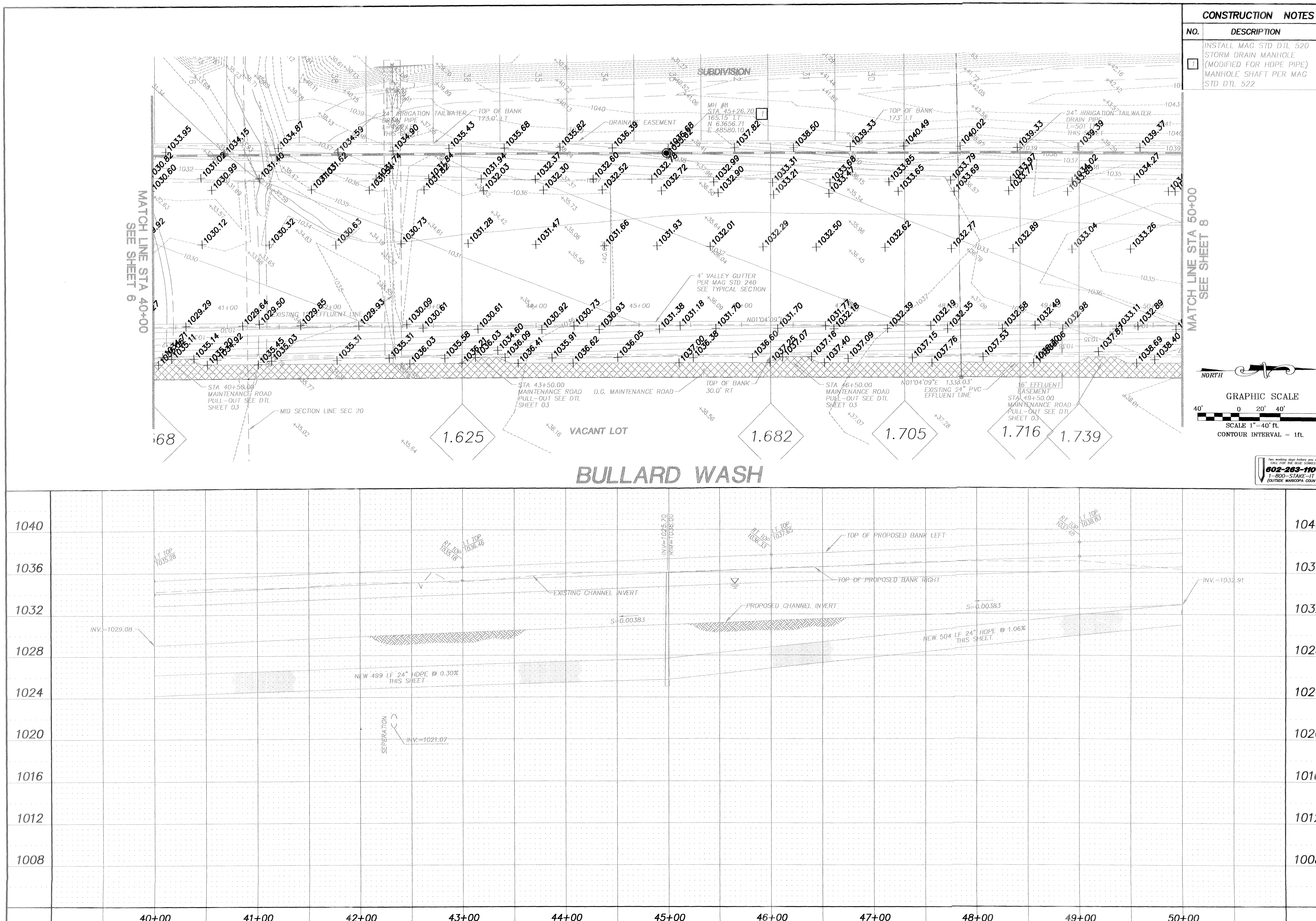
REV.	DATE	DESCRIPTION	CK. BY

PALM VALLEY PHASE V
BULLARD WASH CHANNEL
GRADING & DRAINAGE PLANS

SHEET TITLE: CHANNEL PLAN & PROFILE

Engineering and Environmental Consultants, Inc.
3003 N. Central Avenue, Suite 600
Phoenix, Arizona 85012-2905
TEL:(602)248-7702 FAX:(602)248-7851

DESIGN BY: MJR
DRAWN BY: AJA
CHK'D BY: MTG
DATE: AUGUST, 2004
SCALE: Hor. 1"=40' Vert. 1"=4'
DRAWING NO. 6 of 12



CONSTRUCTION NOTES

NO.	DESCRIPTION
1	INSTALL MAG STD DTL 520 STORM DRAIN MANHOLE (MODIFIED FOR HDPE PIPE) MANHOLE SHAFT PER MAG STD DTL 522

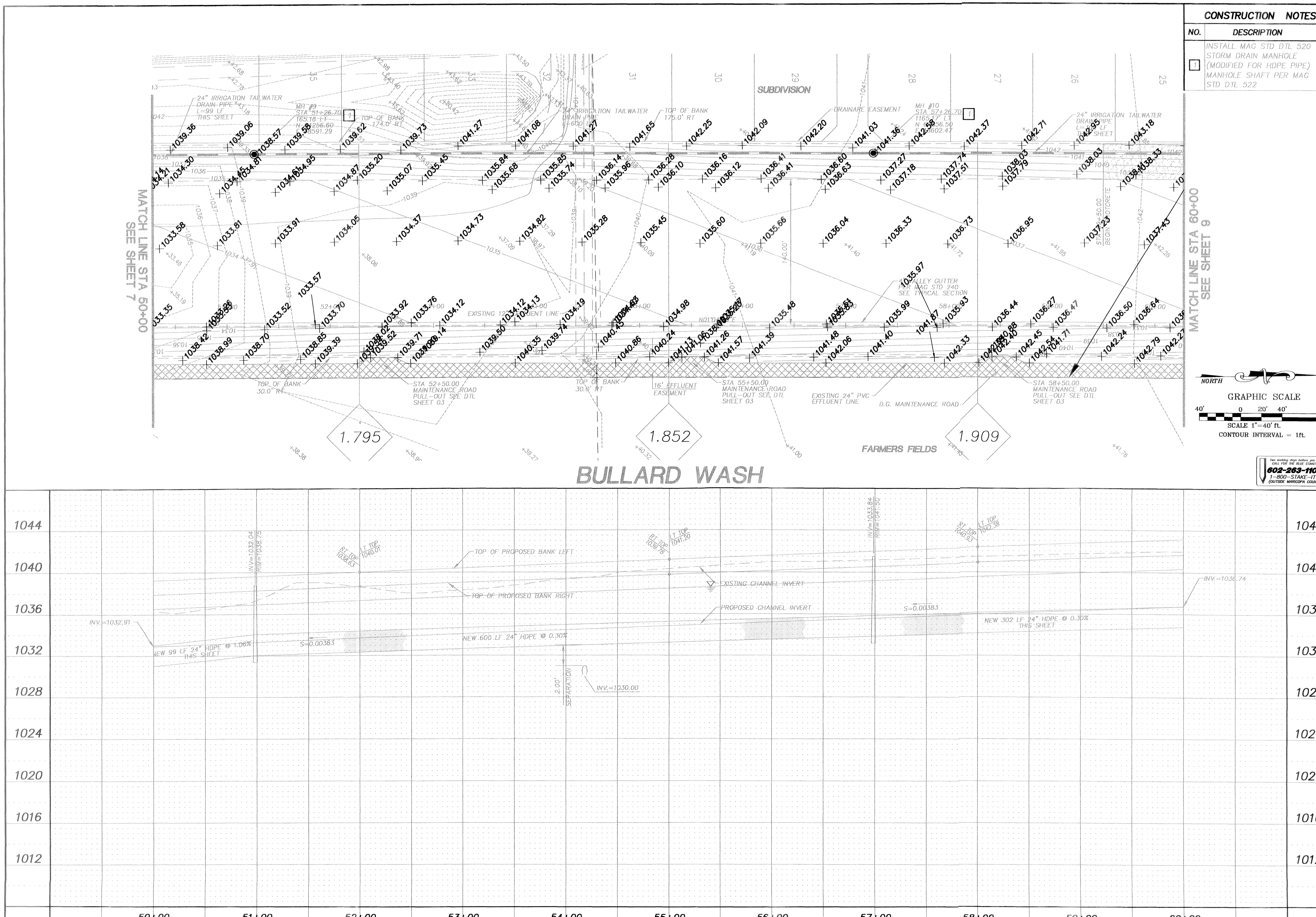
REV.	DATE	DESCRIPTION	CK. BY

PALM VALLEY PHASE V
BULLARD WASH CHANNEL
GRADING & DRAINAGE PLANS

SHEET TITLE: CHANNEL PLAN & PROFILE

Engineering and Environmental Consultants, Inc.
3003 N. Central Avenue, Suite 600
Phoenix, Arizona 85012-2905
TEL:(602)248-7702 FAX:(602)248-7851

DESIGN BY: MJR
DRAWN BY: AJA
CHK'D BY: MTG
DATE: AUGUST, 2004
SCALE: Hor. 1"=40' Vert. 1"=4'
DRAWING NO. 7 of 12



CONSTRUCTION NOTES

NO.	DESCRIPTION
1	INSTALL MAG STD DTL 520 STORM DRAIN MANHOLE (MODIFIED FOR HDPE PIPE) MANHOLE SHAFT PER MAG STD DTL 522

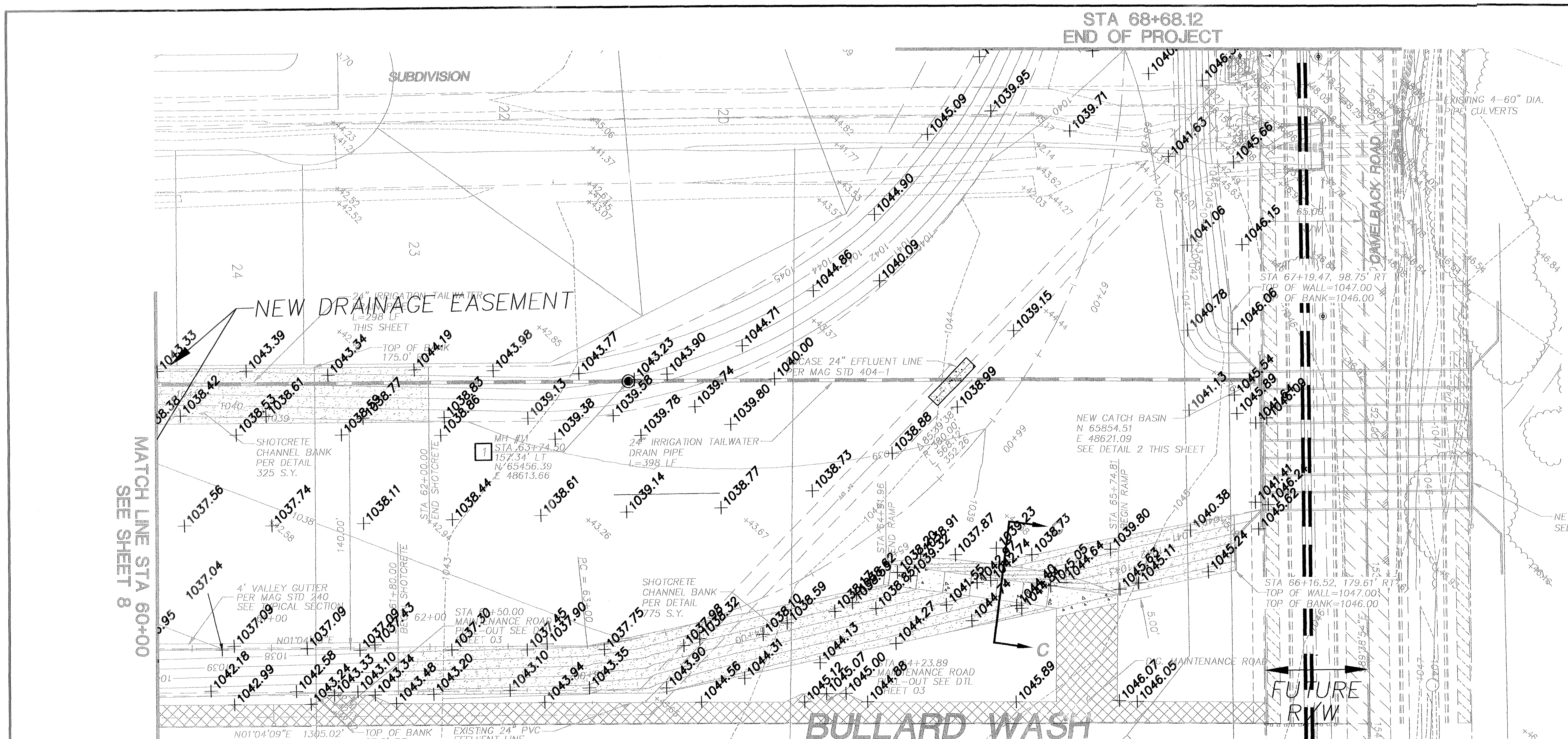
REV.	DATE	DESCRIPTION	CK. BY

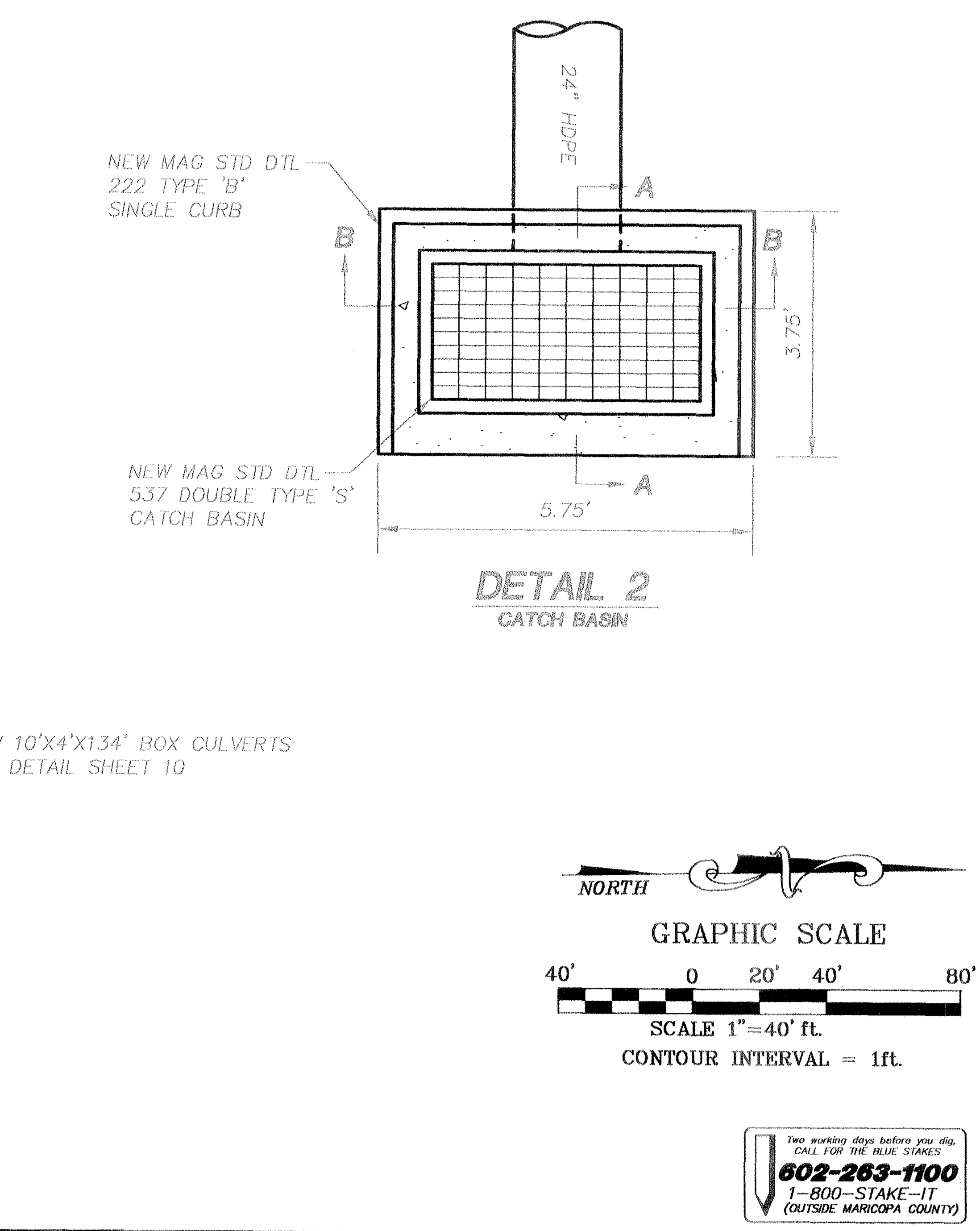
PALM VALLEY PHASE V
BULLARD WASH CHANNEL
GRADING & DRAINAGE PLANS

SHEET TITLE
CHANNEL
PLAN & PROFILE

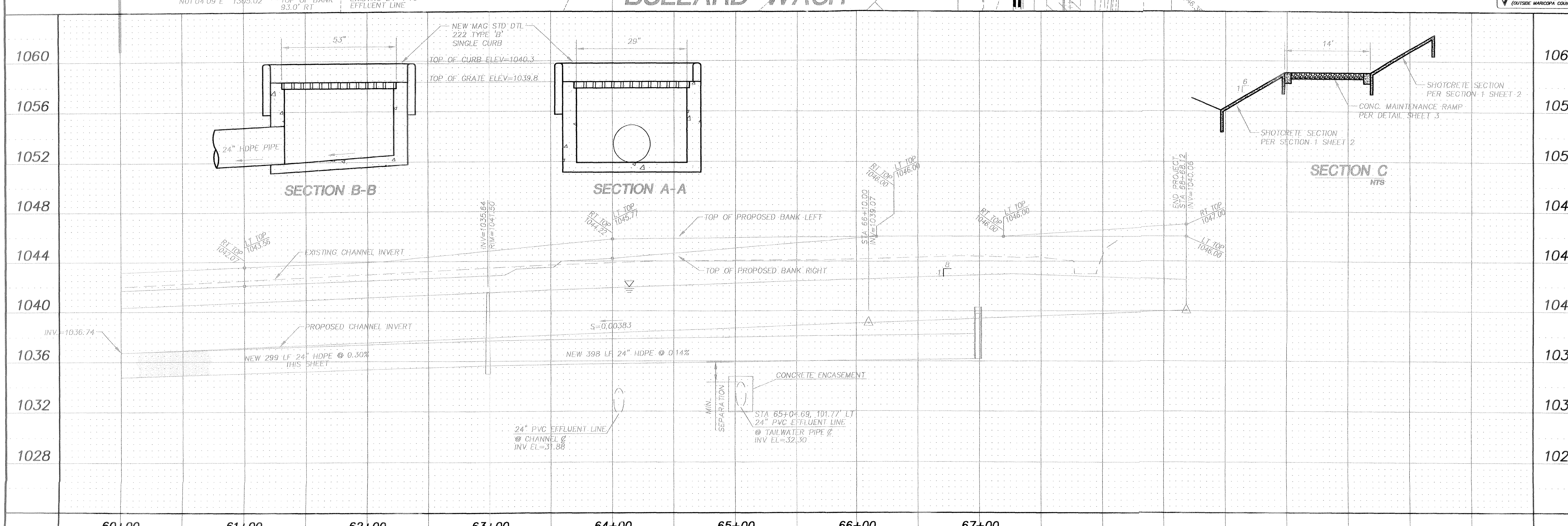
Engineering and Environmental Consultants, Inc.
3003 N. Central Avenue, Suite 600
Phoenix, Arizona 85012-2905
TEL:(602)248-7702 FAX:(602)248-7851

DESIGN BY: MJR
DRAWN BY: AJA
CHK'D BY: MTG
DATE: AUGUST, 2004
SCALE: Hor. 1"=40' Vert. 1"=4'
DRAWING NO. 8 of 12





NO.	DESCRIPTION	NO.	DESCRIPTION
1	INSTALL MAG STD DTL 520 STORM DRAIN MANHOLE (MODIFIED FOR HDPE PIPE) MANHOLE SHAFT PER MAG STD DTL 522	2	SHOTCRETE TO BE REINFORCED WITH POLYPORPYLENE FIBER PER MAG SPEC 525.



PALM VALLEY PHASE V
BULLARD WASH CHANNEL
GRADING & DRAINAGE PLANS

CHANNEL PLAN & PROFILE

Engineering and Environmental Consultants, Inc.
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