SPEEDIE
AND ASSOCIATES
GEOTECHNICAL/MATERIALS/SITE ENGINEERS
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REPORT ON GEOTECHNICAL INVESTIGATION

DESIGNATION: WHITE TANKS FLOOD RETENTION STRUCTURE #4

LOCATION: Jackrabbit Rd. & I-10
Maricopa County, Az.

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JAMES A. SPEEDIE, P.E.
HENRIETTA SPEEDIE, B.S.
GREGG A. CREASER, P.E.
BRETT P. CREASER, P.E.

July 21, 1993

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REMARKS

Mr. Warren Rosebraugh
Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, Arizona 85009

RE: Addendum No. 1.
Project No. 920113SA2
White Tanks Flood Control
Structure No. 4
Jack Rabbit Rd. & I-10
Maricopa County, Arizona

Dear Mr. Warren:

This addendum presents the results of a preliminary soil cement design carried out on a sample of typical soils found at the referenced site.

On July 9, 1993, an additional bulk sample of soil was obtained from the bottom of the channel in the area of Sta 39+60 and returned to our lab for additional testing. Tests included grain size analysis and plasticity index for classification purposes. A moisture density relations test (ASTM D698) was performed to determine the optimum moisture content and maximum dry density. In order to evaluate the soils for use in soil cement mixtures, a compressive strength analysis was performed in accordance with PCA and ADOT guidelines. Eight (8) samples were compacted at four (4) different cement contents based on a percent of weight. Cement used was Phoenix Cement Type II low alkali portland cement with no flyash. The samples were compacted to approximately 100 percent of maximum dry density at optimum moisture content. These samples were then moist cured for seven (7) days, capped and tested for compressive strength. The test results are presented in tabular and graphical form attached hereto.

Based on these test results, it appears that a cement content on the order of 11 percent will be required to obtain a compressive strength of 750 psi at 7 days. It is possible that cleaner soils with less fines may require less cement while the more plastic soils require slightly more to attain these same results.

This addendum should be attached to the original report and made a part thereof.

Respectfully submitted,
SPEEDIE AND ASSOCIATES

Gregg A. Creaser, P.E.

Registered Professional Engineer (Civil)
CERTIFICATE NO.
14388
GREGG ALAN
CREASER
Date Signed 7-21-93
ARIZONA, U.S.A.

GAC:gc
cc: Dibble & Associates
enclosures

SPEEDIE AND ASSOCIATES
GEOTECHNICAL/MATERIALS/SITE ENGINEERS
11029 N. 24th AVE., SUITE 805 • PHOENIX, ARIZONA 85029

REPORT OF LABORATORY TESTS

PROJECT: White Tanks No. 4 Channel Improv. **PROJECT NO.** 92113SA2 **DATE:** 07-09-93
LOCATION: Jack Rabbit Rd from Van Buren
CLIENT: Flood Control Dist of Maricopa Co. **LAB SAMPLE NO.:** 92113SA2
BORING NO.: - **FIELD SAMPLE NO.:** **SAMPLE DEPTH:** -
MATERIAL DESCRIPTION: Brown Silty Sand w/Trace Gravel
SAMPLED BY: CS **DATE:** 07-09-93 **TESTED BY:** SR **DATE:** 07-09-93
REMARKS: **SAMPLE SOURCE:**
SAMPLE LOCATION: On-site

MECHANICAL ANALYSIS:

	PER CENT RETAINED (INDIVIDUAL)	PER CENT PASSING (CUMULATIVE)	SPECIFICATION
3 INCH			
2 1/2 INCH			
1 1/2 INCH		100	
1 INCH		100	
3/4 INCH		99	
1/2 INCH		98	
3/8 INCH		97	
1/4 INCH		95	
NO. 4		94	
NO. 8		90	
NO. 10		88	
NO. 16		82	
NO. 30		73	
NO. 40		68	
NO. 50		62	
NO. 100		50	
NO. 200		38.2	

LIQUID LIMIT: **NATURAL MOISTURE:** 2.9 **ASPHALT CONTENT**
PLASTIC LIMIT: **UNIT DENSITY:** **% OF TOTAL SAMPLE:**
PLASTICITY INDEX: N/P **SPECIFIC GRAVITY:** **% OF DRY WEIGHT:**
MARSHALL DENSITY: **CORE DENSITY:**

SPEEDIE AND ASSOCIATES

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MOISTURE-DENSITY RELATIONS

PROJECT: **Flood Control Channel Improvements** PROJECT NO.: **920113SA** DATE: **7-21-93**

LOCATION: **Jack Rabbit Rd. from Van Buren to Thomas Rd.**

CLIENT: **Flood Control District of Maricopa County** LAB SAMPLE NO.: **920113SA-002**

METHOD OF COMPACTION: **ASTM D698A** FIELD SAMPLE NO.: **B-2**

MATERIAL SOURCE:

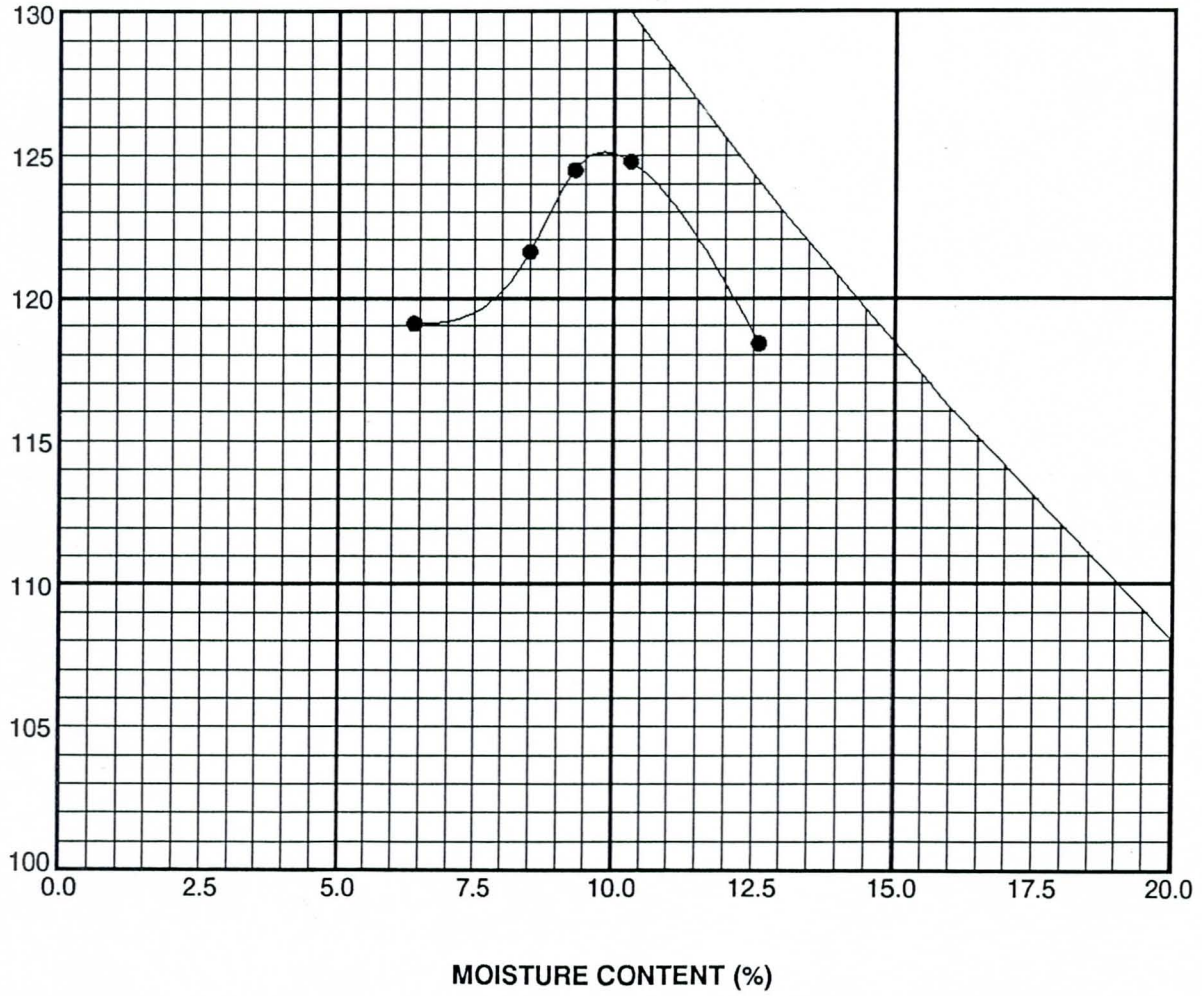
SAMPLE DESCRIPTION: **Brown silty sand with a trace of gravel**

SAMPLE LOCATION: **Stockpile**

SAMPLED BY: **CS** DATE: **7-12-93** TESTED BY: **SR** DATE: **7-12-93**

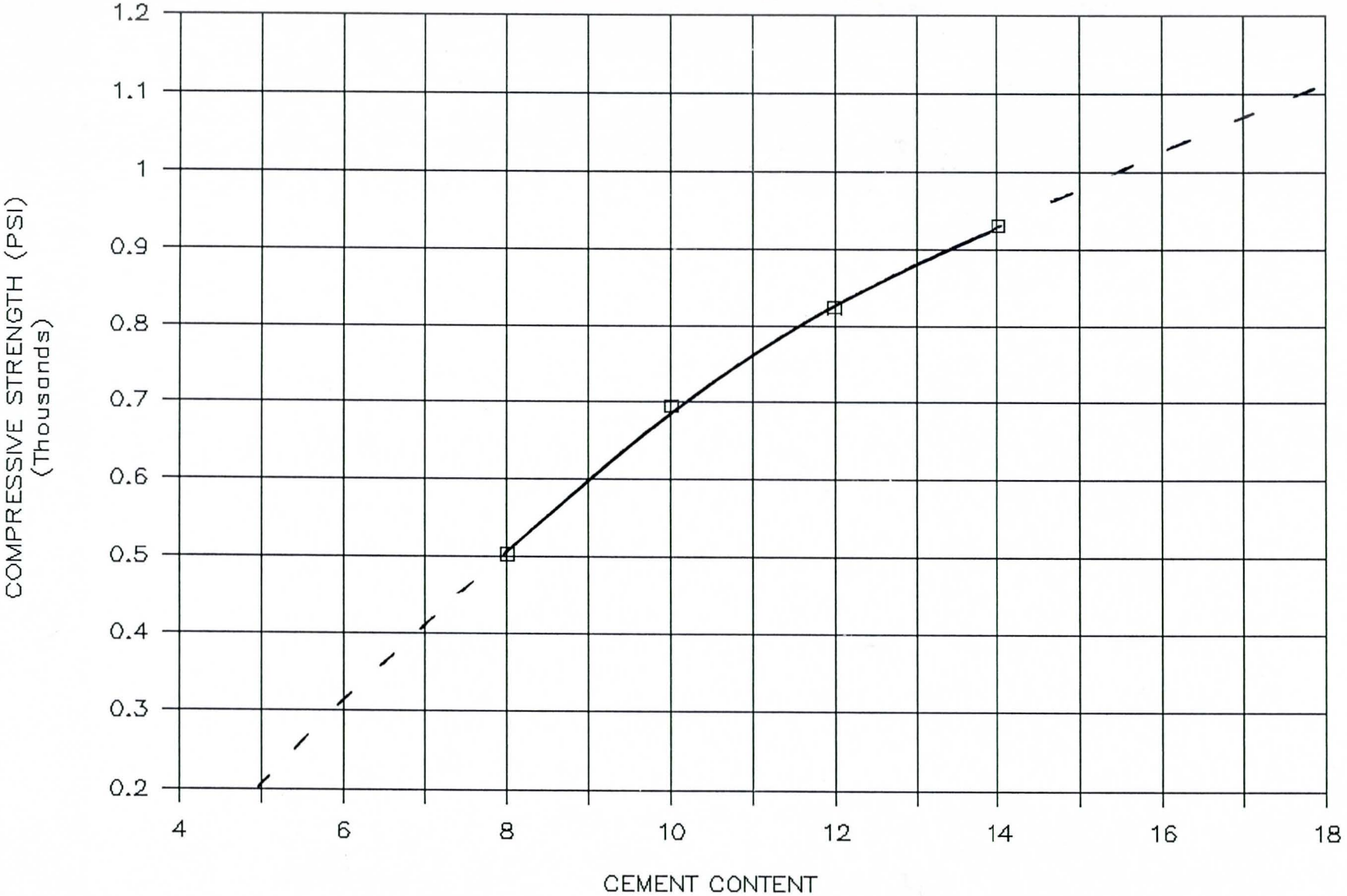
REMARKS: **6.0% rock retained on No. 4 sieve**

MAXIMUM DRY DENSITY: **124.8 PCF** OPTIMUM MOISTURE CONTENT: **10.3 %**



SOIL CEMENT COMPRESSIVE STRENGTH

WHITE TANKS INLET IMPROVEMENT



COMPRESSIVE STRENGTH RESULTS OF SOIL CEMENT SPECIMENS
****

CLIENT: MARICOPA COUNTY FLOOD CONTROL

DATE: 7/20/93

PROJECT: WHITE TANKS NO. 4 INLET IMPROVEMENT

PROJECT NO: ASSIGNMENT NO. 3

MATERIAL DESCRIPTION: SOIL CEMENT CORES

SOURCE OF MATERIAL: ON SITE

SOURCE OF SAMPLE: NATIVE MATERIAL ON SITE

SAMPLED BY: C.S.

LAB NO: 920113SA-2

DESIGN STRENGTH: 750 PSI

SPECIMEN NO.	DRY DENSITY LBS. PER CU. FT.	% CEMENT	% WATER	7 DAY STRENGTH PSI	AVERAGE PSI	P.I.
1	122.3	8.0	10.7	506		
2	122.5	8.0	10.7	498	502	N.P.
3	123.7	10.0	10.2	712		
4	124.2	10.0	10.2	677	695	N.P.
5	123.1	12.0	10.1	823		
6	123.3	12.0	10.1	827	825	N.P.
7	123.4	14.0	10.9	928		
8	123.2	14.0	10.9	933	931	N.P.

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AND ASSOCIATES
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REMARKS

July 21, 1993

Mr. Warren Rosebraugh
Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, Arizona 85009

RE: Addendum No. 1.
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Dear Mr. Warren:

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This addendum should be attached to the original report and made a part thereof.

Respectfully submitted,
SPEEDIE AND ASSOCIATES

Gregg A. Creaser, P.E.

Registered Professional Engineer (Civil)
CERTIFICATE NO.
14388
GREGG ALAN
CREASER
Date Signed 7/21/93
ARIZONA, U.S.A.

GAC:gc
cc: Dibble & Associates
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SPEEDIE
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REPORT OF LABORATORY TESTS

PROJECT: White Tanks No. 4 Channel Improv. **PROJECT NO.** 92113SA2 **DATE:** 07-09-93
LOCATION: Jack Rabbit Rd from Van Buren
CLIENT: Flood Control Dist of Maricopa Co. **LAB SAMPLE NO.:** 92113SA2
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NO. 16		82	
NO. 30		73	
NO. 40		68	
NO. 50		62	
NO. 100		50	
NO. 200		38.2	

LIQUID LIMIT:
PLASTIC LIMIT:
PLASTICITY INDEX: N/P
MARSHALL DENSITY:

NATURAL MOISTURE: 2.9
UNIT DENSITY:
SPECIFIC GRAVITY:

ASPHALT CONTENT
% OF TOTAL SAMPLE:
% OF DRY WEIGHT:
CORE DENSITY:

SPEEDIE AND ASSOCIATES

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MOISTURE-DENSITY RELATIONS

PROJECT: **Flood Control Channel Improvements** PROJECT NO.: **920113SA** DATE: **7-21-93**

LOCATION: **Jack Rabbit Rd. from Van Buren to Thomas Rd.**

CLIENT: **Flood Control District of Maricopa County** LAB SAMPLE NO.: **920113SA-002**

METHOD OF COMPACTION: **ASTM D698A** FIELD SAMPLE NO.: **B-2**

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SAMPLE LOCATION: **Stockpile**

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REMARKS: **6.0% rock retained on No. 4 sieve**

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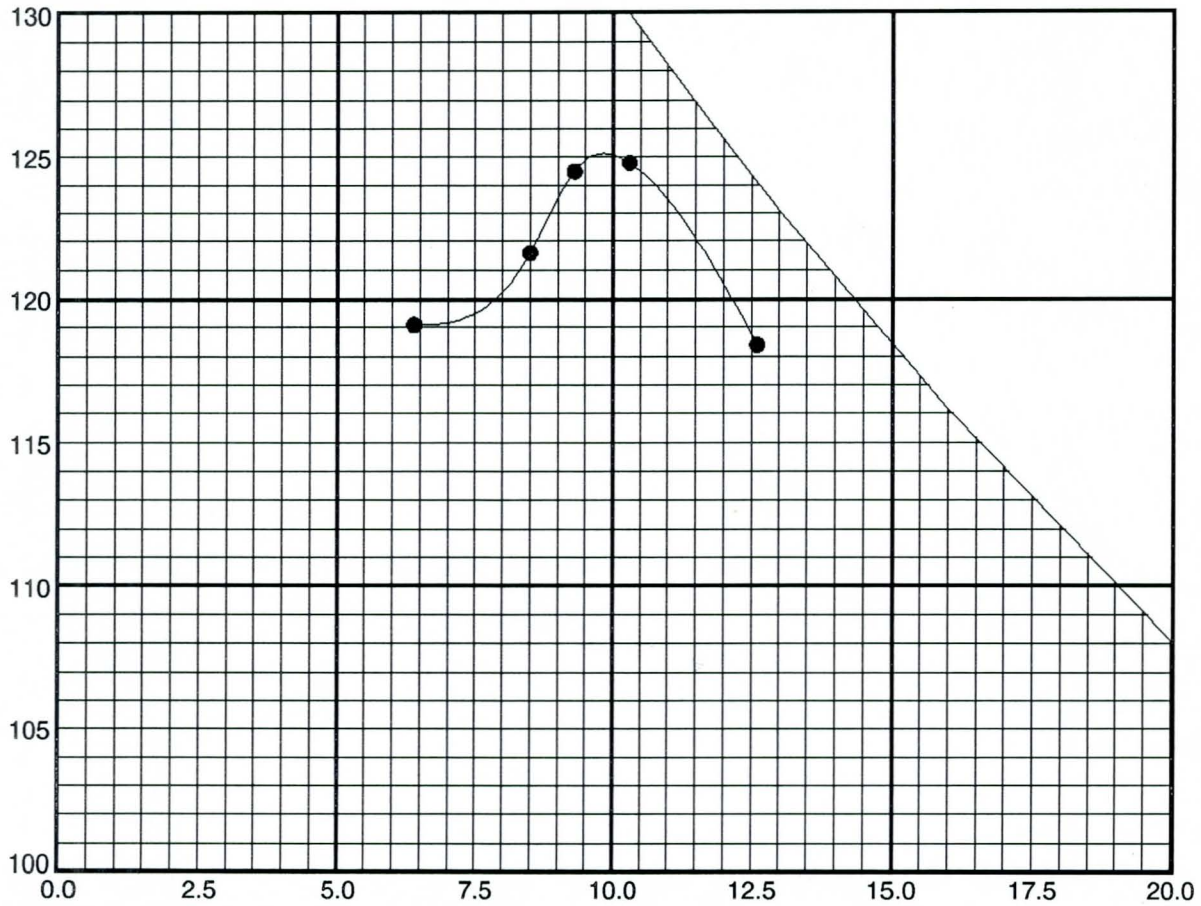
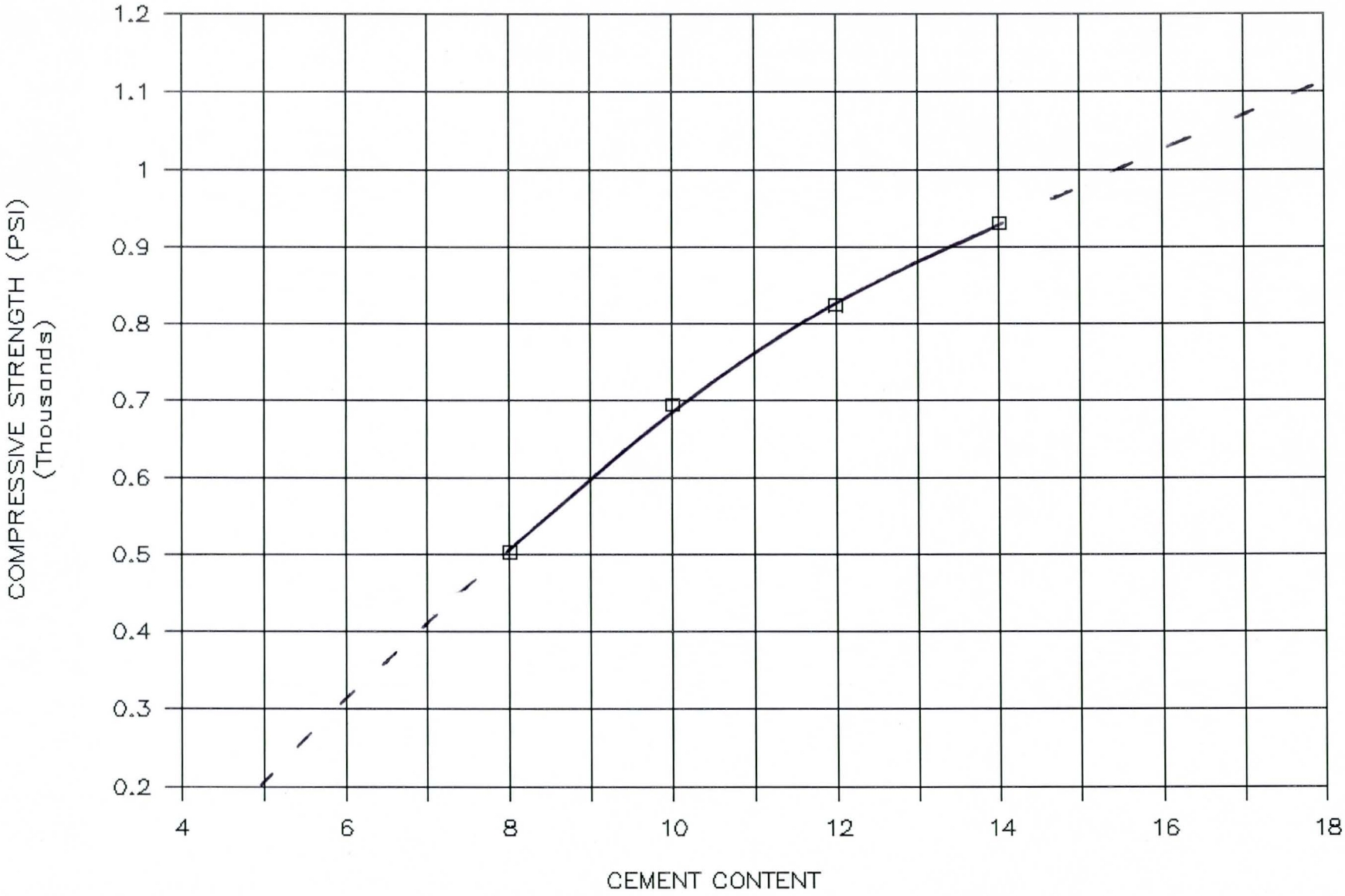


MOISTURE CONTENT (%)

SOIL CEMENT COMPRESSIVE STRENGTH

WHITE TANKS INLET IMPROVEMENT



COMPRESSIVE STRENGTH RESULTS OF SOIL CEMENT SPECIMENS
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CLIENT: MARICOPA COUNTY FLOOD CONTROL

DATE: 7/20/93

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BRETT P. CREASER, P.E.
MICHAEL J. CAYLOR, P.E.
DAVID A. STRATTON, R.L.S.

REPORT ON GEOTECHNICAL INVESTIGATION

DESIGNATION: WHITE TANKS FLOOD RETENTION STRUCTURE #4

LOCATION: Jackrabbit Rd. & I-10
Maricopa County, Az.

CLIENT: Maricopa County FCD

PROJECT NO: 92113SA2

DATE: May 25, 1993

Registered Professional Engineer (Civil)
CERTIFICATE NO. 14388
GREGG ALAN CREASER
Date Signed 5-25-93
ARIZONA, U.S.A.

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Registered Professional Engineer (Civil)
CERTIFICATE NO.
14388
GREGG ALAN
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Date Signed 5-25-93
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INTRODUCTION

This report presents the results of a subsoil investigation carried out at the site of the proposed flood control channel improvements along Jackrabbit Road from Thomas Road to Roosevelt Street in Maricopa County, Arizona.

Preliminary information calls for the construction of inlet structural improvements, channel lining and other erosion protection features. Access to the bottom of the channel was not possible to truck mounted drilling equipment north of I-10. Accordingly, the borings were drilled through the materials on the east bank of the existing channel.

GENERAL SITE AND SOIL CONDITIONS

Site Conditions - The site currently represents an unlined channel located contiguous to the west side of Jackrabbit Road. The channel is unlined except where it passes under the cross roadways. At about Roosevelt Street, the channel turns to the southwest away from the roadway. The banks of the wash are covered with a variable growth of typical desert vegetation including weeds, brush and trees.

General Subsurface Conditions - The bottom of the wash was not accessible to truck mounted drilling equipment north of I-10. Accordingly, the Borings B-3 through B-8 were drilled along the shoulder of the road on the east bank of the wash. Borings B-1 and B-2 were drilled in the wash. The bottom of the wash had been recently graded, removing the loose alluvial sands and exposing the native fine grained soils. The soils are variable throughout the alignment consisting of alternating deposits of sand, clayey sand to sandy clay and clay. There is very little gravel in the soils matrix with the percent retained on the #4 sieve generally ranging from 1.0 to 15 percent. The degree of plasticity is generally low ranging from non-plastic to 12 percent. In some areas, sporadic calcarious cementation was found to exist in the fine grain soils. To aid in determining stream bed load, three samples were obtained from the bottom of the wash adjacent to the bank borings. The materials consist of silty medium to fine sand.

ANALYSIS AND RECOMMENDATIONS

Analysis - Analysis of the field and laboratory data indicates that subsoils at the site are variable but generally consist of low plasticity fine grain sands. This classification makes these soils subject to erosion where disturbed and/or recompacted and subject to higher velocity flows. There is no large size material available on-site that could be used for rip-rap. The relatively sandy nature of the soils makes the use of soils cement an available option for erosion control. Insitu conditions indicate the soils to be relatively dense in most areas (except B-7). Accordingly, they are acceptable for the support of typical lightly loaded spread foundations.

The insitu dry densities range from 115 to 127 pcf with the maximum dry density (per ASTM D-698) determined to be 123 pcf for the clayey sand soil. Based on these results, shrinkage will be low when recompacted. The loose sand in the bottom of the wash will shrink more when compacted. Foe design, a shrinkage value of 5 to 7 percent is recommended.

Site Preparation - Any area to be occupied by the proposed construction should be stripped of all vegetation, debris, rubble and obviously loose surface soils.

Prior to placing structural fill, the existing grade should be scarified to a depth of 8 inches, moisture conditioned to optimum ($\pm$2 percent) and compacted to at least 95 percent of maximum dry density as determined by ASTM D-698. If upon excavation of any foundation, loose soils are found, the exposed grade should be scarified and compacted in the same manner.

Foundation Design - It is recommended that any structures be founded on shallow spread footings bearing on dense undisturbed native soil, or on properly compacted fill at a minimum depth of 18 inches below lowest adjacent grade not subject to scour or erosion. If site preparation is carried out as set forth herein, a recommended safe allowable bearing capacity of 1500 psf can be utilized for design. This bearing capacity refers to the total of all loads, dead and live, and is a net pressure. It may be increased one-third for wind, seismic or other loads of short duration. All footing excavations should be level and cleaned of all loose or disturbed materials.

Estimated settlements under maximum design loads are on the order of 1/2-inch, virtually all of which will occur during construction. Post-construction differential settlements will be negligible, under existing and compacted moisture contents. Additional localized settlements of the same magnitude could occur if native supporting soils were to experience a significant increase in moisture content.

Lateral Pressures - The following lateral pressure values may be utilized for the proposed construction:

Active Pressure	
Unrestrained Walls	35 PCF
Restrained Walls	60 PCF
Passive Pressure	
Continuous Footings	350 PCF
Spread Footings	400 PCF

Coefficient of Friction (With Passive Pressure)	0.35
Coefficient of Friction (Without Passive Pressure)	0.45

All backfill must be compacted to not less than 95 percent (ASTM D-698) to mobilize these passive values at low strain.

Fill And Backfill - Native soils are suitable for use in grading fills provided they are not placed directly beneath building slabs.

Fill should be placed on subgrade which has been properly prepared and approved by a Soils Engineer. Fill must be wetted and thoroughly mixed to achieve optimum moisture content, ± 2 percent (optimum to +3 percent for underslab fill). Fill should be placed in horizontal lifts of 8-inch thickness (or as dictated by compaction equipment) and compacted to 95 percent of maximum dry density per ASTM D-698.

Utilities Installation - Trench excavations for utilities can be accomplished by conventional trenching equipment. Trench walls may stand near-vertically for the short periods of time required to install utilities but some sloughing should be expected in the non-cohesive sandy soils. If trenches are greater than shoulder-height, precautions must be taken to protect workmen in accordance with all current governmental regulations.

Backfill of trenches may be carried out with native excavated material. This material should be moisture-conditioned, placed in 8 inch lifts and mechanically compacted. Water settling is generally not recommended. Compaction requirements are summarized in the "Fill And Backfill" section of this report.

Although backfilling in compacted lifts is preferred to minimize pavement settlements. A less desirable, but more expedient process would involve backfill of trenches in 4.0 foot maximum lifts to 18 inches below finish subgrade, jetting as set forth in Section 601 of the M.A.G. Specification, and allowing time for moisture stabilization. The surface should then be thoroughly wheel-rolled to provide stable conditions. The upper 18 inches should then be placed in two moisture-conditioned lifts and compacted to not less than 95 percent of maximum dry density.

CORROSION PROTECTION - Selected samples were tested for minimum soil resistivity and pH with values ranging from 1700 ohm-cm to 4300 ohm-cm and 8.4 to 9.1 respectively. Based on these results, ADOT Figure 203.04-5 Preliminary Engineering and Design Manual recommends that metal culverts be

bituminous coated or aluminum alloy. Type II low alkali cement is typically supplied in this area. This should provide adequate protection for the potentially reactive soils. Type C fly ash admixtures should not be allowed for concrete in contact with the ground unless the supplier can provide test data to show that the soils and aggregate do not contain harmful levels of sulfates or alkali reactive aggregate.

EROSION CONTROL - The soils are relatively fine grained ranging from non-plastic to a plasticity index of 18. They are subject to erosion at maximum mean velocities greater than 2 feet per second (Corps of Engineers EM 1110-2-1601). Flood Control District of Maricopa County Drainage Design Manual, Sept. 1, 1992 edition, Table 5.1 indicates a maximum velocity of up to 3.5 fps is permissible for the bulk of the soils present. The presence of plasticity in the soils, especially in the southern end (B-5 to the south) should allow increasing the velocity to $4\pm$ fps with little additional maintenance required.

The D_{50} size for the soils is on the order of 0.5 mm with the D_{75} size ranging from 0.6 to 6.0 mm. There is no large size natural material available on-site for use as rip-rap. Suppliers indicate a lack of material on the west side. Such material would have to be imported from pits on the Salt River east of 51st Avenue. The relatively low plasticity sandy nature of the soils makes them suitable for soil cement mixtures. The range of cement content necessary to achieve 500 psi at 28 days will be on the order of 8 to 15 percent for the sand and sandy clay respectively. Mix designs will be necessary to determine the actual amount of cement necessary.

GENERAL

The scope of this investigation and report does not include regional considerations such as seismic activity and ground fissures resulting from subsidence due to groundwater withdrawal, nor any considerations of hazardous releases or toxic contamination of any type.

Our analysis of data and the recommendations presented herein are based on the assumption that soil conditions do not vary significantly from those found at specific sample locations. Our work has been performed in accordance with generally accepted engineering principles and practice; this warranty is in lieu of all other warranties expressed or implied.

We recommend that a Soils Engineer monitor the earthwork and foundation portions of this project to ensure compliance to project specifications and the field applicability of subsurface conditions which are the basis of the recommendations presented in this report. If any significant changes are made in the scope of work or type of construction that was assumed in this report, we must review such revised conditions to confirm our findings if the conclusions and recommendations presented herein are to apply.

Respectfully submitted,
SPEEDIE AND ASSOCIATES

Clay W. Spencer, Staff Geologist

Registered Professional Engineer (Civil)
CERTIFICATE NO.
14388
GREGG ALAN
CREASER
Date Signed 5-25-93
ARIZONA, U.S.A.

Gregg A. Creaser. P.E.

May 25, 1993

APPENDIX

FIELD AND LABORATORY INVESTIGATION

SOIL BORING LOCATION PLAN

SOIL LEGEND

LOG OF TEST BORING

TABULATION OF TEST DATA

CONSOLIDATION DATA

MOISTURE-DENSITY RELATIONS

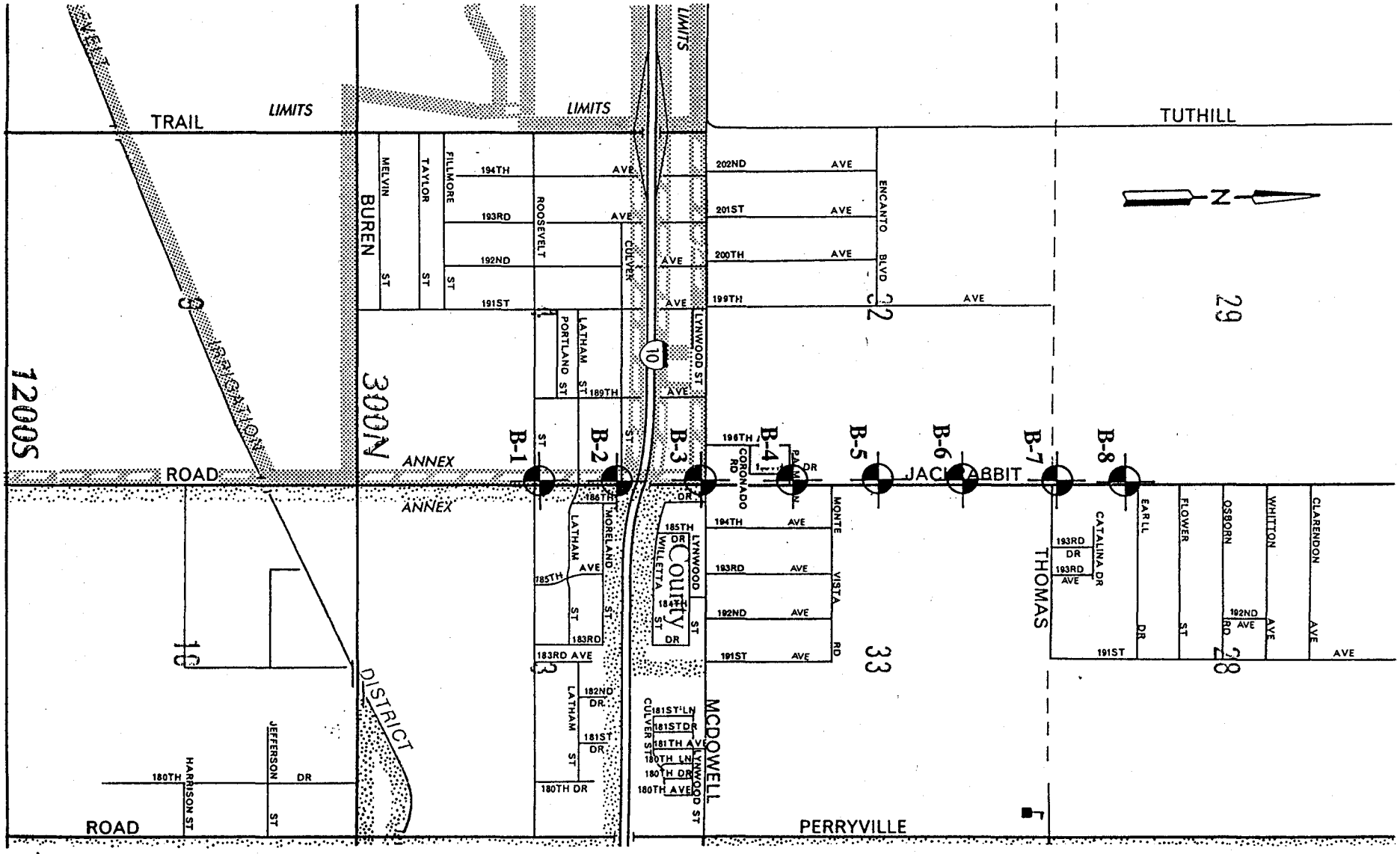
SWELL TEST DATA

TABULATION OF SOIL RESISTIVITY AND pH

FIELD AND LABORATORY INVESTIGATION

On May 3, 1993, eight (8) soil test borings were drilled at the approximate locations shown on the attached Soil Boring Location Plan. All exploration work was carried out under the full-time supervision of Clay Spencer, our staff geologist, who recorded subsurface conditions and obtained samples for laboratory testing. The soil borings were advanced with a truck-mounted CME 55 drill rig utilizing 7.5 inch diameter hollow stem flight augers. Detailed information regarding the borings and samples obtained can be found on an individual Log of Test Boring prepared for each drilling location.

Laboratory testing consisted of moisture content, dry density, grain-size distribution and plasticity (Atterberg Limits) tests for classification and design parameters. Minimum resistivity and Ph tests were conducted to determine the corrosion potential for buried metal products. Compression tests were performed on a selected ring sample in order to estimate settlements and determine effects of inundation. Remolded swell tests were performed on samples compacted to densities and moisture contents expected during construction. All field and laboratory data is presented in this appendix.



Soil Boring Locations

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Soil Boring Location Plan

Flood Control
Channel Improvements
Jack Rabbit Trail
Maricopa County, Arizona

SPEEDIE AND ASSOCIATES
GEOTECHNICAL / MATERIALS / SITE ENGINEERS

PROJECT NO. 92113SA2

SOIL LEGEND

SAMPLE DESIGNATION	DESCRIPTION	
AS	Auger Sample-	A grab sample taken directly from auger flights
BS	Large Bulk Sample-	A grab sample taken directly from auger flights
S	Spoon Sample-	Standard Penetration Test (ASTM D-1586) Driving a 2.0 inch outside diameter split spoon sampler into undisturbed soil for three successive 6-inch increments by means of a 140 lb. weight free falling through a distance of 30 inches. The cumulative number of blows for the final 12 inches of penetration is the Standard Penetration Resistance (N).
RS	Ring Sample-	Driving a 3.0 inch outside diameter spoon equipped with a series of 2.42 inch inside diameter, 1 inch long brass rings, into undisturbed soil for one 12 inch increment by the same means of the Spoon Sample. The blows required for the 12 inches of penetration are recorded.
LS	Liner Sample-	Standard Penetration Test driving a 2.0 inch outside diameter split spoon equipped with two 3 inch long, 1⅜ inch inside diameter brass liners, separated by a 1 inch long spacer, into undisturbed soil by the same means of the spoon sample.
ST	Shelby Tube-	A 3.0 inch outside diameter thin-walled tube continuously pushed into undisturbed soil by a rapid motion, without impact or twisting (ASTM D-1587).
–	Continuous Penetration Resistance-	Driving a 2.0 inch outside diameter "Bullnose Penetrometer" continuously into undisturbed soil by the same means of the spoon sample. The blows for each successive 12 inch increment are recorded.

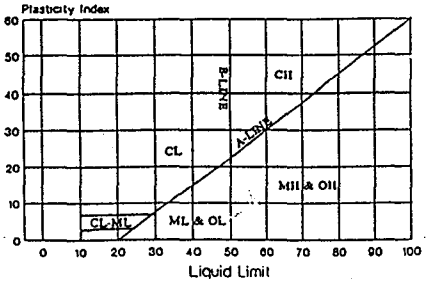
CONSISTENCY			RELATIVE DENSITY	
Clays & Silts	Blows/Foot *	Strength †	Sands and Gravels	Blows/Foot *
Very Soft	0-2	0-¼	Very Loose	0-4
Soft	2-4	¼-½	Loose	5-10
Firm	5-8	½-1	Medium Dense	11-30
Stiff	9-15	1-2	Dense	31-50
Very Stiff	16-30	2-4	Very Dense	> 50
Hard	> 30	> 4		

* Number of blows of a 140 lb hammer free falling 30 inches to drive a 2 inch O.D. split spoon sampler (ASTM D-1588)
† Unconfined compressive strength in tons/sq ft. Read from a pocket penetrometer

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
Coarse Grained Soils	Gravel and Gravelly Soils	Clean Gravels		GW	Well Graded Gravels
				GP	Poorly Graded Gravels
More than 50% of material is larger than #200 sieve size	50% Coarse Fraction is > #4 Sieve Size	Gravels w/Fines		GM	Silty Gravels
				GC	Clayey Gravels
	Sand and Sandy Soils	Clean Sands		SW	Well Graded Sands
				SP	Poorly Graded Sands
	50% Coarse Fraction is < #4 Sieve Size	Sands w/Fines		SM	Silty Sand
				SC	Clayey Sand
Fine Grained Soils	Silts and Clays			ML	Inorganic Silts, Low Plasticity
	Liquid limit is less than 50%			CL	Inorganic Clays, Low Plasticity
				OL	Organic Silts, High Plasticity
More than 50% of material is smaller than #200 sieve size	Silts and Clays			MH	Inorganic Silts, High Plasticity
	Liquid limit is greater than 50%			CH	Inorganic Clays, High Plasticity
				OH	Organic Clays, High Plasticity
Highly Organic Soils				PT	Peat and Humus, Highly Organic

MATERIAL SIZE	PARTICLE SIZE			
	Lower Limit		Upper Limit	
	mm	Sieve Size †	mm	Sieve Size †
Sands				
Fine	.075	#200	0.42	#40
Medium	0.42	#40	2.00	#10
Coarse	2.00	#10	4.76	#4
Gravels				
Fine	4.76	#4	191	¾" °
Coarse	191	¾" °	762	3" °
Cobbles	762	3" °	304.8	12" °
Boulders	304.8	12" °	914.4	36" °

†U.S. Standard °Clear Square Openings



Rig Type: CME-55
Boring Type: Hollow Stem Auger
Surface Elevation: N/A
Sta. 26+40; 80' Lt of CL

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
0	Medium Dense to Dense Brown CLAYEY SAND (SC-Dry) With a Trace of Gravel	RS-1	2.0	7.3	121.4
5		S-2	6.0	--	--
7.5	Very Stiff Brown CLAY (CL-Dry) With a Little Sand				
10		S-3	11.0	--	--
15					
16.0	End of Boring	S-4	16.0	--	--
20					
25					

Penetration Resistance Blows per Foot (0, 25, 50)

Boring Date: 5-3-93
Field Engineer/Technician: C. Spencer
Driller: K. Heinrich
Contractor: Heber Mining

Water Level

Depth	Hour	Date

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B- 1

Flood Control Channel Improvement

Jackrabbit Road, Sta. 26+40 to 115+50

Maricopa County, Arizona

Project No.: 92113SA2

Rig Type: CME-55
Boring Type: Hollow Stem Auger
Surface Elevation: N/A
Sta. 39+60; 95' Lt of CL

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
0	Dense Brown SILTY SAND (SM-Dry) With a Trace of Gravel				
5		RS-1	5.5	16.0	109.2
	Increase in Light Gravel From 7' to 9'				
10		S-2	11.0	--	--
12.5	Medium Dense Brown CLAYEY SAND/SANDY CLAY (SC/CL-Dry) With a Little Gravel				
15		S-3	16.0	--	--
16.0	End of Boring				
20					
25					

Penetration Resistance Blows per Foot (0, 25, 50)

Boring Date: 5-3-93
Field Engineer/Technician: C. Spencer
Driller: K. Heinrich
Contractor: Heber Mining

Water Level

Depth	Hour	Date

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B- 2

Flood Control Channel Improvement

Jackrabbit Road, Sta. 26+40 to 115+50

Maricopa County, Arizona

Project No.: 92113SA2

Rig Type: CME-55
Boring Type: Hollow Stem Auger
Surface Elevation: N/A
Sta. 52+80; 25' Lt of CL

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0–25–50)
0	Medium Dense Brown SAND (SP-Dry) With Some Gravel					
5		S-1	6.0	--	--	
6.5	Dense Brown CLAYEY SAND/SILTY SAND (SC/SM-Dry) With a Trace of Gravel					
10		RS-2	10.5	7.7	120.3	
13.5	Hard Brown SANDY CLAY (CL-Dry) With a Little Silt					
15		S-3	16.0	--	--	
20		S-4	21.0	--	--	51/12"
21.0	End of Boring					
25						

Boring Date: 5-3-93
Field Engineer/Technician: C. Spencer
Driller: K. Heinrich
Contractor: Heber Mining

Water Level

Depth	Hour	Date

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B- 3

Flood Control Channel Improvement

Jackrabbit Road, Sta. 26+40 to 115+50

Maricopa County, Arizona

Project No.: 92113SA2

Rig Type: CME-55
Boring Type: Hollow Stem Auger
Surface Elevation: N/A
Sta. 66+00; 30' Lt of CL

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0	Dense Brown CLAYEY SAND (SC-Dry) With a Trace of Gravel					
5		S-1	6.0	--	--	
8.0	Dense Brown SILTY SAND (SM-Dry) With a Little Gravel					
10		RS-2	10.5	5.3	127.5	
12.5	Dense Brown CLAYEY SAND (SC-Dry) With a Trace of Gravel					
15		S-3	16.0	--	--	
17.0	Hard Brown SANDY CLAY (CL-Dry)					
20		S-4	20.4	--	--	50/5"
21.0	End of Boring					
25						

Boring Date: 5-3-93
Field Engineer/Technician: C. Spencer
Driller: K. Heinrich
Contractor: Heber Mining

Water Level

Depth	Hour	Date

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B- 4

Flood Control Channel Improvement

Jackrabbit Road, Sta. 26+40 to 115+50

Maricopa County, Arizona

Project No.: 92113SA2

Rig Type: CME-55
Boring Type: Hollow Stem Auger
Surface Elevation: N/A
Sta. 79+20; 30' Lt of CL

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0	Stiff Brown SANDY CLAY (CL-Dry)					
4.0						
5	Medium Dense Brown SANDY CLAY/CLAYEY SAND (CL/SC-Dry) With a Little Gravel	S-1	6.0	--	--	
9.0		BS-2	9.0	--	--	
10	Hard Brown SANDY CLAY (CL-Dry) With a Trace of Gravel and Calcareous Cementation	S-3	11.0	--	--	67/12"
15		S-4	16.0	--	--	76/12"
20		S-5	21.0	--	--	56/12"
21.0	End of Boring					
25						

Boring Date: 5-3-93
Field Engineer/Technician: C. Spencer
Driller: K. Heinrich
Contractor: Heber Mining

Water Level

Depth	Hour	Date

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B- 5

Flood Control Channel Improvement

Jackrabbit Road, Sta. 26+40 to 115+50

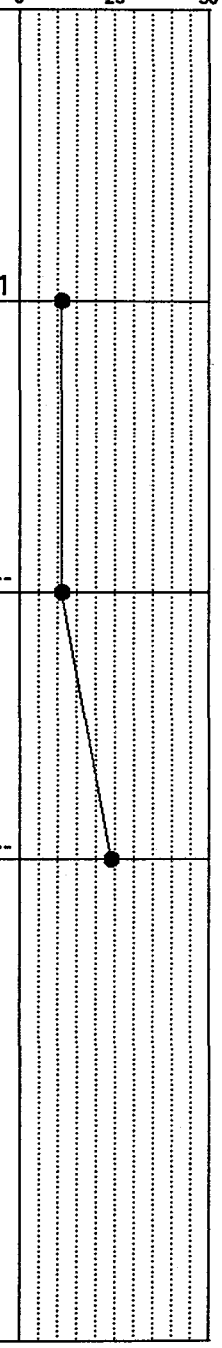
Maricopa County, Arizona

Project No.: 92113SA2

Rig Type: CME-55
Boring Type: Hollow Stem Auger
Surface Elevation: N/A
Sta. 92+40; 25' Lt of CL

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
0	Medium Dense Brown SILTY SAND (SM-Dry) With a Trace of Gravel				
5		RS-1	5.5	4.2	115.1
10		S-2	11.0	--	--
12.0	Very Stiff Brown SANDY CLAY (CL-Dry)				
15		S-3	16.0	--	--
17.5	Dense Brown CLAYEY SAND (SC-Dry) With Some Gravel				
20					
21.0	End of Boring				
25					

Penetration Resistance Blows per Foot (0, 25, 50)



Boring Date: 5-3-93
Field Engineer/Technician: C. Spencer
Driller: K. Heinrich
Contractor: Heber Mining

Water Level

Depth	Hour	Date

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B- 6

Flood Control Channel Improvement

Jackrabbit Road, Sta. 26+40 to 115+50

Maricopa County, Arizona

Project No.: 92113SA2

Rig Type: CME-55
Boring Type: Hollow Stem Auger
Surface Elevation: N/A
Sta. 105+60; 25' Lt of CL

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0	Medium Dense Brown SILTY SAND (SM-Dry) With a Trace of Gravel					
3.5	Loose Brown CLAYEY SAND (SC-Dry) With a Trace of Gravel	S-1	6.0	--	--	
5						
8.0	Very Dense Light Brown SILTY SAND (SM-Dry) With Some Calcareous Cementation and Gravel	RS-2	10.4	--	--	50/11"
10						
13.0	Dense Brown CLAYEY SAND (SC-Dry) With a Trace of Gravel and Calcareous Cementation	S-3	16.0	--	--	
15						
19.0	Hard Brown SANDY CLAY (CL-Dry) With a Trace of Gravel and Calcareous Cementation	S-4	21.0	--	--	50/12"
20						
21.0	End of Boring					
25						

Boring Date: 5-3-93
Field Engineer/Technician: C. Spencer
Driller: K. Heinrich
Contractor: Heber Mining

Water Level

Depth	Hour	Date

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B- 7

Flood Control Channel Improvement

Jackrabbit Road, Sta. 26+40 to 115+50

Maricopa County, Arizona

Project No.: 92113SA2

Rig Type: CME-55
Boring Type: Hollow Stem Auger
Surface Elevation: N/A
Sta. 115+50; 25' Lt of CL

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
0	Medium Dense Brown SAND/SILTY SAND (SW/SM-Dry) With a Trace of Gravel				
5		RS-1	5.5	5.9	114.9
10		S-2	11.0	--	--
12.0	Dense Brown CLAYEY SAND (SC-Dry) With a Little Gravel				
15		S-3	16.0	--	--
20		S-4	21.0	--	--
21.0	End of Boring				
25					

Penetration Resistance Blows per Foot: 0, 25, 50

Boring Date: 5-3-93
Field Engineer/Technician: C. Spencer
Driller: K. Heinrich
Contractor: Heber Mining

Water Level

Depth	Hour	Date

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B- 8

Flood Control Channel Improvement

Jackrabbit Road, Sta. 26+40 to 115+50

Maricopa County, Arizona

Project No.: 92113SA2

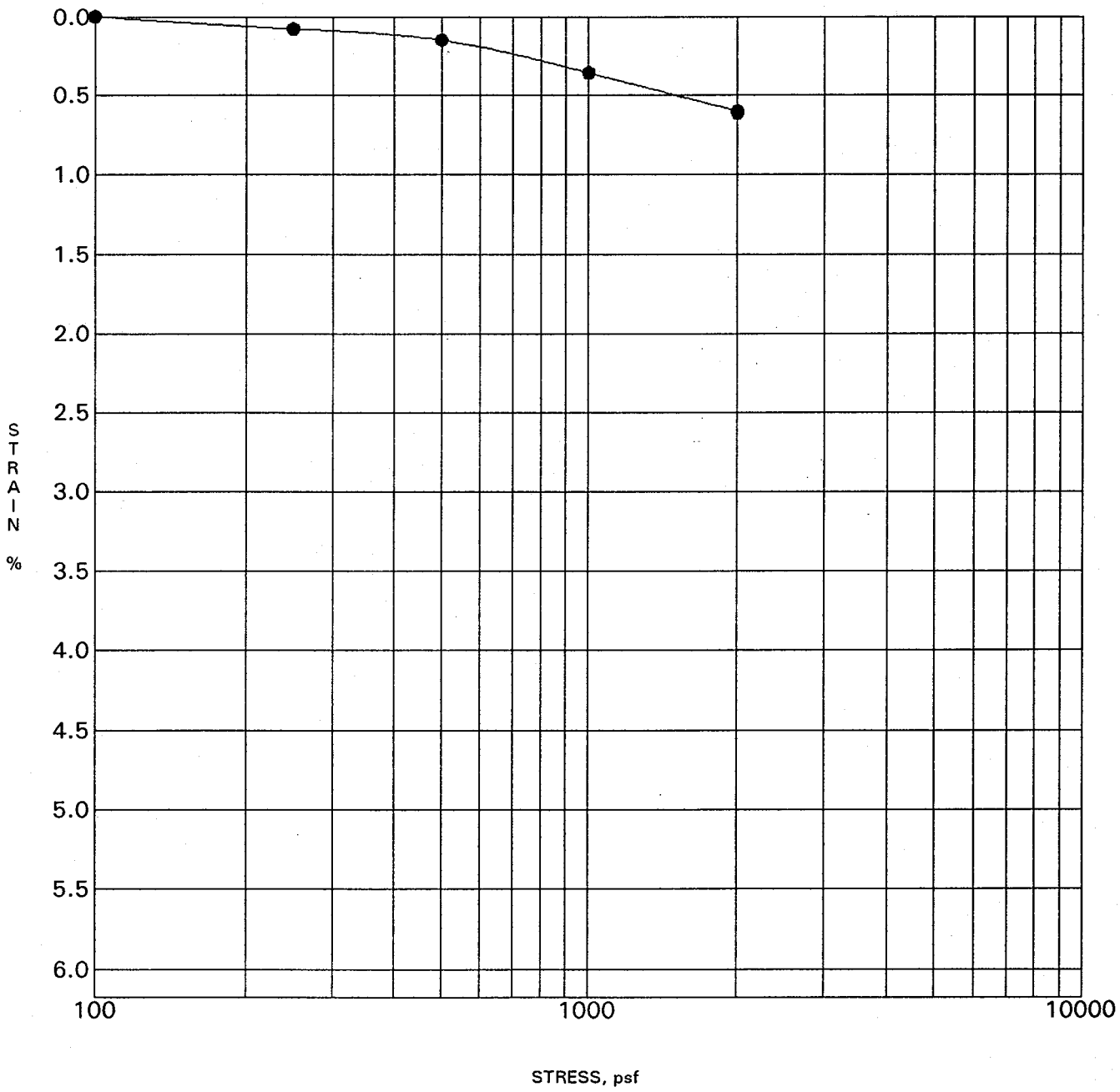
TABULATION OF TEST DATA

PROJECT: Flood Control Channel Improvement - Jackrabbit Road, Sta. 26+40 to 115+50
NUMBER: 92113SA2

Test Boring Number	Sample Depth (feet)	Water Content %	Dry Density (pcf)	<#200 Sieve %	<#40 Sieve %	<#10 Sieve %	<#4 Sieve %	<3" Sieve %	Liquid Limit %	Plastic Limit %	Plast-city Index %	ASTM Classification
B- 1	2.0	7.3	121.4	35	57	82	93	100	31	19	12	SC
B- 2	5.5	16.0	109.2	46	71	94	98	100	39	25	14	SM
B- 3	10.5	7.7	120.3	30	59	86	95	100	27	21	6	SC-SM
B- 4	10.5	5.3	127.5	20	39	67	85	100	21	19	2	SM
B- 5	9.0	--	--	27	42	65	82	100	38	20	18	SC
B- 6	5.5	4.2	115.1	13	38	87	99	100	NP	NP	NP	SM
B- 7	10.4	--	--	17	31	57	77	100	32	28	4	SM
B- 8	5.5	5.9	114.9	9	28	77	95	100	NP	NP	NP	SW-SM
*B-3A/4A	2.0	--	--	40	71	92	98	100	NP	NP	NP	SM
*B-4A/5A	2.0	--	--	12	27	55	72	100	NP	NP	NP	SW-SM
* B-7A	2.0	--	--	15	37	71	81	100	NP	NP	NP	SM

*Respesentative samples from stream bed

CONSOLIDATION TEST



BORING B- 2

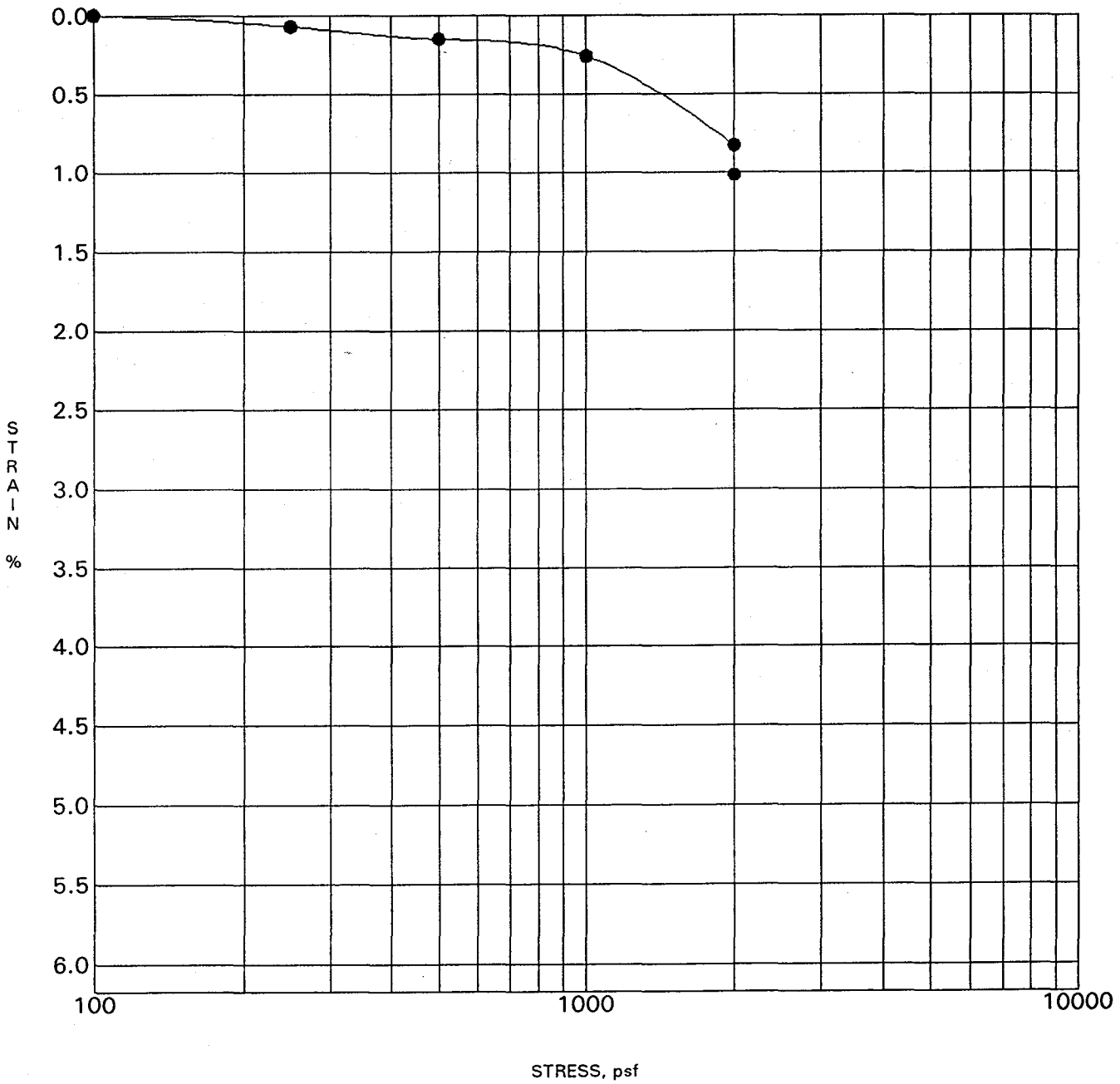
SAMPLE No. RS-1

Sample inundated at end of test at 2000 psf

PROJECT	Flood Control Channel Improvement - Jackrabbit Road, Sta. 26+40 to 115+50	JOB NO.	92113SA2
		DATE	5/3/93

SPEEDIE AND ASSOCIATES

CONSOLIDATION TEST



BORING B- 6

SAMPLE No. RS-1

Sample inundated at end of test at 2000 psf

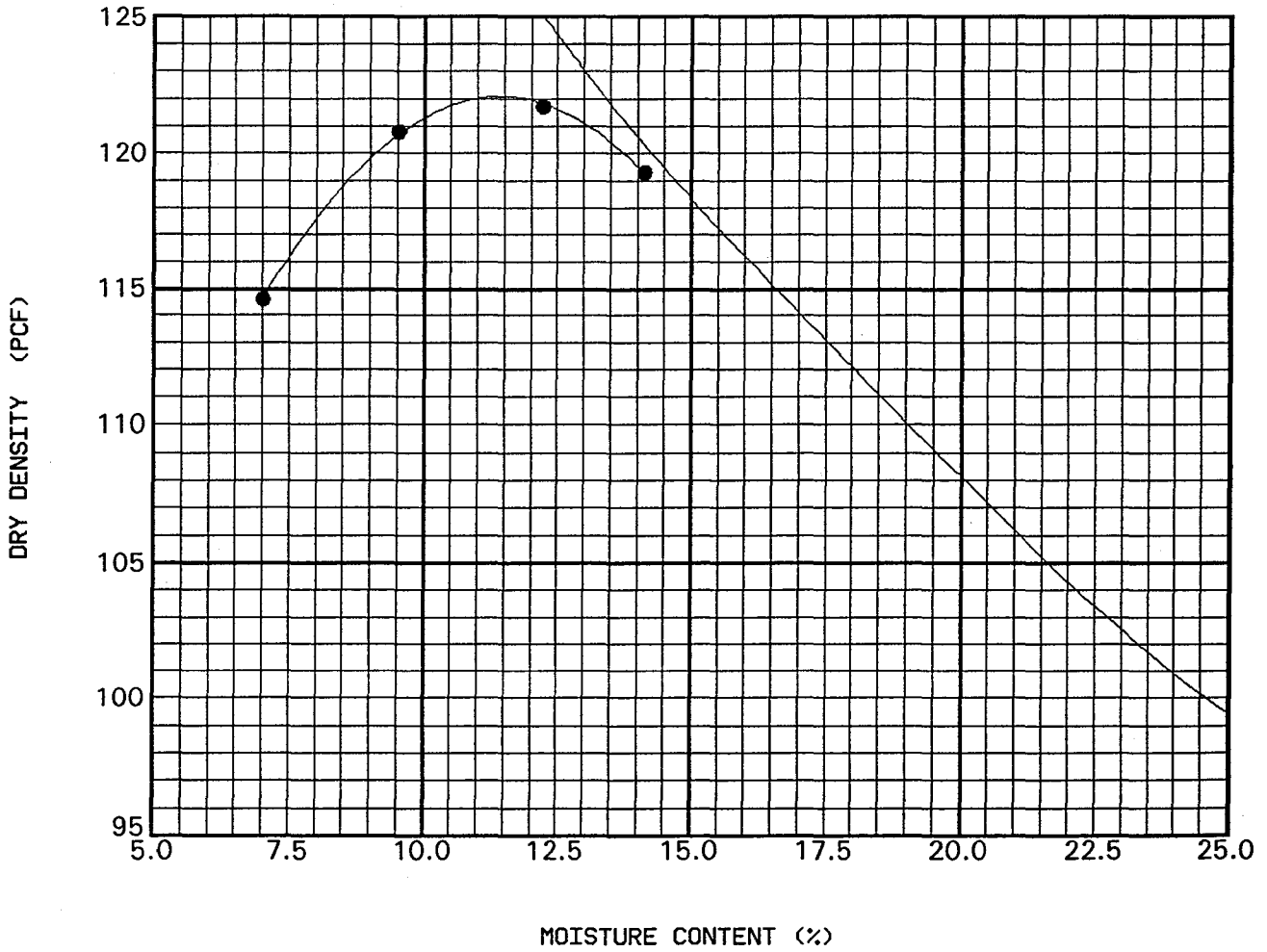
PROJECT	Flood Control Channel Improvement - Jackrabbit Road, Sta. 26+40 to 115+50	JOB NO.	92113SA2
		DATE	5/3/93

SPEEDIE AND ASSOCIATES

MOISTURE-DENSITY RELATIONS

PROJECT: Flood Control Channel Improvemen PROJECT NO.: 92113SA2 DATE: 5/3/93
LOCATION: Jackrabbit Road, Sta. 26+40 to 115+50
BORING NO.: B- 5 SAMPLE NO.: BS-2 SAMPLE DEPTH: 9.00
METHOD OF COMPACTION: ASTM D698A
LIQUID LIMIT: 38 PLASTIC LIMIT: 20 PLASTICITY INDEX: 18
CLASSIFICATION: SC ASTM SOIL DESCRIPTION: CLAYEY SAND with GRAVEL

MAXIMUM DRY DENSITY: 122.8 PCF OPTIMUM MOISTURE CONTENT: 11.1 %



SPEEDIE AND ASSOCIATES

Tabulation of Soil Resistivity and pH

Composite Sample	Average Soil Resistivity	Average pH
B-1 & B-2	3668 ohm-centimeters	8.8
B-3 & B-4	2201 ohm-centimeters	8.6
B-5	1668 ohm-centimeters	9.1
B-7 & B-8	4336 ohm-centimeters	8.4

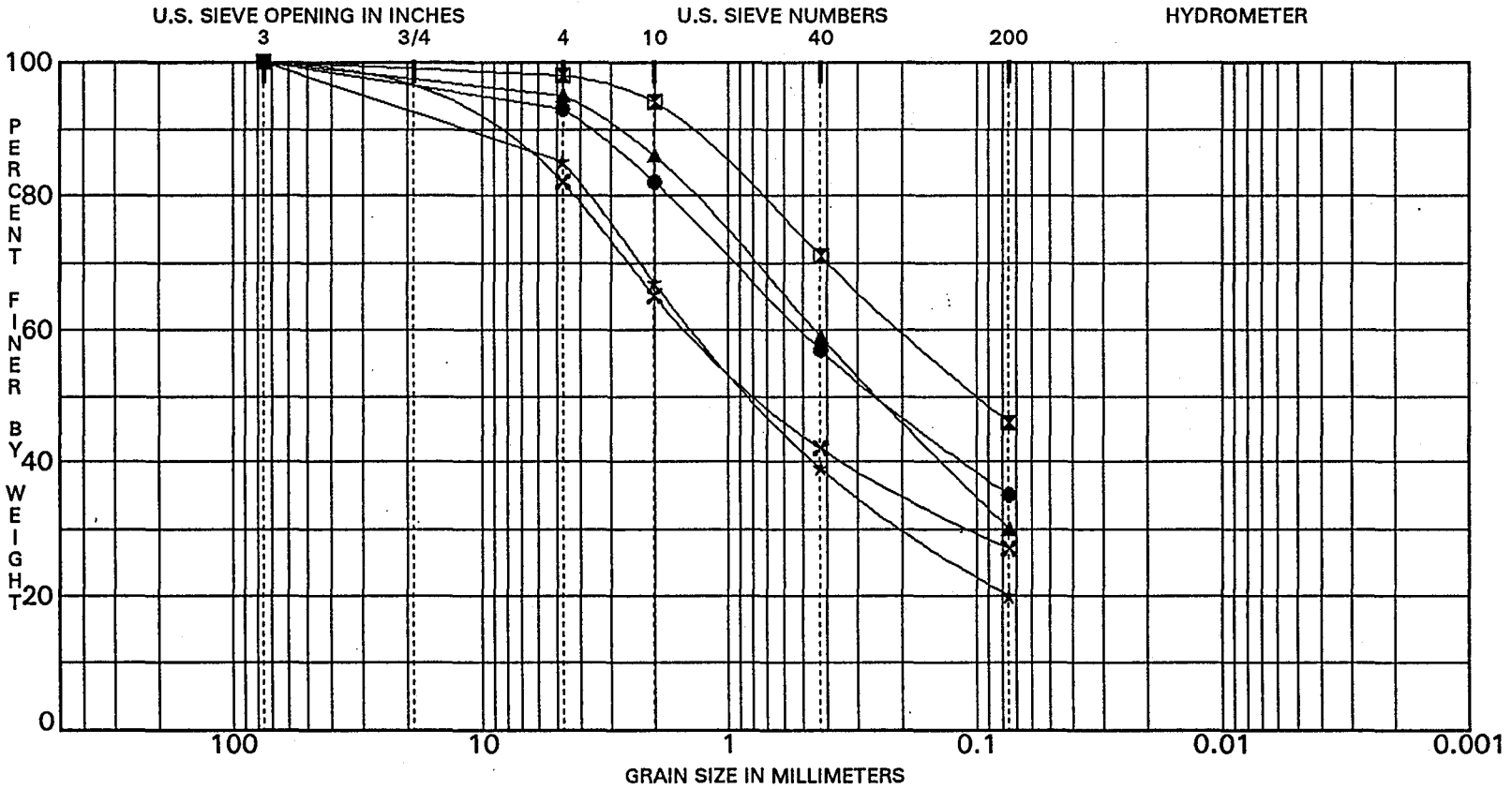
SWELL TEST DATA

BORING/ PIT NO.	SAMPLE DEPTH (FT.)	REMOLDED DRY DENSITY (PCF)	INITIAL MOISTURE CONTENT PERCENT	PERCENT COMPACTION	INITIAL DEGREE OF SATURATION PERCENT	FINAL DEGREE OF SATURATION PERCENT	TOTAL SWELL PERCENT
B-5	9.0	117.1	9.0	95.4*	58	91	2.4

*Based on a maximum dry density of 122.8 pcf at 11.1 percent moisture

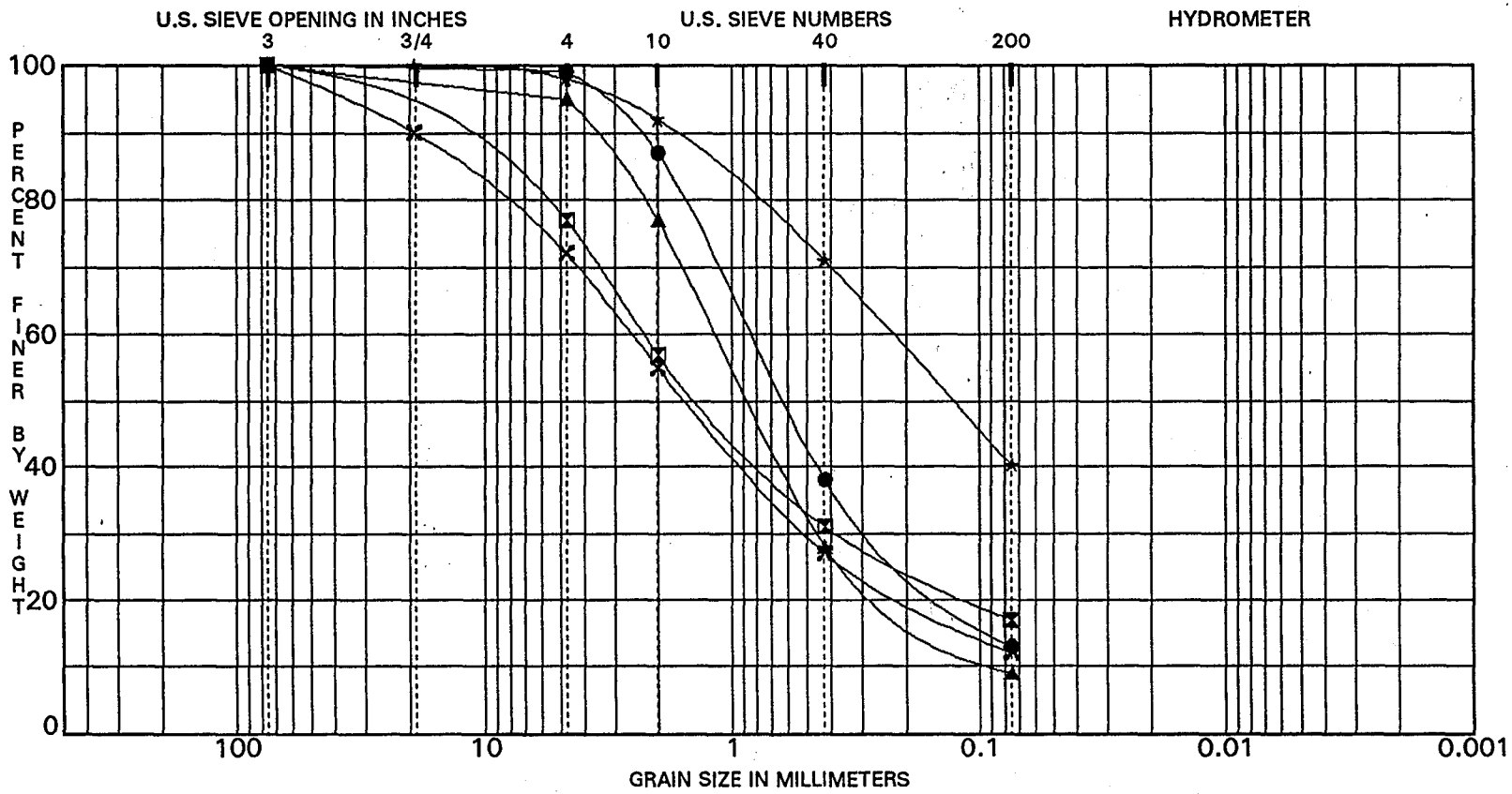
Flood Control
Channel Improvements
Jack Rabbit Trail
Maricopa County, Arizona

SPEEDIE AND ASSOCIATES
GEOTECHNICAL AND SITE ENGINEERS
PROJECT NO. 92113SA2



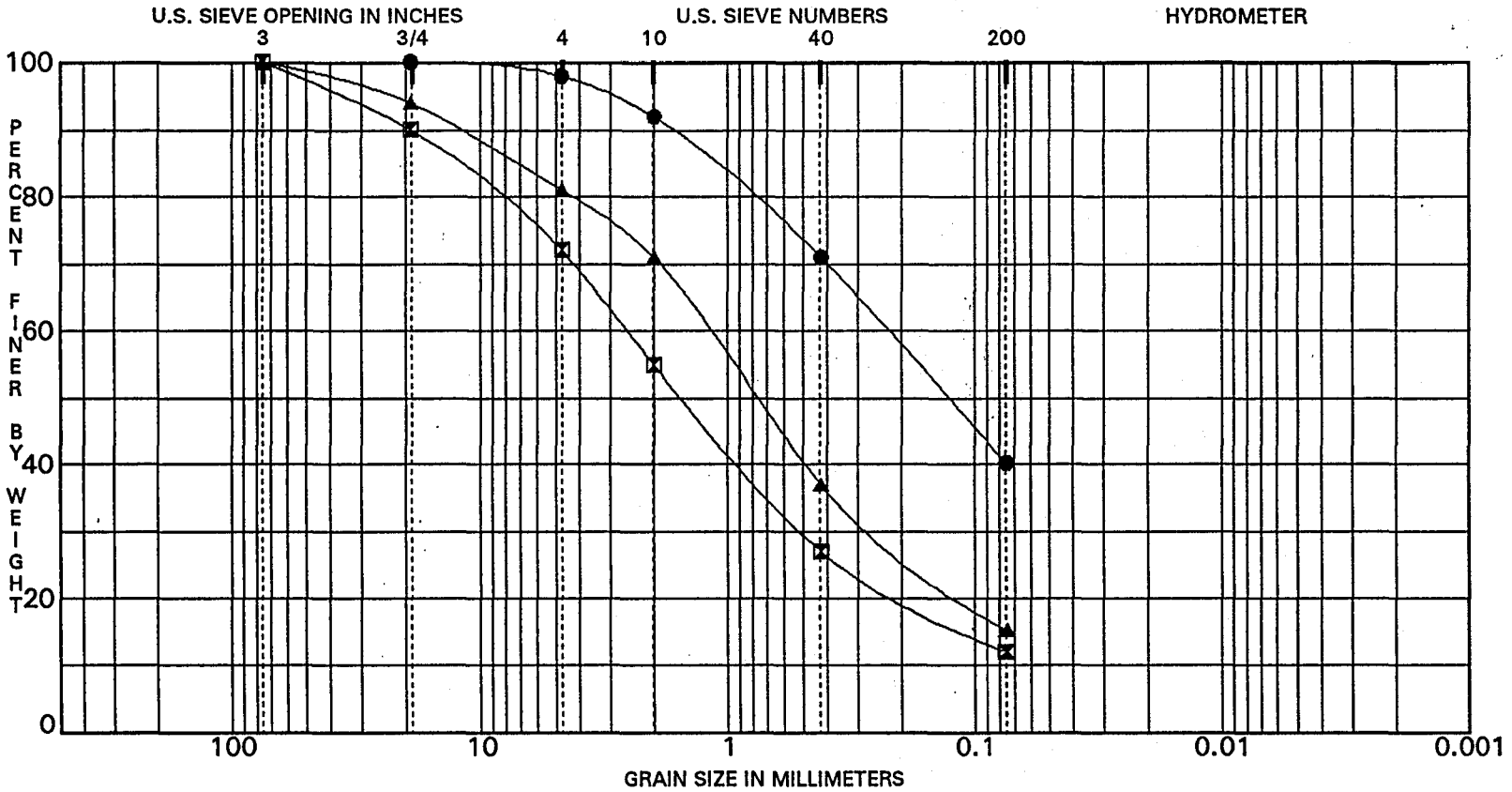
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			ASTM Classification		LL	PL	PI	%Gravel	%Sand	%Fines
●	B- 1	2.0	CLAYEY SAND	SC	31	19	12	7.0	58.0	35.0
⊠	B- 2	5.5	SILTY SAND	SM	39	25	14	2.0	52.0	46.0
▲	B- 3	10.5	SILTY, CLAYEY SAND	SC-SM	27	21	6	5.0	65.0	30.0



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			ASTM Classification		LL	PL	PI	%Gravel	%Sand	%Fines
●	B- 6	5.5	SILTY SAND	SM	NP	NP	NP	1.0	86.0	13.0
⊠	B- 7	10.4	SILTY SAND with GRAVEL	SM	32	28	4	23.0	60.0	17.0
▲	B- 8	5.5	WELL GRADED SAND with SILT	SW-SM	NP	NP	NP	5.0	86.0	9.0



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			ASTM Classification		LL	PL	PI	%Gravel	%Sand	%Fines
●	B-3A/4A	2.0	SILTY SAND	SM	NP	NP	NP	2.0	57.8	40.2
⊠	B-4A/5A	2.0	WELL GRADED SAND with SILT and GRAVEL	SW-SM	NP	NP	NP	28.0	59.9	12.1
▲	B-7A	2.0	SILTY SAND with GRAVEL	SM	NP	NP	NP	19.0	65.7	15.3

HSC

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

WHITE TANKS FLOOD RETENTION STRUCTURE NO. 4
INLET IMPROVEMENTS
CONTRACT NO. FCD 92-38

CONCEPTUAL DESIGN REPORT

Registered Professional Engineer (Civil)
CERTIFICATE NO
12863
KENT M.
DIBBLE
Date Signed 7/29/93
ARIZONA U.S.A.

DIBBLE AND ASSOCIATES
CONSULTING ENGINEERS
PHOENIX, ARIZONA

JULY 29, 1993

INVERT

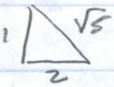
50.5 average width

371 length

area of invert = (50.5)(371)/9 = 2082 SY

WEST BANK

6.7 average hieght



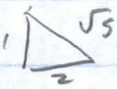
$6.7\sqrt{5} = 14.98 \times 371/9 = 618$

$2 \times 371/9 = 82$

700

EAST BANK

5.9 average hieght



$5.9\sqrt{5} = 13.19 \times 371/9 = 544$

$2 \times 371/9 = 82$

626

TOTAL = 3408 SY

WHITE TANKS FLOOD RETENTION STRUCTURE NO. 4
INLET IMPROVEMENTS
CONTRACT NO. FCD 92-38

CONCEPTUAL DESIGN REPORT

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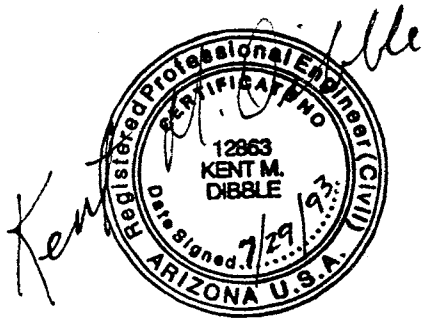


CONCEPTUAL DESIGN REPORT

I. INTRODUCTION

Stormwater run-off from the east slope of the White Tank Mountains currently flows to the southeast and is intercepted by an existing earthen channel just west of Jackrabbit Trail (195th Avenue). Run-off then flows south, paralleling Jackrabbit Trail, crosses an existing box culvert at McDowell Road, and enters an existing concrete-lined channel that crosses Interstate 10. Flows pass through existing box culverts at both ends of the Interstate 10 concrete channel. South of Interstate 10, flows continue in an existing earthen channel that ends at the White Tanks Flood Retention Structure Number 4 (WTFRS #4).

The purpose of the project is to provide an improved flood-control channel capable of intercepting the run-off from a 100-year storm event and conveying the runoff into WTFRS #4.

The limits of this study are from the north-east entrance of the WTFRS #4 to just north of Thomas Road, a distance of approximately two miles. Per the scope of work the existing I-10 box culverts and channel are to remain. Design discharge for the improved inlet channel is 2206 cfs, as provided by the Flood Control District.

Included in the study is an analysis of the existing earthen and concrete channels using the HEC-2 computer program; hydraulic and economic comparisons of various channel linings, alignments, grade control structures; analysis of interception of side-flows from the west; recommendations for a proposed channel; and analysis of the proposed channel with the HEC-2 computer program.

II. EXISTING CONDITIONS HEC-2 WATER SURFACE PROFILES

Input criteria for the HEC-2 model of existing conditions included the following (see Appendix V and VI for HEC-2 input files):

1. Existing sections were surveyed at 500 foot spacing, then interpolated to 100 foot maximum spacing, except in the I-10 reach, where existing sections were surveyed at 50 foot spacing.
2. Manning's n factors of 0.025 for earth and 0.015 for concrete were used.
3. The HEC-2 special bridge method was used at culverts, augmented by traditional culvert hand-calculations.

Analysis of the HEC-2 output for existing conditions yielded the following results (see Appendix V and VI for output files):

1. Reach 1 - WTFRS #4 to I-10 south ramp: HEC-2 iterates to critical depth in both subcritical run and supercritical runs; therefore the existing earthen channel appears to be near the critical slope for the design discharge of 2206 cfs.

2. Reach 2 - I-10 south ramp to I-10 north ramp: Design flow slightly over-tops the south box culvert. The concrete-lined channel between south and north box culverts flows supercritically but conveys the design flow. The north box culvert is surcharged but does not overtop.

3. Reach 3 - I-10 north ramp to McDowell Road box culvert: The existing channel appears to be near the critical slope for the design discharge. The McDowell Road box culvert is surcharged but does not overtop. Since this existing culvert carries the design flows and appears to be constructed to match the full-width (48-feet) of the future Jackrabbit Trail, it is recommended that this structure remain.

4. Reach 4 - McDowell Road box culvert to 1000' north of Thomas Road: existing earthen channel appears to be near critical slope for the design discharge.

5. Capacity of existing channel varies widely with location, due to cross-section variations. By running HEC-2 at several different discharges, and evaluating water surfaces at which existing banks begin to overtop, a plot of Station vs. Flow capacity (Figure I-1, Appendix I) is obtained.

III. FORMULATION OF ALTERNATIVE EVALUATIONS

A. Channel Types Analyzed

Channels were designed to be stable, ie, non-erodible, through the use of velocity control and lining of the bank and bed of the channel. Commonly-used channel liners were analyzed, including the following configurations:

1. Unlined native earth.

2. Plain Rip-rap lined.

3. Reno Mattress (gabion basket) lined.

4. Grouted Rip-rap lined.

5. Soil-Cement lined at 2:1 bank slopes.

6. Soil-Cement lined at 4:1 bank slopes.

7. Shotcrete lined with sloped sidewalls.

8. Concrete lined with vertical sidewalls.

A Grass-lined channel was considered but not evaluated due the cost and difficulty of installing and maintaining an extensive irrigation system in a fairly remote area.

B. Channel Cross-Sections

Standard trapezoidal cross-sections were used for all channel configurations, with the exception of the concrete-lined alternative, which was configured with vertical retaining walls.

The channel cross-sections include a minimum 14 foot access road along the east bank and a 10 foot sheet-flow interceptor swale along the west bank. (See Figure A, page 4.)

The channel cross-section will be modified with access ramps, which per the requirements of the Flood Control District will be required at each grade-control structure to allow vehicular access to the channel for maintenance operations.

C. Horizontal Alignments

The horizontal offset from Jackrabbit Trail allows for a future 70 foot roadway half-right-of-way west of Jackrabbit Trail as per the Maricopa County Department of Transportation (MCDOT). Existing right-of-way varies from 100 feet in Reach 1 and Reach 3 to a minimum of 33 feet in Reach 4. Figure A, page 4 illustrates parameters for channel location and right-of-way determination.

The existing box culverts at McDowell Road and the I-10 on and off-ramps are all within the 70-foot future roadway Right-of-way. It will therefore be necessary to shift the centerline of the proposed channel in the vicinity of these structures to align with the existing culvert centerlines. Horizontal curve lengths used in the transitions were set to meet or exceed the minimums required per the Flood Control District Hydraulics Manual (See Appendix IV).

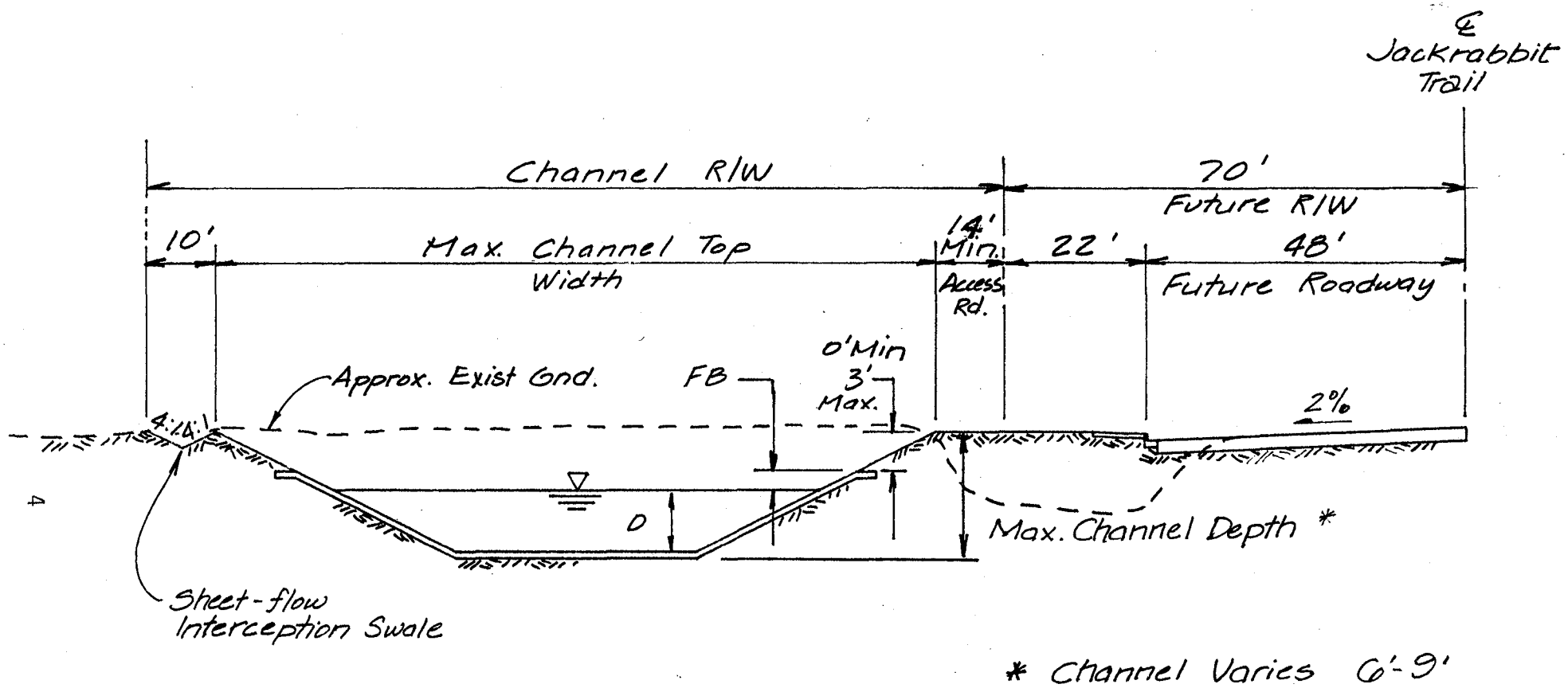
D. Vertical Alignments

Channel depths during analysis were established to meet the following criteria:

1. Match the flowlines of existing controls, ie, the WTFRS #4 inlet, the existing box culvert outlet at the south end of the I-10 channel, the weir inlet at north I-10 box culvert entrance, and the existing McDowell Road box culvert.

2. Maintain the entire channel, including free-board, at or below the existing ground line on the west bank of the channel. This will eliminate the possibility of flooding from bank breach and at the same time will allow sheet-flow from the west to be dropped into the channel at selected locations.

3. Maintain the entire channel below the existing grade of Jackrabbit Trail.



CHANNEL RIGHT-OF-WAY DETERMINATION

N.T.S.

FIGURE A

Most of the channel configurations studied had a flowline slope less than that of the existing ground. Grade-control (drop) structures were therefore required in order to establish the required channel slope. Drop structure height was held to a maximum of three feet for safety reasons. To avoid the relatively high cost of Baffle Chute and Sloping Concrete type drops, a straight drop spillway was selected for evaluation. Appendix III contains spillway and basin sizing and economic calculations. Economic and structural comparisons resulted in the selection of reinforced-concrete wall drop configuration and concrete basin lining.

E. Hydraulic Design Criteria

Hydraulic Design criteria used in the development of channel sections conform to the requirements of the Flood Control District Drainage Design Manual, Volume II, Hydraulics. Table A, page 6 contains a summary of hydraulic criteria used in development of channel alternatives.

1. Earth-lined channel. The project geotechnical report ("Report on Geotechnical Investigation" dated May 1993, prepared by Speedie and Associates) indicated that the existing site soils are relatively fine-grained sands subject to erosion at maximum velocities greater than 2 to 3 fps. Therefore, 3 fps was selected as the maximum allowable velocity for the earthen alternative. Maximum side-slopes were limited to 4:1, with a maximum allowable Froude number of 0.85 (subcritical flow). A Manning's n factor of 0.025 was assumed.

2. Plain Rip-rap lined channel. The maximum allowable velocity for plain rip-rap liner is 9 fps. Maximum side-slopes were limited to 3:1, with a maximum allowable Froude number of 0.85 (subcritical flow).

   Table I-2, Appendix I, contains calculations for Manning's n value and stone size for rip-rap. Stone size analysis based on the U.S. Army Corps of Engineer's "Hydraulic Design of Flood Control Channels" procedure indicated that a D_{50} of 4" is adequate, however, a separate analysis of stone size based on SCS HEC-15 criteria yields a more-conservative D_{50} value of 6". A D_{50} value of 6" was assumed for analysis of alternatives. A Manning's n of 0.035 was used.

3. Reno Mat (gabion) lined channel. The maximum allowable velocity for Reno Mat liner is 9 fps. Maximum side-slopes were limited to 2:1, with a maximum allowable Froude number of 0.85 (subcritical flow). A Manning's n factor of 0.029 was used.

4. Grouted Rip-rap lined channel. The maximum allowable velocity for grouted rip-rap liner is 9 fps. Maximum side-slopes were limited to 2:1, with a maximum allowable Froude number of 0.85 (subcritical flow). A Manning's n factor of 0.029 was used.

TABLE A

WHITE TANKS FLOOD RETENTION STRUCTURE NO. 4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38 HYDSUMM

CHANNEL HYDRAULICS DESIGN CRITERIA SUMMARY

CHANNEL TYPE	MAX BANK SLOPE	MAX. VELOCITY (FPS)	MANNING'S n	FROUDE NUMBER
EARTH	4:1	3(2)	0.025	LESS THAN 0.85
PLAIN RIPRAP	3:1	9	0.035(3)	LESS THAN 0.85
RENO MAT	2:1	9	0.029(4)	LESS THAN 0.85
GROUTED RIPRAP	2:1	9	0.025(5)	LESS THAN 0.85
SOIL-CEMENT	2:1	9	0.020	LESS THAN 0.85
SHOTCRETE	2:1	15	0.019	LESS THAN 2, MORE THAN 1.35, OR LESS THAN 0.85
CONCRETE	0:1	15	0.015	LESS THAN 2, MORE THAN 1.35, OR LESS THAN 0.85

NOTES:

(1) ALL VALUES PER THE FCD HYDRAULICS MANUAL VOL. II UNLESS OTHERWISE NOTED.

(2) BASED ON HIGH END OF ALLOWABLE RANGE PER GEOTECHNICAL REPORT.

(3) U.S.DOT HEC-15.

(4) "HYDRAULIC TESTS TO DEVELOP DESIGN CRITERIA FOR THE USE OF RENO MATTRESSES", COLORADO STATE UNIVERSITY, 1984.

(5) "DESIGN OF FACILITIES TO MANAGE STORMWATER RUNOFF", CITY OF SCOTTSDALE, JUNE 1988.

5. Soil-cement lined channel. The maximum allowable velocity for soil-cement liner is 9 fps. A maximum allowable Froude number of 0.85 (subcritical flow), and a Manning's n factor of 0.029 were used.

   Two alternatives were evaluated for channel sideslope, involving different construction techniques in each case. Channel banks as steep as 2:1 are normally constructed in horizontal lifts about 8 feet wide and 6 inches deep, with each lift being offset horizontally from the previous one. This horizontal "stair-step" offset forms the sloped channel bank. An alternate construction technique is used with bank slopes 4:1 or flatter, involving 6 inch lifts laid parallel to the bank slope. Both 2:1 and 4:1 options were analyzed.

6. Shotcrete lined channel. The maximum allowable velocity for shotcrete (pneumatically-applied mortar) liner is 15 fps. Maximum side-slopes were limited to 2:1. A maximum allowable Froude number of 2.0 was used, since shotcrete channels may be allowed to flow supercritically. However, in order to avoid unstable flow, the Froude number was restricted to be greater than 1.35 or less than 0.85. A Manning's n factor of 0.019 was used.

7. Concrete lined channel. The maximum allowable velocity for concrete (vertical retaining walls) liner is 15 fps. A maximum allowable Froude number of 2.0 was used, since concrete channels may be allowed to flow supercritically. However, in order to avoid unstable flow, the Froude number was restricted to be greater than 1.35 or less than 0.85. A Manning's n factor of 0.015 was selected.

F. Development of Alternatives

A computerized spreadsheet hydraulic "model" incorporating the required hydraulic parameters and using uniform-flow formulas was developed to allow calculation of multiple channel sections for each type of liner. Channel cross-sections and slopes were calculated for each alternative at depths ranging from 1 foot to 9 feet of flow.

A simple economic "model" was also developed. Using the channel configuration from the hydraulic model, various costs (excavation, right-of-way, liner, drop structure, fencing) were calculated at each depth of flow for each alternative.

The two models allowed for preliminary comparison and selection of flow depth using the following procedure:

- The least-cost section was selected from the economic model.

- Using the cross-section and slope for the selected section (as calculated in the hydraulic model), the profile of the channel was plotted on plan and profile against the existing ground and analyzed for conformance to the criteria identified in the **"Vertical Alignments"** section, page 3, (ie, matching existing structures, accepting flows from the west, etc.).

- By trial and error plots of channel slope versus existing ground, a maximum allowable depth of channel was obtained.

Table I-2, Appendix II defines and discusses the symbols and parameters used in both the hydraulic and the economic models.

1. Channel Hydraulic Models

Table I-3, Appendix I illustrates the spreadsheet used to calculate channel configurations for earthen channels of varying depths. Similar "models" were done for the other liner alternatives evaluated.

Channel configurations were calculated as follows: Channel discharge (Q), n factor, side-slopes (Z), and depth (D_n) were all fixed. Channel base width (b) and slope (S_o) were then iterated until the maximum allowable velocity was met. The maximum Froude number was then checked and the section properties reiterated if required. Critical-flow properties, freeboard, and additional channel geometric information were calculated based on the iterated section.

Figure I-2, Appendix I illustrates a plot of channel top and base widths as a function of flow depth. A point of "diminishing returns" is evident, where increasing the depth of flow has little effect on total channel width.

2. Channel Economic Models

Table I-3, Appendix I also contains the economic analysis of the earth channel which calculates comparative costs for the channel configurations developed in the hydraulic "model". Simplifying assumptions include the following:

a. Excavation of the channel cross-section in level ground.

b. A fixed cost for right-of-way, regardless of location. According to the Flood Control District, right-of-way cost are expected to be higher in the vicinity of I-10, however, approximately one-half of the channel is fairly close to 1-10, so an average cost for right-of-way was assumed.

c. All channel construction in new right-of-way.

d. A per-foot-of-width cost for channel drop structures. Per foot cost were calculated for the cost of the drop structure and a net cost for liner, ie, the difference between liner required above and below the drop structure (apron and jump basin) and the cost for the "displaced" area of liner for the rest of the channel.

e. Channel fencing required only on channel slopes steeper than 2:1. (Note that with increasing urbanization, channel fencing would be recommended on slopes steeper than 3:1 in the future).

Appendix II contains the derivation of channel quantities and assumptions as to unit prices for channel construction materials and operations. Table B page 10 summarizes the unit prices used in the economic models.

Similar economic evaluations were conducted for each of the liner alternatives studied.

G. Utility Conflicts

Preliminary review of existing utilities indicate that the only major conflict involves an existing 6" waterline located west of Jackrabbit Trail in the Encanto Boulevard Alignment. All channel options will require vertical relocation and protection of this waterline, however, the cost for this work does not vary significantly for the various channel widths and will not influence selection of the most economical channel.

IV. SELECTION OF BEST CHANNEL CONFIGURATION BY LINER TYPE

A. Unlined Earthen Channel

Review of Table I-3, Appendix I shows that the most economical earthen channel is also the deepest channel.

Plotting the most economical channel (9 foot depth of flow) on plan and profile revealed that construction of the deeper channel section would require elevating the channel banks above the surrounding grades.

Several trial-and-error iterations resulted in selection of a maximum allowable total channel depth of around six feet. This depth best meets all of the requirements listed under **"Vertical Alignments"** section, page 3. The corresponding flow depth for this configuration is 4.5 feet. (NOTE: somewhat deeper channel sections would be possible if the McDowell Road box culvert were removed.)

Figure I-3, Appendix I illustrates the cross-section data for the selected earthen channel.

B. Plain Rip-rap Lined Channel

Table I-4, Appendix I indicates that the most economical section occurs at a flow depth of 6 feet. Note that shallow channels (up to 4 feet) with the maximum allowable velocity of 9 fps were unstable, so the maximum Froude number governed, resulting in velocities significantly less than the maximum allowable. Also note that "NA" in the "Drops" column of the economic analysis indicates that the channel slope is steeper than the existing ground slope, effectively ruling out those sections from a constructibility standpoint.

As with the earthen channel, profile plots yielded a "best fit" section with a total depth of 6 feet, with a corresponding depth of flow of 4.5 feet.

TABLE B

WHITE TANKS FLOOD RETENTION STRUCTURE #4 INLET CHANNEL — JOB 9302

FCD PROJECT NO. 92-38 — PRICESUM

UNIT PRICE SUMMARY

ITEM NO.	DESCRIPTION	BASE UNIT PRICE	UNIT	ESTIMATING UNIT PRICE	UNIT
1	EXCAVATION	$3.00	CY	$3.00	CY
2	PLAIN RIPRAP LINER	$40.00	CY	$2.22	SF
3	RENO MAT (GABION) LINER	$90.00	CY	$3.40	SF
4	GROUTED RIPRAP LINER	$65.00	CY	$2.40	SF
5	SOIL-CEMENT LINER (4:1)	$30.00	CY	$1.11	SF
6	SOIL-CEMENT LINER (2:1)	$30.00	CY	$4.00	SF
7	SHOTCRETE LINER	$150.00	CY	$2.80	SF
8	CONCRETE LINER (RET.WALLS)	$200.00	CY (CONC.)	$18.00	LF (4' HIGH)
		$0.35	LB (STEEL)	$15.00	LF (12' HIGH)
9	DROP STRUCTURES				
	A. IN EARTH CHANNEL	$400.00	LF	$400.00	LF
	B. IN RIPRAP CHANNEL	$405.00	LF	$405.00	LF
	C. IN RENO MAT CHANNEL	$215.00	LF	$215.00	LF
	D. IN GROUTED RIPRAP CHANNEL	$330.00	LF	$330.00	LF
	E. IN SOIL-CEM (4:1) CHANNEL	$475.00	LF	$475.00	LF
	F. IN SOIL-CEM (2:1) CHANNEL	$450.00	LF	$450.00	LF
	G. IN SHOTCRETE CHANNEL	$325.00	LF	$325.00	LF
	H. IN CONCRETE CHANNEL	$270.00	LF	$270.00	LF
10	FENCE AND GATES	NA	NA	$10.00	LF
11	RIGHT-OF-WAY	NA	NA	$13,500.00	ACRE

Figure I-5, Appendix I illustrates the cross-section data for the selected rip-rap channel.

C. Reno Mattress (Gabion) Lined Channel

Table I-5, Appendix I indicates that the most economical section occurs at a flow depth of 8.5 feet.

As with the earthen channel, profile plots yielded a "best fit" section with a total depth of 6 feet, with a corresponding depth of flow of 4.5 feet.

Figure I-7, Appendix I illustrates the cross-section data for the selected Reno Mat channel.

D. Grouted Rip-rap Channel

Table I-6, Appendix I indicates that the most economical section occurs at a flow depth of 6.5 feet.

As with the earthen channel, profile plots yielded a "best fit" section with a total depth of 6 feet, with a corresponding depth of flow of 4.5 feet.

Figure I-9, Appendix I illustrates the cross-section data for the selected grouted rip-rap channel.

E. Soil-cement Lined Channel (4:1 Side-slopes)

Table I-7, Appendix I indicates that the most economical section occurs at a flow depth of 6 feet. Note, however, that in the flow depths ranging from 4.5 feet to 9 feet, total costs are roughly comparable, and removing the McDowell Road culvert to allow a deeper section would not justify the cost of replacing the culvert.

As with the earthen channel, profile plots yielded a "best fit" section with a total depth of 6 feet, with a corresponding depth of flow of 4.5 feet.

Figure I-11, Appendix I illustrates the cross-section data for the selected soil-cement lined channel.

F. Soil-cement Lined Channel (2:1 Side-slopes)

Table I-8, Appendix I indicates that the most economical section occurs at a flow depth of 4.5 feet.

As with the earthen channel, profile plots yielded a "best fit" section with a total depth of 6 feet, with a corresponding depth of flow of 4.5 feet. In this case, the most economical section is also the section that best fits the existing conditions.

Figure I-12, Appendix I illustrates the cross-section data for the selected soil-cement lined channel.

G. Shotcrete Lined Channel

Table I-9, Appendix I indicates that the most economical section occurs at a flow depth of 6 feet. Note that with a depth of flow up to 1.5 feet, the maximum Froude number governs over allowable velocity, and at depths of flow deeper than 6.5 feet, supercritical channels tended to be unstable, and were therefore forced into the sub-critical flow regime.

As with the earthen channel, profile plots yielded a "best fit" section with a total depth of 6 feet, with a corresponding depth of flow of 4 feet. The lower depth of flow vs. the more-common 4.5 feet is due to higher free-board required at supercritical flows.

Note that the "jump" in channel widths on Figure I-13, Appendix I corresponds to the transition point from the more hydraulically-efficient supercritical sections to subcritical sections.

Figure I-14, Appendix I illustrates the cross-section data for the selected shotcrete lined channel.

H. Concrete Lined Channel

Table I-10, Appendix I indicates that the most economical section occurs at a flow depth of 3.5 feet.

Note that with a depth of flow up to 1.5 feet, the maximum Froude number governs over allowable velocity, and at depths of flow deeper than 4 feet, channels tend to be unstable, and are therefore forced into the sub-critical flow regime.

As with the earthen channel, profile plots yielded a "best fit" section with a total depth of 6 feet, with a corresponding depth of flow of 4 feet. (The lower depth of flow vs. the more-common 4.5 feet is due to higher free-board required at supercritical flows.) However, since the most economical section results at a total channel depth of 5 feet and a corresponding depth of flow of 3.5 feet, this is the selected concrete-lined configuration.

Note that the "jump" in channel widths on Figure I-15, Appendix I corresponds to the transition point from the more hydraulically-efficient supercritical sections to subcritical sections.

Figure I-16, Appendix I illustrates the cross-section data for the selected concrete lined channel.

V. COMPARISON OF ALTERNATIVES

A. Ranking by Least Cost

Table C, page 13 lists each of the selected channel configurations by liner type, ranked in ascending order by total estimated cost. Channel base-widths and slopes have been rounded to "constructible" numbers.

Comparative costs range from $2.29 million for the Shotcrete liner to $3.96 million for the vertical-wall Concrete liner.

TABLE C

WHITE TANKS FLOOD RETENTION STRUCTURE #4 INLET CHANNEL

JOB 9302

FCD PROJECT NO. 92-38

ALLSUM

CHANNEL CONFIGURATION SUMMARY

CHANNEL TYPE	Qn (CFS)	n	Z	So ('/')	BASE WIDTH (FT)	Dn (FT)	Vn (FPS)	FLOW REGIME	FROUDE NO.	CHAN. D (FT)	NO. OF Drops	FB (FT)	W.S. tw (FT)	CHAN. Tw (FT)	ROW W (FT)	TOTAL COST $
SHOTCRETE	2206	0.019	2	0.0079	28	4.06	15.03	SUPER	1.45	6.06	3	2.00	44	52	88	$2,288,000
SOIL-CEMENT	2206	0.020	4	0.0028	36	4.59	8.85	SUB	0.84	6.04	19	1.45	73	84	132	$2,760,000
RIPRAP	2206	0.035	3	0.0083	40	4.56	9.01	SUB	0.83	6.02	2	1.46	67	76	119	$2,811,000
SOIL-CEMENT	2206	0.020	2	0.0025	45	4.54	8.98	SUB	0.80	5.89	20	1.45	63	69	105	$3,147,000
GRTED RIPRAP	2206	0.025	3	0.0042	40	4.57	8.99	SUB	0.83	6.03	15	1.46	67	76	118	$3,221,000
RENO MAT	2206	0.029	2	0.0053	45	4.53	9.01	SUB	0.81	5.98	11	1.44	63	69	105	$3,475,000
CONCRETE	2206	0.015	0	0.0053	42	3.50	15.00	SUPER	1.41	5.50	11	2.00	42	42	66	$3,564,000
EARTH	2206	0.025	4	0.0004	145	4.50	3.01	SUB	0.26	5.66	26	1.16	181	190	238	$3,958,000

B. Discussion of Most-economical Channels

1. Shotcrete-lined channel. The Shotcrete-lined channel ranked first on the least-cost list. Channel slopes are comparatively steep (due to the high allowable velocity of 15 fps) and are close to the existing ground slope, resulting in very few drop structures. Channel fencing would most likely be required in the future as the area develops increasing the cost of this section.

   The minimal channel section (and therefore minimal right-of-way) are a result of the hydraulically-efficient supercritical flow regime. However, because of the supercritical flow regime, and the relatively steep (2:1) side-slopes, this section is undesirable from a safety, maintenance, and potential failure standpoint. This is particularly true due to the number of horizontal alignment transitions and culvert entrance/exit transitions, which are highly undesirable in supercritical flow. Given these concerns, a supercritical channel section is not recommended.

   Forcing the shotcrete channel sections into the less-efficient subcritical flow regime results in a 6 foot deep channel cost of around $3.2 million, eliminating this section's cost advantage.

2. Soil-cement lined channel. The Soil-cement Channel with 4:1 side-slopes ranks second on the least-cost list (Table C). According to the geotechnical report, the relatively low-plasticity sandy nature of the existing soils makes them suitable for soil-cement mixtures. A trial mix design conducted by Speedie and Associates resulted in a required cement content of 11%, for a 7-day compression strength of 750 psi.

   Channel slope is fairly flat, resulting in three-foot drop structures spaced at approximately 500 foot intervals. The relatively high design velocity of 8.85 fps means that at lower flows, channel velocities should not result in sediment deposition problems. (Flow of 30 cfs results in velocity of 2 fps.)

   Total channel right-of-way at 132 feet is at the high end of the general range (excluding the earthen channel) of 66 feet to 132 feet. However, from a safety perspective, the flat side-slopes are an advantage considering the somewhat remote location.

3. Plain Rip-rap lined channel. The rip-rap lined channel ranked third on the least-cost list (Table C). Channel slopes are comparatively steep (due to the high "roughness" factor of rip-rap) and are close to the existing ground slope, resulting in the fewest number of drop structures of all the alternatives studied. As with the soil-cement channel, velocities at low flows will be high enough to reduce sedimentation problems.

   Channel right-of-way at 119 feet is in the mid-range of the general range of widths. The 3:1 side-slopes represent an improvement in safety when compared to the 2:1 slopes of the shotcrete channel but still could require fencing in the future due to increasing urbanization.

The Flood Control District requirement that all rip-rap lined channels in urban areas with D_{50} sizes less than one foot be "plated" with earth to reduce vandalism could also represent a significant future capital and maintenance cost.

VI. RECOMMENDATION OF CHANNEL TYPE

Due to the least expected initial cost (for subcritical sections) good hydraulic performance, reasonable channel width, and superior safety characteristics, the Soil-Cement lined channel with 4:1 side-slopes is recommended.

VII. CHANNEL DESIGN DISCUSSION

A. Transition to WTFRS #4

The maximum water surface elevation in the retention structure to be used for channel design (as provided by the Flood Control District) is below the invert elevation of the improved channel, therefore impounded water in the retention structure will not backwater the improved channel.

The improved channel outlet transition was shifted to the west of the existing channel inlet point to maintain an approximately 165 feet clearance from the existing emergency spillway, located at the northeast corner of the retention structure (see plans in overleaf).

The existing channel at the northeast corner of the WTFRS #4 is fairly wide and poorly defined. It does not appear that the water surface in this channel will provide adequate "tailwater" control in the new channel. Some form of grade control is therefore recommended at the beginning of the improved channel.

Positive grade control through use of a drop structure at the south end of the improved channel would require elevating the banks significantly above existing bank grades. In order to avoid this, grade control through an elevated counterweir is proposed. The counterweir height (designed as a broad-crested weir) and width establishes a weir critical depth close to the normal depth of the upstream channel. A widened channel section (from the standard 36 foot base to a 90 foot base) is recommended to reduce flow velocities at the outlet of the improved channel.

HEC-2 analysis of the transition section using a soil-cement liner indicated that as the flow entered the transition flare, it accelerated through critical depth prior to encountering the backwater curve from the counterweir. In order to avoid the resultant excessive velocities, a channel lining of rip-rap from the beginning of the flare to the channel outlet is proposed. The higher n factor of rip-rap, along with a somewhat flatter channel slope, reduces flow velocities to an acceptable level.

B. Horizontal Channel Transitions

Transitions into and out of existing structures at I-10 and McDowell Road are based on channel deflection angles not exceeding thirty degrees, with maximum taper rates of 5:1. Minimum circular curves are as required by the Flood Control District Hydraulics manual.

C. Reach 3 Channel Configuration and Location

Construction of the new channel at Reach 3 (I-10 north ramp to McDowell Road culvert) outside of the future 70 foot roadway right of way was evaluated, however, it was determined that the length of horizontal channel transitions from the desired alignment to the box culvert structures was so long and the reach so short that very little channel would be constructed in the "ultimate" location. It is therefore recommended that the new channel be constructed to align with the existing structures in this reach, recognizing that this will be an "interim" facility requiring replacement in the future when Jackrabbit Trail is widened to its ultimate width.

Since both the McDowell Road box culvert at the north end and the I-10 ramp box culvert at the south end of this reach are both approximately 50 feet wide, a 50 foot base channel width is recommended. Additionally, due to the proximity of the channel to Jackrabbit Trail, a 2:1 sideslope will be required on the west bank. The 2:1 sideslope will require additional guardrail connecting the existing guardrail from the 1-10 culvert to the McDowell Road Culvert.

Appendix IV page IV-2 includes hydraulic calculations for this modified section.

D. Side Inlets

Major existing washes generally invert into the new channel at or above the design bank elevation. These washes will be allowed to flow into the new channel along the 4:1 slope. Each of the side-inlets will require construction of a dedicated apron, extending from the top of bank liner to the right-of-way.

Side inlets were sized to accommodate run-off volumes calculated as follows:

1. Using contour maps, the approximate existing wash slope, sideslope, and maximum flow depth was estimated. Analysis of the wash contours yielded an estimated maximum flow depth of approximately 1 foot. Using this channel information, the estimated "bank-to-bank" channel capacity was calculated (see Appendix IV, pages IV-5 through IV-14).

2. As a comparative check, approximate run-off volumes were also calculated by drainage area using the Rational Method. These estimated volumes are shown in Appendix IV pages IV-5 through IV-14.

3. The smaller of the two estimated flows was used to size the apron required for side-inlets. To simplify construction, two apron sizes were calculated, one to carry flows up to 75 cfs and one to carry flows up to 120 cfs. (See Appendix IV page IV-4). The resultant aprons are 8 feet wide by 1 foot deep, and 16 feet wide by 1 foot deep respectively.

Sheet flow from the west will be collected in a shallow interceptor swale at the west bank and dropped into the new channel at the existing wash locations, if available, or at an approximate maximum spacing of 500 feet.

E. Drop Structure Locations

If possible, drop structures were located above major side inlets to reduce the potential disruption to weir flow. Drop structure locations were adjusted to allow drops downstream of future roadway crossings, to minimize future bridge depths and therefore construction costs.

F. Channel Access

In conformance with Flood Control District requirements, 14 foot wide access ramps were provided between each drop structure for ease of maintenance. Ramp slopes were set at approximately 8%.

Access ramps were placed close to each drop structure to take advantage of the narrower channel at the drop locations. Note that addition of access ramps to the soil-cement channel resulted in an increase of right-of-way required from the 132 feet identified in the hydraulic model to an actual width of 138 feet.

G. Proposed Channel HEC-2 Water Surface Profiles

The HEC-2 "channel improvement" option was used to incise the new channel into the existing ground cross-sections. In several locations, existing bank elevations were artificially raised to allow the "channel improvement" option to cut in a simulated embankment condition.

The "Proposed Channel" HEC-2 model was used to refine channel transitions, evaluate hydraulic conditions at the existing structures, and to define the channel water surface profile and energy grade line.

The HEC-2 input and output (selected summary tables) is included in Appendix VII.

H. Proposed Channel Plan and Profile

The overleaf pocket contains 100-scale plan and profile sheets of the proposed improvements along with side-inlet and access ramp details.

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2	APPENDIX II	QUANTITY AND PRICE DERIVATIONS FOR COST COMPARISONS
3	APPENDIX III	GRADE CONTROL STRUCTURE CALCULATIONS
4	APPENDIX IV	SELECTED CHANNEL DESIGN DATA
5	APPENDIX V	"EXISTING CONDITIONS" HEC-2 INPUT AND OUTPUT - SUBCRITICAL
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7	APPENDIX VII	"PROPOSED CHANNEL" HEC-2 INPUT AND OUTPUT

APPENDIX I

CHANNEL HYDRAULIC AND ECONOMIC CALCULATIONS

APPENDIX I - CHANNEL HYDRAULIC AND ECONOMIC CALCULATIONS

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EXISTING CHANNEL CAPACITY

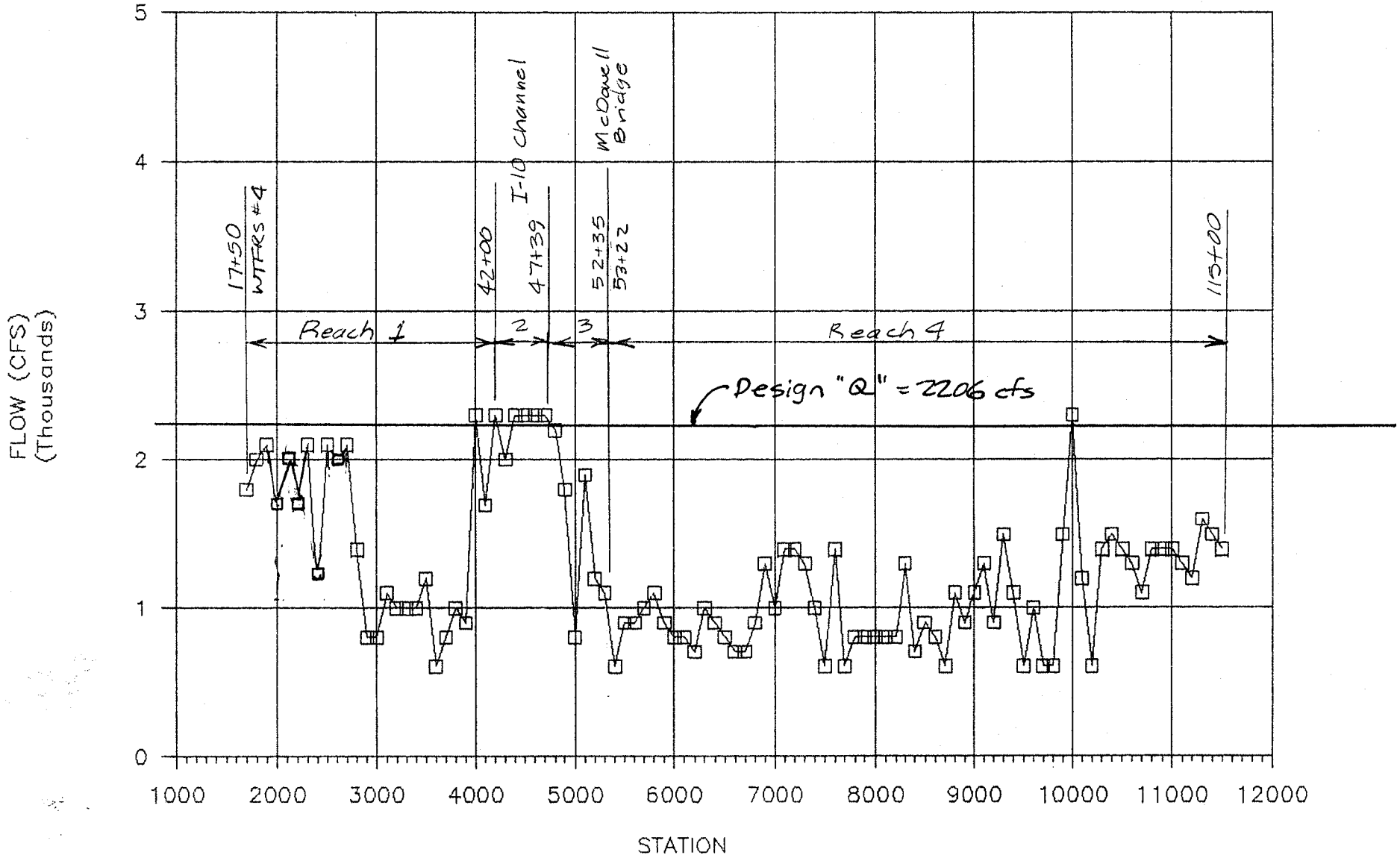


FIGURE I-1

TABLE I-1

KLS WHITE TANKS FLOOD RETENTION STRUCTURE #4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38 RIPRAP CRITERIA

MANNING'S n VALUE FOR RIPRAP

PLAIN RIPRAP		GROUTED RIPRAP		RIPRAP SIZE RANGE			MIN. LINER
				Dmin	D50	Dmax	THICKNESS
D50	n	D50	n	(FT)	(FT)	(FT)	(FT)
0.25	0.031	0.25	0.021	0.08	0.25	0.50	0.75
0.33	0.033	0.33	0.023	0.11	0.33	0.66	0.99
0.50	0.035	0.50	0.025	0.17	0.50	1.00	1.50 ← USE
0.67	0.037	0.67	0.027	0.22	0.67	1.34	2.01
1.00	0.040	1.00	0.030	0.33	1.00	2.00	3.00
1.50	0.042	1.50	0.032	0.50	1.50	3.00	4.50
2.00	0.044	2.00	0.034	0.66	2.00	4.00	6.00
2.50	0.046	2.50	0.036	0.83	2.50	5.00	7.50
3.00	0.047	3.00	0.037	0.99	3.00	6.00	9.00

Dmin = 0.33D50
Dmax = 2.00D50
Tmin = 1.5Dmax

n = 0.0395*(D50^.1667) n = 0.0395*(D50^.1667)-0.01

MIN. D50 (FT)	FLOW VELOCITY (FPS)	SSD ROCK DENSITY (PCF)	Z	ALLOW. BED SHEAR (PSF)	BED-TO BANK k	ALLOW. BANK SHEAR (PSF)	GIVEN CHANNEL DEPTH (FT)	BOUNDARY SHEAR (PSF)
0.11	4.79	150	3	0.385	0.87	0.34	1.00	0.32
0.15	5.82	150	3	0.526	0.87	0.46	1.50	0.46
0.20	6.65	150	3	0.701	0.87	0.61	2.00	0.60
0.23	7.32	150	3	0.806	0.87	0.70	2.50	0.70
0.26	7.86	150	3	0.911	0.87	0.79	3.00	0.79
0.28	8.29	150	3	0.981	0.87	0.85	3.50	0.85
0.29	8.63	150	3	1.016	0.87	0.88	4.00	0.88
0.30	8.86	150	3	1.051	0.87	0.91	4.50	0.90
0.29	8.99	150	3	1.016	0.87	0.88	5.00	0.88
0.28	8.99	150	3	0.981	0.87	0.85	5.50	0.84
0.26	8.99	150	3	0.911	0.87	0.79	6.00	0.79
0.25	9.00	150	3	0.876	0.87	0.76	6.50	0.76
0.24	8.99	150	3	0.841	0.87	0.73	7.00	0.73
0.23	8.99	150	3	0.806	0.87	0.70	7.50	0.70
0.20	8.62	150	3	0.701	0.87	0.61	8.00	0.60
0.14	7.63	150	3	0.491	0.87	0.43	8.50	0.42
0.10	6.81	150	3	0.350	0.87	0.30	9.00	0.29

ITERATE D50 UNTIL BOUNDARY SHEAR (BANK SHEAR

DIBBLE & ASSOCIATES

CONSULTING ENGINEERS

CALC KLS DATE 6/14/93 TITLE FCD White Tanks JOB

CHKD DATE SHT OF

Check Riprap design w/ HEC 15 procedure:

Given: $z = 3:1$ $Q = 2206$ $d = 4.0$, $B = 50.5$, $S_o = 0.0088$ ft/ft $V_* = 8.82$

1 d_{50} (Bed) $= \frac{d \gamma S_o}{S} = \frac{4.0(62.4)(0.0088)}{5} = 0.43$

2 @ $\theta = 40°$ $B/d = 50.5/4.0 = 12.6$, $z = 3:1$ $K_1 = 0.87$ (chart 31)

3. @ $z = 3:1$, $\theta = 40°$. $K_2 = 0.84$

4 D_{50} Sides $= \frac{K_1}{K_2}(D_{50}\ \text{bottom}) = \frac{0.87}{0.84}(0.43) = 0.45'$

TABLE I-2

KLS WHITE TANKS FLOOD RETENTION STRUCTURE #4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38

HYDRAULIC/ECONOMIC MODEL DEFINITION OF SYMBOLS

Symbols	Description	Comments
	A. HYDRAULIC MODEL	
Q	Design discharge, cfs	Fixed value
n	Manning's roughnes coefficient	Fixed value
Z	Channel side-slope	Fixed value
So	Channel slope, ft. per ft.	Input, iterate with base to match maximum Velocity and allowable Froude Number
b	Channel base width, feet	Input, iterate with slope to calculate Qn matching design Q
d	Channel flow depth, feet	Fixed value, set to vary from 1' to 9'in one-half foot increments
Qn	Discharge at normal depth, cfs	Calculated based on uniform flow
Vn	Average Velocity at normal depth, fps	Calculated based on uniform flow
Dn	Normal flow depth	Matches value of d
Froude No.	Froude Number	Calculated from hydraulic properties
Dc	Critical flow depth, feet	Input, trial and error iteration to match hydraulic formula (not shown)
Vc	Average Velocity at critical depth	Calculated from hydraulic properties
Sc	Critical channel slope, ft. per ft.	Calculated from hydraulic properties
Fb	Required channel freeboard	Calculated from hydraulic properties
W.S. tw	Water surface top width, ft.	Calculated from section properties
Chan. D	Channel depth	Dn plus freeboard

HYDRAULIC/ECONOMIC MODEL DEFINITION OF SYMBOLS

Symbols	Description CONT'D	Comments
Chan. Tw	Channel top width	Calculated from section properties
Low Flow	Low flow channel check	Calculated from hydraulic and section properties
	B. ECONOMIC MODEL	
Sog	Slope of existing ground, ft. per ft.	From Site survey, see Appendix II
Lt	Total length of channel, feet	From Site survey, see Appendix II
Channel Dn	Normal flow depth, feet	From Hydraulic model
Dave	Average overall channel depth	See Appendix II
ROW W	Total Channel right-of-way width required	See Appendix II
ROW AREA	Total Channel right-of-way area required, acres	ROW W x Lt
EXC.	Total Channel excavation, CY	Includes liner excavation, See Appendix II
LINER	Total liner area, SF	See Appendix II
DROPS	Number of grade-control structures required	See Appendix II. Drop cost is calculated based on a per lineal foot cost, assuming a drop length equal to the Channel Tw
FENCE	Length of safety fencing required, feet	Fence costs included only where channel slope exceeds 2:1

TABLE I-3

KLS — WHITE TANKS FLOOD RETENTION STRUCTURE #4 INLET CHANNEL — JOB 9302

FCD PROJECT NO. 92-38 — CHANNEL HYDRAULICS @ GIVEN Q

CHANNEL CONFIGURATIONS WITH EARTH LINER AND V = 3 FPS — CHANSUM1

CHANNEL TYPE	Q (CFS)	n	Z (FT)	So ('/')	b (FT)	TRIAL d (FT)	Qn (CFS)	Vn (FPS)	Dn (FT)	FROUDE NO.	FLOW REGIME	Dc (FT)	Vc (FPS)	Sc ('/')	FB (FT)	W.S. tw (FT)	CHAN. D (FT)	CHAN. Tw (FT)	LOW FLOW
EARTH	2206	0.025	4	0.00260	727	1.0	2207	3.02	1.00	0.53	SUBCRIT	0.66	4.6	0.0105	1.00	735	2.00	743	YES
EARTH	2206	0.025	4	0.00152	482	1.5	2204	3.01	1.50	0.44	SUBCRIT	0.86	5.3	0.0096	1.00	494	2.50	502	YES
EARTH	2206	0.025	4	0.00104	360	2.0	2206	3.00	2.00	0.38	SUBCRIT	1.05	5.8	0.0090	1.00	376	3.00	384	YES
EARTH	2206	0.025	4	0.00078	285	2.5	2203	2.99	2.50	0.34	SUBCRIT	1.22	6.2	0.0086	1.00	305	3.50	313	YES
EARTH	2206	0.025	4	0.00064	231	3.0	2204	3.02	3.00	0.32	SUBCRIT	1.40	6.6	0.0082	1.00	255	4.00	263	YES
EARTH	2206	0.025	4	0.00052	197	3.5	2205	2.99	3.50	0.29	SUBCRIT	1.56	7.0	0.0080	1.00	225	4.50	233	YES
EARTH	2206	0.025	4	0.00045	168	4.0	2205	3.00	4.00	0.28	SUBCRIT	1.72	7.3	0.0077	1.03	200	5.03	208	YES
EARTH	2206	0.025	4	0.00040	145	4.5	2207	3.01	4.50	0.26	SUBCRIT	1.90	7.6	0.0075	1.16	181	5.66	190	YES
EARTH	2206	0.025	4	0.00036	127	5.0	2215	3.01	5.00	0.25	SUBCRIT	2.07	7.9	0.0073	1.29	167	6.29	177	YES
EARTH	2206	0.025	4	0.00032	113	5.5	2212	2.98	5.50	0.24	SUBCRIT	2.22	8.2	0.0072	1.41	157	6.91	168	YES
EARTH	2206	0.025	4	0.00030	99	6.0	2213	3.00	6.00	0.24	SUBCRIT	2.41	8.5	0.0071	1.53	147	7.53	159	YES
EARTH	2206	0.025	4	0.00028	87	6.5	2199	2.99	6.50	0.23	SUBCRIT	2.60	8.7	0.0069	1.66	139	8.16	152	YES
EARTH	2206	0.025	4	0.00026	78	7.0	2207	2.97	7.00	0.22	SUBCRIT	2.78	8.9	0.0068	1.78	134	8.78	148	YES
EARTH	2206	0.025	4	0.00025	69	7.5	2220	2.99	7.50	0.22	SUBCRIT	2.99	9.2	0.0067	1.91	129	9.41	144	YES
EARTH	2206	0.025	4	0.00024	60	8.0	2199	2.99	8.00	0.22	SUBCRIT	3.22	9.4	0.0066	2.03	124	10.03	140	YES
EARTH	2206	0.025	4	0.00023	53	8.5	2203	2.98	8.50	0.21	SUBCRIT	3.44	9.6	0.0065	2.16	121	10.66	138	YES
EARTH	2206	0.025	4	0.00023	45	9.0	2198	3.01	9.00	0.21	SUBCRIT	3.73	9.8	0.0065	2.29	117	11.29	135	YES

ROW @ 13,500 $/ACRE — DROPS @ 400 $/LF

EXC. @ 3.00 $/CY — FENCE @ 0.00 $/LF

LINER @ 0.00 $/SF

3 = DROP HEIGHT (FT)

0.009 =Sog 9200 = Lt 0.0 = LINER t (FT)

CHANNEL Dn	Dave (FT)	W (FT)	ROW (ACRES)	COST $	EXC. (CY)	COST $	LINER (SF)	COST $	DROPS (EA)	COST $	FENCE (LF)	COST $	TOTAL COST $
1.00	3.50	791	167.06	2,255,331	883,711	2,651,133	6,953,928	0	19.6	5,833,045	18,400	0	10,739,509
1.50	4.00	550	116.16	1,568,182	678,756	2,036,267	4,737,861	0	22.9	4,606,084	18,400	0	8,210,533
2.00	4.50	432	91.24	1,231,736	579,600	1,738,800	3,653,393	0	24.4	3,749,478	18,400	0	6,720,014
2.50	5.00	361	76.24	1,029,298	519,630	1,558,889	3,001,326	0	25.2	3,156,042	18,400	0	5,744,228
3.00	5.50	311	65.68	886,736	474,141	1,422,422	2,542,458	0	25.6	2,697,047	18,400	0	5,006,205
3.50	6.00	281	59.35	801,198	451,822	1,355,467	2,267,591	0	26.0	2,423,697	18,400	0	4,580,362
4.00	6.53	256	54.13	730,712	432,287	1,296,862	2,041,366	0	26.2	2,184,427	18,400	0	4,212,001
4.50	7.16	238	50.33	679,397	423,641	1,270,923	1,877,206	0	26.4	2,007,341	18,400	0	3,957,661
5.00	7.79	225	47.58	642,333	419,510	1,258,530	1,759,030	0	26.5	1,878,907	18,400	0	3,779,770
5.50	8.41	216	45.68	616,653	420,182	1,260,545	1,677,584	0	26.6	1,791,708	18,400	0	3,668,907
6.00	9.03	207	43.78	591,003	416,035	1,248,106	1,596,234	0	26.7	1,699,828	18,400	0	3,538,937
6.50	9.66	200	42.30	571,042	413,540	1,240,621	1,533,243	0	26.7	1,628,852	18,400	0	3,440,515
7.00	10.28	196	41.45	559,626	417,493	1,252,478	1,497,823	0	26.8	1,589,663	18,400	0	3,401,767
7.50	10.91	192	40.61	548,230	418,721	1,256,164	1,462,466	0	26.8	1,548,580	18,400	0	3,352,974
8.00	11.53	188	39.76	536,823	417,159	1,251,476	1,427,077	0	26.9	1,507,362	18,400	0	3,295,661
8.50	12.16	186	39.34	531,116	421,108	1,263,324	1,410,079	0	26.9	1,487,551	18,400	0	3,281,991
9.00	12.79	183	38.71	522,581	418,835	1,256,506	1,383,957	0	26.9	1,455,348	18,400	0	3,234,435

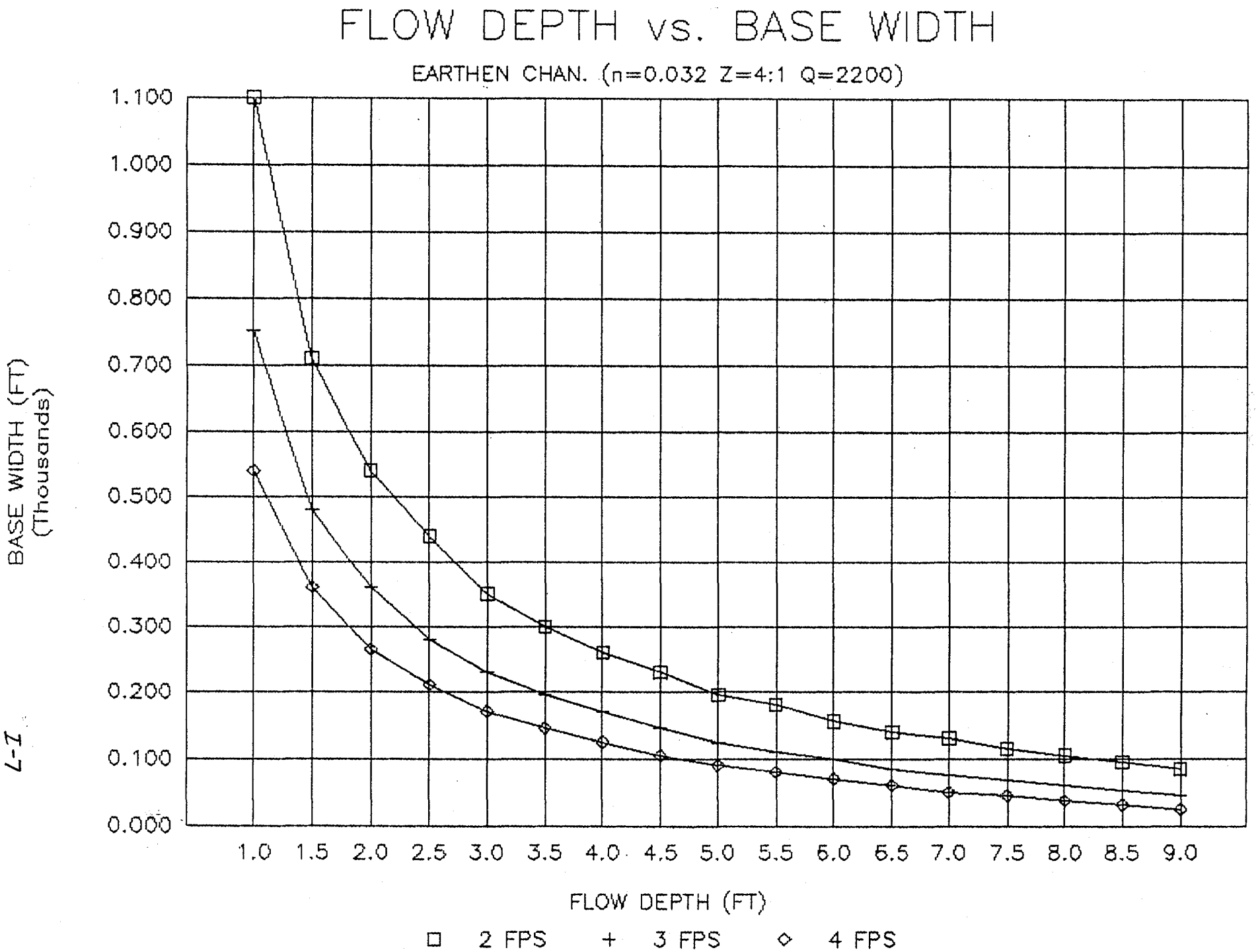
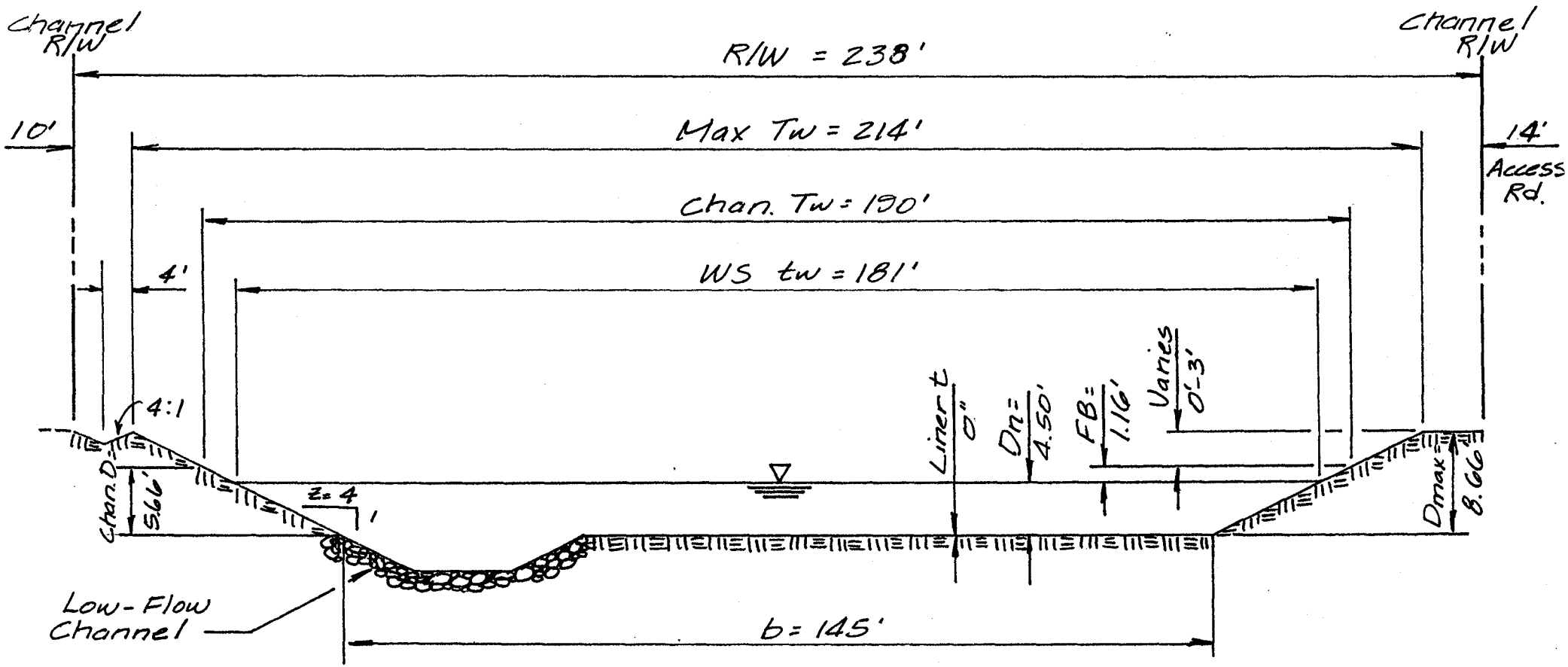

FLOW DEPTH vs. BASE WIDTH
EARTHEN CHAN. (n=0.032 Z=4:1 Q=2200)
BASE WIDTH (FT)
(Thousands)
1.100
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0
FLOW DEPTH (FT)
2 FPS
3 FPS
4 FPS

FIGURE I-2



EARTH

NTS

FIGURE I–3

TABLE I-4

KLS — WHITE TANKS FLOOD RETENTION STRUCTURE #4 INLET CHANNEL — JOB 9302

FCD PROJECT NO. 92-38 — CHANNEL HYDRAULICS @ GIVEN Q

CHANNEL CONFIGURATIONS WITH PLAIN RIPRAP LINER, Vmax = 9 FPS, Fmax = 0.85 (Subcritical) — CHANSUM5

CHANNEL TYPE	Q (CFS)	n	Z (FT)	So ('/')	b (FT)	TRIAL d(FT)	Qn (CFS)	Vn (FPS)	Dn (FT)	FROUDE NO.	FLOW REGIME	Dc (FT)	Vc (FPS)	Sc ('/')	FB (FT)	W.S. tw (FT)	CHAN. D (FT)	CHAN. Tw (FT)	LOW FLOW
RIPRAP	2206	0.035	3	0.01260	462.00	1.0	2206	4.74	1.00	0.84	SUBCRIT	0.89	5.3	0.0187	1.00	468	2.00	474	YES
RIPRAP	2206	0.035	3	0.01130	247.50	1.5	2206	5.84	1.50	0.85	SUBCRIT	1.35	6.5	0.0161	1.00	257	2.50	263	YES
RIPRAP	2206	0.035	3	0.01040	158.80	2.0	2206	6.69	2.00	0.85	SUBCRIT	1.80	7.5	0.0148	1.00	171	3.00	177	YES
RIPRAP	2206	0.035	3	0.00970	112.30	2.5	2206	7.37	2.50	0.85	SUBCRIT	2.24	8.3	0.0141	1.00	127	3.50	133	YES
RIPRAP	2206	0.035	3	0.00930	83.45	3.0	2206	7.95	3.00	0.85	SUBCRIT	2.70	8.9	0.0133	1.00	101	4.00	107	YES
RIPRAP	2206	0.035	3	0.00900	64.24	3.5	2206	8.43	3.50	0.85	SUBCRIT	3.16	9.5	0.0128	1.15	85	4.65	92	YES
RIPRAP	2206	0.035	3	0.00880	50.50	4.0	2206	8.82	4.00	0.85	SUBCRIT	3.61	10.0	0.0126	1.30	75	5.30	82	YES
RIPRAP	2206	0.035	3	0.00837	40.93	4.5	2206	9.00	4.50	0.84	SUBCRIT	4.04	10.3	0.0123	1.44	68	5.94	77	NO
RIPRAP	2206	0.035	3	0.00770	34.17	5.0	2206	8.97	5.00	0.81	SUBCRIT	4.41	10.6	0.0122	1.56	64	6.56	74	NO
RIPRAP	2206	0.035	3	0.00730	28.12	5.5	2206	8.99	5.50	0.79	SUBCRIT	4.82	10.7	0.0121	1.69	61	7.19	71	NO
RIPRAP	2206	0.035	3	0.00700	22.86	6.0	2206	9.00	6.00	0.78	SUBCRIT	5.23	10.9	0.0120	1.81	59	7.81	70	NO
RIPRAP	2206	0.035	3	0.00675	18.27	6.5	2206	8.99	6.50	0.76	SUBCRIT	5.65	11.1	0.0120	1.94	57	8.44	69	NO
RIPRAP	2206	0.035	3	0.00660	14.06	7.0	2206	8.99	7.00	0.76	SUBCRIT	6.10	11.2	0.0119	2.06	56	9.06	68	NO
RIPRAP	2206	0.035	3	0.00650	10.22	7.5	2206	8.99	7.50	0.75	SUBCRIT	6.55	11.3	0.0119	2.19	55	9.69	68	NO
RIPRAP	2206	0.035	3	0.00645	6.66	8.0	2206	8.99	8.00	0.75	SUBCRIT	7.02	11.3	0.0120	2.31	55	10.31	69	NO
RIPRAP	2206	0.035	3	0.00640	3.40	8.5	2206	8.98	8.50	0.74	SUBCRIT	7.49	11.4	0.0121	2.44	54	10.94	69	NO
RIPRAP	2206	0.035	3	0.00640	0.31	9.0	2206	8.97	9.00	0.74	SUBCRIT	7.99	11.4	0.0120	2.56	54	11.56	70	NO

ROW @ 13,500 $/ACRE — DROPS @ 405 $/LF

EXC. @ 3.00 $/CY — FENCE @ 0.00 $/LF

LINER @ 2.22 $/SF

3 = DROP HEIGHT (FT)

0.009 =Sog 9200 = Lt 1.5 = LINER t (FT) — CHANSUM5

CHANNEL Dn	Dave (FT)	W (FT)	ROW (ACRES)	COST $	EXC. (CY)	COST $	LINER (SF)	COST $	DROPS (EA)	COST $	FENCE (LF)	COST $	TOTAL COST $
1.00	3.50	516	108.98	1,471,240	810,947	2,432,842	4,454,051	9,887,993	NA	0	18,400	0	13,792,074
1.50	4.00	305	64.31	868,202	493,119	1,479,357	2,509,744	5,571,631	NA	0	18,400	0	7,919,191
2.00	4.50	219	46.21	623,851	359,904	1,079,713	1,722,797	3,824,608	NA	0	18,400	0	5,528,172
2.50	5.00	175	37.02	499,822	290,442	871,326	1,324,090	2,939,479	NA	0	18,400	0	4,310,627
3.00	5.50	149	31.56	426,118	247,745	743,235	1,087,762	2,414,833	NA	0	18,400	0	3,584,185
3.50	6.15	134	28.33	382,482	226,031	678,094	948,907	2,106,573	NA	0	18,400	0	3,167,149
4.00	6.80	124	26.26	354,449	212,150	636,451	860,400	1,910,087	0.6	20,447	18,400	0	2,921,434
4.50	7.44	119	25.04	338,068	205,309	615,926	809,447	1,796,972	1.9	59,912	18,400	0	2,810,878
5.00	8.06	116	24.40	329,445	203,846	611,539	783,485	1,739,336	4.0	118,745	18,400	0	2,799,065
5.50	8.69	113	23.92	322,910	202,883	608,649	764,266	1,696,670	5.2	150,442	18,400	0	2,778,671
6.00	9.31	112	23.60	318,614	203,030	609,090	752,274	1,670,049	6.1	173,249	18,400	0	2,771,003
6.50	9.94	111	23.42	316,204	204,302	612,907	746,361	1,656,922	6.9	192,543	18,400	0	2,778,576
7.00	10.56	110	23.33	314,897	206,014	618,042	744,010	1,651,702	7.4	204,012	18,400	0	2,788,654
7.50	11.19	110	23.31	314,642	208,325	624,976	745,052	1,654,016	7.7	212,235	18,400	0	2,805,868
8.00	11.81	111	23.35	315,188	211,076	633,229	748,682	1,662,074	7.8	217,086	18,400	0	2,827,576
8.50	12.44	111	23.45	316,566	214,494	643,481	754,992	1,676,083	8.0	222,904	18,400	0	2,859,034
9.00	13.06	112	23.59	318,443	218,188	654,565	762,914	1,693,668	8.0	225,030	18,400	0	2,891,706

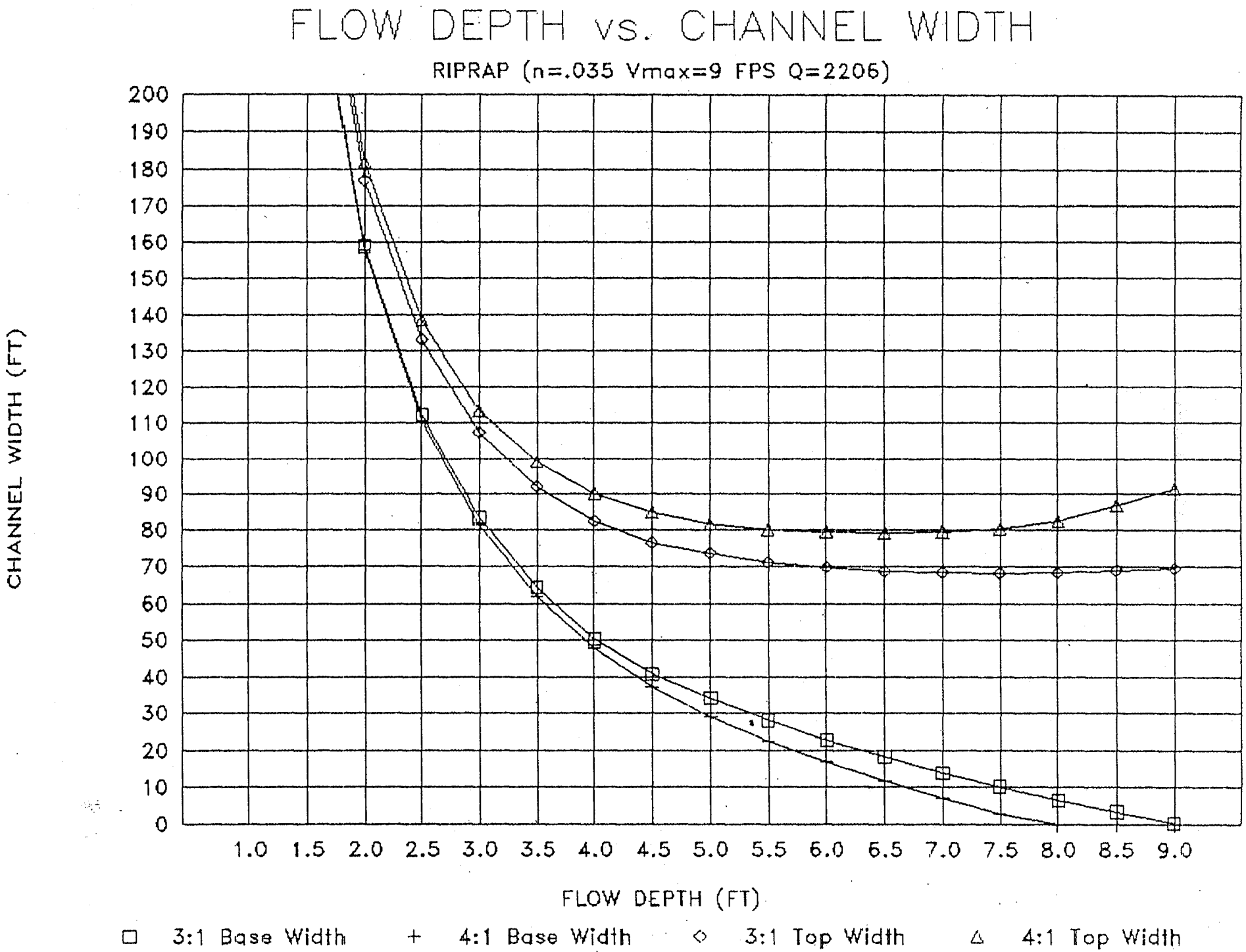
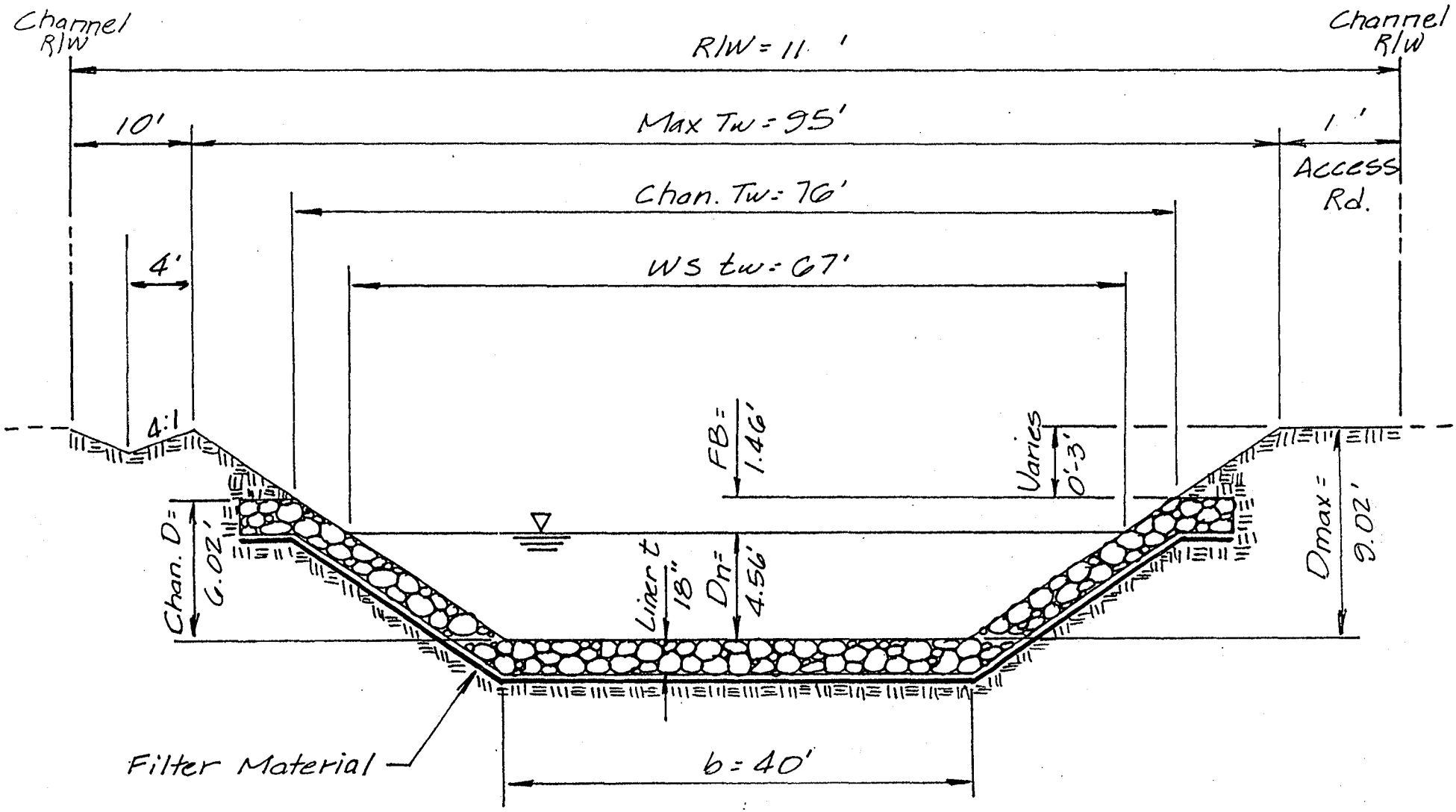

FLOW DEPTH vs. CHANNEL WIDTH
RIPRAP (n=.035 Vmax=9 FPS Q=2206)
CHANNEL WIDTH (FT)
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
FLOW DEPTH (FT)
3:1 Base Width
4:1 Base Width
3:1 Top Width
4:1 Top Width

FIGURE I-4



PLAIN RIPRAP

NTS

FIGURE I–5

TABLE I-5

KLS — WHITE TANKS FLOOD RETENTION STRUCTURE #4 INLET CHANNEL — JOB 9302

FCD PROJECT NO. 92-38 — CHANNEL HYDRAULICS @ GIVEN Q

CHANNEL CONFIGURATIONS WITH RENO MAT LINER, Vmax = 9 FPS, Fmax = 0.85 (Subcritical) — CHANSUM4

CHANNEL TYPE	Q (CFS)	n	Z (FT)	So ('/')	b (FT)	TRIAL d(FT)	Qn (CFS)	Vn (FPS)	Dn (FT)	FROUDE NO.	FLOW REGIME	Dc (FT)	Vc (FPS)	Sc ('/')	FB (FT)	W.S. tw (FT)	CHAN. D (FT)	CHAN. Tw (FT)	LOW FLOW
RENO MAT	2206	0.029	2	0.00880	458.50	1.0	2206	4.79	1.00	0.85	SUBCRIT	0.89	5.4	0.0130	1.00	463	2.00	467	YES
RENO MAT	2206	0.029	2	0.00775	248.20	1.5	2206	5.85	1.50	0.85	SUBCRIT	1.34	6.6	0.0113	1.00	254	2.50	258	YES
RENO MAT	2206	0.029	2	0.00710	160.12	2.0	2206	6.72	2.00	0.85	SUBCRIT	1.79	7.5	0.0103	1.00	168	3.00	172	YES
RENO MAT	2206	0.029	2	0.00670	113.15	2.5	2206	7.47	2.50	0.85	SUBCRIT	2.25	8.3	0.0096	1.00	123	3.50	127	YES
RENO MAT	2206	0.029	2	0.00635	85.20	3.0	2206	8.06	3.00	0.85	SUBCRIT	2.69	9.1	0.0092	1.00	97	4.00	101	YES
RENO MAT	2206	0.029	2	0.00615	66.30	3.5	2206	8.60	3.50	0.85	SUBCRIT	3.15	9.6	0.0088	1.16	80	4.66	85	YES
RENO MAT	2206	0.029	2	0.00594	53.23	4.0	2206	9.01	4.00	0.84	SUBCRIT	3.59	10.2	0.0086	1.31	69	5.31	74	YES
RENO MAT	2206	0.029	2	0.00530	45.56	4.5	2206	8.98	4.50	0.81	SUBCRIT	3.93	10.5	0.0085	1.44	64	5.94	69	NO
RENO MAT	2206	0.029	2	0.00490	38.88	5.0	2206	9.02	5.00	0.78	SUBCRIT	4.30	10.8	0.0083	1.57	59	6.57	65	NO
RENO MAT	2206	0.029	2	0.00450	33.70	5.5	2206	8.97	5.50	0.75	SUBCRIT	4.63	11.1	0.0083	1.69	56	7.19	62	NO
RENO MAT	2206	0.029	2	0.00428	28.83	6.0	2206	9.00	6.00	0.74	SUBCRIT	5.01	11.3	0.0083	1.81	53	7.81	60	NO
RENO MAT	2206	0.029	2	0.00410	24.64	6.5	2206	9.02	6.50	0.72	SUBCRIT	5.40	11.5	0.0082	1.94	51	8.44	58	NO
RENO MAT	2206	0.029	2	0.00390	21.15	7.0	2206	8.97	7.00	0.71	SUBCRIT	5.76	11.7	0.0082	2.06	49	9.06	57	NO
RENO MAT	2206	0.029	2	0.00380	17.77	7.5	2206	8.98	7.50	0.70	SUBCRIT	6.17	11.9	0.0082	2.19	48	9.69	57	NO
RENO MAT	2206	0.029	2	0.00370	14.79	8.0	2206	8.96	8.00	0.69	SUBCRIT	6.58	12.0	0.0082	2.31	47	10.31	56	NO
RENO MAT	2206	0.029	2	0.00370	11.80	8.5	2206	9.01	8.50	0.69	SUBCRIT	7.04	12.1	0.0082	2.44	46	10.94	56	NO
RENO MAT	2206	0.029	2	0.00360	9.39	9.0	2206	8.95	9.00	0.68	SUBCRIT	7.45	12.2	0.0083	2.56	45	11.56	56	NO

ROW @ 13,500 $/ACRE — DROPS @ 215 $/LF

EXC. @ 3.00 $/CY — FENCE @ 0.00 $/LF

3 = DROP HEIGHT (FT) — LINER @ 3.40 $/SF

0.009 =Sog 9200 = Lt — 1.0 = LINER t (FT) — CHANSUM4

CHANNEL Dn	Dave (FT)	W (FT)	ROW (ACRES)	COST $	EXC. (CY)	COST $	LINER (SF)	COST $	DROPS (EA)	COST $	FENCE (LF)	COST $	TOTAL COST $
1.00	3.50	503	106.13	1,432,748	716,715	2,150,145	4,362,203	14,831,489	0.6	61,516	18,400	0	18,475,898
1.50	4.00	294	62.14	838,835	439,858	1,319,575	2,448,015	8,323,250	3.8	212,800	18,400	0	10,694,459
2.00	4.50	208	43.96	593,400	320,734	962,202	1,658,250	5,638,051	5.8	215,620	18,400	0	7,409,274
2.50	5.00	163	34.46	465,180	255,985	767,955	1,246,698	4,238,774	7.1	192,819	18,400	0	5,664,728
3.00	5.50	137	28.98	391,217	217,787	653,360	1,010,226	3,434,767	8.1	176,836	18,400	0	4,656,180
3.50	6.16	121	25.54	344,853	197,066	591,197	863,490	2,935,866	8.7	159,626	18,400	0	4,031,542
4.00	6.81	110	23.34	315,032	183,778	551,333	770,105	2,618,356	9.4	150,287	18,400	0	3,635,009
4.50	7.44	105	22.24	300,274	180,040	540,119	725,194	2,465,660	11.3	169,093	18,400	0	3,475,145
5.00	8.07	101	21.36	288,388	176,739	530,218	689,567	2,344,529	12.6	176,103	18,400	0	3,339,237
5.50	8.69	98	20.79	280,705	175,913	527,740	667,476	2,269,419	13.8	185,289	18,400	0	3,263,153
6.00	9.31	96	20.29	273,972	174,648	523,943	648,475	2,204,814	14.5	186,999	18,400	0	3,189,728
6.50	9.94	94	19.94	269,164	174,344	523,032	635,680	2,161,310	15.0	188,682	18,400	0	3,142,188
7.00	10.56	93	19.73	266,302	175,445	526,334	629,145	2,139,092	15.6	193,008	18,400	0	3,124,736
7.50	11.19	93	19.54	263,799	176,143	528,428	623,788	2,120,881	15.9	193,784	18,400	0	3,106,892
8.00	11.81	92	19.44	262,416	177,636	532,907	622,033	2,114,911	16.3	195,815	18,400	0	3,106,049
8.50	12.44	92	19.34	261,061	178,459	535,378	620,391	2,109,330	16.3	194,154	18,400	0	3,099,923
9.00	13.06	92	19.35	261,269	181,143	543,429	623,761	2,120,787	16.6	198,078	18,400	0	3,123,563

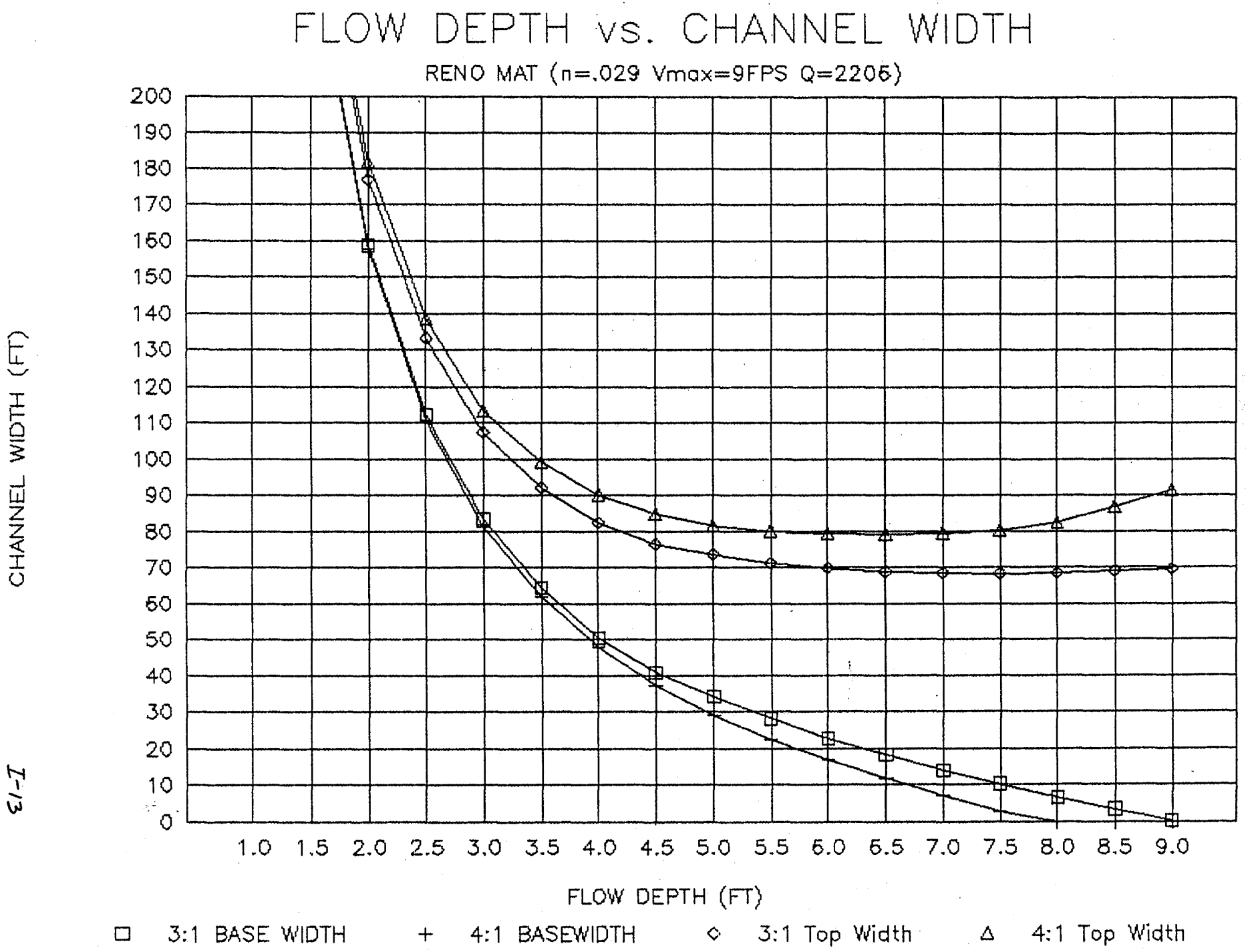
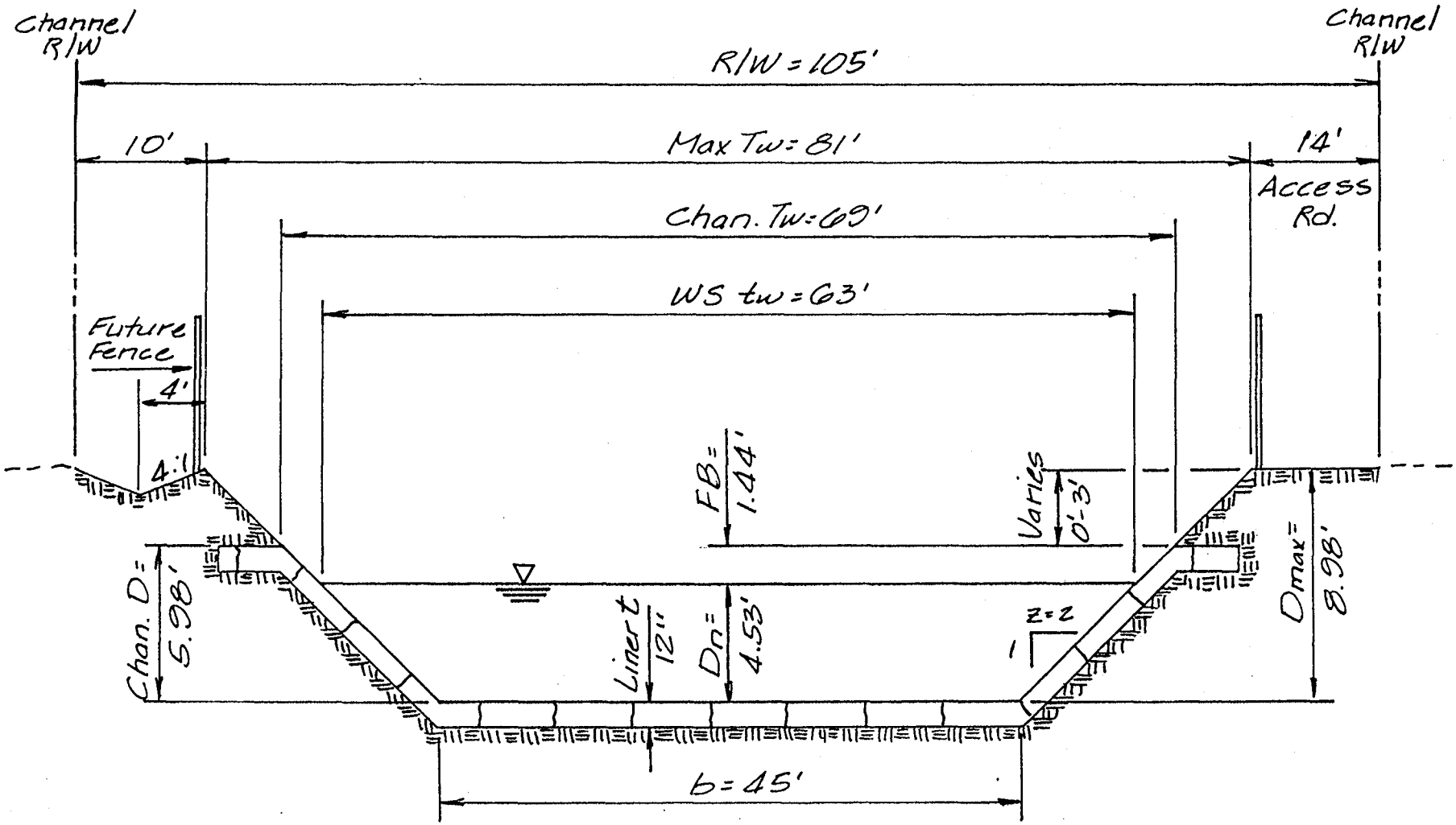

FLOW DEPTH vs. CHANNEL WIDTH
RENO MAT (n=.029 Vmax=9FPS Q=2206)
CHANNEL WIDTH (FT)
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
FLOW DEPTH (FT)
3:1 BASE WIDTH
4:1 BASEWIDTH
3:1 Top Width
4:1 Top Width

FIGURE I-6



RENO-MAT

NTS

FIGURE I-7

TABLE I-6

KLS — WHITE TANKS FLOOD RETENTION STRUCTURE #4 INLET CHANNEL — JOB 9302

FCD PROJECT NO. 92-38 — CHANNEL HYDRAULICS @ GIVEN Q

CHANNEL CONFIGURATIONS WITH GROUTED RIPRAP LINER, Vmax = 9 FPS, Fmax = 0.85 (Subcritical) — CHANSUM6

CHANNEL TYPE	Q (CFS)	n	Z (FT)	So ('/')	b (FT)	TRIAL d(FT)	Qn (CFS)	Vn (FPS)	Dn (FT)	FROUDE NO.	FLOW REGIME	Dc (FT)	Vc (FPS)	Sc ('/')	FB (FT)	W.S. tw (FT)	CHAN. D (FT)	CHAN. Tw (FT)	LOW FLOW
GRTED RIPRAP	2206	0.025	3	0.00660	456.00	1.0	2206	4.81	1.00	0.85	SUBCRIT	0.90	5.3	0.0094	1.00	462	2.00	468	YES
GRTED RIPRAP	2206	0.025	3	0.00580	246.70	1.5	2206	5.85	1.50	0.85	SUBCRIT	1.35	6.5	0.0082	1.00	256	2.50	262	YES
GRTED RIPRAP	2206	0.025	3	0.00531	158.70	2.0	2206	6.70	2.00	0.85	SUBCRIT	1.80	7.5	0.0076	1.00	171	3.00	177	YES
GRTED RIPRAP	2206	0.025	3	0.00495	112.30	2.5	2206	7.37	2.50	0.85	SUBCRIT	2.24	8.3	0.0072	1.00	127	3.50	133	YES
GRTED RIPRAP	2206	0.025	3	0.00476	83.30	3.0	2206	7.97	3.00	0.85	SUBCRIT	2.70	8.9	0.0068	1.00	101	4.00	107	YES
GRTED RIPRAP	2206	0.025	3	0.00460	64.20	3.5	2206	8.44	3.50	0.85	SUBCRIT	3.16	9.5	0.0065	1.15	85	4.65	92	YES
GRTED RIPRAP	2206	0.025	3	0.00450	50.44	4.0	2206	8.83	4.00	0.85	SUBCRIT	3.62	9.9	0.0064	1.30	74	5.30	82	YES
GRTED RIPRAP	2206	0.025	3	0.00426	41.00	4.5	2206	9.00	4.50	0.83	SUBCRIT	4.04	10.3	0.0063	1.44	68	5.94	77	NO
GRTED RIPRAP	2206	0.025	3	0.00396	34.01	5.0	2206	9.00	5.00	0.81	SUBCRIT	4.42	10.6	0.0062	1.56	64	6.56	73	NO
GRTED RIPRAP	2206	0.025	3	0.00373	28.09	5.5	2206	9.00	5.50	0.79	SUBCRIT	4.82	10.8	0.0062	1.69	61	7.19	71	NO
GRTED RIPRAP	2206	0.025	3	0.00355	22.96	6.0	2206	8.98	6.00	0.77	SUBCRIT	5.23	10.9	0.0061	1.81	59	7.81	70	NO
GRTED RIPRAP	2206	0.025	3	0.00345	18.24	6.5	2206	8.99	6.50	0.77	SUBCRIT	5.65	11.1	0.0061	1.94	57	8.44	69	NO
GRTED RIPRAP	2206	0.025	3	0.00337	14.05	7.0	2206	8.99	7.00	0.76	SUBCRIT	6.10	11.2	0.0061	2.06	56	9.06	68	NO
GRTED RIPRAP	2206	0.025	3	0.00332	10.20	7.5	2206	8.99	7.50	0.75	SUBCRIT	6.55	11.3	0.0061	2.19	55	9.69	68	NO
GRTED RIPRAP	2206	0.025	3	0.00329	6.66	8.0	2206	8.99	8.00	0.75	SUBCRIT	7.02	11.3	0.0061	2.31	55	10.31	69	NO
GRTED RIPRAP	2206	0.025	3	0.00327	3.39	8.5	2206	8.98	8.50	0.75	SUBCRIT	7.49	11.4	0.0062	2.44	54	10.94	69	NO
GRTED RIPRAP	2206	0.025	3	0.00328	0.27	9.0	2206	8.99	9.00	0.74	SUBCRIT	7.99	11.4	0.0062	2.56	54	11.56	70	NO

ROW @ 13,500 $/ACRE — DROPS @ 330 $/LF

EXC. @ 3.00 $/CY — FENCE @ 0.00 $/LF

LINER @ 2.40 $/SF

3 = DROP HEIGHT (FT)

0.009 =Sog 9200 = Lt 1.0 = LINER t (FT) — CHANSUM6

CHANNEL Dn	Dave (FT)	W (FT)	ROW (ACRES)	COST $	EXC. (CY)	COST $	LINER (SF)	COST $	DROPS (EA)	COST $	FENCE (LF)	COST $	TOTAL COST $
1.00	3.50	510	107.71	1,454,132	719,265	2,157,795	4,398,851	10,557,242	7.4	1,136,678	18,400	0	15,305,847
1.50	4.00	304	64.14	865,921	445,279	1,335,838	2,502,384	6,005,721	9.8	847,489	18,400	0	9,054,970
2.00	4.50	219	46.19	623,566	327,813	983,440	1,721,877	4,132,504	11.3	659,847	18,400	0	6,399,357
2.50	5.00	175	37.02	499,822	265,922	797,766	1,324,090	3,177,815	12.4	546,343	18,400	0	5,021,746
3.00	5.50	149	31.53	425,690	227,269	681,807	1,086,382	2,607,318	13.0	460,411	18,400	0	4,175,226
3.50	6.15	134	28.32	382,375	208,379	625,136	948,566	2,276,558	13.5	410,141	18,400	0	3,694,210
4.00	6.80	124	26.24	354,288	196,078	588,234	859,884	2,063,721	13.8	374,602	18,400	0	3,380,845
4.50	7.44	119	25.06	338,256	190,500	571,500	810,053	1,944,127	14.5	367,608	18,400	0	3,221,491
5.00	8.06	115	24.37	329,026	188,908	566,725	782,138	1,877,131	15.5	374,363	18,400	0	3,147,245
5.50	8.69	113	23.91	322,831	188,642	565,927	764,012	1,833,628	16.2	379,858	18,400	0	3,102,244
6.00	9.31	112	23.62	318,873	189,405	568,216	753,104	1,807,450	16.7	385,177	18,400	0	3,079,716
6.50	9.94	111	23.42	316,126	190,381	571,144	746,111	1,790,666	17.0	386,834	18,400	0	3,064,770
7.00	10.56	110	23.32	314,872	192,202	576,607	743,930	1,785,431	17.3	389,903	18,400	0	3,066,813
7.50	11.19	110	23.30	314,589	194,452	583,356	744,882	1,787,716	17.4	392,795	18,400	0	3,078,455
8.00	11.81	111	23.35	315,187	197,209	591,628	748,677	1,796,826	17.5	396,081	18,400	0	3,099,722
8.50	12.44	111	23.45	316,544	200,477	601,432	754,922	1,811,814	17.6	400,230	18,400	0	3,130,019
9.00	13.06	112	23.58	318,348	203,900	611,700	762,609	1,830,261	17.5	403,192	18,400	0	3,163,502

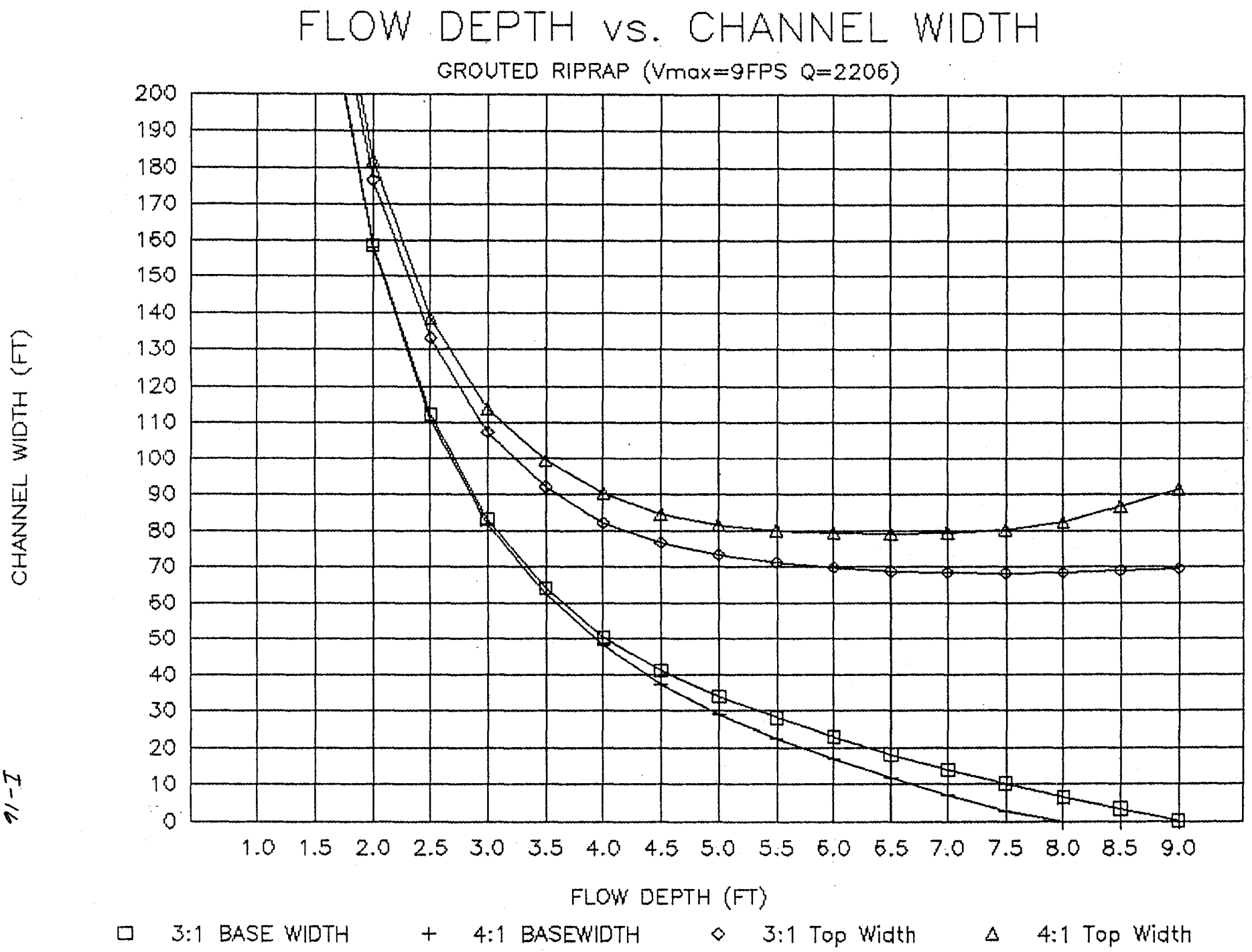
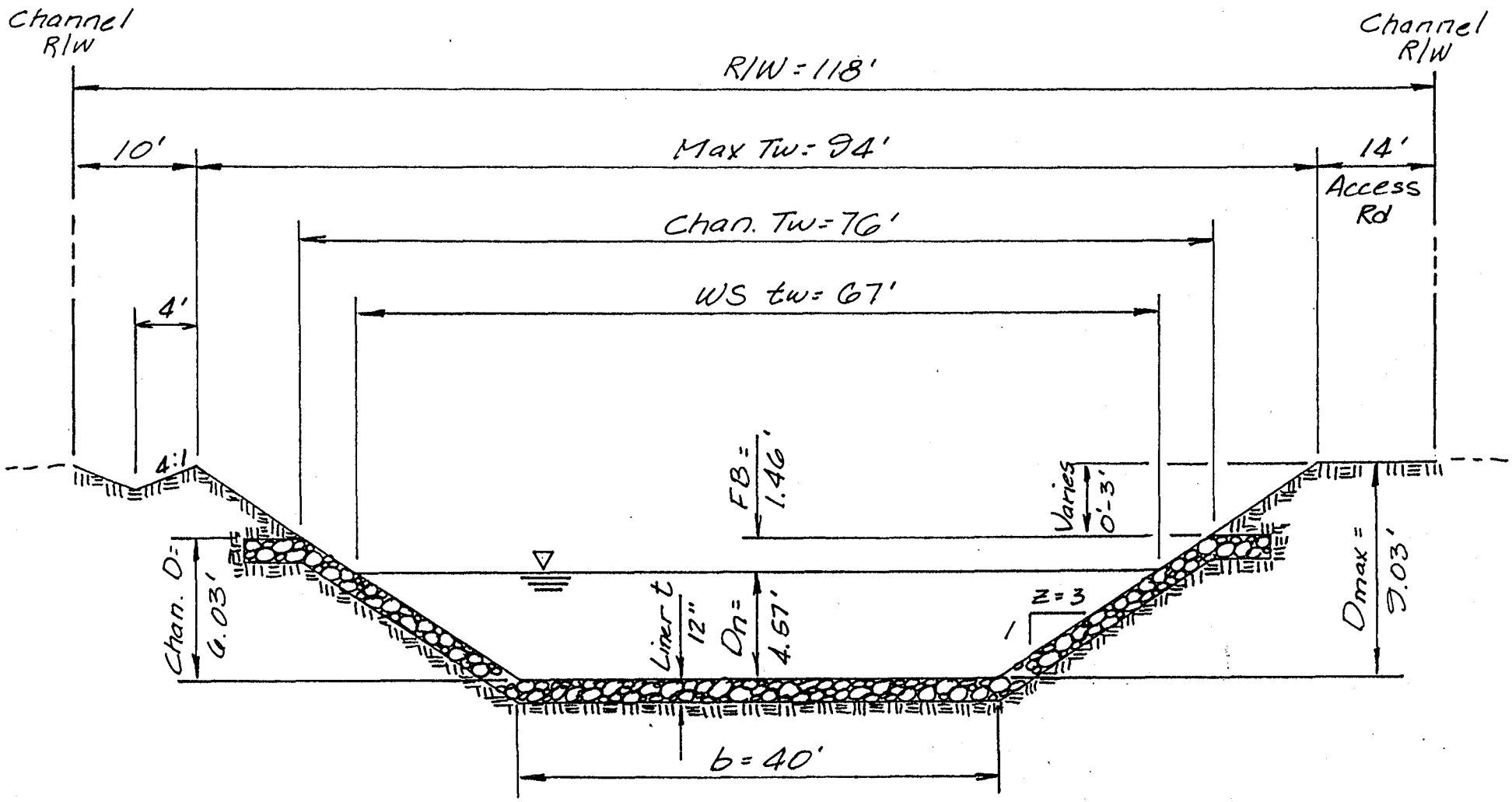

FLOW DEPTH vs. CHANNEL WIDTH
GROUTED RIPRAP (Vmax=9FPS Q=2206)
CHANNEL WIDTH (FT)
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
FLOW DEPTH (FT)
3:1 BASE WIDTH
4:1 BASEWIDTH
3:1 Top Width
4:1 Top Width

FIGURE I-8



GROUTED-RIPRAP

NTS

FIGURE I–9

TABLE I-7

KLS — WHITE TANKS FLOOD RETENTION STRUCTURE #4 INLET CHANNEL — JOB 9302

FCD PROJECT NO. 92-38 — CHANNEL HYDRAULICS @ GIVEN Q

CHANNEL CONFIGURATIONS WITH SOIL-CEMENT LINER, Vmax = 9 FPS, Fmax = 0.85 (Subcritical) — CHANSUM3

CHANNEL TYPE	Q (CFS)	n	Z (FT)	So ('/')	b (FT)	TRIAL d(FT)	Qn (CFS)	Vn (FPS)	Dn (FT)	FROUDE NO.	FLOW REGIME	Dc (FT)	Vc (FPS)	Sc ('/')	FB (FT)	W.S. tw (FT)	CHAN. D (FT)	CHAN. Tw (FT)	LOW FLOW
SOIL-CEMENT	2206	0.020	4	0.00422	455.80	1.0	2206	4.80	1.00	0.85	SUBCRIT	0.90	5.4	0.0061	1.00	464	2.00	472	YES
SOIL-CEMENT	2206	0.020	4	0.00371	246.10	1.5	2206	5.83	1.50	0.85	SUBCRIT	1.35	6.5	0.0053	1.00	258	2.50	266	YES
SOIL-CEMENT	2206	0.020	4	0.00340	157.80	2.0	2206	6.65	2.00	0.85	SUBCRIT	1.80	7.4	0.0049	1.00	174	3.00	182	YES
SOIL-CEMENT	2206	0.020	4	0.00320	110.55	2.5	2206	7.32	2.50	0.85	SUBCRIT	2.25	8.2	0.0046	1.00	131	3.50	139	YES
SOIL-CEMENT	2206	0.020	4	0.00306	81.65	3.0	2206	7.85	3.00	0.85	SUBCRIT	2.70	8.8	0.0044	1.00	106	4.00	114	YES
SOIL-CEMENT	2206	0.020	4	0.00296	62.18	3.5	2206	8.27	3.50	0.85	SUBCRIT	3.16	9.3	0.0042	1.14	90	4.64	99	YES
SOIL-CEMENT	2206	0.020	4	0.00288	48.20	4.0	2206	8.59	4.00	0.85	SUBCRIT	3.62	9.7	0.0041	1.29	80	5.29	90	YES
SOIL-CEMENT	2206	0.020	4	0.00283	37.43	4.5	2206	8.84	4.50	0.85	SUBCRIT	4.09	10.0	0.0041	1.43	73	5.93	85	NO
SOIL-CEMENT	2206	0.020	4	0.00276	29.11	5.0	2206	8.98	5.00	0.84	SUBCRIT	4.54	10.3	0.0040	1.56	69	6.56	82	NO
SOIL-CEMENT	2206	0.020	4	0.00263	22.70	5.5	2206	8.97	5.50	0.82	SUBCRIT	4.97	10.4	0.0040	1.69	67	7.19	80	NO
SOIL-CEMENT	2206	0.020	4	0.00255	16.97	6.0	2206	8.97	6.00	0.81	SUBCRIT	5.41	10.6	0.0040	1.81	65	7.81	79	NO
SOIL-CEMENT	2206	0.020	4	0.00249	11.86	6.5	2206	8.96	6.50	0.80	SUBCRIT	5.87	10.6	0.0040	1.94	64	8.44	79	NO
SOIL-CEMENT	2206	0.020	4	0.00247	7.10	7.0	2206	8.98	7.00	0.80	SUBCRIT	6.34	10.7	0.0040	2.06	63	9.06	80	NO
SOIL-CEMENT	2206	0.020	4	0.00246	2.76	7.5	2206	8.98	7.50	0.80	SUBCRIT	6.83	10.7	0.0040	2.19	63	9.69	80	NO
SOIL-CEMENT	2206	0.020	4	0.00239	0.00	8.0	2296	8.97	8.00	0.79	SUBCRIT	7.28	10.8	0.0040	2.31	64	10.31	82	NO
SOIL-CEMENT	2206	0.020	4	0.00221	0.00	8.5	2596	8.98	8.50	0.77	SUBCRIT	7.65	11.1	0.0039	2.44	68	10.94	88	NO
SOIL-CEMENT	2206	0.020	4	0.00205	0.00	9.0	2911	8.99	9.00	0.75	SUBCRIT	8.01	11.3	0.0038	2.56	72	11.56	93	NO

ROW @ 13,500 $/ACRE — DROPS @ 475 $/LF

EXC. @ 3.00 $/CY — FENCE @ 0.00 $/LF

3 = DROP HEIGHT (FT) — LINER @ 1.11 $/SF

0.009 =Sog 9200 = Lt — 1.0 = LINER t (FT) — (4:1) CHANSUM3

CHANNEL Dn	Dave (FT)	W (FT)	ROW (ACRES)	COST $	EXC. (CY)	COST $	LINER (SF)	COST $	DROPS (EA)	COST $	FENCE (LF)	COST $	TOTAL COST $
1.00	3.50	520	109.78	1,482,074	725,424	2,176,272	4,458,888	4,949,366	14.7	3,285,080	18,400	0	11,892,793
1.50	4.00	314	66.34	895,574	452,328	1,356,985	2,567,581	2,850,014	16.2	2,050,505	18,400	0	7,153,078
2.00	4.50	230	48.53	655,215	335,973	1,007,919	1,793,153	1,990,400	17.2	1,483,003	18,400	0	5,136,537
2.50	5.00	187	39.40	531,899	274,137	822,410	1,396,386	1,549,988	17.8	1,170,563	18,400	0	4,074,859
3.00	5.50	162	34.14	460,903	237,523	712,570	1,168,438	1,296,967	18.2	983,368	18,400	0	3,453,807
3.50	6.14	147	31.11	420,006	219,945	659,835	1,037,928	1,152,100	18.5	873,724	18,400	0	3,105,665
4.00	6.79	138	29.25	394,876	209,729	629,186	958,305	1,063,719	18.8	806,724	18,400	0	2,894,504
4.50	7.43	133	28.06	378,812	203,584	610,751	907,925	1,007,797	18.9	762,678	18,400	0	2,760,037
5.00	8.06	130	27.38	369,566	201,168	603,503	879,529	976,278	19.1	741,855	18,400	0	2,691,201
5.50	8.69	128	27.08	365,527	202,205	606,615	867,913	963,383	19.5	744,167	18,400	0	2,679,693
6.00	9.31	127	26.92	363,451	204,003	612,008	862,631	957,521	19.8	746,673	18,400	0	2,679,654
6.50	9.94	127	26.90	363,121	206,701	620,104	862,978	957,906	20.0	752,519	18,400	0	2,693,651
7.00	10.56	128	26.95	363,825	209,723	629,169	866,670	962,003	20.0	757,182	18,400	0	2,712,180
7.50	11.19	128	27.09	365,710	213,501	640,502	874,167	970,326	20.1	764,639	18,400	0	2,741,176
8.00	11.81	130	27.56	372,083	223,367	670,100	896,145	994,721	20.3	794,344	18,400	0	2,831,247
8.50	12.44	136	28.62	386,357	245,809	737,427	943,620	1,047,419	20.8	865,492	18,400	0	3,036,695
9.00	13.06	141	29.68	400,621	269,301	807,903	991,061	1,100,078	21.3	936,532	18,400	0	3,245,135

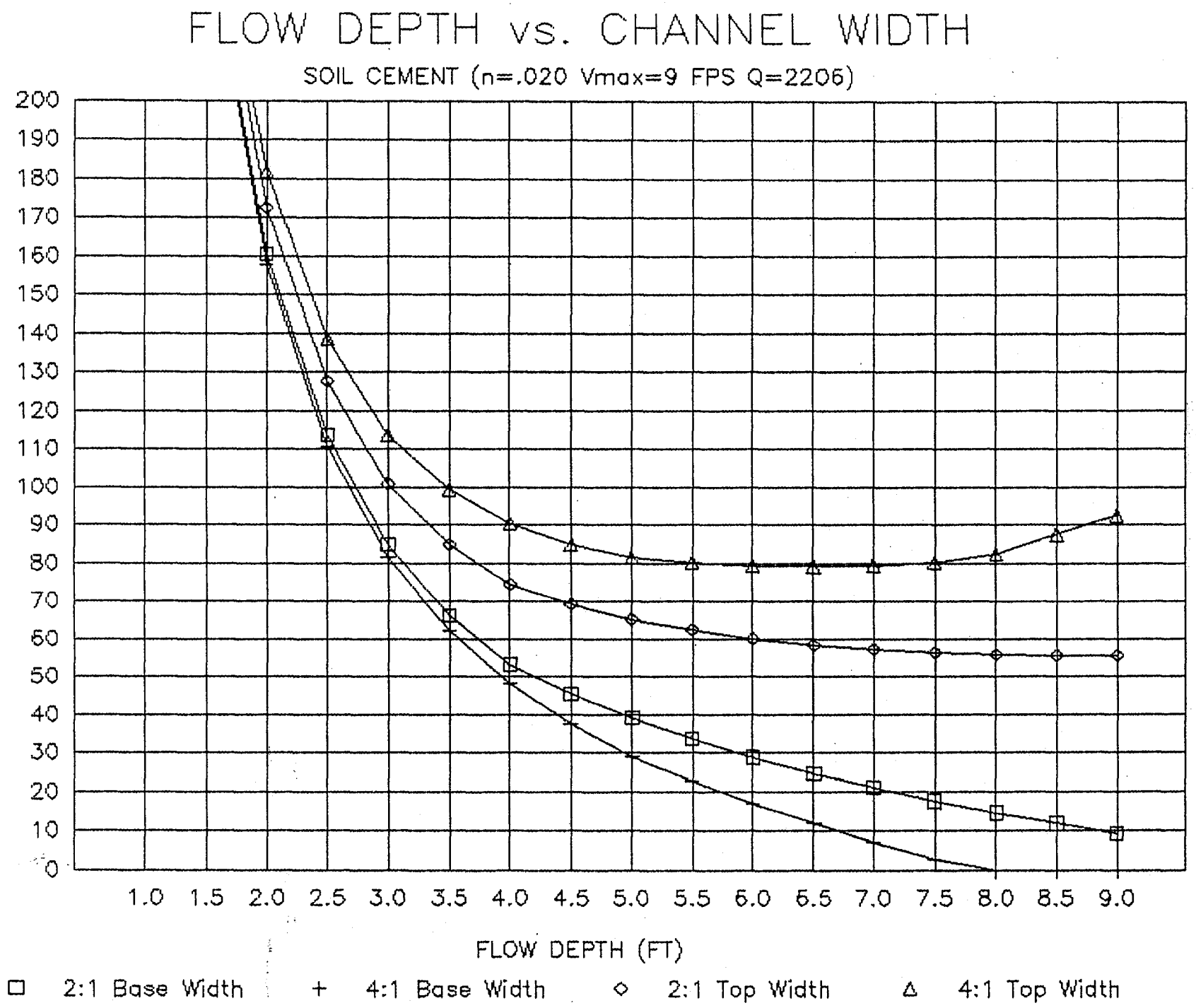
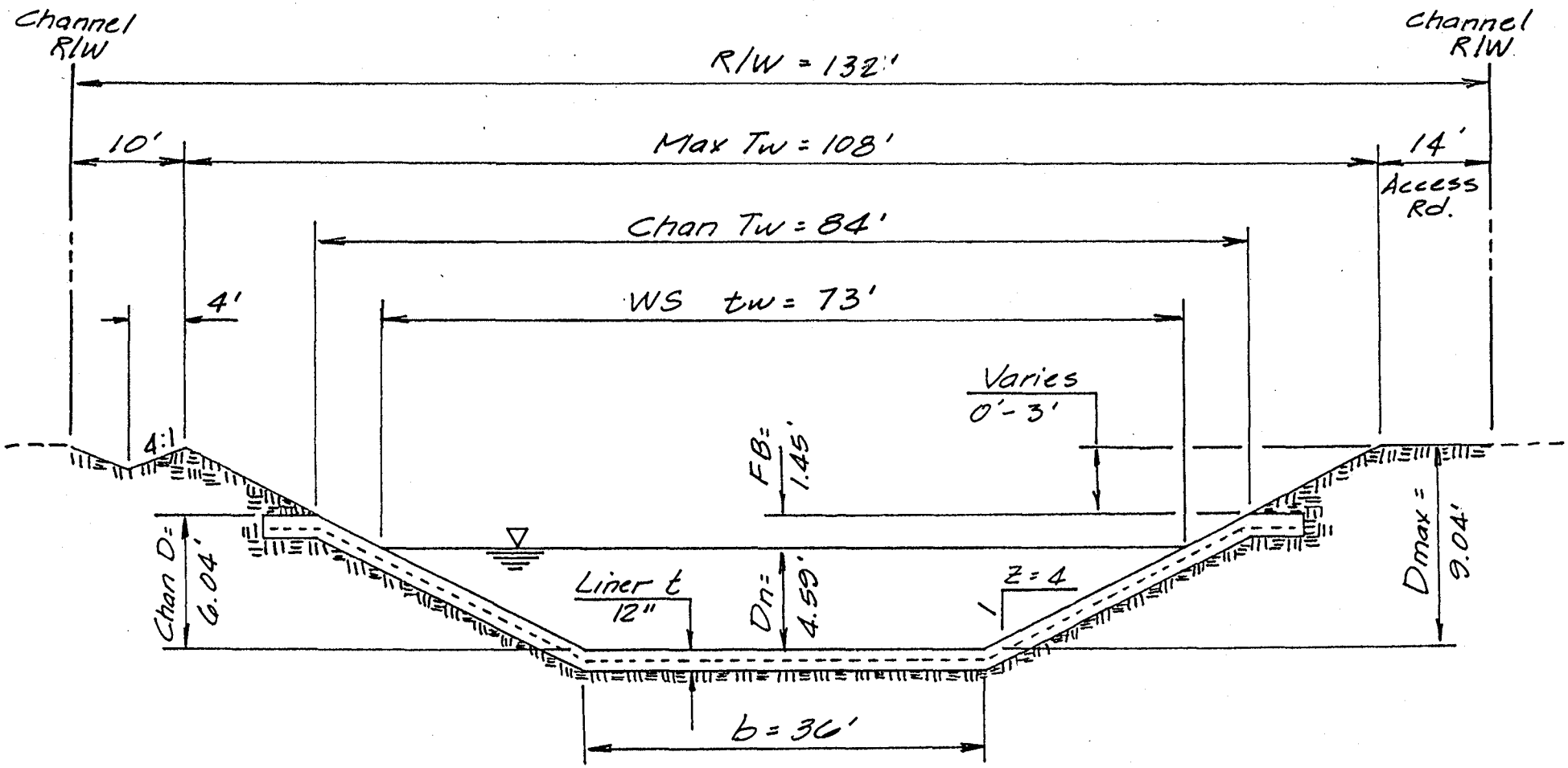

FLOW DEPTH vs. CHANNEL WIDTH
SOIL CEMENT (n=.020 Vmax=9 FPS Q=2206)
CHANNEL WIDTH (FT)
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0
FLOW DEPTH (FT)
2:1 Base Width
4:1 Base Width
2:1 Top Width
4:1 Top Width

FIGURE I-10



SOIL-CEMENT

NTS

FIGURE I-11

TABLE I-8

KLS — WHITE TANKS FLOOD RETENTION STRUCTURE #4 INLET CHANNEL — JOB 9302

FCD PROJECT NO. 92-38 — CHANNEL HYDRAULICS @ GIVEN Q

CHANNEL CONFIGURATIONS WITH SOIL-CEMENT LINER, Vmax = 9 FPS, Fmax = 0.85 (Subcritical) — CHANSUM3

CHANNEL TYPE	Q (CFS)	n	Z (FT)	So ('/')	b (FT)	TRIAL d(FT)	Qn (CFS)	Vn (FPS)	Dn (FT)	FROUDE NO.	FLOW REGIME	Dc (FT)	Vc (FPS)	Sc ('/')	FB (FT)	W.S. tw (FT)	CHAN. D (FT)	CHAN. Tw (FT)	LOW FLOW
SOIL-CEMENT	2206	0.020	2	0.00420	457.80	1.0	2206	4.80	1.00	0.85	SUBCRIT	0.90	5.4	0.0061	1.00	462	2.00	466	YES
SOIL-CEMENT	2206	0.020	2	0.00370	247.80	1.5	2206	5.86	1.50	0.85	SUBCRIT	1.35	6.5	0.0053	1.00	254	2.50	258	YES
SOIL-CEMENT	2206	0.020	2	0.00336	160.58	2.0	2206	6.70	2.00	0.85	SUBCRIT	1.79	7.5	0.0049	1.00	169	3.00	173	YES
SOIL-CEMENT	2206	0.020	2	0.00316	113.62	2.5	2206	7.44	2.50	0.85	SUBCRIT	2.24	8.3	0.0046	1.00	124	3.50	128	YES
SOIL-CEMENT	2206	0.020	2	0.00304	84.92	3.0	2206	8.09	3.00	0.85	SUBCRIT	2.70	9.0	0.0043	1.00	97	4.00	101	YES
SOIL-CEMENT	2206	0.020	2	0.00293	66.25	3.5	2206	8.61	3.50	0.85	SUBCRIT	3.15	9.7	0.0042	1.16	80	4.66	85	YES
SOIL-CEMENT	2206	0.020	2	0.00282	53.28	4.0	2206	9.00	4.00	0.84	SUBCRIT	3.59	10.2	0.0041	1.31	69	5.31	75	YES
SOIL-CEMENT	2206	0.020	2	0.00253	45.48	4.5	2206	9.00	4.50	0.81	SUBCRIT	3.94	10.5	0.0040	1.44	63	5.94	69	NO
SOIL-CEMENT	2206	0.020	2	0.00231	39.07	5.0	2206	8.99	5.00	0.78	SUBCRIT	4.28	10.8	0.0040	1.56	59	6.56	65	NO
SOIL-CEMENT	2206	0.020	2	0.00215	33.62	5.5	2206	8.99	5.50	0.75	SUBCRIT	4.64	11.1	0.0039	1.69	56	7.19	62	NO
SOIL-CEMENT	2206	0.020	2	0.00203	28.88	6.0	2206	8.99	6.00	0.74	SUBCRIT	5.01	11.3	0.0039	1.81	53	7.81	60	NO
SOIL-CEMENT	2206	0.020	2	0.00194	24.72	6.5	2206	9.00	6.50	0.72	SUBCRIT	5.39	11.5	0.0039	1.94	51	8.44	58	NO
SOIL-CEMENT	2206	0.020	2	0.00187	21.03	7.0	2206	9.00	7.00	0.71	SUBCRIT	5.78	11.7	0.0039	2.06	49	9.06	57	NO
SOIL-CEMENT	2206	0.020	2	0.00182	17.68	7.5	2206	9.00	7.50	0.70	SUBCRIT	6.18	11.9	0.0039	2.19	48	9.69	56	NO
SOIL-CEMENT	2206	0.020	2	0.00178	14.65	8.0	2206	9.00	8.00	0.69	SUBCRIT	6.60	12.0	0.0039	2.31	47	10.31	56	NO
SOIL-CEMENT	2206	0.020	2	0.00175	11.87	8.5	2206	8.99	8.50	0.68	SUBCRIT	7.03	12.1	0.0039	2.44	46	10.94	56	NO
SOIL-CEMENT	2206	0.020	2	0.00173	9.28	9.0	2206	8.98	9.00	0.68	SUBCRIT	7.47	12.2	0.0039	2.56	45	11.56	56	NO

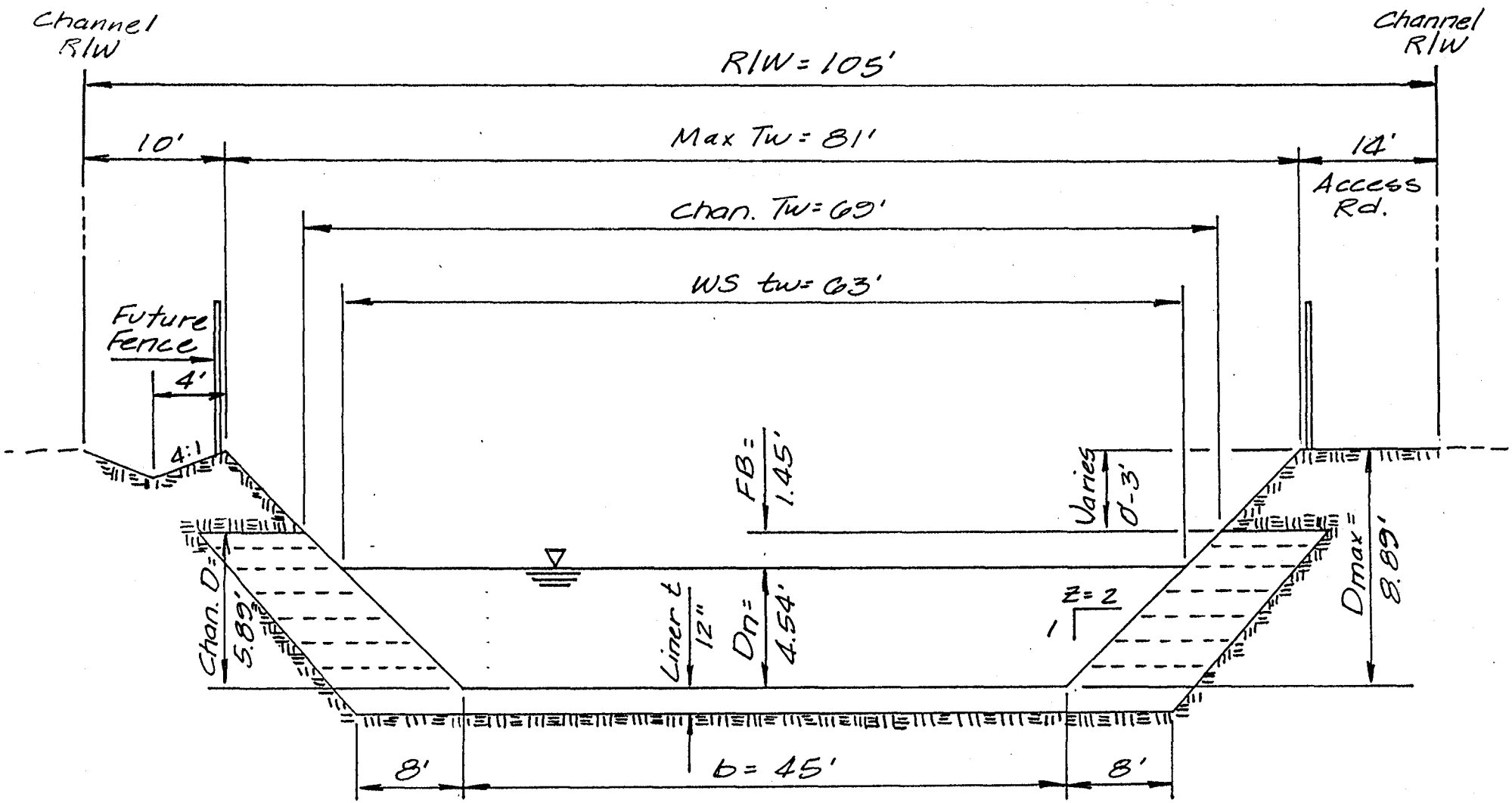
ROW @ 13,500 $/ACRE — DROPS @ 450 $/LF

EXC. @ 3.00 $/CY — FENCE @ 0.00 $/LF

3 = DROP HEIGHT (FT) — BED LINER @ 1.11 $/SF — BANK LINER @ 4.00 $/SF

0.009 =Sog 9200 = Lt — 1.0 = LINER t (FT) — (2:1) CHANSUM3

CHANNEL Dn	Dave (FT)	W (FT)	ROW (ACRES)	COST $	EXC. (CY)	COST $	LINER (SF)	COST $	DROPS (EA)	COST $	FENCE (LF)	COST $	TOTAL COST $
1.00	3.50	502	105.98	1,430,752	715,642	2,146,925	4,355,763	5,251,065	14.7	3,085,459	18,400	0	11,914,201
1.50	4.00	294	62.05	837,694	439,177	1,317,531	2,444,335	3,188,832	16.3	1,885,549	18,400	0	7,229,606
2.00	4.50	209	44.05	594,712	321,596	964,788	1,662,482	2,380,429	17.3	1,343,225	18,400	0	5,283,153
2.50	5.00	164	34.56	466,520	256,946	770,838	1,251,022	1,983,160	17.9	1,028,515	18,400	0	4,249,033
3.00	5.50	137	28.92	390,436	217,226	651,678	1,007,714	1,773,005	18.3	830,175	18,400	0	3,645,294
3.50	6.16	121	25.53	344,715	196,958	590,875	863,049	1,690,740	18.6	711,174	18,400	0	3,337,504
4.00	6.81	111	23.35	315,169	183,895	551,686	770,543	1,665,563	19.0	635,684	18,400	0	3,168,102
4.50	7.44	105	22.23	300,058	179,838	539,513	724,501	1,688,781	19.8	618,195	18,400	0	3,146,547
5.00	8.06	101	21.40	288,901	177,263	531,788	691,214	1,726,063	20.5	603,092	18,400	0	3,149,843
5.50	8.69	98	20.78	280,491	175,680	527,040	666,791	1,773,276	21.0	589,631	18,400	0	3,170,438
6.00	9.31	96	20.30	274,106	174,806	524,417	648,904	1,827,755	21.4	578,421	18,400	0	3,204,699
6.50	9.94	94	19.95	269,376	174,610	523,830	636,359	1,888,183	21.7	569,728	18,400	0	3,251,117
7.00	10.56	93	19.70	265,983	175,019	525,058	628,126	1,953,357	21.9	563,668	18,400	0	3,308,066
7.50	11.19	92	19.52	263,563	175,809	527,427	623,033	2,022,057	22.0	559,211	18,400	0	3,372,258
8.00	11.81	92	19.41	262,049	177,088	531,265	620,861	2,093,930	22.1	557,035	18,400	0	3,444,278
8.50	12.44	92	19.35	261,245	178,750	536,250	620,981	2,168,323	22.2	556,529	18,400	0	3,522,347
9.00	13.06	92	19.33	260,984	180,672	542,015	622,850	2,244,665	22.3	557,145	18,400	0	3,604,808



SOIL-CEMENT

NTS

FIGURE I-12

TABLE I-9

KLS — WHITE TANKS FLOOD RETENTION STRUCTURE #4 INLET CHANNEL — JOB 9302

FCD PROJECT NO. 92-38 — CHANNEL HYDRAULICS @ GIVEN Q

CHANNEL CONFIGURATIONS WITH SHOTCRETE LINER, Vmax = 15 FP AND FROUDE MAX = 2 — CHANSUM7

CHANNEL TYPE	Q (CFS)	n	Z (FT)	So ('/')	b (FT)	TRIAL d (FT)	Qn (CFS)	Vn (FPS)	Dn (FT)	FROUDE NO.	FLOW REGIME	Dc (FT)	Vc (FPS)	Sc ('/')	FB (FT)	W.S. tw (FT)	CHAN. D (FT)	CHAN. Tw (FT)	LOW FLOW
SHOTCRTE	2206	0.019	2	0.02110	193.80	1.0	2206	11.27	1.00	2.00	SPRCRIT	1.58	7.1	0.0046	2.00	198	3.00	206	YES
SHOTCRTE	2206	0.019	2	0.01870	104.35	1.5	2206	13.70	1.50	2.00	SPRCRIT	2.37	8.5	0.0040	2.00	110	3.50	118	YES
SHOTCRTE	2206	0.019	2	0.01590	69.58	2.0	2206	14.99	2.00	1.92	SPRCRIT	3.06	9.5	0.0038	2.00	78	4.00	86	YES
SHOTCRTE	2206	0.019	2	0.01230	54.02	2.5	2206	14.95	2.50	1.74	SPRCRIT	3.56	10.1	0.0037	2.00	64	4.50	72	YES
SHOTCRTE	2206	0.019	2	0.01020	43.15	3.0	2206	14.96	3.00	1.61	SPRCRIT	4.05	10.6	0.0036	2.00	55	5.00	63	NO
SHOTCRTE	2206	0.019	2	0.00880	35.20	3.5	2206	14.94	3.50	1.52	SPRCRIT	4.53	11.0	0.0036	2.00	49	5.50	57	NO
SHOTCRTE	2206	0.019	2	0.00790	28.88	4.0	2206	14.95	4.00	1.45	SPRCRIT	5.01	11.3	0.0035	2.00	45	6.00	53	NO
SHOTCRTE	2206	0.019	2	0.00720	23.91	4.5	2206	14.90	4.50	1.40	SPRCRIT	5.47	11.6	0.0035	2.00	42	6.50	50	NO
SHOTCRTE	2206	0.019	2	0.00684	19.46	5.0	2206	14.97	5.00	1.37	SPRCRIT	5.96	11.8	0.0035	2.12	39	7.12	48	NO
SHOTCRTE	2206	0.019	2	0.00650	15.83	5.5	2206	14.95	5.50	1.33	SPRCRIT	6.43	12.0	0.0035	2.24	38	7.74	47	NO
SHOTCRTE	2206	0.019	2	0.00634	12.51	6.0	2206	15.00	6.00	1.32	SPRCRIT	6.92	12.1	0.0035	2.37	37	8.37	46	NO
SHOTCRTE	2206	0.019	2	0.00620	9.63	6.5	2206	15.00	6.50	1.30	SPRCRIT	7.41	12.2	0.0035	2.50	36	9.00	46	NO
SHOTCRTE	2206	0.019	2	0.00240	16.36	7.0	2206	10.38	7.00	0.84	SUBCRIT	6.36	11.9	0.0035	2.17	44	9.17	53	NO
SHOTCRTE	2206	0.019	2	0.00245	12.87	7.5	2206	10.56	7.50	0.84	SUBCRIT	6.87	12.1	0.0035	2.31	43	9.81	52	NO
SHOTCRTE	2206	0.019	2	0.00244	10.01	8.0	2206	10.60	8.00	0.84	SUBCRIT	7.34	12.2	0.0035	2.44	42	10.44	52	NO
SHOTCRTE	2206	0.019	2	0.00250	7.18	8.5	2206	10.73	8.50	0.85	SUBCRIT	7.85	12.3	0.0036	2.57	41	11.07	51	NO
SHOTCRTE	2206	0.019	2	0.00250	4.81	9.0	2206	10.75	9.00	0.84	SUBCRIT	8.34	12.3	0.0036	2.70	41	11.70	52	NO

ROW @ 13,500 $/ACRE — DROPS @ 325 $/LF

EXC. @ 3.00 $/CY — FENCE @ 0.00 $/LF

3 = DROP HEIGHT (FT) — LINER @ 2.80 $/SF

0.009 =Sog 9200 = Lt — 0.5 = LINER t (FT) — CHANSUM7

CHANNEL Dn	Dave (FT)	W (FT)	ROW (ACRES)	COST $	EXC. (CY)	COST $	LINER (SF)	COST $	DROPS (EA)	COST $	FENCE (LF)	COST $	TOTAL COST $
1.00	4.50	242	51.07	689,430	347,406	1,042,219	1,968,106	5,510,698	NA	0	18,400	0	7,242,347
1.50	5.00	154	32.60	440,089	216,406	649,219	1,165,738	3,264,067	NA	0	18,400	0	4,353,375
2.00	5.50	122	25.68	346,654	167,058	501,173	866,426	2,425,993	NA	0	18,400	0	3,273,820
2.50	6.00	108	22.81	307,991	148,749	446,247	743,846	2,082,769	NA	0	18,400	0	2,837,007
3.00	6.50	99	20.94	282,700	136,666	409,997	664,414	1,860,358	NA	0	18,400	0	2,553,056
3.50	7.00	93	19.68	265,736	128,682	386,045	611,846	1,713,168	0.6	11,402	18,400	0	2,376,350
4.00	7.50	89	18.77	253,418	122,772	368,317	574,273	1,607,965	3.4	57,974	18,400	0	2,287,675
4.50	8.00	86	18.14	244,950	118,961	356,882	549,121	1,537,539	5.5	89,539	18,400	0	2,228,910
5.00	8.62	84	17.73	239,338	117,686	353,057	533,707	1,494,380	6.6	103,209	18,400	0	2,189,983
5.50	9.24	83	17.49	236,082	117,806	353,419	525,905	1,472,533	7.7	116,610	18,400	0	2,178,644
6.00	9.87	82	17.32	233,811	118,173	354,520	521,317	1,459,687	8.2	121,961	18,400	0	2,169,980
6.50	10.50	82	17.24	232,728	119,197	357,592	520,535	1,457,499	8.6	127,319	18,400	0	2,175,138
7.00	10.67	89	18.80	253,854	147,946	443,837	589,441	1,650,435	20.2	348,850	18,400	0	2,696,976
7.50	11.31	88	18.61	251,182	147,512	442,537	583,596	1,634,070	20.1	340,089	18,400	0	2,667,877
8.00	11.94	88	18.53	250,209	148,603	445,810	583,188	1,632,927	20.1	338,378	18,400	0	2,667,325
8.50	12.57	87	18.47	249,396	149,277	447,832	583,326	1,633,313	19.9	333,435	18,400	0	2,663,976
9.00	13.20	88	18.50	249,779	151,219	453,658	587,281	1,644,387	19.9	334,305	18,400	0	2,682,128

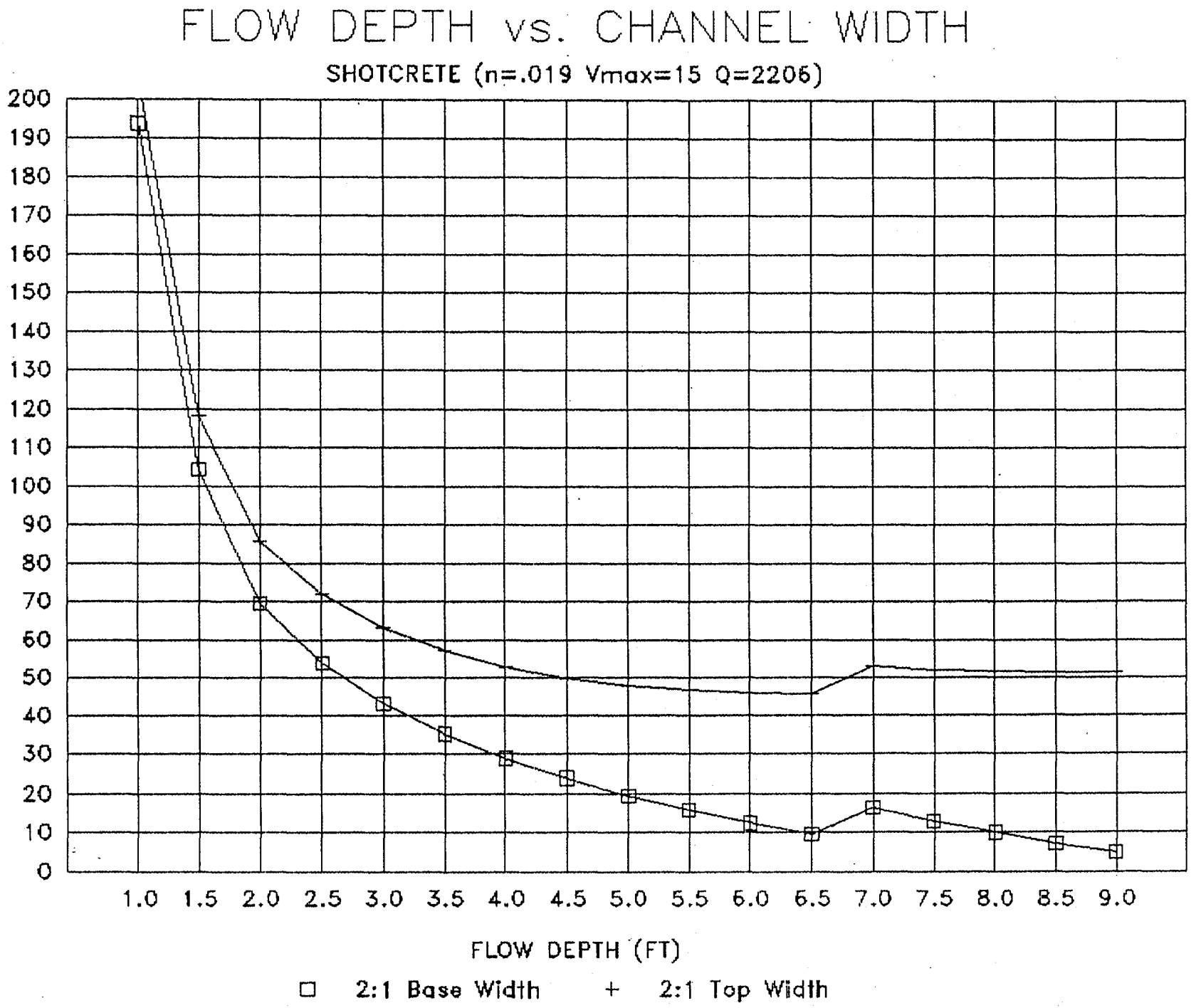
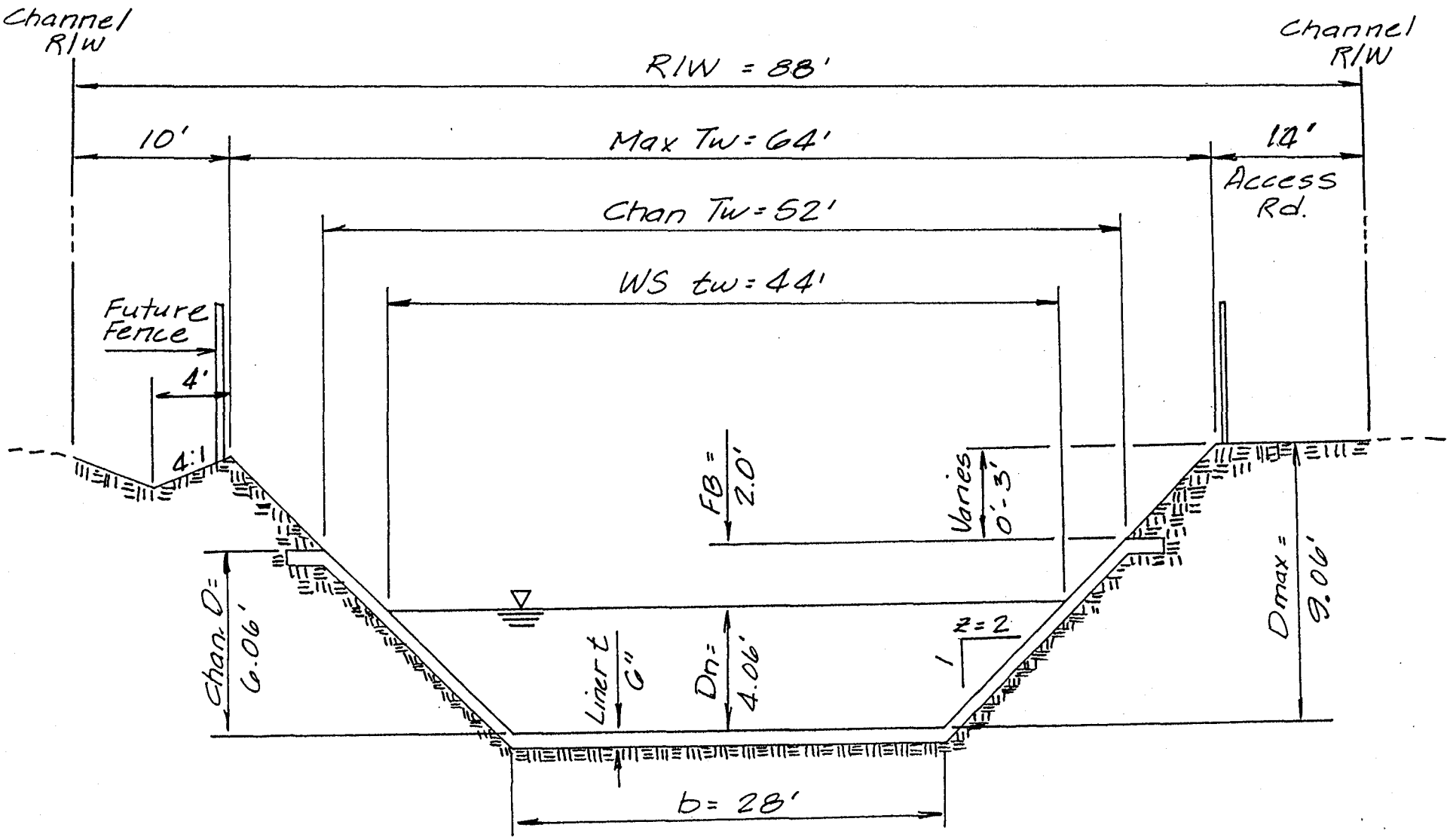

FLOW DEPTH vs. CHANNEL WIDTH
SHOTCRETE (n=.019 Vmax=15 Q=2206)
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0
FLOW DEPTH (FT)
2:1 Base Width
2:1 Top Width

FIGURE I-13



SHOTCRETE

NTS

FIGURE I-14

TABLE I-10

KLS — WHITE TANKS FLOOD RETENTION STRUCTURE #4 INLET CHANNEL — JOB 9302

FCD PROJECT NO. 92-38 — CHANNEL HYDRAULICS @ GIVEN Q

CHANNEL CONFIGURATIONS WITH CONCRETE LINER, Vmax = 15 FP AND FROUDE MAX = 2 — CHANSUM2

CHANNEL TYPE	Q (CFS)	n	Z (FT)	So ('/')	b (FT)	TRIAL d (FT)	Qn (CFS)	Vn (FPS)	Dn (FT)	FROUDE NO.	FLOW REGIME	Dc (FT)	Vc (FPS)	Sc ('/')	FB (FT)	W.S. tw (FT)	CHAN. D (FT)	CHAN. Tw (FT)	LOW FLOW
CONCRETE	2206	0.015	0.0	0.01330	194.40	1.0	2206	11.35	1.00	2.00	SPRCRIT	1.59	7.2	0.0029	2.00	194	3.00	194	YES
CONCRETE	2206	0.015	0.0	0.01190	105.80	1.5	2206	13.90	1.50	2.00	SPRCRIT	2.38	8.8	0.0026	2.00	106	3.50	106	YES
CONCRETE	2206	0.015	0.0	0.00976	73.56	2.0	2206	15.00	2.00	1.87	SPRCRIT	3.04	9.9	0.0025	2.00	74	4.00	74	YES
CONCRETE	2206	0.015	0.0	0.00753	58.83	2.5	2206	15.00	2.50	1.67	SPRCRIT	3.52	10.7	0.0025	2.00	59	4.50	59	YES
CONCRETE	2206	0.015	0.0	0.00618	49.03	3.0	2206	15.00	3.00	1.53	SPRCRIT	3.98	11.3	0.0025	2.00	49	5.00	49	NO
CONCRETE	2206	0.015	0.0	0.00530	42.01	3.5	2206	15.00	3.50	1.41	SPRCRIT	4.41	11.9	0.0026	2.00	42	5.50	42	NO
CONCRETE	2206	0.015	0.0	0.00469	36.78	4.0	2206	14.99	4.00	1.32	SPRCRIT	4.82	12.4	0.0026	2.00	37	6.00	37	NO
CONCRETE	2206	0.015	0.0	0.00180	47.98	4.5	2206	10.22	4.50	0.85	SUBCRIT	4.04	11.4	0.0025	1.53	48	6.03	48	NO
CONCRETE	2206	0.015	0.0	0.00184	41.06	5.0	2206	10.75	5.00	0.85	SUBCRIT	4.48	12.0	0.0026	1.70	41	6.70	41	NO
CONCRETE	2206	0.015	0.0	0.00190	35.66	5.5	2206	11.25	5.50	0.85	SUBCRIT	4.92	12.6	0.0027	1.87	36	7.37	36	NO
CONCRETE	2206	0.015	0.0	0.00200	31.22	6.0	2206	11.78	6.00	0.85	SUBCRIT	5.37	13.2	0.0028	2.04	31	8.04	31	NO
CONCRETE	2206	0.015	0.0	0.00212	27.62	6.5	2206	12.28	6.50	0.85	SUBCRIT	5.83	13.7	0.0029	2.21	28	8.71	28	NO
CONCRETE	2206	0.015	0.0	0.00225	24.72	7.0	2206	12.75	7.00	0.85	SUBCRIT	6.28	14.2	0.0031	2.38	25	9.38	25	NO
CONCRETE	2206	0.015	0.0	0.00239	22.33	7.5	2206	13.17	7.50	0.85	SUBCRIT	6.72	14.7	0.0033	2.55	22	10.05	22	NO
CONCRETE	2206	0.015	0.0	0.00257	20.24	8.0	2206	13.62	8.00	0.85	SUBCRIT	7.18	15.2	0.0035	2.72	20	10.72	20	NO
CONCRETE	2206	0.015	0.0	0.00276	18.49	8.5	2206	14.04	8.50	0.85	SUBCRIT	7.62	15.7	0.0037	2.89	18	11.39	18	NO
CONCRETE	2206	0.015	0.0	0.00297	16.99	9.0	2206	14.43	9.00	0.85	SUBCRIT	8.06	16.1	0.0040	3.06	17	12.06	17	NO

ROW @ 13,500 $/ACRE — DROPS @ 270 $/LF

EXC. @ 3.00 $/CY — FENCE @ 10.00 $/LF

3 = DROP HEIGHT (FT) — BASE @ 2.00 $/SF — WALLS @ 18.00 $/LF(TO 4')

0.009 =Sog 9200 = Lt — 1.0 = LINER t (FT) — 15.00 $/LF(TO 12') CHANSUM2

CHANNEL Dn	Dave (FT)	ROW W (FT)	(ACRES)	COST $	EXC. (CY)	COST $	LINER (SF)	COST $	DROPS (EA)	COST $	FENCE (LF)	COST $	TOTAL COST $
1.00	4.50	218	46.13	622,714	367,387	1,102,162	1,871,280	5,067,360	NA	0	18,400	184,000	6,976,236
1.50	5.00	130	27.41	370,095	219,710	659,131	1,065,360	3,326,720	NA	0	18,400	184,000	4,539,946
2.00	5.50	98	20.61	278,171	166,671	500,013	777,952	2,871,504	NA	0	18,400	184,000	3,833,688
2.50	6.00	83	17.49	236,172	144,411	433,232	651,636	2,738,472	4.5	71,607	18,400	184,000	3,663,483
3.00	6.50	73	15.42	208,231	129,730	389,190	570,676	2,696,152	8.6	114,485	18,400	184,000	3,592,058
3.50	7.00	66	13.94	188,215	119,288	357,865	515,292	2,704,984	11.3	128,705	18,400	184,000	3,563,769
4.00	7.50	61	12.84	173,303	111,639	334,916	476,376	2,746,752	13.2	131,260	18,400	184,000	3,570,232
4.50	7.53	72	15.20	205,237	144,590	433,771	579,970	2,961,146	22.1	286,045	18,400	184,000	4,070,199
5.00	8.20	65	13.74	185,507	134,280	402,839	528,599	3,018,209	22.0	243,431	18,400	184,000	4,033,986
5.50	8.87	60	12.60	170,111	125,925	377,776	491,208	3,103,177	21.8	209,647	18,400	184,000	4,044,711
6.00	9.54	55	11.66	157,452	118,611	355,832	462,732	3,207,062	21.5	180,960	18,400	184,000	4,085,306
6.50	10.21	52	10.90	147,188	112,470	337,411	441,984	3,326,403	21.1	157,351	18,400	184,000	4,152,353
7.00	10.88	49	10.29	138,919	107,495	322,484	427,635	3,458,015	20.7	138,171	18,400	184,000	4,241,589
7.50	11.55	46	9.79	132,105	103,355	310,066	417,933	3,598,334	20.3	122,225	18,400	184,000	4,346,730
8.00	12.22	44	9.34	126,147	99,510	298,530	411,067	3,745,296	19.7	107,770	18,400	184,000	4,461,743
8.50	12.89	42	8.97	121,157	96,299	288,898	407,279	3,897,783	19.1	95,544	18,400	184,000	4,587,383
9.00	13.56	41	8.66	116,867	93,502	280,507	405,736	4,054,628	18.5	84,815	18,400	184,000	4,720,816

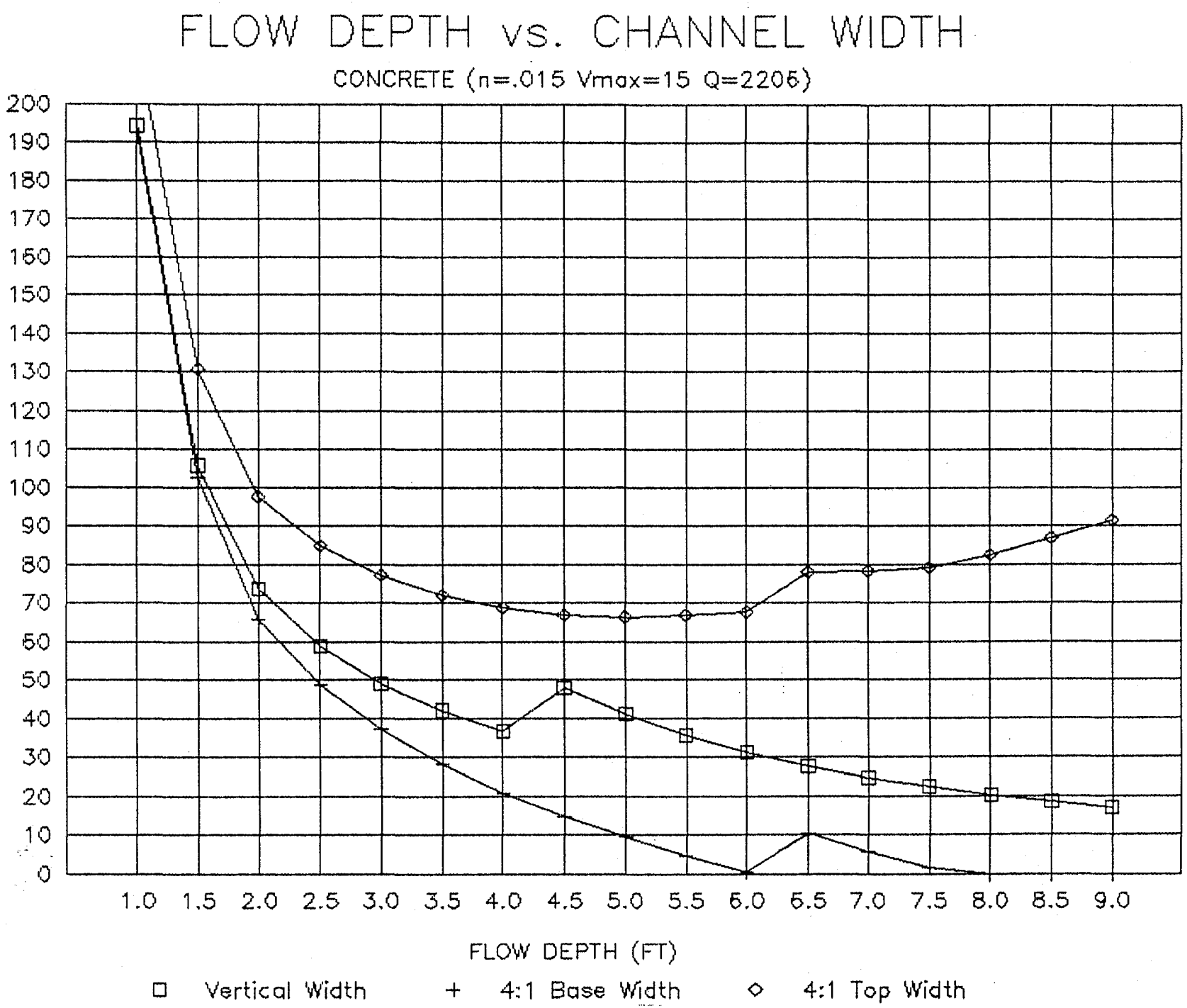
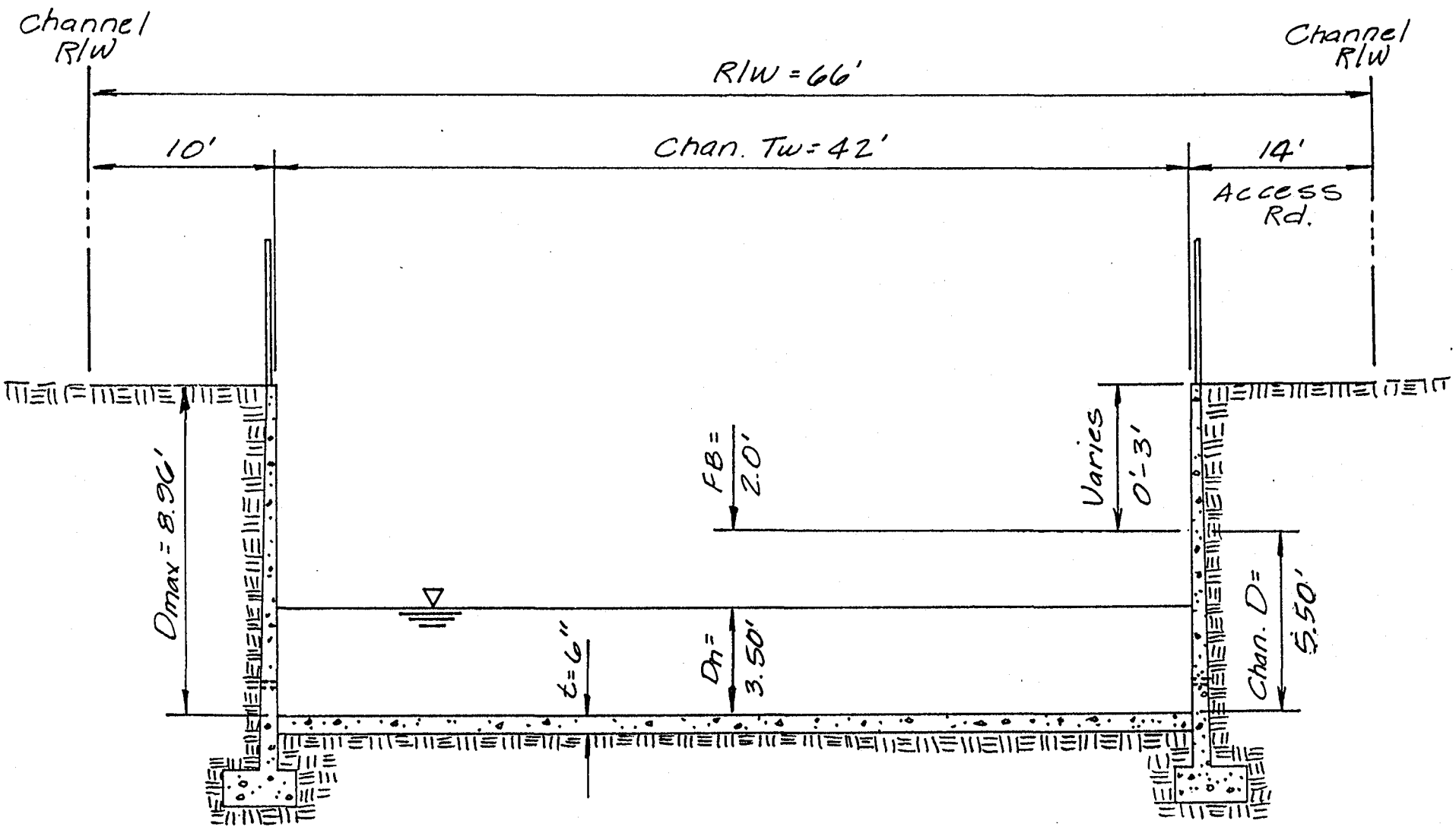

FLOW DEPTH vs. CHANNEL WIDTH
CONCRETE (n=.015 Vmax=15 Q=2206)
CHANNEL WIDTH (FT)
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
FLOW DEPTH (FT)
Vertical Width
4:1 Base Width
4:1 Top Width

FIGURE I-15



CONCRETE

NTS

FIGURE I-16

APPENDIX II - QUANTITY AND PRICE DERIVATIONS FOR COST COMPARISONS

A. Economic Model Section/Quantity Calculation Format II-1
B. Unit Price Derivations II-3

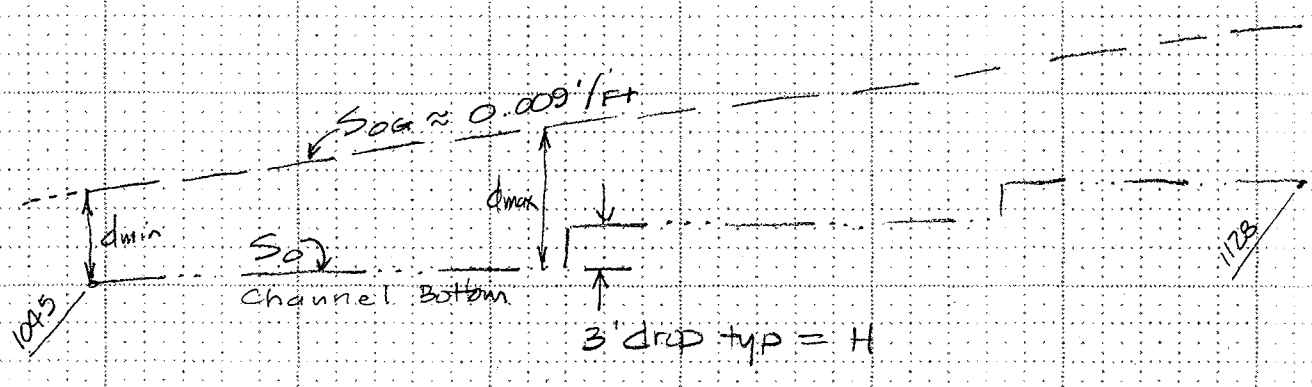
DIBBLE & ASSOCIATES

CONSULTING ENGINEERS

CALC KLS DATE 6/14/93 TITLE WHITE TANKS INLET JOB 9302

CHKD ..... DATE ..... COST COMPARISONS - GTO'S SHT 1 OF 2

ECONOMIC MODEL SECTION/QUANTITY CALCULATION FORMAT



1. L_T = (STA 115+00 - STA 53+22) + (STA 52+35 - STA 47+12) + (STA 42+00 - STA 17+00)
   = 6178 + 523 + 2500
   = 9200 LF

2. DROP SPACING = $\dfrac{H}{S_{OG} - S_O}$

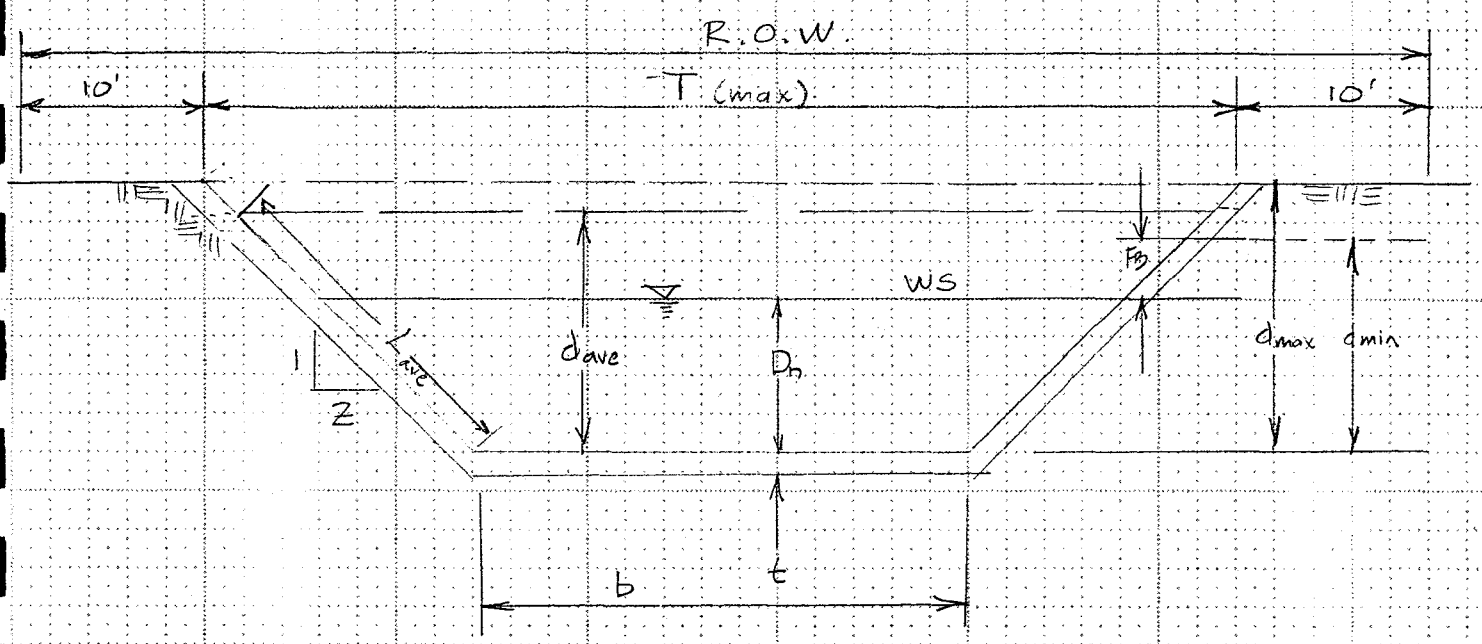
3. NO. OF DROPS = $\dfrac{L_T}{\text{DROP SPACING}}$

DIBBLE & ASSOCIATES

CONSULTING ENGINEERS

CALC KLS DATE 6/14/93 TITLE WHITE TANKS #4 INLET JOB 9302

CHKD ..... DATE ..... COST COMPARISONS - QTO'S SHT 2 OF 2



NOTE: CHANNEL DEPTH WILL VARY FROM d_{min} to d_{max}

$d_{min} = D_n + FB$ $\quad d_{max} = D_{min} + 3'$ $\quad d_{ave} = \frac{d_{min} + d_{max}}{2}$

FT 1. $d_{ave} = \frac{\overbrace{(D_n + FB)}^{\text{Chann D}} + \overbrace{(D_n + FB + 3)}^{\text{Chan D}}}{2}$

FT 2 $L_{ave} = \sqrt{(z\, d_{ave})^2 + d_{ave}^2}$

FT 3. $T_{(max)} = (d_{max})(z)(2) + b$

FT 4 $ROW = [T_{max} + 20] * L_T / 43560$

CY 5. $EXCAV = [[(L_{ave})(2) + b]t + ((b + z * d_{AVE}) * d_{AVE})] \frac{L_T}{27}$

SF 6. LINER AREA $= (2(L_{AVE}) + b) * L_T$

DIBBLE & ASSOCIATES

CONSULTING ENGINEERS

CALC KLS DATE 7/26/93 TITLE WTFRS #4 INLET JOB 9302

CHKD ..... DATE ..... UNIT PRICE DERIVATIONS SHT 1 OF 12

A. CHANNEL EXCAVATION

1. AVE QUANTITY APP. 250,000 CY.
   - ADOT PRICES VARY FROM $0.00 TO $5.00
   - ASSUME 5 MILE HAUL FOR WASTE
   - ASSUME INEXPENSIVE (NO ROCK, SCRAPER EXC) EXCAVATION
   - ASSUME 70% WASTE
2. ∴ EST. EXCAVATION @ $1.25/cy (1.0) = $1.25

   LOAD/HAUL/PLACE @ 5 MILES ($0.50/cy/mile)(0.7) = $1.75

   USE $3.00/cy

B. PLAIN RIP-RAP (1.5' THICK; D_{50} = 6")

1. APPROX QUANTITIES 33,000 – 36,000 CY
2. ESTIMATED MAT'LS/PLACEMENT PRICES:
   - RECENT ADOT PRICES:

     $36.00 / CY AVE (2000 CY)
     28.00 / CY AVE (2200 CY)
     $32.00 AVE

   - RS MEANS: 100 lb Dumped = 18.60 /Ton, $19.60/Ton $\left(\frac{\text{TON}}{2000\text{ lb}}\right)(27)\left(\frac{1301\text{b}}{\text{ft}^2}\right)$ = 32.60

     SAY $33.00 /cy

     NOTE: DISCUSSIONS WITH SUPPLIERS INDICATE THAT VERY FEW ARE PRODUCING RIPRAP ANYMORE, ∴ ADD A 20% PREMIUM
     ∴ 33.00 (1.2) = 39.60 USE 40.00

3. USE 40.00 /cy @ 1.5' THICK = (1)(1)(1.5)(27)(40) = 2.22

   USE $2.22

DIBBLE & ASSOCIATES

CONSULTING ENGINEERS

CALC KLS DATE 7/26/93 TITLE WTFRS #4 INLET JOB 9302

CHKD ..... DATE ..... UNIT PRICE DERIVATIONS SHT 2 OF 12

C RENO MATTRESS (1' GABION BASKETS)

1. APPROX. QUANTITIES ≈ 23 000 – 30,000 CY

2. RECENT ADOT PRICES

65^{00}/CY AVE (1500 CY)
48^{00}/CY AVE (4700 CY)
43^{00}/CY AVE (59000)
52^{00} AVE

3. RS MEANS = 41^{00}/SY = 123^{00}/CY

4. 7TH ST & GREENWAY PARKWAY = 165^{00}/CY

5. AVERAGE = (65 + 48 + 43 + 123 + 165)/5 = 88^{80}

USE 90^{00}/CY

6. COST PER S.F. = ((1'(1')(1.0')/27)(90) = 3^{33}

USE 3^{40}/SF

D. GROUTED RIP-RAP (1' THICK)

1. APPROX QUANTITIES ≈ 28,000 - 63,000

2. RECENT PRICES

- ADOT 32¢/CY AVE, 3600 CY
  57¢/CY AVE, 2000 CY
- RS MEANS = 50¢/SY = $100/CY
- FCD AGUA FRIA = 40¢/CY (85)

AVE = 32 + 57 + 100 + 40 = 57¢ USE $65¢/CY

3. COST PER SF = (1'(1')(1')/27)(65) = USE $2.40/SF

E. SOIL-CEMENT

1. APP. QTY OF CEMENT REQD: (1' THICK)
   - Total liner area = 907,000 SF, @ 12" = 907,000 c.f. = 33,600 c.y.
   - @ 123.5 pcf (ave. of 4 samples @ 10% and 12% cement per Speedie & Assoc. Mix design) = 907,000 ft³ (123.5 lb/ft³)/2000
     = 56,000 Tons
   - @ 11% Cement, estimated cement = 56,000 T (0.11) ≈ 6200 Tons
   - 6200 Tons / 33,600 cy = 0.1845 Tons Cement / cy Soil Cement

2. ESTIMATED CEMENT PRICES
   - PER PHOENIX CEMENT, GIVEN JOB SIZE, LOCATION, AND PROJECTED END-OF-YEAR PRICE INCREASE ≈ $80.00/TON
   - PAST ADOT JOBS, SIM. SIZE ≈ 70.00/TON

     USE 78.00/TON

3. ESTIMATED SOIL CEMENT COST:
   - BASED ON REVIEW OF FCD AND ADOT PRICES USE 15.00/cy

4. TOTAL COST/c.y. = $15.00/cy + 0.1845 Tons Cement/cy ($78.00/Ton)
   = $15.00/cy Soil-cem + $14.39/cy Cement = 29.40/cy

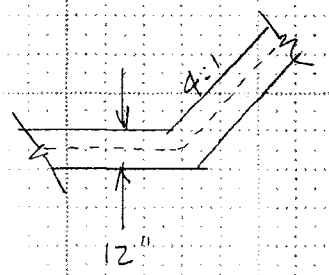
5. COMPARE VS RS MEANS:
   - 12% MIX, 12" DEEP = 10.60/SY @ 1' THICK 1 SY = 1/3 CY
     10.60/SY / 0.33 = 32.12/cy

     USE $30.00/cy

SOIL-CEMENT CONTINUED

6. COST PER SQUARE FOOT:

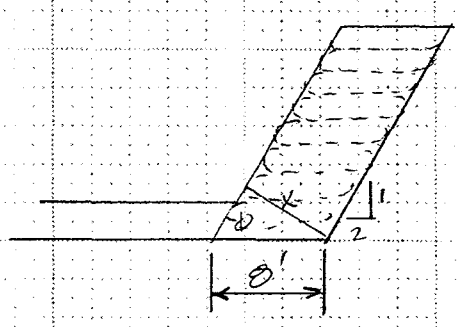
- 12" BANK (4:1) AND 12" BED (4:1 & 2:1):



$1\,ft^2 = (1')(1')(1')/27 = 0.0370\ c.y.$

$\therefore$ COST/C.F. $= \$30^{00}/cy\left(0.0370\frac{cy}{cf}\right) = \$1^{11}/SF$

- 3.6' BANK (2:1)



$\phi = \tan^{-1}\frac{1}{2} = 26.57°$

$x = \sin 26.56°(8') = 3.6'$

$1\,ft^2 = 1'(1')(3.6')/27 = 0.1333\ cy$

$\therefore$ COST/CF $= \$30/cy\left(0.1333\frac{cy}{cf}\right) = \$4^{00}/SF$

F. SHOTCRETE (6" REINF.)

1. APPROX QUANTITIES ≈ 58,000 SY – 95,000 SY
2. ADOT PRICES VARY $2.00 – 3.50 /SF
3. EST. CONCRETE @ $150.00/CY APPLIED

∴ COST = ((1')(1')(0.5')/27)(150.00) = 2.77 USE $2.80/SF

G. CONCRETE (CANTILEVER RET. WALLS)

1. APPROX QUANTITIES = 400,000 SF – 650,000 SF
2. CONCRETE QUANTITIES * STEEL QUANTITIES * * ADOT DET 3-18.20

	CONCRETE QUANTITIES *	STEEL QUANTITIES *
4' WALL	0.32 CY/LF = 0.08 CY/SF	21.2 lb/LF = 5.3 lb/SF
7' WALL	0.47 CY/LF = 0.067 CY/SF	28.7 lb/LF = 4.1 lb/SF
10' WALL	0.64 CY/LF = 0.064 CY/SF	43.2 lb/LF = 4.3 lb/SF
13' WALL	0.81 CY/LF = 0.062 CY/SF	74.0 lb/LF = 5.7 lb/SF

3. MATERIALS PRICES
   - CONCRETE: ADOT RECENT JOBS AVE $200.00/CY USE
   - STEEL " " " " $0.35/lb USE
4. COST PER S.F.

4' WALL	= 0.08 CY/SF ($200/CY) + 5.3 lb/SF ($0.35/lb)	= 17.85	SAY $18.00
7' WALL	= 0.067 (200) + 4.1 (0.35)	= 14.83	SAY 15.00
10' WALL	= 0.064 (200) + 4.3 (0.35)	= 14.30	SAY 14.50
13' WALL	= 0.062 (200) + 5.7 (0.35)	= 14.00	SAY 14.50

CONCRETE CONT'D

UP TO 4' USE $18.00/SF ALL OTHERS USE $15.00/SF

6. FLOOR (6" REINF.) USE SHOTCRETE @ $2.80/SF

H DROP STRUCTURES

1. ESTIMATING ASSUMPTIONS:

a. DROP STRUCTURE TO BE EVALUATED ON A COST-PER-LINEAL-FOOT BASIS.

b. ALL CHANNELS WILL REQUIRE AN UPSTREAM IMPERMEABLE APRON FOR SEEPAGE CONTROL, WITH AN ASSUMED LENGTH OF 40', USING SHOTCRETE MATERIALS, PER APPENDIX III.

c. A REINFORCED-CONCRETE DROP STRUCTURE AT $105.00/LF IS ASSUMED, PER APPENDIX III

d. ALL CHANNELS WILL REQUIRE A DOWNSTREAM "JUMP" BASIN OF 9" CONCRETE, AT A COST OF $50.00/SY = $5.56/SF AS PER APPENDIX III

e. JUMP BASIN LENGTH IS BASED ON AN "AVERAGE" DEPTH CHANNEL FOR EACH LINER TYPE, FROM APPENDIX I. USING THE "AVERAGE" CHANNEL'S BASE WIDTH AND CRITICAL DEPTH YIELDS AN APPROXIMATE JUMP BASIN LENGTH FOR DROP PRICING (SEE FOLLOWING PAGES)

f. SINCE THE ECONOMIC MODEL FOR CHANNEL COSTS IN APPENDIX I ASSUMES THAT THE CHANNEL IS LINED FULL LENGTH, THE APRON AND JUMP BASIN COST FOR EACH DROP STRUCTURE WILL BE THE NET DIFFERENCE BETWEEN THE "BASE" CHANNEL LINER COST AND THE APRON (SHOTCRETE)/BASIN (CONCRETE) COST.

2. JUMP BASIN LENGTH - SEE PG II-8 THROUGH II-11

KLS WHITE TANKS FLOOD RETENTION STRUCTURE #4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38

STRAIGHT DROP SPILLWAY HYDRAULICS - EARTH CHANNEL STRTDRP1

```
        ->|     |<-----Lc =     6.6
        ----
            --  ---
  1.90 =Dc       \<---Do =    1.36          WATER SURFACE
       ********  \      .-----------------------------
  3.00 =H        *   \__.'                          3.51 =Ds
                 *     0.92 =Dj
                 ***************************************
   9.0 =Ld--->|       |<--       24 =L              -->|
```

Q =	2206 CFS		D =	0.26623
C =	3.4		Ld =	9.0 FT.
Wdrop =	145 FT.		Dj =	0.92 FT.
Wjet =	145 FT.		Ds =	3.51 FT.
Wbasin =	145		Fr =	3.023
Dc(@DROP) =	1.90 FT.		L =	24 FT.
H =	3.00 FT.		L+Ld =	33 FT.
Do =	1.36 FT.		Vo =	11.21 FPS
q =	15.2 CFS/FT		Vj =	16.48 FPS
			Vs =	4.3 FPS
Lc =	6.6 FT.			

STRAIGHT DROP SPILLWAY HYDRAULICS - PLAIN RIPRAP STRTDRP1

```
        ->|     |<-----Lc =    14.1
        ----
            --  ---
  4.04 =Dc       \<---Do =    2.89          WATER SURFACE
       ********  \      .-----------------------------
  3.00 =H        *   \__.'                          6.92 =Ds
                 *     2.70 =Dj
                 ***************************************
  17.9 =Ld--->|       |<--       48 =L              -->|
```

Q =	2206 CFS		D =	3.32984
C =	3.4		Ld =	17.9 FT.
Wdrop =	41 FT.		Dj =	2.70 FT.
Wjet =	41 FT.		Ds =	6.92 FT.
Wbasin =	41		Fr =	2.136
Dc(@DROP) =	4.04 FT.		L =	48 FT.
H =	3.00 FT.		L+Ld =	66 FT.
Do =	2.89 FT.		Vo =	18.65 FPS
q =	53.8 CFS/FT		Vj =	19.92 FPS
			Vs =	7.8 FPS
Lc =	14.1 FT.			

KLS WHITE TANKS FLOOD RETENTION STRUCTURE #4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38

STRAIGHT DROP SPILLWAY HYDRAULICS - RENO MATTRESS STRTDRP1

```
        ->|     |<-----Lc =     13.8
        ----
            --
            ---
3.93 =Dc        \<---Do =     2.81          WATER SURFACE
     ********    \      .-------------------------------
3.00 =H      *    \__.'                          6.51 =Ds
             *      2.45 =Dj
             ****************************************
16.8 =Ld--->|       |<--       45 =L              -->|
```

Q =	2206 CFS		D =	2.64530	
C =	3.4		Ld =	16.8	FT.
Wdrop =	46	FT.	Dj =	2.45	FT.
Wjet =	46	FT.	Ds =	6.51	FT.
Wbasin =	46		Fr =	2.205	
Dc(@DROP) =	3.93	FT.	L =	45	FT.
H =	3.00	FT.	L+Ld =	62	FT.
Do =	2.81	FT.	Vo =	17.08	FPS
q =	48.0	CFS/FT	Vj =	19.58	FPS
			Vs =	7.4	FPS
Lc =	13.8	FT.			

STRAIGHT DROP SPILLWAY HYDRAULICS - GROUTED RIPRAP STRTDRP1

```
        ->|     |<-----Lc =     14.1
        ----
            --
            ---
4.04 =Dc        \<---Do =     2.89          WATER SURFACE
     ********    \      .-------------------------------
3.00 =H      *    \__.'                          6.92 =Ds
             *      2.70 =Dj
             ****************************************
17.9 =Ld--->|       |<--       48 =L              -->|
```

Q =	2206 CFS		D =	3.32984	
C =	3.4		Ld =	17.9	FT.
Wdrop =	41	FT.	Dj =	2.70	FT.
Wjet =	41	FT.	Ds =	6.92	FT.
Wbasin =	41		Fr =	2.136	
Dc(@DROP) =	4.04	FT.	L =	48	FT.
H =	3.00	FT.	L+Ld =	66	FT.
Do =	2.89	FT.	Vo =	18.65	FPS
q =	53.8	CFS/FT	Vj =	19.92	FPS
			Vs =	7.8	FPS
Lc =	14.1	FT.			

KLS WHITE TANKS FLOOD RETENTION STRUCTURE #4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38

STRAIGHT DROP SPILLWAY HYDRAULICS - SOIL-CEMENT (4:1 SLOPES) STRTDRP1

```
        ->|     |<-----Lc =     14.3
        ----
            __
            ___
  4.09 =Dc       \<---Do =     2.92          WATER SURFACE
       ********  \      .-----------------------------
  3.00 =H      *   \__.'                          7.20 =Ds
               *     2.88 =Dj
               ****************************************
  18.6 =Ld--->|       |<--       50 =L              -->|
```

Q =	2206 CFS		D =	3.87636	
C =	3.4		Ld =	18.6	FT.
Wdrop =	38	FT.	Dj =	2.88	FT.
Wjet =	38	FT.	Ds =	7.20	FT.
Wbasin =	38		Fr =	2.092	
Dc(@DROP) =	4.09	FT.	L =	50	FT.
H =	3.00	FT.	L+Ld =	68	FT.
Do =	2.92	FT.	Vo =	19.87	FPS
q =	58.1	CFS/FT	Vj =	20.15	FPS
			Vs =	8.1	FPS
Lc =	14.3	FT.			

STRAIGHT DROP SPILLWAY HYDRAULICS - SOIL-CEMENT (2:1 SLOPES) STRTDRP1

```
        ->|     |<-----Lc =     13.8
        ----
            __
            ___
  3.94 =Dc       \<---Do =     2.81          WATER SURFACE
       ********  \      .-----------------------------
  3.00 =H      *   \__.'                          6.51 =Ds
               *     2.45 =Dj
               ****************************************
  16.8 =Ld--->|       |<--       45 =L              -->|
```

Q =	2206 CFS		D =	2.64530	
C =	3.4		Ld =	16.8	FT.
Wdrop =	46	FT.	Dj =	2.45	FT.
Wjet =	46	FT.	Ds =	6.51	FT.
Wbasin =	46		Fr =	2.205	
Dc(@DROP) =	3.94	FT.	L =	45	FT.
H =	3.00	FT.	L+Ld =	62	FT.
Do =	2.81	FT.	Vo =	17.04	FPS
q =	48.0	CFS/FT	Vj =	19.58	FPS
			Vs =	7.4	FPS
Lc =	13.8	FT.			

KLS WHITE TANKS FLOOD RETENTION STRUCTURE #4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38

STRAIGHT DROP SPILLWAY HYDRAULICS - SHOTCRETE STRTDRP1

```
        ->|     |<-----Lc =     17.5
        ----
            --  ---
  5.01 =Dc       \<---Do =     3.58          WATER SURFACE
       ********   \      .-----------------------------
  3.00 =H      *    \__.'                          8.31 =Ds
               *      3.63 =Dj
               ****************************************
  21.5 =Ld--->|       |<--       57 =L              -->|
```

Q =	2206 CFS		D =	6.65573
C =	3.4		Ld =	21.5 FT.
Wdrop =	29 FT.		Dj =	3.63 FT.
Wjet =	29 FT.		Ds =	8.31 FT.
Wbasin =	29		Fr =	1.942
Dc(@DROP) =	5.01 FT.		L =	57 FT.
H =	3.00 FT.		L+Ld =	79 FT.
Do =	3.58 FT.		Vo =	21.26 FPS
q =	76.1 CFS/FT		Vj =	20.98 FPS
			Vs =	9.2 FPS
Lc =	17.5 FT.			

STRAIGHT DROP SPILLWAY HYDRAULICS - CONCRETE STRTDRP1

```
        ->|     |<-----Lc =     13.9
        ----
            --  ---
  3.98 =Dc       \<---Do =     2.84          WATER SURFACE
       ********   \      .-----------------------------
  3.00 =H      *    \__.'                          6.29 =Ds
               *      2.32 =Dj
               ****************************************
  16.2 =Ld--->|       |<--       43 =L              -->|
```

Q =	2206 CFS		D =	2.33131
C =	3.4		Ld =	16.2 FT.
Wdrop =	49 FT.		Dj =	2.32 FT.
Wjet =	49 FT.		Ds =	6.29 FT.
Wbasin =	49		Fr =	2.243
Dc(@DROP) =	3.98 FT.		L =	43 FT.
H =	3.00 FT.		L+Ld =	60 FT.
Do =	2.84 FT.		Vo =	15.84 FPS
q =	45.0 CFS/FT		Vj =	19.39 FPS
			Vs =	7.2 FPS
Lc =	13.9 FT.			

DROP STRUCTURES CONTINUED

3. FOR A UNIT WIDTH OF DROP STRUCTURE:

LINER TYPE	APRON COST		DROP COST		BASIN COST		TOTAL COST
1. EARTH	1'(40')(\$2.80 - ϕ)	+	1'(\$105.00)	+	1'(33')(\$5.55 - ϕ)	=	\$400/LF
2. RIPRAP	1'(40')(2.80 - 1.70)	+	1'(105.00)	+	1'(66')(5.55 - 1.70)	=	\$405/LF
3. RENO MAT	1'(40')(2.80 - 3.40)	+	1'(105.00)	+	1'(62')(5.55 - 3.40)	=	\$215/LF
4. GRTD RIPRAP	1'(40')(2.80 - 2.40)	+	1'(105.00)	+	1'(66')(5.55 - 2.40)	=	\$330/LF
5. SOIL-CEM. (4:1)	1'(40')(2.80 - 1.11)	+	1'(105.00)	+	1'(68')(5.55 - 1.11)	=	\$475/LF
6. SOIL CEM (2:1)	1'(40')(2.80 - 1.11)	+	1'(105.00)	+	1'(62')(5.55 - 1.11)	=	\$450/LF
7. SHOTCRETE	1'(40')(2.80 - 2.80)	+	1'(105.00)	+	1'(79')(5.55 - 2.80)	=	\$325/LF
8. CONCRETE	1'(40')(2.80 - 2.80)	+	1'(105.00)	+	1'(60')(5.55 - 2.80)	=	\$270/LF

I. FENCE AND GATES

1. 6' HIGH CHAIN-LINK FENCE VARIES \$8.00 TO \$12.00, USE \$10.00/LF

J. RIGHT-OF-WAY

1. R.O.W. IS EXPECTED TO VARY FROM \$12,000 TO \$15,000.00 PER ACRE, WITH THE HIGHER PRICE EXPECTED NEAR THE I-10 FREEWAY. (DATA PER FLOOD CONTROL DISTRICT)

2. APPROXIMATELY 50% OF CHANNEL IS FAIRLY CLOSE TO FREEWAY, USE AVERAGE OF TWO PRICES

(12,000 + 15,000)/2 = USE \$13,500.00/AC

APPENDIX III

GRADE CONTROL STRUCTURE CALCULATIONS

APPENDIX III - GRADE CONTROL STRUCTURE CALCULATIONS

Required Weir Width III-1
Jump Basin Sizing III-4
Seepage Analysis III-8
Spillway Design - Concrete III-10
Spillway Design - Gabions III-18
Spillway Cost Comparison III-22
Apron Design III-23
Apron Cost Comparison III-25

DIBBLE & ASSOCIATES

CONSULTING ENGINEERS

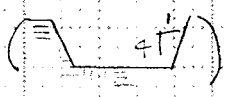
CALC KLS DATE 6/18/93 TITLE WHITE TANKS #4 INLET JOB 9302

CHKD ..... DATE ..... STRAIGHT DROP SPILLWAY SHT 1 OF 7

A CALCULATE WEIR WIDTH REQ'D SCS NEH SECTION 11

1. Set upstream H = D_n approach channel = 4.6'

2. $Q = CL\left(H + \frac{V_a^2}{2g}\right)^{3/2}$ Rectangular weir, unsubmerged

$C = 3.1$ Rectangular $C = 3.386$ Cippoletti 

3. $L = Q / C\left(H + \frac{V_a^2}{2g}\right)^{3/2}$ $\frac{V_a^2}{2g} = \frac{8.85^2}{64.4} = 1.216'$

$\therefore L = 2206\text{ cfs} / 3.386\left(4.6 + 1.216\right)^{3/2} = 46.5'$

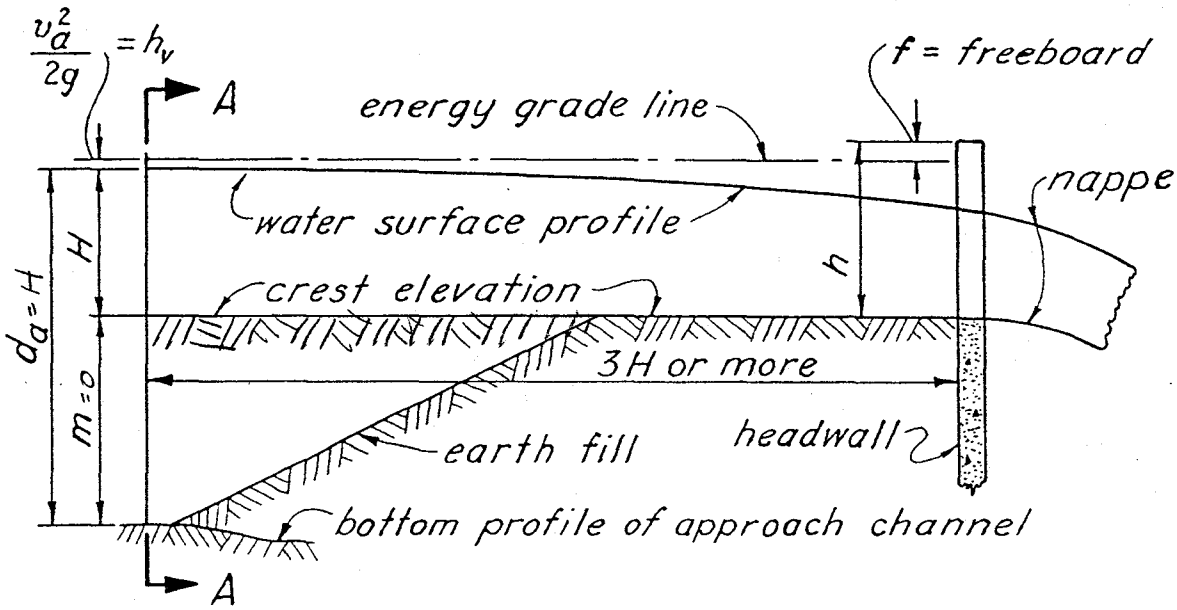
4. check free-fall assumption:

a. Drop Sequent Depth $(D_s) = 1.66\, D_n^{0.27}\,(H_{drop})$

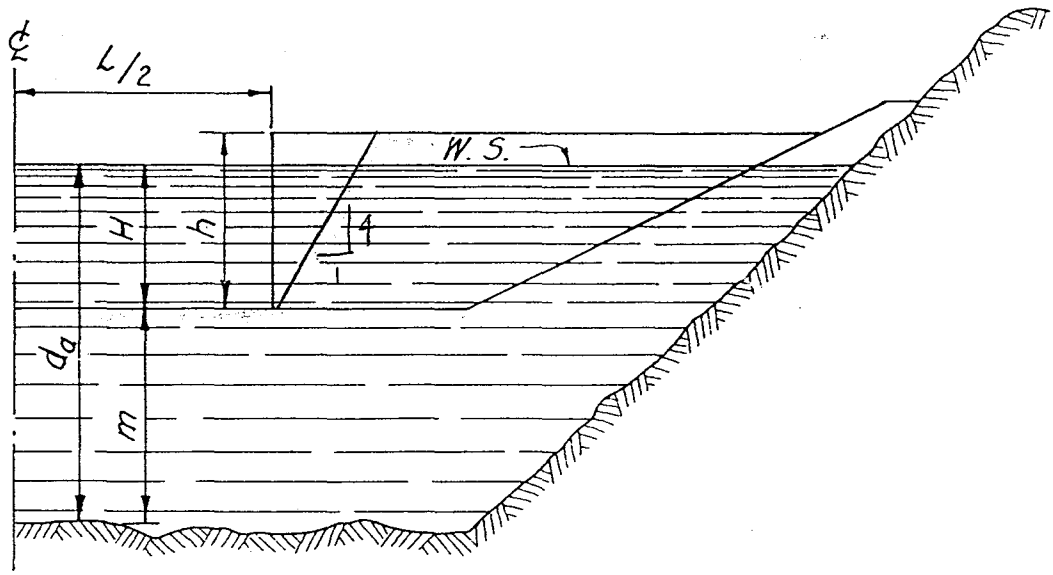
b. $D_n = q^2/(g)(H^3) = \left(\frac{2206\text{cfs}}{46.5\text{ft}}\right)^2 / 32.2\,(3')^3 = 2.589$

c. $D_s = 1.66\,(2.589)^{0.27}\,(3) = 6.44'$

$D_s > H \therefore$ Drop is partially submerged



Condensed Profile on ℄ Spillway

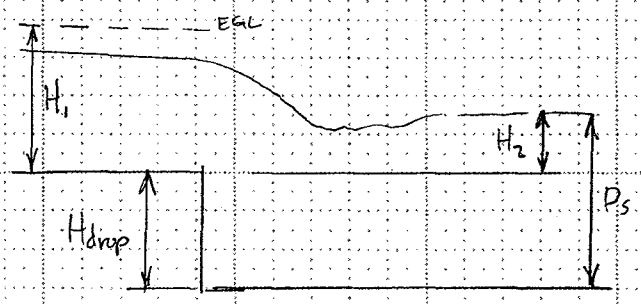


Section AA

Half Cross Section of Approach Channel showing Projected Weir Opening

FIGURE 3.1

5. Adjust weir width for submergence



a. $H_1 = H + \frac{V_0^2}{2g} = 4.6 + 1.216 = 5.82'$

b. $H_2 = D_s - H_{drop} = 6.44' - 3' = 3.44'$

c. $H_2/H_1 = 3.44/5.82 = 0.6$

d. @ $H_2/H_1 = 0.6$, $R = 0.94$ NEH 11 FIG 3.4

e. $q_{free} = 2206/46.5 = 47.44$ cfs/ft

$q_{sub} = R(q_f) = 0.94(47.44) = 44.6$

f. $\therefore L = Q/q_f = 2206/44.6 = 49.5$ Use 50'

Weir width to compensate for submergence = 50'

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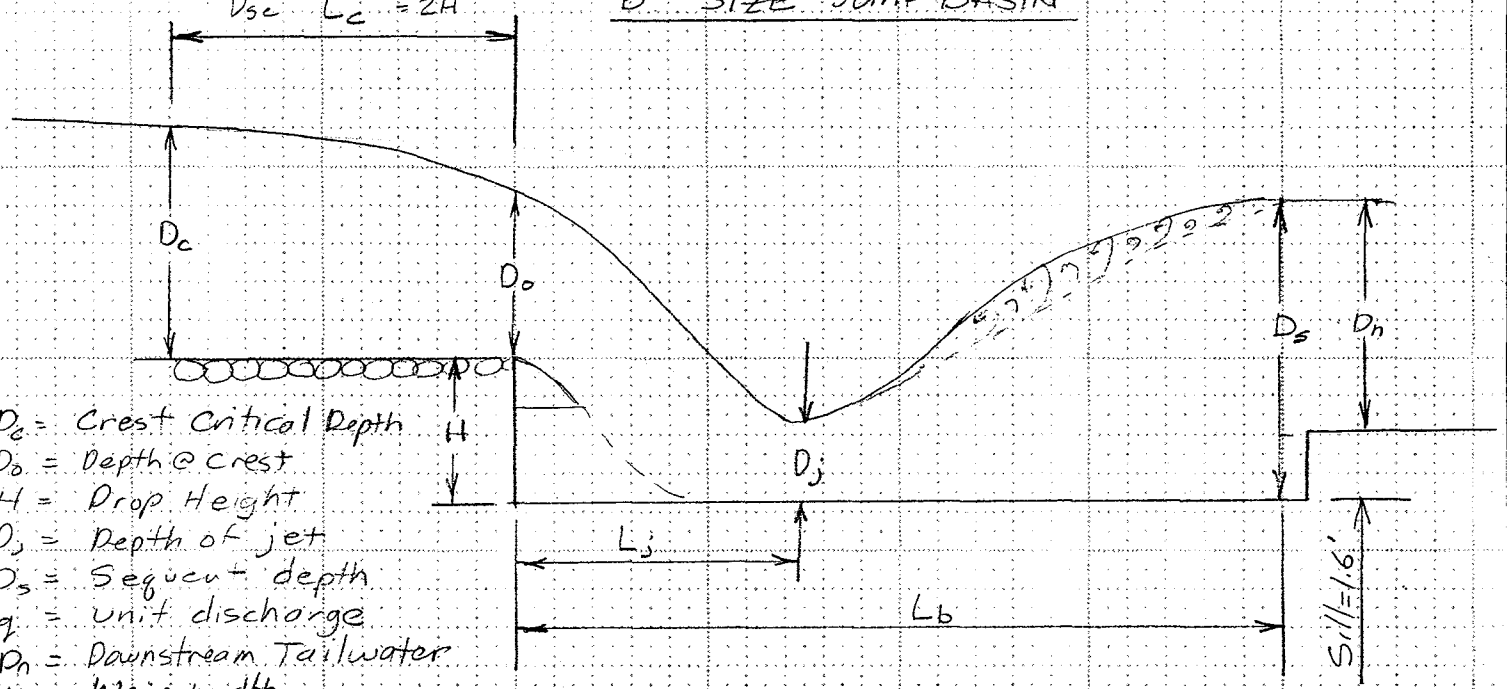
CALC KLS DATE 6/18/93 TITLE WHITE TANKS #4 INLET JOB 9302

CHKD ..... DATE ..... STRAIGHT DROP SPILLWAY SHT 4 OF 7

B. SIZE JUMP BASIN



D_c = Crest Critical Depth
D_o = Depth @ crest
H = Drop Height
D_j = Depth of jet
D_s = Sequent depth
q = unit discharge
D_n = Downstream Tailwater
W = Weir width

@W = 50'

1. Drop No. $D_n = q^2 / (g)(H)^3$ = 2.239
2. $L_j = (4.3\ D_n^{0.27})H$ = 16.04'
3. $D_j = (0.54\ D_n^{0.425})H$ = 2.28'
4. $D_s = (1.66\ D_n^{0.27})H$ = 6.19'
5. * $L_b = L_j + 6.9\ D_s$ = 59'
6. $L_c = 2h = 2(6)$ = 12'

7. Since D_s > Tailwater (D_n), use sill to contain jump.

8. Sill Height = $D_s - D_n$ = 6.2 − 4.6 = 1.6'. Trickle channel will be required between drops to drain jump basin

* Assumes jump is forced @ impact point

```
==================================================================================
KLS                WHITE TANKS FRS #4 INLET CHANNEL                      JOB 9302
FCD PROJECT NO. 92-38                      CHANNEL HYDRAULICS @    GIVEN Q
==================================================================================
    STRAIGHT-DROP SPILLWAY - WEIR CONFIGURATION                            WEIR1
----------------------------------------------------------------------------------


                    52.6 FT
 |<------CHANNEL WIDTH-------->|

**                  51.9 FT       *****     CALC. Q =          2206 cfs
 ** |<-----TOP WIDTH------>| **            ACTUAL Q =          2206 cfs(ENTER)
  **-------------------------**                    S =        0.0028 ft/ft
   **              3.73       **                    n =         0.015
    **           FT DEEP     **                    b =            50 ft
     **                     **                     z =          0.25 :1
      ********************            TRIAL DEPTH =          3.73 ft
                    50.0 FT
       |<--BASE WIDTH-->|


    NORMAL DEPTH CALCS                 CRITICAL DEPTH CALCS
--------------------------          ---------------------------------
         FLOW=     2206 CFS          CRITICAL  DEPTH =          3.90 FT
NORMAL DEPTH=      3.73 FT           CRIT.  VELOCITY =         11.10 FPS
 N. VELOCITY=     11.61 FPS          CRITICAL  SLOPE =        0.0024 FT/FT
   FREEBOARD=      1.46              FROUDE NO.      =          1.07
```

KLS WHITE TANKS FLOOD RETENTION STRUCTURE #4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38

STRAIGHT DROP SPILLWAY HYDRAULICS STRTDRP1

```
      ->|     |<-----Lc =     13.7
      ----
          --___
3.90 =Dc       \<---Do =     2.79          WATER SURFACE
      ********  \      .-----------------------------
3.00 =H      *    \__.`                          6.23 =Ds
             *      2.28 =Dj
             ****************************************
16.0 =Ld--->|       |<--       43 =L              -->|
```

Q =	2206	CFS	D =	2.23899	
C =	3.4		Ld =	16.0	FT.
Wdrop =	50	FT.	Dj =	2.28	FT.
Wjet =	50	FT.	Ds =	6.23	FT.
Wbasin =	50		Fr =	2.256	
Dc(@DROP) =	3.90	FT.	L =	43	FT.
H =	3.00	FT.	L+Ld =	59	FT.
Do =	2.79	FT.	Vo =	15.84	FPS
q =	44.1	CFS/FT	Vj =	19.34	FPS
			Vs =	7.1	FPS
Lc =	13.7	FT.			

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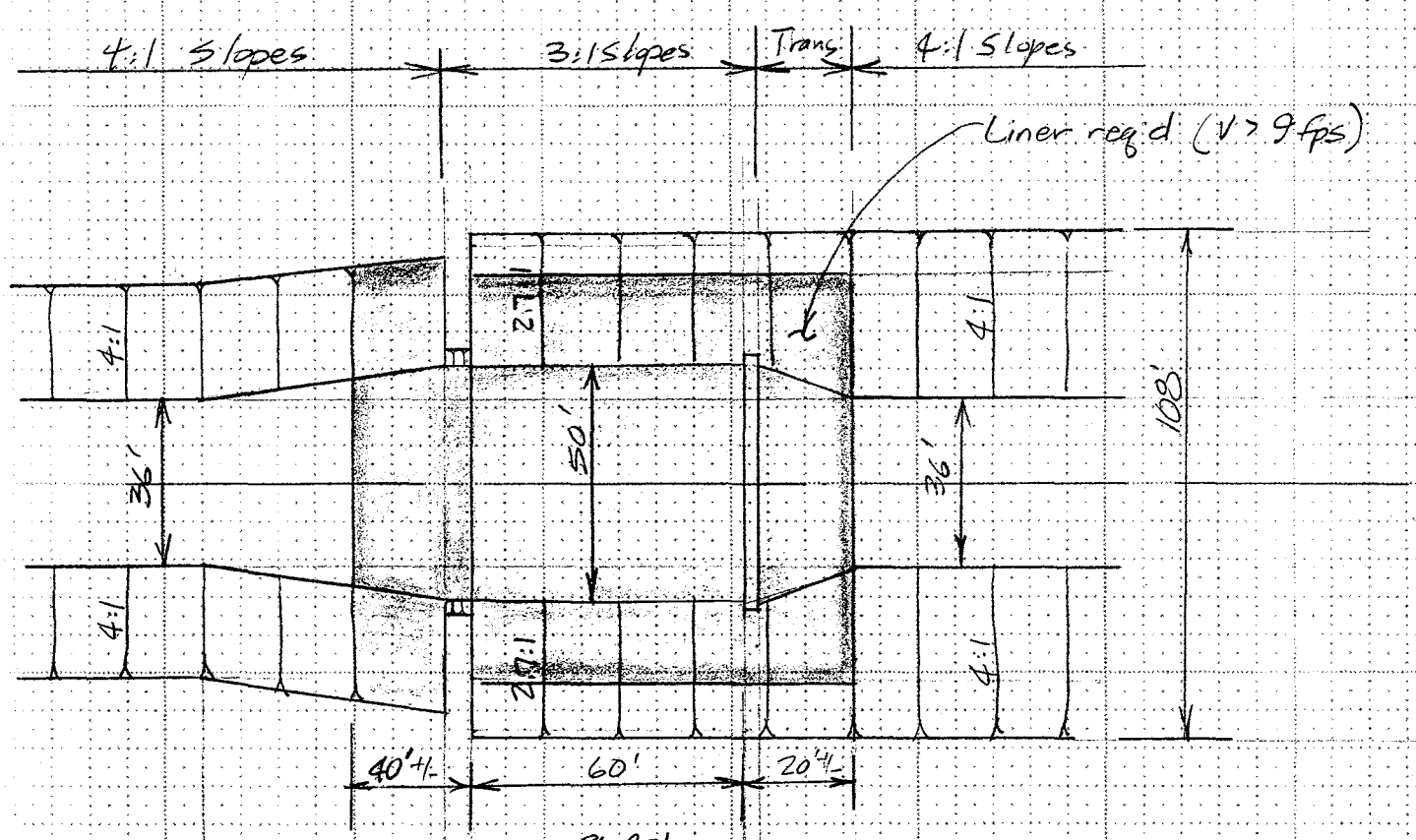
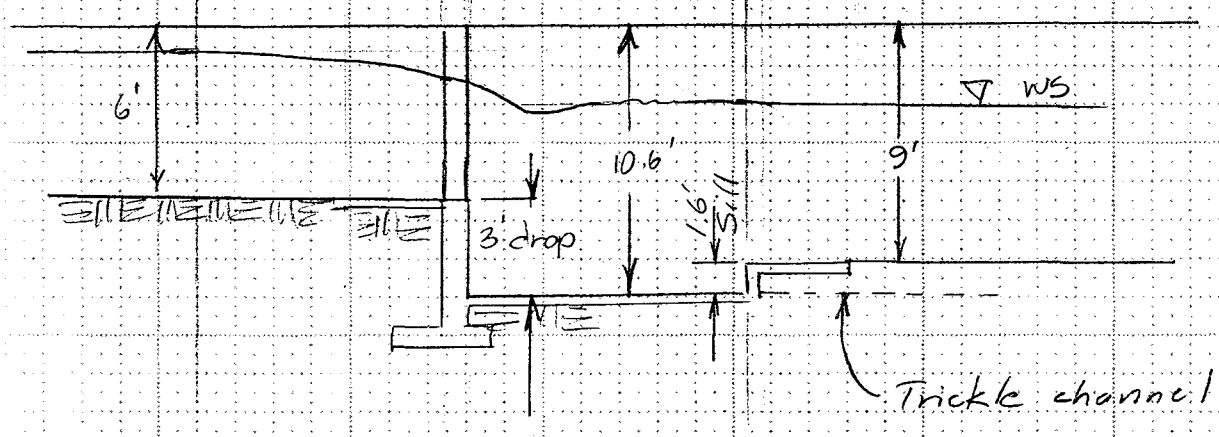
CALC KLS DATE 6/19/93 TITLE WHITE TANKS # 4 INLET JOB 9302

CHKD ..... DATE ..... STRAIGHT DROP SPILLWAY SHT 7 OF 7



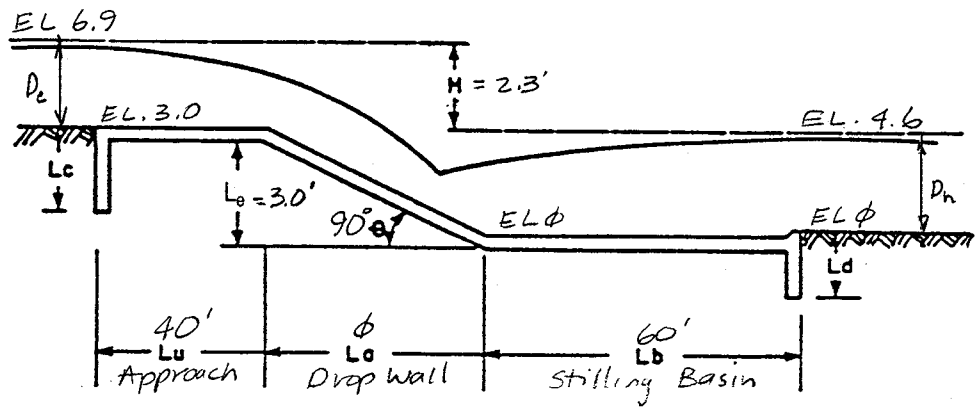
PLAN



ELEVATION

9302 6/22/93 1 OF 2

C SEEPAGE ANALYSIS



Assume $L_c = L_d$

For $\theta < 45°$ — $\Sigma L_H = L_u + L_a + L_b$

$\Sigma L_V = 2(L_c + L_d)$

For $\theta > 45°$ — $\Sigma L_H = L_u + L_b$ $\quad L_H = 40' + 60' = 100'$

$\Sigma L_V = 2(L_c + L_d) + L_e$ $\quad L_V = 4L_c + 3'$

where:

L_H	=	Horizontal seepage length, ft
L_V	=	Vertical seepage length, ft
L_u	=	Horizontal length from crest to upstream cutoff wall, ft
L_a	=	Horizontal length along face of drop structure, ft
L_b	=	Horizontal length along downstream basin, ft
L_c	=	Depth of cutoff wall, ft
L_d	=	Depth of cutoff at downstream end of basin, ft
L_e	=	Vertical drop height, ft

Figure 6.6
Definition Sketch for Weighted-Creep Theory for Nonporous Liner and Cutoffs
(Adapted from: Simons, Li and Associates 1981)

$$C_w = \frac{(L_H + 3L_V)}{3H}$$ $C_w = 7.0$ Fine Sand

$$\therefore \frac{C_w(3H) - L_H}{3} = L_V$$

$$L_V = 4L_c + 3$$

$$\therefore \frac{\left(\frac{C_w(3H) - L_H}{3}\right) - 3}{4} = L_c$$

$$\frac{\left(\frac{7.0(3)(2.3) - 100}{3}\right) - 3}{4} = -7.3 = L_c \therefore$$ Cut-off walls not req'd

check $H_{max} = 3' +/-$ $L_c = \frac{\left(\frac{7(3)(3) - 100}{3}\right) - 3}{4} = -3.8$ ok

Due to length of impermeable liner assumed, cut off walls are not req'd.

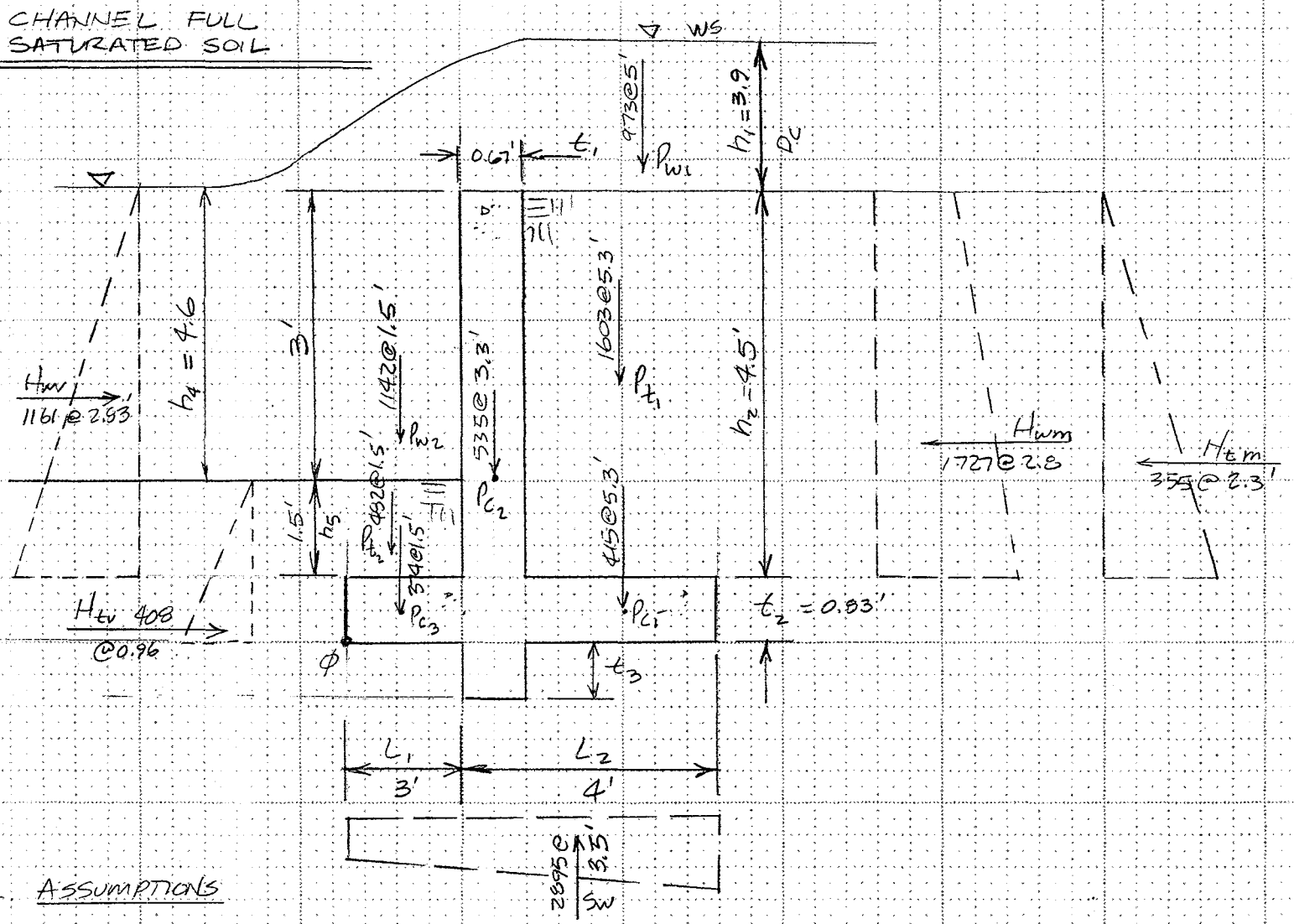
DIBBLE & ASSOCIATES

CONSULTING ENGINEERS

CALC KLS DATE 6/21/93 TITLE WHITE TANKS FRS #4 INLET JOB 9302

CHKD ..... DATE ..... SPILLWAY DESIGN - CONCRETE SHT 1 OF 8

CHANNEL FULL
SATURATED SOIL



A. ASSUMPTIONS

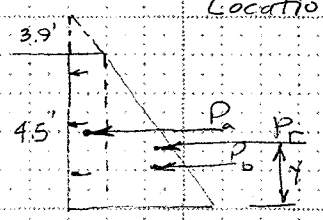
1. SOIL DENSITY = γ_s = 118 PCF (Ave. from soils report)
2. ACTIVE PRESSURE = 35 PCF
3. PASSIVE PRESSURE = 350 PCF
4. UNIT WIDTH OF STRUCTURE TO BE ANALYZED
5. COEFFICIENT OF FRICTION = 0.35 (w/PASSIVE PRESSURE)
6. SATURATED SOIL = $\gamma_t = \gamma_s(1-n) + n(\gamma_w) = 118(0.8) + 0.2(62.4) = 107$ pcf
   $n = 0.20$ assumed
7. F.S. = 1.5
8. UP/DOWNSTREAM CHANNEL IS PERMEABLE (LINER LEAKAGE) TO EVALUATE SEEPAGE/UPLIFT.

B HORIZONTAL FORCES

1. Water $H_{wm} = \frac{1}{2}(\gamma_w)((h_1+h_2)^2 - h_1^2)$

$= 0.5(62.4)((3.9'+4.5')^2 - 3.9'^2) = 1727\ \#/ft$

Location:



a. $P_a = (62.4)(3.9')(4.5') = 1095\ \#/ft$

b. $P_b = \frac{1}{2}(62.4)(4.5)(4.5) = 631\ \#/ft$

c. $\therefore P_r = 1095 + 631 = 1726\ \#/ft$

d. $P_r(y) = P_a\left(\frac{4.5}{2}\right) + P_b\left(\frac{4.5}{3}\right)$

$y = [1095(2.25) + 631(1.5)]/1726$

$y = 1.97'$

$\therefore$ Moment arm $= y + t_2 = 1.97 + 0.83 = 2.80$ ft.

$H_{wm} = 1727\ \#/ft \leftarrow @\ 2.8ft$

2. Water $H_{wv} = \frac{1}{2}\gamma_w(h_4+h_5)^2$

$= 0.5(62.4)(4.6'+1.5')^2 = 1,161\ \#/ft$

Location $= \frac{1}{3}(h_4+h_5)$

$= \frac{1}{3}(4.6+1.5) = 2.0$

$\therefore$ Moment arm $= 2.0 + 0.83 = 2.83'$

$H_{wv} = 1,161\ \#/ft \rightarrow @\ 2.83$ ft.

3. Soil Pressure $H_{tm} = \frac{1}{2}\gamma_a (h_2)^2$

$= 0.5(35\,pcf)(4.5)^2 = 355\ \#/ft$

Location $= \frac{1}{3} h_2 = \frac{1}{3}(4.5) = 1.48$

Moment arm $= 1.48 + 0.83 = 2.31$

$H_{tm} = 355\ \#/ft \leftarrow @\ 2.31'$

4. Soil Pressure $H_{tv} = \frac{1}{2}\gamma_p (h_3 + t_2)^2$

$= 0.5(350)(1.5 + 0.83) = 408\ \#/ft$

Location $= \frac{1}{3}(1.5 + 0.83) = 0.76\ ft$

$H_{tv} = 408\ \#/ft \rightarrow @\ 0.76\ ft$

C. VERTICAL FORCES

1. Water $P_{w1} = \gamma_w (h_1)(A)$

$= \gamma_w (h_1)(1')(L_2)$

$= 62.4(3.9)(1')(4') = 973\ \#/ft$

Location $= L_2/2 + L_1 = 4/2 + 3 = 5\ ft$

$P_{w1} = 973\ \#/LF \downarrow @\ 5'$

2. Water $P_{w_2} = \gamma_w (h_4 + h_5)(1')(L_1)$

$= 62.4(4.6 + 1.5)(1')(3') = 1142\ \#/ft$

Location $L_1/2 = 3/2 = 1.5\ ft$

$P_{w_2} = 1142\ \#/ft \downarrow @\ 1.5'$

3. Soil $P_{t_1} = \gamma_t (h_2)(1')(L_2 - t_1)$

$= 107(4.5)(1')(4' - 0.67') = 1603\ \#/ft$

Location $= L_1 + t_1 + \left(\frac{L_2 - t_1}{2}\right)$

$= 3' + 0.67' + \left(\frac{4' - 0.67'}{2}\right) = 5.3\ ft$

$P_{t_1} = 1603\ \#/ft \downarrow @\ 5.3'$

4. Soil $P_{t_2} = \gamma_t (h_5)(1')(L_1)$

$= 107(1.5)(1')(3') = 482\ \#/ft$

Location $= L_1/2 = 3/2 = 1.5\ ft$

$P_{t_2} = 482\ \#/ft \downarrow @\ 1.5'$

5 Concrete $P_{c_1} = \gamma_c (L_2 - t_1)(t_2)(1')$

$= 150(4 - 0.67)(0.83)(1') = 415\ \#/ft$

Location $= L_1 + \left(\frac{L_2 - t_1}{2}\right) + t_1$

$= 3' + \left(\frac{4' - 0.67'}{2}\right) + 0.67 = 5.3\ ft$

$P_{c_1} = 415\ \#/ft \downarrow @\ 5.3\ ft$

6. Concrete $P_{c_2} = t_1 (1')(h_2 + t_2 + t_3)\gamma_c$

$= 0.67(1')(4.5' + 0.83' + \phi)(150) = 535\#/ft$

Location $= L_1 + t_1/2 = 3' + 0.67/2 = 3.3\ ft$

$P_{c_2} = 535\#/ft \downarrow @ 3.3'$

7. Concrete $P_{c3} = \gamma_c (L_1)(1')(t_2)$

$= 150(3)(1)(0.83) = 374\#/ft$

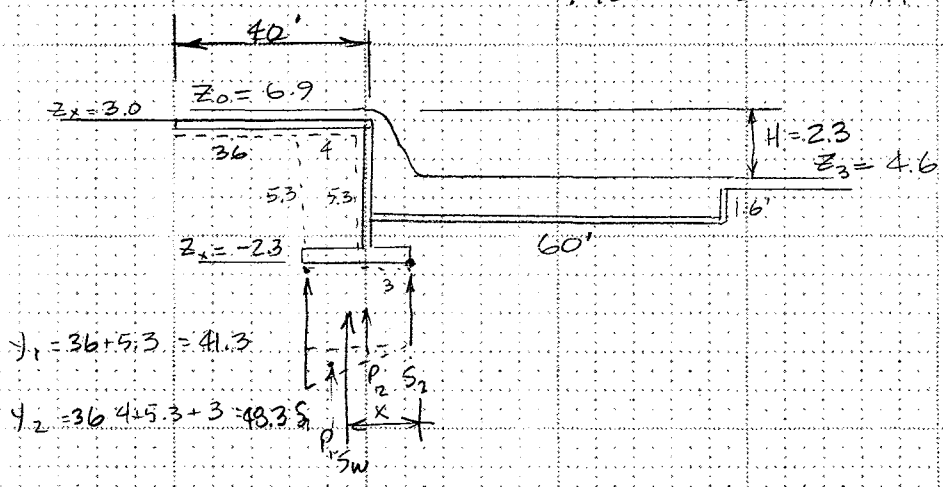
Location $= L_1/2 \quad 3/2 = 1.5\ ft$

$P_{c3} = 374\#/ft \downarrow @ 1.5\ ft$

8. Uplift Pressure

a. Weighted creep distance = 1/3(40+60) + 5.3 + 1.6 = 40'

b. Δh = 2.3/40 = 0.0575'/ft (pressure drop proportional to weighted creep distance: FCD manual II pg 278)



Δh = rate of pressure drop
y = dist. from apron to point x

c. $S_x = \gamma_w \left[\left(Z_0 - \Delta h\, y \right) - Z_x \right]$

d. $S_1 = 62.4 \left[\left(6.9 - 0.0575(41.3) \right) - -2.3 \right] = 426$ #/ft

e. $S_2 = 62.4 \left[\left(6.9 - 0.0575(48.3) \right) - -2.3 \right] = 401$ #/ft

f. $P_1 = \frac{1}{2}(S_1 - S_2)(7') = \frac{1}{2}(426 - 401)(7) = 88$ #/ft ↑ @ 4.66' (P_x, x)

$P_2 = S_2(7') = 401(7) = 2807$ #/ft ↑ @ 3.5'

$P_r = P_1 + P_2 = 88 + 2807 = 2895$

$[88(4.7) + 2807(3.5)]/2895 = 3.54$

S_w = 2895 #/ft ↑ @ 3.54'

D. STRUCTURAL STABILITY - OVERTURNING ΣM ABOUT "ϕ"

1. $M_{STABILITY(F)} = M_{S(F)}$

$\curvearrowright$ $M_{S(F)} = P_{w_1}(x) + P_{t_1}(x) + P_{c_1}(x) + P_{c_2}(x) + P_{t_2}(x) + H_{wv}(x) + H_{tv}(x) + P_{c_3} + P_{w_2}$

$= 973(5) + 1603(5.3) + 415(5.3) + 535(3.3) + 482(1.5) + 1,161(2.8) + 408(0.96) + 374(1.5) + 1142(1.5)$

$= 23,970$ lb-ft $\curvearrowright$

$\curvearrowleft$ 2. $M_{OVERTURNING(F)} = M_{O(F)}$

$= H_{wm}(x) + H_{tm}(x) + S_w(x)$

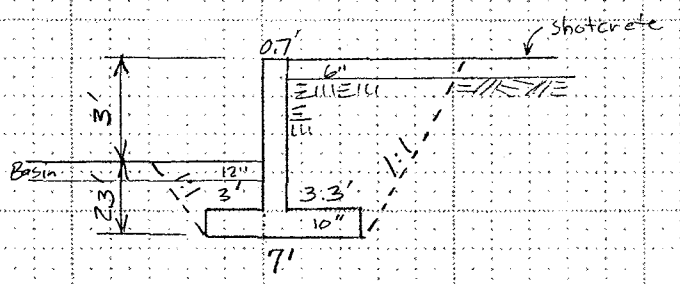
$= 1727(2.8) + 355(2.3) + 2895(3.5')$

$= 15,785$

3. $S_F = M_S / M_O = 23,970 / 15,785 = 1.52 > 1.5 \therefore$ OK

OK FOR PRELIM. COMPARISON - CHECK SLIDING, BEARING PRIOR TO DESIGN.

E. COST ESTIMATE



QUANTITIES

1. Structural excavation: $3'(2.3') + 0.5(2.3')(2.3') + 4'(5.3') + 0.5(5.3')(5.3')$
$= 44.8\ ft^3/LF$ $= 1.65\ cy/LF$

2. Concrete: $7'(0.83') + 4.5'(0.67') = 8.8\ ft^3/LF$ $= 0.32\ cy/LF$

3. Structural backfill $1.3'(3') + 1.3(1.3)(0.5) + 5(4') + 5(5)0.5$
$= 37.2\ ft^3/LF$ $= 1.38\ cy/LF$

COSTS

1. Structural Exc.: $1.65\ cy/LF\ (3^{00}) =$ $= \$4^{95}/LF$
2. Concrete: $0.40\ cy/LF$ conc $(\$200^{00}) + 25.0\#/LF$ steel $(\$0^{35}) =$ $= \$88^{75}/LF$
3. Backfill: $1.38\ cy/LF\ (8^{00}) =$ $= \$11^{00}/LF$

$\$104^{70}/LF$ TOTAL

NOTE - CONCRETE COST BASED ON AVERAGE BETWEEN 4' WALL AND 7' WALL - SEE APPENDIX II PAGE II-8

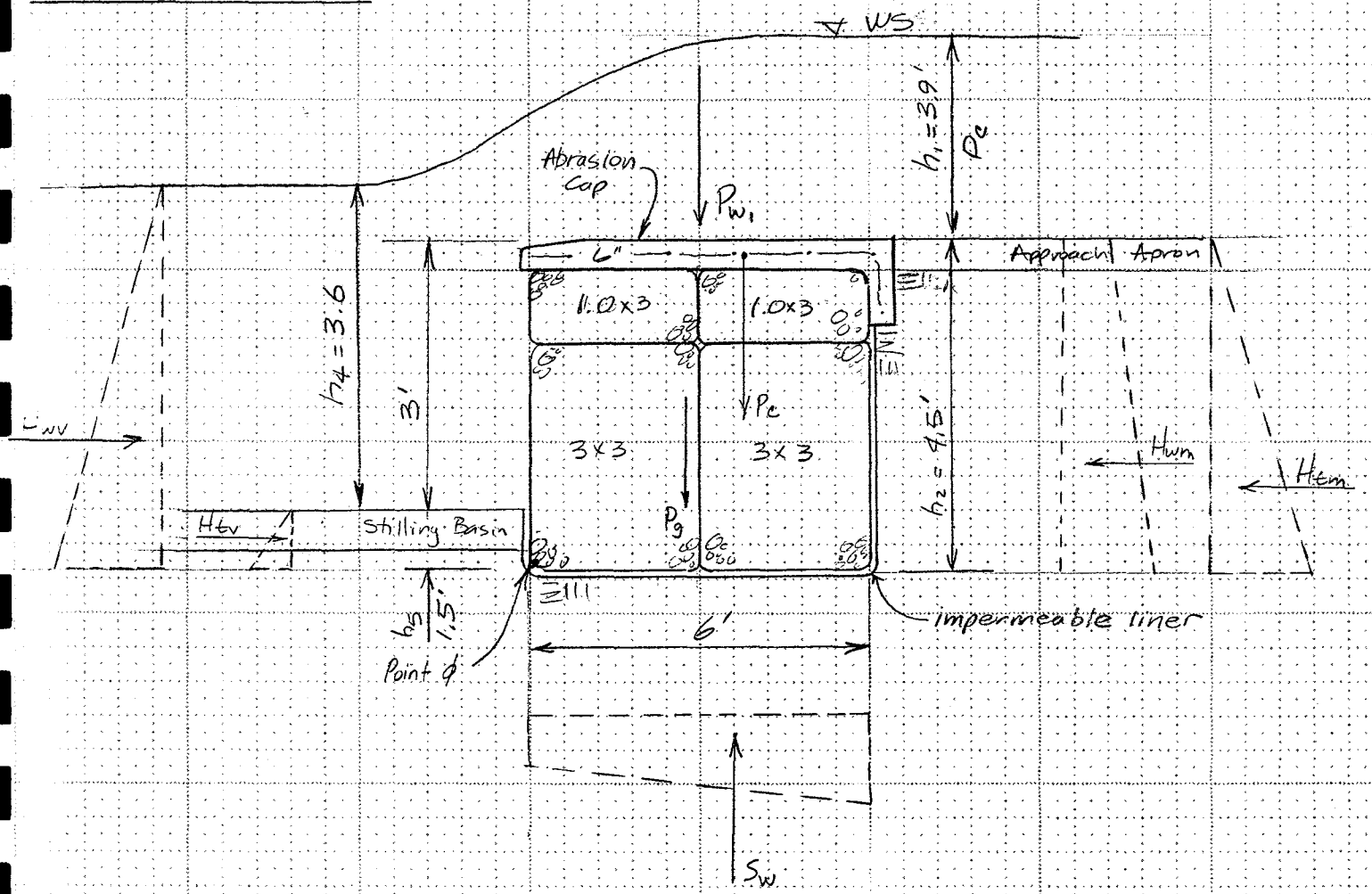
DIBBLE & ASSOCIATES

CONSULTING ENGINEERS

CALC KLS DATE 6/28/93 TITLE WHITE TANKS FRS # 4 INLET JOB 9302

CHKD ..... DATE ..... SPILLWAY DESIGN - GABIONS SHT 1 OF 5

CHANNEL FULL
SATURATED SOIL



A. ASSUMPTIONS

1. SOIL DENSITY = γ_s = 118 PCF, SATURATED = γ_s = 107 pcf
2. ACTIVE PRESSURE = 35 PCF PASSIVE = 350 PCF
3. COEFFICIENT OF FRICTION = 0.35
4. F.S = 1.5
5. GABION FILLER ROCK = γ_R = 145 PCF
6. GABION POROSITY = n = 0.3 ∴ $\gamma_g = \gamma_R(1-n) = 145(1-0.3) = 102$ PCF
   SATURATED = $\gamma_{g_1} = [\gamma_R(1-n) + n\,\gamma_w] = [145(1-0.3) + 0.3(62.4)] = 120.$ PCF
7. TIED BASKETS ~~ACT~~ AS A UNIT

B. HORIZONTAL FORCES

1. Water $H_{wm} = \frac{1}{2}(\gamma_w)((h_1+h_2)^2 - h_1^2) = 1727\#/FT \leftarrow @ 2.8'$
(Same h_1, h_2 as for concrete analysis)

2. Water $H_{wv} = \frac{1}{2}\gamma_w(h_4+h_5)^2 = 1161\#/FT \rightarrow @ 2.83'$
(Same h_4, h_5 as for concrete)

3. Soil pressure $H_{Tm} = \frac{1}{2}\gamma_a(h_2) = 355\#/FT \leftarrow @ 2.31'$
(Same h_2 as for concrete)

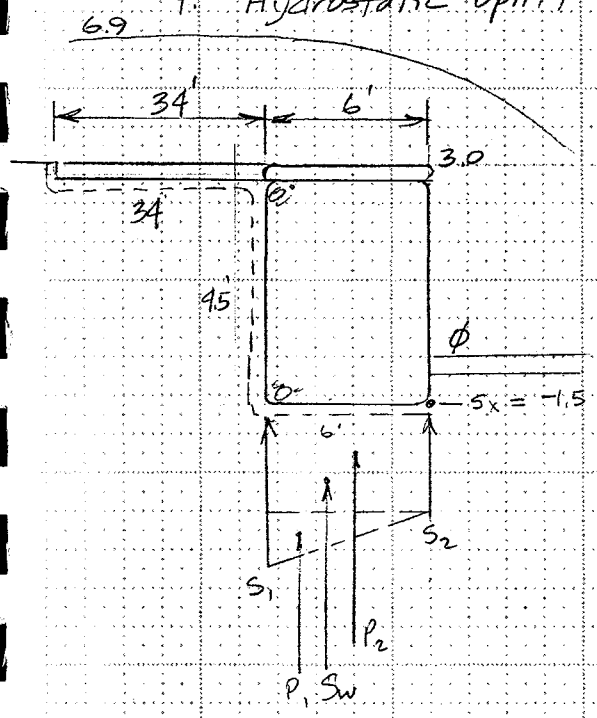
4. Soil Pressure $H_{tv} = \frac{1}{2}\gamma_p(h_5)^2$
(ignore basin liner)
$= \frac{1}{2}(350)(1.5')^2 = 394\#/FT \rightarrow @ 0.5'$

C. VERTICAL FORCES

1. Water $P_{w1} = \gamma_w(h_1)(A) = 62.4(3.9')(1')(6.5') = 1582\#/FT \downarrow @ 3.25'$
2. Concrete $P_c = \gamma_c(6")(1')(6.5) = 150(0.5)(1')(6.5) = 488\#/FT \downarrow @ 3.25'$
3. Gabions $P_g = \gamma_{gi}(h_2 - 6")(A) = 120(4.5-0.5)(1')(6') = 2880\#/FT \downarrow @ 3.0$

4. Hydrostatic uplift

See Concrete analysis pg 6



a. Weighted creep distance = 40'

b. $\Delta h = 2.3/40 = 0.0575$ '/ft

c. $y_1 = 34' + 4.5' = 38.5'$

d. $y_2 = 34' + 4.5 + 6' = 44.5'$

e. $S_1 = 62.4((6.9 - 0.0575(38.5)) - -1.5) = 386$ #/ft

f. $S_2 = 62.4((6.9 - 0.0575(44.5)) - -1.5) = 364$ #/ft

g. $P_1 = 1/2(S_1 - S_2)(6') =$

$= 1/2(386 - 364)(6) = 66$ #/ft ↑ @ 4'

h. $P_2 = S_2(6) = 364(6) = 2184$ #/ft ↑ @ 3'

i. $S_w = P_1 + P_2 = 66$ #/ft $+ 2184$ #/ft $= 2250$ #/ft ↑

S_w Location $= (66(4) + 2184(3))/2250 = 3.03'$

$\therefore S_w = 2250$ #/ft ↑ @ 3.03'

D. STRUCTURAL STABILITY - OVERTURNING

1. $M_S = \Sigma M_\phi = P_{w1}(x) + P_c(x) + P_g(x) + H_{wv}(x) + H_{bv}(x)$

$= 1582(3.25) + 488(3.25) + 2880(3.0) + 1761(2.83) + 394(0.5)$

$= 18,850$ lb-ft ↻

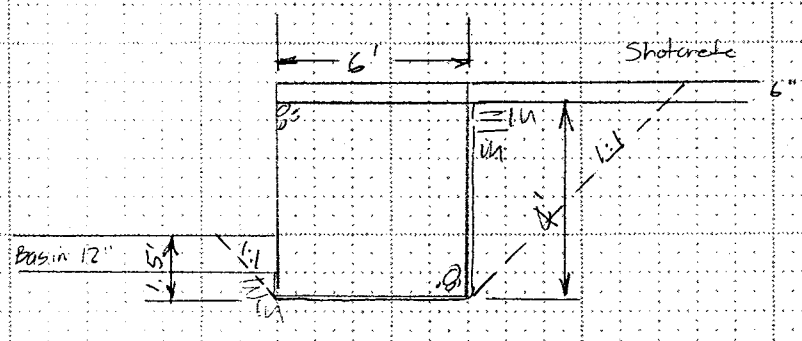
2. $M_o = \Sigma M_\phi \quad H_{wm}(x) + H_{bm}(x) + S_m(x)$

$= 1727(2.8) + 355(2.31) + 2250(3.03)$

$= 12,470$ lb-ft ↺

3. $S_F = M_S / M_o = 18,850 / 12470 = 1.51 > 1.5 \therefore$ OK

E. COST ESTIMATE



QUANTITIES

1. Structural Excavation = 1.5'(1.5')(0.5) + 6'(4.5') + 4.5'(4.5')(0.5')
   = 38.3 cf = 1.42 cy/LF
2. Gabions = 4'(6')(1') = 24 cf = 0.89 cy/LF
3. Conc. Cap = 6'(0.5')(1') = 3 CF = 0.11 cy/LF
4. Structural backfill = 0.5(0.5)(0.5) + 4(4)(0.5) = 8 CF = 0.30 cy/LF

COSTS

1. Structural Exc = 1.42 cy/LF (3.00) = $4.26
2. Gabions (incl. liner) = 0.89 cy/LF (100.00) = 89.00
3. Conc. Cap = 0.11 cy/LF (70.00) = 7.70
4. Structure Backfill = 0.30 cy/LF (8.00) = 2.40

$103.36 TOTAL/LF

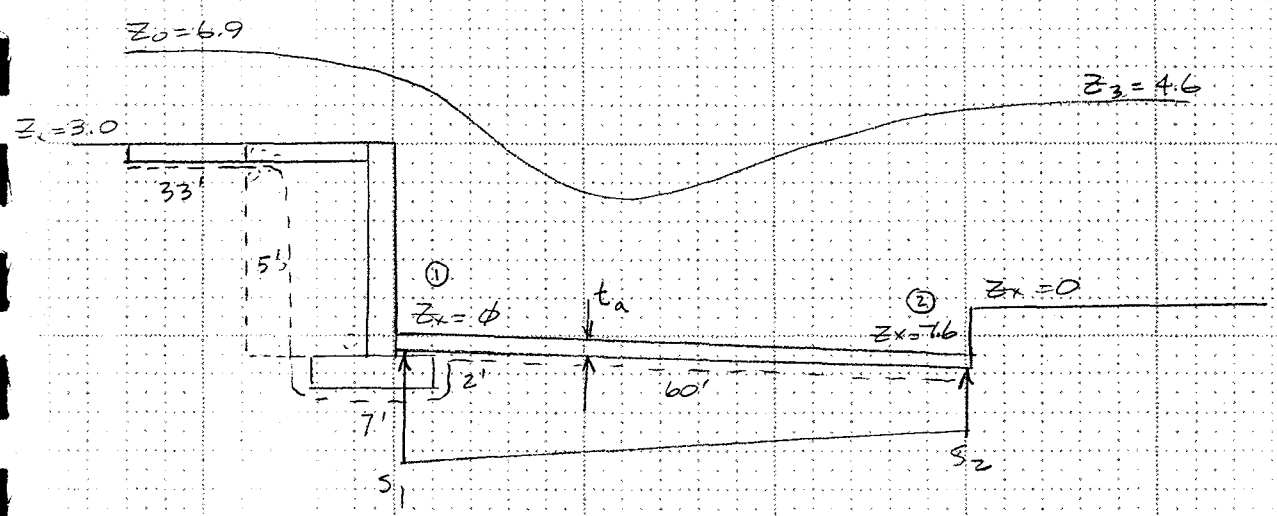
CONCRETE VS GABIONS SAME INITIAL COST. GABION MAINTENANCE WILL BE HIGHER, USE CONCRETE

DIBBLE & ASSOCIATES

CONSULTING ENGINEERS

CALC KLS DATE 6/24/93 TITLE WHITE TANKS FRS# 4 INLET JOB 9302

CHKD ..... DATE ..... APRON DESIGN SHT 1 OF 3



A. UPLIFT PRESSURE

1. $y_1 = 33' + 5' + 7' + 2' = 47'$
2. $y_2 = y_1 + 60' = 47' + 60' = 107'$
3. $\Delta h = 0.0575''/ft$
4. $S_1 = 62.4((6.9 - 0.0575(47)) - \phi) = 262\ lb/ft^2$ ← USE
5. $S_2 = 62.4((6.9 - 0.0575(107)) - 7.6) = 147\ lb/ft^2$

B. APRON DESIGN

1. $SF = (\gamma_a (t_a) + \gamma_w (h)) / p$

Agostini pg. 48

γ_a = unit wt. of apron
t_a = thickness of apron
h = Ht of water above apron
p = uplift pressure

$$\therefore \quad t_a = \frac{SF(p) - \gamma_w (h)}{\gamma_a}$$

Assume $h = Z_3$ ie, partially submerged drop

2. Req'd concrete thickness:

$$t_c = \frac{1.5(262\ lb/ft^2) - 62.4\ lb/ft^3 (4.6\ ft)}{150\ lb/ft^3} = 0.71\ ft$$

use $t_c = 9''$

3. Req'd Gabion thickness @ $\gamma_g = 120\ pcf$ (saturated)

$$t_g = \frac{1.5(262\ lb/ft^2) - 62.4(4.6')}{120\ pcf} = 0.89\ ft$$

Note: Agostini et. al. recommends a double layer of 1.5' deep baskets w/ 8-12" stones to avoid stone movement and ease maintenance. ∴ uplift does not govern, use

$t_g = 3.0'$

4. Required grouted rock thickness:

Assume rock $\gamma_r = 150\ pcf$, $n = 0.4$

grout $\gamma_{gt} = 120\ pcf$, 2/3 of depth of t_r grouted:

$$\gamma_{gr} = 150(1-0.4) + 120(0.4)(0.67) = 122\ pcf$$

$$t_{gr} = \frac{1.5(262\ lb/ft^2) - 62.4(4.6')}{122} = 0.87$$

Note: FCD Manual II recommends min 18" boulders, 12" grout ∴ use

$t_{gr} = 18''$

DIBBLE & ASSOCIATES

CONSULTING ENGINEERS

CALC KLS DATE 6/29/93 TITLE WHITE TANKS FRS #4 INLET JOB 9302

CHKD ..... DATE ..... APRON DESIGN SHT 3 OF 3

C. COST COMPARISON - Per S.Y.

	Liner	t	C.Y.	UNIT PRICE	COST	EXC CY.	UNIT PRICE	COST	TOTAL
1	Concrete	0.75	0.25	$200.00	50.00	0.25	3.00	0.75	$50.75
2	Gabions	3.0	1.0	$90.00	90.00	1.0	3.00	3.00	$93.00
3	Grouted Rock	1.5	0.5	$65.00	32.50	1.5	3.00	4.50	69.50

USE CONCRETE BASIN @ $t_c = 9''$

APPENDIX IV

SELECTED CHANNEL DESIGN DATA CALCULATIONS

APPENDIX IV - SELECTED CHANNEL DESIGN DATA

Horizontal Curves and Superelevation IV-1
Interim Channel - I-10 to McDowell Road IV-2
Channel Freeboard - North of McDowell Road IV-3
Proposed Side-Inlets IV-4
Existing Side-Inlet Channel Analysis IV-5

KLS WHITE TANKS FLOOD RETENTION STRUCTURE #4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38 HORIZCRV

SELECTED CHANNEL - HORIZONTAL CURVES AND SUPERELEVATION

CURVE LOCATION STATION TO STATION	VELOCITY V (fps)	CHANNEL Tw (ft)	CHANNEL Dn (ft)	MIN. RADIUS (ft)	ACTUAL RADIUS (ft)	SUPER-ELEVATION (ft)
16+34 TO 19+45	9.00	73.00	4.59	219.00	240.00	0.77
24+07 TO 27+59	9.00	73.00	4.59	219.00	350.00	0.52
38+68 TO 41+08	9.00	73.00	4.59	219.00	220.00	0.83
53+25 TO 55+92	9.00	73.00	4.59	219.00	250.00	0.73

KLS WHITE TANKS FLOOD RETENTION STRUCTURE #4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38 CHANNEL HYDRAULICS @ GIVEN Q

INTERIM CHANNEL I-10 TO McDOWELL RD WITH SOIL-CEMENT LINER, Vmax = 9 FPS, Fmax = 0.85 (Subcritical)

CHANNEL TYPE	Q (CFS)	n	Z (FT)	So ('/')	b (FT)	TRIAL d(FT)	Qn (CFS)	Vn (FPS)	Dn (FT)	FROUDE NO.	FLOW REGIME	Dc (FT)	Vc (FPS)	Sc ('/')	FB (FT)	W.S. tw (FT)	CHAN. D (FT)	CHAN. Tw (FT)	LOW FLOW
SOIL-CEMENT	2206	0.020	3	0.00240	50.00	4.2	2206	8.32	4.23	0.78	SUBCRIT	3.64	9.9	0.0041	1.33	75	5.56	83	YES

INTERIM CHANNEL - STA 47+39 TO STA 52+10
CHANNEL HYDRAULICS CHARACTERISTICS

```
**                T                  **
 **-------------------------------**
  **            4.23            **
Za **        FT DEEP        ** Zb
    **                    **
     ******************
                B
```

Q =	2206.0	cfs
So =	0.0024	ft/ft
n =	0.02	
B =	50	ft
Za =	4	: 1
Zb =	2	: 1
Zave =	3.00	: 1
TRIAL DEPTH =	4.233	ft

NORMAL FLOW CALCULATIONS

flow (Qn) =	2205.9	cfs
depth (dn) =	4.23	ft
velocity (Vn) =	8.31	fps
Froude Number =	0.78	

CRITICAL FLOW CALCULATIONS

depth (dc) =	3.64	FT
velocity (Vc) =	9.95	FPS
slope (Sc) =	0.0041	FT/FT

(Values equal for Crit. Depth)
10,903,950 10,857,291
3.07350 3.08670

An =	265.405	sq ft	Ac =	221.749	sq ft
Pn =	76.918	ft	Pc =	73.147	ft
Rn =	3.450	ft	Rc =	3.032	ft
Tn =	75.398	ft	Tc =	71.840	ft

KLS WHITE TANKS FLOOD RETENTION STRUCTURE NO. 4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38

CHANNEL FREEBOARD - NORTH OF MCDOWELL RD CULVERT FREEBRD1

STATION	FLOW VELOCITY (FT)	FLOW DEPTH (FT)	REQ'D FREEBOARD (FT)	CHANNEL DEPTH (FT)
5323	8.49	5.10	1.55	6.65
5350	6.43	5.63	1.57	7.20
5400	6.97	5.47	1.56	7.03
5500	7.29	5.29	1.53	6.82
5600	7.60	5.13	1.51	6.64
5700	7.88	5.00	1.49	6.49
5800	8.13	4.88	1.48	6.36
5900	8.33	4.80	1.47	6.27
6000	8.49	4.73	1.46	6.19

KLS WHITE TANKS FRS #4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38 CHANNEL HYDRAULICS @ GIVEN Q

SIDE INLETS - EXISTING CHANNEL CALCULATIONS SIDEINLT

A. PROPOSED SIDE INLET CHANNEL BASED ON MAX FLOW OF 71 CFS

```
**                16.0 FT       *****    CALC. Q =          73 cfs
 ** |<------TOP WIDTH------>| **        ACTUAL Q =          71 cfs(ENTER)
  **-------------------------**                S =        0.01 ft/ft
   **            1.00       **                  n =        0.02
    **        FT DEEP     **                    b =           8 ft
     **                  **                     z =           4 :1
      ******************              TRIAL DEPTH =        1.00 ft
                 8.0 FT
       |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS	
FLOW=	73 CFS	CRITICAL DEPTH =	1.11 FT
NORMAL DEPTH=	1.00 FT	CRIT. VELOCITY =	5.28 FPS
N. VELOCITY=	6.07 FPS	CRITICAL SLOPE =	0.0067 FT/FT
FREEBOARD=	0.39	FROUDE NO. =	1.24

VALUES = FOR CRITICAL DEPTH--> 2,633 -10
2,643

B. PROPOSED SIDE INLET CHANNEL BASED ON MAX FLOW OF 120 CFS

```
**                24.0 FT       *****    CALC. Q =         131 cfs
 ** |<------TOP WIDTH------>| **        ACTUAL Q =         120 cfs(ENTER)
  **-------------------------**                S =        0.01 ft/ft
   **            1.00       **                  n =        0.02
    **        FT DEEP     **                    b =          16 ft
     **                  **                     z =           4 :1
      ******************              TRIAL DEPTH =        1.00 ft
                16.0 FT
       |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS	
FLOW=	131 CFS	CRITICAL DEPTH =	1.09 FT
NORMAL DEPTH=	1.00 FT	CRIT. VELOCITY =	5.89 FPS
N. VELOCITY=	6.54 FPS	CRITICAL SLOPE =	0.0074 FT/FT
FREEBOARD=	0.42	FROUDE NO. =	1.26

KLS WHITE TANKS FRS #4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38 CHANNEL HYDRAULICS @ GIVEN Q

SIDE INLETS - EXISTING CHANNEL CALCULATIONS SIDEINLT

A. EXISTING SIDE CHANNEL CAPACITY BASED ON 1' FLOW DEPTH STA. 67+90

```
**                36.0 FT       *****    CALC. Q =          79 cfs
 ** |<------TOP WIDTH------>| **        ACTUAL Q =          79 cfs(ENTER)
  **-------------------------**                S =      0.0138 ft/ft
   **             1.00       **                 n =       0.025
    **          FT DEEP     **                  b =           0 ft
     **                     **                  z =          18 :1
      ******************                TRIAL DEPTH =        1.00 ft
                 0.0 FT
       |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS	
FLOW=	79 CFS	CRITICAL DEPTH =	1.04 FT
NORMAL DEPTH=	1.00 FT	CRIT. VELOCITY =	4.06 FPS
N. VELOCITY=	4.39 FPS	CRITICAL SLOPE =	0.0112 FT/FT
FREEBOARD=	0.32	FROUDE NO. =	1.10

VALUES = FOR CRITICAL DEPTH--> 7,379 123
7,257

B. EXISTING SIDE-INLET FLOW DEPTH BASED ON HYDROLOGICALLY-DERIVED FLOW

```
**                17.3 FT       *****    CALC. Q =          11 cfs
 ** |<------TOP WIDTH------>| **        ACTUAL Q =          11 cfs(ENTER)
  **-------------------------**                S =      0.0138 ft/ft
   **             0.48       **                 n =       0.025
    **          FT DEEP     **                  b =           0 ft
     **                     **                  z =          18 :1
      ******************                TRIAL DEPTH =        0.48 ft
                 0.0 FT
       |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS	
FLOW=	11 CFS	CRITICAL DEPTH =	0.47 FT
NORMAL DEPTH=	0.48 FT	CRIT. VELOCITY =	2.81 FPS
N. VELOCITY=	2.69 FPS	CRITICAL SLOPE =	0.0154 FT/FT
FREEBOARD=	0.15	FROUDE NO. =	0.97

KLS WHITE TANKS FRS #4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38 CHANNEL HYDRAULICS @ GIVEN Q

SIDE INLETS - EXISTING CHANNEL CALCULATIONS SIDEINLT

A. EXISTING SIDE CHANNEL CAPACITY BASED ON 1' FLOW DEPTH STA. 73+70

```
**                28.0 FT       *****    CALC. Q =          52 cfs
 ** |<------TOP WIDTH------->| **       ACTUAL Q =          52 cfs(ENTER)
  **-------------------------**                S =      0.0098 ft/ft
   **             1.00       **                 n =       0.025
    **          FT DEEP     **                  b =           0 ft
     **                     **                  z =          14 :1
      ********************          TRIAL DEPTH =        1.00 ft
                 0.0 FT
       |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS	
FLOW=	52 CFS	CRITICAL DEPTH =	0.97 FT
NORMAL DEPTH=	1.00 FT	CRIT. VELOCITY =	3.93 FPS
N. VELOCITY=	3.70 FPS	CRITICAL SLOPE =	0.0115 FT/FT
FREEBOARD=	0.30	FROUDE NO. =	0.92

VALUES = FOR CRITICAL DEPTH--> 2,286 5
2,281

B. EXISTING SIDE-INLET FLOW DEPTH BASED ON HYDROLOGICALLY-DERIVED FLOW

```
**                33.6 FT       *****    CALC. Q =          84 cfs
 ** |<------TOP WIDTH------->| **       ACTUAL Q =          83 cfs(ENTER)
  **-------------------------**                S =      0.0098 ft/ft
   **             1.20       **                 n =       0.025
    **          FT DEEP     **                  b =           0 ft
     **                     **                  z =          14 :1
      ********************          TRIAL DEPTH =        1.20 ft
                 0.0 FT
       |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS	
FLOW=	84 CFS	CRITICAL DEPTH =	1.17 FT
NORMAL DEPTH=	1.20 FT	CRIT. VELOCITY =	4.40 FPS
N. VELOCITY=	4.18 FPS	CRITICAL SLOPE =	0.0112 FT/FT
FREEBOARD=	0.37	FROUDE NO. =	0.95

KLS WHITE TANKS FRS #4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38 CHANNEL HYDRAULICS @ GIVEN Q

SIDE INLETS - EXISTING CHANNEL CALCULATIONS SIDEINLT

A. EXISTING SIDE CHANNEL CAPACITY BASED ON 1' FLOW DEPTH STA. 75+40

```
**                120.0 FT       *****    CALC. Q =          208 cfs
 ** |<------TOP WIDTH------->| **        ACTUAL Q =          208 cfs(ENTER)
  **-------------------------**                 S =       0.0086 ft/ft
   **              1.00       **                 n =        0.025
    **           FT DEEP     **                  b =            0 ft
     **                      **                  z =           60 :1
      ********************              TRIAL DEPTH =         1.00 ft
                   0.0 FT
        |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS	
FLOW=	208 CFS	CRITICAL DEPTH =	0.94 FT
NORMAL DEPTH=	1.00 FT	CRIT. VELOCITY =	3.93 FPS
N. VELOCITY=	3.47 FPS	CRITICAL SLOPE =	0.0120 FT/FT
FREEBOARD=	0.30	FROUDE NO. =	0.87

VALUES = FOR CRITICAL DEPTH--> 149,012 -2546
151,558

B. EXISTING SIDE-INLET FLOW DEPTH BASED ON HYDROLOGICALLY-DERIVED FLOW

```
**                38.4 FT       *****    CALC. Q =           10 cfs
 ** |<------TOP WIDTH------->| **        ACTUAL Q =           10 cfs(ENTER)
  **-------------------------**                 S =       0.0086 ft/ft
   **              0.32       **                 n =        0.025
    **           FT DEEP     **                  b =            0 ft
     **                      **                  z =           60 :1
      ********************              TRIAL DEPTH =         0.32 ft
                   0.0 FT
        |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS	
FLOW=	10 CFS	CRITICAL DEPTH =	0.28 FT
NORMAL DEPTH=	0.32 FT	CRIT. VELOCITY =	2.12 FPS
N. VELOCITY=	1.62 FPS	CRITICAL SLOPE =	0.0175 FT/FT
FREEBOARD=	0.09	FROUDE NO. =	0.72

KLS WHITE TANKS FRS #4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38 CHANNEL HYDRAULICS @ GIVEN Q

SIDE INLETS - EXISTING CHANNEL CALCULATIONS SIDEINLT

A. EXISTING SIDE CHANNEL CAPACITY BASED ON 1' FLOW DEPTH STA. 78+00

```
**                40.0 FT       *****    CALC. Q =          106 cfs
 ** |<------TOP WIDTH------>| **        ACTUAL Q =          106 cfs(ENTER)
  **-------------------------**                S =         0.02 ft/ft
   **             1.00       **                 n =        0.025
    **          FT DEEP     **                  b =            0 ft
     **                     **                  z =           20 :1
      ******************                TRIAL DEPTH =         1.00 ft
                 0.0 FT
       |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS	
FLOW=	106 CFS	CRITICAL DEPTH =	1.12 FT
NORMAL DEPTH=	1.00 FT	CRIT. VELOCITY =	4.22 FPS
N. VELOCITY=	5.29 FPS	CRITICAL SLOPE =	0.0109 FT/FT
FREEBOARD=	0.36	FROUDE NO. =	1.32

VALUES = FOR CRITICAL DEPTH--> 15,791 158
15,633

B. EXISTING SIDE-INLET FLOW DEPTH BASED ON HYDROLOGICALLY-DERIVED FLOW

```
**                17.2 FT       *****    CALC. Q =           11 cfs
 ** |<------TOP WIDTH------>| **        ACTUAL Q =           11 cfs(ENTER)
  **-------------------------**                S =         0.02 ft/ft
   **             0.43       **                 n =        0.025
    **          FT DEEP     **                  b =            0 ft
     **                     **                  z =           20 :1
      ******************                TRIAL DEPTH =         0.43 ft
                 0.0 FT
       |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS	
FLOW=	11 CFS	CRITICAL DEPTH =	0.45 FT
NORMAL DEPTH=	0.43 FT	CRIT. VELOCITY =	2.75 FPS
N. VELOCITY=	3.01 FPS	CRITICAL SLOPE =	0.0157 FT/FT
FREEBOARD=	0.14	FROUDE NO. =	1.15

KLS WHITE TANKS FRS #4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38 CHANNEL HYDRAULICS @ GIVEN Q

SIDE INLETS - EXISTING CHANNEL CALCULATIONS SIDEINLT

A. EXISTING SIDE CHANNEL CAPACITY BASED ON 1' FLOW DEPTH STA. 83+50

```
**                140.0 FT       *****    CALC. Q =          269 cfs
 ** |<------TOP WIDTH------->| **        ACTUAL Q =          269 cfs(ENTER)
  **-------------------------**                 S =       0.0105 ft/ft
   **             1.00       **                  n =        0.025
    **          FT DEEP     **                   b =            0 ft
     **                     **                   z =           70 :1
      ******************                TRIAL DEPTH =         1.00 ft
                 0.0 FT
       |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS	
FLOW=	269 CFS	CRITICAL DEPTH =	0.98 FT
NORMAL DEPTH=	1.00 FT	CRIT. VELOCITY =	3.99 FPS
N. VELOCITY=	3.84 FPS	CRITICAL SLOPE =	0.0117 FT/FT
FREEBOARD=	0.31	FROUDE NO. =	0.96

VALUES = FOR CRITICAL DEPTH--> 303,844 -4477
308,321

B. EXISTING SIDE-INLET FLOW DEPTH BASED ON HYDROLOGICALLY-DERIVED FLOW

```
**                 61.6 FT       *****    CALC. Q =           30 cfs
 ** |<------TOP WIDTH------->| **        ACTUAL Q =           29 cfs(ENTER)
  **-------------------------**                 S =       0.0105 ft/ft
   **             0.44       **                  n =        0.025
    **          FT DEEP     **                   b =            0 ft
     **                     **                   z =           70 :1
      ******************                TRIAL DEPTH =         0.44 ft
                 0.0 FT
       |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS	
FLOW=	30 CFS	CRITICAL DEPTH =	0.40 FT
NORMAL DEPTH=	0.44 FT	CRIT. VELOCITY =	2.69 FPS
N. VELOCITY=	2.22 FPS	CRITICAL SLOPE =	0.0175 FT/FT
FREEBOARD=	0.13	FROUDE NO. =	0.83

KLS WHITE TANKS FRS #4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38 CHANNEL HYDRAULICS @ GIVEN Q

SIDE INLETS - EXISTING CHANNEL CALCULATIONS SIDEINLT

A. EXISTING SIDE CHANNEL CAPACITY BASED ON 1' FLOW DEPTH STA. 88+60

```
**                130.0 FT       *****    CALC. Q =          230 cfs
 ** |<-----TOP WIDTH------>| **        ACTUAL Q =          230 cfs(ENTER)
  **-------------------------**                S =       0.0089 ft/ft
   **             1.00       **                 n =        0.025
    **          FT DEEP     **                  b =            0 ft
     **                     **                  z =           65 :1
      ********************           TRIAL DEPTH =         1.00 ft
                  0.0 FT
       |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS		
FLOW=	230 CFS	CRITICAL DEPTH =	0.95	FT
NORMAL DEPTH=	1.00 FT	CRIT. VELOCITY =	3.91	FPS
N. VELOCITY=	3.53 FPS	CRITICAL SLOPE =	0.0117	FT/FT
FREEBOARD=	0.30	FROUDE NO. =	0.88	

VALUES = FOR CRITICAL DEPTH--> 201,875 -1018
202,893

B. EXISTING SIDE-INLET FLOW DEPTH BASED ON HYDROLOGICALLY-DERIVED FLOW

```
**                 37.7 FT       *****    CALC. Q =            8 cfs
 ** |<-----TOP WIDTH------>| **        ACTUAL Q =            8 cfs(ENTER)
  **-------------------------**                S =       0.0089 ft/ft
   **             0.29       **                 n =        0.025
    **          FT DEEP     **                  b =            0 ft
     **                     **                  z =           65 :1
      ********************           TRIAL DEPTH =         0.29 ft
                  0.0 FT
       |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS		
FLOW=	8 CFS	CRITICAL DEPTH =	0.25	FT
NORMAL DEPTH=	0.29 FT	CRIT. VELOCITY =	2.08	FPS
N. VELOCITY=	1.55 FPS	CRITICAL SLOPE =	0.0196	FT/FT
FREEBOARD=	0.08	FROUDE NO. =	0.72	

KLS WHITE TANKS FRS #4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38 CHANNEL HYDRAULICS @ GIVEN Q

SIDE INLETS - EXISTING CHANNEL CALCULATIONS SIDEINLT

A. EXISTING SIDE CHANNEL CAPACITY BASED ON 1' FLOW DEPTH STA. 91+00

```
**                66.0 FT       *****    CALC. Q =          120 cfs
 ** |<------TOP WIDTH------->| **       ACTUAL Q =          120 cfs(ENTER)
  **-------------------------**                S =       0.0095 ft/ft
   **             1.00       **                 n =        0.025
    **          FT DEEP     **                  b =            0 ft
     **                    **                   z =           33 :1
      ********************          TRIAL DEPTH =         1.00 ft
                 0.0 FT
       |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS	
FLOW=	120 CFS	CRITICAL DEPTH =	0.95 FT
NORMAL DEPTH=	1.00 FT	CRIT. VELOCITY =	4.04 FPS
N. VELOCITY=	3.65 FPS	CRITICAL SLOPE =	0.0125 FT/FT
FREEBOARD=	0.30	FROUDE NO. =	0.91

VALUES = FOR CRITICAL DEPTH--> 26,417 -1623
28,040

B. EXISTING SIDE-INLET FLOW DEPTH BASED ON HYDROLOGICALLY-DERIVED FLOW

```
**                88.4 FT       *****    CALC. Q =          263 cfs
 ** |<------TOP WIDTH------->| **       ACTUAL Q =          260 cfs(ENTER)
  **-------------------------**                S =       0.0095 ft/ft
   **             1.34       **                 n =        0.025
    **          FT DEEP     **                  b =            0 ft
     **                    **                   z =           33 :1
      ********************          TRIAL DEPTH =         1.34 ft
                 0.0 FT
       |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS	
FLOW=	263 CFS	CRITICAL DEPTH =	1.31 FT
NORMAL DEPTH=	1.34 FT	CRIT. VELOCITY =	4.64 FPS
N. VELOCITY=	4.43 FPS	CRITICAL SLOPE =	0.0107 FT/FT
FREEBOARD=	0.41	FROUDE NO. =	0.95

KLS WHITE TANKS FRS #4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38 CHANNEL HYDRAULICS @ GIVEN Q

SIDE INLETS - EXISTING CHANNEL CALCULATIONS SIDEINLT

A. EXISTING SIDE CHANNEL CAPACITY BASED ON 1' FLOW DEPTH STA. 97+00

```
**                40.0 FT       *****    CALC. Q =          71 cfs
 ** |<------TOP WIDTH------->| **       ACTUAL Q =          71 cfs(ENTER)
  **-------------------------**                S =      0.0091 ft/ft
   **             1.00       **                 n =       0.025
    **          FT DEEP     **                  b =           0 ft
     **                    **                   z =          20 :1
      ********************          TRIAL DEPTH =        1.00 ft
                 0.0 FT
       |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS	
FLOW=	71 CFS	CRITICAL DEPTH =	0.95 FT
NORMAL DEPTH=	1.00 FT	CRIT. VELOCITY =	3.95 FPS
N. VELOCITY=	3.57 FPS	CRITICAL SLOPE =	0.0120 FT/FT
FREEBOARD=	0.30	FROUDE NO. =	0.89

VALUES = FOR CRITICAL DEPTH--> 5,881 -68
5,949

B. EXISTING SIDE-INLET FLOW DEPTH BASED ON HYDROLOGICALLY-DERIVED FLOW

```
**                56.8 FT       *****    CALC. Q =         182 cfs
 ** |<------TOP WIDTH------->| **       ACTUAL Q =         180 cfs(ENTER)
  **-------------------------**                S =      0.0091 ft/ft
   **             1.42       **                 n =       0.025
    **          FT DEEP     **                  b =           0 ft
     **                    **                   z =          20 :1
      ********************          TRIAL DEPTH =        1.42 ft
                 0.0 FT
       |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS	
FLOW=	182 CFS	CRITICAL DEPTH =	1.38 FT
NORMAL DEPTH=	1.42 FT	CRIT. VELOCITY =	4.77 FPS
N. VELOCITY=	4.51 FPS	CRITICAL SLOPE =	0.0106 FT/FT
FREEBOARD=	0.43	FROUDE NO. =	0.94

KLS WHITE TANKS FRS #4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38 CHANNEL HYDRAULICS @ GIVEN Q

SIDE INLETS - EXISTING CHANNEL CALCULATIONS SIDEINLT

A. EXISTING SIDE CHANNEL CAPACITY BASED ON 1' FLOW DEPTH STA.106+70

```
**                200.0 FT       *****    CALC. Q =          419 cfs
 ** |<------TOP WIDTH------->| **        ACTUAL Q =          419 cfs(ENTER)
  **-------------------------**                 S =       0.0125 ft/ft
   **              1.00       **                 n =        0.025
    **           FT DEEP     **                  b =            0 ft
     **                      **                  z =          100 :1
      ********************           TRIAL DEPTH =         1.00 ft
                   0.0 FT
       |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS	
FLOW=	419 CFS	CRITICAL DEPTH =	1.02 FT
NORMAL DEPTH=	1.00 FT	CRIT. VELOCITY =	4.02 FPS
N. VELOCITY=	4.19 FPS	CRITICAL SLOPE =	0.0112 FT/FT
FREEBOARD=	0.32	FROUDE NO. =	1.04

VALUES = FOR CRITICAL DEPTH--> 1,126,162 13913
1,112,250

B. EXISTING SIDE-INLET FLOW DEPTH BASED ON HYDROLOGICALLY-DERIVED FLOW

```
**                 54.0 FT       *****    CALC. Q =           13 cfs
 ** |<------TOP WIDTH------->| **        ACTUAL Q =           13 cfs(ENTER)
  **-------------------------**                 S =       0.0125 ft/ft
   **              0.27       **                 n =        0.025
    **           FT DEEP     **                  b =            0 ft
     **                      **                  z =          100 :1
      ********************           TRIAL DEPTH =         0.27 ft
                   0.0 FT
       |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS	
FLOW=	13 CFS	CRITICAL DEPTH =	0.25 FT
NORMAL DEPTH=	0.27 FT	CRIT. VELOCITY =	2.04 FPS
N. VELOCITY=	1.75 FPS	CRITICAL SLOPE =	0.0188 FT/FT
FREEBOARD=	0.08	FROUDE NO. =	0.84

KLS WHITE TANKS FRS #4 INLET CHANNEL JOB 9302
FCD PROJECT NO. 92-38 CHANNEL HYDRAULICS @ GIVEN Q

SIDE INLETS - EXISTING CHANNEL CALCULATIONS SIDEINLT

A. EXISTING SIDE CHANNEL CAPACITY BASED ON 1' FLOW DEPTH STA.111+20

```
**                30.0 FT       *****    CALC. Q =          68 cfs
 ** |<------TOP WIDTH------->| **       ACTUAL Q =          68 cfs(ENTER)
  **-------------------------**                S =      0.0145 ft/ft
   **             1.00       **                 n =       0.025
    **          FT DEEP     **                  b =           0 ft
     **                     **                  z =          15 :1
      ******************                TRIAL DEPTH =        1.00 ft
                 0.0 FT
       |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS	
FLOW=	68 CFS	CRITICAL DEPTH =	1.05 FT
NORMAL DEPTH=	1.00 FT	CRIT. VELOCITY =	4.08 FPS
N. VELOCITY=	4.50 FPS	CRITICAL SLOPE =	0.0112 FT/FT
FREEBOARD=	0.33	FROUDE NO. =	1.12

VALUES = FOR CRITICAL DEPTH--> 4,523 -1
4,523

B. EXISTING SIDE-INLET FLOW DEPTH BASED ON HYDROLOGICALLY-DERIVED FLOW

```
**                29.4 FT       *****    CALC. Q =          64 cfs
 ** |<------TOP WIDTH------->| **       ACTUAL Q =          65 cfs(ENTER)
  **-------------------------**                S =      0.0145 ft/ft
   **             0.98       **                 n =       0.025
    **          FT DEEP     **                  b =           0 ft
     **                     **                  z =          15 :1
      ******************                TRIAL DEPTH =        0.98 ft
                 0.0 FT
       |<--BASE WIDTH-->|
```

NORMAL DEPTH CALCS		CRITICAL DEPTH CALCS	
FLOW=	64 CFS	CRITICAL DEPTH =	1.03 FT
NORMAL DEPTH=	0.98 FT	CRIT. VELOCITY =	4.02 FPS
N. VELOCITY=	4.44 FPS	CRITICAL SLOPE =	0.0111 FT/FT
FREEBOARD=	0.32	FROUDE NO. =	1.12

APPENDIX V

"EXISTING CONDITIONS" HEC-2 INPUT AND OUTPUT - SUBCRITICAL

INPUT - SUBCRITICAL

EXISTING

```
T1 WHITE TANKS #4 FLOOD RETENTION INLET CHANNEL
T2 DESIGN CONCEPT REPORT                    7/28/93
T3      EXIST CHANNEL, SUBCRITICAL FLOW   (Q100=2206 CFS)
T4      STATION 17+48 TO 115+50

J1   -10                                -1              .3    2206
J2    -1                                                -1
J3   100            105             150

NC   .04     .04    .025     .1      .3

X1  1748      11     204     260       0       0       0
X3                          165
GR1047.8     115  1048.4     130  1049.0     165  1048.2     204  1045.0     219
GR1044.5     230  1045.3     248  1049.4     260  1050.0     285  1049.1     312
GR1049.9     330

X1  1800      14     170     228      52      52      52
X3                          134
GR1049.2     100  1049.2     132  1050.1     134  1049.7     170  1046.5     180
GR1045.4     188  1044.8     200  1045.0     209  1046.2     218  1050.4     228
GR1050.5     248  1050.8     260  1049.8     277  1051.0     305

X1  1900      11     161     237     100     100     100
X3                          145
GR1049.7     100  1050.2     133  1052.8     145  1052.6     161  1045.9     190
GR1045.6     200  1046.7     215  1051.7     237  1051.0     259  1052.0     260
GR1052.9     300

X1  2000      11     151     227     100     100     100
X3                          138
GR1049.5     100  1050.4     124  1055.4     138  1055.3     151  1046.5     191
GR1046.0     200  1047.0     211  1050.5     227  1050.7     245  1052.4     260
GR1052.9     300

X1  2100      14     149     230     100     100     100
X3                          137
GR1051.0     100  1051.7     126  1055.1     137  1055.3     149  1050.7     169
GR1047.4     189  1046.8     200  1047.7     210  1052.4     230  1052.8     235
GR1051.9     242  1052.6     250  1052.8     280  1053.0     300

X1  2200      15     156     236     100     100     100
X3                          142
GR1051.2     100  1052.1     128  1055.4     142  1055.3     156  1051.1     173
GR1048.2     190  1047.6     200  1048.2     210  1051.9     233  1053.1     236
GR1053.1     246  1052.0     251  1052.9     256  1052.8     280  1052.9     300

X1  2300      15     160     238     100     100     100
X3                          146
GR1051.0     100  1051.9     132  1056.0     146  1055.7     160  1053.2     171
GR1048.8     189  1048.3     200  1048.1     207  1051.8     222  1051.3     225
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GR1054.1     238  1053.2     243  1052.2     253  1052.9     259  1053.2     300

X1  2400      14     161     242     100     100     100
X3                           141
GR1051.4     100  1051.9     123  1056.9     141  1056.8     161  1052.5     172
GR1049.6     187  1049.1     200  1049.6     211  1052.0     231  1053.6     242
GR1053.8     250  1053.1     262  1053.4     271  1053.4     303

X1  2500      16     187     288     100     100     100
X3                           139
GR1051.6     114  1058.8     139  1058.4     155  1057.9     157  1055.5     187
GR1051.8     206  1050.2     216  1049.8     228  1050.1     239  1051.2     249
GR1051.4     253  1055.8     288  1055.7     292  1053.7     297  1053.7     313
GR1053.8     328

X1  2600      17     194     301     100     100     100
X3                           149
GR1052.6     120  1058.9     149  1059.0     159  1058.7     160  1058.1     194
GR1053.8     201  1052.4     210  1050.7     227  1050.3     240  1051.0     255
GR1053.1     270  1054.5     285  1056.1     301  1056.2     311  1054.7     314
GR1054.5     335  1054.5     360

X1  2700      18     159     225     100     100     100
GR1054.2      97  1053.5     110  1053.9     111  1054.4     117  1057.4     135
GR1056.5     159  1053.9     165  1051.5     180  1050.8     193  1051.1     205
GR1051.4     209  1054.5     220  1055.1     225  1056.4     267  1056.5     274
GR1054.8     278  1055.0     286  1054.9     323

X1  2800      18     108     172     100     100     100
GR1055.4      70  1055.0      83  1055.8      85  1056.6      93  1056.3     108
GR1055.7     111  1052.3     123  1051.9     139  1052.4     157  1054.7     164
GR1055.4     172  1056.0     176  1055.7     182  1054.2     192  1055.2     219
GR1055.7     229  1055.2     232  1055.2     249

X1  2900      15      80     148     100     100     100
GR1056.3      54  1055.7      70  1055.7      80  1053.6      88  1052.8      97
GR1052.7     108  1052.9     125  1053.9     128  1056.1     139  1058.7     148
GR1058.0     150  1056.7     166  1055.9     175  1056.1     193  1056.3     208

X1  3000      12      65     132     100     100     100
GR1057.0      48  1056.6      65  1053.8      75  1053.5      95  1053.8     114
GR1054.8     122  1056.0     128  1057.8     132  1058.5     139  1057.1     157
GR1057.0     180  1057.0     195

X1  3145      17     132     193     145     145     145
GR1058.1     100  1058.1     118  1057.2     132  1056.1     136  1055.2     148
GR1054.7     164  1055.1     180  1056.3     193  1057.7     193  1057.7     197
GR1058.9     203  1059.6     210  1058.1     226  1058.1     250  1058.7     300
GR1058.7     350  1058.7     400

X1  3200      16     132     203      55      55      55
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GR1058.5     100  1058.5     118  1057.6     132  1056.6     135  1055.6     145
GR1054.5     164  1055.6     181  1056.6     193  1057.7     197  1059.2     203
GR1059.9     212  1058.6     228  1058.6     250  1059.1     300  1059.1     350
GR1059.1     400

X1  3300      16     132     202     100     100     100
GR1059.3     100  1059.3     118  1058.3     132  1057.5     134  1056.3     144
GR1055.3     163  1056.4     183  1057.2     192  1058.6     198  1059.8     202
GR1060.3     215  1059.5     231  1059.5     250  1059.9     300  1059.9     350
GR1059.9     400

X1  3400      16     131     201     100     100     100
GR1060.1     100  1060.0     118  1059.0     131  1058.4     133  1057.0     143
GR1056.1     163  1057.2     186  1057.8     192  1059.5     199  1060.3     201
GR1060.8     218  1060.4     234  1060.4     250  1060.6     300  1060.7     350
GR1060.7     400

X1  3500      16     131     201     100     100     100
GR1060.8     100  1060.8     118  1059.7     131  1059.4     132  1057.7     142
GR1056.9     163  1058.0     188  1058.4     192  1060.4     199  1060.9     201
GR1061.3     221  1061.4     237  1061.3     250  1061.4     300  1061.5     350
GR1061.5     400

X1  3600      16     131     200     100     100     100
GR1061.6     100  1061.5     118  1060.4     131  1060.3     131  1058.4     141
GR1057.7     162  1058.8     190  1058.9     191  1061.3     200  1061.4     200
GR1061.8     225  1062.3     241  1062.2     250  1062.2     300  1062.3     350
GR1062.3     400

X1  3645      13     131     200      45      45      45
GR1061.9     100  1061.9     118  1060.7     131  1058.7     141  1058.1     162
GR1059.2     191  1061.7     200  1062.0     226  1062.7     242  1062.6     250
GR1062.5     300  1062.7     350  1062.9     400

X1  3700      13     132     202      55      55      55
GR1062.6     100  1062.5     118  1061.2     132  1059.1     141  1058.5     163
GR1059.6     193  1062.2     202  1062.5     225  1063.1     240  1063.0     247
GR1063.0     300  1063.2     350  1063.4     400

X1  3800      13     133     205     100     100     100
GR1063.8     100  1063.6     119  1062.1     133  1059.7     142  1059.3     166
GR1060.5     195  1063.1     205  1063.3     222  1063.8     236  1063.7     241
GR1063.9     300  1064.0     350  1064.2     400

X1  3900      13     135     208     100     100     100
GR1064.9     100  1064.6     120  1063.3     135  1060.4     143  1060.1     169
GR1061.3     198  1064.1     208  1064.2     219  1064.5     232  1064.4     236
GR1064.7     300  1064.8     350  1065.0     400

X1  4000      13     136     211     100     100     100
GR1066.1     100  1065.7     121  1064.0     136  1061.0     143  1060.9     171
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GR1062.1     201  1065.0     211  1065.0     217  1065.2     229  1065.2     230
GR1065.6     300  1065.7     350  1065.9     400

X1  4100      11     138     214     100     100     100
GR1067.3     100  1066.8     122  1064.9     138  1061.7     144  1061.7     174
GR1062.9     204  1065.9     214  1065.9     225  1066.5     300  1066.5     350
GR1066.7     400

X1  4145      12     137     217      45      45      45
GR1067.8     100  1067.5     122  1066.8     137  1062.8     145  1062.0     180
GR1063.3     206  1064.6     209  1066.8     217  1067.1     250  1066.9     300
GR1066.9     350  1067.1     400

NC                           .3      .5

X1  4150       8     137     220       5       5       5
GR1067.9     100  1066.7     137  1062.5     145  1061.7     146  1062.0     175
GR1063.0     203  1066.8     220  1066.8     225

NC   .03     .03    .015

X1  4186       7     133     195      11      11      11
X3    10
GR1069.0     100  1069.0     121  1065.5     133  1062.4  133.01  1062.4  194.99
GR1065.5     195  1069.0     210

X1  4197       7     153     207      11      11      11
X3    10
GR1068.5     100  1068.1     123  1068.2     153  1062.5  153.01  1062.5  206.99
GR1069.0     207  1069.0     230

* South I-10 Bridge

SB  1.25     1.6      3.      70      54       4     200          1062.7  1062.5
X1  4248       8     153     207      51      51      51
X2                     1.  1066.7    1069
X3    10
GR1069.0     100  1068.8     123  1068.7     143  1068.6     153  1062.7  153.01
GR1062.7  206.99  1068.1     207  1069.6     229

X1  4300       9     139     197      52      52      52
GR1069.7     100  1069.1     123  1068.2     139  1063.1     146  1063.1     167
GR1063.2     184  1064.5     192  1068.1     197  1072.5     216

NC                           .1      .3

X1  4350       6     133     185      50      50      50
GR1070.0     100  1068.8     133  1063.4     141  1063.4     179  1068.3     185
GR1073.1     216

X1  4400       7     132     184      50      50      50
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GR1070.5     100  1069.3     132  1063.8     139  1063.9     159  1063.6     177
GR1068.6     184  1073.6     216

X1  4450       6     132     185      50      50      50
GR1070.9     100  1069.6     132  1064.1     138  1064.0     178  1068.9     185
GR1074.2     216

X1  4500       8     132     183      50      50      50
GR1071.3     100  1070.9     122  1070.0     132  1064.5     137  1064.2     159
GR1064.2     178  1069.1     183  1074.8     215

X1  4550       8     132     183      50      50      50
GR1071.1     100  1071.2     112  1070.4     132  1064.5     138  1064.5     160
GR1064.5     178  1069.2     183  1075.3     215

X1  4600       7     137     192      50      50      50
GR1072.1     100  1070.6     137  1064.7     145  1064.7     166  1064.7     187
GR1069.5     192  1075.9     215

NC                           .3      .5

X1  4645      14     141     216      45      45      45
GR1072.4     100  1072.0     123  1070.6     141  1066.6     147  1065.5     180
GR1066.2     189  1065.8     195  1066.5     196  1066.8     211  1070.2     216
GR1071.5     227  1073.8     255  1075.7     300  1076.2     350

X1  4660       6     153     207      15      15      15
X3    10
GR1072.5     100  1073.0     153  1065.0  153.01  1065.0  206.99  1073.0     207
GR1073.0     210

* North I-10 Bridge

SB 1.25      1.6       3      70      54       4     250          1065.3  1065.0
X1  4712       6     153     207      52      52      52
X2                     1  1070.3    1073
X3    10
GR1072.9     100  1072.5     153  1065.3  153.01  1065.3  206.99  1072.5     207
GR1072.5     215

X1  4733       6     153     207      21      21      21
GR1073.1     100  1067.9     153  1065.4  153.01  1065.4  206.99  1067.9     207
GR1073.0     250

X1  4739       7     123     213       6       6       6
GR1073.1     100  1072.6     123  1071.9     145  1067.9     153  1067.9     207
GR1071.5     213  1071.7     226

NC   .04     .04    .025      .1      .3

X1  4750      12     145     211      11      11      11
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GR1073.2     100  1072.7     123  1071.9     145  1068.8     151  1068.3     154
GR1067.8     156  1067.6     176  1067.8     181  1068.4     183  1068.3     205
GR1071.9     211  1071.9     226

X1 4800.      13     142     208      50      50      50
GR1073.6     100  1073.1     123  1072.3     142  1069.2     150  1068.7     153
GR1068.2     156  1068.2     173  1068.2     178  1068.7     182  1068.7     201
GR1072.1     208  1072.3     223  1072.3     225


X1  4900      13     136     202     100     100     100
GR1074.3     100  1073.8     122  1073.1     136  1069.9     148  1069.6     150
GR1069.1     156  1069.1     168  1068.9     172  1069.4     180  1069.4     194
GR1072.7     202  1073.1     217  1073.1     223

X1  5000      13     131     195     100     100     100
GR1075.0     100  1074.6     122  1073.8     131  1070.7     146  1070.5     147
GR1070.0     156  1070.0     162  1069.6     165  1070.0     177  1070.2     187
GR1073.3     195  1073.8     212  1073.9     222

X1  5100      11     135     189     100     100     100
GR1075.8     100  1075.4     122  1074.6     135  1071.4     144  1070.9     157
GR1070.3     159  1070.8     175  1070.9     180  1073.8     189  1074.6     206
GR1074.6     250


X1  5145      15     133     194      45      45      45
GR1077.0     100  1076.5     122  1075.1     133  1072.5     142  1071.9    148.
GR1071.8     167  1070.9     170  1070.8     175  1071.2     177  1071.3    186.
GR1074.0     194  1075.6     250  1075.9     300  1075.7     350  1076.1    400.

NC                           .3      .5

X1  5200       9     137     221      55      55      55
GR1078.2     100  1077.7     123  1077.1     137  1075.6     144  1073.0     145
GR1072.0     171  1072.1     193  1074.9     202  1075.6     221

NC   .03     .03    .015

X1  5235       6     148     199      25      25      25
X3    10
GR1079.0     100  1081.0     148  1072.0  148.01  1072.0  198.99  1078.2     199
GR1078.2     227

* McDowell Road Bridge

SB  1.05     1.6       3      70      51       3     216          1072.9  1072.0
X1  5323       6     148     199      88      88      88
X2                     1  1077.4    1080
X3    10
GR1080.4     100  1082.0     148  1072.9  148.01  1072.9  198.99  1079.2     199
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GR1078.7     224

NC   .04     .04    .025

X1  5350       8     123     225      27      27      27
GR1080.9     100  1080.5     123  1074.8     146  1073.5     171  1074.4     200
GR1076.9     201  1077.2     220  1078.8     225

NC                          .1       .3

X1  5400      11     137     225      50      50      50
GR1081.6     100  1081.2     122  1079.9     137  1075.9     145  1075.3     155
GR1074.1     158  1073.7     170  1074.2     200  1077.4     204  1077.4     220
GR1078.8     225

X1  5500      15     136     213     100     100     100
GR1082.4     100  1082.1     121  1080.9     136  1079.5     138  1076.8     144
GR1076.1     145  1075.7     152  1074.8     157  1074.6     165  1074.9     188
GR1075.1     189  1077.3     192  1078.4     194  1079.0     213  1079.0     280

X1  5600      18     134     185     100     100     100
GR1083.2     100  1082.9     120  1081.8     134  1079.2     139  1077.8     143
GR1076.2     145  1076.0     148  1075.6     156  1075.4     160  1075.6     175
GR1076.1     178  1077.1     179  1079.4     185  1079.5     207  1079.7     240
GR1079.7     273  1079.9     307  1080.1     340

X1  5700      15     133     175     100     100     100
GR1084.0     100  1083.7     118  1082.8     133  1078.8     140  1078.7     142
GR1076.4     145  1076.3     155  1076.3     163  1077.0     167  1080.4     175
GR1080.6     200  1080.8     250  1080.9     300  1081.2     350  1081.4     400

X1  5800      19     131     171     100     100     100
GR1084.4     100  1084.1     117  1084.0     119  1083.4     131  1083.4     131
GR1080.2     137  1079.1     140  1077.3     142  1077.1     152  1077.2     160
GR1078.3     164  1081.3     171  1081.7     200  1081.9     250  1082.0     299
GR1082.1     300  1082.0     301  1082.3     350  1082.5     400

X1  5900      19     129     168     100     100     100
GR1084.7     100  1084.4     115  1084.3     119  1083.9     129  1083.9     129
GR1081.5     133  1079.5     137  1078.1     139  1078.0     149  1078.0     157
GR1079.7     161  1082.2     168  1082.8     200  1083.0     250  1083.1     297
GR1083.3     300  1083.1     303  1083.4     350  1083.6     400

X1  6000      19     127     164     100     100     100
GR1085.1     100  1084.7     113  1084.6     119  1084.5     126  1084.5     127
GR1082.9     130  1079.9     135  1079.0     136  1078.8     145  1078.9     155
GR1081.0     157  1083.1     164  1083.8     200  1084.1     250  1084.3     296
GR1084.6     299  1084.2     304  1084.5     350  1084.7     400

X1  6100      19     125     161     100     100     100
GR1085.4     100  1085.1     112  1084.8     120  1085.0     124  1085.0     125
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GR1084.2     126  1080.3     132  1079.8     133  1079.7     142  1079.7     152
GR1082.4     154  1084.0     161  1084.9     200  1085.2     250  1085.4     294
GR1085.8     299  1085.3     306  1085.6     350  1085.8     400

X16200.       17     123     157     100     100     100
GR1085.7     100  1085.4     110  1085.1     120  1085.6     122  1085.6     123
GR1080.7     130  1080.5     139  1080.6     149  1083.7     151  1084.9     157
GR1086.0     200  1086.3     250  1086.5     293  1087.0     299  1086.4     307
GR1086.7     350  1086.9     400

X1  6300      24     122     157     100     100     100
GR1086.7     100  1086.4     110  1086.0     120  1086.6     122  1086.6     122
GR1085.9     124  1081.7     130  1081.4     139  1081.5     148  1084.6     151
GR1084.8     152  1086.1     157  1086.4     171  1086.2     177  1086.5     181
GR1086.8     201  1086.6     201  1086.9     203  1087.4     247  1087.4     286
GR1087.9     292  1087.5     306  1087.8     350  1087.9     400

X1  6400      24     122     157     100     100     100
GR1087.7     100  1087.4     109  1087.0     119  1087.6     121  1087.6     122
GR1086.2     125  1082.7     129  1082.3     138  1082.4     147  1085.5     150
GR1085.9     153  1087.3     157  1087.5     171  1087.1     177  1087.6     181
GR1087.7     201  1087.3     202  1087.8     206  1088.4     244  1088.3     280
GR1088.9     286  1088.6     304  1088.9     350  1088.9     400

X1  6500      24     121     157     100     100     100
GR1088.7     100  1088.4     109  1087.9     119  1088.7     121  1088.7     121
GR1086.6     125  1083.6     129  1083.2     138  1083.3     147  1086.3     150
GR1087.0     153  1088.5     157  1088.5     171  1087.9     177  1088.6     181
GR1088.5     202  1087.9     204  1088.8     208  1089.5     240  1089.1     273
GR1089.8     279  1089.7     303  1090.0     350  1090.0     400

X1  6600      24     121     157     100     100     100
GR1089.7     100  1089.4     108  1088.9     118  1089.7     120  1089.7     121
GR1086.9     126  1084.6     128  1084.1     137  1084.2     146  1087.2     149
GR1088.1     154  1089.7     157  1089.6     171  1088.8     177  1089.7     181
GR1089.4     202  1088.6     205  1089.7     211  1090.5     237  1090.0     267
GR1090.8     273  1090.8     301  1091.1     350  1091.0     400

X1  6700      23     120     157     100     100     100
GR1090.7     100  1090.4     108  1089.8     118  1090.7     120  1087.2     127
GR1085.6     128  1085.0     137  1085.1     145  1088.1     149  1089.2     155
GR1090.9     157  1090.7     171  1089.6     177  1090.7     181  1090.2     203
GR1089.2     206  1090.6     214  1091.6     234  1090.9     260  1091.7     266
GR1091.9     300  1092.2     350  1092.0     400

X1  6800      24     120     156     100     100     100
GR1091.6     100  1091.3     107  1090.7     118  1091.6     120  1088.1     126
GR1086.5     128  1086.0     137  1086.1     146  1088.5     149  1089.8     155
GR1091.2     156  1091.1     168  1090.7     178  1091.6     181  1091.2     198
GR1090.4     207  1091.6     213  1092.4     229  1092.0     262  1092.7     269
GR1092.8     301  1093.1     350  1093.1     398  1093.2     404
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X1  6900      24     120     155     100     100     100
GR1092.5     100  1092.2     107  1091.7     118  1092.6     120  1088.9     126
GR1087.5     128  1087.1     138  1087.1     147  1088.9     150  1090.4     154
GR1091.4     155  1091.4     166  1091.8     178  1092.4     181  1092.1     194
GR1091.7     207  1092.5     212  1093.1     224  1093.1     264  1093.7     271
GR1093.7     302  1093.9     350  1094.1     396  1094.5     408

X1  7000      24     119     155     100     100     100
GR1093.4     100  1093.1     107  1092.6     117  1093.5     119  1089.8     125
GR1088.4     127  1088.1     138  1088.1     149  1089.3     150  1091.0     154
GR1091.7     155  1091.8     163  1092.8     179  1093.3     180  1093.1     189
GR1092.9     208  1093.5     211  1093.9     219  1094.1     265  1094.8     274
GR1094.5     302  1094.8     350  1095.2     394  1095.7     412

X1  7100      24     119     179     100     100     100
GR1094.3     100  1094.0     106  1093.6     117  1094.5     119  1090.6     125
GR1089.4     127  1089.2     139  1089.1     150  1089.7     151  1091.6     153
GR1091.9     154  1092.1     161  1093.9     179  1094.1     180  1094.0     185
GR1094.2     208  1094.4     210  1094.6     214  1095.2     267  1095.8     276
GR1095.4     303  1095.6     350  1096.2     392  1097.0     416

X1  7200      18     119     180     100     100     100
GR1095.2     100  1094.9     106  1094.5     117  1095.4     119  1091.5     124
GR1090.3     127  1090.2     139  1090.1     151  1092.2     153  1092.5     158
GR1095.0     180  1095.4     209  1096.3     269  1096.8     279  1096.3     304
GR1096.5     350  1097.3     390  1098.2     420

X1  7300      20     120     181     100     100     100
GR1096.0     100  1095.7     106  1095.1     118  1096.0     120  1096.0     120
GR1092.4     125  1091.2     128  1091.1     140  1091.1     152  1093.1     154
GR1093.5     159  1095.7     181  1096.0     206  1095.9     209  1096.9     269
GR1097.5     282  1097.2     308  1097.4     350  1097.6     392  1098.3     416

X1  7400      20     121     182     100     100     100
GR1096.7     100  1096.5     106  1095.7     118  1096.7     121  1096.6     121
GR1093.3     127  1092.2     129  1092.0     141  1092.1     153  1094.0     155
GR1094.5     160  1096.4     182  1096.6     203  1096.3     208  1097.4     269
GR1098.2     285  1098.1     312  1098.3     350  1097.9     394  1098.5     412

X1  7500      20     123     182     100     100     100
GR1097.5     100  1097.3     106  1096.4     119  1097.3     121  1097.3     123
GR1094.3     128  1093.1     130  1092.9     142  1093.0     153  1094.8     155
GR1095.5     162  1097.1     182  1097.3     201  1096.8     208  1098.0     270
GR1098.9     289  1099.0     316  1099.1     350  1098.3     396  1098.6     408

X1  7600      20     124     183     100     100     100
GR1098.3     100  1098.0     106  1097.0     119  1098.0     122  1097.9     124
GR1095.2     130  1094.1     131  1093.8     143  1094.0     154  1095.7     156
GR1096.5     163  1097.8     183  1097.9     198  1097.2     207  1098.5     270
GR1099.6     292  1099.9     320  1100.0     350  1098.6     398  1098.8     404
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X1  7700      19     125     164     100     100     100
GR1099.1     100  1098.8     106  1097.6     120  1098.6     123  1098.5     125
GR1096.1     131  1095.0     132  1094.7     144  1095.0     155  1096.6     157
GR1097.5     164  1098.5     184  1098.5     195  1097.7     207  1099.1     270
GR1100.3     295  1100.8     324  1100.9     350  1098.9     400

X1  7800      20     125     167     100     100     100
GR1100.0     100  1099.8     106  1098.6     120  1099.6     123  1099.6     125
GR1097.0     130  1095.9     132  1095.6     143  1095.9     154  1096.1     155
GR1097.7     157  1098.7     167  1099.7     185  1099.7     195  1099.0     210
GR1100.3     268  1101.4     296  1101.9     324  1102.1     350  1100.5     400

X1  7900      20     124     169      25      25      25
GR1100.9     100  1100.7     106  1099.8     120  1100.6     122  1100.7     124
GR1097.9     130  1096.8     131  1096.5     142  1096.7     153  1097.3     154
GR1098.8     157  1099.9     169  1100.8     185  1100.8     195  1100.3     213
GR1101.5     266  1102.5     297  1103.0     324  1103.2     350  1102.1     400

X1  8000      20     124     172     100     100     100
GR1101.8     100  1101.6     105  1100.7     119  1101.7     122  1101.7     124
GR1098.9     129  1097.6     131  1097.3     142  1097.6     153  1098.4     154
GR1099.9     156  1101.1     172  1102.0     186  1102.0     195  1101.7     216
GR1102.6     264  1103.6     298  1104.1     325  1104.4     350  1103.7     400

X1  8100      20     123     174     100     100     100
GR1102.8     100  1102.5     105  1101.7     119  1102.7     121  1102.8     123
GR1099.8     129  1098.5     130  1098.2     141  1098.4     152  1099.6     153
GR1101.0     156  1102.3     174  1103.1     186  1103.1     195  1103.0     219
GR1103.8     262  1104.7     299  1105.2     325  1105.5     350  1105.3     400

X1  8200      18     123     177     100     100     100
GR1103.7     100  1103.5     105  1102.7     119  1103.7     121  1103.9     123
GR1100.7     128  1099.4     130  1099.1     140  1099.3     151  1100.7     153
GR1102.1     156  1103.5     177  1104.3     187  1104.3     222  1105.0     260
GR1105.8     300  1106.7     350  1106.9     400

X1  8300      24     123     175     100     100     100
GR1104.6     100  1104.4     105  1103.6     119  1104.6     121  1104.7     123
GR1101.6     128  1100.2     130  1100.0     140  1100.2     150  1101.5     152
GR1102.9     155  1104.1     174  1104.3     175  1104.3     180  1104.3     181
GR1104.3     182  1104.4     184  1103.9     185  1105.1     194  1105.1     222
GR1105.6     261  1106.1     299  1107.0     350  1107.4     400

X1  8400      24     123     172     100     100     100
GR1105.6     100  1105.4     105  1104.5     120  1105.4     121  1105.5     123
GR1102.5     129  1101.0     131  1100.8     140  1101.0     150  1102.3     151
GR1103.6     154  1104.7     171  1105.0     172  1105.1     183  1105.0     184
GR1105.1     186  1105.3     191  1104.3     193  1105.9     202  1105.9     223
GR1106.2     261  1106.4     298  1107.4     351  1107.8     400
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X1  8500      24     124     170     100     100     100
GR1106.5     100  1106.3     104  1105.3     120  1106.3     122  1106.3     124
GR1103.4     129  1101.9     131  1101.7     140  1101.9     149  1103.1     151
GR1104.4     153  1105.4     167  1105.8     170  1106.0     187  1105.8     188
GR1106.0     191  1106.3     198  1104.8     202  1106.8     209  1106.8     223
GR1106.9     262  1106.8     298  1107.7     351  1108.3     400

X1  8600      24     124     167     100     100     100
GR1107.4     100  1107.2     104  1106.2     121  1107.1     122  1107.1     124
GR1104.3     130  1102.7     132  1102.5     140  1102.7     149  1103.9     150
GR1105.1     152  1106.0     164  1106.5     167  1106.8     190  1106.5     191
GR1106.8     195  1107.2     205  1105.2     210  1107.6     217  1107.6     224
GR1107.5     262  1107.1     297  1108.1     352  1108.7     400

X18700.       22     124     165     100     100     100
GR1108.4     100  1108.2     103  1107.1     121  1108.0     122  1107.9     124
GR1105.2     130  1103.5     132  1103.4     140  1103.6     148  1105.9     151
GR1106.6     161  1107.3     165  1107.6     193  1107.3     195  1107.6     200
GR1108.1     212  1105.6     218  1108.4     224  1108.1     263  1107.4     296
GR1108.4     352  1109.2     400

X1  8800      24     123     154     100     100     100
GR1109.4     100  1109.2     104  1108.1     120  1108.9     121  1108.9     123
GR1106.0     129  1105.3     130  1104.4     131  1104.4     140  1104.6     148
GR1105.8     150  1107.6     154  1107.8     175  1108.4     178  1108.6     201
GR1108.3     216  1108.6     220  1109.0     233  1106.8     238  1109.3     244
GR1109.1     280  1108.6     307  1109.5     362  1110.2     400

X1  8900      24     121     157     100     100     100
GR1110.4     100  1110.2     104  1109.2     119  1109.9     120  1110.0     121
GR1106.7     128  1106.3     129  1105.3     131  1105.3     139  1105.5     149
GR1106.8     150  1109.2     157  1109.1     189  1109.5     192  1109.7     209
GR1109.4     237  1109.6     240  1109.9     253  1108.0     258  1110.1     263
GR1110.1     298  1109.7     318  1110.6     371  1111.1     400

X1  9000      24     120     159     100     100     100
GR1111.4     100  1111.2     103  1110.2     118  1110.8     119  1111.0     120
GR1107.5     126  1107.2     128  1106.3     130  1106.3     139  1106.5     149
GR1107.9     151  1110.9     159  1110.3     204  1110.6     205  1110.7     216
GR1110.4     258  1110.5     260  1110.7     274  1109.1     278  1111.0     283
GR1111.2     315  1110.9     328  1111.8     381  1112.1     400

X1  9100      24     118     162     100     100     100
GR1112.4     100  1112.2     103  1111.3     117  1111.8     118  1112.1     118
GR1108.2     125  1108.2     127  1107.2     130  1107.2     138  1107.4     150
GR1108.9     151  1112.5     162  1111.6     218  1111.7     219  1111.8     224
GR1111.5     279  1111.5     280  1111.6     294  1110.3     298  1111.8     302
GR1112.2     333  1112.0     339  1112.9     390  1113.0     400

X1  9200      18     117     165     100     100     100
GR1113.4     100  1113.2     103  1112.3     116  1113.1     117  1109.0     124
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GR1109.1     126  1108.1     129  1108.2     138  1108.4     150  1110.0     152
GR1114.2     165  1112.8     232  1112.5     300  1112.5     315  1111.5     318
GR1112.7     322  1113.2     350  1114.0     400

X1  9300      25     117     162     100     100     100
GR1114.2     100  1114.0     103  1113.2     116  1114.0     117  1110.1     124
GR1110.2     126  1109.0     129  1109.1     138  1109.3     150  1110.7     151
GR1114.3     162  1114.3     164  1114.6     165  1114.9     167  1114.7     171
GR1114.8     176  1114.4     176  1114.9     178  1114.9     187  1114.4     188
GR1114.3     188  1114.4     189  1113.8     243  1113.8     309  1113.8     332

X1  9400      25     117     159     100     100     100
GR1115.0     100  1114.9     103  1114.0     116  1114.9     117  1111.2     124
GR1111.3     126  1109.9     129  1110.0     138  1110.1     149  1111.5     151
GR1114.4     159  1114.4     162  1115.0     164  1115.5     169  1115.2     177
GR1115.5     187  1114.7     188  1115.6     191  1115.6     209  1114.6     211
GR1114.4     212  1114.5     213  1114.7     254  1115.1     318  1115.1     349

X1  9500      25     118     164     100     100     100
GR1115.8     100  1115.7     102  1114.9     116  1115.9     118  1112.4     123
GR1112.5     125  1110.9     129  1110.9     139  1111.0     149  1112.2     150
GR1114.6     156  1114.5     161  1115.4     164  1116.2     170  1115.7     183
GR1116.1     197  1114.9     199  1116.3     205  1116.3     230  1114.8     233
GR1114.6     235  1114.7     236  1115.7     265  1116.3     327  1116.5     366

X1  9600      25     118     172     100     100     100
GR1116.6     100  1116.6     102  1115.7     116  1116.8     118  1113.5     123
GR1113.6     125  1111.8     129  1111.8     139  1111.8     148  1113.0     150
GR1114.7     153  1114.6     159  1115.8     163  1116.8     172  1116.2     189
GR1116.8     208  1115.2     211  1117.0     218  1117.0     252  1115.0     256
GR1114.7     259  1114.8     260  1116.6     276  1117.6     336  1117.8     383

X1  9700      24     118     174     100     100     100
GR1117.4     100  1117.4     102  1116.6     116  1117.7     118  1114.6     123
GR1114.7     125  1112.7     129  1112.7     139  1112.7     148  1114.8     150
GR1114.7     158  1116.2     163  1117.5     174  1116.7     195  1117.4     219
GR1115.4     222  1117.7     231  1117.7     274  1115.2     279  1114.8     282
GR1115.0     284  1117.6     287  1118.9     345  1119.1     400

X1  9800      19     119     166     100     100     100
GR1118.2     100  1118.2     102  1117.7     116  1118.8     119  1115.3     125
GR1115.4     127  1113.5     131  1113.5     141  1113.6     150  1115.7     153
GR1115.5     161  1117.1     166  1118.2     182  1117.7     206  1118.3     235
GR1116.8     242  1118.5     256  1118.7     265  1118.7     300

X1  9900      18     119     169     100     100     100
GR1119.1     100  1119.0     102  1118.7     117  1119.9     119  1116.0     127
GR1116.1     129  1114.3     133  1114.3     143  1114.4     152  1116.6     156
GR1116.3     163  1118.0     169  1118.9     189  1118.7     217  1119.3     251
GR1118.3     263  1119.4     281  1119.7     299
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X1 10000      18     120     171     100     100     100
GR1119.9     100  1119.9     101  1119.8     117  1121.0     120  1116.8     130
GR1116.8     130  1115.2     136  1115.1     145  1115.3     155  1117.4     158
GR1117.2     166  1118.9     171  1119.5     197  1119.8     228  1120.2     268
GR1119.7     283  1120.2     306  1120.8     332

X1 10100      18     120     174     100     100     100
GR1120.7     100  1120.7     101  1120.8     118  1122.1     120  1117.5     132
GR1117.5     132  1116.0     138  1115.9     147  1116.1     157  1118.3     161
GR1118.0     168  1119.8     174  1120.2     204  1120.8     239  1121.2     284
GR1121.2     304  1121.1     331  1121.8     366

X1 10200      17     121     177     100     100     100
GR1121.5     100  1121.5     101  1121.9     118  1123.2     121  1118.2     134
GR1116.8     140  1116.7     149  1117.0     159  1119.2     164  1118.8     171
GR1120.7     177  1120.9     212  1121.8     250  1122.1     300  1122.6     324
GR1121.9     356  1122.8     400

X1 10300      17     120     176     100     100     100
GR1122.3     100  1122.2     101  1122.5     117  1123.9     120  1119.3     132
GR1117.6     138  1117.5     147  1117.8     157  1120.0     162  1119.9     168
GR1121.9     176  1122.1     215  1122.8     254  1123.0     301  1123.5     323
GR1122.9     357  1123.8     400

X1 10400      17     120     175     100     100     100
GR1123.0     100  1123.0     101  1123.1     117  1124.5     120  1120.4     130
GR1118.4     136  1118.3     145  1118.6     154  1120.8     159  1121.0     165
GR1123.1     175  1123.3     218  1123.9     259  1123.8     302  1124.4     322
GR1123.9     358  1124.8     400

X1 10500      17     119     174     100     100     100
GR1123.8     100  1123.7     101  1123.8     116  1125.2     119  1121.5     128
GR1119.3     134  1119.1     143  1119.3     152  1121.7     157  1122.1     162
GR1124.2     174  1124.6     221  1124.9     263  1124.7     302  1125.4     322
GR1124.8     358  1125.8     400

X1 10600      17     119     173     100     100     100
GR1124.5     100  1124.5     101  1124.4     116  1125.8     119  1122.6     126
GR1120.1     132  1119.9     141  1120.1     149  1122.5     154  1123.2     159
GR1125.4     173  1125.8     224  1126.0     268  1125.5     303  1126.3     321
GR1125.8     359  1126.8     400

X1 10700      16     118     172     100     100     100
GR1125.3     100  1125.2     102  1125.0     115  1126.5     118  1120.9     130
GR1120.7     139  1120.9     147  1123.3     152  1124.3     156  1126.6     172
GR1127.0     227  1127.0     272  1126.4     304  1127.2     320  1126.8     360
GR1127.8     400

X1 10800      18     118     163     100     100     100
GR1126.2     100  1126.2     101  1125.9     115  1127.3     118  1121.7     128
GR1121.4     139  1121.6     147  1122.4     148  1124.6     154  1125.5     163
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GR1127.4     187  1127.4     235  1127.7     273  1127.0     302  1127.9     316
GR1127.7     360  1128.5     400  1128.5     405

X1 10900      18     117     156     100     100     100
GR1127.1     100  1127.1     101  1126.8     114  1128.1     117  1122.5     127
GR1122.2     139  1122.3     147  1123.8     149  1125.9     156  1126.6     170
GR1128.2     201  1127.7     243  1128.4     274  1127.6     301  1128.6     312
GR1128.6     359  1129.2     400  1129.3     410

X1 11000      18     117     157     100     100     100
GR1128.0     100  1128.0     100  1127.6     114  1128.8     117  1123.3     125
GR1122.9     140  1123.1     146  1125.3     150  1127.2     157  1127.8     176
GR1128.9     216  1128.1     251  1129.0     274  1128.1     299  1129.2     308
GR1129.5     359  1129.9     400  1130.0     415

X1 11100      18     116     159     100     100     100
GR1128.9     100  1128.9     100  1128.5     113  1129.6     116  1124.1     124
GR1123.7     140  1123.8     146  1126.7     151  1128.5     159  1128.9     183
GR1129.7     230  1128.4     259  1129.7     275  1128.7     298  1129.9     304
GR1130.4     358  1130.6     400  1130.8     420

X1 11200      17     116     161     100     100     100
GR1129.8     100  1129.4     113  1130.4     116  1124.9     122  1124.4     140
GR1124.5     146  1128.2     152  1129.8     161  1130.1     190  1130.5     245
GR1128.8     267  1130.4     276  1129.3     296  1130.6     300  1131.3     358
GR1131.3     400  1131.5     425

X1 11300      21     115     158     100     100     100
GR1130.7     100  1130.7     100  1130.3     112  1131.3     115  1131.1     116
GR1127.9     120  1125.7     125  1125.5     126  1125.1     140  1125.3     147
GR1128.0     151  1130.3     158  1131.0     183  1131.2     236  1130.3     260
GR1131.5     266  1130.7     280  1131.7     304  1132.1     350  1132.3     386
GR1132.6     418

X1 11400      21     114     155     100     100     100
GR1131.5      99  1131.5     100  1131.2     112  1132.2     114  1131.8     116
GR1128.2     121  1126.5     129  1126.2     130  1125.9     141  1126.2     147
GR1127.7     150  1130.8     155  1131.9     175  1131.9     226  1131.8     252
GR1132.5     256  1132.0     265  1132.9     307  1132.8     343  1133.3     371
GR1133.6     411

X1 11500      21     113     152     100     100     100
GR1132.4      99  1132.4     100  1132.1     111  1133.1     113  1132.5     116
GR1128.5     122  1127.3     132  1126.8     134  1126.6     141  1127.0     148
GR1127.5     149  1131.3     152  1132.8     168  1132.6     217  1133.3     245
GR1133.6     246  1133.4     249  1134.0     311  1133.6     335  1134.3     357
GR1134.7     404

X1 11550      18     113     164      50      50      50
GR1132.8      99  1132.8     100  1132.5     111  1133.5     113  1132.9     116
GR1128.6     123  1127.7     134  1127.1     136  1127.0     141  1127.4     148
```

```
GR1131.5    150   1133.2     164  1132.9     212  1134.1     241  1134.6     313
GR1134.0    331   1134.8     350  1135.2     400

EJ
ER
```

OUTPUT - SUBCRITICAL

EXISTING

```
*******************************************
*  HEC-2 WATER SURFACE PROFILES           *
*                                         *
*  Version   4.6.2;  May 1991             *
*                                         *
*  RUN DATE    29JUL93    TIME   09:46:53 *
*******************************************
```

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****************************************
*  U.S. ARMY CORPS OF ENGINEERS        *
*  HYDROLOGIC ENGINEERING CENTER       *
*  609 SECOND STREET, SUITE D          *
*  DAVIS, CALIFORNIA 95616-4687        *
*          (916) 756-1104              *
****************************************
```

```
X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X            X     X
X     X  X        X                        X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                   X
X     X  X        X     X             X
X     X  XXXXXXX   XXXXX              XXXXXXX
```

THIS RUN EXECUTED 29JUL93 09:46:53

```
*************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
*************************************

T1 WHITE TANKS #4 FLOOD RETENTION INLET CHANNEL
T2 DESIGN CONCEPT REPORT                7/28/93
T3      EXIST CHANNEL, SUBCRITICAL FLOW   (Q100=2206 CFS)
T4      STATION 17+48 TO 115+50

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

     -10                                     -1                   .3      2206

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

     -1                                                          -1

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

    100                   105                   150
```

THIS RUN EXECUTED 29JUL93 09:47:15

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************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
************************************
```

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

EXIST CHANNEL, SUBCRITIC

SUMMARY PRINTOUT TABLE 100

	SECNO	EGLWC	ELLC	EGPRS	ELTRD	QPR	QWEIR	CLASS	H3	DEPTH	CWSEL	VCH	EG
*	4248.000	1068.78	1066.70	1069.58	1069.00	2143.26	55.16	30.00	.00	5.99	1068.69	6.81	1069.41
	4712.000	1071.58	1070.30	1072.19	1073.00	2206.00	.00	10.00	.43	6.21	1071.51	6.58	1072.19
*	5323.000	1079.12	1077.40	1078.67	1080.00	2206.00	.00	2.00	.00	5.10	1078.00	8.49	1079.12

EXIST CHANNEL, SUBCRITIC

SUMMARY PRINTOUT TABLE 105

	SECNO	CWSEL	HL	OLOSS	TOPWID	QLOB	QCH	QROB
*	4186.000	1066.84	.02	.15	72.31	3.59	2197.88	4.53
	4197.000	1066.56	.01	.29	53.99	.00	2206.00	.00
*	4248.000	1068.69	1.28	.00	72.49	.07	2204.56	1.37
	4300.000	1068.60	.04	.13	67.40	.73	2204.96	.31
	4645.000	1070.14	.06	.08	74.23	.00	2206.00	.00
	4660.000	1070.25	.02	.02	53.99	.00	2206.00	.00
	4712.000	1071.51	.99	.00	54.00	.00	2206.00	.00
	4733.000	1071.76	.01	.05	125.90	106.22	2012.04	87.74
*	5200.000	1076.13	.27	.19	79.50	.00	2206.00	.00
*	5235.000	1076.08	.09	.14	50.99	.00	2206.00	.00
*	5323.000	1078.00	1.29	.00	50.99	.00	2206.00	.00
*	5350.000	1078.20	.05	.03	90.90	.00	2206.00	.00

EXIST CHANNEL, SUBCRITIC

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	1748.000	.00	.00	.00	1044.50	2206.00	1049.72	1049.72	1051.07	44.12	9.61	272.04	332.11
*	1800.000	52.00	.00	.00	1044.80	2206.00	1049.96	1049.96	1051.66	56.19	10.47	213.83	294.30
*	1900.000	100.00	.00	.00	1045.60	2206.00	1050.88	1050.88	1052.52	62.54	10.30	214.13	278.95
*	2000.000	100.00	.00	.00	1046.00	2206.00	1051.66	1051.66	1053.20	53.95	10.09	235.65	300.34
	2100.000	100.00	.00	.00	1046.80	2206.00	1052.19	1052.15	1053.80	62.47	10.20	217.13	279.11
	2200.000	100.00	.00	.00	1047.60	2206.00	1053.19	1052.89	1054.35	41.18	8.70	273.40	343.75
*	2300.000	100.00	.00	.00	1048.10	2206.00	1053.81	1053.81	1055.04	48.69	9.14	279.10	316.15
*	2400.000	100.00	.00	.00	1049.10	2206.00	1054.70	1054.00	1055.43	24.12	7.07	366.60	449.19
	2500.000	100.00	.00	.00	1049.80	2206.00	1054.91	1054.41	1055.75	35.07	7.47	321.56	372.50
	2600.000	100.00	.00	.00	1050.30	2206.00	1055.27	1054.81	1056.10	35.37	7.43	322.75	370.93
*	2700.000	100.00	.00	.00	1050.80	2206.00	1055.72	1055.72	1056.89	46.74	9.09	301.37	322.68
*	2800.000	100.00	.00	.00	1051.90	2206.00	1056.42	1056.42	1057.46	47.36	8.86	327.82	320.56
*	2900.000	100.00	.00	.00	1052.70	2206.00	1057.17	1057.17	1058.37	46.91	9.21	294.77	322.08
*	3000.000	100.00	.00	.00	1053.50	2206.00	1057.72	1057.72	1059.00	48.02	9.26	272.56	318.36
*	3145.000	145.00	.00	.00	1054.70	2206.00	1059.17	1059.17	1060.05	32.06	8.09	402.83	389.60
*	3200.000	55.00	.00	.00	1054.50	2206.00	1059.41	1059.41	1060.32	34.07	8.01	367.53	377.96
*	3300.000	100.00	.00	.00	1055.30	2206.00	1060.15	1060.15	1061.10	33.89	8.10	353.29	378.95
*	3400.000	100.00	.00	.00	1056.10	2206.00	1060.84	1060.84	1061.83	34.12	8.18	336.81	377.64
*	3500.000	100.00	.00	.00	1056.90	2206.00	1061.55	1061.55	1062.58	35.40	8.31	317.00	370.74
*	3600.000	100.00	.00	.00	1057.70	2206.00	1061.92	1061.92	1063.26	51.33	9.41	256.32	307.91
*	3645.000	45.00	.00	.00	1058.10	2206.00	1062.25	1062.25	1063.61	52.61	9.48	256.46	304.14
*	3700.000	55.00	.00	.00	1058.50	2206.00	1062.64	1062.64	1064.00	51.82	9.42	250.48	306.44
*	3800.000	100.00	.00	.00	1059.30	2206.00	1063.28	1063.28	1064.75	59.67	9.75	232.68	285.57
*	3900.000	100.00	.00	.00	1060.10	2206.00	1064.00	1064.00	1065.51	62.39	9.85	226.36	279.28

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	4000.000	100.00	.00	.00	1060.90	2206.00	1064.65	1064.65	1066.15	62.82	9.81	226.56	278.32
*	4100.000	100.00	.00	.00	1061.70	2206.00	1065.36	1065.36	1066.86	64.08	9.84	225.02	275.58
*	4145.000	45.00	.00	.00	1062.00	2206.00	1065.87	1065.87	1067.39	65.66	9.88	223.23	272.24
*	4150.000	5.00	.00	.00	1061.70	2206.00	1066.97	1065.62	1067.65	19.92	6.61	335.59	494.27
*	4186.000	11.00	.00	.00	1062.40	2206.00	1066.84	1065.79	1067.82	10.13	7.99	281.90	692.94
	4197.000	11.00	.00	.00	1062.50	2206.00	1066.56	1066.23	1068.13	19.24	10.07	219.05	502.90
*	4248.000	51.00	1069.00	1066.70	1062.70	2206.00	1068.69	.00	1069.41	5.58	6.81	326.89	933.62
	4300.000	52.00	.00	.00	1063.10	2206.00	1068.60	1067.27	1069.57	8.40	7.91	280.67	760.98
*	4350.000	50.00	.00	.00	1063.40	2206.00	1068.16	1067.84	1069.84	17.87	10.41	211.89	521.87
*	4400.000	50.00	.00	.00	1063.60	2206.00	1068.24	1068.24	1070.20	22.62	11.25	196.10	463.80
*	4450.000	50.00	.00	.00	1064.00	2206.00	1068.39	1068.39	1070.33	22.55	11.17	197.52	464.50
*	4500.000	50.00	.00	.00	1064.20	2206.00	1068.60	1068.60	1070.59	22.99	11.33	194.67	460.10
*	4550.000	50.00	.00	.00	1064.50	2206.00	1068.86	1068.86	1070.86	23.07	11.37	194.10	459.31
	4600.000	50.00	.00	.00	1064.70	2206.00	1069.73	1068.92	1071.02	12.44	9.12	242.05	625.38
	4645.000	45.00	.00	.00	1065.50	2206.00	1070.14	1069.43	1071.16	12.30	8.09	272.52	629.13
	4660.000	15.00	.00	.00	1065.00	2206.00	1070.25	1068.71	1071.19	8.60	7.79	283.11	752.15
	4712.000	52.00	1073.00	1070.30	1065.30	2206.00	1071.51	.00	1072.19	5.08	6.58	335.48	978.54
	4733.000	21.00	.00	.00	1065.40	2206.00	1071.76	1069.20	1072.25	3.34	5.86	482.23	1207.50
*	4739.000	6.00	.00	.00	1067.90	2206.00	1071.46	1071.46	1073.09	23.29	10.23	215.63	457.10
*	4750.000	11.00	.00	.00	1067.60	2206.00	1071.68	1071.68	1073.33	64.01	10.31	213.97	275.74
*	4800.000	50.00	.00	.00	1068.20	2206.00	1072.21	1072.21	1073.84	62.79	10.24	215.91	278.39
*	4900.000	100.00	.00	.00	1068.90	2206.00	1073.21	1073.21	1074.76	58.30	10.01	225.20	288.90
*	5000.000	100.00	.00	.00	1069.60	2206.00	1074.20	1074.20	1075.70	54.33	9.89	235.71	299.28
*	5100.000	100.00	.00	.00	1070.30	2206.00	1075.44	1075.44	1076.76	41.56	9.53	279.98	342.19
*	5145.000	45.00	.00	.00	1070.80	2206.00	1075.92	1075.92	1077.00	35.85	8.67	318.08	368.42
*	5200.000	55.00	.00	.00	1072.00	2206.00	1076.13	1076.13	1077.60	68.73	9.70	227.39	266.08

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	5235.000	25.00	.00	.00	1072.00	2206.00	1076.08	1075.86	1077.83	21.39	10.60	208.10	476.94
*	5323.000	88.00	1080.00	1077.40	1072.90	2206.00	1078.00	.00	1079.12	10.67	8.49	259.89	675.38
*	5350.000	27.00	.00	.00	1073.50	2206.00	1078.20	1077.76	1079.20	43.31	8.04	274.49	335.21
	5400.000	50.00	.00	.00	1073.70	2206.00	1078.31	1078.01	1079.49	49.85	8.69	253.82	312.45
*	5500.000	100.00	.00	.00	1074.60	2206.00	1079.51	1079.51	1080.73	50.27	8.98	273.75	311.15
*	5600.000	100.00	.00	.00	1075.40	2206.00	1080.81	1080.81	1081.80	33.15	8.74	376.09	383.15
*	5700.000	100.00	.00	.00	1076.30	2206.00	1082.10	1082.10	1082.96	30.79	8.63	448.48	397.59
*	5800.000	100.00	.00	.00	1077.10	2206.00	1083.15	1083.15	1084.04	30.95	8.77	444.39	396.56
*	5900.000	100.00	.00	.00	1078.00	2206.00	1084.19	1084.19	1085.09	29.07	8.75	444.34	409.13
*	6000.000	100.00	.00	.00	1078.80	2206.00	1085.26	1085.26	1086.14	27.96	8.73	458.72	417.20
*	6100.000	100.00	.00	.00	1079.70	2206.00	1086.25	1086.25	1087.14	26.38	8.69	460.85	429.48
*	6200.000	100.00	.00	.00	1080.50	2206.00	1087.24	1087.24	1088.15	26.48	8.83	453.35	428.70
*	6300.000	100.00	.00	.00	1081.40	2206.00	1088.32	1088.32	1089.16	24.45	8.53	467.89	446.13
*	6400.000	100.00	.00	.00	1082.30	2206.00	1089.29	1089.29	1090.16	25.27	8.64	455.55	438.84
*	6500.000	100.00	.00	.00	1083.20	2206.00	1090.22	1090.22	1091.14	25.95	8.74	431.35	433.01
*	6600.000	100.00	.00	.00	1084.10	2206.00	1091.20	1091.20	1092.14	26.55	8.78	419.78	428.09
*	6700.000	100.00	.00	.00	1085.00	2206.00	1092.07	1092.07	1093.09	29.19	9.04	382.09	408.30
*	6800.000	100.00	.00	.00	1086.00	2206.00	1092.75	1092.75	1093.92	32.13	9.56	346.22	389.21
*	6900.000	100.00	.00	.00	1087.10	2206.00	1093.56	1093.56	1094.78	32.62	9.75	338.70	386.24
*	7000.000	100.00	.00	.00	1088.10	2206.00	1094.35	1094.35	1095.57	32.21	9.69	329.39	388.67
*	7100.000	100.00	.00	.00	1089.10	2206.00	1094.83	1094.83	1096.19	47.42	9.53	265.53	320.34
*	7200.000	100.00	.00	.00	1090.10	2206.00	1095.67	1095.67	1097.05	48.35	9.57	255.88	317.25
*	7300.000	100.00	.00	.00	1091.10	2206.00	1096.54	1096.54	1097.85	46.82	9.42	274.07	322.39
*	7400.000	100.00	.00	.00	1092.00	2206.00	1097.52	1097.52	1098.62	40.17	8.83	320.11	348.04
*	7500.000	100.00	.00	.00	1092.90	2206.00	1098.34	1098.34	1099.39	40.28	8.80	336.81	347.57
*	7600.000	100.00	.00	.00	1093.80	2206.00	1099.05	1099.05	1100.05	43.45	8.79	352.58	334.67

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	7700.000	100.00	.00	.00	1094.70	2206.00	1099.90	1099.90	1100.88	38.19	9.33	390.14	356.97
*	7800.000	100.00	.00	.00	1095.60	2206.00	1100.97	1100.97	1102.00	37.39	9.29	371.41	360.75
*	7900.000	25.00	.00	.00	1096.50	2206.00	1102.00	1102.00	1103.09	38.20	9.30	353.20	356.90
*	8000.000	100.00	.00	.00	1097.30	2206.00	1103.03	1103.03	1104.15	38.08	9.22	339.98	357.47
*	8100.000	100.00	.00	.00	1098.20	2206.00	1104.04	1104.04	1105.19	39.38	9.21	324.41	351.52
*	8200.000	100.00	.00	.00	1099.10	2206.00	1105.04	1105.04	1106.23	40.37	9.21	306.60	347.18
*	8300.000	100.00	.00	.00	1100.00	2206.00	1105.91	1105.91	1107.04	39.01	9.13	325.23	353.22
*	8400.000	100.00	.00	.00	1100.80	2206.00	1106.83	1106.83	1107.82	34.57	8.78	369.46	375.22
*	8500.000	100.00	.00	.00	1101.70	2206.00	1107.67	1107.67	1108.61	34.18	8.77	398.92	377.33
*	8600.000	100.00	.00	.00	1102.50	2206.00	1108.41	1108.41	1109.28	34.36	8.72	431.66	376.31
*	8700.000	100.00	.00	.00	1103.40	2206.00	1109.20	1109.20	1109.91	30.89	8.23	486.94	396.92
*	8800.000	100.00	.00	.00	1104.40	2206.00	1110.06	1110.06	1110.91	33.95	9.26	463.49	378.60
*	8900.000	100.00	.00	.00	1105.30	2206.00	1111.08	1111.08	1111.85	29.78	8.58	482.82	404.26
*	9000.000	100.00	.00	.00	1106.30	2206.00	1112.01	1112.01	1112.85	31.18	8.70	460.16	395.08
*	9100.000	100.00	.00	.00	1107.20	2206.00	1113.01	1113.01	1113.85	31.11	8.49	450.86	395.49
*	9200.000	100.00	.00	.00	1108.10	2206.00	1114.02	1114.02	1114.85	29.92	8.29	439.52	403.27
*	9300.000	100.00	.00	.00	1109.00	2206.00	1115.06	1115.06	1116.01	29.98	8.63	402.06	402.88
*	9400.000	100.00	.00	.00	1109.90	2206.00	1116.00	1116.00	1116.93	28.17	8.66	419.13	415.62
*	9500.000	100.00	.00	.00	1110.90	2206.00	1116.93	1116.93	1117.76	27.60	8.24	435.58	419.93
*	9600.000	100.00	.00	.00	1111.80	2206.00	1117.55	1117.55	1118.49	36.56	8.58	376.66	364.86
*	9700.000	100.00	.00	.00	1112.70	2206.00	1118.17	1118.17	1119.18	42.27	8.86	349.76	339.30
*	9800.000	100.00	.00	.00	1113.50	2206.00	1119.14	1119.14	1120.20	35.07	9.01	361.26	372.53
*	9900.000	100.00	.00	.00	1114.30	2206.00	1119.95	1119.95	1120.98	34.83	8.85	362.86	373.80
*	10000.000	100.00	.00	.00	1115.10	2206.00	1120.87	1120.87	1121.80	31.59	8.48	391.58	392.52
*	10100.000	100.00	.00	.00	1115.90	2206.00	1121.67	1121.67	1122.60	31.41	8.41	389.11	393.60
*	10200.000	100.00	.00	.00	1116.70	2206.00	1122.42	1122.42	1123.39	32.61	8.51	371.60	386.32

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	10300.000	100.00	.00	.00	1117.50	2206.00	1123.42	1123.42	1124.37	31.28	8.38	381.09	394.40
*	10400.000	100.00	.00	.00	1118.30	2206.00	1124.43	1124.43	1125.37	31.03	8.36	387.84	395.99
*	10500.000	100.00	.00	.00	1119.10	2206.00	1125.42	1125.42	1126.37	30.62	8.35	386.17	398.65
*	10600.000	100.00	.00	.00	1119.90	2206.00	1126.43	1126.43	1127.39	30.45	8.38	385.48	399.79
*	10700.000	100.00	.00	.00	1120.70	2206.00	1127.40	1127.40	1128.38	30.83	8.43	375.27	397.27
*	10800.000	100.00	.00	.00	1121.40	2206.00	1128.00	1128.00	1129.04	28.37	8.77	371.00	414.18
*	10900.000	100.00	.00	.00	1122.20	2206.00	1128.70	1128.70	1129.73	27.90	8.99	383.64	417.60
*	11000.000	100.00	.00	.00	1122.90	2206.00	1129.41	1129.41	1130.42	27.90	8.89	390.41	417.63
*	11100.000	100.00	.00	.00	1123.70	2206.00	1130.07	1130.07	1131.16	31.01	9.04	368.82	396.13
*	11200.000	100.00	.00	.00	1124.40	2206.00	1130.93	1130.93	1131.97	29.52	8.77	370.24	406.03
*	11300.000	100.00	.00	.00	1125.10	2206.00	1131.78	1131.78	1132.91	29.19	9.04	352.27	408.32
*	11400.000	100.00	.00	.00	1125.90	2206.00	1132.75	1132.75	1133.90	28.42	9.13	347.74	413.80
*	11500.000	100.00	.00	.00	1126.60	2206.00	1133.59	1133.59	1134.89	31.96	9.63	312.09	390.24
*	11550.000	50.00	.00	.00	1127.00	2206.00	1133.90	1133.90	1135.26	44.02	9.69	281.22	332.51

EXIST CHANNEL, SUBCRITIC

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	1748.000	2206.00	1049.72	.00	.00	.00	140.52	.00
*	1800.000	2206.00	1049.96	.00	.24	.00	86.28	52.00
*	1900.000	2206.00	1050.88	.00	.92	.00	64.92	100.00
*	2000.000	2206.00	1051.66	.00	.78	.00	85.92	100.00
	2100.000	2206.00	1052.19	.00	.53	.00	72.31	100.00
	2200.000	2206.00	1053.19	.00	1.00	.00	135.50	100.00
*	2300.000	2206.00	1053.81	.00	.62	.00	128.77	100.00
*	2400.000	2206.00	1054.70	.00	.89	.00	136.64	100.00
	2500.000	2206.00	1054.91	.00	.21	.00	124.85	100.00
	2600.000	2206.00	1055.27	.00	.35	.00	141.23	100.00
*	2700.000	2206.00	1055.72	.00	.45	.00	159.16	100.00
*	2800.000	2206.00	1056.42	.00	.70	.00	168.03	100.00
*	2900.000	2206.00	1057.17	.00	.76	.00	136.56	100.00
*	3000.000	2206.00	1057.72	.00	.54	.00	129.76	100.00
*	3145.000	2206.00	1059.17	.00	1.45	.00	291.13	145.00
*	3200.000	2206.00	1059.41	.00	.24	.00	287.62	55.00
*	3300.000	2206.00	1060.15	.00	.74	.00	293.15	100.00
*	3400.000	2206.00	1060.84	.00	.69	.00	300.00	100.00
*	3500.000	2206.00	1061.55	.00	.71	.00	300.00	100.00
*	3600.000	2206.00	1061.92	.00	.37	.00	128.75	100.00
*	3645.000	2206.00	1062.25	.00	.33	.00	131.67	45.00
*	3700.000	2206.00	1062.64	.00	.40	.00	128.62	55.00
*	3800.000	2206.00	1063.28	.00	.63	.00	98.16	100.00
*	3900.000	2206.00	1064.00	.00	.72	.00	80.74	100.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	4000.000	2206.00	1064.65	.00	.65	.00	79.58	100.00
*	4100.000	2206.00	1065.36	.00	.71	.00	78.09	100.00
*	4145.000	2206.00	1065.87	.00	.51	.00	74.75	45.00
*	4150.000	2206.00	1066.97	.00	1.11	.00	96.63	5.00
*	4186.000	2206.00	1066.84	.00	-.14	.00	72.31	11.00
	4197.000	2206.00	1066.56	.00	-.28	.00	53.99	11.00
*	4248.000	2206.00	1068.69	.00	2.13	.00	72.49	51.00
	4300.000	2206.00	1068.60	.00	-.09	.00	67.40	52.00
*	4350.000	2206.00	1068.16	.00	-.44	.00	50.90	50.00
*	4400.000	2206.00	1068.24	.00	.08	.00	50.14	50.00
*	4450.000	2206.00	1068.39	.00	.16	.00	50.96	50.00
*	4500.000	2206.00	1068.60	.00	.21	.00	49.22	50.00
*	4550.000	2206.00	1068.86	.00	.26	.00	49.07	50.00
	4600.000	2206.00	1069.73	.00	.87	.00	54.68	50.00
	4645.000	2206.00	1070.14	.00	.41	.00	74.23	45.00
	4660.000	2206.00	1070.25	.00	.11	.00	53.99	15.00
	4712.000	2206.00	1071.51	.00	1.26	.00	54.00	52.00
	4733.000	2206.00	1071.76	.00	.25	.00	125.90	21.00
*	4739.000	2206.00	1071.46	.00	-.30	.00	67.06	6.00
*	4750.000	2206.00	1071.68	.00	.22	.00	65.20	11.00
*	4800.000	2206.00	1072.21	.00	.53	.00	74.10	50.00
*	4900.000	2206.00	1073.21	.00	1.00	.00	89.18	100.00
*	5000.000	2206.00	1074.20	.00	.99	.00	95.51	100.00
*	5100.000	2206.00	1075.44	.00	1.24	.00	130.10	100.00
*	5145.000	2206.00	1075.92	.00	.48	.00	250.61	45.00
*	5200.000	2206.00	1076.13	.00	.22	.00	79.50	55.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	5235.000	2206.00	1076.08	.00	-.05	.00	50.99	25.00
*	5323.000	2206.00	1078.00	.00	1.92	.00	50.99	88.00
*	5350.000	2206.00	1078.20	.00	.20	.00	90.90	27.00
	5400.000	2206.00	1078.31	.00	.11	.00	83.09	50.00
*	5500.000	2206.00	1079.51	.00	1.20	.00	142.02	100.00
*	5600.000	2206.00	1080.81	.00	1.29	.00	204.09	100.00
*	5700.000	2206.00	1082.10	.00	1.29	.00	265.78	100.00
*	5800.000	2206.00	1083.15	.00	1.05	.00	268.53	100.00
*	5900.000	2206.00	1084.19	.00	1.04	.00	278.25	100.00
*	6000.000	2206.00	1085.26	.00	1.07	.00	300.00	100.00
*	6100.000	2206.00	1086.25	.00	1.00	.00	300.00	100.00
*	6200.000	2206.00	1087.24	.00	.99	.00	300.00	100.00
*	6300.000	2206.00	1088.32	.00	1.07	.00	300.00	100.00
*	6400.000	2206.00	1089.29	.00	.98	.00	300.00	100.00
*	6500.000	2206.00	1090.22	.00	.93	.00	300.00	100.00
*	6600.000	2206.00	1091.20	.00	.98	.00	300.00	100.00
*	6700.000	2206.00	1092.07	.00	.87	.00	247.40	100.00
*	6800.000	2206.00	1092.75	.00	.68	.00	185.90	100.00
*	6900.000	2206.00	1093.56	.00	.81	.00	169.37	100.00
*	7000.000	2206.00	1094.35	.00	.79	.00	168.22	100.00
*	7100.000	2206.00	1094.83	.00	.48	.00	134.66	100.00
*	7200.000	2206.00	1095.67	.00	.83	.00	126.69	100.00
*	7300.000	2206.00	1096.54	.00	.87	.00	147.12	100.00
*	7400.000	2206.00	1097.52	.00	.98	.00	171.32	100.00
*	7500.000	2206.00	1098.34	.00	.82	.00	180.49	100.00
*	7600.000	2206.00	1099.05	.00	.72	.00	202.48	100.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	7700.000	2206.00	1099.90	.00	.85	.00	211.58	100.00
*	7800.000	2206.00	1100.97	.00	1.07	.00	199.53	100.00
*	7900.000	2206.00	1102.00	.00	1.04	.00	181.63	25.00
*	8000.000	2206.00	1103.03	.00	1.02	.00	178.52	100.00
*	8100.000	2206.00	1104.04	.00	1.02	.00	172.03	100.00
*	8200.000	2206.00	1105.04	.00	1.00	.00	162.02	100.00
*	8300.000	2206.00	1105.91	.00	.87	.00	184.36	100.00
*	8400.000	2206.00	1106.83	.00	.92	.00	220.65	100.00
*	8500.000	2206.00	1107.67	.00	.84	.00	249.03	100.00
*	8600.000	2206.00	1108.41	.00	.75	.00	277.12	100.00
*	8700.000	2206.00	1109.20	.00	.79	.00	300.00	100.00
*	8800.000	2206.00	1110.06	.00	.86	.00	292.64	100.00
*	8900.000	2206.00	1111.08	.00	1.02	.00	298.99	100.00
*	9000.000	2206.00	1112.01	.00	.93	.00	294.52	100.00
*	9100.000	2206.00	1113.01	.00	.99	.00	300.00	100.00
*	9200.000	2206.00	1114.02	.00	1.02	.00	290.86	100.00
*	9300.000	2206.00	1115.06	.00	1.04	.00	232.00	100.00
*	9400.000	2206.00	1116.00	.00	.93	.00	249.00	100.00
*	9500.000	2206.00	1116.93	.00	.93	.00	266.00	100.00
*	9600.000	2206.00	1117.55	.00	.62	.00	232.84	100.00
*	9700.000	2206.00	1118.17	.00	.62	.00	212.34	100.00
*	9800.000	2206.00	1119.14	.00	.98	.00	200.00	100.00
*	9900.000	2206.00	1119.95	.00	.80	.00	199.00	100.00
*	10000.000	2206.00	1120.87	.00	.92	.00	231.34	100.00
*	10100.000	2206.00	1121.67	.00	.80	.00	257.64	100.00
*	10200.000	2206.00	1122.42	.00	.76	.00	261.33	100.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	10300.000	2206.00	1123.42	.00	1.00	.00	271.61	100.00
*	10400.000	2206.00	1124.43	.00	1.01	.00	282.44	100.00
*	10500.000	2206.00	1125.42	.00	.99	.00	283.93	100.00
*	10600.000	2206.00	1126.43	.00	1.01	.00	284.76	100.00
*	10700.000	2206.00	1127.40	.00	.98	.00	284.17	100.00
*	10800.000	2206.00	1128.00	.00	.59	.00	274.91	100.00
*	10900.000	2206.00	1128.70	.00	.70	.00	265.50	100.00
*	11000.000	2206.00	1129.41	.00	.71	.00	242.92	100.00
*	11100.000	2206.00	1130.07	.00	.67	.00	222.62	100.00
*	11200.000	2206.00	1130.93	.00	.86	.00	227.41	100.00
*	11300.000	2206.00	1131.78	.00	.85	.00	212.87	100.00
*	11400.000	2206.00	1132.75	.00	.97	.00	200.81	100.00
*	11500.000	2206.00	1133.59	.00	.85	.00	169.58	100.00
*	11550.000	2206.00	1133.90	.00	.31	.00	137.09	50.00

SUMMARY OF ERRORS AND SPECIAL NOTES

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CAUTION SECNO=   1748.000  PROFILE=  1  CRITICAL DEPTH ASSUMED

CAUTION SECNO=   1800.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
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WARNING SECNO=   2400.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

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CAUTION SECNO=   2700.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

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WARNING SECNO=   4150.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=   4186.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=   4248.000  PROFILE=  1  HYDRAULIC JUMP D.S.
WARNING SECNO=   4248.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=   4350.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=   4400.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
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CAUTION SECNO=   5323.000  PROFILE=  1  HYDRAULIC JUMP D.S.
WARNING SECNO=   5323.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=   5350.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

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APPENDIX VI

"EXISTING CONDITIONS " HEC-2 INPUT AND OUTPUT - SUPERCRITICAL

INPUT - SUPERCRITICAL

EXISTING

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T1 WHITE TANKS #4 FLOOD RETENTION INLET CHANNEL
T2 DESIGN CONCEPT REPORT                    7/28/93
T3      EXIST CHANNEL, SUPERCRITICAL FLOW  (Q100= 2200 CFS)
T4      STA 115+50 TO STA 17+48

J1   -10                        1      -1              .3    2206
J2    -1                                               -1
J3   100             105             150

NC   .04     .04    .025     .1       .3

X1 11550     18      113     164      50      50      50
GR1132.8     99   1132.8     100  1132.5     111  1133.5     113  1132.9     116
GR1128.6    123   1127.7     134  1127.1     136  1127.0     141  1127.4     148
GR1131.5    150   1133.2     164  1132.9     212  1134.1     241  1134.6     313
GR1134.0    331   1134.8     350  1135.2     400

X1 11500     21      113     152     100     100     100
GR1132.4     99   1132.4     100  1132.1     111  1133.1     113  1132.5     116
GR1128.5    122   1127.3     132  1126.8     134  1126.6     141  1127.0     148
GR1127.5    149   1131.3     152  1132.8     168  1132.6     217  1133.3     245
GR1133.6    246   1133.4     249  1134.0     311  1133.6     335  1134.3     357
GR1134.7    404

X1 11400     21      114     155     100     100     100
GR1131.5     99   1131.5     100  1131.2     112  1132.2     114  1131.8     116
GR1128.2    121   1126.5     129  1126.2     130  1125.9     141  1126.2     147
GR1127.7    150   1130.8     155  1131.9     175  1131.9     226  1131.8     252
GR1132.5    256   1132.0     265  1132.9     307  1132.8     343  1133.3     371
GR1133.6    411

X1 11300     21      115     158     100     100     100
GR1130.7    100   1130.7     100  1130.3     112  1131.3     115  1131.1     116
GR1127.9    120   1125.7     125  1125.5     126  1125.1     140  1125.3     147
GR1128.0    151   1130.3     158  1131.0     183  1131.2     236  1130.3     260
GR1131.5    266   1130.7     280  1131.7     304  1132.1     350  1132.3     386
GR1132.6    418

X1 11200     17      116     161     100     100     100
GR1129.8    100   1129.4     113  1130.4     116  1124.9     122  1124.4     140
GR1124.5    146   1128.2     152  1129.8     161  1130.1     190  1130.5     245
GR1128.8    267   1130.4     276  1129.3     296  1130.6     300  1131.3     358
GR1131.3    400   1131.5     425

X1 11100     18      116     159     100     100     100
GR1128.9    100   1128.9     100  1128.5     113  1129.6     116  1124.1     124
GR1123.7    140   1123.8     146  1126.7     151  1128.5     159  1128.9     183
GR1129.7    230   1128.4     259  1129.7     275  1128.7     298  1129.9     304
GR1130.4    358   1130.6     400  1130.8     420

X1 11000     18      117     157     100     100     100
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GR1128.0     100  1128.0     100  1127.6     114  1128.8     117  1123.3     125
GR1122.9     140  1123.1     146  1125.3     150  1127.2     157  1127.8     176
GR1128.9     216  1128.1     251  1129.0     274  1128.1     299  1129.2     308
GR1129.5     359  1129.9     400  1130.0     415

X1 10900      18     117     156     100     100     100
GR1127.1     100  1127.1     101  1126.8     114  1128.1     117  1122.5     127
GR1122.2     139  1122.3     147  1123.8     149  1125.9     156  1126.6     170
GR1128.2     201  1127.7     243  1128.4     274  1127.6     301  1128.6     312
GR1128.6     359  1129.2     400  1129.3     410

X1 10800      18     118     163     100     100     100
GR1126.2     100  1126.2     101  1125.9     115  1127.3     118  1121.7     128
GR1121.4     139  1121.6     147  1122.4     148  1124.6     154  1125.5     163
GR1127.4     187  1127.4     235  1127.7     273  1127.0     302  1127.9     316
GR1127.7     360  1128.5     400  1128.5     405

X1 10700      16     118     172     100     100     100
GR1125.3     100  1125.2     102  1125.0     115  1126.5     118  1120.9     130
GR1120.7     139  1120.9     147  1123.3     152  1124.3     156  1126.6     172
GR1127.0     227  1127.0     272  1126.4     304  1127.2     320  1126.8     360
GR1127.8     400

X1 10600      17     119     173     100     100     100
GR1124.5     100  1124.5     101  1124.4     116  1125.8     119  1122.6     126
GR1120.1     132  1119.9     141  1120.1     149  1122.5     154  1123.2     159
GR1125.4     173  1125.8     224  1126.0     268  1125.5     303  1126.3     321
GR1125.8     359  1126.8     400

X1 10500      17     119     174     100     100     100
GR1123.8     100  1123.7     101  1123.8     116  1125.2     119  1121.5     128
GR1119.3     134  1119.1     143  1119.3     152  1121.7     157  1122.1     162
GR1124.2     174  1124.6     221  1124.9     263  1124.7     302  1125.4     322
GR1124.8     358  1125.8     400

X1 10400      17     120     175     100     100     100
GR1123.0     100  1123.0     101  1123.1     117  1124.5     120  1120.4     130
GR1118.4     136  1118.3     145  1118.6     154  1120.8     159  1121.0     165
GR1123.1     175  1123.3     218  1123.9     259  1123.8     302  1124.4     322
GR1123.9     358  1124.8     400

X1 10300      17     120     176     100     100     100
GR1122.3     100  1122.2     101  1122.5     117  1123.9     120  1119.3     132
GR1117.6     138  1117.5     147  1117.8     157  1120.0     162  1119.9     168
GR1121.9     176  1122.1     215  1122.8     254  1123.0     301  1123.5     323
GR1122.9     357  1123.8     400

X1 10200      17     121     177     100     100     100
GR1121.5     100  1121.5     101  1121.9     118  1123.2     121  1118.2     134
GR1116.8     140  1116.7     149  1117.0     159  1119.2     164  1118.8     171
GR1120.7     177  1120.9     212  1121.8     250  1122.1     300  1122.6     324
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GR1121.9     356  1122.8     400

X1 10100      18     120     174     100     100     100
GR1120.7     100  1120.7     101  1120.8     118  1122.1     120  1117.5     132
GR1117.5     132  1116.0     138  1115.9     147  1116.1     157  1118.3     161
GR1118.0     168  1119.8     174  1120.2     204  1120.8     239  1121.2     284
GR1121.2     304  1121.1     331  1121.8     366

X1 10000      18     120     171     100     100     100
GR1119.9     100  1119.9     101  1119.8     117  1121.0     120  1116.8     130
GR1116.8     130  1115.2     136  1115.1     145  1115.3     155  1117.4     158
GR1117.2     166  1118.9     171  1119.5     197  1119.8     228  1120.2     268
GR1119.7     283  1120.2     306  1120.8     332

X1  9900      18     119     169     100     100     100
GR1119.1     100  1119.0     102  1118.7     117  1119.9     119  1116.0     127
GR1116.1     129  1114.3     133  1114.3     143  1114.4     152  1116.6     156
GR1116.3     163  1118.0     169  1118.9     189  1118.7     217  1119.3     251
GR1118.3     263  1119.4     281  1119.7     299

X1  9800      19     119     166     100     100     100
GR1118.2     100  1118.2     102  1117.7     116  1118.8     119  1115.3     125
GR1115.4     127  1113.5     131  1113.5     141  1113.6     150  1115.7     153
GR1115.5     161  1117.1     166  1118.2     182  1117.7     206  1118.3     235
GR1116.8     242  1118.5     256  1118.7     265  1118.7     300

X1  9700      24     118     174     100     100     100
GR1117.4     100  1117.4     102  1116.6     116  1117.7     118  1114.6     123
GR1114.7     125  1112.7     129  1112.7     139  1112.7     148  1114.8     150
GR1114.7     158  1116.2     163  1117.5     174  1116.7     195  1117.4     219
GR1115.4     222  1117.7     231  1117.7     274  1115.2     279  1114.8     282
GR1115.0     284  1117.6     287  1118.9     345  1119.1     400

X1  9600      25     118     172     100     100     100
GR1116.6     100  1116.6     102  1115.7     116  1116.8     118  1113.5     123
GR1113.6     125  1111.8     129  1111.8     139  1111.8     148  1113.0     150
GR1114.7     153  1114.6     159  1115.8     163  1116.8     172  1116.2     189
GR1116.8     208  1115.2     211  1117.0     218  1117.0     252  1115.0     256
GR1114.7     259  1114.8     260  1116.6     276  1117.6     336  1117.8     383

X1  9500      25     118     164     100     100     100
GR1115.8     100  1115.7     102  1114.9     116  1115.9     118  1112.4     123
GR1112.5     125  1110.9     129  1110.9     139  1111.0     149  1112.2     150
GR1114.6     156  1114.5     161  1115.4     164  1116.2     170  1115.7     183
GR1116.1     197  1114.9     199  1116.3     205  1116.3     230  1114.8     233
GR1114.6     235  1114.7     236  1115.7     265  1116.3     327  1116.5     366

X1  9400      25     117     159     100     100     100
GR1115.0     100  1114.9     103  1114.0     116  1114.9     117  1111.2     124
GR1111.3     126  1109.9     129  1110.0     138  1110.1     149  1111.5     151
GR1114.4     159  1114.4     162  1115.0     164  1115.5     169  1115.2     177
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GR1115.5     187  1114.7     188  1115.6     191  1115.6     209  1114.6     211
GR1114.4     212  1114.5     213  1114.7     254  1115.1     318  1115.1     349

X1  9300      25     117     162     100     100     100
GR1114.2     100  1114.0     103  1113.2     116  1114.0     117  1110.1     124
GR1110.2     126  1109.0     129  1109.1     138  1109.3     150  1110.7     151
GR1114.3     162  1114.3     164  1114.6     165  1114.9     167  1114.7     171
GR1114.8     176  1114.4     176  1114.9     178  1114.9     187  1114.4     188
GR1114.3     188  1114.4     189  1113.8     243  1113.8     309  1113.8     332

X1  9200      18     117     165     100     100     100
GR1113.4     100  1113.2     103  1112.3     116  1113.1     117  1109.0     124
GR1109.1     126  1108.1     129  1108.2     138  1108.4     150  1110.0     152
GR1114.2     165  1112.8     232  1112.5     300  1112.5     315  1111.5     318
GR1112.7     322  1113.2     350  1114.0     400

X1  9100      24     118     162     100     100     100
GR1112.4     100  1112.2     103  1111.3     117  1111.8     118  1112.1     118
GR1108.2     125  1108.2     127  1107.2     130  1107.2     138  1107.4     150
GR1108.9     151  1112.5     162  1111.6     218  1111.7     219  1111.8     224
GR1111.5     279  1111.5     280  1111.6     294  1110.3     298  1111.8     302
GR1112.2     333  1112.0     339  1112.9     390  1113.0     400

X1  9000      24     120     159     100     100     100
GR1111.4     100  1111.2     103  1110.2     118  1110.8     119  1111.0     120
GR1107.5     126  1107.2     128  1106.3     130  1106.3     139  1106.5     149
GR1107.9     151  1110.9     159  1110.3     204  1110.6     205  1110.7     216
GR1110.4     258  1110.5     260  1110.7     274  1109.1     278  1111.0     283
GR1111.2     315  1110.9     328  1111.8     381  1112.1     400

X1  8900      24     121     157     100     100     100
GR1110.4     100  1110.2     104  1109.2     119  1109.9     120  1110.0     121
GR1106.7     128  1106.3     129  1105.3     131  1105.3     139  1105.5     149
GR1106.8     150  1109.2     157  1109.1     189  1109.5     192  1109.7     209
GR1109.4     237  1109.6     240  1109.9     253  1108.0     258  1110.1     263
GR1110.1     298  1109.7     318  1110.6     371  1111.1     400

X1  8800      24     123     154     100     100     100
GR1109.4     100  1109.2     104  1108.1     120  1108.9     121  1108.9     123
GR1106.0     129  1105.3     130  1104.4     131  1104.4     140  1104.6     148
GR1105.8     150  1107.6     154  1107.8     175  1108.4     178  1108.6     201
GR1108.3     216  1108.6     220  1109.0     233  1106.8     238  1109.3     244
GR1109.1     280  1108.6     307  1109.5     362  1110.2     400

X18700.       22     124     165     100     100     100
GR1108.4     100  1108.2     103  1107.1     121  1108.0     122  1107.9     124
GR1105.2     130  1103.5     132  1103.4     140  1103.6     148  1105.9     151
GR1106.6     161  1107.3     165  1107.6     193  1107.3     195  1107.6     200
GR1108.1     212  1105.6     218  1108.4     224  1108.1     263  1107.4     296
GR1108.4     352  1109.2     400
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X1  8600      24     124     167     100     100     100
GR1107.4     100  1107.2     104  1106.2     121  1107.1     122  1107.1     124
GR1104.3     130  1102.7     132  1102.5     140  1102.7     149  1103.9     150
GR1105.1     152  1106.0     164  1106.5     167  1106.8     190  1106.5     191
GR1106.8     195  1107.2     205  1105.2     210  1107.6     217  1107.6     224
GR1107.5     262  1107.1     297  1108.1     352  1108.7     400

X1  8500      24     124     170     100     100     100
GR1106.5     100  1106.3     104  1105.3     120  1106.3     122  1106.3     124
GR1103.4     129  1101.9     131  1101.7     140  1101.9     149  1103.1     151
GR1104.4     153  1105.4     167  1105.8     170  1106.0     187  1105.8     188
GR1106.0     191  1106.3     198  1104.8     202  1106.8     209  1106.8     223
GR1106.9     262  1106.8     298  1107.7     351  1108.3     400

X1  8400      24     123     172     100     100     100
GR1105.6     100  1105.4     105  1104.5     120  1105.4     121  1105.5     123
GR1102.5     129  1101.0     131  1100.8     140  1101.0     150  1102.3     151
GR1103.6     154  1104.7     171  1105.0     172  1105.1     183  1105.0     184
GR1105.1     186  1105.3     191  1104.3     193  1105.9     202  1105.9     223
GR1106.2     261  1106.4     298  1107.4     351  1107.8     400

X1  8300      24     123     175     100     100     100
GR1104.6     100  1104.4     105  1103.6     119  1104.6     121  1104.7     123
GR1101.6     128  1100.2     130  1100.0     140  1100.2     150  1101.5     152
GR1102.9     155  1104.1     174  1104.3     175  1104.3     180  1104.3     181
GR1104.3     182  1104.4     184  1103.9     185  1105.1     194  1105.1     222
GR1105.6     261  1106.1     299  1107.0     350  1107.4     400

X1  8200      18     123     177     100     100     100
GR1103.7     100  1103.5     105  1102.7     119  1103.7     121  1103.9     123
GR1100.7     128  1099.4     130  1099.1     140  1099.3     151  1100.7     153
GR1102.1     156  1103.5     177  1104.3     187  1104.3     222  1105.0     260
GR1105.8     300  1106.7     350  1106.9     400

X1  8100      20     123     174     100     100     100
GR1102.8     100  1102.5     105  1101.7     119  1102.7     121  1102.8     123
GR1099.8     129  1098.5     130  1098.2     141  1098.4     152  1099.6     153
GR1101.0     156  1102.3     174  1103.1     186  1103.1     195  1103.0     219
GR1103.8     262  1104.7     299  1105.2     325  1105.5     350  1105.3     400

X1  8000      20     124     172     100     100     100
GR1101.8     100  1101.6     105  1100.7     119  1101.7     122  1101.7     124
GR1098.9     129  1097.6     131  1097.3     142  1097.6     153  1098.4     154
GR1099.9     156  1101.1     172  1102.0     186  1102.0     195  1101.7     216
GR1102.6     264  1103.6     298  1104.1     325  1104.4     350  1103.7     400

X1  7900      20     124     169     100     100     100
GR1100.9     100  1100.7     106  1099.8     120  1100.6     122  1100.7     124
GR1097.9     130  1096.8     131  1096.5     142  1096.7     153  1097.3     154
GR1098.8     157  1099.9     169  1100.8     185  1100.8     195  1100.3     213
GR1101.5     266  1102.5     297  1103.0     324  1103.2     350  1102.1     400
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X1  7800      20     125     167     100     100     100
GR1100.0     100  1099.8     106  1098.6     120  1099.6     123  1099.6     125
GR1097.0     130  1095.9     132  1095.6     143  1095.9     154  1096.1     155
GR1097.7     157  1098.7     167  1099.7     185  1099.7     195  1099.0     210
GR1100.3     268  1101.4     296  1101.9     324  1102.1     350  1100.5     400

X1  7700      19     125     164     100     100     100
GR1099.1     100  1098.8     106  1097.6     120  1098.6     123  1098.5     125
GR1096.1     131  1095.0     132  1094.7     144  1095.0     155  1096.6     157
GR1097.5     164  1098.5     184  1098.5     195  1097.7     207  1099.1     270
GR1100.3     295  1100.8     324  1100.9     350  1098.9     400

X1  7600      20     124     183     100     100     100
GR1098.3     100  1098.0     106  1097.0     119  1098.0     122  1097.9     124
GR1095.2     130  1094.1     131  1093.8     143  1094.0     154  1095.7     156
GR1096.5     163  1097.8     183  1097.9     198  1097.2     207  1098.5     270
GR1099.6     292  1099.9     320  1100.0     350  1098.6     398  1098.8     404

X1  7500      20     123     182     100     100     100
GR1097.5     100  1097.3     106  1096.4     119  1097.3     121  1097.3     123
GR1094.3     128  1093.1     130  1092.9     142  1093.0     153  1094.8     155
GR1095.5     162  1097.1     182  1097.3     201  1096.8     208  1098.0     270
GR1098.9     289  1099.0     316  1099.1     350  1098.3     396  1098.6     408

X1  7400      20     121     182     100     100     100
GR1096.7     100  1096.5     106  1095.7     118  1096.7     121  1096.6     121
GR1093.3     127  1092.2     129  1092.0     141  1092.1     153  1094.0     155
GR1094.5     160  1096.4     182  1096.6     203  1096.3     208  1097.4     269
GR1098.2     285  1098.1     312  1098.3     350  1097.9     394  1098.5     412

X1  7300      20     120     181     100     100     100
GR1096.0     100  1095.7     106  1095.1     118  1096.0     120  1096.0     120
GR1092.4     125  1091.2     128  1091.1     140  1091.1     152  1093.1     154
GR1093.5     159  1095.7     181  1096.0     206  1095.9     209  1096.9     269
GR1097.5     282  1097.2     308  1097.4     350  1097.6     392  1098.3     416

X17200.       18     119     180     100     100     100
GR1095.2     100  1094.9     106  1094.5     117  1095.4     119  1091.5     124
GR1090.3     127  1090.2     139  1090.1     151  1092.2     153  1092.5     158
GR1095.0     180  1095.4     209  1096.3     269  1096.8     279  1096.3     304
GR1096.5     350  1097.3     390  1098.2     420

X1  7100      24     119     179     100     100     100
GR1094.3     100  1094.0     106  1093.6     117  1094.5     119  1090.6     125
GR1089.4     127  1089.2     139  1089.1     150  1089.7     151  1091.6     153
GR1091.9     154  1092.1     161  1093.9     179  1094.1     180  1094.0     185
GR1094.2     208  1094.4     210  1094.6     214  1095.2     267  1095.8     276
GR1095.4     303  1095.6     350  1096.2     392  1097.0     416

X1  7000      24     119     155     100     100     100
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GR1093.4     100  1093.1     107  1092.6     117  1093.5     119  1089.8     125
GR1088.4     127  1088.1     138  1088.1     149  1089.3     150  1091.0     154
GR1091.7     155  1091.8     163  1092.8     179  1093.3     180  1093.1     189
GR1092.9     208  1093.5     211  1093.9     219  1094.1     265  1094.8     274
GR1094.5     302  1094.8     350  1095.2     394  1095.7     412

X1  6900      24     120     155     100     100     100
GR1092.5     100  1092.2     107  1091.7     118  1092.6     120  1088.9     126
GR1087.5     128  1087.1     138  1087.1     147  1088.9     150  1090.4     154
GR1091.4     155  1091.4     166  1091.8     178  1092.4     181  1092.1     194
GR1091.7     207  1092.5     212  1093.1     224  1093.1     264  1093.7     271
GR1093.7     302  1093.9     350  1094.1     396  1094.5     408

X1  6800      24     120     156     100     100     100
GR1091.6     100  1091.3     107  1090.7     118  1091.6     120  1088.1     126
GR1086.5     128  1086.0     137  1086.1     146  1088.5     149  1089.8     155
GR1091.2     156  1091.1     168  1090.7     178  1091.6     181  1091.2     198
GR1090.4     207  1091.6     213  1092.4     229  1092.0     262  1092.7     269
GR1092.8     301  1093.1     350  1093.1     398  1093.2     404

X1  6700      23     120     157     100     100     100
GR1090.7     100  1090.4     108  1089.8     118  1090.7     120  1087.2     127
GR1085.6     128  1085.0     137  1085.1     145  1088.1     149  1089.2     155
GR1090.9     157  1090.7     171  1089.6     177  1090.7     181  1090.2     203
GR1089.2     206  1090.6     214  1091.6     234  1090.9     260  1091.7     266
GR1091.9     300  1092.2     350  1092.0     400

X1  6600      24     121     157     100     100     100
GR1089.7     100  1089.4     108  1088.9     118  1089.7     120  1089.7     121
GR1086.9     126  1084.6     128  1084.1     137  1084.2     146  1087.2     149
GR1088.1     154  1089.7     157  1089.6     171  1088.8     177  1089.7     181
GR1089.4     202  1088.6     205  1089.7     211  1090.5     237  1090.0     267
GR1090.8     273  1090.8     301  1091.1     350  1091.0     400

X1  6500      24     121     157     100     100     100
GR1088.7     100  1088.4     109  1087.9     119  1088.7     121  1088.7     121
GR1086.6     125  1083.6     129  1083.2     138  1083.3     147  1086.3     150
GR1087.0     153  1088.5     157  1088.5     171  1087.9     177  1088.6     181
GR1088.5     202  1087.9     204  1088.8     208  1089.5     240  1089.1     273
GR1089.8     279  1089.7     303  1090.0     350  1090.0     400

X1  6400      24     122     157     100     100     100
GR1087.7     100  1087.4     109  1087.0     119  1087.6     121  1087.6     122
GR1086.2     125  1082.7     129  1082.3     138  1082.4     147  1085.5     150
GR1085.9     153  1087.3     157  1087.5     171  1087.1     177  1087.6     181
GR1087.7     201  1087.3     202  1087.8     206  1088.4     244  1088.3     280
GR1088.9     286  1088.6     304  1088.9     350  1088.9     400

X1  6300      24     122     157     100     100     100
GR1086.7     100  1086.4     110  1086.0     120  1086.6     122  1086.6     122
GR1085.9     124  1081.7     130  1081.4     139  1081.5     148  1084.6     151
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GR1084.8     152  1086.1     157  1086.4     171  1086.2     177  1086.5     181
GR1086.8     201  1086.6     201  1086.9     203  1087.4     247  1087.4     286
GR1087.9     292  1087.5     306  1087.8     350  1087.9     400

X16200.       17     123     157     100     100     100
GR1085.7     100  1085.4     110  1085.1     120  1085.6     122  1085.6     123
GR1080.7     130  1080.5     139  1080.6     149  1083.7     151  1084.9     157
GR1086.0     200  1086.3     250  1086.5     293  1087.0     299  1086.4     307
GR1086.7     350  1086.9     400

X1  6100      19     125     161     100     100     100
GR1085.4     100  1085.1     112  1084.8     120  1085.0     124  1085.0     125
GR1084.2     126  1080.3     132  1079.8     133  1079.7     142  1079.7     152
GR1082.4     154  1084.0     161  1084.9     200  1085.2     250  1085.4     294
GR1085.8     299  1085.3     306  1085.6     350  1085.8     400

X1  6000      19     127     164     100     100     100
GR1085.1     100  1084.7     113  1084.6     119  1084.5     126  1084.5     127
GR1082.9     130  1079.9     135  1079.0     136  1078.8     145  1078.9     155
GR1081.0     157  1083.1     164  1083.8     200  1084.1     250  1084.3     296
GR1084.6     299  1084.2     304  1084.5     350  1084.7     400

X1  5900      19     129     168     100     100     100
GR1084.7     100  1084.4     115  1084.3     119  1083.9     129  1083.9     129
GR1081.5     133  1079.5     137  1078.1     139  1078.0     149  1078.0     157
GR1079.7     161  1082.2     168  1082.8     200  1083.0     250  1083.1     297
GR1083.3     300  1083.1     303  1083.4     350  1083.6     400

X1  5800      19     131     171     100     100     100
GR1084.4     100  1084.1     117  1084.0     119  1083.4     131  1083.4     131
GR1080.2     137  1079.1     140  1077.3     142  1077.1     152  1077.2     160
GR1078.3     164  1081.3     171  1081.7     200  1081.9     250  1082.0     299
GR1082.1     300  1082.0     301  1082.3     350  1082.5     400

X1  5700      15     133     175     100     100     100
GR  1084     100  1083.7     118  1082.8     133  1078.8     140  1078.7     142
GR1076.4     145  1076.3     155  1076.3     163  1077.0     167  1080.4     175
GR1080.6     200  1080.8     250  1080.9     300  1081.2     350  1081.4     400

X1  5600      18     134     185     100     100     100
GR1083.2     100  1082.9     120  1081.8     134  1079.2     139  1077.8     143
GR1076.2     145  1076.0     148  1075.6     156  1075.4     160  1075.6     175
GR1076.1     178  1077.1     179  1079.4     185  1079.5     207  1079.7     240
GR1079.7     273  1079.9     307  1080.1     340

X1  5500      15     136     213     100     100     100
GR1082.4     100  1082.0     121  1080.9     136  1079.5     138  1076.8     144
GR1076.1     145  1075.7     152  1074.8     157  1074.6     165  1074.9     188
GR1075.1     189  1077.3     192  1078.4     194  1079.0     213  1079.0     280

X1  5400      11     137     225      50      50      50
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GR1081.6     100  1081.2     122  1079.9     137  1075.9     145  1075.3     155
GR1074.1     158  1073.7     170  1074.2     200  1077.4     204  1077.4     220
GR1078.8     225

NC                           .3     .5

X1  5350       8     123     225      27      27      27
GR1080.9     100  1080.5     123  1074.8     146  1073.5     171  1074.4     200
GR1076.9     201  1077.2     220  1078.8     225

NC   .03     .03    .015

X1  5323       6     148     199      88      88      88
X3    10
GR1080.4     100  1082.0     148  1072.9  148.01  1072.9  198.99  1079.2     199
GR1078.7     224

SB 1.05      1.6       3      70      51       3     216          1072.9    1072
X1  5235       6     148     199      35      35      35
X2                     1  1077.4    1080
X3    10
GR1079.0     100  1081.0     148  1072.0  148.01  1072.0  198.99  1078.2     199
GR1078.2     227

NC   .04     .04    .025

X1  5200       9     137     221      55      55      55
GR1078.2     100  1077.7     123  1077.1     137  1075.6     144  1073.0     145
GR1072.0     171  1072.1     193  1074.9     202  1075.6     221

NC                           .1     .3

X1  5145      15     133     194      45      45      45
GR1077.0     100  1076.5     122  1075.1     133  1072.5     142  1071.9    148.
GR1071.8     167  1070.9     170  1070.8     175  1071.2     177  1071.3    186.
GR1074.0     194  1075.6     250  1075.9     300  1075.7     350  1076.1    400.

X1  5100      11     135     189     100     100     100
GR1075.8     100  1075.4     122  1074.6     135  1071.4     144  1070.9     157
GR1070.3     159  1070.8     175  1070.9     180  1073.8     189  1074.6     206
GR1074.6     250

X1  5000      13     131     195     100     100     100
GR1075.0     100  1074.6     122  1073.8     131  1070.7     146  1070.5     147
GR1070.0     156  1070.0     162  1069.6     165  1070.0     177  1070.2     187
GR1073.3     195  1073.8     212  1073.9     222

X1  4900      13     136     202     100     100     100
GR1074.3     100  1073.8     122  1073.1     136  1069.9     148  1069.6     150
GR1069.1     156  1069.1     168  1068.9     172  1069.4     180  1069.4     194
GR1072.7     202  1073.1     217  1073.1     223
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X1 4800.      13     142     208      50      50      50
GR1073.6     100  1073.1     123  1072.3     142  1069.2     150  1068.7     153
GR1068.2     156  1068.2     173  1068.2     178  1068.7     182  1068.7     201
GR1072.1     208  1072.3     223  1072.3     225

X1  4750      12     145     211      11      11      11
GR1073.2     100  1072.7     123  1071.9     145  1068.8     151  1068.3     154
GR1067.8     156  1067.6     176  1067.8     181  1068.4     183  1068.3     205
GR1071.9     211  1071.9     226

NC   .03     .03    .015      .3      .5

X1  4739       7     145     213       6       6       6
GR1073.1     100  1072.6     123  1071.9     145  1067.9     153  1067.9     207
GR1071.5     213  1071.7     226

X1  4733       6     153     207      21      21      21
GR1073.1     100  1067.9     153  1065.4  153.01  1065.4  206.99  1067.9     207
GR1073.0     250

X1  4712       6     153     207      52      52      52
X3    10
GR1072.9     100  1072.5     153  1065.3  153.01  1065.3  206.99  1072.5     207
GR1072.5     215

SB 1.25      1.6       3      70      54       4     250          1065.3  1065.0
X1  4660       6     153     207      15      15      15
X2                     1  1070.3    1073
X3    10
GR1072.5     100  1073.0     153  1065.0  153.01  1065.0  206.99  1073.0     207
GR1073.0     210

X1  4645      14     141     216      45      45      45
GR1072.4     100  1072.0     123  1070.6     141  1066.6     147  1065.5     180
GR1066.2     189  1065.8     195  1066.5     196  1066.8     211  1070.2     216
GR1071.5     227  1073.8     255  1075.7     300  1076.2     350

NC                          .1      .3

X1  4600       7     137     192      50      50      50
GR1072.1     100  1070.6     137  1064.7     145  1064.7     166  1064.7     187
GR1069.5     192  1075.9     215

X1  4550       8     132     183      50      50      50
GR1071.1     100  1071.2     112  1070.4     132  1064.5     138  1064.5     160
GR1064.5     178  1069.2     183  1075.3     215

X1  4500       8     132     183      50      50      50
GR1071.3     100  1070.9     122  1070.0     132  1064.5     137  1064.2     159
GR1064.2     178  1069.1     183  1074.8     215
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X1  4450       6     132     185      50      50      50
GR1070.9     100  1069.6     132  1064.1     138  1064.0     178  1068.9     185
GR1074.2     216

X1  4400       7     132     184      50      50      50
GR1070.5     100  1069.3     132  1063.8     139  1063.9     159  1063.6     177
GR1068.6     184  1073.6     216

X1  4350       6     133     185      50      50      50
GR1070.0     100  1068.8     133  1063.4     141  1063.4     179  1068.3     185
GR1073.1     216

NC                           .3      .5

X1  4300       9     139     197      52      52      52
GR1069.7     100  1069.1     123  1068.2     139  1063.1     146  1063.1     167
GR1063.2     184  1064.5     192  1068.1     197  1072.5     216

X1  4248       8     153     207      51      51      51
X3    10
GR1069.0     100  1068.8     123  1068.7     143  1068.6     153  1062.7  153.01
GR1062.7  206.99  1068.1     207  1069.6     229

SB  1.25     1.6      3.      70      54       4     200          1062.7  1062.5
X1  4197       7     153     207      11      11      11
X2                    1.  1066.7    1069
X3    10
GR1068.5     100  1068.1     123  1068.2     153  1062.5  153.01  1062.5  206.99
GR1069.0     207  1069.0     230

X1  4186       7     133     195      36      36      36
X3    10
GR1069.0     100  1069.0     126  1065.5     133  1062.4  133.01  1062.4  194.99
GR1065.5     195  1063.0     210

NC   .04     .04    .025

X1  4150       8     137     220       5       5       5
GR1067.9     100  1066.7     137  1062.5     145  1061.7     146  1062.0     175
GR1063.0     203  1066.8     220  1066.8     225

NC                           .1      .3

X1  4145      12     137     217      45      45      45
GR1067.8     100  1067.5     122  1066.8     137  1062.8     145  1062.0     180
GR1063.3     206  1064.6     209  1066.8     217  1067.1     250  1066.9     300
GR1066.9     350  1067.1     400

X1  4100      11     138     214     100     100     100
GR1067.3     100  1066.8     122  1064.9     138  1061.7     144  1061.7     174
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GR1062.9     204  1065.9     214  1065.9     225  1066.5     300  1066.5     350
GR1066.7     400

X1  4000      13     136     211     100     100     100
GR1066.1     100  1065.7     121  1064.0     136  1061.0     143  1060.9     171
GR1062.1     201  1065.0     211  1065.0     217  1065.2     229  1065.2     230
GR1065.6     300  1065.7     350  1065.9     400

X1  3900      13     135     208     100     100     100
GR1064.9     100  1064.6     120  1063.3     135  1060.4     143  1060.1     169
GR1061.3     198  1064.1     208  1064.2     219  1064.5     232  1064.4     236
GR1064.7     300  1064.8     350  1065.0     400

X1  3800      13     133     205     100     100     100
GR1063.8     100  1063.6     119  1062.1     133  1059.7     142  1059.3     166
GR1060.5     195  1063.1     205  1063.3     222  1063.8     236  1063.7     241
GR1063.9     300  1064.0     350  1064.2     400

X1  3700      13     132     202      55      55      55
GR1062.6     100  1062.5     118  1061.2     132  1059.1     141  1058.5     163
GR1059.6     193  1062.2     202  1062.5     225  1063.1     240  1063.0     247
GR1063.0     300  1063.2     350  1063.4     400

X1  3645      13     131     200      45      45      45
GR1061.9     100  1061.9     118  1060.7     131  1058.7     141  1058.1     162
GR1059.2     191  1061.7     200  1062.0     226  1062.7     242  1062.6     250
GR1062.5     300  1062.7     350  1062.9     400

X1  3600      16     131     200     100     100     100
GR1061.6     100  1061.5     118  1060.4     131  1060.3     131  1058.4     141
GR1057.7     162  1058.8     190  1058.9     191  1061.3     200  1061.4     200
GR1061.8     225  1062.3     241  1062.2     250  1062.2     300  1062.3     350
GR1062.3     400

X1  3500      16     131     201     100     100     100
GR1060.8     100  1060.8     118  1059.7     131  1059.4     132  1057.7     142
GR1056.9     163  1058.0     188  1058.4     192  1060.4     199  1060.9     201
GR1061.3     221  1061.4     237  1061.3     250  1061.4     300  1061.5     350
GR1061.5     400

X1  3400      16     131     201     100     100     100
GR1060.1     100  1060.0     118  1059.0     131  1058.4     133  1057.0     143
GR1056.1     163  1057.2     186  1057.8     192  1059.5     199  1060.3     201
GR1060.8     218  1060.4     234  1060.4     250  1060.6     300  1060.7     350
GR1060.7     400

X1  3300      16     132     202     100     100     100
GR1059.3     100  1059.3     118  1058.3     132  1057.5     134  1056.3     144
GR1055.3     163  1056.4     183  1057.2     192  1058.6     198  1059.8     202
GR1060.3     215  1059.5     231  1059.5     250  1059.9     300  1059.9     350
GR1059.9     400
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X1  3200      16     132     203      55      55      55
GR1058.5     100  1058.5     118  1057.6     132  1056.6     135  1055.6     145
GR1054.5     164  1055.6     181  1056.6     193  1057.7     197  1059.2     203
GR1059.9     212  1058.6     228  1058.6     250  1059.1     300  1059.1     350
GR1059.1     400

X1  3145      17     132     193      45      45      45
GR1058.1     100  1058.1     118  1057.2     132  1056.1     136  1055.2     148
GR1054.7     164  1055.1     180  1056.3     193  1057.7     193  1057.7     197
GR1058.9     203  1059.6     210  1058.1     226  1058.1     250  1058.7     300
GR1058.7     350  1058.7     400

X1  3001                         1       1       1

X1  3000      12      65     132     100     100     100
GR1057.0      48  1056.6      65  1053.8      75  1053.5      95  1053.8     114
GR1054.8     122  1056.0     128  1057.8     132  1058.5     139  1057.1     157
GR1057.0     180  1057.0     195

X1  2900      15      80     148     100     100     100
GR1056.3      54  1055.7      70  1055.7      80  1053.6      88  1052.8      97
GR1052.7     108  1052.9     125  1053.9     128  1056.1     139  1058.7     148
GR1058.0     150  1056.7     166  1055.9     175  1056.1     193  1056.3     208

X1  2800      18     108     172     100     100     100
GR1055.4      70  1055.0      83  1055.8      85  1056.6      93  1056.3     108
GR1055.7     111  1052.3     123  1051.9     139  1052.4     157  1054.7     164
GR1055.4     172  1056.0     176  1055.7     182  1054.2     192  1055.2     219
GR1055.7     229  1055.2     232  1055.2     249

X1  2700      18     159     225     100     100     100
GR1054.2      97  1053.5     110  1053.9     111  1054.4     117  1057.4     135
GR1056.5     159  1053.9     165  1051.5     180  1050.8     193  1051.1     205
GR1051.4     209  1054.5     220  1055.1     225  1056.4     267  1056.5     274
GR1054.8     278  1055.0     286  1054.9     323

X1  2600      17     194     301     100     100     100
X3                          149
GR1052.6     120  1058.9     149  1059.0     159  1058.7     160  1058.1     194
GR1053.8     201  1052.4     210  1050.7     227  1050.3     240  1051.0     255
GR1053.1     270  1054.5     285  1056.1     301  1056.2     311  1054.7     314
GR1054.5     335  1054.5     360

X1  2500      16     187     288     100     100     100
X3                          139
GR1051.6     114  1058.8     139  1058.4     155  1057.9     157  1055.5     187
GR1051.8     206  1050.2     216  1049.8     228  1050.1     239  1051.2     249
GR1051.4     253  1055.8     288  1055.7     292  1053.7     297  1053.7     313
GR1053.8     328
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X1  2400      14     161     242     100     100     100
X3                           141
GR1051.4     100  1051.9     123  1056.9     141  1056.8     161  1052.5     172
GR1049.6     187  1049.1     200  1049.6     211  1052.0     231  1053.6     242
GR1053.8     250  1053.1     262  1053.4     271  1053.4     303

X1  2300      15     160     238     100     100     100
X3                           146
GR1051.0     100  1051.9     132  1056.0     146  1055.7     160  1053.2     171
GR1048.8     189  1048.3     200  1048.1     207  1051.8     222  1051.3     225
GR1054.1     238  1053.2     243  1052.2     253  1052.9     259  1053.2     300

X1  2200      15     156     236     100     100     100
X3                           142
GR1051.2     100  1052.1     128  1055.4     142  1055.3     156  1051.1     173
GR1048.2     190  1047.6     200  1048.2     210  1051.9     233  1053.1     236
GR1053.1     246  1052.0     251  1052.9     256  1052.8     280  1052.9     300

X1  2100      14     149     230     100     100     100
X3                           137
GR1051.0     100  1051.7     126  1055.1     137  1055.3     149  1050.7     169
GR1047.4     189  1046.8     200  1047.7     210  1052.4     230  1052.8     235
GR1051.9     242  1052.6     250  1052.8     280  1053.0     300

X1  2000      11     151     227     100     100     100
X3                           138
GR1049.5     100  1050.4     124  1055.4     138  1055.3     151  1046.5     191
GR1046.0     200  1047.0     211  1050.5     227  1050.7     245  1052.4     260
GR1052.9     300

X1  1900      11     161     237     100     100     100
X3                           145
GR1049.7     100  1050.2     133  1052.8     145  1052.6     161  1045.9     190
GR1045.6     200  1046.7     215  1051.7     237  1051.0     259  1052.0     260
GR1052.9     300

X1  1800      14     170     228      52      52      52
X3                           134
GR1049.2     100  1049.2     132  1050.1     134  1049.7     170  1046.5     180
GR1045.4     188  1044.8     200  1045.0     209  1046.2     218  1050.4     228
GR1050.5     248  1050.8     260  1049.8     277  1051.0     305

X1  1748      11     204     260       0       0       0
X3                           165
GR1047.8     115  1048.4     130  1049.0     165  1048.2     204  1045.0     219
GR1044.5     230  1045.3     248  1049.4     260  1050.0     285  1049.1     312
GR1049.9     330

EJ
ER
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OUTPUT - SUPERCRITICAL

EXISTING

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*****************************************
*  HEC-2 WATER SURFACE PROFILES         *
*                                       *
*  Version   4.6.2;  May 1991           *
*                                       *
*  RUN DATE    28JUL93    TIME   11:07:29 *
*****************************************
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*************************************
*  U.S. ARMY CORPS OF ENGINEERS     *
*  HYDROLOGIC ENGINEERING CENTER    *
*  609 SECOND STREET, SUITE D       *
*  DAVIS, CALIFORNIA 95616-4687     *
*          (916) 756-1104           *
*************************************
```

```
X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X            X     X
X     X  X        X                        X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX   XXXXX             XXXXXXX
```

THIS RUN EXECUTED 28JUL93 11:07:29

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************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
************************************

T1 WHITE TANKS #4 FLOOD RETENTION INLET CHANNEL
T2 DESIGN CONCEPT REPORT                7/28/93
T3      EXIST CHANNEL, SUPERCRITICAL FLOW  (Q100= 2200 CFS)
T4      STA 115+50 TO STA 17+48

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

     -10                           1        -1                   .3      2206

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

     -1                                                          -1

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

    100                   105                   150
```

THIS RUN EXECUTED 28JUL93 11:08:07

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*************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
*************************************
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

EXIST CHANNEL, SUPERCRIT

SUMMARY PRINTOUT TABLE 100

	SECNO	EGLWC	ELLC	EGPRS	ELTRD	QPR	QWEIR	CLASS	H3	DEPTH	CWSEL	VCH	EG
*	5235.000	1078.04	1077.40	1078.74	1080.00	2206.00	.00	10.00	.00	6.11	1078.11	7.07	1078.89
	4660.000	1071.21	1070.30	1069.67	1073.00	2206.00	.00	3.00	.00	2.73	1067.73	14.97	1071.21
*	4197.000	1068.37	1066.70	1069.04	1069.00	2199.07	.54	30.00	.00	5.73	1068.23	7.13	1069.02

EXIST CHANNEL, SUPERCRIT

SUMMARY PRINTOUT TABLE 105

	SECNO	CWSEL	HL	OLOSS	TOPWID	QLOB	QCH	QROB
*	5350.000	1077.29	.16	.18	84.33	.00	2206.00	.00
*	5323.000	1076.15	.19	.22	50.99	.00	2206.00	.00
*	5235.000	1078.11	.00	.00	51.00	.00	2206.00	.00
*	5200.000	1075.25	.06	.65	67.48	.00	2206.00	.00
*	4733.000	1067.73	.04	.72	54.00	.00	2206.00	.00
	4712.000	1067.74	.22	.23	53.99	.00	2206.00	.00
	4660.000	1067.73	.87	.00	53.99	.00	2206.00	.00
*	4645.000	1069.02	.07	.10	70.89	.00	2206.00	.00
*	4300.000	1066.93	.03	.08	54.62	.00	2206.00	.00
*	4248.000	1066.02	.06	.10	53.99	.00	2206.00	.00
*	4197.000	1068.23	.64	.00	91.49	.67	2205.33	.00
*	4186.000	1064.79	.02	.79	62.00	.00	2206.00	.00

EXIST CHANNEL, SUPERCRIT

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	11550.000	.00	.00	.00	1127.00	2206.00	1133.88	1133.88	1135.26	44.54	9.72	279.61	330.55
*	11500.000	50.00	.00	.00	1126.60	2206.00	1133.13	1133.59	1134.98	48.74	11.18	242.59	315.98
*	11400.000	100.00	.00	.00	1125.90	2206.00	1131.58	1132.74	1134.26	76.48	13.18	174.89	252.25
	11300.000	100.00	.00	.00	1125.10	2206.00	1130.45	1131.78	1133.38	94.48	13.74	161.72	226.96
*	11200.000	100.00	.00	.00	1124.40	2206.00	1129.99	1130.93	1132.31	76.62	12.35	200.65	252.02
	11100.000	100.00	.00	.00	1123.70	2206.00	1129.27	1130.14	1131.56	72.56	12.36	215.60	258.97
	11000.000	100.00	.00	.00	1122.90	2206.00	1128.51	1129.42	1130.84	70.73	12.54	215.31	262.30
	10900.000	100.00	.00	.00	1122.20	2206.00	1127.71	1128.73	1130.11	73.37	12.81	205.43	257.54
	10800.000	100.00	.00	.00	1121.40	2206.00	1126.89	1128.02	1129.33	82.58	12.73	193.39	242.75
*	10700.000	100.00	.00	.00	1120.70	2206.00	1126.71	1127.43	1128.50	66.37	10.98	222.32	270.78
*	10600.000	100.00	.00	.00	1119.90	2206.00	1125.49	1126.43	1127.69	86.45	12.06	196.24	237.26
	10500.000	100.00	.00	.00	1119.10	2206.00	1124.40	1125.42	1126.77	93.27	12.45	187.98	228.42
	10400.000	100.00	.00	.00	1118.30	2206.00	1123.46	1124.46	1125.84	92.28	12.47	192.95	229.65
	10300.000	100.00	.00	.00	1117.50	2206.00	1122.37	1123.42	1124.88	98.96	12.78	187.71	221.76
	10200.000	100.00	.00	.00	1116.70	2206.00	1121.41	1122.43	1123.87	98.97	12.77	194.50	221.74
*	10100.000	100.00	.00	.00	1115.90	2206.00	1120.88	1121.67	1122.93	76.58	11.77	221.12	252.09
	10000.000	100.00	.00	.00	1115.10	2206.00	1120.12	1120.82	1122.17	75.00	11.81	232.49	254.73
	9900.000	100.00	.00	.00	1114.30	2206.00	1119.23	1119.95	1121.39	80.16	12.09	227.10	246.39
	9800.000	100.00	.00	.00	1113.50	2206.00	1118.44	1119.16	1120.59	79.71	12.17	231.32	247.09
	9700.000	100.00	.00	.00	1112.70	2206.00	1117.40	1118.18	1119.64	112.47	12.53	212.01	208.02
*	9600.000	100.00	.00	.00	1111.80	2206.00	1117.02	1117.53	1118.67	71.60	10.89	262.63	260.71
	9500.000	100.00	.00	.00	1110.90	2206.00	1116.29	1116.93	1118.00	60.68	11.05	272.17	283.19
*	9400.000	100.00	.00	.00	1109.90	2206.00	1115.27	1115.99	1117.35	67.42	12.01	247.50	268.67
	9300.000	100.00	.00	.00	1109.00	2206.00	1114.22	1115.05	1116.58	83.51	12.60	221.16	241.40

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	9200.000	100.00	.00	.00	1108.10	2206.00	1113.02	1114.01	1115.65	98.59	13.31	207.06	222.17
	9100.000	100.00	.00	.00	1107.20	2206.00	1112.19	1113.04	1114.63	94.03	13.04	232.78	227.49
	9000.000	100.00	.00	.00	1106.30	2206.00	1111.23	1112.02	1113.68	95.46	13.38	248.36	225.79
	8900.000	100.00	.00	.00	1105.30	2206.00	1110.25	1111.02	1112.70	99.23	13.70	255.50	221.46
	8800.000	100.00	.00	.00	1104.40	2206.00	1109.36	1110.10	1111.70	94.60	13.86	272.12	226.81
	8700.000	100.00	.00	.00	1103.40	2206.00	1108.38	1109.09	1110.67	109.07	13.34	260.74	211.23
*	8600.000	100.00	.00	.00	1102.50	2206.00	1107.83	1108.43	1109.67	78.20	11.89	282.11	249.47
	8500.000	100.00	.00	.00	1101.70	2206.00	1107.07	1107.69	1108.91	73.54	11.62	260.99	257.24
	8400.000	100.00	.00	.00	1100.80	2206.00	1106.12	1106.79	1108.13	80.80	11.87	231.88	245.42
	8300.000	100.00	.00	.00	1100.00	2206.00	1105.24	1105.91	1107.30	83.88	11.86	219.39	240.86
	8200.000	100.00	.00	.00	1099.10	2206.00	1104.37	1105.04	1106.45	85.18	11.83	210.13	239.02
	8100.000	100.00	.00	.00	1098.20	2206.00	1103.32	1104.05	1105.55	91.50	12.30	211.66	230.61
	8000.000	100.00	.00	.00	1097.30	2206.00	1102.28	1103.05	1104.61	94.11	12.67	215.32	227.40
	7900.000	100.00	.00	.00	1096.50	2206.00	1101.24	1102.04	1103.65	98.08	13.03	224.26	222.75
	7800.000	100.00	.00	.00	1095.60	2206.00	1100.17	1101.01	1102.64	102.57	13.40	229.97	217.82
	7700.000	100.00	.00	.00	1094.70	2206.00	1099.13	1099.95	1101.58	107.62	13.69	240.89	212.65
*	7600.000	100.00	.00	.00	1093.80	2206.00	1098.45	1099.06	1100.42	101.10	11.81	241.40	219.39
*	7500.000	100.00	.00	.00	1092.90	2206.00	1097.89	1098.35	1099.52	69.93	10.65	261.07	263.80
	7400.000	100.00	.00	.00	1092.00	2206.00	1096.97	1097.50	1098.77	76.70	10.98	233.37	251.89
	7300.000	100.00	.00	.00	1091.10	2206.00	1096.06	1096.56	1097.98	79.65	11.20	210.77	247.17
	7200.000	100.00	.00	.00	1090.10	2206.00	1095.13	1095.65	1097.15	84.36	11.45	198.17	240.19
	7100.000	100.00	.00	.00	1089.10	2206.00	1094.33	1094.85	1096.31	80.97	11.34	207.25	245.16
*	7000.000	100.00	.00	.00	1088.10	2206.00	1094.02	1094.27	1095.62	43.82	10.83	275.83	333.25
*	6900.000	100.00	.00	.00	1087.10	2206.00	1092.89	1093.56	1095.03	62.96	12.36	236.38	278.01
	6800.000	100.00	.00	.00	1086.00	2206.00	1091.91	1092.75	1094.32	74.49	12.94	218.63	255.59
	6700.000	100.00	.00	.00	1085.00	2206.00	1091.10	1092.07	1093.54	80.19	13.05	217.19	246.34

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	6600.000	100.00	.00	.00	1084.10	2206.00	1090.14	1091.21	1092.71	82.46	13.34	211.85	242.93
	6500.000	100.00	.00	.00	1083.20	2206.00	1089.09	1090.24	1091.84	88.03	13.72	201.47	235.12
	6400.000	100.00	.00	.00	1082.30	2206.00	1088.18	1089.27	1090.96	88.43	13.83	204.00	234.59
	6300.000	100.00	.00	.00	1081.40	2206.00	1087.14	1088.34	1090.04	93.28	14.11	196.36	228.41
	6200.000	100.00	.00	.00	1080.50	2206.00	1086.14	1087.34	1089.10	93.33	14.23	193.75	228.34
	6100.000	100.00	.00	.00	1079.70	2206.00	1085.19	1086.40	1088.16	94.73	14.13	188.15	226.66
	6000.000	100.00	.00	.00	1078.80	2206.00	1084.27	1085.35	1087.19	96.12	14.09	197.29	225.01
	5900.000	100.00	.00	.00	1078.00	2206.00	1083.19	1084.24	1086.20	99.88	14.23	193.36	220.73
	5800.000	100.00	.00	.00	1077.10	2206.00	1082.23	1083.21	1085.17	101.64	14.19	207.43	218.81
	5700.000	100.00	.00	.00	1076.30	2206.00	1081.17	1082.15	1084.12	106.90	14.23	207.13	213.36
*	5600.000	100.00	.00	.00	1075.40	2206.00	1079.60	1080.83	1082.90	132.87	14.59	155.03	191.38
	5500.000	100.00	.00	.00	1074.60	2206.00	1078.18	1079.51	1081.47	152.76	14.56	151.49	178.48
*	5400.000	100.00	.00	.00	1073.70	2206.00	1077.21	1078.01	1079.87	131.15	13.11	168.30	192.63
*	5350.000	50.00	.00	.00	1073.50	2206.00	1077.29	1077.78	1079.30	124.14	11.36	194.15	197.99
*	5323.000	27.00	.00	.00	1072.90	2206.00	1076.15	1076.77	1078.89	43.71	13.28	166.07	333.68
*	5235.000	88.00	1080.00	1077.40	1072.00	2206.00	1078.11	999999.00	1078.89	6.05	7.07	312.12	896.53
*	5200.000	35.00	.00	.00	1072.00	2206.00	1075.25	1076.13	1078.18	174.83	13.74	160.57	166.84
*	5145.000	55.00	.00	.00	1070.80	2206.00	1074.98	1075.74	1077.23	100.73	12.13	195.47	219.80
*	5100.000	45.00	.00	.00	1070.30	2206.00	1075.28	1075.43	1076.78	49.13	10.08	259.21	314.74
*	5000.000	100.00	.00	.00	1069.60	2206.00	1073.83	1074.20	1075.77	81.21	11.20	201.15	244.80
	4900.000	100.00	.00	.00	1068.90	2206.00	1072.72	1073.22	1074.87	96.64	11.76	187.53	224.41
	4800.000	100.00	.00	.00	1068.20	2206.00	1071.85	1072.21	1073.91	89.59	11.50	191.83	233.06
	4750.000	50.00	.00	.00	1067.60	2206.00	1071.26	1071.66	1073.43	97.36	11.82	186.69	223.57
*	4739.000	11.00	.00	.00	1067.90	2206.00	1070.88	1071.47	1073.29	42.72	12.45	177.18	337.52
*	4733.000	6.00	.00	.00	1065.40	2206.00	1067.73	1069.20	1072.53	114.42	17.59	125.40	206.23
	4712.000	21.00	.00	.00	1065.30	2206.00	1067.74	1069.02	1072.08	97.04	16.72	131.97	223.93

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	4660.000	52.00	1073.00	1070.30	1065.00	2206.00	1067.73	999999.00	1071.21	68.11	14.97	147.32	267.30
*	4645.000	15.00	.00	.00	1065.50	2206.00	1069.02	1069.45	1071.09	37.49	11.56	190.88	360.30
	4600.000	45.00	.00	.00	1064.70	2206.00	1068.52	1068.91	1070.90	31.87	12.39	177.99	390.77
*	4550.000	50.00	.00	.00	1064.50	2206.00	1068.88	1068.88	1070.86	22.71	11.31	195.09	462.90
*	4500.000	50.00	.00	.00	1064.20	2206.00	1068.18	1068.60	1070.67	32.30	12.66	174.23	388.15
	4450.000	50.00	.00	.00	1064.00	2206.00	1067.80	1068.38	1070.48	36.98	13.14	167.87	362.77
*	4400.000	50.00	.00	.00	1063.60	2206.00	1067.86	1068.23	1070.26	30.73	12.45	177.15	397.92
*	4350.000	50.00	.00	.00	1063.40	2206.00	1067.16	1067.85	1070.04	40.15	13.62	161.94	348.15
*	4300.000	50.00	.00	.00	1063.10	2206.00	1066.93	1067.29	1069.18	30.97	12.04	183.18	396.37
*	4248.000	52.00	.00	.00	1062.70	2206.00	1066.02	1066.43	1068.38	36.66	12.34	178.79	364.34
*	4197.000	51.00	1069.00	1066.70	1062.50	2206.00	1068.23	.00	1069.02	6.52	7.13	312.28	863.91
*	4186.000	11.00	.00	.00	1062.40	2206.00	1064.79	1065.78	1068.21	77.30	14.85	148.59	250.91
*	4150.000	36.00	.00	.00	1061.70	2206.00	1065.17	1065.61	1067.23	105.78	11.52	191.45	214.49
*	4145.000	5.00	.00	.00	1062.00	2206.00	1065.88	1065.88	1067.39	65.22	9.86	223.73	273.17
	4100.000	45.00	.00	.00	1061.70	2206.00	1064.93	1065.35	1066.97	103.82	11.46	192.42	216.50
*	4000.000	100.00	.00	.00	1060.90	2206.00	1064.54	1064.65	1066.15	70.85	10.19	217.58	262.07
*	3900.000	100.00	.00	.00	1060.10	2206.00	1063.98	1063.98	1065.51	63.83	9.92	224.58	276.11
	3800.000	100.00	.00	.00	1059.30	2206.00	1063.03	1063.28	1064.78	78.83	10.63	210.86	248.46
	3700.000	100.00	.00	.00	1058.50	2206.00	1062.44	1062.65	1064.01	64.85	10.10	227.07	273.95
	3645.000	55.00	.00	.00	1058.10	2206.00	1062.04	1062.30	1063.64	66.97	10.24	229.52	269.56
	3600.000	45.00	.00	.00	1057.70	2206.00	1061.59	1061.92	1063.31	74.84	10.60	216.33	255.00
	3500.000	100.00	.00	.00	1056.90	2206.00	1060.99	1061.15	1062.57	65.98	10.14	228.12	271.58
	3400.000	100.00	.00	.00	1056.10	2206.00	1060.17	1060.44	1061.86	73.28	10.49	218.88	257.70
	3300.000	100.00	.00	.00	1055.30	2206.00	1059.69	1060.15	1061.13	58.29	9.75	247.40	288.93
	3200.000	100.00	.00	.00	1054.50	2206.00	1058.77	1059.40	1060.46	73.58	10.50	226.97	257.18
*	3145.000	55.00	.00	.00	1054.70	2206.00	1059.17	1059.17	1060.05	32.15	8.10	402.23	389.06

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	3001.000	45.00	.00	.00	1054.70	2206.00	1059.18	1059.18	1060.05	31.71	8.05	405.25	391.73
*	3000.000	1.00	.00	.00	1053.50	2206.00	1056.56	1057.72	1059.80	188.62	14.45	152.64	160.62
*	2900.000	100.00	.00	.00	1052.70	2206.00	1057.18	1057.18	1058.37	46.74	9.20	295.23	322.67
*	2800.000	100.00	.00	.00	1051.90	2206.00	1056.09	1056.40	1057.53	70.80	10.23	276.96	262.18
*	2700.000	100.00	.00	.00	1050.80	2206.00	1055.69	1055.74	1056.88	47.50	9.15	299.10	320.08
*	2600.000	100.00	.00	.00	1050.30	2206.00	1054.28	1054.81	1056.14	103.65	10.94	201.65	216.68
*	2500.000	100.00	.00	.00	1049.80	2206.00	1054.42	1054.42	1055.64	57.21	8.98	262.43	291.66
*	2400.000	100.00	.00	.00	1049.10	2206.00	1054.00	1054.00	1055.24	50.11	9.07	271.31	311.63
*	2300.000	100.00	.00	.00	1048.10	2206.00	1053.83	1053.83	1055.04	47.88	9.08	281.29	318.79
	2200.000	100.00	.00	.00	1047.60	2206.00	1052.49	1052.82	1054.37	80.66	10.99	201.88	245.63
*	2100.000	100.00	.00	.00	1046.80	2206.00	1052.19	1052.19	1053.81	62.74	10.21	216.77	278.51
	2000.000	100.00	.00	.00	1046.00	2206.00	1051.57	1051.66	1053.20	58.49	10.38	228.06	288.43
	1900.000	100.00	.00	.00	1045.60	2206.00	1050.69	1050.84	1052.53	72.63	10.88	202.74	258.85
	1800.000	100.00	.00	.00	1044.80	2206.00	1049.49	1049.90	1051.71	83.71	11.97	184.37	241.11
	1748.000	52.00	.00	.00	1044.50	2206.00	1049.05	1049.72	1051.27	86.69	12.05	197.95	236.93

EXIST CHANNEL, SUPERCRIT

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	11550.000	2206.00	1133.88	.00	.00	.00	136.80	.00
*	11500.000	2206.00	1133.13	.00	-.17	.00	139.07	50.00
*	11400.000	2206.00	1131.58	.00	-.45	.00	66.58	100.00
	11300.000	2206.00	1130.45	.00	-1.12	.00	56.73	100.00
*	11200.000	2206.00	1129.99	.00	-.17	.00	115.51	100.00
	11100.000	2206.00	1129.27	.00	-.72	.00	149.51	100.00
	11000.000	2206.00	1128.51	.00	-.76	.00	143.96	100.00
	10900.000	2206.00	1127.71	.00	-.80	.00	95.61	100.00
	10800.000	2206.00	1126.89	.00	-.82	.00	78.95	100.00
*	10700.000	2206.00	1126.71	.00	-.13	.00	109.47	100.00
*	10600.000	2206.00	1125.49	.00	-.54	.00	82.73	100.00
	10500.000	2206.00	1124.40	.00	-1.09	.00	93.86	100.00
	10400.000	2206.00	1123.46	.00	-.94	.00	123.35	100.00
	10300.000	2206.00	1122.37	.00	-1.08	.00	116.45	100.00
	10200.000	2206.00	1121.41	.00	-.96	.00	107.83	100.00
*	10100.000	2206.00	1120.88	.00	-.38	.00	143.02	100.00
	10000.000	2206.00	1120.12	.00	-.75	.00	189.09	100.00
	9900.000	2206.00	1119.23	.00	-.89	.00	170.75	100.00
	9800.000	2206.00	1118.44	.00	-.79	.00	153.90	100.00
	9700.000	2206.00	1117.40	.00	-1.04	.00	135.16	100.00
*	9600.000	2206.00	1117.02	.00	-.32	.00	201.33	100.00
	9500.000	2206.00	1116.29	.00	-.73	.00	201.71	100.00
*	9400.000	2206.00	1115.27	.00	-.58	.00	213.29	100.00
	9300.000	2206.00	1114.22	.00	-1.04	.00	188.40	100.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	9200.000	2206.00	1113.02	.00	-1.20	.00	175.42	100.00
	9100.000	2206.00	1112.19	.00	-.83	.00	226.58	100.00
	9000.000	2206.00	1111.23	.00	-.96	.00	244.88	100.00
	8900.000	2206.00	1110.25	.00	-.98	.00	247.78	100.00
	8800.000	2206.00	1109.36	.00	-.89	.00	253.04	100.00
	8700.000	2206.00	1108.38	.00	-.98	.00	248.83	100.00
*	8600.000	2206.00	1107.83	.00	-.51	.00	237.04	100.00
	8500.000	2206.00	1107.07	.00	-.76	.00	213.94	100.00
	8400.000	2206.00	1106.12	.00	-.95	.00	151.09	100.00
	8300.000	2206.00	1105.24	.00	-.88	.00	133.01	100.00
	8200.000	2206.00	1104.37	.00	-.87	.00	125.82	100.00
	8100.000	2206.00	1103.32	.00	-1.05	.00	136.03	100.00
	8000.000	2206.00	1102.28	.00	-1.05	.00	146.29	100.00
	7900.000	2206.00	1101.24	.00	-1.03	.00	154.62	100.00
	7800.000	2206.00	1100.17	.00	-1.08	.00	162.47	100.00
	7700.000	2206.00	1099.13	.00	-1.04	.00	176.31	100.00
*	7600.000	2206.00	1098.45	.00	-.63	.00	167.44	100.00
*	7500.000	2206.00	1097.89	.00	-.79	.00	164.59	100.00
	7400.000	2206.00	1096.97	.00	-.92	.00	145.37	100.00
	7300.000	2206.00	1096.06	.00	-.91	.00	118.53	100.00
	7200.000	2206.00	1095.13	.00	-.93	.00	87.28	100.00
	7100.000	2206.00	1094.33	.00	-.79	.00	108.76	100.00
*	7000.000	2206.00	1094.02	.00	.20	.00	147.53	100.00
*	6900.000	2206.00	1092.89	.00	-.56	.00	119.81	100.00
	6800.000	2206.00	1091.91	.00	-.98	.00	119.24	100.00
	6700.000	2206.00	1091.10	.00	-.81	.00	133.29	100.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	6600.000	2206.00	1090.14	.00	-.96	.00	134.75	100.00
	6500.000	2206.00	1089.09	.00	-1.05	.00	121.11	100.00
	6400.000	2206.00	1088.18	.00	-.91	.00	129.82	100.00
	6300.000	2206.00	1087.14	.00	-1.05	.00	123.49	100.00
	6200.000	2206.00	1086.14	.00	-1.00	.00	123.09	100.00
	6100.000	2206.00	1085.19	.00	-.95	.00	139.07	100.00
	6000.000	2206.00	1084.27	.00	-.91	.00	174.20	100.00
	5900.000	2206.00	1083.19	.00	-1.08	.00	185.22	100.00
	5800.000	2206.00	1082.23	.00	-.96	.00	206.03	100.00
	5700.000	2206.00	1081.17	.00	-1.06	.00	208.50	100.00
*	5600.000	2206.00	1079.60	.00	-.77	.00	85.29	100.00
	5500.000	2206.00	1078.18	.00	-1.42	.00	52.70	100.00
*	5400.000	2206.00	1077.21	.00	-.33	.00	61.37	100.00
*	5350.000	2206.00	1077.29	.00	-.05	.00	84.33	50.00
*	5323.000	2206.00	1076.15	.00	-1.14	.00	50.99	27.00
*	5235.000	2206.00	1078.11	.00	1.96	.00	51.00	88.00
*	5200.000	2206.00	1075.25	.00	-2.86	.00	67.48	35.00
*	5145.000	2206.00	1074.98	.00	-.10	.00	94.95	55.00
*	5100.000	2206.00	1075.28	.00	.30	.00	125.97	45.00
*	5000.000	2206.00	1073.83	.00	-.22	.00	84.10	100.00
	4900.000	2206.00	1072.72	.00	-1.11	.00	65.15	100.00
	4800.000	2206.00	1071.85	.00	-.86	.00	64.32	100.00
	4750.000	2206.00	1071.26	.00	-.59	.00	63.67	50.00
*	4739.000	2206.00	1070.88	.00	-.38	.00	64.93	11.00
*	4733.000	2206.00	1067.73	.00	-3.16	.00	54.00	6.00
	4712.000	2206.00	1067.74	.00	.01	.00	53.99	21.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	4660.000	2206.00	1067.73	.00	-.01	.00	53.99	52.00
*	4645.000	2206.00	1069.02	.00	1.29	.00	70.89	15.00
	4600.000	2206.00	1068.52	.00	-.50	.00	51.16	45.00
*	4550.000	2206.00	1068.88	.00	-.01	.00	49.11	50.00
*	4500.000	2206.00	1068.18	.00	-.29	.00	48.41	50.00
	4450.000	2206.00	1067.80	.00	-.38	.00	49.47	50.00
*	4400.000	2206.00	1067.86	.00	.05	.00	49.12	50.00
*	4350.000	2206.00	1067.16	.00	-.30	.00	48.17	50.00
*	4300.000	2206.00	1066.93	.00	-.37	.00	54.62	50.00
*	4248.000	2206.00	1066.02	.00	-.49	.00	53.99	52.00
*	4197.000	2206.00	1068.23	.00	2.21	.00	91.49	51.00
*	4186.000	2206.00	1064.79	.00	-3.44	.00	62.00	11.00
*	4150.000	2206.00	1065.17	.00	.38	.00	72.80	36.00
*	4145.000	2206.00	1065.88	.00	.71	.00	74.79	5.00
	4100.000	2206.00	1064.93	.00	-.95	.00	73.01	45.00
*	4000.000	2206.00	1064.54	.00	-.48	.00	78.18	100.00
*	3900.000	2206.00	1063.98	.00	-.56	.00	80.41	100.00
	3800.000	2206.00	1063.03	.00	-.95	.00	80.39	100.00
	3700.000	2206.00	1062.44	.00	-.59	.00	102.04	100.00
	3645.000	2206.00	1062.04	.00	-.40	.00	126.91	55.00
	3600.000	2206.00	1061.59	.00	-.45	.00	109.51	45.00
	3500.000	2206.00	1060.99	.00	-.60	.00	105.53	100.00
	3400.000	2206.00	1060.17	.00	-.82	.00	100.67	100.00
	3300.000	2206.00	1059.69	.00	-.48	.00	148.95	100.00
	3200.000	2206.00	1058.77	.00	-.92	.00	142.56	100.00
*	3145.000	2206.00	1059.17	.00	.21	.00	291.09	55.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	3001.000	2206.00	1059.18	.00	.01	.00	291.30	45.00
*	3000.000	2206.00	1056.56	.00	-2.62	.00	64.12	1.00
*	2900.000	2206.00	1057.18	.00	.03	.00	136.61	100.00
*	2800.000	2206.00	1056.09	.00	-.20	.00	158.03	100.00
*	2700.000	2206.00	1055.69	.00	-.40	.00	158.54	100.00
*	2600.000	2206.00	1054.28	.00	-1.42	.00	82.41	100.00
*	2500.000	2206.00	1054.42	.00	.14	.00	117.24	100.00
*	2400.000	2206.00	1054.00	.00	-.41	.00	134.84	100.00
*	2300.000	2206.00	1053.83	.00	-.17	.00	129.02	100.00
	2200.000	2206.00	1052.49	.00	-1.34	.00	72.08	100.00
*	2100.000	2206.00	1052.19	.00	-.30	.00	72.17	100.00
	2000.000	2206.00	1051.57	.00	-.62	.00	84.73	100.00
	1900.000	2206.00	1050.69	.00	-.87	.00	63.37	100.00
	1800.000	2206.00	1049.49	.00	-1.20	.00	55.20	100.00
	1748.000	2206.00	1049.05	.00	-.44	.00	94.01	52.00

SUMMARY OF ERRORS AND SPECIAL NOTES

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CAUTION SECNO=  11550.000  PROFILE=  1  CRITICAL DEPTH ASSUMED

CAUTION SECNO=  11500.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=  11400.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=  11200.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=  10700.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=  10600.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=  10100.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=   9600.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=   9400.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=   8600.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=   7600.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=   7500.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=   7000.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=   6900.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=   5600.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=   5400.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=   5350.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

WARNING SECNO=   5323.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=   5235.000  PROFILE=  1  BRIDGE DROWNS U.S. PROFILE
                                         NEW BACKWATER REQUIRED
WARNING SECNO=   5235.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=   5200.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=   5145.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=   5100.000  PROFILE=  1  WSEL ASSUMED BASED ON MIN DIFF
CAUTION SECNO=   5100.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=   5000.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

WARNING SECNO=   4739.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=   4733.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
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CAUTION SECNO=   4645.000  PROFILE=  1  WSEL ASSUMED BASED ON MIN DIFF
CAUTION SECNO=   4645.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=   4550.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=   4500.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=   4400.000  PROFILE=  1  WSEL ASSUMED BASED ON MIN DIFF
CAUTION SECNO=   4400.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=   4350.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=   4300.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=   4248.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=   4197.000  PROFILE=  1  BRIDGE DROWNS U.S. PROFILE
                                        NEW BACKWATER REQUIRED
WARNING SECNO=   4197.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=   4186.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=   4150.000  PROFILE=  1  WSEL ASSUMED BASED ON MIN DIFF
CAUTION SECNO=   4150.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=   4145.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   4145.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   4145.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=   4000.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=   3900.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   3900.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   3900.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=   3145.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=   3001.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   3001.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   3001.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO=   3000.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=   2900.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=   2800.000  PROFILE=  1  INTERPOLATED X-SECTIONS USED

CAUTION SECNO=   2700.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

WARNING SECNO=   2600.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=   2500.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   2500.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   2500.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
```

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CAUTION SECNO=   2400.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   2400.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   2400.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=   2300.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   2300.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   2300.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=   2100.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   2100.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   2100.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
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APPENDIX VII

"PROPOSED CHANNEL" HEC-2 INPUT AND OUTPUT

INPUT - SUBCRITICAL

PROPOSED

```
T1 WHITE TANKS #4 FLOOD RETENTION INLET CHANNEL
T2 DESIGN CONCEPT REPORT                    7/28/93
T3      CHANNEL IMPROVE, SUBCRITICAL FLOW  (Q100 = 2206CFS)
T4      STATION 17+48 TO 115+50

J1   -10                                                .3    2206 1048.65
J2    -1                                                -1       7
J3   100             105             120             150

NC   .04     .04    .025      .1      .3

* Counterweir (Upstream flow depth = 4.6')
* Begin New Channel Transition
X1  1634       6     120     235       0       0       0
CI   190 1044.21    .035       4       4     .01     -90
X3                             0
GR1050.0     110  1050.0     120  1046.0     164  1048.0     190  1050.0     235
GR1049.0     350

X1  1748      11     204     260     114     114     114
CI    -1 .002007                                     -70
X3                           165
GR1047.8     115  1048.4     130  1049.0     165  1048.2     204  1045.0     219
GR1044.5     230  1045.3     248  1049.4     260  1050.0     285  1049.1     312
GR1049.9     330

X1  1800      14     170     228      52      52      52
CI                                                    -61
X3                           134
GR1049.2     100  1049.2     132  1050.1     134  1049.7     170  1046.5     180
GR1045.4     188  1044.8     200  1045.0     209  1046.2     218  1050.4     228
GR1050.5     248  1050.8     260  1049.8     277  1051.0     305

X1  1900      11     161     237     100     100     100
CI                                                    -44
X3                           145
GR1049.7     100  1050.2     133  1052.8     145  1052.6     161  1045.9     190
GR1045.6     200  1046.7     215  1051.7     237  1051.0     259  1052.0     260
GR1052.9     300

* End New Channel Transition @ 19+45
X1  1945                                 45      45      45              .2
CI                                                    -36

X1  2000      11     151     227      55      55      55
CI                  .02
X3                           138
GR1049.5     100  1050.4     124  1055.4     138  1055.3     151  1046.5     191
GR1046.0     200  1047.0     211  1050.5     227  1050.7     245  1052.4     260
GR1052.9     300
```

```
X1  2100      14     149     230     100     100     100
X3                           137
GR1051.0     100  1051.7     126  1055.1     137  1055.3     149  1050.7     169
GR1047.4     189  1046.8     200  1047.7     210  1052.4     230  1052.8     235
GR1051.9     242  1052.6     250  1052.8     280  1053.0     300

X1  2200      15     156     236     100     100     100
X3                           142
GR1051.2     100  1052.1     128  1055.4     142  1055.3     156  1051.1     173
GR1048.2     190  1047.6     200  1048.2     210  1051.9     233  1053.1     236
GR1053.1     246  1052.0     251  1052.9     256  1052.8     280  1052.9     300

X1  2300      15     160     238     100     100     100
X3                           146
GR1051.0     100  1051.9     132  1056.0     146  1055.7     160  1053.2     171
GR1048.8     189  1048.3     200  1048.1     207  1051.8     222  1051.3     225
GR1054.1     238  1053.2     243  1052.2     253  1052.9     259  1053.2     300

X1  2400      14     161     242     100     100     100
X3                           141
GR1051.4     100  1051.9     123  1056.9     141  1056.8     161  1052.5     172
GR1049.6     187  1049.1     200  1049.6     211  1052.0     231  1053.6     242
GR1053.8     250  1053.1     262  1053.4     271  1053.4     303

X1  2500      16     187     288     100     100     100
X3                           139
GR1051.6     114  1058.8     139  1058.4     155  1057.9     157  1055.5     187
GR1051.8     206  1050.2     216  1049.8     228  1050.1     239  1051.2     249
GR1051.4     253  1055.8     288  1055.7     292  1053.7     297  1053.7     313
GR1053.8     328

X1  2600      17     194     301     100     100     100
X3                           149
GR1052.6     120  1058.9     149  1059.0     159  1058.7     160  1058.1     194
GR1053.8     201  1052.4     210  1050.7     227  1050.3     240  1051.0     255
GR1053.1     270  1054.5     285  1056.1     301  1056.2     311  1054.7     314
GR1054.5     335  1054.5     360

X1  2700      18     159     225     100     100     100
GR1054.2      97  1053.5     110  1053.9     111  1054.4     117  1057.4     135
GR1056.5     159  1053.9     165  1051.5     180  1050.8     193  1051.1     205
GR1051.4     209  1054.5     220  1055.1     225  1056.4     267  1056.5     274
GR1054.8     278  1055.0     286  1054.9     323

X1  2800      18     108     172     100     100     100
GR1055.4      70  1055.0      83  1055.8      85  1056.6      93  1056.3     108
GR1055.7     111  1052.3     123  1051.9     139  1052.4     157  1054.7     164
GR1055.4     172  1056.0     176  1055.7     182  1054.2     192  1055.2     219
GR1055.7     229  1055.2     232  1055.2     249

X1  2900      15      80     148     100     100     100
```

```
GR1056.3      54  1055.7      70  1055.7      80  1053.6      88  1052.8      97
GR1052.7     108  1052.9     125  1053.9     128  1056.1     139  1058.7     148
GR1058.0     150  1056.7     166  1055.9     175  1056.1     193  1056.3     208

* Drop Structure
X1  2901                              1       1       1
CI       1049.75

X1  3000      12      65     132     100     100     100
CI          .0028
GR1057.0      48  1056.6      65  1053.8      75  1053.5      95  1053.8     114
GR1054.8     122  1056.0     128  1057.8     132  1058.5     139  1057.1     157
GR1057.0     180  1057.0     195

X1  3145      17     132     193     145     145     145
CI   244
GR1058.1     100  1058.1     118  1057.2     132  1056.1     136  1055.2     148
GR1054.7     164  1055.1     180  1056.3     193  1057.7     193  1057.7     197
GR1058.9     203  1059.6     210  1058.1     226  1058.1     250  1058.7     300
GR1058.7     350  1058.7     400

X1  3200      16     132     203      55      55      55
GR1058.5     100  1058.5     118  1057.6     132  1056.6     135  1055.6     145
GR1054.5     164  1055.6     181  1056.6     193  1057.7     197  1059.2     203
GR1059.9     212  1058.6     228  1058.6     250  1059.1     300  1059.1     350
GR1059.1     400

X1  3300      16     132     202     100     100     100
GR1059.3     100  1059.3     118  1058.3     132  1057.5     134  1056.3     144
GR1055.3     163  1056.4     183  1057.2     192  1058.6     198  1059.8     202
GR1060.3     215  1059.5     231  1059.5     250  1059.9     300  1059.9     350
GR1059.9     400

X1  3400      16     131     201     100     100     100
GR1060.1     100  1060.0     118  1059.0     131  1058.4     133  1057.0     143
GR1056.1     163  1057.2     186  1057.8     192  1059.5     199  1060.3     201
GR1060.8     218  1060.4     234  1060.4     250  1060.6     300  1060.7     350
GR1060.7     400

* Drop Structure
X1  3401                              1       1       1
CI       1054.15

X1  3500      16     131     201     100     100     100
CI          .0028
GR1060.8     100  1060.8     118  1059.7     131  1059.4     132  1057.7     142
GR1056.9     163  1058.0     188  1058.4     192  1060.4     199  1060.9     201
GR1061.3     221  1061.4     237  1061.3     250  1061.4     300  1061.5     350
GR1061.5     400

X1  3600      16     131     200     100     100     100
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GR1061.6     100  1061.5     118  1060.4     131  1060.3     131  1058.4     141
GR1057.7     162  1058.8     190  1058.9     191  1061.3     200  1061.4     200
GR1061.8     225  1062.3     241  1062.2     250  1062.2     300  1062.3     350
GR1062.3     400

X1  3645      13     131     200      45      45      45
GR1061.9     100  1061.9     118  1060.7     131  1058.7     141  1058.1     162
GR1059.2     191  1061.7     200  1062.0     226  1062.7     242  1062.6     250
GR1062.5     300  1062.7     350  1062.9     400

X1  3700      13     132     202      55      55      55
GR1062.6     100  1062.5     118  1061.2     132  1059.1     141  1058.5     163
GR1059.6     193  1062.2     202  1062.5     225  1063.1     240  1063.0     247
GR1063.0     300  1063.2     350  1063.4     400

X1  3800      13     133     205     100     100     100
GR1063.8     100  1063.6     119  1062.1     133  1059.7     142  1059.3     166
GR1060.5     195  1063.1     205  1063.3     222  1063.8     236  1063.7     241
GR1063.9     300  1064.0     350  1064.2     400

* Drop Structure
X1  3801                              1       1       1
CI       1058.27

X1  3900      13     135     208     100     100     100
CI   236 .002793
GR1064.9     100  1064.6     120  1063.3     135  1060.4     143  1060.1     169
GR1061.3     198  1064.1     208  1064.2     219  1064.5     232  1064.4     236
GR1064.7     300  1064.8     350  1065.0     400

X1  4000      13     136     211     100     100     100
CI   209
GR1066.1     100  1065.7     121  1064.0     136  1061.0     143  1060.9     171
GR1062.1     201  1065.0     211  1065.0     217  1065.2     229  1065.2     230
GR1065.6     300  1065.7     350  1065.9     400

* Begin New Channel Transition @ 4080

X1  4100      11     138     214     100     100     100
CI   182                    3.67    3.67           -39.0
GR1067.3     100  1066.8     122  1064.9     138  1061.7     144  1061.7     174
GR1062.9     204  1065.9     214  1065.9     225  1066.5     300  1066.5     350
GR1066.7     400

* E Q U A T I O N
* 41+08.64 Bk =
* 40+97.00 Ahd

X1  4145      12     137     217   51.64   51.64   51.64
*   4145      12     137     217      45      45      45
CI   180                    2.67    2.67           -48.0
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```
GR1067.8     100  1067.5     122  1066.8     137  1062.8     145  1062.0     180
GR1063.3     206  1064.6     209  1066.8     217  1067.1     250  1066.9     300
GR1066.9     350  1067.1     400

NC                            .3      .5

X1  4150       8     137     220       5       5       5
CI                          2.56    2.56           -49.0
GR1067.9     100  1066.7     137  1062.5     145  1061.7     146  1062.0     175
GR1063.0     203  1066.8     220  1066.8     225

* End New Channel Transition
X1  4175                              25      25      25
CI                              2      2             -54

* Drop Structure
X1  4176                               1       1       1
CI       1062.35
NC   .03     .03    .015

* End Channel Improvements
X1  4186       7     133     195      11      11      11
CI                                                  .01
X3    10
GR1069.0     100  1069.0     121  1065.5     133  1062.4  133.01  1062.4  194.99
GR1065.5     195  1069.0     210

X1  4197       7     153     207      11      11      11
X3    10
GR1068.5     100  1068.1     123  1068.2     153  1062.5  153.01  1062.5  206.99
GR1069.0     207  1069.0     230

* South I-10 Bridge

SB  1.25     1.6      3.      70      54       4     200          1062.7  1062.5
X1  4248       8     153     207      51      51      51
X2                    1.  1066.7    1069
X3    10
GR1069.0     100  1068.8     123  1068.7     143  1068.6     153  1062.7  153.01
GR1062.7  206.99  1068.1     207  1069.6     229

X1  4300       9     139     197      52      52      52
GR1069.7     100  1069.1     123  1068.2     139  1063.1     146  1063.1     167
GR1063.2     184  1064.5     192  1068.1     197  1072.5     216

NC                            .1      .3

X1  4350       6     133     185      50      50      50
GR1070.0     100  1068.8     133  1063.4     141  1063.4     179  1068.3     185
GR1073.1     216
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X1  4400       7     132     184      50      50      50
GR1070.5     100  1069.3     132  1063.8     139  1063.9     159  1063.6     177
GR1068.6     184  1073.6     216

X1  4450       6     132     185      50      50      50
GR1070.9     100  1069.6     132  1064.1     138  1064.0     178  1068.9     185
GR1074.2     216

X1  4500       8     132     183      50      50      50
GR1071.3     100  1070.9     122  1070.0     132  1064.5     137  1064.2     159
GR1064.2     178  1069.1     183  1074.8     215

X1  4550       8     132     183      50      50      50
GR1071.1     100  1071.2     112  1070.4     132  1064.5     138  1064.5     160
GR1064.5     178  1069.2     183  1075.3     215

X1  4600       7     137     192      50      50      50
GR1072.1     100  1070.6     137  1064.7     145  1064.7     166  1064.7     187
GR1069.5     192  1075.9     215

NC                           .3      .5

X1  4645      14     141     216      45      45      45
GR1072.4     100  1072.0     123  1070.6     141  1066.6     147  1065.5     180
GR1066.2     189  1065.8     195  1066.5     196  1066.8     211  1070.2     216
GR1071.5     227  1073.8     255  1075.7     300  1076.2     350

X1  4660       6     153     207      15      15      15
X3    10
GR1072.5     100  1073.0     153  1065.0  153.01  1065.0  206.99  1073.0     207
GR1073.0     210

* North I-10 Bridge

SB 1.25      1.6       3      70      54       4     250          1065.3  1065.0
X1  4712       6     153     207      52      52      52
X2                     1  1070.3    1073
X3    10
GR1072.9     100  1072.5     153  1065.3  153.01  1065.3  206.99  1072.5     207
GR1072.5     215

X1  4733       6     153     207      21      21      21
GR1073.1     100  1067.9     153  1065.4  153.01  1065.4  206.99  1067.9     207
GR1073.0     250

* Begin Channel Improvements
* Begin New Channel Slope Transition
* Drop Structure
X1  4739       7     123     213       6       6       6
CI   180 1067.90     .02       2       2     .01   -50.0
GR1073.1     100  1072.6     123  1071.9     145  1067.9     153  1067.9     207
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```
GR1071.5     213  1071.7     226

NC   .04     .04    .025     .1       .3

X1  4750      12     145     211      11       11       11
CI        .002399                   2.36
GR1073.2     100  1072.7     123  1071.9      145  1068.8      151  1068.3      154
GR1067.8     156  1067.6     176  1067.8      181  1068.4      183  1068.3      205
GR1071.9     211  1071.9     226

* End New Channel Slope Transition
X1 4800       13     142     208      50       50       50
CI   179                              4
GR1073.6     100  1073.1     123  1072.3      142  1069.2      150  1068.7      153
GR1068.2     156  1068.2     173  1068.2      178  1068.7      182  1068.7      201
GR1072.1     208  1072.3     223  1072.3      225

X1  4900      13     136     202     100      100      100
CI   178
GR1074.3     100  1073.8     122  1073.1      136  1069.9      148  1069.6      150
GR1069.1     156  1069.1     168  1068.9      172  1069.4      180  1069.4      194
GR1072.7     202  1073.1     217  1073.1      223

X1  5000      13     131     195     100      100      100
CI   176
GR1075.0     100  1074.6     122  1073.8      131  1070.7      146  1070.5      147
GR1070.0     156  1070.0     162  1069.6      165  1070.0      177  1070.2      187
GR1073.3     195  1073.8     212  1073.9      222

X1  5100      11     135     189     100      100      100
CI   175
GR1075.8     100  1075.4     122  1074.6      135  1071.4      144  1070.9      157
GR1070.3     159  1070.8     175  1070.9      180  1073.8      189  1074.6      206
GR1074.6     250

X1  5145      15     133     194      45       45       45
CI   174
GR1077.0     100  1076.5     122  1075.1      133  1072.5      142  1071.9     148.
GR1071.8     167  1070.9     170  1070.8      175  1071.2      177  1071.3     186.
GR1074.0     194  1075.6     250  1075.9      300  1075.7      350  1076.1     400.

NC                           .3     .5

* Begin New Channel Slope Transition @ 5150

X1  5200       9     137     221      55       55       55
CI                                 2.33
GR1078.2     100  1077.7     123  1077.1      137  1075.6      144  1073.0      145
GR1072.0     171  1072.1     193  1074.9      202  1075.6      221

* End New Channel Slope Transition
```

```
X1  5210                                10      10      10
CI                                       2

* Drop Structure
X1  5211                                 1       1       1
CI       1071.67

NC   .03     .03    .015

X1  5235       6     148     199      25      25      25
CI                                                    .01
X3    10
GR1079.0     100  1081.0     148  1072.0  148.01  1072.0  198.99  1078.2     199
GR1078.2     227

* McDowell Road Bridge

SB  1.05     1.6       3      70      51       3     216          1072.9  1072.0
X1  5323       6     148     199      88      88      88
X2                     1  1077.4    1080
X3    10
GR1080.4     100  1082.0     148  1072.9  148.01  1072.9  198.99  1079.2     199
GR1078.7     224

* Begin New Channel Transition @ 5325

NC   .04     .04    .025

X1  5350       8     123     225      27      27      27
CI   180 1073.02            2.67    2.67           -46.0
GR1080.9     100  1080.5     123  1074.8     146  1073.5     171  1074.4     200
GR1076.9     201  1077.2     220  1078.8     225

NC                          .1       .3

* End New Channel Transition
X1  5400      11     137     225      50      50      50
CI   194 .002795               4       4             -36
GR1081.6     100  1081.2     122  1079.9     137  1075.9     145  1075.3     155
GR1074.1     158  1073.7     170  1074.2     200  1077.4     204  1077.4     220
GR1078.8     225

X1  5500      15     136     213     100     100     100
CI   220
GR1082.4     100  1082.1     121  1080.9     136  1079.5     138  1076.8     144
GR1076.1     145  1075.7     152  1074.8     157  1074.6     165  1074.9     188
GR1075.1     189  1077.3     192  1078.4     194  1079.0     213  1079.0     280

* E Q U A T I O N
* 55+92.76 Bk =
* 55+80.16 Ahd
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X1  5600      18    134      185  112.60  112.60  112.60
*   5600      18    134      185     100     100     100
CI   244
GR1083.2     100  1082.9     120  1081.8     134  1079.2     139  1077.8     143
GR1076.2     145  1076.0     148  1075.6     156  1075.4     160  1075.6     175
GR1076.1     178  1077.1     179  1079.4     185  1079.5     207  1079.7     240
GR1079.7     273  1079.9     307  1080.1     340

X1  5700      15     133     175     100     100     100
GR1084.0     100  1083.7     118  1082.8     133  1078.8     140  1078.7     142
GR1076.4     145  1076.3     155  1076.3     163  1077.0     167  1080.4     175
GR1080.6     200  1080.8     250  1080.9     300  1081.2     350  1081.4     400

X1  5800      19     131     171     100     100     100
GR1084.4     100  1084.1     117  1084.0     119  1083.4     131  1083.4     131
GR1080.2     137  1079.1     140  1077.3     142  1077.1     152  1077.2     160
GR1078.3     164  1081.3     171  1081.7     200  1081.9     250  1082.0     299
GR1082.1     300  1082.0     301  1082.3     350  1082.5     400

X1  5900      19     129     168     100     100     100
GR1084.7     100  1084.4     115  1084.3     119  1083.9     129  1083.9     129
GR1081.5     133  1079.5     137  1078.1     139  1078.0     149  1078.0     157
GR1079.7     161  1082.2     168  1082.8     200  1083.0     250  1083.1     297
GR1083.3     300  1083.1     303  1083.4     350  1083.6     400

X1  6000      19     127     164     100     100     100
GR1085.1     100  1084.7     113  1084.6     119  1084.5     126  1084.5     127
GR1082.9     130  1079.9     135  1079.0     136  1078.8     145  1078.9     155
GR1081.0     157  1083.1     164  1083.8     200  1084.1     250  1084.3     296
GR1084.6     299  1084.2     304  1084.5     350  1084.7     400

* Drop Structure
X1  6001                              1       1       1
CI       1077.87

X1  6100      19     125     161     100     100     100
CI         .0028
GR1085.4     100  1085.1     112  1084.8     120  1085.0     124  1085.0     125
GR1084.2     126  1080.3     132  1079.8     133  1079.7     142  1079.7     152
GR1082.4     154  1084.0     161  1084.9     200  1085.2     250  1085.4     294
GR1085.8     299  1085.3     306  1085.6     350  1085.8     400

X16200.       17     123     157     100     100     100
GR1085.7     100  1085.4     110  1085.1     120  1085.6     122  1085.6     123
GR1080.7     130  1080.5     139  1080.6     149  1083.7     151  1084.9     157
GR1086.0     200  1086.3     250  1086.5     293  1087.0     299  1086.4     307
GR1086.7     350  1086.9     400

X1  6300      24     122     157     100     100     100
GR1086.7     100  1086.4     110  1086.0     120  1086.6     122  1086.6     122
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GR1085.9     124  1081.7     130  1081.4     139  1081.5     148  1084.6     151
GR1084.8     152  1086.1     157  1086.4     171  1086.2     177  1086.5     181
GR1086.8     201  1086.6     201  1086.9     203  1087.4     247  1087.4     286
GR1087.9     292  1087.5     306  1087.8     350  1087.9     400

X1  6400      24     122     157     100     100     100
GR1087.7     100  1087.4     109  1087.0     119  1087.6     121  1087.6     122
GR1086.2     125  1082.7     129  1082.3     138  1082.4     147  1085.5     150
GR1085.9     153  1087.3     157  1087.5     171  1087.1     177  1087.6     181
GR1087.7     201  1087.3     202  1087.8     206  1088.4     244  1088.3     280
GR1088.9     286  1088.6     304  1088.9     350  1088.9     400

* Drop Structure
X1  6401                              1       1       1
CI       1081.99

X1  6500      24     121     157     100     100     100
CI          .0028
GR1088.7     100  1088.4     109  1087.9     119  1088.7     121  1088.7     121
GR1086.6     125  1083.6     129  1083.2     138  1083.3     147  1086.3     150
GR1087.0     153  1088.5     157  1088.5     171  1087.9     177  1088.6     181
GR1088.5     202  1087.9     204  1088.8     208  1089.5     240  1089.1     273
GR1089.8     279  1089.7     303  1090.0     350  1090.0     400

X1  6600      24     121     157     100     100     100
GR1089.7     100  1089.4     108  1088.9     118  1089.7     120  1089.7     121
GR1086.9     126  1084.6     128  1084.1     137  1084.2     146  1087.2     149
GR1088.1     154  1089.7     157  1089.6     171  1088.8     177  1089.7     181
GR1089.4     202  1088.6     205  1089.7     211  1090.5     237  1090.0     267
GR1090.8     273  1090.8     301  1091.1     350  1091.0     400

X1  6700      23     120     157     100     100     100
GR1090.7     100  1090.4     108  1089.8     118  1090.7     120  1087.2     127
GR1085.6     128  1085.0     137  1085.1     145  1088.1     149  1089.2     155
GR1090.9     157  1090.7     171  1089.6     177  1090.7     181  1090.2     203
GR1089.2     206  1090.6     214  1091.6     234  1090.9     260  1091.7     266
GR1091.9     300  1092.2     350  1092.0     400

X1  6800      24     120     156     100     100     100
GR1091.6     100  1091.3     107  1090.7     118  1091.6     120  1088.1     126
GR1086.5     128  1086.0     137  1086.1     146  1088.5     149  1089.8     155
GR1091.2     156  1091.1     168  1090.7     178  1091.6     181  1091.2     198
GR1090.4     207  1091.6     213  1092.4     229  1092.0     262  1092.7     269
GR1092.8     301  1093.1     350  1093.1     398  1093.2     404

X1  6900      24     120     155     100     100     100
GR1092.5     100  1092.2     107  1091.7     118  1092.6     120  1088.9     126
GR1087.5     128  1087.1     138  1087.1     147  1088.9     150  1090.4     154
GR1091.4     155  1091.4     166  1091.8     178  1092.4     181  1092.1     194
GR1091.7     207  1092.5     212  1093.1     224  1093.1     264  1093.7     271
GR1093.7     302  1093.9     350  1094.1     396  1094.5     408
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* Drop Structure
X1  6901                                1       1       1
CI       1086.39

X1  7000      24     119     155     100     100     100
CI         .0028
GR1093.4     100  1093.1     107  1092.6     117  1093.5     119  1089.8     125
GR1088.4     127  1088.1     138  1088.1     149  1089.3     150  1091.0     154
GR1091.7     155  1091.8     163  1092.8     179  1093.3     180  1093.1     189
GR1092.9     208  1093.5     211  1093.9     219  1094.1     265  1094.8     274
GR1094.5     302  1094.8     350  1095.2     394  1095.7     412

X1  7100      24     119     179     100     100     100
GR1094.3     100  1094.0     106  1093.6     117  1094.5     119  1090.6     125
GR1089.4     127  1089.2     139  1089.1     150  1089.7     151  1091.6     153
GR1091.9     154  1092.1     161  1093.9     179  1094.1     180  1094.0     185
GR1094.2     208  1094.4     210  1094.6     214  1095.2     267  1095.8     276
GR1095.4     303  1095.6     350  1096.2     392  1097.0     416

X1  7200      18     119     180     100     100     100
GR1095.2     100  1094.9     106  1094.5     117  1095.4     119  1091.5     124
GR1090.3     127  1090.2     139  1090.1     151  1092.2     153  1092.5     158
GR1095.0     180  1095.4     209  1096.3     269  1096.8     279  1096.3     304
GR1096.5     350  1097.3     390  1098.2     420

X1  7300      20     120     181     100     100     100
GR1096.0     100  1095.7     106  1095.1     118  1096.0     120  1096.0     120
GR1092.4     125  1091.2     128  1091.1     140  1091.1     152  1093.1     154
GR1093.5     159  1095.7     181  1096.0     206  1095.9     209  1096.9     269
GR1097.5     282  1097.2     308  1097.4     350  1097.6     392  1098.3     416

X1  7400      20     121     182     100     100     100
GR1096.7     100  1096.5     106  1095.7     118  1096.7     121  1096.6     121
GR1093.3     127  1092.2     129  1092.0     141  1092.1     153  1094.0     155
GR1094.5     160  1096.4     182  1096.6     203  1096.3     208  1097.4     269
GR1098.2     285  1098.1     312  1098.3     350  1097.9     394  1098.5     412

X1  7500      20     123     182     100     100     100
GR1097.5     100  1097.3     106  1096.4     119  1097.3     121  1097.3     123
GR1094.3     128  1093.1     130  1092.9     142  1093.0     153  1094.8     155
GR1095.5     162  1097.1     182  1097.3     201  1096.8     208  1098.0     270
GR1098.9     289  1099.0     316  1099.1     350  1098.3     396  1098.6     408

* Drop Structure
X1  7501                                1       1       1
CI       1091.07

X1  7600      20     124     183     100     100     100
CI         .0028
GR1098.3     100  1098.0     106  1097.0     119  1098.0     122  1097.9     124
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GR1095.2     130  1094.1     131  1093.8     143  1094.0     154  1095.7     156
GR1096.5     163  1097.8     183  1097.9     198  1097.2     207  1098.5     270
GR1099.6     292  1099.9     320  1100.0     350  1098.6     398  1098.8     404

X1  7700      19     125     164     100     100     100
GR1099.1     100  1098.8     106  1097.6     120  1098.6     123  1098.5     125
GR1096.1     131  1095.0     132  1094.7     144  1095.0     155  1096.6     157
GR1097.5     164  1098.5     184  1098.5     195  1097.7     207  1099.1     270
GR1100.3     295  1100.8     324  1100.9     350  1098.9     400

X1  7800      20     125     167     100     100     100
GR1100.0     100  1099.8     106  1098.6     120  1099.6     123  1099.6     125
GR1097.0     130  1095.9     132  1095.6     143  1095.9     154  1096.1     155
GR1097.7     157  1098.7     167  1099.7     185  1099.7     195  1099.0     210
GR1100.3     268  1101.4     296  1101.9     324  1102.1     350  1100.5     400

X1  7875                             75      75      75              .7

* Drop Structure
X1  7876                              1       1       1
CI       1095.12

X1  7900      20     124     169      25      25      25
CI         .0028
GR1100.9     100  1100.7     106  1099.8     120  1100.6     122  1100.7     124
GR1097.9     130  1096.8     131  1096.5     142  1096.7     153  1097.3     154
GR1098.8     157  1099.9     169  1100.8     185  1100.8     195  1100.3     213
GR1101.5     266  1102.5     297  1103.0     324  1103.2     350  1102.1     400

X1  8000      20     124     172     100     100     100
GR1101.8     100  1101.6     105  1100.7     119  1101.7     122  1101.7     124
GR1098.9     129  1097.6     131  1097.3     142  1097.6     153  1098.4     154
GR1099.9     156  1101.1     172  1102.0     186  1102.0     195  1101.7     216
GR1102.6     264  1103.6     298  1104.1     325  1104.4     350  1103.7     400

X1  8100      20     123     174     100     100     100
GR1102.8     100  1102.5     105  1101.7     119  1102.7     121  1102.8     123
GR1099.8     129  1098.5     130  1098.2     141  1098.4     152  1099.6     153
GR1101.0     156  1102.3     174  1103.1     186  1103.1     195  1103.0     219
GR1103.8     262  1104.7     299  1105.2     325  1105.5     350  1105.3     400

X1  8200      18     123     177     100     100     100
GR1103.7     100  1103.5     105  1102.7     119  1103.7     121  1103.9     123
GR1100.7     128  1099.4     130  1099.1     140  1099.3     151  1100.7     153
GR1102.1     156  1103.5     177  1104.3     187  1104.3     222  1105.0     260
GR1105.8     300  1106.7     350  1106.9     400

X1  8300      24     123     175     100     100     100
GR1104.6     100  1104.4     105  1103.6     119  1104.6     121  1104.7     123
GR1101.6     128  1100.2     130  1100.0     140  1100.2     150  1101.5     152
GR1102.9     155  1104.1     174  1104.3     175  1104.3     180  1104.3     181
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GR1104.3      182  1104.4      184  1103.9      185  1105.1      194  1105.1      222
GR1105.6      261  1106.1      299  1107.0      350  1107.4      400

X1  8400       24     123      172     100      100     100
GR1105.6      100  1105.4      105  1104.5      120  1105.4      121  1105.5      123
GR1102.5      129  1101.0      131  1100.8      140  1101.0      150  1102.3      151
GR1103.6      154  1104.7      171  1105.0      172  1105.1      183  1105.0      184
GR1105.1      186  1105.3      191  1104.3      193  1105.9      202  1105.9      223
GR1106.2      261  1106.4      298  1107.4      351  1107.8      400

X1  8500       24     124      170     100      100     100
GR1106.5      100  1106.3      104  1105.3      120  1106.3      122  1106.3      124
GR1103.4      129  1101.9      131  1101.7      140  1101.9      149  1103.1      151
GR1104.4      153  1105.4      167  1105.8      170  1106.0      187  1105.8      188
GR1106.0      191  1106.3      198  1104.8      202  1106.8      209  1106.8      223
GR1106.9      262  1106.8      298  1107.7      351  1108.3      400

* Drop Structure
X1  8501                              1        1       1
CI       1099.87

X1  8600       24     124      167     100      100     100
CI          .0028
GR1107.4      100  1107.2      104  1106.2      121  1107.1      122  1107.1      124
GR1104.3      130  1102.7      132  1102.5      140  1102.7      149  1103.9      150
GR1105.1      152  1106.0      164  1106.5      167  1106.8      190  1106.5      191
GR1106.8      195  1107.2      205  1105.2      210  1107.6      217  1107.6      224
GR1107.5      262  1107.1      297  1108.1      352  1108.7      400

X18700.        22     124      165     100      100     100
GR1108.4      100  1108.2      103  1107.1      121  1108.0      122  1107.9      124
GR1105.2      130  1103.5      132  1103.4      140  1103.6      148  1105.9      151
GR1106.6      161  1107.3      165  1107.6      193  1107.3      195  1107.6      200
GR1108.1      212  1105.6      218  1108.4      224  1108.1      263  1107.4      296
GR1108.4      352  1109.2      400

X1  8800       24     123      154     100      100     100
GR1109.4      100  1109.2      104  1108.1      120  1108.9      121  1108.9      123
GR1106.0      129  1105.3      130  1104.4      131  1104.4      140  1104.6      148
GR1105.8      150  1107.6      154  1107.8      175  1108.4      178  1108.6      201
GR1108.3      216  1108.6      220  1109.0      233  1106.8      238  1109.3      244
GR1109.1      280  1108.6      307  1109.5      362  1110.2      400

X1  8900       24     121      157     100      100     100
GR1110.4      100  1110.2      104  1109.2      119  1109.9      120  1110.0      121
GR1106.7      128  1106.3      129  1105.3      131  1105.3      139  1105.5      149
GR1106.8      150  1109.2      157  1109.1      189  1109.5      192  1109.7      209
GR1109.4      237  1109.6      240  1109.9      253  1108.0      258  1110.1      263
GR1110.1      298  1109.7      318  1110.6      371  1111.1      400

X1  9000       24     120      159     100      100     100
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GR1111.4     100  1111.2     103  1110.2     118  1110.8     119  1111.0     120
GR1107.5     126  1107.2     128  1106.3     130  1106.3     139  1106.5     149
GR1107.9     151  1110.9     159  1110.3     204  1110.6     205  1110.7     216
GR1110.4     258  1110.5     260  1110.7     274  1109.1     278  1111.0     283
GR1111.2     315  1110.9     328  1111.8     381  1112.1     400

* Drop Structure
X1  9001                              1       1       1
CI       1104.27

X1  9100      24     118     162     100     100     100
CI          .0028
GR1112.4     100  1112.2     103  1111.3     117  1111.8     118  1112.1     118
GR1108.2     125  1108.2     127  1107.2     130  1107.2     138  1107.4     150
GR1108.9     151  1112.5     162  1111.6     218  1111.7     219  1111.8     224
GR1111.5     279  1111.5     280  1111.6     294  1110.3     298  1111.8     302
GR1112.2     333  1112.0     339  1112.9     390  1113.0     400

X1  9200      18     117     165     100     100     100
GR1113.4     100  1113.2     103  1112.3     116  1113.1     117  1109.0     124
GR1109.1     126  1108.1     129  1108.2     138  1108.4     150  1110.0     152
GR1114.2     165  1112.8     232  1112.5     300  1112.5     315  1111.5     318
GR1112.7     322  1113.2     350  1114.0     400

X1  9300      25     117     162     100     100     100
GR1114.2     100  1114.0     103  1113.2     116  1114.0     117  1110.1     124
GR1110.2     126  1109.0     129  1109.1     138  1109.3     150  1110.7     151
GR1114.3     162  1114.3     164  1114.6     165  1114.9     167  1114.7     171
GR1114.8     176  1114.4     176  1114.9     178  1114.9     187  1114.4     188
GR1114.3     188  1114.4     189  1113.8     243  1113.8     309  1113.8     332

X1  9400      25     117     159     100     100     100
GR1115.0     100  1114.9     103  1114.0     116  1114.9     117  1111.2     124
GR1111.3     126  1109.9     129  1110.0     138  1110.1     149  1111.5     151
GR1114.4     159  1114.4     162  1115.0     164  1115.5     169  1115.2     177
GR1115.5     187  1114.7     188  1115.6     191  1115.6     209  1114.6     211
GR1114.4     212  1114.5     213  1114.7     254  1115.1     318  1115.1     349

* Drop Structure
X1  9401                              1       1       1
CI       1108.36

X1  9500      25     118     164     100     100     100
CI          .0028
GR1115.8     100  1115.7     102  1114.9     116  1115.9     118  1112.4     123
GR1112.5     125  1110.9     129  1110.9     139  1111.0     149  1112.2     150
GR1114.6     156  1114.5     161  1115.4     164  1116.2     170  1115.7     183
GR1116.1     197  1114.9     199  1116.3     205  1116.3     230  1114.8     233
GR1114.6     235  1114.7     236  1115.7     265  1116.3     327  1116.5     366

X1  9600      25     118     172     100     100     100
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GR1116.6     100  1116.6     102  1115.7     116  1116.8     118  1113.5     123
GR1113.6     125  1111.8     129  1111.8     139  1111.8     148  1113.0     150
GR1114.7     153  1114.6     159  1115.8     163  1116.8     172  1116.2     189
GR1116.8     208  1115.2     211  1117.0     218  1117.0     252  1115.0     256
GR1114.7     259  1114.8     260  1116.6     276  1117.6     336  1117.8     383

X1  9700      24     118     174     100     100     100
GR1117.4     100  1117.4     102  1116.6     116  1117.7     118  1114.6     123
GR1114.7     125  1112.7     129  1112.7     139  1112.7     148  1114.8     150
GR1114.7     158  1116.2     163  1117.5     174  1116.7     195  1117.4     219
GR1115.4     222  1117.7     231  1117.7     274  1115.2     279  1114.8     282
GR1115.0     284  1117.6     287  1118.9     345  1119.1     400

X1  9800      19     119     166     100     100     100
GR1118.2     100  1118.2     102  1117.7     116  1118.8     119  1115.3     125
GR1115.4     127  1113.5     131  1113.5     141  1113.6     150  1115.7     153
GR1115.5     161  1117.1     166  1118.2     182  1117.7     206  1118.3     235
GR1116.8     242  1118.5     256  1118.7     265  1118.7     300

X1  9900      18     119     169     100     100     100
GR1119.1     100  1119.0     102  1118.7     117  1119.9     119  1116.0     127
GR1116.1     129  1114.3     133  1114.3     143  1114.4     152  1116.6     156
GR1116.3     163  1118.0     169  1118.9     189  1118.7     217  1119.3     251
GR1118.3     263  1119.4     281  1119.7     299

* Drop Structure
X1  9901                              1       1       1
CI       1112.79

X1 10000      18     120     171     100     100     100
CI         .0028
GR1119.9     100  1119.9     101  1119.8     117  1121.0     120  1116.8     130
GR1116.8     130  1115.2     136  1115.1     145  1115.3     155  1117.4     158
GR1117.2     166  1118.9     171  1119.5     197  1119.8     228  1120.2     268
GR1119.7     283  1120.2     306  1120.8     332

X1 10100      18     120     174     100     100     100
GR1120.7     100  1120.7     101  1120.8     118  1122.1     120  1117.5     132
GR1117.5     132  1116.0     138  1115.9     147  1116.1     157  1118.3     161
GR1118.0     168  1119.8     174  1120.2     204  1120.8     239  1121.2     284
GR1121.2     304  1121.1     331  1121.8     366

X1 10200      17     121     177     100     100     100
GR1121.5     100  1121.5     101  1121.9     118  1123.2     121  1118.2     134
GR1116.8     140  1116.7     149  1117.0     159  1119.2     164  1118.8     171
GR1120.7     177  1120.9     212  1121.8     250  1122.1     300  1122.6     324
GR1121.9     356  1122.8     400

X1 10300      17     120     176     100     100     100
GR1122.3     100  1122.2     101  1122.5     117  1123.9     120  1119.3     132
GR1117.6     138  1117.5     147  1117.8     157  1120.0     162  1119.9     168
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GR1121.9     176  1122.1     215  1122.8     254  1123.0     301  1123.5     323
GR1122.9     357  1123.8     400

X1 10400      17     120     175     100     100     100
GR1123.0     100  1123.0     101  1123.1     117  1124.5     120  1120.4     130
GR1118.4     136  1118.3     145  1118.6     154  1120.8     159  1121.0     165
GR1123.1     175  1123.3     218  1123.9     259  1123.8     302  1124.4     322
GR1123.9     358  1124.8     400

X1 10500      17     119     174     100     100     100
GR1123.8     100  1123.7     101  1123.8     116  1125.2     119  1121.5     128
GR1119.3     134  1119.1     143  1119.3     152  1121.7     157  1122.1     162
GR1124.2     174  1124.6     221  1124.9     263  1124.7     302  1125.4     322
GR1124.8     358  1125.8     400

* Drop Structure
X1 10501                          1       1       1
CI       1117.47

X1 10600      17     119     173     100     100     100
CI         .0028
GR1124.5     100  1124.5     101  1124.4     116  1125.8     119  1122.6     126
GR1120.1     132  1119.9     141  1120.1     149  1122.5     154  1123.2     159
GR1125.4     173  1125.8     224  1126.0     268  1125.5     303  1126.3     321
GR1125.8     359  1126.8     400

X1 10700      16     118     172     100     100     100
GR1125.3     100  1125.2     102  1125.0     115  1126.5     118  1120.9     130
GR1120.7     139  1120.9     147  1123.3     152  1124.3     156  1126.6     172
GR1127.0     227  1127.0     272  1126.4     304  1127.2     320  1126.8     360
GR1127.8     400

X1 10800      18     118     163     100     100     100
GR1126.2     100  1126.2     101  1125.9     115  1127.3     118  1121.7     128
GR1121.4     139  1121.6     147  1122.4     148  1124.6     154  1125.5     163
GR1127.4     187  1127.4     235  1127.7     273  1127.0     302  1127.9     316
GR1127.7     360  1128.5     400  1128.5     405

X1 10900      18     117     156     100     100     100
GR1127.1     100  1127.1     101  1126.8     114  1128.1     117  1122.5     127
GR1122.2     139  1122.3     147  1123.8     149  1125.9     156  1126.6     170
GR1128.2     201  1127.7     243  1128.4     274  1127.6     301  1128.6     312
GR1128.6     359  1129.2     400  1129.3     410

X1 11000      18     117     157     100     100     100
GR1128.0     100  1128.0     100  1127.6     114  1128.8     117  1123.3     125
GR1122.9     140  1123.1     146  1125.3     150  1127.2     157  1127.8     176
GR1128.9     216  1128.1     251  1129.0     274  1128.1     299  1129.2     308
GR1129.5     359  1129.9     400  1130.0     415

* Drop Structure
```

```
X1 11001                                1       1       1
CI       1121.87

X1 11100      18     116     159     100     100     100
CI          .0028
GR1128.9     100  1128.9     100  1128.5     113  1129.6     116  1124.1     124
GR1123.7     140  1123.8     146  1126.7     151  1128.5     159  1128.9     183
GR1129.7     230  1128.4     259  1129.7     275  1128.7     298  1129.9     304
GR1130.4     358  1130.6     400  1130.8     420

X1 11200      17     116     161     100     100     100
GR1129.8     100  1129.4     113  1130.4     116  1124.9     122  1124.4     140
GR1124.5     146  1128.2     152  1129.8     161  1130.1     190  1130.5     245
GR1128.8     267  1130.4     276  1129.3     296  1130.6     300  1131.3     358
GR1131.3     400  1131.5     425

X1 11300      21     115     158     100     100     100
GR1130.7     100  1130.7     100  1130.3     112  1131.3     115  1131.1     116
GR1127.9     120  1125.7     125  1125.5     126  1125.1     140  1125.3     147
GR1128.0     151  1130.3     158  1131.0     183  1131.2     236  1130.3     260
GR1131.5     266  1130.7     280  1131.7     304  1132.1     350  1132.3     386
GR1132.6     418

X1 11400      21     114     155     100     100     100
GR1131.5      99  1131.5     100  1131.2     112  1132.2     114  1131.8     116
GR1128.2     121  1126.5     129  1126.2     130  1125.9     141  1126.2     147
GR1127.7     150  1130.8     155  1131.9     175  1131.9     226  1131.8     252
GR1132.5     256  1132.0     265  1132.9     307  1132.8     343  1133.3     371
GR1133.6     411

X1 11500      21     113     152     100     100     100
GR1132.4      99  1132.4     100  1132.1     111  1133.1     113  1132.5     116
GR1128.5     122  1127.3     132  1126.8     134  1126.6     141  1127.0     148
GR1127.5     149  1131.3     152  1132.8     168  1132.6     217  1133.3     245
GR1133.6     246  1133.4     249  1134.0     311  1133.6     335  1134.3     357
GR1134.7     404

* Drop Structure
X1 11501                                1       1       1
CI       1126.27

X1 11550      18     113     164      50      50      50
CI   239   .0084
GR1132.8      99  1132.8     100  1132.5     111  1133.5     113  1132.9     116
GR1128.6     123  1127.7     134  1127.1     136  1127.0     141  1127.4     148
GR1131.5     150  1133.2     164  1132.9     212  1134.1     241  1134.6     313
GR1134.0     331  1134.8     350  1135.2     400

* Begin Channel Transition @ 116+61

X1 11650                              100     100     100              .7
```

```
CI   202                                          -36

X1 11750                          100     100     100          .7
CI   164                                          -30

* Match Existing Channel
X1 11825                           75      75      75          .6
CI   136                                          .01

EJ
ER
```

OUTPUT - SUBCRITICAL

PROPOSED

```
*****************************************
*  HEC-2 WATER SURFACE PROFILES         *
*                                       *
*  Version   4.6.2;  May 1991           *
*                                       *
*  RUN DATE    28JUL93    TIME   11:10:54  *
*****************************************
```

```
*************************************
*  U.S. ARMY CORPS OF ENGINEERS     *
*  HYDROLOGIC ENGINEERING CENTER    *
*  609 SECOND STREET, SUITE D       *
*  DAVIS, CALIFORNIA 95616-4687     *
*          (916) 756-1104           *
*************************************
```

```
X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X            X     X
X     X  X        X                        X
XXXXXXX  XXXX     X          XXXXX     XXXXX
X     X  X        X                   X
X     X  X        X     X             X
X     X  XXXXXXX   XXXXX              XXXXXXX
```

THIS RUN EXECUTED 28JUL93 11:10:54

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************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
************************************


T1 WHITE TANKS #4 FLOOD RETENTION INLET CHANNEL
T2 DESIGN CONCEPT REPORT                7/28/93
T3      CHANNEL IMPROVE, SUBCRITICAL FLOW  (Q100 = 2206CFS)
T4      STATION 17+48 TO 115+50

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

     -10                                                          .3      2206   1048.65

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

     -1                                                          -1         7

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

    100                   105                   120                   150
```

THIS RUN EXECUTED 28JUL93 11:11:19

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************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
************************************
```

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

CHANNEL IMPROVE, SUBCRIT

SUMMARY PRINTOUT TABLE 100

	SECNO	EGLWC	ELLC	EGPRS	ELTRD	QPR	QWEIR	CLASS	H3	DEPTH	CWSEL	VCH	EG
*	4248.000	1068.78	1066.70	1069.24	1069.00	2184.41	16.01	30.00	.00	5.68	1068.38	7.18	1069.18
	4712.000	1071.58	1070.30	1072.19	1073.00	2206.00	.00	10.00	.43	6.22	1071.52	6.56	1072.19
*	5323.000	1079.12	1077.40	1078.45	1080.00	2206.00	.00	2.00	.00	5.10	1078.00	8.49	1079.12

CHANNEL IMPROVE, SUBCRIT

SUMMARY PRINTOUT TABLE 105

	SECNO	CWSEL	HL	OLOSS	TOPWID	QLOB	QCH	QROB
*	4186.000	1066.46	.02	.12	69.35	1.70	2202.16	2.14
*	4197.000	1066.22	.02	.34	53.99	.00	2206.00	.00
*	4248.000	1068.38	1.09	.00	58.22	.00	2205.79	.21
	4300.000	1068.26	.04	.16	59.96	.00	2206.00	.00
	4645.000	1070.15	.06	.09	74.26	.00	2206.00	.00
	4660.000	1070.26	.02	.02	53.99	.00	2206.00	.00
	4712.000	1071.52	.99	.00	54.00	.00	2206.00	.00
	4733.000	1071.77	.01	.05	126.10	106.67	2011.22	88.11
*	5211.000	1075.39	.00	.22	64.89	.00	2206.00	.00
*	5235.000	1075.86	.08	.15	50.99	.00	2206.00	.00
*	5323.000	1078.00	1.31	.00	50.99	.00	2206.00	.00
	5350.000	1078.65	.03	.14	76.03	.00	2206.00	.00

CHANNEL IMPROVE, SUBCRIT

SUMMARY PRINTOUT TABLE 120

	SECNO	CWSEL	EG	VCH	10*KS	DEPTH	TOPWID	CLSTA	BW	STCHL	XLBEL	STCHR	RBEL
	1634.000	1048.65	1048.98	4.61	20.03	4.44	125.52	190.00	90.00	120.00	1050.00	257.38	1049.81
	1748.000	1048.81	1049.33	5.77	33.22	4.37	110.15	232.00	70.00	179.98	1048.69	288.75	1049.88
	1800.000	1048.92	1049.56	6.43	42.63	4.37	95.96	199.00	61.00	146.84	1049.96	253.92	1050.65
	1900.000	1049.21	1050.20	7.99	68.90	4.46	79.70	199.00	44.00	144.88	100000.00	247.49	1051.37
	1945.000	1049.38	1050.62	8.96	88.84	4.54	72.35	199.00	36.00	148.51	1052.96	244.33	1051.67
*	2000.000	1049.84	1050.86	8.12	21.97	4.89	75.12	189.00	36.00	134.37	100000.00	229.33	1050.53
	2100.000	1050.08	1051.08	8.01	21.15	4.94	75.51	189.50	36.00	134.62	100000.00	237.06	1052.54
	2200.000	1050.30	1051.29	8.00	21.06	4.95	75.56	196.00	36.00	139.83	100000.00	245.02	1053.10
	2300.000	1050.53	1051.50	7.92	20.47	4.98	75.85	199.00	36.00	142.86	100000.00	246.30	1052.87
	2400.000	1050.73	1051.71	7.92	20.47	4.99	75.85	201.50	36.00	140.00	100000.00	251.39	1053.72
	2500.000	1050.94	1051.91	7.91	20.41	4.99	75.88	237.50	36.00	178.60	1056.17	292.96	1055.31
	2600.000	1051.15	1052.11	7.90	20.32	5.00	75.93	247.50	36.00	180.76	1058.33	305.48	1056.14
	2700.000	1051.35	1052.32	7.88	20.22	5.00	75.98	192.00	36.00	131.88	1056.88	247.83	1055.81
	2800.000	1051.56	1052.52	7.87	20.13	5.01	76.03	140.00	36.00	85.00	1055.80	189.88	1054.52
	2900.000	1051.76	1052.72	7.86	20.06	5.01	76.06	114.00	36.00	58.47	1056.13	170.28	1056.32
*	2901.000	1053.89	1055.49	10.14	41.18	4.14	69.11	114.00	36.00	72.20	1055.70	161.32	1057.08
	3000.000	1054.69	1055.85	8.66	26.38	4.66	73.28	98.50	36.00	53.10	1056.88	147.68	1057.82
	3145.000	1055.06	1056.25	8.75	27.16	4.62	72.99	244.00	36.00	196.94	1057.70	294.81	1058.64
	3200.000	1055.21	1056.40	8.75	27.16	4.62	72.99	244.00	36.00	132.00	1057.60	295.87	1059.06
	3300.000	1055.48	1056.67	8.78	27.38	4.61	72.91	244.00	36.00	132.00	1058.30	298.06	1059.88
	3400.000	1055.75	1056.95	8.80	27.54	4.60	72.86	244.00	36.00	131.00	1059.00	299.80	1060.60
*	3401.000	1058.27	1059.89	10.19	41.78	4.12	68.98	244.00	36.00	201.36	1060.31	287.60	1060.55
	3500.000	1059.08	1060.26	8.71	26.73	4.65	73.15	244.00	36.00	131.00	1059.70	289.80	1061.38
	3600.000	1059.36	1060.53	8.68	26.52	4.65	73.23	244.00	36.00	131.00	1060.40	291.96	1062.20

	SECNO	CWSEL	EG	VCH	10*KS	DEPTH	TOPWID	CLSTA	BW	STCHL	XLBEL	STCHR	RBEL
	3645.000	1059.47	1060.65	8.70	26.66	4.64	73.18	244.00	36.00	131.00	1060.70	292.71	1062.51
	3700.000	1059.61	1060.80	8.73	26.98	4.62	73.06	244.00	36.00	132.00	1061.20	294.04	1063.00
	3800.000	1059.88	1061.07	8.77	27.31	4.61	72.94	244.00	36.00	133.00	1062.10	296.47	1063.89
*	3801.000	1062.66	1063.93	9.15	31.41	4.39	144.02	244.00	36.00	206.60	1063.12	284.31	1063.85
	3900.000	1062.90	1064.30	9.50	34.17	4.35	70.80	236.00	36.00	135.00	1063.30	278.19	1064.60
	4000.000	1063.39	1064.63	8.91	28.58	4.57	72.50	209.00	36.00	136.00	1064.00	253.01	1065.33
	4100.000	1063.84	1064.90	8.25	22.68	4.73	73.79	182.00	39.00	138.00	1064.90	226.47	1065.91
	4145.000	1064.19	1065.02	7.29	15.28	4.94	74.42	180.00	48.00	135.68	1066.86	224.33	1066.87
	4150.000	1064.21	1065.03	7.24	14.96	4.95	74.30	180.00	49.00	136.42	1066.72	223.79	1066.80
	4175.000	1064.36	1065.09	6.86	12.55	5.02	74.09	180.00	54.00	137.00	1066.70	221.93	1066.80
*	4176.000	1065.91	1067.51	10.14	41.01	3.56	68.24	180.00	54.00	137.00	1066.70	220.00	1066.80
*	4186.000	1066.46	1067.65	8.77	13.75	4.06	69.35	.00	.01	133.00	1065.50	195.00	1065.50
*	4197.000	1066.22	1068.09	11.00	25.42	3.72	53.99	.00	.01	153.00	1068.20	207.00	1069.00
*	4248.000	1068.38	1069.18	7.18	6.64	5.68	58.22	.00	.01	153.00	1068.60	207.00	1068.10
	4300.000	1068.26	1069.39	8.51	10.72	5.16	59.96	.00	.01	139.00	1068.20	197.00	1068.10
*	4350.000	1067.85	1069.82	11.26	22.59	4.45	50.04	.00	.01	133.00	1068.80	185.00	1068.30
*	4400.000	1068.23	1070.20	11.28	22.81	4.63	50.11	.00	.01	132.00	1069.30	184.00	1068.60
*	4450.000	1068.39	1070.33	11.17	22.56	4.39	50.96	.00	.01	132.00	1069.60	185.00	1068.90
*	4500.000	1068.60	1070.59	11.33	23.00	4.40	49.22	.00	.01	132.00	1070.00	183.00	1069.10
*	4550.000	1068.86	1070.86	11.36	23.06	4.36	49.07	.00	.01	132.00	1070.40	183.00	1069.20
	4600.000	1069.71	1071.02	9.17	12.67	5.01	54.55	.00	.01	137.00	1070.60	192.00	1069.50
	4645.000	1070.15	1071.16	8.07	12.17	4.65	74.26	.00	.01	141.00	1070.60	216.00	1070.20
	4660.000	1070.26	1071.20	7.78	8.56	5.26	53.99	.00	.01	153.00	1073.00	207.00	1073.00
	4712.000	1071.52	1072.19	6.56	5.06	6.22	54.00	.00	.01	153.00	1072.50	207.00	1072.50
	4733.000	1071.77	1072.26	5.85	3.32	6.37	126.10	.00	.01	153.00	1067.90	207.00	1067.90
*	4739.000	1071.62	1073.27	10.32	41.22	3.72	73.21	180.00	50.00	123.00	1072.60	213.00	1071.50

	SECNO	CWSEL	EG	VCH	10*KS	DEPTH	TOPWID	CLSTA	BW	STCHL	XLBEL	STCHR	RBEL
	4750.000	1072.16	1073.35	8.79	26.07	4.23	87.98	180.00	50.00	145.00	1071.90	214.38	1071.90
	4800.000	1072.60	1073.49	7.58	18.78	4.56	90.09	179.00	50.00	142.00	1072.30	220.90	1072.27
	4900.000	1072.76	1073.70	7.77	19.67	4.48	76.86	178.00	50.00	136.00	1073.10	222.25	1073.10
	5000.000	1072.94	1073.91	7.90	20.64	4.42	76.50	176.00	50.00	131.00	1073.80	222.00	1073.78
	5100.000	1073.14	1074.13	8.00	21.44	4.37	76.22	175.00	50.00	135.00	1074.60	223.34	1074.60
	5145.000	1073.23	1074.23	8.01	21.54	4.36	76.18	174.00	50.00	133.00	1075.10	222.80	1074.82
	5200.000	1073.26	1074.45	8.75	25.29	4.26	68.43	174.00	50.00	132.42	1077.30	221.00	1075.60
	5210.000	1073.27	1074.49	8.87	25.82	4.24	67.00	174.00	50.00	132.47	1077.29	221.00	1075.60
*	5211.000	1075.39	1077.05	10.32	40.76	3.72	64.89	174.00	50.00	137.00	1077.10	221.00	1075.60
*	5235.000	1075.86	1077.81	11.21	25.51	3.86	50.99	.00	.01	148.00	1081.00	199.00	1078.20
*	5323.000	1078.00	1079.12	8.49	10.67	5.10	50.99	.00	.01	148.00	1082.00	199.00	1079.20
	5350.000	1078.65	1079.29	6.43	10.40	5.63	76.03	180.00	46.00	123.00	1080.50	225.00	1078.80
	5400.000	1078.58	1079.40	7.27	14.56	5.42	70.69	194.00	36.00	137.00	1079.90	225.00	1076.41
	5500.000	1078.73	1079.56	7.29	16.25	5.29	78.34	220.00	36.00	136.00	1080.90	260.24	1079.00
	5600.000	1078.87	1079.78	7.63	18.45	5.12	76.95	244.00	36.00	203.09	1079.48	286.09	1079.78
	5700.000	1079.02	1079.99	7.91	20.39	4.99	75.89	244.00	36.00	199.74	1080.60	289.38	1080.88
	5800.000	1079.19	1080.22	8.15	22.20	4.88	75.01	244.00	36.00	196.64	1081.65	292.70	1081.99
	5900.000	1079.38	1080.46	8.35	23.74	4.79	74.33	244.00	36.00	193.65	1082.68	296.02	1083.10
	6000.000	1079.60	1080.72	8.50	24.99	4.73	73.82	244.00	36.00	190.99	1083.62	300.45	1084.48
*	6001.000	1082.01	1083.61	10.13	41.02	4.14	69.15	244.00	36.00	202.23	1083.81	287.57	1084.26
	6100.000	1082.81	1083.97	8.67	26.44	4.66	73.25	244.00	36.00	199.08	1084.88	290.94	1085.39
	6200.000	1083.06	1084.25	8.74	27.01	4.63	73.05	244.00	36.00	196.12	1085.90	294.92	1086.66
	6300.000	1083.33	1084.52	8.74	27.00	4.62	73.05	244.00	36.00	194.06	1086.70	298.07	1087.73
	6400.000	1083.59	1084.79	8.78	27.38	4.60	72.91	244.00	36.00	191.35	1087.65	300.66	1088.66
*	6401.000	1086.13	1087.73	10.14	41.13	4.14	69.12	244.00	36.00	203.84	1087.53	289.41	1088.84
	6500.000	1086.93	1088.09	8.67	26.39	4.66	73.27	244.00	36.00	201.06	1088.50	291.90	1089.75

	SECNO	CWSEL	EG	VCH	10*KS	DEPTH	TOPWID	CLSTA	BW	STCHL	XLBEL	STCHR	RBEL
	6600.000	1087.18	1088.37	8.73	26.98	4.63	73.06	244.00	36.00	198.39	1089.45	295.00	1090.80
	6700.000	1087.45	1088.64	8.75	27.09	4.62	73.02	244.00	36.00	195.87	1090.36	298.24	1091.89
	6800.000	1087.72	1088.91	8.78	27.38	4.61	72.91	244.00	36.00	193.19	1091.31	300.76	1092.80
	6900.000	1087.99	1089.19	8.80	27.56	4.60	72.85	244.00	36.00	190.87	1092.17	303.26	1093.71
*	6901.000	1090.53	1092.13	10.14	41.13	4.14	69.12	244.00	36.00	204.45	1091.78	291.24	1093.70
	7000.000	1091.31	1092.50	8.73	26.97	4.64	73.06	244.00	36.00	200.78	1092.98	293.68	1094.59
	7100.000	1091.59	1092.77	8.71	26.76	4.64	73.14	244.00	36.00	197.37	1094.11	296.20	1095.50
	7200.000	1091.85	1093.04	8.74	27.00	4.62	73.05	244.00	36.00	194.14	1095.20	298.70	1096.41
	7300.000	1092.12	1093.31	8.78	27.36	4.61	72.92	244.00	36.00	192.68	1095.84	301.08	1097.28
	7400.000	1092.39	1093.59	8.80	27.57	4.60	72.84	244.00	36.00	191.21	1096.49	303.37	1098.13
	7500.000	1092.66	1093.87	8.83	27.80	4.59	72.77	244.00	36.00	189.56	1097.18	305.56	1098.96
*	7501.000	1095.21	1096.81	10.14	41.17	4.14	69.11	244.00	36.00	201.11	1097.29	293.39	1098.92
	7600.000	1096.01	1097.17	8.66	26.38	4.66	73.28	244.00	36.00	200.61	1097.70	295.13	1099.63
	7700.000	1096.26	1097.45	8.73	26.97	4.63	73.06	244.00	36.00	199.80	1098.18	296.80	1100.33
	7800.000	1096.53	1097.72	8.75	27.09	4.62	73.02	244.00	36.00	194.84	1099.70	300.26	1101.48
	7875.000	1096.73	1097.92	8.76	27.24	4.61	72.96	244.00	36.00	192.88	1100.40	302.38	1102.21
*	7876.000	1099.22	1100.86	10.28	42.79	4.10	68.77	244.00	36.00	207.15	1099.83	288.79	1101.82
	7900.000	1099.73	1100.98	8.98	29.17	4.54	72.30	244.00	36.00	204.63	1100.53	290.39	1102.29
	8000.000	1100.06	1101.27	8.84	27.96	4.59	72.71	244.00	36.00	200.18	1101.93	294.06	1103.48
	8100.000	1100.34	1101.55	8.85	27.97	4.59	72.71	244.00	36.00	196.63	1103.09	297.67	1104.67
	8200.000	1100.62	1101.83	8.85	27.98	4.59	72.70	244.00	36.00	192.92	1104.30	301.16	1105.82
	8300.000	1100.90	1102.11	8.85	28.00	4.59	72.70	244.00	36.00	191.94	1104.83	301.32	1106.14
	8400.000	1101.18	1102.39	8.85	28.01	4.59	72.69	244.00	36.00	194.26	1104.52	301.50	1106.47
	8500.000	1101.46	1102.67	8.85	28.01	4.59	72.69	244.00	36.00	189.80	1105.92	301.99	1106.87
*	8501.000	1104.01	1105.61	10.14	41.14	4.14	69.12	244.00	36.00	204.00	1105.37	289.81	1106.82
	8600.000	1104.81	1105.97	8.67	26.40	4.66	73.27	244.00	36.00	198.79	1106.95	290.11	1107.18

	SECNO	CWSEL	EG	VCH	10*KS	DEPTH	TOPWID	CLSTA	BW	STCHL	XLBEL	STCHR	RBEL
	8700.000	1105.06	1106.25	8.73	26.97	4.63	73.06	244.00	36.00	197.84	1107.47	290.36	1107.52
	8800.000	1105.33	1106.52	8.75	27.09	4.62	73.02	244.00	36.00	194.66	1108.54	294.49	1108.83
	8900.000	1105.60	1106.79	8.78	27.38	4.61	72.91	244.00	36.00	191.97	1109.50	298.41	1110.09
	9000.000	1105.87	1107.07	8.80	27.56	4.60	72.85	244.00	36.00	189.09	1110.50	301.38	1111.11
*	9001.000	1108.41	1110.01	10.13	41.10	4.14	69.13	244.00	36.00	201.76	1110.33	289.07	1111.04
	9100.000	1109.21	1110.37	8.67	26.41	4.66	73.27	244.00	36.00	196.41	1111.95	290.09	1111.57
	9200.000	1109.46	1110.65	8.73	26.98	4.63	73.06	244.00	36.00	190.67	1113.66	292.81	1112.53
	9300.000	1109.73	1110.92	8.75	27.10	4.62	73.01	244.00	36.00	186.84	1114.90	296.76	1113.80
	9400.000	1110.00	1111.19	8.78	27.38	4.61	72.91	244.00	36.00	185.71	1115.46	300.40	1114.99
*	9401.000	1112.50	1114.10	10.13	41.11	4.14	69.13	244.00	36.00	197.04	1115.60	288.22	1114.91
	9500.000	1113.30	1114.46	8.67	26.41	4.66	73.27	244.00	36.00	196.25	1116.08	291.26	1115.95
	9600.000	1113.55	1114.74	8.73	26.98	4.63	73.06	244.00	36.00	196.00	1116.42	293.91	1116.90
	9700.000	1113.82	1115.01	8.75	27.10	4.62	73.01	244.00	36.00	195.90	1116.73	296.45	1117.81
	9800.000	1114.09	1115.28	8.78	27.38	4.61	72.91	244.00	36.00	191.95	1117.99	298.88	1118.70
	9900.000	1114.36	1115.56	8.80	27.57	4.60	72.85	244.00	36.00	189.45	1118.90	299.00	1119.01
*	9901.000	1116.93	1118.53	10.13	41.10	4.14	69.13	244.00	36.00	201.93	1118.81	288.97	1119.53
	10000.000	1117.73	1118.89	8.67	26.41	4.66	73.27	244.00	36.00	200.16	1119.53	289.04	1119.83
	10100.000	1117.98	1119.17	8.73	26.98	4.63	73.06	244.00	36.00	198.87	1120.13	293.40	1121.20
	10200.000	1118.25	1119.44	8.75	27.10	4.62	73.01	244.00	36.00	197.26	1120.82	295.78	1122.07
	10300.000	1118.52	1119.71	8.78	27.38	4.61	72.91	244.00	36.00	193.68	1121.99	298.31	1122.99
	10400.000	1118.79	1119.99	8.80	27.56	4.60	72.85	244.00	36.00	190.08	1123.17	300.45	1123.80
	10500.000	1119.06	1120.27	8.82	27.77	4.59	72.77	244.00	36.00	186.65	1124.31	303.07	1124.74
*	10501.000	1121.61	1123.21	10.14	41.18	4.14	69.11	244.00	36.00	198.25	1124.41	291.14	1124.76
	10600.000	1122.41	1123.57	8.66	26.38	4.66	73.28	244.00	36.00	194.72	1125.57	293.54	1125.64
	10700.000	1122.66	1123.85	8.73	26.97	4.63	73.06	244.00	36.00	191.16	1126.74	296.07	1126.55
	10800.000	1122.93	1124.12	8.75	27.08	4.62	73.02	244.00	36.00	189.64	1127.40	297.22	1127.12

	SECNO	CWSEL	EG	VCH	10*KS	DEPTH	TOPWID	CLSTA	BW	STCHL	XLBEL	STCHR	RBEL
	10900.000	1123.20	1124.39	8.78	27.37	4.61	72.92	244.00	36.00	189.86	1127.63	298.35	1127.68
	11000.000	1123.47	1124.67	8.80	27.56	4.60	72.85	244.00	36.00	188.86	1128.15	298.93	1128.10
*	11001.000	1126.01	1127.61	10.14	41.14	4.14	69.12	244.00	36.00	199.68	1128.45	288.44	1128.48
	11100.000	1126.81	1127.97	8.67	26.40	4.66	73.27	244.00	36.00	197.98	1129.15	289.65	1129.06
	11200.000	1127.06	1128.25	8.73	26.97	4.63	73.06	244.00	36.00	195.17	1130.14	290.66	1129.59
	11300.000	1127.33	1128.52	8.75	27.09	4.62	73.02	244.00	36.00	192.69	1131.04	296.75	1131.40
	11400.000	1127.60	1128.79	8.78	27.37	4.61	72.92	244.00	36.00	190.36	1131.90	301.14	1132.77
	11500.000	1127.87	1129.07	8.80	27.56	4.60	72.85	244.00	36.00	188.21	1132.72	304.67	1133.94
*	11501.000	1130.41	1132.01	10.13	41.10	4.14	69.13	244.00	36.00	200.41	1132.67	292.19	1133.82
*	11550.000	1130.83	1132.43	10.12	40.98	4.14	69.15	239.00	36.00	195.75	1133.00	287.94	1134.43
*	11650.000	1131.67	1133.27	10.12	40.98	4.14	69.15	202.00	36.00	113.00	1134.20	249.31	1134.86
*	11750.000	1132.84	1134.49	10.30	40.74	4.47	65.77	164.00	30.00	113.00	1134.90	202.95	1134.36
*	11825.000	1135.88	1137.31	9.88	29.51	6.88	136.62	.00	.01	113.00	1135.50	164.00	1135.20

CHANNEL IMPROVE, SUBCRIT

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	1634.000	.00	.00	.00	1044.21	2206.00	1048.65	1046.76	1048.98	20.03	4.61	478.46	492.87
	1748.000	114.00	.00	.00	1044.44	2206.00	1048.81	1047.38	1049.33	33.22	5.77	382.58	382.74
	1800.000	52.00	.00	.00	1044.54	2206.00	1048.92	1047.73	1049.56	42.63	6.43	342.95	337.85
	1900.000	100.00	.00	.00	1044.74	2206.00	1049.21	1048.52	1050.20	68.90	7.99	275.98	265.77
	1945.000	45.00	.00	.00	1044.83	2206.00	1049.38	1048.97	1050.62	88.84	8.96	246.18	234.05
*	2000.000	55.00	.00	.00	1044.94	2206.00	1049.84	1049.08	1050.86	21.97	8.12	271.68	470.62
	2100.000	100.00	.00	.00	1045.15	2206.00	1050.08	1049.29	1051.08	21.15	8.01	275.39	479.66
	2200.000	100.00	.00	.00	1045.35	2206.00	1050.30	1049.49	1051.29	21.06	8.00	275.79	480.66
	2300.000	100.00	.00	.00	1045.55	2206.00	1050.53	1049.69	1051.50	20.47	7.92	278.61	487.57
	2400.000	100.00	.00	.00	1045.75	2206.00	1050.73	1049.89	1051.71	20.47	7.92	278.60	487.55
	2500.000	100.00	.00	.00	1045.95	2206.00	1050.94	1050.09	1051.91	20.41	7.91	278.91	488.30
	2600.000	100.00	.00	.00	1046.15	2206.00	1051.15	1050.29	1052.11	20.32	7.90	279.36	489.42
	2700.000	100.00	.00	.00	1046.35	2206.00	1051.35	1050.49	1052.32	20.22	7.88	279.85	490.63
	2800.000	100.00	.00	.00	1046.55	2206.00	1051.56	1050.69	1052.52	20.13	7.87	280.29	491.70
	2900.000	100.00	.00	.00	1046.75	2206.00	1051.76	1050.89	1052.72	20.06	7.86	280.61	492.50
*	2901.000	1.00	.00	.00	1049.75	2206.00	1053.89	1053.89	1055.49	41.18	10.14	217.52	343.75
	3000.000	100.00	.00	.00	1050.03	2206.00	1054.69	1054.17	1055.85	26.38	8.66	254.59	429.47
	3145.000	145.00	.00	.00	1050.44	2206.00	1055.06	1054.58	1056.25	27.16	8.75	251.98	423.28
	3200.000	55.00	.00	.00	1050.59	2206.00	1055.21	1054.73	1056.40	27.16	8.75	251.98	423.28
	3300.000	100.00	.00	.00	1050.87	2206.00	1055.48	1055.01	1056.67	27.38	8.78	251.27	421.59
	3400.000	100.00	.00	.00	1051.15	2206.00	1055.75	1055.29	1056.95	27.54	8.80	250.76	420.39
*	3401.000	1.00	.00	.00	1054.15	2206.00	1058.27	1058.27	1059.89	41.78	10.19	216.42	341.28
	3500.000	100.00	.00	.00	1054.43	2206.00	1059.08	1058.58	1060.26	26.73	8.71	253.41	426.67
	3600.000	100.00	.00	.00	1054.71	2206.00	1059.36	1058.85	1060.53	26.52	8.68	254.13	428.39

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	3645.000	45.00	.00	.00	1054.84	2206.00	1059.47	1058.98	1060.65	26.66	8.70	253.67	427.28
	3700.000	55.00	.00	.00	1054.99	2206.00	1059.61	1059.13	1060.80	26.98	8.73	252.57	424.68
	3800.000	100.00	.00	.00	1055.27	2206.00	1059.88	1059.41	1061.07	27.31	8.77	251.50	422.14
*	3801.000	1.00	.00	.00	1058.27	2206.00	1062.66	1062.66	1063.93	31.41	9.15	273.29	393.63
	3900.000	100.00	.00	.00	1058.55	2206.00	1062.90	1062.68	1064.30	34.17	9.50	232.31	377.36
	4000.000	100.00	.00	.00	1058.83	2206.00	1063.39	1062.98	1064.63	28.58	8.91	247.48	412.65
	4100.000	100.00	.00	.00	1059.11	2206.00	1063.84	1063.14	1064.90	22.68	8.25	267.31	463.19
	4145.000	51.64	.00	.00	1059.25	2206.00	1064.19	1062.99	1065.02	15.28	7.29	302.80	564.41
	4150.000	5.00	.00	.00	1059.27	2206.00	1064.21	1062.97	1065.03	14.96	7.24	304.66	570.42
	4175.000	25.00	.00	.00	1059.34	2206.00	1064.36	1062.89	1065.09	12.55	6.86	321.60	622.67
*	4176.000	1.00	.00	.00	1062.35	2206.00	1065.91	1065.91	1067.51	41.01	10.14	217.54	344.49
*	4186.000	11.00	.00	.00	1062.40	2206.00	1066.46	1065.80	1067.65	13.75	8.77	254.73	594.82
*	4197.000	11.00	.00	.00	1062.50	2206.00	1066.22	1066.22	1068.09	25.42	11.00	200.62	437.57
*	4248.000	51.00	1069.00	1066.70	1062.70	2206.00	1068.38	.00	1069.18	6.64	7.18	307.67	856.00
	4300.000	52.00	.00	.00	1063.10	2206.00	1068.26	1067.28	1069.39	10.72	8.51	259.20	673.78
*	4350.000	50.00	.00	.00	1063.40	2206.00	1067.85	1067.85	1069.82	22.59	11.26	195.92	464.10
*	4400.000	50.00	.00	.00	1063.60	2206.00	1068.23	1068.23	1070.20	22.81	11.28	195.56	461.89
*	4450.000	50.00	.00	.00	1064.00	2206.00	1068.39	1068.39	1070.33	22.56	11.17	197.52	464.48
*	4500.000	50.00	.00	.00	1064.20	2206.00	1068.60	1068.60	1070.59	23.00	11.33	194.65	460.02
*	4550.000	50.00	.00	.00	1064.50	2206.00	1068.86	1068.86	1070.86	23.06	11.36	194.12	459.40
	4600.000	50.00	.00	.00	1064.70	2206.00	1069.71	1068.92	1071.02	12.67	9.17	240.63	619.66
	4645.000	45.00	.00	.00	1065.50	2206.00	1070.15	1069.43	1071.16	12.17	8.07	273.42	632.38
	4660.000	15.00	.00	.00	1065.00	2206.00	1070.26	1068.72	1071.20	8.56	7.78	283.55	754.00
	4712.000	52.00	1073.00	1070.30	1065.30	2206.00	1071.52	.00	1072.19	5.06	6.56	336.04	981.06
	4733.000	21.00	.00	.00	1065.40	2206.00	1071.77	1069.20	1072.26	3.32	5.85	483.59	1211.39
*	4739.000	6.00	.00	.00	1067.90	2206.00	1071.62	1071.62	1073.27	41.22	10.32	214.19	343.59

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	4750.000	11.00	.00	.00	1067.93	2206.00	1072.16	1071.60	1073.35	26.07	8.79	254.56	432.01
	4800.000	50.00	.00	.00	1068.05	2206.00	1072.60	1071.67	1073.49	18.78	7.58	293.01	509.10
	4900.000	100.00	.00	.00	1068.29	2206.00	1072.76	1071.91	1073.70	19.67	7.77	283.97	497.34
	5000.000	100.00	.00	.00	1068.53	2206.00	1072.94	1072.15	1073.91	20.64	7.90	279.38	485.59
	5100.000	100.00	.00	.00	1068.77	2206.00	1073.14	1072.39	1074.13	21.44	8.00	275.77	476.41
	5145.000	45.00	.00	.00	1068.87	2206.00	1073.23	1072.49	1074.23	21.54	8.01	275.33	475.28
	5200.000	55.00	.00	.00	1069.01	2206.00	1073.26	1072.71	1074.45	25.29	8.75	252.06	438.69
	5210.000	10.00	.00	.00	1069.03	2206.00	1073.27	1072.74	1074.49	25.82	8.87	248.60	434.10
*	5211.000	1.00	.00	.00	1071.67	2206.00	1075.39	1075.39	1077.05	40.76	10.32	213.80	345.55
*	5235.000	25.00	.00	.00	1072.00	2206.00	1075.86	1075.86	1077.81	25.51	11.21	196.80	436.73
*	5323.000	88.00	1080.00	1077.40	1072.90	2206.00	1078.00	.00	1079.12	10.67	8.49	259.91	675.45
	5350.000	27.00	.00	.00	1073.02	2206.00	1078.65	1076.84	1079.29	10.40	6.43	343.09	684.00
	5400.000	50.00	.00	.00	1073.16	2206.00	1078.58	1077.28	1079.40	14.56	7.27	303.47	578.05
	5500.000	100.00	.00	.00	1073.44	2206.00	1078.73	1077.58	1079.56	16.25	7.29	302.53	547.28
	5600.000	112.60	.00	.00	1073.75	2206.00	1078.87	1077.89	1079.78	18.45	7.63	289.12	513.59
	5700.000	100.00	.00	.00	1074.03	2206.00	1079.02	1078.17	1079.99	20.39	7.91	278.99	488.51
	5800.000	100.00	.00	.00	1074.31	2206.00	1079.19	1078.45	1080.22	22.20	8.15	270.70	468.23
	5900.000	100.00	.00	.00	1074.59	2206.00	1079.38	1078.73	1080.46	23.74	8.35	264.32	452.77
	6000.000	100.00	.00	.00	1074.87	2206.00	1079.60	1079.02	1080.72	24.99	8.50	259.55	441.32
*	6001.000	1.00	.00	.00	1077.87	2206.00	1082.01	1082.01	1083.61	41.02	10.13	217.84	344.45
	6100.000	100.00	.00	.00	1078.15	2206.00	1082.81	1082.29	1083.97	26.44	8.67	254.39	429.00
	6200.000	100.00	.00	.00	1078.43	2206.00	1083.06	1082.57	1084.25	27.01	8.74	252.49	424.49
	6300.000	100.00	.00	.00	1078.71	2206.00	1083.33	1082.85	1084.52	27.00	8.74	252.50	424.51
	6400.000	100.00	.00	.00	1078.99	2206.00	1083.59	1083.13	1084.79	27.38	8.78	251.28	421.61
*	6401.000	1.00	.00	.00	1081.99	2206.00	1086.13	1086.13	1087.73	41.13	10.14	217.62	343.96
	6500.000	100.00	.00	.00	1082.27	2206.00	1086.93	1086.42	1088.09	26.39	8.67	254.55	429.38

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	6600.000	100.00	.00	.00	1082.55	2206.00	1087.18	1086.69	1088.37	26.98	8.73	252.59	424.72
	6700.000	100.00	.00	.00	1082.83	2206.00	1087.45	1086.97	1088.64	27.09	8.75	252.21	423.83
	6800.000	100.00	.00	.00	1083.11	2206.00	1087.72	1087.25	1088.91	27.38	8.78	251.28	421.61
	6900.000	100.00	.00	.00	1083.39	2206.00	1087.99	1087.53	1089.19	27.56	8.80	250.69	420.23
*	6901.000	1.00	.00	.00	1086.39	2206.00	1090.53	1090.53	1092.13	41.13	10.14	217.62	343.96
	7000.000	100.00	.00	.00	1086.67	2206.00	1091.31	1090.82	1092.50	26.97	8.73	252.61	424.76
	7100.000	100.00	.00	.00	1086.95	2206.00	1091.59	1091.09	1092.77	26.76	8.71	253.33	426.48
	7200.000	100.00	.00	.00	1087.23	2206.00	1091.85	1091.37	1093.04	27.00	8.74	252.53	424.57
	7300.000	100.00	.00	.00	1087.51	2206.00	1092.12	1091.65	1093.31	27.36	8.78	251.33	421.74
	7400.000	100.00	.00	.00	1087.79	2206.00	1092.39	1091.93	1093.59	27.57	8.80	250.65	420.12
	7500.000	100.00	.00	.00	1088.07	2206.00	1092.66	1092.21	1093.87	27.80	8.83	249.93	418.42
*	7501.000	1.00	.00	.00	1091.07	2206.00	1095.21	1095.21	1096.81	41.17	10.14	217.55	343.81
	7600.000	100.00	.00	.00	1091.35	2206.00	1096.01	1095.50	1097.17	26.38	8.66	254.60	429.49
	7700.000	100.00	.00	.00	1091.63	2206.00	1096.26	1095.77	1097.45	26.97	8.73	252.62	424.78
	7800.000	100.00	.00	.00	1091.91	2206.00	1096.53	1096.05	1097.72	27.09	8.75	252.23	423.87
	7875.000	75.00	.00	.00	1092.12	2206.00	1096.73	1096.26	1097.92	27.24	8.76	251.72	422.67
*	7876.000	1.00	.00	.00	1095.12	2206.00	1099.22	1099.22	1100.86	42.79	10.28	214.62	337.25
	7900.000	25.00	.00	.00	1095.19	2206.00	1099.73	1099.34	1100.98	29.17	8.98	245.70	408.47
	8000.000	100.00	.00	.00	1095.47	2206.00	1100.06	1099.61	1101.27	27.96	8.84	249.41	417.20
	8100.000	100.00	.00	.00	1095.75	2206.00	1100.34	1099.89	1101.55	27.97	8.85	249.38	417.12
	8200.000	100.00	.00	.00	1096.03	2206.00	1100.62	1100.17	1101.83	27.98	8.85	249.33	417.01
	8300.000	100.00	.00	.00	1096.31	2206.00	1100.90	1100.45	1102.11	28.00	8.85	249.29	416.91
	8400.000	100.00	.00	.00	1096.59	2206.00	1101.18	1100.73	1102.39	28.01	8.85	249.26	416.85
	8500.000	100.00	.00	.00	1096.87	2206.00	1101.46	1101.01	1102.67	28.01	8.85	249.25	416.83
*	8501.000	1.00	.00	.00	1099.87	2206.00	1104.01	1104.01	1105.61	41.14	10.14	217.60	343.92
	8600.000	100.00	.00	.00	1100.15	2206.00	1104.81	1104.30	1105.97	26.40	8.67	254.54	429.36

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	8700.000	100.00	.00	.00	1100.43	2206.00	1105.06	1104.57	1106.25	26.97	8.73	252.62	424.80
	8800.000	100.00	.00	.00	1100.71	2206.00	1105.33	1104.85	1106.52	27.09	8.75	252.23	423.87
	8900.000	100.00	.00	.00	1100.99	2206.00	1105.60	1105.13	1106.79	27.38	8.78	251.27	421.59
	9000.000	100.00	.00	.00	1101.27	2206.00	1105.87	1105.41	1107.07	27.56	8.80	250.67	420.18
*	9001.000	1.00	.00	.00	1104.27	2206.00	1108.41	1108.41	1110.01	41.10	10.13	217.68	344.09
	9100.000	100.00	.00	.00	1104.55	2206.00	1109.21	1108.70	1110.37	26.41	8.67	254.52	429.30
	9200.000	100.00	.00	.00	1104.83	2206.00	1109.46	1108.97	1110.65	26.98	8.73	252.59	424.72
	9300.000	100.00	.00	.00	1105.11	2206.00	1109.73	1109.25	1110.92	27.10	8.75	252.20	423.79
	9400.000	100.00	.00	.00	1105.39	2206.00	1110.00	1109.53	1111.19	27.38	8.78	251.25	421.55
*	9401.000	1.00	.00	.00	1108.36	2206.00	1112.50	1112.50	1114.10	41.11	10.13	217.67	344.07
	9500.000	100.00	.00	.00	1108.64	2206.00	1113.30	1112.79	1114.46	26.41	8.67	254.52	429.30
	9600.000	100.00	.00	.00	1108.92	2206.00	1113.55	1113.06	1114.74	26.98	8.73	252.59	424.72
	9700.000	100.00	.00	.00	1109.20	2206.00	1113.82	1113.34	1115.01	27.10	8.75	252.20	423.79
	9800.000	100.00	.00	.00	1109.48	2206.00	1114.09	1113.62	1115.28	27.38	8.78	251.25	421.55
	9900.000	100.00	.00	.00	1109.76	2206.00	1114.36	1113.90	1115.56	27.57	8.80	250.66	420.16
*	9901.000	1.00	.00	.00	1112.79	2206.00	1116.93	1116.93	1118.53	41.10	10.13	217.68	344.09
	10000.000	100.00	.00	.00	1113.07	2206.00	1117.73	1117.22	1118.89	26.41	8.67	254.52	429.30
	10100.000	100.00	.00	.00	1113.35	2206.00	1117.98	1117.49	1119.17	26.98	8.73	252.59	424.72
	10200.000	100.00	.00	.00	1113.63	2206.00	1118.25	1117.77	1119.44	27.10	8.75	252.20	423.79
	10300.000	100.00	.00	.00	1113.91	2206.00	1118.52	1118.05	1119.71	27.38	8.78	251.25	421.55
	10400.000	100.00	.00	.00	1114.19	2206.00	1118.79	1118.33	1119.99	27.56	8.80	250.67	420.18
	10500.000	100.00	.00	.00	1114.47	2206.00	1119.06	1118.61	1120.27	27.77	8.82	250.01	418.61
*	10501.000	1.00	.00	.00	1117.47	2206.00	1121.61	1121.61	1123.21	41.18	10.14	217.53	343.77
	10600.000	100.00	.00	.00	1117.75	2206.00	1122.41	1121.90	1123.57	26.38	8.66	254.60	429.49
	10700.000	100.00	.00	.00	1118.03	2206.00	1122.66	1122.17	1123.85	26.97	8.73	252.62	424.78
	10800.000	100.00	.00	.00	1118.31	2206.00	1122.93	1122.45	1124.12	27.08	8.75	252.24	423.89

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	10900.000	100.00	.00	.00	1118.59	2206.00	1123.20	1122.73	1124.39	27.37	8.78	251.30	421.66
	11000.000	100.00	.00	.00	1118.87	2206.00	1123.47	1123.01	1124.67	27.56	8.80	250.70	420.25
*	11001.000	1.00	.00	.00	1121.87	2206.00	1126.01	1126.01	1127.61	41.14	10.14	217.61	343.94
	11100.000	100.00	.00	.00	1122.15	2206.00	1126.81	1126.30	1127.97	26.40	8.67	254.53	429.32
	11200.000	100.00	.00	.00	1122.43	2206.00	1127.06	1126.57	1128.25	26.97	8.73	252.61	424.78
	11300.000	100.00	.00	.00	1122.71	2206.00	1127.33	1126.85	1128.52	27.09	8.75	252.23	423.87
	11400.000	100.00	.00	.00	1122.99	2206.00	1127.60	1127.13	1128.79	27.37	8.78	251.29	421.64
	11500.000	100.00	.00	.00	1123.27	2206.00	1127.87	1127.41	1129.07	27.56	8.80	250.70	420.25
*	11501.000	1.00	.00	.00	1126.27	2206.00	1130.41	1130.41	1132.01	41.10	10.13	217.68	344.11
*	11550.000	50.00	.00	.00	1126.69	2206.00	1130.83	1130.83	1132.43	40.98	10.12	217.89	344.59
*	11650.000	100.00	.00	.00	1127.53	2206.00	1131.67	1131.67	1133.27	40.98	10.12	217.89	344.59
*	11750.000	100.00	.00	.00	1128.37	2206.00	1132.84	1132.84	1134.49	40.74	10.30	214.12	345.62
*	11825.000	75.00	.00	.00	1129.00	2206.00	1135.88	1135.88	1137.31	29.51	9.88	278.58	406.06

CHANNEL IMPROVE, SUBCRIT

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	1634.000	2206.00	1048.65	.00	.00	.00	125.52	.00
	1748.000	2206.00	1048.81	.00	.16	.00	110.15	114.00
	1800.000	2206.00	1048.92	.00	.11	.00	95.96	52.00
	1900.000	2206.00	1049.21	.00	.29	.00	79.70	100.00
	1945.000	2206.00	1049.38	.00	.17	.00	72.35	45.00
*	2000.000	2206.00	1049.84	.00	.46	.00	75.12	55.00
	2100.000	2206.00	1050.08	.00	.25	.00	75.51	100.00
	2200.000	2206.00	1050.30	.00	.21	.00	75.56	100.00
	2300.000	2206.00	1050.53	.00	.23	.00	75.85	100.00
	2400.000	2206.00	1050.73	.00	.20	.00	75.85	100.00
	2500.000	2206.00	1050.94	.00	.21	.00	75.88	100.00
	2600.000	2206.00	1051.15	.00	.21	.00	75.93	100.00
	2700.000	2206.00	1051.35	.00	.21	.00	75.98	100.00
	2800.000	2206.00	1051.56	.00	.20	.00	76.03	100.00
	2900.000	2206.00	1051.76	.00	.20	.00	76.06	100.00
*	2901.000	2206.00	1053.89	.00	2.13	.00	69.11	1.00
	3000.000	2206.00	1054.69	.00	.80	.00	73.28	100.00
	3145.000	2206.00	1055.06	.00	.37	.00	72.99	145.00
	3200.000	2206.00	1055.21	.00	.15	.00	72.99	55.00
	3300.000	2206.00	1055.48	.00	.27	.00	72.91	100.00
	3400.000	2206.00	1055.75	.00	.27	.00	72.86	100.00
*	3401.000	2206.00	1058.27	.00	2.52	.00	68.98	1.00
	3500.000	2206.00	1059.08	.00	.81	.00	73.15	100.00
	3600.000	2206.00	1059.36	.00	.27	.00	73.23	100.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	3645.000	2206.00	1059.47	.00	.12	.00	73.18	45.00
	3700.000	2206.00	1059.61	.00	.14	.00	73.06	55.00
	3800.000	2206.00	1059.88	.00	.26	.00	72.94	100.00
*	3801.000	2206.00	1062.66	.00	2.78	.00	144.02	1.00
	3900.000	2206.00	1062.90	.00	.24	.00	70.80	100.00
	4000.000	2206.00	1063.39	.00	.49	.00	72.50	100.00
	4100.000	2206.00	1063.84	.00	.45	.00	73.79	100.00
	4145.000	2206.00	1064.19	.00	.35	.00	74.42	51.64
	4150.000	2206.00	1064.21	.00	.02	.00	74.30	5.00
	4175.000	2206.00	1064.36	.00	.14	.00	74.09	25.00
*	4176.000	2206.00	1065.91	.00	1.55	.00	68.24	1.00
*	4186.000	2206.00	1066.46	.00	.55	.00	69.35	11.00
*	4197.000	2206.00	1066.22	.00	-.24	.00	53.99	11.00
*	4248.000	2206.00	1068.38	.00	2.16	.00	58.22	51.00
	4300.000	2206.00	1068.26	.00	-.12	.00	59.96	52.00
*	4350.000	2206.00	1067.85	.00	-.41	.00	50.04	50.00
*	4400.000	2206.00	1068.23	.00	.38	.00	50.11	50.00
*	4450.000	2206.00	1068.39	.00	.17	.00	50.96	50.00
*	4500.000	2206.00	1068.60	.00	.21	.00	49.22	50.00
*	4550.000	2206.00	1068.86	.00	.26	.00	49.07	50.00
	4600.000	2206.00	1069.71	.00	.85	.00	54.55	50.00
	4645.000	2206.00	1070.15	.00	.44	.00	74.26	45.00
	4660.000	2206.00	1070.26	.00	.11	.00	53.99	15.00
	4712.000	2206.00	1071.52	.00	1.27	.00	54.00	52.00
	4733.000	2206.00	1071.77	.00	.25	.00	126.10	21.00
*	4739.000	2206.00	1071.62	.00	-.15	.00	73.21	6.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	4750.000	2206.00	1072.16	.00	.54	.00	87.98	11.00
	4800.000	2206.00	1072.60	.00	.45	.00	90.09	50.00
	4900.000	2206.00	1072.76	.00	.16	.00	76.86	100.00
	5000.000	2206.00	1072.94	.00	.18	.00	76.50	100.00
	5100.000	2206.00	1073.14	.00	.19	.00	76.22	100.00
	5145.000	2206.00	1073.23	.00	.09	.00	76.18	45.00
	5200.000	2206.00	1073.26	.00	.03	.00	68.43	55.00
	5210.000	2206.00	1073.27	.00	.01	.00	67.00	10.00
*	5211.000	2206.00	1075.39	.00	2.12	.00	64.89	1.00
*	5235.000	2206.00	1075.86	.00	.47	.00	50.99	25.00
*	5323.000	2206.00	1078.00	.00	2.14	.00	50.99	88.00
	5350.000	2206.00	1078.65	.00	.65	.00	76.03	27.00
	5400.000	2206.00	1078.58	.00	-.06	.00	70.69	50.00
	5500.000	2206.00	1078.73	.00	.15	.00	78.34	100.00
	5600.000	2206.00	1078.87	.00	.14	.00	76.95	112.60
	5700.000	2206.00	1079.02	.00	.15	.00	75.89	100.00
	5800.000	2206.00	1079.19	.00	.17	.00	75.01	100.00
	5900.000	2206.00	1079.38	.00	.19	.00	74.33	100.00
	6000.000	2206.00	1079.60	.00	.22	.00	73.82	100.00
*	6001.000	2206.00	1082.01	.00	2.41	.00	69.15	1.00
	6100.000	2206.00	1082.81	.00	.79	.00	73.25	100.00
	6200.000	2206.00	1083.06	.00	.26	.00	73.05	100.00
	6300.000	2206.00	1083.33	.00	.27	.00	73.05	100.00
	6400.000	2206.00	1083.59	.00	.26	.00	72.91	100.00
*	6401.000	2206.00	1086.13	.00	2.54	.00	69.12	1.00
	6500.000	2206.00	1086.93	.00	.80	.00	73.27	100.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	6600.000	2206.00	1087.18	.00	.25	.00	73.06	100.00
	6700.000	2206.00	1087.45	.00	.27	.00	73.02	100.00
	6800.000	2206.00	1087.72	.00	.27	.00	72.91	100.00
	6900.000	2206.00	1087.99	.00	.27	.00	72.85	100.00
*	6901.000	2206.00	1090.53	.00	2.54	.00	69.12	1.00
	7000.000	2206.00	1091.31	.00	.78	.00	73.06	100.00
	7100.000	2206.00	1091.59	.00	.28	.00	73.14	100.00
	7200.000	2206.00	1091.85	.00	.26	.00	73.05	100.00
	7300.000	2206.00	1092.12	.00	.26	.00	72.92	100.00
	7400.000	2206.00	1092.39	.00	.27	.00	72.84	100.00
	7500.000	2206.00	1092.66	.00	.27	.00	72.77	100.00
*	7501.000	2206.00	1095.21	.00	2.55	.00	69.11	1.00
	7600.000	2206.00	1096.01	.00	.80	.00	73.28	100.00
	7700.000	2206.00	1096.26	.00	.25	.00	73.06	100.00
	7800.000	2206.00	1096.53	.00	.27	.00	73.02	100.00
	7875.000	2206.00	1096.73	.00	.20	.00	72.96	75.00
*	7876.000	2206.00	1099.22	.00	2.49	.00	68.77	1.00
	7900.000	2206.00	1099.73	.00	.52	.00	72.30	25.00
	8000.000	2206.00	1100.06	.00	.33	.00	72.71	100.00
	8100.000	2206.00	1100.34	.00	.28	.00	72.71	100.00
	8200.000	2206.00	1100.62	.00	.28	.00	72.70	100.00
	8300.000	2206.00	1100.90	.00	.28	.00	72.70	100.00
	8400.000	2206.00	1101.18	.00	.28	.00	72.69	100.00
	8500.000	2206.00	1101.46	.00	.28	.00	72.69	100.00
*	8501.000	2206.00	1104.01	.00	2.55	.00	69.12	1.00
	8600.000	2206.00	1104.81	.00	.80	.00	73.27	100.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	8700.000	2206.00	1105.06	.00	.25	.00	73.06	100.00
	8800.000	2206.00	1105.33	.00	.27	.00	73.02	100.00
	8900.000	2206.00	1105.60	.00	.27	.00	72.91	100.00
	9000.000	2206.00	1105.87	.00	.27	.00	72.85	100.00
*	9001.000	2206.00	1108.41	.00	2.54	.00	69.13	1.00
	9100.000	2206.00	1109.21	.00	.80	.00	73.27	100.00
	9200.000	2206.00	1109.46	.00	.25	.00	73.06	100.00
	9300.000	2206.00	1109.73	.00	.27	.00	73.01	100.00
	9400.000	2206.00	1110.00	.00	.27	.00	72.91	100.00
*	9401.000	2206.00	1112.50	.00	2.51	.00	69.13	1.00
	9500.000	2206.00	1113.30	.00	.80	.00	73.27	100.00
	9600.000	2206.00	1113.55	.00	.25	.00	73.06	100.00
	9700.000	2206.00	1113.82	.00	.27	.00	73.01	100.00
	9800.000	2206.00	1114.09	.00	.27	.00	72.91	100.00
	9900.000	2206.00	1114.36	.00	.27	.00	72.85	100.00
*	9901.000	2206.00	1116.93	.00	2.57	.00	69.13	1.00
	10000.000	2206.00	1117.73	.00	.80	.00	73.27	100.00
	10100.000	2206.00	1117.98	.00	.25	.00	73.06	100.00
	10200.000	2206.00	1118.25	.00	.27	.00	73.01	100.00
	10300.000	2206.00	1118.52	.00	.27	.00	72.91	100.00
	10400.000	2206.00	1118.79	.00	.27	.00	72.85	100.00
	10500.000	2206.00	1119.06	.00	.27	.00	72.77	100.00
*	10501.000	2206.00	1121.61	.00	2.55	.00	69.11	1.00
	10600.000	2206.00	1122.41	.00	.80	.00	73.28	100.00
	10700.000	2206.00	1122.66	.00	.25	.00	73.06	100.00
	10800.000	2206.00	1122.93	.00	.27	.00	73.02	100.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	10900.000	2206.00	1123.20	.00	.27	.00	72.92	100.00
	11000.000	2206.00	1123.47	.00	.27	.00	72.85	100.00
*	11001.000	2206.00	1126.01	.00	2.54	.00	69.12	1.00
	11100.000	2206.00	1126.81	.00	.80	.00	73.27	100.00
	11200.000	2206.00	1127.06	.00	.25	.00	73.06	100.00
	11300.000	2206.00	1127.33	.00	.27	.00	73.02	100.00
	11400.000	2206.00	1127.60	.00	.27	.00	72.92	100.00
	11500.000	2206.00	1127.87	.00	.27	.00	72.85	100.00
*	11501.000	2206.00	1130.41	.00	2.54	.00	69.13	1.00
*	11550.000	2206.00	1130.83	.00	.42	.00	69.15	50.00
*	11650.000	2206.00	1131.67	.00	.84	.00	69.15	100.00
*	11750.000	2206.00	1132.84	.00	1.17	.00	65.77	100.00
*	11825.000	2206.00	1135.88	.00	3.04	.00	136.62	75.00

SUMMARY OF ERRORS AND SPECIAL NOTES

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WARNING SECNO=   2000.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=   2901.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   2901.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=   3401.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   3401.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

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CAUTION SECNO=   4176.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
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WARNING SECNO=   4186.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=   4197.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
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CAUTION SECNO=   4248.000  PROFILE=  1  HYDRAULIC JUMP D.S.
WARNING SECNO=   4248.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=   4350.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
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WARNING SECNO=   5323.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=   6001.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
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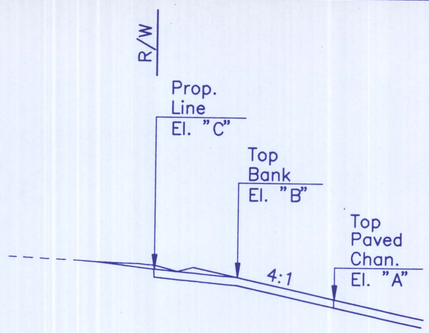
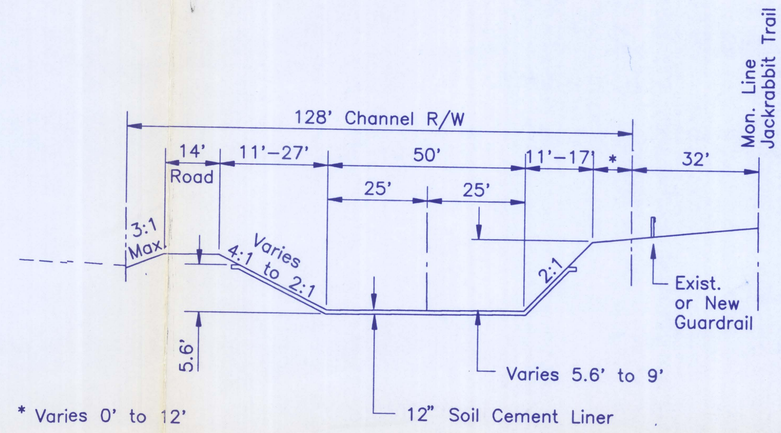


℄ INLET SECTION

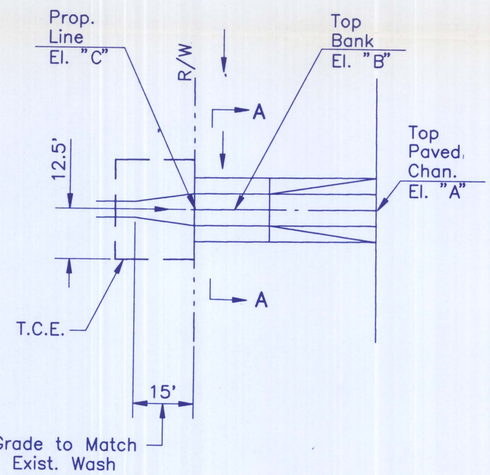
EXISTING WASHES				
Sta.	El."A"	El."B"	El."C"	Width
67+90	89.08	90.9	91.0	8'
73+70	93.70	93.9	94.0	8'
75+40	97.18	96.9	97.0	8'
78+00	97.91	98.4	98.5	8'
83+50	02.45	02.9	03.0	8'
88+60	06.87	06.9	07.0	8'
91+00	10.55	10.0	10.1	16'
97+00	15.23	15.5	15.6	8'
106+70	23.94	25.4	25.5	8'
111+20	28.20	28.2	28.3	8'
OTHERS				
28+00	53.5	54.90	55.0	8'
33+00	56.9	58.40	58.5	8'
37+50	61.3	62.40	62.5	8'
47+30	71.4	68.00	68.1	Ditch
53+40	79.0	75.00	75.1	Ditch
58+00	80.8	81.40	81.5	8'
63+00	84.7	85.50	85.6	8'



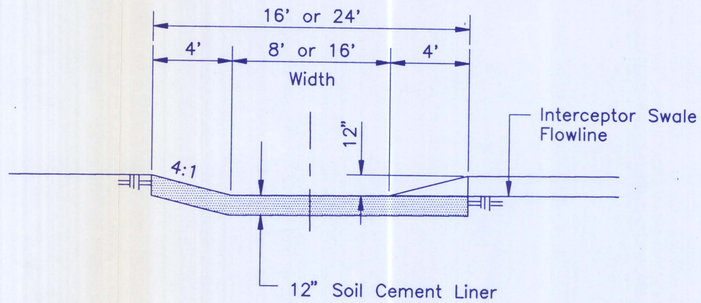
* Varies 0' to 12'

TYPICAL SECTION

INTERIM CHANNEL STA. 47+39 TO STA. 52+10

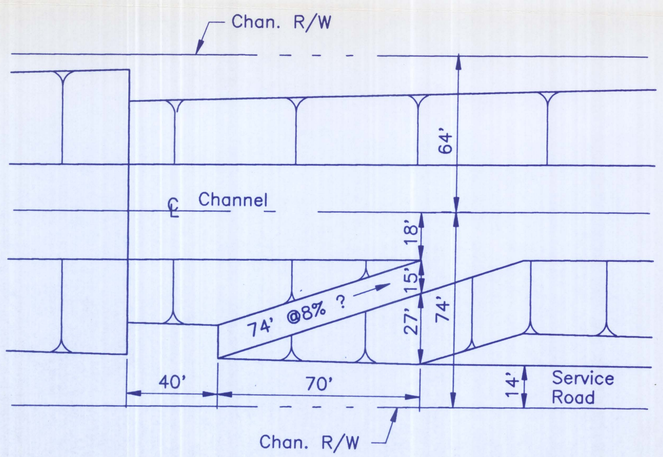


PLAN

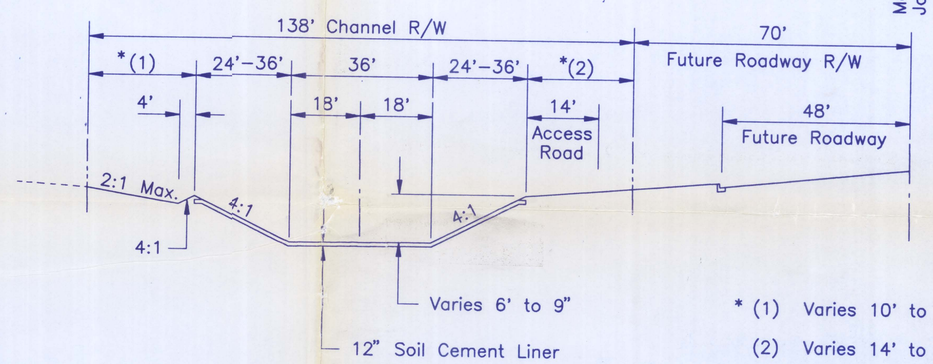


SECTION A–A

SIDE INLET DETAIL



ACCESS RAMP DETAIL



* (1) Varies 10' to 22'

(2) Varies 14' to 26"

TYPICAL SECTION

FLOOD CONTROL DISTRICT RECEIVED
JUL 30 '93
CHIEF
DEP
ADMIN
ENGINEER
C & C
ENGR.
REMARKS

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WHITE TANKS #4 FLOOD RETENTION STRUCTURE INLET IMPROVEMENTS

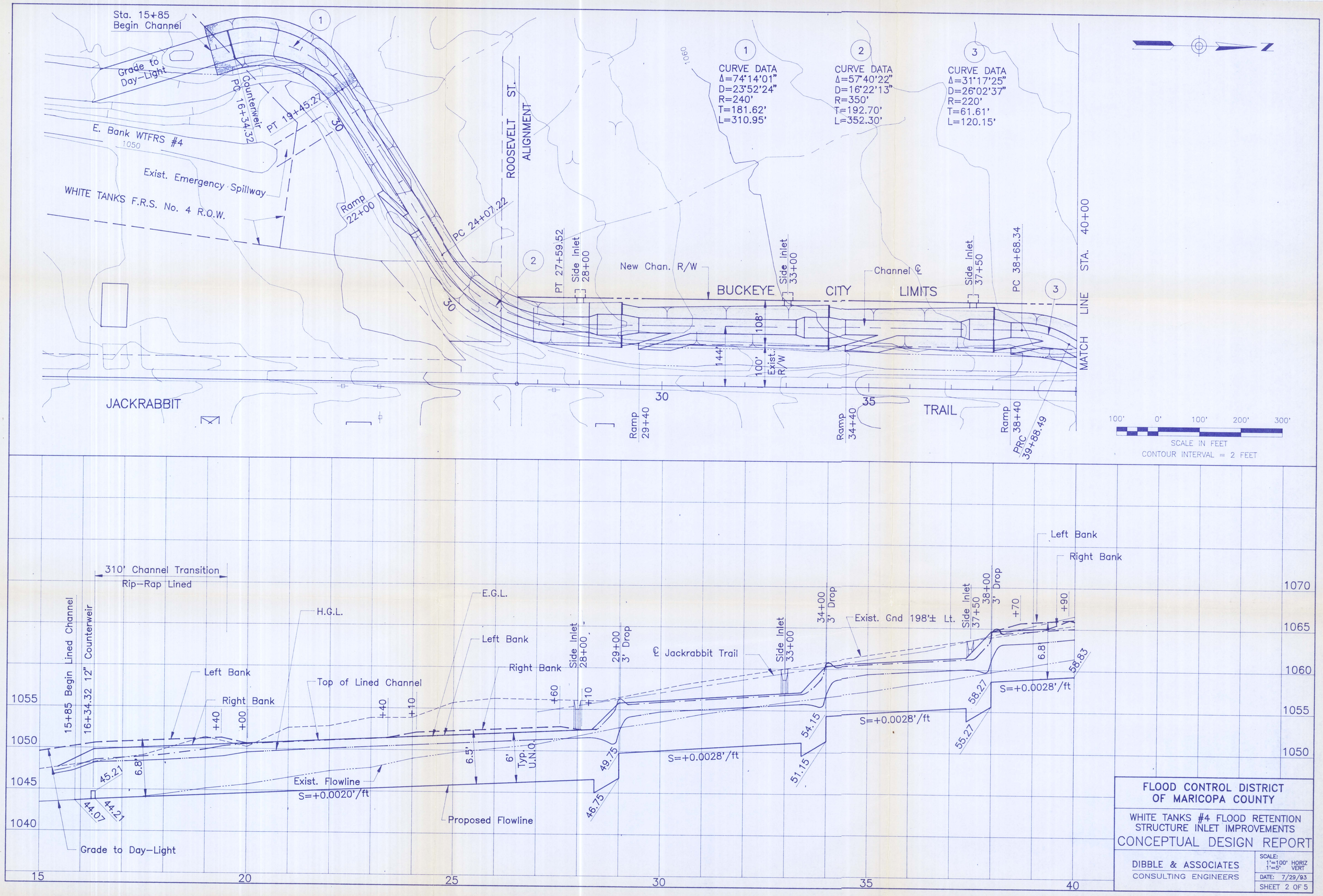
CONCEPTUAL DESIGN REPORT

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

SCALE: 1'=100' HORIZ 1'=5' VERT

DATE: 7/29/93

SHEET 1 OF 5



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WHITE TANKS #4 FLOOD RETENTION STRUCTURE INLET IMPROVEMENTS

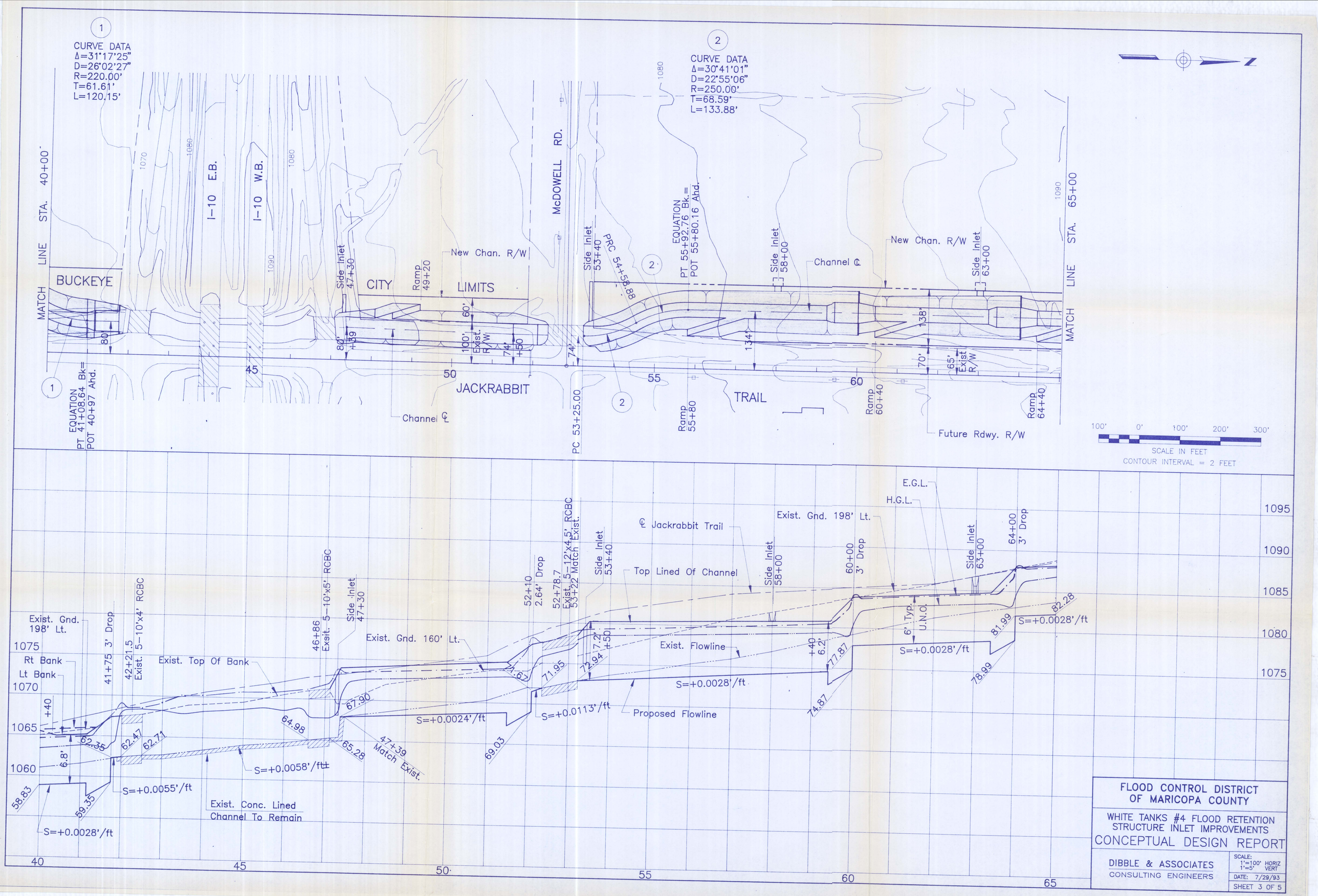
CONCEPTUAL DESIGN REPORT

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

SCALE: 1"=100' HORIZ, 1"=5' VERT

DATE: 7/29/93

SHEET 2 OF 5



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WHITE TANKS #4 FLOOD RETENTION STRUCTURE INLET IMPROVEMENTS

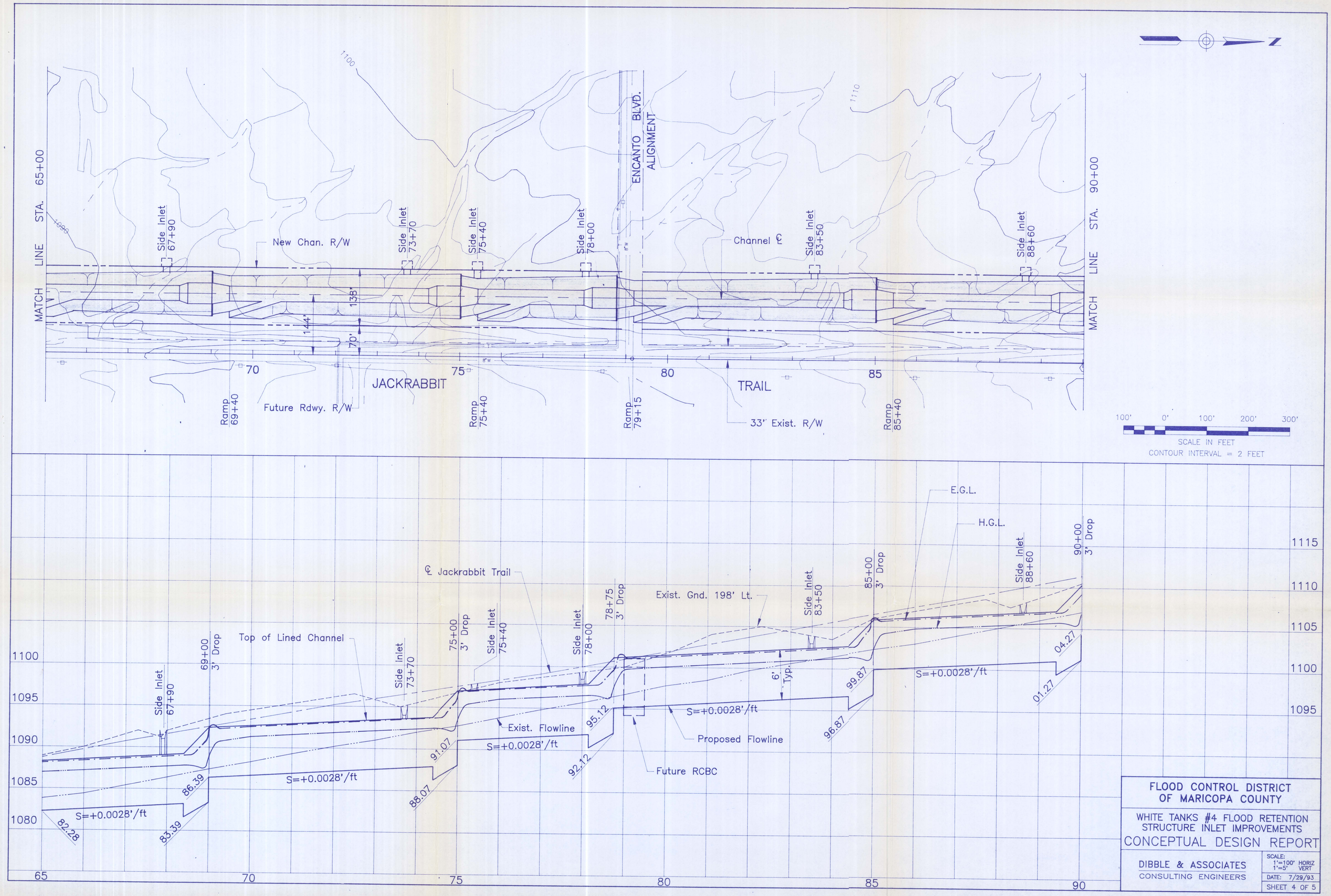
CONCEPTUAL DESIGN REPORT

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

SCALE: 1"=100' HORIZ 1"=5' VERT

DATE: 7/29/93

SHEET 3 OF 5



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WHITE TANKS #4 FLOOD RETENTION STRUCTURE INLET IMPROVEMENTS

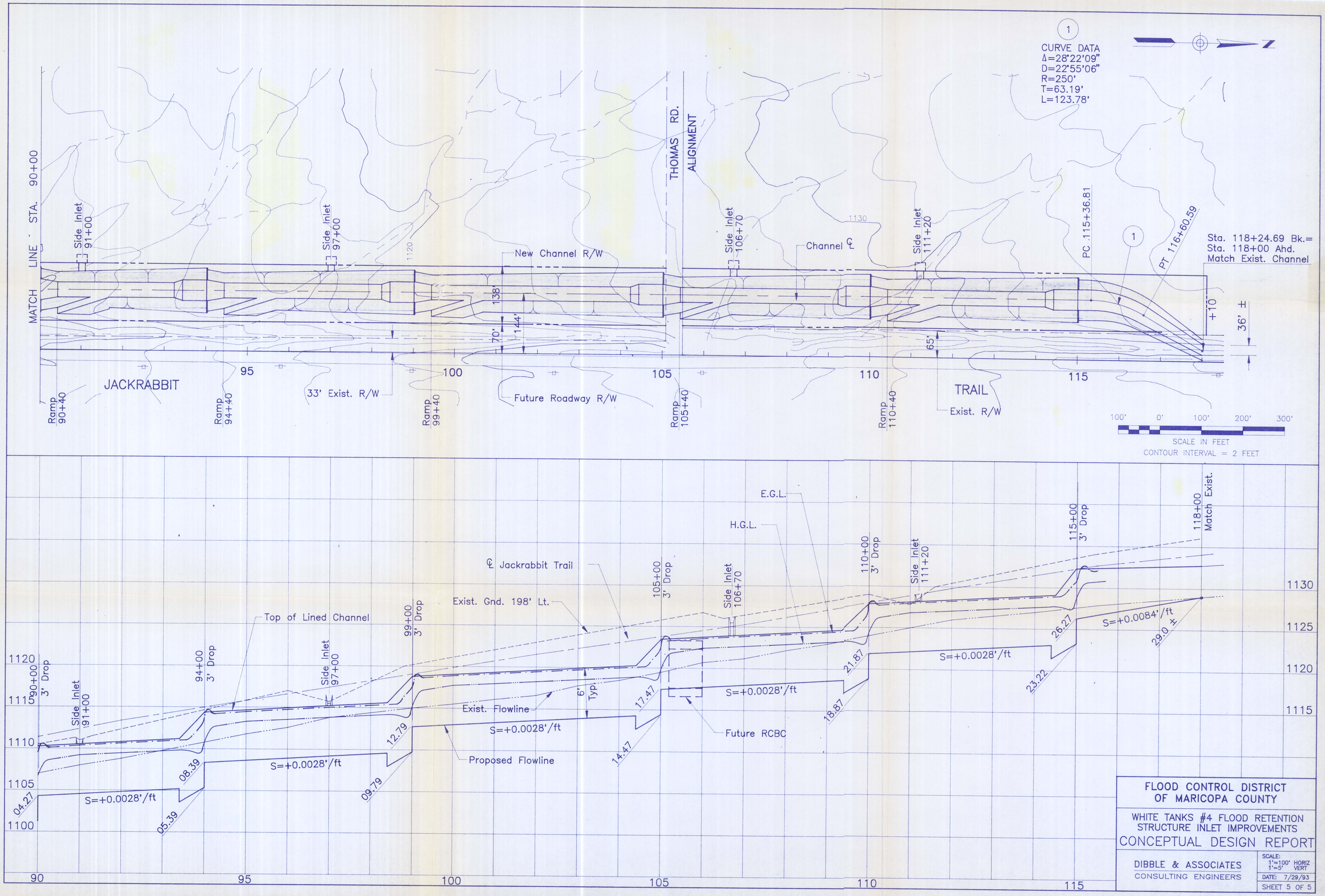
CONCEPTUAL DESIGN REPORT

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

SCALE: 1'=100' HORIZ 1'=5' VERT

DATE: 7/29/93

SHEET 4 OF 5



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

WHITE TANKS #4 FLOOD RETENTION
STRUCTURE INLET IMPROVEMENTS

CONCEPTUAL DESIGN REPORT

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

SCALE: 1'=100' HORIZ 1'=5' VERT

DATE: 7/29/93

SHEET 5 OF 5