Granite Reef Wash Drainage Study
& Preliminary Design Improvements Project

Project No. F0201
Contract No. 2006-227-COS

Drainage Design Report – Volume 2

March 7, 2008

Prepared for:

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C. Hydraulic Analysis - Pima Road Conduit (PRC) Alternative

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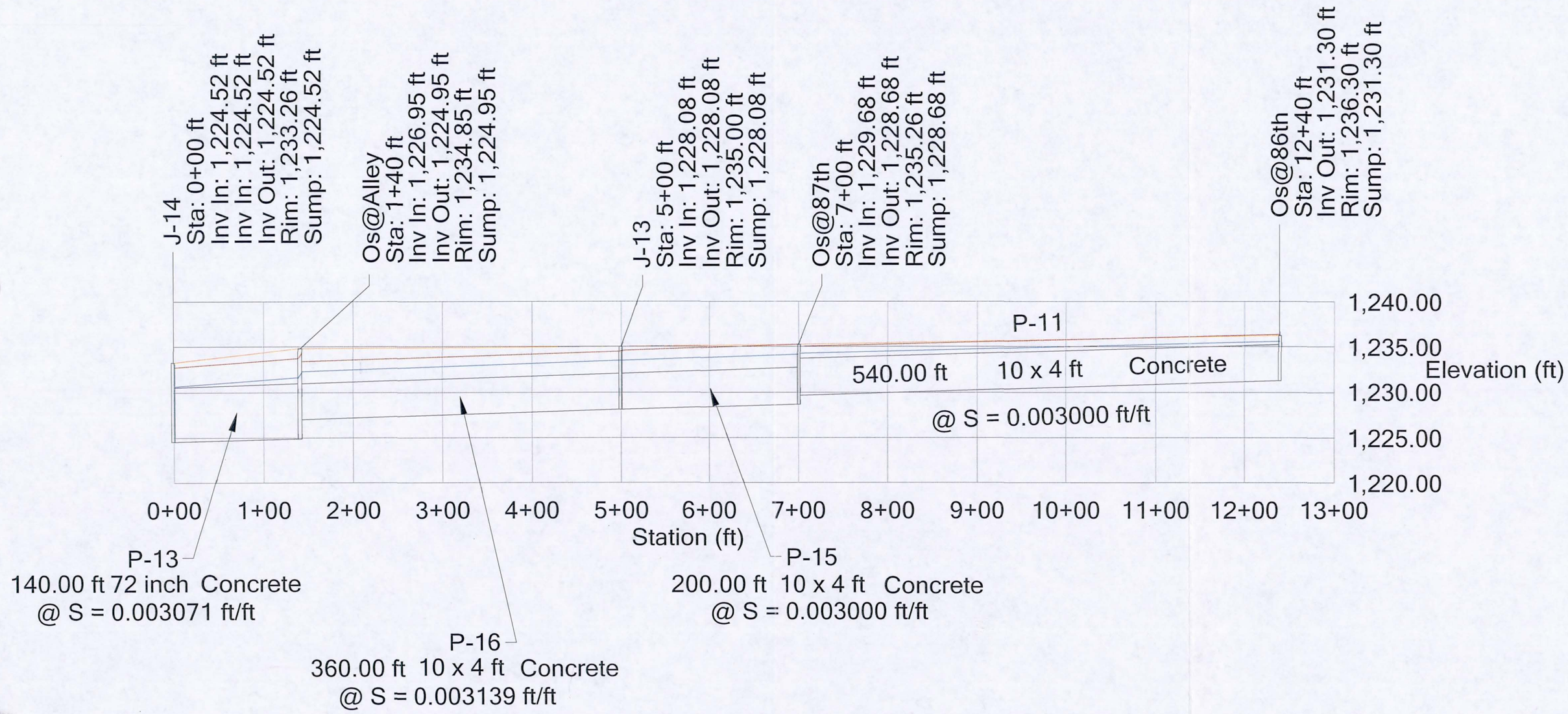
1. StormCAD Analysis

Osborn Road



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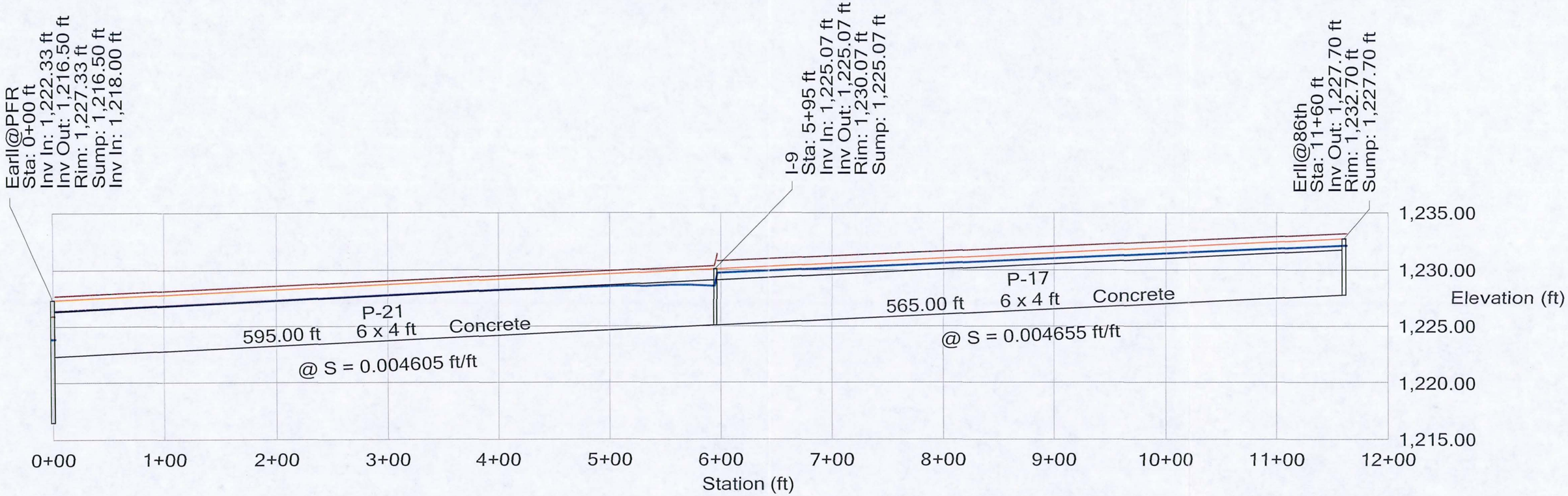
Earll Drive



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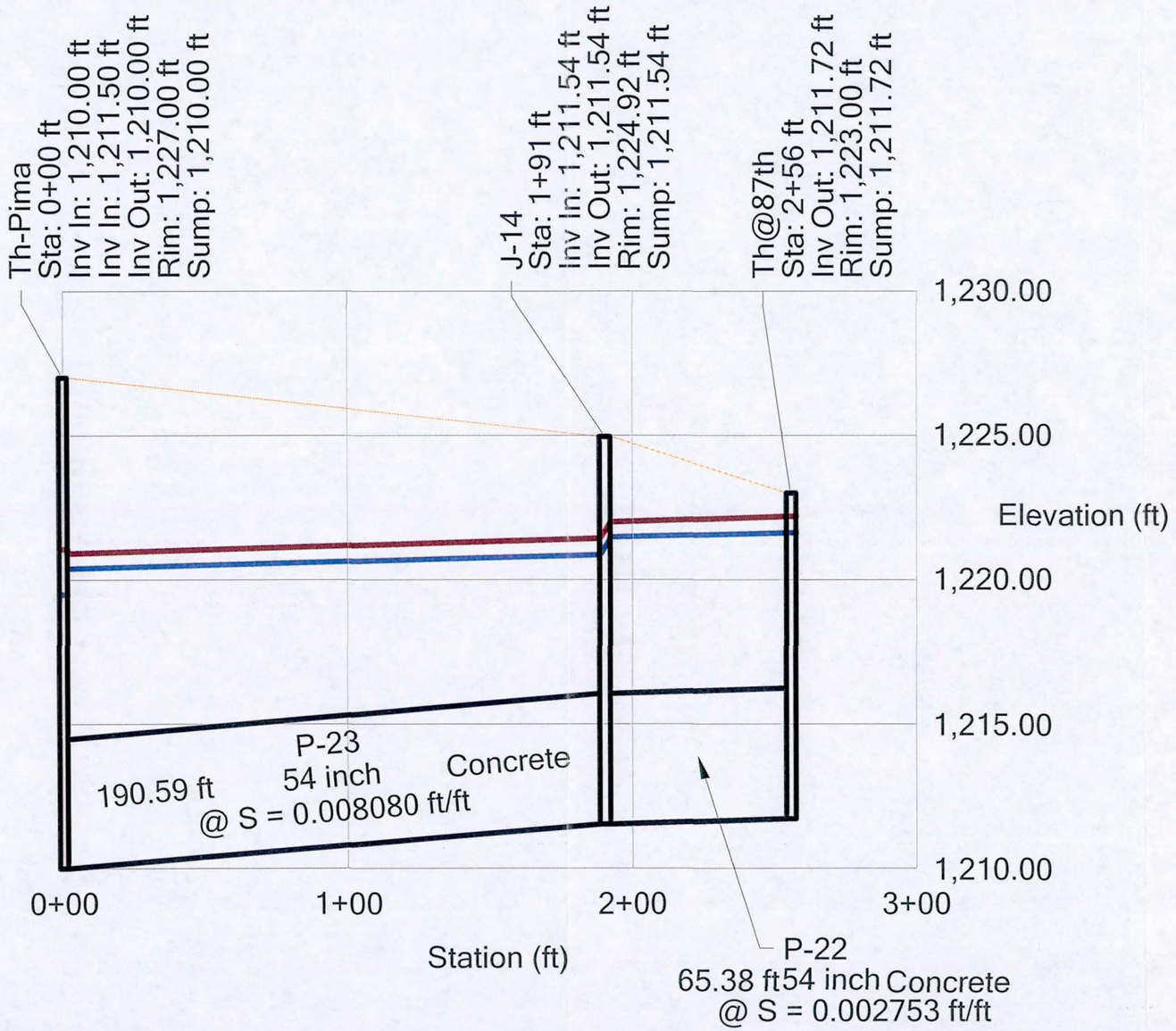
Profile: Thomas



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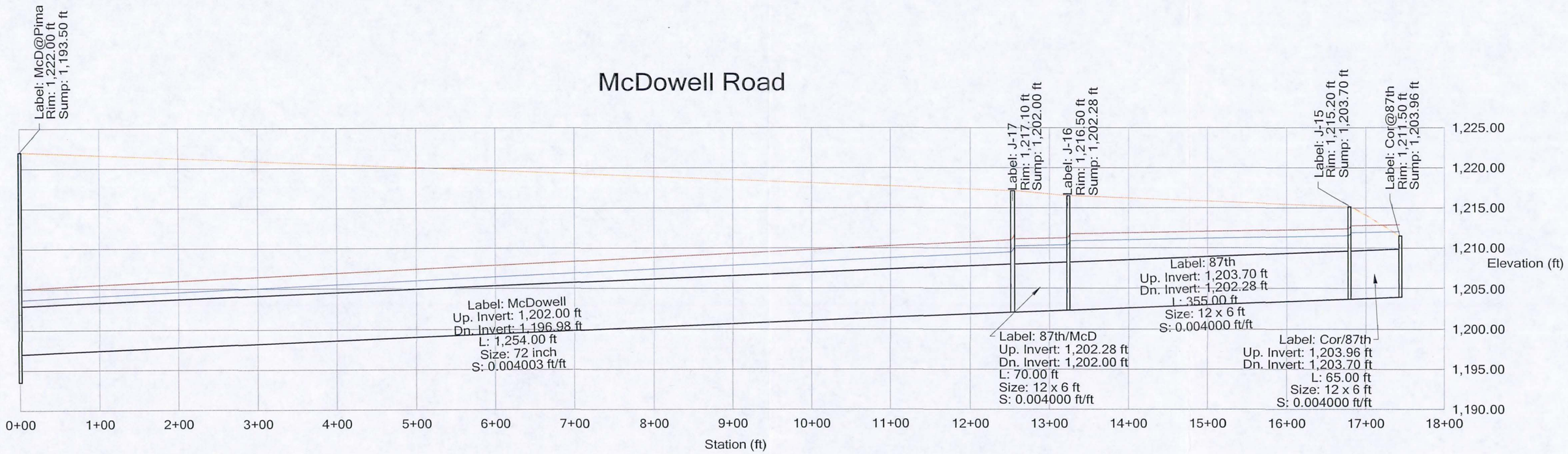
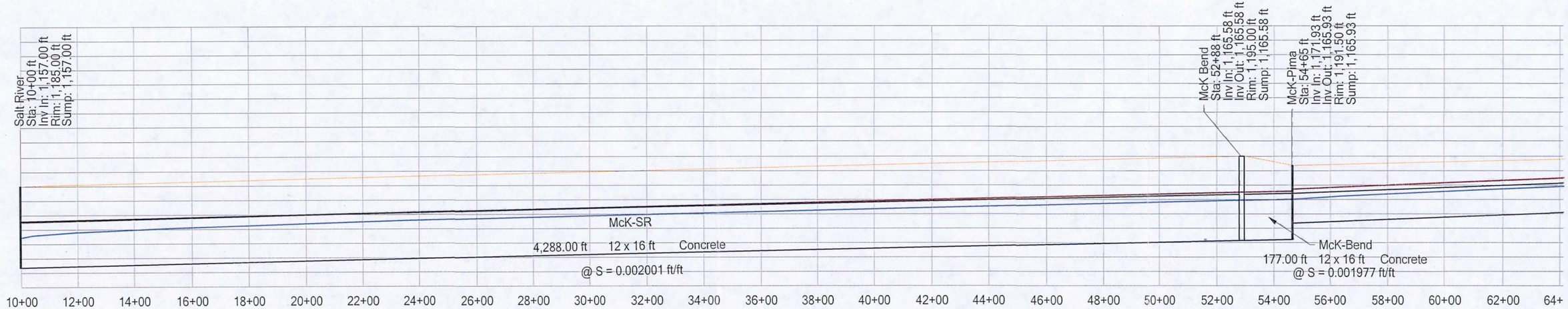
Profile
Scenario: Pima Base

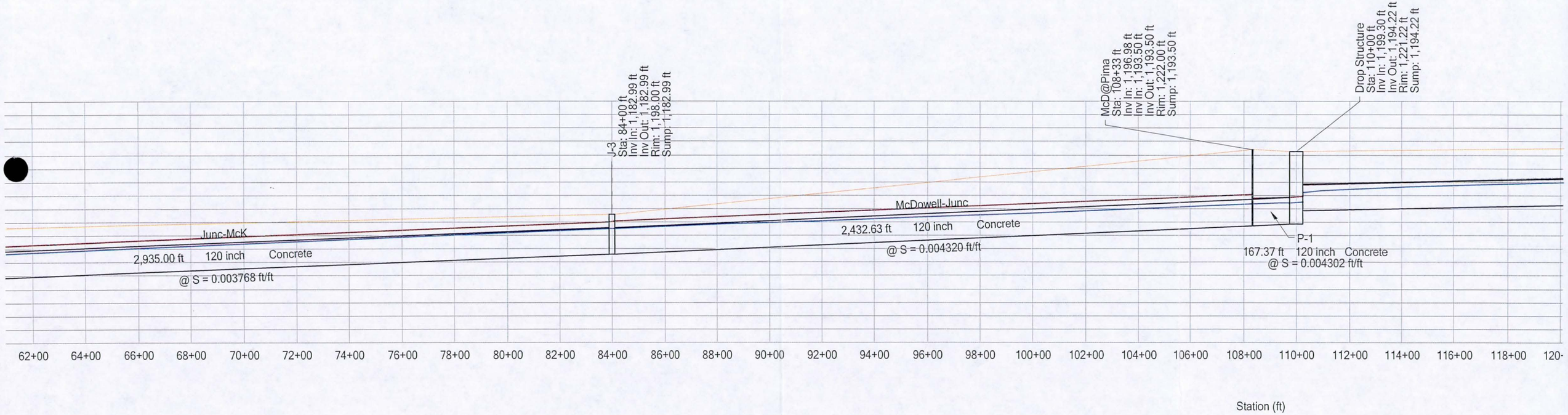


Profile
Scenario: Pima Base

Pima Road Conduit



Profile
Scenario: Pima Base



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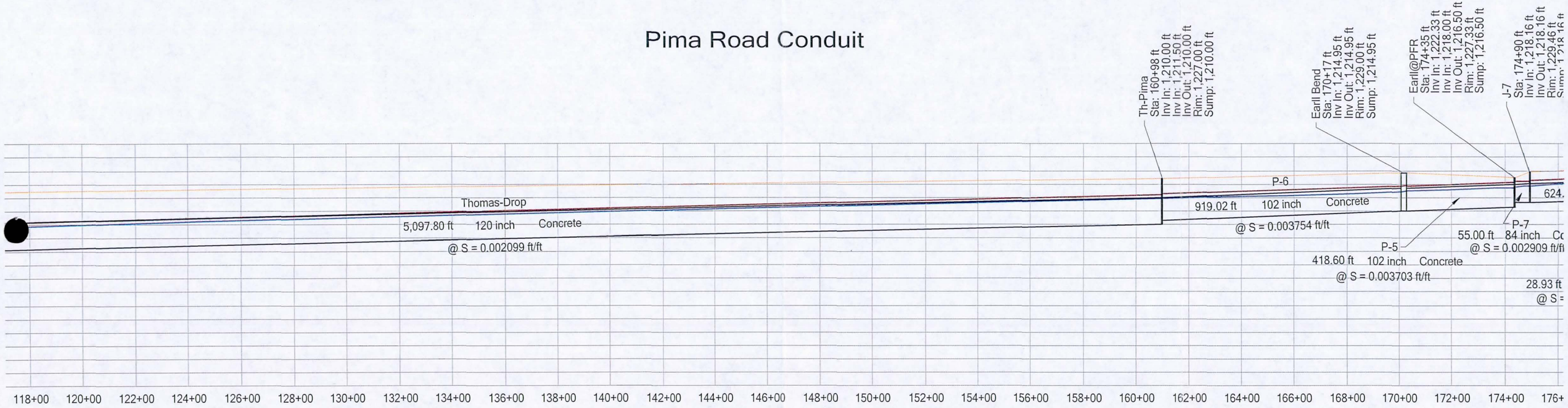
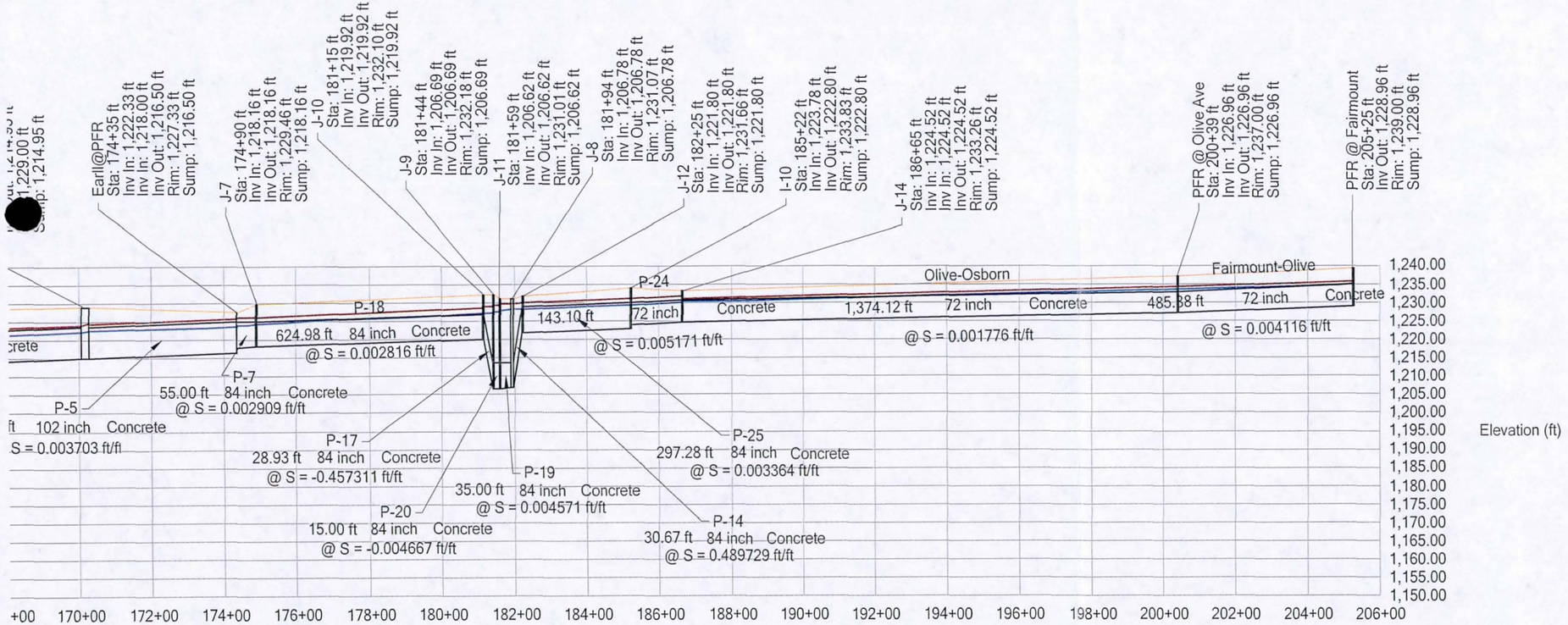
Scenario: Pima Base



Profile
Scenario: Pima Base

Pima Road Conduit



Scenario: Pima Base

Pipe Report GRW

Label	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Mannings n	Full Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Cover (ft)	Downstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Average Velocity (ft/s)
P-11	279.00	540.00	0.003000	10 x 4 ft	0.013	317.64	1,231.30	1,229.68	1,236.30	1,235.26	1.00	1.58	1,235.55	1,234.30	6.97
P-15	331.00	200.00	0.003000	10 x 4 ft	0.013	317.64	1,228.68	1,228.08	1,235.26	1,235.00	2.58	2.92	1,234.17	1,233.52	8.28
P-16	331.00	360.00	0.003139	10 x 4 ft	0.013	324.91	1,228.08	1,226.95	1,235.00	1,234.85	2.92	3.90	1,233.46	1,232.29	8.28
Fairmount-Olive	200.00	485.88	0.004116	72 inch	0.014	252.29	1,228.96	1,226.96	1,239.00	1,237.00	4.04	4.04	1,234.82	1,233.59	9.90
P-13	331.00	140.00	0.003071	72 inch	0.014	217.93	1,224.95	1,224.52	1,234.85	1,233.26	3.90	2.74	1,231.62	1,230.63	11.71
Olive-Osborn	400.00	1,374.12	0.001776	72 inch	0.014	331.41	1,226.96	1,224.52	1,237.00	1,233.26	4.04	2.74	1,233.56	1,230.14	7.07
P-24	587.00	143.10	0.005171	72 inch	0.014	565.56	1,224.52	1,223.78	1,233.26	1,233.83	2.74	4.05	1,230.07	1,229.41	11.36
P-25	787.00	297.28	0.003364	84 inch	0.014	688.06	1,222.80	1,221.80	1,233.83	1,231.66	4.03	2.86	1,229.32	1,228.10	10.22
P-14	787.00	30.67	0.489729	84 inch	0.014	8,302.07	1,221.80	1,206.78	1,231.66	1,231.07	2.86	17.29	1,228.03	1,228.11	67.90 ← INCOMING LEG OF SIPHON
P-19	787.00	35.00	0.004571	84 inch	0.014	802.11	1,206.78	1,206.62	1,231.07	1,231.01	17.29	17.39	1,228.01	1,227.85	10.22
P-20	787.00	15.00	-0.004667	84 inch	0.014	-810.42	1,206.62	1,206.69	1,231.01	1,232.18	17.39	18.49	1,227.64	1,227.58	10.22
P-17	787.00	28.93	-0.457311	84 inch	0.014	-8,022.58	1,206.69	1,219.92	1,232.18	1,232.10	18.49	5.18	1,227.27	1,227.14	10.22
P-18	787.00	624.98	0.002816	84 inch	0.014	629.55	1,219.92	1,218.16	1,232.10	1,229.46	5.18	4.30	1,227.04	1,224.30	10.22
P-17	203.00	565.00	0.004655	6 x 4 ft	0.013	211.35	1,227.70	1,225.07	1,232.70	1,230.07	1.00	1.00	1,232.08	1,229.65	8.46
P-7	787.00	55.00	0.002909	84 inch	0.014	639.86	1,218.16	1,218.00	1,229.46	1,227.33	4.30	2.33	1,224.18	1,223.86	10.22
P-21	224.00	595.00	0.004605	6 x 4 ft	0.013	210.22	1,225.07	1,222.33	1,230.07	1,227.33	1.00	1.00	1,228.58	1,226.33	9.33
P-5	1,167.00	418.60	0.003703	102 inch	0.014	1,211.52	1,216.50	1,214.95	1,227.33	1,229.00	2.33	5.55	1,223.61	1,222.45	12.16
P-22	188.00	65.38	0.002753	54 inch	0.014	191.61	1,211.72	1,211.54	1,223.00	1,224.92	6.78	8.88	1,221.62	1,221.45	5.91
Cor/87th	539.00	65.00	0.004000	12 x 6 ft	0.013	826.23	1,203.96	1,203.70	1,211.50	1,215.20	1.54	5.50	1,212.07	1,211.96	7.49
P-6	1,167.00	919.02	0.003754	102 inch	0.014	1,219.86	1,214.95	1,211.50	1,229.00	1,227.00	5.55	7.00	1,221.98	1,219.47	12.24
P-23	188.00	190.59	0.008080	54 inch	0.014	328.26	1,211.54	1,210.00	1,224.92	1,227.00	8.88	12.50	1,220.87	1,220.37	5.91
87th	539.00	355.00	0.004000	12 x 6 ft	0.013	826.23	1,203.70	1,202.28	1,215.20	1,216.50	5.50	8.22	1,211.51	1,210.91	7.49
Thomas-Drop	1,550.00	5,097.80	0.002099	120 inch	0.014	1,406.96	1,210.00	1,199.30	1,227.00	1,221.22	7.00	11.92	1,219.45	1,206.01	9.87
87th/McD	539.00	70.00	0.004000	12 x 6 ft	0.013	826.23	1,202.28	1,202.00	1,216.50	1,217.10	8.22	9.10	1,210.44	1,210.32	7.49
P-1	1,550.00	167.37	0.004302	120 inch	0.014	2,014.22	1,194.22	1,193.50	1,221.22	1,222.00	17.00	18.50	1,202.11	1,201.92	14.14
McDowell	539.00	1,254.00	0.004003	72 inch	0.014	497.61	1,202.00	1,196.98	1,217.10	1,222.00	9.10	19.02	1,209.55	1,203.66	9.53
McDowell-Junc	2,052.00	2,432.63	0.004320	120 inch	0.014	2,018.57	1,193.50	1,182.99	1,222.00	1,198.00	18.50	5.01	1,201.86	1,192.66	14.64
Junc-McK	2,052.00	2,935.00	0.003768	120 inch	0.014	1,885.18	1,182.99	1,171.93	1,198.00	1,191.50	5.01	9.57	1,192.39	1,180.05	13.06
McK-Bend	2,223.00	177.00	0.001977	12 x 16 ft	0.013	2,218.92	1,165.93	1,165.58	1,191.50	1,195.00	9.57	13.42	1,180.02	1,179.67	11.58
McK-SR	2,223.00	4,288.00	0.002001	12 x 16 ft	0.013	2,232.09	1,165.58	1,157.00	1,195.00	1,185.00	13.42	12.00	1,179.50	1,167.22	13.30

1088.86
521.9

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2. Interception Structure Analysis

INTERCEPTION CALCULATIONS							
86TH STREET / OSBORN ROAD							
	Irregular Section			Intercepted Flow, Qi			
	6.	1.	2.	3.	4.	5.	
Iteration	Qactual	Actual Depth	Qdummy	Half Street (Qi)	Full Street (2*Qi)	Qremain	Incremental Grate Length
	cfs	ft	cfs	cfs	cfs	cfs	ft
CD06 1	306	1.67	503	52.6	105.2	200.8	6
2	200.8	1.51	382	44.4	88.8	112.0	6
3	112.0	1.28	243	33.6	67.2	44.8	6
4	44.8	0.98	116	21.2	42.4	2.4	6
Total Intercepted Flow			303.6	cfs			
Total Bypass			2.4	cfs			
Total Grate Length (each side of street)			24	ft			

1. The HEC-1 Q was input into a Flowmaster Irregular Section to determine the actual depth of flow in the roadway section.
2. Due to limitations in defining the cross section for a curb and gutter section in Flowmaster, a "Dummy Q" was input into the Grate and Gutter section in order to match the actual depth observed from the Irregular Section from Step 1. This is to insure an accurate accounting of grate interception which is directly proportional to depth.
3. Based on a 50% clogging factor and a 24" wide grate (MAG Std. Det. 533-1), the intercepted flow for an incremental grate length of 6', Q_i, for half of the street cross section was calculated in the Grate and Gutter section. (See Flowmaster output).
4. Assuming linear grate inlets on both sides of the street, the incremental intercepted flow, Q_i for half of the street cross section was multiplied by 2 to determine the incremental intercepted flow for the entire street cross section.
5. The intercepted flow for the entire street cross section was then subtracted from the actual HEC-1 Q, to obtain a new Actual Q, which represents the remaining flow (after 6 feet of interception) for the entire roadway section after 6 feet of grate interception.
6. The new Actual Q was again input into the Flowmaster Irregular Channel section to determine the actual depth of flow at an incremental grate length 6 feet downstream of the original observation and the process repeated.

The above steps were executed until acceptable bypass flow remained or all flow was intercepted. From this analysis, it was determined that 2 grates, each 24 feet long and 2' wide, will be needed in order to intercept the flow along 86th Street at Osborn Road.

After layout in CAD (see included 30% detail sheet), it was determined that the angle of approach for flow spread out through the roadway section and through adjacent yards

may be too sharp to recede along a 24' length of grate inlet. Though calculations indicate interception could be obtained from a grate capacity standpoint, it was determined that the physical proximity of stormflows may not make it into the grate inlets. Therefore a safety factor of 3.0 was applied to grate length to insure interception. Also, based on roadway geometry and historical flow paths, transverse grates were recommended to insure flows not intercepted within the roadway grate inlets and flows coming from the west would be caught by two transverse grate structures.

Cross Section for Osborn/86th - Irregular Section - Iteration 1

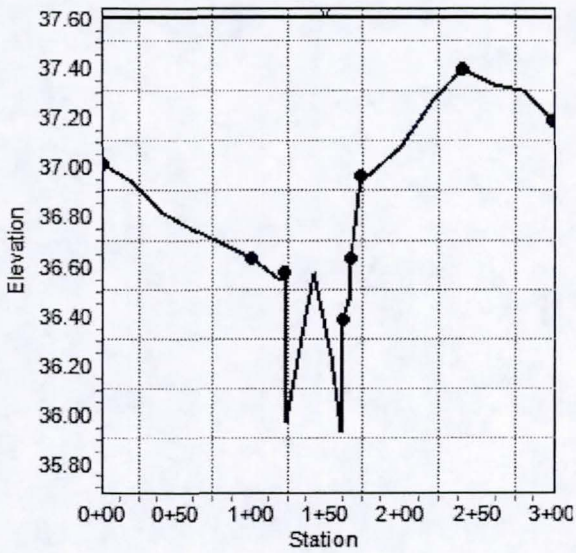
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00605	ft/ft
Normal Depth	1.67	ft
Discharge	306.0	cfs ← ACTUAL Q_{100} (FROM HEC-1)

Cross Section Image



Osborn/86th - Irregular Section - Iteration 1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00605	ft/ft
Discharge	306.0	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	37.01
0+20.00	36.94
0+40.00	36.82
0+60.00	36.75
0+80.00	36.69
1+00.00	36.63
1+20.00	36.54
1+22.40	36.57
1+24.30	35.97
1+41.80	36.57
1+53.60	36.23
1+60.10	35.93
1+61.70	36.38
1+65.90	36.46
1+67.40	36.63
1+73.10	36.96
1+80.00	36.97
2+00.00	37.08
2+20.00	37.26
2+40.00	37.39
2+60.00	37.33
2+80.00	37.30
3+00.00	37.18

SECTION FROM INROADS

Roughness Segment Definitions

Osborn/86th - Irregular Section - Iteration 1

Input Data

Start Station	Ending Station	Roughness Coefficient (SEE NOTES NEXT PAGE)
(0+00.00, 37.01)	(1+00.00, 36.63)	0.080
(1+00.00, 36.63)	(1+22.40, 36.57)	0.013
(1+22.40, 36.57)	(1+61.70, 36.38)	0.016
(1+61.70, 36.38)	(1+67.40, 36.63)	0.013
(1+67.40, 36.63)	(1+73.10, 36.96)	0.025
(1+73.10, 36.96)	(2+40.00, 37.39)	0.080
(2+40.00, 37.39)	(3+00.00, 37.18)	0.050

Results

Normal Depth		1.67	ft
Elevation Range	35.93 to 37.39 ft		
Flow Area		213.7	ft²
Wetted Perimeter		301.21	ft
Top Width		300.00	ft
Normal Depth		1.67	ft
Critical Depth		1.18	ft
Critical Slope		0.08083	ft/ft
Velocity		1.4	ft/s
Velocity Head		0.03	ft
Specific Energy		1.70	ft
Froude Number		0.30	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.67	ft

Osborn/86th - Irregular Section - Iteration 1

GVF Output Data

Critical Depth	1.18	ft
Channel Slope	0.00605	ft/ft
Critical Slope	0.08083	ft/ft

Messages

Notes	Slope and section obtained from InRoads and Aerial Mapping data for Granite Reef Wash Drainage Study and Preliminary Design Improvements project (2007). Manning's 'n' values reflect asphalt street (0.016), curb/gutter/sidwalk (0.013), yards (0.025), blocked yards (0.050) and houses/fences/block walls (0.080).

Cross Section for Osborn/86th - Grate Inlet On Grade - Iteration 1

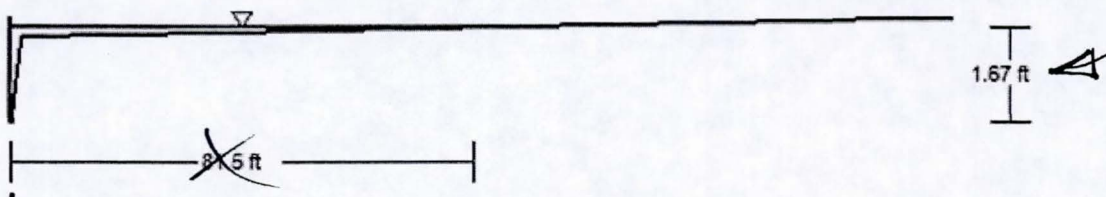
Project Description

Solve For	Efficiency

Input Data

Discharge	503.0	cfs	← DUMMY Q TO OBTAIN THIS DEPTH
Slope	0.00605	ft/ft	
Gutter Width	2.0	ft	
Gutter Cross Slope	0.0416	ft/ft	
Road Cross Slope	0.0200	ft/ft	
Roughness Coefficient	0.016		
Efficiency	10.46	%	
Grate Width	2.00	ft	
Grate Length	6.00	ft	← INCREMENTAL GRATE LENGTH
Grate Type	P-50 mm (P-1-7/8")		
Clogging	50.00	%	

Cross Section Image



GRATE LOCATION AT d = 1.67 ft
(REST OF SECTION/ROADWAY CROSS-SLOPE DOES NOT APPLY ...)

V: 10
H: 1

Osborn/86th - Grate Inlet On Grade - Iteration 1

Project Description

Solve For	Efficiency

Input Data

Discharge	503.0	cfs
Slope	0.00605	ft/ft
Gutter Width	2.0	ft
Gutter Cross Slope	0.0416	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.016	
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	10.46	%
Intercepted Flow	☆ 52.6	cfs ← INCREMENTAL INTERCEPTION RATE FOR 1st 6-FEET OF GRATE INLET (ONE SIDE OF STREET ONLY)
Bypass Flow	450.4	cfs
Spread	81.5	ft
Depth	1.67	ft
Flow Area	66.5	ft²
Gutter Depression	0.04	ft
Total Depression	0.04	ft
Velocity	7.6	ft/s
Splash Over Velocity	10.0	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.04	
Grate Flow Ratio	0.07	
Active Grate Length	3.00	ft

Messages

Notes

Normal depth from Irregular Section - Iteration 1 = 1.67 feet for Q100=306 cfs (inital peak discharge from HEC-1 arriving at location).

Since the primary variable affecting amount of grate interception is depth, a dummy Q of 503 cfs was input into

Messages

this worksheet to obtain equivalent depth to that shown in the Irregular Section - Iteration 1.

The value of interception shown (52.6 cfs) will then be multiplied by two (to account for both sides of the street section) and subtracted from the total Q in the irregular section to obtain a new depth.

The goal of this calculation is not to obtain a specific grate efficiency or spread, but purely to obtain an accurate interception quantity for a 6-foot length of 2-foot wide grate at the actual modeled depth for the entire street section.

The 6-foot length was selected as a convenient length to iterate on, that is, to obtain the number of 6-foot lengths it will take to intercept the entire peak discharge.

Reason for the iteration is that FlowMaster is normally utilized for relatively small Q's that are contained within one side of a normal crown street section. Due to the limitations of modeling a larger Q flowing through an entire street section (and through adjacent yards) in the 'Grate Inlet On Grade' function of FlowMaster, this process was used to 'trick' the model into providing accurate interception rates for a large Q and a very long grate while accounting for a continuously decreasing depth over the entire grate length.

Cross Section for Osborn/86th - Irregular Section - Iteration 2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00605	ft/ft
Normal Depth	1.51	ft
Discharge	200.8	cfs

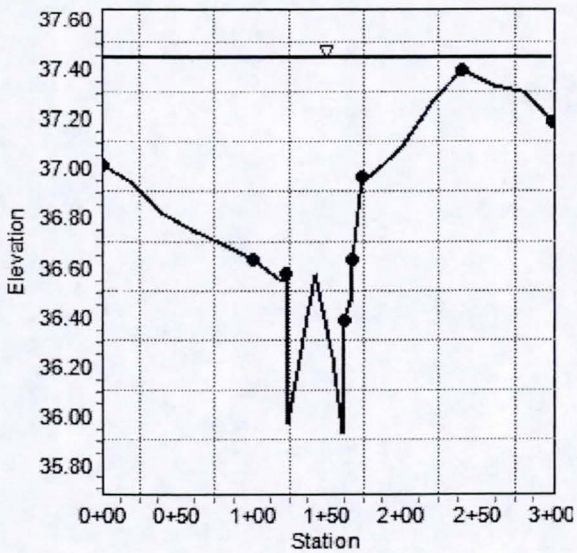
$Q = (306 - (2 \times 52.6))$ cfs

ORIGINAL Q

6-foot GRATE INCREMENTAL INTERCEPTION RATE (ONE SIDE OF STREET x2)

RESULTING DEPTH

Cross Section Image



Osborn/86th - Irregular Section - Iteration 2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00605	ft/ft
Discharge	200.8	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	37.01
0+20.00	36.94
0+40.00	36.82
0+60.00	36.75
0+80.00	36.69
1+00.00	36.63
1+20.00	36.54
1+22.40	36.57
1+24.30	35.97
1+41.80	36.57
1+53.60	36.23
1+60.10	35.93
1+61.70	36.38
1+65.90	36.46
1+67.40	36.63
1+73.10	36.96
1+80.00	36.97
2+00.00	37.08
2+20.00	37.26
2+40.00	37.39
2+60.00	37.33
2+80.00	37.30
3+00.00	37.18

Roughness Segment Definitions

Osborn/86th - Irregular Section - Iteration 2

Input Data

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 37.01)	(1+00.00, 36.63)	0.080
(1+00.00, 36.63)	(1+22.40, 36.57)	0.013
(1+22.40, 36.57)	(1+61.70, 36.38)	0.016
(1+61.70, 36.38)	(1+67.40, 36.63)	0.013
(1+67.40, 36.63)	(1+73.10, 36.96)	0.025
(1+73.10, 36.96)	(2+40.00, 37.39)	0.080
(2+40.00, 37.39)	(3+00.00, 37.18)	0.050

Results

Normal Depth		1.51	ft
Elevation Range	35.93 to 37.39 ft		
Flow Area		165.9	ft²
Wetted Perimeter		300.89	ft
Top Width		300.00	ft
Normal Depth		1.51	ft
Critical Depth		1.06	ft
Critical Slope		0.08621	ft/ft
Velocity		1.2	ft/s
Velocity Head		0.02	ft
Specific Energy		1.53	ft
Froude Number		0.29	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.51	ft

Osborn/86th - Irregular Section - Iteration 2

GVF Output Data

Critical Depth	1.06	ft
Channel Slope	0.00605	ft/ft
Critical Slope	0.08621	ft/ft

Messages

Notes

Slope and section obtained from InRoads and Aerial Mapping data for Granite Reef Wash Drainage Study and Preliminary Design Improvements project (2007). Manning's 'n' values reflect asphalt street (0.016), curb/gutter/sidwalk (0.013), yards (0.025), blocked yards (0.050) and houses/fences/block walls (0.080).

Cross Section for Osborn/86th - Grate Inlet On Grade - Iteration 2

Project Description

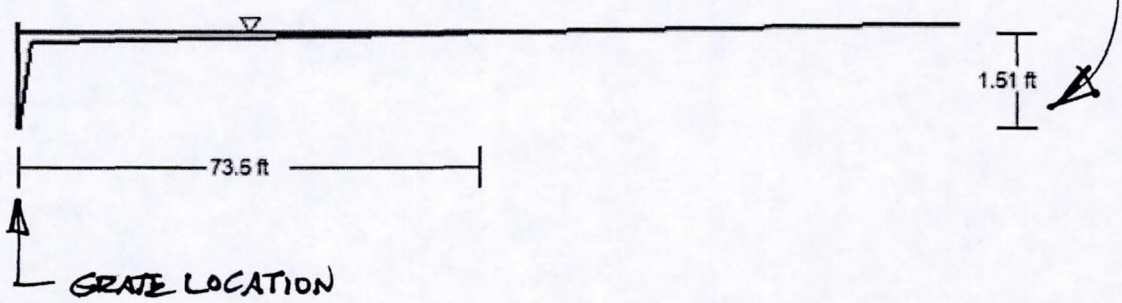
Solve For	Efficiency

Input Data

Discharge	382.0	cfs
Slope	0.00605	ft/ft
Gutter Width	2.0	ft
Gutter Cross Slope	0.0416	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.016	
Efficiency	11.63	%
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

DUMMY Q TO OBTAIN REDUCED DEPTH AFTER 6-ft OF GRATE INLET INTERCEPTION

Cross Section Image



V: 10
H: 1

Osborn/86th - Grate Inlet On Grade - Iteration 2

Project Description

Solve For	Efficiency

Input Data

Discharge	382.0	cfs
Slope	0.00605	ft/ft
Gutter Width	2.0	ft
Gutter Cross Slope	0.0416	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.016	
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	11.63	%
Intercepted Flow	☆ 44.4	cfs ← INCREMENTAL INTERCEPTION RATE FOR 2nd 6-FEET OF GRATE INLET (ONE SIDE OF STREET ONLY)
Bypass Flow	337.6	cfs
Spread	73.5	ft
Depth	1.51	ft
Flow Area	54.1	ft²
Gutter Depression	0.04	ft
Total Depression	0.04	ft
Velocity	7.1	ft/s
Splash Over Velocity	10.0	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.05	
Grate Flow Ratio	0.07	
Active Grate Length	3.00	ft

Messages

Notes

Normal depth from Irregular Section - Iteration 2 = 1.51 feet for Q100=200.8 cfs (remaining peak discharge).

Dummy Q of 382 cfs was input into this worksheet to obtain equivalent depth to that shown in the Irregular

Osborn/86th - Grate Inlet On Grade - Iteration 2

Messages

Section - Iteration 2.

Interception of 44.4 cfs will be multiplied by two (both sides of street section) and subtracted from total Q in irregular section for next iteration.

Cross Section for Osborn/86th - Irregular Section - Iteration 3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00605	ft/ft
Normal Depth	1.28	ft
Discharge	112.0	cfs

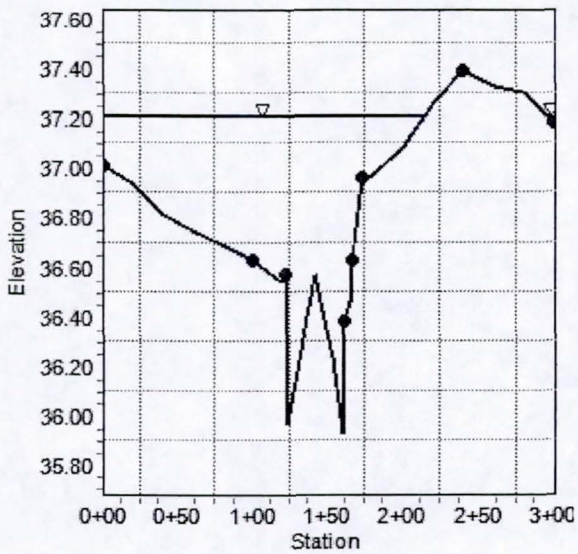
$Q = (200.8 - (44.4 \times 2))$ cfs

ACTUAL REDUCED Q AFTER 1st 6-FEET OF INTERCEPTION

INCREMENTAL INTERCEPTION FROM 2nd, 6-FOOT PIECE

RESULTING DEPTH

Cross Section Image



Osborn/86th - Irregular Section - Iteration 3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00605	ft/ft
Discharge	112.0	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	37.01
0+20.00	36.94
0+40.00	36.82
0+60.00	36.75
0+80.00	36.69
1+00.00	36.63
1+20.00	36.54
1+22.40	36.57
1+24.30	35.97
1+41.80	36.57
1+53.60	36.23
1+60.10	35.93
1+61.70	36.38
1+65.90	36.46
1+67.40	36.63
1+73.10	36.96
1+80.00	36.97
2+00.00	37.08
2+20.00	37.26
2+40.00	37.39
2+60.00	37.33
2+80.00	37.30
3+00.00	37.18

Roughness Segment Definitions

Osborn/86th - Irregular Section - Iteration 3

Input Data

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 37.01)	(1+00.00, 36.63)	0.080
(1+00.00, 36.63)	(1+22.40, 36.57)	0.013
(1+22.40, 36.57)	(1+61.70, 36.38)	0.016
(1+61.70, 36.38)	(1+67.40, 36.63)	0.013
(1+67.40, 36.63)	(1+73.10, 36.96)	0.025
(1+73.10, 36.96)	(2+40.00, 37.39)	0.080
(2+40.00, 37.39)	(3+00.00, 37.18)	0.050

Results

Normal Depth		1.28	ft
Elevation Range	35.93 to 37.39 ft		
Flow Area		104.0	ft²
Wetted Perimeter		219.06	ft
Top Width		218.64	ft
Normal Depth		1.28	ft
Critical Depth		0.91	ft
Critical Slope		0.09519	ft/ft
Velocity		1.1	ft/s
Velocity Head		0.02	ft
Specific Energy		1.30	ft
Froude Number		0.28	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.28	ft

Osborn/86th - Irregular Section - Iteration 3

GVF Output Data

Critical Depth	0.91	ft
Channel Slope	0.00605	ft/ft
Critical Slope	0.09519	ft/ft

Messages

Notes

Slope and section obtained from InRoads and Aerial Mapping data for Granite Reef Wash Drainage Study and Preliminary Design Improvements project (2007). Manning's 'n' values reflect asphalt street (0.016), curb/gutter/sidwalk (0.013), yards (0.025), blocked yards (0.050) and houses/fences/block walls (0.080).

Cross Section for Osborn/86th - Grate Inlet On Grade - Iteration 3

Project Description

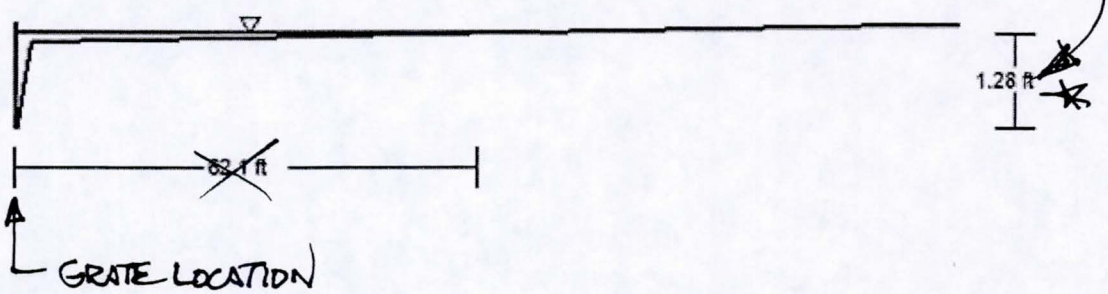
Solve For	Efficiency

Input Data

Discharge	243.0	cfs
Slope	0.00605	ft/ft
Gutter Width	2.0	ft
Gutter Cross Slope	0.0416	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.016	
Efficiency	13.82	%
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

DUMMY Q TO OBTAIN REDUCED DEPTH AFTER ANOTHER 6 FEET OF GRATE INLET INTERCEPTION

Cross Section Image



V: 10
H: 1

Osborn/86th - Grate Inlet On Grade - Iteration 3

Project Description

Solve For	Efficiency

Input Data

Discharge	243.0	cfs
Slope	0.00605	ft/ft
Gutter Width	2.0	ft
Gutter Cross Slope	0.0416	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.016	
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	13.82	%
Intercepted Flow	☆ 33.6	cfs ← INCREMENTAL INTERCEPTION RATE FOR 3RD, 6-FOOT SECTION OF GRATE INLET (ONE SIDE OF STREET ONLY)
Bypass Flow	209.4	cfs
Spread	62.1	ft
Depth	1.28	ft
Flow Area	38.6	ft²
Gutter Depression	0.04	ft
Total Depression	0.04	ft
Velocity	6.3	ft/s
Splash Over Velocity	10.0	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.06	
Grate Flow Ratio	0.09	
Active Grate Length	3.00	ft

Messages

Notes	Normal depth from Irregular Section - Iteration 3 = 1.28 feet for Q100=112.0 cfs (remaining peak discharge). Dummy Q of 243 cfs was input into this worksheet to obtain equivalent depth to that shown in the Irregular

Osborn/86th - Grate Inlet On Grade - Iteration 3

Messages

Section - Iteration 3.

Interception of 33.6 cfs will be multiplied by two (both sides of street section) and subtracted from total Q in irregular section for next iteration.

Cross Section for Osborn/86th - Irregular Section - Iteration 4

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

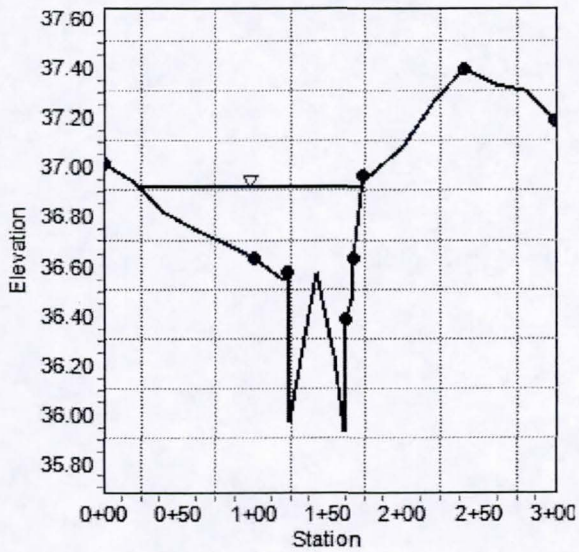
Channel Slope	0.00605	ft/ft
Normal Depth	0.98	ft
Discharge	44.8	cfs

RESULTING DEPTH

$Q = (112.0 - (2 \times 33.6))$ cfs

INCREMENTAL INTERCEPTION FROM 3RD, 6-FOOT PIECE

Cross Section Image



Osborn/86th - Irregular Section - Iteration 4

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00605	ft/ft
Discharge	44.8	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	37.01
0+20.00	36.94
0+40.00	36.82
0+60.00	36.75
0+80.00	36.69
1+00.00	36.63
1+20.00	36.54
1+22.40	36.57
1+24.30	35.97
1+41.80	36.57
1+53.60	36.23
1+60.10	35.93
1+61.70	36.38
1+65.90	36.46
1+67.40	36.63
1+73.10	36.96
1+80.00	36.97
2+00.00	37.08
2+20.00	37.26
2+40.00	37.39
2+60.00	37.33
2+80.00	37.30
3+00.00	37.18

Roughness Segment Definitions

Osborn/86th - Irregular Section - Iteration 4

Input Data

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 37.01)	(1+00.00, 36.63)	0.080
(1+00.00, 36.63)	(1+22.40, 36.57)	0.013
(1+22.40, 36.57)	(1+61.70, 36.38)	0.016
(1+61.70, 36.38)	(1+67.40, 36.63)	0.013
(1+67.40, 36.63)	(1+73.10, 36.96)	0.025
(1+73.10, 36.96)	(2+40.00, 37.39)	0.080
(2+40.00, 37.39)	(3+00.00, 37.18)	0.050

Results

Normal Depth		0.98	ft
Elevation Range	35.93 to 37.39 ft		
Flow Area		47.8	ft²
Wetted Perimeter		147.62	ft
Top Width		147.42	ft
Normal Depth		0.98	ft
Critical Depth		0.70	ft
Critical Slope		0.07965	ft/ft
Velocity		0.9	ft/s
Velocity Head		0.01	ft
Specific Energy		0.99	ft
Froude Number		0.29	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.98	ft

Osborn/86th - Irregular Section - Iteration 4

GVF Output Data

Critical Depth	0.70	ft
Channel Slope	0.00605	ft/ft
Critical Slope	0.07965	ft/ft

Messages

Notes

Slope and section obtained from InRoads and Aerial Mapping data for Granite Reef Wash Drainage Study and Preliminary Design Improvements project (2007). Manning's 'n' values reflect asphalt street (0.016), curb/gutter/sidwalk (0.013), yards (0.025), blocked yards (0.050) and houses/fences/block walls (0.080).

Cross Section for Osborn/86th - Grate Inlet On Grade - Iteration 4

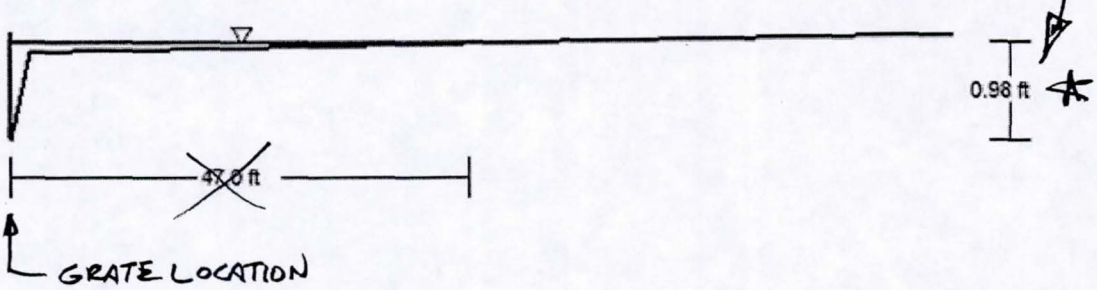
Project Description

Solve For	Efficiency

Input Data

Discharge	116.0	cfs ← DUMMY Q
Slope	0.00605	ft/ft
Gutter Width	2.0	ft
Gutter Cross Slope	0.0416	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.016	
Efficiency	18.26	%
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Cross Section Image



V: 10
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Osborn/86th - Grate Inlet On Grade - Iteration 4

Project Description

Solve For	Efficiency

Input Data

Discharge	116.0	cfs
Slope	0.00605	ft/ft
Gutter Width	2.0	ft
Gutter Cross Slope	0.0416	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.016	
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	18.26	%
Intercepted Flow	★21.2	cfs ← INCREMENTAL INTERCEPTION RATE FOR 4th, 6-FOOT SECTION OF GRATE INLET (ONE SIDE ONLY)
Bypass Flow	94.8	cfs
Spread	47.0	ft
Depth	0.98	ft
Flow Area	22.1	ft²
Gutter Depression	0.04	ft
Total Depression	0.04	ft
Velocity	5.2	ft/s
Splash Over Velocity	10.0	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.08	
Grate Flow Ratio	0.11	
Active Grate Length	3.00	ft

Messages

Notes

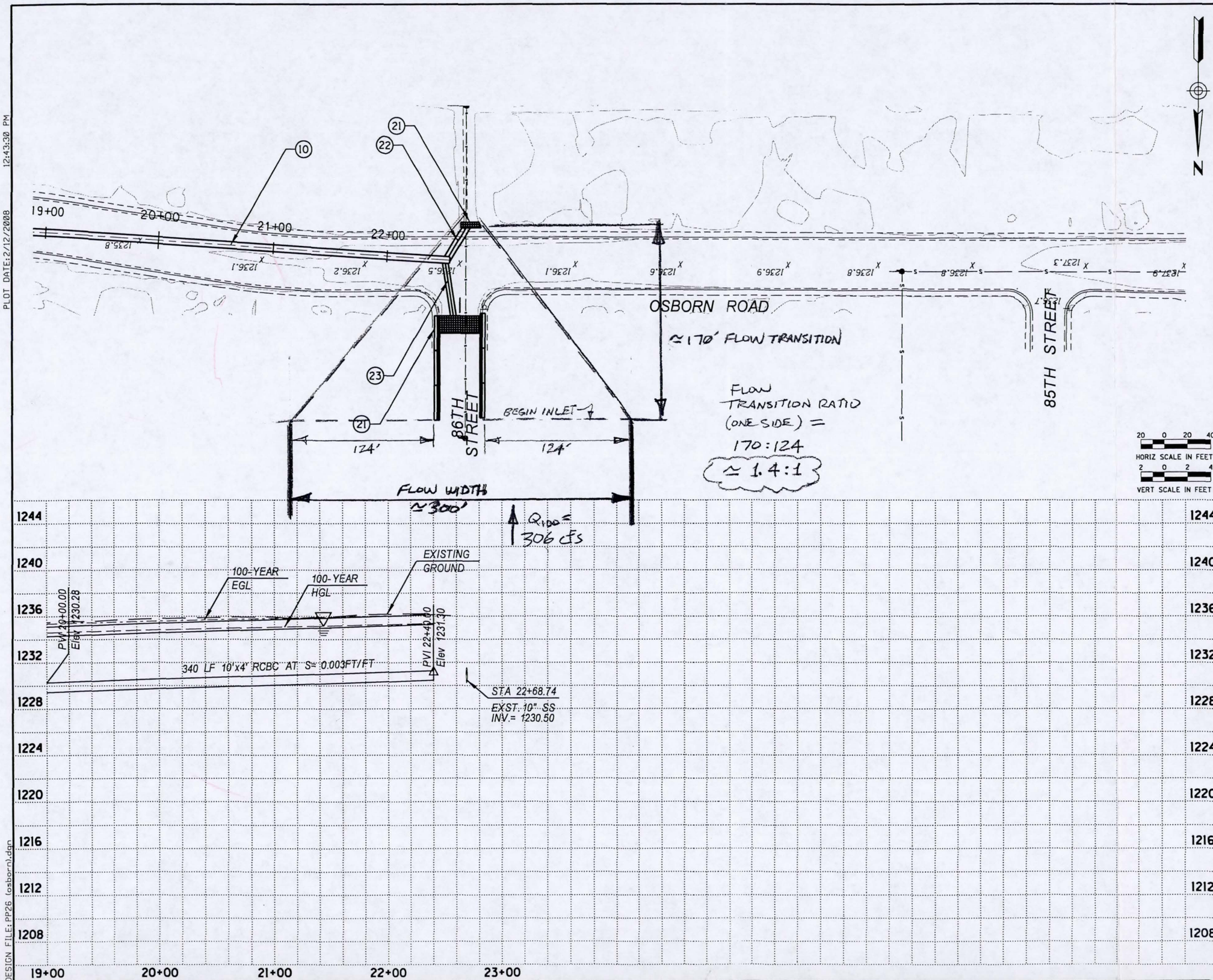
Normal depth from Irregular Section - Iteration 4 = 0.98 feet for Q100=44.8 cfs (remaining peak discharge).

Dummy Q of 116 cfs was input into this worksheet to obtain equivalent depth to that shown in the Irregular Section - Iteration 4.

Osborn/86th - Grate Inlet On Grade - Iteration 4

Messages

Interception of 21.2 cfs will be multiplied by two (both sides of street section) and subtracted from total Q in irregular section for next iteration.



PSOMAS
3800 North Central Avenue, Suite 1200
Phoenix, AZ 85012
(602) 222-8260 (602) 266-0218 (FAX)

REMOVAL & RELOCATION NOTES

Description	Unit	Quan

CONSTRUCTION NOTES

Description	Unit	Quan
(10) CONSTRUCT NEW 10'x 4' RCBC	LF	340
(21) INTERCEPTION STRUCTURE PER DTL.4, SHEET DTL03	EA	1
(22) CONSTRUCT NEW 2-38"x24" ARCH PIPE	LF	29
(23) CONSTRUCT NEW 7'X3'RCBC	LF	46

28

Two working days before you dig, CALL FOR THE BLUE STAKES
1-800-STAKE-IT
Blue Stake Center
CALL COLLECT

DATE	REVISION	BY

ENGINEER

30% PRELIMINARY NOT FOR CONSTRUCTION

MUNICIPAL SERVICES DEPARTMENT
CAPITAL PROJECT MANAGEMENT
7447 E. INDIAN SCHOOL RD.
SCOTTSDALE, ARIZONA 85251

SHEET TITLE
OSBORN ROAD CONDUIT - PLAN & PROFILE

PROJECT TITLE
GRANITE REEF WASH DRAINAGE STUDY AND PRELIMINARY DESIGN IMPROVEMENTS

SCALE	DESIGNED	DATE	BID NO.	SHT.
HORIZ. 1"=40'	JKK	08/07	XXXX	PP28
VERT. 1"=4'	DRAWN GRS	AS-BUILT XX/XX	PROJECT NO. 06077-XX	32 OF 27

PLOT DATE:2/12/2008 12:43:30 PM
DESIGN FILE: PP26 (osborn).dgn

INTERCEPTION CALCULATIONS							
87TH STREET / OSBORN ROAD							
	Irregular Section			Intercepted Flow, Qi			
	6.	1.	2.	3.	4.	5.	
Iteration	Q_{actual}	Actual Depth	Q_{dummy}	Half Street (Q_i)	Full Street ($2*Q_i$)	Q_{remain}	Incremental Grate Length
	cfs	ft	cfs	cfs	cfs	cfs	ft
1	66 67	0.58	33	9.1	18.2	48.8	6
2	48.8	0.44	15	5.4	10.9	38.0	6
3	38.0	0.39	11	4.4	8.8	29.1	6
4	29.1	0.34	7	3.3	6.5	22.6	6
5	22.6	0.31	5.5	2.8	5.5	17.1	6
6	17.1	0.28	4	2.2	4.4	12.7	6
7	12.7	0.25	3	1.8	3.6	9.2	6
Total Intercepted Flow			64.3	cfs			
Total Bypass			9.2	cfs			
Total Grate Length (each side of street)			42	ft			

1. The HEC-1 Q was input into a Flowmaster Irregular Section to determine the actual depth of flow in the roadway section.
2. Due to limitations in defining the cross section for a curb and gutter section in Flowmaster, a "Dummy Q" was input into the Grate and Gutter section in order to match the actual depth observed from the Irregular Section from Step 1. This is to insure an accurate accounting of grate interception which is directly proportional to depth.
3. Based on a 50% clogging factor and a 24" wide grate (MAG Std. Det. 533-1), the intercepted flow for an incremental grate length of 6', Q_i, for half of the street cross section was calculated in the Grate and Gutter section. (See Flowmaster output).
4. Assuming linear grate inlets on both sides of the street, the incremental intercepted flow, Q_i for half of the street cross section was multiplied by 2 to determine the incremental intercepted flow for the entire street cross section.
5. The intercepted flow for the entire street cross section was then subtracted from the actual HEC-1 Q, to obtain a new Actual Q, which represents the remaining flow (after 6 feet of interception) for the entire roadway section after 6 feet of grate interception.
6. The new Actual Q was again input into the Flowmaster Irregular Channel section to determine the actual depth of flow at an incremental grate length 6 feet downstream of the original observation and the process repeated.

The above steps were executed until acceptable bypass flow remained or all flow was intercepted. From this analysis, it was determined that 2 grates, each 42 feet long and 2' wide, will be needed in order to intercept the flow along 87th Street at Osborn Road.

After layout in CAD (see included 30% detail sheet), it was determined that the angle of approach for flow spread out through the roadway section and through adjacent yards may be too sharp to recede along a 42' length of grate inlet. Though calculations indicate interception could be obtained from a grate capacity standpoint, it was determined that the physical proximity of stormflows may not make it into the grate inlets. Therefore a safety factor of 3.0 was applied to grate length to insure interception. Also, based on roadway geometry and historical flow paths, transverse grates were recommended to insure flows not intercepted within the roadway grate inlets and flows coming from the west would be caught by two transverse grate structures.

Cross Section for Irregular Section - 1

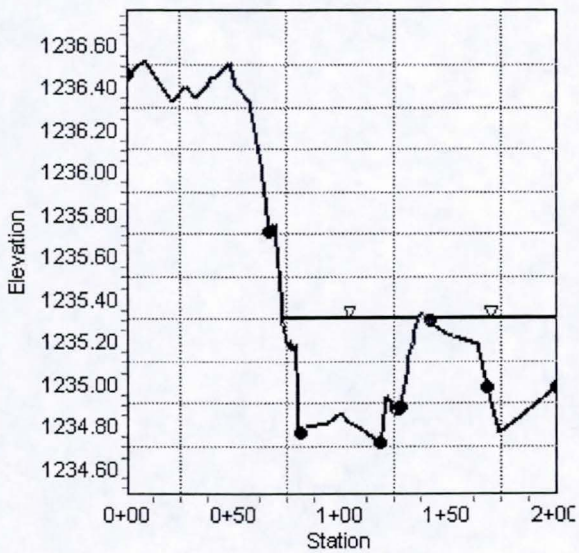
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Normal Depth	0.58	ft
Discharge	67.00	ft³/s ← ACTUAL Q_{100} (FROM HEC-1)

Cross Section Image



Worksheet for Irregular Section - 1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Discharge	67.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	1236.46
0+08	1236.52
0+21	1236.33
0+28	1236.40
0+32	1236.35
0+37	1236.40
0+40	1236.44
0+41	1236.44
0+48	1236.51
0+52	1236.40
0+58	1236.33
0+63	1236.03
0+67	1235.71
0+69	1235.73
0+70	1235.75
0+72	1235.42
0+73	1235.28
0+75	1235.18
0+76	1235.20
0+77	1235.15
0+79	1235.18
0+79	1235.05
0+80	1234.78
0+81	1234.79
0+81	1234.76
0+83	1234.78
0+83	1234.79

SECTION FROM IN ROADS

Worksheet for Irregular Section - 1

Input Data

Station (ft)	Elevation (ft)
0+94	1234.81
1+01	1234.86

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1236.46)	(0+67, 1235.71)	0.080
(0+67, 1235.71)	(0+81, 1234.76)	0.013
(0+81, 1234.76)	(1+19, 1234.72)	0.016
(1+19, 1234.72)	(1+28, 1234.88)	0.013
(1+28, 1234.88)	(1+42, 1235.29)	0.025
(1+42, 1235.29)	(1+68, 1234.98)	0.080
(1+68, 1234.98)	(2+00, 1234.98)	0.050

Results

Normal Depth		0.58	ft
Elevation Range	1234.72 to 1236.52 ft		
Flow Area		42.60	ft²
Wetted Perimeter		123.70	ft
Top Width		123.29	ft ← INCOMING
Normal Depth		0.58	ft
Critical Depth		0.39	ft
Critical Slope		0.04911	ft/ft
Velocity		1.57	ft/s
Velocity Head		0.04	ft
Specific Energy		0.62	ft
Froude Number		0.47	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

Worksheet for Irregular Section - 1

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.58	ft
Critical Depth	0.39	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.04911	ft/ft

Cross Section for Osborn/87th - Grate Inlet on Grade - Iteration 1

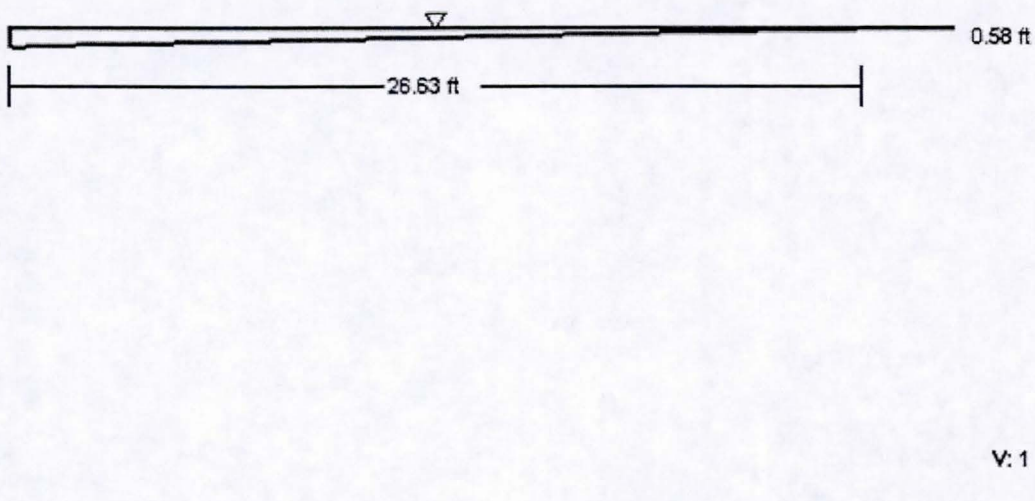
Project Description

Solve For	Efficiency

Input Data

Discharge	33.00	ft^3/s
Slope	0.01000	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Efficiency	27.56	%
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Cross Section Image



Worksheet for Osborn/87th - Grate Inlet on Grade - Iteration 1

Project Description

Solve For	Efficiency

Input Data

Discharge	33.00	ft^3/s
Slope	0.01000	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	27.56	%
Intercepted Flow	9.09	ft^3/s
Bypass Flow	23.91	ft^3/s
Spread	26.63	ft
Depth	0.58	ft
Flow Area	7.14	ft^2
Gutter Depression	0.04	ft
Total Depression	0.04	ft
Velocity	4.62	ft/s
Splash Over Velocity	9.97	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.10	
Grate Flow Ratio	0.20	
Active Grate Length	3.00	ft

Cross Section for Osborn/87th - Irregular Section - Iteration 2

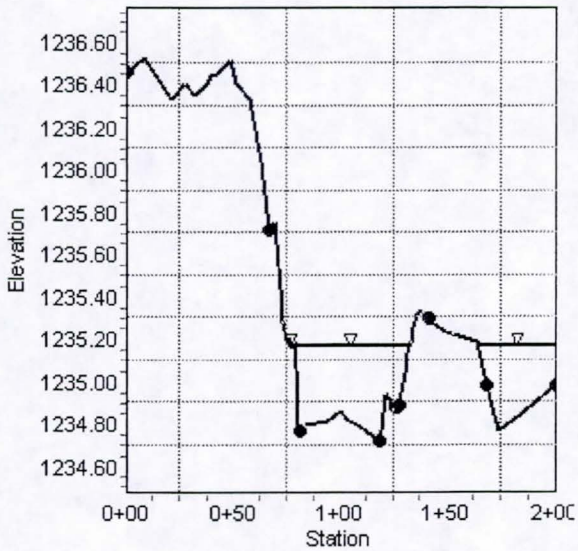
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Normal Depth	0.44	ft
Discharge	48.80	ft^3/s

Cross Section Image



Worksheet for Osborn/87th - Irregular Section - Iteration 2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Discharge	48.80	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	1236.46
0+08	1236.52
0+21	1236.33
0+28	1236.40
0+32	1236.35
0+37	1236.40
0+40	1236.44
0+41	1236.44
0+48	1236.51
0+52	1236.40
0+58	1236.33
0+63	1236.03
0+67	1235.71
0+69	1235.73
0+70	1235.75
0+72	1235.42
0+73	1235.28
0+75	1235.18
0+76	1235.20
0+77	1235.15
0+79	1235.18
0+79	1235.05
0+80	1234.78
0+81	1234.79
0+81	1234.76
0+83	1234.78
0+83	1234.79

Worksheet for Osborn/87th - Irregular Section - Iteration 2

Input Data

Station (ft)	Elevation (ft)
0+94	1234.81
1+01	1234.86

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1236.46)	(0+67, 1235.71)	0.080
(0+67, 1235.71)	(0+81, 1234.76)	0.013
(0+81, 1234.76)	(1+19, 1234.72)	0.016
(1+19, 1234.72)	(1+28, 1234.88)	0.013
(1+28, 1234.88)	(1+42, 1235.29)	0.025
(1+42, 1235.29)	(1+68, 1234.98)	0.080
(1+68, 1234.98)	(2+00, 1234.98)	0.050

Results

Normal Depth	0.44	ft
Elevation Range	1234.72 to 1236.52 ft	
Flow Area	26.84	ft²
Wetted Perimeter	90.16	ft
Top Width	89.91	ft
Normal Depth	0.44	ft
Critical Depth	0.34	ft
Critical Slope	0.03230	ft/ft
Velocity	1.82	ft/s
Velocity Head	0.05	ft
Specific Energy	0.49	ft
Froude Number	0.59	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

Worksheet for Osborn/87th - Irregular Section - Iteration 2

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.44	ft
Critical Depth	0.34	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.03230	ft/ft

Cross Section for Osborn/87th - Grate Inlet on Grade - Iteration 2

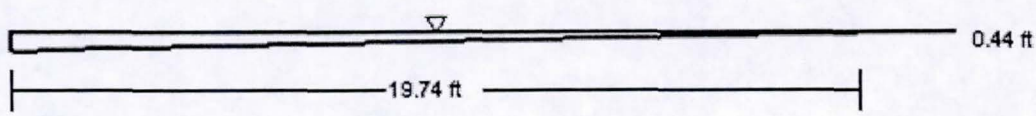
Project Description

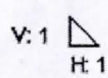
Solve For	Efficiency

Input Data

Discharge	15.00	ft³/s
Slope	0.01000	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Efficiency	36.20	%
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Cross Section Image





Worksheet for Osborn/87th - Grate Inlet on Grade - Iteration 2

Project Description

Solve For	Efficiency

Input Data

Discharge	15.00	ft^3/s
Slope	0.01000	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	36.20	%
Intercepted Flow	5.43	ft^3/s
Bypass Flow	9.57	ft^3/s
Spread	19.74	ft
Depth	0.44	ft
Flow Area	3.94	ft^2
Gutter Depression	0.04	ft
Total Depression	0.04	ft
Velocity	3.81	ft/s
Splash Over Velocity	9.97	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.13	
Grate Flow Ratio	0.27	
Active Grate Length	3.00	ft

Cross Section for Osborn/87th - Irregular Section - Iteration 3

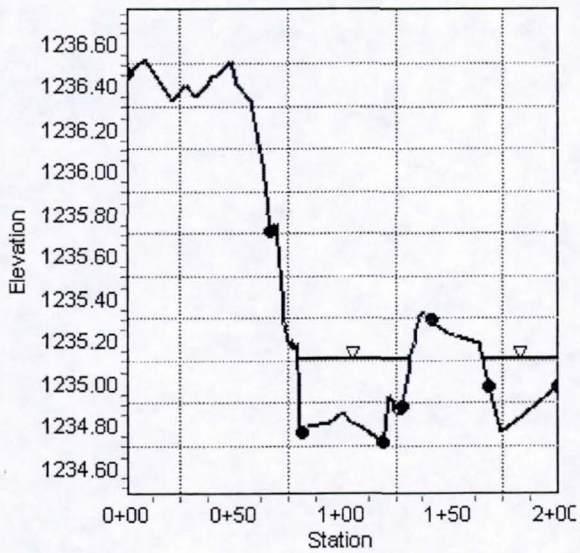
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Normal Depth	0.39	ft
Discharge	38.00	ft^3/s

Cross Section Image



Worksheet for Osborn/87th - Irregular Section - Iteration 3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Discharge	38.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	1236.46
0+08	1236.52
0+21	1236.33
0+28	1236.40
0+32	1236.35
0+37	1236.40
0+40	1236.44
0+41	1236.44
0+48	1236.51
0+52	1236.40
0+58	1236.33
0+63	1236.03
0+67	1235.71
0+69	1235.73
0+70	1235.75
0+72	1235.42
0+73	1235.28
0+75	1235.18
0+76	1235.20
0+77	1235.15
0+79	1235.18
0+79	1235.05
0+80	1234.78
0+81	1234.79
0+81	1234.76
0+83	1234.78
0+83	1234.79

Worksheet for Osborn/87th - Irregular Section - Iteration 3

Input Data

Station (ft)	Elevation (ft)
0+94	1234.81
1+01	1234.86

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1236.46)	(0+67, 1235.71)	0.080
(0+67, 1235.71)	(0+81, 1234.76)	0.013
(0+81, 1234.76)	(1+19, 1234.72)	0.016
(1+19, 1234.72)	(1+28, 1234.88)	0.013
(1+28, 1234.88)	(1+42, 1235.29)	0.025
(1+42, 1235.29)	(1+68, 1234.98)	0.080
(1+68, 1234.98)	(2+00, 1234.98)	0.050

Results

Normal Depth	0.39	ft
Elevation Range	1234.72 to 1236.52 ft	
Flow Area	22.59	ft²
Wetted Perimeter	87.48	ft
Top Width	87.28	ft
Normal Depth	0.39	ft
Critical Depth	0.31	ft
Critical Slope	0.03286	ft/ft
Velocity	1.68	ft/s
Velocity Head	0.04	ft
Specific Energy	0.43	ft
Froude Number	0.58	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

Worksheet for Osborn/87th - Irregular Section - Iteration 3

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.39	ft
Critical Depth	0.31	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.03286	ft/ft

Cross Section for Osborn/87th - Grate Inlet on Grade - Iteration 3

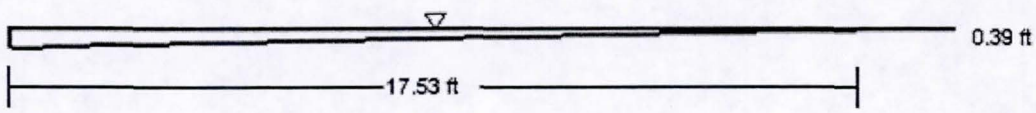
Project Description

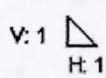
Solve For	Efficiency

Input Data

Discharge	11.00	ft^3/s
Slope	0.01000	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Efficiency	40.13	%
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Cross Section Image





Worksheet for Osborn/87th - Grate Inlet on Grade - Iteration 3

Project Description

Solve For	Efficiency

Input Data

Discharge	11.00	ft^3/s
Slope	0.01000	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	40.13	%
Intercepted Flow	4.41	ft^3/s
Bypass Flow	6.59	ft^3/s
Spread	17.53	ft
Depth	0.39	ft
Flow Area	3.12	ft^2
Gutter Depression	0.04	ft
Total Depression	0.04	ft
Velocity	3.53	ft/s
Splash Over Velocity	9.97	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.15	
Grate Flow Ratio	0.30	
Active Grate Length	3.00	ft

Cross Section for Osborn/87th - Irregular Section - Iteration 4

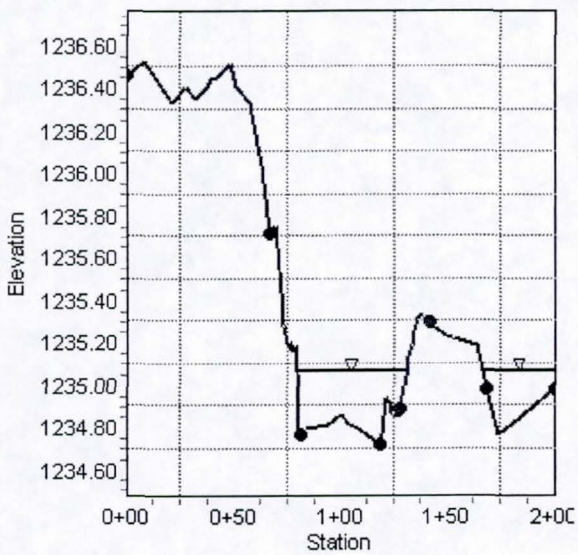
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Normal Depth	0.34	ft
Discharge	29.10	ft^3/s

Cross Section Image



Worksheet for Osborn/87th - Irregular Section - Iteration 4

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Discharge	29.10	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	1236.46
0+08	1236.52
0+21	1236.33
0+28	1236.40
0+32	1236.35
0+37	1236.40
0+40	1236.44
0+41	1236.44
0+48	1236.51
0+52	1236.40
0+58	1236.33
0+63	1236.03
0+67	1235.71
0+69	1235.73
0+70	1235.75
0+72	1235.42
0+73	1235.28
0+75	1235.18
0+76	1235.20
0+77	1235.15
0+79	1235.18
0+79	1235.05
0+80	1234.78
0+81	1234.79
0+81	1234.76
0+83	1234.78
0+83	1234.79

Worksheet for Osborn/87th - Irregular Section - Iteration 4

Input Data

Station (ft)	Elevation (ft)
0+94	1234.81
1+01	1234.86

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1236.46)	(0+67, 1235.71)	0.080
(0+67, 1235.71)	(0+81, 1234.76)	0.013
(0+81, 1234.76)	(1+19, 1234.72)	0.016
(1+19, 1234.72)	(1+28, 1234.88)	0.013
(1+28, 1234.88)	(1+42, 1235.29)	0.025
(1+42, 1235.29)	(1+68, 1234.98)	0.080
(1+68, 1234.98)	(2+00, 1234.98)	0.050

Results

Normal Depth		0.34	ft
Elevation Range	1234.72 to 1236.52 ft		
Flow Area		18.88	ft²
Wetted Perimeter		85.80	ft
Top Width		85.66	ft
Normal Depth		0.34	ft
Critical Depth		0.27	ft
Critical Slope		0.03340	ft/ft
Velocity		1.54	ft/s
Velocity Head		0.04	ft
Specific Energy		0.38	ft
Froude Number		0.58	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

Worksheet for Osborn/87th - Irregular Section - Iteration 4

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.34	ft
Critical Depth	0.27	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.03340	ft/ft

Cross Section for Osborn/87th - Grate Inlet on Grade - Iteration 4

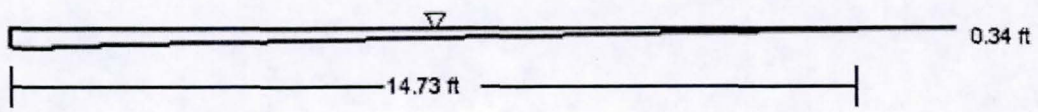
Project Description

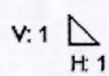
Solve For	Efficiency

Input Data

Discharge	7.00	ft^3/s
Slope	0.01000	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Efficiency	46.38	%
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Cross Section Image





Worksheet for Osborn/87th - Grate Inlet on Grade - Iteration 4

Project Description

Solve For	Efficiency

Input Data

Discharge	7.00	ft^3/s
Slope	0.01000	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	46.38	%
Intercepted Flow	3.25	ft^3/s
Bypass Flow	3.75	ft^3/s
Spread	14.73	ft
Depth	0.34	ft
Flow Area	2.21	ft^2
Gutter Depression	0.04	ft
Total Depression	0.04	ft
Velocity	3.16	ft/s
Splash Over Velocity	9.97	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.17	
Grate Flow Ratio	0.35	
Active Grate Length	3.00	ft

Cross Section for Osborn/87th - Irregular Section - Iteration 5

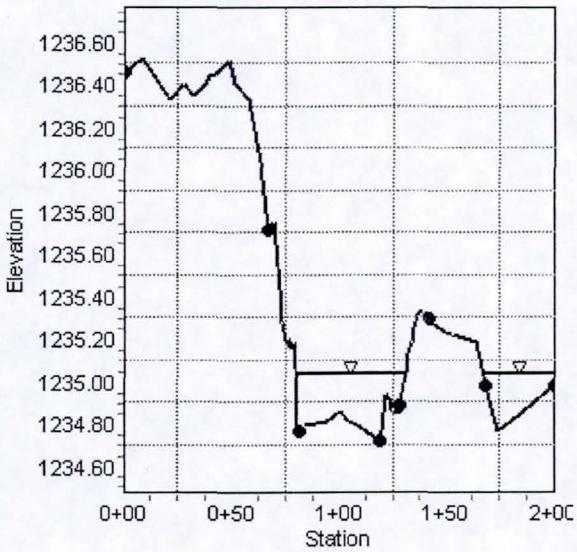
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Normal Depth	0.31	ft
Discharge	22.60	ft^3/s

Cross Section Image



Worksheet for Osborn/87th - Irregular Section - Iteration 5

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Discharge	22.60	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	1236.46
0+08	1236.52
0+21	1236.33
0+28	1236.40
0+32	1236.35
0+37	1236.40
0+40	1236.44
0+41	1236.44
0+48	1236.51
0+52	1236.40
0+58	1236.33
0+63	1236.03
0+67	1235.71
0+69	1235.73
0+70	1235.75
0+72	1235.42
0+73	1235.28
0+75	1235.18
0+76	1235.20
0+77	1235.15
0+79	1235.18
0+79	1235.05
0+80	1234.78
0+81	1234.79
0+81	1234.76
0+83	1234.78
0+83	1234.79

Worksheet for Osborn/87th - Irregular Section - Iteration 5

Input Data

Station (ft)	Elevation (ft)
0+94	1234.81
1+01	1234.86

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1236.46)	(0+67, 1235.71)	0.080
(0+67, 1235.71)	(0+81, 1234.76)	0.013
(0+81, 1234.76)	(1+19, 1234.72)	0.016
(1+19, 1234.72)	(1+28, 1234.88)	0.013
(1+28, 1234.88)	(1+42, 1235.29)	0.025
(1+42, 1235.29)	(1+68, 1234.98)	0.080
(1+68, 1234.98)	(2+00, 1234.98)	0.050

Results

Normal Depth	0.31	ft
Elevation Range	1234.72 to 1236.52 ft	
Flow Area	15.96	ft²
Wetted Perimeter	84.43	ft
Top Width	84.33	ft
Normal Depth	0.31	ft
Critical Depth	0.25	ft
Critical Slope	0.03394	ft/ft
Velocity	1.42	ft/s
Velocity Head	0.03	ft
Specific Energy	0.34	ft
Froude Number	0.57	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

Worksheet for Osborn/87th - Irregular Section - Iteration 5

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.31	ft
Critical Depth	0.25	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.03394	ft/ft

Cross Section for Osborn/87th - Grate Inlet on Grade - Iteration 5

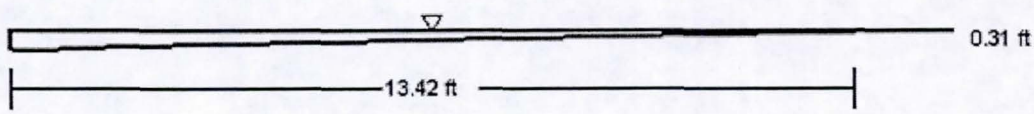
Project Description

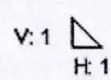
Solve For	Efficiency

Input Data

Discharge	5.50	ft^3/s
Slope	0.01000	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Efficiency	49.96	%
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Cross Section Image





Worksheet for Osborn/87th - Grate Inlet on Grade - Iteration 5

Project Description

Solve For	Efficiency

Input Data

Discharge	5.50	ft^3/s
Slope	0.01000	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	49.96	%
Intercepted Flow	2.75	ft^3/s
Bypass Flow	2.75	ft^3/s
Spread	13.42	ft
Depth	0.31	ft
Flow Area	1.84	ft^2
Gutter Depression	0.04	ft
Total Depression	0.04	ft
Velocity	2.98	ft/s
Splash Over Velocity	9.97	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.19	
Grate Flow Ratio	0.38	
Active Grate Length	3.00	ft

Cross Section for Osborn/87th - Irregular Section - Iteration 6

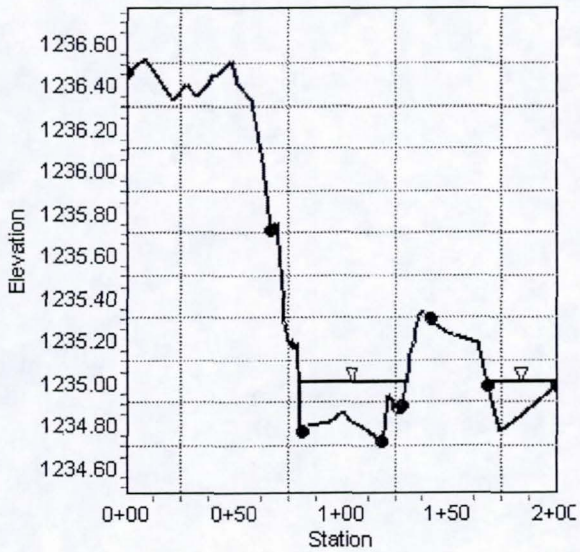
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Normal Depth	0.28	ft
Discharge	17.10	ft³/s

Cross Section Image



Worksheet for Osborn/87th - Irregular Section - Iteration 6

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Discharge	17.10	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	1236.46
0+08	1236.52
0+21	1236.33
0+28	1236.40
0+32	1236.35
0+37	1236.40
0+40	1236.44
0+41	1236.44
0+48	1236.51
0+52	1236.40
0+58	1236.33
0+63	1236.03
0+67	1235.71
0+69	1235.73
0+70	1235.75
0+72	1235.42
0+73	1235.28
0+75	1235.18
0+76	1235.20
0+77	1235.15
0+79	1235.18
0+79	1235.05
0+80	1234.78
0+81	1234.79
0+81	1234.76
0+83	1234.78
0+83	1234.79

Worksheet for Osborn/87th - Irregular Section - Iteration 6

Input Data

Station (ft)	Elevation (ft)
0+94	1234.81
1+01	1234.86

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1236.46)	(0+67, 1235.71)	0.080
(0+67, 1235.71)	(0+81, 1234.76)	0.013
(0+81, 1234.76)	(1+19, 1234.72)	0.016
(1+19, 1234.72)	(1+28, 1234.88)	0.013
(1+28, 1234.88)	(1+42, 1235.29)	0.025
(1+42, 1235.29)	(1+68, 1234.98)	0.080
(1+68, 1234.98)	(2+00, 1234.98)	0.050

Results

Normal Depth	0.28	ft
Elevation Range	1234.72 to 1236.52 ft	
Flow Area	13.28	ft²
Wetted Perimeter	83.05	ft
Top Width	82.98	ft
Normal Depth	0.28	ft
Critical Depth	0.22	ft
Critical Slope	0.03449	ft/ft
Velocity	1.29	ft/s
Velocity Head	0.03	ft
Specific Energy	0.30	ft
Froude Number	0.57	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

Worksheet for Osborn/87th - Irregular Section - Iteration 6

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.28	ft
Critical Depth	0.22	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.03449	ft/ft

Cross Section for Osborn/87th - Grate Inlet on Grade - Iteration 6

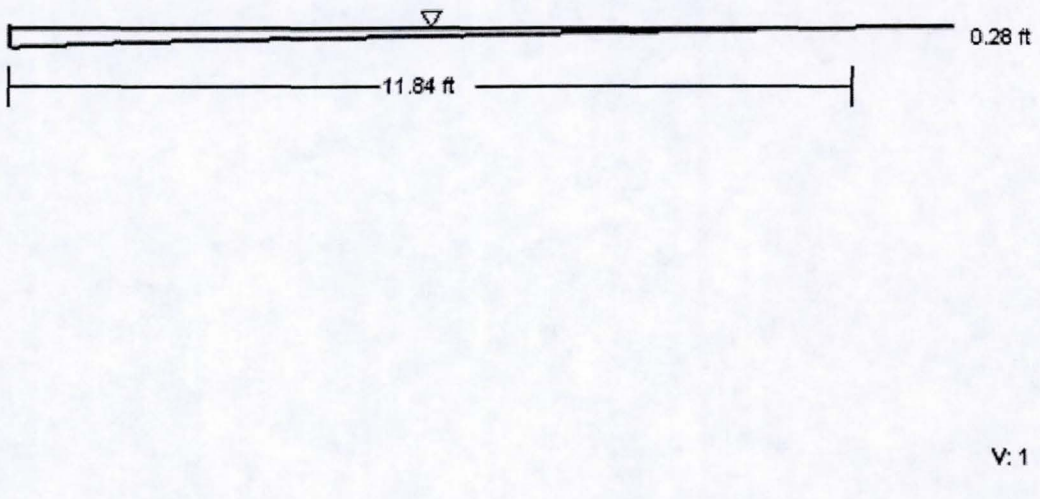
Project Description

Solve For	Efficiency

Input Data

Discharge	4.00	ft^3/s
Slope	0.01000	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Efficiency	54.92	%
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Cross Section Image



Worksheet for Osborn/87th - Grate Inlet on Grade - Iteration 6

Project Description

Solve For	Efficiency

Input Data

Discharge	4.00	ft^3/s
Slope	0.01000	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	54.92	%
Intercepted Flow	2.20	ft^3/s
Bypass Flow	1.80	ft^3/s
Spread	11.84	ft
Depth	0.28	ft
Flow Area	1.45	ft^2
Gutter Depression	0.04	ft
Total Depression	0.04	ft
Velocity	2.77	ft/s
Splash Over Velocity	9.97	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.21	
Grate Flow Ratio	0.43	
Active Grate Length	3.00	ft

Cross Section for Osborn/87th - Irregular Section - Iteration 7

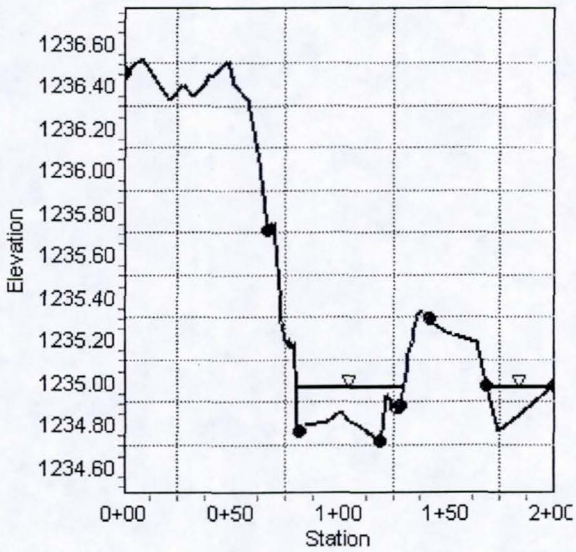
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Normal Depth	0.25	ft
Discharge	12.70	ft³/s

Cross Section Image



Worksheet for Osborn/87th - Irregular Section - Iteration 7

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01000	ft/ft
Discharge	12.70	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	1236.46
0+08	1236.52
0+21	1236.33
0+28	1236.40
0+32	1236.35
0+37	1236.40
0+40	1236.44
0+41	1236.44
0+48	1236.51
0+52	1236.40
0+58	1236.33
0+63	1236.03
0+67	1235.71
0+69	1235.73
0+70	1235.75
0+72	1235.42
0+73	1235.28
0+75	1235.18
0+76	1235.20
0+77	1235.15
0+79	1235.18
0+79	1235.05
0+80	1234.78
0+81	1234.79
0+81	1234.76
0+83	1234.78
0+83	1234.79

Worksheet for Osborn/87th - Irregular Section - Iteration 7

Input Data

Station (ft)	Elevation (ft)
0+94	1234.81
1+01	1234.86

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1236.46)	(0+67, 1235.71)	0.080
(0+67, 1235.71)	(0+81, 1234.76)	0.013
(0+81, 1234.76)	(1+19, 1234.72)	0.016
(1+19, 1234.72)	(1+28, 1234.88)	0.013
(1+28, 1234.88)	(1+42, 1235.29)	0.025
(1+42, 1235.29)	(1+68, 1234.98)	0.080
(1+68, 1234.98)	(2+00, 1234.98)	0.050

Results

Normal Depth	0.25	ft
Elevation Range	1234.72 to 1236.52 ft	
Flow Area	10.80	ft²
Wetted Perimeter	80.24	ft
Top Width	80.19	ft
Normal Depth	0.25	ft
Critical Depth	0.20	ft
Critical Slope	0.03466	ft/ft
Velocity	1.18	ft/s
Velocity Head	0.02	ft
Specific Energy	0.27	ft
Froude Number	0.56	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

Worksheet for Osborn/87th - Irregular Section - Iteration 7

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.25	ft
Critical Depth	0.20	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.03466	ft/ft

Cross Section for Osborn/87th - Grate Inlet on Grade - Iteration 7

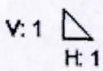
Project Description

Solve For	Efficiency

Input Data

Discharge	3.00	ft^3/s
Slope	0.01000	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Efficiency	59.60	%
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Cross Section Image



Worksheet for Osborn/87th - Grate Inlet on Grade - Iteration 7

Project Description

Solve For	Efficiency

Input Data

Discharge	3.00	ft^3/s
Slope	0.01000	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.04	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

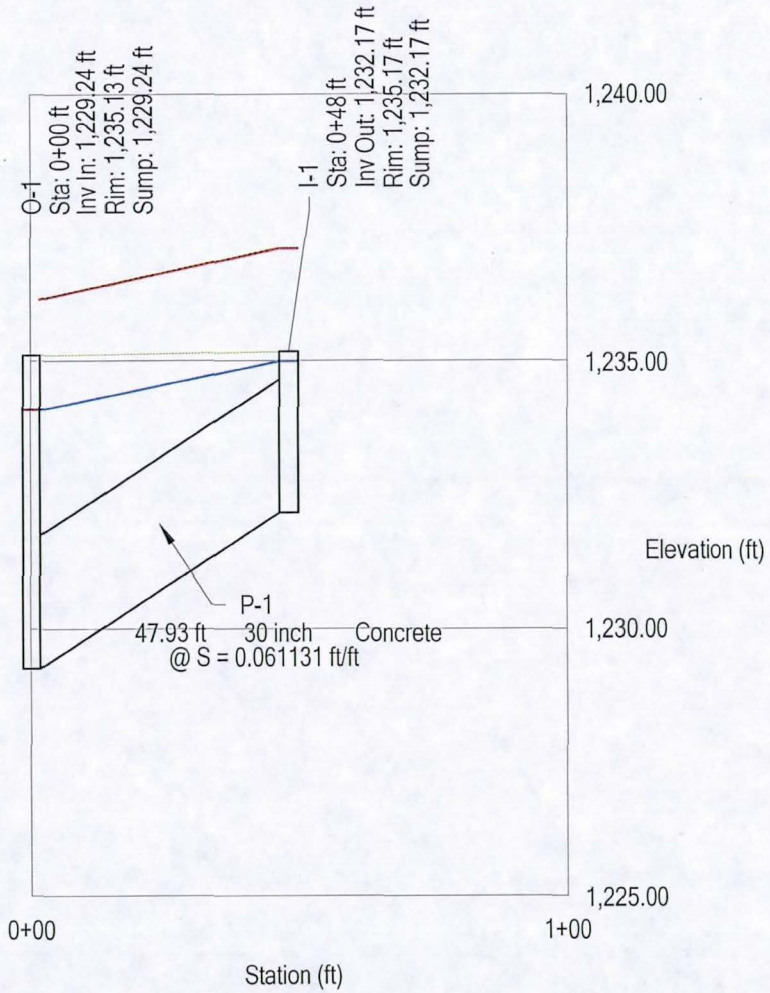
Grate Flow Option	Exclude None

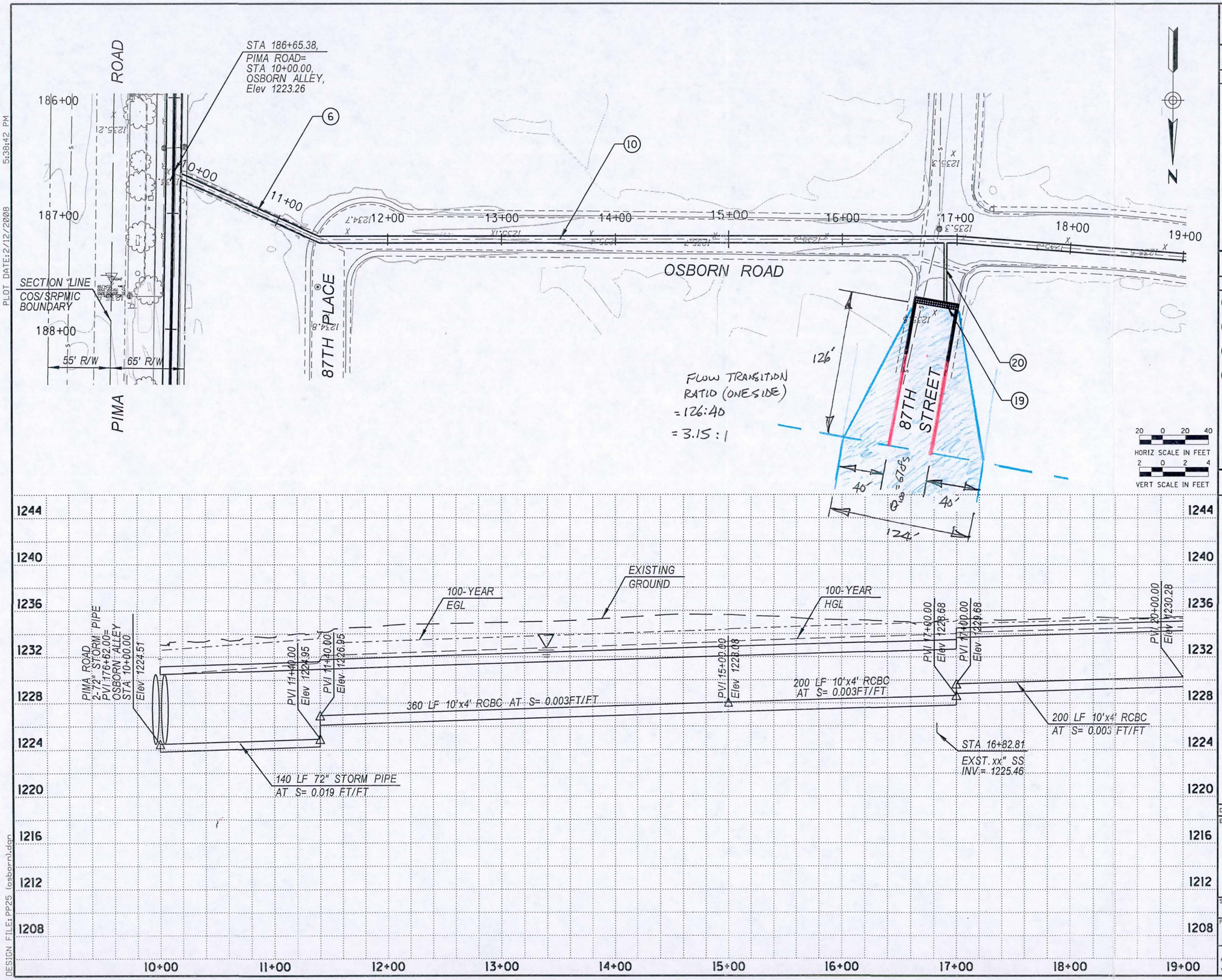
Results

Efficiency	59.60	%
Intercepted Flow	1.79	ft^3/s
Bypass Flow	1.21	ft^3/s
Spread	10.57	ft
Depth	0.25	ft
Flow Area	1.16	ft^2
Gutter Depression	0.04	ft
Total Depression	0.04	ft
Velocity	2.59	ft/s
Splash Over Velocity	9.97	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.23	
Grate Flow Ratio	0.47	
Active Grate Length	3.00	ft

Profile: Grate To Box

87th Street and Osborn





PLOT DATE: 2/12/2008 5:38:42 PM

DESIGN FILE: PP25 (osborn).dgn

PSOMAS
3800 North Central Avenue, Suite 1200
Phoenix, AZ 85012
(602) 222-8260 (602) 266-0218 (FAX)

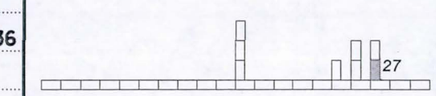
REMOVAL & RELOCATION NOTES

Description	Unit	Quan

CONSTRUCTION NOTES

Description	Unit	Quan
(6) CONSTRUCT NEW 72" PIPE	LF	140
(10) CONSTRUCT NEW 10'x4' RCBC	LF	760
(19) INTERCEPTION STRUCTURE PER DTL. #, SHEET #	EA	1
(20) CONSTRUCT NEW 30" PIPE	LF	50.93

GENERAL NOTES



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Blue Stake Center
CALL COLLECT

DATE	REVISION	BY

ENGINEER

30% PRELIMINARY NOT FOR CONSTRUCTION

MUNICIPAL SERVICES DEPARTMENT
CAPITAL PROJECT MANAGEMENT
7447 E. INDIAN SCHOOL RD.
SCOTTSDALE, ARIZONA 85251

SHEET TITLE
OSBORN ROAD CONDUIT - PLAN & PROFILE

PROJECT TITLE
GRANITE REEF WASH DRAINAGE STUDY AND PRELIMINARY DESIGN IMPROVEMENTS

SCALE	DESIGNED	DATE	BID NO.	SHT.
HORIZ. 1"=40'	JKK	02/08	-	PP27
VERT. 1"=4'	DRAWN GRS	AS-BUILT -	PROJECT NO. 06077-01	31 OF 36

XXX-XXX

FAIRMOUNT @ PFR

Worksheet for Ditch Inlet On Grade - 1

Project Description

Solve For	Efficiency

Input Data

Roughness Coefficient	0.016	
Slope	0.00230	ft/ft
Left Side Slope	0.02	ft/ft (H:V)
Right Side Slope	0.02	ft/ft (H:V)
Bottom Width	36.00	ft
Discharge	817.00	ft^3/s
Grate Width	10.00	ft
Grate Length	10.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	32.02	%
Intercepted Flow	261.63	ft^3/s
Bypass Flow	555.37	ft^3/s
Flow Area	101.35	ft^2
Wetted Perimeter	41.62	ft
Top Width	36.11	ft
Velocity	8.06	ft/s
Splash Over Velocity	13.09	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.06	
Grate Flow Ratio	0.28	
Active Grate Length	5.00	ft
Critical Depth	2.52	ft
Critical Slope	0.00325	ft/ft
Froude Number	0.85	
Flow Type	Subcritical	
Specific Energy	3.82	ft
Velocity Head	1.01	ft
Depth	2.81	ft

OLIVE @ PFR*

Worksheet for Ditch Inlet On Grade - 1

Project Description

Solve For	Efficiency

Input Data

Roughness Coefficient	0.016	
Slope	0.00290	ft/ft
Left Side Slope	0.02	ft/ft (H:V) } REPRESENTS VERTICAL WALLS ALONG PFR
Right Side Slope	0.02	ft/ft (H:V) }
Bottom Width	36.00	ft ← STREET WIDTH
Discharge	621.00	ft³/s ← REMAINING Q AFTER INTERCEPTION FROM FAIRMOUNT @ PFR
Grate Width	12.00	ft
Grate Length	12.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

817
−621
196

Options

Grate Flow Option	Exclude None

Results

Efficiency	39.41	%
Intercepted Flow	244.74	ft³/s
Bypass Flow	376.26	ft³/s
Flow Area	79.24	ft²
Wetted Perimeter	40.40	ft
Top Width	36.09	ft
Velocity	7.84	ft/s
Splash Over Velocity	15.04	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.09	
Grate Flow Ratio	0.33	
Active Grate Length	6.00	ft
Critical Depth	2.10	ft
Critical Slope	0.00337	ft/ft
Froude Number	0.93	
Flow Type	Subcritical	
Specific Energy	3.15	ft
Velocity Head	0.95	ft
Depth	2.20	ft

* PFR = "PIMA FRONTAGE ROAD"

OSBORN @ PFR

Worksheet for Ditch Inlet On Grade - 1

Project Description

Solve For	Efficiency

Input Data

Roughness Coefficient	0.016		
Slope	0.00290	ft/ft	
Left Side Slope	0.02	ft/ft (H:V)	VERTICAL WALLS
Right Side Slope	0.02	ft/ft (H:V)	
Bottom Width	36.00	ft	
Discharge	460.00	ft^3/s	← REMAINING Q FROM OLIVE AVE/PFR
Grate Width	14.00	ft	
Grate Length	14.00	ft	
Grate Type	P-50 mm (P-1-7/8")		
Clogging	50.00	%	

Options

Grate Flow Option	Exclude None

Results

Efficiency	48.01	%
Intercepted Flow	220.85	ft^3/s
Bypass Flow	239.15	ft^3/s
Flow Area	65.68	ft^2
Wetted Perimeter	39.65	ft
Top Width	36.07	ft
Velocity	7.00	ft/s
Splash Over Velocity	17.69	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.15	
Grate Flow Ratio	0.39	
Active Grate Length	7.00	ft
Critical Depth	1.72	ft
Critical Slope	0.00351	ft/ft
Froude Number	0.92	
Flow Type	Subcritical	
Specific Energy	2.58	ft
Velocity Head	0.76	ft
Depth	1.82	ft

EARLL @ PFR

Worksheet for Ditch Inlet In Sag - 1

Project Description

Solve For	Spread

Input Data

Discharge	270.00	ft^3/s ← REMAINING FROM OSBORN/PFR
Left Side Slope	0.02	ft/ft (H:V)
Right Side Slope	0.02	ft/ft (H:V)
Bottom Width	42.00	ft
Grate Width	12.00	ft
Grate Length	12.00	ft
Local Depression	6.00	in
Local Depression Width	12.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Results

Spread	42.05	ft
Depth	1.34	ft
Wetted Perimeter	44.68	ft
Top Width	42.05	ft
Open Grate Area	64.80	ft^2
Active Grate Weir Length	36.00	ft

Worksheet for Ditch Inlet on Grade: Thomas & 87th.

Project Description

Solve For	Efficiency

Input Data

Roughness Coefficient	0.018		
Slope	0.01000	ft/ft	
Left Side Slope	0.02	ft/ft (H:V)	REPRESENTS CMU WALLS NEAR BACK OF SIDEWALKS
Right Side Slope	0.02	ft/ft (H:V)	
Bottom Width	60.00	ft	
Discharge	192.00	ft^3/s	
Grate Width	40.00	ft	FACE OF CURB TO FACE OF CURB
Grate Length	75.00	ft	
Grate Type	P-50 mm (P-1-7/8")		
Clogging	50.00	%	

Options

Grate Flow Option	Exclude None

Results

Efficiency	97.53	%	
Intercepted Flow	187.25	ft^3/s	
Bypass Flow	4.75	ft^3/s	
Flow Area	34.25	ft^2	
Wetted Perimeter	61.14	ft	
Top Width	60.02	ft	
Velocity	5.61	ft/s	
Splash Over Velocity	2172.35	ft/s	NULL - DUE TO GRATE LENGTH
Frontal Flow Factor	1.00		
Side Flow Factor	0.93		
Grate Flow Ratio	0.67		
Active Grate Length	37.50	ft	
Critical Depth	0.68	ft	
Critical Slope	0.00552	ft/ft	
Froude Number	1.31		
Flow Type	Supercritical		
Specific Energy	1.06	ft	
Velocity Head	0.49	ft	
Depth	0.57	ft	

Culvert Calculator Report
Worksheet-2

Solve For: Headwater Elevation

ANALYSIS TO DETERMINE WHETHER STRUCTURE OUTLET (MODELED AS A 90° HEADWALL, CIRCULAR - 2 BARRELL, 54" CULVERT)*
HEADWATER WOULD EXCEED EITHER GRATE ELEVATION OR HGL FROM STORMCAD.

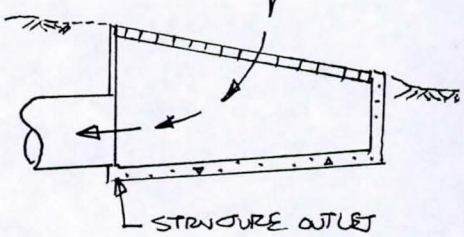
Culvert Summary			
Allowable HW Elevation	1,222.32 ft	Headwater Depth/Height	1.04
Computed Headwater Elev	1,216.39 ft	Discharge	192.00 cfs
Inlet Control HW Elev. ✓	1,216.19 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	1,216.39 ft	Control Type	Outlet Control

IGNORE

Grades			
Upstream Invert	1,211.72 ft	Downstream Invert	1,211.54 ft
Length	65.38 ft	Constructed Slope	0.002753 ft/ft

Hydraulic Profile			
Profile	M2	Depth, Downstream	2.88 ft
Slope Type	Mild	Normal Depth	3.70 ft
Flow Regime	Subcritical	Critical Depth	2.88 ft
Velocity Downstream	8.94 ft/s	Critical Slope	0.005066 ft/ft

*STRUCTURE OUTLET IS POTENTIAL BOTTLENECK - CONFIGURATION IS BELOW GRATE



Section			
Section Shape	Circular	Mannings Coefficient	0.014
Section Material	Concrete	Span	4.50 ft
Section Size	54 inch ✓	Rise	4.50 ft
Number Sections	2 ✓		

Outlet Control Properties			
Outlet Control HW Elev.	1,216.39 ft	Upstream Velocity Head	0.94 ft
Ke	0.50	Entrance Loss	0.47 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,216.19 ft	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	31.8 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

INTERCEPTION CALCULATIONS							
PIMA ROAD / THOMAS ROAD							
	Irregular Section			Intercepted Flow, Qi			
	6.	1.	2.	3.	4.	5.	
Iteration	Q_{actual}	Actual Depth	Q_{dummy}	Half Street (Q_i)	Full Street ($2*Q_i$)	Q_{remain}	Incremental Grate Length
	cfs	ft	cfs	cfs	cfs	cfs	ft
1	560	2.63	830	102.3	204.6	355.4	6
2	355.4	2.14	476	72.7	145.4	210.0	6
3	210.0	1.68	246	48.1	96.2	113.8	6
4	113.8	1.27	114	29.3	58.6	55.2	6
5	55.2	0.89	42.8	15.2	30.4	24.8	6
6	24.8	0.60	14.2	6.9	13.8	11.0	6
Total Intercepted Flow			549.0	cfs			
Total Bypass			11.0	cfs			
Total Grate Length (each side of street)			36	ft			

1. The HEC-1 Q was input into a Flowmaster Irregular Section to determine the actual depth of flow in the roadway section.
2. Due to limitations in defining the cross section for a curb and gutter section in Flowmaster, a "Dummy Q" was input into the Grate and Gutter section in order to match the actual depth observed from the Irregular Section from Step 1. This is to insure an accurate accounting of grate interception which is directly proportional to depth.
3. Based on a 50% clogging factor and a 24" wide grate (MAG Std. Det. 533-1), the intercepted flow for an incremental grate length of 6', Q_i, for half of the street cross section was calculated in the Grate and Gutter section. (See Flowmaster output).
4. Assuming linear grate inlets on both sides of the street, the incremental intercepted flow, Q_i for half of the street cross section was multiplied by 2 to determine the incremental intercepted flow for the entire street cross section.
5. The intercepted flow for the entire street cross section was then subtracted from the actual HEC-1 Q, to obtain a new Actual Q, which represents the remaining flow (after 6 feet of interception) for the entire roadway section after 6 feet of grate interception.
6. The new Actual Q was again input into the Flowmaster Irregular Channel section to determine the actual depth of flow at an incremental grate length 6 feet downstream of the original observation and the process repeated.

The above steps were executed until acceptable bypass flow remained or all flow was intercepted. From this analysis, it was determined that 2 grates, each 36 feet long and

2' wide, will be needed in order to intercept the flow along Pima Road just north of Thomas Road.

After layout in CAD (see included 30% detail sheet), it was determined that the angle of approach for flow spread out through the roadway section and through adjacent yards may be too sharp to recede along a 36' length of grate inlet. Though calculations indicate interception could be obtained from a grate capacity standpoint, it was determined that the physical proximity of stormflows may not make it into the grate inlets. Therefore a safety factor of 3.0 was applied to grate length to insure interception. Also, based on roadway geometry and sump conditions in Thomas Road, curb opening catchbasins at the intersection will be recommended for final design.

Cross Section for Thomas & Pima - Irregular Section - Iteration 1

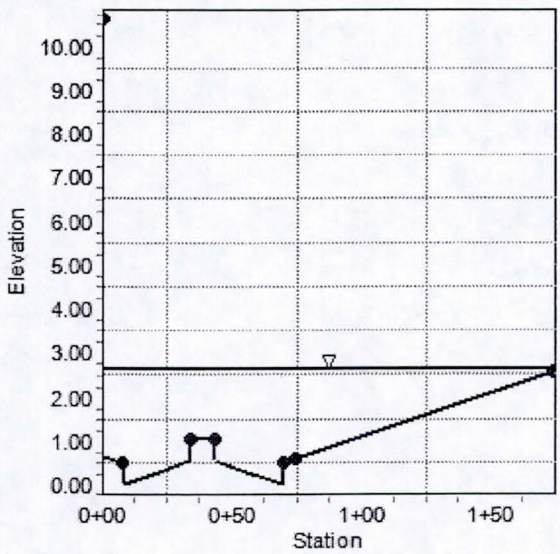
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.0014	ft/ft	
Normal Depth	2.63	ft	← ACTUAL DEPTH IN ROADWAY SECTION & ADJ. ROW
Discharge	560.00	ft³/s	← HEC-1 PEAK 100-YR Q

Cross Section Image



Thomas & Pima - Irregular Section - Iteration 1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.0014	ft/ft
Discharge	560.00	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	10.62
0+00.10	0.62
0+08.00	0.50
0+08.50	0.00
0+22.00	0.28
0+33.50	0.52
0+34.00	1.02
0+38.50	1.02
0+43.00	1.02
0+43.50	0.52
0+55.50	0.28
0+69.50	0.00
0+70.00	0.50
0+74.50	0.57
1+74.50	2.57

SECTION BASED ON PIMA ROAD GEOMETRIC CONCEPT REPORT, BRW, DEC 12 1992

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 10.62)	(0+08.00, 0.50)	0.022
(0+08.00, 0.50)	(0+34.00, 1.02)	0.016
(0+34.00, 1.02)	(0+43.00, 1.02)	0.022
(0+43.00, 1.02)	(0+70.00, 0.50)	0.016
(0+70.00, 0.50)	(0+74.50, 0.57)	0.013
(0+74.50, 0.57)	(1+74.50, 2.57)	0.045

Thomas & Pima - Irregular Section - Iteration 1

Results

Normal Depth		2.63	ft
Elevation Range	0.00 to 10.62 ft		
Flow Area		271.13	ft²
Wetted Perimeter		177.33	ft
Top Width		174.42	ft
Normal Depth		2.63	ft
Critical Depth		1.52	ft
Critical Slope		0.01988	ft/ft
Velocity		2.07	ft/s
Velocity Head		0.07	ft
Specific Energy		2.69	ft
Froude Number		0.29	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	1227.87	ft
Length	492.66	ft
Number Of Steps	10	

GVF Output Data

Upstream Depth	1227.18	ft
Profile Description	M1	
Profile Headloss	0.00	ft
Downstream Velocity	0.00	ft/s
Upstream Velocity	0.00	ft/s
Normal Depth	2.63	ft
Critical Depth	1.52	ft
Channel Slope	0.00140	ft/ft
Critical Slope	0.01988	ft/ft

Cross Section for Thomas & Pima - Grate on Grade Iteration 1

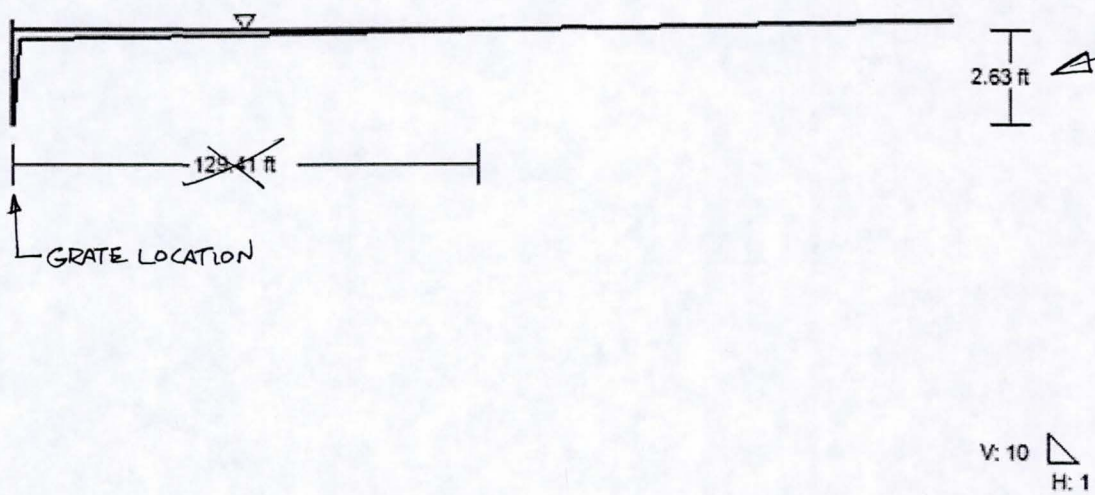
Project Description

Solve For	Efficiency

Input Data

Discharge	830.00	ft³/s	← DUMMY Q TO GET ACTUAL DEPTH
Slope	0.0014	ft/ft	
Gutter Width	2.00	ft	
Gutter Cross Slope	0.0417	ft/ft	
Road Cross Slope	0.0200	ft/ft	
Roughness Coefficient	0.016		
Efficiency	12.33	%	
Grate Width	2.00	ft	
Grate Length	6.00	ft	← INCREMENTAL LENGTH
Grate Type	P-50 mm (P-1-7/8")		
Clogging	50.00	%	

Cross Section Image



Thomas & Pima - Grate on Grade Iteration 1

Project Description

Solve For	Efficiency

Input Data

Discharge	830.00	ft^3/s
Slope	0.0014	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0417	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.016	
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	12.33	%
Intercepted Flow	102.34	ft^3/s ← INTERCEPTED FOR 6-Foot LENGTH
Bypass Flow	727.66	ft^3/s
Spread	129.41	ft
Depth	2.63	ft
Flow Area	167.52	ft^2
Gutter Depression	0.04	ft
Total Depression	0.04	ft
Velocity	4.95	ft/s
Splash Over Velocity	9.97	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.09	
Grate Flow Ratio	0.04	
Active Grate Length	3.00	ft

Cross Section for Thomas & Pima - Irregular Section - Iteration 2

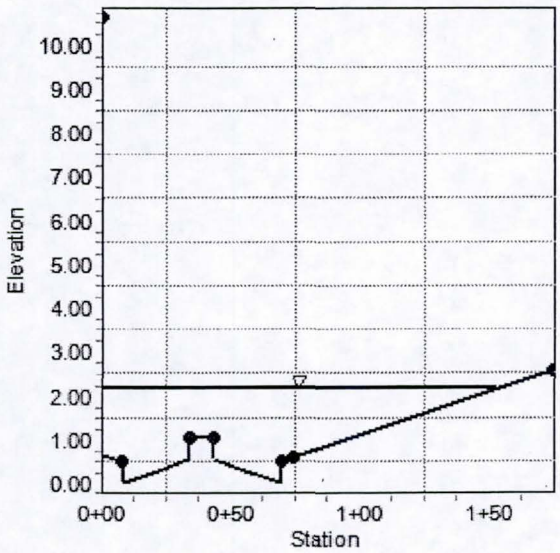
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.0014	ft/ft
Normal Depth	2.14	ft
Discharge	355.4	ft^3/s ← ACTUAL REMAINING (AFTER 6-ft OF GRATE INTERCEPTION - BOTH SIDES)

Cross Section Image



Thomas & Pima - Irregular Section - Iteration 2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.0014	ft/ft
Discharge	355.4	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	10.62
0+00.10	0.62
0+08.00	0.50
0+08.50	0.00
0+22.00	0.28
0+33.50	0.52
0+34.00	1.02
0+38.50	1.02
0+43.00	1.02
0+43.50	0.52
0+55.50	0.28
0+69.50	0.00
0+70.00	0.50
0+74.50	0.57
1+74.50	2.57

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 10.62)	(0+08.00, 0.50)	0.022
(0+08.00, 0.50)	(0+34.00, 1.02)	0.016
(0+34.00, 1.02)	(0+43.00, 1.02)	0.022
(0+43.00, 1.02)	(0+70.00, 0.50)	0.016
(0+70.00, 0.50)	(0+74.50, 0.57)	0.013
(0+74.50, 0.57)	(1+74.50, 2.57)	0.045

Thomas & Pima - Irregular Section - Iteration 2

Results

Normal Depth		2.14	ft
Elevation Range	0.00 to 10.62 ft		
Flow Area		191.04	ft²
Wetted Perimeter		155.43	ft
Top Width		153.07	ft
Normal Depth		2.14	ft
Critical Depth		1.26	ft
Critical Slope		0.01973	ft/ft
Velocity		1.86	ft/s
Velocity Head		0.05	ft
Specific Energy		2.20	ft
Froude Number		0.29	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	1227.87	ft
Length	492.66	ft
Number Of Steps	10	

GVF Output Data

Upstream Depth	1227.18	ft
Profile Description	M1	
Profile Headloss	0.00	ft
Downstream Velocity	0.00	ft/s
Upstream Velocity	0.00	ft/s
Normal Depth	2.14	ft
Critical Depth	1.26	ft
Channel Slope	0.00140	ft/ft
Critical Slope	0.01973	ft/ft

Cross Section for Thomas & Pima - Grate on Grade Iteration 2

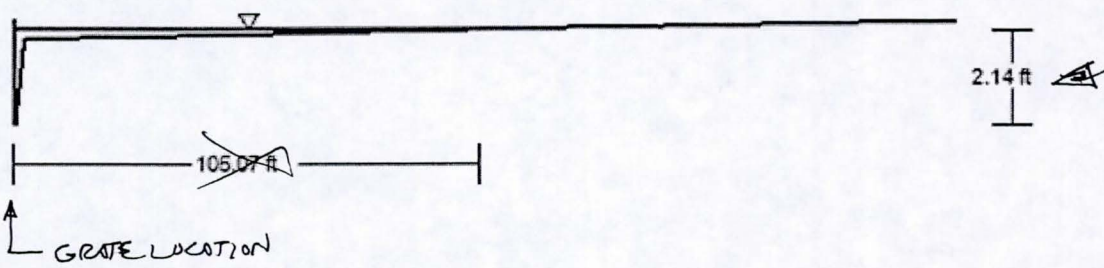
Project Description

Solve For	Efficiency

Input Data

Discharge	476.0	ft³/s ← DUMMY Q TO GET
Slope	0.0014	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0417	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.016	
Efficiency	15.27	%
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Cross Section Image



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Thomas & Pima - Grate on Grade Iteration 2

Project Description

Solve For	Efficiency

Input Data

Discharge	476.0	ft^3/s
Slope	0.0014	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0417	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.016	
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	15.27	%
Intercepted Flow	72.7	ft^3/s ← INTERCEPTION FOR 6-ft LENGTH (ONE SIDE OF STREET ONLY)
Bypass Flow	403.30	ft^3/s
Spread	105.07	ft
Depth	2.14	ft
Flow Area	110.45	ft^2
Gutter Depression	0.04	ft
Total Depression	0.04	ft
Velocity	4.31	ft/s
Splash Over Velocity	9.97	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.11	
Grate Flow Ratio	0.05	
Active Grate Length	3.00	ft

Cross Section for Thomas & Pima - Irregular Section - Iteration 3

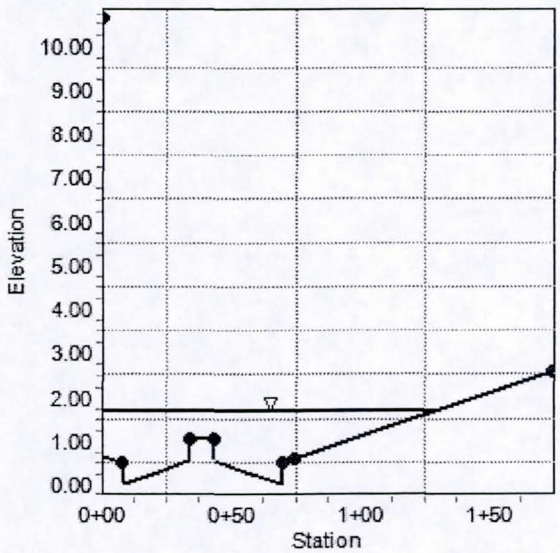
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.0014	ft/ft
Normal Depth	1.68	ft
Discharge	210.0	ft^3/s

Cross Section Image



Thomas & Pima - Irregular Section - Iteration 3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.0014	ft/ft
Discharge	210.0	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	10.62
0+00.10	0.62
0+08.00	0.50
0+08.50	0.00
0+22.00	0.28
0+33.50	0.52
0+34.00	1.02
0+38.50	1.02
0+43.00	1.02
0+43.50	0.52
0+55.50	0.28
0+69.50	0.00
0+70.00	0.50
0+74.50	0.57
1+74.50	2.57

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 10.62)	(0+08.00, 0.50)	0.022
(0+08.00, 0.50)	(0+34.00, 1.02)	0.016
(0+34.00, 1.02)	(0+43.00, 1.02)	0.022
(0+43.00, 1.02)	(0+70.00, 0.50)	0.016
(0+70.00, 0.50)	(0+74.50, 0.57)	0.013
(0+74.50, 0.57)	(1+74.50, 2.57)	0.045

Thomas & Pima - Irregular Section - Iteration 3

Results

Normal Depth		1.68	ft
Elevation Range	0.00 to 10.62 ft		
Flow Area		125.25	ft²
Wetted Perimeter		131.71	ft
Top Width		129.81	ft
Normal Depth		1.68	ft
Critical Depth		1.02	ft
Critical Slope		0.01888	ft/ft
Velocity		1.68	ft/s
Velocity Head		0.04	ft
Specific Energy		1.72	ft
Froude Number		0.30	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	1227.87	ft
Length	492.66	ft
Number Of Steps	10	

GVF Output Data

Upstream Depth		1227.18	ft
Profile Description	M1		
Profile Headloss		0.00	ft
Downstream Velocity		0.00	ft/s
Upstream Velocity		0.00	ft/s
Normal Depth		1.68	ft
Critical Depth		1.02	ft
Channel Slope		0.00140	ft/ft
Critical Slope		0.01888	ft/ft

Cross Section for Thomas & Pima - Grate on Grade Iteration 3

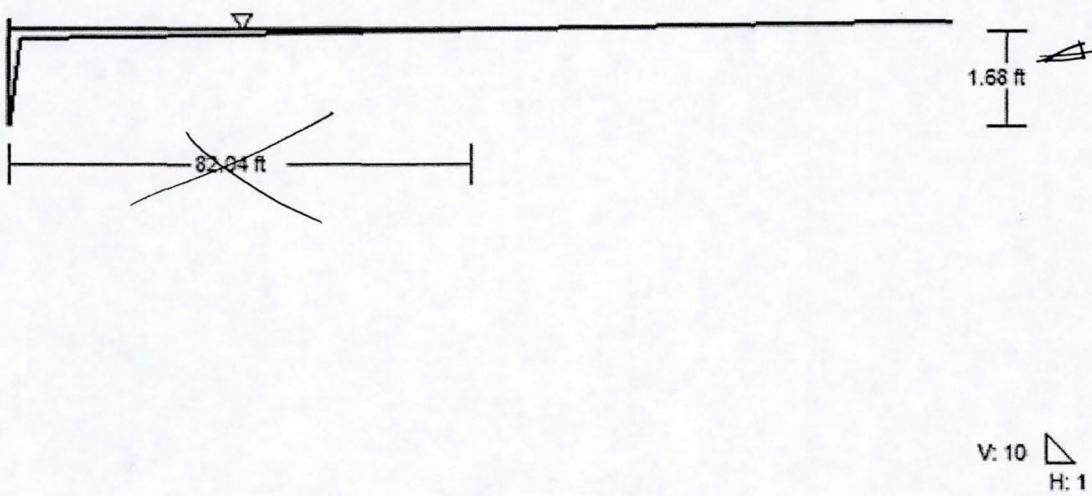
Project Description

Solve For	Efficiency

Input Data

Discharge	246.0	ft³/s ← DUMMY Q TO GET
Slope	0.0014	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0417	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.016	
Efficiency	19.54	%
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Cross Section Image



Worksheet for Thomas & Pima - Grate on Grade Iteration 3

Project Description

Solve For	Efficiency

Input Data

Discharge	246.0	ft^3/s
Slope	0.0014	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0417	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.016	
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	19.54	%
Intercepted Flow	48.1	ft^3/s ← ONE SIDE OF STREET FOR 6-Foot LENGTH
Bypass Flow	197.93	ft^3/s
Spread	82.04	ft
Depth	1.68	ft
Flow Area	67.35	ft^2
Gutter Depression	0.04	ft
Total Depression	0.04	ft
Velocity	3.65	ft/s
Splash Over Velocity	9.97	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.14	
Grate Flow Ratio	0.07	
Active Grate Length	3.00	ft

Cross Section for Thomas & Pima - Irregular Section - Iteration 4

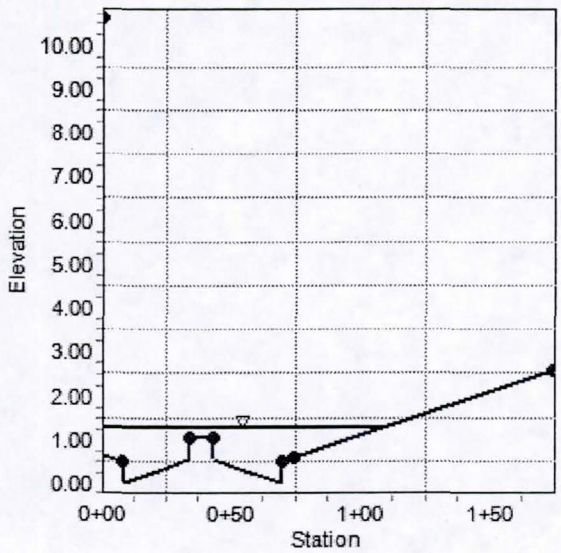
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.0014	ft/ft
Normal Depth	1.27	ft
Discharge	113.8	ft^3/s

Cross Section Image



Thomas & Pima - Irregular Section - Iteration 4

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.0014	ft/ft
Discharge	113.8	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	10.62
0+00.10	0.62
0+08.00	0.50
0+08.50	0.00
0+22.00	0.28
0+33.50	0.52
0+34.00	1.02
0+38.50	1.02
0+43.00	1.02
0+43.50	0.52
0+55.50	0.28
0+69.50	0.00
0+70.00	0.50
0+74.50	0.57
1+74.50	2.57

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 10.62)	(0+08.00, 0.50)	0.022
(0+08.00, 0.50)	(0+34.00, 1.02)	0.016
(0+34.00, 1.02)	(0+43.00, 1.02)	0.022
(0+43.00, 1.02)	(0+70.00, 0.50)	0.016
(0+70.00, 0.50)	(0+74.50, 0.57)	0.013
(0+74.50, 0.57)	(1+74.50, 2.57)	0.045

Thomas & Pima - Irregular Section - Iteration 4

Results

Normal Depth		1.27	ft
Elevation Range	0.00 to 10.62 ft		
Flow Area		76.34	ft²
Wetted Perimeter		110.84	ft
Top Width		109.35	ft
Normal Depth		1.27	ft
Critical Depth		0.78	ft
Critical Slope		0.01679	ft/ft
Velocity		1.49	ft/s
Velocity Head		0.03	ft
Specific Energy		1.30	ft
Froude Number		0.31	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	1227.87	ft
Length	492.66	ft
Number Of Steps	10	

GVF Output Data

Upstream Depth	1227.18	ft
Profile Description	M1	
Profile Headloss	0.00	ft
Downstream Velocity	0.00	ft/s
Upstream Velocity	0.00	ft/s
Normal Depth	1.27	ft
Critical Depth	0.78	ft
Channel Slope	0.00140	ft/ft
Critical Slope	0.01679	ft/ft

Cross Section for Thomas & Pima - Grate on Grade Iteration 4

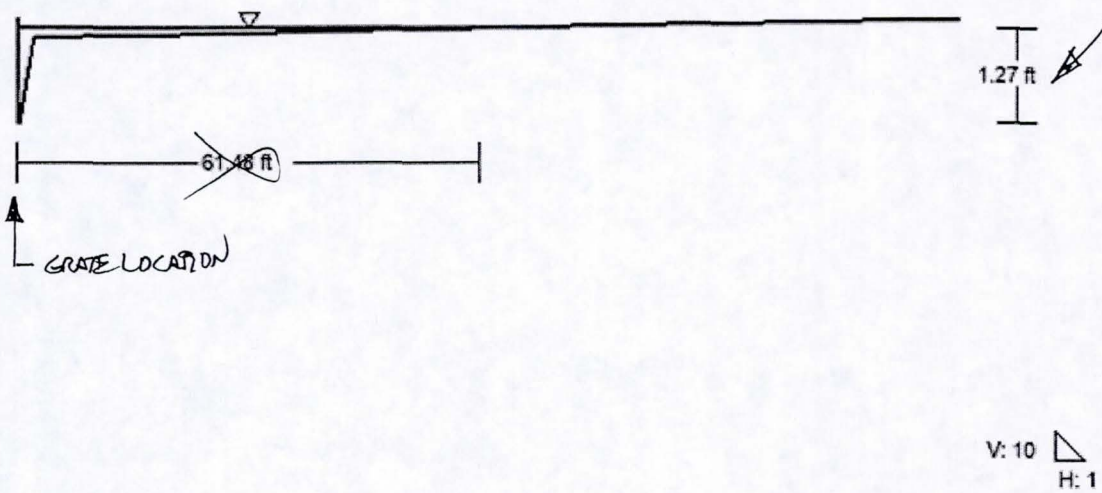
Project Description

Solve For	Efficiency

Input Data

Discharge	114.0	ft³/s ← DUMMY Q
Slope	0.0014	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0417	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.016	
Efficiency	25.70	%
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Cross Section Image



Thomas & Pima - Grate on Grade Iteration 4

Project Description

Solve For	Efficiency

Input Data

Discharge	114.0	ft^3/s
Slope	0.0014	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0417	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.016	
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	25.70	%
Intercepted Flow	29.3	ft^3/s ← FOR 6-ft LENGTH, ONE SIDE
Bypass Flow	84.70	ft^3/s
Spread	61.48	ft
Depth	1.27	ft
Flow Area	37.84	ft^2
Gutter Depression	0.04	ft
Total Depression	0.04	ft
Velocity	3.01	ft/s
Splash Over Velocity	9.97	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.19	
Grate Flow Ratio	0.09	
Active Grate Length	3.00	ft

Cross Section for Thomas & Pima - Irregular Section - Iteration 5

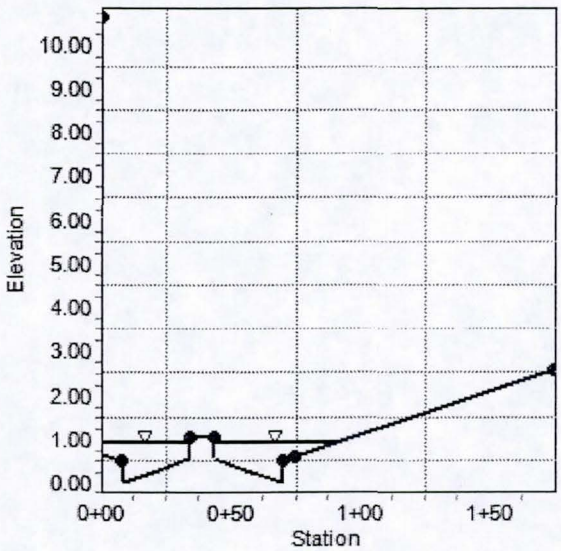
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.0014	ft/ft
Normal Depth	0.89	ft
Discharge	55.2	ft^3/s ← REMAINING Q AFTER 6 MORE FEET OF INTERCEPTION...

Cross Section Image



Thomas & Pima - Irregular Section - Iteration 5

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.0014	ft/ft
Discharge	55.2	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	10.62
0+00.10	0.62
0+08.00	0.50
0+08.50	0.00
0+22.00	0.28
0+33.50	0.52
0+34.00	1.02
0+38.50	1.02
0+43.00	1.02
0+43.50	0.52
0+55.50	0.28
0+69.50	0.00
0+70.00	0.50
0+74.50	0.57
1+74.50	2.57

PIMA ROAD REPORT
BRW, DEC 12 1992

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 10.62)	(0+08.00, 0.50)	0.022
(0+08.00, 0.50)	(0+34.00, 1.02)	0.016
(0+34.00, 1.02)	(0+43.00, 1.02)	0.022
(0+43.00, 1.02)	(0+70.00, 0.50)	0.016
(0+70.00, 0.50)	(0+74.50, 0.57)	0.013
(0+74.50, 0.57)	(1+74.50, 2.57)	0.045

Thomas & Pima - Irregular Section - Iteration 5

Results

Normal Depth		0.89	ft
Elevation Range	0.00 to 10.62 ft		
Flow Area		40.07	ft²
Wetted Perimeter		82.40	ft
Top Width		81.39	ft
Normal Depth		0.89	ft
Critical Depth		0.60	ft
Critical Slope		0.01396	ft/ft
Velocity		1.38	ft/s
Velocity Head		0.03	ft
Specific Energy		0.92	ft
Froude Number		0.35	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	1227.87	ft
Length	492.66	ft
Number Of Steps	10	

GVF Output Data

Upstream Depth	1227.18	ft
Profile Description	M1	
Profile Headloss	0.00	ft
Downstream Velocity	0.00	ft/s
Upstream Velocity	0.00	ft/s
Normal Depth	0.89	ft
Critical Depth	0.60	ft
Channel Slope	0.00140	ft/ft
Critical Slope	0.01396	ft/ft

Cross Section for Thomas & Pima - Grate on Grade Iteration 5

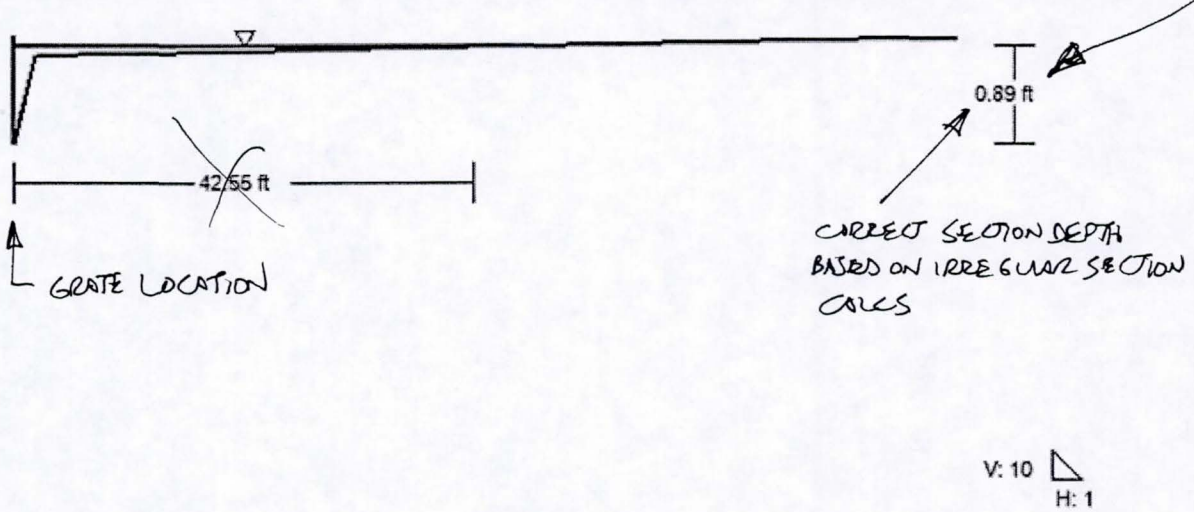
Project Description

Solve For	Efficiency

Input Data

Discharge	42.8	ft³/s ← DUMMY Q
Slope	0.0014	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0417	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.016	
Efficiency	35.50	%
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Cross Section Image



V: 10
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Thomas & Pima - Grate on Grade Iteration 5

Project Description

Solve For	Efficiency

Input Data

Discharge	42.8	ft^3/s
Slope	0.0014	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0417	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.016	
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	35.50	%
Intercepted Flow	15.2	ft^3/s
Bypass Flow	27.61	ft^3/s
Spread	42.55	ft
Depth	0.89	ft
Flow Area	18.15	ft^2
Gutter Depression	0.04	ft
Total Depression	0.04	ft
Velocity	2.36	ft/s
Splash Over Velocity	9.97	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.26	
Grate Flow Ratio	0.13	
Active Grate Length	3.00	ft

Cross Section for Thomas & Pima - Irregular Section - Iteration 6

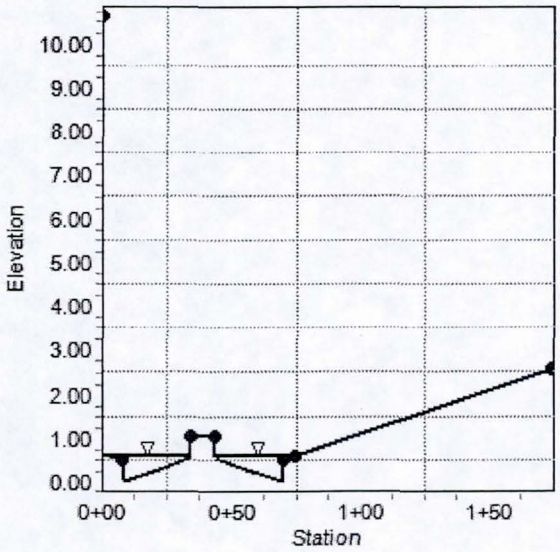
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.0014	ft/ft
Normal Depth	0.60	ft
Discharge	24.8	ft^3/s

Cross Section Image



Thomas & Pima - Irregular Section - Iteration 6

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.0014	ft/ft
Discharge	24.8	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	10.62
0+00.10	0.62
0+08.00	0.50
0+08.50	0.00
0+22.00	0.28
0+33.50	0.52
0+34.00	1.02
0+38.50	1.02
0+43.00	1.02
0+43.50	0.52
0+55.50	0.28
0+69.50	0.00
0+70.00	0.50
0+74.50	0.57
1+74.50	2.57

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 10.62)	(0+08.00, 0.50)	0.022
(0+08.00, 0.50)	(0+34.00, 1.02)	0.016
(0+34.00, 1.02)	(0+43.00, 1.02)	0.022
(0+43.00, 1.02)	(0+70.00, 0.50)	0.016
(0+70.00, 0.50)	(0+74.50, 0.57)	0.013
(0+74.50, 0.57)	(1+74.50, 2.57)	0.045

Thomas & Pima - Irregular Section - Iteration 6

Results

Normal Depth		0.60	ft
Elevation Range	*0.00 to 10.62 ft*		
Flow Area		18.44	ft²
Wetted Perimeter		65.39	ft
Top Width		64.90	ft
Normal Depth		0.60	ft
Critical Depth		0.43	ft
Critical Slope		0.00774	ft/ft
Velocity		1.35	ft/s
Velocity Head		0.03	ft
Specific Energy		0.63	ft
Froude Number		0.44	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	1227.87	ft
Length	492.66	ft
Number Of Steps	10	

GVF Output Data

Upstream Depth	1227.18	ft
Profile Description	M1	
Profile Headloss	0.00	ft
Downstream Velocity	0.00	ft/s
Upstream Velocity	0.00	ft/s
Normal Depth	0.60	ft
Critical Depth	0.43	ft
Channel Slope	0.00140	ft/ft
Critical Slope	0.00774	ft/ft

Cross Section for Thomas & Pima - Grate on Grade Iteration 6

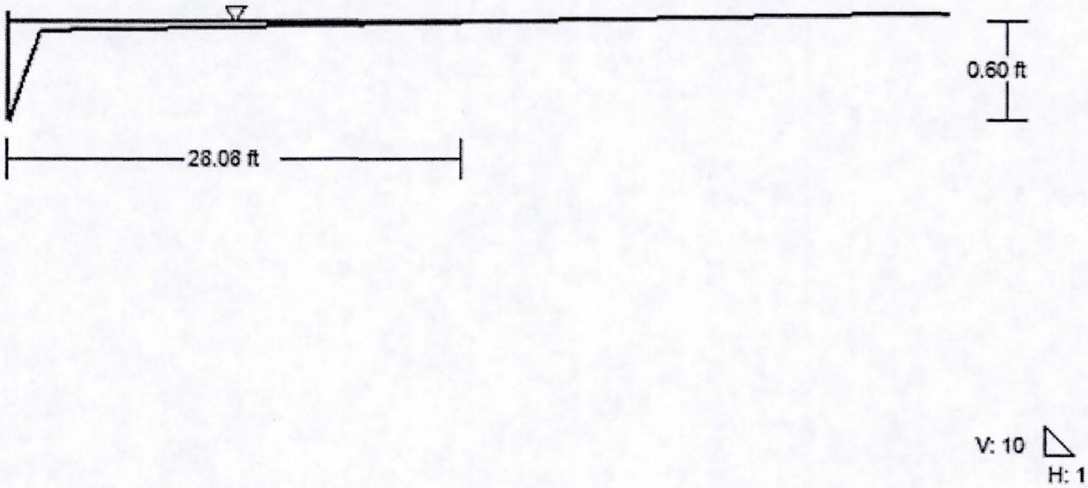
Project Description

Solve For	Efficiency

Input Data

Discharge	14.2	ft^3/s
Slope	0.0014	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0417	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.016	
Efficiency	48.80	%
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Cross Section Image



Thomas & Pima - Grate on Grade Iteration 6

Project Description

Solve For	Efficiency

Input Data

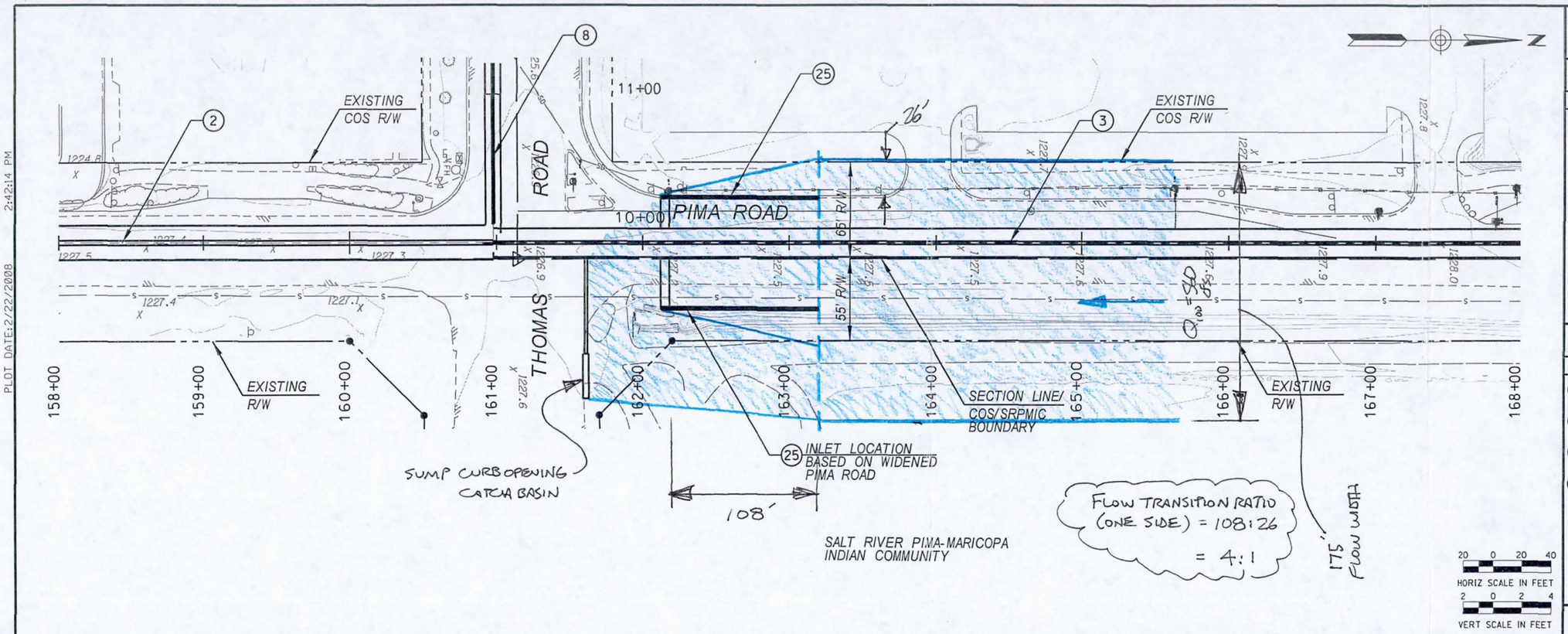
Discharge	14.2	ft^3/s
Slope	0.0014	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.0417	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.016	
Grate Width	2.00	ft
Grate Length	6.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

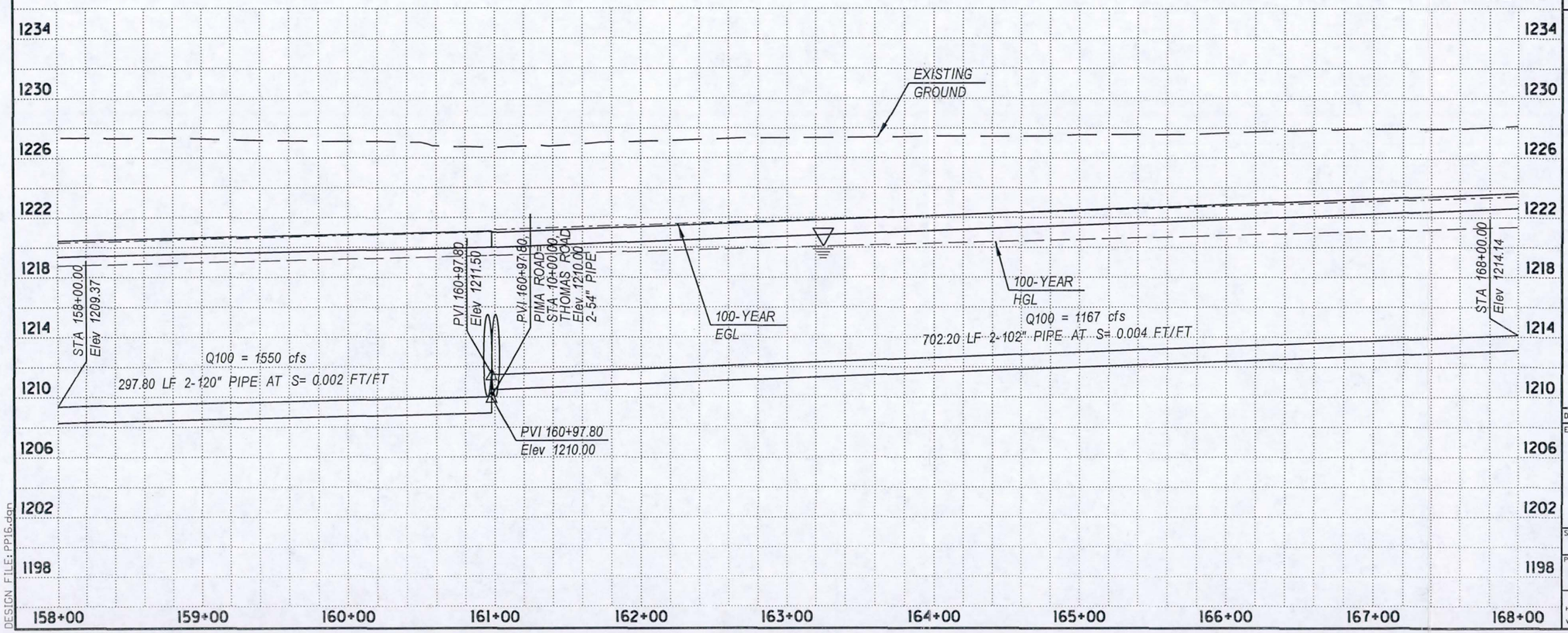
Options

Grate Flow Option	Exclude None

Results

Efficiency	48.80	%
Intercepted Flow	6.9	ft^3/s
Bypass Flow	7.27	ft^3/s
Spread	28.08	ft
Depth	0.60	ft
Flow Area	7.93	ft^2
Gutter Depression	0.04	ft
Total Depression	0.04	ft
Velocity	1.79	ft/s
Splash Over Velocity	9.97	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.37	
Grate Flow Ratio	0.19	
Active Grate Length	3.00	ft





PSOMAS
3800 North Central Avenue, Suite 1200
Phoenix, AZ 85012
(602) 222-8260 (602) 266-0218 (FAX)

REMOVAL & RELOCATION NOTES

Description	Unit	Quan

CONSTRUCTION NOTES

Description	Unit	Quan
(2) CONSTRUCT NEW 2-120" PIPE	LF	297.8
(3) CONSTRUCT NEW 2-102" PIPE	LF	702.2
(8) SEE SHEET PP24		
(25) CONSTRUCT INTERCEPTION STRUCTURE PER DTL * SHEET **	EA	2

GENERAL NOTES

16

Two working days before you dig CALL FOR THE BLUE STAKES 1-800-STAKE-IT Blue Stake Center CALL COLLECT

DATE	REVISION	BY

ENGINEER

30% PRELIMINARY NOT FOR CONSTRUCTION

MUNICIPAL SERVICES DEPARTMENT
CAPITAL PROJECT MANAGEMENT
7447 E. INDIAN SCHOOL RD.
SCOTTSDALE, ARIZONA 85251

SHEET TITLE
PIMA ROAD CONDUIT – PLAN & PROFILE

PROJECT TITLE
GRANITE REEF WASH DRAINAGE STUDY AND PRELIMINARY DESIGN IMPROVEMENTS

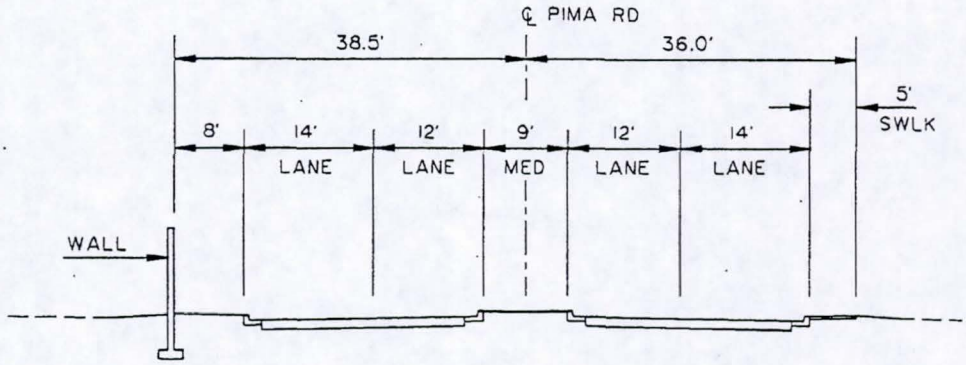
SCALE	DESIGNED	DATE	BID NO.	SHT.
HORIZ. 1"=40'	JKK	02/08	-	PP16
VERT. 1"=4'	DRAWN GRS	AS-BUILT -	PROJECT NO. 06077-01	20 OF 36

PLOT DATE: 2/22/2008 2:42:14 PM

DESIGN FILE: PP16.dgn

FIGURE 3

SELECTED TYPICAL SECTION



MODIFIED MINOR ARTERIAL STREET
(FOUR-LANE WITH RAISED MEDIAN)

12 December 1992

Pima Road
Geometeric Concept

BRW

Alternatives E and F, classified as "Major Collector Streets," consist of a five-lane Urban street, four travel lanes and a dual center left-turn lane. Alternative G, classified as a "Modified Major Collector Street," is a five-lane urban street with 11-foot lanes.

At the November 3 meeting, the committee consensus was to focus the study on the Alternative A typical section. Plan overlays (clear) were used by the committee to determine the effects of each typical section. Due to some of the effects produced by Alternative A, it was decided to look at other alternative typical sections with lesser overall widths between outside curbs. It was the consensus of the committee that Alternative A creates some severe effects and that the committee would review these other alternatives for further discussion at the next committee meeting.

- Steering Committee Meeting, 12 January 1993 - Since the last committee meeting the two communities have been evaluating the effects of the seven alternative typical sections. At this meeting it was the consensus of the committee that the desirable alternative should provide the least overall width between outside curbs while still providing acceptable lane widths. The consensus of the committee is that all further study be undertaken with Alternative D, shown as the "Selected Typical Section" in Appendix A.

2.4 Recommended Typical Section

It is the consensus of the Steering Committee that the recommended typical section be Alternative D, Modified Minor Arterial Street, as depicted in Figure 3 and in Appendix A under Selected Typical Section. Alternative D consists of a four- lane urban street with a 9-foot raised median. All measurements on this exhibit are to the face of curb whereas measurements on previous exhibits are to the back of curb. Therefore, a previously stated 8-foot median is now a 9-foot median.

At the first Steering Committee Meeting it was agreed that there is not enough right-of-way to construct the six-lane section as specified by the SRP-MIC published standards. Furthermore, the construction of the future Pima Freeway will reduce traffic on Pima Road to a level that will be accommodated by a four- lane urban roadway for the immediate future. Therefore, the selected typical section is a four-lane urban street.

It was also decided that an off-road bicycle pathway will need to be provided in lieu of on-street bike lanes. Again, there is not enough right-of-way to provide on-street bike lanes. Further discussion on bicycle pathways is contained in subsection 4.4.

Worksheet for Coronado & 87th Street - Transverse Grate Inlets

Project Description

Solve For	Spread

Input Data

Discharge	193.00	ft^3/s
Left Side Slope	0.02	ft/ft (H:V)
Right Side Slope	0.02	ft/ft (H:V)
Bottom Width	24.00	ft
Grate Width	24.00	ft
Grate Length	14.00	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Results

Spread	24.05	ft
Depth	1.15	ft
Wetted Perimeter	26.31	ft
Top Width	24.05	ft
Open Grate Area	151.20	ft^2
Active Grate Weir Length	52.00	ft

Messages

Notes

Design interception flowrate of 193 cfs = 40% of 483 cfs (total flow arriving at location). Remaining 290 cfs is intercepted via culvert inlet in park area south of Coronado Road and west of 87th Street. Average transverse grate elevation = 1212.50. WSE from HEC-RAS xsec 1.262 = 1213.63. Max depth occurring over grate (in sump condition) = 1.13 without backing up flow.

Grate is located at sump location in 87th Street approximately 165 feet south~~west~~ east of Coronado Road.

Culvert Designer/Analyzer Report
Coronado and 87th Interception Structure

Comments: Culvert width of 72 feet is appoximately 60% of the flow width based on HEC-RAS cross section 1.262 (PimaSD6.out - WSE=1213.63); Total 100-yr, 6-hr peak flowrate at Coronado and 87th per HEC-1 = 483 cfs (includes subtracting out 56 cfs for existing 48" stormdrain). 60% of 483 = 290 cfs <-- Assumed design flow. Remainder of flow (193 cfs) will be intercepted via transverse grate in 87th Street.

Peak Discharge Method: User-Specified			
Design Discharge	290.00 cfs	Check Discharge	0.00 cfs

Grades Model: Inverts			
Invert Upstream	1,211.00 ft	Invert Downstream	999.99 ft
Length	999.99 ft	Slope	0.211012 ft/ft
Drop	211.01 ft		

Headwater Model: Maximum Allowable HW	
Headwater Elevation	1,213.63 ft

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev.	Velocity
x Trial-1	20-3 x 2 ft Box	290.00 cfs	1,212.47 ft	18.99 ft/s

Culvert Designer/Analyzer Report
Coronado and 87th Interception Structure

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	1,213.63	ft	Storm Event	Design	
Computed Headwater Elev	1,212.47	ft	Discharge	290.00	cfs
Headwater Depth/Height	0.74		Tailwater Elevation	N/A	ft
Inlet Control HW Elev.	1,212.47	ft	Control Type	Inlet Control	
Outlet Control HW Elev.	1,212.44	ft			

Grades					
Upstream Invert	1,211.00	ft	Downstream Invert	999.99	ft
Length	999.99	ft	Constructed Slope	0.211012	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.25	ft
Slope Type	Steep		Normal Depth	0.25	ft
Flow Regime	Supercritical		Critical Depth	0.90	ft
Velocity Downstream	18.99	ft/s	Critical Slope	0.004772	ft/ft

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.00	ft
Section Size	3 x 2 ft		Rise	2.00	ft
Number Sections	20				

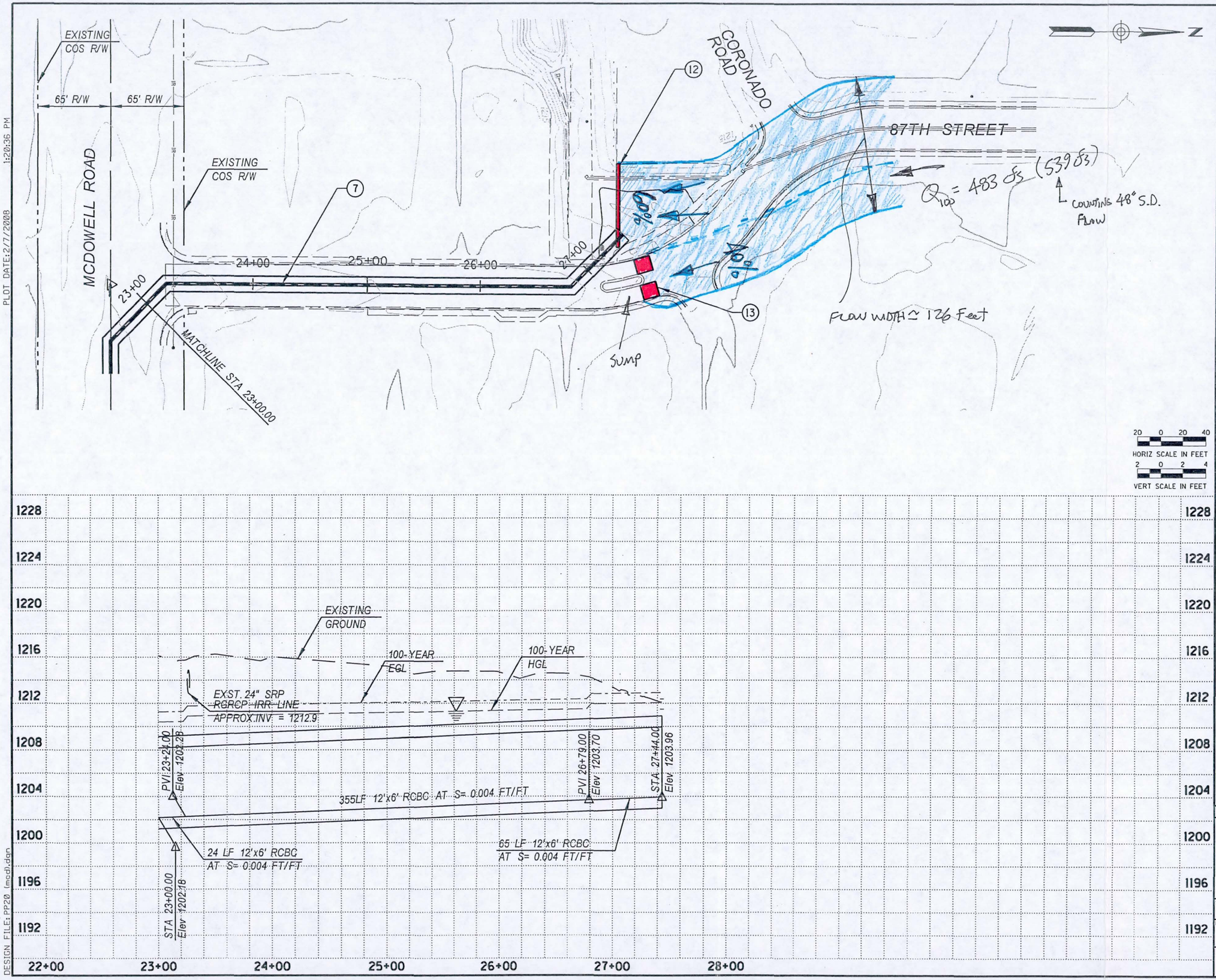
Outlet Control Properties					
Outlet Control HW Elev.	1,212.44	ft	Upstream Velocity Head	0.45	ft
Ke	0.20		Entrance Loss	0.09	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,212.47	ft	Flow Control	Unsubmerged	
Inlet Type	90° headwall w 3/4 inch chamfers		Area Full	120.0	ft²
K	0.51500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	1	
C	0.03750		Equation Form	2	
Y	0.79000				

HEC-RAS Plan: exstjkktweaks River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	1.67	BASE6.OUT	1752.00	1216.00	1220.37		1221.58	0.002186	9.50	281.78	127.69	0.85
Reach-1	1.67	PIMASD6.OUT	286.00	1216.00	1218.00		1218.29	0.001677	4.43	75.96	63.50	0.64
Reach-1	1.575	BASE6.OUT	1752.00	1215.30	1219.81		1220.55	0.001451	8.13	449.97	197.90	0.70
Reach-1	1.575	PIMASD6.OUT	286.00	1215.30	1217.09		1217.39	0.001954	4.65	89.21	78.27	0.68
Reach-1	1.522	BASE6.OUT	1752.00	1214.80	1218.89		1220.02	0.002212	9.77	444.92	237.76	0.86
Reach-1	1.522	PIMASD6.OUT	286.00	1214.80	1216.38		1216.78	0.002397	5.25	71.25	65.19	0.76
Reach-1	1.499	BASE6.OUT	1752.00	1214.60	1218.59	1218.59	1219.77	0.002064	9.11	515.89	315.88	0.83
Reach-1	1.499	PIMASD6.OUT	286.00	1214.60	1216.22		1216.50	0.001709	4.30	93.17	86.21	0.64
Reach-1	1.438	BASE6.OUT	1752.00	1213.80	1218.11	1217.71	1218.81	0.001417	7.69	496.65	286.00	0.69
Reach-1	1.438	PIMASD6.OUT	286.00	1213.80	1215.63		1215.93	0.001819	4.45	72.88	75.38	0.66
Reach-1	1.373	BASE6.OUT	1752.00	1213.00	1217.50		1218.30	0.001542	8.17	454.86	302.00	0.72
Reach-1	1.373	PIMASD6.OUT	286.00	1213.00	1215.17		1215.41	0.001188	4.01	87.24	76.26	0.55
Reach-1	1.353	BASE6.OUT	1752.00	1212.80	1217.71		1218.05	0.000656	5.95	846.63	373.37	0.48
Reach-1	1.353	PIMASD6.OUT	286.00	1212.80	1215.23		1215.30	0.000315	2.50	214.04	152.00	0.29
Reach-1	1.301	BASE6.OUT	1800.00	1212.10	1216.84		1217.74	0.001518	8.49	401.16	241.87	0.72
Reach-1	1.301	PIMASD6.OUT	483.00	1212.10	1214.49		1215.02	0.002208	6.03	103.41	78.61	0.76
Reach-1	1.262	BASE6.OUT	1800.00	1212.00	1216.79		1217.07	0.000578	5.44	781.04	313.69	0.45
CORONADO ROAD → Reach-1	1.262	PIMASD6.OUT	539.00	1212.00	1213.73	1213.73	1214.35	0.004321	7.04	✓ 126.38	116.10	1.02
Reach-1	1.260	BASE6.OUT	1800.00	1211.96	1216.79		1217.06	0.000560	5.38	792.41	323.45	0.44
☆ Reach-1	1.260	PIMASD6.OUT	1.00	1211.96	1211.93	1212.01	1212.83	7.148734		0.13	3.84	0.00
Reach-1	1.239	BASE6.OUT	1800.00	1210.90	1216.67		1216.92	0.003285	4.82	523.85	274.20	0.41
Reach-1	1.239	PIMASD6.OUT	1.00	1210.90	1211.11	1211.11	1211.17	0.062203	1.94	0.52	4.50	1.01
Reach-1	1.224	BASE6.OUT	1800.00	1206.50	1216.63		1216.73	0.000517	2.97	1038.21	543.10	0.18
Reach-1	1.224	PIMASD6.OUT	1.00	1206.50	1210.89	1206.73	1210.89	0.000000	0.01	117.26	40.34	0.00
Reach-1	1.181	BASE6.OUT	1800.00	1204.95	1216.21		1216.47	0.001360	4.41	506.68	181.82	0.29
Reach-1	1.181	PIMASD6.OUT	1.00	1204.95	1210.89		1210.89	0.000000	0.01	106.72	32.74	0.00

☆ HEC-RAS CROSS-SECTION 1.260 ADDED TO DEFINE WSE AT INTERCEPTION STRUCTURE



PLOT DATE:2/7/2008 1:20:36 PM

DESIGN FILE: PP20 (mcd).dgn

PSOMAS 3800 North Central Avenue, Suite 1200 Phoenix, AZ 85012 (602) 222-8260 (602) 266-0218 (FAX)

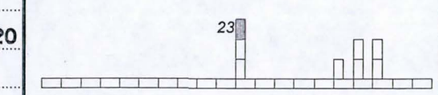
REMOVAL & RELOCATION NOTES

Description	Unit	Quan

CONSTRUCTION NOTES

Description	Unit	Quan
(7) CONSTRUCT NEW 12'x6' RCBC	LF	444
(12) CULVERT INTERCEPTION STRUCTURE PER DTL #, SHEET #	LF	72
(13) GRATE INTERCEPTION STRUCTURE PER DTL #, SHEET #	EA	2

GENERAL NOTES



Two working days before you dig CALL FOR THE BLUE STAKES 1-800-STAKE-IT Blue Stake Center CALL COLLECT

DATE	REVISION	BY

ENGINEER

30% PRELIMINARY NOT FOR CONSTRUCTION

MUNICIPAL SERVICES DEPARTMENT

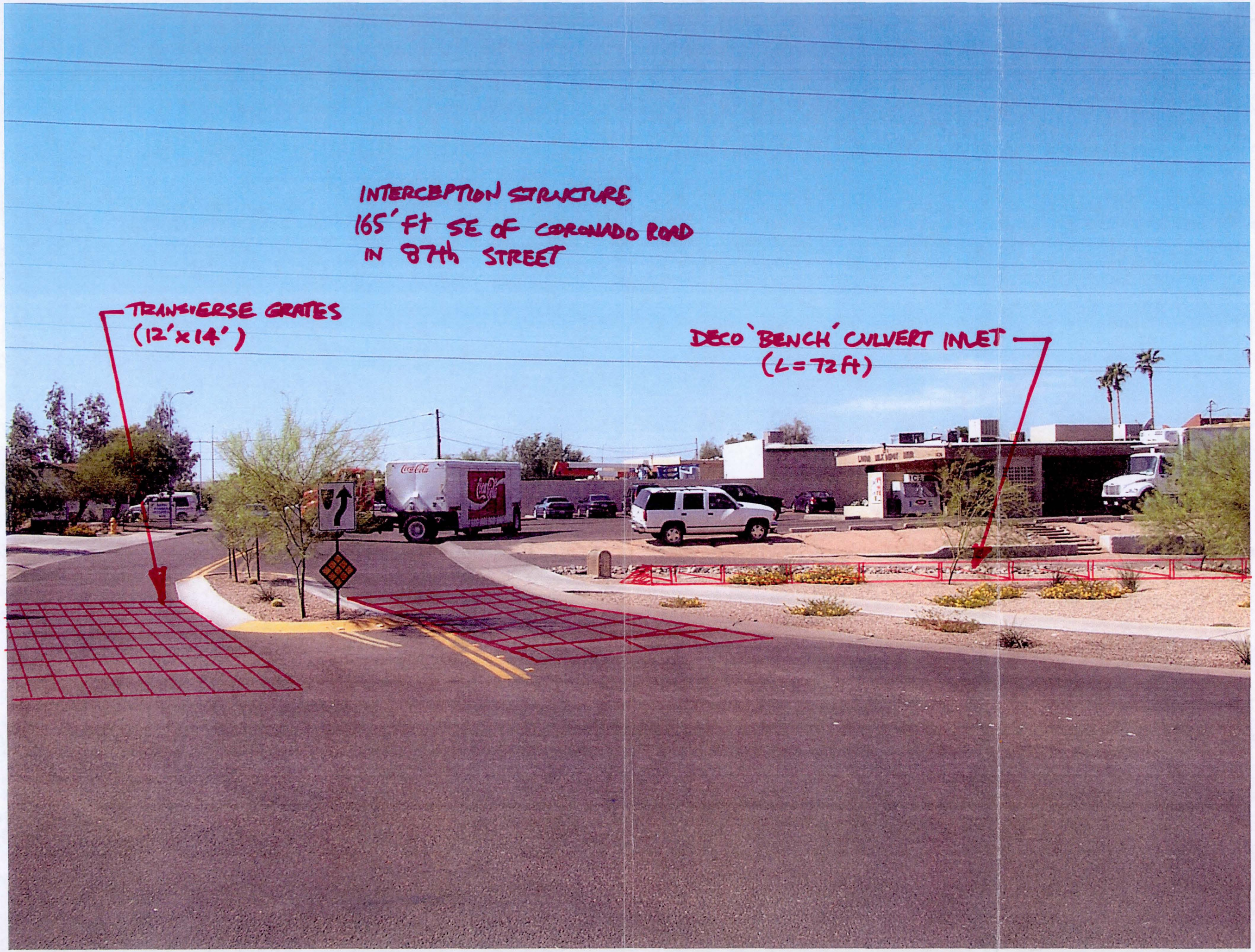
CAPITAL PROJECT MANAGEMENT

7447 E. INDIAN SCHOOL RD. SCOTTSDALE, ARIZONA 85251

SHEET TITLE: McDOWELL ROAD CONDUIT - PLAN & PROFILE

PROJECT TITLE: GRANITE REEF WASH DRAINAGE STUDY AND PRELIMINARY DESIGN IMPROVEMENTS

SCALE	DESIGNED	DATE	BID NO.	SHT.
HORIZ. 1"=40'	JKK	08/07	XXXX	PP23
VERT. 1"=4'	DRAWN GRS	AS-BUILT XX/XX	PROJECT NO. 06077-XX	27 OF 27


INTERCEPTION STRUCTURE
165' ft SE OF CORONADO ROAD
IN 87th STREET
TRANSVERSE GRATES
(12'x14')
DECO 'BENCH' CULVERT INLET
(L=72 ft)

3. FLO-2D Analysis

FLO-2D Model Analysis
for the Granite Reef Wash Study

Introduction

The purpose of this analysis was to provide a comparison to HEC-1 generated peak flows for the preliminary design of the Pima Road Conduit. FLO-2D provided a distribution and attenuation of flows through the streets and neighborhoods within the project area north of the Granite Reef Wash corridor that HEC-1 routing may not address in an urbanized setting. The FLO-2D model may be key in evaluating the overall design of the interception structures. To insure the model had enough area to properly distribute the flows, the watershed was bounded by Chaparral Road on the north, Virginia Avenue to the south and the existing HEC-1 boundaries on the west and east. In addition, SRPMIC land was assumed to be under future conditions and considered fully developed.

This model was not developed to replace the existing HEC-1 model, but was done to enhance the level of detail available for comparison to HEC-1 peak flows. The same watershed boundaries and infiltration parameters used in the HEC-1 model were applied to the FLO-2D model.

Initial Model Setup

To achieve the highest data resolution for the model without creating unreasonable runtimes, the grid elements were set to a spacing of 20 feet. Based on the watershed delineation established by the Granite Reef Wash Drainage Master Plan (FCDMC September 2002), the boundary elements were defined to include the area between Chaparral Road and Virginia Avenue.

For the grid elements west of Pima Road, elevation data was obtained from the City of Scottsdale's GIS department. This data, consisting of both points and breaklines, is from topographic mapping created in 1993, using NAVD 88, for the City. Since no information was available for the east side of Pima Road (SRPMIC), points were created at a 50-foot grid based on assumptions similar to those in the GRW Drainage Master Plan for future conditions. The resulting surface is assumed to be at a +0.25% slope from the centerline of Pima Road.

Additional elevation data was included in the model to better represent land features. Points were added to the grid elements that fell along the centerline of the channel on the south side of Earll Dr. from 86th St. and the Pima Frontage Road. The channel and street options were not used due the short length of the channel and the significant impact on the runtime of the model.

Rainfall and Infiltration

A rainfall value of 3.20 inches was obtained from the Granite Reef Wash Drainage Master Plan (GRWDMP) for the 100-yr, 6-hour storm event. This value was estimated from the NOAA Atlas 2 rainfall data for the study area. An areal reduction factor was applied to the rainfall value based on the watershed area north of Thomas Road. The resulting area was found to be 2.92 sq. mi. for a reduction factor of 0.974. The adjusted rainfall value was calculated to be 3.12 inches. Pattern 2 from the FCDMC's Hydrology Manual, also based on the watershed area, was used for the 6-hour rainfall distribution applied to the model.

The Green-Ampt infiltration values were based entirely on the GRWDMP. Grid elements were assigned values from the corresponding subbasin input values.

Manning's Roughness Coefficient

All grid elements were provided roughness coefficients based on visual inspection of aerial photography of the City. The Granite Reef Wash Floodplain Delineation Study (FCDMC 1997) was also used to assist in the determination of coefficients. The following was used as a general approach to assigning values:

- **0.016** – Used to represent streets, parking lots and undeveloped SRPMIC lands (future conditions).
- **0.025** – Used to represent sidewalks/front yards, parks and open space.
- **0.055** – Used to represent single-family homes/lots, apartments, schools and large buildings.

Reduction Factors

These factors were applied to control the amount of storage for each of the grid elements and control conveyance between them. Similar to Manning's roughness coefficient, reduction factors were based on inspection of the aerial photography and assigned accordingly. The first type of factor, known as the area reduction factor (ARF), represented how much water each of the elements could hold. This was typically due to buildings or any other obstructions that prevent the storage of flow. The following was used as a general approach to assigning the factors:

- **None** – Any areas with no obstructions such as streets, open space, parking lots and undeveloped SRPMIC lands.
- **0.15** – Any areas with minimal obstructions such as sidewalks/front yards.
- **0.65** – Any areas with significant obstructions such single-family homes, apartments, schools and other small buildings.
- **Blocked** – Any areas that are apart of a larger obstruction such as office buildings and large retail/industrial buildings.

Some exceptions were made to the model to better represent the area. Several properties within the area bounded by Highland Ave. to the north, Camelback Rd. to the south, Granite Reef Rd. to the west and the Pima Frontage Road to the east were assigned a factor of **0.3** in place of 0.65. This was done due to the larger size of the lots and fewer obstructions.

The second type of factor, known as the width reduction factor (WRF), controlled how water was conveyed between grid elements. These factors were useful in representing walls or similar structures. Since conveyance, such as small openings or drains, through walls was assumed to be insignificant, the WRFs were set to **1.0** to completely block flow. Only significant walls were considered in the model that would prevent flows from spilling from one street into another through private properties.

The only exception was in the area, previously mention above, where the lots were larger. These walls were set to **0.5** due to fewer walls and significant openings.

Inflow and Outflow Conditions

Three inflow hydrographs were inserted into the model along Chaparral Rd. corresponding to the three concentration points established in the 100-yr, 6-hr HEC-1 model originally developed for the GRWDMP. After running HEC-1 using the full output option, FLO-2D was able the extract the outflow hydrographs for each of the three concentration points and apply them to their locations within the model:

- **CF01** – Granite Reef Rd.
- **CF02** – 86th St.
- **CF07** – Pima Rd.

Outflow elements were inserted along the southern boundary of the effective model area immediately south of Virginia Ave. Since most of the boundary elements fall along walls, outflow was only permitted within streets and other areas with no obstructions. They were setup to allow flow to freely pass out of the model as floodplain only element.

Note: Due to the small outflow within effective model area, all storm drains (Chaparral Rd., Camelback Rd. and Indian School Rd.) were assumed to be insignificant and not included in the calculations.

Floodplain Cross Sections

In order to obtain pertinent output data, the floodplain cross section option was used to estimate both the peak flows and maximum flow depths for all selected grid elements. Any locations of interest such as corresponding HEC-1 concentration points and proposed interception structures between Chaparral Rd. and Thomas Rd. were analyzed. This was achieved by selecting enough grid elements in a linear group to properly bracket the incoming flows from one or more directions.

Running FLO-2D

Additional parameters were included in the model through the use of control variables when running FLO-2D. In the Global Data Modification section, all fields were set to zero to insure that the model uses the parameters set within the individual grid elements except the for the Floodplain Limiting Froude No. This was set to **2.5** to prevent any unrealistic flow conditions to may occur in the calculations.

Under the System Components Switches section, only the Area Reduction Factor (ARF) box should be checked since no other components were used in the model. For the Physical Processes Switches section, only Rainfall and Infiltration should be checked. If any additional boxes are checked within these two sections, the model will not run properly.

Results

The following table shows the peak flows and maximum depths along three streets (Granite Reef Rd., 86th St. and the Pima Frontage Road) at several cross streets between Camelback Rd. and Thomas Rd:

FLO-2D Peak Flows and Maximum Depths

	Granite Reef Rd.		86th St.		Pima Frontage Road	
	Flow (cfs)	Depth (ft)	Flow (cfs)	Depth (ft)	Flow (cfs)	Depth (ft)
Camelback Rd.	7	0.30	294	1.39	300	2.14
Indian School Rd.	10	0.59	81	0.83	490	2.00
Osborn Rd.	11	0.53	182	1.14	502	2.19
Earll Dr.	18	0.37	77	0.80	733	4.43
Thomas Rd.	112	1.25	218	1.86	1318*	3.48*

*Located at Thomas Rd. and 87th St.

HEC-1 Comparison

The table below shows the HEC-1 results (BASE6.OUT) for the same street intersections mentioned above including a comparison of peak flows with FLO-2D.

HEC-1 Peak Flows and Comparison

	Granite Reef Rd.		86th St.		Pima Frontage Road	
	Flow (cfs)	Difference (cfs)	Flow (cfs)	Difference (cfs)	Flow (cfs)	Difference (cfs)
Camelback Rd.	68	61	804	510	87	-213
Indian School Rd.	217	207	276	195	907	417
Osborn Rd.	221	210	306	124	847	345
Earll Dr.	216	198	418	341	1070	337
Thomas Rd.	181	69	429	211	1637*	319*

*Located at Thomas Rd. and 87th St.

Comparing the results of both models, the peak flows for FLO-2D were found to be significantly less than HEC-1. The following observations were made from reviewing the FLO-2D model while running and after completion:

- Very little flow was conveyed along most of Granite Reef Rd.

- In some places, flows appeared to have been routed differently.
- Runoff had a tendency to move more in easterly direction and collect in the Pima Frontage Road than HEC-1.
- Attenuation of flows was greater than HEC-1.
    - 200± cfs along Granite Reef Rd.
    - 300+ cfs along the Pima Frontage Road
- Additional flow splits exist than previously modeled.

Conclusions

Based on the results of FLO-2D, the Pima Road Conduit design was adjusted to better intercept the 100-year, 6-hour storm. The following changes were made to the interception area design:

- Any interception structures located west of 86th St. were eliminated due to a possible lack of flow.
- An additional storm drain was extended north of Osborn Rd. along the Pima Frontage Road with two interception structures (one immediately south of Indian School Rd. and the other at Olive Ave).

Since HEC-1 is still the approved model to use for the design, the above changes were applied to the HEC-1 model (PIMASD6.DAT). The resulting peak flows were then used to size the interception structures and storm drain pipes.

4. Utility Conflicts Inventory

Potential Utility Conflict Inventory

Location	Water	Sewer	Storm Drain	SRP
Fairmont / Pima Frontage	24"	None	18"	None
Olive / Pima Frontage	6" 24"	None	24"	None
Osborn / 86th	4" 8"	8"	None	None
Osborn / 87th	6" (2) 8"	8"	None	None
Osborn / Pima Frontage	24"	None	24"	None
Earll / 86th	(2) 6" 12" 24" 30" 36" 60"	8" 10"	None	None
Earll / 87th	6" 8"	8" 10"	None	None
Earll / Pima Frontage	24"	None	30" 48"	None
Thomas / 87th	8" 24"	8"	48" 36"	24"
Thomas / Pima	8" 24"	On SRPMIC Land	54"	24"
Coronado / 87th	8"	None	48"	None
McDowell / Pima	12"	On SRPMIC Land	48"	None
McKellips / Pima	None	On SRPMIC Land	None	None

5. Salt River – FEMA floodplain data

DATUM SHIFT – TO CALCULATE FEMA FLOODPLAIN ELEVATION AT SALT RIVER/PIMA ROAD ALIGN TO NAVD 88 FROM NGVD 29

Questions concerning the VERTCON process may be mailed to NGS

Latitude: 33 26 20.63

Longitude: 111 53 32.79

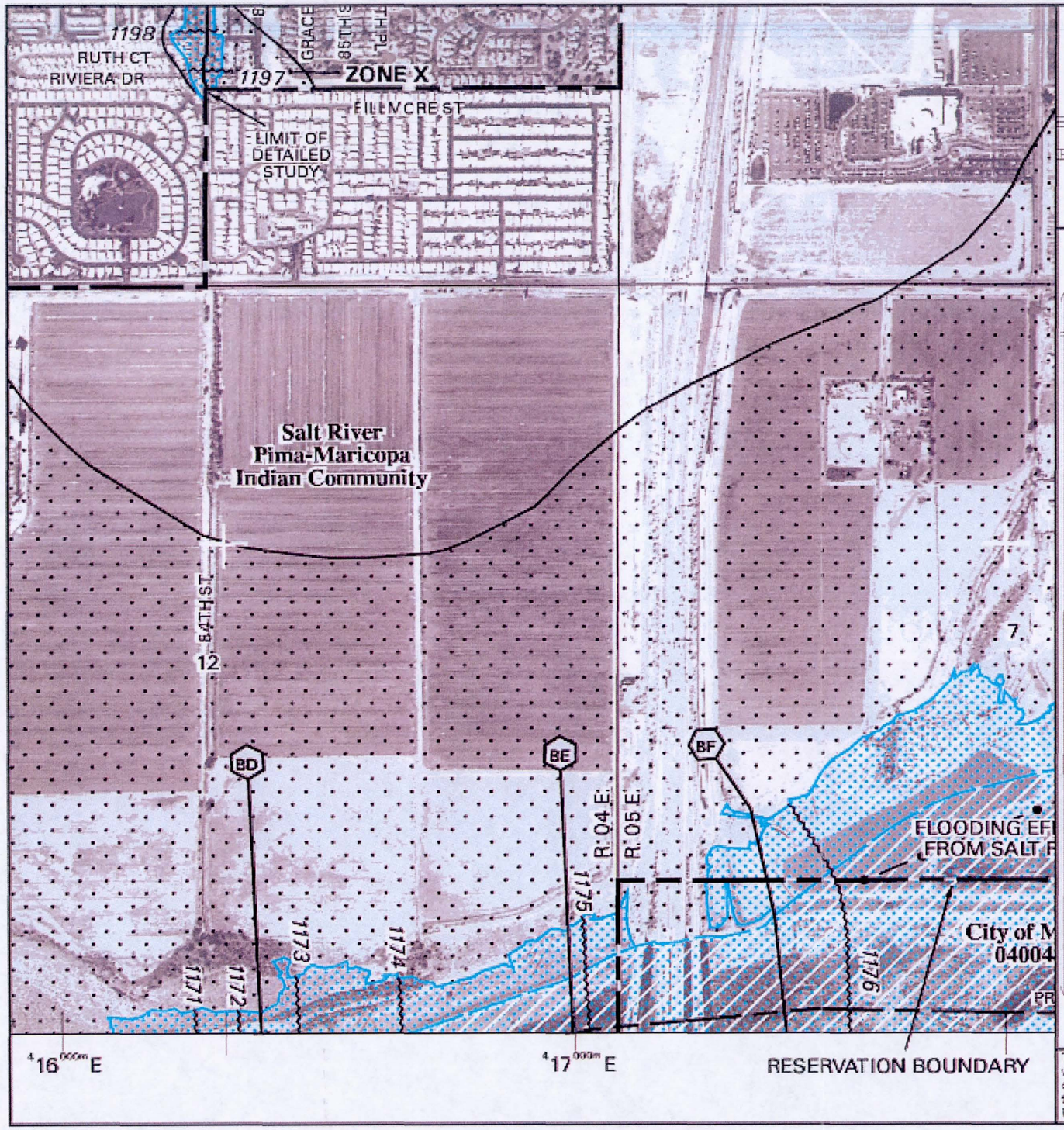
NGVD 29 height: 1175 ft

Datum shift (NAVD 88 minus NGVD 29): 1.959 feet

Converted to NAVD 88 height: 1176.959 feet

Salt River outfall location for Pima Road Conduit

Pima Conduit Outfall Location



MAP SCALE 1" = 1000'

0 1000 2000 FEET

0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2160F

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA

AND INCORPORATED AREAS

PANEL 2160 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	2160	F
MESA, CITY OF	040048	2160	F
SCOTTSDALE, CITY OF	045012	2160	F
TEMPE, CITY OF	040054	2160	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER

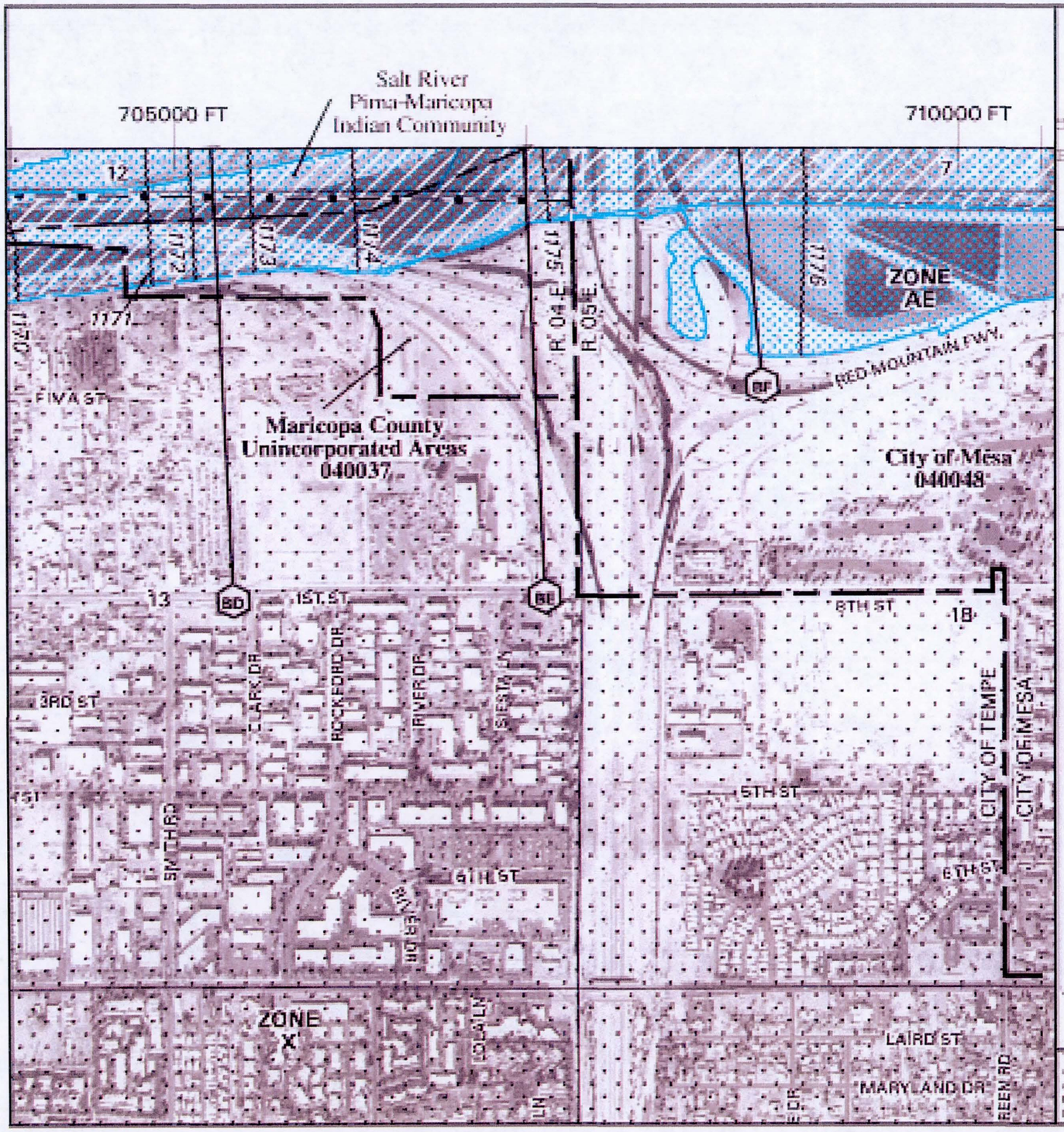
04013C2160F

MAP REVISED

SEPTEMBER 30, 2005

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



MAP SCALE 1" = 1000'

0 1000 2000 FEET

0 300 600 METERS

NFIP

PANEL 2170G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY,
ARIZONA
AND INCORPORATED AREAS

PANEL 2170 OF 4350

COMMUNITY NUMBER PANEL SUFFIX

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	2170	G
MESA, CITY OF	040048	2170	G
TEMPE, CITY OF	040054	2170	G

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C2170G

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency

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D. Floodplain Analysis

1. **HEC-2 to HEC-RAS Conversion**
   a. **Summary Description**
   b. **Figure 3A – HEC-RAS Schematic**
   c. **Comparison of Results**
   d. **HEC-2 Results**
   e. **HEC-RAS Results**

2. **Floodplain Analysis**
   a. **HEC-RAS Output Table**
   b. **Existing Conditions**
      i. **Exhibit 4 – Delineation (Schematic)**
      ii. **Results**
   c. **Detention Basin Alternative**
      i. **Exhibit 5 – Delineation (Schematic)**
      ii. **Results**
   d. **PRC Alternative**
      i. **Exhibit 6 – Delineation (Schematic)**
      ii. **Results**

1. HEC-2 to HEC-RAS Conversion

Job No. 06077-01 Sheet 1 of 1 Prepared by RAK Date 4/3/07

Project Name Granite Reef Wash Reviewed by JAK Date 5/3/07

Title HEC-2 to HEC-RAS Conversion FWA No.

The HEC-RAS model was created using the HEC-2 model obtained from the FCDMC's 1997 study. Several minor changes were made to the new model to improve the representation of the existing conditions.

- All of the rectangular portions (meant to represent structures) of the cross-sections were changed to "obstructions." This was done due to the availability of the "obstructions" option in HEC-RAS and to properly account for buildings in the model.
- Adjustments were made to a few cross-sections based on a review of the 1993 topographic map provided by the City of Scottsdale.
- Modifications were made to both culverts and the bridge.
  - Due to the conversion from HEC-2 to HEC-RAS, the cross-sections upstream and downstream of the culverts and bridge had to be moved away, respectively, for the model to work. So they were adjusted to allow a foot at both ends of each culvert and bridge.
  - In the Bridge Modeling Approach, the method was changed from Yarnell to Energy (Standard Step) due to the availability in HEC-RAS.
  - The pier was raised for the bridge to eliminate a small gap.
  - The ineffective area elevations were raised in the cross-sections adjacent to the bridge to account for increased flows.

HEC-2 to HEC-RAS Conversion

Comparison of Results

Section	Q* (cfs)	HEC-2 WSEL (feet)	HEC-RAS WSEL (feet)	Δ (feet)	Comments
2.355	644	1228.58	1228.59	0.01	
2.295	644	1227.3	1227.31	0.01	
2.218	1240	1226.14	1226.25	0.11	Thomas Rd. and 87th St.
2.208	1240	1225.88	1225.92	0.04	
2.192	1240	1225.94	1226	0.06	
2.168	1240	1225.93	1226.01	0.08	
2.128	1240	1224.92	1224.88	-0.04	
2.044	1240	1223.89	1223.94	0.05	
1.961	1240	1223.34	1223.37	0.03	Virginia Ave. and 87th St.
1.925	1240	1222.62	1222.69	0.07	
1.879	1240	1221.74	1221.81	0.07	
1.81	1240	1221.39	1221.43	0.04	
1.725	1240	1220.42	1220.46	0.04	Upstream of Oak St. and 87th St.
1.67	1240	1219.82	1219.79	-0.03	
1.575	1240	1218.58	1219.15	0.57	
1.522	1240	1218.2	1218.11	-0.09	
1.499	1240	1217.96	1217.79	-0.17	
1.438	1240	1217.55	1217.56	0.01	Hubbell St. and 87th St.
1.373	1240	1216.61	1216.64	0.03	
1.353	1240	1216.94	1216.96	0.02	
1.301	1240	1216.36	1216.34	-0.02	
1.262	1240	1216.32	1216.3	-0.02	
1.239	1240	1215.42	1215.47	0.05	
1.224	1240	1215.34	1215.45	0.11	Upstream end of earthen channel.
1.181	1240	1214.95	1215.1	0.15	
1.138	1240	1214.63	1214.81	0.18	
1.121	1240	1214.45	1214.62	0.17	
1.115	1240	1214.45	1214.63	0.18	
1.1115	Bridge				Apartment leasing office.
1.108	1240	1214.44	1214.54	0.10	
1.101	1240	1214.41	1214.51	0.10	
1.084	1240	1214.34	1214.43	0.09	
1.075	1240	1214.33	1214.42	0.09	
1.0645	Culvert				Box culvert at McDowell Rd.
1.054	1417	1213.17	1213.22	0.05	
1.042	1417	1213.34	1213.4	0.06	
1.001	1417	1212.99	1213.05	0.06	
0.966	1417	1212.9	1212.96	0.06	
0.915	1417	1212.72	1212.78	0.06	
0.883	1417	1212.58	1212.65	0.07	
0.865	1417	1212.56	1212.63	0.07	Downstream end of earthen channel.
0.857	1417	1211.47	1211.5	0.03	
0.821	1417	1211.44	1211.61	0.17	Belleview St. and 84th Pl.
0.786	1417	1210.53	1211.01	0.48	
0.729	1417	1209.94	1209.97	0.03	
0.674	1417	1208.95	1209.03	0.08	
0.627	1417	1207.8	1208.01	0.21	
0.542	1417	1205.84	1205.52	-0.32	Downstream of 84th Pl. and Granite Reef Rd.
0.503	1417	1204.58	1204.37	-0.21	Roosevelt St. and Granite Reef Rd.
0.459	1417	1202.42	1202.48	0.06	
0.421	1417	1201.68	1201.67	-0.01	

HEC-2 to HEC-RAS Conversion

Comparison of Results

Section	Q* (cfs)	HEC-2 WSEL (feet)	HEC-RAS WSEL (feet)	Δ (feet)	Comments
0.369	1417	1200.75	1200.75	0.00	
0.326	1417	1200.09	1200.06	-0.03	
0.32	1417	1199.75	1199.99	0.24	
0.303	1417	1199	1199.21	0.21	Southern end of Granite Reef Rd.
0.288	1417	1198.83	1199.03	0.20	Upstream end of concrete channel.
0.272	1417	1198.88	1199.11	0.23	
0.257	1417	1198.61	1198.76	0.15	
0.244	Culvert				Box culvert at SRP well site.
0.231	1417	1198.02	1198.45	0.43	
0.225	1417	1196.08	1196.62	0.54	

*Based on flows provided by the FEMA Flood Insurance Study (September 30, 1995)

Note:

Since the input data is a little different between the two models, modifications had to be made to HEC-RAS for it to run. All modifications were minor and meant to reproduce the HEC-2 results based on identical input data.

```
*******************************************
*  HEC-2 WATER SURFACE PROFILES           *
*                                         *
*  Version   4.6.2;  May 1991             *
*                                         *
*  RUN DATE    01MAY97    TIME   14:31:47 *
*******************************************
```

```
****************************************
*  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 01MAY97 14:31:47

```
*************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
*************************************


SPLIT FLOW BEING PERFORMED

SF  SPLIT FLOW CALCULATIONS


TW West bank between 0.320 and 0.326
WS     2   0.320   0.326    .257     2.5
WC          1199      34    1201


TW West bank between 0.303 and 0.320
WS     2   0.303   0.320    .257     2.5
WC          1198     100    1199


TW West bank between 0.288 and 0.303
WS     2   0.288   0.303    .257     2.5
WC          1198      77    1198


TW West bank between 0.272 and 0.288
WS     2   0.272   0.288    .257     2.5
WC          1198      83    1198


TW West bank between 0.257 and 0.272
WS     2   0.257   0.272    .257     2.5
WC          1197      80    1198


TW East bank between 0.303 and 0.320
WS     2   0.303   0.320      -1     2.5
WC        1201.1     100    1201


TW East bank between 0.288 and 0.303
WS     2   0.288   0.303      -1     2.5
WC          1199      77  1201.1
```

```
TW East bank between 0.272 and 0.288
WS     2   0.272   0.288      -1     2.5
WC          1198      83    1199

TW East bank between 0.257 and 0.272
WS     2   0.257   0.272      -1     2.5
WC          1198      80    1198
```

```
T1      Granite Reef Wash - Floodplain Delineation                File:GRW1.H2
T1      For the  Flood Control District of Maricopa County
T1      by ENTELLUS                                             March 21, 1996

T2      Existing  conditions
T3      City of Scottsdale  -  Granite Reef Wash (FIS)

T4 GR data digitized from 1"=100' 1-foot map dated November 1993
T4 GR data modified for flowpaths.  non flowing ares blocked out

T5 1"=100' 1-feet Contour mapping from Michael Baker, Jr., Inc.
T6 Provided by the city of Scottsdale

T7 Supplemental cross section data surveyed by City of Scottsdale

T8 Downstream reach from "Granite Reef Wash Stabilization Plans" Project F1705

T9 Subcritical analysis
T9 This model was developed and configured to determine water surface elevation
T9 for a 100-year floodplain delineation study, Velocity from this model
T9 may not be accurate and should not be used


J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

                2                           -1                                    1196.43

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

     1                                                -1


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

    38        43         1         2         8         4        26       100       200

  Critical conditions assumed Dowstrream from culvert
  X-sec 0.225 obtained from improvement plans


NC     .028      .035      .020       .1        .3
QT        2      1417      1417

   51.5
X1    0.225         8      9991     10009       370       370       370
X3                                   9962      1200     10017      1200
GR     1195      9962    1195.0      9981    1194.9      9991    1188.9      9995   1188.73     10000
GR   1188.9     10005    1194.9     10009      1195     10017

  ******************************************************************************
  *****              Culvert outlet dowstream from water well              ********
  ******************************************************************************
```

```
NC                                      .3        .5
  51
X1    0.231        35     9993.5    10006.5       31        31        31
X3       10                                                          1195      1195
GR     1203   9776.97       1203       9798     1194      9798      1194      9849      1203      9849
GR     1203      9897       1194       9897     1194    9901.22      1195   9905.06      1196    9922.2
GR   1196.1   9954.45       1196    9986.69     1195    9988.5      1194   9990.19      1193   9991.88
GR   1189.2    9993.5    1189.29    9995.26  1189.29     10000   1189.29   10003.2   1189.29     10005
GR   1189.3   10006.5       1194   10008.6     1195   10010.5      1196   10012.4    1196.5  10027.40
GR     1196   10042.4     1195.9  10061.45     1196   10080.5    1196.3  10092.80      1196   10105.1
GR   1195.9     10110       1203     10110     1203     10218   1195.18     10218      1195   10243.7

  ******************************************************************************
  *****          13' X 7.5'concrete box culvert  at well site          ********
  ******************************************************************************

SC    1.013       0.4        2.7                7.5        13       137       8.1   1189.59   1189.29


  ******************************************************************************
  *****                       Culvert inlet                              *******
  ******************************************************************************
  Upstream from water well
   49
X1    0.257        27     9993.5    10006.5      135       135       137
X2                            2                1197.41
X3       10                                                       1197.67   1197.41
BT       -3      9933    1197.67                10000   1197.83                10132   1197.41
GR     1208   9900.62       1208    9932.99  1198.29      9933   1197.67      9933      1197   9982.93
GR     1196   9983.45       1195    9983.96     1194   9984.61      1193   9989.53      1192   9991.53
GR   1189.5    9993.5    1189.59      10000  1189.59   10006.5      1192   10014.6      1193   10016.2
GR     1194   10017.3       1195   10018.3     1196   10019.3      1197   10020.1      1198   10033.7
GR     1198   10039.4       1197     10041     1196   10099.5   1197.41  10131.99   1197.41     10132
GR     1208  10132.01       1208   10169.1

  Reach GRW-2 concrete channel between water well and Granite Reef Road

NC    0.041     0.029      0.018

  effective area limited to 4 to 1 expancion
  Effective area boundary withing buildings no X3 record needed
   48
X1    0.272        29    9985.49    10017.7       80        80        80
X3       10
GR     1198   9920.49       1198     9922.9     1197   9934.09      1196   9934.29      1195   9935.29
GR     1194    9935.8       1193    9935.96     1192   9936.13      1191   9936.28      1190   9936.41
GR     1189   9936.54       1188    9936.67     1188   9963.96      1189   9968.23      1190    9972.5
GR     1191   9976.77       1192    9981.02     1193   9985.49      1192   9995.42      1191   9996.32
GR   1190.8     10000       1191    10004.1     1192   10005.7      1193   10007.1      1194   10008.6
GR     1195   10009.7       1196    10010.7     1197   10012.1      1198   10017.7
```

```
NC                                        .1          .3

  effective area limited to 4 to 1 expancion
  Effective area boundary withing buildings no X3 record needed
   47
X1    0.288        29    9989.19    10015.1        83        83        83
X3                                                        10205      1210
GR     1199   9893.77      1198    9916.31      1198   9919.53      1198   9935.85      1197   9936.82
GR     1196   9937.79      1195    9938.97      1194   9939.61      1193   9940.15      1192   9940.58
GR     1191   9944.28      1192    9962.15      1193   9972.89      1194   9979.65      1195   9987.74
GR     1195   9989.19      1193    9991.84      1192   9992.81      1191   9993.54    1190.9     10000
GR     1191   10005.1      1193    10007.8      1194   10009.3      1195   10010.5      1196   10012.1
GR     1197   10013.5      1198    10015.1      1198   10034.6      1198   10054.3

  Reach GRW-3   from south end of Granite Reef Road to 84th Place

NC    0.057     0.046     0.018

   46
X1    0.303         9    9987.96    10053.2        77        77        77
X3                                     9815      1210     10198      1210
GR     1199    9915.2      1198    9924.29      1197   9936.33    1196.9   9945.96      1197   9955.59
GR   1197.3   9987.96    1197.3      10000      1198   10053.2    1198.1   10060.45

   45.5

X1    0.320        15    9978.8    10036.9        89        89        89
GR     1211   9800.57      1211       9815    1200.8      9815    1200.4      9835      1211      9835
GR     1211   9860.24      1211       9897    1199.5      9897    1199.3    9915.2      1199   9937.98
GR     1198    9978.8    1197.3      10000      1198   10036.9    1198.7   10124.9      1199   10166.5

  ########################## BEGINNING OF STUDY AREA ###########################

  basin on rigth bank may need to modified for storage
   45

X1    0.326        18    9987.35    10021.9        34        34        34
X3                                                        10110      1198
GR     1201   9861.86    1200.83       9877      1211      9877      1211      9952      1200      9952
GR     1199   9965.85      1198    9987.35    1197.4     10000      1198   10021.9      1198   10048.5
GR     1197   10058.2      1197    10090.2      1198   10102.5      1199   10120.2      1200   10143.8
GR   1200.5     10157      1211      10157      1211   10331.1

  Basin on rigth bank may need modification for storage
   44
```

```
X1    0.369        36      9981     10019       226       226       226
X3                                              10021.7      1199
GR     1207   9666.43      1206   9668.28      1205   9677.66      1204   9678.25      1203   9678.81
GR     1202   9679.37      1202   9688.01      1202      9717      1212      9717      1212   9739.79
GR     1212   9808.24      1212      9857    1201.2      9857      1201   9860.23      1201      9882
GR     1212      9882      1212   9905.43      1212   9951.14      1212   9960.03      1200   9960.03
GR     1199   9973.09    1198.2      9981      1198   9994.77    1197.8     10000      1198   10005.8
GR   1198.2     10019      1199   10021.7      1199   10038.7      1198   10051.2      1198   10089.9
GR     1199   10098.8      1201   10121.7      1201   10142.1      1201   10147.9      1202   10157.3
GR     1212   10157.3

   43

X1    0.421        34      9981     10019       278       278       278
GR     1209   9668.66      1208   9671.36      1207   9673.72      1206   9676.24      1205    9678.6
GR     1204   9681.44      1204      9710      1214      9710      1214   9794.16      1214    9838.9
GR     1214      9856      1203      9856      1203      9883      1214      9883      1214   9897.08
GR     1214   9942.77      1214      9955    1203.5      9955      1202      9962      1201   9965.84
GR     1200   9972.86    1199.1      9981      1199   9984.84    1198.5     10000      1199   10015.6
GR   1199.1     10019      1200   10086.4      1201   10101.3      1202   10118.1    1202.6   10142.5
GR     1203   10149.7    1203.6     10173      1214     10173      1214   10191.4

   42

X1    0.459        28   9980.62   10020.9       200       200       200
X3                                              10020.9      1200
GR     1205    9674.5      1204      9684      1204      9710      1214      9710      1214      9853
GR     1204      9853      1204      9878      1214      9878      1214   9888.27      1214   9897.21
GR     1214      9955      1203   9955.25      1202   9963.49      1201   9972.43      1200   9980.62
GR   1199.4     10000      1200   10020.9      1200   10043.3      1199   10047.1      1198   10050.9
GR     1198   10059.6      1199   10092.1      1200   10099.7      1201   10107.4      1202   10113.1
GR     1203   10128.8      1204   10151.3      1205   10165.4

  Expancion-Contraction modified to acount for bend

NC                                     .3        .5

   41
X1    0.503        14      9978     10022       229       229       229
GR     1205      9663   1204.32      9765      1215      9765      1215   9814.93      1215      9925
GR   1203.9      9925      1203   9936.49    1202.7      9978    1202.3     10000    1202.7     10022
GR     1203   10074.5      1204   10128.3      1205   10166.6      1206   10215.4

   40

X1    0.542        31     9969.9   10043.9       220       205       208
GR     1215   9502.51      1215      9545      1207      9545      1207   9579.21   1206.89      9602
GR     1215      9602      1215      9683   1206.52      9683   1206.39      9710      1215      9710
GR     1215   9794.96      1215      9800      1206      9800      1206   9844.04      1206      9857
GR     1215      9857      1215   9902.47      1215   9932.06      1215      9940      1206      9940
GR     1206    9958.6      1205   9964.22      1204    9969.9    1203.6     10000    1203.2     10019
GR     1204   10043.9      1205   10062.2      1206   10075.9      1207   10082.8      1208   10091.3
GR     1208     10099
```

Reach GRW-4 along 84th Place
Expancion-Conptration back after turn

NC	.045	.045	.018	.1	.3					
39										
X1	0.627	51	9983.76	10014.9	200	220	451			
GR	1211	9499.13	1210	9504.25	1209	9606.9	1208.72	9642	1215	9642
GR	1215	9696	1208.28	9696	1208.19	9708	1215	9708	1215	9731.19
GR	1215	9757	1207.88	9757	1207.82	9770	1215	9770	1215	9816
GR	1207.6	9816	1207.55	9833	1215	9833	1215	9877	1207.35	9877
GR	1207.3	9893	1215	9893	1215	9943	1207.06	9943	1207	9955.49
GR	1206	9983.76	1205.9	10000	1206	10014.9	1206	10019.9	1206	10020.1
GR	1206	10021.9	1207	10045.2	1207.17	10060	1215	10060	1215	10129.4
GR	1208	10130	1207	10155	1206	10170	1206	10183	1206.5	10204
GR	1215	10204	1215	10280	1207	10280	1206	10295	1205	10300
GR	1205	10315	1206	10360	1207	10360	1208	10385	1209	10390
GR	1210	10396								
38										
X1	0.674	59	9985	10015.2	270	220	248			
GR	1212	9085	1212	9472	1211	9510	1215	9510	1215	9610
GR	1210.9	9610	1210.8	9662	1215	9662	1215	9705	1210.5	9705
GR	1210.5	9720	1215	9720	1215	9770	1210.2	9770	1210.2	9785
GR	1215	9785	1215	9830	1210	9830	1210	9842.93	1209.9	9845
GR	1215	9845	1215	9875.24	1215	9893	1208.8	9893	1208.5	9910
GR	1215	9910	1215	9957	1208.06	9957	1208	9962.63	1207	9971.69
GR	1206	9985	1205.5	10000	1206	10015.2	1207	10031	1208	10050
GR	1215	10050	1215	10095	1208	10095	1208	10119	1208	10119
GR	1215	10119	1215	10168	1208.4	10168	1208.7	10190	1215	10190
GR	1215	10228	1208.8	10228	1208.8	10242	1215	10242	1215	10285
GR	1208.2	10285	1207	10300	1207	10310	1208	10327	1208	10342
GR	1208	10377	1209	10382	1210	10390	1211	10424		
37										
X1	0.729	55	9985.4	10016.8	289	289	289			
X3				9919.11	1209					
GR	1214	9347	1213	9456	1212	9468	1211	9476	1211	9510
GR	1216	9510	1216	9560	1211.2	9560	1211.2	9582	1216	9582
GR	1216	9625	1210.6	9625	1210.6	9650	1216	9650	1216	9690
GR	1209.8	9690	1209.8	9705	1216	9705	1216	9750	1209.5	9750
GR	1209.5	9762	1216	9762	1216	9811	1209	9811	1209	9811.46
GR	1208	9821.48	1208	9840.72	1208.5	9867	1216	9867	1216	9893.2
GR	1216	9919.11	1216	9945	1208.45	9945	1208	9965.49	1207	9985.4
GR	1206.6	10000	1207	10016.8	1208	10029.9	1209	10043.8	1209	10053
GR	1216	10053	1216	10145	1209	10145	1209	10162.2	1209	10200
GR	1216	10200	1216	10209.1	1216	10282	1208.5	10282	1208	10310
GR	1208	10363	1209	10390	1209	10404	1210	10410	1211	10428
36										

```
X1    0.786        60       9988    10014.5       290       298       298
GR     1213      9399       1212       9430      1212      9510      1216      9510      1216      9570
GR     1212      9570       1212       9585      1216      9585      1216      9622      1212      9622
GR     1212      9647       1216       9647      1216      9690      1212      9690      1212      9707
GR     1216      9707       1216       9753    1211.5      9753    1211.5      9770      1216      9770
GR     1216    9809.9       1216    9811.65      1216   9818.97      1216      9820   1208.75      9820
GR     1208   9822.85       1208     9834.5      1209   9845.28      1210    9853.9      1211   9867.28
GR     1216    9867.3       1216    9942.19      1216      9948   1210.73      9948      1210    9963.6
GR     1209   9970.61       1208     9976.1    1207.3      9985      1207      9988    1206.9     10000
GR     1207   10014.5       1208    10025.9      1209   10031.4      1210   10033.3      1211     10057
GR     1216     10057       1216    10147.9      1211     10148      1210   10171.5      1210   10177.6
GR   1210.8     10203       1216      10203      1216   10208.4      1216     10287   1210.08     10287
GR     1210   10293.6       1210      10360      1211     10385      1212     10390      1213     10405

  35

X1    0.821        58       9985      10015       180       190       190
GR     1215      9455       1214       9464      1213      9466      1212      9474      1211      9477
GR   1210.5   9480.35    1210.36       9507      1217      9507      1217      9566   1210.07      9566
GR     1210   9580.93       1217       9581      1217      9630   1209.75      9630   1209.67      9645
GR     1217      9645       1217       9695   1209.41      9695   1209.33      9710      1217      9710
GR     1217      9755     1209.1       9755   1209.02      9770      1217      9770      1217   9773.71
GR     1217      9826     1208.6    9827.31   1208.34      9862      1217      9862      1217   9906.42
GR     1217      9945    1207.61       9945    1207.2      9985    1207.1     10000    1207.4     10015
GR     1208   10016.9       1209     10024.4      1210   10027.2      1211   10043.7      1211     10053
GR     1217     10053       1217      10102      1211     10102      1211     10125      1217     10125
GR     1217     10170       1211      10170      1211     10188      1217     10188      1217     10225
GR     1211     10225       1211      10240      1217     10240      1217     10292      1211     10292
GR     1211   10323.5       1212    10361.8      1213   10375.9

  Expancion -Contraction increased to account for end of channel

NC                                      .3        .5

  34
X1    0.857        45    9987.55   10030.36       158       220       187
GR     1214      9457       1213       9468      1213      9475      1212      9492      1211      9510
GR     1217      9510       1217       9563      1212      9563      1212      9580      1217      9580
GR     1217      9625       1212       9625      1212      9640      1217      9640      1217      9688
GR     1212      9688       1212       9700      1217      9700      1217      9750      1212   9750.01
GR     1212      9762       1217    9762.01      1217      9805      1212      9805      1212      9821
GR     1211      9830     1210.2       9833      1211   9836.21      1212   9851.37      1212      9860
GR     1217      9860       1217       9947      1212      9947      1212   9952.61      1211   9958.18
GR     1210   9964.22       1209    9987.55    1208.5     10000      1209  10030.36      1210  10060.39
GR     1211  10096.99       1212   10104.86      1213  10113.12      1214  10117.56      1215  10121.10

  Reach GRW-5A Earthen channel upstream from 84th place
```

```
NC    0.043      0.036      0.038

  33
X1    0.865         61    9979.89   10024.62         50         20         45
GR     1215       9398       1215       9448       1214       9458       1213       9460       1212       9465
GR     1213       9474       1211       9478       1211       9509       1211       9510       1217       9510
GR     1217       9562       1211       9562       1211       9580       1217       9580       1217       9625
GR     1211       9625       1211       9640       1217    9640.01       1217       9685       1211    9685.01
GR     1211       9700       1217    9700.01       1217    9722.87       1217       9757     1210.7       9757
GR   1210.6       9767       1217       9767       1217     9813.7       1217       9818    1210.39       9818
GR     1211    9832.09       1212    9849.77       1212       9857       1217       9857       1217       9944
GR     1212       9944       1212    9959.25       1211    9967.61       1210    9975.97       1210    9979.89
GR     1209    9983.88       1208    9986.15       1207    9987.87       1206     9989.6       1205    9991.32
GR     1204    9993.05       1203    9997.63     1202.9      10000       1203   10002.75       1204   10007.61
GR     1205   10011.06       1206   10014.61       1207   10017.97       1208    10021.3       1209   10024.62
GR     1210    10054.5       1211   10081.35       1212   10098.82       1213   10101.86       1214   10104.88
GR     1215   10107.92
```

Expancion-Contraction back to normal after trancition

```
NC                                       .1         .3

  32
X1    0.883         63     9980.8   10021.12         95         95         95
GR     1216       9443       1215       9454       1214       9466       1213       9471       1212       9476
GR     1213       9477       1213       9479       1212       9480       1212    9535.85       1212       9545
GR     1217       9545       1217       9595       1212       9595       1212       9608       1217       9608
GR     1217       9656       1212       9656       1212       9670       1217       9670       1217       9715
GR     1212       9715       1212       9730       1217       9730       1217       9782       1212       9782
GR     1212       9793       1217       9793       1217    9837.05       1217       9843     1211.4       9843
GR     1211     9848.7       1211    9865.29       1212    9888.13       1217     9888.2       1217    9909.79
GR     1217    9927.63       1217    9930.97       1217    9935.36       1217    9939.35       1217       9973
GR   1212.1       9973       1212     9980.8       1211    9982.17       1210    9983.43       1209    9984.27
GR     1208    9985.47       1207    9986.43       1206    9987.53       1204    9989.55     1203.1      10000
GR     1204   10009.62       1205   10011.1       1206   10014.32       1207   10016.82       1208   10018.92
GR     1209   10021.12       1210   10044.42       1211   10079.42       1212   10095.12       1213   10102.22
GR     1214   10105.12       1215   10111.62       1215   10140.82
```

Reach GRW-5B Earthen channel south of McDowell Road

```
NC     .035      0.050      0.038

  31
X1    0.915         47    9976.92   10017.23        169        202        170
GR     1216       9522       1215       9526       1214       9534       1213       9541       1212       9546
GR   1211.8    9565.50       1212       9585     1212.2       9630       1217    9630.01       1217       9710
GR   1212.1    9710.01       1212    9725.13     1211.9       9728       1217       9728       1217    9805.79
GR     1217       9817     1210.9       9817     1210.8       9828       1217       9828       1217       9913
GR   1210.1       9913     1210.0       9923       1217       9923       1217    9929.11       1217    9956.27
GR     1217       9965       1210       9965       1210    9976.92       1209    9984.09       1208    9985.77
GR     1207    9987.33       1206    9989.12       1205    9991.47       1204    9992.44     1203.1      10000
GR     1204   10005.33       1205   10008.06       1206   10010.33       1207   10012.93       1208   10015.03
GR     1209   10017.23       1210   10046.73       1211   10084.03       1212   10102.23       1213   10115.63
```

```
GR     1217    10115.7       1217      10295

  30

X1    0.966         32    9970.98   10019.52        170      266.5        266
GR     1217       9500       1217       9595       1213    9595.01       1213       9600       1212       9620
GR     1212       9633       1213       9677       1214       9695     1214.2       9717       1214    9749.24
GR     1213    9961.38       1212    9962.38       1211    9966.22       1210    9970.98       1209    9977.76
GR     1208    9986.36       1207    9988.49       1206    9990.56       1204    9994.83     1203.6      10000
GR     1204     10003.8       1206   10010.32       1207   10013.12       1208   10016.52       1209   10019.52
GR     1210    10062.52       1211   10109.72       1212   10112.42       1213   10118.62       1217   10118.63
GR     1217      10247       1215      10247

  29

X1    1.001         41    9958.34   10018.25        240        190        190
GR     1218       9600       1218       9663    1213.50    9663.01       1213       9669       1212       9681
GR   1212.5       9707       1212    9752.16     1211.8    9755.84       1212    9759.51       1213    9769.04
GR     1213    9821.08     1213.2    9860.20       1213    9899.32       1213    9956.08       1212    9958.34
GR     1211    9964.14       1210    9968.88       1209    9976.61       1208    9983.87       1207     9986.9
GR     1206     9990.1       1205    9995.89       1204    9996.34     1203.7      10000       1204   10003.42
GR     1206   10007.75       1207   10009.75       1208   10012.15       1209   10015.05       1210   10018.25
GR     1211   10030.25       1212   10054.25     1212.3      10058       1218      10058       1218   10064.35
GR     1218   10077.15       1218      10243     1214.7      10243       1215   10287.55       1216   10294.75
GR     1217   10296.85

  28

X1    1.042         38    9984.27   10024.32        245        215        215
X3
GR     1220       9568       1220       9597     1214.2    9597.01       1214       9610       1213       9614
GR     1212       9618       1212       9711       1213       9714       1213    9724.53       1213    9762.76
GR     1213    9768.92       1212    9789.95       1212    9928.08       1212    9946.55       1211    9984.27
GR     1210    9986.38       1209    9988.27       1208    9990.31       1207    9992.57       1206    9994.62
GR     1205    9995.41       1204    9997.09     1203.7      10000       1204   10002.77       1207   10007.52
GR     1208   10008.72       1209   10010.02       1210   10012.02       1211   10014.52       1212   10017.02
GR     1213   10024.32       1214   10057.72       1214      10067       1220      10067       1220   10157.22
GR     1220      10227     1214.5      10227       1215   10288.32

NC                                        .3         .5

  ******************************************************************************
  ******                  McDowell Road Culvert Outlet                   ********
  ******************************************************************************
  27
X1    1.054         31       9994      10006         60         69         64
X3       10                                                                    1212       1212
GR     1216    9275.46       1215    9441.9       1214       9550     1213.5       9610       1220       9610
GR     1220    9662.52       1220    9703.87      1220    9730.46       1220    9829.45       1212    9829.45
GR     1212     9909.4       1212    9992.74      1211    9993.14       1210    9993.65    1202.58       9994
GR   1202.5    9994.75    1202.58      10000    1202.58      10006       1209    10009.2       1210    10011.1
GR     1211    10012.8       1212    10014.5      1213    10021.1    1213.67      10055       1220      10055
GR     1220    10069.6       1220    10083.6      1220      10147    1215.57      10147       1216    10194.1
```

```
GR     1217    10297.2

  ******************************************************************************
  *****        12' X 8' Concrete Box Culvert at McDowell Road              *****
  ******************************************************************************


QT        2       1240       1240
SC    1.013         .3        2.7                     8          12      112.25        12.3     1202.63     1202.58

  ******************************************************************************
  *****                   McDowell Road Culvert Inlet                      *****
  ******************************************************************************
  26
X1    1.075         43    10008.5    10020.5        112         112         112
X2                               2                1213.01
X3       10                                                                1213.01     1213.01
BT       -3       9940    1213.09                 10000     1213.01                  10057.6     1213.09
GR     1217       9195       1216       9325     1215.62        9381        1222       9381        1222        9428
GR   1215.3       9428       1215     9475.5     1214.54        9513        1222       9513        1222     9557.88
GR     1222    9812.39       1222    9887.85        1222     9929.52        1222       9940     1217.73        9940
GR   1211.8       9940       1211    9973.46        1210     9985.78        1209     9992.7        1208        9994
GR     1208      10000       1207    10003.4        1206       10006     1202.62    10008.5     1202.62     10014.5
GR   1202.6    10020.5       1206    10022.9        1207     10024.3        1208    10025.4        1209     10026.3
GR     1210    10027.5       1211    10028.8        1212       10033        1213    10037.4        1214     10044.7
GR     1215    10057.6    1217.68    10057.6        1222     10057.6        1222    10082.2        1222     10116.3
GR     1222    10154.5       1222    10196.4        1222     10313.8

  Reach GRW-6 upstream from McDowell Road

NC    0.037      0.044      0.045

  25
X1    1.084         26    9990.97    10010.8          43          43          43
GR     1222     9960.8       1222       9965     1214.31        9965        1214     9966.9        1213     9972.36
GR     1212    9976.52       1211    9979.05        1210     9981.58        1209     9987.9        1208     9990.97
GR     1207    9993.32       1206    9995.66      1205.2       10000        1206    10003.8        1207     10007.3
GR     1208    10010.8       1209    10038.5        1210     10039.3        1211    10040.4        1212     10042.6
GR     1213    10044.7       1214    10048.6        1215     10058.6      1215.1      10068        1222       10068
GR     1222    10155.2


NC                                       0.1        0.3

  24
X1    1.101         28     9989.9    10012.2          90          90          90
GR     1222    9932.86       1222       9963     1215.07        9963        1215    9965.07        1214     9969.83
GR     1213    9973.77       1212    9976.76        1211     9980.16        1210    9983.42        1209     9986.54
GR     1208     9989.9       1207    9992.93        1206     9996.47      1205.5      10000        1206     10004.5
GR     1207      10008       1208    10012.2      1208.8     10027.3        1209      10040        1210     10041.3
GR     1211    10042.1       1212    10044.4        1213     10046.8        1214    10055.5        1215     10073.9
GR   1215.6      10108       1222      10108        1222     10124.7
```

```
NC                                    0.3        0.5

  ******************************************************************************
  *****                    Office Bridge outlet                             *****
  ******************************************************************************
  23
X1    1.108        28    9970.84    10057.1        40         40         40
X3       10                                                                  1215       1215
GR     1224    9955.7       1224       9963    1215.2       9963       1215   9965.16       1214    9970.84
GR     1213   9974.78       1212    9978.09      1211    9981.24       1210   9984.23       1209    9987.54
GR     1208   9991.01       1207    9994.48      1206    9998.85     1205.6     10000       1206    10007.1
GR     1207   10011.7       1208    10016.2      1209    10022.5       1210   10028.9       1211    10036.4
GR     1212   10040.2       1213    10043.4      1214    10057.1       1215   10111.6       1216      10140
GR   1215.8     10170       1224      10170      1224      10175

  ******************************************************************************
  *****                Special Bridge data at Office bridge                 *****
  ******************************************************************************

SB     1.05      1.56        2.7                  23          4        467          3    1205.72     1205.6

  ******************************************************************************
  *****                    Office Bridge inlet                              *****
  ******************************************************************************
X1    1.115        33    9971.29    10045.2        34         34         34
X2                            1       1215    1215.1
X3       10                                                                  1215       1215
BT       -8      9970       1215       1215   9971.29     1215.1     1215.1    9971.3     1219.1     1215.1
BT             10000     1235.1     1215.1  10019.53       1230     1215.1  10045.12     1219.1     1214.5
BT          10045.21     1215.1     1214.5    10094.       1215       1215
GR     1224   9958.97       1224    9964.65      1215    9964.65       1215      9970       1215    9970.01
GR     1215   9971.29     1215.1    9971.29      1213    9974.73       1212   9977.29       1211    9980.22
GR     1211   9980.52    1210.89    9981.29      1210     9982.6       1209    9985.9       1208    9989.74
GR     1207   9993.41    1205.66    9999.33   1205.72      10000    1205.88   10012.1    1207.42    10019.5
GR     1210   10026.9    1212.95    10035.2      1214    10045.2     1214.5   10045.2       1215    10094.5
GR     1224   10094.5       1224      10125   1215.87      10125       1216   10129.7       1217    10158.6
GR     1217     10170       1224      10170      1224      10223

X1    1.121        34     9983.8    10020.3        36         36         36
GR     1224    9959.9       1224       9963   1214.59       9963       1214   9967.38       1213    9973.14
GR     1212   9976.59       1211    9980.24      1210     9983.8       1209   9986.76       1208    9990.02
GR     1207    9993.1     1206.1      10000      1206    10001.2       1206   10004.1       1207    10009.8
GR     1208     10015       1209    10018.8      1210    10020.3       1211   10022.6       1212    10026.1
GR     1213   10029.7       1214    10034.5      1215    10040.7       1215   10049.1       1215    10093.2
GR   1215.1     10097       1224      10097      1224    10127.4       1224     10133     1216.3      10133
GR     1217   10146.2       1218    10177.3      1224    10177.3       1224     10200

  Reach GRW-7 Earthen channel downstream from 87th Street
  Expancion-Contraction increase to acount for bend
```

NC	0.045	0.045	0.045	.5	.8					
X1	1.138	33	9952.84	10021.4	37	150	90			
GR	1225	9857.9	1225	9930.22	1225	9937.9	1215	9937.9	1214	9952.84
GR	1213	9959.84	1212	9963.34	1211	9966.85	1210	9971.05	1209	9975.49
GR	1208	9979.69	1207.5	10000	1208	10008.3	1209	10010.5	1210	10012.7
GR	1211	10014.9	1212	10017	1213	10019.4	1214	10021.4	1215	10025.7
GR	1216	10029.9	1217	10052.3	1217	10074	1225	10074	1225	10135
GR	1217	10135	1217	10156.4	1217	10169.2	1217	10173.7	1217	10185
GR	1217.7	10210	1225	10210	1225	10220				

Expancion Contraction back to normal after bend

NC				.1	.3					
X1	1.181	34	9976.04	10021.36	225	225	225			
GR	1225	9803.86	1225	9847.76	1225	9888.05	1225	9947	1213.33	9947
GR	1213	9976.04	1212	9979.56	1211	9982.13	1210	9984.58	1209	9987.04
GR	1208	9989.28	1207	9991.63	1206	9994.94	1205	9999.53	1204.95	10000
GR	1205	10001	1206	10002.52	1207	10005.92	1208	10008.42	1209	10010.62
GR	1210	10013.02	1211	10015.42	1212	10017.72	1213	10021.36	1214	10024.42
GR	1215	10051.82	1225	10051.82	1225	10113	1215.52	10113	1216	10168.82
GR	1216	10190	1225	10190	1225	10206	1225	10256		

Expancion contraction increased for trancition and bend

NC				.5	.8					
X1	1.224	34	9973.16	10020.6	230	130	230			
GR	1217	9577	1215	9724	1216	9790	1225	9790	1225	9840
GR	1216	9840	1216	9868	1215	9915.7	1214	9959.52	1213	9968.92
GR	1212	9973.16	1211	9975.75	1210	9978.62	1209	9981.65	1208	9986.21
GR	1207	9994.84	1206.5	10000	1207	10006.3	1208	10010.9	1209	10013.4
GR	1210	10015	1211	10016.6	1212	10020.6	1213	10039.1	1214	10050.5
GR	1214.1	10055	1225	10055	1225	10083.13	1225	10125	1215.2	10125
GR	1216	10258	1216	10267	1225	10267	1225	10300		

X1	1.239	34	9985.94	10034.7	90	30	75			
GR	1227	9720	1227	9740	1217	9740	1217	9752	1216.42	9815
GR	1227	9815	1227	9860.12	1227	9870	1215.74	9870	1215	9897.7
GR	1215	9901.82	1215.2	9915	1227	9915	1227	9960	1215.8	9960
GR	1216	9975.83	1215	9981.92	1214	9985.94	1213	9989.85	1212	9994.01
GR	1211.4	9997	1211	9999.1	1210.9	10000	1211	10001.7	1212	10013.9
GR	1213	10024.7	1214	10034.7	1227	10034.8	1227	10123	1214.5	10123
GR	1215	10209.3	1215.81	10250	1227	10250	1227	10259.6		

Reach GRW-8 along 87th Street

```
NC    0.055     0.055      .018       .5        .8

X1    1.262        54   9990.73  10032.2       256        20       123
GR     1227   9417.43      1227     9475   1218.47      9475   1218.38      9485      1227      9485
GR     1227   9526.89      1227     9535   1217.96      9535   1217.86      9555      1227      9555
GR     1227      9617   1217.55     9617   1217.48      9630      1227      9630      1227      9686
GR   1217.2      9686   1217.13     9700      1227      9700      1227   9725.93      1227      9765
GR   1216.8      9765   1216.71     9778      1227      9778      1227      9828   1216.43      9828
GR   1216.3      9845      1227     9845      1227   9903.71      1227      9911   1215.63      9911
GR     1215   9923.34      1214  9924.07      1213   9949.26   1212.50   9990.73      1212   10032.2
GR   1211.9  10034.52      1212  10037.8      1213     10043      1214   10048.5      1214     10058
GR     1227     10058      1227    10143      1214     10143      1214   10185.7      1215   10221.6
GR   1215.0     10225      1227    10225      1227     10321    1216.4     10321    1216.4     10348
GR     1227     10348      1227    10422   1216.68     10422      1217     10502

X1    1.301        73   9980.84  10019.8       225       130       204
GR     1228   9329.73      1228     9385   1218.54      9385   1218.43      9398      1228      9398
GR     1228   9448.73      1228     9455   1217.98      9455   1217.92      9470      1228      9470
GR     1228      9527   1217.71     9527   1217.64      9545      1228      9545      1228      9598
GR   1217.4      9598   1217.35     9614      1228      9614      1228      9673   1217.15      9673
GR   1217.1      9684      1228     9684      1228   9714.37      1228      9737    1216.9      9737
GR   1216.8      9755      1228     9755      1228      9805   1216.59      9805   1216.52      9822
GR     1228      9822      1228     9868   1216.31      9868   1216.24      9885      1228      9885
GR     1228   9937.98      1216  9937.98      1215   9954.58      1214   9968.17      1213   9980.84
GR   1212.1     10000      1213  10019.8      1214   10031.6      1215   10049.1   1215.14     10057
GR     1228     10057      1228  10104.6      1228     10110   1216.02     10110   1216.09     10128
GR     1228     10128      1228    10183   1216.32     10183    1216.4     10205      1228     10205
GR     1228     10273   1216.68    10273      1217   10353.4      1228   10353.4      1228     10397
GR   1217.8     10397      1218  10418.6   1218.13     10435      1228     10435      1228     10470
GR   1218.3     10470    1218.4    10483      1228     10483      1228     10535   1218.67     10535
GR   1218.7     10550      1228    10550      1228   10596.9

  Expancion-Contraction back to normal after bend/trancition
  N value .5 to block inefective area

NC                                  0.1       0.3
NH        5        .9      9860     .055      9981      .018     10019      .055     10180        .9
NH    10500
   14.5
X1    1.353        64      9981    10019       290       235       278
GR     1228      9457      1228     9475    1217.9      9475   1217.84      9485      1228      9485
GR     1228      9555   1217.45     9555   1217.39      9566      1228      9566      1228      9625
GR   1217.1      9625      1217     9635   1216.94      9644      1228      9644      1228      9700
GR   1216.5      9700    1216.3   9735.7      1216   9778.68   1215.91      9790      1228      9790
GR     1228      9840   1215.48     9840   1215.34      9858      1228      9858      1228   9898.59
GR     1228      9918   1214.62     9918      1214   9949.53    1213.1      9981      1213      9994
GR   1212.8     10000      1213  10007.5    1213.1     10019      1214   10041.4   1214.06     10045
GR     1228     10045      1228    10095   1214.83     10095      1215     10106   1215.14     10120
GR     1228     10120      1228    10140   1215.34     10140   1215.48     10155      1228     10155
GR     1228   10207.4      1216  10207.4   1217.23     10223      1228     10223      1228   10255.8
GR     1228     10267   1217.35    10267    1217.4   10282.9    1217.8     10330      1228     10330
GR     1228     10382    1218.2    10382    1218.3     10400      1228     10400      1228     10445
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GR   1218.6      10445     1218.8      10470       1228      10470       1228      10500

NC     0.055      0.055       .018

X1     1.373         82    9980.32    10021.3        150        105        106
GR      1228    9447.57       1228    9495.13       1228       9512    1218.82       9512     1218.7       9524
GR      1228       9524       1228       9583    1218.08       9583       1218    9591.07    1217.94       9597
GR      1228       9597       1228       9663    1217.24       9663       1217    9685.49       1217    9734.12
GR    1216.8       9763       1228       9763       1228       9818    1216.55       9818     1216.1       9903
GR      1228       9903       1228    9920.85       1228       9948     1215.5       9948       1215    9967.69
GR      1214    9980.32     1213.0      10000       1214    10021.3       1215    10035.4    1215.45      10040
GR      1228      10040       1228    10048.7       1228    10073.7       1228      10080     1217.1      10080
GR    1217.5      10105       1228      10105       1228    10136.8       1228      10142    1218.04      10142
GR    1218.3      10168       1228      10168       1228      10214    1218.63      10214    1218.83      10240
GR      1228      10240       1228    10260.2       1228      10288    1219.29      10288     1219.4      10298
GR      1228      10298       1228      10353    1219.98      10353       1220    10355.1    1220.11      10363
GR      1228      10363       1228      10415    1220.84      10415       1221    10426.3    1221.02      10433
GR      1228      10433       1228      10482    1221.16      10482     1221.2      10496       1228      10496
GR      1228      10553    1221.36      10553    1221.39      10562       1228      10562       1228      10618
GR    1221.5      10618    1221.58      10628       1228      10628       1228      10683    1221.73      10683
GR    1221.8      10695       1228      10695       1228      10750    1221.92      10750    1221.96      10764
GR      1228      10764       1228    10776.9

 N value .5 to block inefective area

NH         4         .5       9850       .055    9979.61       .018    10023.8       .055    10744.6
X1     1.438         75    9979.61    10023.8        280        390        344
GR      1220     9434.9    1219.88       9450       1229       9450       1229       9510    1219.45       9510
GR    1219.3       9525       1229       9525       1229       9583    1218.78       9583    1218.67       9593
GR      1229       9593       1229       9657    1218.06       9657       1218    9662.88    1217.98       9667
GR      1229       9667       1229       9726    1217.65       9726    1217.57       9740       1229       9740
GR      1229       9793    1217.28       9793    1217.18       9810       1229       9810       1229    9842.52
GR      1229       9880    1216.61       9880    1216.22       9917       1229       9917       1229    9937.81
GR      1229       9950     1215.7       9950       1215    9979.61       1214    9995.34     1213.8      10000
GR      1214    10004.4       1214      10017       1214    10019.9       1215    10023.8       1216    10031.1
GR      1217      10050       1229      10050       1229      10102       1217      10102       1217      10133
GR      1229      10133       1229      10200       1217      10200       1217    10252.2       1218    10276.1
GR    1218.0      10277       1229      10277       1229      10340    1218.81      10340       1219    10354.7
GR    1219.0      10355       1229      10355       1229      10410    1219.61      10410    1219.71      10420
GR      1229      10420       1229      10477    1220.29      10477    1220.39      10487       1229      10487
GR      1229      10545    1220.92      10545       1221    10553.1    1221.02      10557       1229      10557
GR      1229      10613    1221.31      10613    1221.38      10626       1229      10626       1229    10744.6

 N value .5 to block inefective area

NH         4         .5       9960       .055    9977.58       .018    10023.8       .055      10483
   12.5
X1     1.499         73    9977.58    10023.8        350        250        320
GR      1221     9454.9    1220.76       9485       1230       9485       1230    9493.9       1230    9546.9
GR      1230       9553    1219.92       9553    1219.78       9565       1230       9565       1230    9627.37
GR      1230       9633    1218.93       9633    1218.77       9647       1230       9647       1230       9704
GR    1218.1       9704       1218    9713.36    1217.96       9716       1230       9716       1230       9776
GR    1217.2       9776       1217    9787.79    1216.98       9793       1230       9793       1230       9857
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GR	1216.7	9857	1216.7	9865.46	1216.07	9915	1230	9915	1230	9920.48
GR	1230	9953	1215.43	9953	1215	9977.58	1214.6	10000	1215	10023.8
GR	1216	10027	1217	10030.8	1218	10035.6	1218	10043	1230	10043
GR	1230	10049.2	1230	10082	1218	10082	1218	10096.2	1219	10103.1
GR	1220	10109.3	1221	10111.7	1222	10115.6	1222	10119.7	1221	10123
GR	1220	10123.7	1219	10124.1	1218	10124.8	1218	10143.3	1230	10143.3
GR	1230	10202	1218	10202	1218	10263.4	1218.2	10295	1230	10295
GR	1230	10348	1218.53	10348	1218.64	10364	1230	10364	1230	10421.8
GR	1219	10421.8	1219.13	10435	1230	10435	1230	10483	1219.62	10483
GR	1219.7	10492	1230	10492	1230	10520.5				

N value .5 to block inefective area

NH	4	.5	9940	.055	9983	.018	10017.6	.055	10527	
X1	1.522	67	9983.44	10017.6	115	125	122			
GR	1221	9448.46	1220.59	9495	1230	9495	1230	9533	1220.27	9533
GR	1220.0	9560	1230	9560	1230	9563.9	1230	9630	1219.09	9630
GR	1219	9636.57	1218.95	9643	1230	9643	1230	9708	1218.4	9708
GR	1218.3	9718	1230	9718	1230	9763.77	1230	9777	1217.93	9777
GR	1217.9	9787	1230	9787	1230	9855	1217.53	9855	1217.2	9918
GR	1230	9918	1230	9957.24	1217	9957.24	1216	9971.63	1215	9983.44
GR	1214.6	10000	1215	10017.6	1216	10027.3	1217	10038	1217.3	10048
GR	1230	10048	1230	10071.1	1230	10092	1218	10092	1218	10124.5
GR	1218.1	10140	1230	10140	1230	10197	1218.5	10197	1218.62	10213
GR	1230	10213	1230	10260	1218.94	10260	1219	10268.2	1219.03	10271
GR	1230	10271	1230	10330	1219.58	10330	1219.75	10348	1230	10348
GR	1230	10375.2	1230	10395	1220.12	10395	1220.21	10410	1230	10410
GR	1230	10464	1220.53	10464	1220.59	10475	1230	10475	1230	10527
GR	1220.9	10527	1221	10543						

NC	0.055	0.055	.018	.1	.3					
X1	1.575	42	9983.07	10019.9	272	283	277			
GR	1221	9565.27	1220.53	9627	1230	9627	1230	9693	1220.02	9693
GR	1220	9696.06	1219.94	9705	1230	9705	1230	9770	1219.49	9770
GR	1219.4	9780	1230	9780	1230	9842.02	1219	9842.02	1218	9847.21
GR	1217.9	9852	1230	9852	1230	9892	1217.53	9892	1217.39	9905
GR	1230	9905	1230	9941.73	1230	9955	1216.38	9955	1216	9983.07
GR	1215.3	10000	1216	10019.9	1216	10024.8	1216	10026	1217	10033
GR	1218	10036	1218.17	10058	1230	10058	1230	10130	1218.66	10130
GR	1219	10180.6	1220	10194.6	1220	10206.9	1221	10209.4	1222	10210.4
GR	1222	10214.2	1222	10636.9						

X1	1.670	57	9978.69	10020	504	504	504			
GR	1224	9505.95	1224	9530	1232	9530	1232	9550	1224	9550
GR	1224	9561.19	1223.87	9575	1232	9575	1232	9635	1223.33	9635
GR	1223.1	9657	1232	9657	1232	9671.25	1232	9725	1222.23	9725
GR	1222	9741.51	1232	9741.51	1232	9795	1221.59	9795	1221.45	9813
GR	1232	9813	1232	9871.35	1221	9871.35	1220.56	9893	1232	9893
GR	1232	9920.01	1232	9957	1219.12	9957	1219	9961.85	1218	9970.31
GR	1217	9978.69	1216	10000	1217	10020	1217	10025.7	1218	10033.8
GR	1219	10037.1	1219.04	10044	1232	10044	1232	10113	1219.44	10113

GR	1219.5	10128	1232	10128	1232	10195	1219.92	10195	1219.98	10205
GR	1232	10205	1232	10208.5	1232	10260	1220.28	10260	1220.42	10286
GR	1232	10286	1232	10350	1220.78	10350	1221	10389.5	1222	10400.2
GR	1222	10541.1	1222.1	10620.2						

X1	1.725	57	9981.03	10017.3	292	292	292			
GR	1225	9582.57	1224	9586.95	1223	9592.66	1222.7	9620	1232	9620
GR	1232	9678	1222.05	9678	1222	9682.95	1221.95	9688	1232	9688
GR	1232	9750	1221.32	9750	1221.22	9760	1232	9760	1232	9782.28
GR	1232	9813	1220.75	9813	1220.59	9833	1232	9833	1232	9892
GR	1220.1	9892	1220.04	9902	1232	9902	1232	9907.33	1232	9956.88
GR	1232	9960	1218.72	9960	1218	9967.88	1217	9981.03	1216.5	10000
GR	1217	10017.3	1218	10025.5	1219	10030.1	1219.45	10055	1232	10055
GR	1232	10085.4	1232	10120	1220.16	10120	1220.2	10130	1232	10130
GR	1232	10198	1220.51	10198	1220.58	10213	1232	10213	1232	10278
GR	1220.8	10278	1220.94	10293	1232	10293	1232	10305.7	1232	10365
GR	1221	10365	1221	10378	1232	10378	1232	10425.8	1232	10436.1
GR	1221	10436.1	1221	10454.1						

X1	1.810	57	9989.25	10022.7	460	449	449			
GR	1232	9731.02	1232	9748.28	1232	9773	1222.25	9773	1222	9781.35
GR	1221.2	9795	1232	9795	1232	9800.14	1232	9823	1220.71	9823
GR	1220.5	9843	1232	9843	1232	9880.65	1232	9890	1219.83	9890
GR	1219.4	9913	1232	9913	1232	9935.88	1232	9960	1218.5	9960
GR	1218	9989.25	1217.4	10000	1218	10022.7	1218.52	10040	1232	10040
GR	1232	10055.84	1232	10111	1219.94	10111	1220	10114.76	1220	10135
GR	1232	10135	1232	10155	1220	10155	1220	10185	1232	10185
GR	1232	10227	1220	10227	1220	10248.9	1220.04	10253	1232	10253
GR	1232	10272	1220.22	10272	1220.62	10314	1232	10314	1232	10352.8
GR	1232	10373	1221.2	10373	1221.28	10387	1232	10387	1232	10447
GR	1221.7	10447	1221.9	10462	1232	10462	1232	10473.5	1232	10522
GR	1222.6	10522	1223	10555.3						

7

X1	1.879	46	9981.65	10020.1	359	359	359			
GR	1227	9481.36	1226	9516.9	1225	9560.7	1224	9571.89	1224	9573.86
GR	1224.9	9613.26	1224.31	9682	1232	9682	1232	9718.68	1224	9718.68
GR	1223	9744.16	1223	9806.92	1222.77	9827	1232	9827	1232	9892
GR	1222.0	9892	1222	9894.66	1221.88	9903	1232	9903	1232	9963
GR	1221.0	9963	1221	9966.26	1220	9974.66	1219	9981.65	1218.3	10000
GR	1219	10020.1	1220	10028.8	1221	10044.2	1221.64	10072	1232	10072
GR	1232	10087.85	1232	10135	1222	10135	1222	10160	1232	10160
GR	1232	10223	1222	10223	1222	10266	1232	10266	1232	10320
GR	1222	10320	1222	10375.5	1222.39	10389	1232	10389	1232	10410.1
GR	1232	10450								

6.5

X1	1.925	27	9982	10020	245	250	245			
GR	1226	9804	1226	9840	1226	9877	1222.66	9877	1222.45	9900
GR	1226	9900	1226	9950	1226	9962	1221.2	9962	1221	9965
GR	1220	9982	1219	9991	1218.7	10000	1219	10012	1220	10020
GR	1221	10037	1221.07	10043	1226	10043	1226	10082	1221.56	10082
GR	1221.8	10106	1226	10106	1226	10149	1222.38	10149	1222.51	10160
GR	1226	10160	1226	10217						

6

X1	1.961	66	9981	10019	192	194	192			
GR	1227	9554.95	1226	9560.92	1226	9564	1232	9564	1232	9589.58
GR	1232	9609.98	1232	9645.35	1232	9668.31	1224	9668.31	1224	9715
GR	1232	9715	1232	9783	1224	9783	1224	9789.67	1223.64	9814
GR	1232	9814	1232	9856.74	1232	9877	1222.46	9877	1222	9894.48
GR	1232	9894.48	1232	9922.03	1232	9945.39	1232	9954	1219.8	9954
GR	1219.1	9981	1219	9993.01	1218.9	10000	1219	10008.6	1219.1	10019
GR	1219.8	10033	1232	10033	1232	10037.7	1232	10069.6	1232	10082
GR	1221.2	10082	1221.42	10094	1232	10094	1232	10128.2	1232	10152
GR	1222.2	10152	1222.26	10165	1232	10165	1232	10230	1222.72	10230
GR	1222.8	10242	1232	10242	1232	10269.6	1232	10305	1223.24	10305
GR	1223.3	10315	1232	10315	1232	10377	1223.73	10377	1223.8	10387
GR	1232	10387	1232	10417.1	1232	10453	1224.23	10453	1224.31	10466
GR	1232	10466	1232	10520	1224.66	10520	1224.76	10536	1232	10536
GR	1232	10574.1								

X1	2.044	66	9981	10018.7	436.2	392	437			
GR	1232	9714.95	1232	9731	1225.45	9731	1225	9744.01	1224	9781.61
GR	1224	9810	1232	9810	1232	9855	1224	9855	1224	9860.78
GR	1223.2	9910	1232	9910	1232	9928.59	1232	9958	1223.29	9958
GR	1222	9970.12	1221.1	9981	1221	9987.95	1220.2	10000	1221	10018.7
GR	1222	10028.1	1223	10032.7	1223.02	10042	1232	10042	1232	10092
GR	1223.1	10092	1223.15	10107	1232	10107	1232	10159	1223.26	10159
GR	1223.3	10176	1232	10176	1232	10235	1223.41	10235	1223.44	10250
GR	1232	10250	1232	10312	1223.57	10312	1223.59	10325	1232	10325
GR	1232	10385	1223.71	10385	1223.73	10395	1232	10395	1232	10453
GR	1223.8	10453	1223.88	10465	1232	10465	1232	10520	1223.99	10520
GR	1224	10525.8	1224.1	10537	1232	10537	1232	10595	1224.66	10595
GR	1224.8	10614	1232	10614	1232	10670	1225.3	10670	1225.38	10680
GR	1232	10680	1232	10741	1225.85	10741	1225.89	10747	1232	10747
GR	1232	10761								

X1	2.128	57	9990.25	10012.6	444	460	444			
GR	1226	9720	1225	9750.5	1224.82	9785	1232	9785	1232	9871
GR	1224.4	9871	1224.2	9900	1232	9900	1232	9953	1224.43	9953
GR	1223	9964.4	1222	9975.61	1221	9990.25	1220.75	10000	1221	10012.6
GR	1221	10022.8	1222	10024.7	1223	10027.9	1223.26	10035	1232	10035
GR	1232	10055.2	1232	10095	1224.44	10095	1224.57	10108	1232	10108
GR	1232	10146.3	1232	10158	1225.02	10158	1225.05	10172	1232	10172
GR	1232	10227	1225.15	10227	1225.18	10243	1232	10243	1232	10296
GR	1225.2	10296	1225.31	10309	1232	10309	1232	10372	1225.42	10372

GR	1225.4	10381	1232	10381	1232	10442	1225.56	10442	1225.58	10453
GR	1232	10453	1232	10513	1225.69	10513	1225.72	10528	1232	10528
GR	1232	10590	1225.83	10590	1225.86	10601	1232	10601	1232	10663
GR	1225.9	10663	1226	10678						

NC	0.035	0.055	0.018

X1	2.168	74	9982.63	10019	209	209	209			
GR	1227	9752.74	1226	9774.47	1225	9780.04	1224.68	9820	1232	9820
GR	1232	9867	1224.3	9867	1224.08	9894	1232	9894	1232	9903.41
GR	1232	9942.61	1232	9953	1223.53	9953	1223	9964.62	1222	9982.63
GR	1221.3	9998.34	1221.3	10000	1222	10012.1	1222	10019	1222.5	10045
GR	1232	10045	1232	10060	1222.82	10060	1223	10069	1223.1	10083
GR	1232	10083	1232	10130	1223.3	10130	1223.4	10155	1232	10155
GR	1232	10192	1223.6	10192	1223.8	10216	1232	10216	1232	10249
GR	1232	10274	1224.0	10274	1224.1	10292	1232	10292	1232	10341
GR	1224.2	10341	1224.2	10361	1232	10361	1232	10424	1224.4	10424
GR	1224.5	10440	1232	10440	1232	10492	1224.6	10492	1224.7	10504
GR	1232	10504	1232	10570	1224.8	10570	1224.8	10587	1232	10587
GR	1232	10634.1	1232	10637	1225.0	10637	1225.1	10662	1232	10662
GR	1232	10716	1225.5	10716	1225.6	10730	1232	10730	1232	10789
GR	1225.9	10789	1226	10793	1226.1	10810	1232	10810	1232	10860
GR	1226.4	10860	1226.6	10875	1232	10875	1232	10930		

X1	2.192	63	9981	10019.6	125	135	129			
GR	1227	9765	1226	9795	1225	9853.2	1225	9859.8	1225	9888.43
GR	1225	9897.6	1224	9927.88	1223	9972.11	1222.1	9981	1222	9985.69
GR	1221.4	10000	1222	10009.5	1223	10019.6	1223	10022.4	1223	10029
GR	1223.1	10038	1232	10038	1232	10098	1223.77	10098	1223.8	10107
GR	1232	10107	1232	10118.5	1232	10166	1224.2	10166	1224.2	10185
GR	1232	10185	1232	10238	1224.5	10238	1224.58	10258	1232	10258
GR	1232	10287	1232	10298	1224.78	10298	1224.96	10323	1232	10323
GR	1232	10328.1	1232	10380	1225.13	10380	1225.18	10400	1232	10400
GR	1232	10455	1225.3	10455	1225.35	10468	1232	10468	1232	10524
GR	1225.5	10524	1225.52	10538	1232	10538	1232	10599	1225.6	10599
GR	1225.7	10613	1232	10613	1232	10662	1225.83	10662	1225.8	10685
GR	1232	10685	1232	10740	1226.1	10740	1226.21	10752	1232	10752
GR	1232	10810	1226.8	10810	1227	10835				

X1	2.208	34	9980.97	10018.4	90	82	82			
GR	1227	9773.3	1226	9803.3	1226	9807.87	1226	9810.36	1225	9874.79
GR	1224	9937.09	1223	9980.97	1222.5	10000	1223	10018.4	1224	10028.1
GR	1232	10028.1	1232	10060.3	1232	10103	1225.44	10103	1225.55	10114
GR	1232	10114	1232	10157.5	1232	10178	1226.07	10178	1226.13	10193
GR	1232	10193	1232	10245	1226.32	10245	1226.39	10263	1232	10263
GR	1232	10308	1226.5	10308	1226.65	10335	1232	10335	1232	10387
GR	1226.8	10387	1226.9	10404	1232	10404	1232	10431.5		

X1	2.218	42	9977.16	10049.8	48	58	54			
GR	1227	9752.2	1226	9802.2	1225	9861.06	1224	9954.31	1223.85	9977.16
GR	1223.7	10000	1224	10049.8	1232	10049.9	1232	10104	1224.52	10104
GR	1224.6	10117	1232	10117	1232	10153.5	1232	10175	1225.07	10175
GR	1225.1	10192	1232	10192	1232	10245	1225.3	10245	1225.35	10262
GR	1232	10262	1232	10308	1225.5	10308	1225.61	10340	1232	10340
GR	1232	10390	1225.7	10390	1225.8	10405	1232	10405	1232	10459.7
GR	1226	10459.7	1226.1	10480	1232	10480	1232	10528	1226.41	10528
GR	1226.5	10550	1232	10550	1232	10600	1226.85	10600	1226.97	10620
GR	1232	10620	1232	10625						

Upstream from Thomas Road

NC	.020	0.055	0.018
QT	2	644	644

X1	2.295	12	9968	10048.25	405	405	405			
GR	1227	9848	1227.5	9852	1227	9860	1227.5	9875	1227	9900
GR	1226.4	9968	1226.3	10000	1226.48	10048.25	1226.65	10096.50	1227	10193
GR	1228	10230	1239	10335						

X1	2.355	9	9960	10038	320	320	320			
GR	1228	9960	1227	9970	1227.2	10000	1228	10038	1228	10060
GR	1227	10090	1228	10095	1229	10105	1230	10160		

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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

*PROF 1
0

CCHV=     .100 CEHV=     .300
*SECNO  .225
3280 CROSS SECTION       .22 EXTENDED      1.08 FEET

3720 CRITICAL DEPTH ASSUMED

3470 ENCROACHMENT STATIONS=     9962.0   10017.0  TYPE=      1  TARGET=       55.000
 ELENCL=   1200.00  ELENCR=   1200.00
     .225      7.35   1196.08   1196.08   1196.43   1197.66      1.57       .00       .00   1194.90
   1231.6      93.7    1117.5      20.4      31.9     106.1       9.1        .0        .0   1194.90
     .00      2.94     10.53      2.26      .028      .020      .035      .000   1188.73   9962.00
  .002834      370.      370.      370.         0        10         0       .00     55.00  10017.00


CCHV=     .300 CEHV=     .500
*SECNO  .231

3265 DIVIDED FLOW

3280 CROSS SECTION       .23 EXTENDED      3.02 FEET


3301 HV CHANGED MORE THAN HVINS


3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  4.40

     .231      8.82   1198.02       .00       .00   1198.11       .09       .01       .44   1189.20
   1231.6     557.2     433.0     241.4     434.6     113.5     287.9        .3        .1   1189.30
     .00      1.28      3.81       .84      .028      .020      .035      .000   1189.20   9798.00
  .000147       31.       31.       31.         4         0         0       .00    289.70  10243.70


SPECIAL CULVERT

SC  CUNO      CUNV      ENTLC     COFQ      RDLEN     RISE      SPAN      CULVLN    CHRT      SCL       ELCHU     ELCHD
     1         .013      .40      2.70       .00      7.50     13.00    137.00      8         1       1189.59   1189.29

CHART  8 - BOX CULVERT WITH FLARED WINGWALLS; NO INLET TOP EDGE BEVEL
SCALE  1 - WINGWALLS FLARED 30 TO 75 DEGREES

*SECNO  .257

SPECIAL CULVERT OUTLET CONTROL + WEIR FLOW EG =   1198.83
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 SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
 Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
 TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
 SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

SPECIAL CULVERT

   EGIC      EGOC        H4     QWEIR     QCULV       VCH     ACULV     ELTRD    WEIRLN
 1201.80   1202.01       .72      679.      556.     5.167      97.5   1197.41      199.

    .257      9.11   1198.61       .00       .00   1198.83       .22       .72       .00   1189.50
  1231.6     202.4     607.5     421.7     122.0     117.6     293.5       2.5        .9   1189.59
     .02      1.66      5.17      1.44      .028      .020      .035      .000   1189.50   9933.00
 .000257      135.      137.      135.         2         0         0       .00    199.00  10132.00

*SECNO  .272
3280 CROSS SECTION        .27 EXTENDED       .88 FEET

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  1.62

    .272     10.88   1198.88       .00       .00   1198.90       .02       .01       .06   1193.00
   817.3     530.8     286.5        .0     507.3     180.1        .0       3.6       1.2   1198.00
     .03      1.05      1.59       .00      .041      .018      .000      .000   1188.00   9920.49
 .000043       80.       80.       80.         2         0         0       .00     97.21  10017.70

CCHV=     .100 CEHV=     .300
*SECNO  .288
3280 CROSS SECTION        .29 EXTENDED       .83 FEET

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =   .64

3470 ENCROACHMENT STATIONS=          .0   10205.0  TYPE=      1  TARGET=    10205.000
    .288      7.93   1198.83       .00       .00   1198.93       .10       .01       .02   1195.00
  1037.6     508.0     510.9      18.8     342.7     157.8      32.6       4.8       1.4   1198.00
     .04      1.48      3.24       .58      .041      .018      .029      .000   1190.90   9897.56
 .000166       83.       83.       83.         3         0         0       .00    156.74  10054.30

*SECNO  .303
3280 CROSS SECTION        .30 EXTENDED       .90 FEET
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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

3301 HV CHANGED MORE THAN HVINS

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

3470 ENCROACHMENT STATIONS= 9815.0 10198.0 TYPE= 1 TARGET= 383.000
ELENCL= 1210.00 ELENCR= 1210.00

.303	2.10	1199.00	1199.00	.00	1199.82	.83	.04	.22	1197.30
1205.5	391.2	797.8	16.5	121.7	92.0	6.9	5.4	1.7	1198.00
.05	3.21	8.67	2.40	.057	.018	.046	.000	1196.90	9915.23
.006968	77.	77.	77.	20	14	0	.00	145.22	10060.45

*SECNO .320
3280 CROSS SECTION .32 EXTENDED .75 FEET

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

.320	2.45	1199.75	1199.75	.00	1200.40	.66	.40	.02	1198.00
1407.5	107.7	950.0	349.9	70.7	121.8	160.1	6.0	2.1	1198.00
.05	1.52	7.80	2.19	.057	.018	.046	.000	1197.30	9897.00
.003330	89.	89.	89.	20	8	0	.00	269.50	10166.50

*SECNO .326

3470 ENCROACHMENT STATIONS= .0 10110.0 TYPE= 1 TARGET= 10110.000

.326	3.09	1200.09	.00	.00	1200.52	.43	.10	.02	1198.00
1417.0	68.4	610.1	738.5	42.6	82.8	254.4	6.3	2.3	1198.00
.05	1.61	7.37	2.90	.057	.018	.046	.000	1197.00	9952.00
.002487	34.	34.	34.	2	0	0	.00	194.34	10146.34

*SECNO .369
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

3470 ENCROACHMENT STATIONS= .0 10021.7 TYPE= 1 TARGET= 10021.700

.369	2.95	1200.75	1200.75	.00	1201.64	.89	.64	.14	1198.20
1417.0	69.0	940.4	407.6	33.4	102.9	158.4	8.0	3.2	1198.20
.06	2.07	9.13	2.57	.057	.018	.046	.000	1197.80	9960.03
.003243	226.	226.	226.	20	10	0	.00	158.82	10118.85

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   SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS      L-BANK ELEV
   Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA        R-BANK ELEV
   TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
   SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST

*SECNO  .421
     .421       3.18    1201.68        .00        .00    1202.47        .79        .81        .01    1199.10
   1417.0       51.2      935.8      430.1       26.5      109.1      164.9        9.9        4.2    1199.10
      .07       1.93       8.58       2.61       .057       .018       .046       .000    1198.50    9963.23
  .002646       278.       278.       278.          3          0          0        .00     149.47   10112.70

*SECNO  .459

3470 ENCROACHMENT STATIONS=          .0   10020.9  TYPE=       1  TARGET=    10020.900
     .459       4.42    1202.42    1201.88        .00    1202.97        .54        .47        .02    1200.00
   1417.0       39.1      819.1      558.8       24.8      109.8      212.8       11.4        4.9    1200.00
      .08       1.58       7.46       2.63       .057       .018       .046       .000    1198.00    9959.97
  .002143       200.       200.       200.         16         11          0        .00     159.82   10119.80

CCHV=      .300 CEHV=      .500
*SECNO  .503

3265 DIVIDED FLOW

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
     .503       2.28    1204.58    1204.58        .00    1205.30        .72        .67        .09    1202.70
   1417.0      201.7      803.7      411.7       90.3       91.7      155.9       13.2        6.0    1202.70
      .09       2.23       8.76       2.64       .057       .018       .046       .000    1202.30    9725.34
  .004232       229.       229.       229.         20         11          0        .00     265.34   10150.68

*SECNO  .542
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
     .542       2.64    1205.84    1205.84        .00    1206.83        .99        .79        .14    1204.00
   1417.0       15.6     1340.2       61.2        9.5      163.2       29.2       14.5        6.9    1204.00
     .10       1.63       8.21       2.10       .057       .018       .046       .000    1203.20    9959.52
  .003447       220.       208.       205.          3          8          0        .00     114.12   10073.65

CCHV=      .100 CEHV=      .300
*SECNO  .627
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 SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
 Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
 TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
 SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST


3265 DIVIDED FLOW


3301 HV CHANGED MORE THAN HVINS

     .627      2.80   1207.80       .00       .00   1208.11       .31      1.21       .07   1206.00
   1417.0     108.7     410.5     897.7      58.0      57.7     322.0      16.7       8.3   1206.00
     .13      1.88      7.12      2.79      .045      .018      .045      .000   1205.00   9816.00
  .003265     200.      451.      220.         2         0         0       .00    319.13  10380.07


*SECNO  .674

3265 DIVIDED FLOW

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
     .674      3.45   1208.95   1208.95       .00   1209.71       .76       .67       .14   1206.00
   1417.0     134.3     854.3     428.4      55.9      96.5     213.4      18.9       9.8   1206.00
     .14      2.40      8.85      2.01      .045      .018      .045      .000   1205.50   9893.00
  .002443     270.      248.      220.        20        11         0       .00    266.73  10381.73


*SECNO  .729

3265 DIVIDED FLOW


3470 ENCROACHMENT STATIONS=     9919.1   10428.0  TYPE=      1  TARGET=    -9919.110
 ELENCL=   1209.00  ELENCR= 100000.00
     .729      3.34   1209.94       .00       .00   1210.27       .34       .53       .04   1207.00
   1417.0     233.9     653.9     529.3     143.5      98.5     316.7      21.9      12.0   1207.00
     .16      1.63      6.64      1.67      .045      .018      .045      .000   1206.60   9690.00
  .001407     289.      289.      289.         2         0         0       .00    373.63  10409.63


*SECNO  .786

3265 DIVIDED FLOW
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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

3301 HV CHANGED MORE THAN HVINS

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

.786	3.63	1210.53	1210.53	.00	1211.41	.88	.53	.16	1207.00
1417.0	331.5	885.9	199.6	125.5	94.9	104.2	24.9	14.1	1207.00
.17	2.64	9.33	1.91	.045	.018	.045	.000	1206.90	9820.00
.002332	290.	298.	298.	20	8	0	.00	256.49	10373.30

*SECNO .821

3265 DIVIDED FLOW

3301 HV CHANGED MORE THAN HVINS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.92

.821	4.34	1211.44	.00	.00	1211.68	.24	.20	.06	1207.20
1417.0	635.2	690.9	90.8	407.6	127.1	95.9	26.9	15.4	1207.40
.19	1.56	5.44	.95	.045	.018	.045	.000	1207.10	9475.69
.000633	180.	190.	190.	3	0	0	.00	338.59	10340.21

CCHV= .300 CEHV= .500
*SECNO .857

3265 DIVIDED FLOW

3301 HV CHANGED MORE THAN HVINS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

.857	2.97	1211.47	1211.47	.00	1212.38	.91	.22	.33	1209.00
1417.0	154.0	1030.1	232.9	62.6	116.6	95.7	28.8	16.5	1209.00
.19	2.46	8.84	2.43	.045	.018	.045	.000	1208.50	9501.49
.003016	158.	187.	220.	5	20	0	.00	171.30	10100.71

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   SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS      L-BANK ELEV
   Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA        R-BANK ELEV
   TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
   SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST

*SECNO  .865

3265 DIVIDED FLOW

3301 HV CHANGED MORE THAN HVINS

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  2.50

     .865       9.66    1212.56    1208.63        .00    1212.66        .10        .04        .24    1210.00
   1417.0      230.0      912.6      274.4      242.7      305.1      165.9       29.3       16.7    1209.00
     .20        .95       2.99       1.65       .043       .038       .036       .000    1202.90    9462.19
  .000484       50.        45.        20.          8         17          0        .00     296.53   10100.53

CCHV=     .100 CEHV=     .300
*SECNO  .883

3265 DIVIDED FLOW

     .883       9.48    1212.58        .00        .00    1212.73        .15        .05        .01    1212.00
   1417.0      106.0     1005.6      305.4      133.3      289.5      163.1       30.7       17.3    1209.00
     .21        .80       3.47       1.87       .043       .038       .036       .000    1203.10    9473.08
  .000652       95.        95.        95.          2          0          0        .00     293.50   10099.27

*SECNO  .915

3265 DIVIDED FLOW

     .915       9.62    1212.72        .00        .00    1212.85        .13        .12        .00    1210.00
   1417.0      196.3      929.3      291.4      152.5      267.6      203.0       33.2       18.5    1209.00
     .22       1.29       3.47       1.44       .035       .038       .050       .000    1203.10    9542.43
  .000688      169.       170.       202.          2          0          0        .00     273.38   10111.81

*SECNO  .966

3265 DIVIDED FLOW

     .966       9.30    1212.90        .00        .00    1213.02        .12        .17        .00    1210.00
   1417.0       55.8      964.3      396.9       54.9      302.0      265.8       36.7       19.8    1209.00
     .25       1.02       3.19       1.49       .035       .038       .050       .000    1203.60    9601.99
  .000612      170.       266.       267.          2          0          0        .00     227.15   10118.00
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   SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS      L-BANK ELEV
   Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA        R-BANK ELEV
   TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
   SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST

*SECNO 1.001

3265 DIVIDED FLOW

    1.001       9.29    1212.99        .00        .00    1213.20        .21        .16        .03    1212.00
   1417.0      86.3     1225.2      105.5       73.3      314.8       69.2       39.2       20.8    1210.00
      .27       1.18       3.89       1.52       .035       .038       .050       .000    1203.70    9669.01
  .001147      240.       190.       190.          0          0          0        .00     201.95   10058.00

*SECNO 1.042
    1.042       9.64    1213.34        .00        .00    1213.45        .11        .24        .01    1211.00
   1417.0     730.3      686.2         .6      447.3      201.4        2.0       42.1       22.5    1213.00
      .29       1.63       3.41        .29       .035       .038       .050       .000    1203.70    9612.63
  .001005      245.       215.       215.          3          0          0        .00     423.13   10035.76

CCHV=      .300 CEHV=      .500
*SECNO 1.054

3301 HV CHANGED MORE THAN HVINS

    1.054      10.67    1213.17        .00        .00    1213.79        .62        .08        .26    1202.58
   1417.0     358.8      960.5       97.8      193.7      127.2       42.9       42.8       23.0    1202.58
      .29       1.85       7.55       2.28       .035       .038       .050       .000    1202.50    9829.45
  .001602       60.        64.        69.          4          0          0        .00     199.72   10029.17


SPECIAL CULVERT

SC  CUNO      CUNV      ENTLC     COFQ      RDLEN     RISE      SPAN      CULVLN    CHRT      SCL       ELCHU     ELCHD
     1         .013      .30      2.70       .00      8.00     12.00     112.25     12        3       1202.63   1202.58

CHART 12 - BOX CULVERT; NON-OFFSET FLARED WINGWALLS; 3/4-INCH CHAMFER AT TOP OF INLET
SCALE  3 - WINGWALLS FLARED 18.4 DEGREES (3:1); INLET SKEWED 30 DEGREES

*SECNO 1.075

SPECIAL CULVERT OUTLET CONTROL + WEIR FLOW EG =   1214.45

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  1.93

SPECIAL CULVERT

    EGIC       EGOC        H4      QWEIR     QCULV       VCH     ACULV     ELTRD    WEIRLN
  1214.75    1216.98       .67       527.      720.     3.656      96.0   1213.01      118.


    1.075      11.73    1214.33        .00        .00    1214.45        .12        .67        .00    1202.62
   1240.0     609.9      514.0      116.0      292.8      140.6       85.3       43.9       23.3    1202.60
      .31       2.08       3.66       1.36       .035       .038       .050       .000    1202.60    9940.00
  .000329      112.       112.       112.          2          0          0        .00     108.96   10048.96
```

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 1.084

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .68

1.084	9.14	1214.34	.00	.00	1214.48	.14	.02	.01	1208.00
1240.0	207.4	530.4	502.2	78.0	156.9	183.8	44.4	23.4	1208.00
.31	2.66	3.38	2.73	.037	.045	.044	.000	1205.20	9965.00
.000702	43.	43.	43.	3	0	0	.00	87.00	10052.00

CCHV= .100 CEHV= .300
*SECNO 1.101

1.101	8.91	1214.41	.00	.00	1214.54	.13	.06	.00	1208.00
1240.0	173.3	575.7	491.1	67.5	175.2	191.0	45.3	23.6	1208.00
.32	2.57	3.29	2.57	.037	.045	.044	.000	1205.50	9967.87
.000657	90.	90.	90.	2	0	0	.00	95.19	10063.06

CCHV= .300 CEHV= .500
*SECNO 1.108

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA= 1215.00 ELREA= 1215.00

1.108	8.84	1214.44	.00	.00	1214.59	.15	.04	.01	1214.00
1240.0	.0	1240.0	.0	.0	394.4	.0	45.7	23.7	1214.00
.32	.00	3.14	.00	.000	.045	.000	.000	1205.60	9970.84
.001231	40.	40.	40.	2	0	0	.00	86.26	10057.10

SPECIAL BRIDGE

SB	XK	XKOR	COFQ	RDLEN	BWC	BWP	BAREA	SS	ELCHU	ELCHD
	1.05	1.56	2.70	.00	23.00	4.00	467.00	3.00	1205.72	1205.60

*SECNO 1.115
CLASS A LOW FLOW

3420 BRIDGE W.S.= 1214.47 BRIDGE VELOCITY= 3.10 CALCULATED CHANNEL AREA= 396.

EGPRS	EGLWC	H3	QWEIR	QLOW	BAREA	TRAPEZOID AREA	ELLC	ELTRD	WEIRLN
.00	1214.61	.02	0.	1240.	467.	435.	1215.00	1215.10	0.

```
   SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS      L-BANK ELEV
   Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA        R-BANK ELEV
   TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
   SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST


3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1215.00 ELREA=      1215.00

    1.115      8.79   1214.45        .00        .00   1214.61        .16        .03        .00   1215.10
   1240.0        .0    1240.0         .0         .0     382.4         .0       46.0       23.8   1214.50
      .33       .00      3.24        .00       .000      .045       .000       .000    1205.66   9972.35
  .001120       34.       34.        34.          0         0          0        .00      72.85  10045.20


*SECNO 1.121
    1.121      8.45   1214.45        .00        .00   1214.70        .25        .04        .04   1210.00
   1240.0     101.5    1070.0       68.4       37.8     256.2       31.7       46.3       23.8   1210.00
      .33      2.68      4.18       2.16       .037      .045       .044       .000    1206.00   9964.02
  .001241       36.       36.        36.          2         0          0        .00      73.29  10037.31


CCHV=     .500 CEHV=     .800
*SECNO 1.138
    1.138      7.13   1214.63        .00        .00   1214.84        .21        .12        .02   1214.00
   1240.0       1.8    1237.7         .5        3.0     337.0         .9       46.9       24.0   1214.00
      .33       .60      3.67        .59       .045      .045       .045       .000    1207.50   9943.39
  .001538       37.       90.       150.          3         0          0        .00      80.73  10024.12


CCHV=     .100 CEHV=     .300
*SECNO 1.181
    1.181     10.00   1214.95        .00        .00   1215.19        .24        .34        .01   1213.00
   1240.0      93.8    1129.7       16.5       51.7     276.1       16.7       48.7       24.5   1213.00
      .35      1.81      4.09        .99       .045      .045       .045       .000    1204.95   9947.00
  .001503      225.      225.       225.          3         0          0        .00     103.33  10050.33


CCHV=     .500 CEHV=     .800
*SECNO 1.224

3265 DIVIDED FLOW


3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  1.41

    1.224      8.84   1215.34        .00        .00   1215.48        .14        .23        .05   1212.00
   1240.0      77.6    1033.2      129.3       77.0     324.4       81.0       50.8       25.2   1212.00
      .37      1.01      3.18       1.60       .045      .045       .045       .000    1206.50   9698.99
  .000751      230.      230.       130.          3         0          0        .00     226.30  10148.32
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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 1.239

3265 DIVIDED FLOW

3301 HV CHANGED MORE THAN HVINS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

1.239	4.52	1215.42	1215.42	.00	1216.10	.68	.13	.44	1214.00
1240.0	25.8	1061.2	153.0	13.4	149.7	62.1	51.3	25.5	1214.00
.38	1.93	7.09	2.47	.045	.045	.045	.000	1210.90	9882.04
.010455	90.	75.	30.	4	11	0	.00	195.61	10230.31

CCHV= .500 CEHV= .800
*SECNO 1.262

3265 DIVIDED FLOW

3301 HV CHANGED MORE THAN HVINS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 5.04

1.262	4.42	1216.32	.00	.00	1216.49	.17	.14	.25	1212.50
1240.0	274.6	720.6	244.9	232.9	168.8	250.8	52.6	26.1	1212.00
.39	1.18	4.27	.98	.055	.018	.055	.000	1211.90	9842.30
.000411	256.	123.	20.	2	0	0	.00	231.70	10225.00

*SECNO 1.301

3265 DIVIDED FLOW

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .60

1.301	4.26	1216.36	.00	.00	1216.95	.59	.13	.33	1213.00
1240.0	113.2	1007.7	119.1	77.5	148.6	82.5	54.6	26.9	1213.00
.40	1.46	6.78	1.44	.055	.018	.055	.000	1212.10	9868.00
.001134	225.	204.	130.	2	0	0	.00	166.16	10195.14

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   SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS      L-BANK ELEV
   Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA        R-BANK ELEV
   TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
   SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST

CCHV=     .100 CEHV=     .300
1490 NH CARD USED
*SECNO 1.353

3265 DIVIDED FLOW

    1.353      4.14   1216.94        .00        .00   1217.21        .27        .23        .03   1213.10
   1240.0     270.1     778.3      191.6      281.8      149.9      163.5       57.4       28.3   1213.10
      .42       .96      5.19       1.17       .066       .018       .056       .000    1212.80   9643.78
  .000635      290.      278.       235.          2          0          0        .00     287.16  10219.34

*SECNO 1.373

3265 DIVIDED FLOW

3301 HV CHANGED MORE THAN HVINS

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =   .53

    1.373      3.61   1216.61   1216.44        .00   1217.53        .92        .12        .20   1214.00
   1240.0     110.0    1058.9      71.1       77.9      127.5       36.2       58.6       29.0   1214.00
      .42      1.41      8.30       1.97       .055       .018       .055       .000    1213.00   9818.00
  .002229      150.      106.       105.          6         11          0        .00     177.00  10040.00

1490 NH CARD USED
*SECNO 1.438

3265 DIVIDED FLOW

    1.438      3.75   1217.55        .00        .00   1218.15        .60        .59        .03   1215.00
   1240.0     150.7    1012.7      76.6      112.8      148.1       84.6       60.9       30.6   1215.00
      .44      1.34      6.84        .91       .056       .018       .055       .000    1213.80   9793.00
  .001375      280.      344.       390.          2          0          0        .00     250.42  10265.42

1490 NH CARD USED
*SECNO 1.499
```

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

3265 DIVIDED FLOW

1.499	3.36	1217.96	.00	.00	1218.67	.71	.49	.03	1215.00
1240.0	152.5	1062.9	24.6	171.0	145.9	15.6	63.4	32.1	1215.00
.45	.89	7.29	1.57	.100	.018	.055	.000	1214.60	9776.00
.001682	350.	320.	250.	3	0	0	.00	157.39	10035.39

1490 NH CARD USED
*SECNO 1.522

3265 DIVIDED FLOW

1.522	3.60	1218.20	1217.76	.00	1218.87	.68	.20	.00	1215.00
1240.0	251.0	890.3	98.8	110.8	115.8	62.9	64.2	32.6	1215.00
.46	2.26	7.69	1.57	.034	.018	.055	.000	1214.60	9777.00
.001703	115.	122.	125.	4	10	0	.00	211.76	10140.00

CCHV= .100 CEHV= .300
*SECNO 1.575

3265 DIVIDED FLOW

1.575	3.28	1218.58	1218.45	.00	1219.55	.97	.59	.09	1216.00
1240.0	186.8	962.5	90.7	86.2	108.4	44.9	65.9	33.7	1216.00
.47	2.17	8.88	2.02	.055	.018	.055	.000	1215.30	9844.13
.002744	272.	277.	283.	4	11	0	.00	123.87	10058.00

*SECNO 1.670

3265 DIVIDED FLOW

1.670	3.82	1219.82	.00	.00	1220.69	.87	1.13	.01	1217.00
1240.0	58.7	1091.3	90.0	34.3	137.1	50.0	68.6	35.0	1217.00
.49	1.71	7.96	1.80	.055	.018	.055	.000	1216.00	9957.00
.001879	504.	504.	504.	3	0	0	.00	102.00	10128.00

*SECNO 1.725

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

3265 DIVIDED FLOW

1.725	3.92	1220.42	.00	.00	1221.20	.77	.50	.01	1217.00
1240.0	109.6	1028.4	102.0	58.3	133.3	65.2	70.2	35.7	1217.00
.50	1.88	7.71	1.56	.055	.018	.055	.000	1216.50	9892.00
.001539	292.	292.	292.	2	0	0	.00	115.00	10130.00

*SECNO 1.810

3265 DIVIDED FLOW

1.810	3.99	1221.39	.00	.00	1221.80	.40	.56	.04	1218.00
1240.0	219.3	782.1	238.7	149.1	123.6	209.0	74.0	37.6	1218.00
.53	1.47	6.33	1.14	.055	.018	.055	.000	1217.40	9791.67
.001029	460.	449.	449.	2	0	0	.00	262.33	10387.00

*SECNO 1.879

3301 HV CHANGED MORE THAN HVINS

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

1.879	3.44	1221.74	1221.74	.00	1222.91	1.17	.57	.23	1219.00
1240.0	57.3	1095.1	87.6	28.4	118.7	50.1	76.8	39.2	1219.00
.54	2.01	9.23	1.75	.055	.018	.055	.000	1218.30	9963.00
.002784	359.	359.	359.	20	9	0	.00	109.00	10072.00

*SECNO 1.925

3265 DIVIDED FLOW

1.925	3.92	1222.62	1222.23	.00	1223.49	.87	.55	.03	1220.00
1240.0	73.6	1061.8	104.6	41.8	131.9	69.5	78.1	39.9	1220.00
.55	1.76	8.05	1.50	.055	.018	.055	.000	1218.70	9882.36
.001818	245.	245.	250.	7	8	0	.00	133.64	10160.00

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 1.961

3265 DIVIDED FLOW

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.64

1.961	4.44	1223.34	.00	.00	1223.74	.39	.20	.05	1219.10
1240.0	182.0	940.6	117.4	124.6	164.7	101.2	79.5	40.5	1219.10
.56	1.46	5.71	1.16	.055	.018	.055	.000	1218.90	9877.00
.000677	192.	192.	194.	3	0	0	.00	143.48	10315.00

*SECNO 2.044

3265 DIVIDED FLOW

3301 HV CHANGED MORE THAN HVINS

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

2.044	3.69	1223.89	1223.89	.00	1224.88	1.00	.50	.18	1221.10
1240.0	89.7	1049.4	100.9	55.0	120.8	71.9	82.6	42.2	1221.00
.58	1.63	8.69	1.40	.055	.018	.055	.000	1220.20	9867.72
.002347	436.	437.	392.	20	12	0	.00	208.28	10465.00

*SECNO 2.128

3265 DIVIDED FLOW

2.128	4.17	1224.92	1224.50	.00	1225.85	.93	.96	.01	1221.00
1240.0	227.0	838.9	174.1	109.3	90.3	72.1	85.2	44.0	1221.00
.59	2.08	9.29	2.42	.055	.018	.055	.000	1220.75	9767.08
.001971	444.	444.	460.	5	5	0	.00	141.92	10108.00

*SECNO 2.168

3265 DIVIDED FLOW

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

3301 HV CHANGED MORE THAN HVINS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 2.33

2.168	4.63	1225.93	.00	.00	1226.08	.14	.15	.08	1222.00
1240.0	246.3	634.9	358.8	186.7	154.2	437.5	87.8	45.2	1222.00
.62	1.32	4.12	.82	.035	.018	.055	.000	1221.30	9774.80
.000363	209.	209.	209.	2	0	0	.00	359.80	10790.61

*SECNO 2.192

3265 DIVIDED FLOW

2.192	4.54	1225.94	.00	.00	1226.15	.21	.06	.02	1222.10
1240.0	361.1	725.0	153.9	249.1	153.9	197.4	89.8	46.3	1223.00
.63	1.45	4.71	.78	.035	.018	.055	.000	1221.40	9798.51
.000516	125.	129.	135.	2	0	0	.00	396.49	10685.00

*SECNO 2.208

3265 DIVIDED FLOW

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .64

2.208	3.38	1225.88	.00	.00	1226.27	.39	.07	.05	1223.00
1240.0	465.0	737.8	37.2	215.4	117.2	27.3	90.8	46.9	1223.00
.63	2.16	6.30	1.36	.035	.018	.055	.000	1222.50	9818.06
.001271	90.	82.	82.	3	0	0	.00	221.04	10114.00

*SECNO 2.218

3265 DIVIDED FLOW

2.218	2.44	1226.14	.00	.00	1226.35	.20	.06	.02	1223.85
1240.0	430.5	751.4	58.0	242.9	168.5	79.5	91.3	47.3	1224.00
.64	1.77	4.46	.73	.035	.018	.055	.000	1223.70	9794.87
.000950	48.	54.	58.	3	0	0	.00	369.26	10480.00

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 2.295

3265 DIVIDED FLOW

3280 CROSS SECTION 2.30 EXTENDED .30 FEET

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

2.295	1.00	1227.30	1227.30	.00	1227.60	.31	.58	.03	1226.40
644.0	150.4	390.3	103.3	45.2	74.1	82.5	94.5	50.5	1226.48
.66	3.33	5.27	1.25	.020	.018	.055	.000	1226.30	9848.00
.004533	405.	405.	405.	20	18	0	.00	334.89	10203.99

*SECNO 2.355
3280 CROSS SECTION 2.36 EXTENDED .58 FEET

2.355	1.58	1228.58	1228.54	.00	1229.07	.49	1.41	.06	1228.00
644.0	.0	556.8	87.2	.0	92.3	52.2	95.8	52.3	1228.00
.68	.00	6.03	1.67	.000	.018	.055	.000	1227.00	9960.00
.004306	320.	320.	320.	5	14	0	.00	140.79	10100.79

TW West bank between 0.320 and 0.326

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
9.50	9.88	3.91	9.50	9.88	3.91	7	1199.746	1200.092	.320	.326

TW West bank between 0.303 and 0.320

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
201.97	203.78	.89	211.47	213.66	1.03	7	1198.996	1199.746	.303	.320

TW West bank between 0.288 and 0.303

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
167.90	168.33	.25	379.37	381.99	.69	7	1198.831	1198.996	.288	.303

TW West bank between 0.272 and 0.288

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
163.20	163.56	.22	542.57	545.55	.55	7	1198.875	1198.831	.272	.288

TW West bank between 0.257 and 0.272

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
279.35	280.05	.25	821.92	825.60	.45	7	1198.610	1198.875	.257	.272

TW East bank between 0.303 and 0.320

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
.00	.00	.00	821.92	825.60	.45	7	1198.996	1199.746	.303	.320

TW East bank between 0.288 and 0.303

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
.00	.00	.00	821.92	825.60	.45	7	1198.831	1198.996	.288	.303

TW East bank between 0.272 and 0.288

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
57.16	56.97	.32	879.08	882.57	.40	7	1198.875	1198.831	.272	.288

TW East bank between 0.257 and 0.272

ASQ	QCOMP	ERRAC	TASQ	TCQ	TABER	NITER	DSWS	USWS	DSSNO	USSNO
128.24	128.48	.19	1007.32	1011.06	.37	7	1198.610	1198.875	.257	.272

THIS RUN EXECUTED 01MAY97 14:31:55

****
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

City of Scottsdale - G

SUMMARY PRINTOUT

	SECNO	Q	CWSEL	CRIWS	DEPTH	TOPWID	VCH
*	.225	1231.60	1196.08	1196.08	7.35	55.00	10.53
*	.225	1231.60	1196.08	1196.08	7.35	55.00	10.53
*	.231	1231.60	1198.02	.00	8.82	289.70	3.81
	.231	1231.60	1198.02	.00	8.82	289.70	3.81
	.257	1231.60	1198.61	.00	9.11	199.00	5.17
	.257	1231.60	1198.61	.00	9.11	199.00	5.17
*	.272	817.27	1198.88	.00	10.88	97.21	1.59
*	.272	817.27	1198.88	.00	10.88	97.21	1.59
*	.288	1037.63	1198.83	.00	7.93	156.74	3.24
*	.288	1037.63	1198.83	.00	7.93	156.74	3.24
*	.303	1205.53	1199.00	1199.00	2.10	145.22	8.67
*	.303	1205.53	1199.00	1199.00	2.10	145.22	8.67
*	.320	1407.50	1199.75	1199.75	2.45	269.50	7.80
*	.320	1407.50	1199.75	1199.75	2.45	269.50	7.80
	.326	1417.00	1200.09	.00	3.09	194.34	7.37
	.326	1417.00	1200.09	.00	3.09	194.34	7.37
*	.369	1417.00	1200.75	1200.75	2.95	158.82	9.13
*	.369	1417.00	1200.75	1200.75	2.95	158.82	9.13
	.421	1417.00	1201.68	.00	3.18	149.47	8.58
	.421	1417.00	1201.68	.00	3.18	149.47	8.58
	.459	1417.00	1202.42	1201.88	4.42	159.82	7.46
	.459	1417.00	1202.42	1201.88	4.42	159.82	7.46

	SECNO	Q	CWSEL	CRIWS	DEPTH	TOPWID	VCH
*	.503	1417.00	1204.58	1204.58	2.28	265.34	8.76
*	.503	1417.00	1204.58	1204.58	2.28	265.34	8.76
*	.542	1417.00	1205.84	1205.84	2.64	114.12	8.21
*	.542	1417.00	1205.84	1205.84	2.64	114.12	8.21
	.627	1417.00	1207.80	.00	2.80	319.13	7.12
	.627	1417.00	1207.80	.00	2.80	319.13	7.12
*	.674	1417.00	1208.95	1208.95	3.45	266.73	8.85
*	.674	1417.00	1208.95	1208.95	3.45	266.73	8.85
	.729	1417.00	1209.94	.00	3.34	373.63	6.64
	.729	1417.00	1209.94	.00	3.34	373.63	6.64
*	.786	1417.00	1210.53	1210.53	3.63	256.49	9.33
*	.786	1417.00	1210.53	1210.53	3.63	256.49	9.33
*	.821	1417.00	1211.44	.00	4.34	338.59	5.44
*	.821	1417.00	1211.44	.00	4.34	338.59	5.44
*	.857	1417.00	1211.47	1211.47	2.97	171.30	8.84
	.857	1417.00	1211.47	1211.47	2.97	171.30	8.84
*	.865	1417.00	1212.56	1208.63	9.66	296.53	2.99
*	.865	1417.00	1212.56	1208.63	9.66	296.53	2.99
	.883	1417.00	1212.58	.00	9.48	293.50	3.47
	.883	1417.00	1212.58	.00	9.48	293.50	3.47
	.915	1417.00	1212.72	.00	9.62	273.38	3.47
	.915	1417.00	1212.72	.00	9.62	273.38	3.47
	.966	1417.00	1212.90	.00	9.30	227.15	3.19
	.966	1417.00	1212.90	.00	9.30	227.15	3.19
	1.001	1417.00	1212.99	.00	9.29	201.95	3.89
	1.001	1417.00	1212.99	.00	9.29	201.95	3.89
	1.042	1417.00	1213.34	.00	9.64	423.13	3.41
	1.042	1417.00	1213.34	.00	9.64	423.13	3.41
	1.054	1417.00	1213.17	.00	10.67	199.72	7.55
	1.054	1417.00	1213.17	.00	10.67	199.72	7.55
*	1.075	1240.00	1214.33	.00	11.73	108.96	3.66
*	1.075	1240.00	1214.33	.00	11.73	108.96	3.66
*	1.084	1240.00	1214.34	.00	9.14	87.00	3.38
*	1.084	1240.00	1214.34	.00	9.14	87.00	3.38

	SECNO	Q	CWSEL	CRIWS	DEPTH	TOPWID	VCH
	1.101	1240.00	1214.41	.00	8.91	95.19	3.29
	1.101	1240.00	1214.41	.00	8.91	95.19	3.29
	1.108	1240.00	1214.44	.00	8.84	86.26	3.14
	1.108	1240.00	1214.44	.00	8.84	86.26	3.14
	1.115	1240.00	1214.45	.00	8.79	72.85	3.24
	1.115	1240.00	1214.45	.00	8.79	72.85	3.24
	1.121	1240.00	1214.45	.00	8.45	73.29	4.18
	1.121	1240.00	1214.45	.00	8.45	73.29	4.18
	1.138	1240.00	1214.63	.00	7.13	80.73	3.67
	1.138	1240.00	1214.63	.00	7.13	80.73	3.67
	1.181	1240.00	1214.95	.00	10.00	103.33	4.09
	1.181	1240.00	1214.95	.00	10.00	103.33	4.09
*	1.224	1240.00	1215.34	.00	8.84	226.30	3.18
*	1.224	1240.00	1215.34	.00	8.84	226.30	3.18
*	1.239	1240.00	1215.42	1215.42	4.52	195.61	7.09
	1.239	1240.00	1215.42	1215.42	4.52	195.61	7.09
*	1.262	1240.00	1216.32	.00	4.42	231.70	4.27
*	1.262	1240.00	1216.32	.00	4.42	231.70	4.27
*	1.301	1240.00	1216.36	.00	4.26	166.16	6.78
*	1.301	1240.00	1216.36	.00	4.26	166.16	6.78
	1.353	1240.00	1216.94	.00	4.14	287.16	5.19
	1.353	1240.00	1216.94	.00	4.14	287.16	5.19
*	1.373	1240.00	1216.61	1216.44	3.61	177.00	8.30
*	1.373	1240.00	1216.61	1216.44	3.61	177.00	8.30
	1.438	1240.00	1217.55	.00	3.75	250.42	6.84
	1.438	1240.00	1217.55	.00	3.75	250.42	6.84
	1.499	1240.00	1217.96	.00	3.36	157.39	7.29
	1.499	1240.00	1217.96	.00	3.36	157.39	7.29
	1.522	1240.00	1218.20	1217.76	3.60	211.76	7.69
	1.522	1240.00	1218.20	1217.76	3.60	211.76	7.69
	1.575	1240.00	1218.58	1218.45	3.28	123.87	8.88
	1.575	1240.00	1218.58	1218.45	3.28	123.87	8.88
	1.670	1240.00	1219.82	.00	3.82	102.00	7.96
	1.670	1240.00	1219.82	.00	3.82	102.00	7.96

	SECNO	Q	CWSEL	CRIWS	DEPTH	TOPWID	VCH
	1.725	1240.00	1220.42	.00	3.92	115.00	7.71
	1.725	1240.00	1220.42	.00	3.92	115.00	7.71
	1.810	1240.00	1221.39	.00	3.99	262.33	6.33
	1.810	1240.00	1221.39	.00	3.99	262.33	6.33
*	1.879	1240.00	1221.74	1221.74	3.44	109.00	9.23
*	1.879	1240.00	1221.74	1221.74	3.44	109.00	9.23
	1.925	1240.00	1222.62	1222.23	3.92	133.64	8.05
	1.925	1240.00	1222.62	1222.23	3.92	133.64	8.05
*	1.961	1240.00	1223.34	.00	4.44	143.48	5.71
*	1.961	1240.00	1223.34	.00	4.44	143.48	5.71
*	2.044	1240.00	1223.89	1223.89	3.69	208.28	8.69
	2.044	1240.00	1223.89	1223.89	3.69	208.28	8.69
	2.128	1240.00	1224.92	1224.50	4.17	141.92	9.29
	2.128	1240.00	1224.92	1224.50	4.17	141.92	9.29
*	2.168	1240.00	1225.93	.00	4.63	359.80	4.12
*	2.168	1240.00	1225.93	.00	4.63	359.80	4.12
	2.192	1240.00	1225.94	.00	4.54	396.49	4.71
	2.192	1240.00	1225.94	.00	4.54	396.49	4.71
*	2.208	1240.00	1225.88	.00	3.38	221.04	6.30
*	2.208	1240.00	1225.88	.00	3.38	221.04	6.30
	2.218	1240.00	1226.14	.00	2.44	369.26	4.46
	2.218	1240.00	1226.14	.00	2.44	369.26	4.46
*	2.295	644.00	1227.30	1227.30	1.00	334.89	5.27
*	2.295	644.00	1227.30	1227.30	1.00	334.89	5.27
	2.355	644.00	1228.58	1228.54	1.58	140.79	6.03
	2.355	644.00	1228.58	1228.54	1.58	140.79	6.03

City of Scottsdale - G

SUMMARY PRINTOUT TABLE 100

SECNO	EGLWC	ELLC	EGPRS	ELTRD	QPR	QWEIR	CLASS	H3	DEPTH	CWSEL	VCH	EG
1.115	1214.61	1215.00	.00	1215.10	1240.00	.00	1.00	.02	8.79	1214.45	3.24	1214.61
1.115	1214.61	1215.00	.00	1215.10	1240.00	.00	1.00	.02	8.79	1214.45	3.24	1214.61

SUMMARY OF ERRORS AND SPECIAL NOTES

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CAUTION SECNO=      .225  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .225  PROFILE=  2  CRITICAL DEPTH ASSUMED

WARNING SECNO=      .231  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      .231  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      .272  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      .272  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      .288  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      .288  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=      .303  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .303  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .303  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=      .303  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .303  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .303  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=      .320  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .320  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .320  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=      .320  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .320  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .320  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=      .369  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .369  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .369  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=      .369  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .369  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .369  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=      .503  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .503  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .503  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=      .503  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .503  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .503  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=      .542  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .542  PROFILE=  1  MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .542  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .542  PROFILE=  2  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=      .674  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .674  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .674  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=      .674  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .674  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .674  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL
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CAUTION SECNO=      .786  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .786  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .786  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=      .786  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .786  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .786  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO=      .821  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      .821  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=      .857  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .857  PROFILE=  1  MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .857  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .857  PROFILE=  2  MINIMUM SPECIFIC ENERGY

WARNING SECNO=      .865  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      .865  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     1.075  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     1.075  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     1.084  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     1.084  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

 ARNING SECNO=     1.224  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     1.224  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=     1.239  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     1.239  PROFILE=  1  MINIMUM SPECIFIC ENERGY
CAUTION SECNO=     1.239  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     1.239  PROFILE=  2  MINIMUM SPECIFIC ENERGY

WARNING SECNO=     1.262  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     1.262  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     1.301  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     1.301  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     1.373  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     1.373  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=     1.879  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     1.879  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=     1.879  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=     1.879  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     1.879  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=     1.879  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO=     1.961  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     1.961  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=     2.044  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=     2.044  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
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CAUTION SECNO=      2.044  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=      2.044  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      2.044  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      2.044  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO=      2.168  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.168  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      2.208  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.208  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=      2.295  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      2.295  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      2.295  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=      2.295  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      2.295  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      2.295  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL
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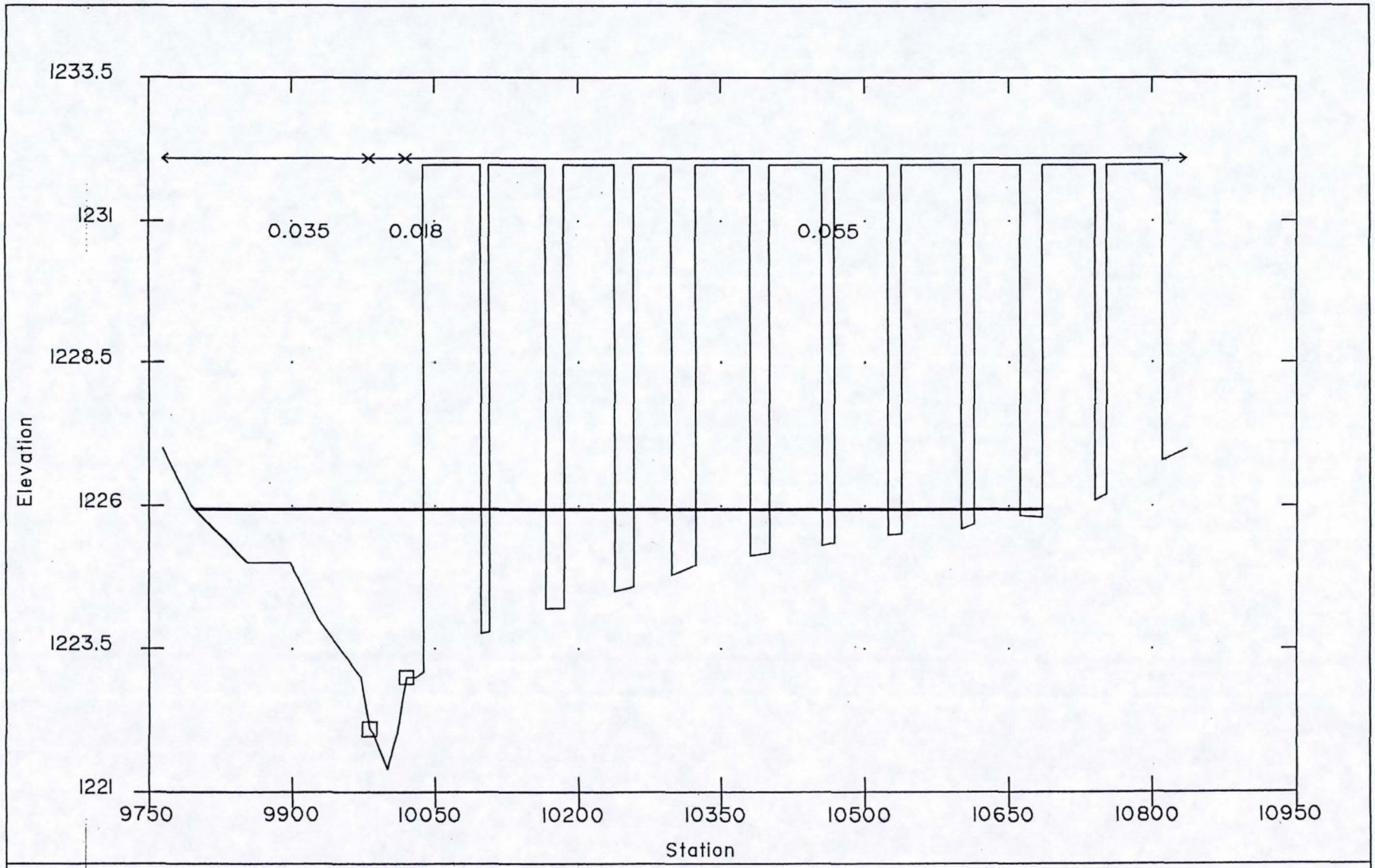
FLOODWAY DATA, City of Scottsdale - G
PROFILE NO. 2

STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WATER SURFACE ELEVATION WITHOUT FLOODWAY	DIFFERENCE
.225	55.	147.	8.4	1196.1	1196.1	.0
.231	446.	836.	1.5	1198.0	1198.0	.0
.257	199.	533.	2.3	1198.6	1198.6	.0
.272	97.	687.	1.2	1198.9	1198.9	.0
.288	157.	533.	1.9	1198.8	1198.8	.0
.303	145.	221.	5.5	1199.0	1199.0	.0
.320	270.	353.	4.0	1199.7	1199.7	.0
.326	194.	380.	3.7	1200.1	1200.1	.0
.369	159.	295.	4.8	1200.8	1200.8	.0
.421	149.	300.	4.7	1201.7	1201.7	.0
.459	160.	347.	4.1	1202.4	1202.4	.0
.503	425.	338.	4.2	1204.6	1204.6	.0
.542	114.	202.	7.0	1205.8	1205.8	.0
.627	564.	438.	3.2	1207.8	1207.8	.0
.674	489.	366.	3.9	1208.9	1208.9	.0
.729	720.	559.	2.5	1209.9	1209.9	.0
.786	553.	325.	4.4	1210.5	1210.5	.0
.821	865.	631.	2.2	1211.4	1211.4	.0
.857	599.	275.	5.2	1211.5	1211.5	.0
.865	638.	714.	2.0	1212.6	1212.6	.0
.883	626.	586.	2.4	1212.6	1212.6	.0
.915	569.	623.	2.3	1212.7	1212.7	.0
.966	516.	623.	2.3	1212.9	1212.9	.0
1.001	389.	457.	3.1	1213.0	1213.0	.0
1.042	423.	651.	2.2	1213.3	1213.3	.0
1.054	200.	364.	3.9	1213.2	1213.2	.0
1.075	109.	519.	2.4	1214.3	1214.3	.0
1.084	87.	419.	3.0	1214.3	1214.3	.0
1.101	95.	434.	2.9	1214.4	1214.4	.0
1.108	86.	394.	3.1	1214.4	1214.4	.0
1.115	73.	382.	3.2	1214.5	1214.5	.0
1.121	73.	326.	3.8	1214.5	1214.5	.0
1.138	81.	341.	3.6	1214.6	1214.6	.0
1.181	103.	344.	3.6	1215.0	1215.0	.0
1.224	449.	482.	2.6	1215.3	1215.3	.0
1.239	348.	225.	5.5	1215.4	1215.4	.0
1.262	383.	653.	1.9	1216.3	1216.3	.0
1.301	327.	309.	4.0	1216.4	1216.4	.0
1.353	576.	595.	2.1	1216.9	1216.9	.0
1.373	222.	242.	5.1	1216.6	1216.6	.0
1.438	472.	346.	3.6	1217.5	1217.5	.0
1.499	259.	333.	3.7	1218.0	1218.0	.0

FLOODWAY DATA, City of Scottsdale - G
PROFILE NO. 2

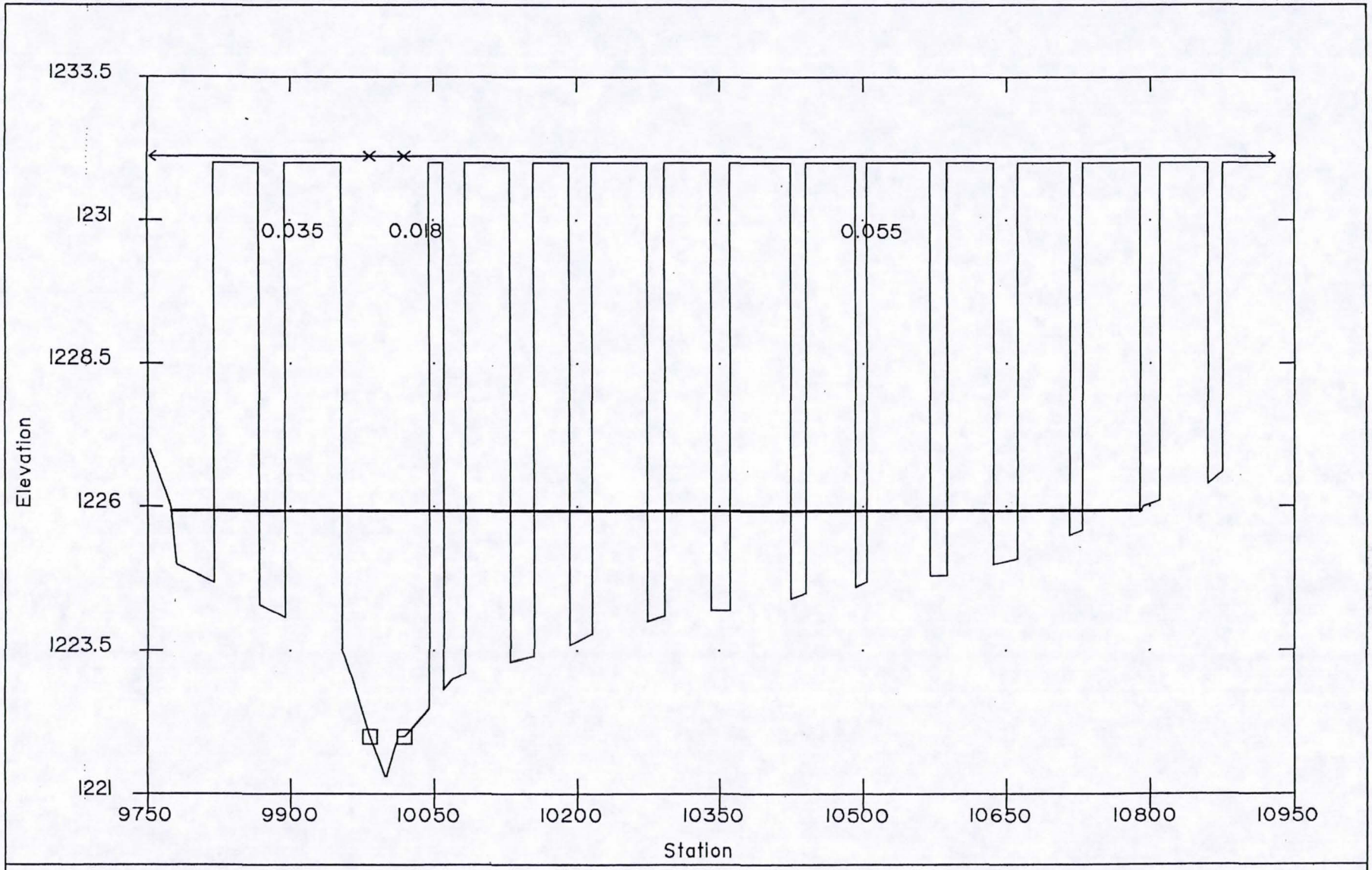
STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WATER SURFACE ELEVATION WITHOUT FLOODWAY	DIFFERENCE
1.522	363.	290.	4.3	1218.2	1218.2	.0
1.575	214.	240.	5.2	1218.6	1218.6	.0
1.670	171.	221.	5.6	1219.8	1219.8	.0
1.725	238.	257.	4.8	1220.4	1220.4	.0
1.810	595.	482.	2.6	1221.4	1221.4	.0
1.879	109.	197.	6.3	1221.7	1221.7	.0
1.925	278.	243.	5.1	1222.6	1222.6	.0
1.961	438.	391.	3.2	1223.3	1223.3	.0
2.044	597.	248.	5.0	1223.9	1223.9	.0
2.128	341.	272.	4.6	1224.9	1224.9	.0
2.168	1016.	778.	1.6	1225.9	1225.9	.0
2.192	886.	600.	2.1	1225.9	1225.9	.0
2.208	296.	360.	3.4	1225.9	1225.9	.0
2.218	685.	491.	2.5	1226.1	1226.1	.0
2.295	356.	202.	3.2	1227.3	1227.3	.0
2.355	141.	145.	4.5	1228.6	1228.6	.0



SECTION : 2.192

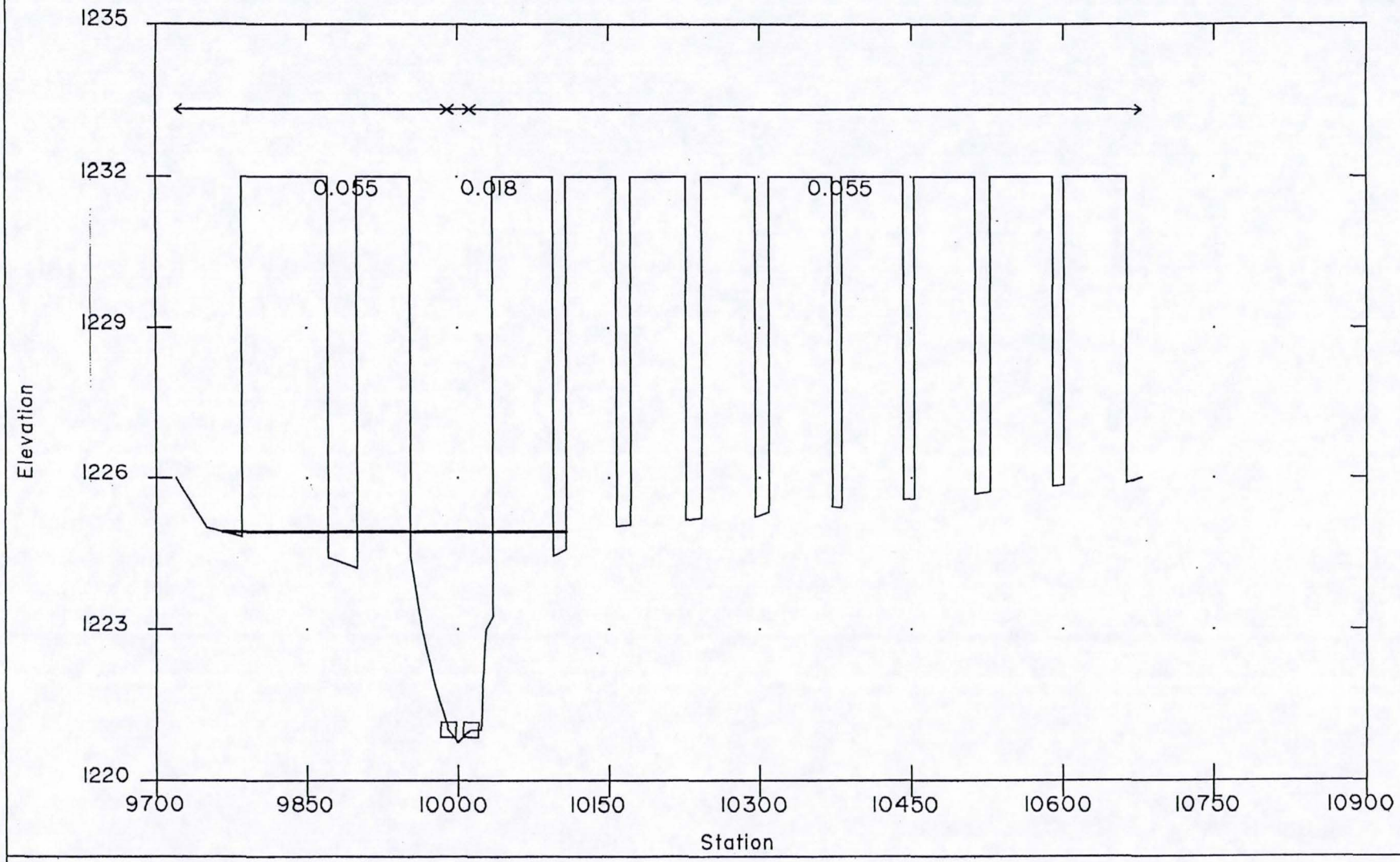
Granite Reef Wash
Floodplain Delineation Study

HEC-2 CROSS-SECTIONS



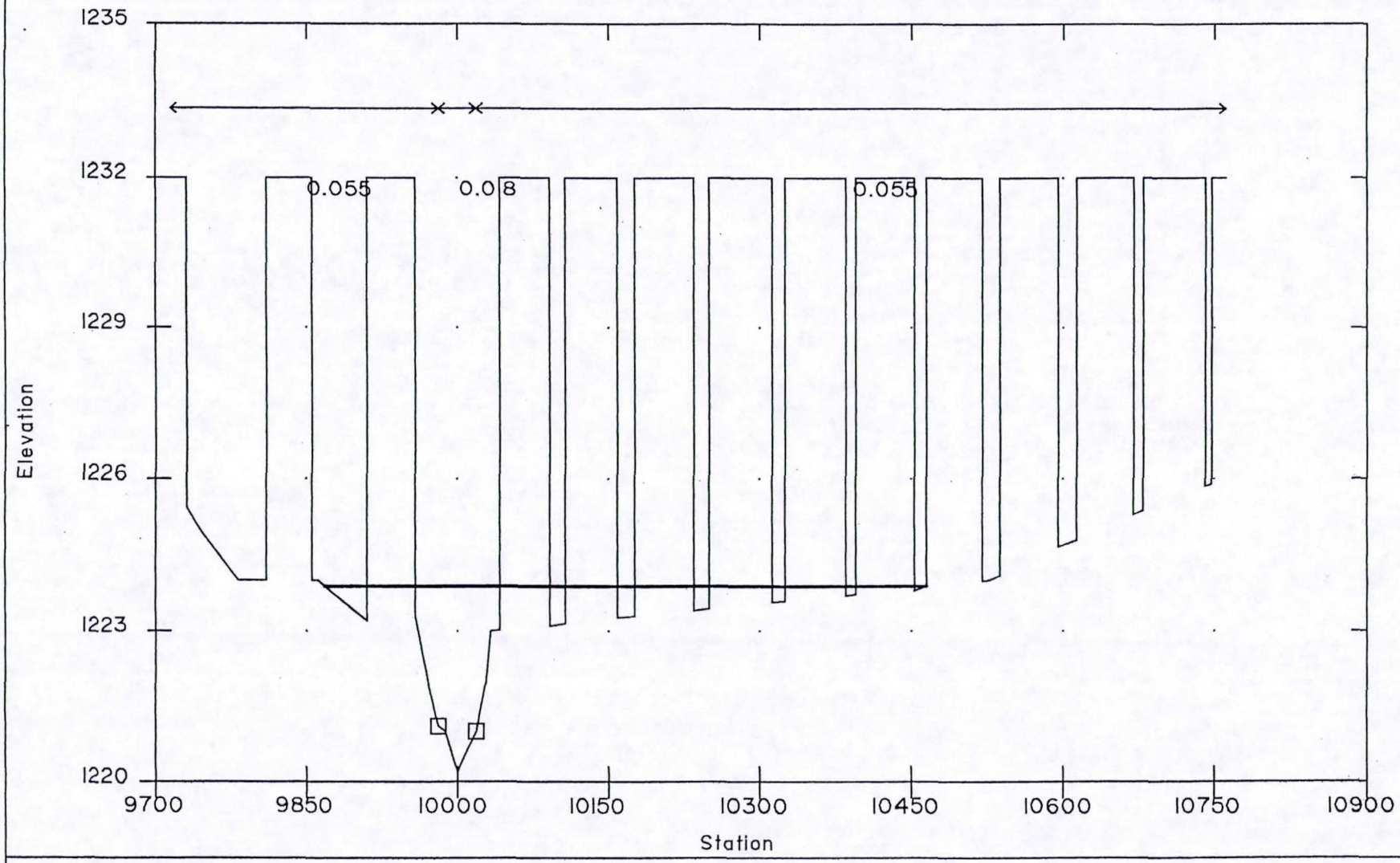
SECTION : 2.168

Granite Reef Wash
Floodplain Delineation Study



SECTION : 2.128

Granite Reef Wash
Floodplain Delineation Study



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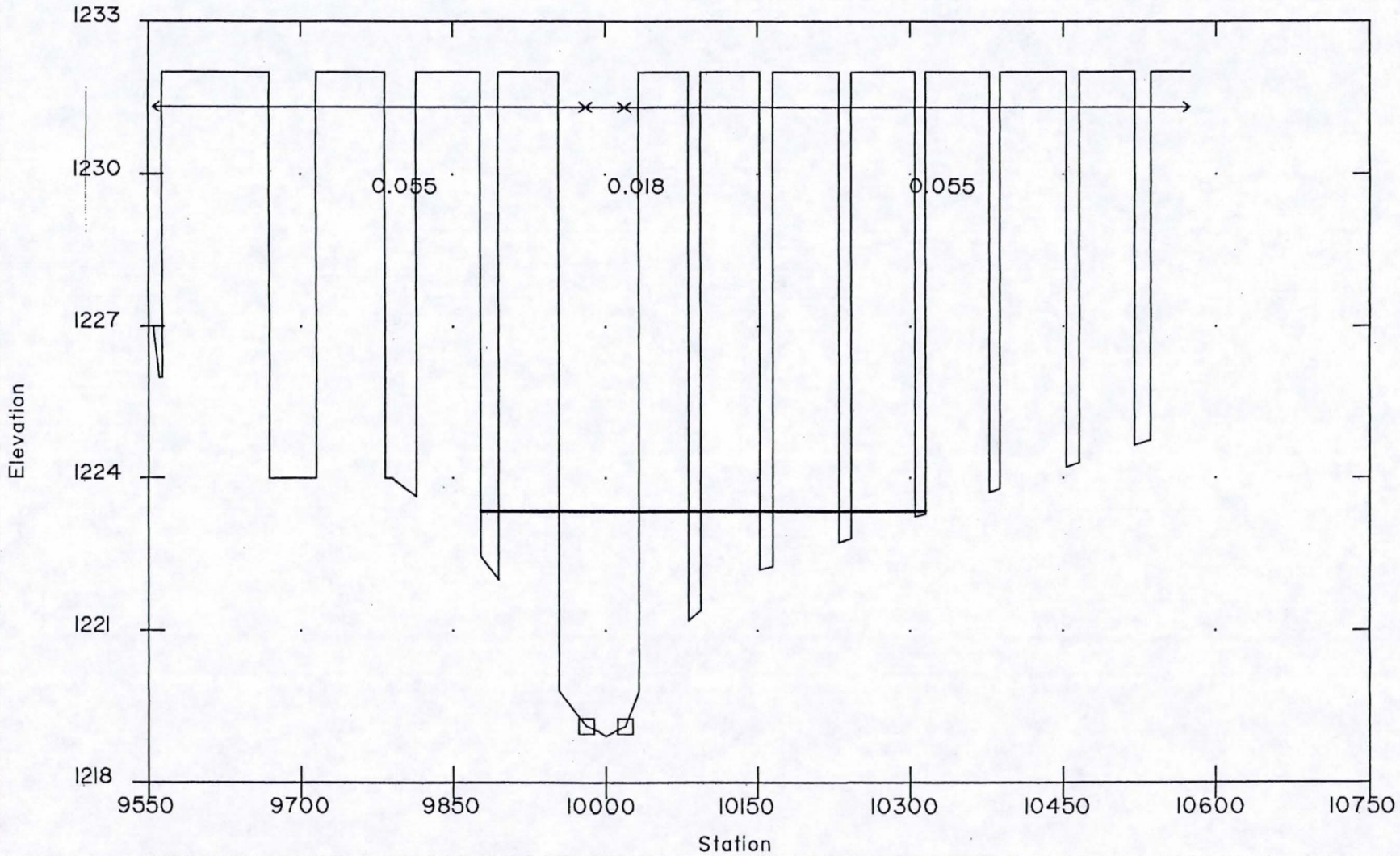
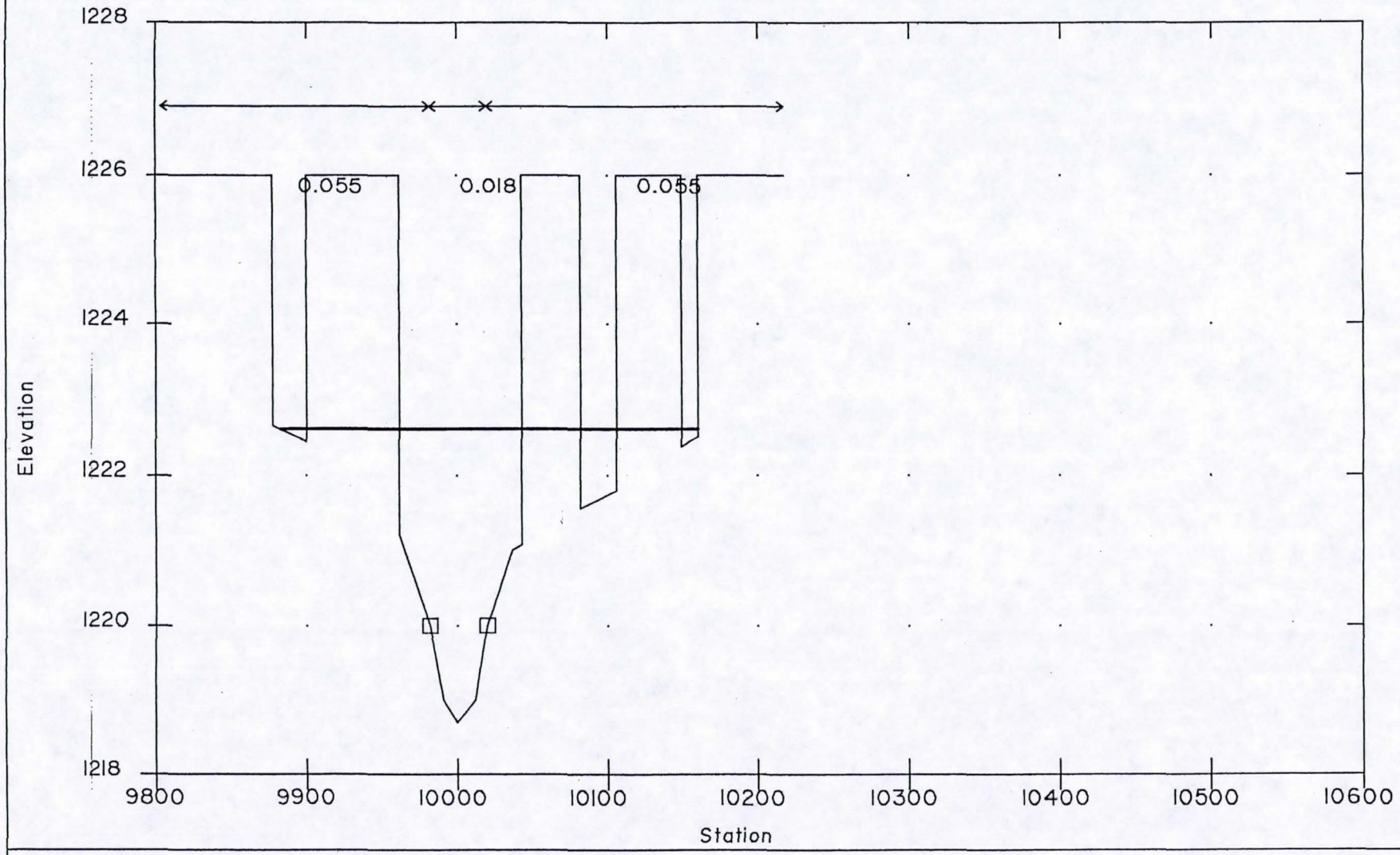
Granite Reef Wash
Floodplain Delineation Study



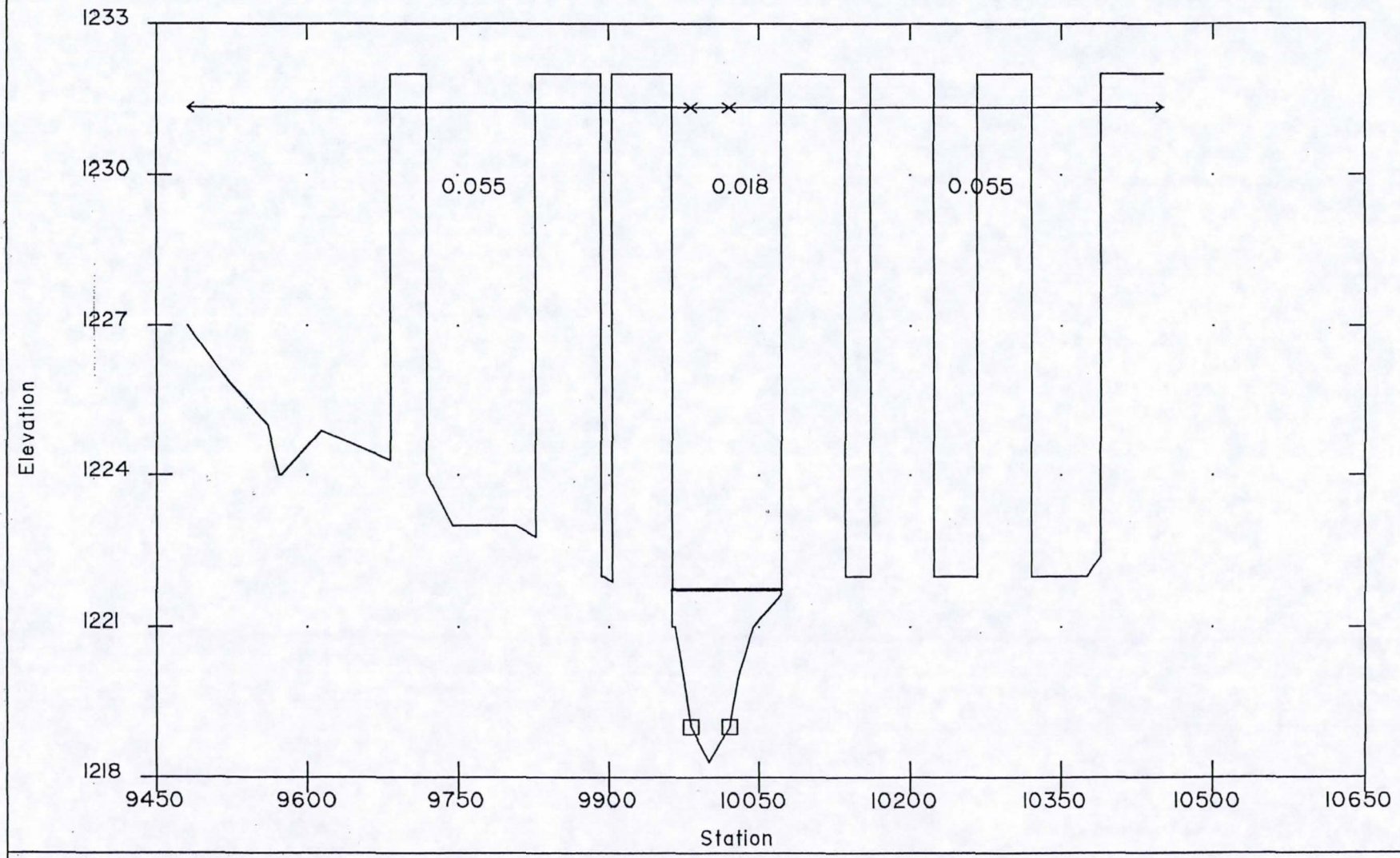
SECTION : 1.961

Granite Reef Wash
Floodplain Delineation Study



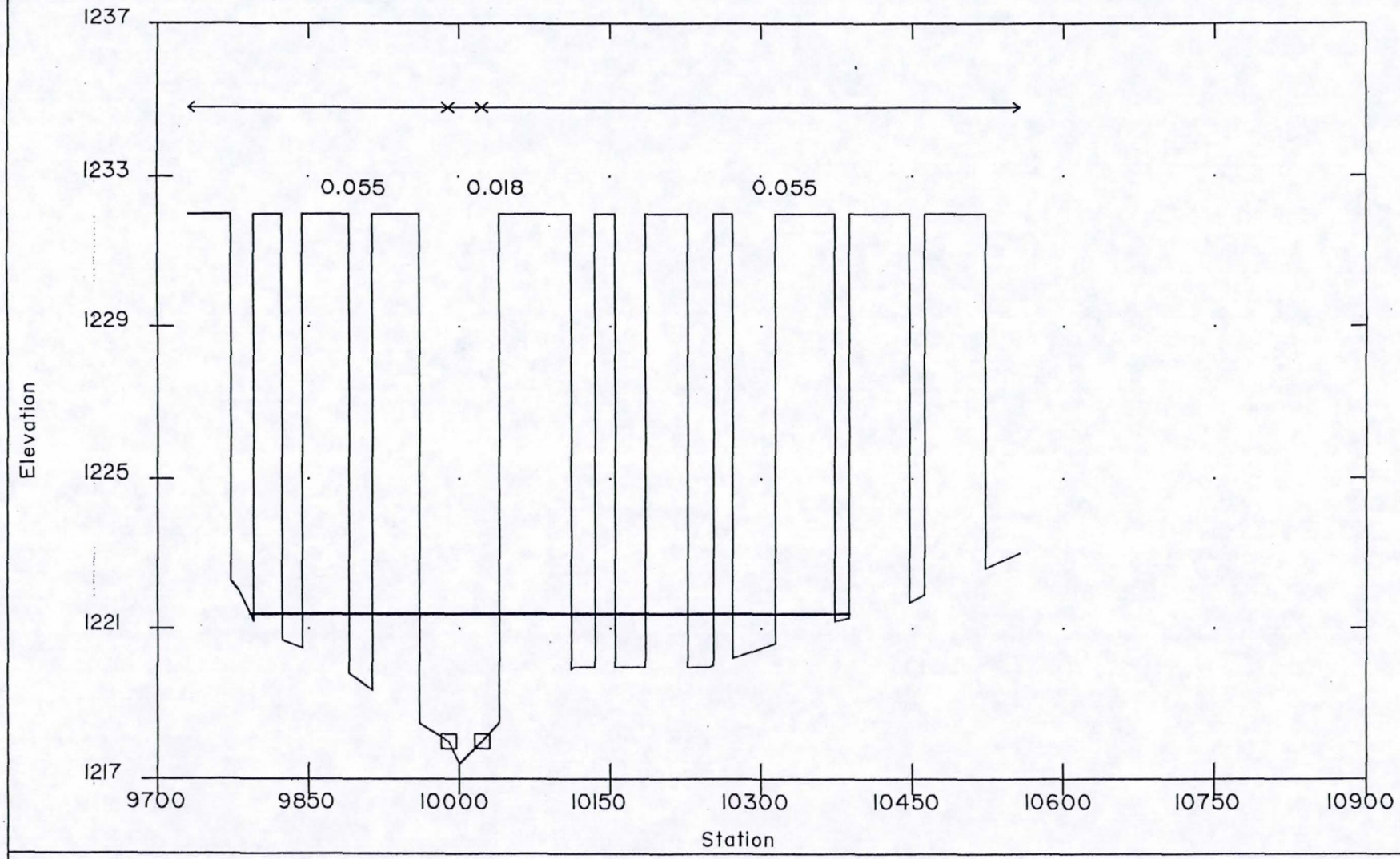
SECTION : 1.925

Granite Reef Wash
Floodplain Delineation Study



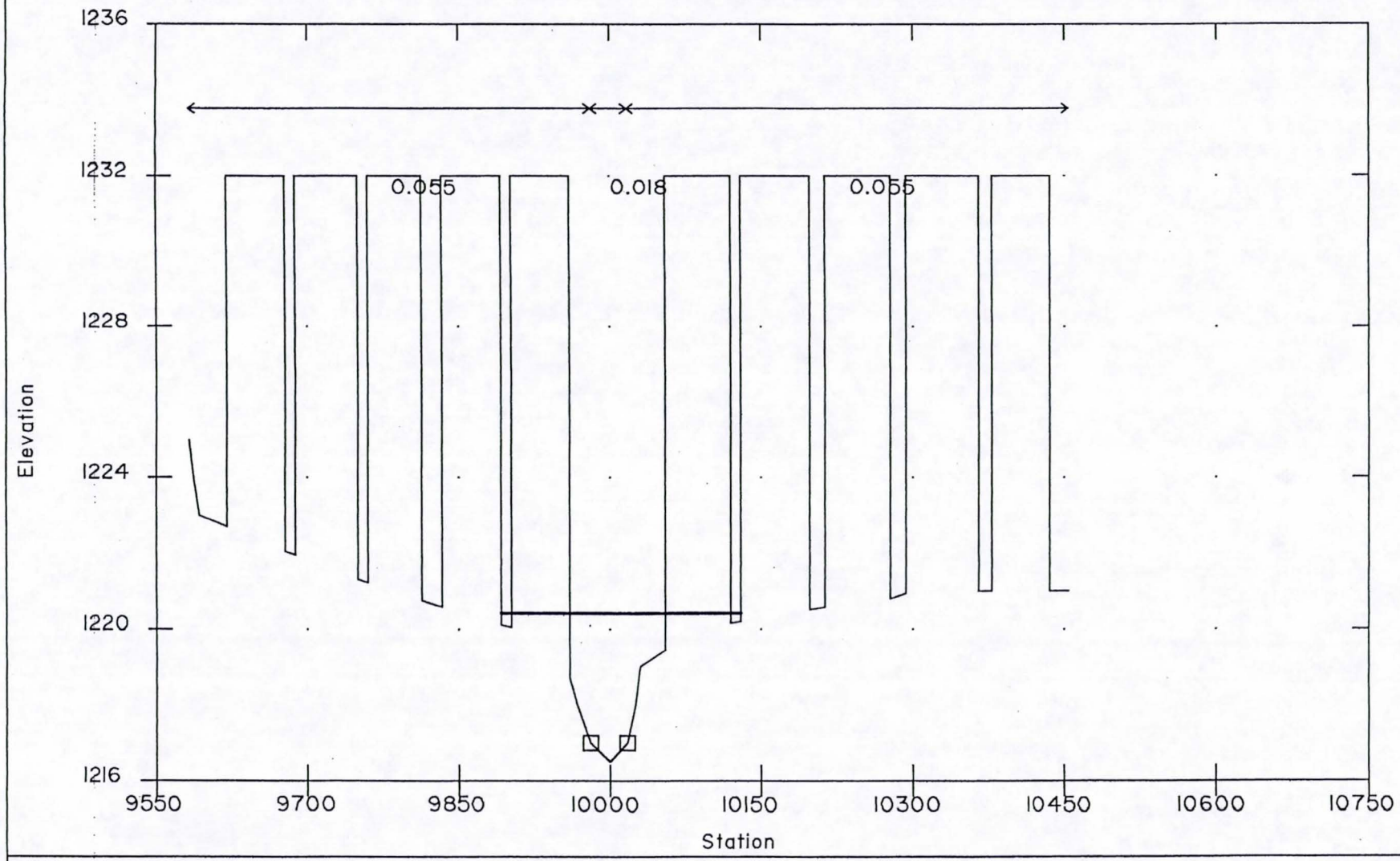
SECTION : 1.879

Granite Reef Wash
Floodplain Delineation Study



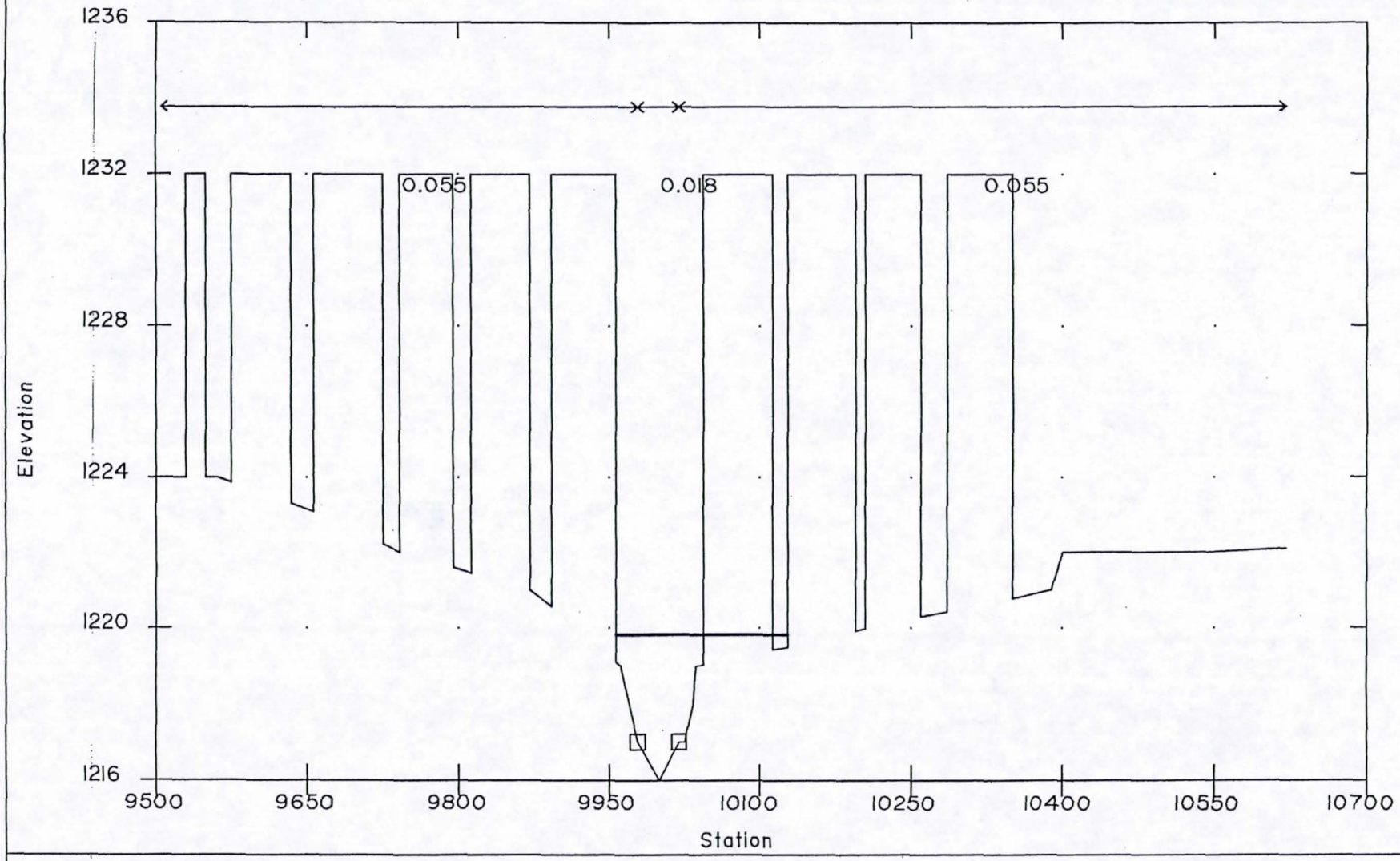
SECTION : 1.810

Granite Reef Wash
Floodplain Delineation Study



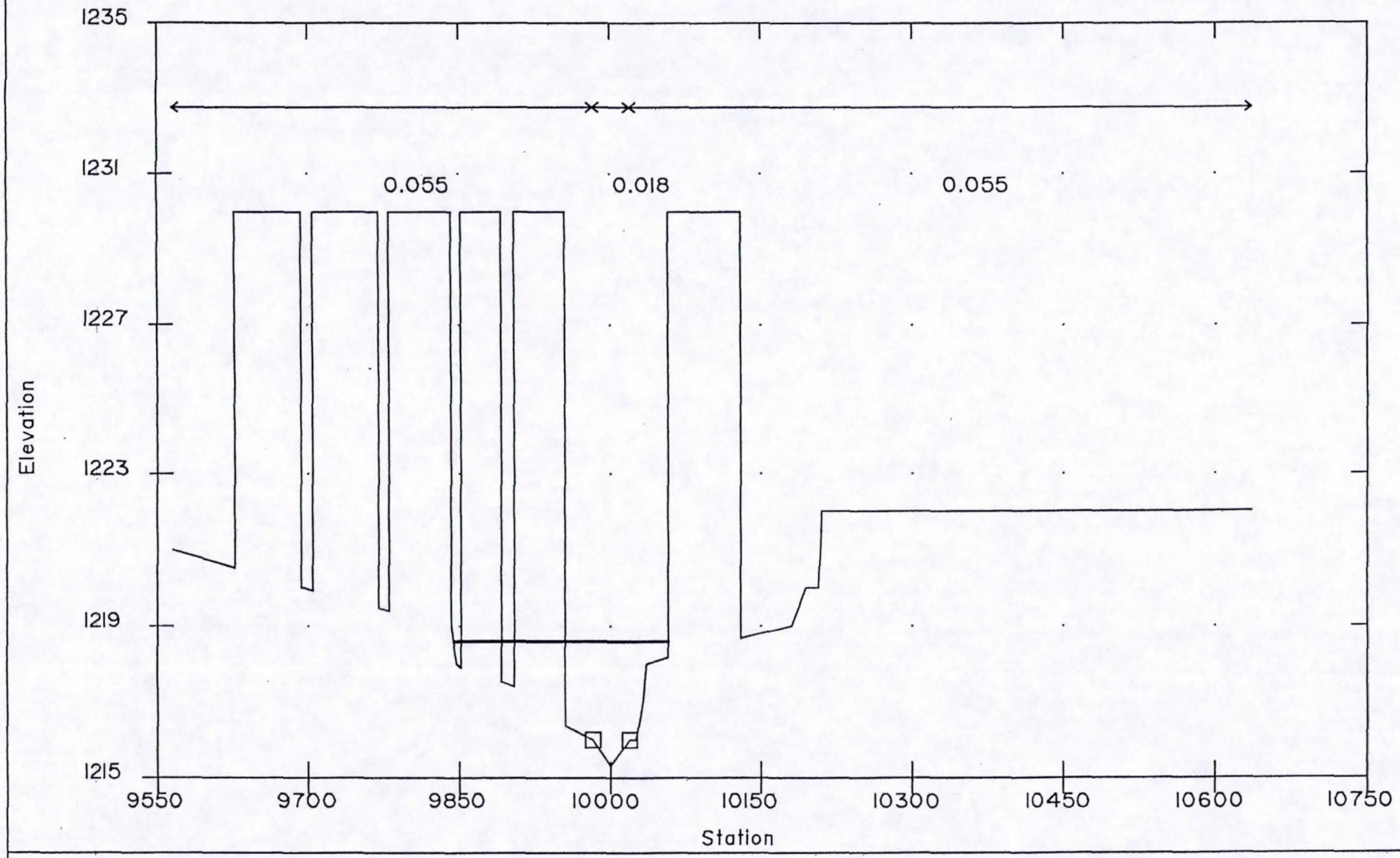
SECTION : 1.725

Granite Reef Wash
Floodplain Delineation Study



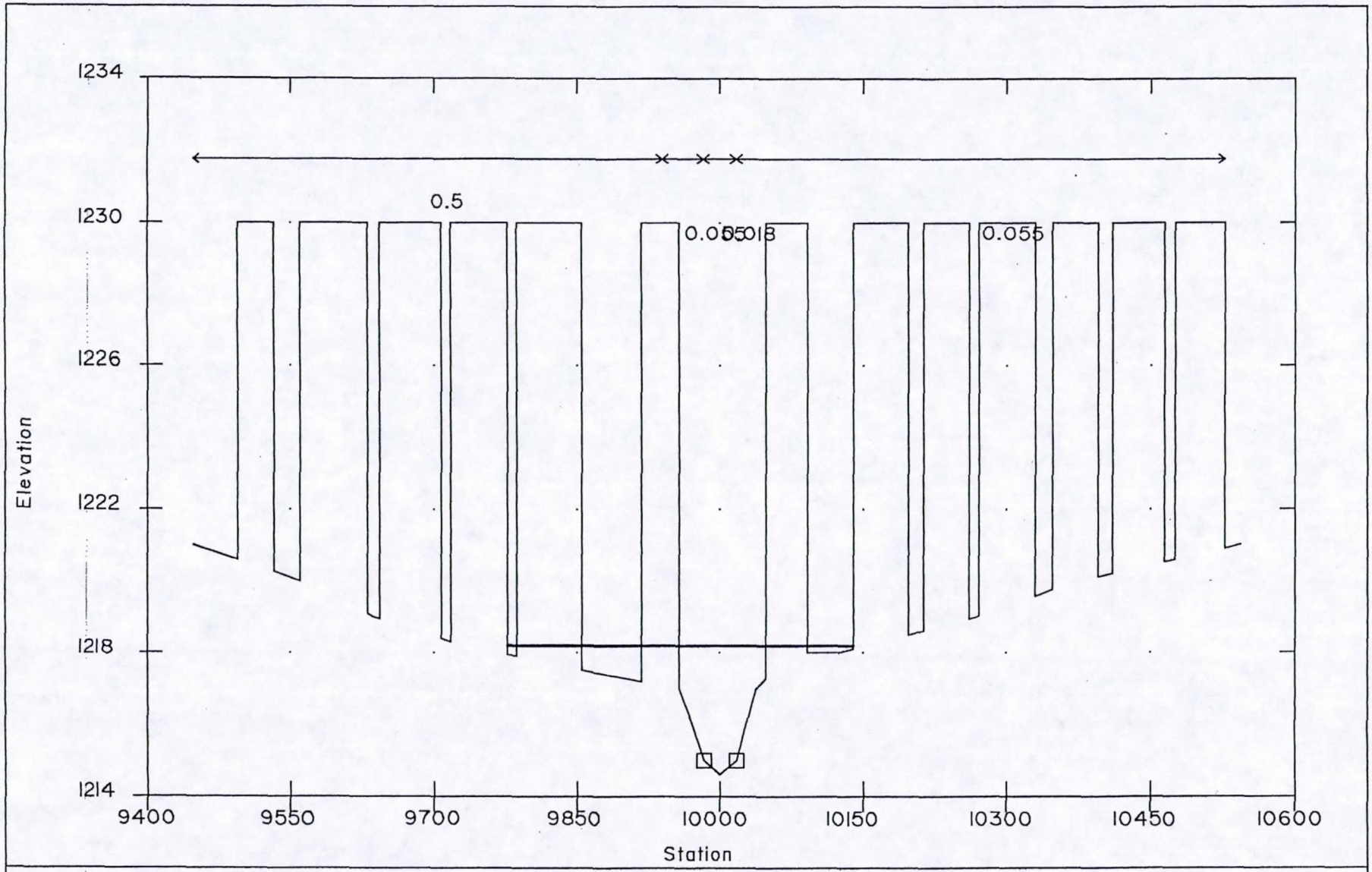
SECTION : 1.670

Granite Reef Wash
Floodplain Delineation Study



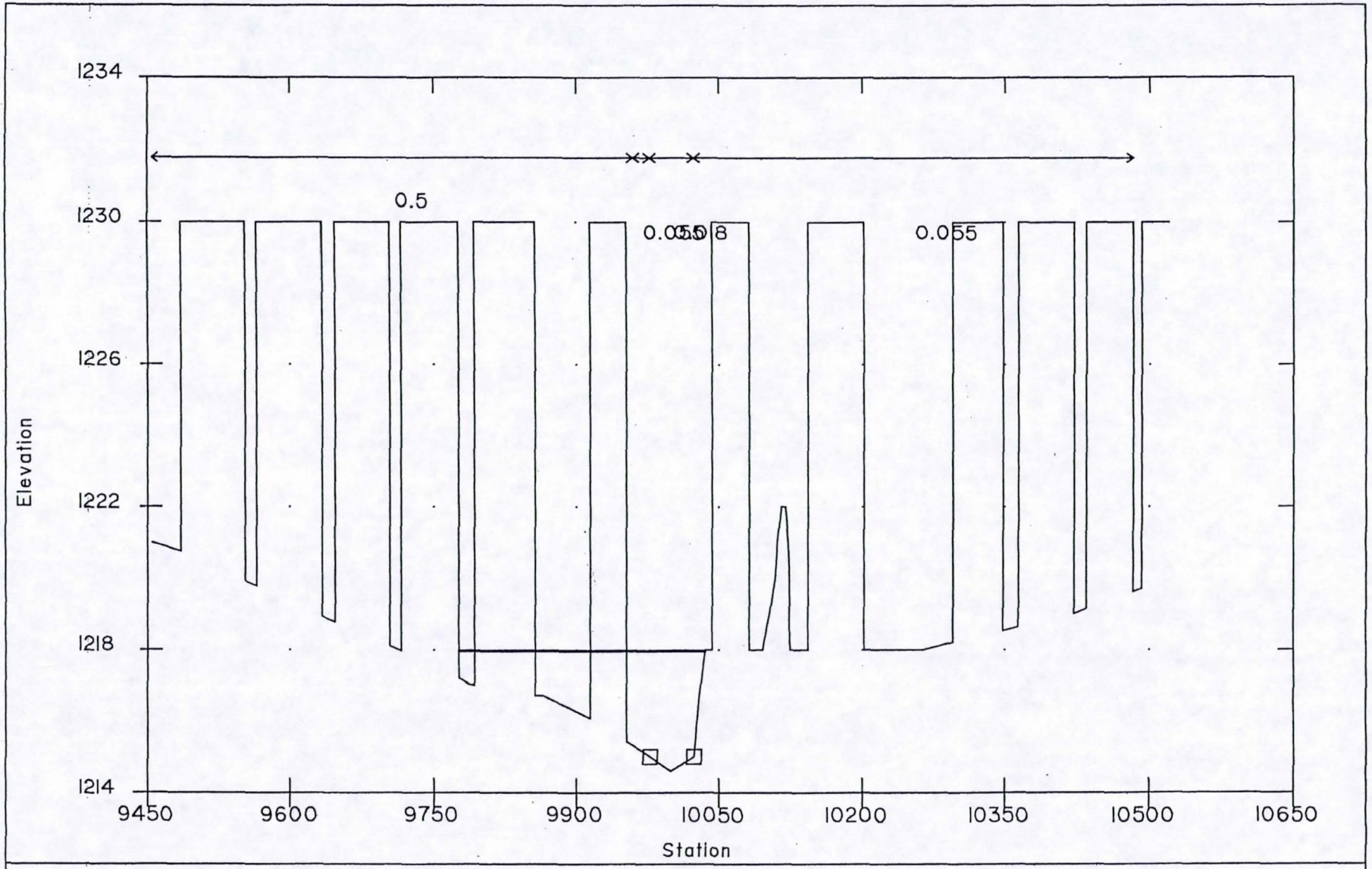
SECTION : 1.575

Granite Reef Wash
Floodplain Delineation Study



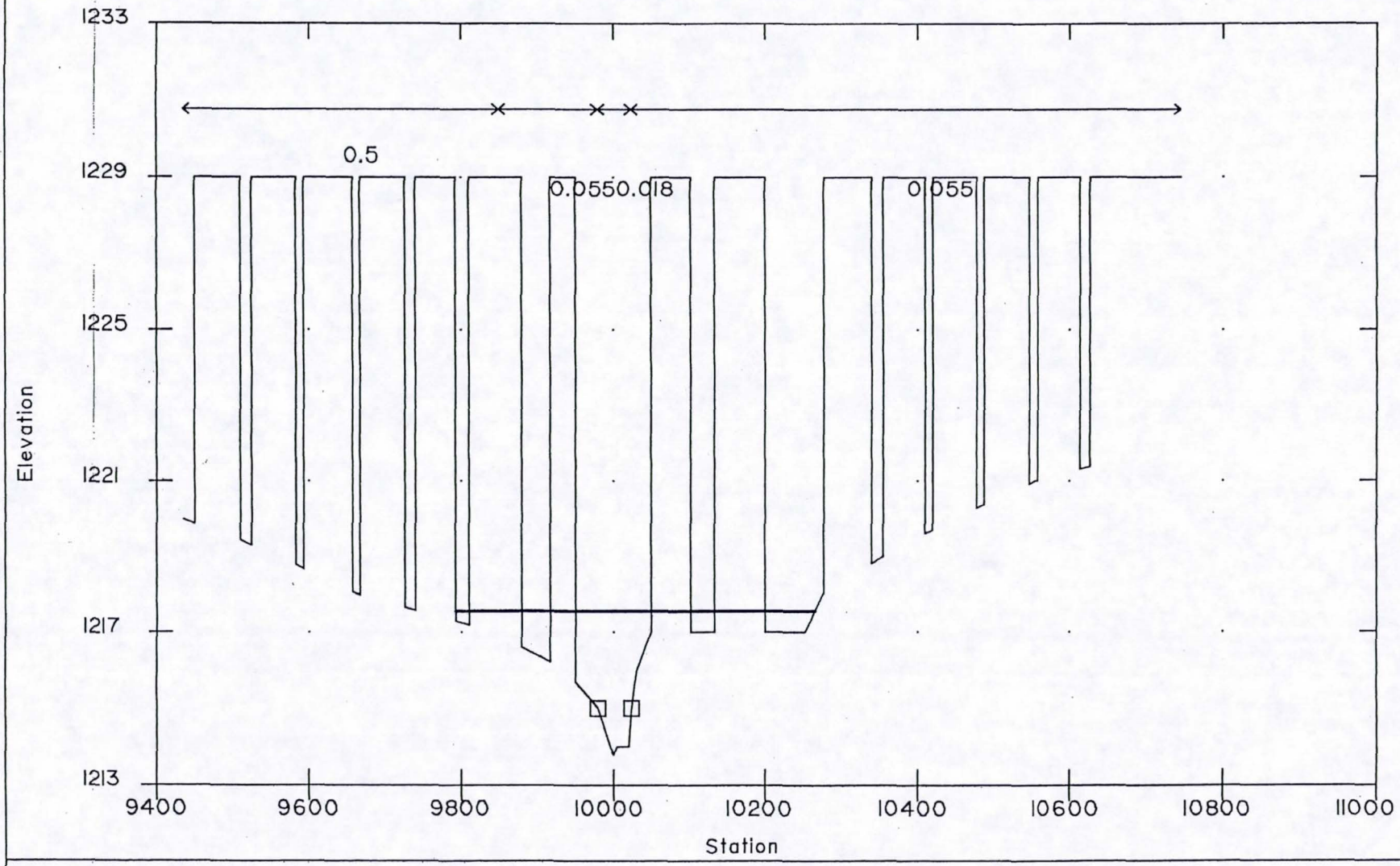
SECTION : 1.522

Granite Reef Wash
Floodplain Delineation Study



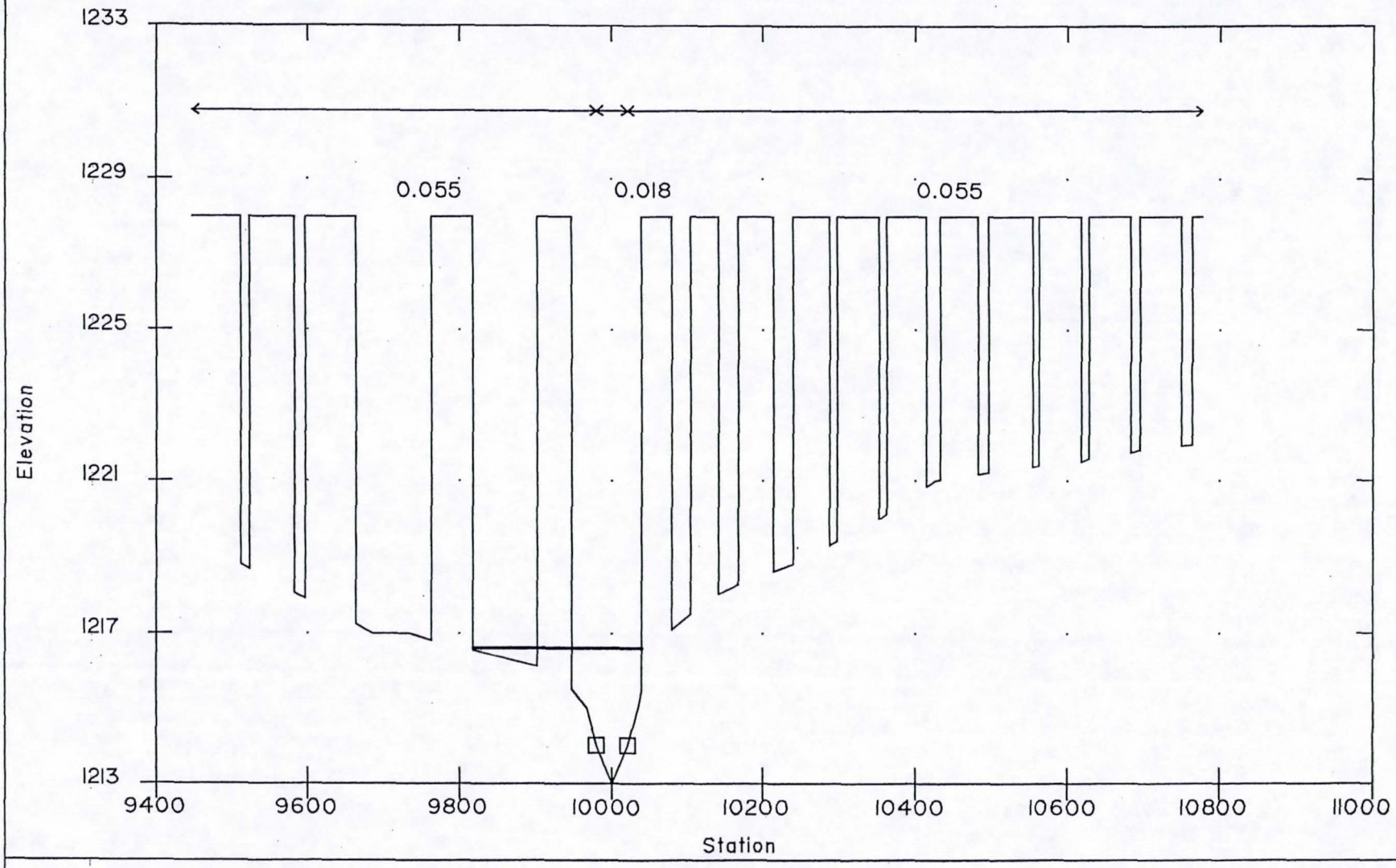
SECTION : 1.499

Granite Reef Wash
Floodplain Delineation Study



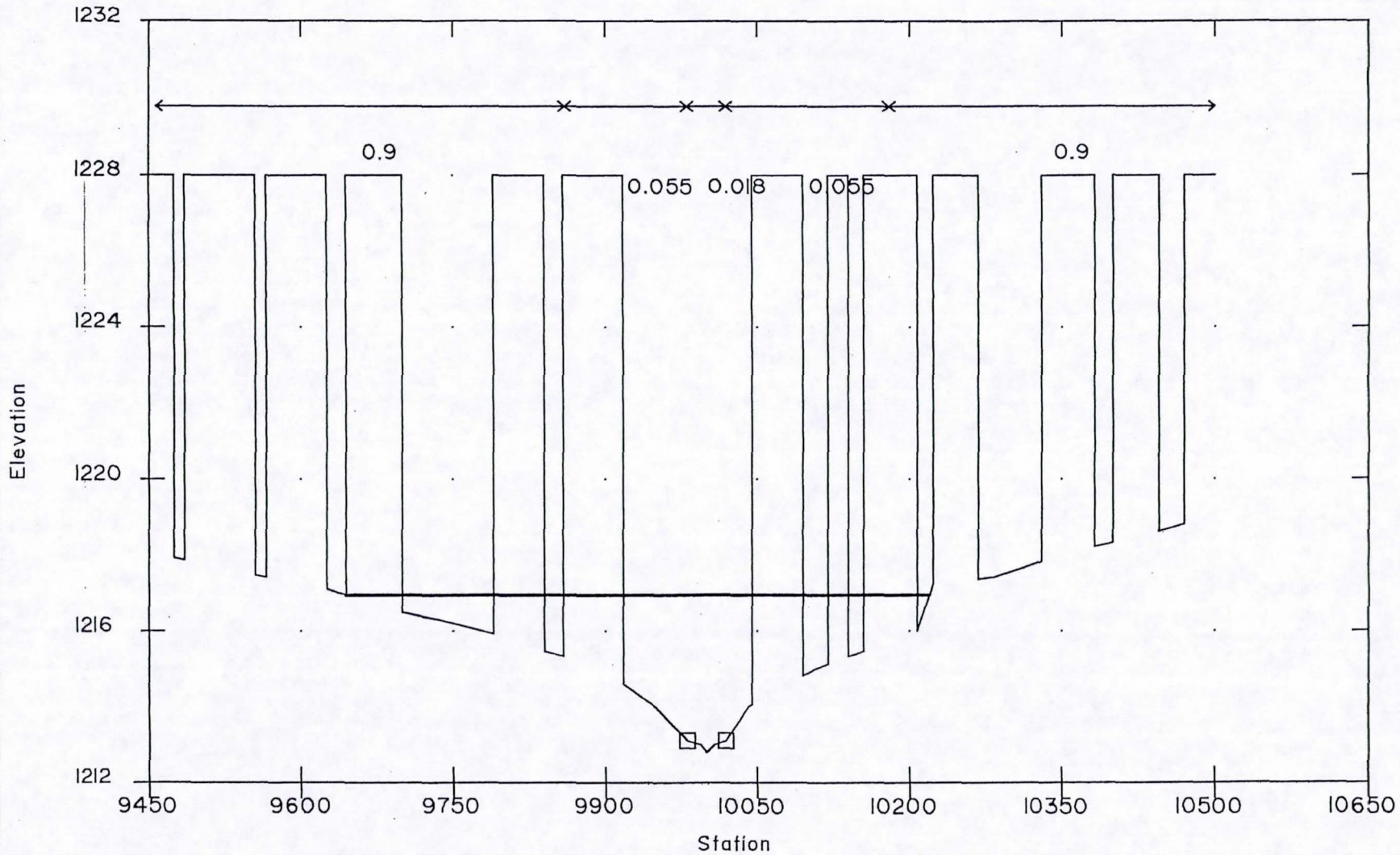
SECTION : 1.438

Granite Reef Wash
Floodplain Delineation Study



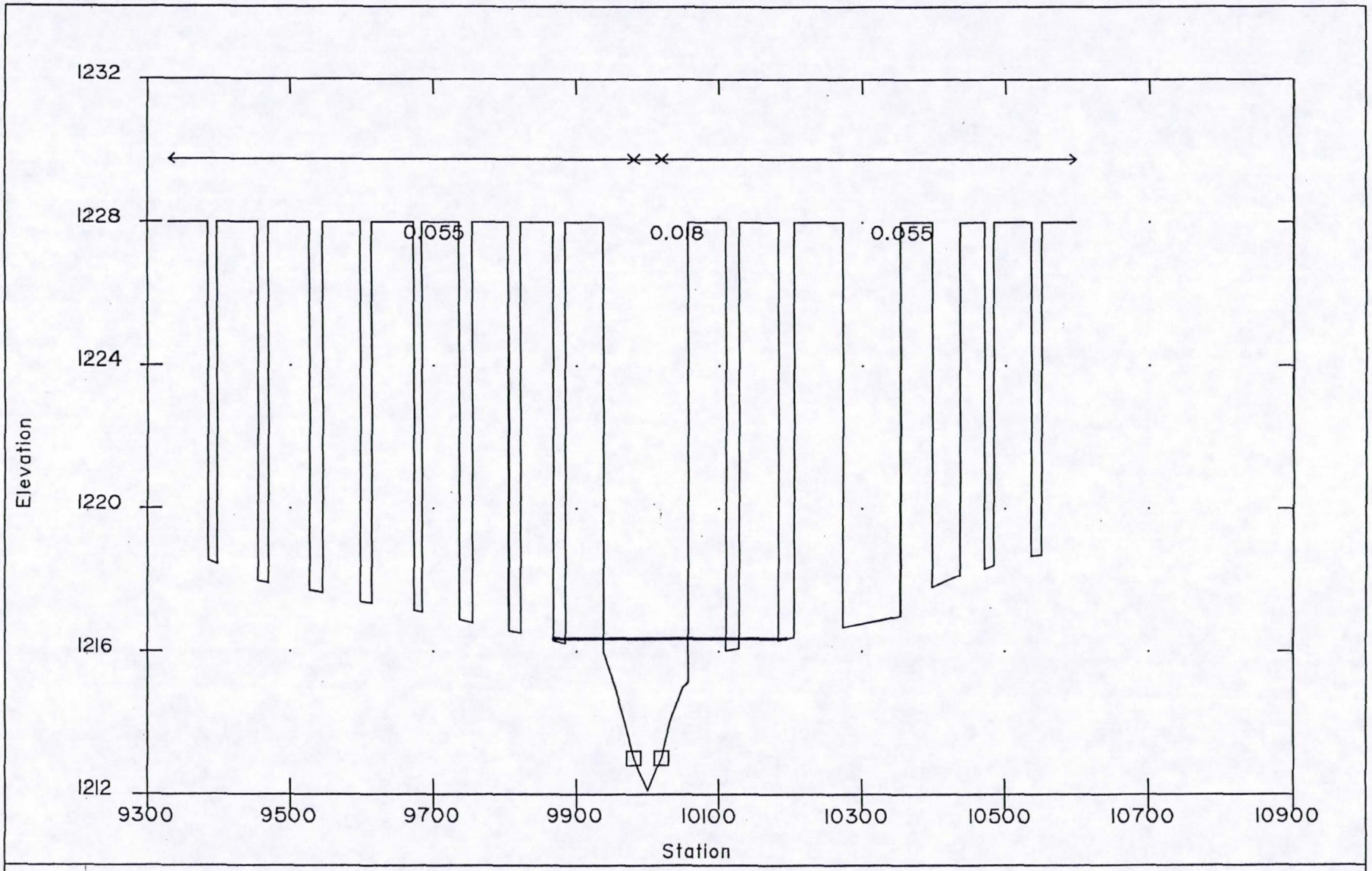
SECTION : 1.373

Granite Reef Wash
Floodplain Delineation Study



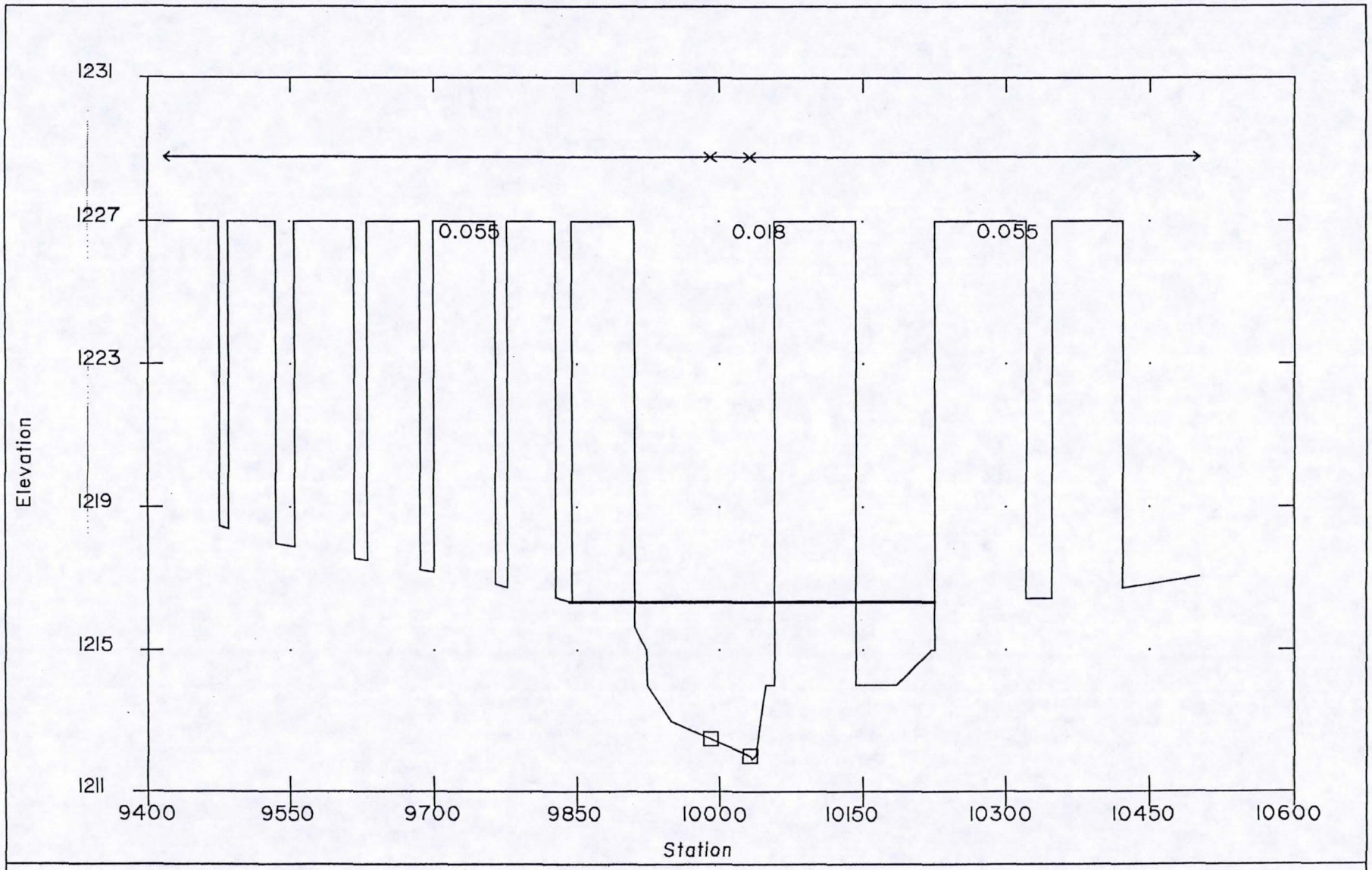
SECTION : 1.353

Granite Reef Wash
Floodplain Delineation Study



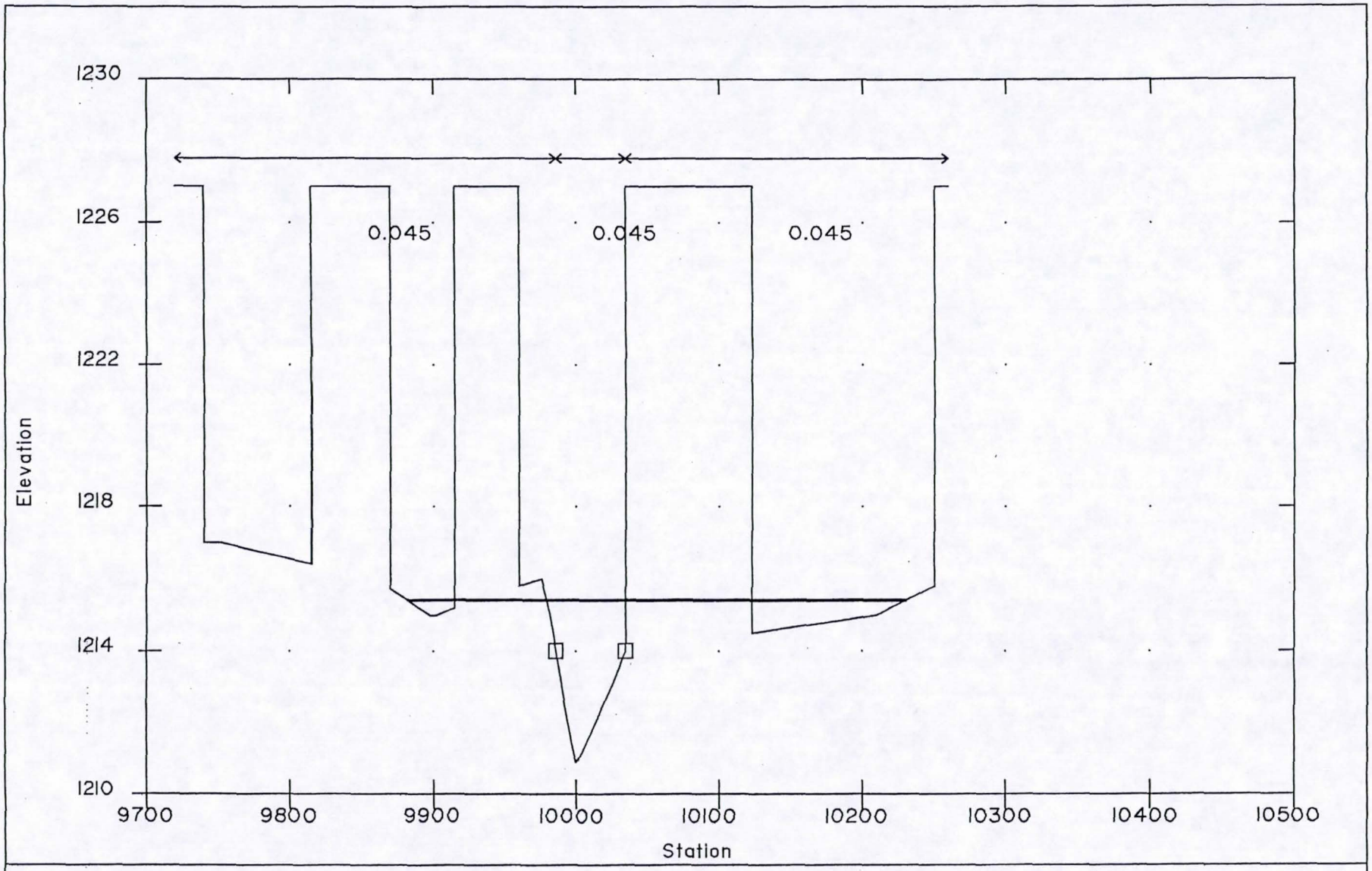
SECTION : 1.301

Granite Reef Wash
Floodplain Delineation Study



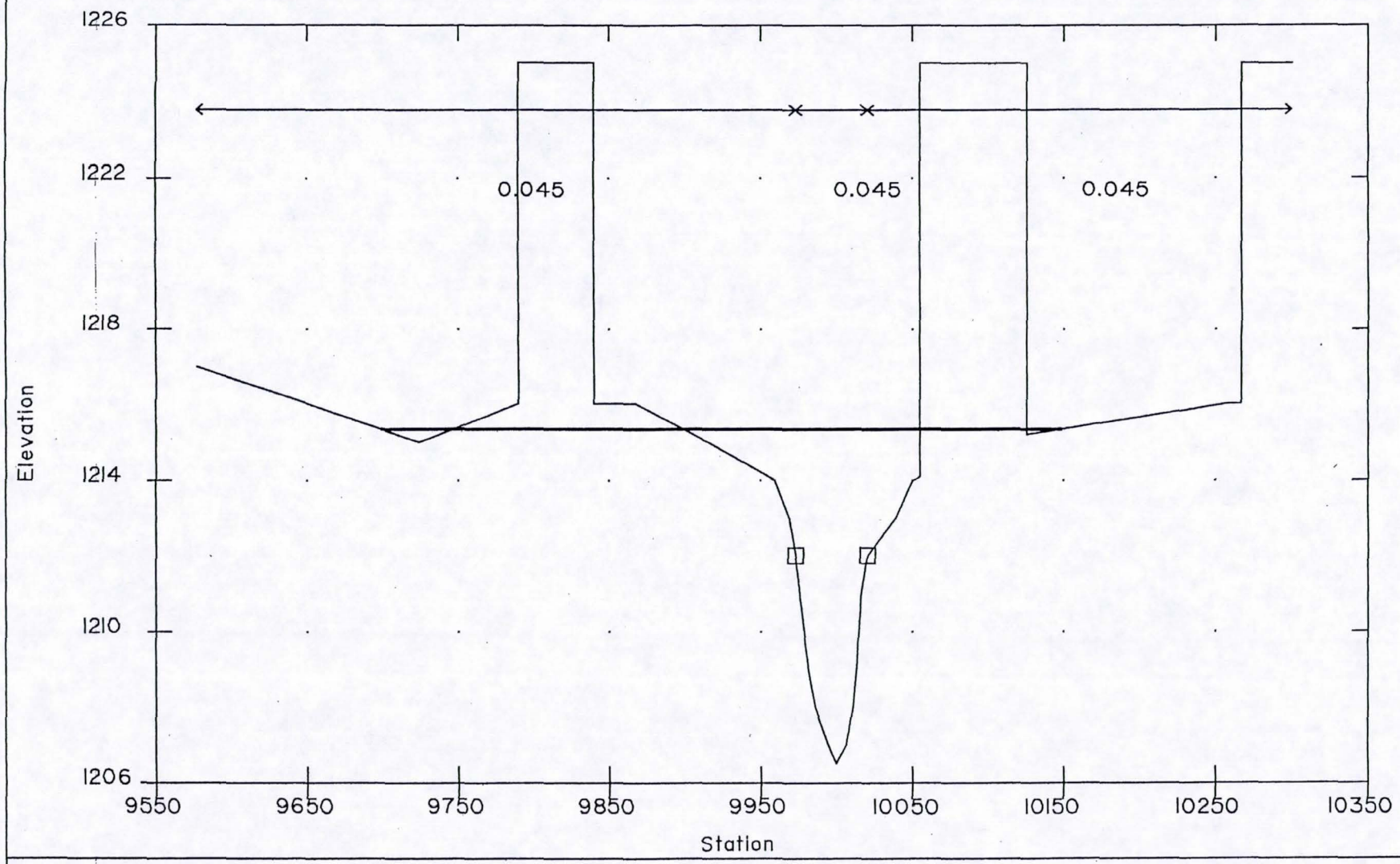
SECTION : 1.262

Granite Reef Wash
Floodplain Delineation Study



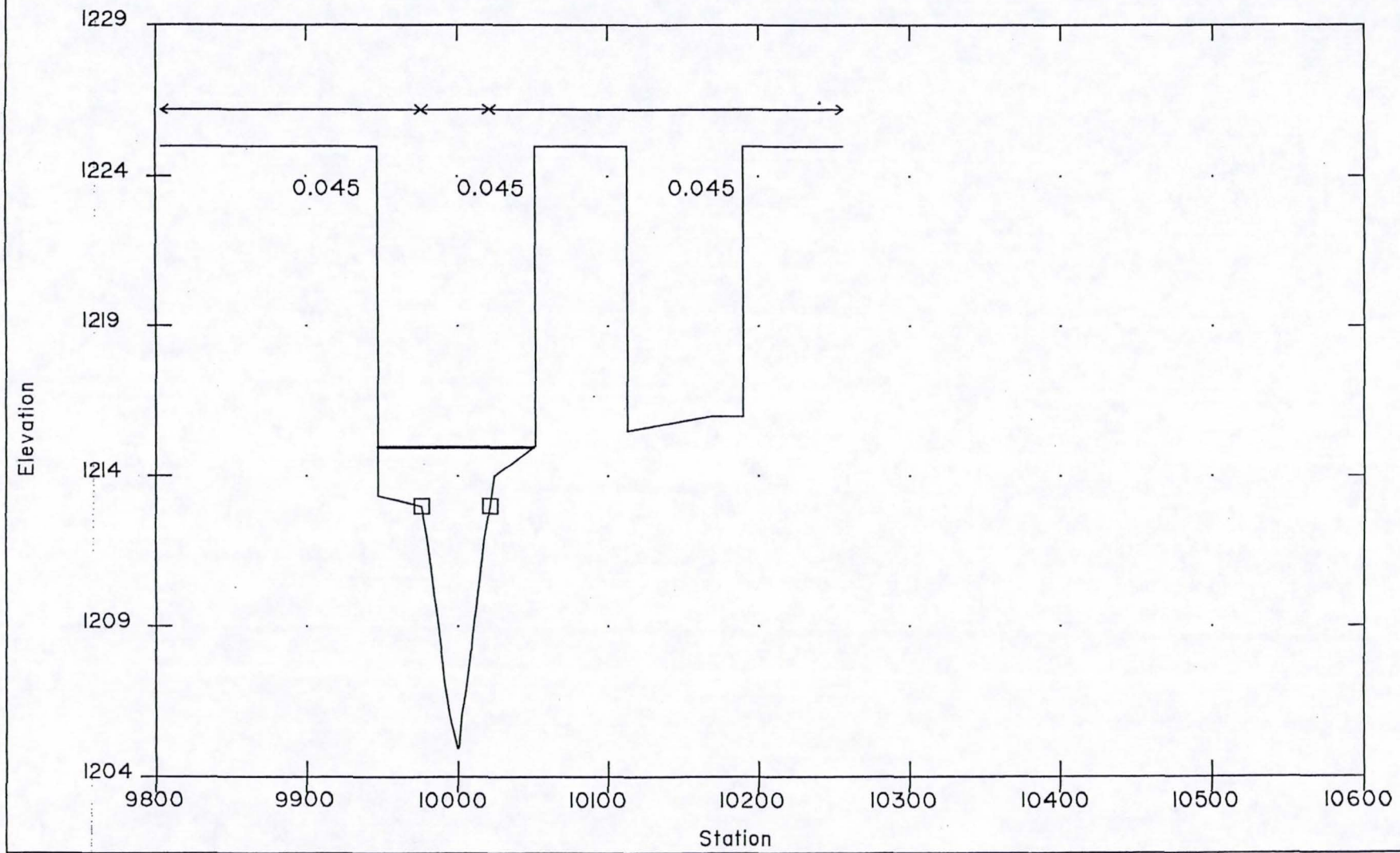
SECTION : 1.239

Granite Reef Wash
Floodplain Delineation Study



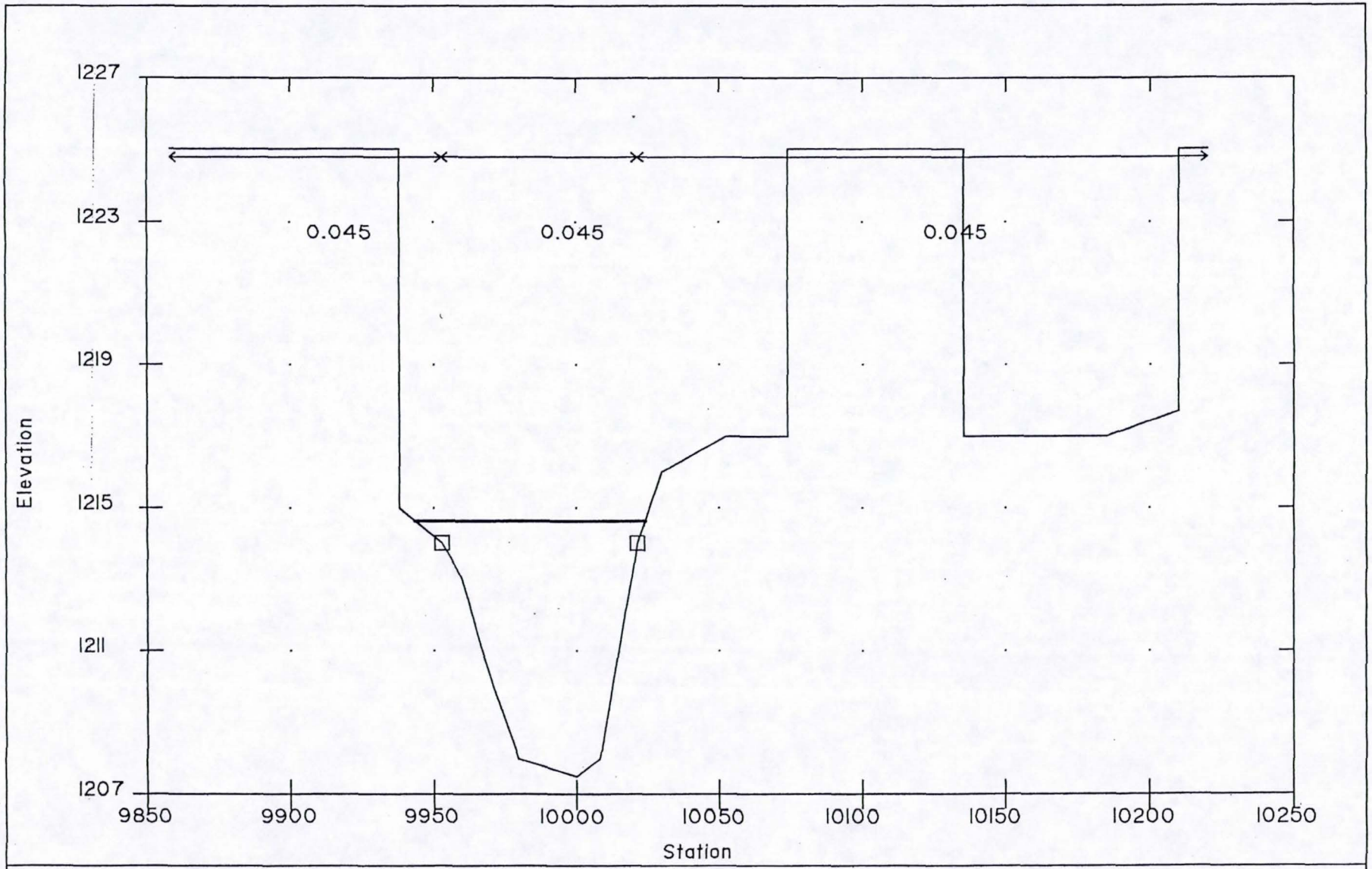
SECTION : 1.224

Granite Reef Wash
Floodplain Delineation Study



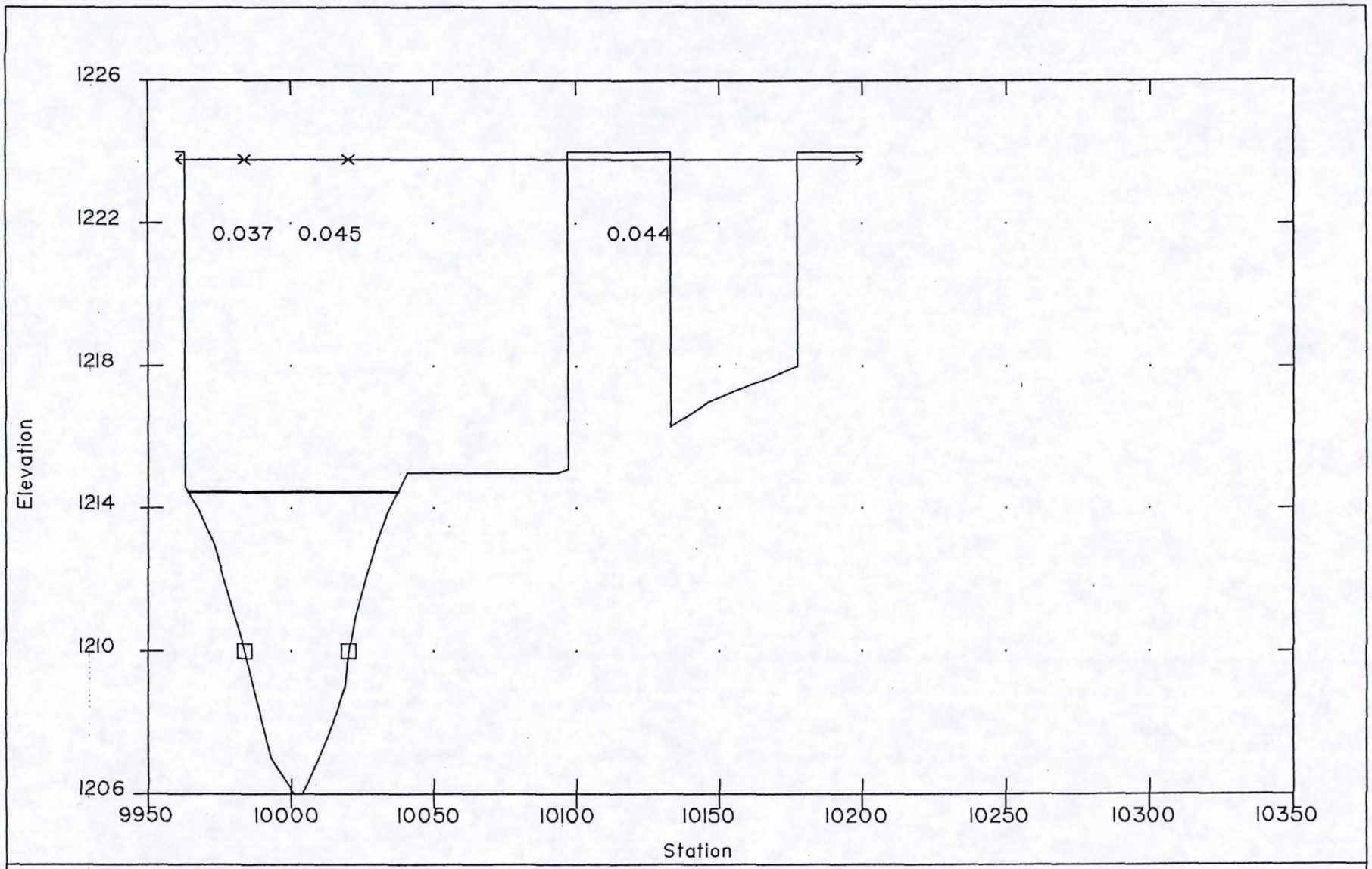
SECTION : 1.181

Granite Reef Wash
Floodplain Delineation Study



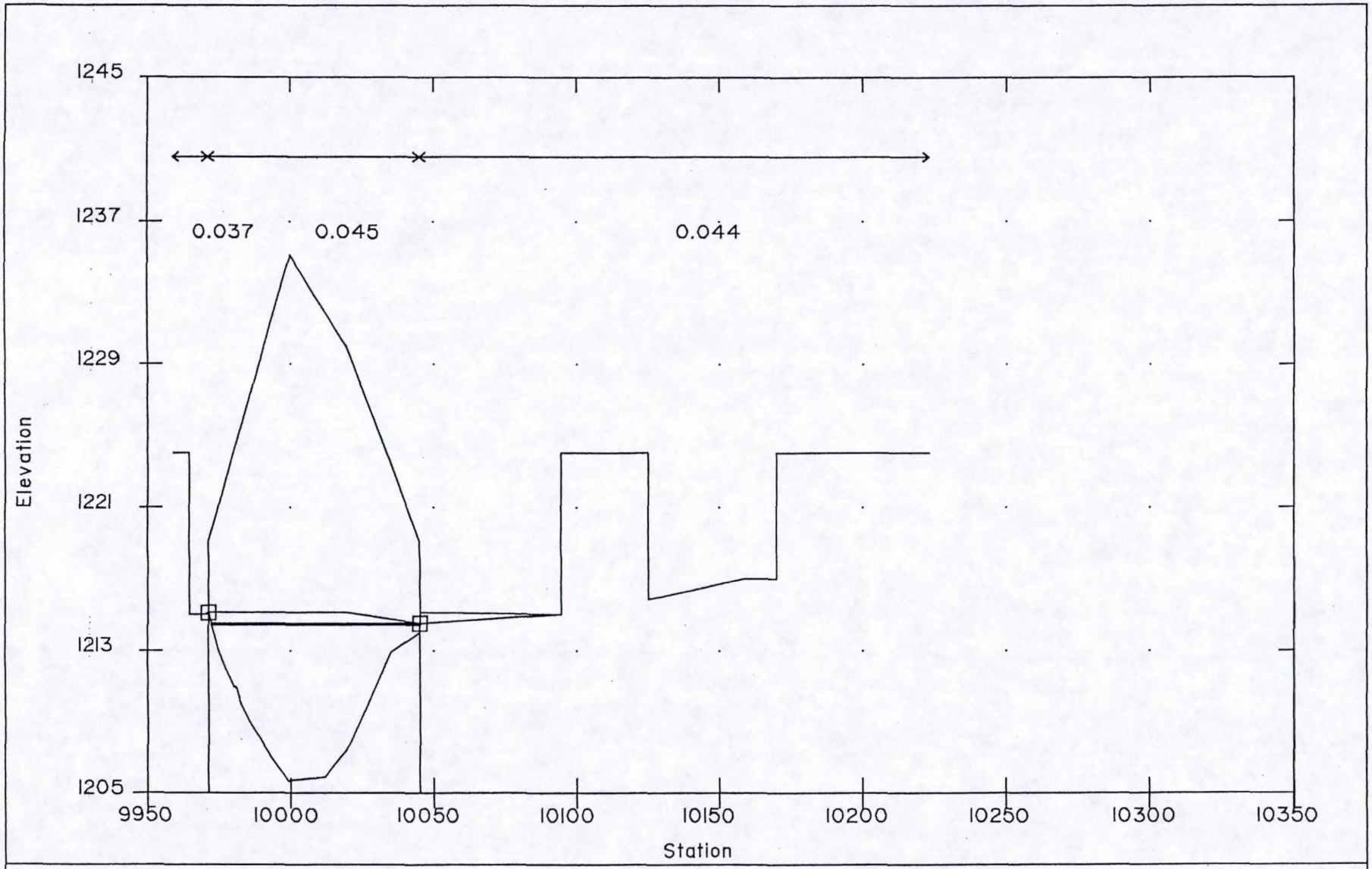
SECTION : 1.138

Granite Reef Wash
Floodplain Delineation Study



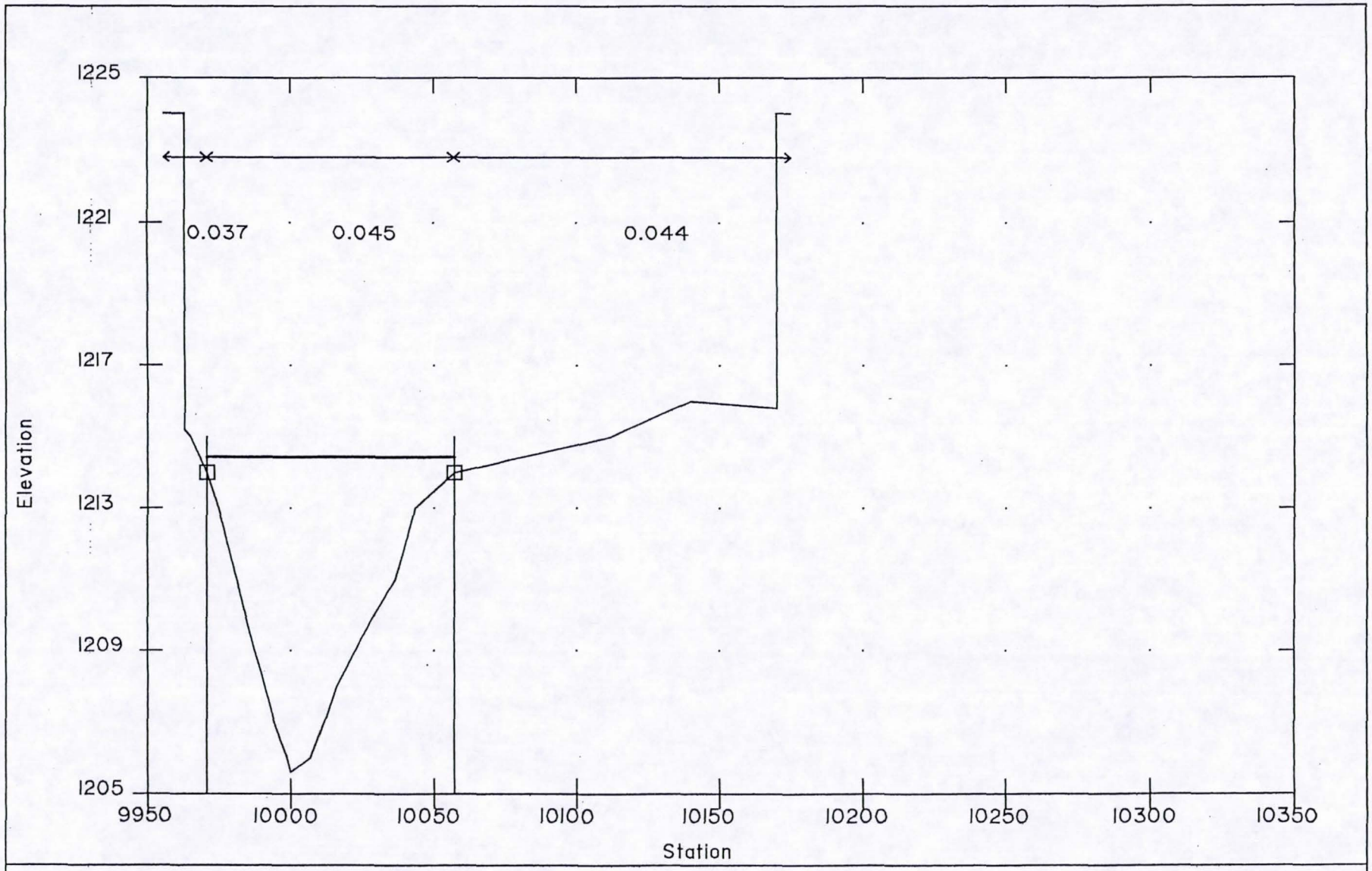
SECTION : 1.121

Granite Reef Wash
Floodplain Delineation Study



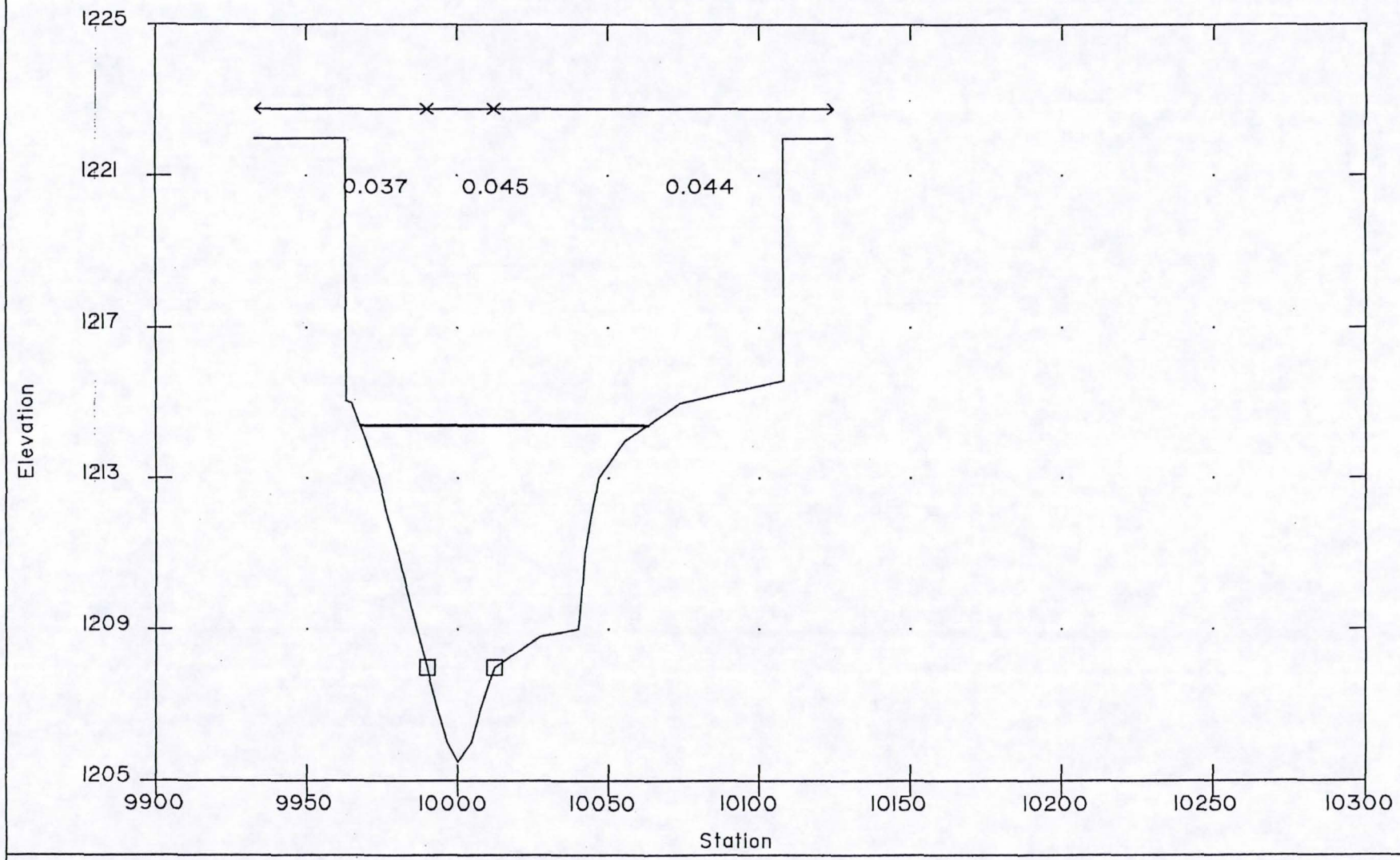
SECTION : 1.115

Granite Reef Wash
Floodplain Delineation Study



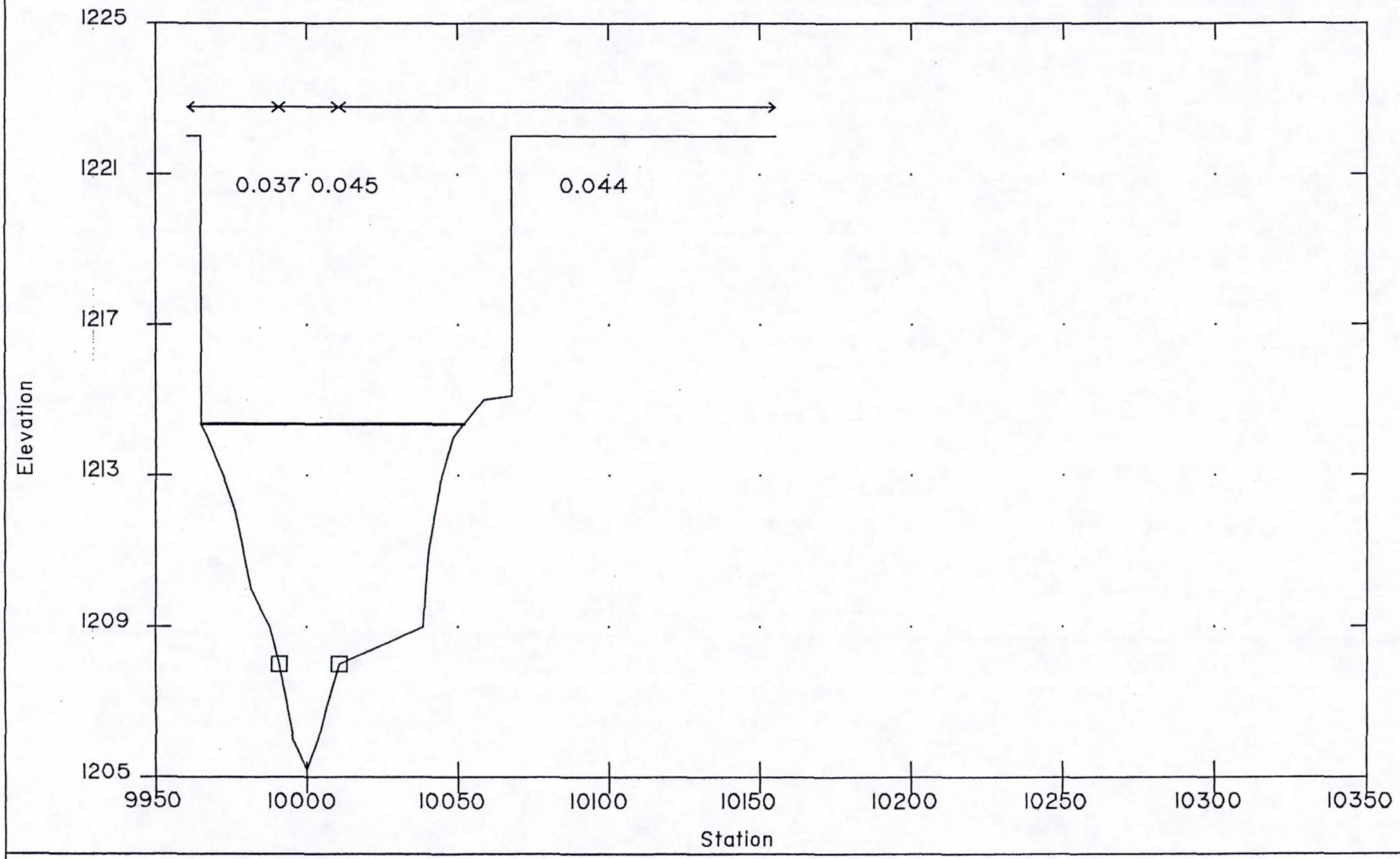
SECTION : 1.108

Granite Reef Wash
Floodplain Delineation Study



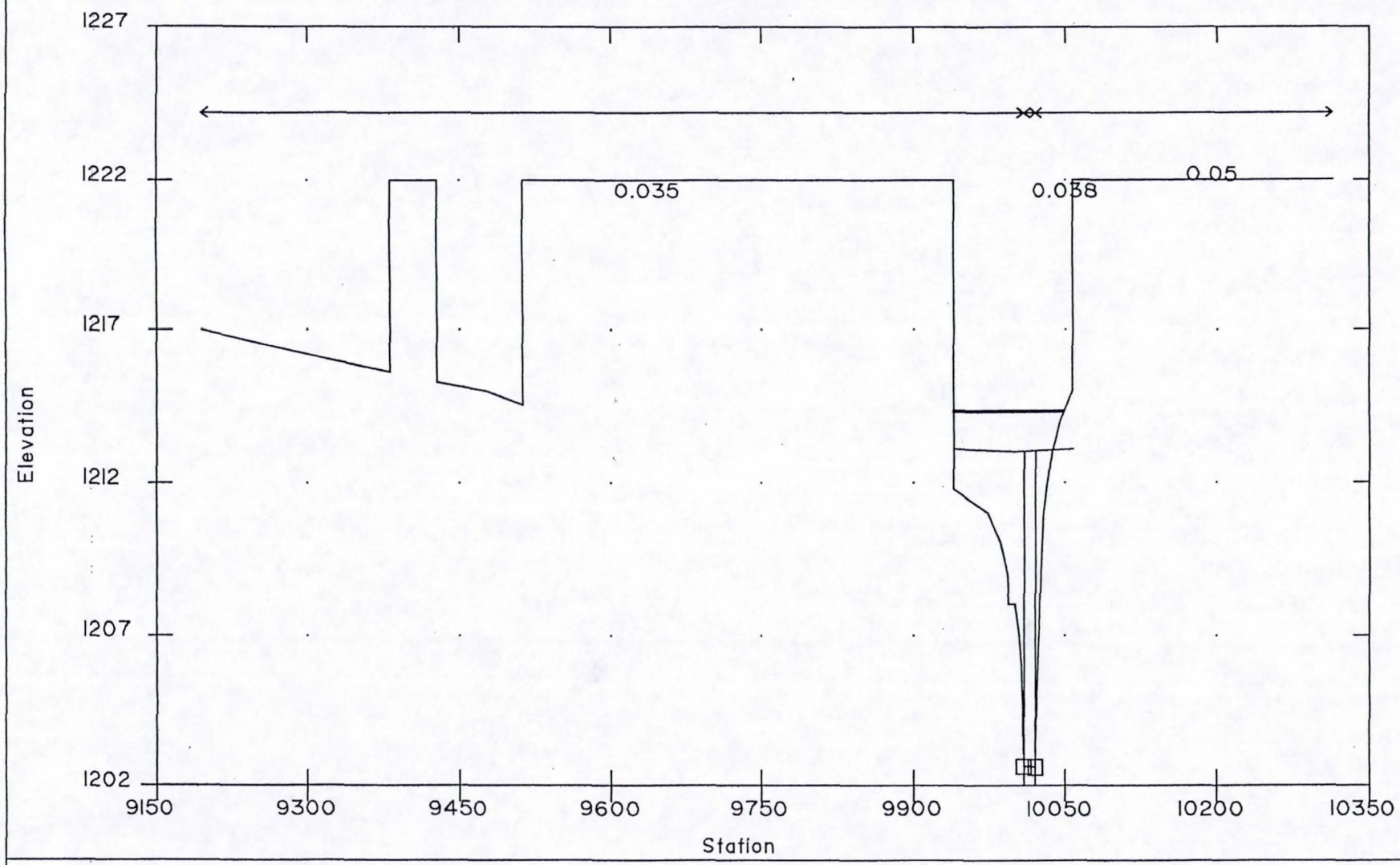
SECTION : 1.101

Granite Reef Wash
Floodplain Delineation Study



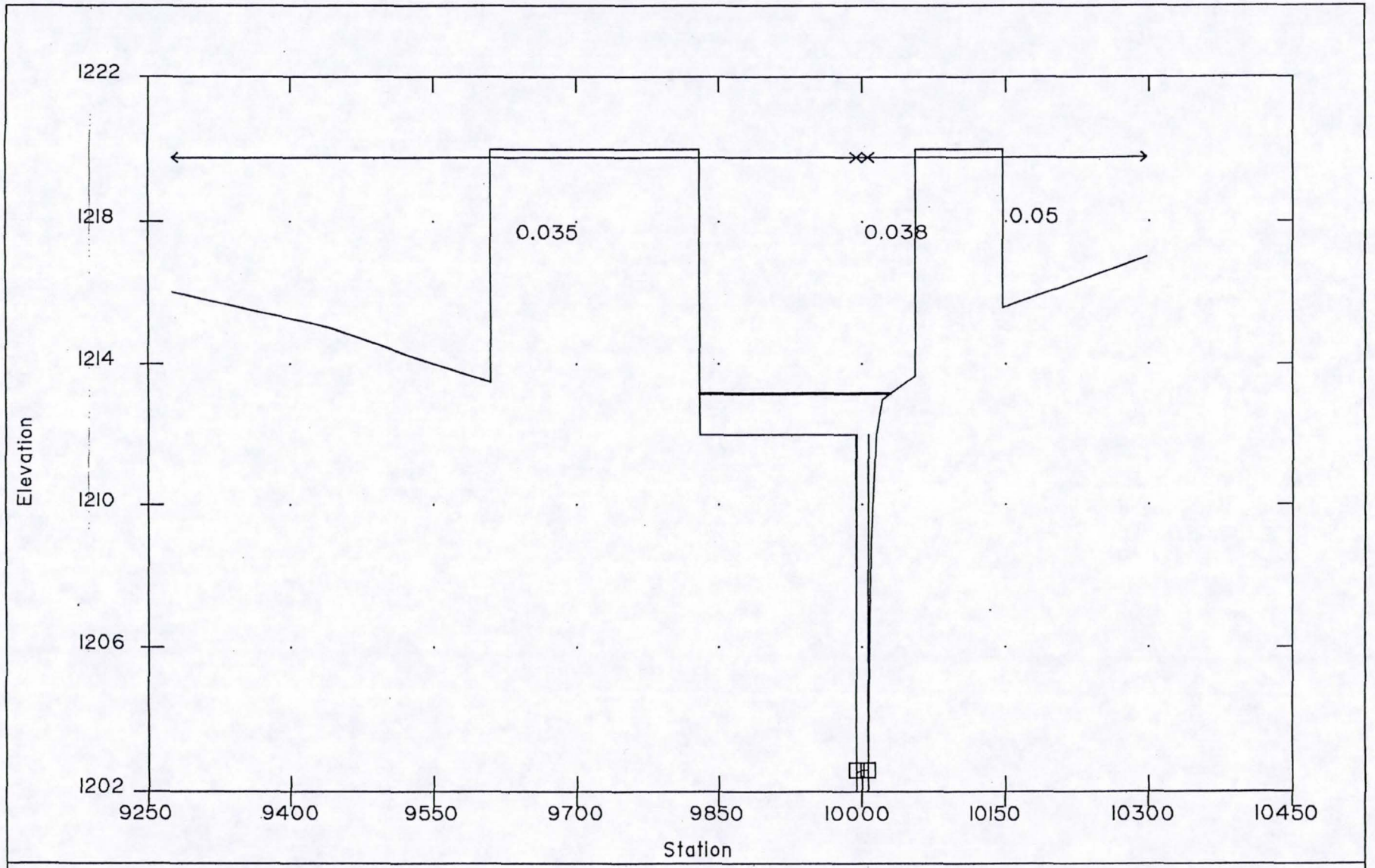
SECTION : 1.084

Granite Reef Wash
Floodplain Delineation Study



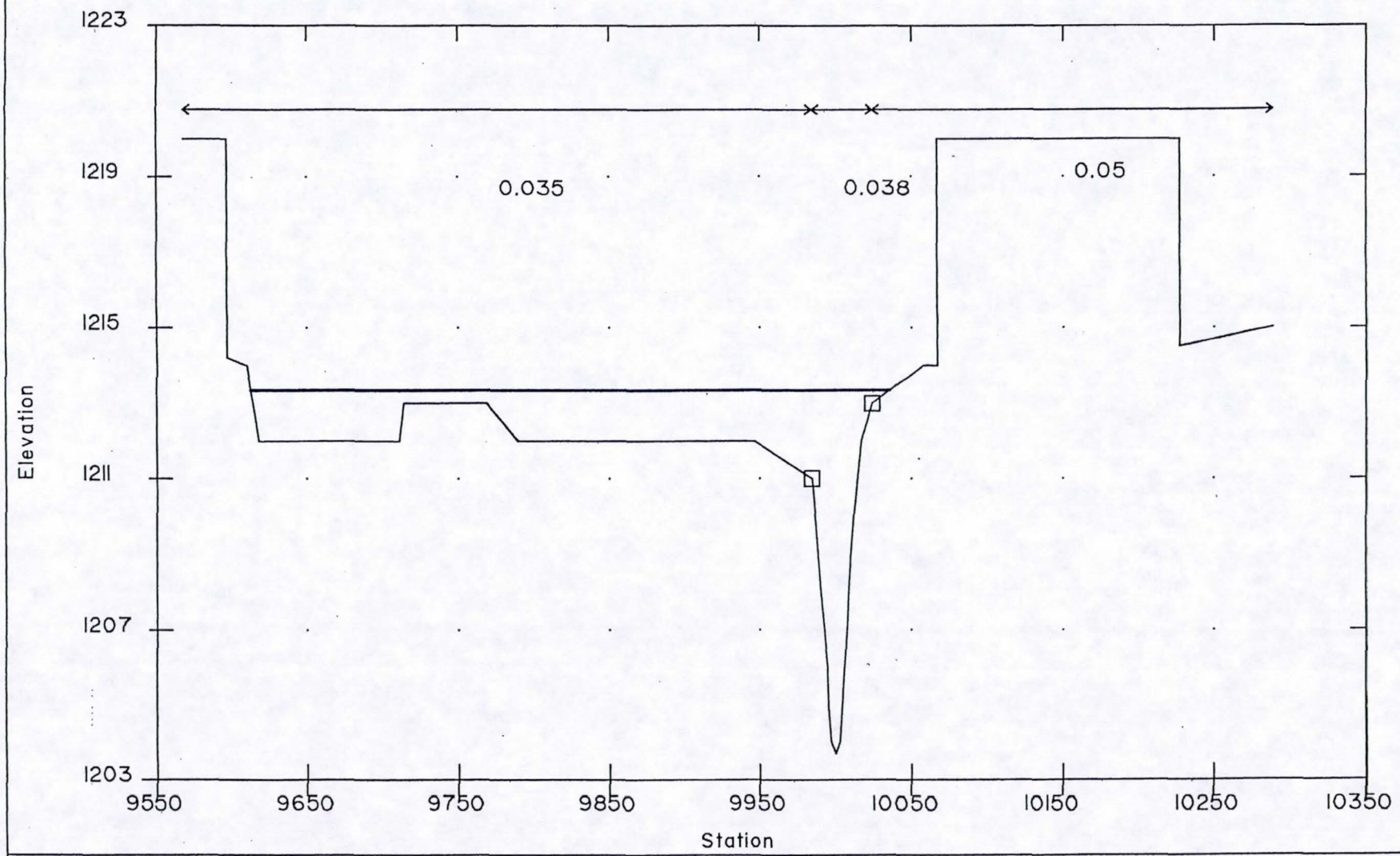
SECTION : 1.075

Granite Reef Wash
Floodplain Delineation Study



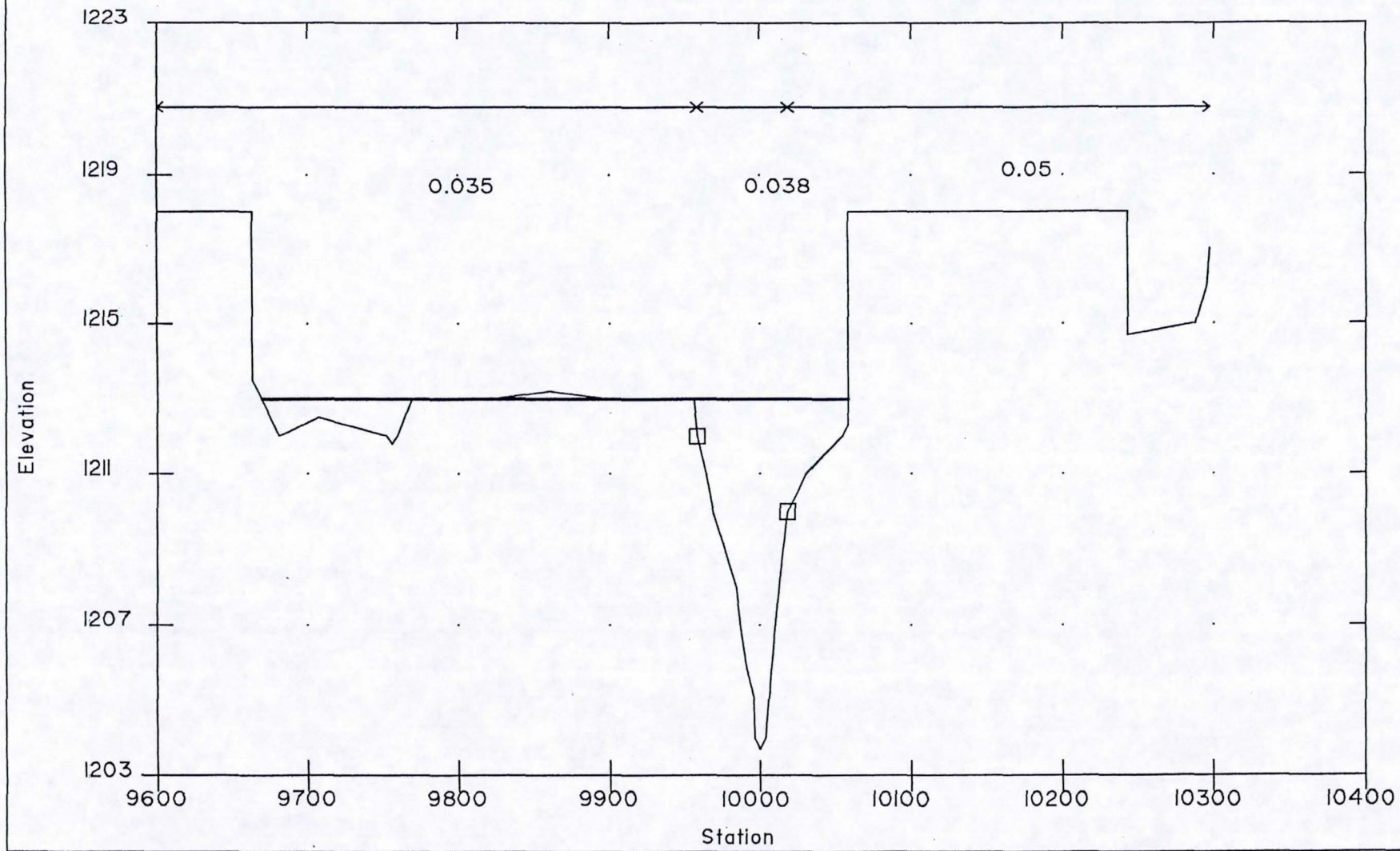
SECTION : 1.054

Granite Reef Wash
Floodplain Delineation Study



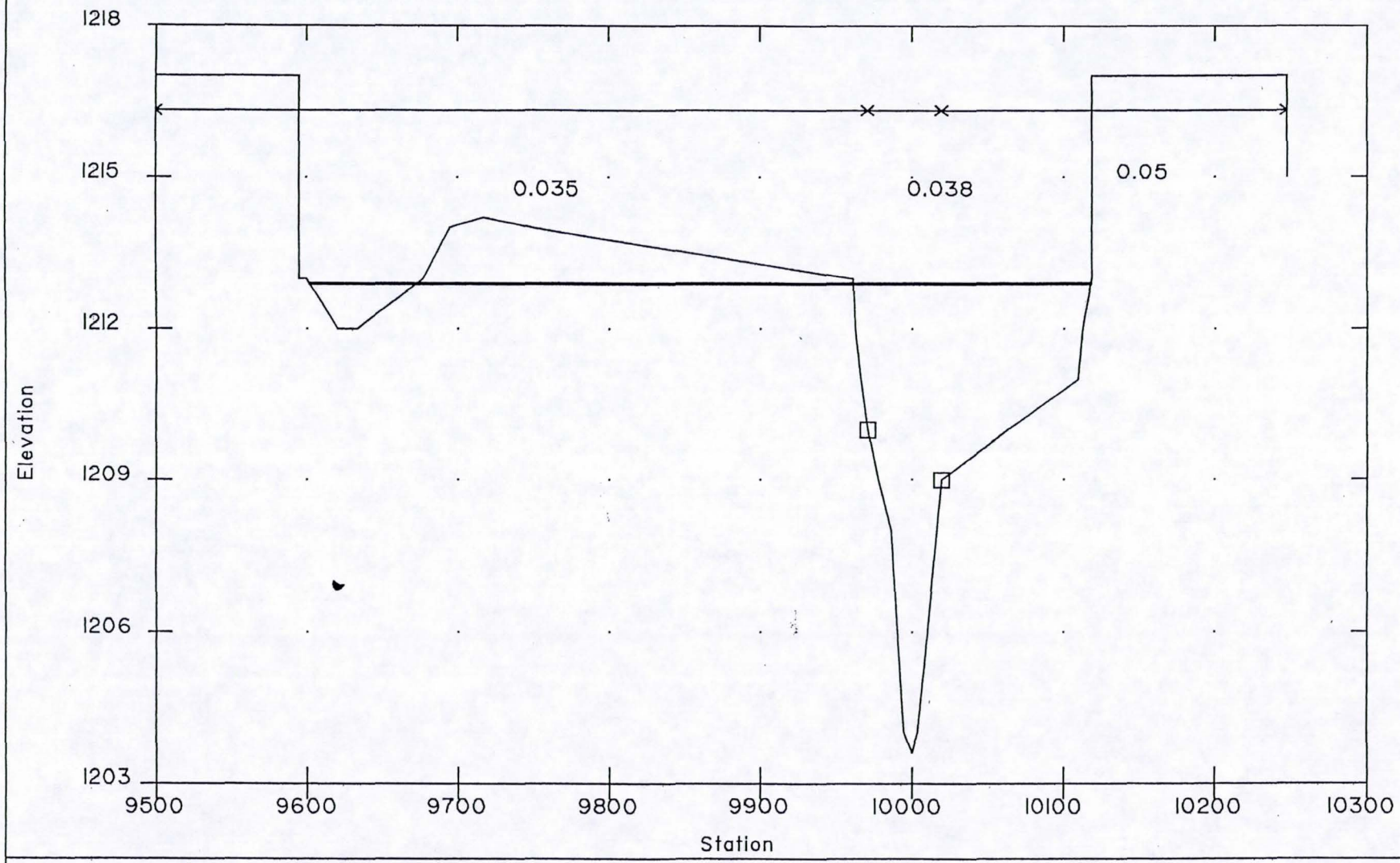
SECTION : 1.042

Granite Reef Wash
Floodplain Delineation Study



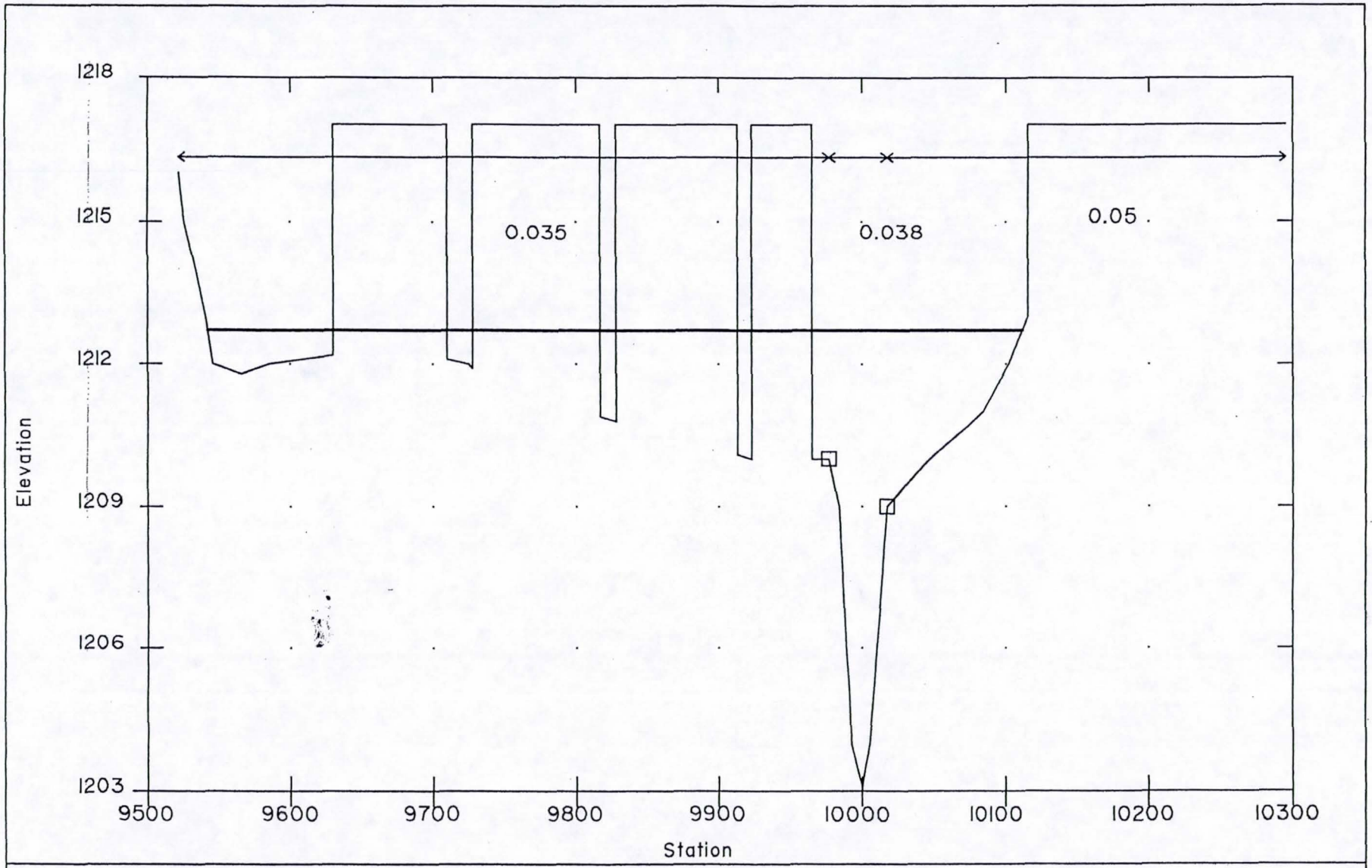
SECTION : 1.001

Granite Reef Wash
Floodplain Delineation Study



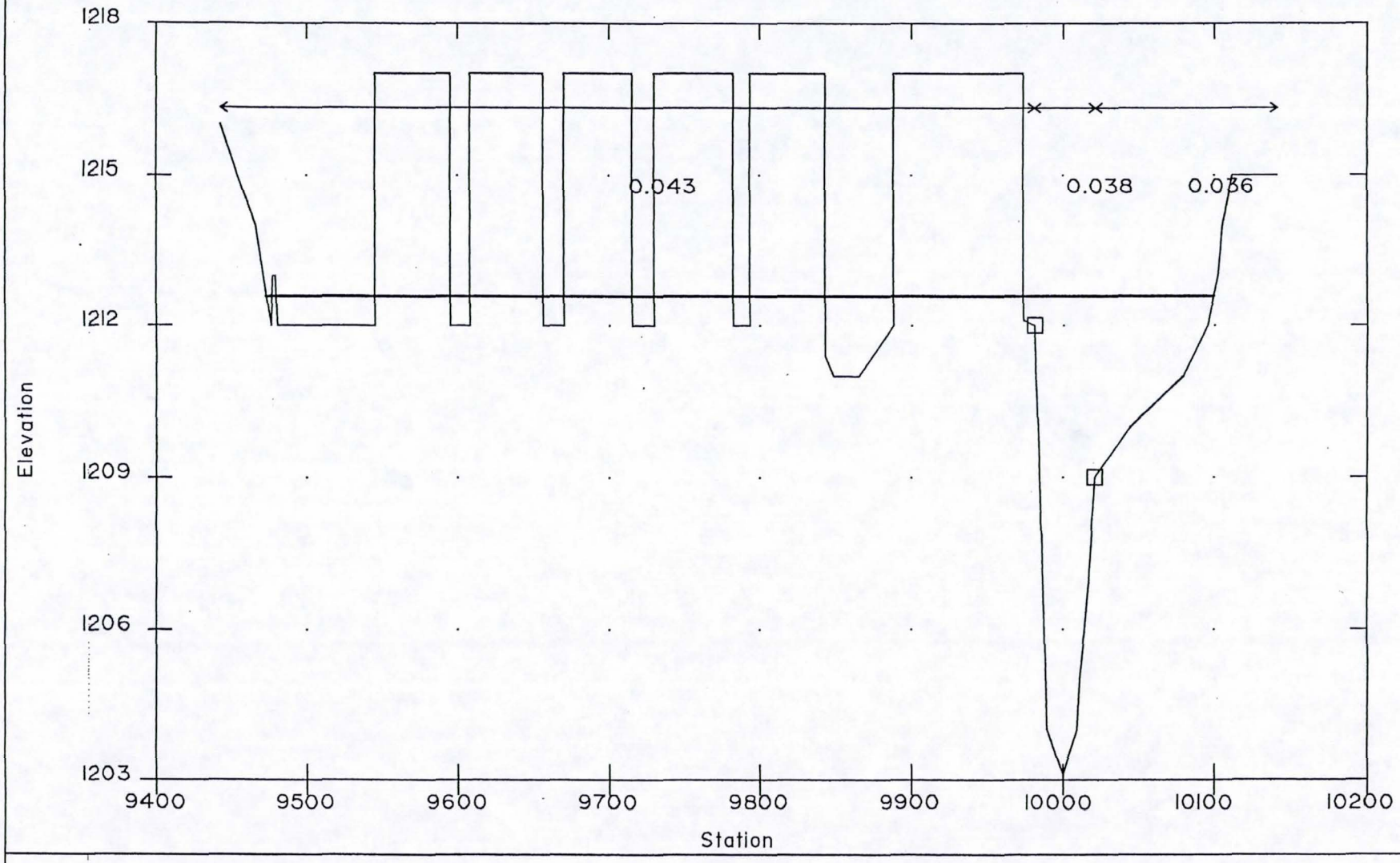
SECTION : 0.966

Granite Reef Wash
Floodplain Delineation Study



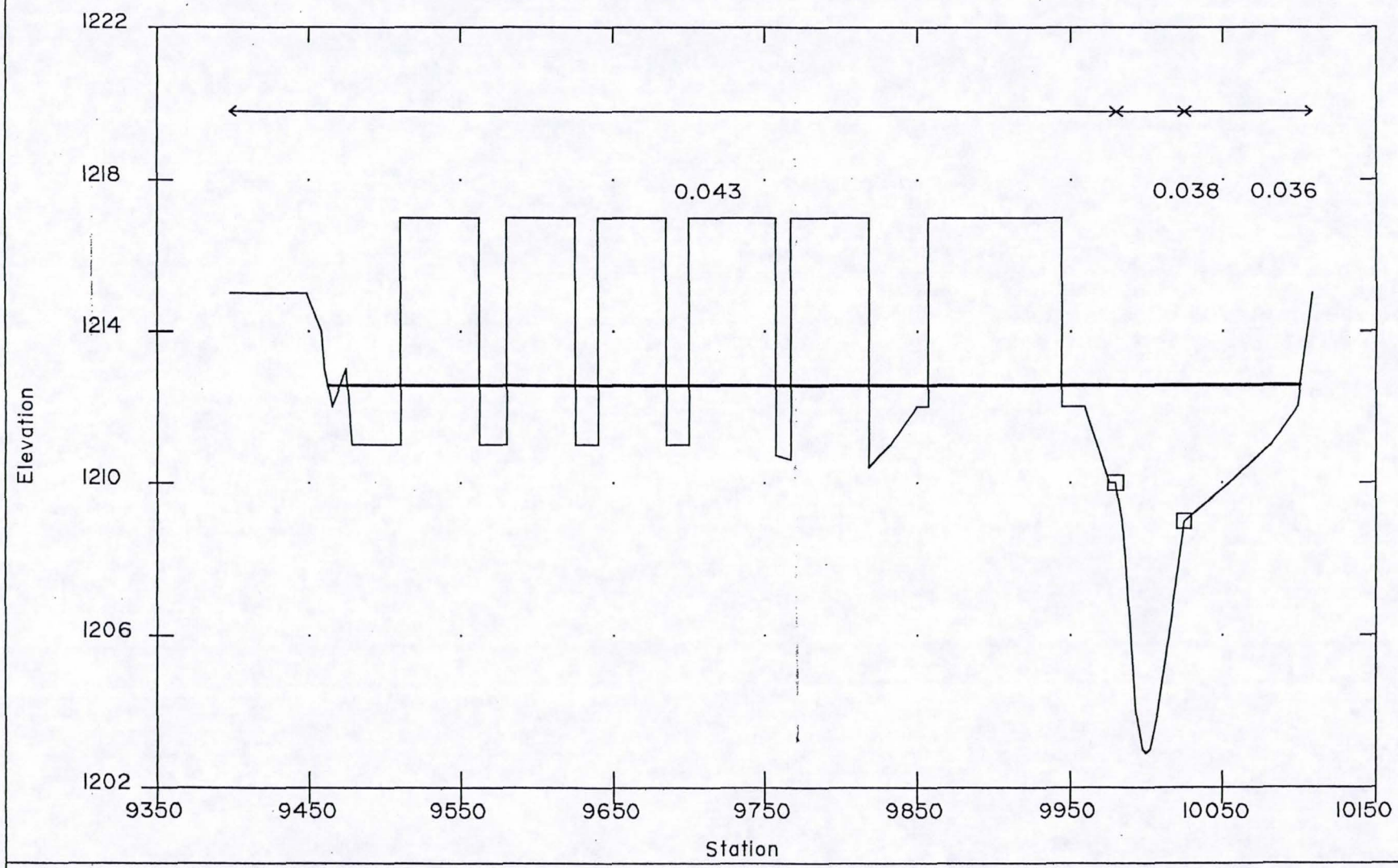
SECTION : 0.915

Granite Reef Wash
Floodplain Delineation Study



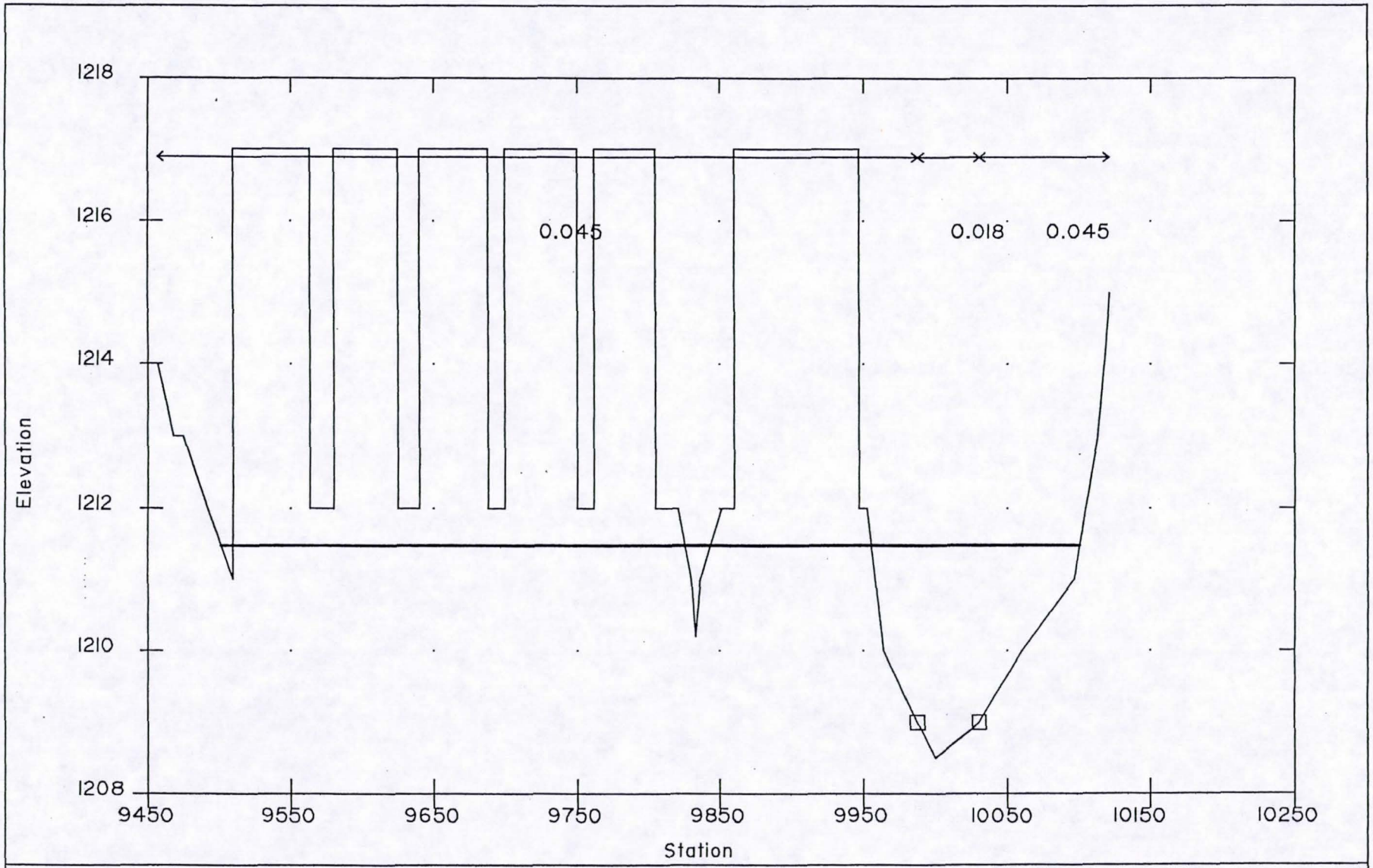
SECTION : 0.883

Granite Reef Wash
Floodplain Delineation Study



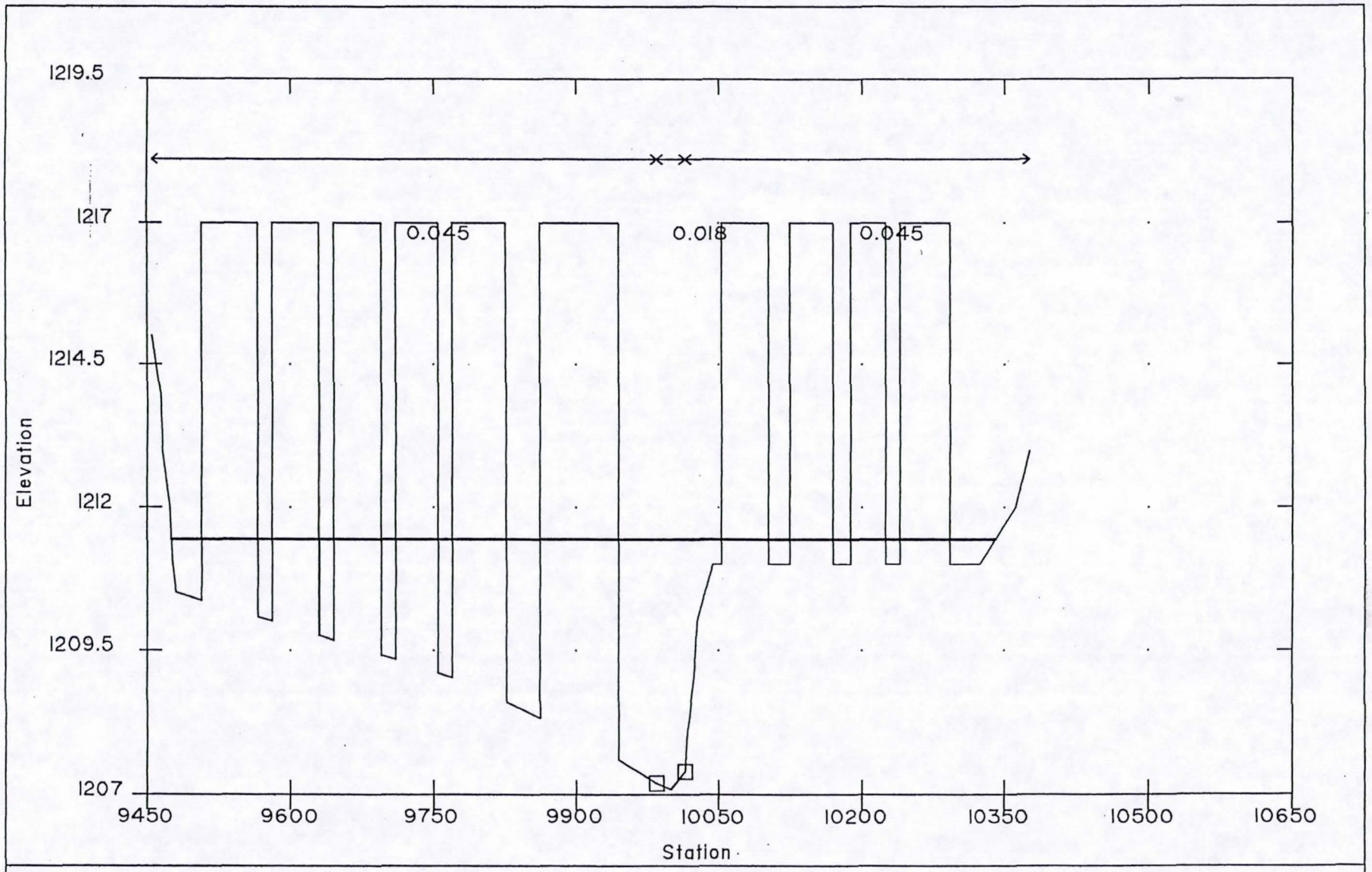
SECTION : 0.865

Granite Reef Wash
Floodplain Delineation Study



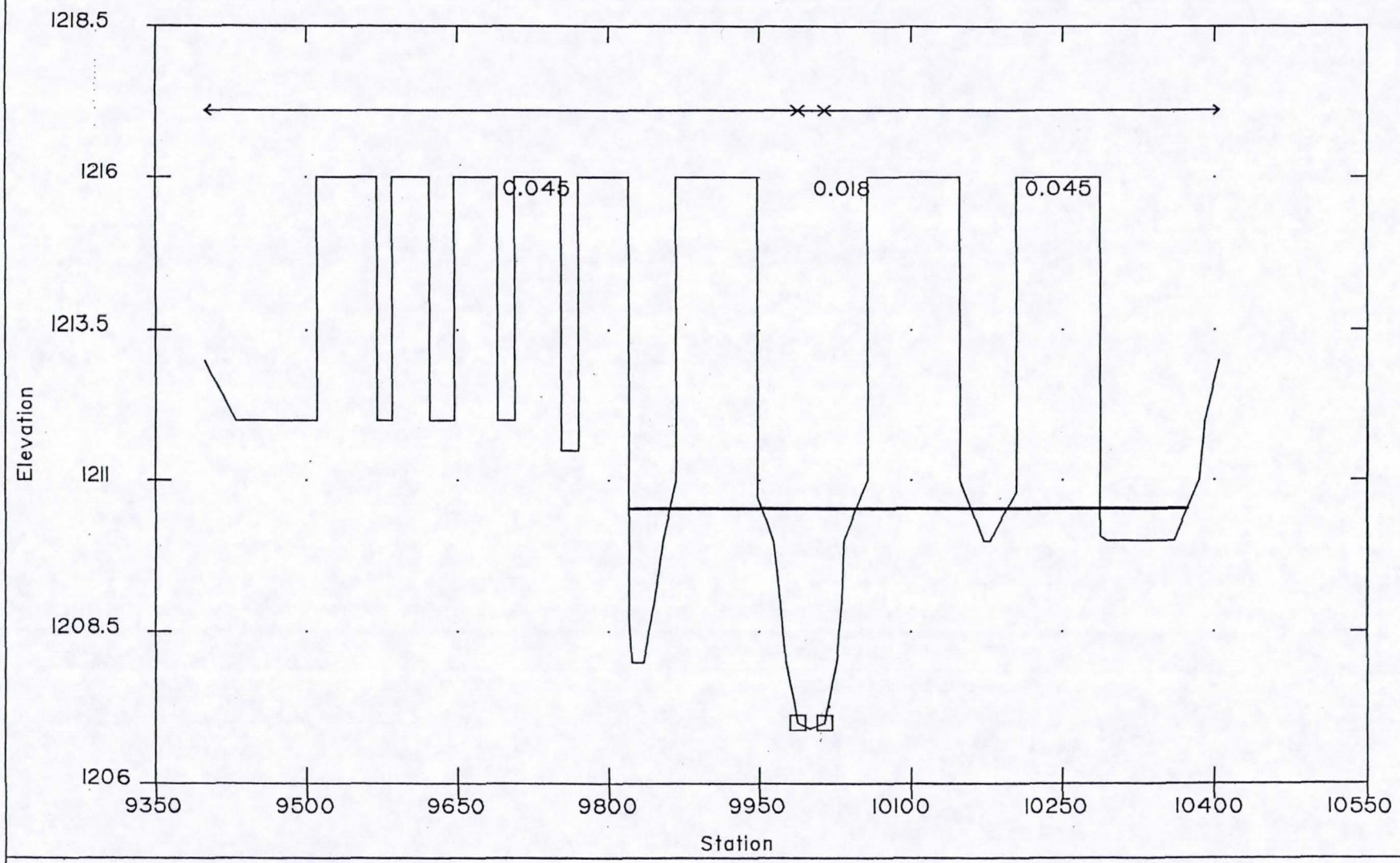
SECTION : 0.857

Granite Reef Wash
Floodplain Delineation Study



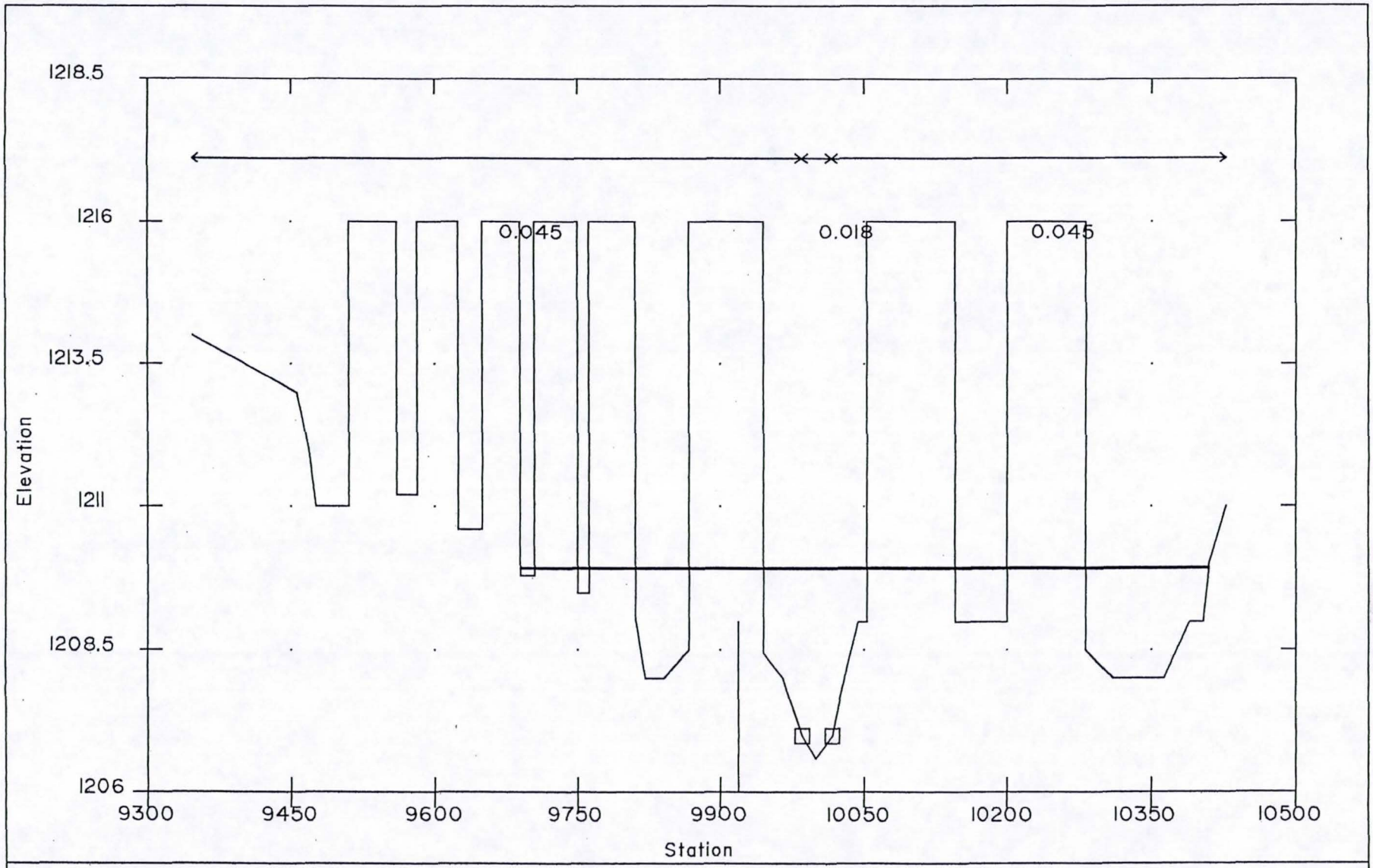
SECTION : 0.821

Granite Reef Wash
Floodplain Delineation Study



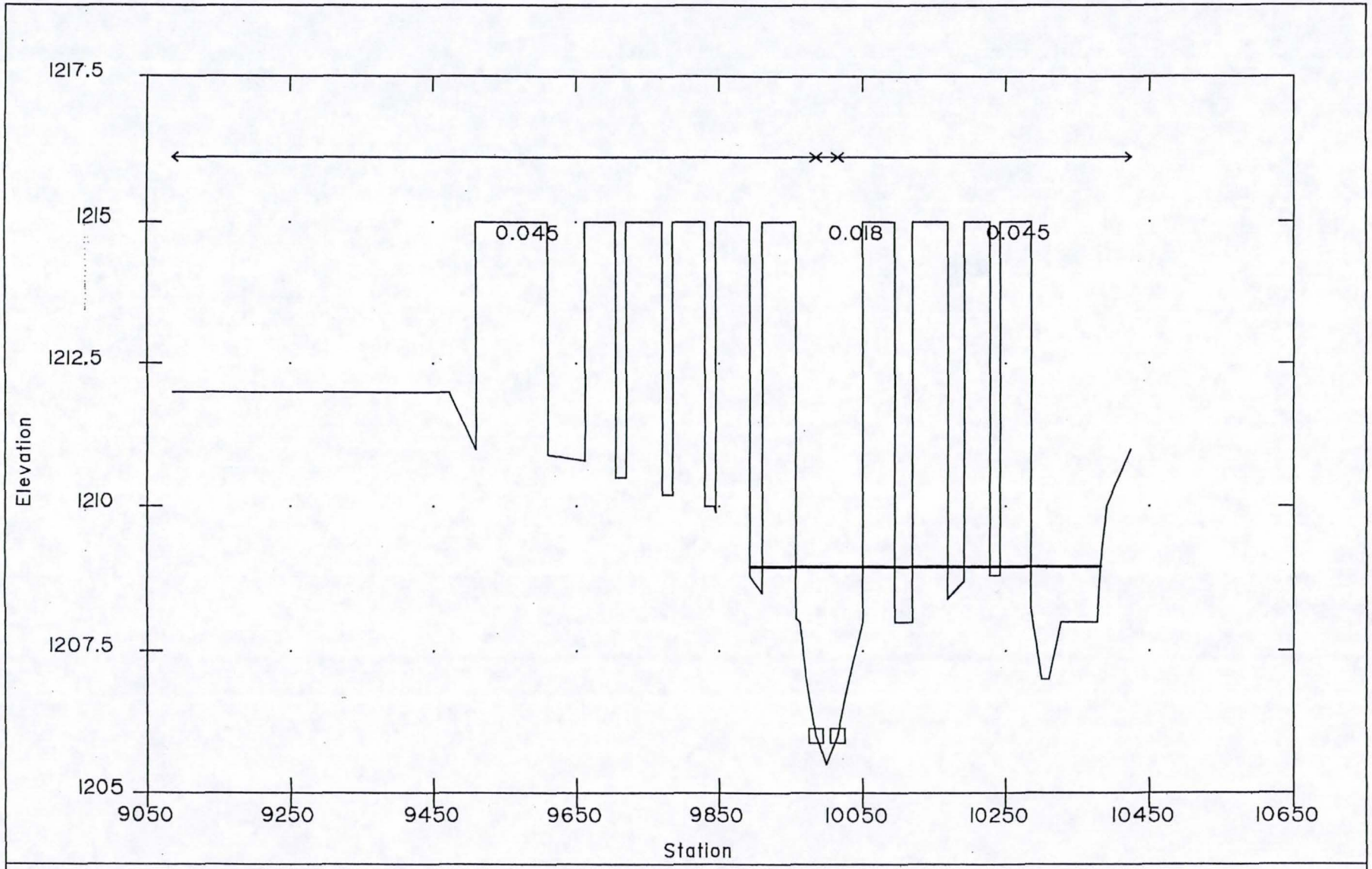
SECTION : 0.786

Granite Reef Wash
Floodplain Delineation Study



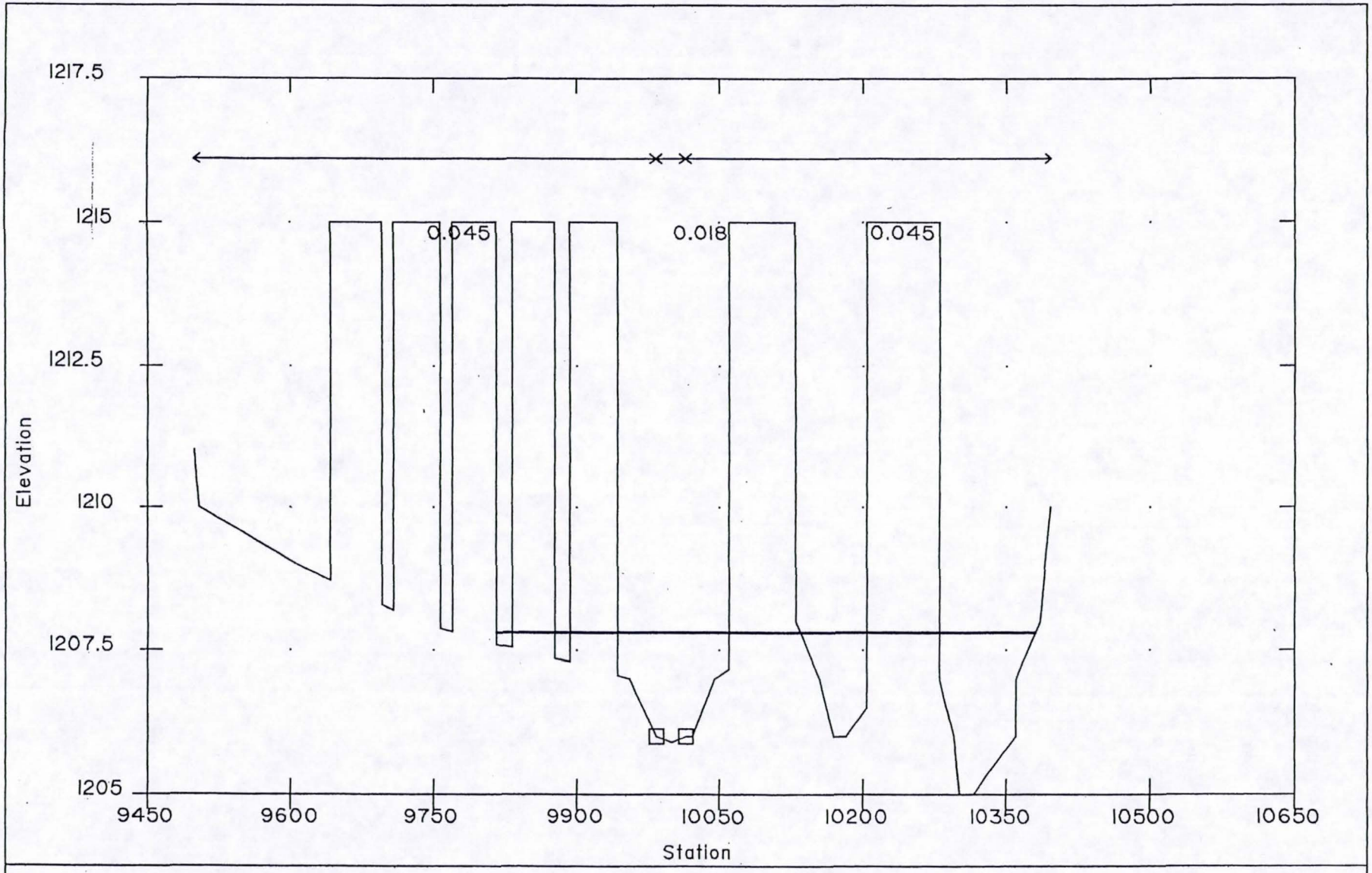
SECTION : 0.729

Granite Reef Wash
Floodplain Delineation Study



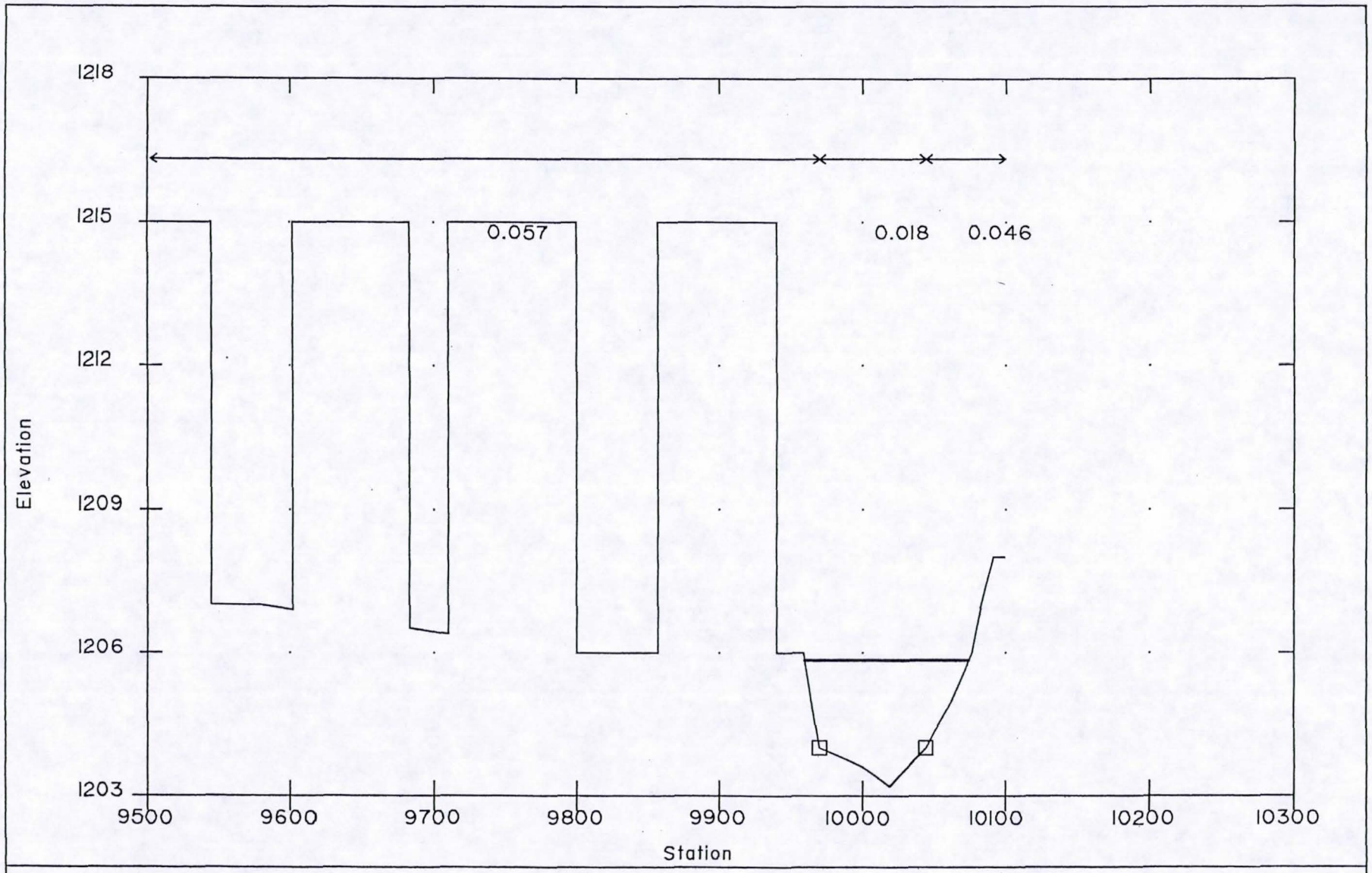
SECTION : 0.674

Granite Reef Wash
Floodplain Delineation Study



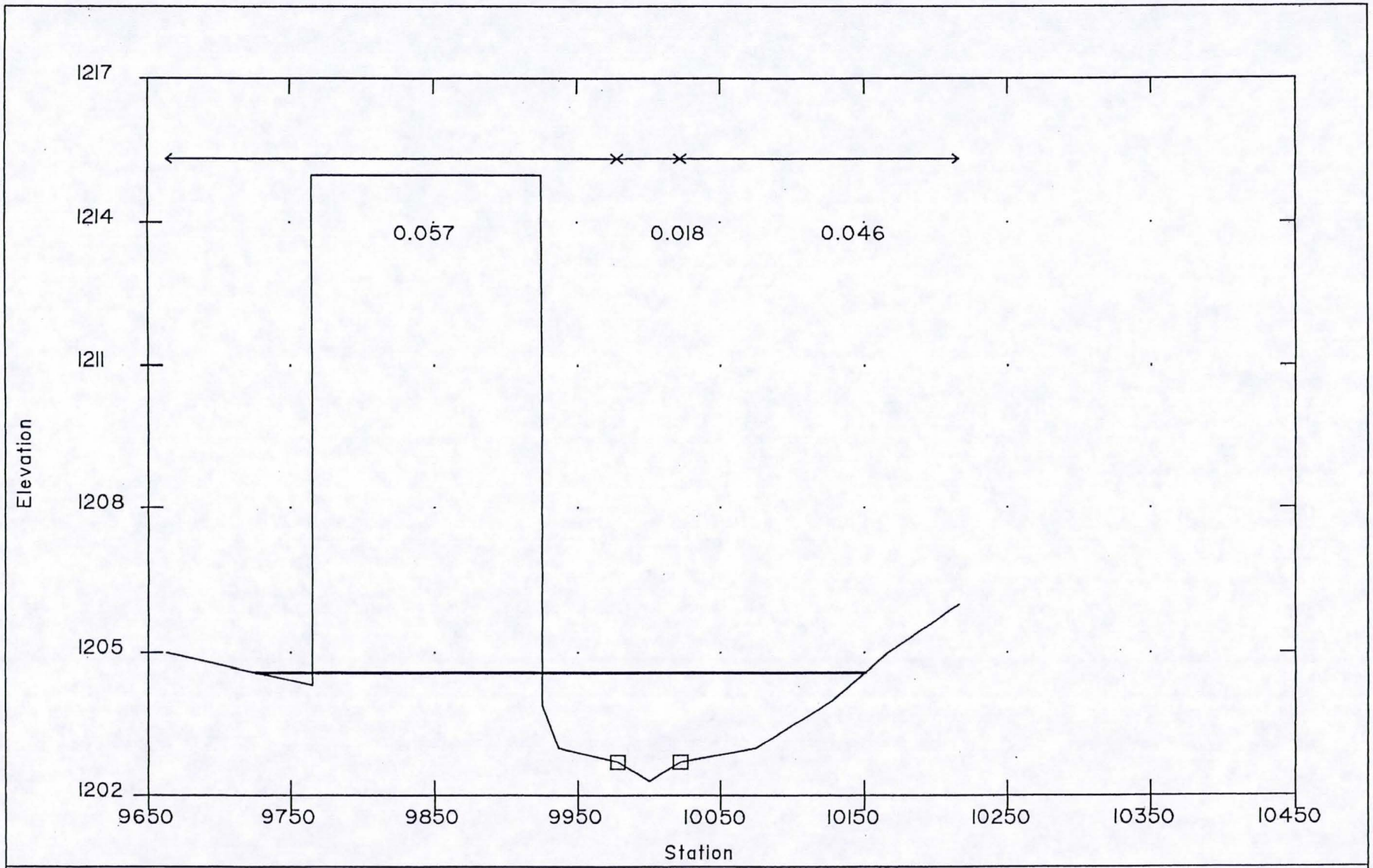
SECTION : 0.627

Granite Reef Wash
Floodplain Delineation Study



SECTION : 0.542

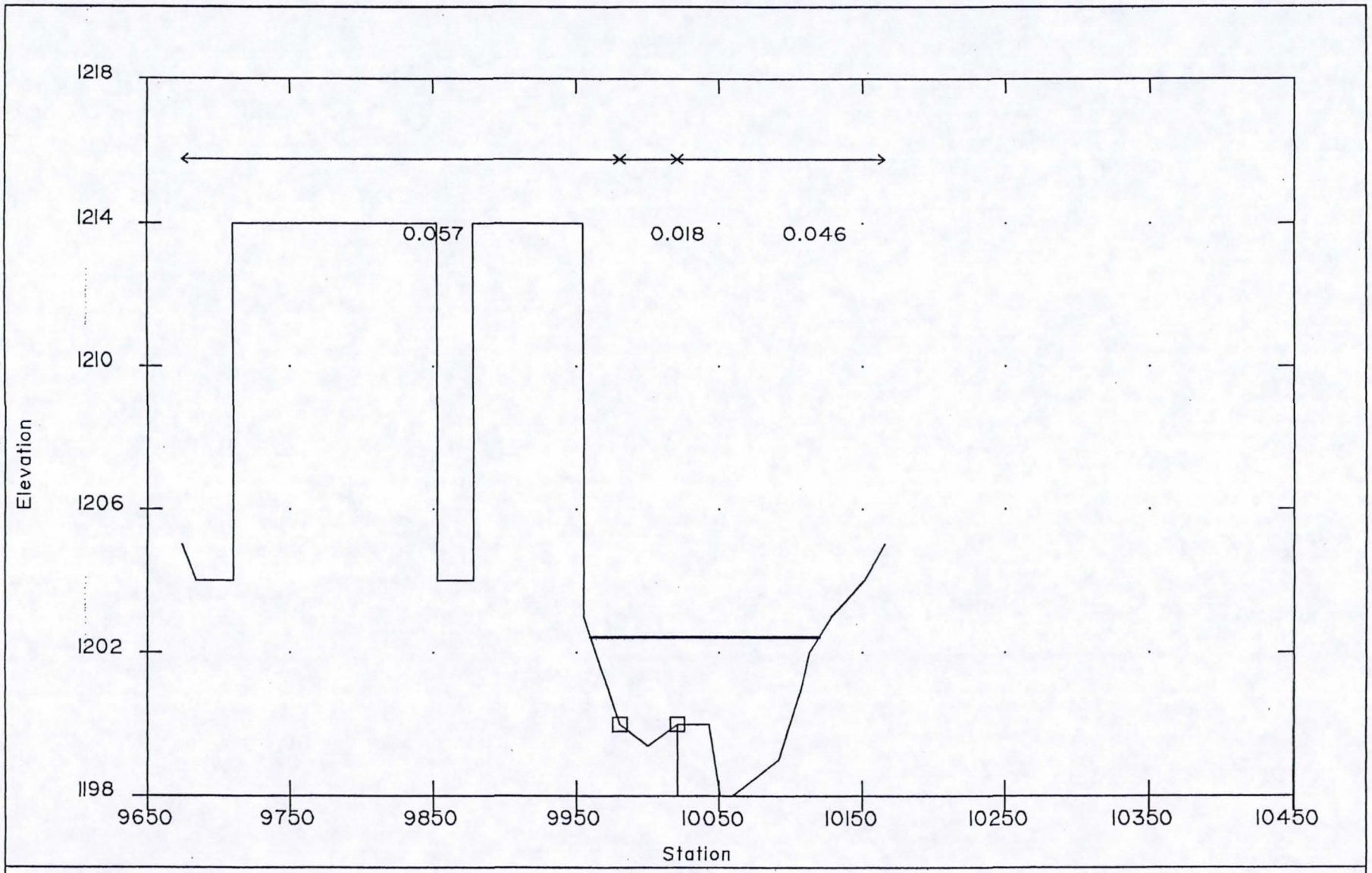
Granite Reef Wash
Floodplain Delineation Study



SECTION : 0.503

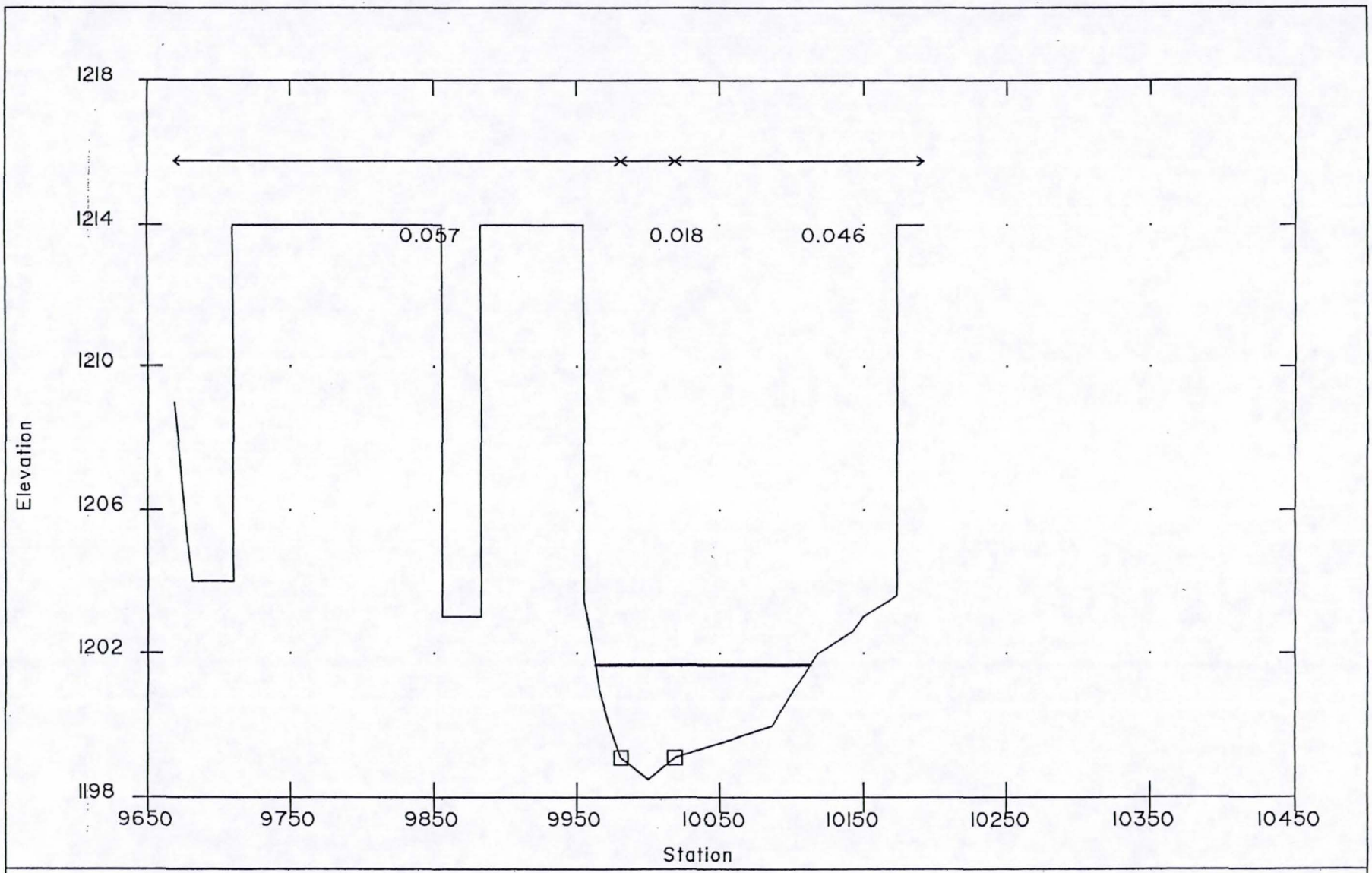
ROOSEVELT STREET

Granite Reef Wash
Floodplain Delineation Study



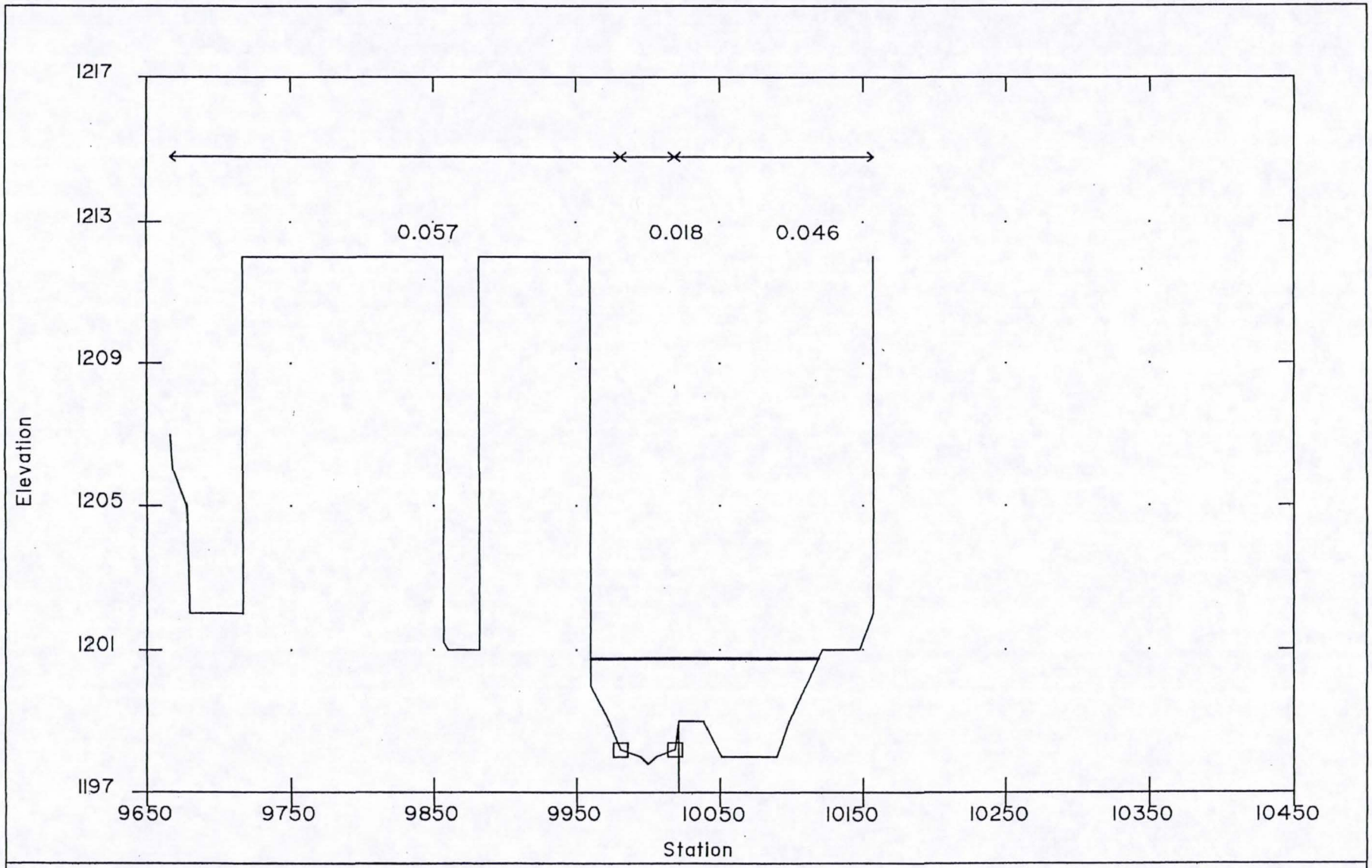
SECTION : 0.459

Granite Reef Wash
Floodplain Delineation Study



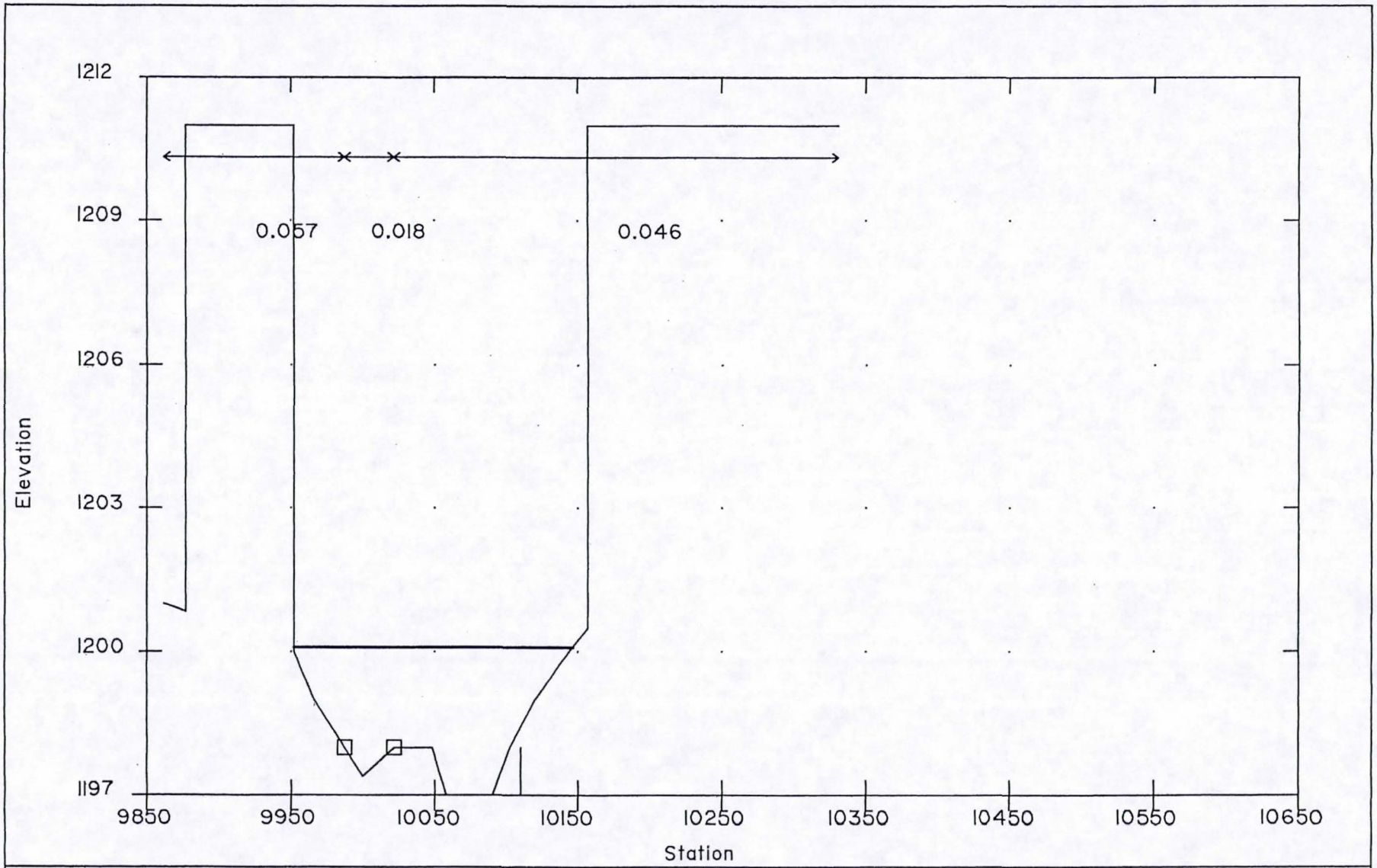
SECTION : 0.421

Granite Reef Wash
Floodplain Delineation Study



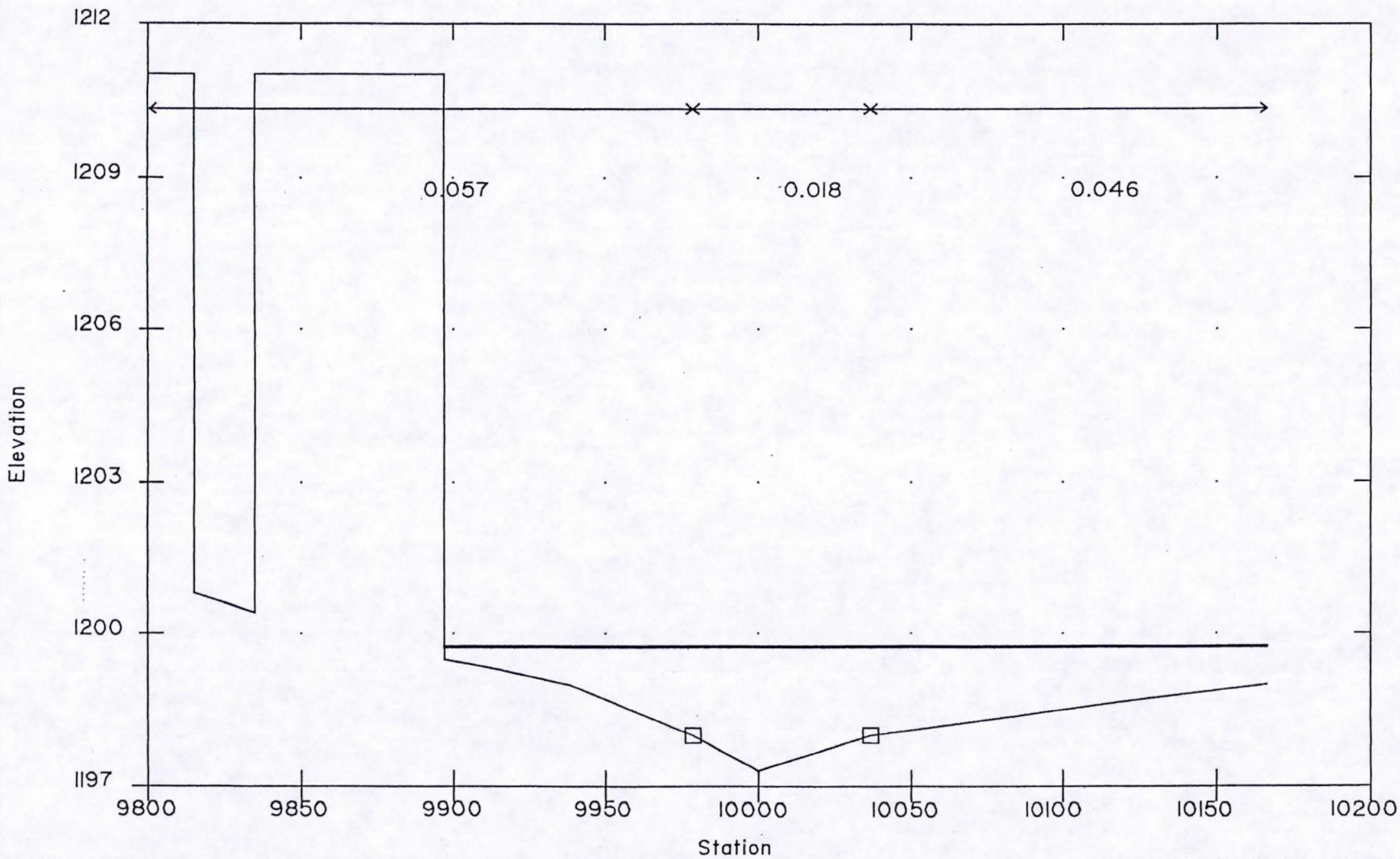
SECTION : 0.369

Granite Reef Wash
Floodplain Delineation Study



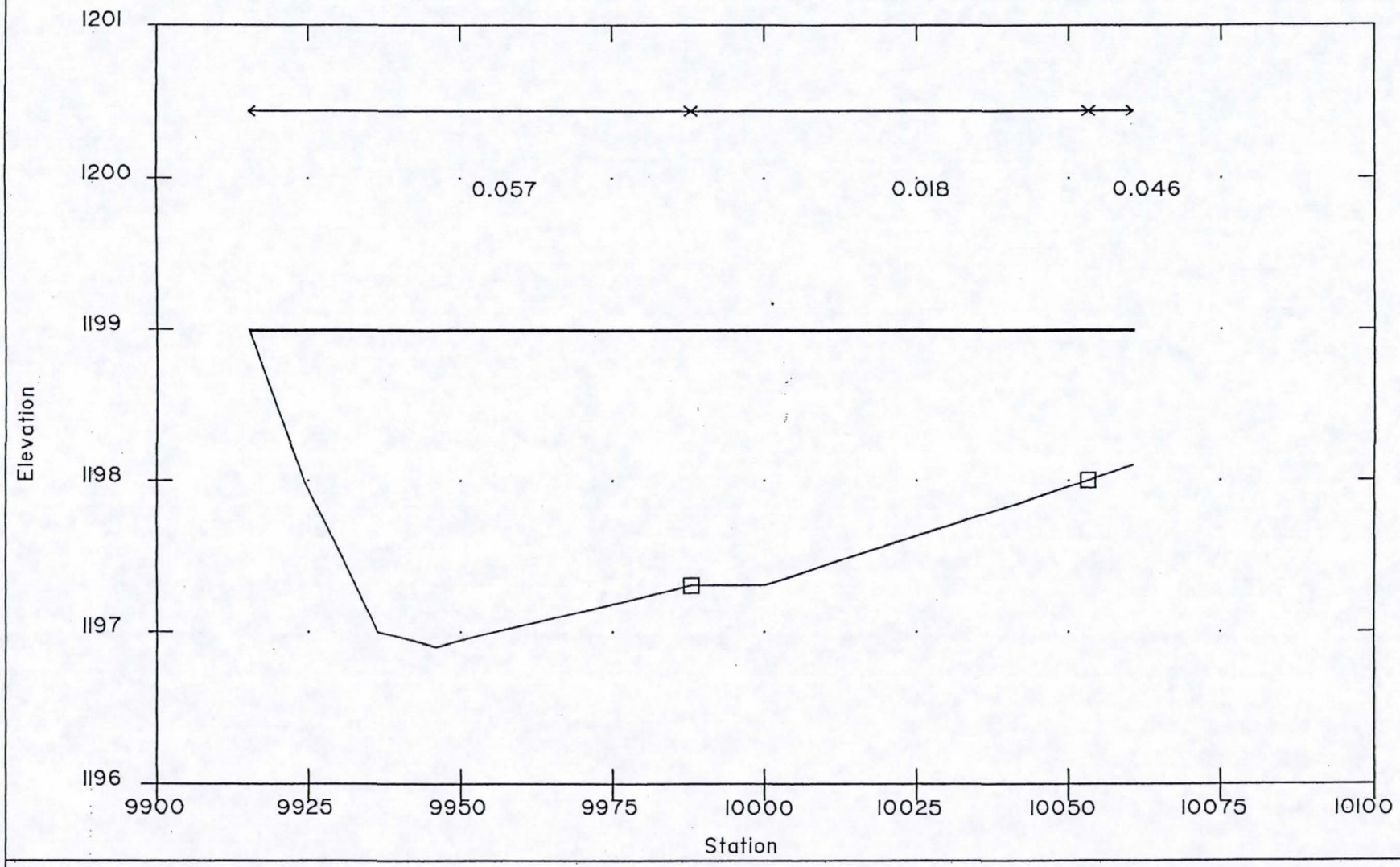
SECTION : 0.326

Granite Reef Wash
Floodplain Delineation Study



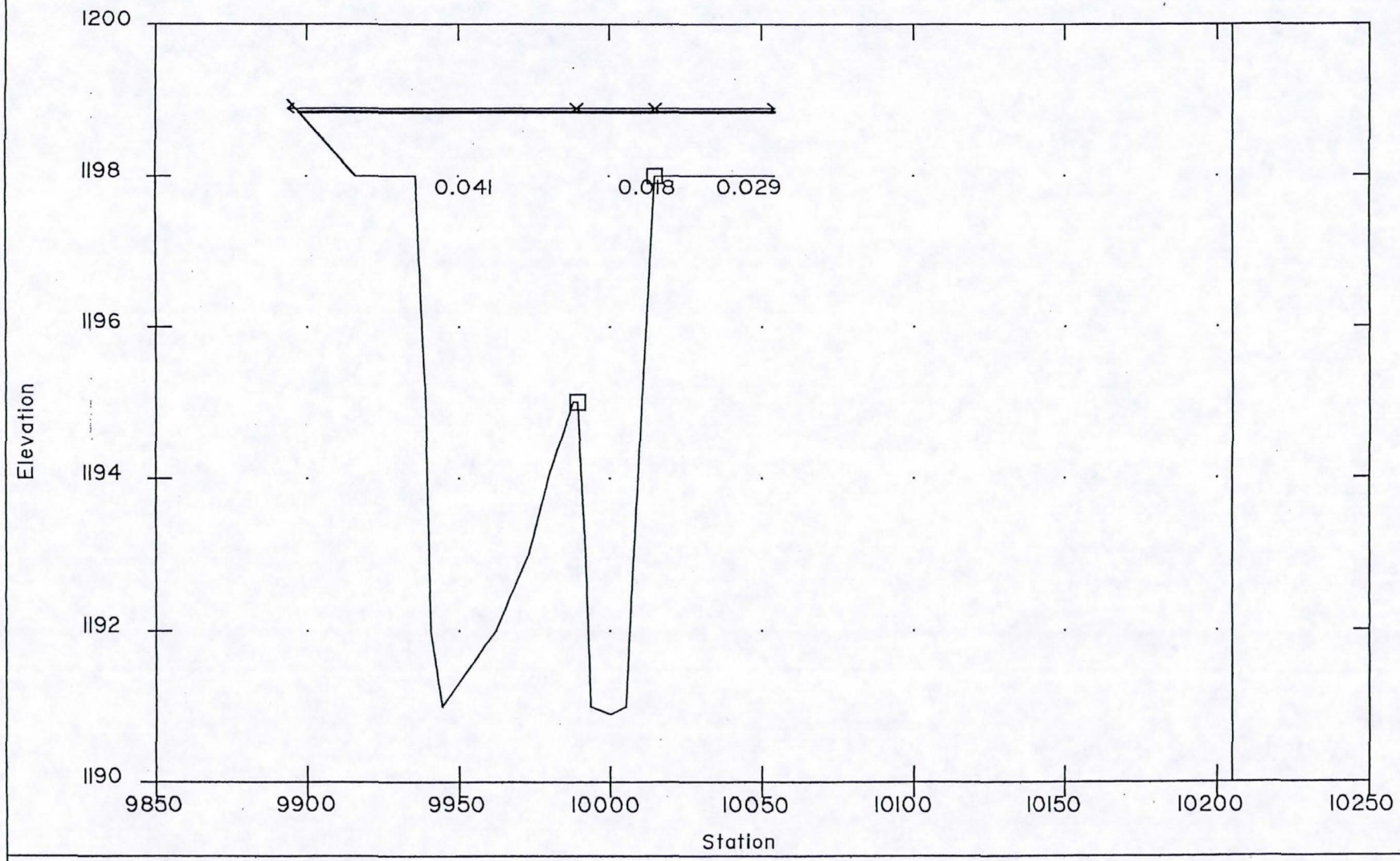
SECTION : 0.320

Granite Reef Wash
Floodplain Delineation Study



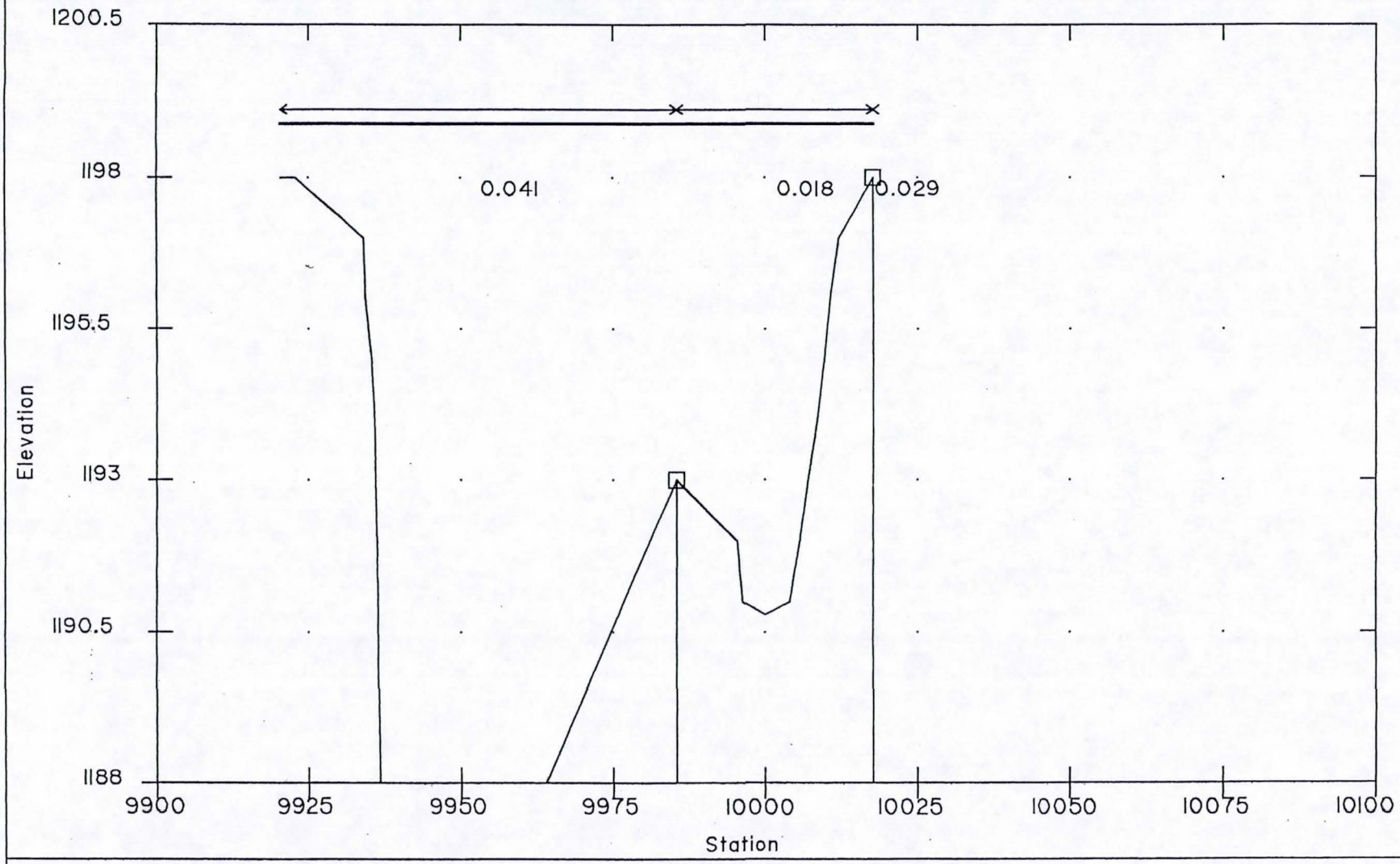
SECTION : 0.303

Granite Reef Wash
Floodplain Delineation Study



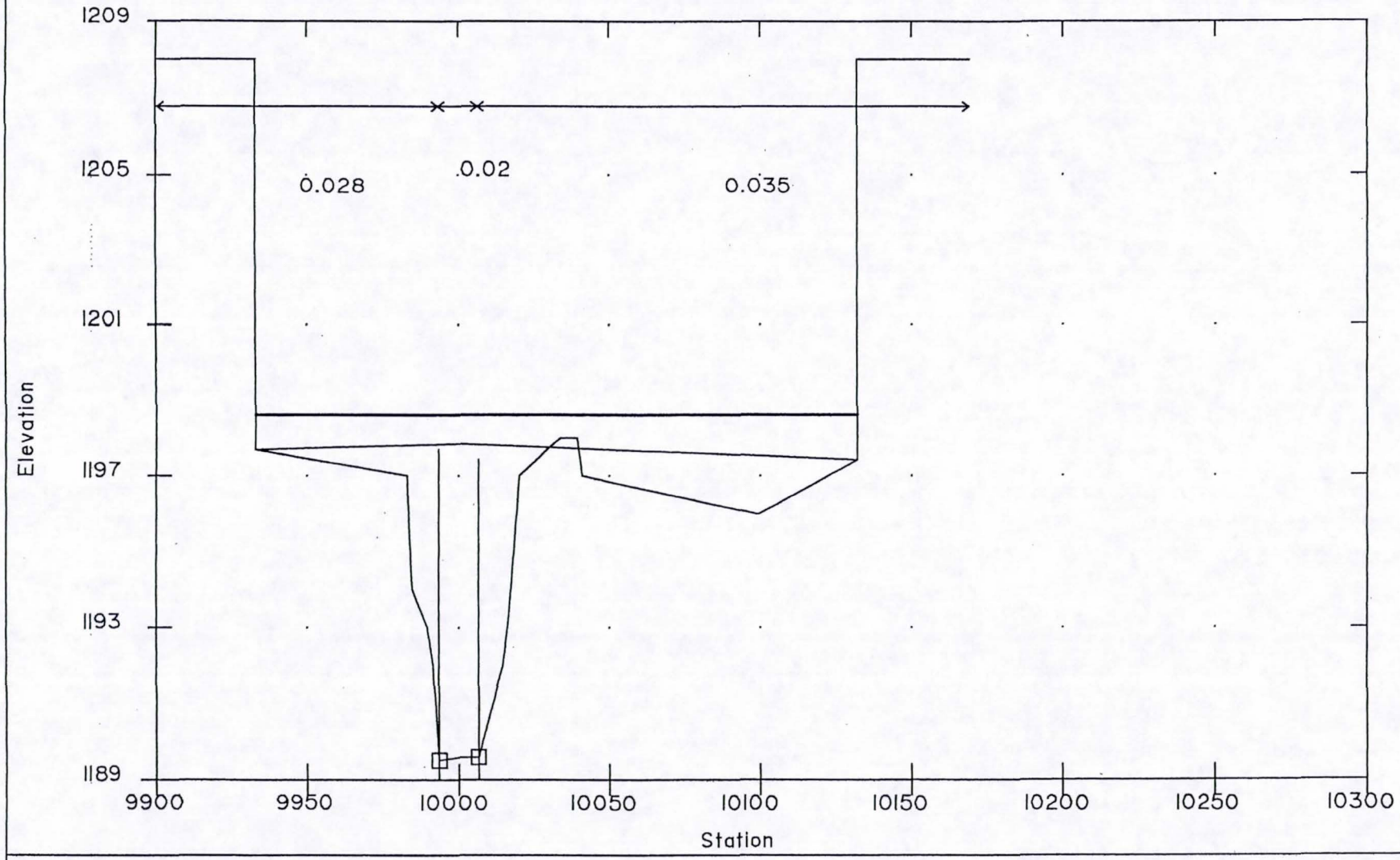
SECTION : 0.288

Granite Reef Wash
Floodplain Delineation Study



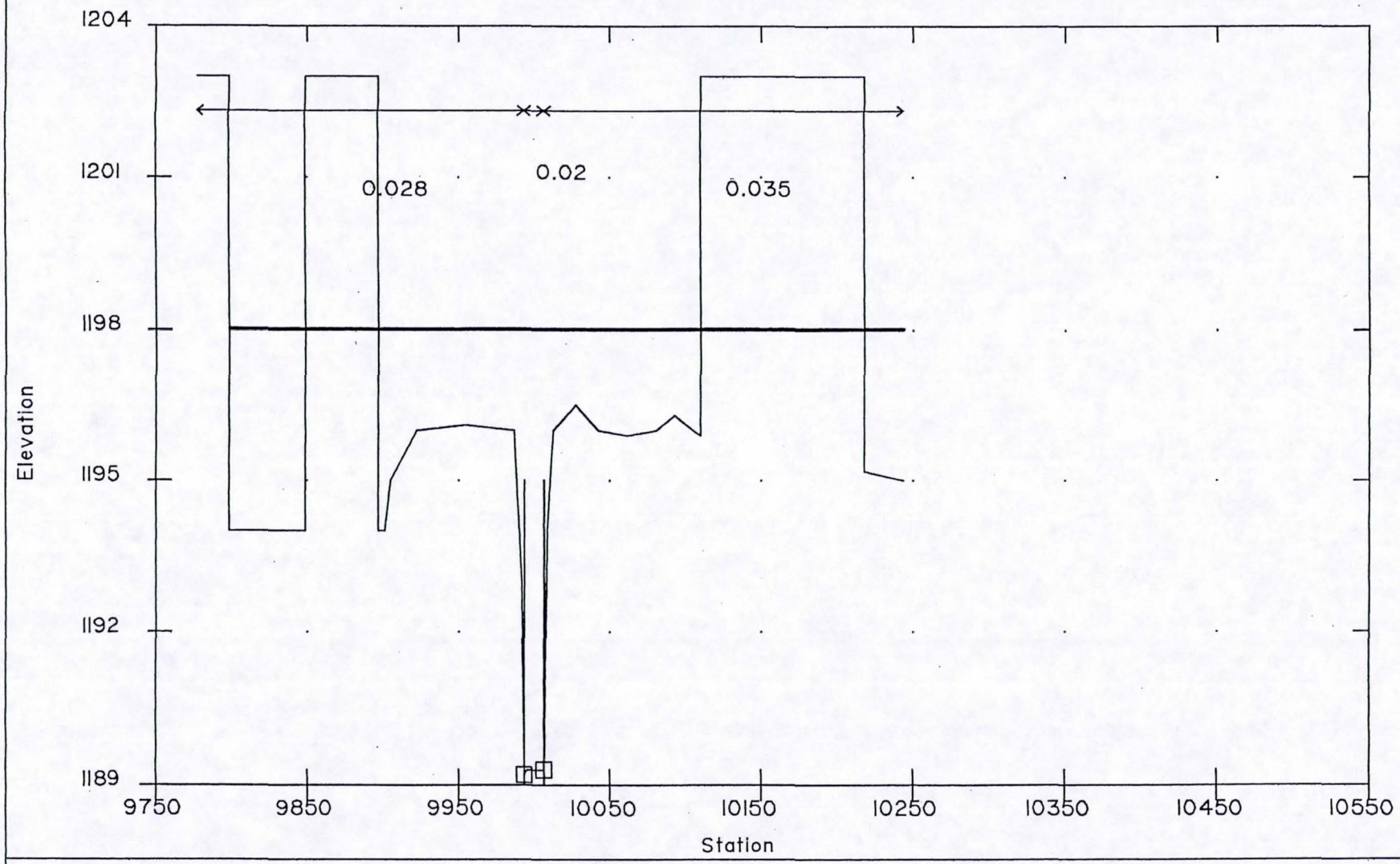
SECTION : 0.272

Granite Reef Wash
Floodplain Delineation Study



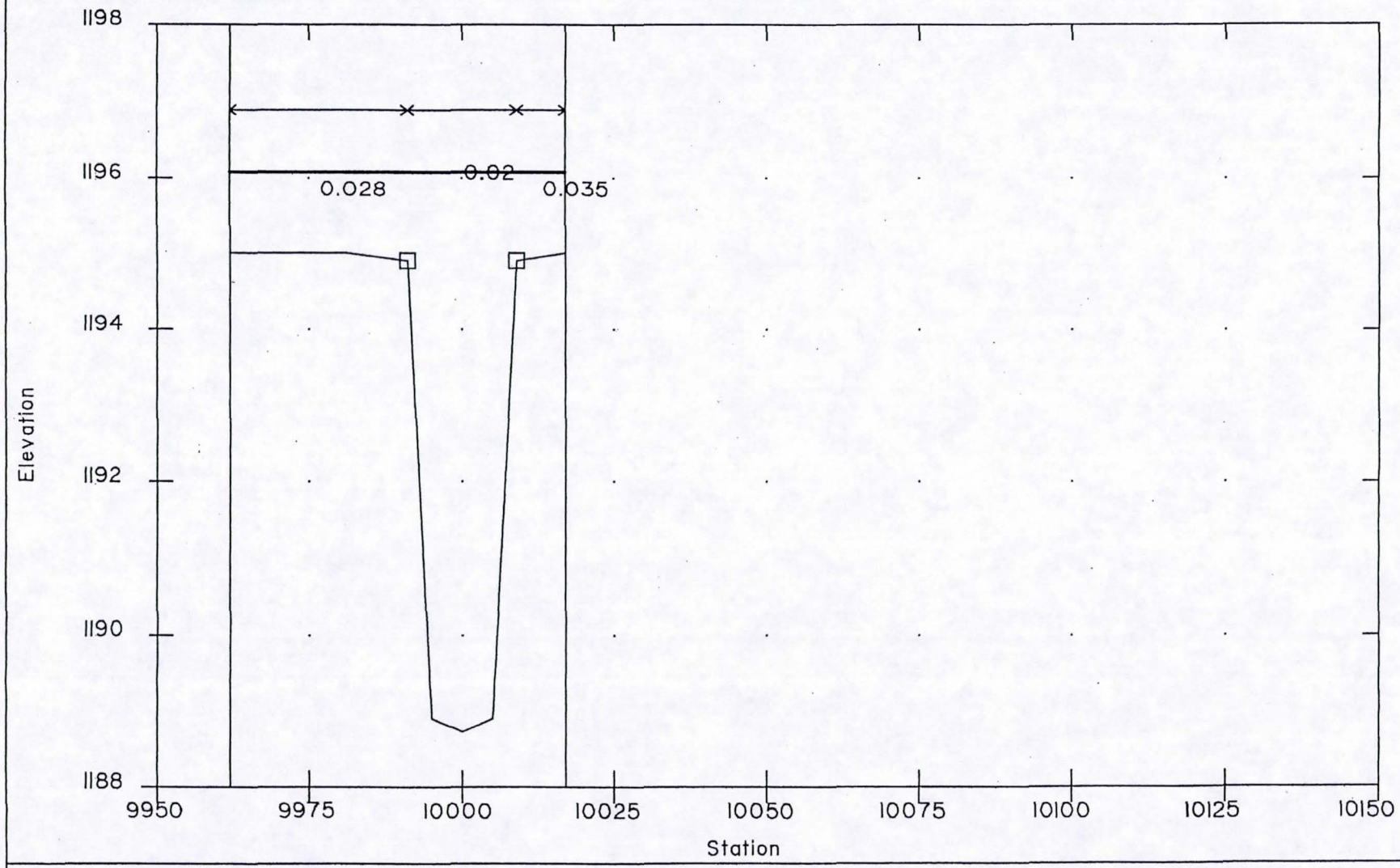
SECTION : 0.257

Granite Reef Wash
Floodplain Delineation Study



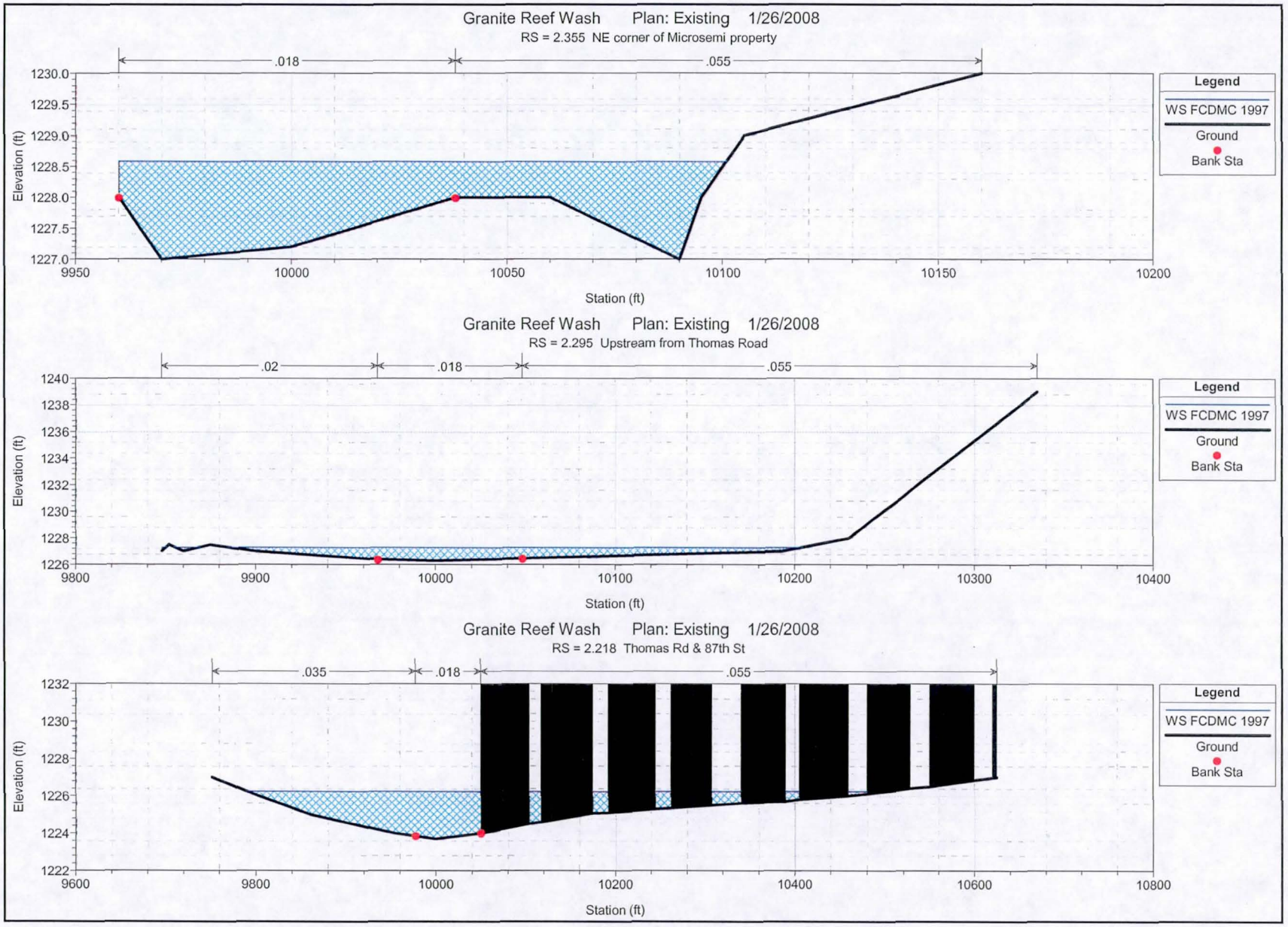
SECTION : 0.231

Granite Reef Wash
Floodplain Delineation Study

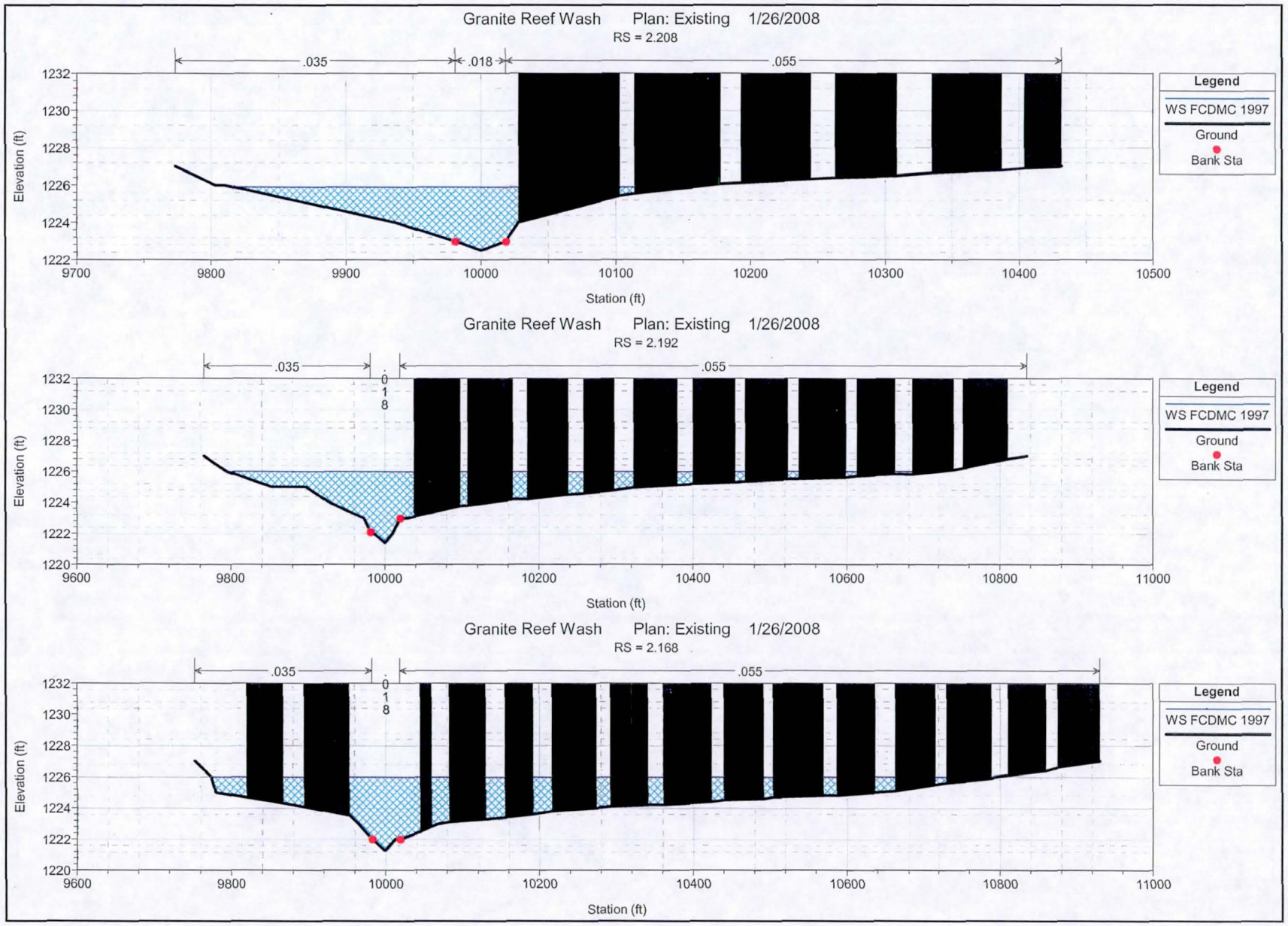


SECTION : 0.225

Granite Reef Wash
Floodplain Delineation Study

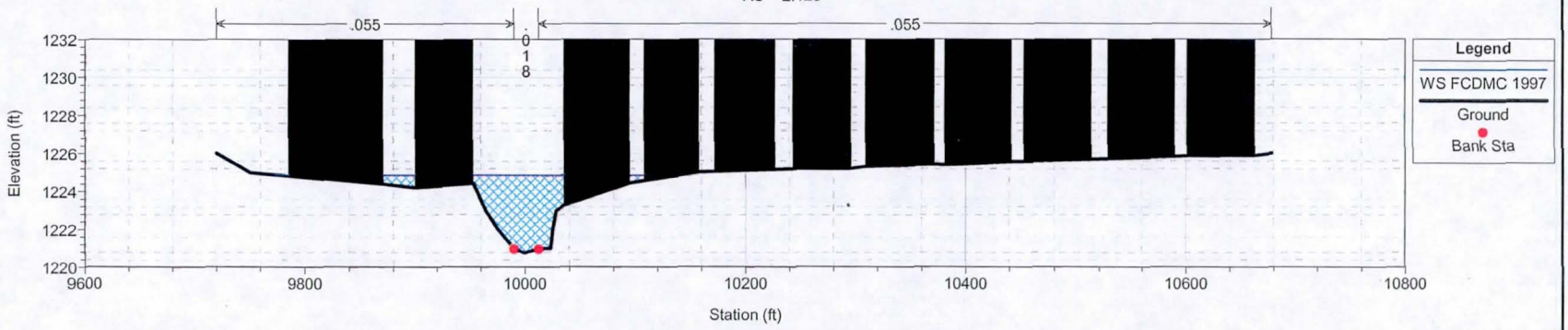


HEC-RAS CROSS-SECTIONS


Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.208
.035
.018
.055
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.192
.035
.018
.055
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.168
.035
.018
.055
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta

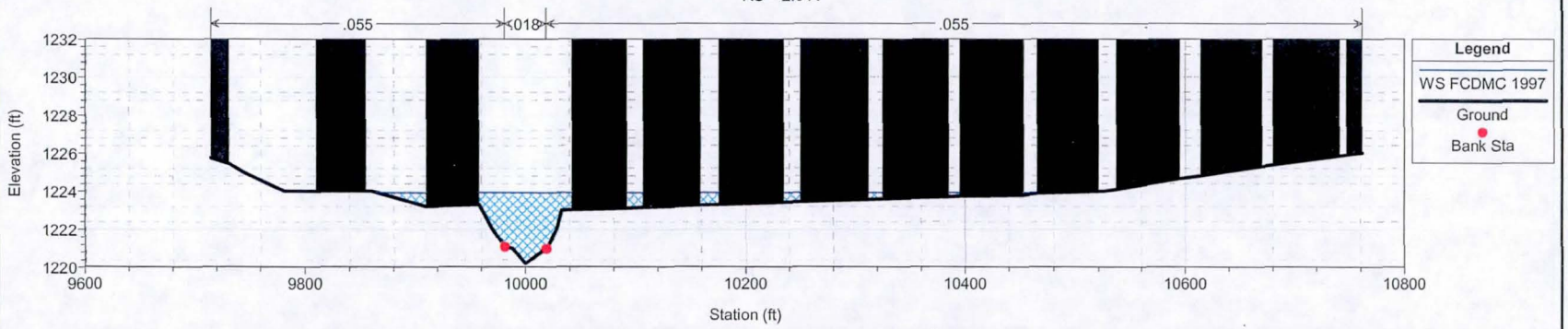
Granite Reef Wash Plan: Existing 1/26/2008

RS = 2.128



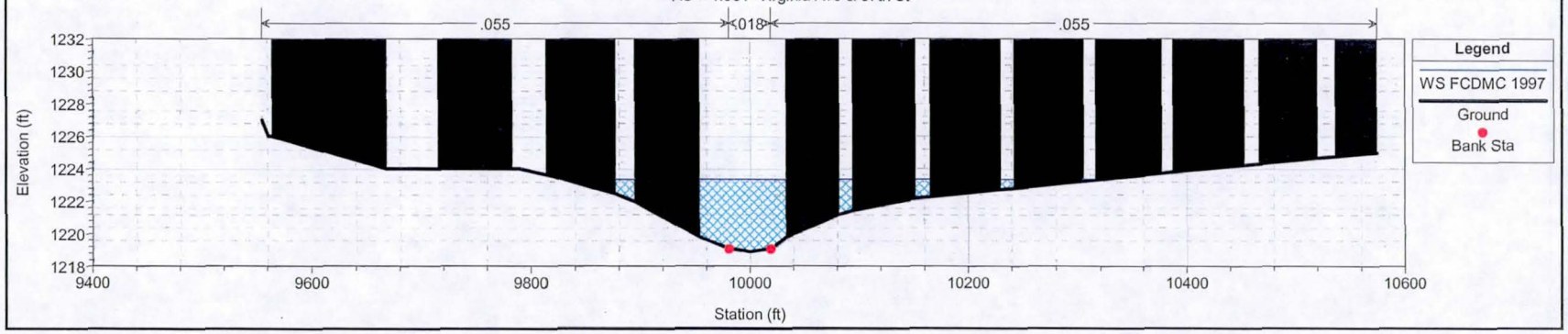
Granite Reef Wash Plan: Existing 1/26/2008

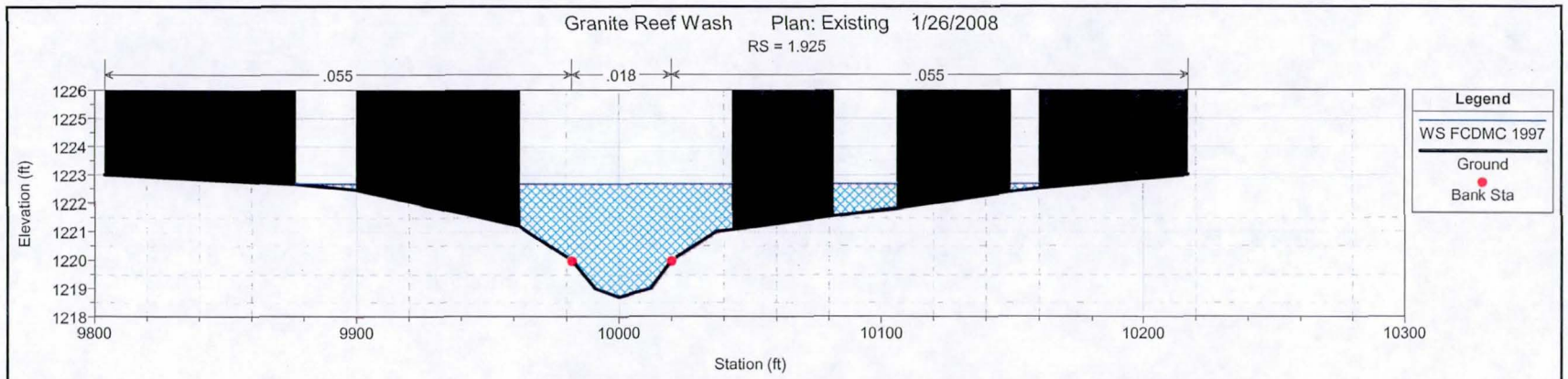
RS = 2.044

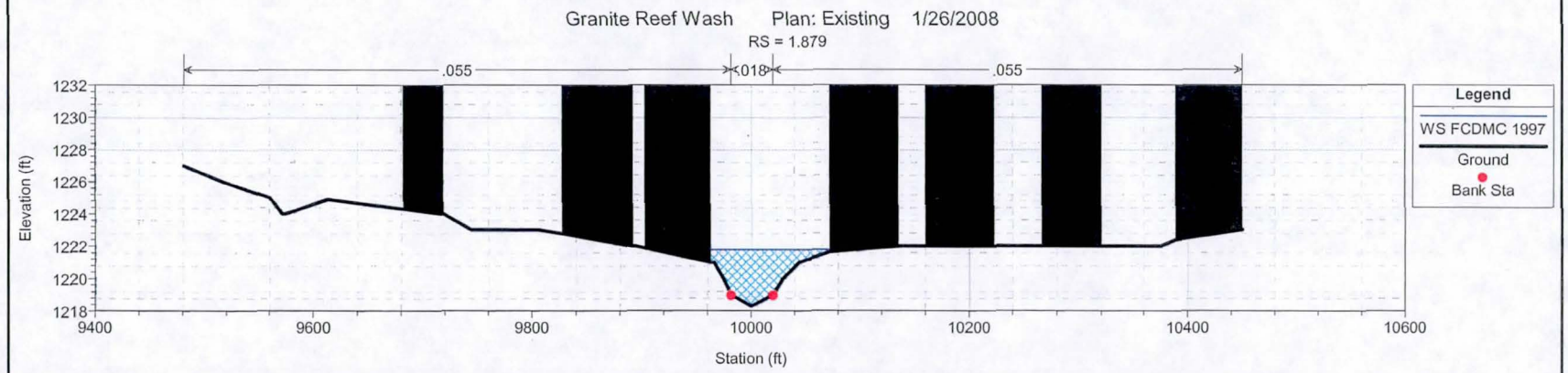


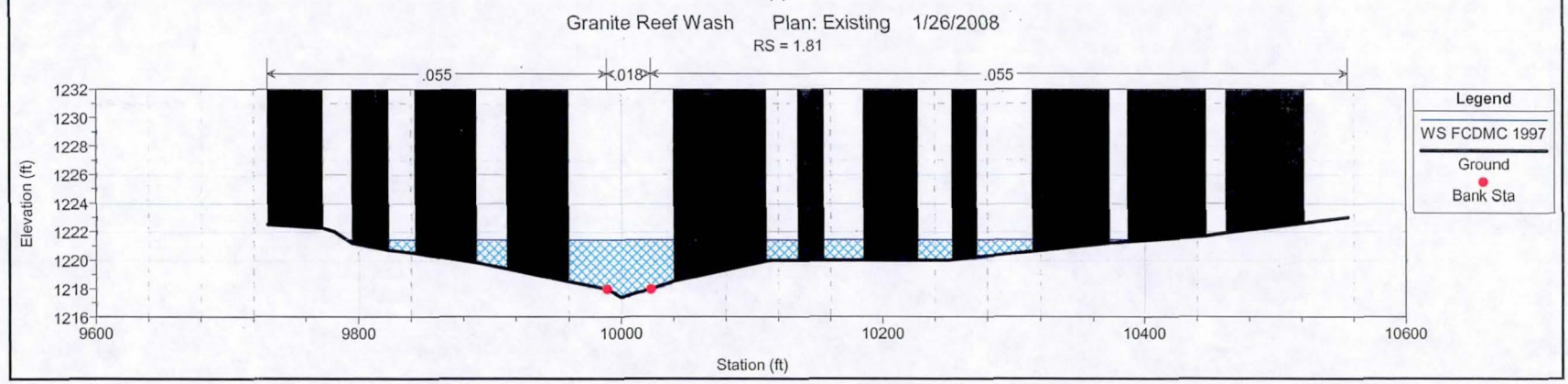
Granite Reef Wash Plan: Existing 1/26/2008

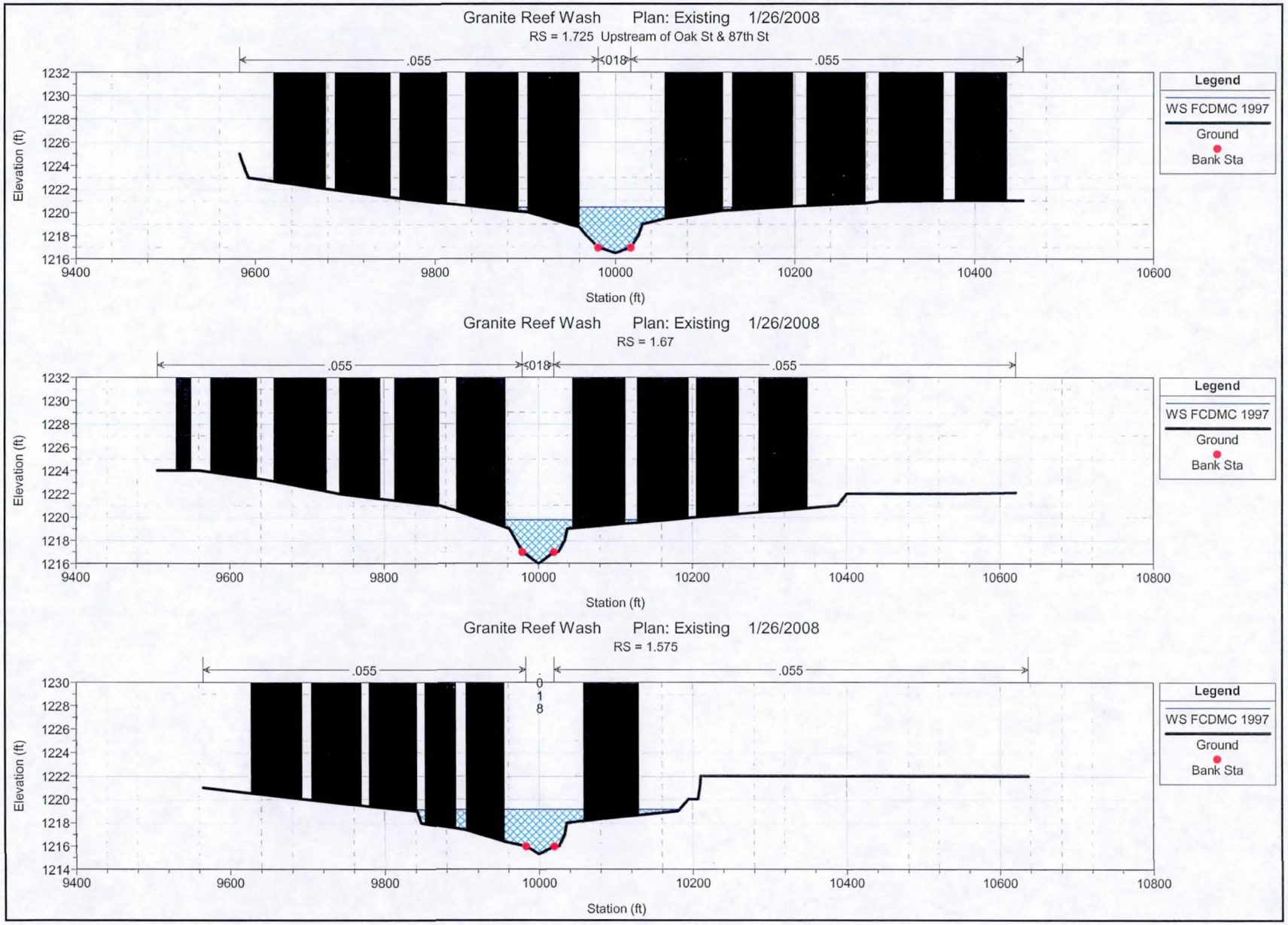
RS = 1.961 Virginia Ave & 87th St

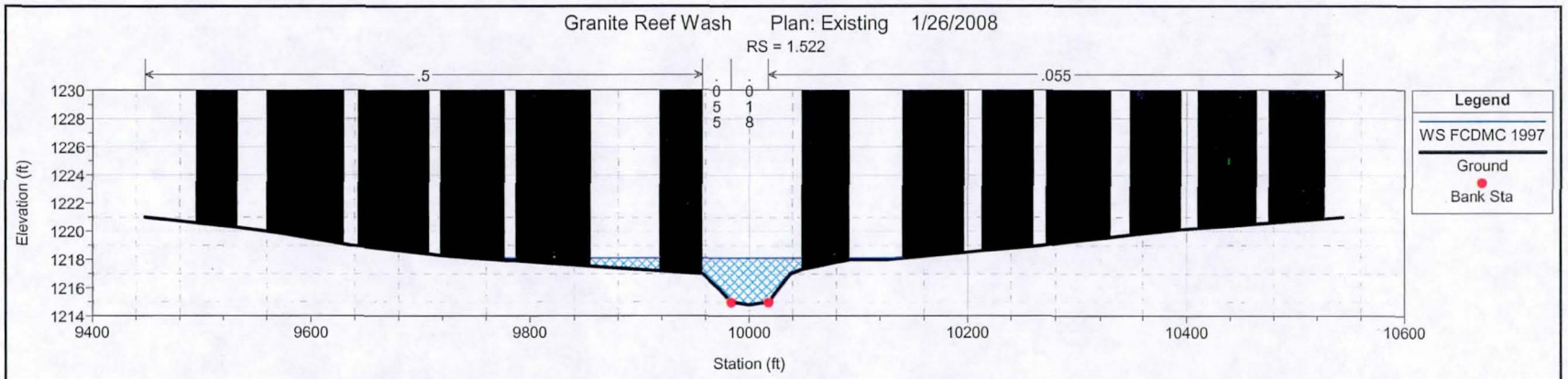


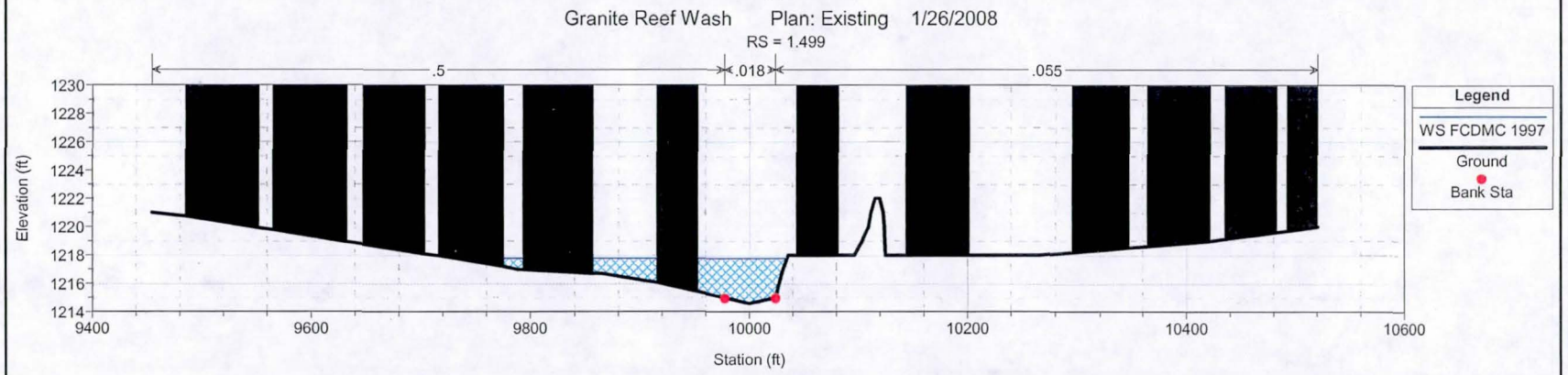

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.925
.055
.018
.055
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta

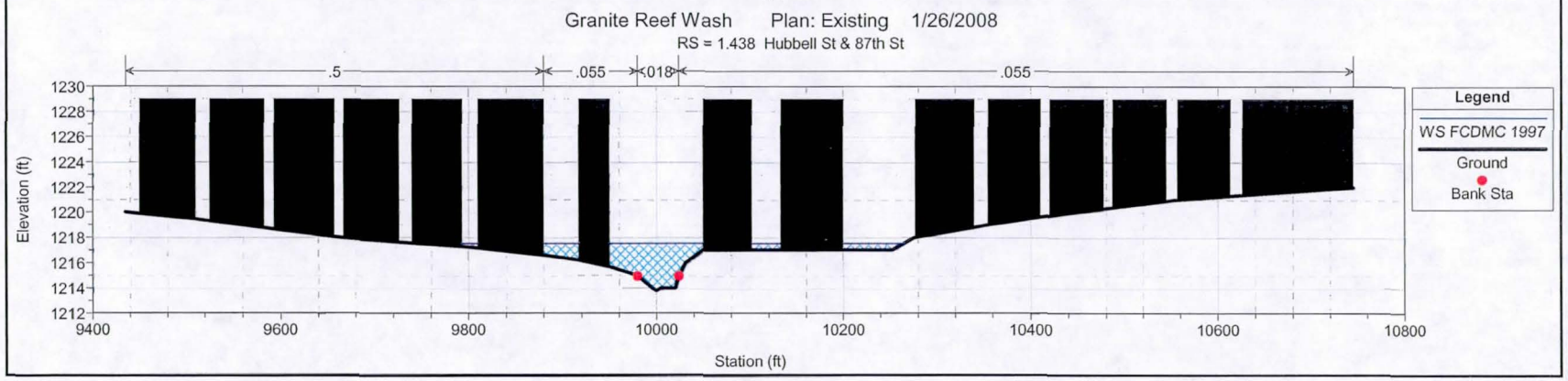

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.879
.055
.018
.055
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta

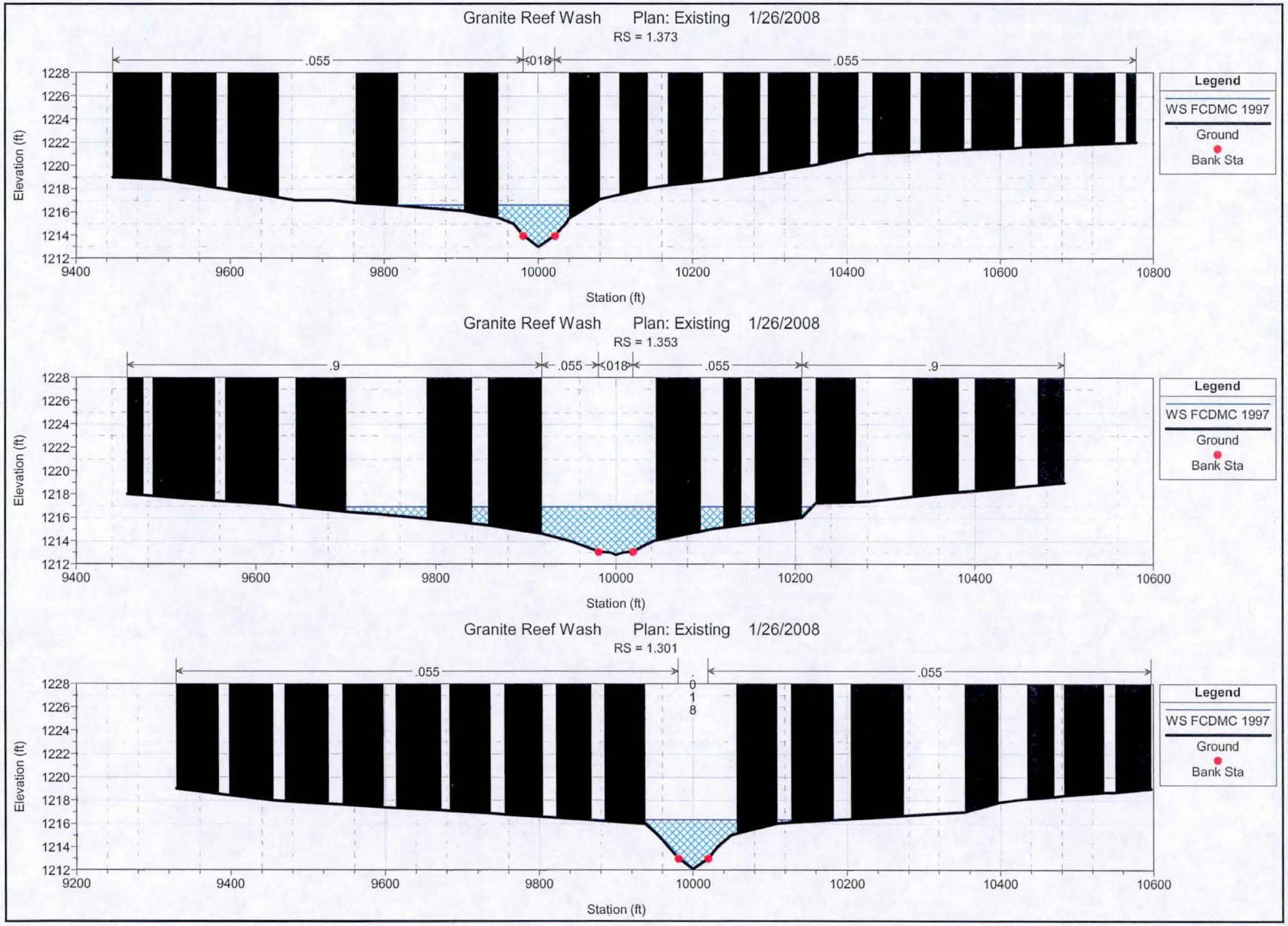

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.81
.055
.018
.055
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta

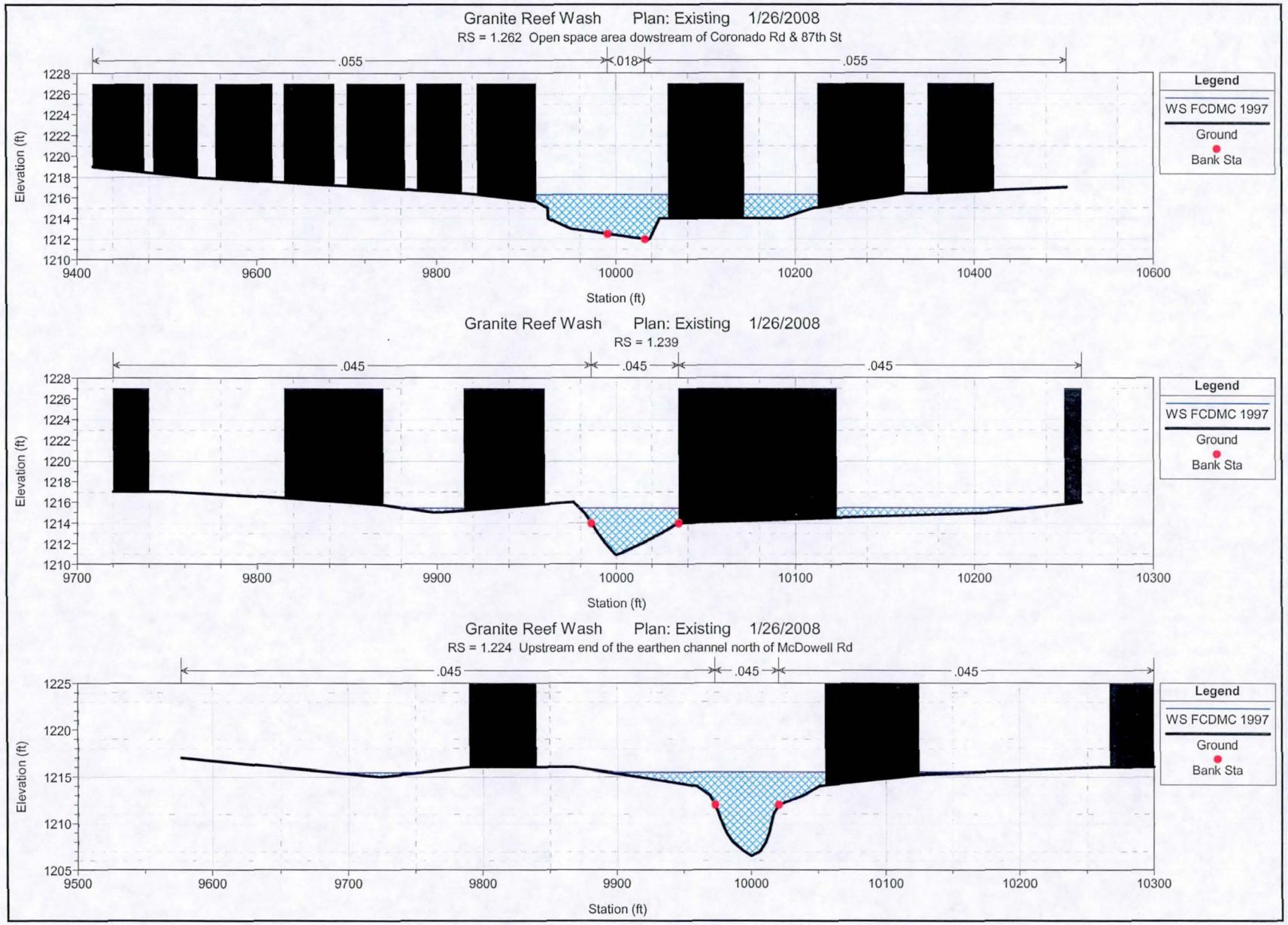

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.725 Upstream of Oak St & 87th St
.055
.018
.055
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.67
.055
.018
.055
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.575
.055
.018
.055
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta

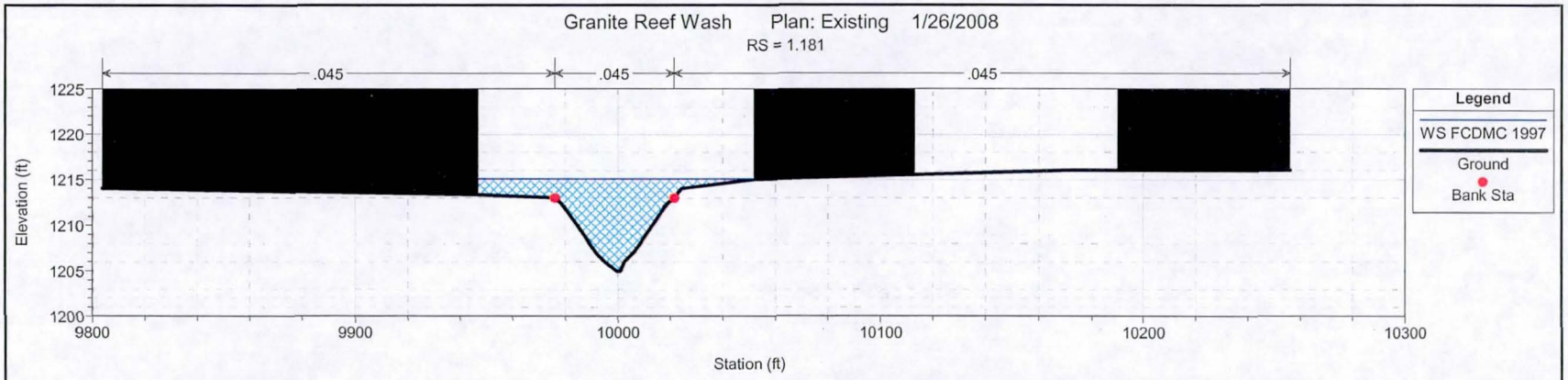

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.522
.5
.055
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta

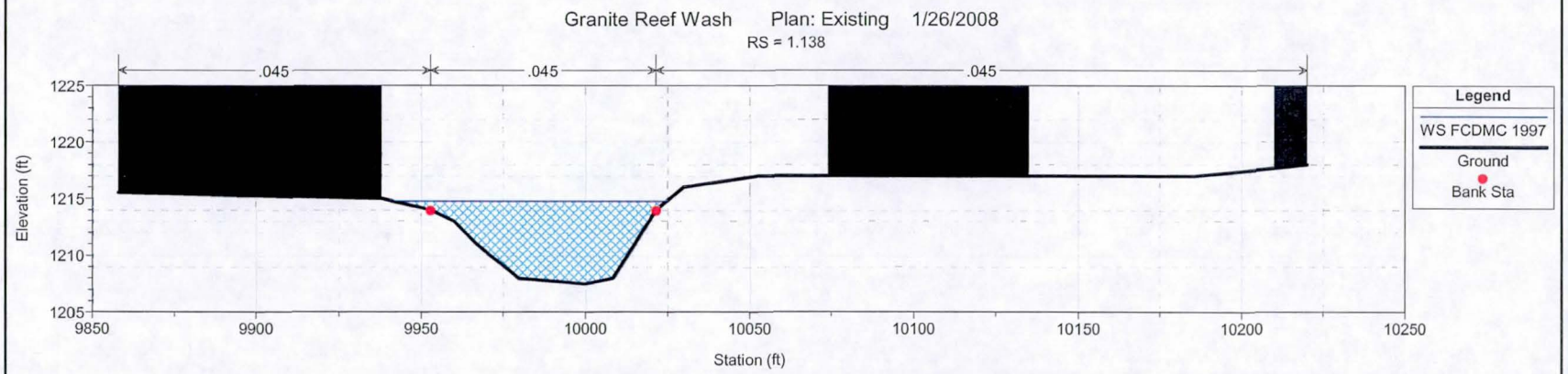

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.499
.5
.018
.055
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta

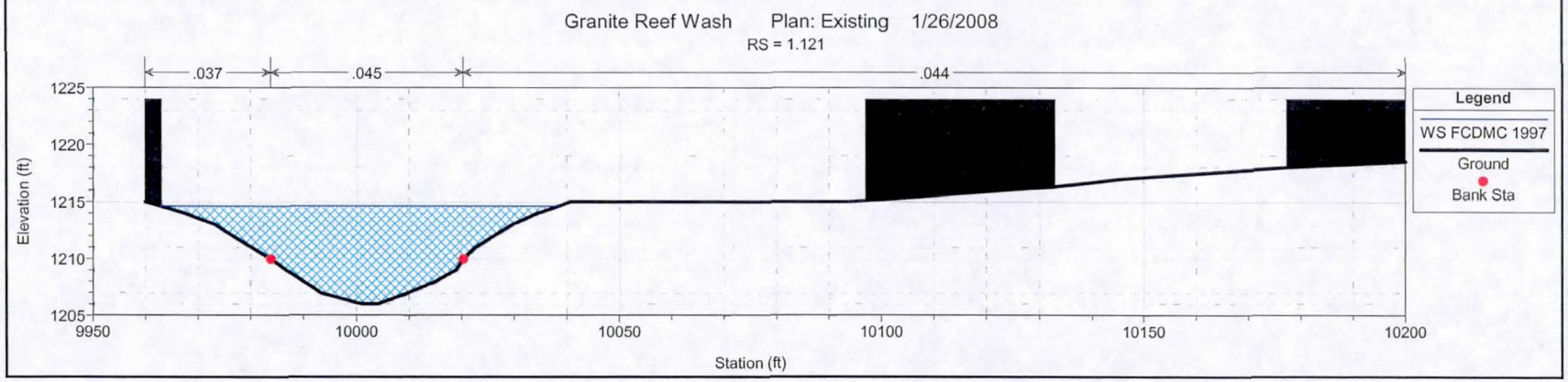

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.438 Hubbell St & 87th St
.5
.055
.018
.055
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.373
.055
.018
.055
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.353
.9
.055
.018
.055
.9
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.301
.055
.018
.055
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.262 Open space area dowstream of Coronado Rd & 87th St
.055
.018
.055
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.239
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.224 Upstream end of the earthen channel north of McDowell Rd
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta

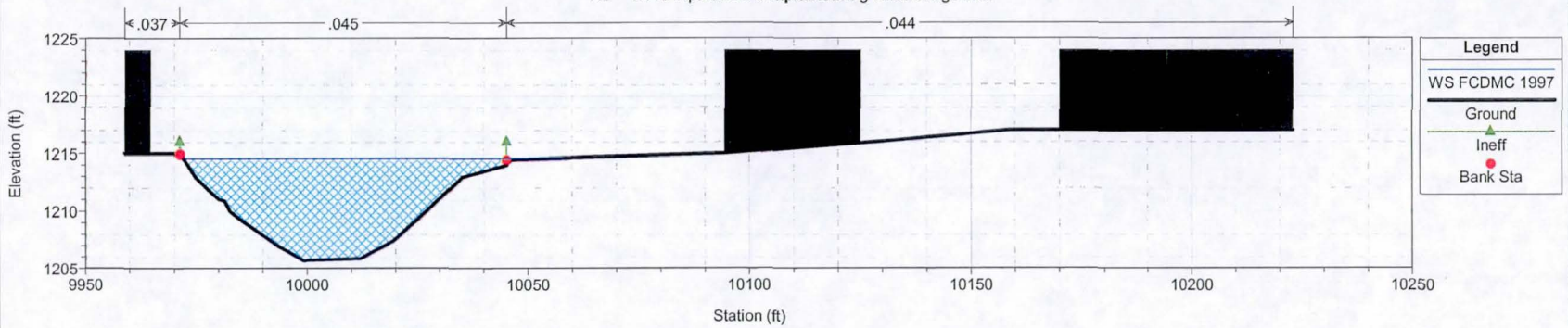

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.181
.045
.045
.045
Elevation (ft)
1225
1220
1215
1210
1205
1200
9800
9900
10000
10100
10200
10300
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.138
.045
.045
.045
Elevation (ft)
1225
1220
1215
1210
1205
9850
9900
9950
10000
10050
10100
10150
10200
10250
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.121
.037
.045
.044
Elevation (ft)
1225
1220
1215
1210
1205
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta

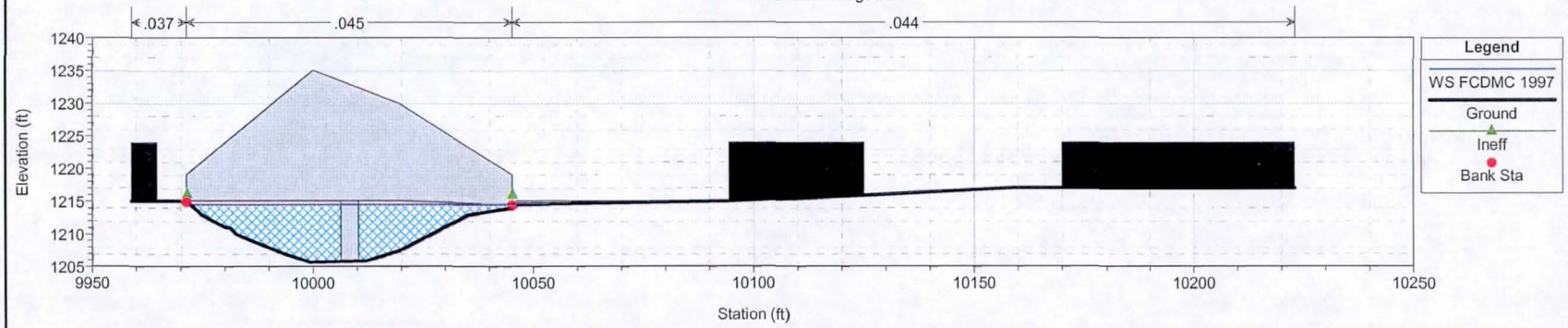
Granite Reef Wash Plan: Existing 1/26/2008

RS = 1.115 Apartment complex leasing office bridge inlet



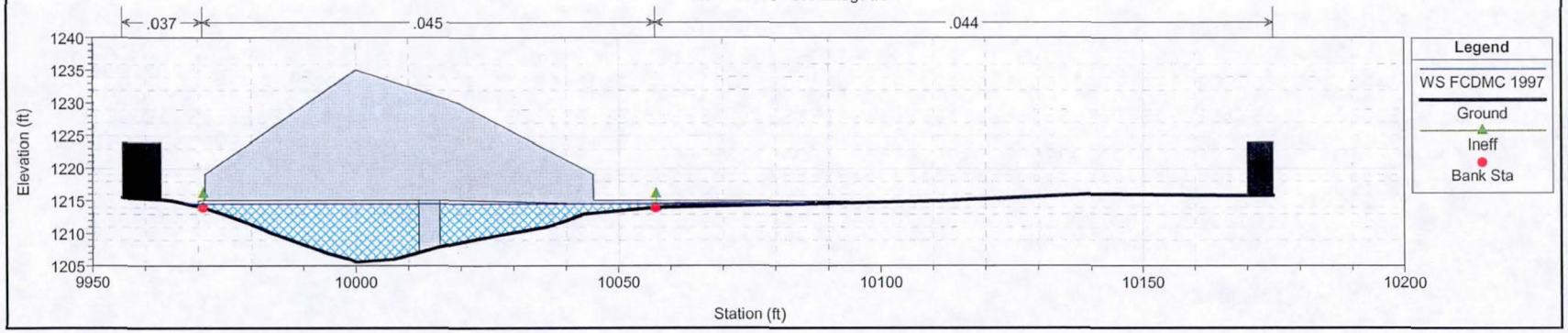
Granite Reef Wash Plan: Existing 1/26/2008

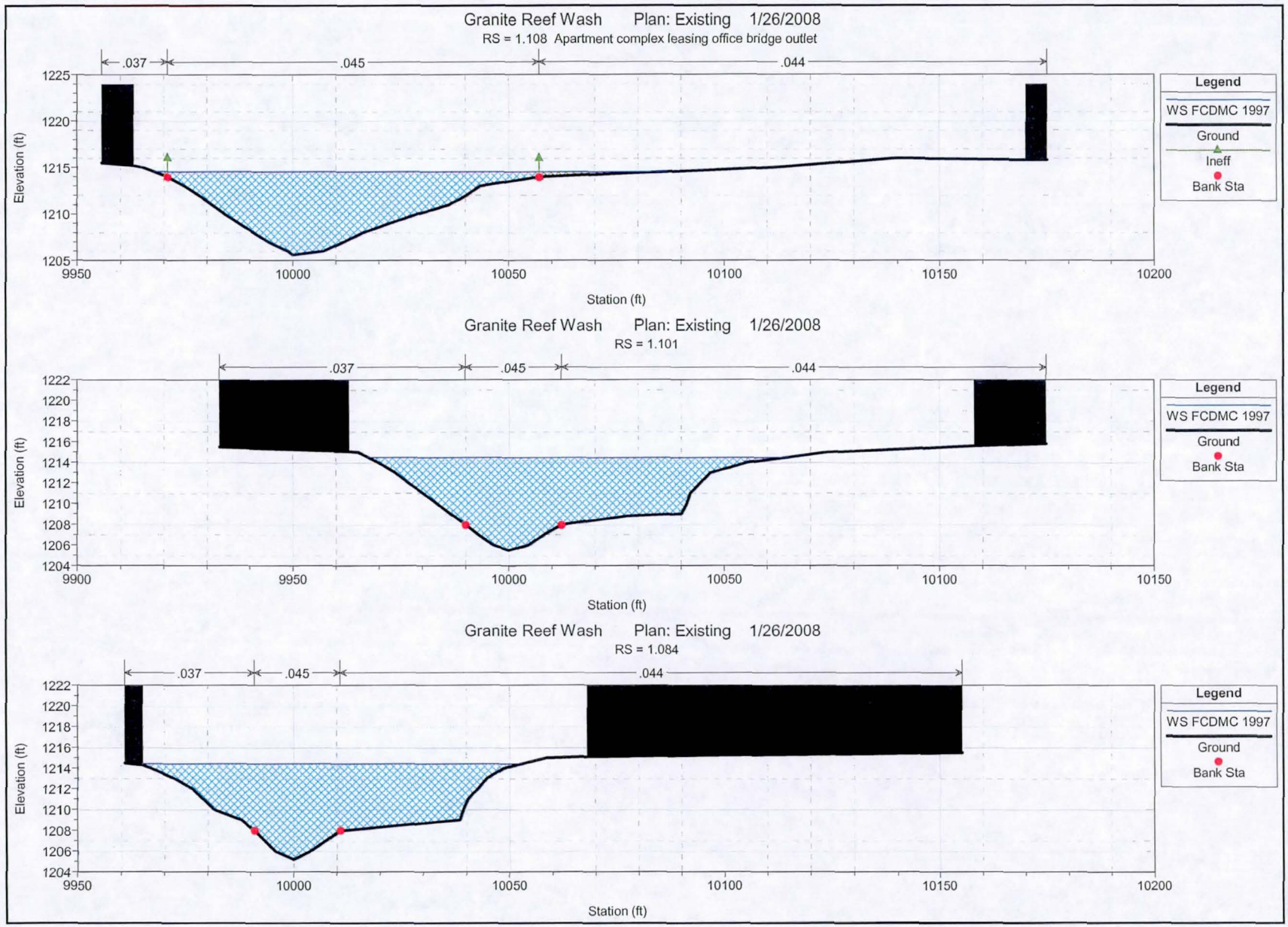
RS = 1.1115 BR Bridge #3



Granite Reef Wash Plan: Existing 1/26/2008

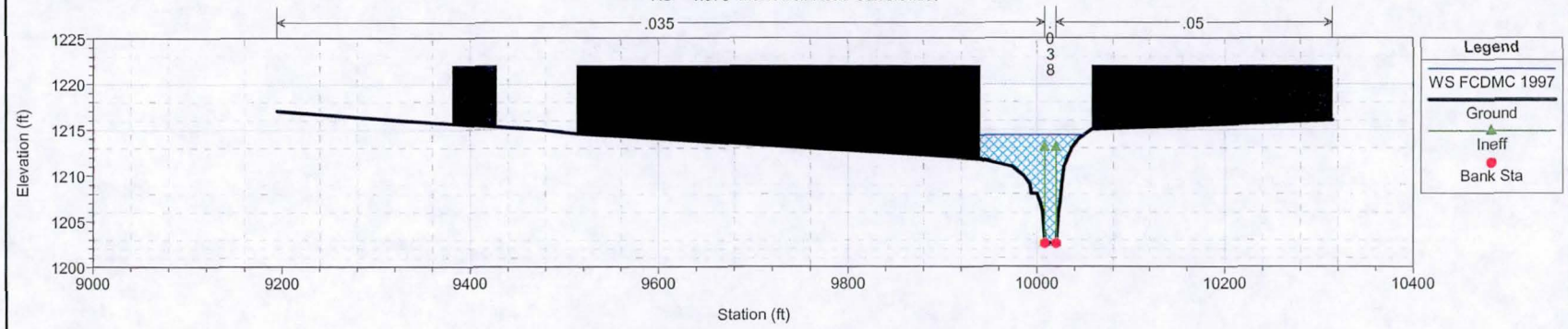
RS = 1.1115 BR Bridge #3




Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.108 Apartment complex leasing office bridge outlet
.037
.045
.044
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Ineff
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.101
.037
.045
.044
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.084
.037
.045
.044
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta

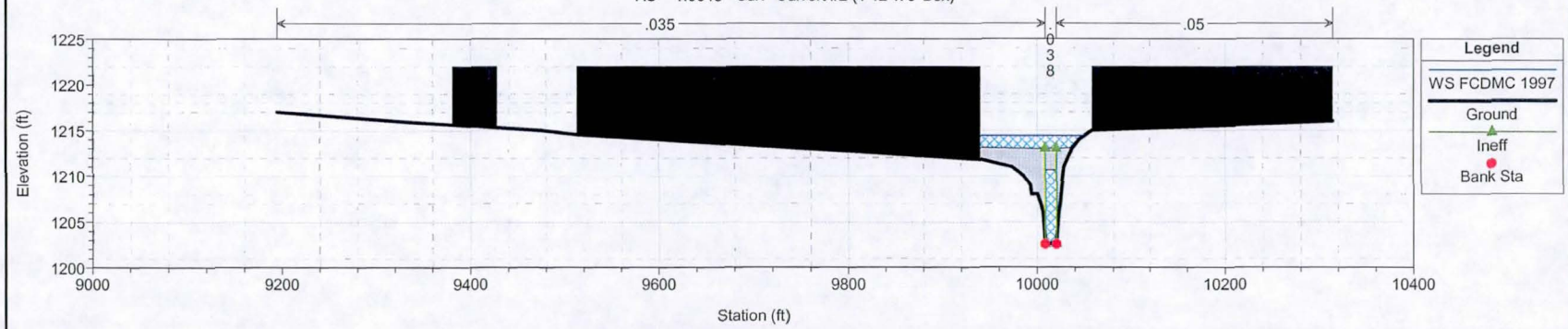
Granite Reef Wash Plan: Existing 1/26/2008

RS = 1.075 McDowell Road Culvert Inlet



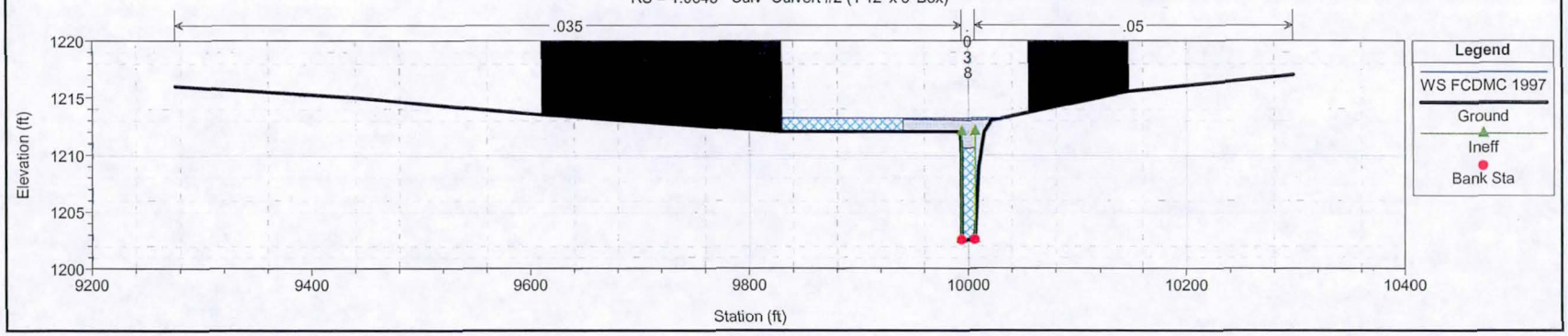
Granite Reef Wash Plan: Existing 1/26/2008

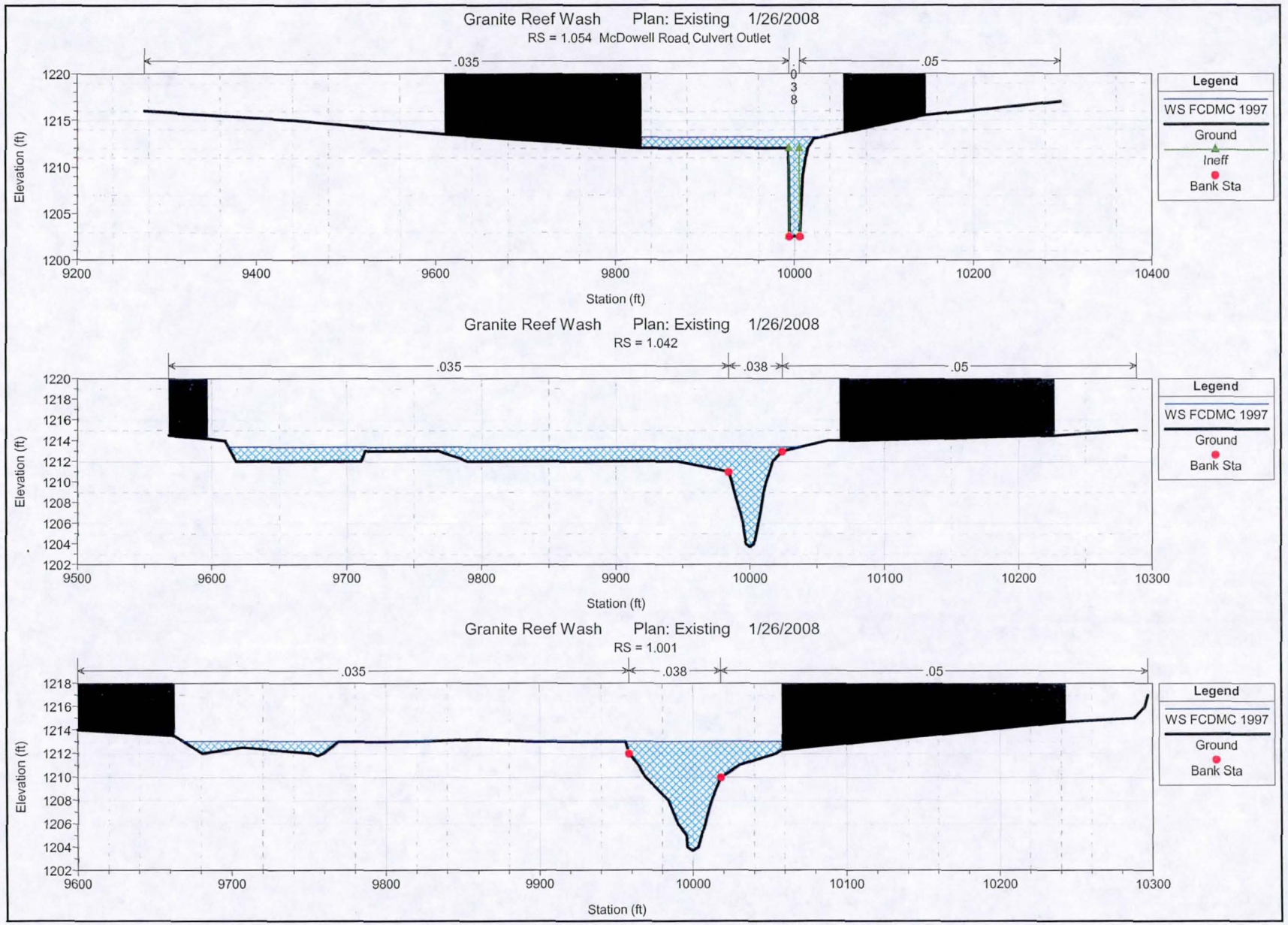
RS = 1.0645 Culv Culvert #2 (1 12' x 8' Box)

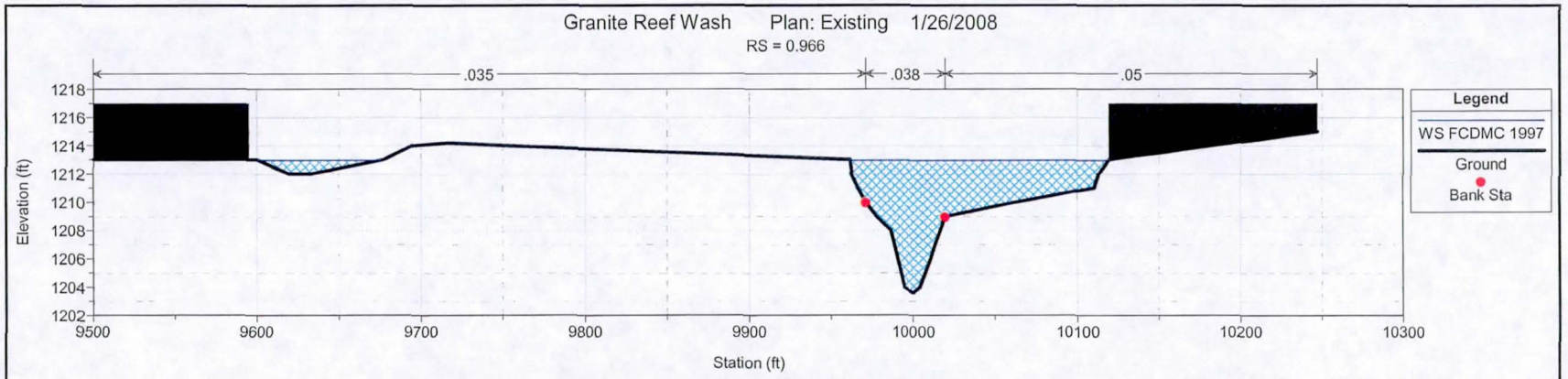


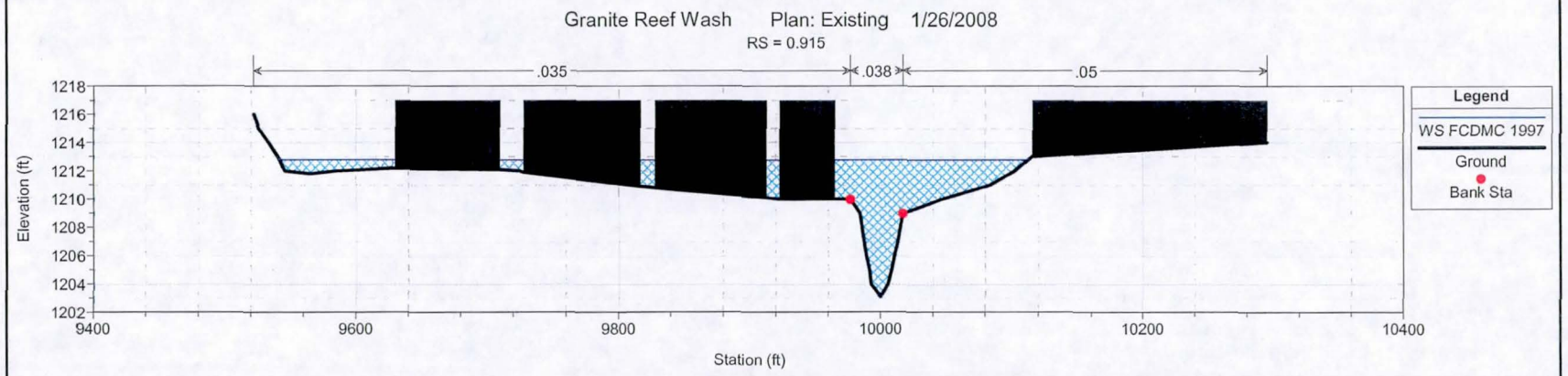
Granite Reef Wash Plan: Existing 1/26/2008

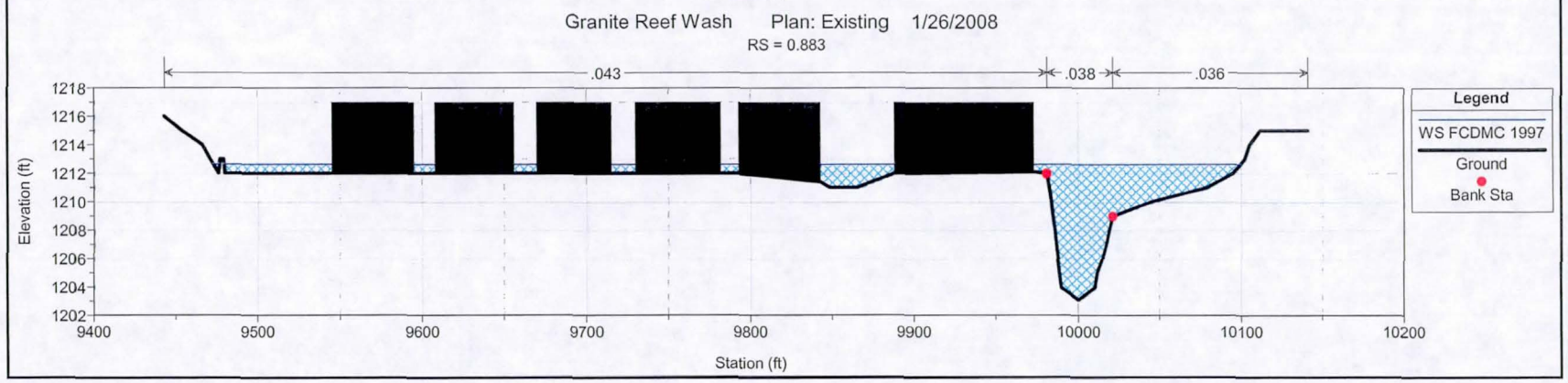
RS = 1.0645 Culv Culvert #2 (1 12' x 8' Box)




Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.054 McDowell Road Culvert Outlet
.035
.038
.05
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Ineff
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.042
.035
.038
.05
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.001
.035
.038
.05
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta

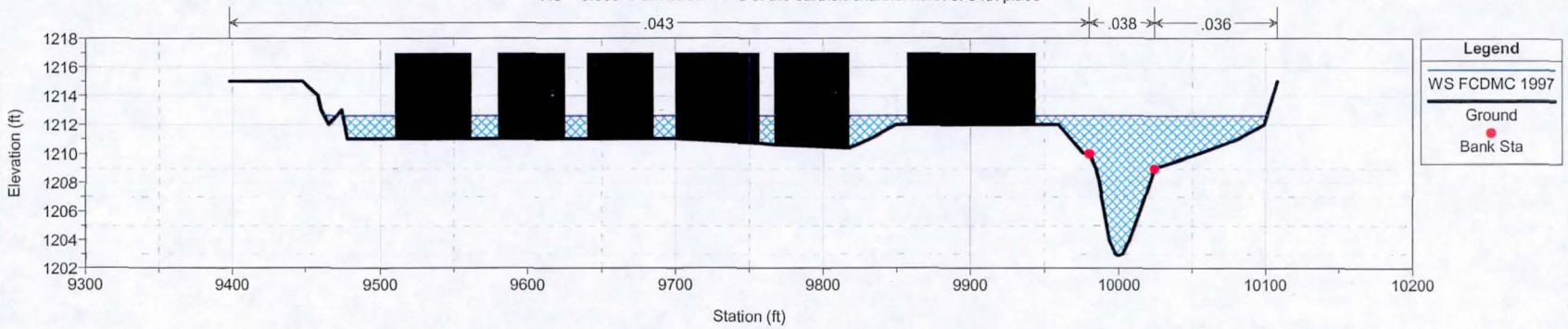

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.966
.035
.038
.05
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.915
.035
.038
.05
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.883
.043
.038
.036
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta

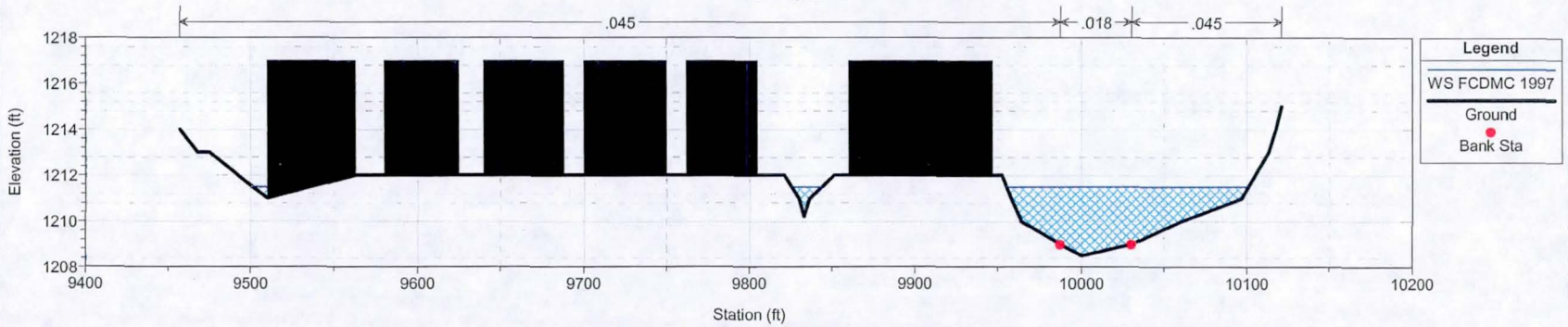
Granite Reef Wash Plan: Existing 1/26/2008

RS = 0.865 Downstream end of the earthen channel north of 84th place



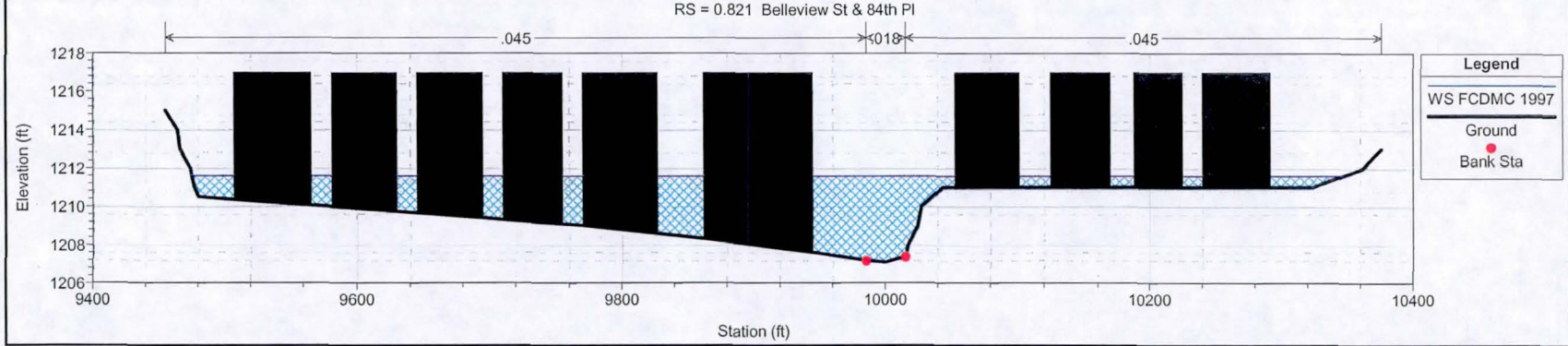
Granite Reef Wash Plan: Existing 1/26/2008

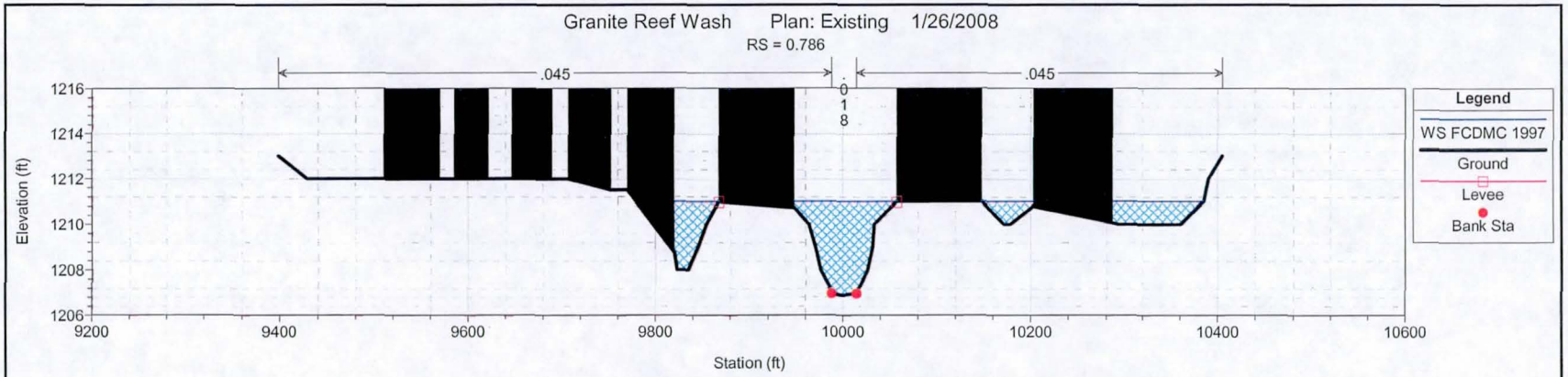
RS = 0.857

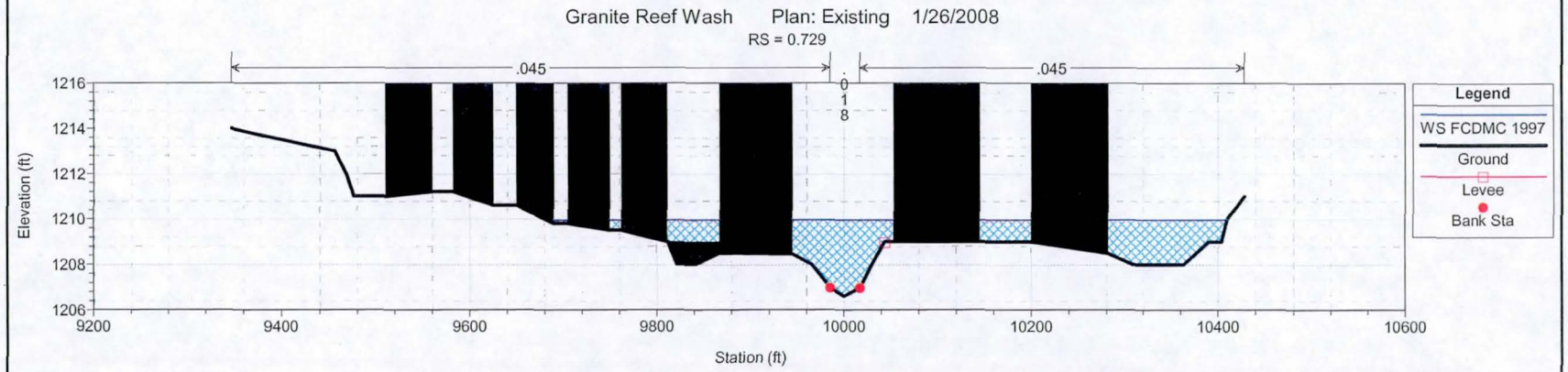


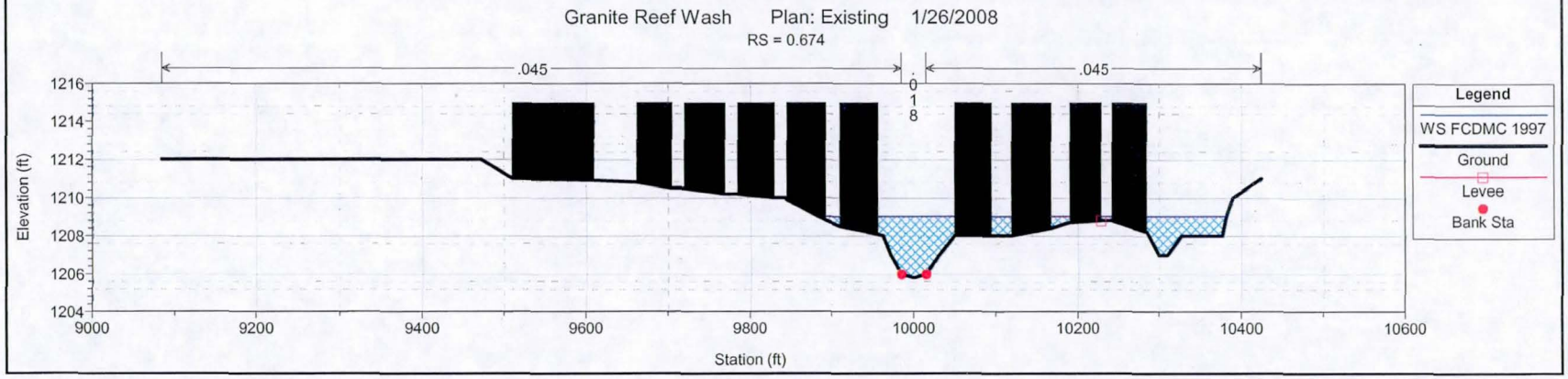
Granite Reef Wash Plan: Existing 1/26/2008

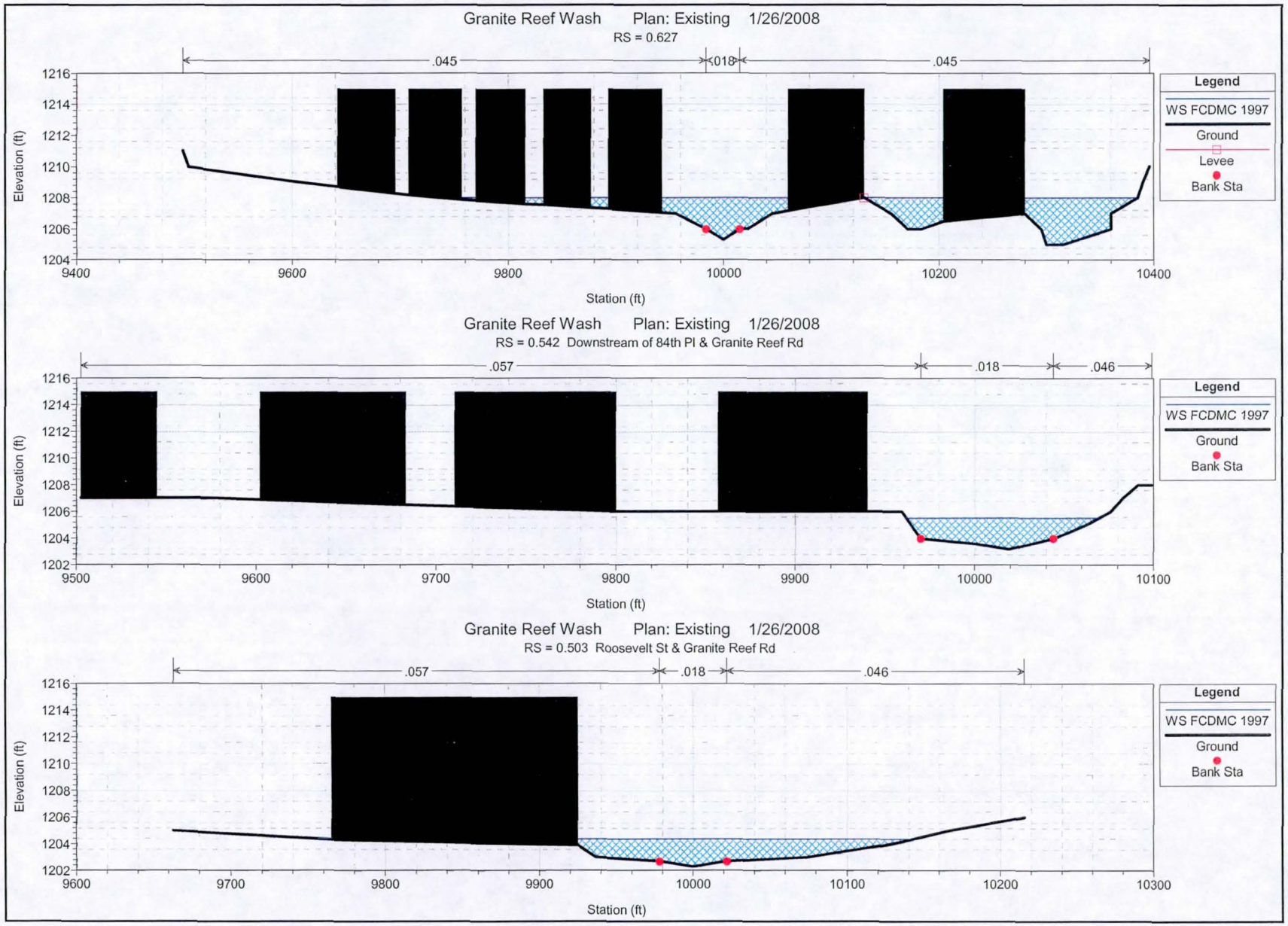
RS = 0.821 Belleview St & 84th Pl

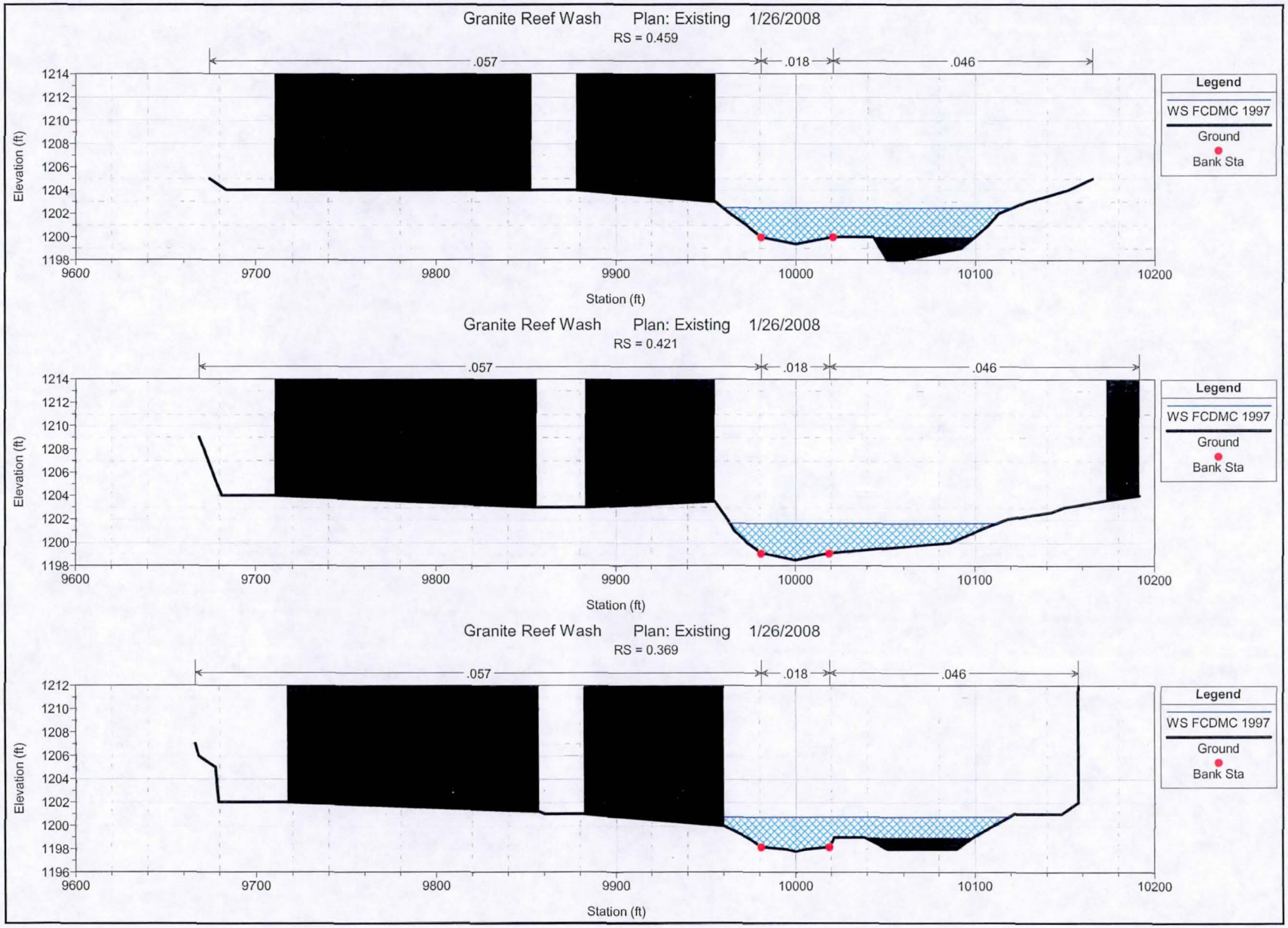


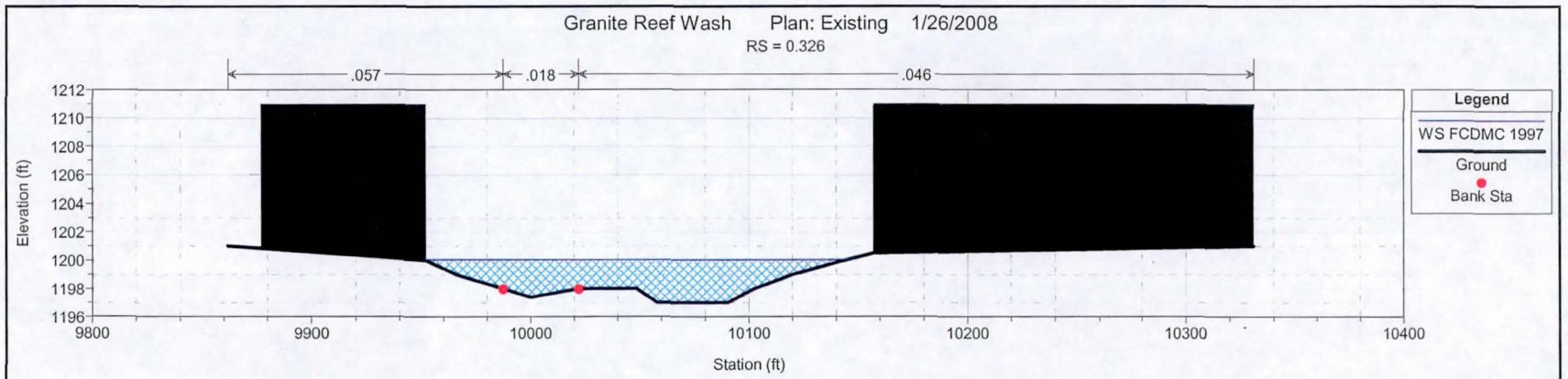

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.786
.045
.018
.045
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Levee
Bank Sta

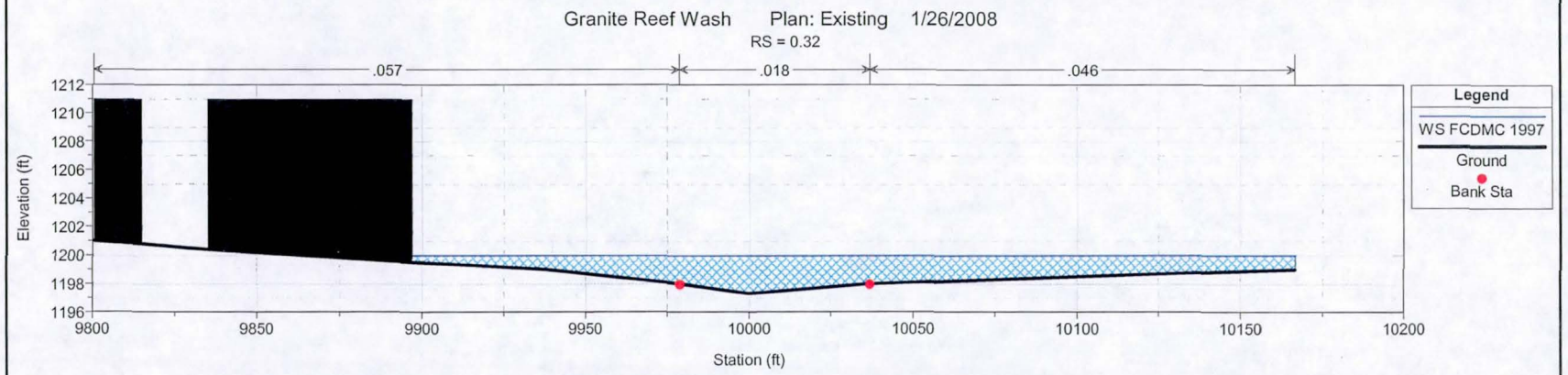

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.729
.045
.018
.045
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Levee
Bank Sta

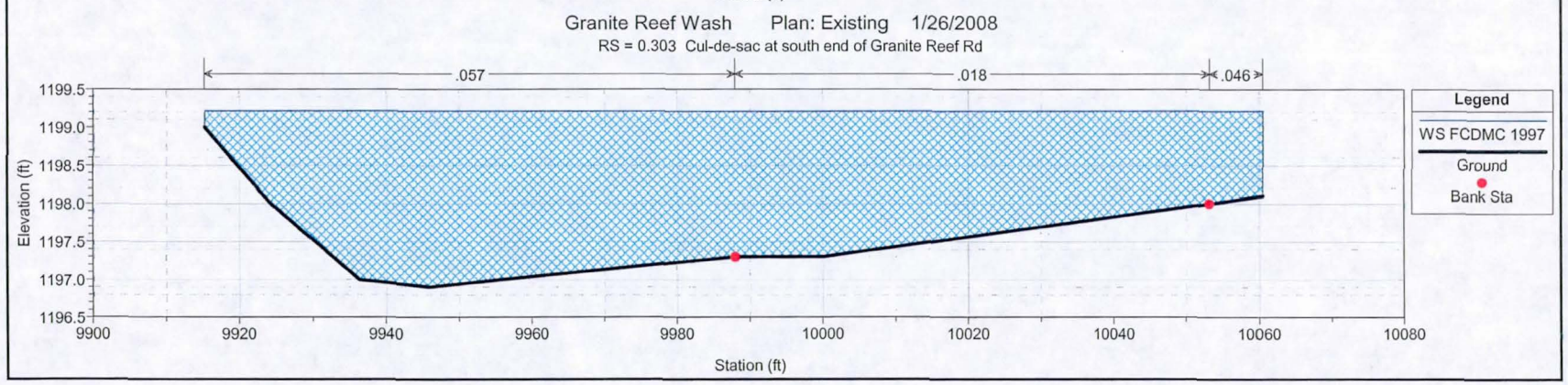

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.674
.045
.018
.045
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Levee
Bank Sta

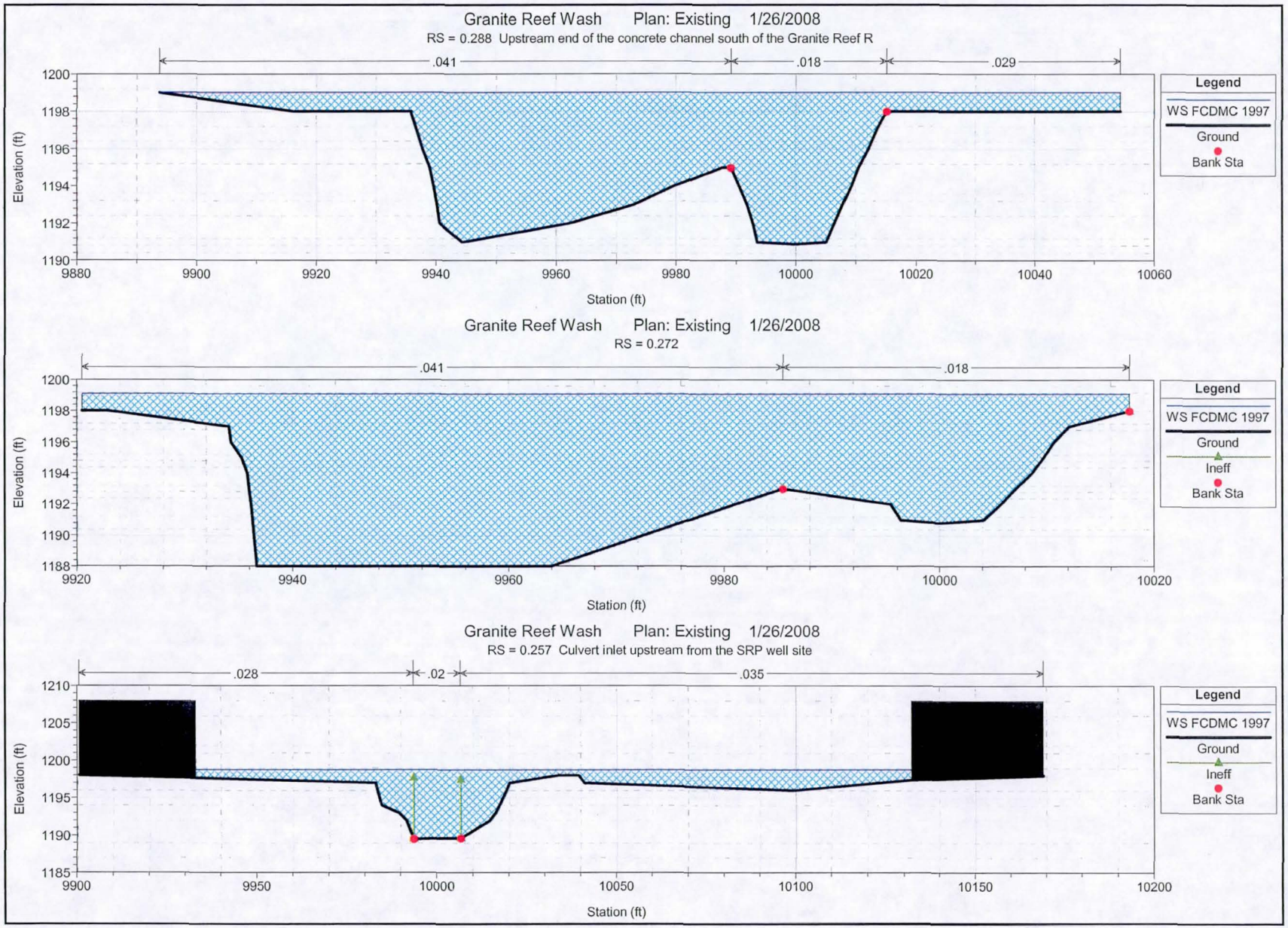

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.627
.045
.018
.045
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Levee
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.542 Downstream of 84th Pl & Granite Reef Rd
.057
.018
.046
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.503 Roosevelt St & Granite Reef Rd
.057
.018
.046
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta

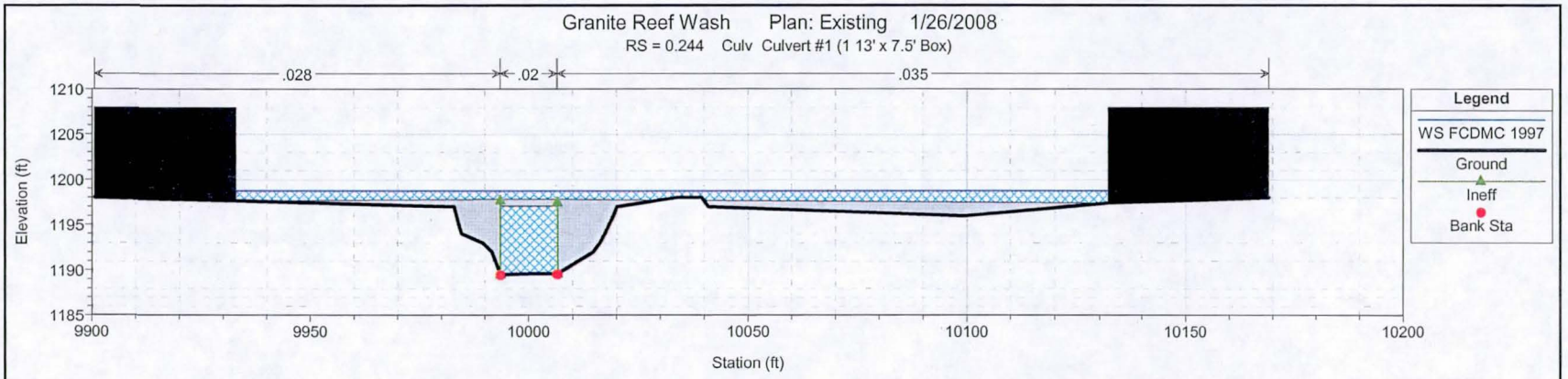

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.459
.057
.018
.046
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.421
.057
.018
.046
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.369
.057
.018
.046
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta

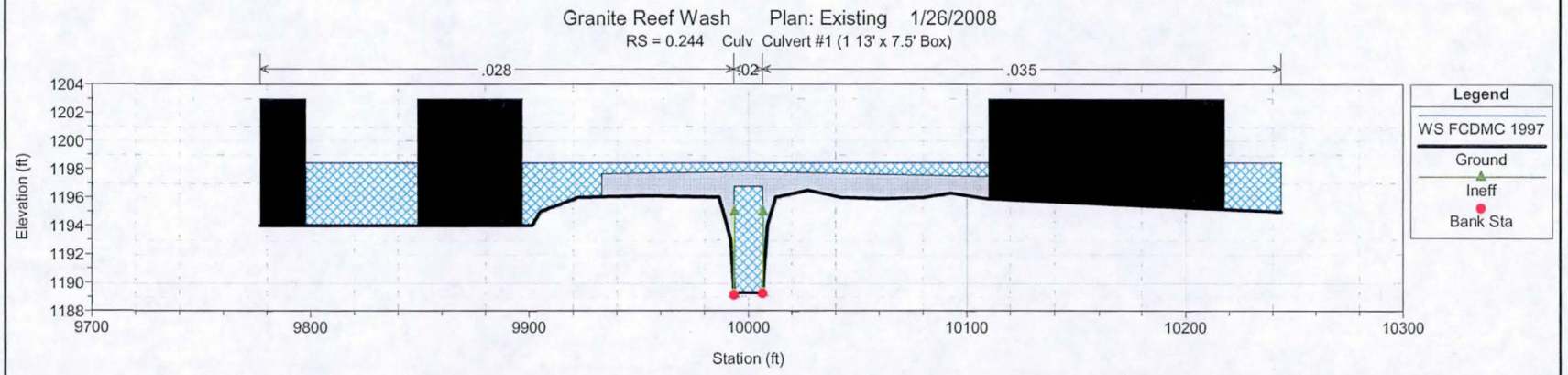

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.326
.057
.018
.046
Elevation (ft)
1212
1210
1208
1206
1204
1202
1200
1198
1196
9800
9900
10000
10100
10200
10300
10400
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta

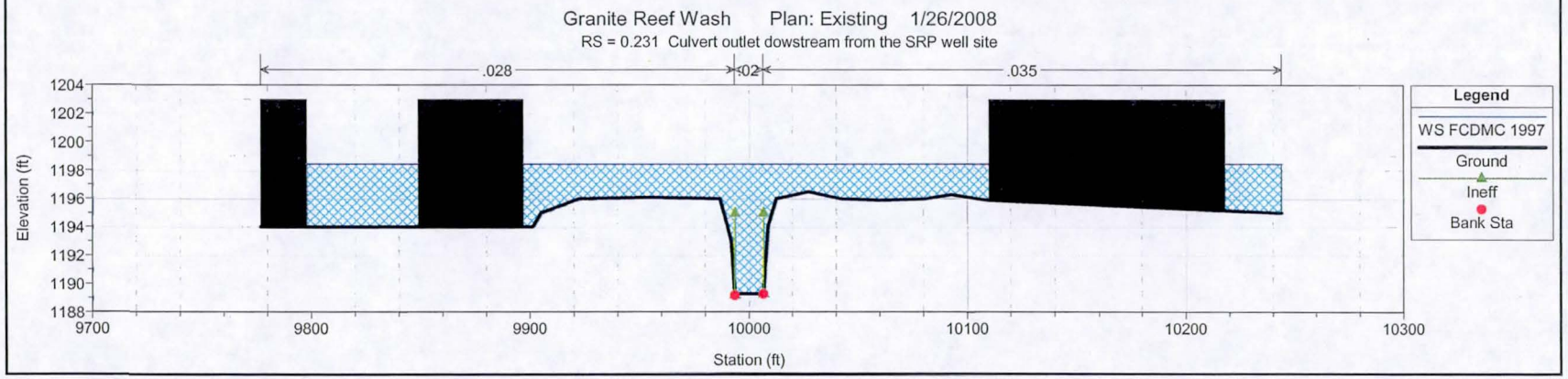

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.32
.057
.018
.046
Elevation (ft)
1212
1210
1208
1206
1204
1202
1200
1198
1196
9800
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.303 Cul-de-sac at south end of Granite Reef Rd
.057
.018
.046
Elevation (ft)
1199.5
1199.0
1198.5
1198.0
1197.5
1197.0
1196.5
9900
9920
9940
9960
9980
10000
10020
10040
10060
10080
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.288 Upstream end of the concrete channel south of the Granite Reef R
.041
.018
.029
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.272
.041
.018
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Ineff
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.257 Culvert inlet upstream from the SRP well site
.028
.02
.035
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Ineff
Bank Sta

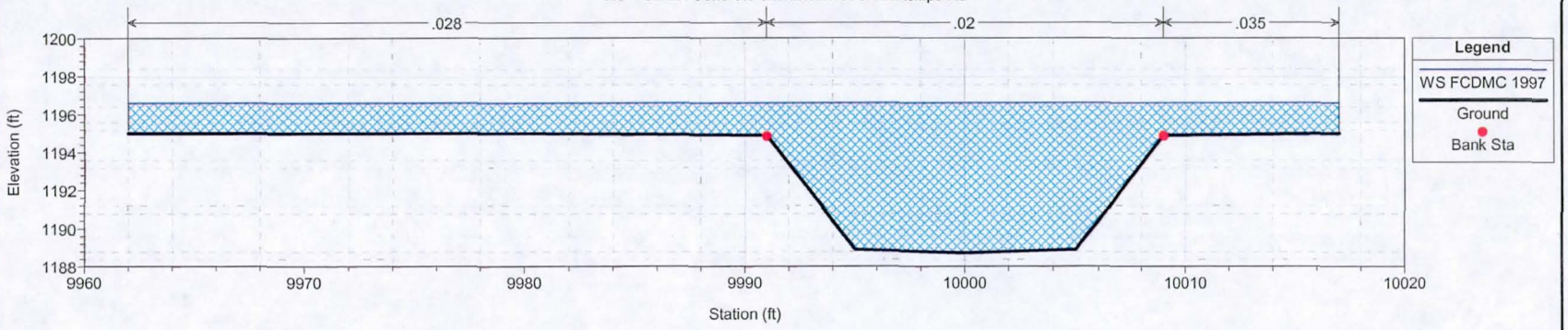

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.244 Culv Culvert #1 (1 13' x 7.5' Box)
.028
.02
.035
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Ineff
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.244 Culv Culvert #1 (1 13' x 7.5' Box)
.028
.02
.035
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Ineff
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.231 Culvert outlet dowstream from the SRP well site
.028
.02
.035
Elevation (ft)
Station (ft)
Legend
WS FCDMC 1997
Ground
Ineff
Bank Sta

Granite Reef Wash Plan: Existing 1/26/2008

RS = 0.225 Concrete channel north of McKellips Rd



HEC-RAS Flows

Table showing corresponding HEC-1 ID's with flows

RD08 = 844 cfs RD08 = 844 cfs RD08 = 233 cfs

		PF1	PF2	PF3	PF4	PF5		
HEC-RAS X-sec	HEC-1 I.D. (Alt. I.D.)	TDN: Hydraulics (FCDMC 1997) (cfs)	TDN: Hydrology (FCDMC 2002) (cfs)	BASE6.OUT (cfs)	BASIN6.OUT (cfs)	PIMASD6.OUT* (cfs)	Storm Drain Size (cfs)	Storm Drain Flow (cfs)
2.355	~~RD08~~ (RD12)	644	874	1057	1041	0	N/A	0
2.218	CD03	1240	1767	1637	1619	188	N/A	0
2.208						0	48"	56
1.961	CC11	1240	1799	1708	1689	187 (131) 56	48"	56
1.725	CC08	1240	1843	1752	1730	342 (286) 56	48"	56
1.301	CC06	1240	1895	1800	1780	539 (483) 56	48"	56
1.262						0	48"	56
1.054	CC03	1417	2204	2044	1953	334	N/A	0
0.865	CB07	1417	2204	2038	1721	339 (275) 64	48"	64
0.542	CB05	1417	2230	2092	1756	437 (308) 129	54"	129
0.503	CB03	1417	2247	2109	1782	520 (391) 129	54"	129
0.288	CB01	1417	2244	2105	1782	549	N/A	0

*(#) Flow adjusted for storm drain in street

87th St. 48" SD (Thomas to Coronado)

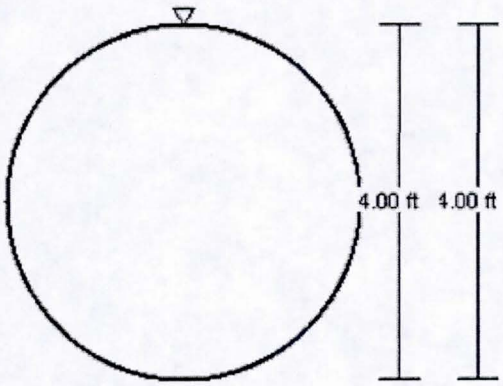
Project Description

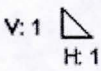
Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00150	ft/ft
Normal Depth	4.00	ft
Diameter	4.00	ft
Discharge	55.63	ft^3/s

Cross Section Image





87th St. 48" SD (Thomas to Coronado)

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00150	ft/ft
Normal Depth	4.00	ft
Diameter	4.00	ft

Results

Discharge	55.63	ft^3/s
Flow Area	12.57	ft^2
Wetted Perimeter	12.57	ft
Top Width	0.00	ft
Critical Depth	2.24	ft
Percent Full	100.0	%
Critical Slope	0.00411	ft/ft
Velocity	4.43	ft/s
Velocity Head	0.30	ft
Specific Energy	4.30	ft
Froude Number	0.00	
Maximum Discharge	59.84	ft^3/s
Discharge Full	55.63	ft^3/s
Slope Full	0.00150	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s

87th St. 48" SD (Thomas to Coronado)

GVF Output Data

Normal Depth	4.00	ft
Critical Depth	2.24	ft
Channel Slope	0.00150	ft/ft
Critical Slope	0.00411	ft/ft

84th Pl. 48" SD (North of Belleview to Granite Reef)

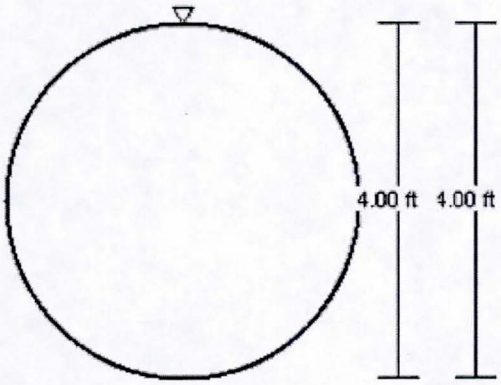
Project Description

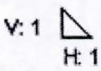
Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00200	ft/ft
Normal Depth	4.00	ft
Diameter	4.00	ft
Discharge	64.24	ft^3/s

Cross Section Image





84th Pl. 48" SD (North of Belleview to Granite Reef)

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00200	ft/ft
Normal Depth	4.00	ft
Diameter	4.00	ft

Results

Discharge	64.24	ft^3/s
Flow Area	12.57	ft^2
Wetted Perimeter	12.57	ft
Top Width	0.00	ft
Critical Depth	2.42	ft
Percent Full	100.0	%
Critical Slope	0.00433	ft/ft
Velocity	5.11	ft/s
Velocity Head	0.41	ft
Specific Energy	4.41	ft
Froude Number	0.00	
Maximum Discharge	69.10	ft^3/s
Discharge Full	64.24	ft^3/s
Slope Full	0.00200	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s

84th Pl. 48" SD (North of Belleview to Granite Reef)

GVF Output Data

Normal Depth	4.00	ft
Critical Depth	2.42	ft
Channel Slope	0.00200	ft/ft
Critical Slope	0.00433	ft/ft

Granite Reef Rd. 54" SD (84th to south end of Granite Reef)

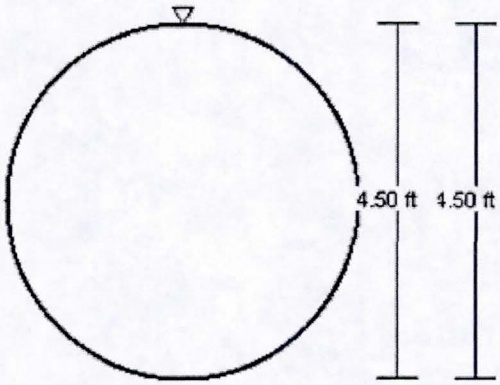
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00433	ft/ft
Normal Depth	4.50	ft
Diameter	4.50	ft
Discharge	129.39	ft^3/s

Cross Section Image



V: 1
H: 1

Granite Reef Rd. 54" SD (84th to south end of Granite Reef)

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00433	ft/ft
Normal Depth	4.50	ft
Diameter	4.50	ft

Results

Discharge	129.39	ft^3/s
Flow Area	15.90	ft^2
Wetted Perimeter	14.14	ft
Top Width	0.00	ft
Critical Depth	3.35	ft
Percent Full	100.0	%
Critical Slope	0.00531	ft/ft
Velocity	8.14	ft/s
Velocity Head	1.03	ft
Specific Energy	5.53	ft
Froude Number	0.00	
Maximum Discharge	139.19	ft^3/s
Discharge Full	129.39	ft^3/s
Slope Full	0.00433	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s

Granite Reef Rd. 54" SD (84th to south end of Granite Reef)

GVF Output Data

Normal Depth	4.50	ft
Critical Depth	3.35	ft
Channel Slope	0.00433	ft/ft
Critical Slope	0.00531	ft/ft

WSE does not match GRW, prj on the Appendix H CD.

HEC-RAS Output

Profile Names:
FCDMC 1997 - Granite Reef Wash Floodplain Delineation Study (FCDMC May 1997)
FCDMC 2002 - Granite Reef Wash Drainage Master Plan (FCDMC September 2002)
BASE6.OUT - Updated base HEC-1 model for this study.
BASIN6.OUT - Detention basin alternative HEC-1 model.
PIMASD6.OUT - Pima Road storm drain conduit alternative HEC-1 model.

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Comments
2.355	FCDMC 1997	644	1227	1228.59	1228.55	1229.09	0.004282	6.04	145.62	140.87	0.97	FEMA FIS: GRW at Pima Rd.
2.355	FCDMC 2002	874	1227	1228.8	1228.8	1229.44	0.004519	6.9	175.19	142.95	1.03	HEC-1 ID: RD08
2.355	BASE6.OUT	1057	1227	1228.95	1228.95	1229.7	0.004578	7.44	197.86	144.53	1.05	HEC-1 ID: RD12
2.355	BASIN6.OUT	1041	1227	1228.95	1228.95	1229.68	0.00451	7.36	196.84	144.46	1.04	HEC-1 ID: RD12
2.355	PIMASD6.OUT	1	1227	1227.09	1227.09	1227.12	0.017117	1.38	0.82	17.9	1.14	Flow intercepted at structure #8 (INT8).
2.295	FCDMC 1997	644	1226.3	1227.31	1227.31	1227.62	0.004567	5.32	204.57	336.06	0.97	
2.295	FCDMC 2002	874	1226.3	1227.42	1227.45	1227.82	0.00518	6.13	244.36	352.36	1.06	
2.295	BASE6.OUT	1057	1226.3	1227.49	1227.57	1227.97	0.005865	6.79	268.25	361.8	1.13	
2.295	BASIN6.OUT	1041	1226.3	1227.48	1227.57	1227.96	0.005908	6.78	264.59	360.37	1.14	
2.295	PIMASD6.OUT	1	1226.3	1226.52	1226.36	1226.52	0.000012	0.08	13.13	106.62	0.04	
2.218	FCDMC 1997	1240	1223.7	1226.25	1225.49	1226.44	0.000881	4.33	528.51	374.28	0.49	FEMA FIS: GRW at McDowell Rd.
2.218	FCDMC 2002	1767	1223.7	1227.06	1225.84	1227.21	0.000544	4.09	863.96	453.9	0.4	HEC-1 ID: CD03
2.218	BASE6.OUT	1637	1223.7	1226.88	1225.76	1227.04	0.000592	4.12	784.91	433.06	0.42	HEC-1 ID: CD03
2.218	BASIN6.OUT	1619	1223.7	1226.86	1225.75	1227.02	0.000599	4.12	774.14	427.64	0.42	HEC-1 ID: CD03
2.218	PIMASD6.OUT	188	1223.7	1224.37	1224.37	1224.61	0.00574	4.16	56.21	130.12	0.99	HEC-1 ID: CD03
2.208	FCDMC 1997	1240	1222.5	1225.92		1226.36	0.001362	6.57	368.05	223.39	0.65	
2.208	FCDMC 2002	1767	1222.5	1226.82		1227.16	0.000859	6.17	615.98	323.73	0.54	
2.208	BASE6.OUT	1637	1222.5	1226.63		1226.98	0.000924	6.2	556.43	311.56	0.55	
2.208	BASIN6.OUT	1619	1222.5	1226.61		1226.96	0.000935	6.2	548.07	305.87	0.56	
2.208	PIMASD6.OUT	1	1222.5	1222.55	1222.64	1224.17	2.033023	10.21	0.1	3.83	11.26	Flow intercepted at structure #9 (INT9).
2.192	FCDMC 1997	1240	1221.4	1226		1226.23	0.000536	4.84	622.74	399.75	0.42	
2.192	FCDMC 2002	1767	1221.4	1226.88		1227.06	0.00038	4.66	999.14	449.08	0.37	
2.192	BASE6.OUT	1637	1221.4	1226.7		1226.88	0.000398	4.65	918.37	433	0.38	
2.192	BASIN6.OUT	1619	1221.4	1226.67		1226.86	0.000401	4.65	906.86	432.2	0.38	
2.192	PIMASD6.OUT	1	1221.4	1221.67	1221.57	1221.68	0.001054	0.7	1.43	10.64	0.34	
2.168	FCDMC 1997	1240	1221.3	1226.01		1226.14	0.00034	4.03	802.4	363.79	0.34	
2.168	FCDMC 2002	1767	1221.3	1226.87		1227.01	0.000302	4.28	1142.62	413.41	0.33	
2.168	BASE6.OUT	1637	1221.3	1226.69		1226.83	0.000304	4.2	1068.43	409.49	0.33	
2.168	BASIN6.OUT	1619	1221.3	1226.66		1226.8	0.000305	4.19	1057.79	408.93	0.33	
2.168	PIMASD6.OUT	1	1221.3	1221.53	1221.43	1221.53	0.001172	0.73	1.38	10.6	0.35	

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Comments
2.128	FCDMC 1997	1240	1220.75	1224.88		1225.91	0.002151	9.65	266.87	135.27	0.85	
2.128	FCDMC 2002	1767	1220.75	1225.54	1225.54	1226.76	0.002262	10.95	391.61	226.83	0.89	
2.128	BASE6.OUT	1637	1220.75	1225.35	1225.35	1226.58	0.002329	10.82	350.9	212.21	0.9	
2.128	BASIN6.OUT	1619	1220.75	1225.32	1225.32	1226.55	0.002342	10.8	345.03	211.37	0.9	
2.128	PIMASD6.OUT	1	1220.75	1220.87	1220.87	1220.91	0.018723	1.68	0.59	10.3	1.24	
2.044	FCDMC 1997	1240	1220.2	1223.94	1223.94	1224.91	0.002247	8.58	258.01	211.3	0.84	
2.044	FCDMC 2002	1767	1220.2	1224.32	1224.58	1225.64	0.002786	10.29	357.54	278.33	0.95	
2.044	BASE6.OUT	1637	1220.2	1224.23	1224.47	1225.48	0.002671	9.92	333.56	275.07	0.93	
2.044	BASIN6.OUT	1619	1220.2	1224.22	1224.45	1225.45	0.002648	9.85	330.71	274.68	0.92	
2.044	PIMASD6.OUT	1	1220.2	1220.66	1220.38	1220.66	0.000064	0.25	4.04	17.63	0.09	
1.961	FCDMC 1997	1240	1218.9	1223.37	1221.68	1223.75	0.000665	5.68	393.63	143.48	0.48	
1.961	FCDMC 2002	1799	1218.9	1224.17	1222.42	1224.69	0.000749	6.74	529.9	231.17	0.52	HEC-1 ID: CC11
1.961	BASE6.OUT	1708	1218.9	1224.03	1222.29	1224.55	0.000746	6.61	499.28	231.17	0.52	HEC-1 ID: CC11
1.961	BASIN6.OUT	1689	1218.9	1224.01	1222.26	1224.51	0.000744	6.58	492.99	231.17	0.52	HEC-1 ID: CC11
1.961	PIMASD6.OUT	131	1218.9	1220.44		1220.5	0.000374	2.03	95.05	79	0.3	HEC-1 ID: CC11
1.925	FCDMC 1997	1240	1218.7	1222.69		1223.51	0.00169	7.87	252.66	137.93	0.74	
1.925	FCDMC 2002	1799	1218.7	1223.03		1224.37	0.002477	10.14	300.39	137.93	0.91	
1.925	BASE6.OUT	1708	1218.7	1222.98		1224.24	0.002357	9.8	292.95	137.93	0.88	
1.925	BASIN6.OUT	1689	1218.7	1222.96		1224.21	0.002337	9.74	291.06	137.93	0.88	
1.925	PIMASD6.OUT	131	1218.7	1220.19	1219.83	1220.36	0.001494	3.29	40.44	44.43	0.57	
1.879	FCDMC 1997	1240	1218.3	1221.81	1221.81	1222.97	0.002634	9.12	205.34	109	0.9	
1.879	FCDMC 2002	1799	1218.3	1222.7	1222.7	1223.75	0.001928	9.2	403.12	257	0.81	
1.879	BASE6.OUT	1708	1218.3	1222.61	1222.61	1223.65	0.001926	9.06	380.15	257	0.8	
1.879	BASIN6.OUT	1689	1218.3	1222.59	1222.59	1223.62	0.001921	9.02	375.73	257	0.8	
1.879	PIMASD6.OUT	131	1218.3	1219.36	1219.36	1219.71	0.005329	4.79	28.24	44.07	1	
1.81	FCDMC 1997	1240	1217.4	1221.43	1220.68	1221.82	0.000984	6.23	491.71	262.98	0.57	
1.81	FCDMC 2002	1799	1217.4	1222.42	1221.23	1222.78	0.000742	6.33	771.06	296	0.51	
1.81	BASE6.OUT	1708	1217.4	1222.29	1221.15	1222.65	0.000756	6.27	732.29	296	0.52	
1.81	BASIN6.OUT	1689	1217.4	1222.26	1221.14	1222.62	0.000763	6.27	722.5	296	0.52	
1.81	PIMASD6.OUT	131	1217.4	1219.1	1218.5	1219.17	0.000513	2.34	86.35	80	0.35	
1.725	FCDMC 1997	1240	1216.5	1220.46		1221.24	0.001527	7.72	260.15	115	0.71	
1.725	FCDMC 2002	1843	1216.5	1221.36		1222.27	0.001429	8.64	408.98	206	0.71	HEC-1 ID: CC08
1.725	BASE6.OUT	1752	1216.5	1221.22		1222.13	0.001459	8.56	381.63	196.13	0.71	HEC-1 ID: CC08
1.725	BASIN6.OUT	1730	1216.5	1221.19		1222.1	0.001466	8.54	375.17	196	0.71	HEC-1 ID: CC08
1.725	PIMASD6.OUT	286	1216.5	1218.46		1218.73	0.001336	4.31	84.18	64.78	0.58	HEC-1 ID: CC08
1.67	FCDMC 1997	1240	1216	1219.79		1220.72	0.001983	8.13	218.78	102	0.79	
1.67	FCDMC 2002	1843	1216	1220.46		1221.73	0.002218	9.71	294	138	0.86	
1.67	BASE6.OUT	1752	1216	1220.37		1221.58	0.002186	9.5	281.78	127.69	0.85	
1.67	BASIN6.OUT	1730	1216	1220.34		1221.55	0.00218	9.45	278.87	123.38	0.85	
1.67	PIMASD6.OUT	286	1216	1218		1218.29	0.001677	4.43	75.96	63.5	0.64	

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Comments
1.575	FCDMC 1997	1240	1215.3	1219.15		1219.78	0.001452	7.25	325.73	178.69	0.68	
1.575	FCDMC 2002	1843	1215.3	1219.92		1220.68	0.001441	8.25	472.41	199.48	0.7	
1.575	BASE6.OUT	1752	1215.3	1219.81		1220.55	0.001451	8.13	449.97	197.9	0.7	
1.575	BASIN6.OUT	1730	1215.3	1219.78		1220.52	0.001463	8.12	443.29	197.43	0.7	
1.575	PIMASD6.OUT	286	1215.3	1217.09		1217.39	0.001954	4.65	89.21	78.27	0.68	
1.522	FCDMC 1997	1240	1214.8	1218.11		1219.2	0.002641	9.23	269.49	211.76	0.91	
1.522	FCDMC 2002	1843	1214.8	1218.99		1220.15	0.002215	9.93	468.71	249.35	0.87	
1.522	BASE6.OUT	1752	1214.8	1218.89		1220.02	0.002212	9.77	444.92	237.76	0.86	
1.522	BASIN6.OUT	1730	1214.8	1218.89		1219.99	0.00216	9.65	444.51	237.76	0.85	
1.522	PIMASD6.OUT	286	1214.8	1216.38		1216.78	0.002398	5.25	71.23	65.18	0.76	
1.499	FCDMC 1997	1240	1214.6	1217.79		1218.89	0.002512	8.59	306.34	156.59	0.88	
1.499	FCDMC 2002	1843	1214.6	1218.7	1218.7	1219.89	0.002024	9.2	551.46	324.02	0.82	
1.499	BASE6.OUT	1752	1214.6	1218.59	1218.59	1219.77	0.002064	9.11	515.89	315.88	0.83	
1.499	BASIN6.OUT	1730	1214.6	1218.56	1218.56	1219.74	0.002079	9.1	506.52	311.31	0.83	
1.499	PIMASD6.OUT	286	1214.6	1216.21		1216.5	0.001711	4.3	93.13	86.17	0.64	
1.438	FCDMC 1997	1240	1213.8	1217.56		1218.16	0.001367	6.83	347.71	250.63	0.66	
1.438	FCDMC 2002	1843	1213.8	1218.19	1217.78	1218.91	0.001438	7.85	518.93	286	0.69	
1.438	BASE6.OUT	1752	1213.8	1218.11	1217.71	1218.81	0.001418	7.69	496.58	286	0.69	
1.438	BASIN6.OUT	1730	1213.8	1218.09	1217.69	1218.79	0.001412	7.65	491.07	286	0.68	
1.438	PIMASD6.OUT	286	1213.8	1215.63		1215.93	0.001807	4.44	73.08	75.52	0.65	
1.373	FCDMC 1997	1240	1213	1216.64		1217.55	0.00218	8.25	245.97	177	0.82	
1.373	FCDMC 2002	1843	1213	1217.65		1218.42	0.001444	8.1	499.36	302	0.7	
1.373	BASE6.OUT	1752	1213	1217.51		1218.3	0.001539	8.16	455.41	302	0.72	
1.373	BASIN6.OUT	1730	1213	1217.47		1218.28	0.001562	8.17	444.83	300.11	0.72	
1.373	PIMASD6.OUT	286	1213	1215.19		1215.42	0.001147	3.96	88.51	77.08	0.54	
1.353	FCDMC 1997	1240	1212.8	1216.96		1217.23	0.00063	5.19	601.37	290.63	0.46	
1.353	FCDMC 2002	1843	1212.8	1217.83		1218.19	0.000662	6.07	891.88	383.6	0.49	
1.353	BASE6.OUT	1752	1212.8	1217.71		1218.06	0.000655	5.94	847.04	373.5	0.48	
1.353	BASIN6.OUT	1730	1212.8	1217.69		1218.02	0.000654	5.91	836.42	370.13	0.48	
1.353	PIMASD6.OUT	286	1212.8	1215.24		1215.32	0.000306	2.48	216.44	152	0.29	
1.301	FCDMC 1997	1240	1212.1	1216.34		1216.97	0.001197	6.94	304.91	160.02	0.63	
1.301	FCDMC 2002	1895	1212.1	1216.99		1217.87	0.001453	8.5	441.51	289.76	0.71	HEC-1 ID: CC06
1.301	BASE6.OUT	1800	1212.1	1216.85		1217.74	0.001508	8.47	402.82	244.81	0.72	HEC-1 ID: CC06
1.301	BASIN6.OUT	1780	1212.1	1216.8		1217.7	0.001553	8.53	390.54	222.56	0.73	HEC-1 ID: CC06
1.301	PIMASD6.OUT	483	1212.1	1214.22	1214.22	1214.97	0.003766	7.11	83.17	70.15	0.97	HEC-1 ID: CC06
1.262	FCDMC 1997	1240	1212	1216.3		1216.48	0.000439	4.39	646.8	229	0.38	
1.262	FCDMC 2002	1895	1212	1216.95		1217.22	0.000558	5.47	832.63	353.18	0.44	
1.262	BASE6.OUT	1800	1212	1216.8		1217.07	0.000574	5.43	783.35	316.37	0.45	
1.262	BASIN6.OUT	1780	1212	1216.75		1217.02	0.00059	5.46	766.48	294.82	0.45	
1.262	PIMASD6.OUT	1	1212	1211.96	1212.05	1213.71	17.37347		0.09	3.25	0	Flow intercepted at structure #11 (INT11).

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Comments
1.239	FCDMC 1997	1240	1210.9	1215.47		1216.11	0.010024	6.88	236.15	200.77	0.69	
1.239	FCDMC 2002	1895	1210.9	1216.83		1217.06	0.002963	4.68	568.2	291.24	0.39	
1.239	BASE6.OUT	1800	1210.9	1216.67		1216.92	0.003289	4.82	523.61	274.11	0.41	
1.239	BASIN6.OUT	1780	1210.9	1216.61		1216.87	0.0035	4.93	506.66	267.31	0.42	
1.239	PIMASD6.OUT	1	1210.9	1211.11	1211.11	1211.17	0.062203	1.94	0.52	4.5	1.01	
1.224	FCDMC 1997	1240	1206.5	1215.45		1215.58	0.00072	3.15	508.68	264.18	0.21	
1.224	FCDMC 2002	1895	1206.5	1216.79		1216.88	0.000488	2.92	1125.66	554.81	0.18	
1.224	BASE6.OUT	1800	1206.5	1216.63		1216.73	0.000518	2.97	1037.68	543.03	0.18	
1.224	BASIN6.OUT	1780	1206.5	1216.57		1216.67	0.000541	3.02	1002.77	538.28	0.19	
1.224	PIMASD6.OUT	1	1206.5	1210.89	1206.73	1210.89	0	0.01	117.26	40.34	0	
1.181	FCDMC 1997	1240	1204.95	1215.1		1215.32	0.001357	3.95	360.2	104.82	0.28	
1.181	FCDMC 2002	1895	1204.95	1216.36		1216.63	0.001359	4.47	534.29	181.82	0.29	
1.181	BASE6.OUT	1800	1204.95	1216.21		1216.47	0.001361	4.42	506.43	181.82	0.29	
1.181	BASIN6.OUT	1780	1204.95	1216.14		1216.4	0.001398	4.45	493.34	181.82	0.29	
1.181	PIMASD6.OUT	1	1204.95	1210.89		1210.89	0	0.01	106.72	32.74	0	
1.138	FCDMC 1997	1240	1207.5	1214.81		1215	0.001362	3.54	355.57	84.16	0.28	
1.138	FCDMC 2002	1895	1207.5	1216.03		1216.31	0.00149	4.27	464.37	92.64	0.3	
1.138	BASE6.OUT	1800	1207.5	1215.89		1216.15	0.001456	4.16	451.6	91.54	0.29	
1.138	BASIN6.OUT	1780	1207.5	1215.81		1216.08	0.001489	4.17	444.6	91.21	0.3	
1.138	PIMASD6.OUT	1	1207.5	1210.89		1210.89	0	0.01	116.76	47.33	0	
1.121	FCDMC 1997	1240	1206	1214.62		1214.87	0.00119	4.16	338.27	75.36	0.27	
1.121	FCDMC 2002	1895	1206	1215.81		1216.15	0.00141	5.01	475.83	134	0.3	
1.121	BASE6.OUT	1800	1206	1215.67		1215.99	0.001395	4.93	456.4	134	0.3	
1.121	BASIN6.OUT	1780	1206	1215.58		1215.91	0.001448	4.98	444.05	134	0.31	
1.121	PIMASD6.OUT	1	1206	1210.89		1210.89	0	0.01	128.3	41.7	0	
1.115	FCDMC 1997	1240	1205.66	1214.63	1210.04	1214.78	0.001009	3.14	395.37	85.9	0.24	
1.115	FCDMC 2002	1895	1205.66	1215.81	1211.08	1216.05	0.00123	3.93	482.7	129.85	0.27	
1.115	BASE6.OUT	1800	1205.66	1215.67	1210.93	1215.9	0.001194	3.81	472.29	129.85	0.27	
1.115	BASIN6.OUT	1780	1205.66	1215.58	1210.91	1215.81	0.001224	3.82	465.68	129.85	0.27	
1.115	PIMASD6.OUT	1	1205.66	1210.89	1205.84	1210.89	0	0.01	167.34	48.1	0	
1.1115		Bridge										Apartment leasing office.
1.108	FCDMC 1997	1240	1205.6	1214.54	1210.59	1214.69	0.001142	3.07	403.37	118.72	0.25	
1.108	FCDMC 2002	1895	1205.6	1215.46	1211.57	1215.7	0.001467	3.93	482.6	161.61	0.29	
1.108	BASE6.OUT	1800	1205.6	1215.36	1211.45	1215.58	0.001405	3.8	474.1	158.81	0.29	
1.108	BASIN6.OUT	1780	1205.6	1215.28	1211.41	1215.51	0.001441	3.81	467.36	156.59	0.29	
1.108	PIMASD6.OUT	1	1205.6	1210.89	1205.83	1210.89	0	0.01	149.23	53.98	0	

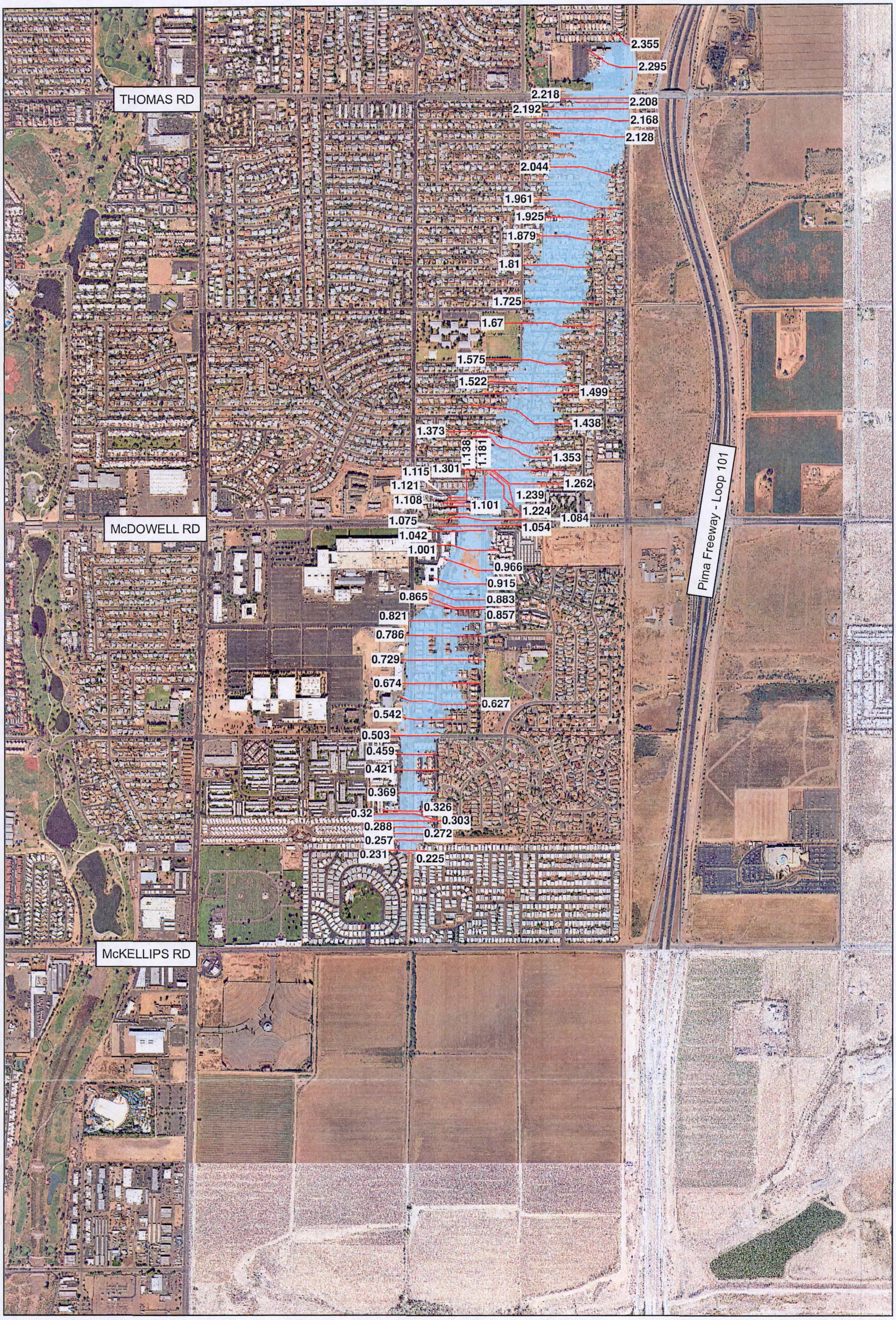
River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Comments
1.101	FCDMC 1997	1240	1205.5	1214.51		1214.65	0.000783	3.61	442.8	97.36	0.23	
1.101	FCDMC 2002	1895	1205.5	1215.39		1215.64	0.00128	4.96	541.1	132.96	0.29	
1.101	BASE6.OUT	1800	1205.5	1215.3		1215.53	0.001197	4.76	529.06	127.7	0.28	
1.101	BASIN6.OUT	1780	1205.5	1215.22		1215.45	0.001204	4.75	519.42	123.34	0.28	
1.101	PIMASD6.OUT	1	1205.5	1210.89		1210.89	0	0.01	175.16	61.48	0	
1.084	FCDMC 1997	1240	1205.2	1214.43		1214.58	0.0008	3.63	426.64	87.9	0.23	
1.084	FCDMC 2002	1895	1205.2	1215.27		1215.53	0.001285	4.92	505.67	103	0.29	
1.084	BASE6.OUT	1800	1205.2	1215.18		1215.42	0.001225	4.77	496.48	103	0.28	
1.084	BASIN6.OUT	1780	1205.2	1215.1		1215.34	0.001259	4.81	487.94	102.76	0.29	
1.084	PIMASD6.OUT	1	1205.2	1210.89		1210.89	0	0.01	173.23	60.94	0	
1.075	FCDMC 1997	1240	1202.6	1214.42	1209.53	1214.55	0.000354	3.81	528.1	110.07	0.2	
1.075	FCDMC 2002	1895	1202.6	1215.26	1211.79	1215.47	0.000525	4.87	649.48	196.74	0.24	
1.075	BASE6.OUT	1800	1202.6	1215.17	1211.49	1215.36	0.000498	4.72	632.36	182.44	0.23	
1.075	BASIN6.OUT	1780	1202.6	1215.09	1211.44	1215.29	0.000511	4.75	617.63	169.19	0.24	
1.075	PIMASD6.OUT	1	1202.6	1210.89	1202.68	1210.89	0	0.01	99.27	53.8	0	
1.0645		Culvert										McDowell Rd. crossing.
1.054	FCDMC 1997	1417	1202.5	1213.22	1212.9	1213.84	0.001599	7.57	375.33	202.61	0.41	FEMA FIS: GRW at Van Buren St.
1.054	FCDMC 2002	2204	1202.5	1214.11	1213.75	1214.66	0.001609	8.01	593.54	297.32	0.42	HEC-1 ID: CC03
1.054	BASE6.OUT	2044	1202.5	1214	1213.56	1214.54	0.001542	7.79	562.09	285.66	0.41	HEC-1 ID: CC03
1.054	BASIN6.OUT	1953	1202.5	1213.72	1213.47	1214.4	0.001879	8.46	485.35	251.38	0.45	HEC-1 ID: CC03
1.054	PIMASD6.OUT	334	1202.5	1210.71	1205.44	1210.89	0.000466	3.42	97.75	19.01	0.21	HEC-1 ID: CC03
1.042	FCDMC 1997	1417	1203.7	1213.4		1213.51	0.000982	3.39	674.38	425.22	0.26	
1.042	FCDMC 2002	2204	1203.7	1214.28		1214.36	0.000683	3.14	1066.79	469.99	0.23	
1.042	BASE6.OUT	2044	1203.7	1214.17		1214.25	0.000676	3.09	1014.1	467.84	0.23	
1.042	BASIN6.OUT	1953	1203.7	1213.93		1214.03	0.000827	3.33	906.86	445.2	0.25	
1.042	PIMASD6.OUT	334	1203.7	1210.68		1210.82	0.001176	3.02	110.41	28.78	0.27	
1.001	FCDMC 1997	1417	1203.7	1213.05		1213.26	0.001142	3.91	472.53	329.81	0.3	
1.001	FCDMC 2002	2204	1203.7	1214		1214.17	0.000944	3.96	841.58	394.99	0.28	
1.001	BASE6.OUT	2044	1203.7	1213.89		1214.06	0.000914	3.86	800.25	394.99	0.27	
1.001	BASIN6.OUT	1953	1203.7	1213.56		1213.79	0.00123	4.31	669.25	394.99	0.32	
1.001	PIMASD6.OUT	334	1203.7	1210.59		1210.64	0.000494	1.9	177.97	59.17	0.18	
0.966	FCDMC 1997	1417	1203.6	1212.96		1213.07	0.000605	3.19	635.51	231.14	0.22	
0.966	FCDMC 2002	2204	1203.6	1213.86		1214	0.000696	3.74	935.26	436.5	0.25	
0.966	BASE6.OUT	2044	1203.6	1213.76		1213.9	0.00065	3.59	895.71	415.12	0.24	
0.966	BASIN6.OUT	1953	1203.6	1213.41		1213.58	0.000804	3.86	764.03	334.24	0.26	
0.966	PIMASD6.OUT	334	1203.6	1210.52		1210.56	0.000319	1.67	237.5	118.62	0.15	

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Comments
0.915	FCDMC 1997	1417	1203.1	1212.78		1212.91	0.000678	3.47	639.87	274.5	0.24	
0.915	FCDMC 2002	2204	1203.1	1213.67		1213.82	0.000747	3.96	889.77	283.3	0.25	
0.915	BASE6.OUT	2044	1203.1	1213.59		1213.73	0.000684	3.76	868.24	282.77	0.24	
0.915	BASIN6.OUT	1953	1203.1	1213.19		1213.36	0.000888	4.13	753.47	279.92	0.27	
0.915	PIMASD6.OUT	334	1203.1	1210.43		1210.48	0.000329	1.81	214.98	107.64	0.15	
0.883	FCDMC 1997	1417	1203.1	1212.65		1212.79	0.000639	3.46	604.73	294.4	0.23	
0.883	FCDMC 2002	2204	1203.1	1213.53		1213.69	0.000716	3.95	868.82	305.51	0.24	
0.883	BASE6.OUT	2044	1203.1	1213.47		1213.61	0.000648	3.74	849.96	305.02	0.23	
0.883	BASIN6.OUT	1953	1203.1	1213		1213.2	0.000882	4.2	710.24	301.38	0.27	
0.883	PIMASD6.OUT	334	1203.1	1210.39		1210.43	0.000204	1.6	226.15	75.13	0.12	
0.865	FCDMC 1997	1417	1202.9	1212.63		1212.73	0.000478	2.99	732.86	297.75	0.2	
0.865	FCDMC 2002	2204	1202.9	1213.5		1213.62	0.00055	3.47	997.6	307.35	0.22	HEC-1 ID: CB07
0.865	BASE6.OUT	2038	1202.9	1213.44		1213.55	0.000492	3.27	979.82	307.06	0.21	HEC-1 ID: CB07
0.865	BASIN6.OUT	1721	1202.9	1213.01		1213.11	0.000506	3.19	846.64	304.87	0.21	HEC-1 ID: CB07
0.865	PIMASD6.OUT	275	1202.9	1210.38		1210.41	0.000145	1.27	238.14	92.04	0.1	HEC-1 ID: CB07
0.857	FCDMC 1997	1417	1208.5	1211.5	1211.5	1212.44	0.003014	8.9	280.28	173.03	0.95	
0.857	FCDMC 2002	2204	1208.5	1212.35	1212.35	1213.32	0.00242	9.54	475.36	295.73	0.89	
0.857	BASE6.OUT	2038	1208.5	1211.95	1211.95	1213.17	0.003404	10.45	362.51	197.69	1.03	
0.857	BASIN6.OUT	1721	1208.5	1211.83	1211.83	1212.81	0.002841	9.31	338.93	190.95	0.93	
0.857	PIMASD6.OUT	275	1208.5	1209.82	1209.82	1210.26	0.004184	5.57	63.38	86.34	0.95	
0.821	FCDMC 1997	1417	1207.1	1211.61	1209.97	1211.82	0.000547	5.19	687.9	345.14	0.44	
0.821	FCDMC 2002	2204	1207.1	1212.26	1210.74	1212.57	0.000693	6.41	922.4	367.2	0.5	
0.821	BASE6.OUT	2038	1207.1	1212.14	1210.59	1212.43	0.000664	6.17	877.52	364.49	0.49	
0.821	BASIN6.OUT	1721	1207.1	1211.89	1210.26	1212.14	0.000606	5.69	785.86	356.67	0.46	
0.821	PIMASD6.OUT	275	1207.1	1209.26	1208.26	1209.35	0.000451	2.84	175.74	129.83	0.35	
0.786	FCDMC 1997	1417	1206.9	1211.01	1211.01	1211.63	0.001449	7.99	460.85	309.32	0.7	
0.786	FCDMC 2002	2204	1206.9	1211.45	1211.45	1212.31	0.001955	9.94	597.61	311.52	0.83	
0.786	BASE6.OUT	2038	1206.9	1211.34	1211.34	1212.18	0.001909	9.67	564.78	310.99	0.81	
0.786	BASIN6.OUT	1721	1206.9	1211.14	1211.14	1211.91	0.001784	9.06	501.19	309.97	0.78	
0.786	PIMASD6.OUT	275	1206.9	1208.97	1208.33	1209.21	0.001057	4.29	92.55	60.44	0.53	
0.729	FCDMC 1997	1417	1206.6	1209.97	1209.64	1210.31	0.001385	6.63	570.65	373.82	0.66	
0.729	FCDMC 2002	2204	1206.6	1210.69	1210.05	1211.03	0.001208	7.1	847.9	411.48	0.63	
0.729	BASE6.OUT	2038	1206.6	1210.55	1209.98	1210.89	0.001241	7.02	789.76	383.87	0.64	
0.729	BASIN6.OUT	1721	1206.6	1210.26	1209.82	1210.6	0.001305	6.83	681.21	378.75	0.65	
0.729	PIMASD6.OUT	275	1206.6	1208.08	1208.07	1208.62	0.004111	6.22	59.18	68.87	0.97	
0.674	FCDMC 1997	1417	1205.8	1209.03	1209.03	1209.75	0.002453	8.75	383.22	267.23	0.87	
0.674	FCDMC 2002	2204	1205.8	1209.54	1209.54	1210.46	0.002842	10.41	520.75	271.31	0.96	
0.674	BASE6.OUT	2038	1205.8	1209.46	1209.46	1210.32	0.00272	10.03	497.86	270.64	0.94	
0.674	BASIN6.OUT	1721	1205.8	1209.26	1209.26	1210.04	0.002559	9.36	444.5	269.06	0.9	
0.674	PIMASD6.OUT	275	1205.8	1207.69	1207.19	1207.93	0.001248	4.29	95.17	78.6	0.57	

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Comments
0.627	FCDMC 1997	1417	1205.3	1208.01	1208.01	1208.31	0.002196	6.85	515.5	342.04	0.79	
0.627	FCDMC 2002	2204	1205.3	1208.4	1208.04	1208.84	0.002726	8.46	653.49	356.02	0.9	
0.627	BASE6.OUT	2038	1205.3	1208.29	1208.01	1208.72	0.002776	8.31	614.02	355.46	0.9	
0.627	BASIN6.OUT	1721	1205.3	1208.02	1208.01	1208.46	0.003156	8.24	520.35	342.11	0.94	
0.627	PIMASD6.OUT	275	1205.3	1206.92	1206.92	1207.41	0.003847	6	67.83	85.59	0.94	
0.542	FCDMC 1997	1417	1203.2	1205.52	1205.84	1206.94	0.005938	9.73	167.11	108.06	1.25	
0.542	FCDMC 2002	2230	1203.2	1206.68	1206.68	1207.8	0.002647	8.93	359.7	224.59	0.9	HEC-1 ID: CB05
0.542	BASE6.OUT	2092	1203.2	1206.57	1206.57	1207.66	0.002679	8.77	335.29	223.84	0.9	HEC-1 ID: CB05
0.542	BASIN6.OUT	1756	1203.2	1206.26	1206.26	1207.3	0.002859	8.42	272.19	194.72	0.91	HEC-1 ID: CB05
0.542	PIMASD6.OUT	308	1203.2	1204.31	1204.44	1204.89	0.009058	6.09	51.62	81.48	1.3	HEC-1 ID: CB05
0.503	FCDMC 1997	1417	1202.3	1204.37	1204.62	1205.43	0.006847	10.38	286.19	225.67	1.34	
0.503	FCDMC 2002	2247	1202.3	1204.58	1205.22	1206.55	0.011367	14.35	337.3	264.9	1.75	HEC-1 ID: CB03
0.503	BASE6.OUT	2109	1202.3	1204.52	1205.14	1206.41	0.011319	14.03	320.83	252.93	1.74	HEC-1 ID: CB03
0.503	BASIN6.OUT	1782	1202.3	1204.37	1204.91	1206.05	0.010892	13.08	285.55	225.14	1.69	HEC-1 ID: CB03
0.503	PIMASD6.OUT	391	1202.3	1203.58	1203.58	1203.97	0.004592	5.87	126.52	176.31	1	HEC-1 ID: CB03
0.459	FCDMC 1997	1417	1199.4	1202.48	1201.91	1203.03	0.002095	7.47	356.48	161.18	0.79	
0.459	FCDMC 2002	2247	1199.4	1203.44	1202.59	1204.14	0.001855	8.56	521.33	183.43	0.78	
0.459	BASE6.OUT	2109	1199.4	1203.28	1202.48	1203.96	0.001904	8.43	492.64	179.87	0.78	
0.459	BASIN6.OUT	1782	1199.4	1202.9	1202.19	1203.53	0.002033	8.07	424.85	171.03	0.8	
0.459	PIMASD6.OUT	391	1199.4	1200.42	1200.78	1201.67	0.023556	10.19	63.77	125.79	2.11	
0.421	FCDMC 1997	1417	1198.5	1201.67		1202.52	0.002804	8.82	299.78	149.37	0.92	
0.421	FCDMC 2002	2247	1198.5	1202.33	1202.15	1203.6	0.003309	10.98	402.89	170.88	1.03	
0.421	BASE6.OUT	2109	1198.5	1202.24	1202.02	1203.43	0.003182	10.6	388.59	167.04	1.01	
0.421	BASIN6.OUT	1782	1198.5	1202.12		1203.04	0.002586	9.32	368.42	161.47	0.9	
0.421	PIMASD6.OUT	391	1198.5	1200.37	1200.2	1200.72	0.002223	5.24	123.07	121.69	0.74	
0.369	FCDMC 1997	1417	1197.8	1200.75	1200.75	1201.67	0.003304	9.22	294.99	158.84	0.99	
0.369	FCDMC 2002	2247	1197.8	1201.59	1201.59	1202.67	0.002941	10.4	460.47	218.37	0.97	
0.369	BASE6.OUT	2109	1197.8	1201.49	1201.49	1202.54	0.002905	10.16	440.12	217.5	0.96	
0.369	BASIN6.OUT	1782	1197.8	1200.95	1200.95	1202.13	0.003976	10.59	325.91	161.06	1.1	
0.369	PIMASD6.OUT	391	1197.8	1199.51	1199.51	1199.98	0.003099	5.94	108.29	138.27	0.86	
0.326	FCDMC 1997	1417	1197.4	1200.06	1199.5	1200.57	0.002981	7.98	372	193.28	0.92	
0.326	FCDMC 2002	2247	1197.4	1200.89	1200.2	1201.52	0.002527	8.98	539.55	209.95	0.89	
0.326	BASE6.OUT	2109	1197.4	1200.75	1200.1	1201.37	0.002642	8.91	510.51	205	0.9	
0.326	BASIN6.OUT	1782	1197.4	1200.41	1199.83	1201.01	0.002924	8.66	441.21	202.52	0.93	
0.326	PIMASD6.OUT	391	1197.4	1199.14	1198.31	1199.25	0.001149	3.57	210.25	159.63	0.52	
0.320	FCDMC 1997	1417	1197.3	1199.99		1200.48	0.002186	6.8	418.46	269.5	0.78	
0.320	FCDMC 2002	2247	1197.3	1200.96		1201.4	0.001364	6.77	686.29	289.5	0.66	
0.320	BASE6.OUT	2109	1197.3	1200.81		1201.25	0.001445	6.75	642.72	289.5	0.67	
0.320	BASIN6.OUT	1782	1197.3	1200.43		1200.89	0.001703	6.74	538.07	271.2	0.71	
0.320	PIMASD6.OUT	391	1197.3	1198.75	1198.75	1199.15	0.003834	5.43	109.89	182.8	0.91	

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Comments
0.303	FCDMC 1997	1417	1197.3	1199.21	1199.21	1200.13	0.006274	9.05	252.3	145.25	1.25	
0.303	FCDMC 2002	2247	1197.3	1199.86	1199.86	1201.1	0.005382	10.48	346.25	145.25	1.22	
0.303	BASE6.OUT	2109	1197.3	1199.76	1199.76	1200.95	0.005509	10.28	331.24	145.25	1.23	
0.303	BASIN6.OUT	1782	1197.3	1199.51	1199.51	1200.57	0.005786	9.72	295.61	145.25	1.23	
0.303	PIMASD6.OUT	391	1197.3	1198.05	1198.06	1198.5	0.019019	6.78	86.72	132.61	1.76	
0.288	FCDMC 1997	1417	1190.9	1199.03	1195.28	1199.25	0.000357	4.85	565.06	160.53	0.34	
0.288	FCDMC 2002	2244	1190.9	1200.3	1196.22	1200.58	0.000384	5.69	768.65	160.53	0.36	HEC-1 ID: CB01
0.288	BASE6.OUT	2105	1190.9	1200.04	1196.08	1200.32	0.000397	5.64	726.63	160.53	0.37	HEC-1 ID: CB01
0.288	BASIN6.OUT	1782	1190.9	1199.5	1195.71	1199.77	0.000404	5.41	640.41	160.53	0.37	HEC-1 ID: CB01
0.288	PIMASD6.OUT	549	1190.9	1196.21	1193.61	1196.31	0.000292	3.25	272.76	74.81	0.29	HEC-1 ID: CB01
0.272	FCDMC 1997	1417	1190.8	1199.11	1193.01	1199.19	0.000148	3.02	710.05	97.21	0.22	
0.272	FCDMC 2002	2244	1190.8	1200.37	1193.05	1200.52	0.000221	4.11	832.02	97.21	0.27	
0.272	BASE6.OUT	2105	1190.8	1200.11	1193.01	1200.25	0.000214	3.97	807.27	97.21	0.27	
0.272	BASIN6.OUT	1782	1190.8	1199.59	1193.01	1199.7	0.000191	3.58	756.07	97.21	0.25	
0.272	PIMASD6.OUT	549	1190.8	1196.25	1193.01	1196.28	0.000075	1.71	457.7	76.82	0.15	
0.257	FCDMC 1997	1417	1189.5	1198.76	1196.74	1199.1	0.000367	6.25	563.34	199	0.36	
0.257	FCDMC 2002	2244	1189.5	1200.16	1198.53	1200.46	0.000326	6.47	841.7	199	0.35	
0.257	BASE6.OUT	2105	1189.5	1199.87	1198.43	1200.18	0.000349	6.57	783.23	199	0.36	
0.257	BASIN6.OUT	1782	1189.5	1199.26	1197.93	1199.61	0.000389	6.66	661.81	199	0.38	
0.257	PIMASD6.OUT	549	1189.5	1195.09	1193.36	1196	0.001083	7.64	71.84	34.48	0.57	
0.244		Culvert										SRP well site crossing.
0.231	FCDMC 1997	1417	1189.2	1198.45	1196.46	1198.54	0.000136	3.79	961.02	289.7	0.22	
0.231	FCDMC 2002	2244	1189.2	1200.26	1197.1	1200.33	0.0001	3.66	1485.64	289.7	0.19	
0.231	BASE6.OUT	2105	1189.2	1199.98	1197.02	1200.05	0.000103	3.67	1404.2	289.7	0.2	
0.231	BASIN6.OUT	1782	1189.2	1199.3	1196.8	1199.37	0.000115	3.69	1206.16	289.7	0.21	
0.231	PIMASD6.OUT	549	1189.2	1193.92	1193.11	1195.21	0.001947	9.11	60.25	18.24	0.75	
0.225	FCDMC 1997	1417	1188.73	1196.62	1196.49	1198.1	0.002502	10.48	176.47	55	0.73	
0.225	FCDMC 2002	2244	1188.73	1198.04	1197.71	1199.81	0.002501	11.97	254.51	55	0.75	
0.225	BASE6.OUT	2105	1188.73	1197.82	1197.53	1199.54	0.002501	11.75	242.49	55	0.75	
0.225	BASIN6.OUT	1782	1188.73	1197.28	1197.07	1198.9	0.002502	11.19	213.07	55	0.74	
0.225	PIMASD6.OUT	549	1188.73	1194.01	1192.95	1194.98	0.0025	7.92	69.34	16.81	0.69	

2. Floodplain Analysis



Feet
0 500 1,000 1,500

Exhibit 4
Existing Conditions

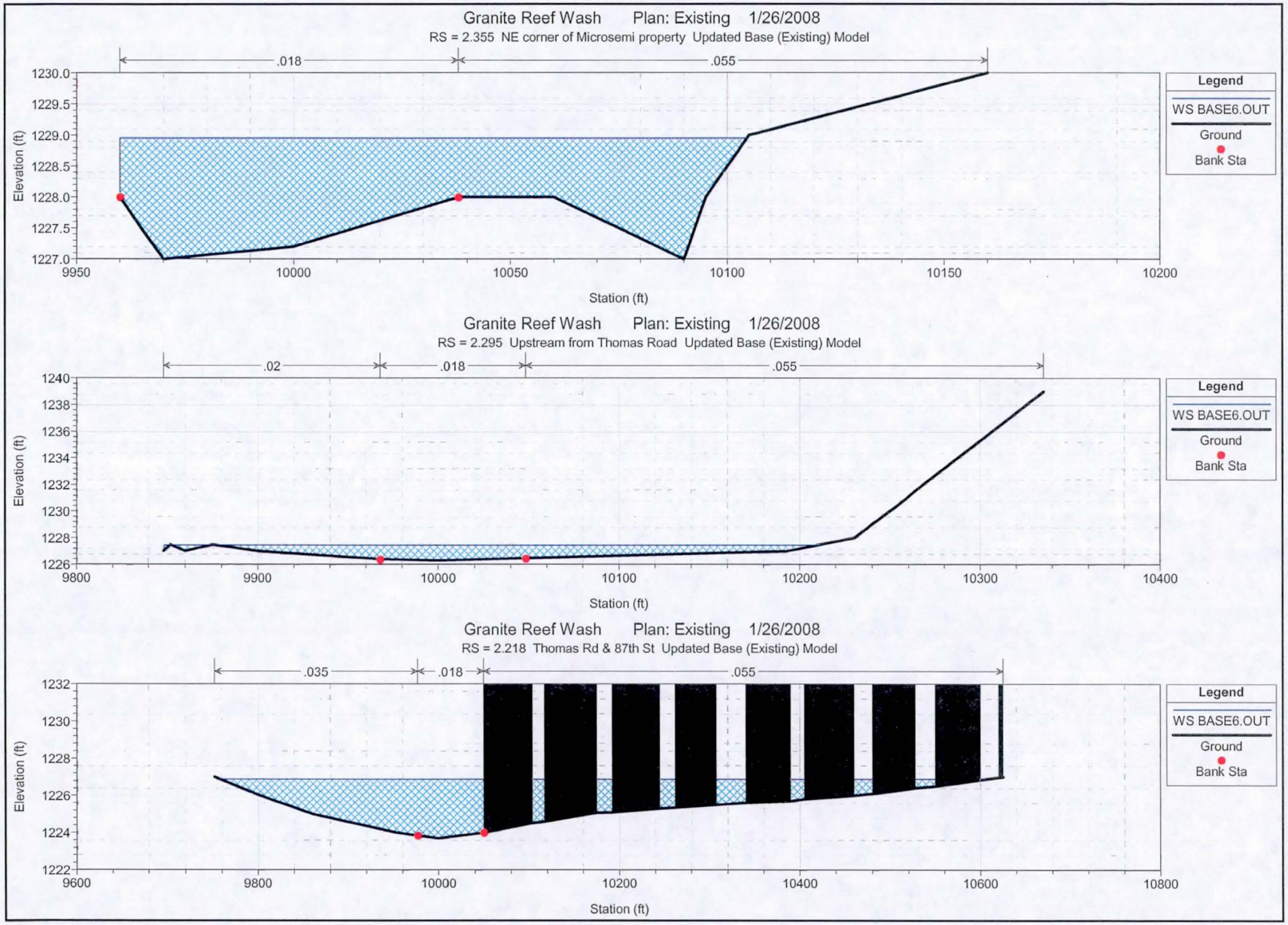
City of Scottsdale
Granite Reef Wash Project

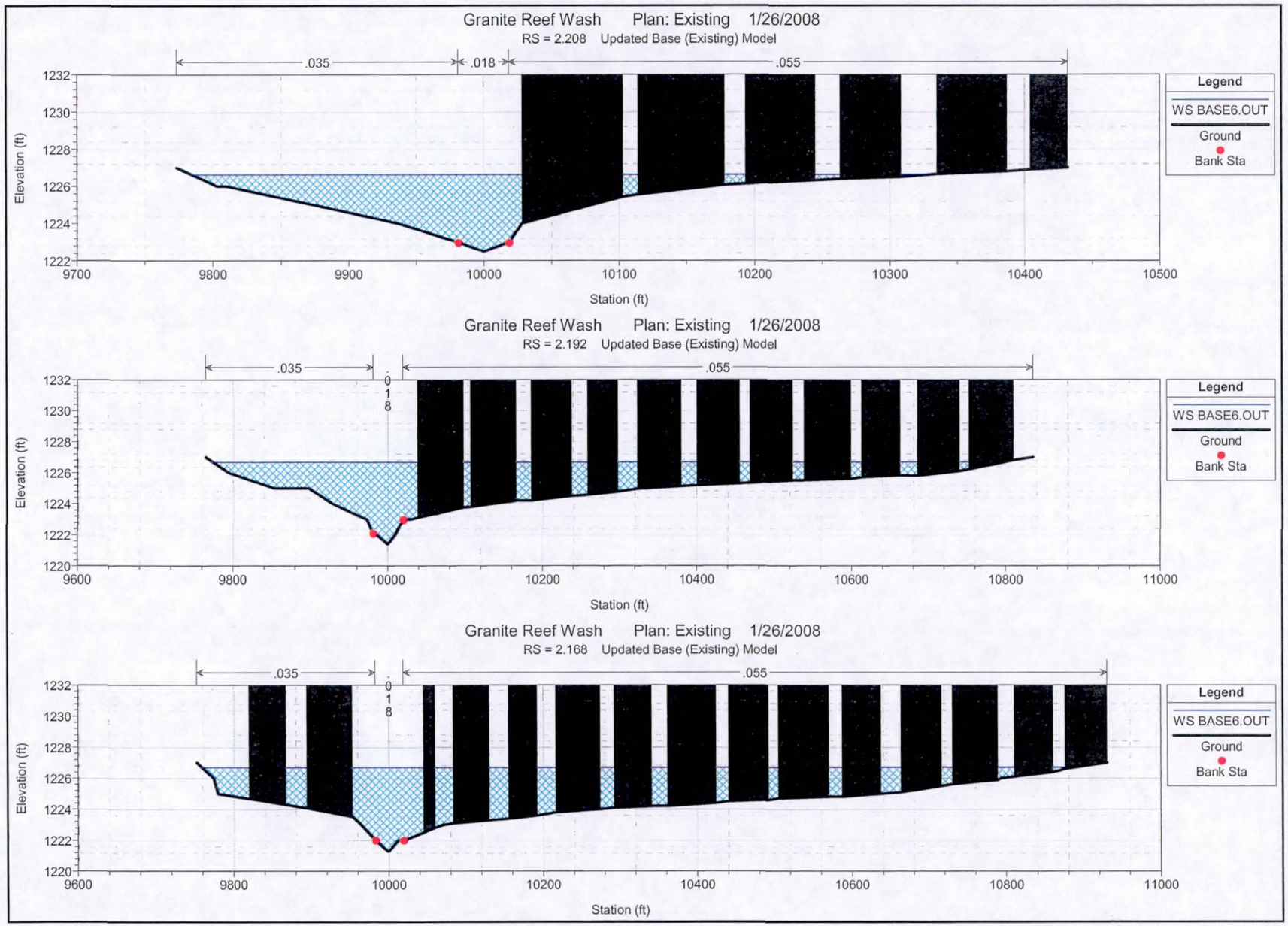
Floodplain Delineation

Map: SCDL-3

Printed On: 01/24/2008

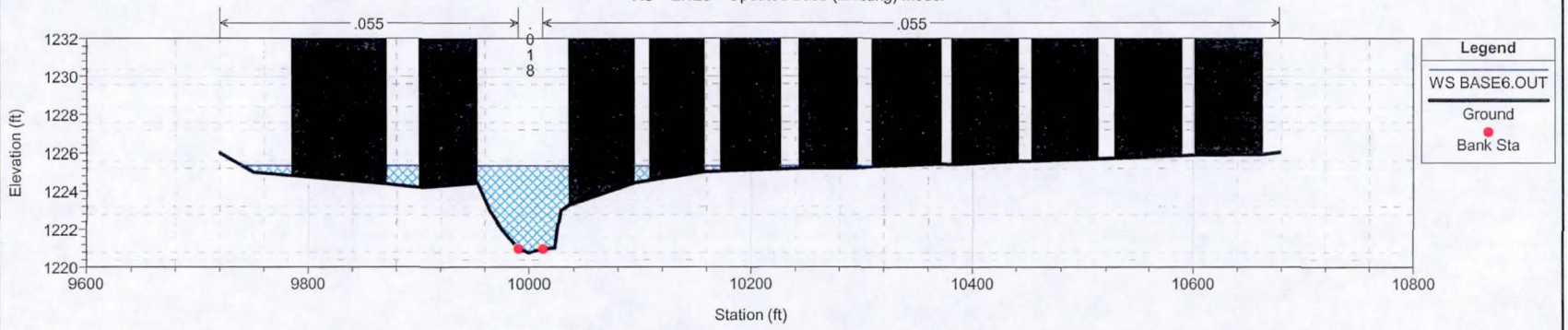
Created By: PSOMAS


Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.355 NE corner of Microsemi property Updated Base (Existing) Model
.018
.055
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.295 Upstream from Thomas Road Updated Base (Existing) Model
.02
.018
.055
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.218 Thomas Rd & 87th St Updated Base (Existing) Model
.035
.018
.055
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.208 Updated Base (Existing) Model
.035
.018
.055
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.192 Updated Base (Existing) Model
.035
.018
.055
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.168 Updated Base (Existing) Model
.035
.018
.055
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta

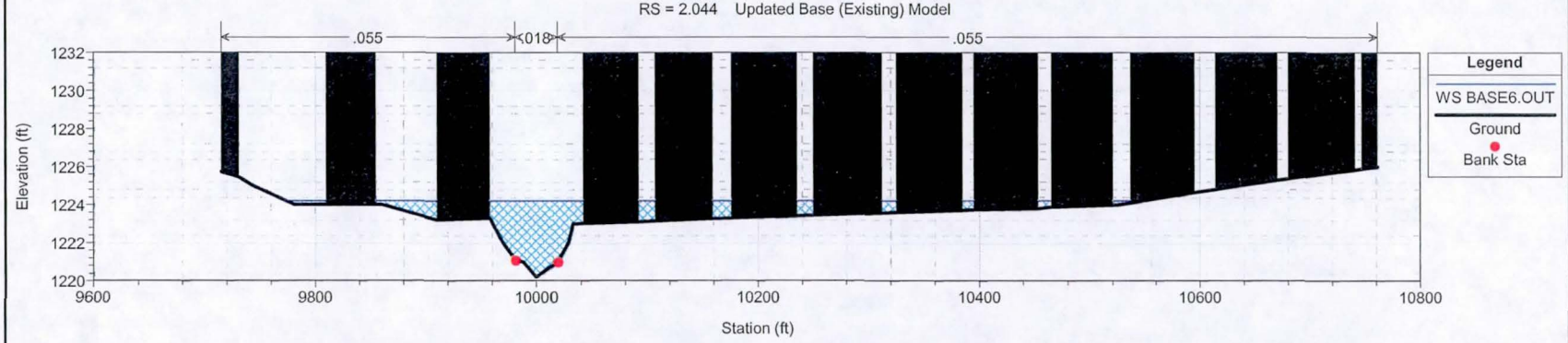
Granite Reef Wash Plan: Existing 1/26/2008

RS = 2.128 Updated Base (Existing) Model



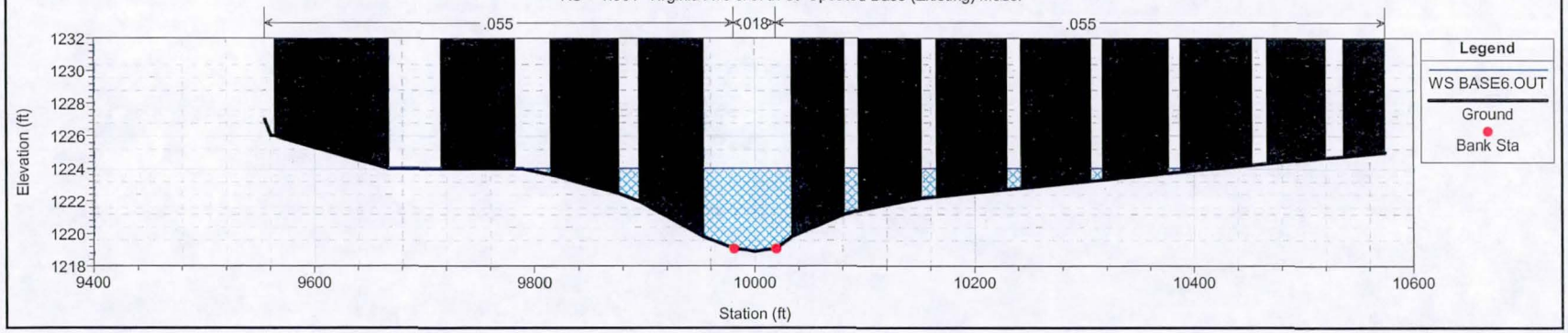
Granite Reef Wash Plan: Existing 1/26/2008

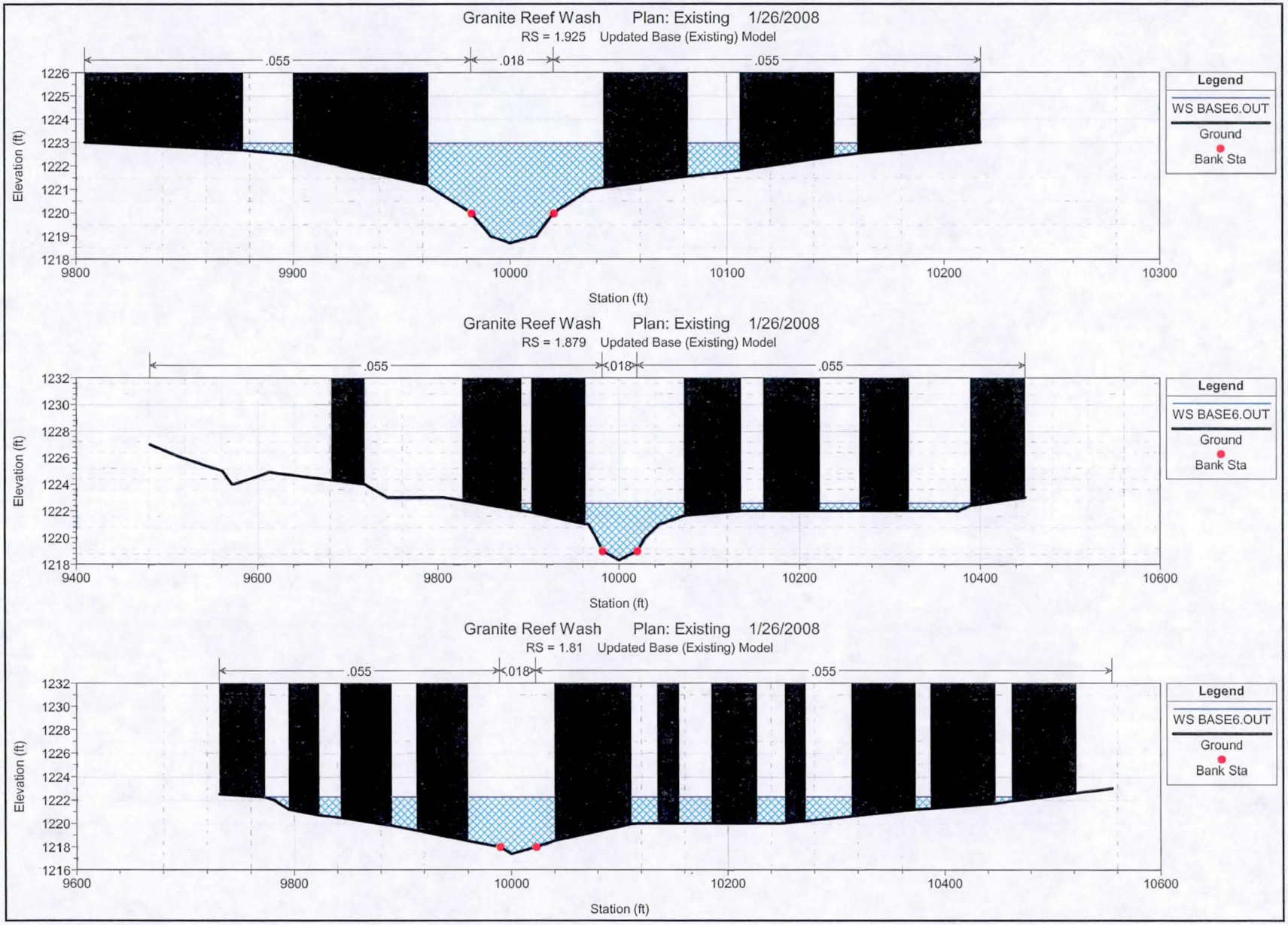
RS = 2.044 Updated Base (Existing) Model

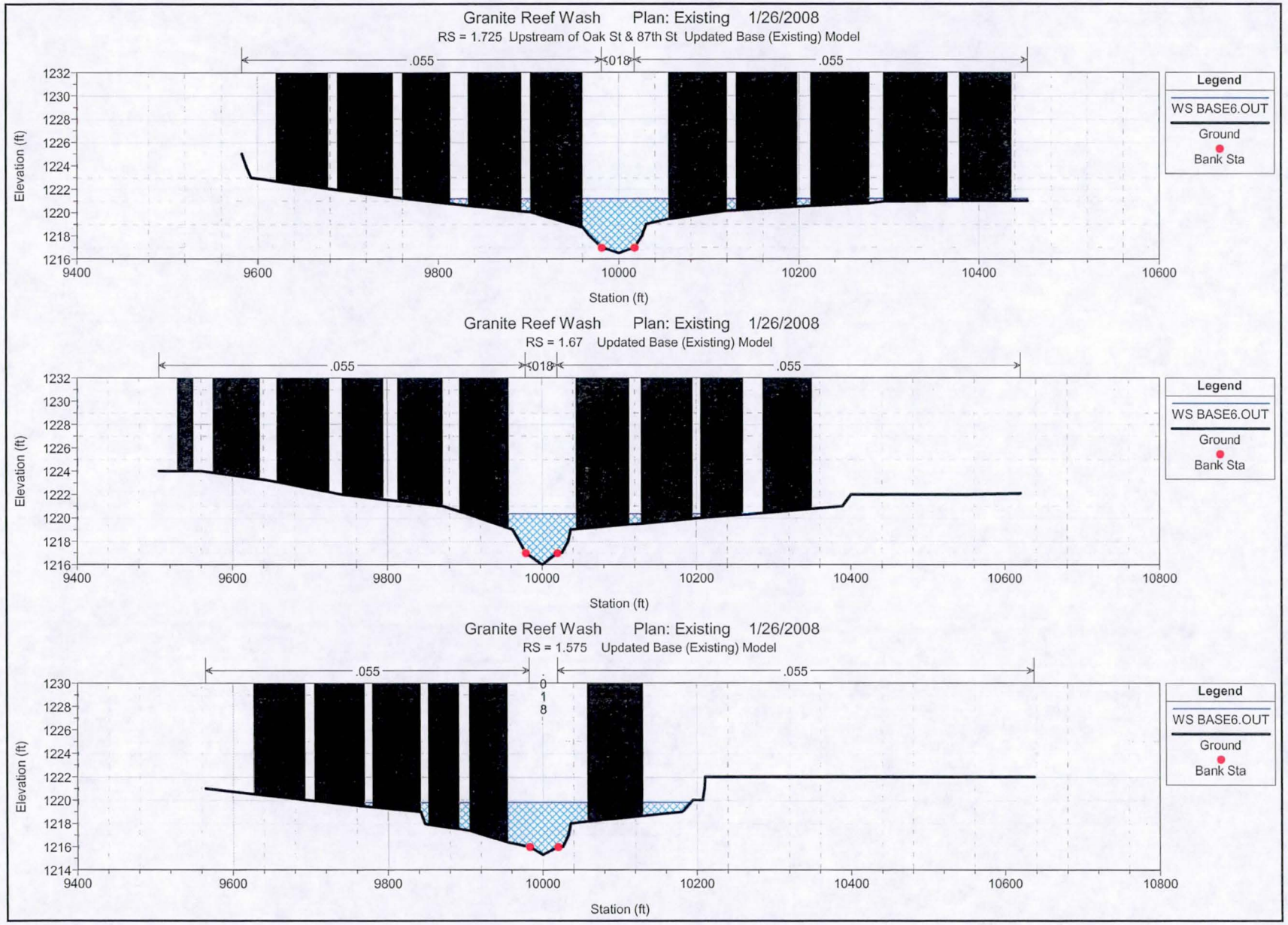


Granite Reef Wash Plan: Existing 1/26/2008

RS = 1.961 Virginia Ave & 87th St Updated Base (Existing) Model

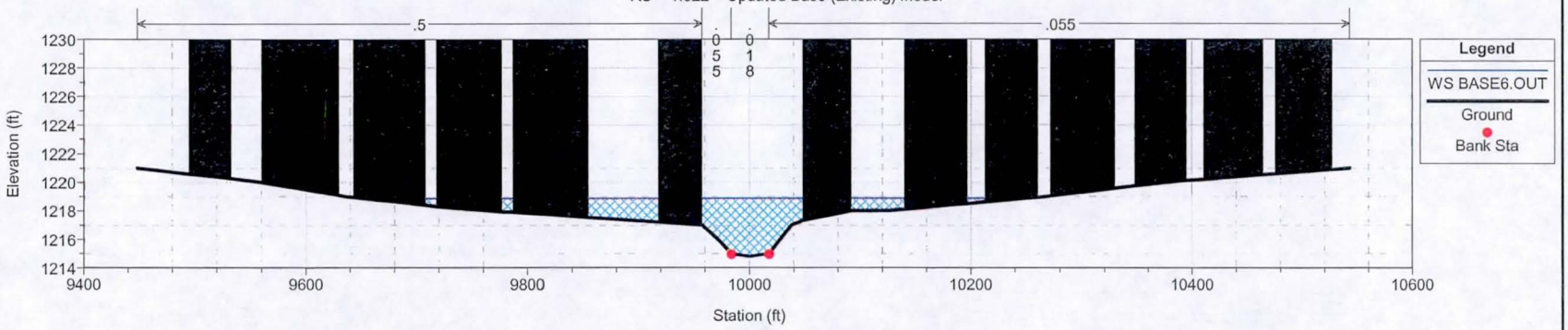



Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.925 Updated Base (Existing) Model
.055
.018
.055
Elevation (ft)
1226
1225
1224
1223
1222
1221
1220
1219
1218
9800
9900
10000
10100
10200
10300
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.879 Updated Base (Existing) Model
.055
.018
.055
Elevation (ft)
1232
1230
1228
1226
1224
1222
1220
1218
9400
9600
9800
10000
10200
10400
10600
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.81 Updated Base (Existing) Model
.055
.018
.055
Elevation (ft)
1232
1230
1228
1226
1224
1222
1220
1218
1216
9600
9800
10000
10200
10400
10600
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.725 Upstream of Oak St & 87th St Updated Base (Existing) Model
.055
.018
.055
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.67 Updated Base (Existing) Model
.055
.018
.055
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.575 Updated Base (Existing) Model
.055
.018
.055
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta

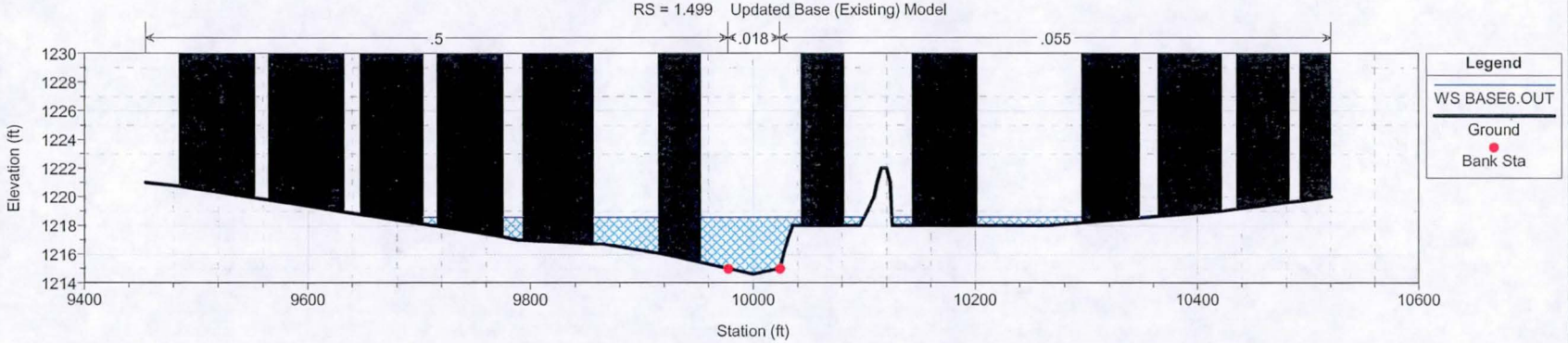
Granite Reef Wash Plan: Existing 1/26/2008

RS = 1.522 Updated Base (Existing) Model



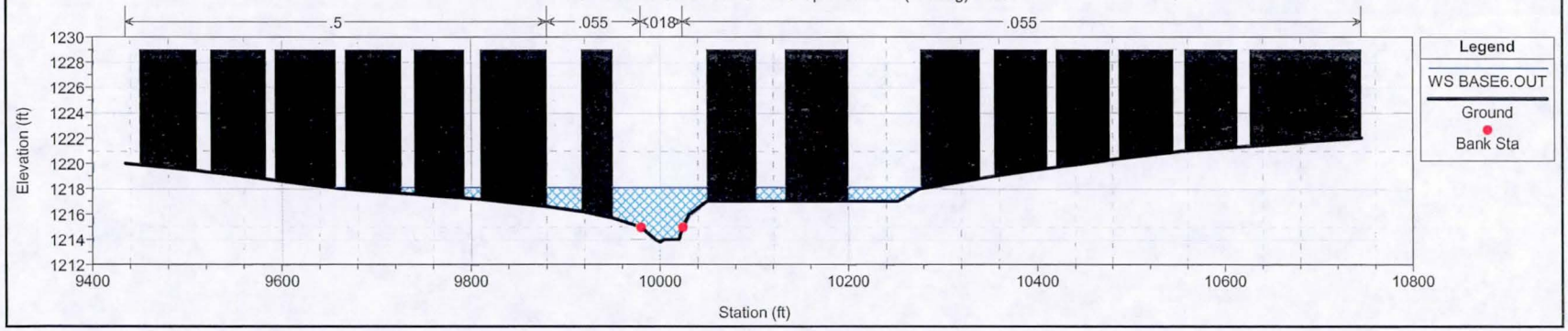
Granite Reef Wash Plan: Existing 1/26/2008

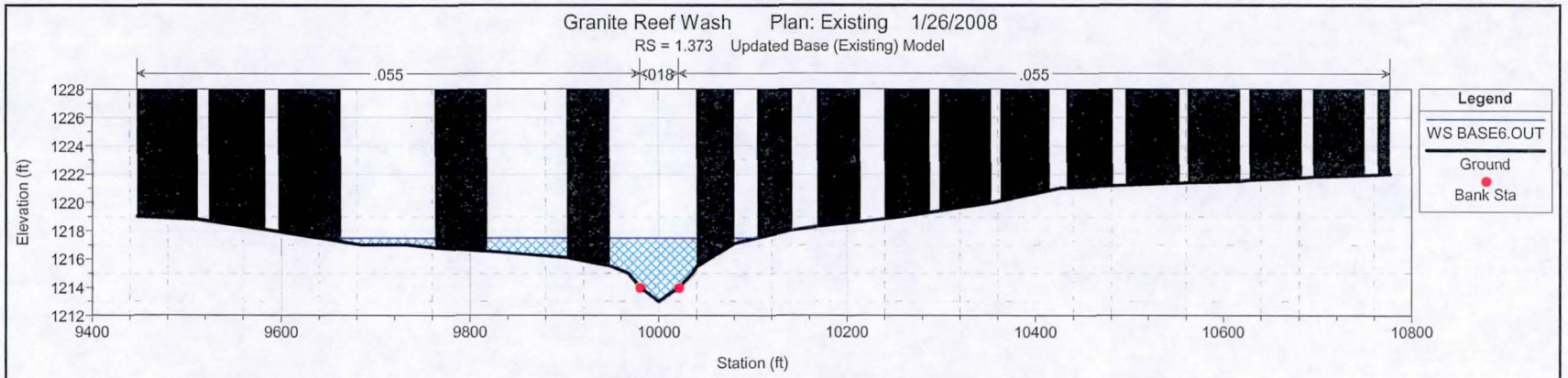
RS = 1.499 Updated Base (Existing) Model

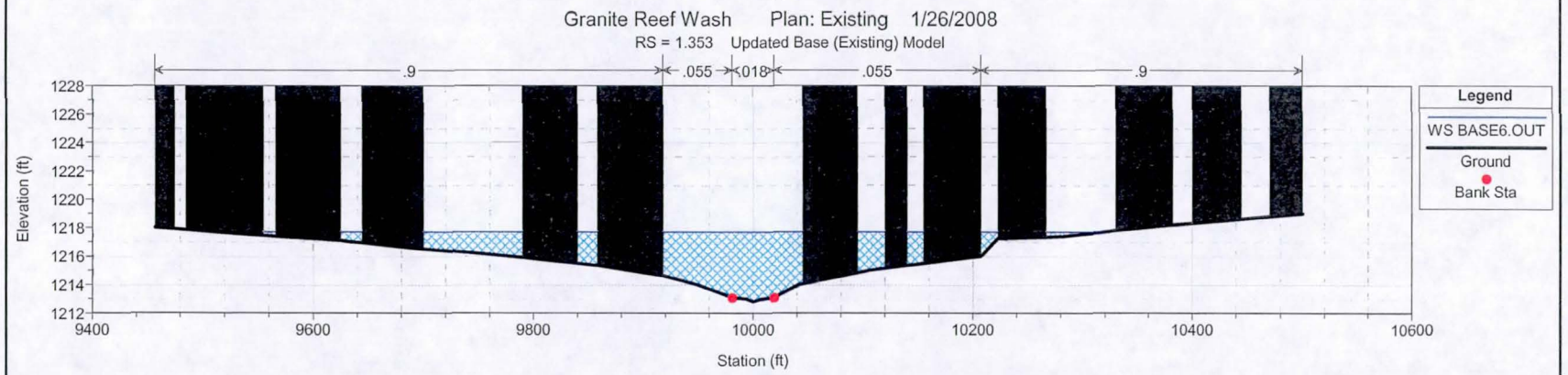


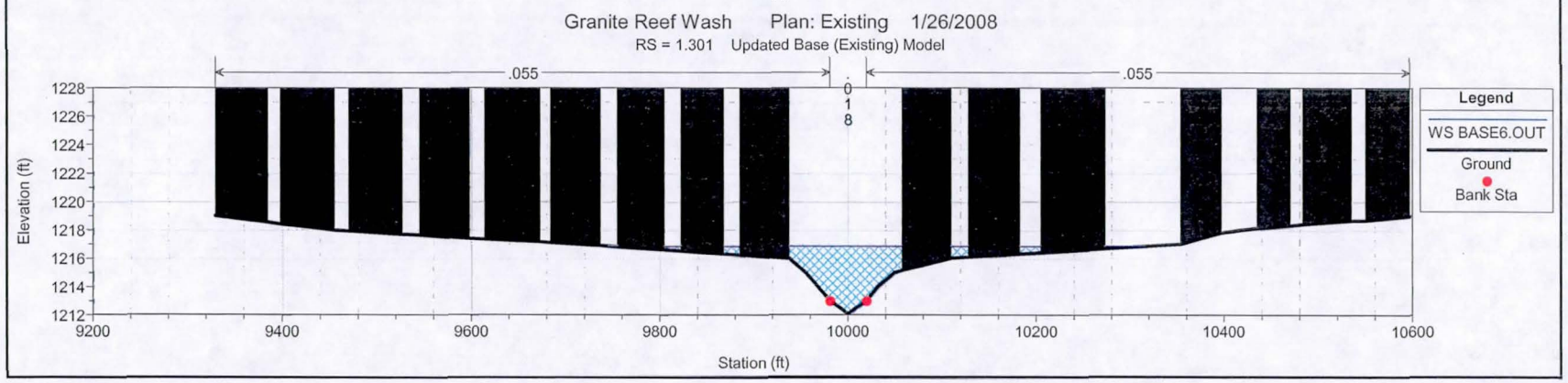
Granite Reef Wash Plan: Existing 1/26/2008

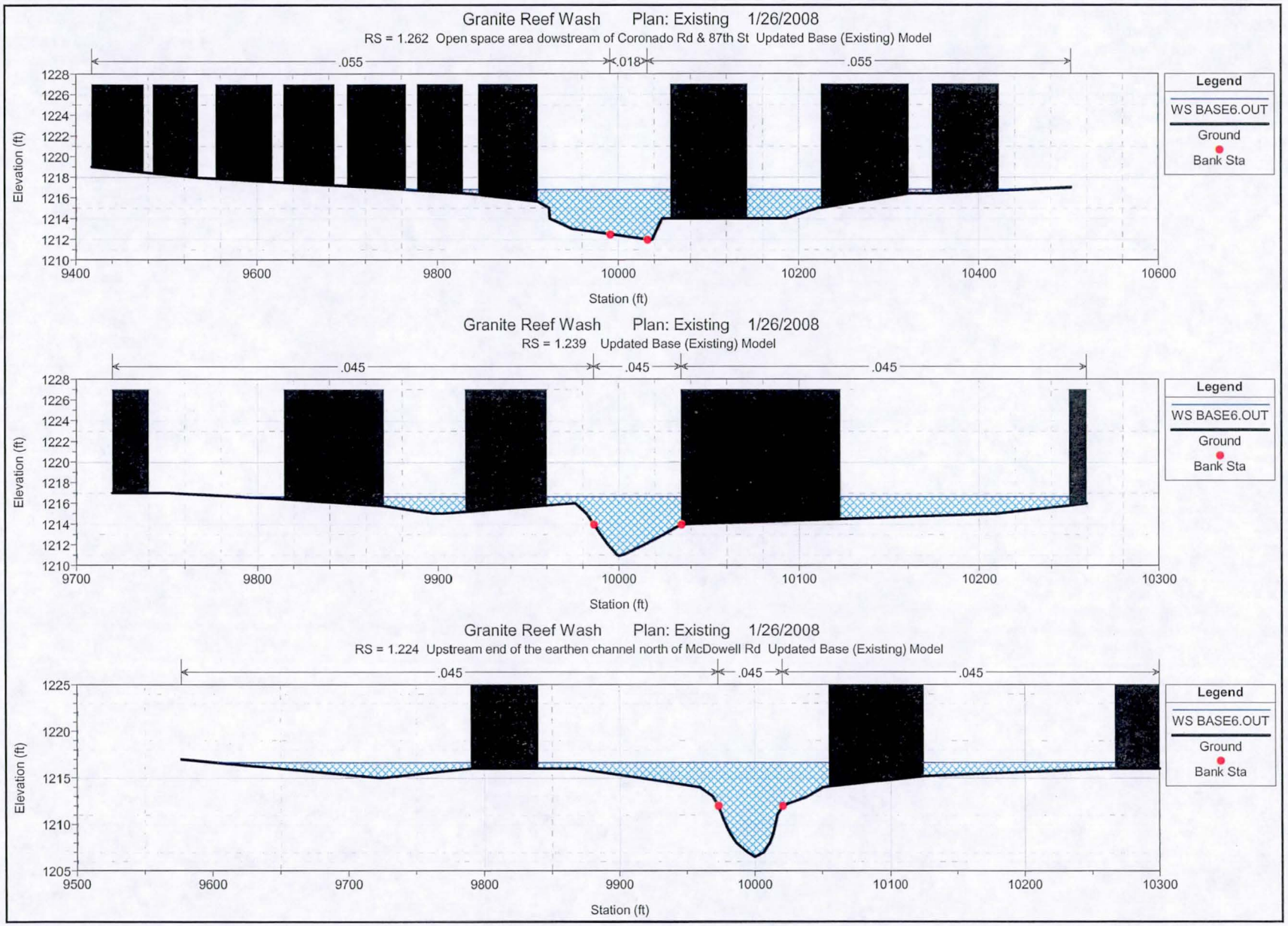
RS = 1.438 Hubbell St & 87th St Updated Base (Existing) Model

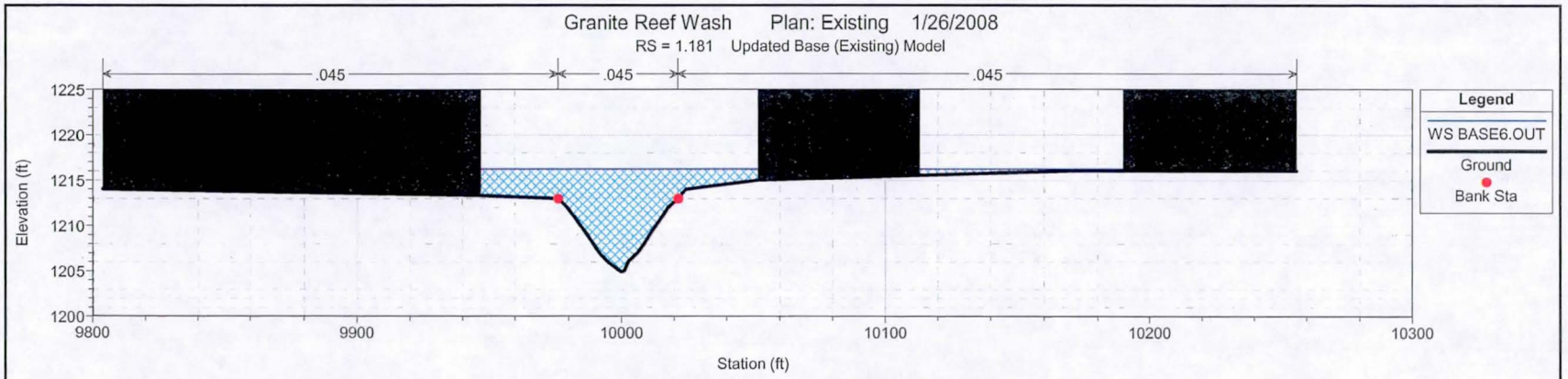


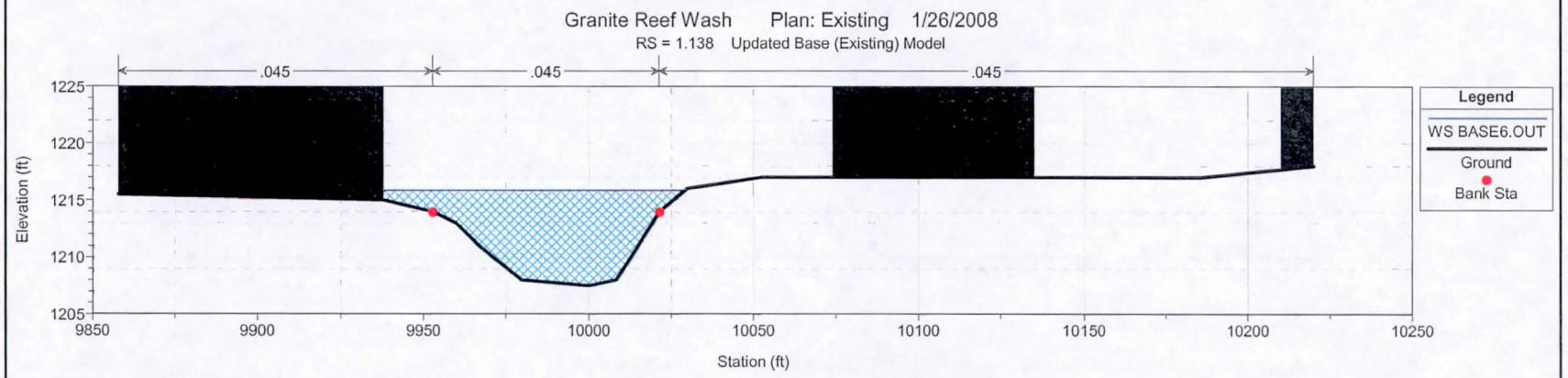

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.373 Updated Base (Existing) Model
.055
.018
.055
Elevation (ft)
1228
1226
1224
1222
1220
1218
1216
1214
1212
9400
9600
9800
10000
10200
10400
10600
10800
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta

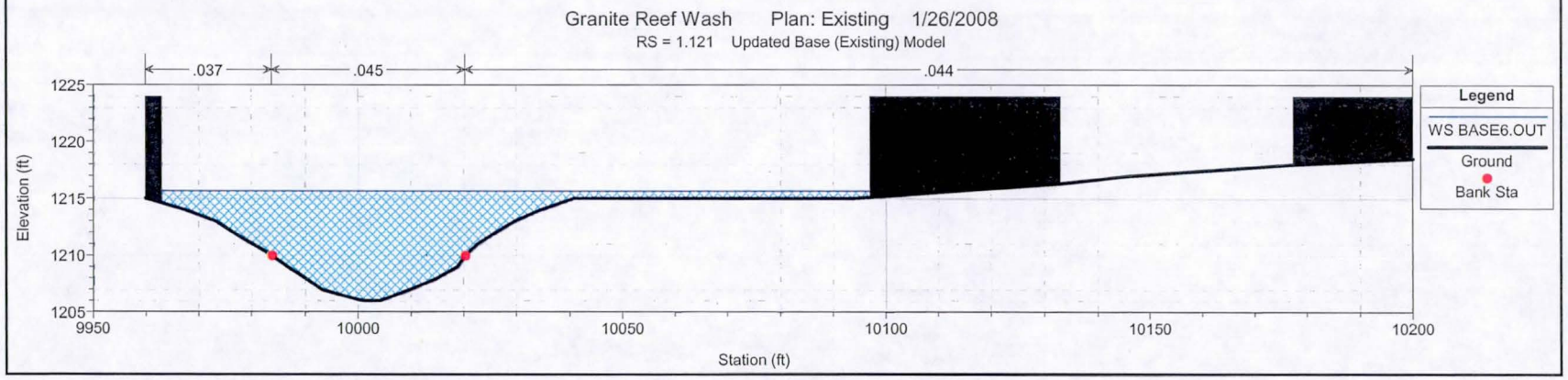

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.353 Updated Base (Existing) Model
.9
.055
.018
.055
.9
Elevation (ft)
1228
1226
1224
1222
1220
1218
1216
1214
1212
9400
9600
9800
10000
10200
10400
10600
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.301 Updated Base (Existing) Model
.055
.018
.055
Elevation (ft)
1228
1226
1224
1222
1220
1218
1216
1214
1212
9200
9400
9600
9800
10000
10200
10400
10600
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.262 Open space area dowstream of Coronado Rd & 87th St Updated Base (Existing) Model
.055
.018
.055
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.239 Updated Base (Existing) Model
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.224 Upstream end of the earthen channel north of McDowell Rd Updated Base (Existing) Model
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta

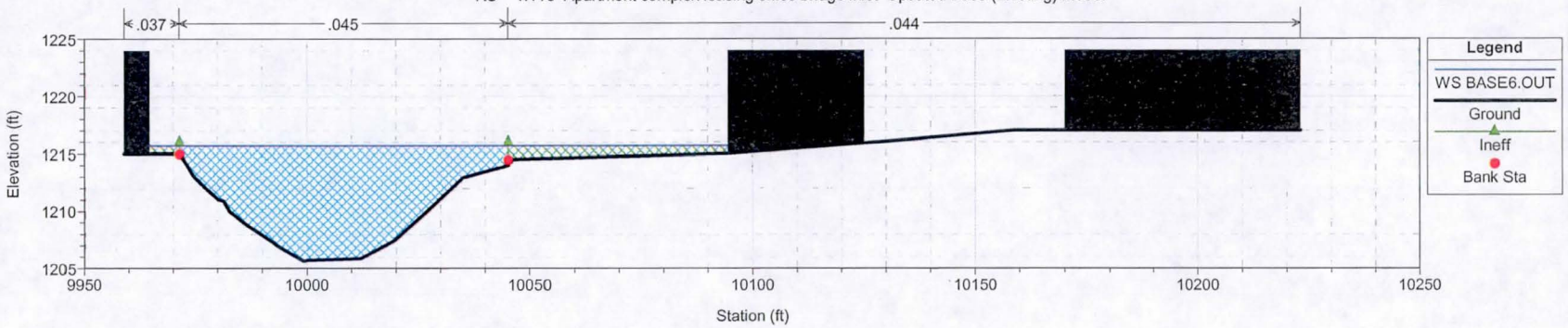

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.181 Updated Base (Existing) Model
.045
.045
.045
Elevation (ft)
1225
1220
1215
1210
1205
1200
9800
9900
10000
10100
10200
10300
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.138 Updated Base (Existing) Model
.045
.045
.045
Elevation (ft)
1225
1220
1215
1210
1205
9850
9900
9950
10000
10050
10100
10150
10200
10250
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.121 Updated Base (Existing) Model
.037
.045
.044
Elevation (ft)
1225
1220
1215
1210
1205
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta

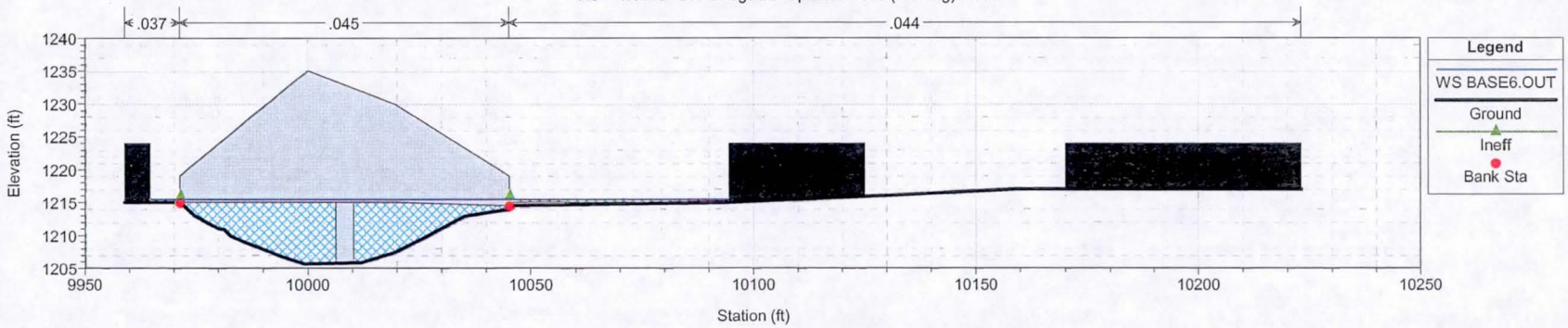
Granite Reef Wash Plan: Existing 1/26/2008

RS = 1.115 Apartment complex leasing office bridge inlet Updated Base (Existing) Model



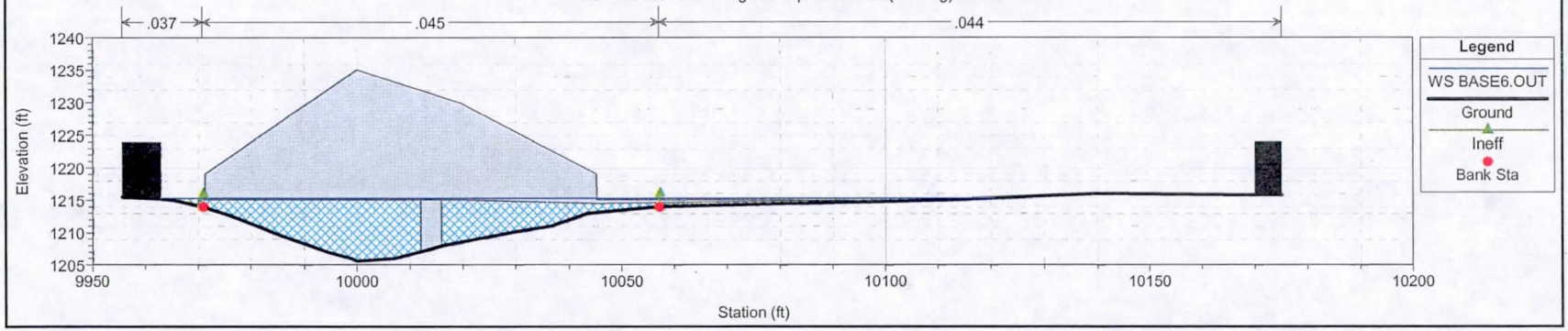
Granite Reef Wash Plan: Existing 1/26/2008

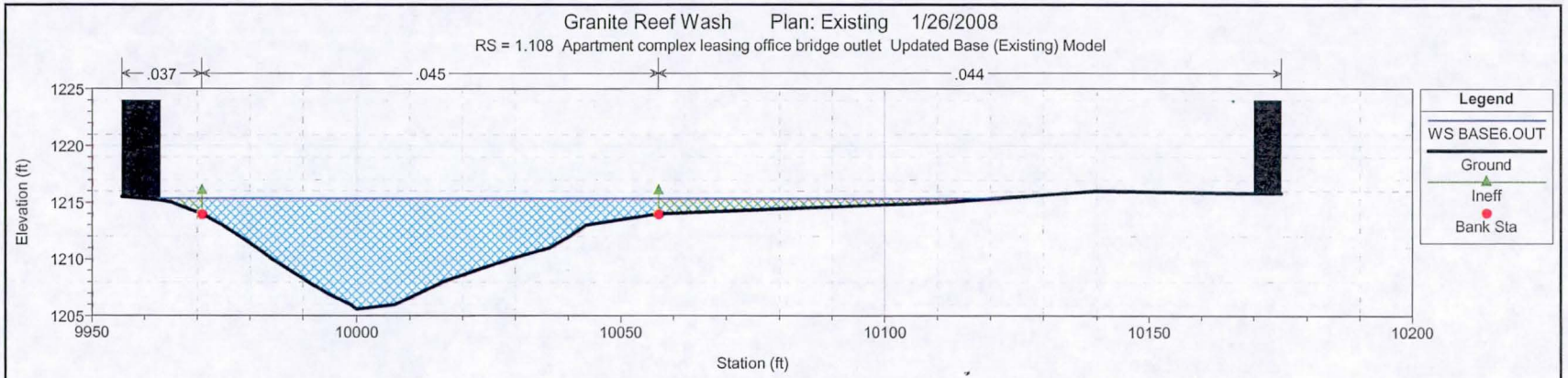
RS = 1.1115 BR Bridge #3 Updated Base (Existing) Model

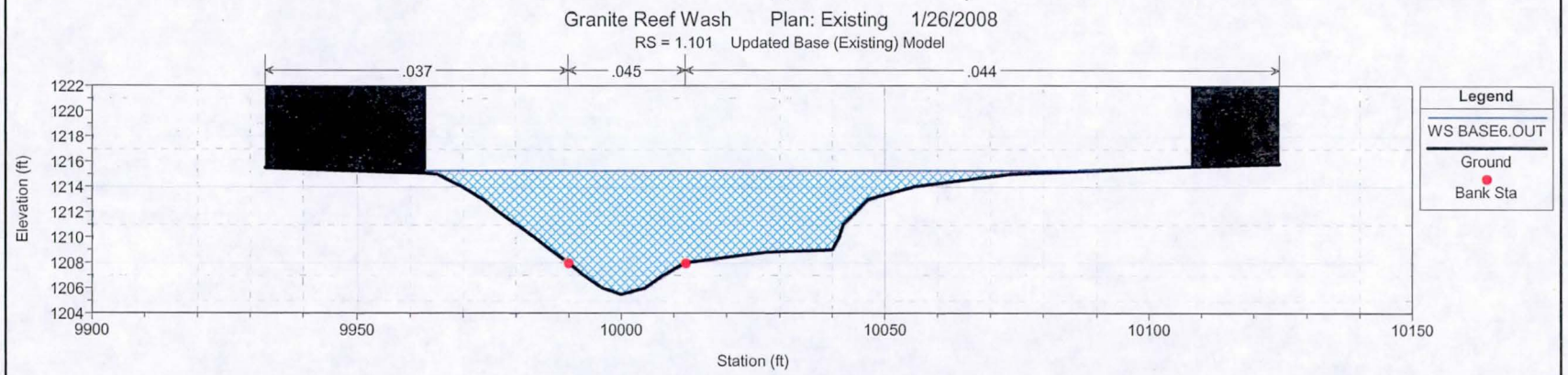


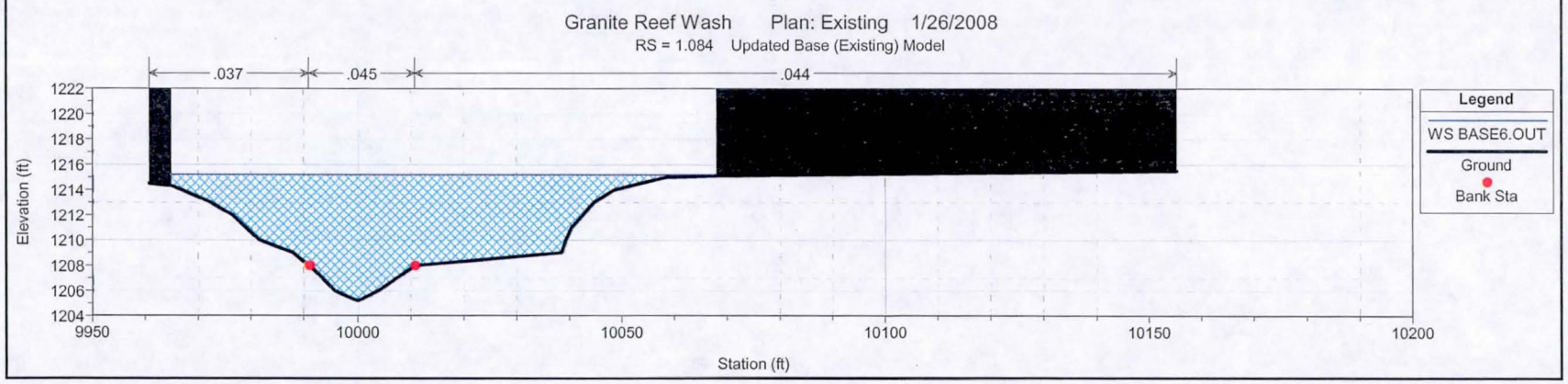
Granite Reef Wash Plan: Existing 1/26/2008

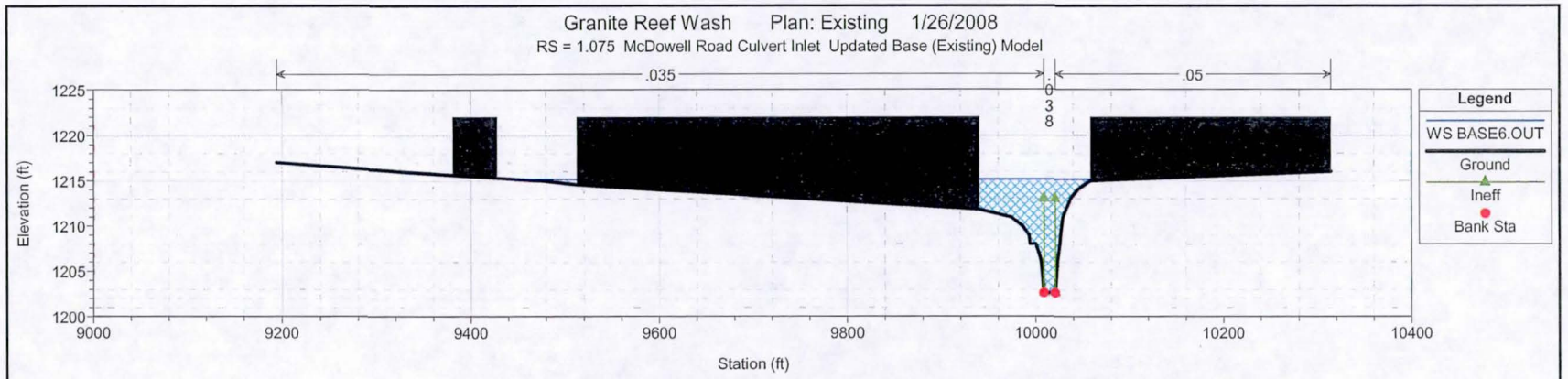
RS = 1.1115 BR Bridge #3 Updated Base (Existing) Model

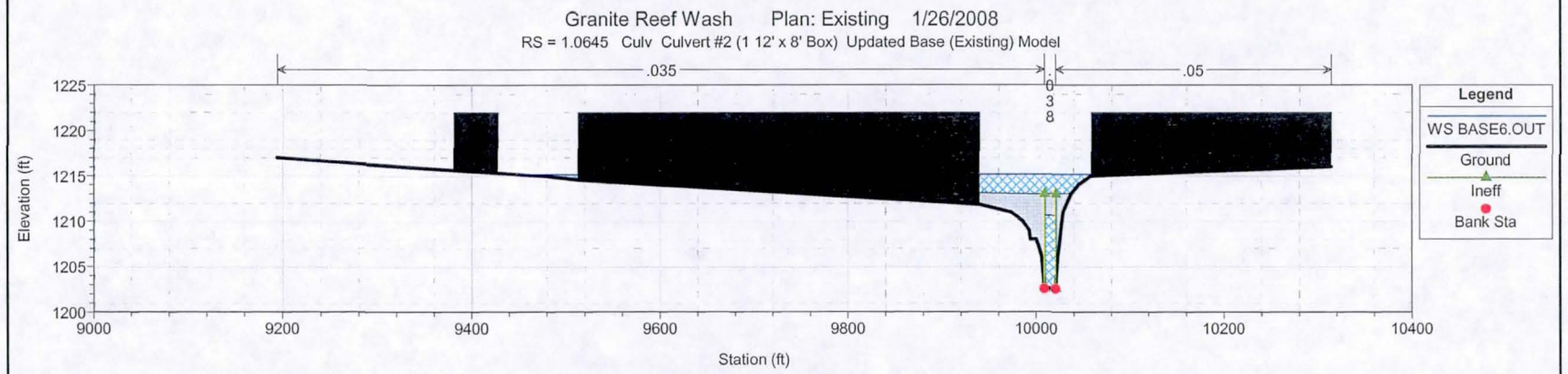


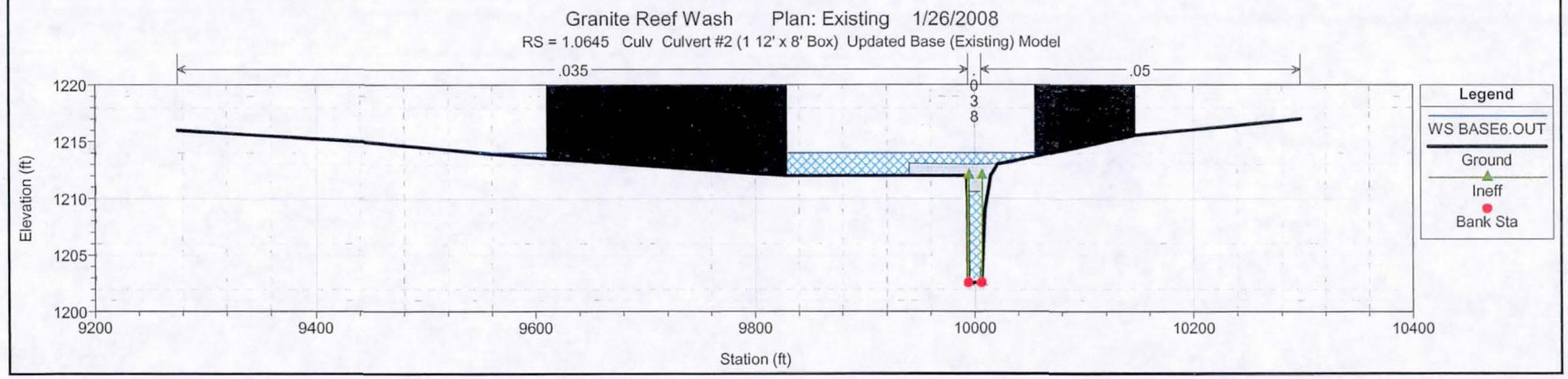

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.108 Apartment complex leasing office bridge outlet Updated Base (Existing) Model
.037
.045
.044
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Ineff
Bank Sta

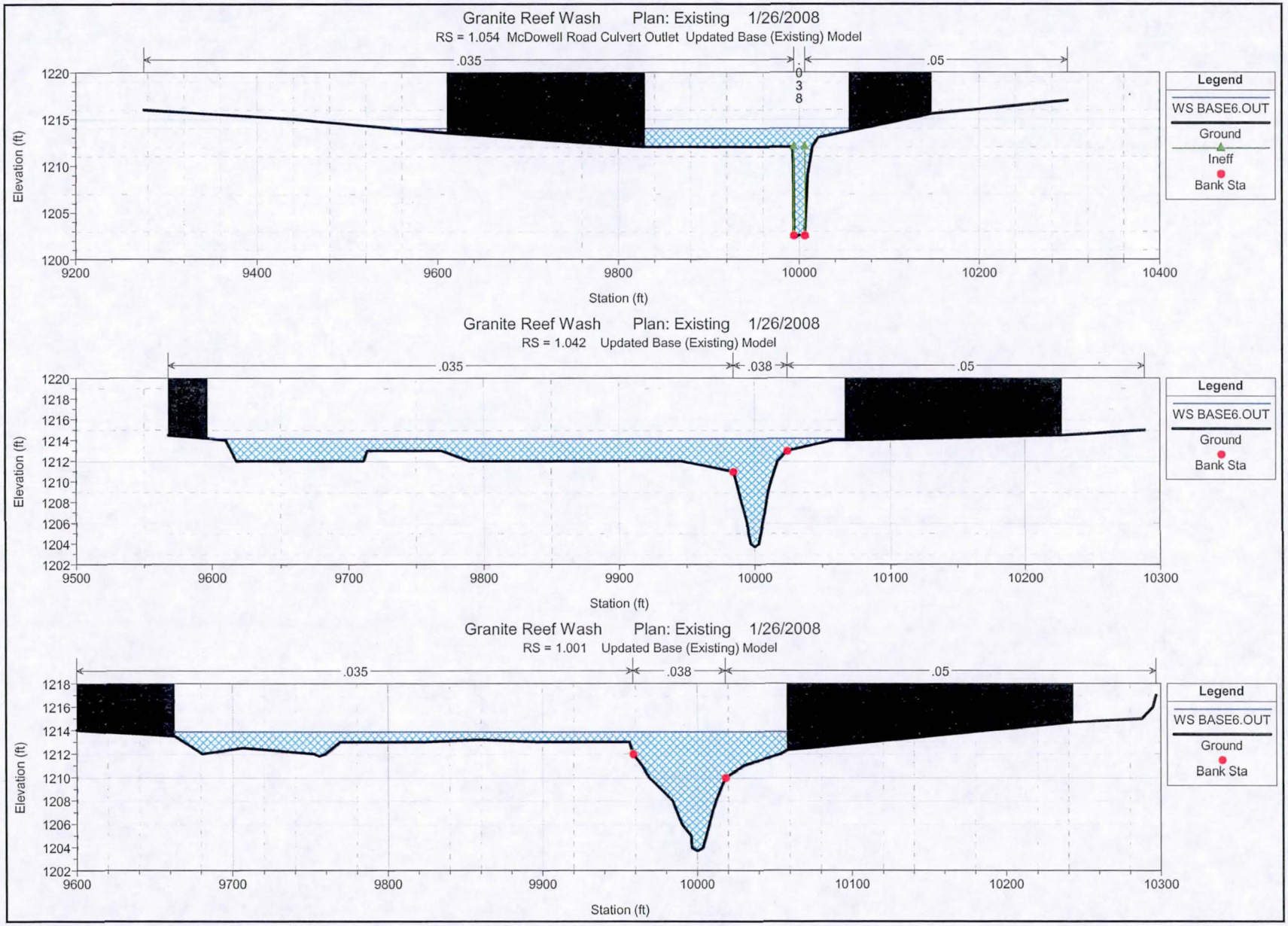

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.101 Updated Base (Existing) Model
.037
.045
.044
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta

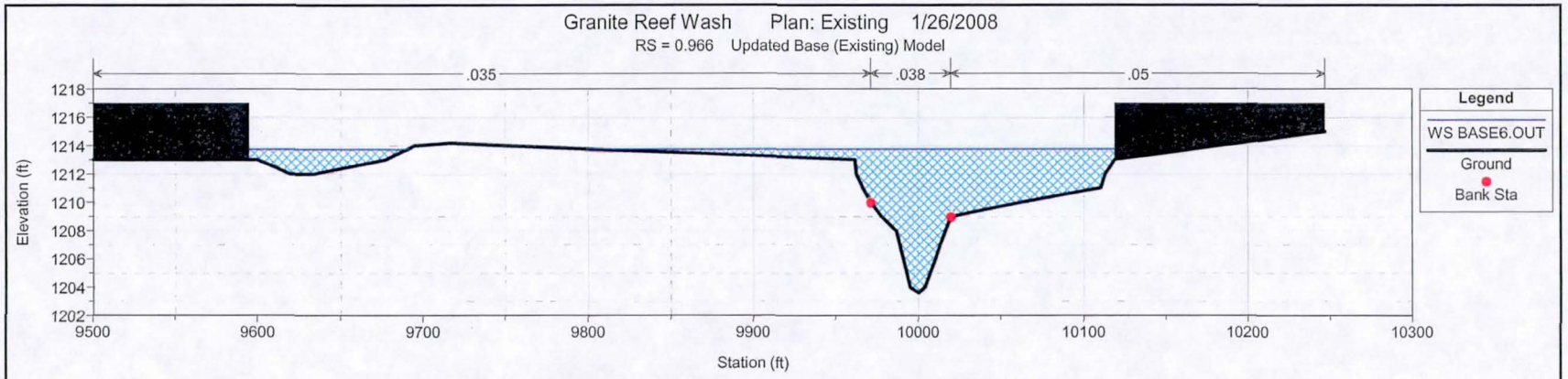

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.084 Updated Base (Existing) Model
.037
.045
.044
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta

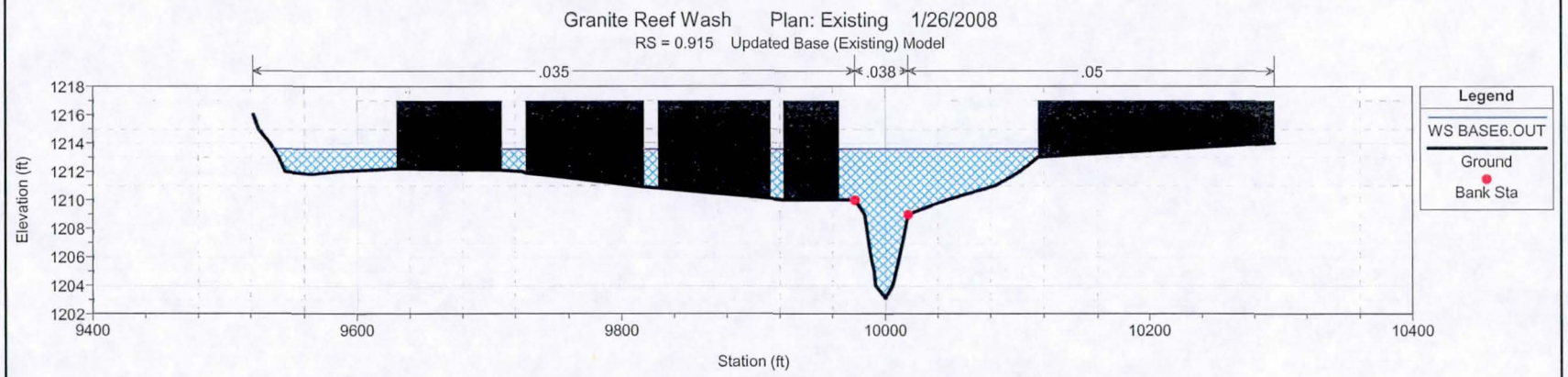

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.075 McDowell Road Culvert Inlet Updated Base (Existing) Model
.035
.038
.05
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Ineff
Bank Sta

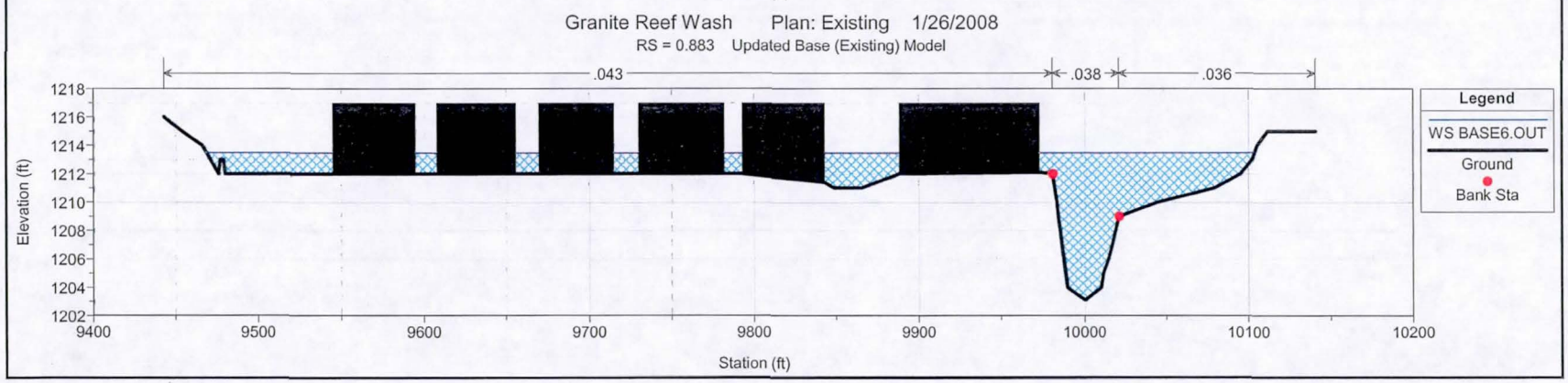

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.0645 Culv Culvert #2 (1 12' x 8' Box) Updated Base (Existing) Model
.035
.038
.05
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Ineff
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.0645 Culv Culvert #2 (1 12' x 8' Box) Updated Base (Existing) Model
.035
.038
.05
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Ineff
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.054 McDowell Road Culvert Outlet Updated Base (Existing) Model
.035
.038
.05
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Ineff
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.042 Updated Base (Existing) Model
.035
.038
.05
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.001 Updated Base (Existing) Model
.035
.038
.05
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta

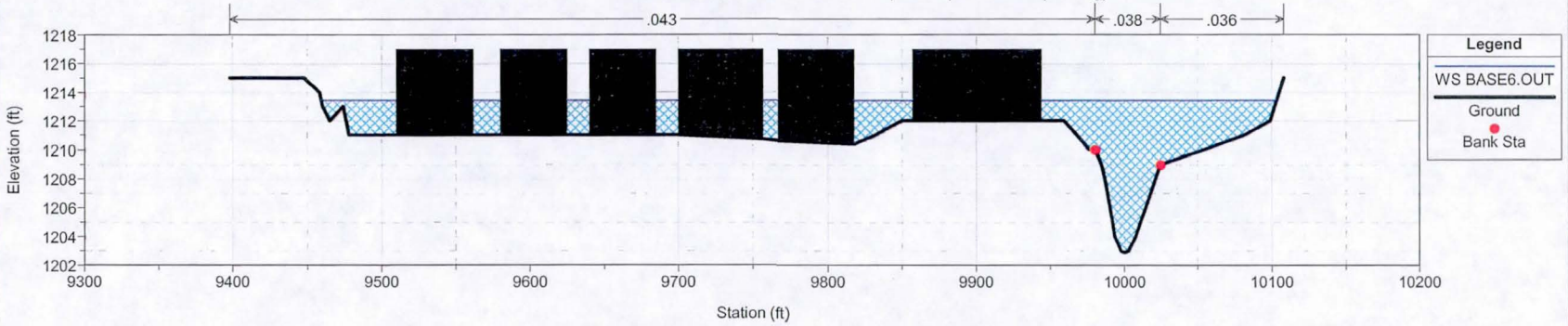

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.966 Updated Base (Existing) Model
.035
.038
.05
Elevation (ft)
1218
1216
1214
1212
1210
1208
1206
1204
1202
9500
9600
9700
9800
9900
10000
10100
10200
10300
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.915 Updated Base (Existing) Model
.035
.038
.05
Elevation (ft)
1218
1216
1214
1212
1210
1208
1206
1204
1202
9400
9600
9800
10000
10200
10400
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.883 Updated Base (Existing) Model
.043
.038
.036
Elevation (ft)
1218
1216
1214
1212
1210
1208
1206
1204
1202
9400
9500
9600
9700
9800
9900
10000
10100
10200
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta

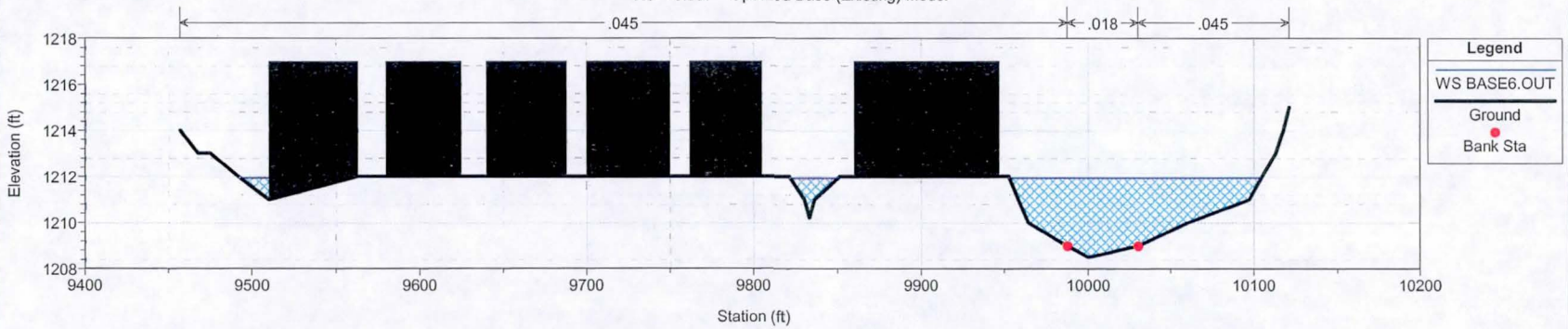
Granite Reef Wash Plan: Existing 1/26/2008

RS = 0.865 Downstream end of the earthen channel north of 84th place Updated Base (Existing) Model



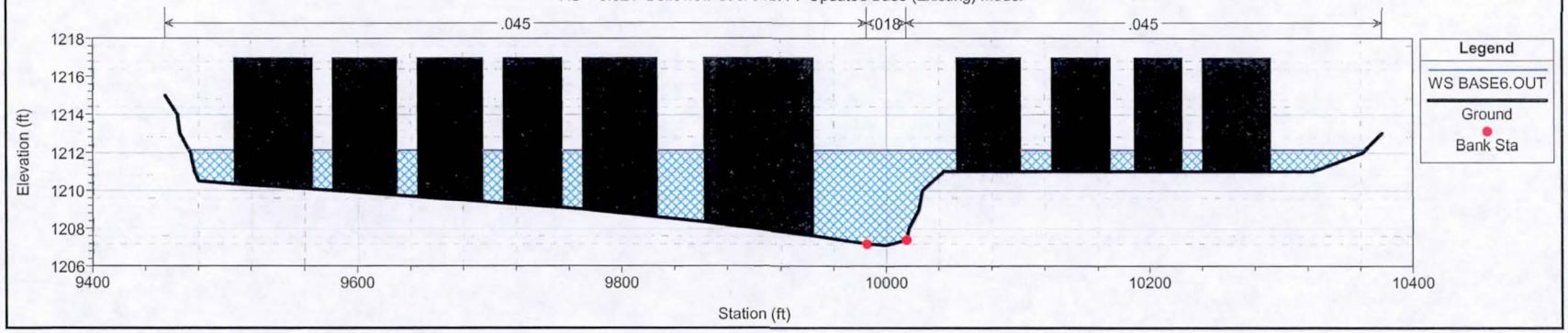
Granite Reef Wash Plan: Existing 1/26/2008

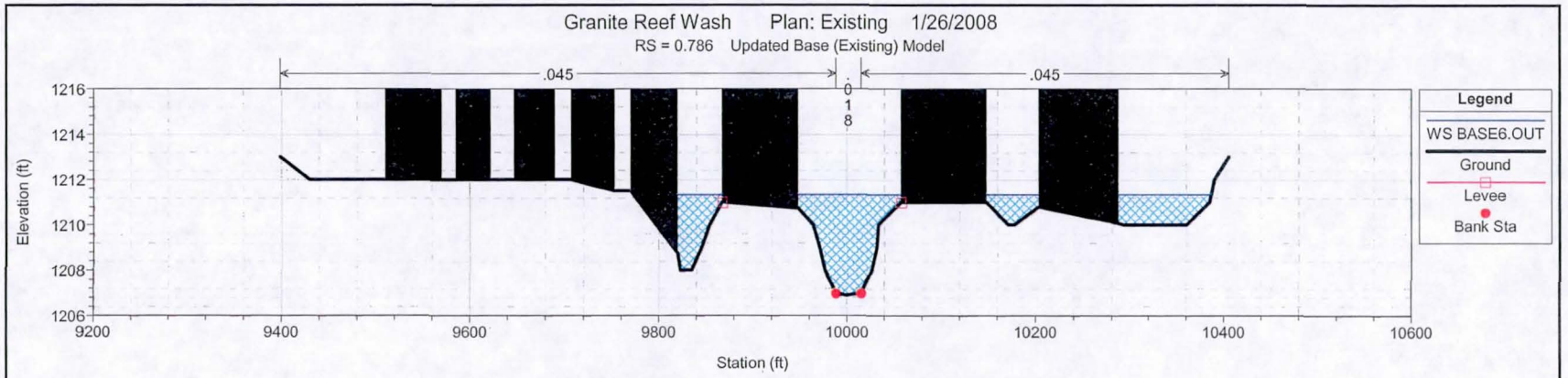
RS = 0.857 Updated Base (Existing) Model

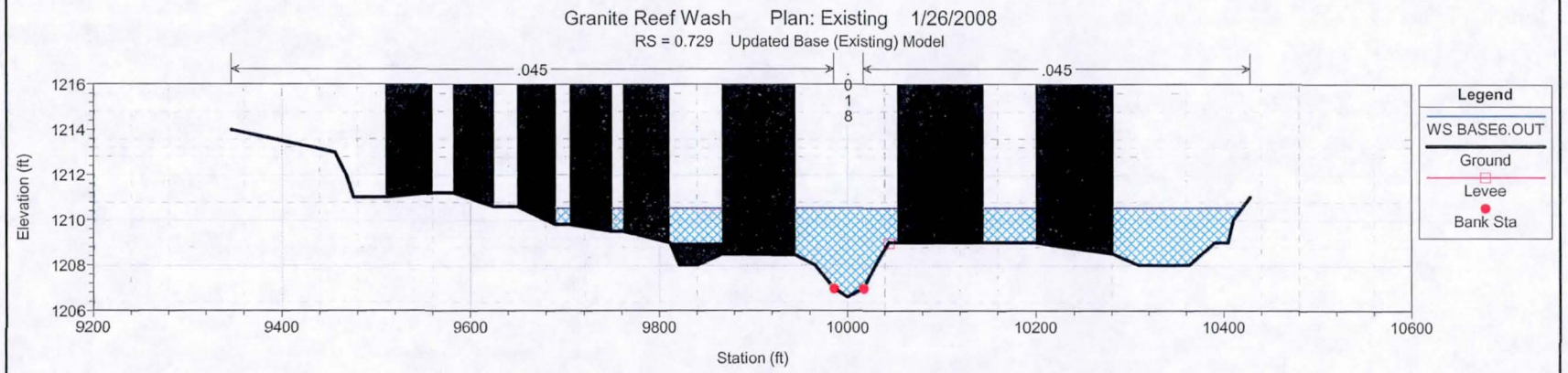


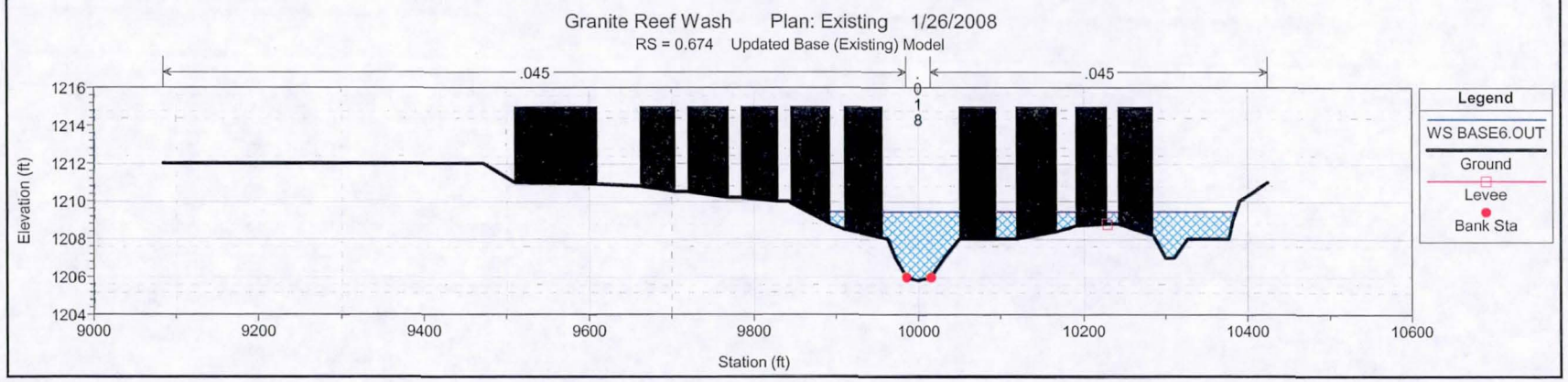
Granite Reef Wash Plan: Existing 1/26/2008

RS = 0.821 Belleview St & 84th Pl Updated Base (Existing) Model



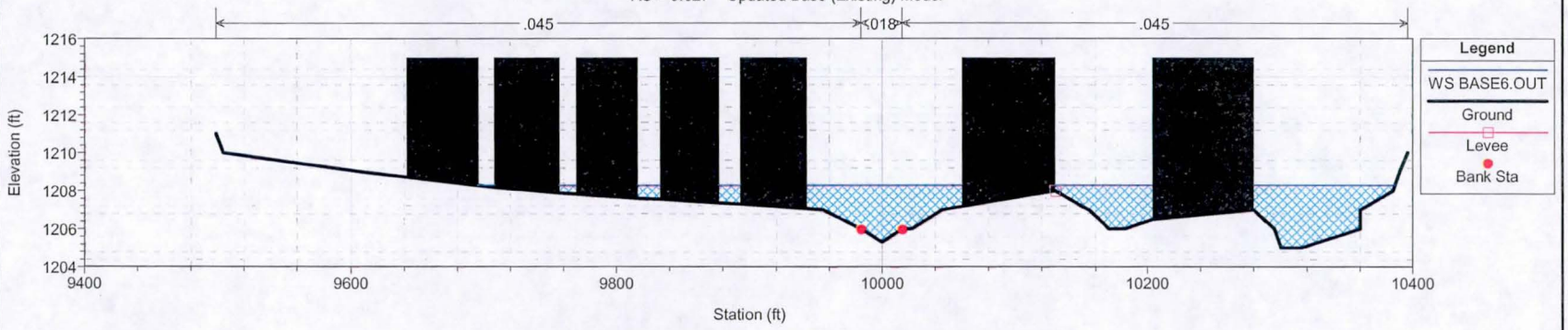

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.786 Updated Base (Existing) Model
.045
.018
.045
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Levee
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.729 Updated Base (Existing) Model
.045
.018
.045
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Levee
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.674 Updated Base (Existing) Model
.045
.018
.045
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Levee
Bank Sta

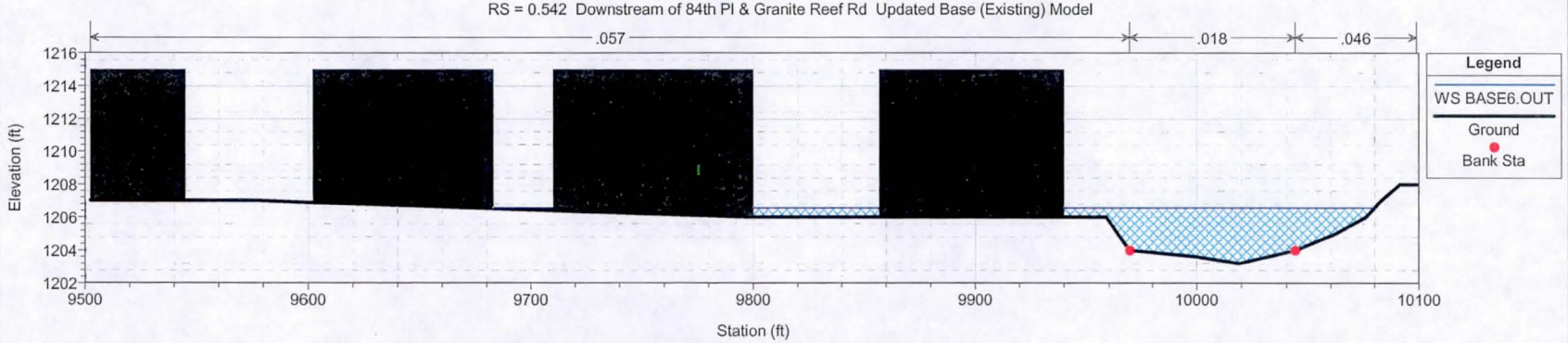
Granite Reef Wash Plan: Existing 1/26/2008

RS = 0.627 Updated Base (Existing) Model



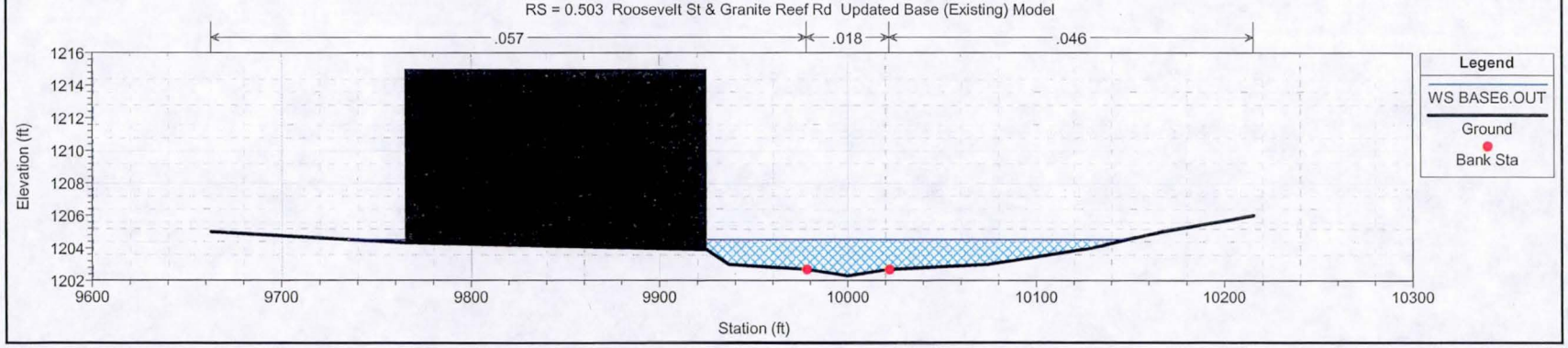
Granite Reef Wash Plan: Existing 1/26/2008

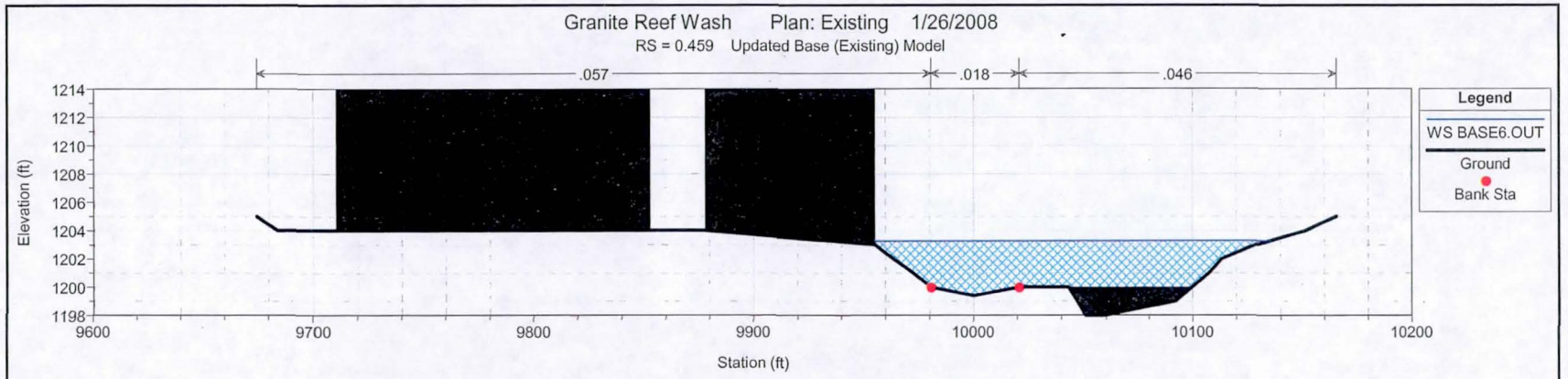
RS = 0.542 Downstream of 84th Pl & Granite Reef Rd Updated Base (Existing) Model

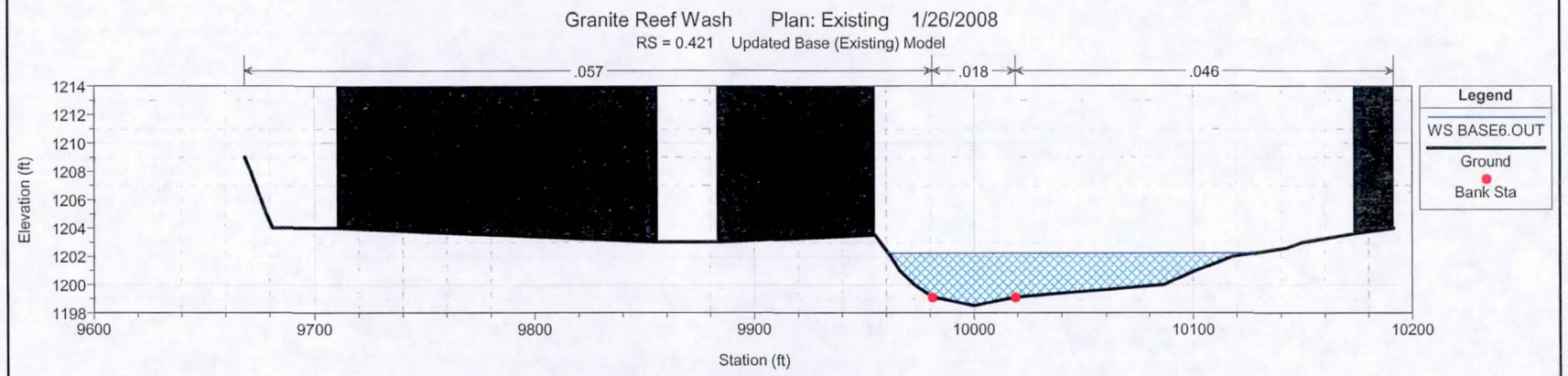


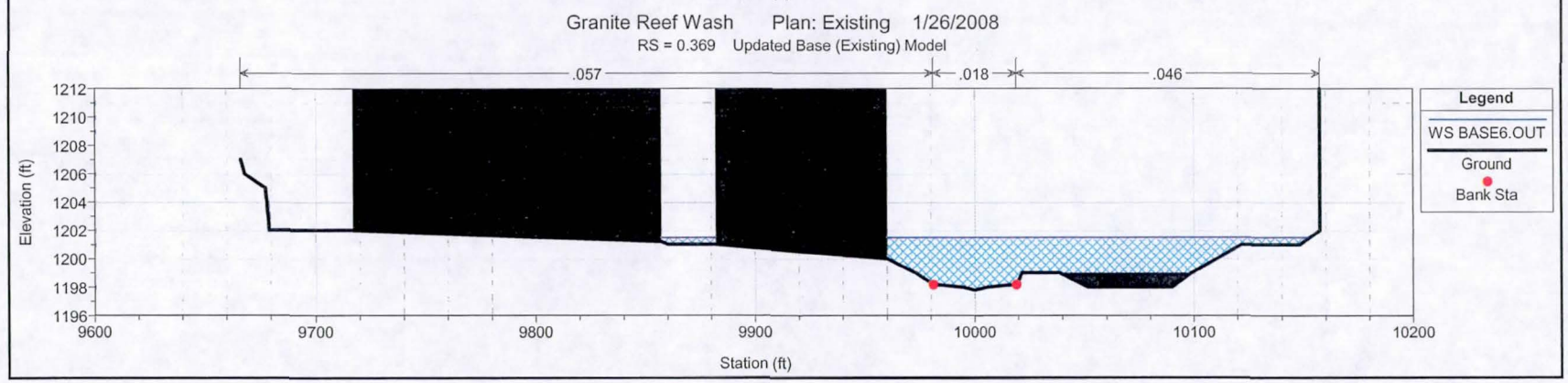
Granite Reef Wash Plan: Existing 1/26/2008

RS = 0.503 Roosevelt St & Granite Reef Rd Updated Base (Existing) Model



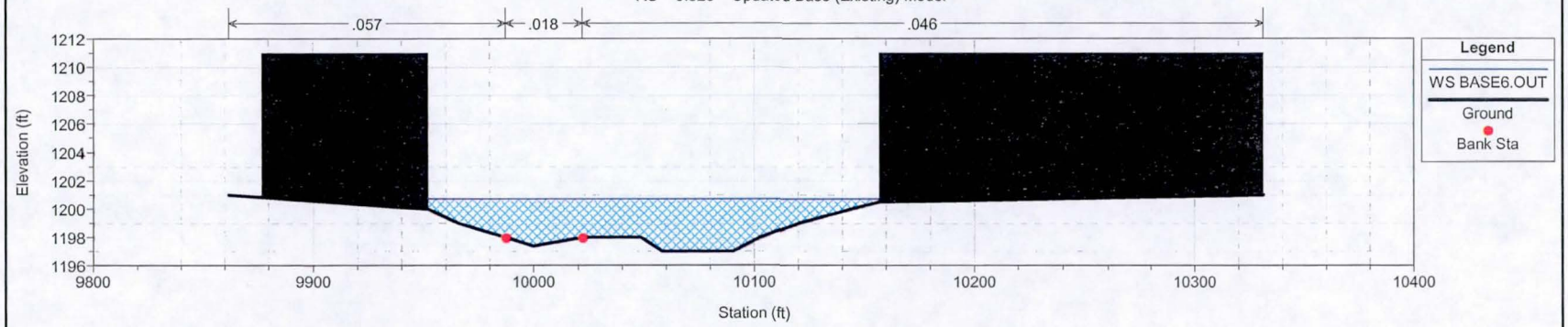

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.459 Updated Base (Existing) Model
.057
.018
.046
Elevation (ft)
1214
1212
1210
1208
1206
1204
1202
1200
1198
9600
9700
9800
9900
10000
10100
10200
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.421 Updated Base (Existing) Model
.057
.018
.046
Elevation (ft)
1214
1212
1210
1208
1206
1204
1202
1200
1198
9600
9700
9800
9900
10000
10100
10200
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.369 Updated Base (Existing) Model
.057
.018
.046
Elevation (ft)
1212
1210
1208
1206
1204
1202
1200
1198
1196
9600
9700
9800
9900
10000
10100
10200
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta

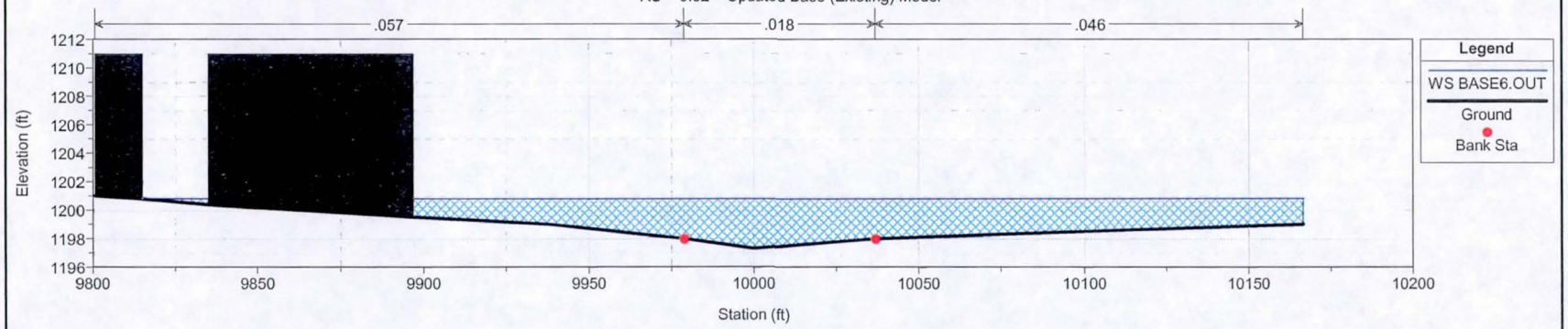
Granite Reef Wash Plan: Existing 1/26/2008

RS = 0.326 Updated Base (Existing) Model



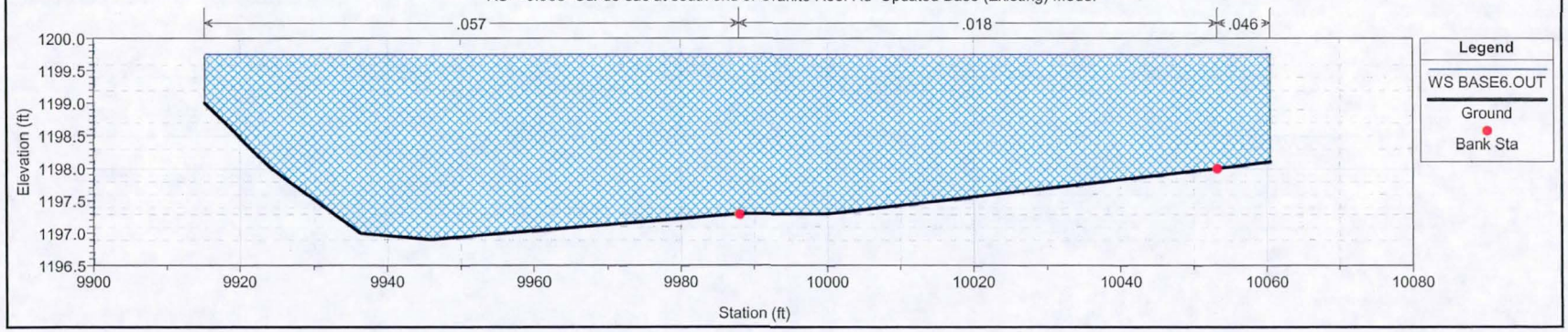
Granite Reef Wash Plan: Existing 1/26/2008

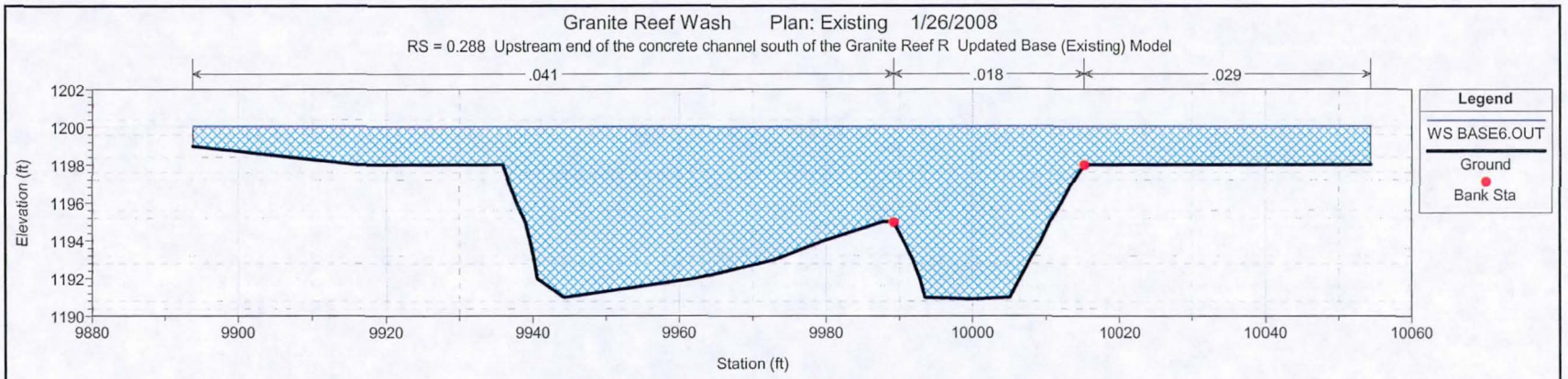
RS = 0.32 Updated Base (Existing) Model

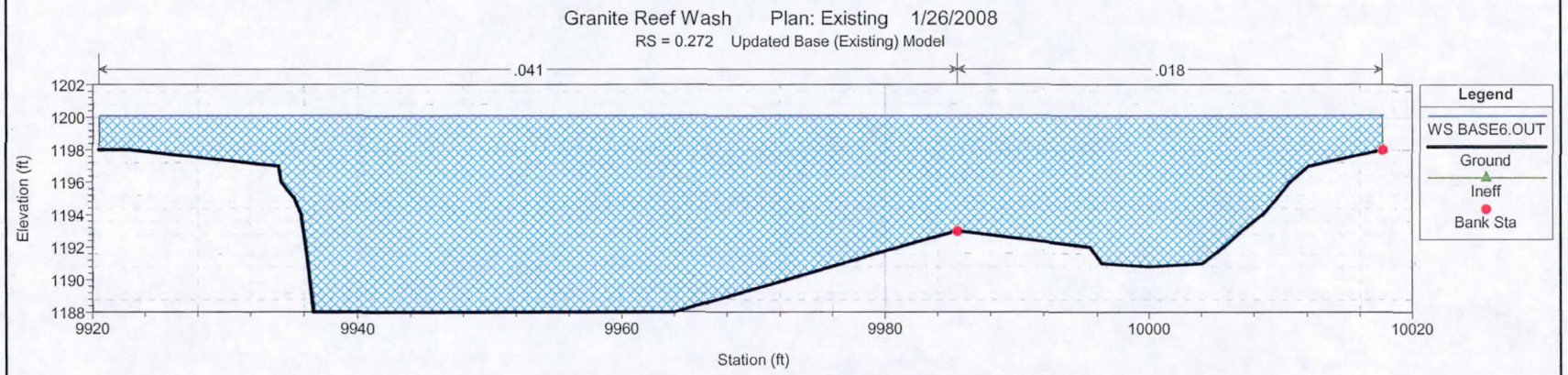


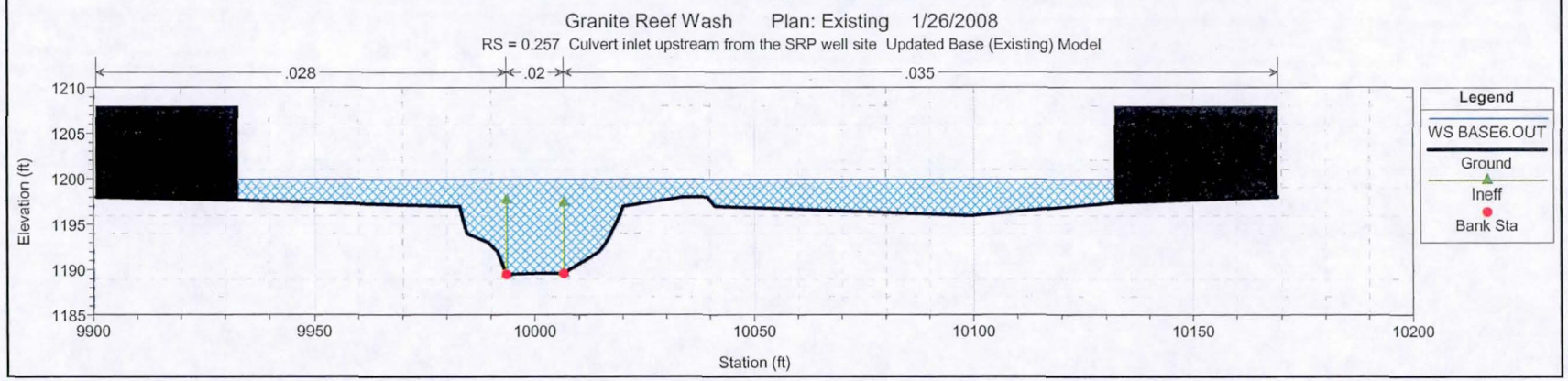
Granite Reef Wash Plan: Existing 1/26/2008

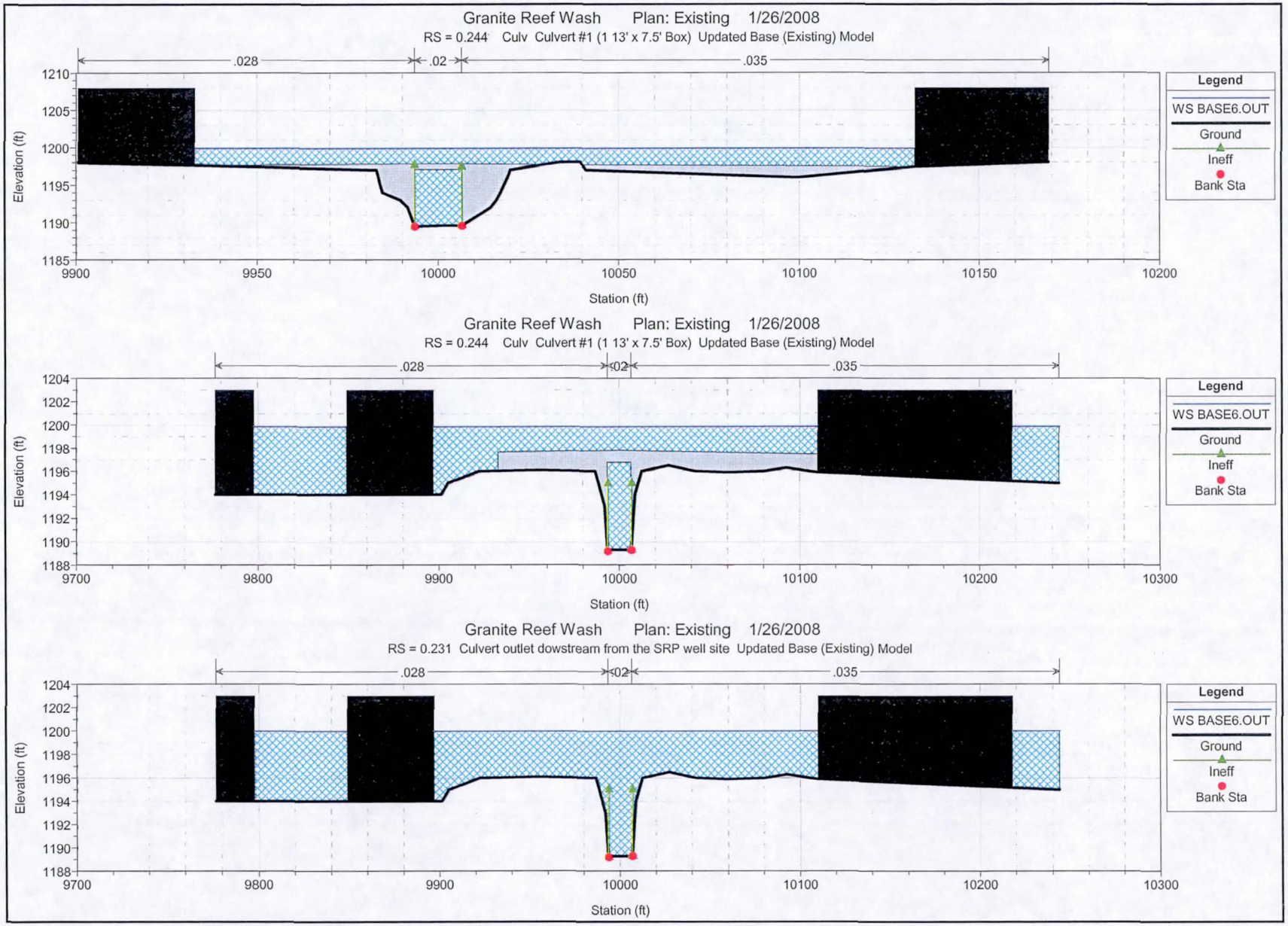
RS = 0.303 Cul-de-sac at south end of Granite Reef Rd Updated Base (Existing) Model




Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.288 Upstream end of the concrete channel south of the Granite Reef R Updated Base (Existing) Model
.041
.018
.029
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Bank Sta

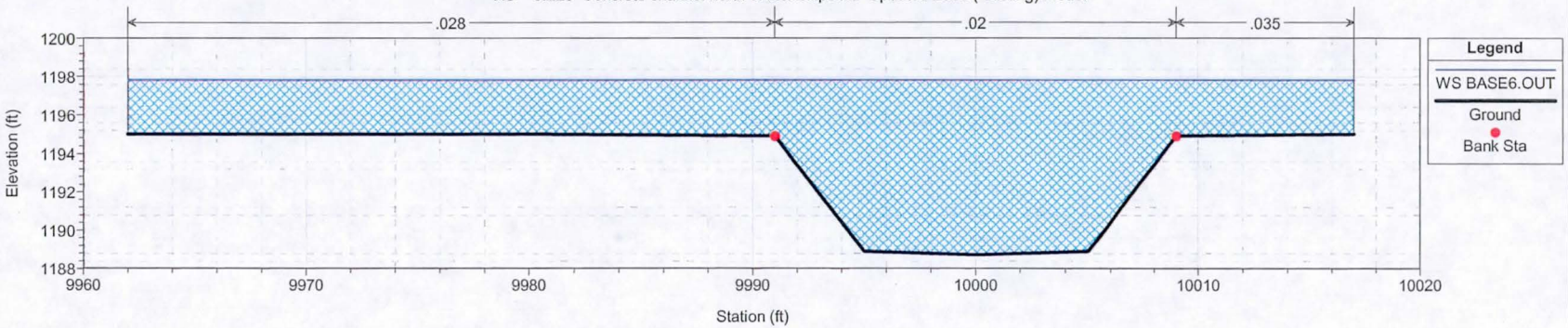

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.272 Updated Base (Existing) Model
.041
.018
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Ineff
Bank Sta

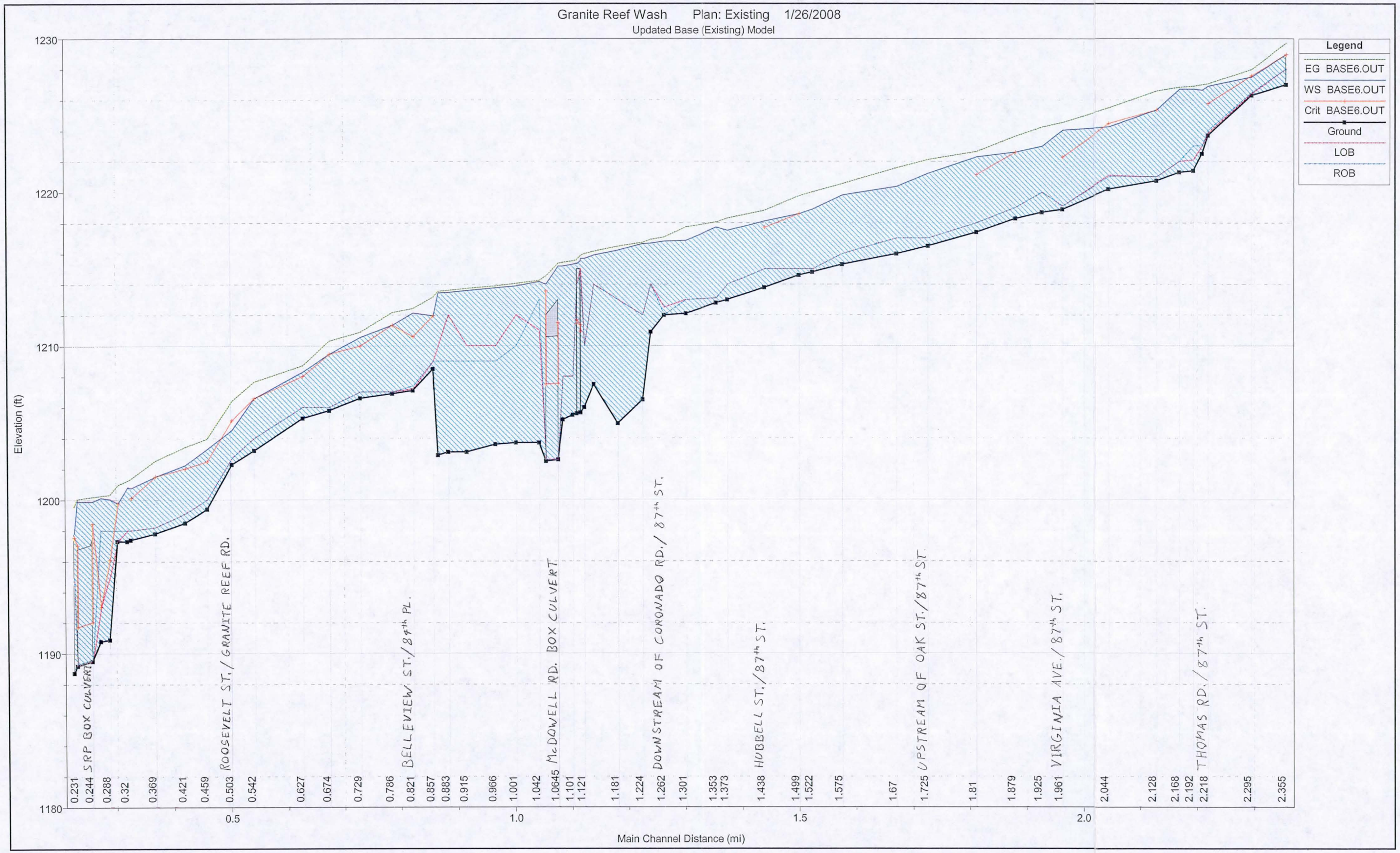

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.257 Culvert inlet upstream from the SRP well site Updated Base (Existing) Model
.028
.02
.035
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Ineff
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.244 Culv Culvert #1 (1 13' x 7.5' Box) Updated Base (Existing) Model
.028
.02
.035
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Ineff
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.244 Culv Culvert #1 (1 13' x 7.5' Box) Updated Base (Existing) Model
.028
.02
.035
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Ineff
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.231 Culvert outlet dowstream from the SRP well site Updated Base (Existing) Model
.028
.02
.035
Elevation (ft)
Station (ft)
Legend
WS BASE6.OUT
Ground
Ineff
Bank Sta

Granite Reef Wash Plan: Existing 1/26/2008

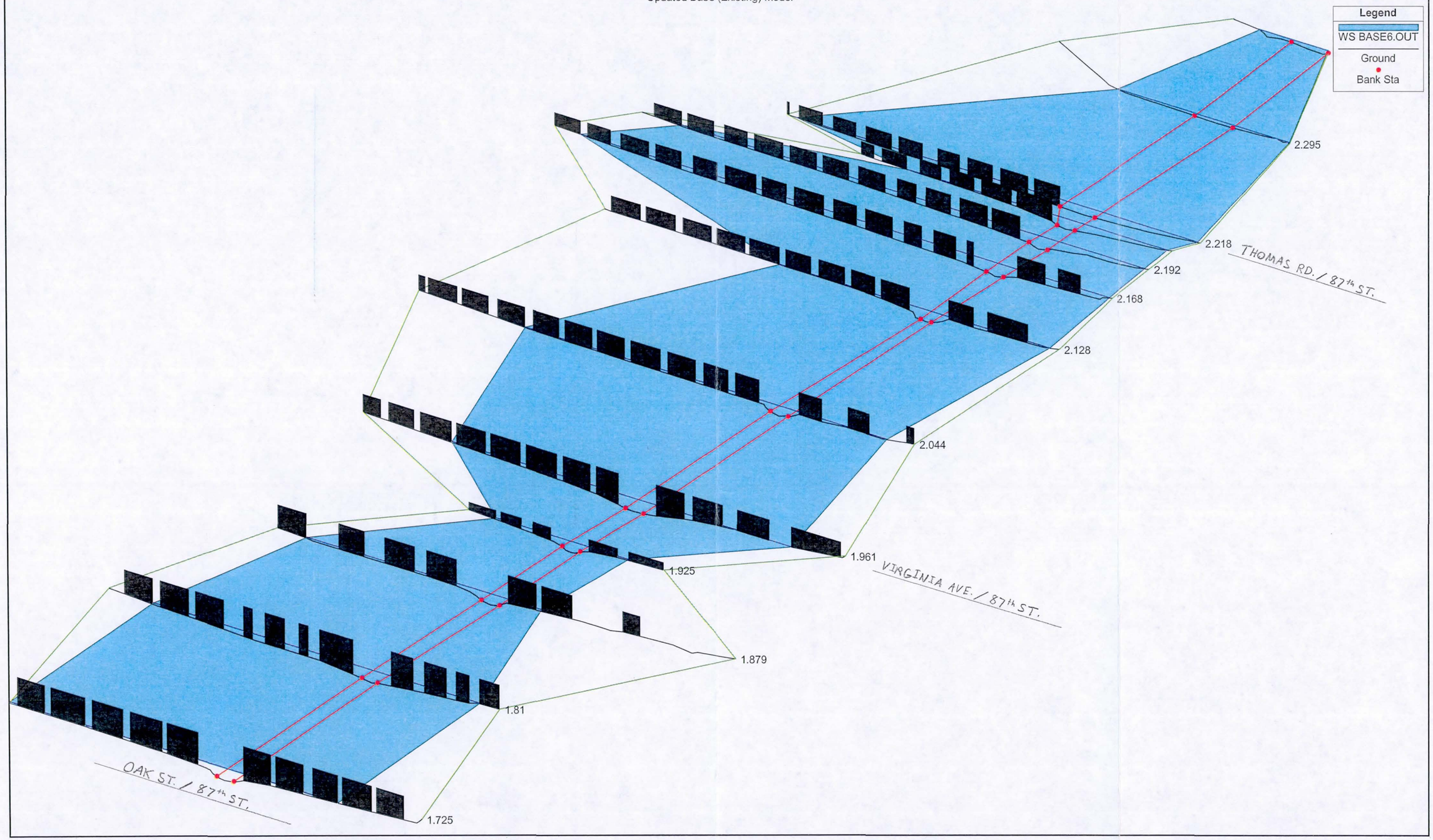
RS = 0.225 Concrete channel north of McKellips Rd Updated Base (Existing) Model




Granite Reef Wash Plan: Existing 1/26/2008
Updated Base (Existing) Model
Legend
EG BASE6.OUT
WS BASE6.OUT
Crit BASE6.OUT
Ground
LOB
ROB
Elevation (ft)
1230
1220
1210
1200
1190
1180
Main Channel Distance (mi)
0.5
1.0
1.5
2.0
0.231 SRP BOX CULVERT
0.244
0.288
0.32
0.369
0.421
0.459
0.503 ROOSEVELT ST./GRANITE REEF RD.
0.542
0.627
0.674
0.729
0.786
0.821 BELLEVIEW ST./84th PL.
0.857
0.883
0.915
0.966
1.001
1.042
1.0645 McDOWELL RD. BOX CULVERT
1.101
1.121
1.181
1.224
1.262 DOWNSTREAM OF CORONADO RD./87th ST.
1.301
1.353
1.373
1.438 HUBBELL ST./87th ST.
1.499
1.522
1.575
1.67
1.725 UPSTREAM OF OAK ST./87th ST.
1.81
1.879
1.925
1.961 VIRGINIA AVE./87th ST.
2.044
2.128
2.168
2.192
2.218 THOMAS RD./87th ST.
2.295
2.355

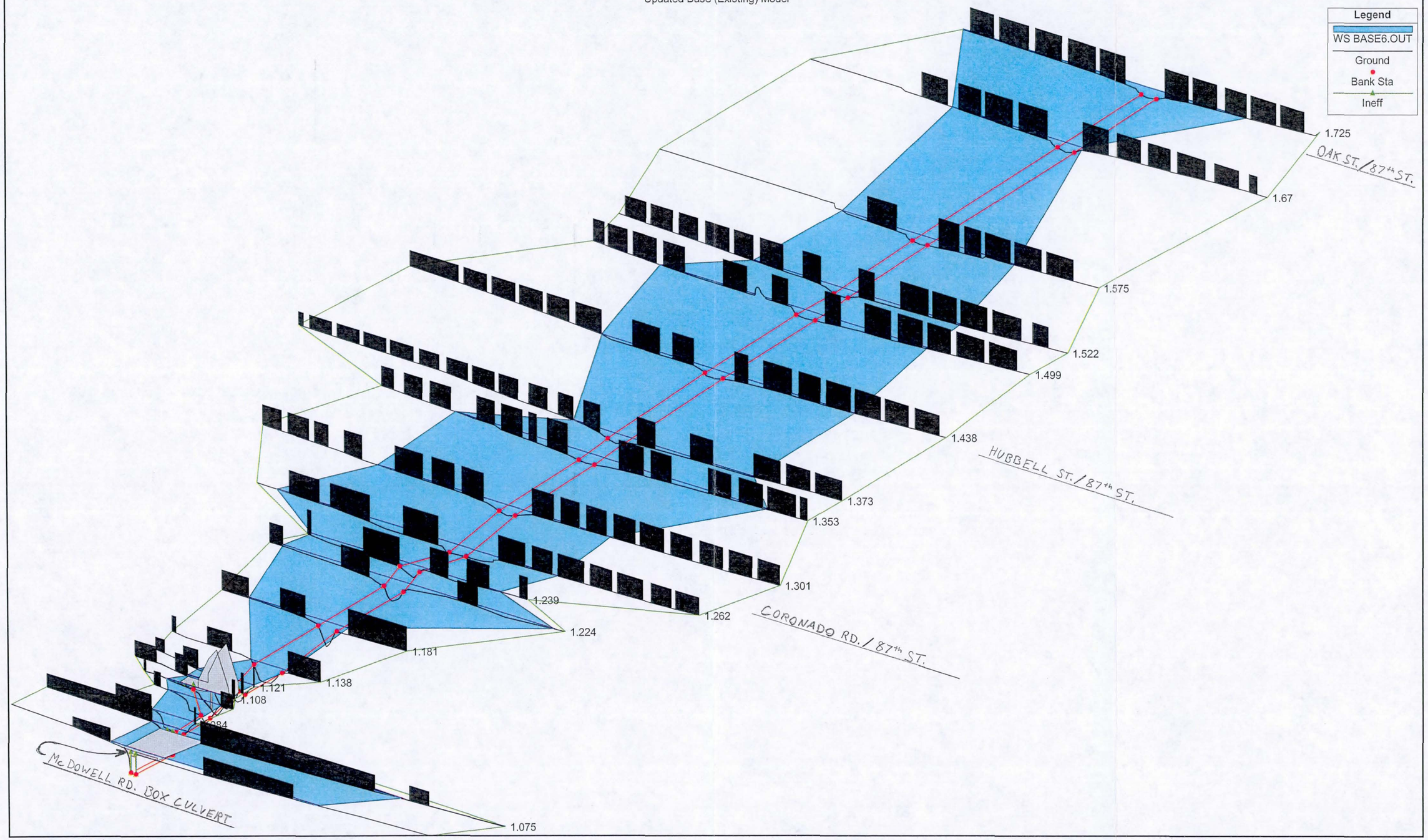
Granite Reef Wash Plan: Existing 1/26/2008

Updated Base (Existing) Model



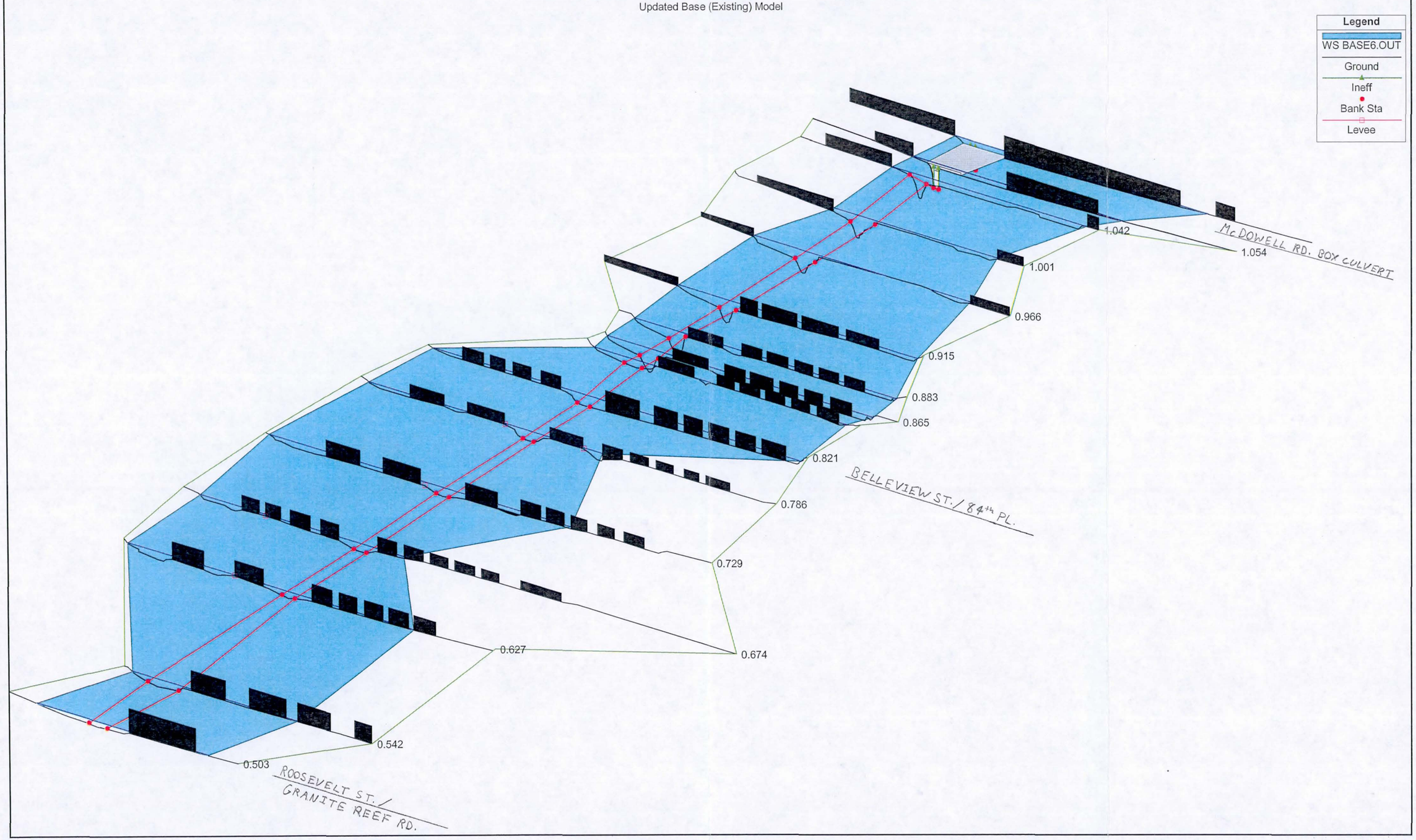
Granite Reef Wash Plan: Existing 1/26/2008

Updated Base (Existing) Model



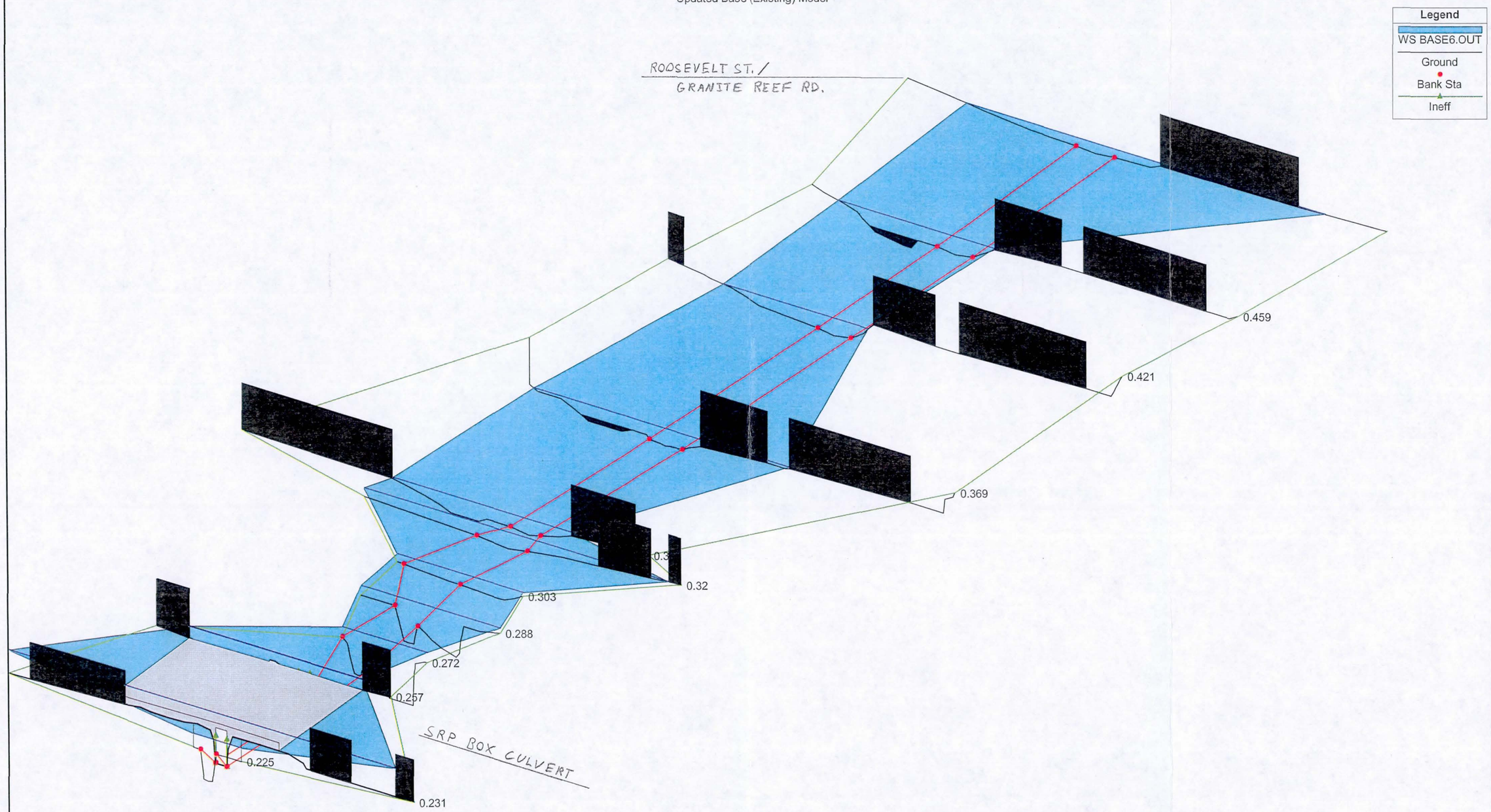
Granite Reef Wash Plan: Existing 1/26/2008

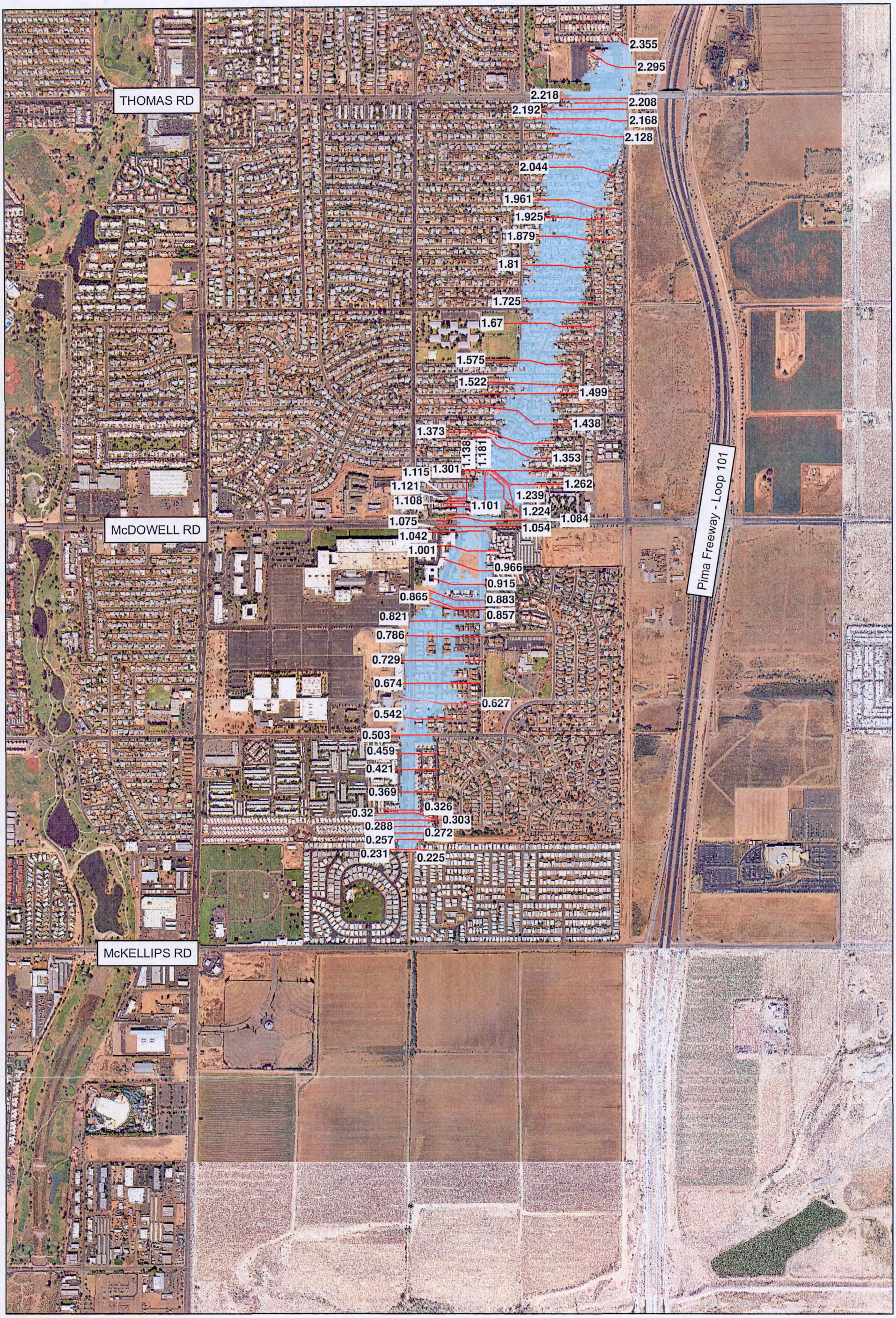
Updated Base (Existing) Model



Granite Reef Wash Plan: Existing 1/26/2008

Updated Base (Existing) Model





Feet
0 500 1,000 1,500

Exhibit 5
Detention Basin Alternative

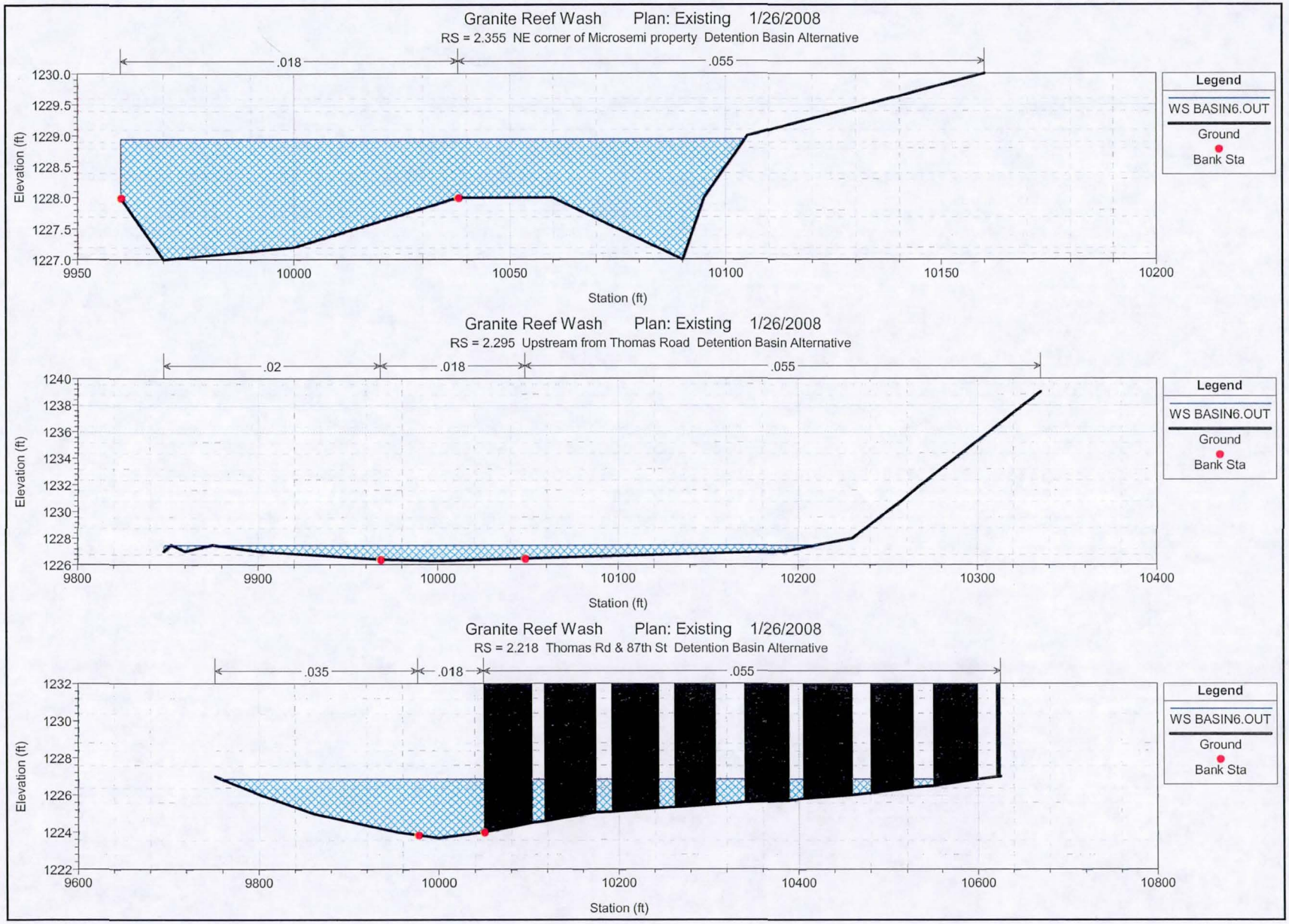
City of Scottsdale
Granite Reef Wash Project

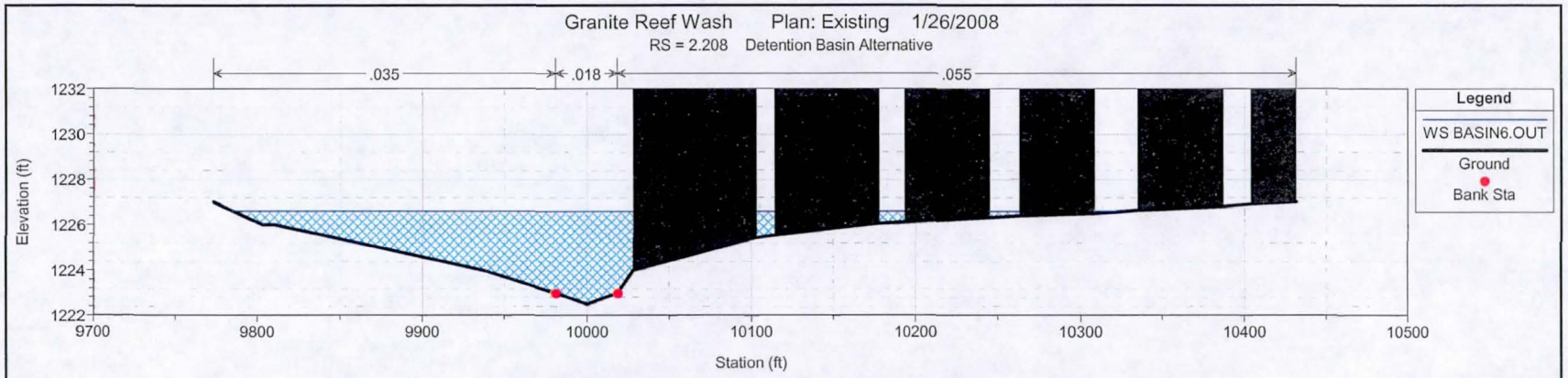
Floodplain Delineation

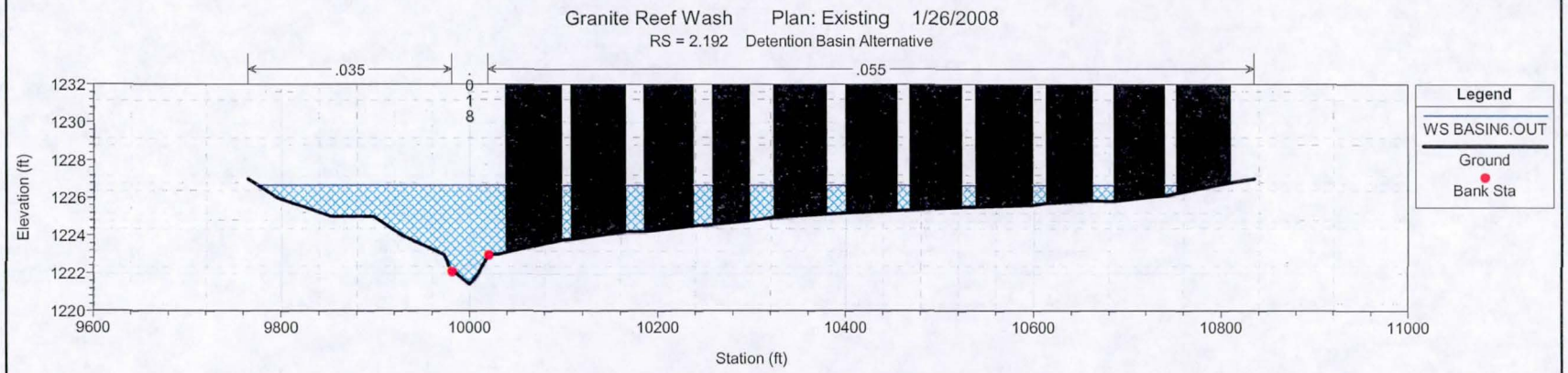
Map: SCDL-EX5

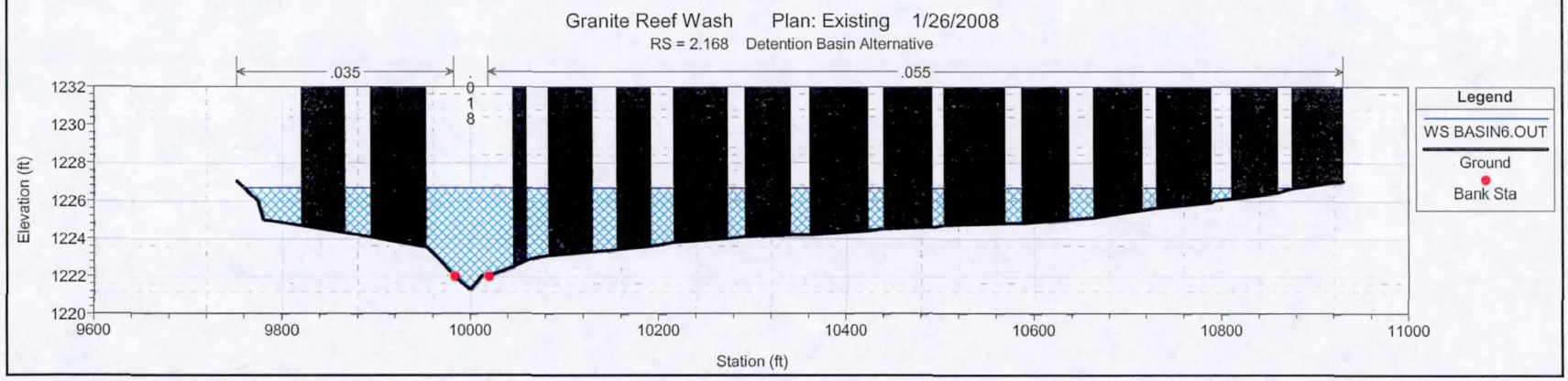
Printed On: 01/24/2008

Created By: PSOMAS


Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.355 NE corner of Microsemi property Detention Basin Alternative
.018
.055
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.295 Upstream from Thomas Road Detention Basin Alternative
.02
.018
.055
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.218 Thomas Rd & 87th St Detention Basin Alternative
.035
.018
.055
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta

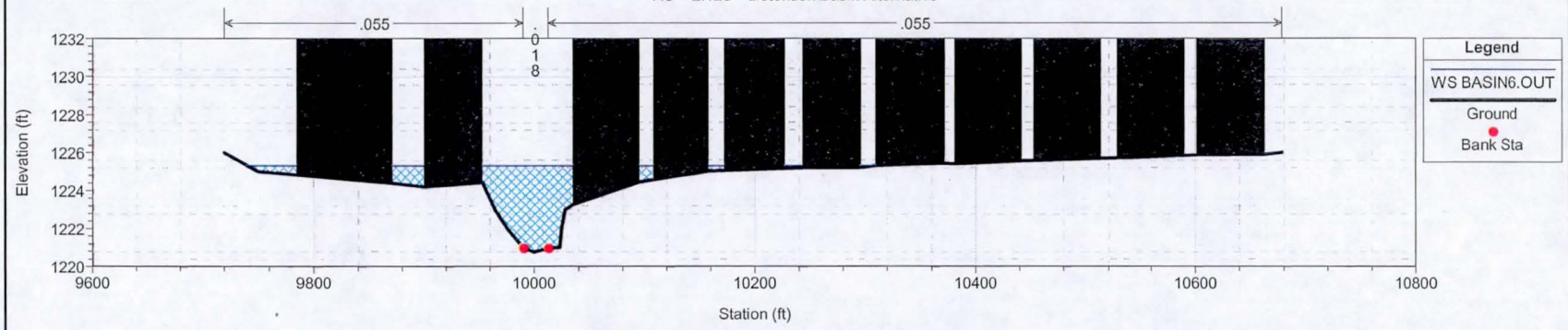

Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.208 Detention Basin Alternative
.035
.018
.055
Elevation (ft)
1232
1230
1228
1226
1224
1222
9700
9800
9900
10000
10100
10200
10300
10400
10500
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.192 Detention Basin Alternative
.035
.018
.055
Elevation (ft)
1232
1230
1228
1226
1224
1222
1220
9600
9800
10000
10200
10400
10600
10800
11000
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.168 Detention Basin Alternative
.035
.018
.055
Elevation (ft)
1232
1230
1228
1226
1224
1222
1220
9600
9800
10000
10200
10400
10600
10800
11000
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta

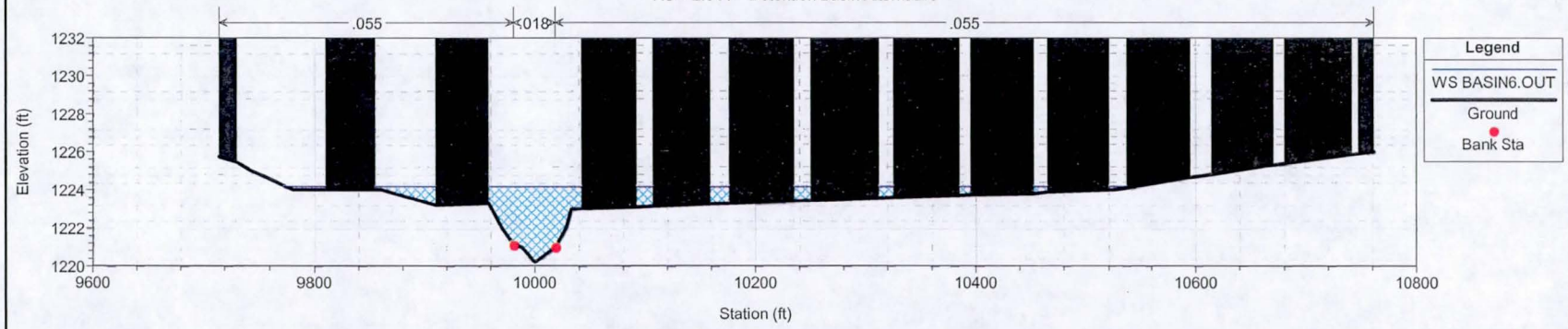
Granite Reef Wash Plan: Existing 1/26/2008

RS = 2.128 Detention Basin Alternative



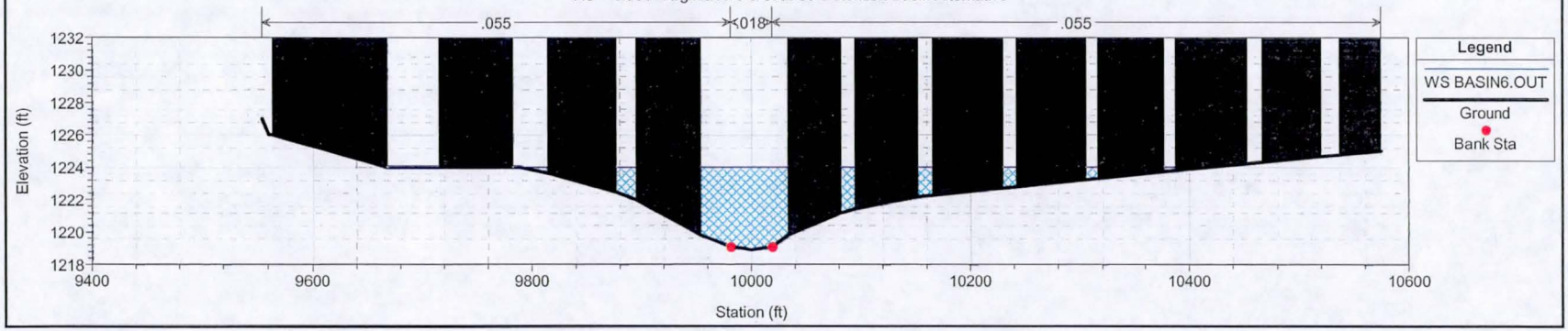
Granite Reef Wash Plan: Existing 1/26/2008

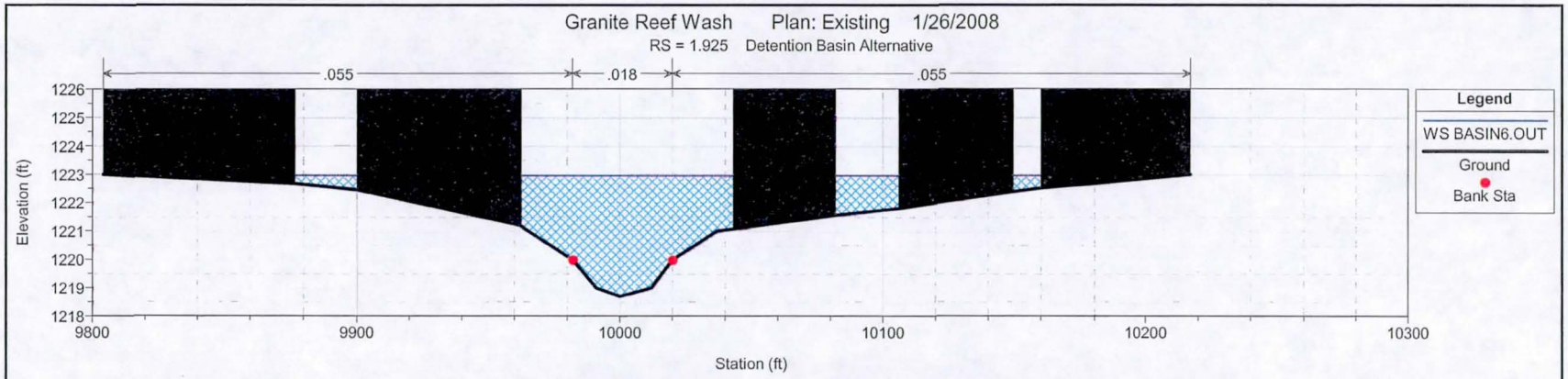
RS = 2.044 Detention Basin Alternative

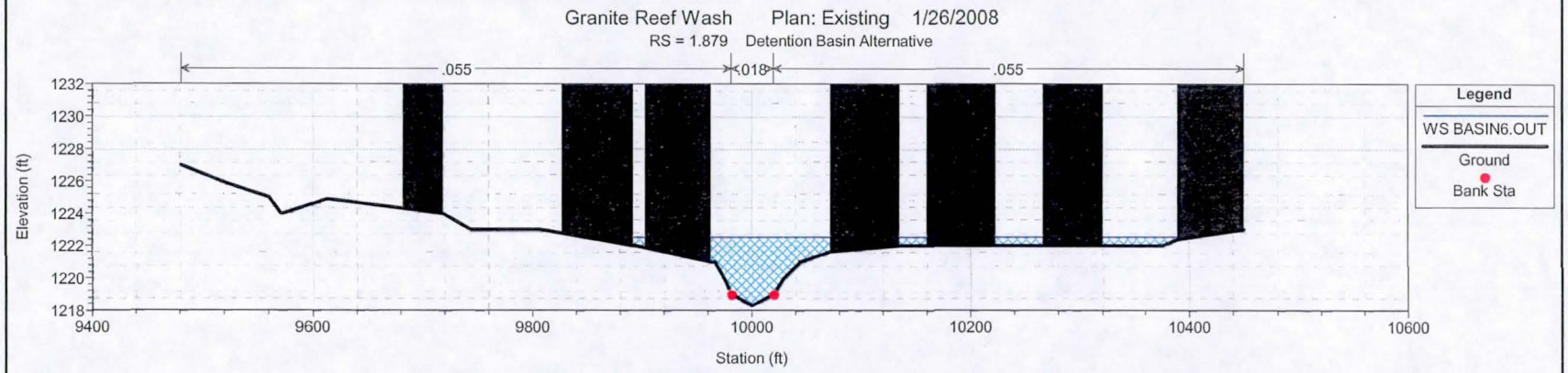


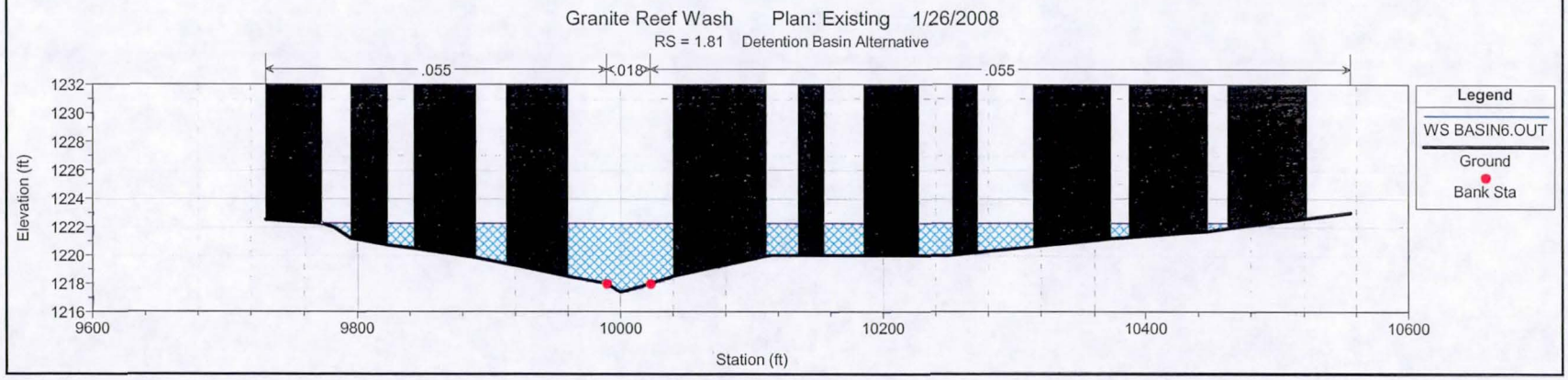
Granite Reef Wash Plan: Existing 1/26/2008

RS = 1.961 Virginia Ave & 87th St Detention Basin Alternative



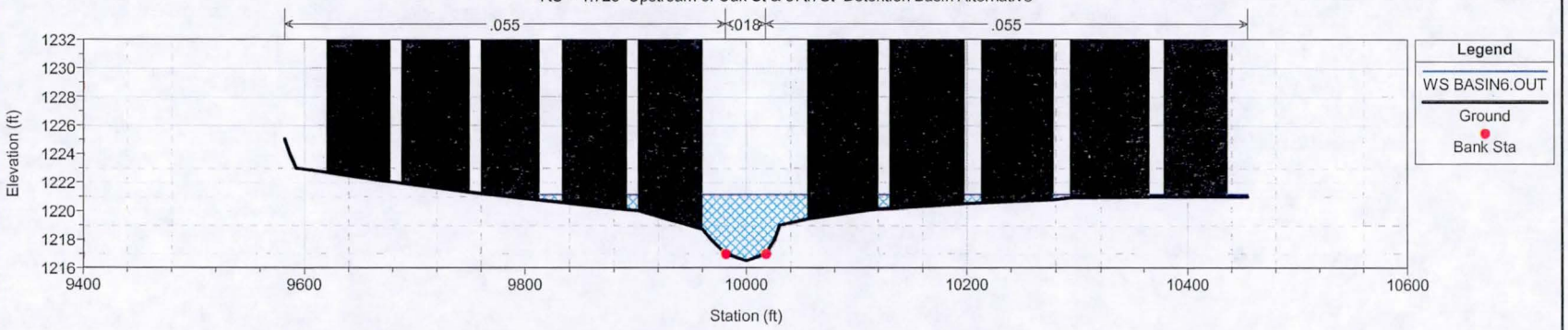

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.925 Detention Basin Alternative
.055
.018
.055
Elevation (ft)
1226
1225
1224
1223
1222
1221
1220
1219
1218
9800
9900
10000
10100
10200
10300
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.879 Detention Basin Alternative
.055
.018
.055
Elevation (ft)
1232
1230
1228
1226
1224
1222
1220
1218
9400
9600
9800
10000
10200
10400
10600
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.81 Detention Basin Alternative
.055
.018
.055
Elevation (ft)
1232
1230
1228
1226
1224
1222
1220
1218
1216
9600
9800
10000
10200
10400
10600
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta

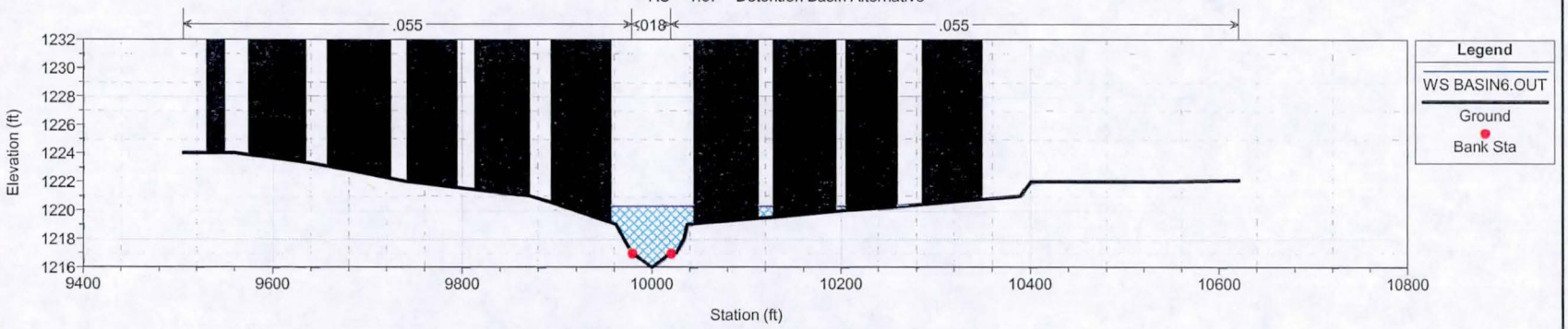
Granite Reef Wash Plan: Existing 1/26/2008

RS = 1.725 Upstream of Oak St & 87th St Detention Basin Alternative



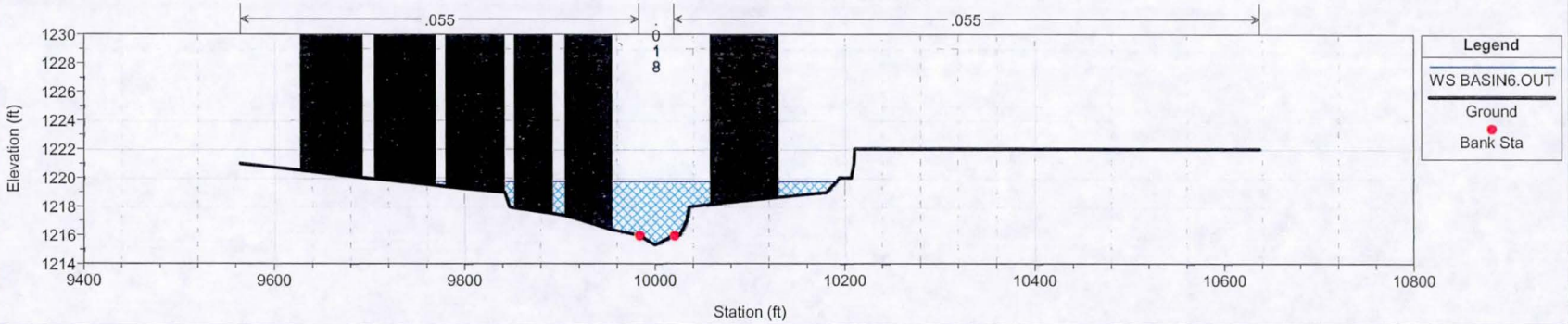
Granite Reef Wash Plan: Existing 1/26/2008

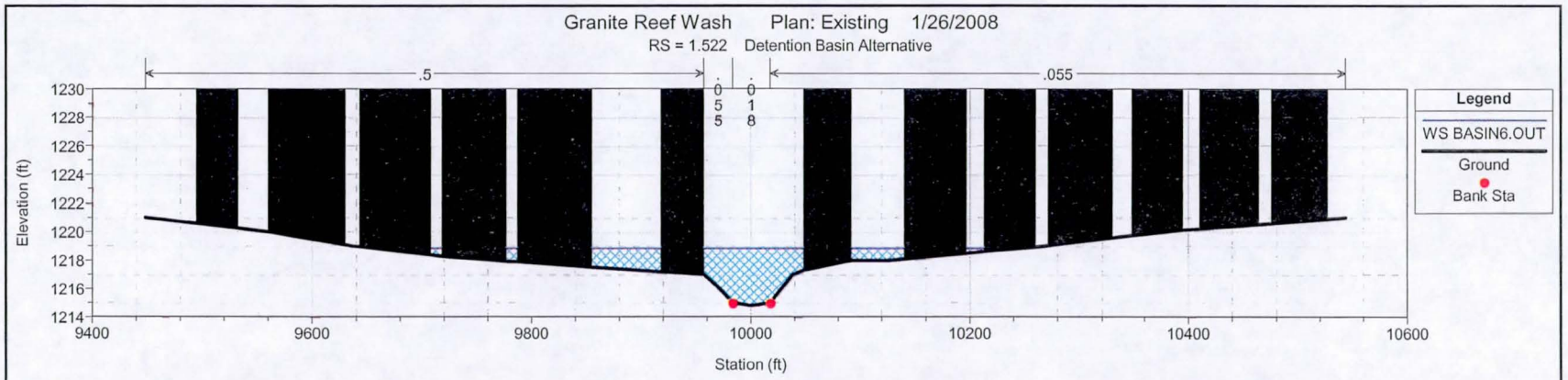
RS = 1.67 Detention Basin Alternative

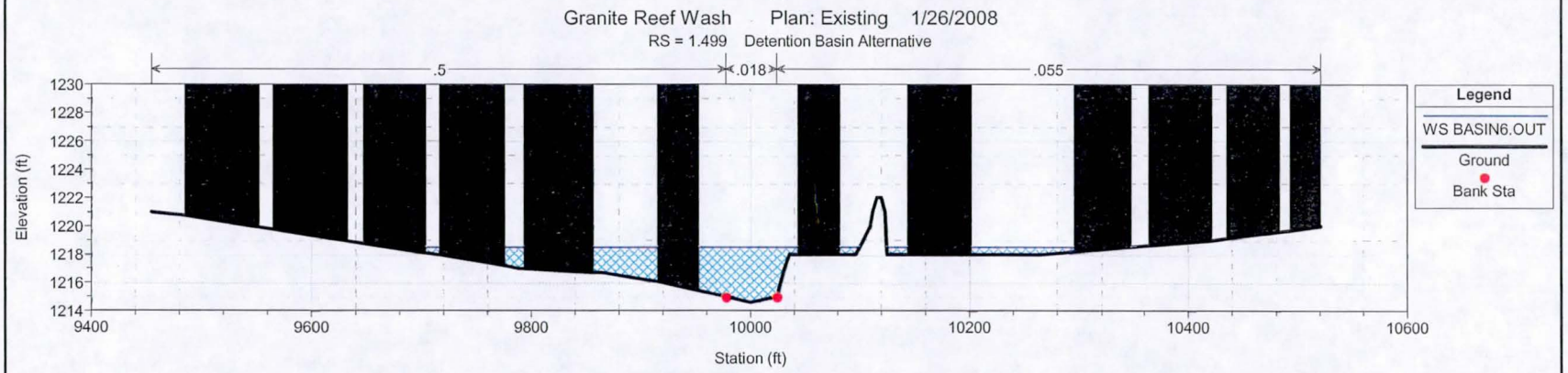


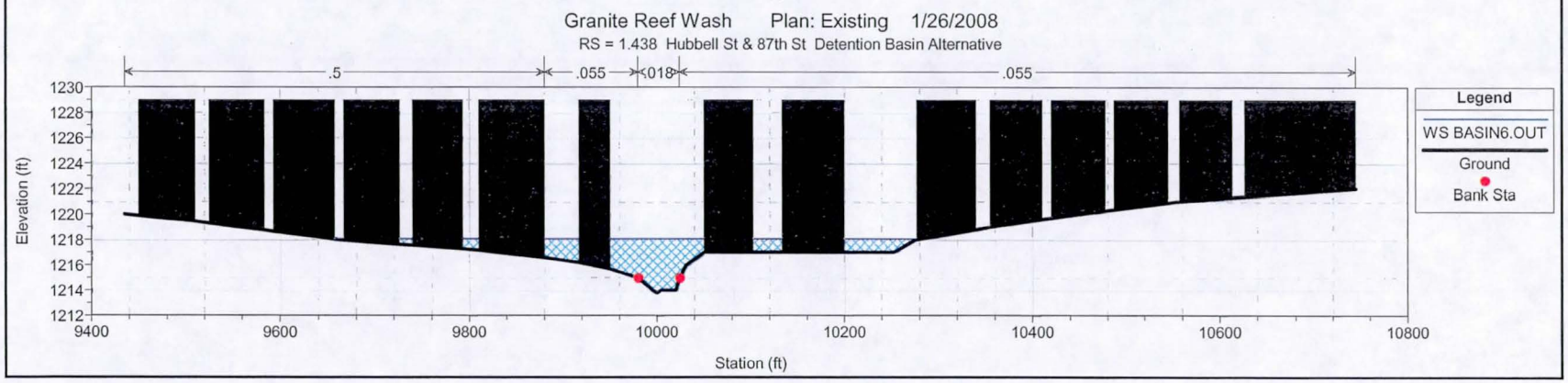
Granite Reef Wash Plan: Existing 1/26/2008

RS = 1.575 Detention Basin Alternative



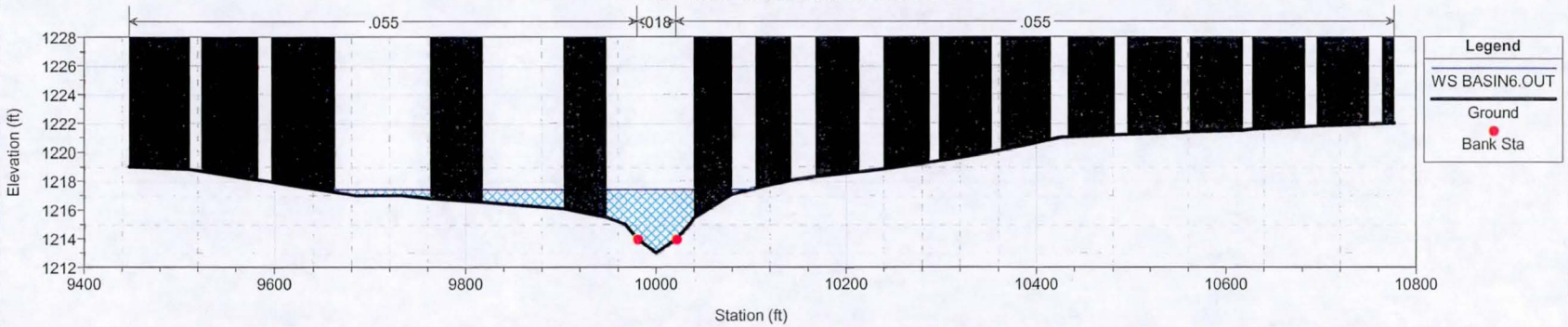

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.522 Detention Basin Alternative
.5
.055
.055
.018
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.499 Detention Basin Alternative
.5
.018
.055
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.438 Hubbell St & 87th St Detention Basin Alternative
.5
.055
.018
.055
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta

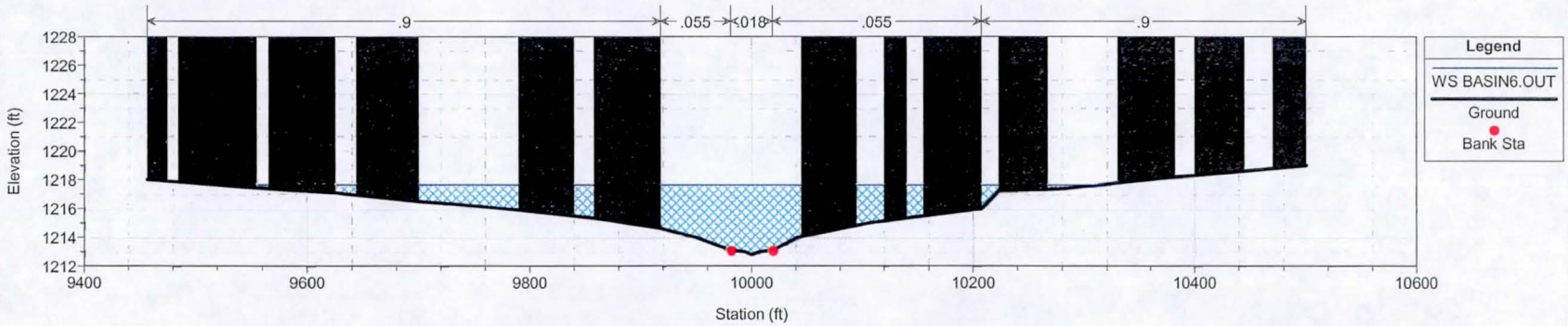
Granite Reef Wash Plan: Existing 1/26/2008

RS = 1.373 Detention Basin Alternative



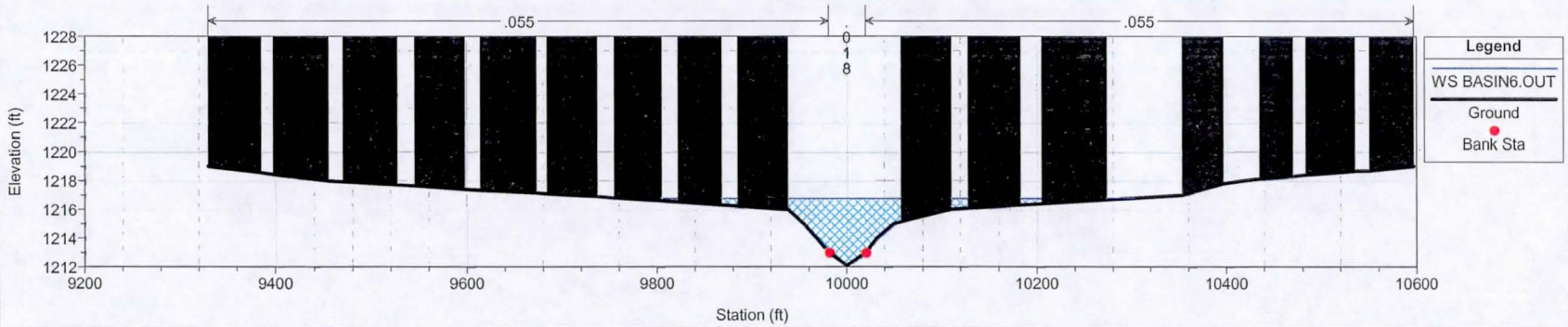
Granite Reef Wash Plan: Existing 1/26/2008

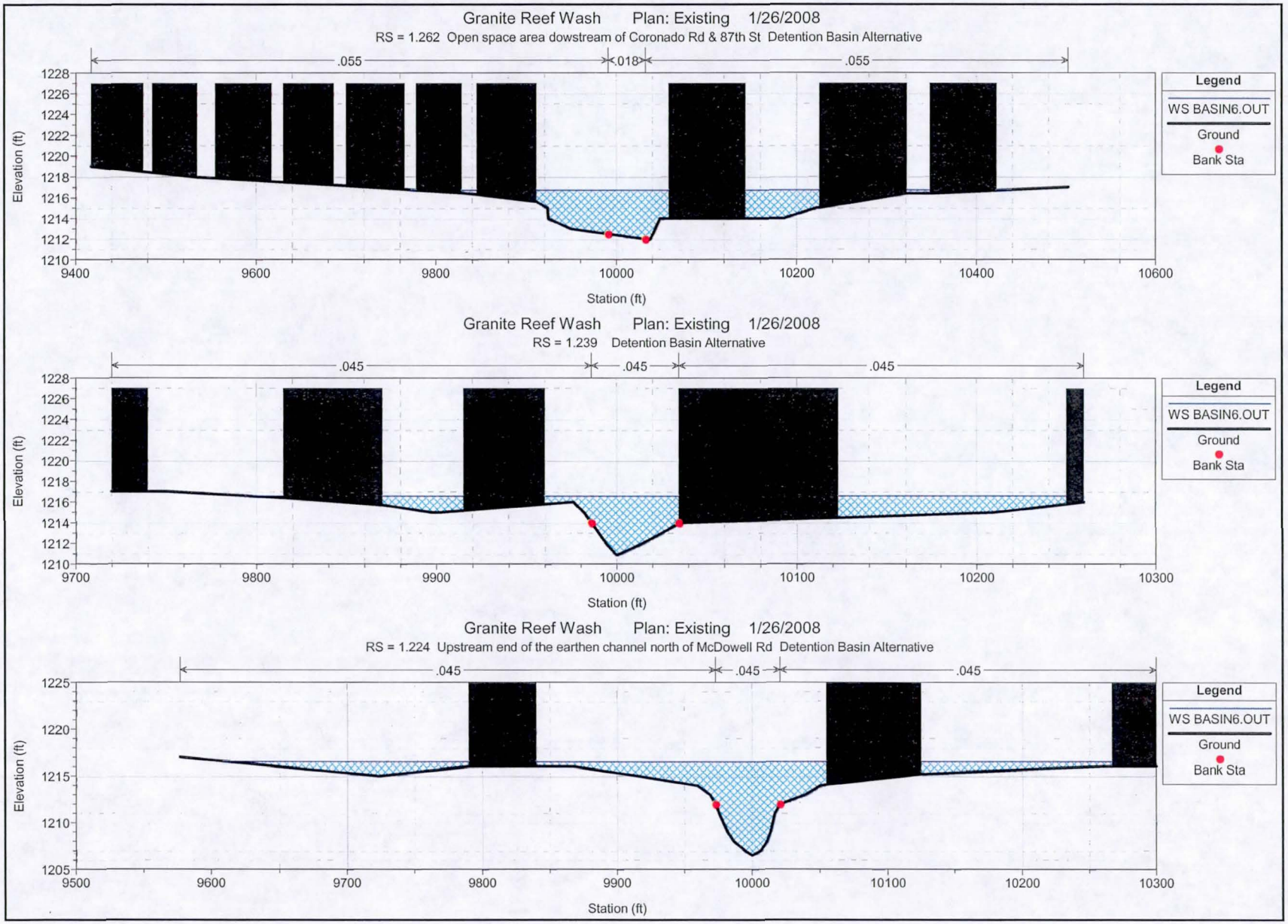
RS = 1.353 Detention Basin Alternative

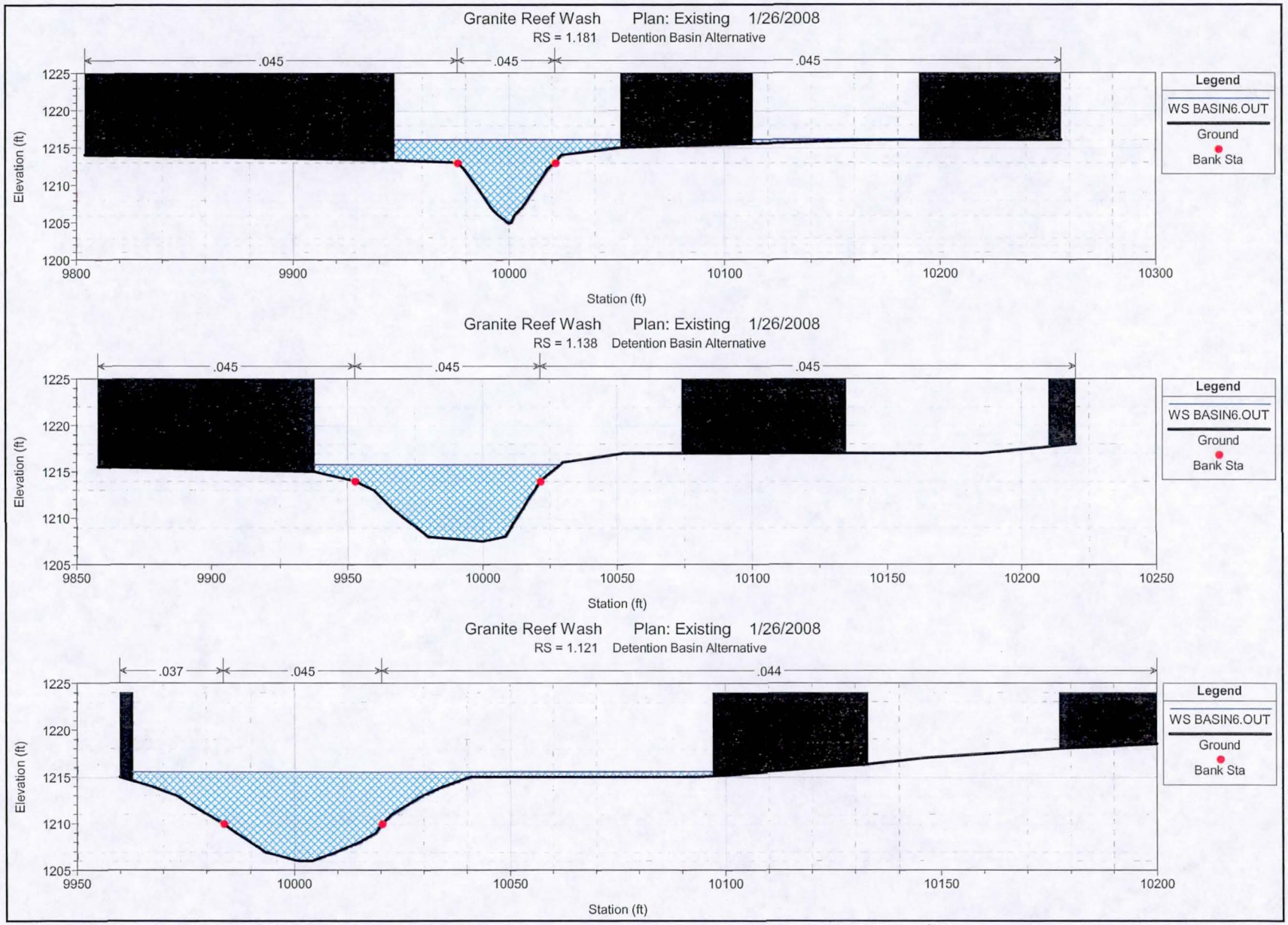


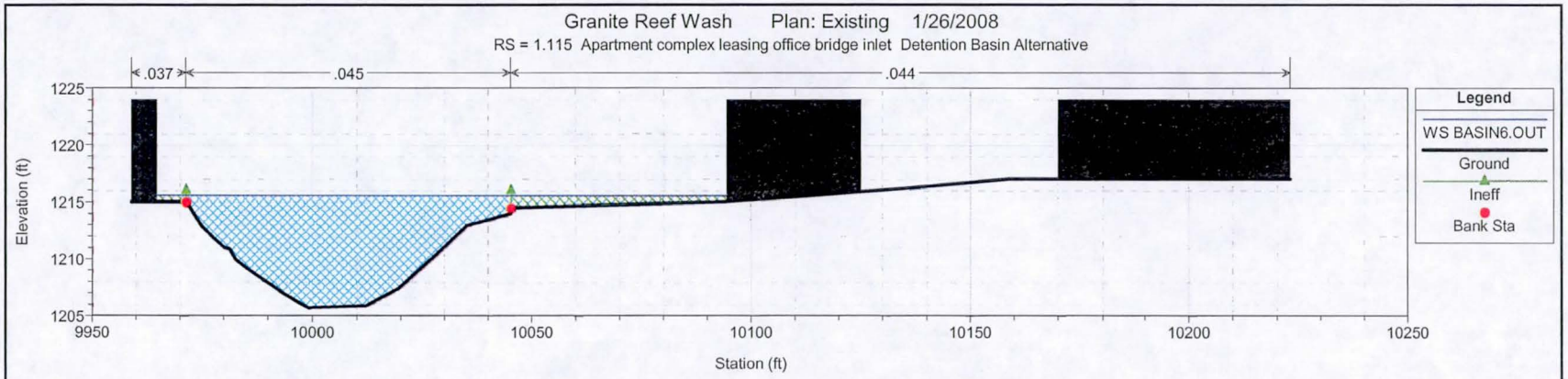
Granite Reef Wash Plan: Existing 1/26/2008

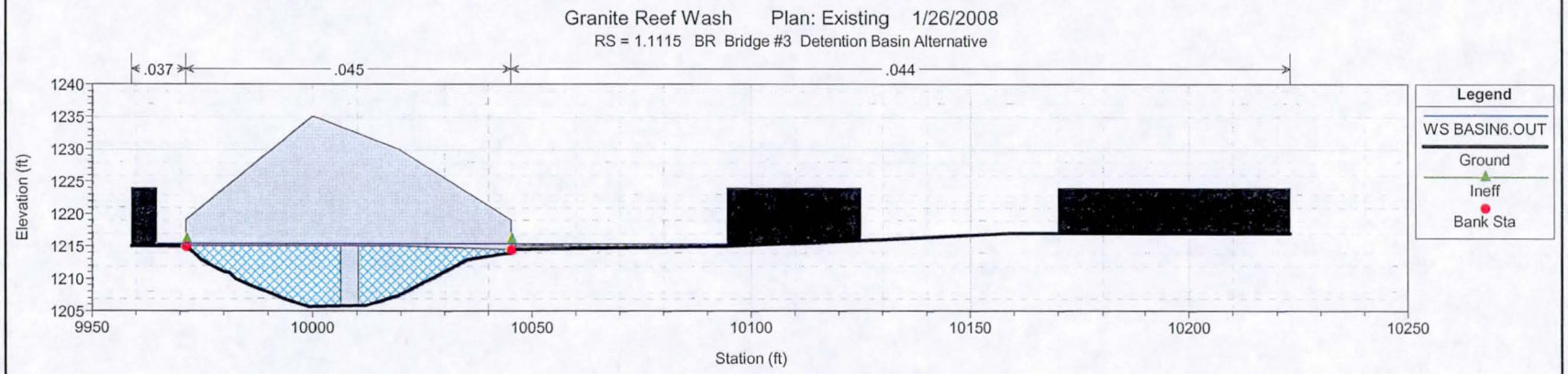
RS = 1.301 Detention Basin Alternative

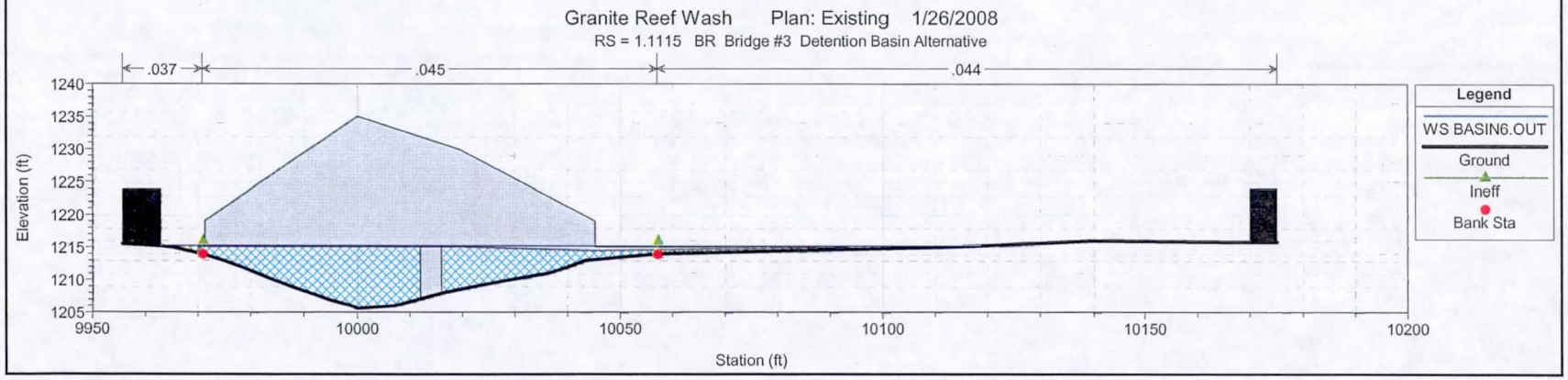


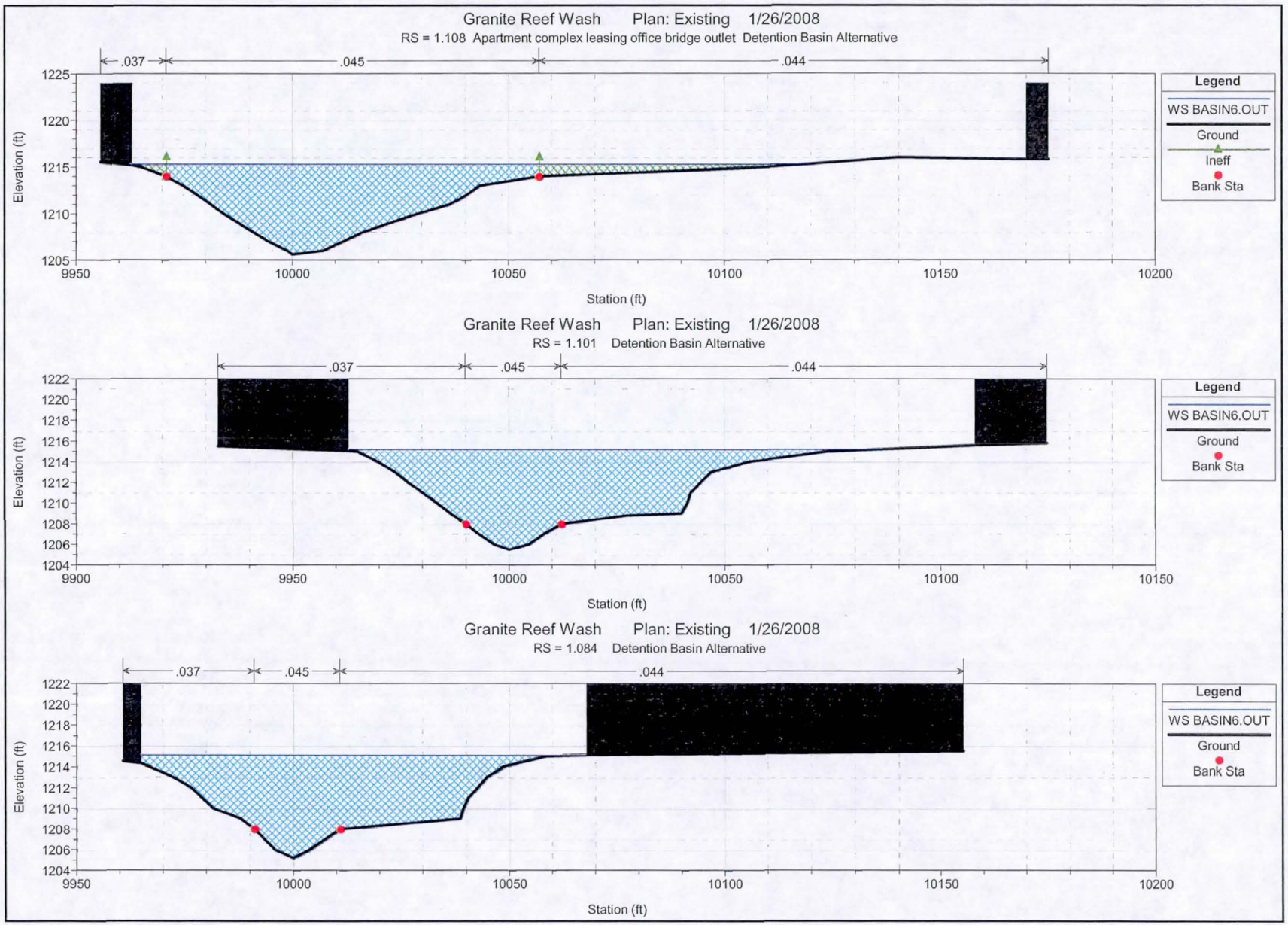

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.262 Open space area dowstream of Coronado Rd & 87th St Detention Basin Alternative
.055
.018
.055
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.239 Detention Basin Alternative
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.224 Upstream end of the earthen channel north of McDowell Rd Detention Basin Alternative
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.181 Detention Basin Alternative
.045
.045
.045
Elevation (ft)
1225
1220
1215
1210
1205
1200
9800
9900
10000
10100
10200
10300
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.138 Detention Basin Alternative
.045
.045
.045
Elevation (ft)
1225
1220
1215
1210
1205
9850
9900
9950
10000
10050
10100
10150
10200
10250
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.121 Detention Basin Alternative
.037
.045
.044
Elevation (ft)
1225
1220
1215
1210
1205
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.115 Apartment complex leasing office bridge inlet Detention Basin Alternative
.037
.045
.044
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Ineff
Bank Sta

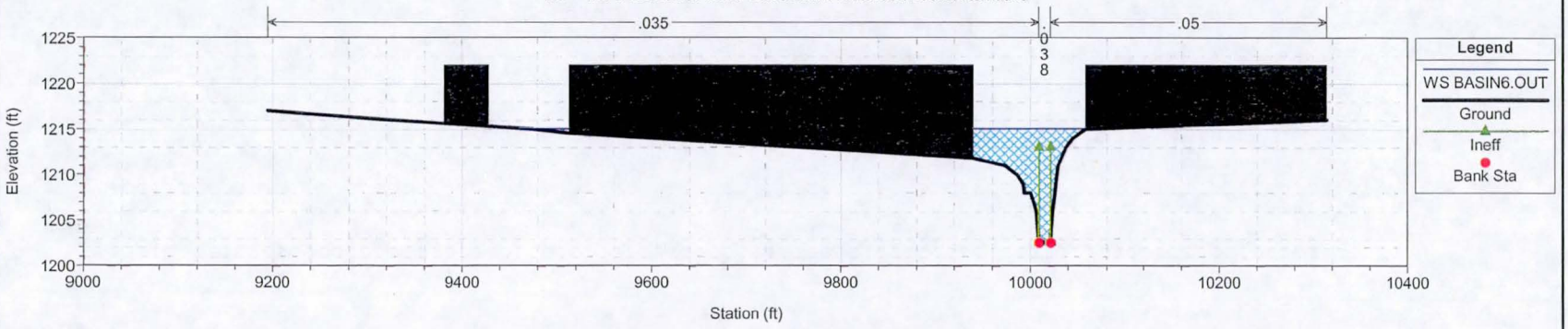

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.1115 BR Bridge #3 Detention Basin Alternative
.037
.045
.044
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Ineff
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.1115 BR Bridge #3 Detention Basin Alternative
.037
.045
.044
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Ineff
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.108 Apartment complex leasing office bridge outlet Detention Basin Alternative
.037
.045
.044
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Ineff
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.101 Detention Basin Alternative
.037
.045
.044
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.084 Detention Basin Alternative
.037
.045
.044
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta

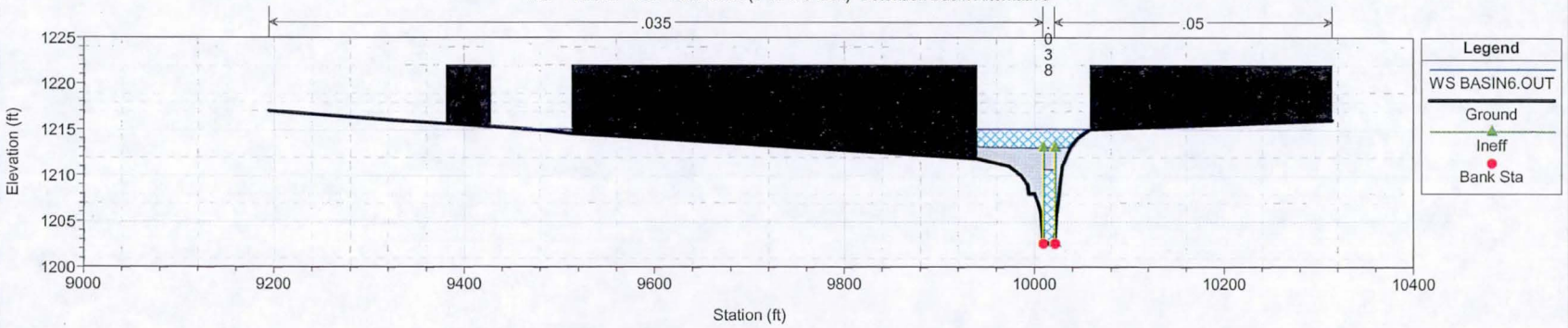
Granite Reef Wash Plan: Existing 1/26/2008

RS = 1.075 McDowell Road Culvert Inlet Detention Basin Alternative



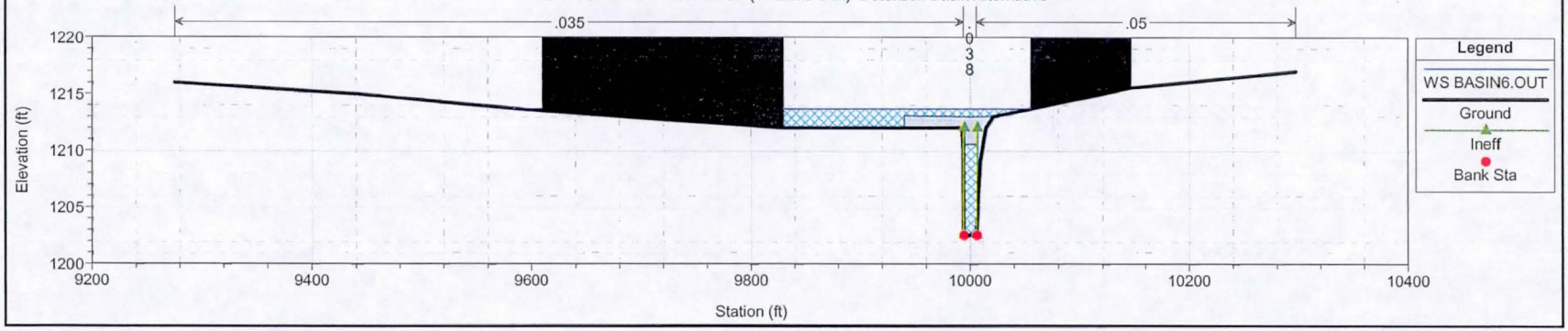
Granite Reef Wash Plan: Existing 1/26/2008

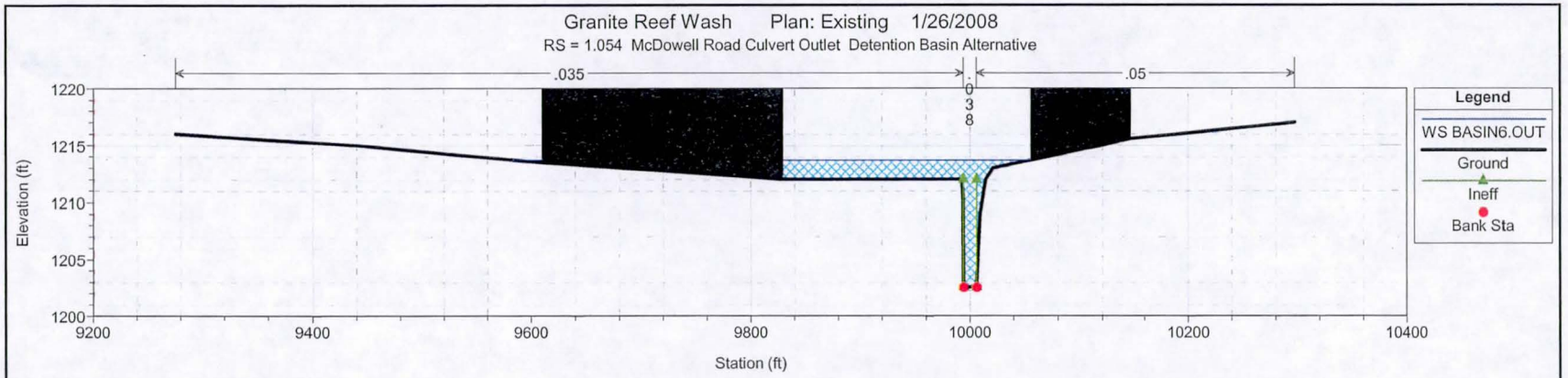
RS = 1.0645 Culv Culvert #2 (1 12' x 8' Box) Detention Basin Alternative

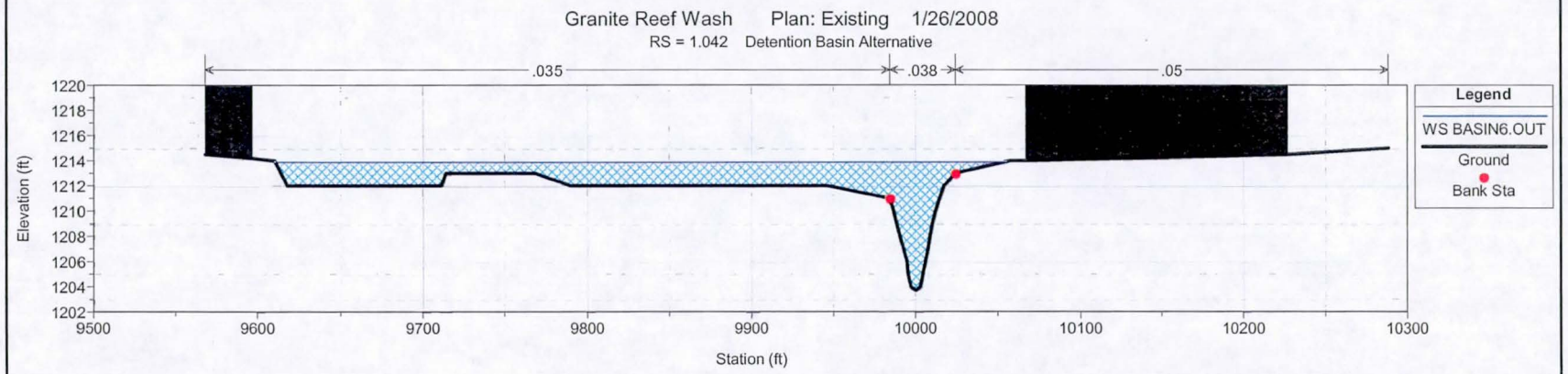


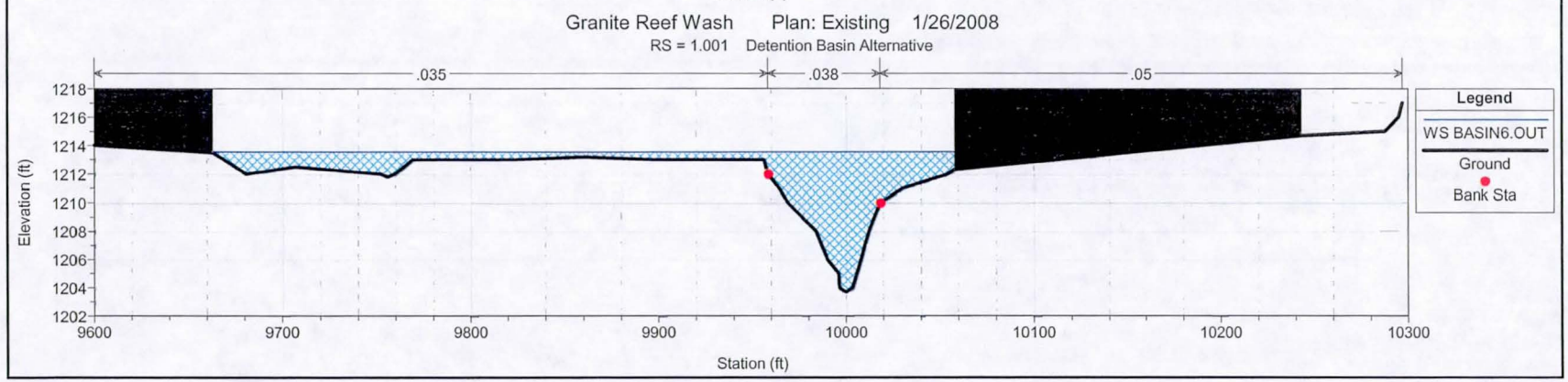
Granite Reef Wash Plan: Existing 1/26/2008

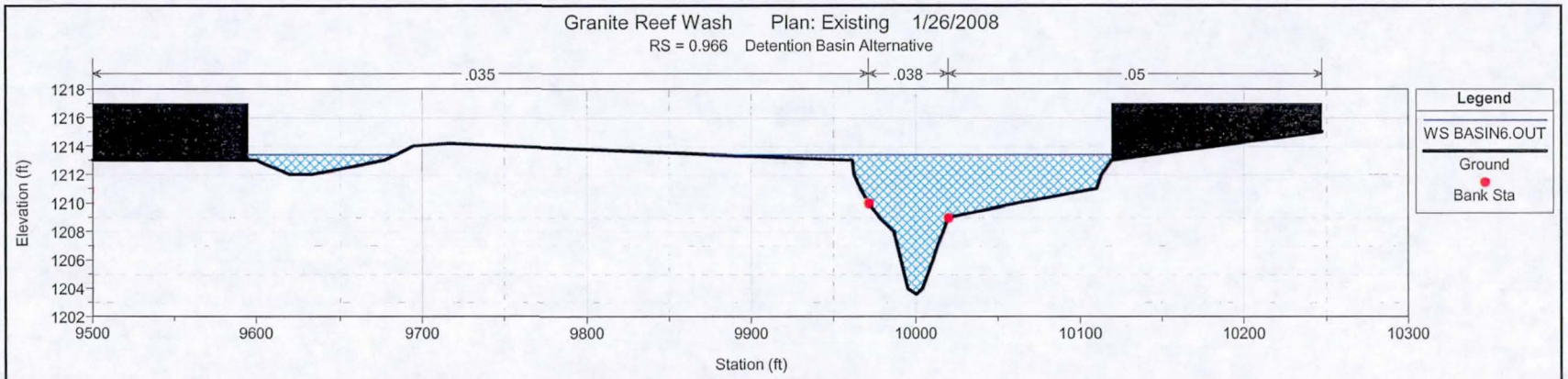
RS = 1.0645 Culv Culvert #2 (1 12' x 8' Box) Detention Basin Alternative

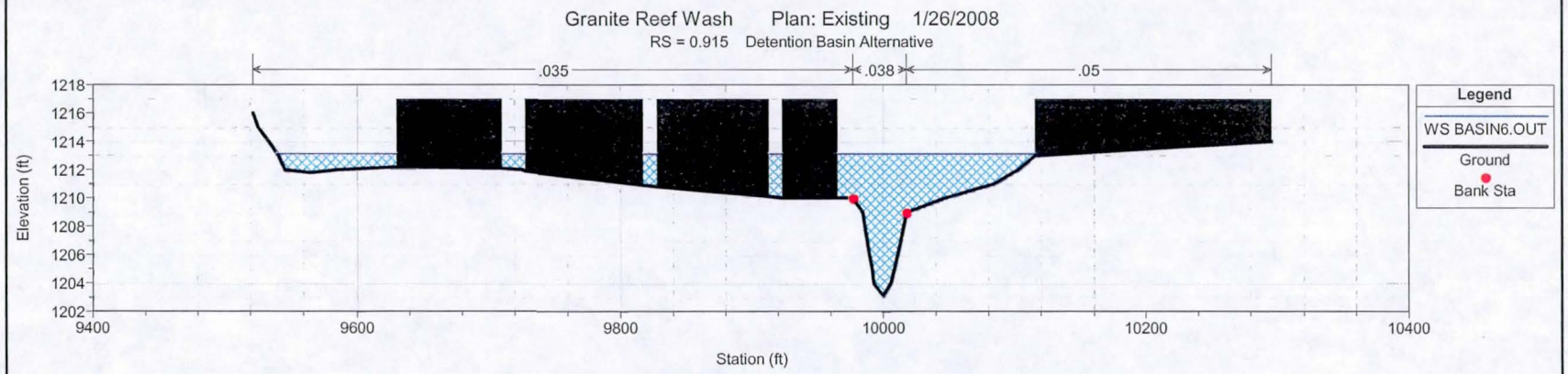


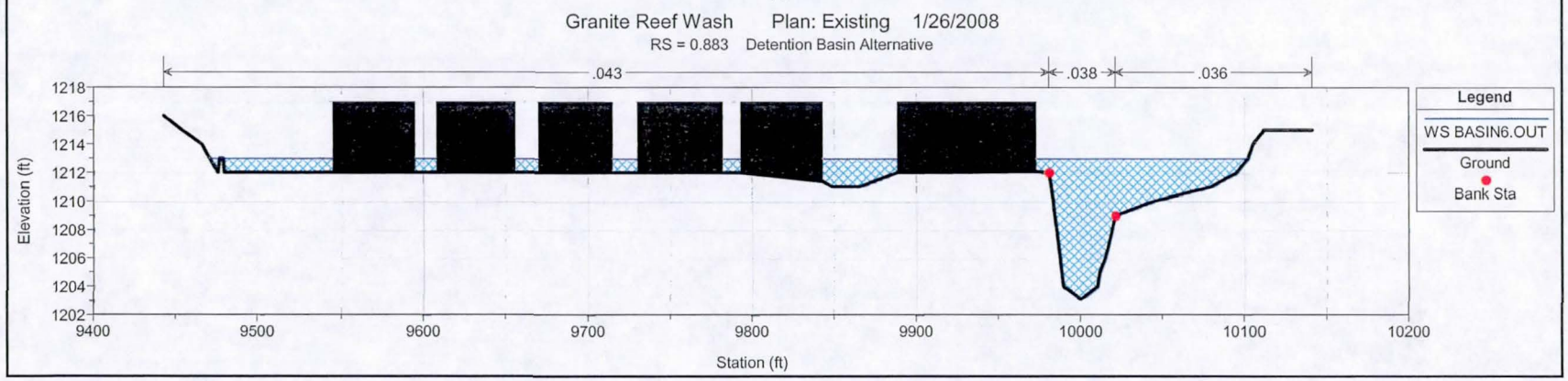

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.054 McDowell Road Culvert Outlet Detention Basin Alternative
.035
.038
.05
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Ineff
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.042 Detention Basin Alternative
.035
.038
.05
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.001 Detention Basin Alternative
.035
.038
.05
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta

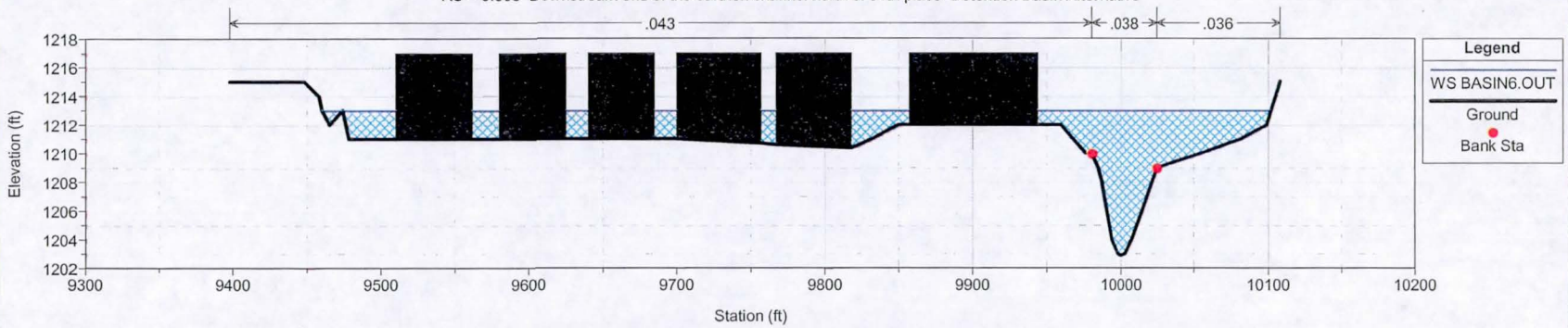

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.966 Detention Basin Alternative
.035
.038
.05
Elevation (ft)
1218
1216
1214
1212
1210
1208
1206
1204
1202
9500
9600
9700
9800
9900
10000
10100
10200
10300
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.915 Detention Basin Alternative
.035
.038
.05
Elevation (ft)
1218
1216
1214
1212
1210
1208
1206
1204
1202
9400
9600
9800
10000
10200
10400
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.883 Detention Basin Alternative
.043
.038
.036
Elevation (ft)
1218
1216
1214
1212
1210
1208
1206
1204
1202
9400
9500
9600
9700
9800
9900
10000
10100
10200
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta

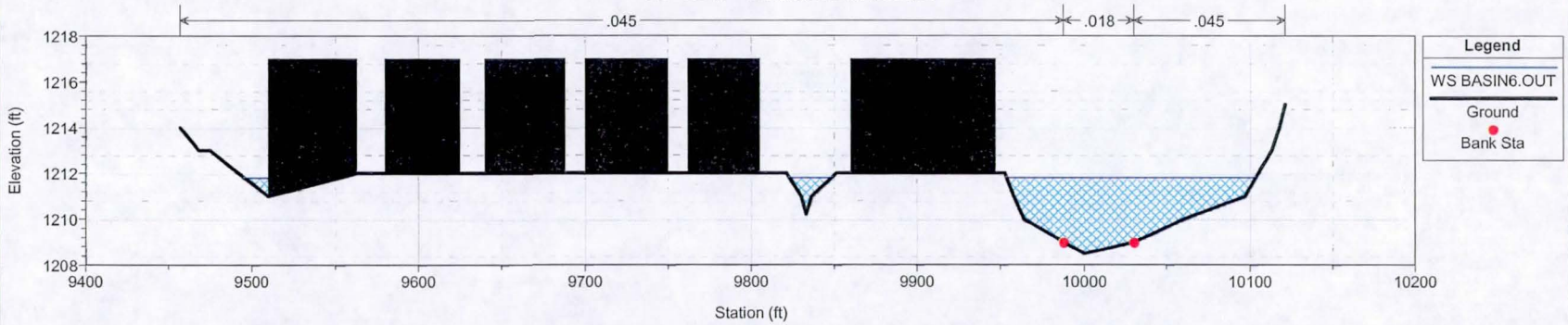
Granite Reef Wash Plan: Existing 1/26/2008

RS = 0.865 Downstream end of the earthen channel north of 84th place Detention Basin Alternative



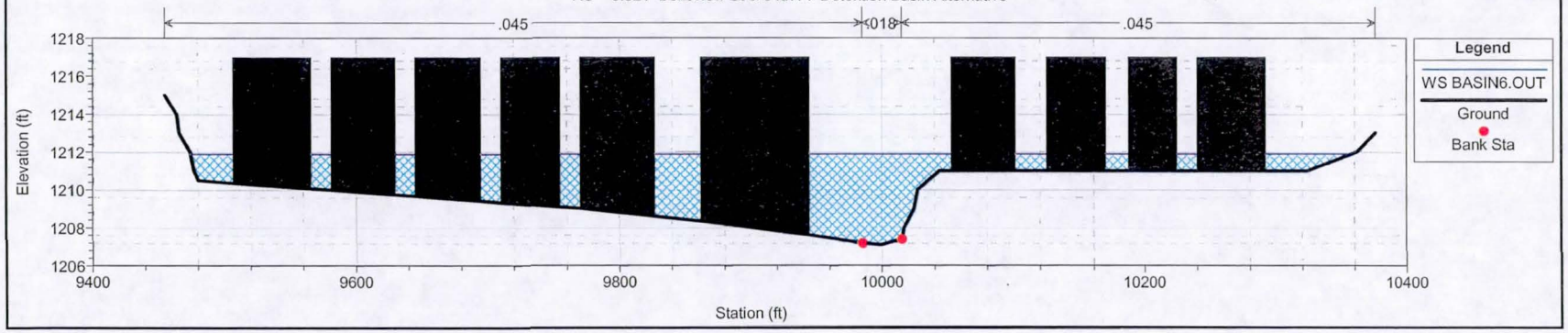
Granite Reef Wash Plan: Existing 1/26/2008

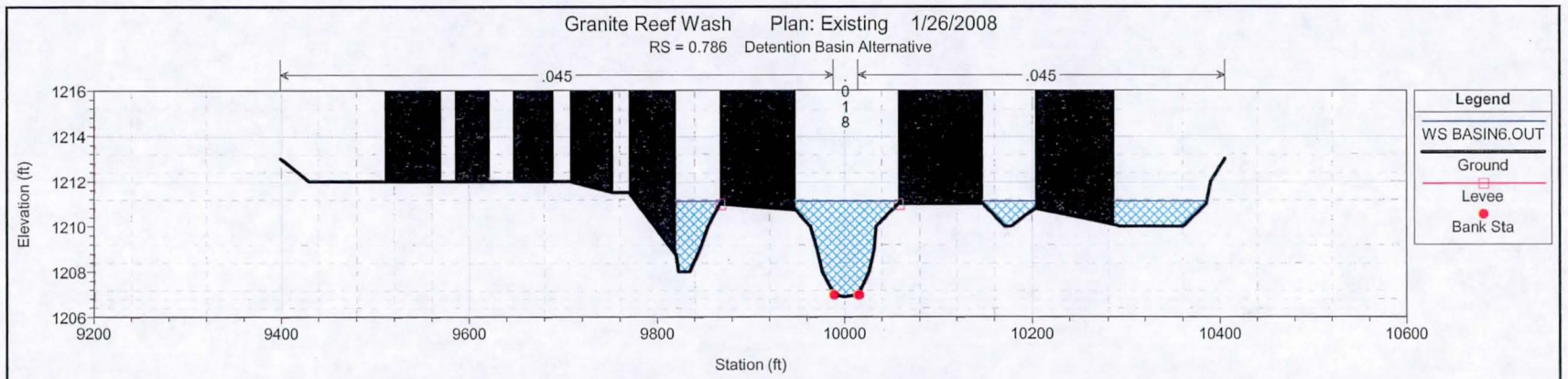
RS = 0.857 Detention Basin Alternative

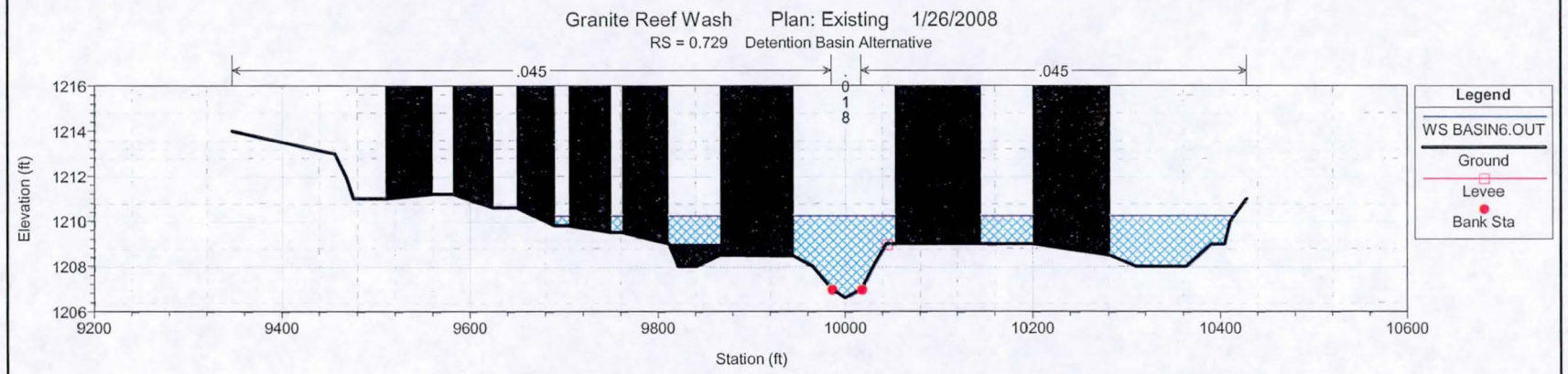


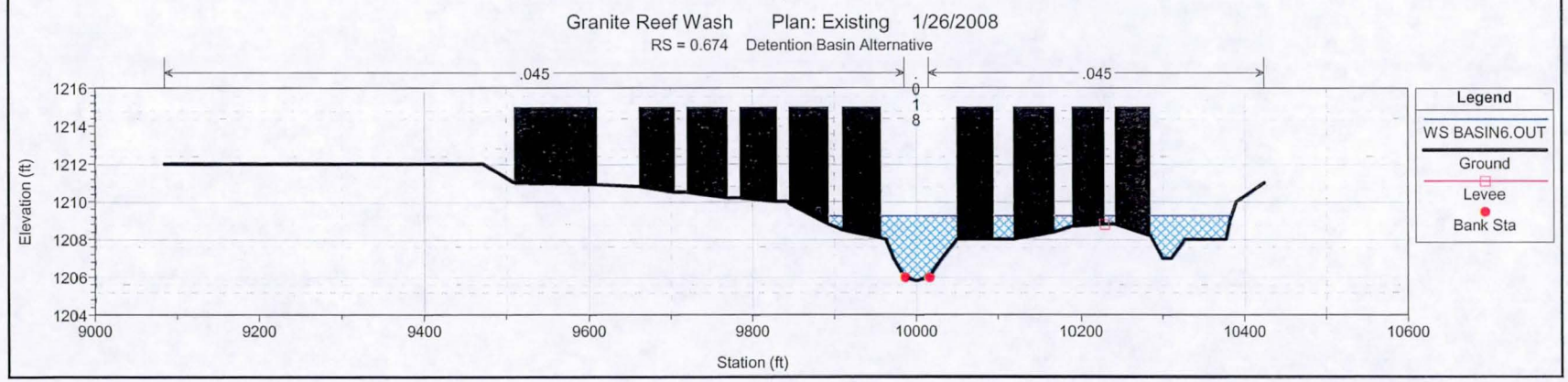
Granite Reef Wash Plan: Existing 1/26/2008

RS = 0.821 Belleview St & 84th Pl Detention Basin Alternative



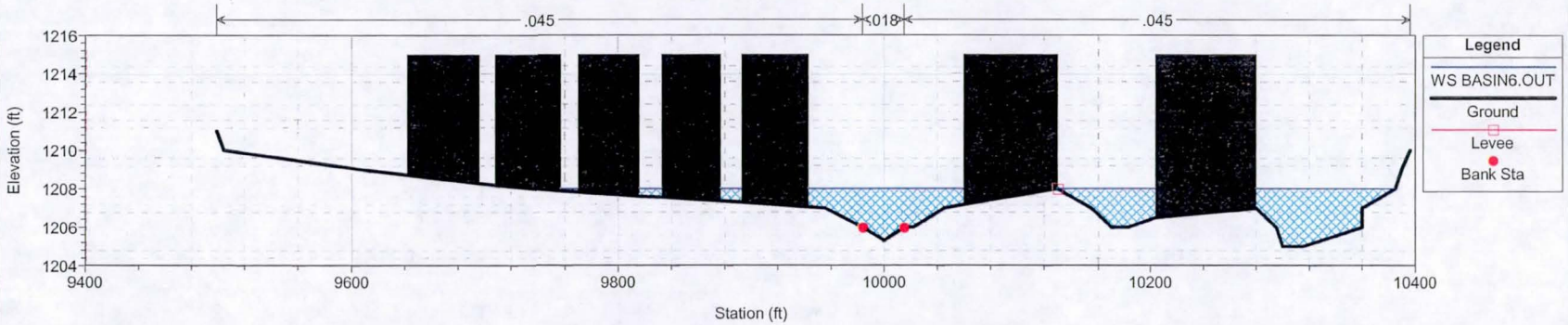

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.786 Detention Basin Alternative
.045
.018
.045
Elevation (ft)
1216
1214
1212
1210
1208
1206
9200
9400
9600
9800
10000
10200
10400
10600
Station (ft)
Legend
WS BASIN6.OUT
Ground
Levee
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.729 Detention Basin Alternative
.045
.018
.045
Elevation (ft)
1216
1214
1212
1210
1208
1206
9200
9400
9600
9800
10000
10200
10400
10600
Station (ft)
Legend
WS BASIN6.OUT
Ground
Levee
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.674 Detention Basin Alternative
.045
.018
.045
Elevation (ft)
1216
1214
1212
1210
1208
1206
1204
9000
9200
9400
9600
9800
10000
10200
10400
10600
Station (ft)
Legend
WS BASIN6.OUT
Ground
Levee
Bank Sta

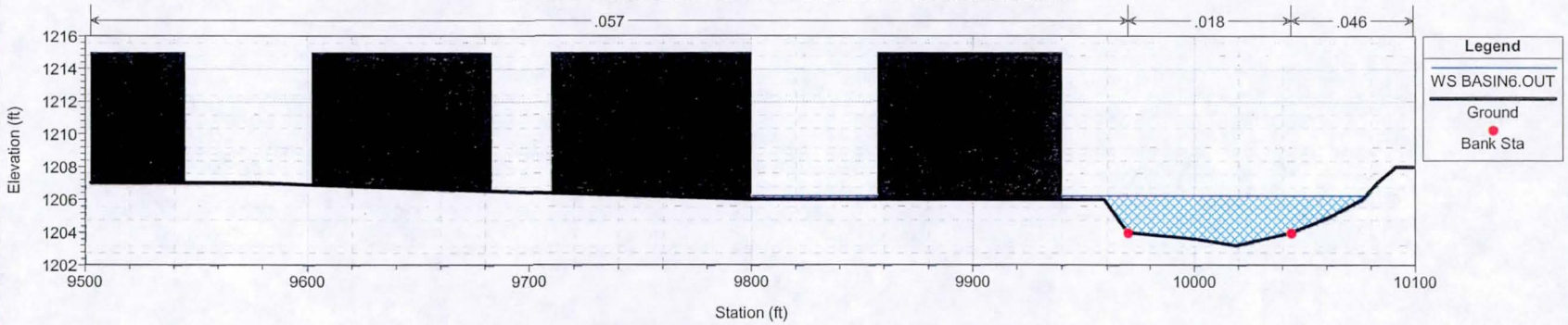
Granite Reef Wash Plan: Existing 1/26/2008

RS = 0.627 Detention Basin Alternative



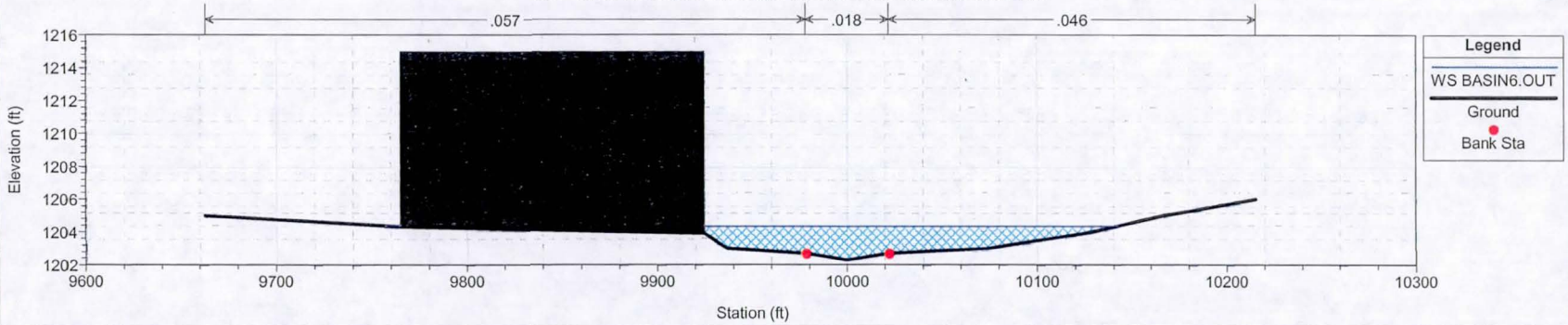
Granite Reef Wash Plan: Existing 1/26/2008

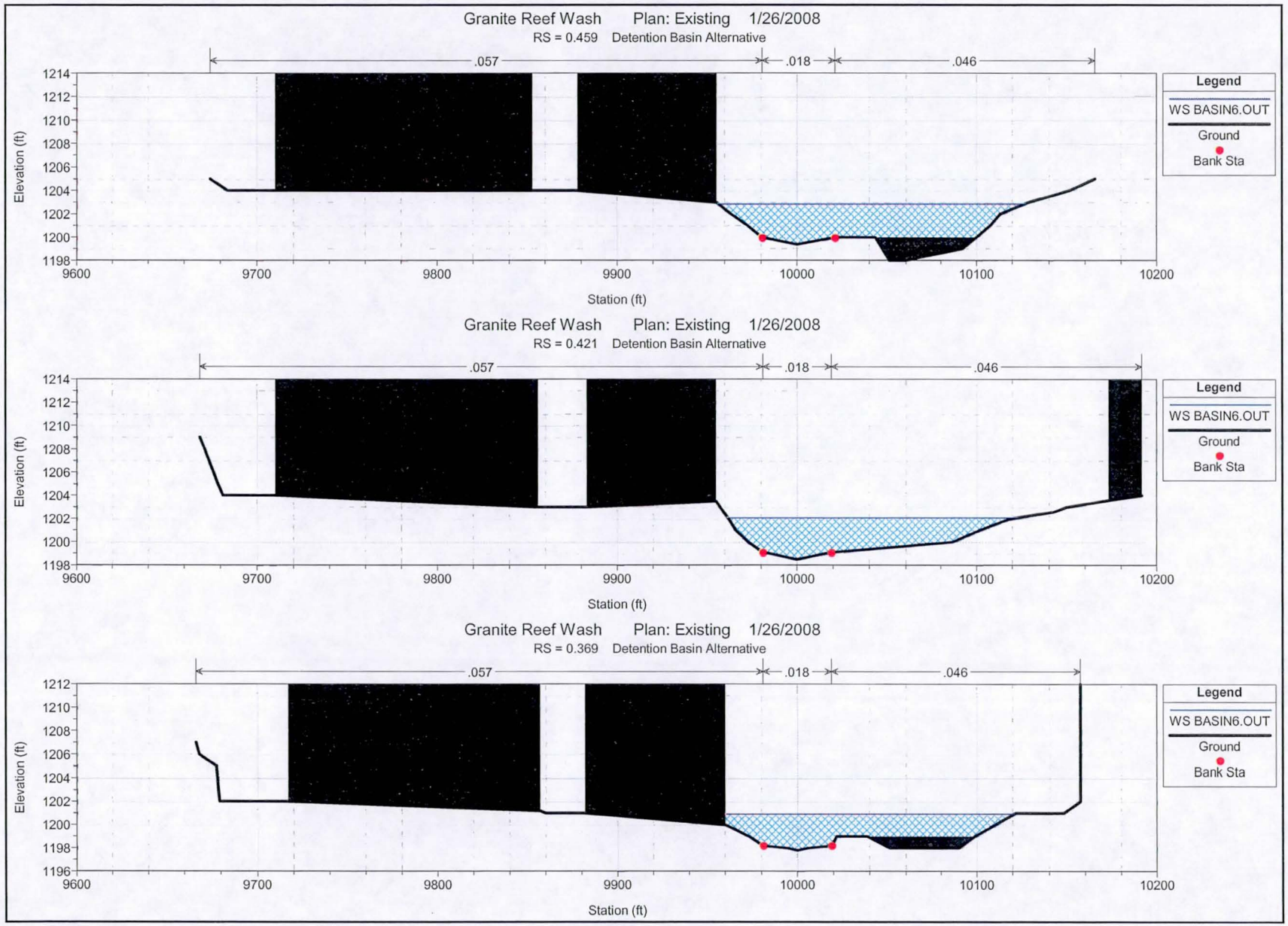
RS = 0.542 Downstream of 84th Pl & Granite Reef Rd Detention Basin Alternative

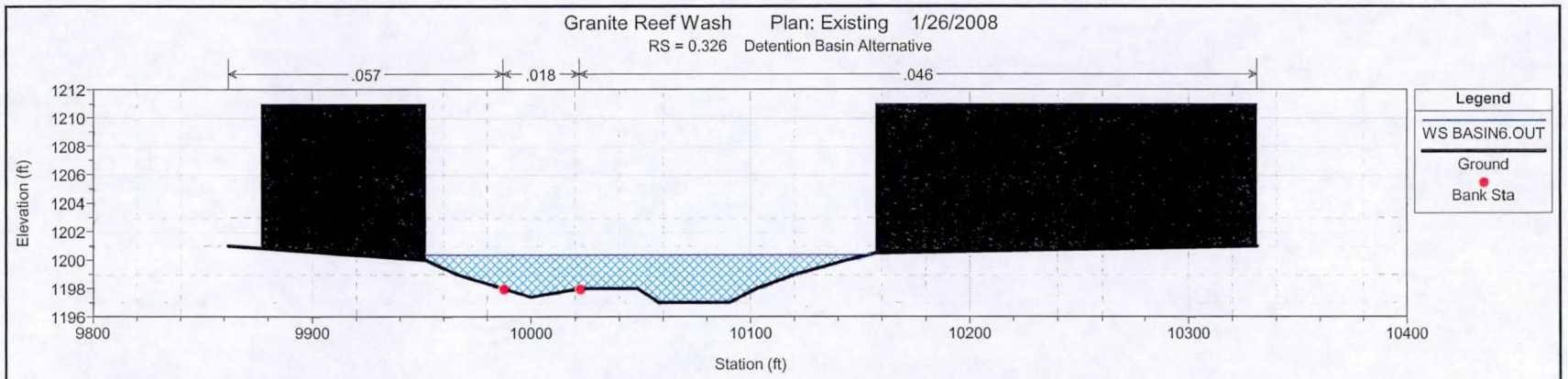


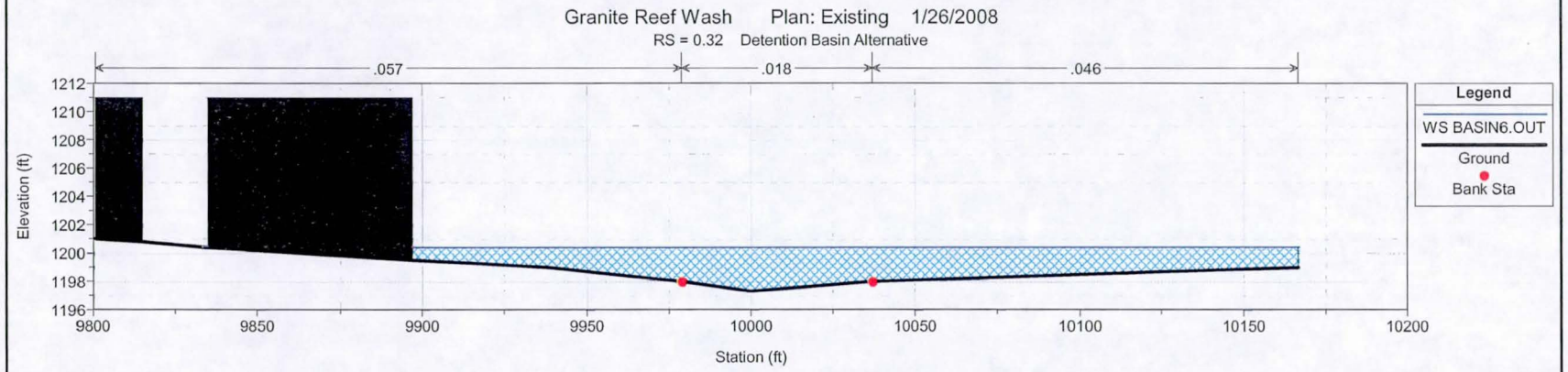
Granite Reef Wash Plan: Existing 1/26/2008

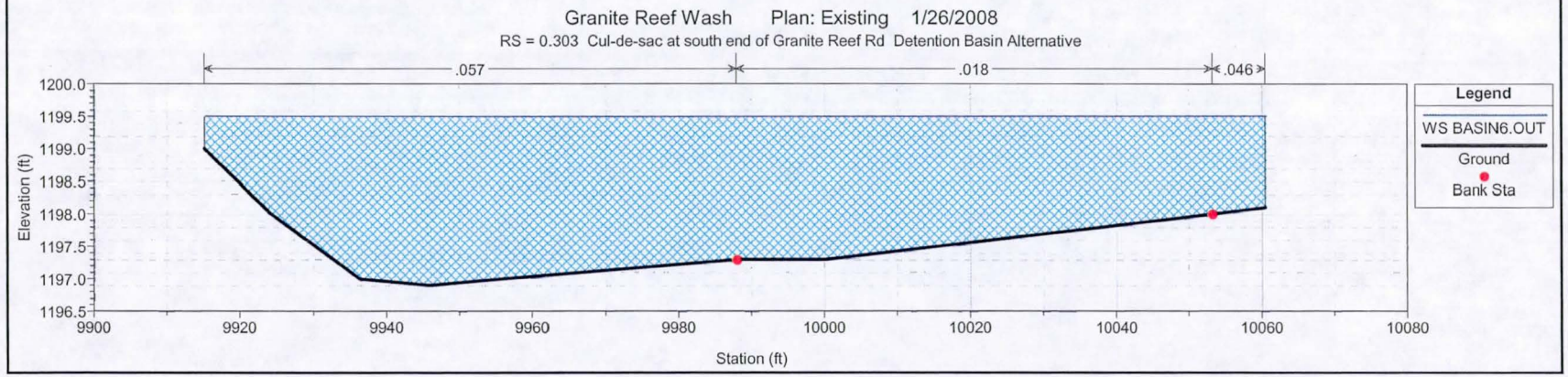
RS = 0.503 Roosevelt St & Granite Reef Rd Detention Basin Alternative




Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.459 Detention Basin Alternative
.057
.018
.046
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.421 Detention Basin Alternative
.057
.018
.046
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.369 Detention Basin Alternative
.057
.018
.046
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta

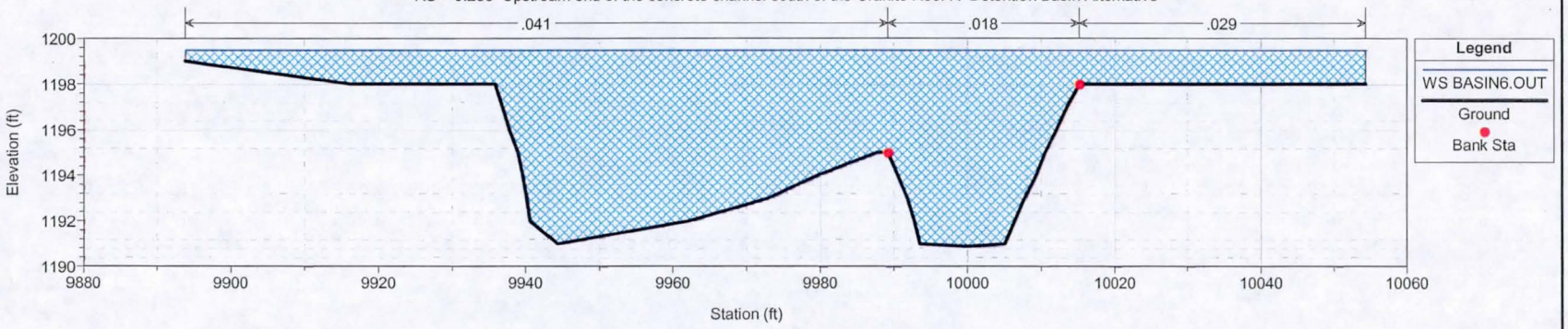

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.326 Detention Basin Alternative
.057
.018
.046
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.32 Detention Basin Alternative
.057
.018
.046
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.303 Cul-de-sac at south end of Granite Reef Rd Detention Basin Alternative
.057
.018
.046
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta

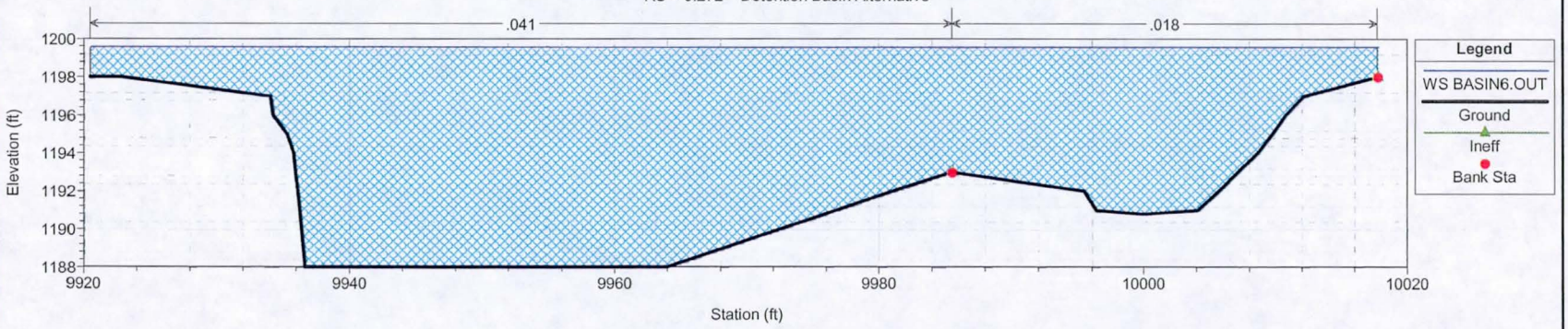
Granite Reef Wash Plan: Existing 1/26/2008

RS = 0.288 Upstream end of the concrete channel south of the Granite Reef R Detention Basin Alternative



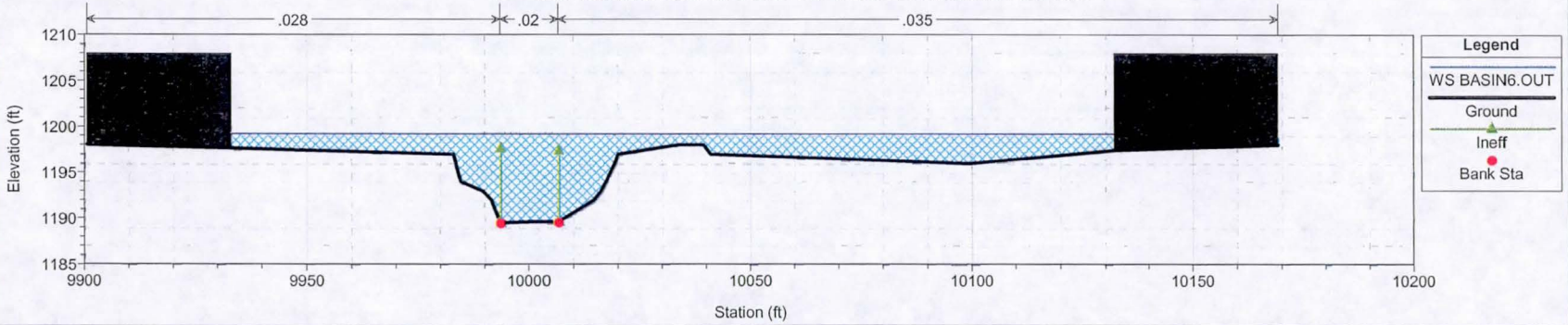
Granite Reef Wash Plan: Existing 1/26/2008

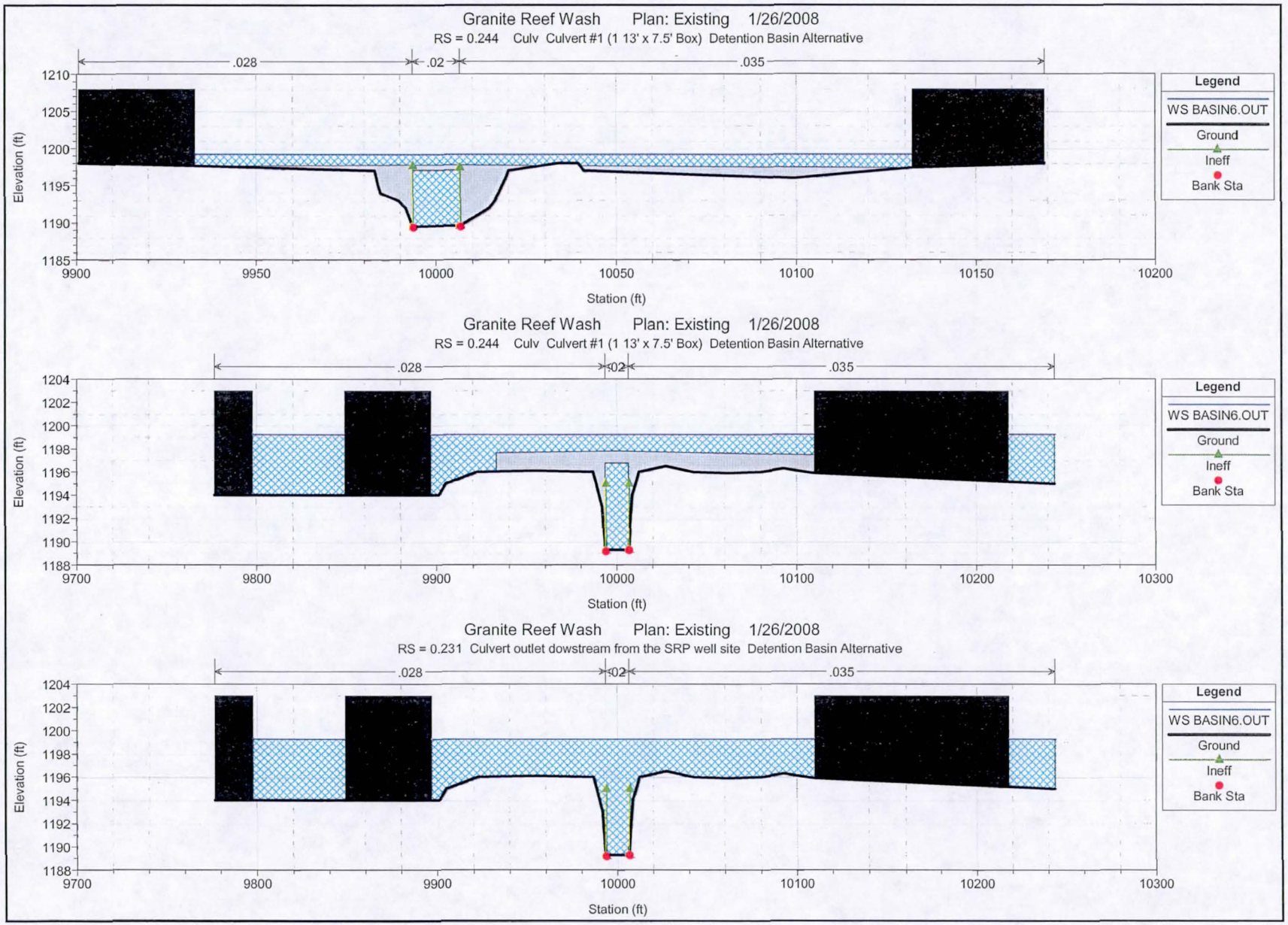
RS = 0.272 Detention Basin Alternative

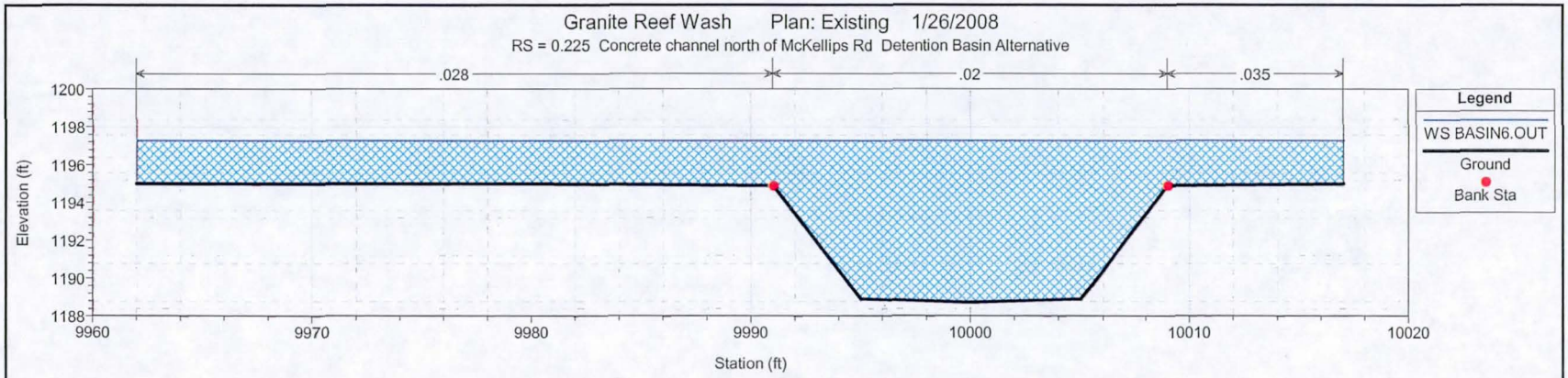


Granite Reef Wash Plan: Existing 1/26/2008

RS = 0.257 Culvert inlet upstream from the SRP well site Detention Basin Alternative

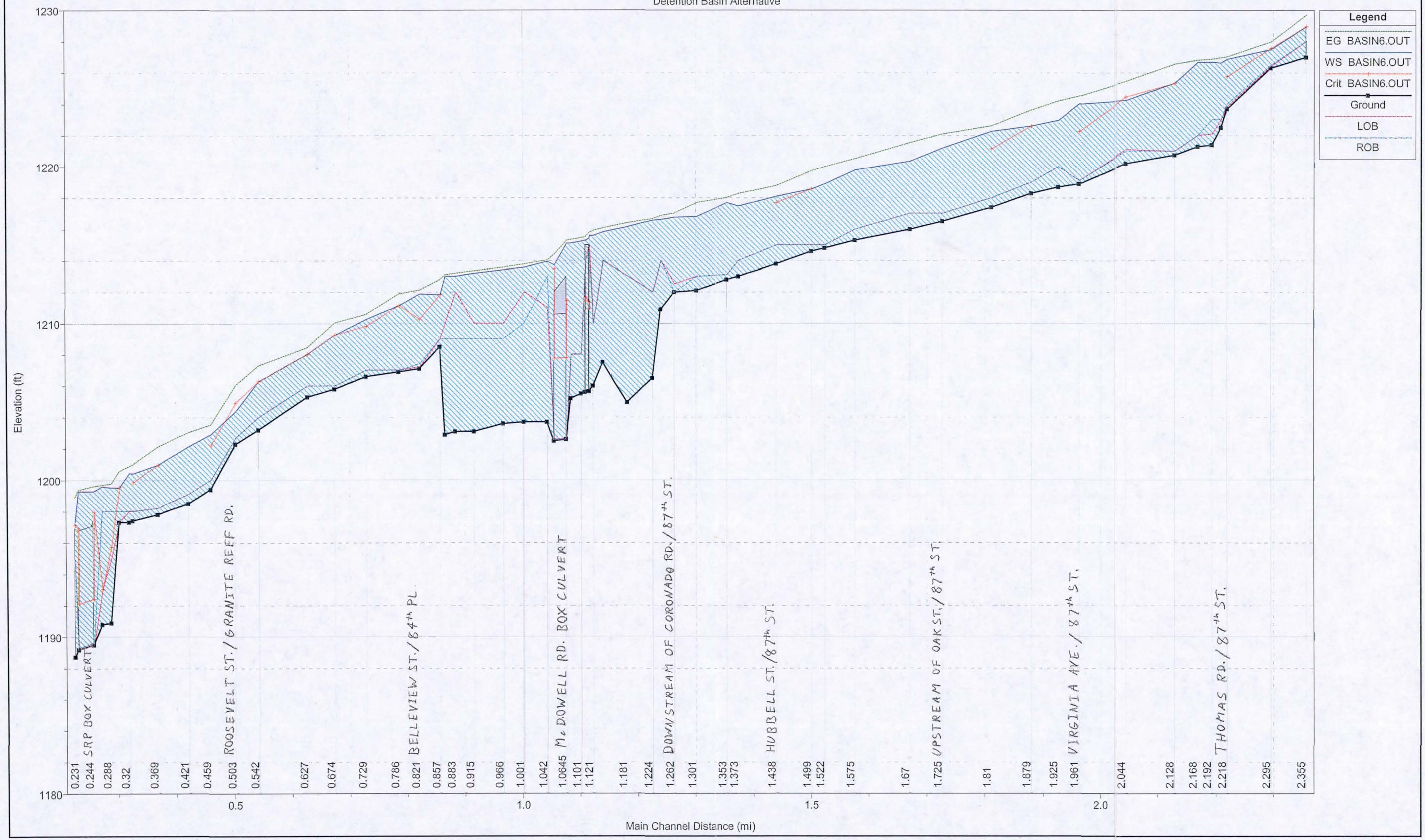



Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.244 Culv Culvert #1 (1 13' x 7.5' Box) Detention Basin Alternative
.028
.02
.035
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Ineff
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.244 Culv Culvert #1 (1 13' x 7.5' Box) Detention Basin Alternative
.028
.02
.035
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Ineff
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.231 Culvert outlet dowstream from the SRP well site Detention Basin Alternative
.028
.02
.035
Elevation (ft)
Station (ft)
Legend
WS BASIN6.OUT
Ground
Ineff
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.225 Concrete channel north of McKellips Rd Detention Basin Alternative
.028
.02
.035
1200
1198
1196
1194
1192
1190
1188
Elevation (ft)
9960
9970
9980
9990
10000
10010
10020
Station (ft)
Legend
WS BASIN6.OUT
Ground
Bank Sta

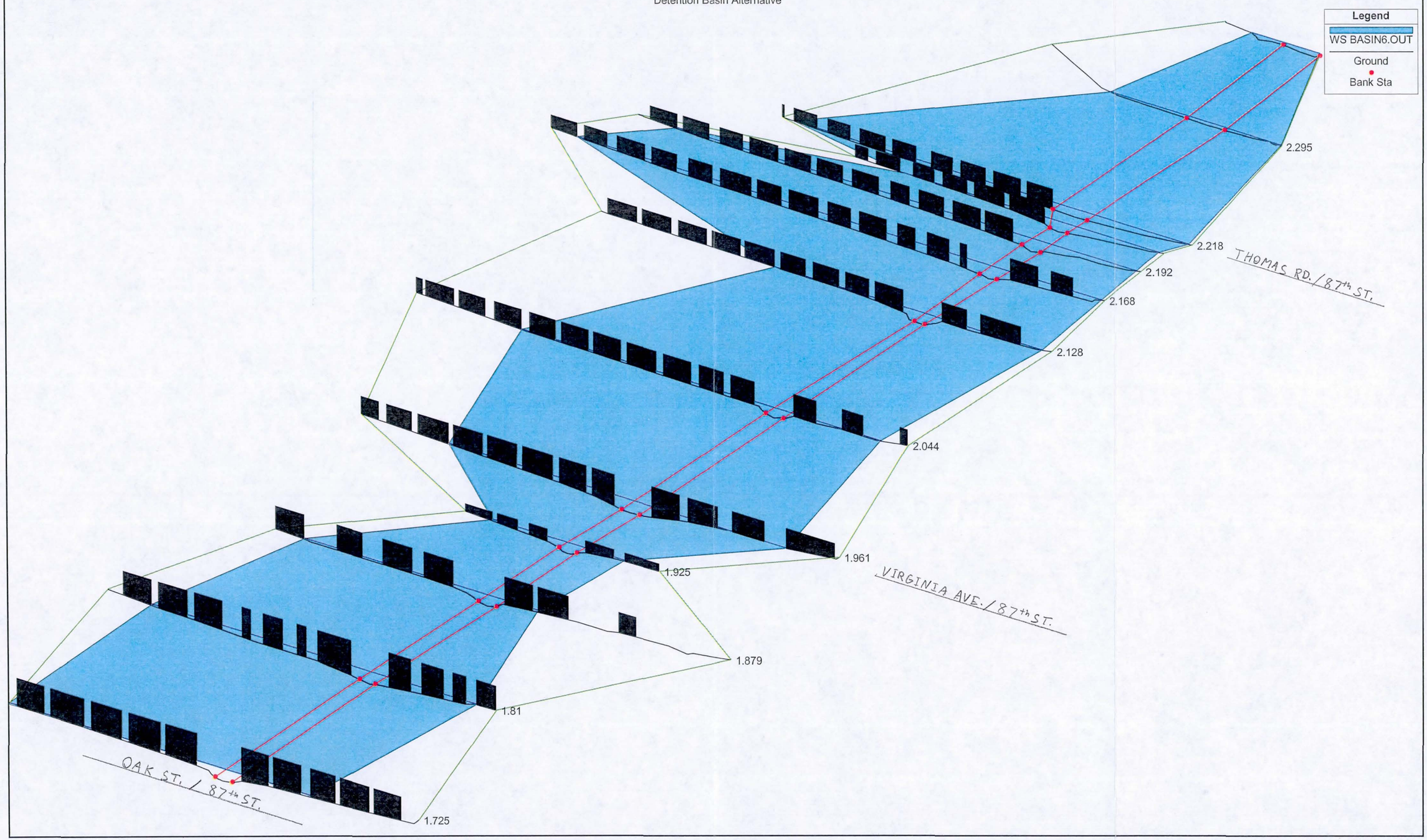
Granite Reef Wash Plan: Existing 1/26/2008

Detention Basin Alternative



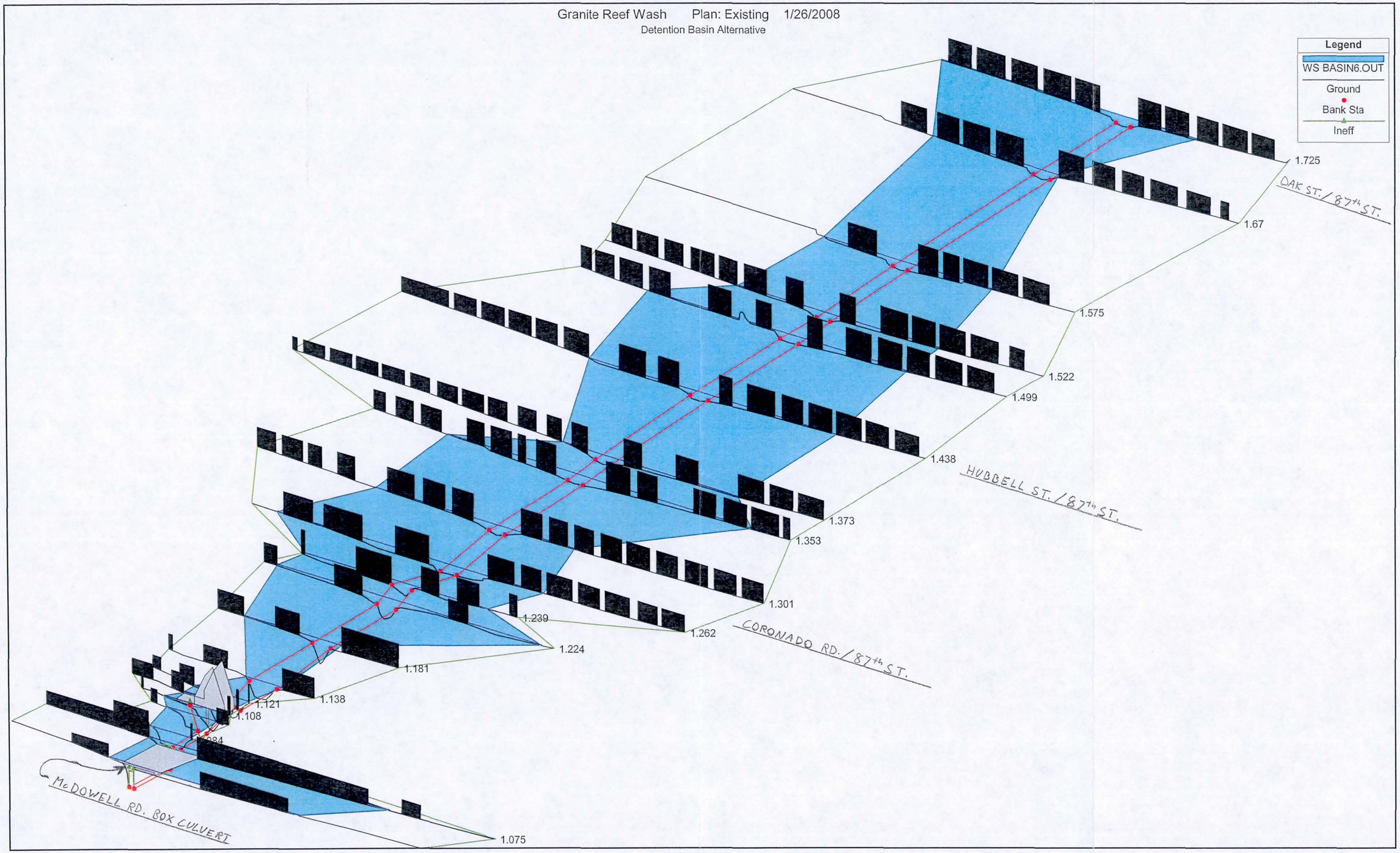
Granite Reef Wash Plan: Existing 1/26/2008

Detention Basin Alternative



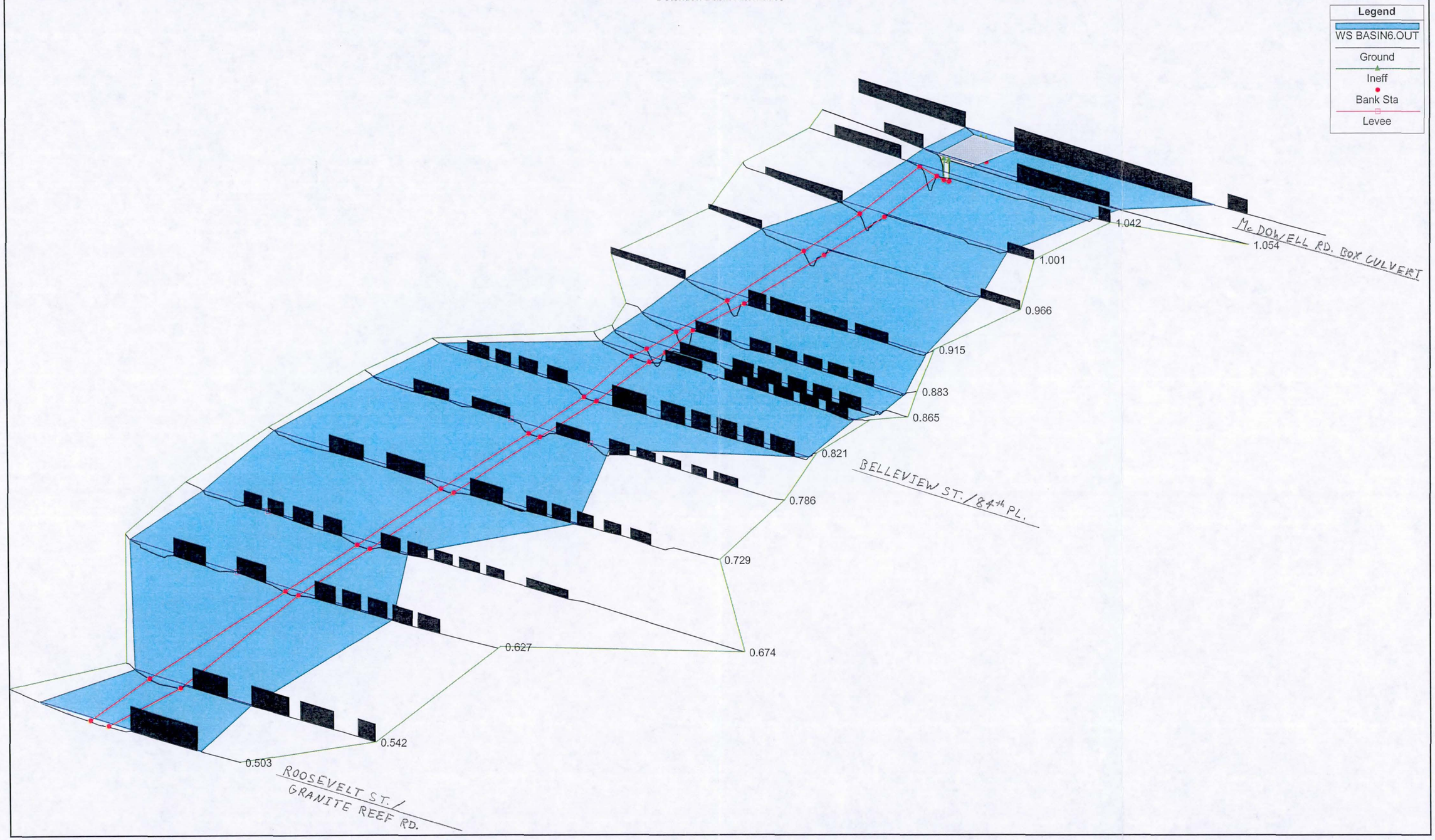
Granite Reef Wash Plan: Existing 1/26/2008

Detention Basin Alternative



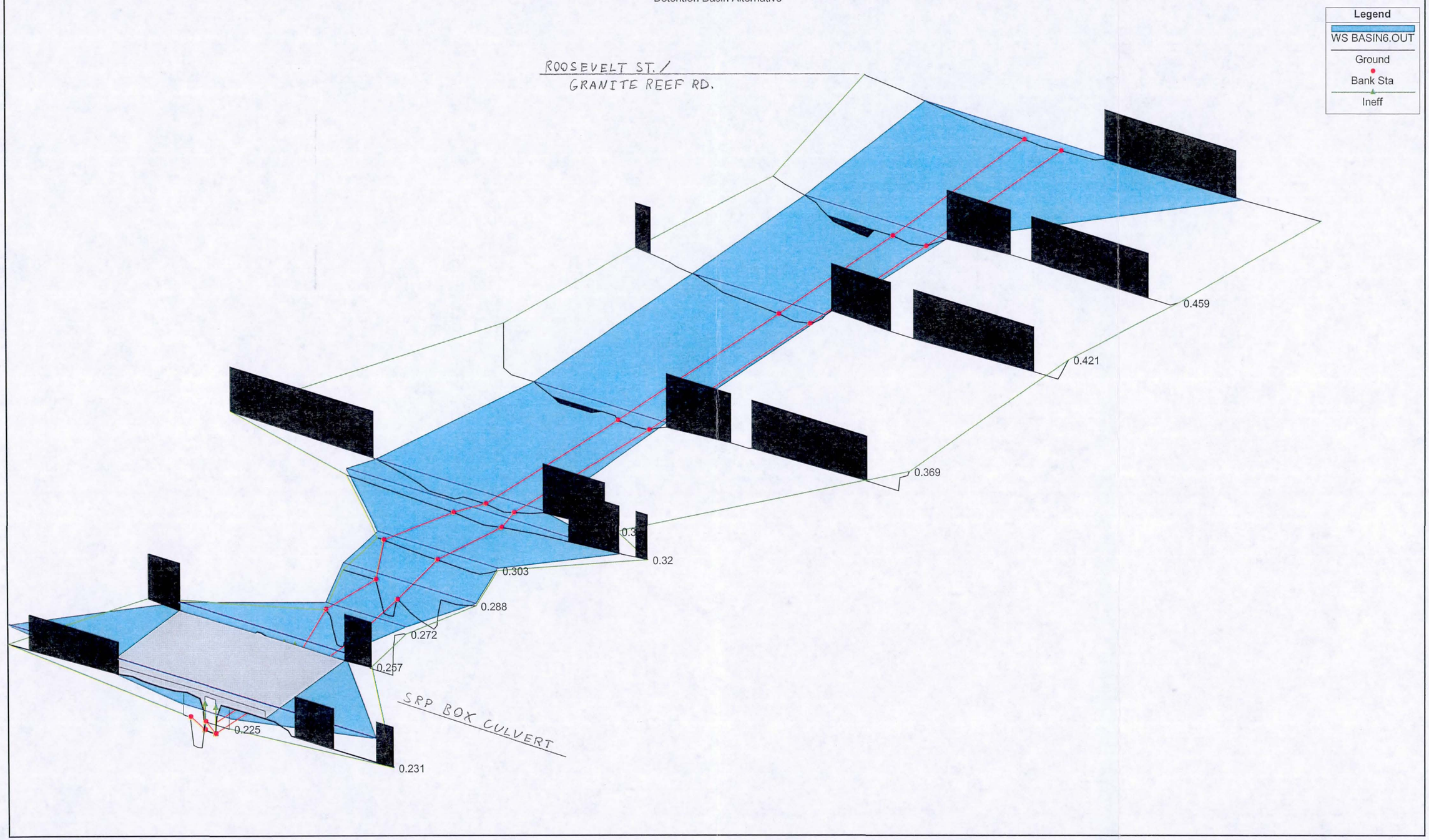
Granite Reef Wash Plan: Existing 1/26/2008

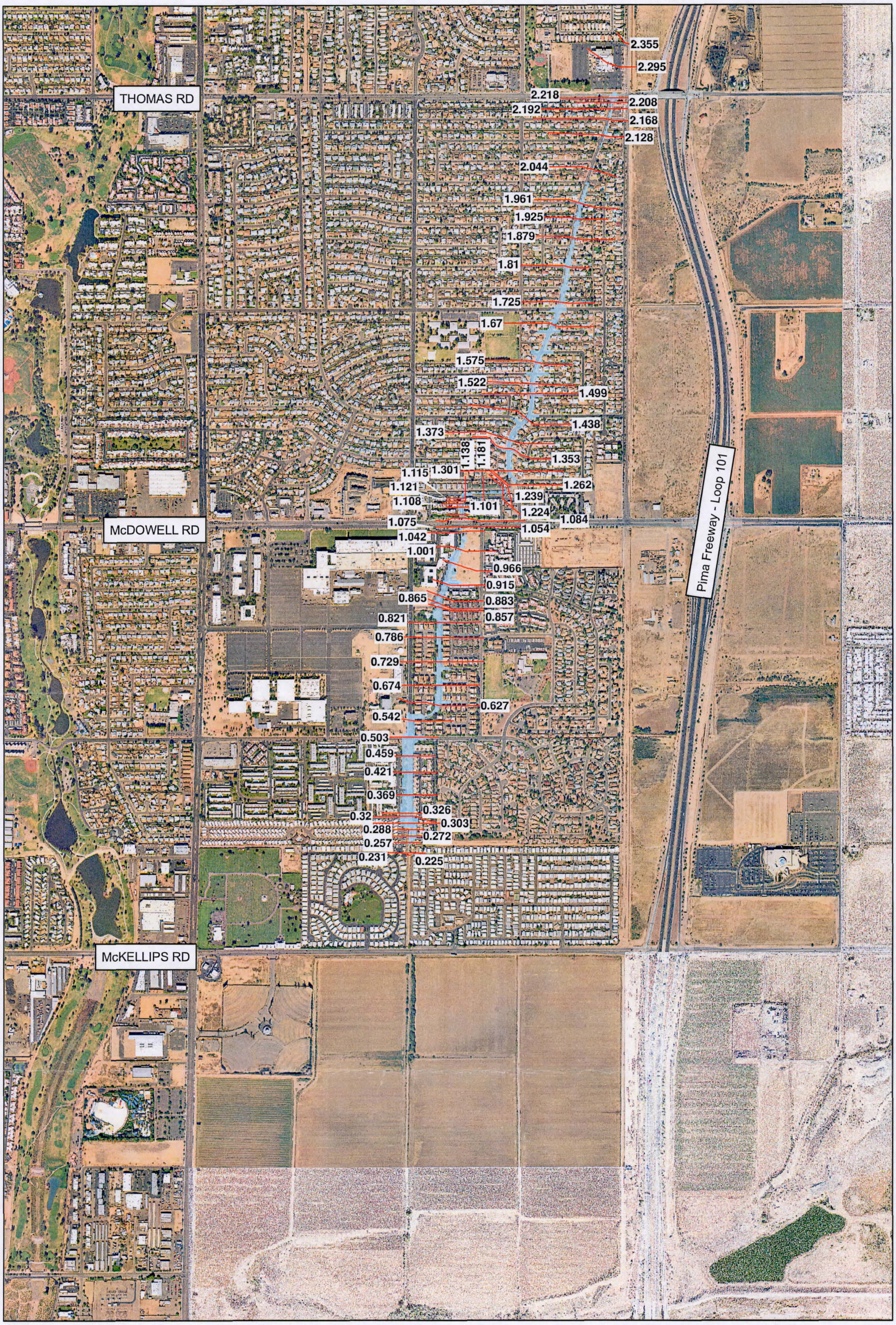
Detention Basin Alternative



Granite Reef Wash Plan: Existing 1/26/2008

Detention Basin Alternative





Feet
0 500 1,000 1,500

Exhibit 6
Pima Road Conduit Alternative

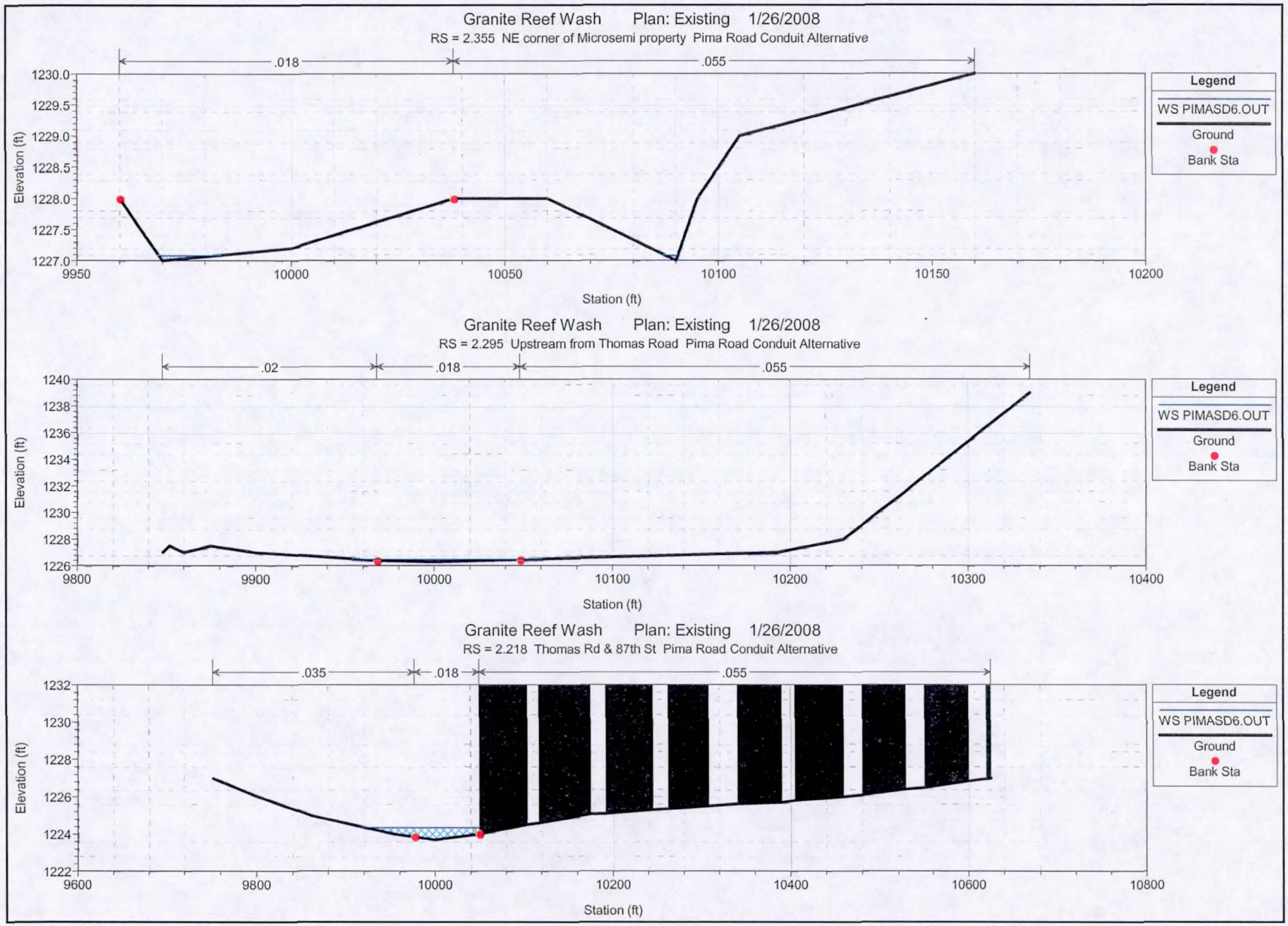
City of Scottsdale
Granite Reef Wash Project

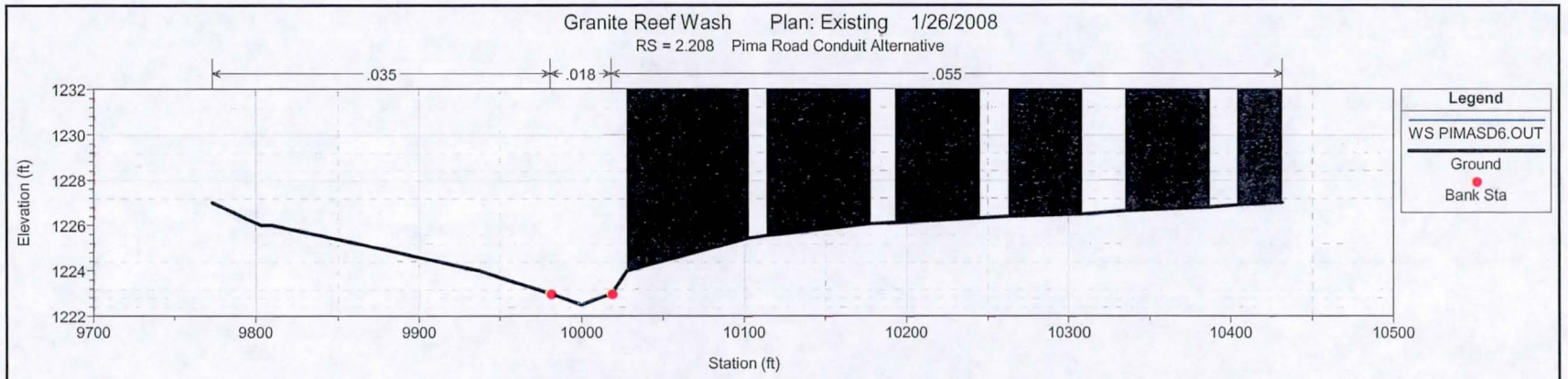
Floodplain Delineation

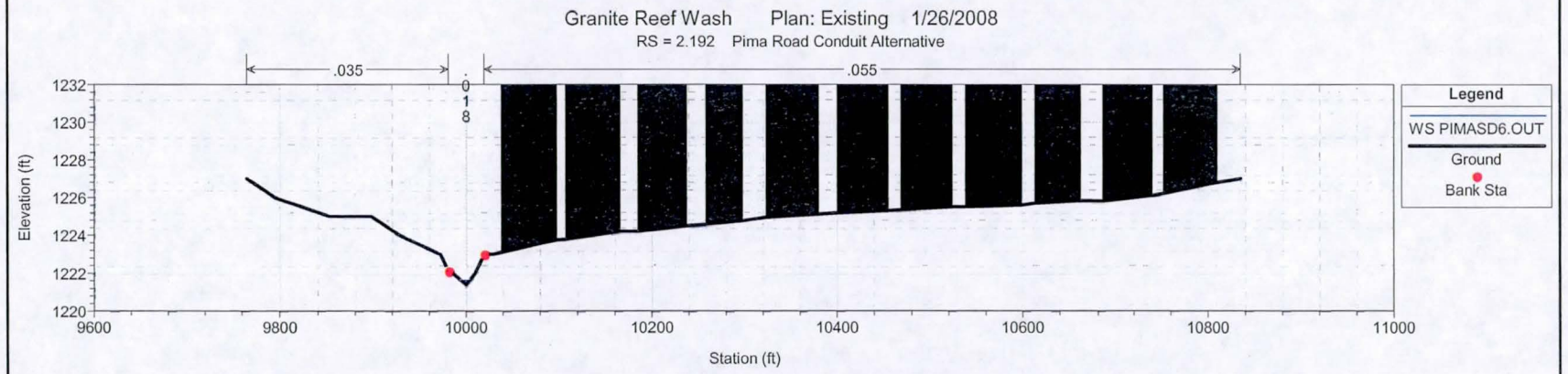
Map: SCDL-EX6

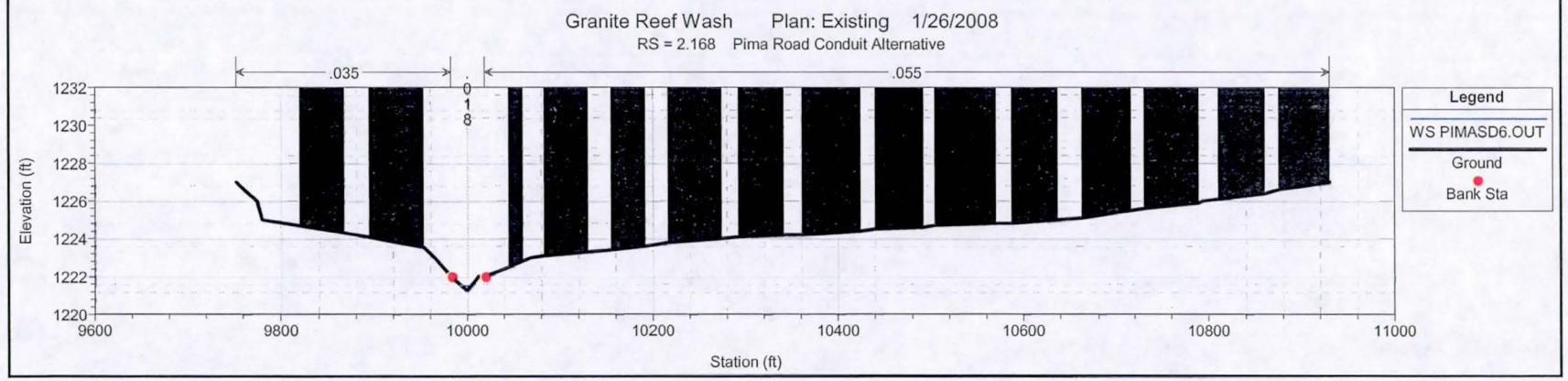
Printed On: 01/24/2008

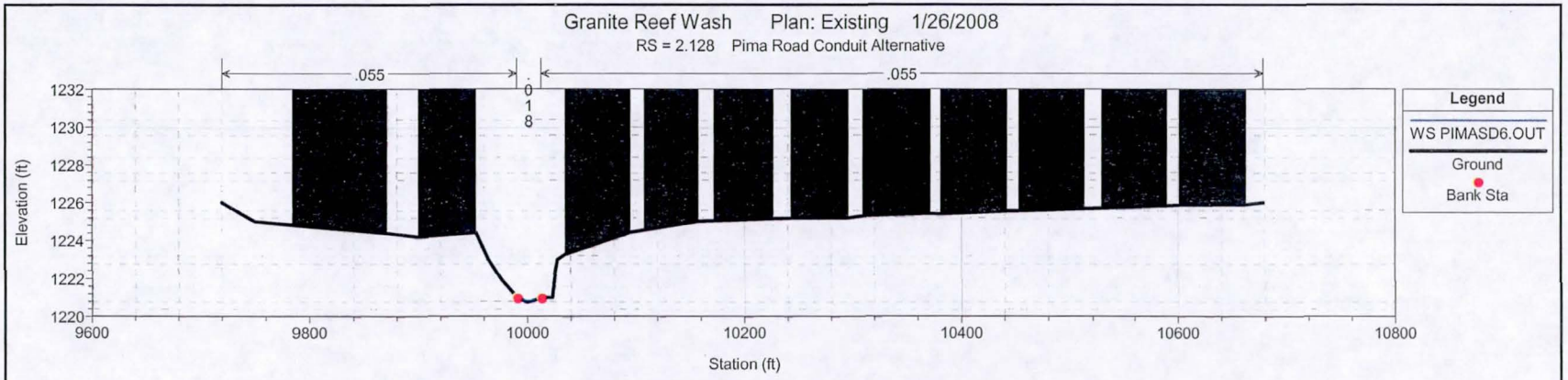
Created By: PSOMAS

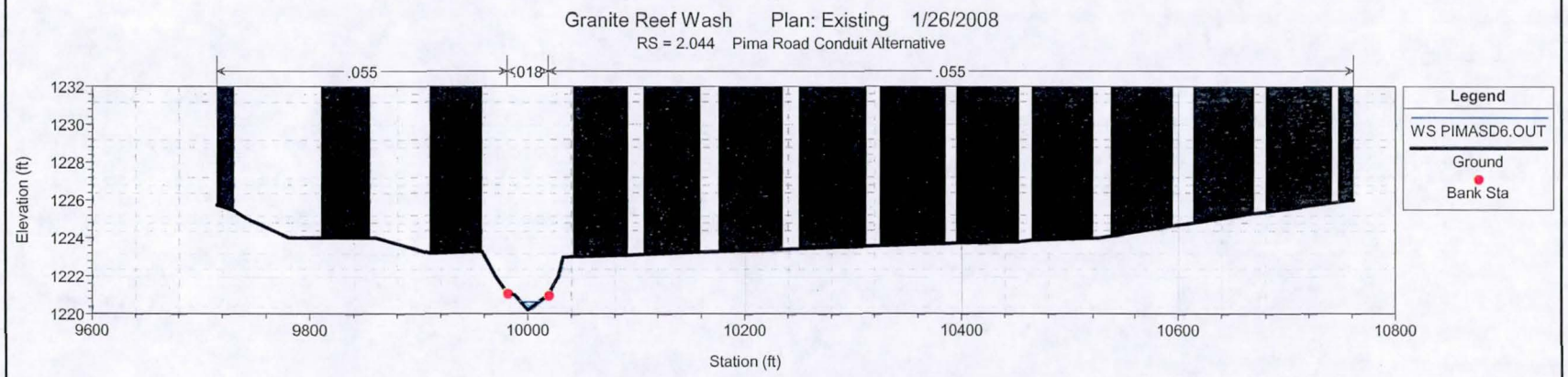

Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.355 NE corner of Microsemi property Pima Road Conduit Alternative
.018
.055
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.295 Upstream from Thomas Road Pima Road Conduit Alternative
.02
.018
.055
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.218 Thomas Rd & 87th St Pima Road Conduit Alternative
.035
.018
.055
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta

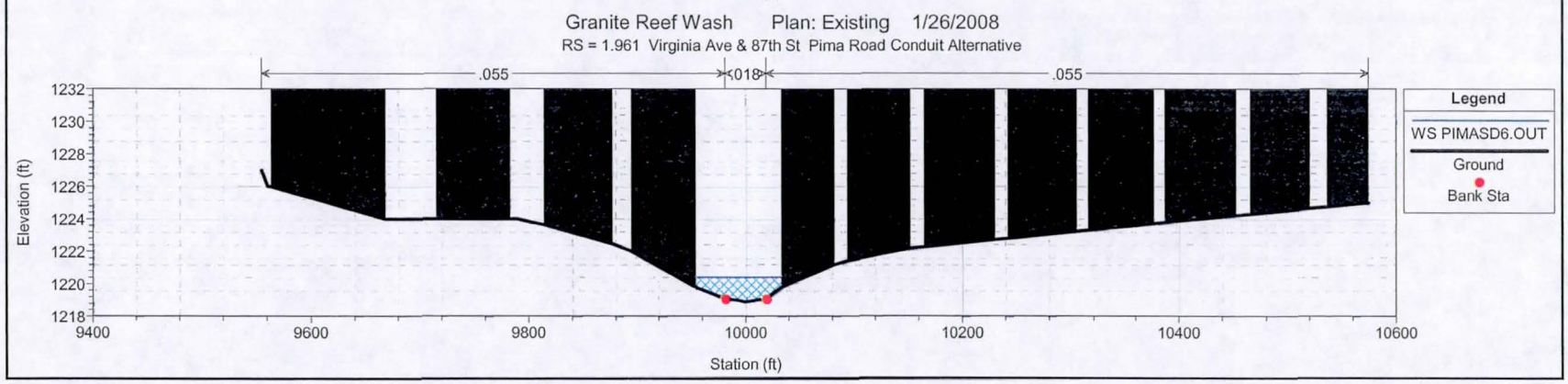

Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.208 Pima Road Conduit Alternative
.035
.018
.055
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta

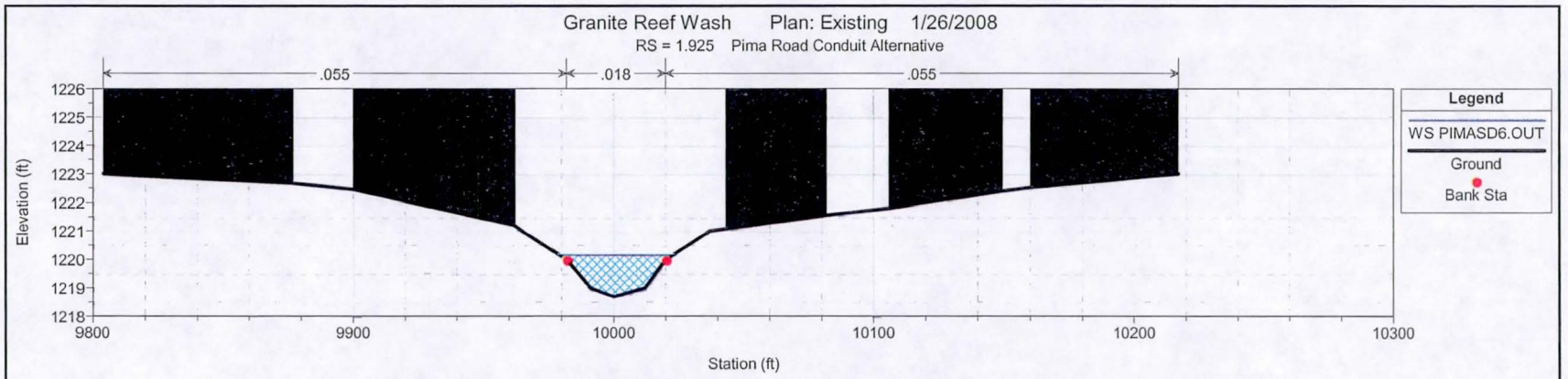

Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.192 Pima Road Conduit Alternative
.035
.018
.055
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta

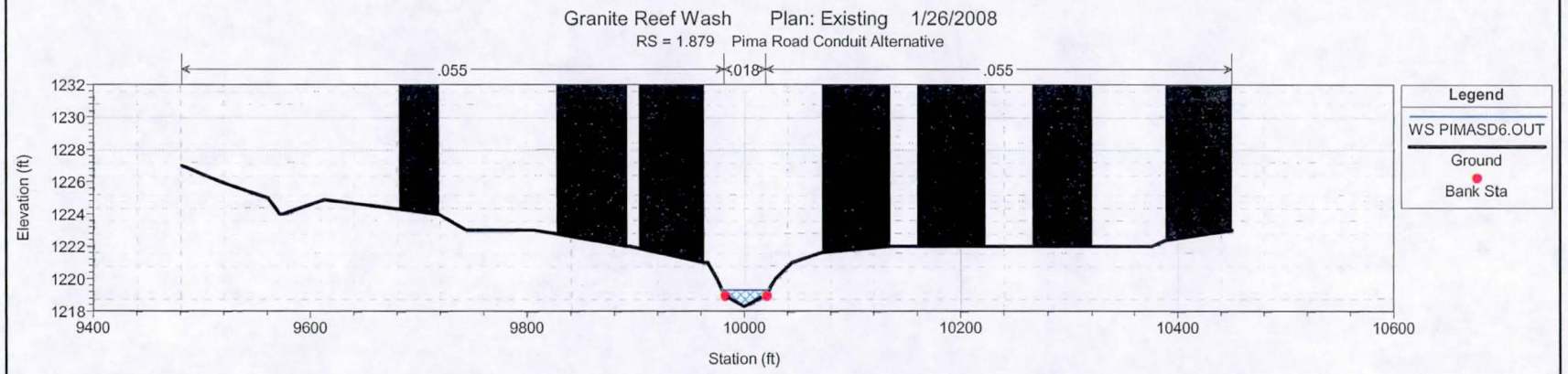

Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.168 Pima Road Conduit Alternative
.035
.018
.055
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta

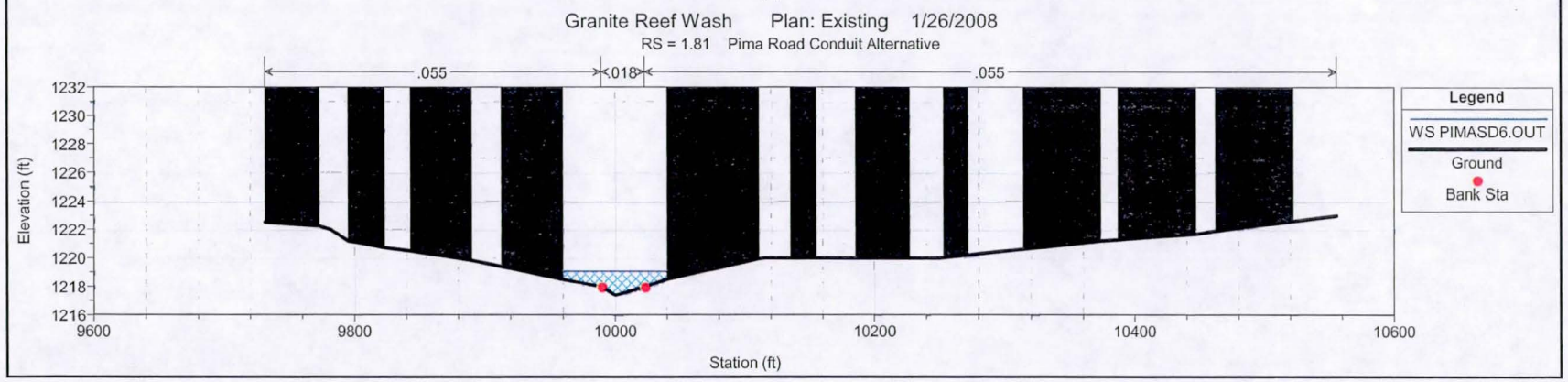

Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.128 Pima Road Conduit Alternative
.055
.018
.055
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 2.044 Pima Road Conduit Alternative
.055
.018
.055
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.961 Virginia Ave & 87th St Pima Road Conduit Alternative
.055
.018
.055
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta

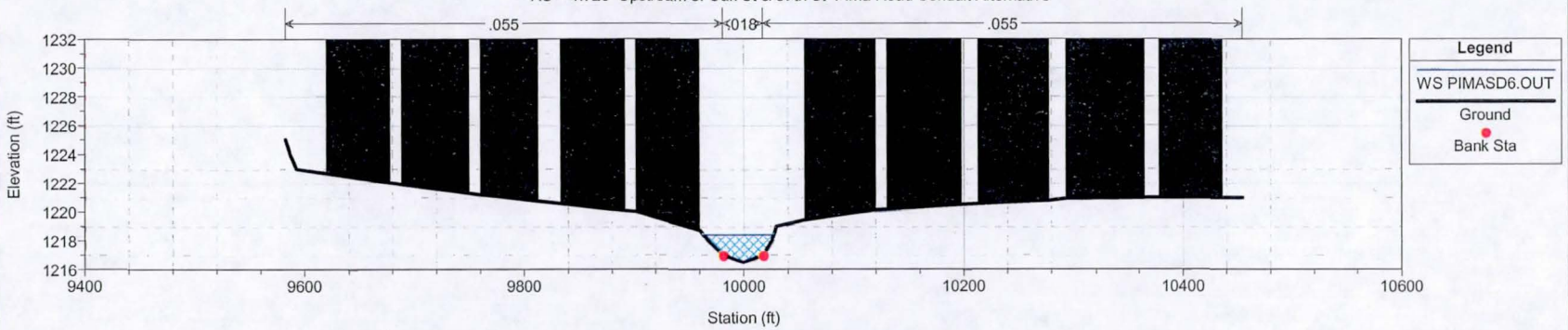

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.925 Pima Road Conduit Alternative
.055
.018
.055
Elevation (ft)
1226
1225
1224
1223
1222
1221
1220
1219
1218
9800
9900
10000
10100
10200
10300
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.879 Pima Road Conduit Alternative
.055
.018
.055
Elevation (ft)
1232
1230
1228
1226
1224
1222
1220
1218
9400
9600
9800
10000
10200
10400
10600
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.81 Pima Road Conduit Alternative
.055
.018
.055
Elevation (ft)
1232
1230
1228
1226
1224
1222
1220
1218
1216
9600
9800
10000
10200
10400
10600
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta

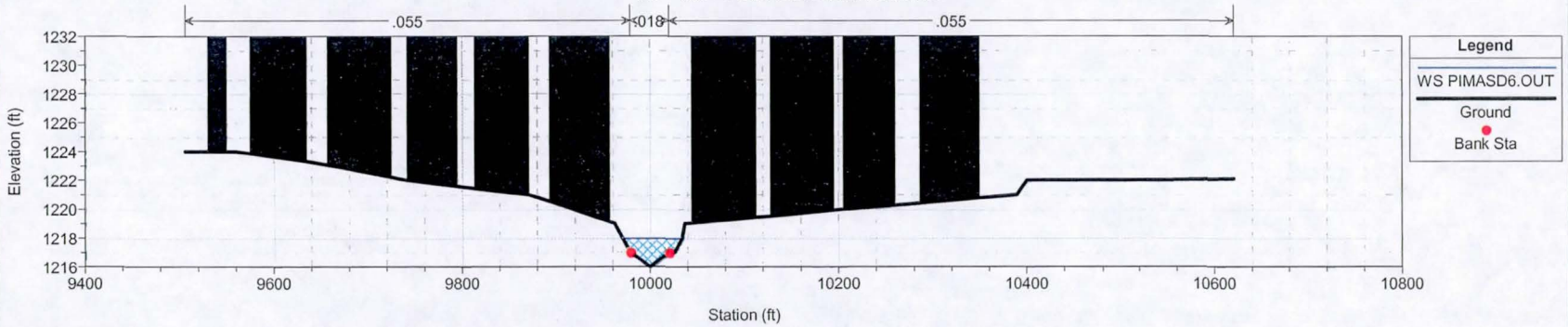
Granite Reef Wash Plan: Existing 1/26/2008

RS = 1.725 Upstream of Oak St & 87th St Pima Road Conduit Alternative



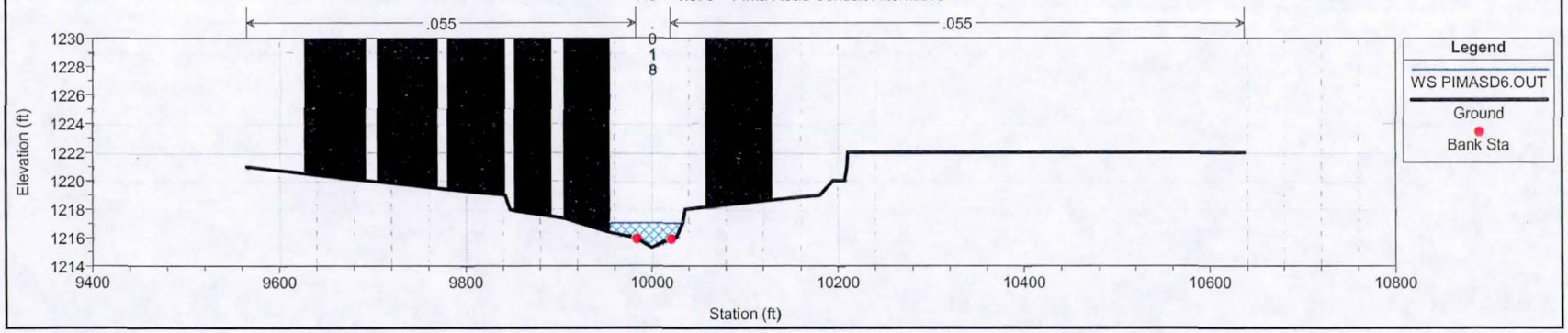
Granite Reef Wash Plan: Existing 1/26/2008

RS = 1.67 Pima Road Conduit Alternative



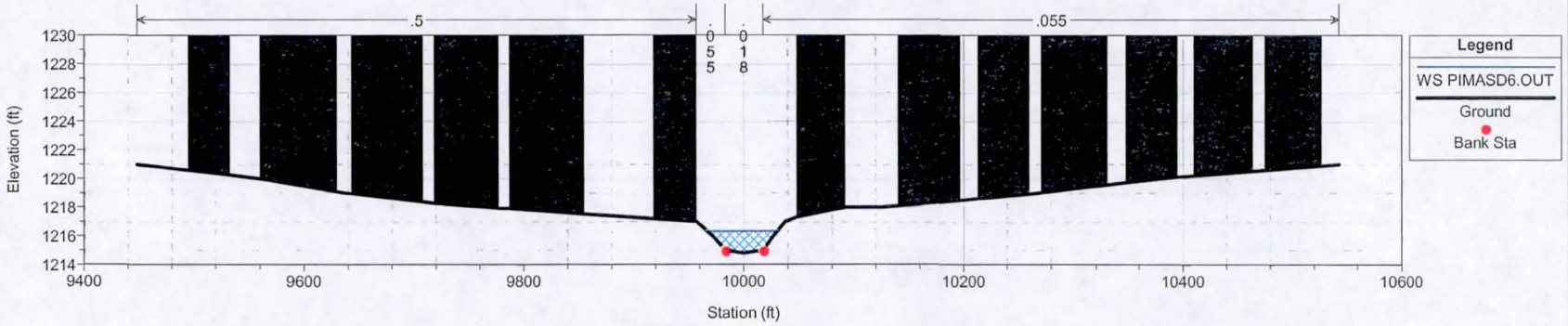
Granite Reef Wash Plan: Existing 1/26/2008

RS = 1.575 Pima Road Conduit Alternative



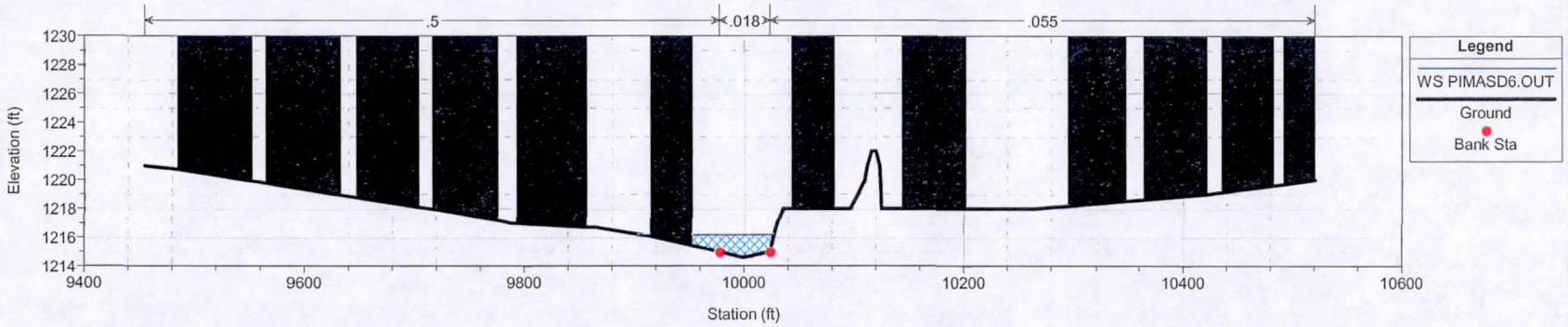
Granite Reef Wash Plan: Existing 1/26/2008

RS = 1.522 Pima Road Conduit Alternative



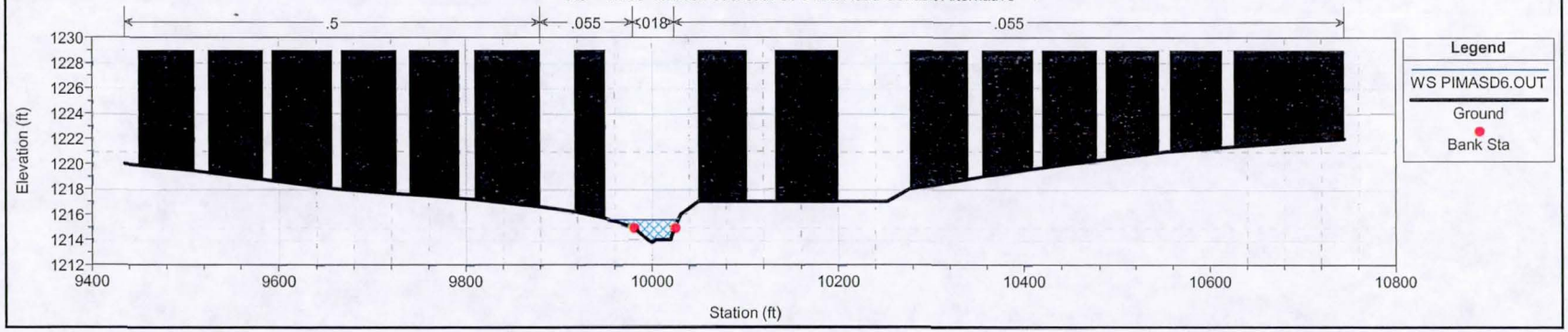
Granite Reef Wash Plan: Existing 1/26/2008

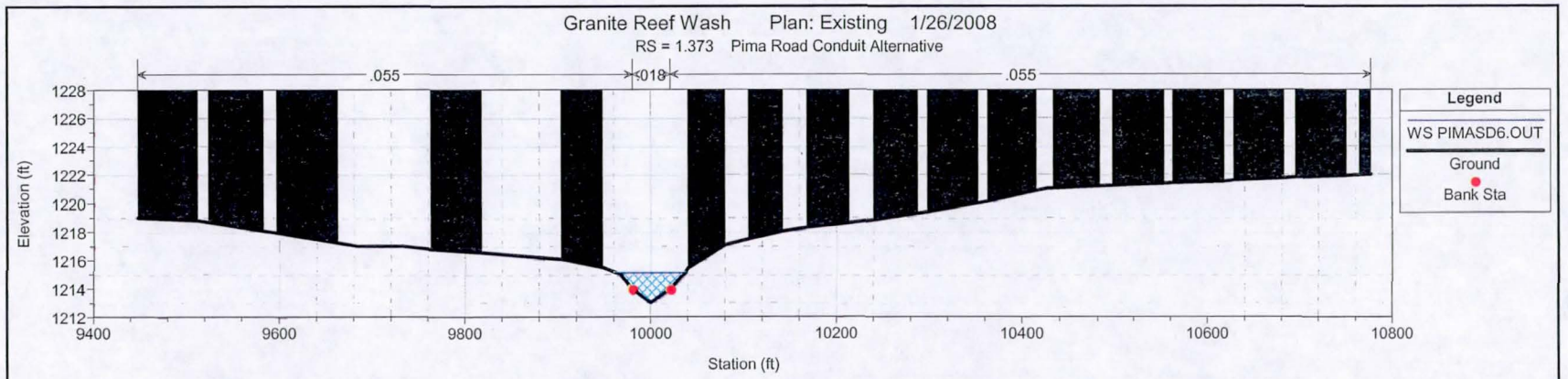
RS = 1.499 Pima Road Conduit Alternative

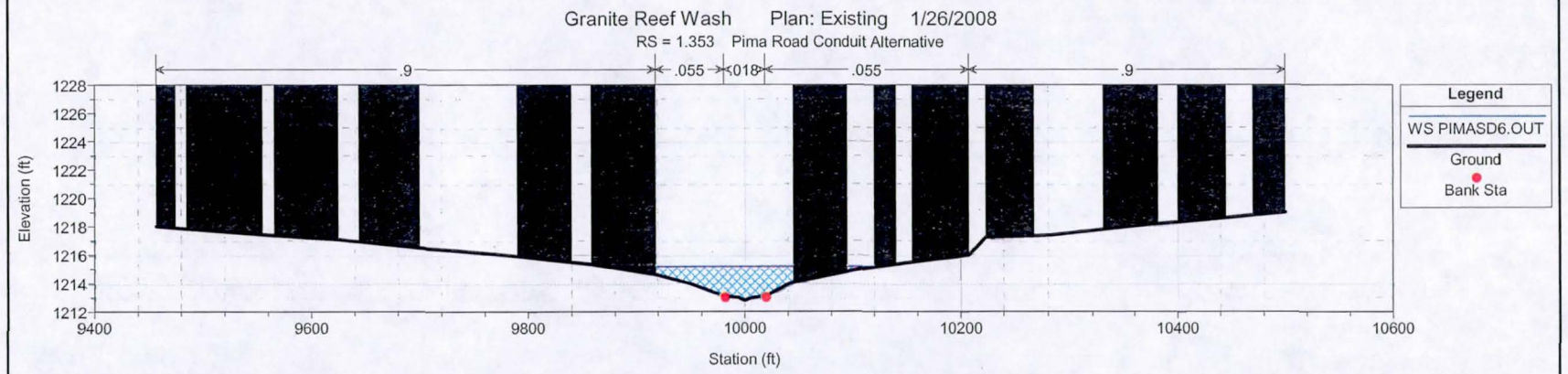


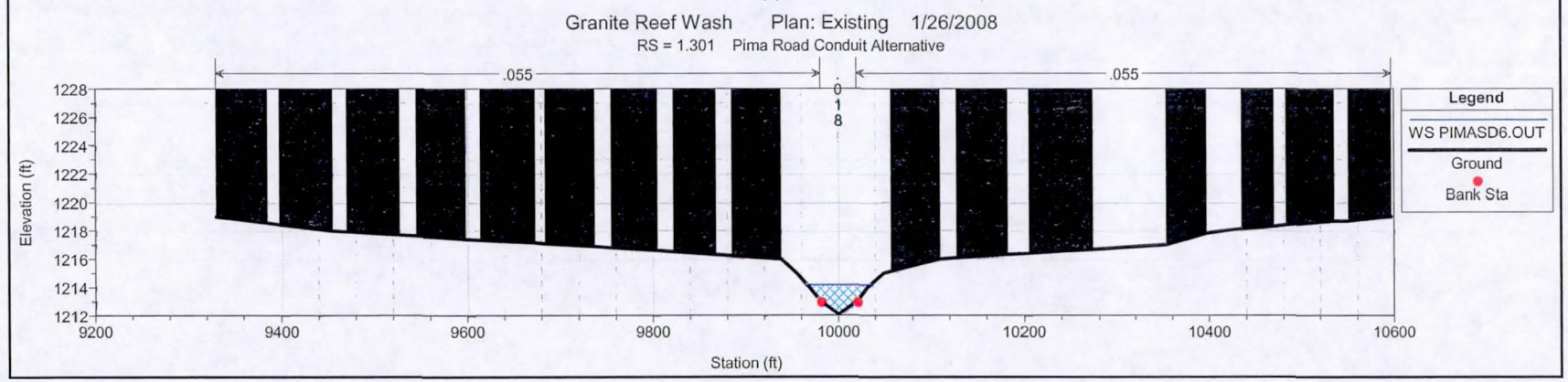
Granite Reef Wash Plan: Existing 1/26/2008

RS = 1.438 Hubbell St & 87th St Pima Road Conduit Alternative



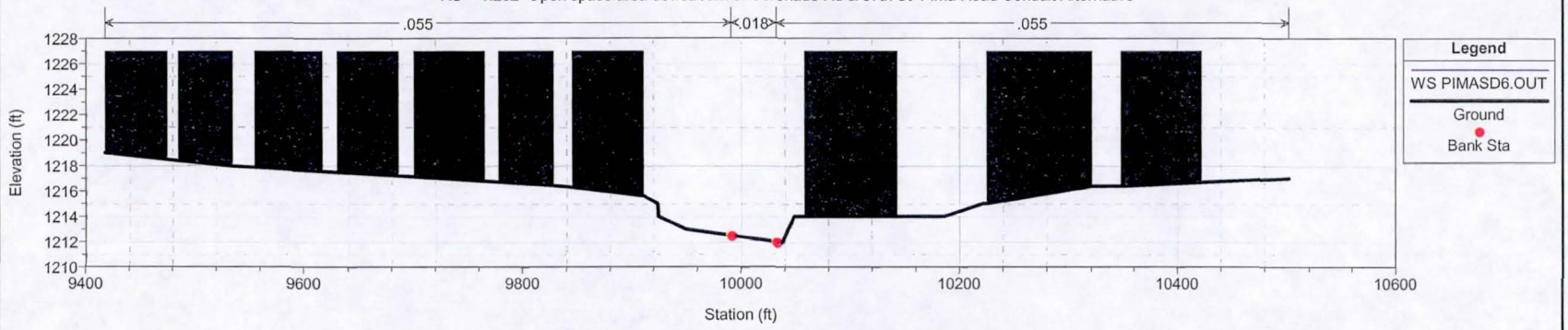

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.373 Pima Road Conduit Alternative
.055
.018
.055
Elevation (ft)
1228
1226
1224
1222
1220
1218
1216
1214
1212
9400
9600
9800
10000
10200
10400
10600
10800
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.353 Pima Road Conduit Alternative
.9
.055
.018
.055
.9
Elevation (ft)
1228
1226
1224
1222
1220
1218
1216
1214
1212
9400
9600
9800
10000
10200
10400
10600
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.301 Pima Road Conduit Alternative
.055
.018
.055
Elevation (ft)
1228
1226
1224
1222
1220
1218
1216
1214
1212
9200
9400
9600
9800
10000
10200
10400
10600
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta

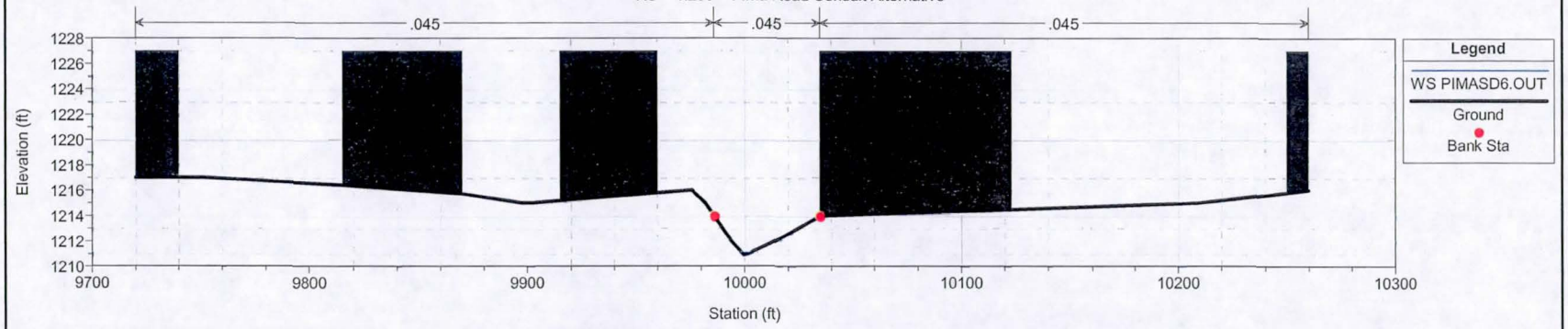
Granite Reef Wash Plan: Existing 1/26/2008

RS = 1.262 Open space area dowstream of Coronado Rd & 87th St Pima Road Conduit Alternative



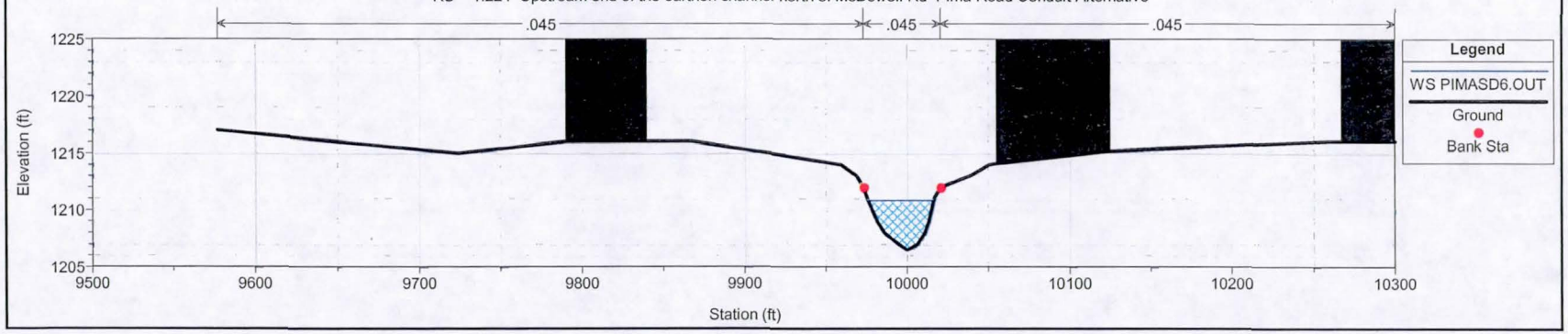
Granite Reef Wash Plan: Existing 1/26/2008

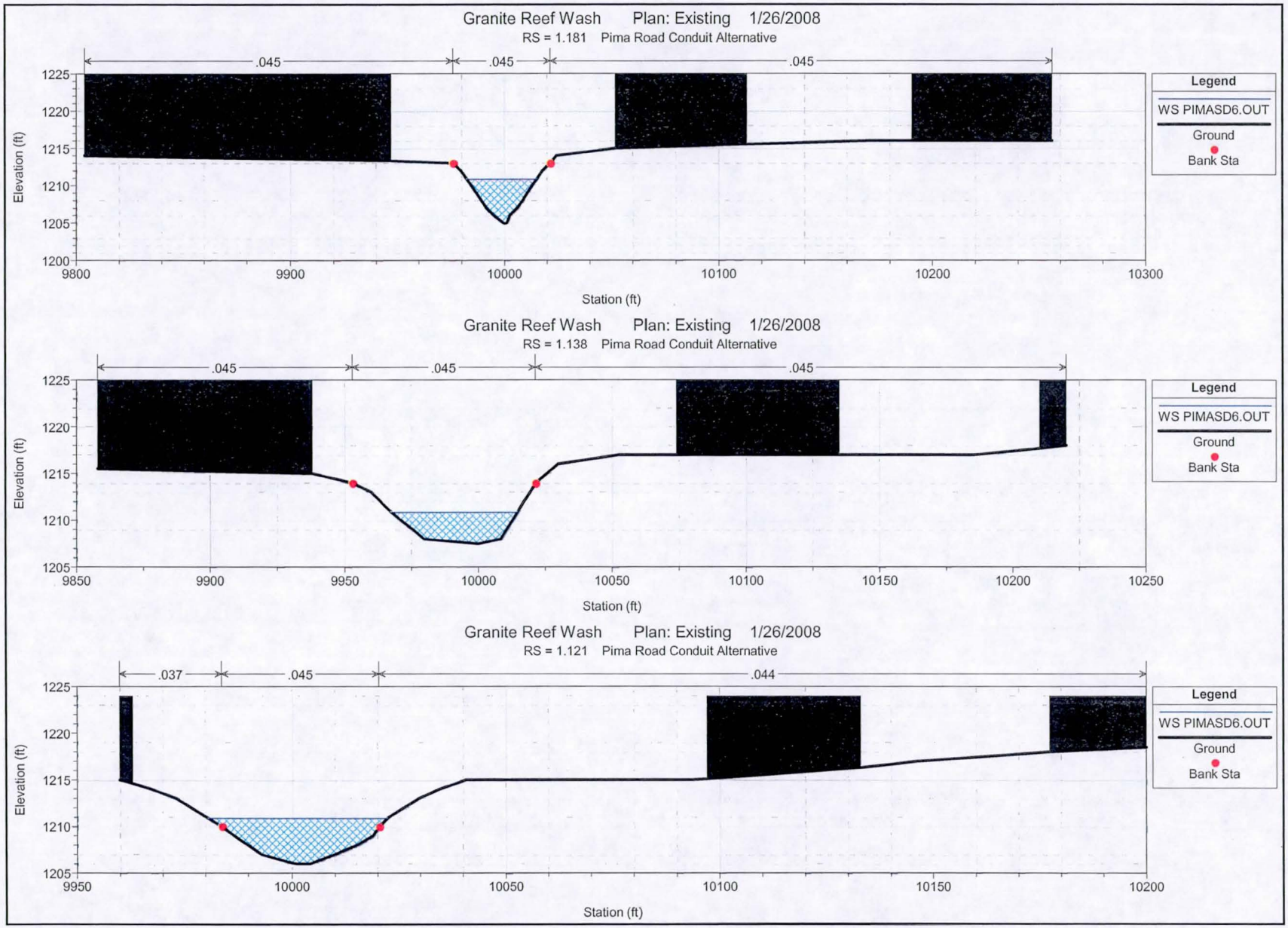
RS = 1.239 Pima Road Conduit Alternative

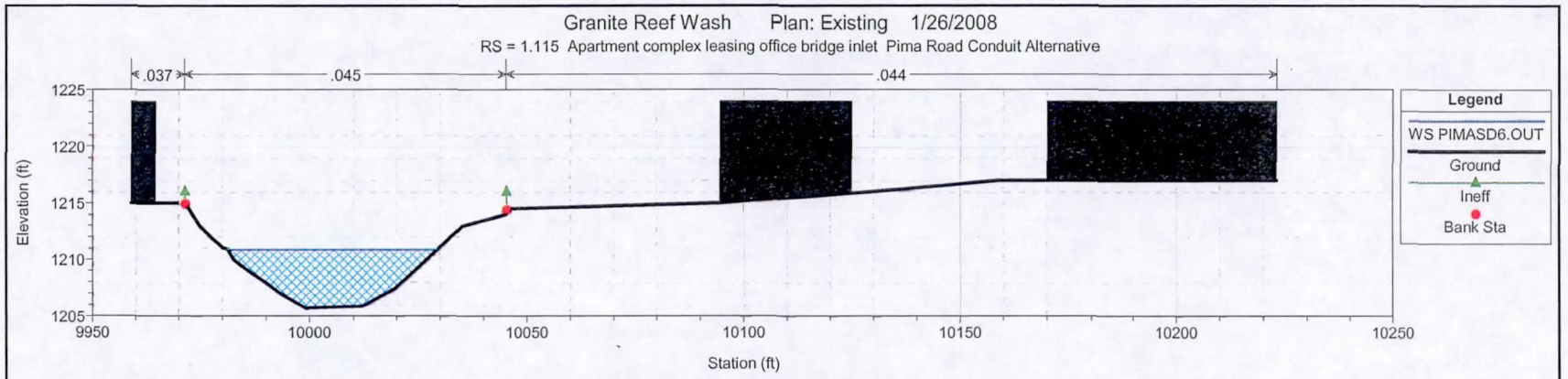


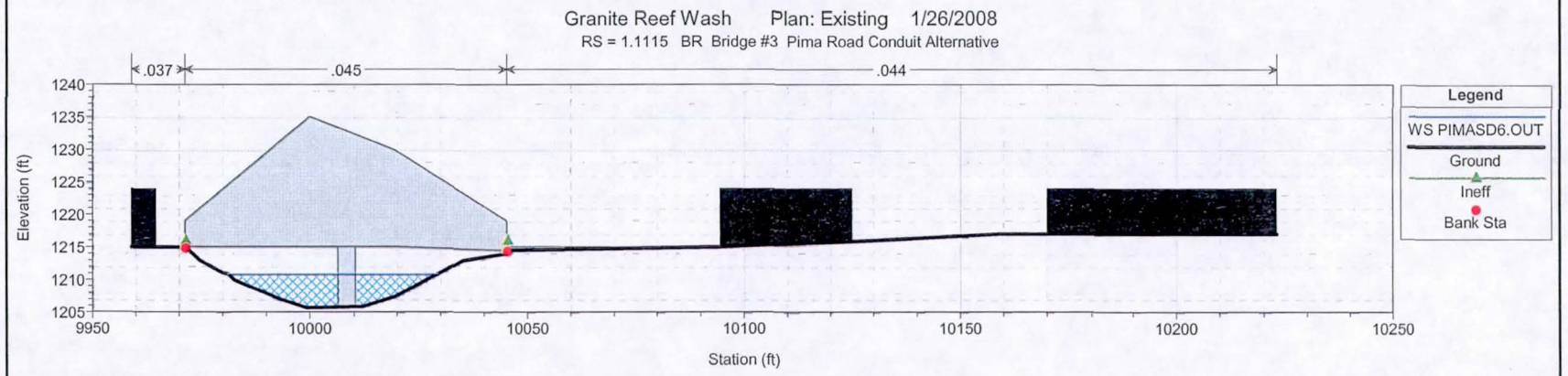
Granite Reef Wash Plan: Existing 1/26/2008

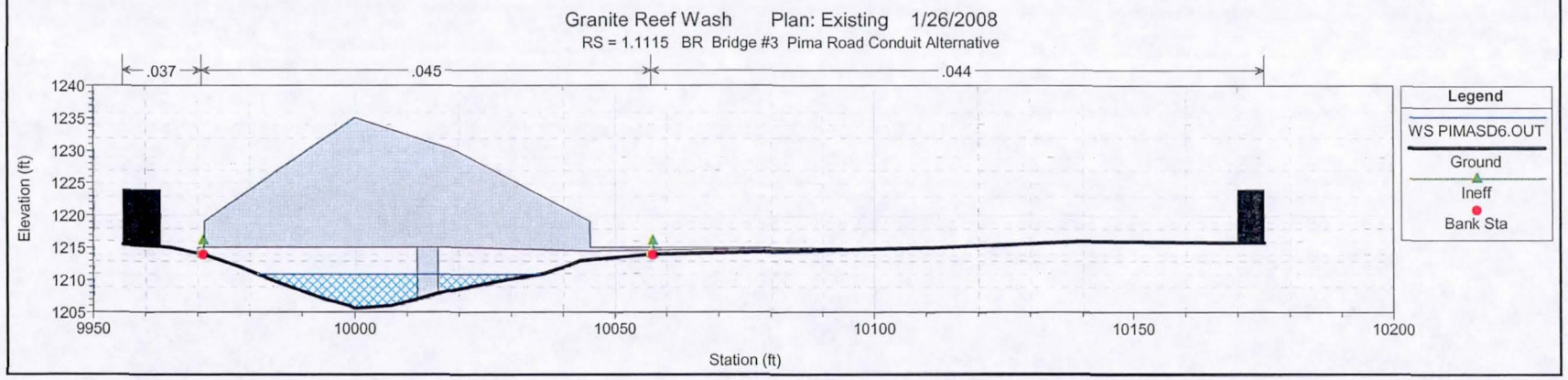
RS = 1.224 Upstream end of the earthen channel north of McDowell Rd Pima Road Conduit Alternative




Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.181 Pima Road Conduit Alternative
.045
.045
.045
Elevation (ft)
1225
1220
1215
1210
1205
1200
9800
9900
10000
10100
10200
10300
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.138 Pima Road Conduit Alternative
.045
.045
.045
Elevation (ft)
1225
1220
1215
1210
1205
9850
9900
9950
10000
10050
10100
10150
10200
10250
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.121 Pima Road Conduit Alternative
.037
.045
.044
Elevation (ft)
1225
1220
1215
1210
1205
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta

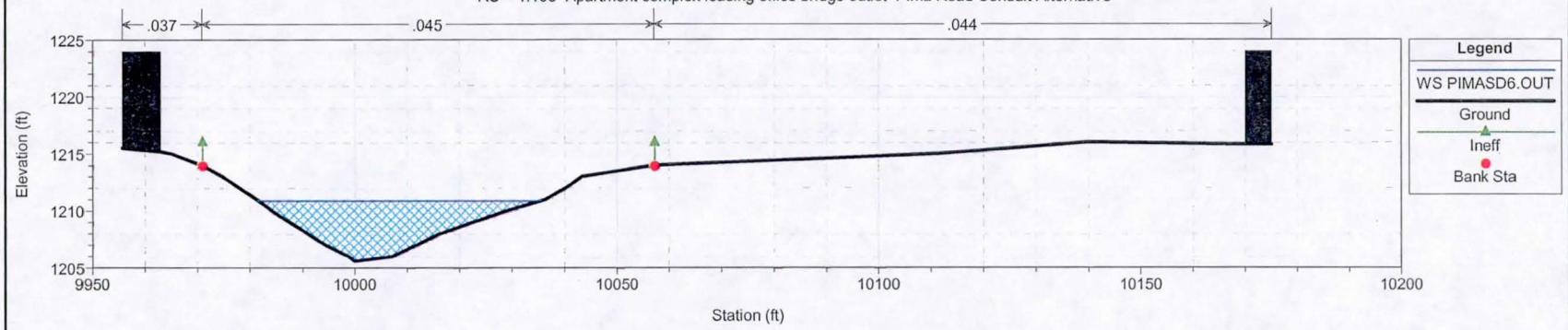

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.115 Apartment complex leasing office bridge inlet Pima Road Conduit Alternative
.037
.045
.044
Elevation (ft)
1225
1220
1215
1210
1205
9950
10000
10050
10100
10150
10200
10250
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Ineff
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.1115 BR Bridge #3 Pima Road Conduit Alternative
.037
.045
.044
Elevation (ft)
1240
1235
1230
1225
1220
1215
1210
1205
9950
10000
10050
10100
10150
10200
10250
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Ineff
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.1115 BR Bridge #3 Pima Road Conduit Alternative
.037
.045
.044
Elevation (ft)
1240
1235
1230
1225
1220
1215
1210
1205
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Ineff
Bank Sta

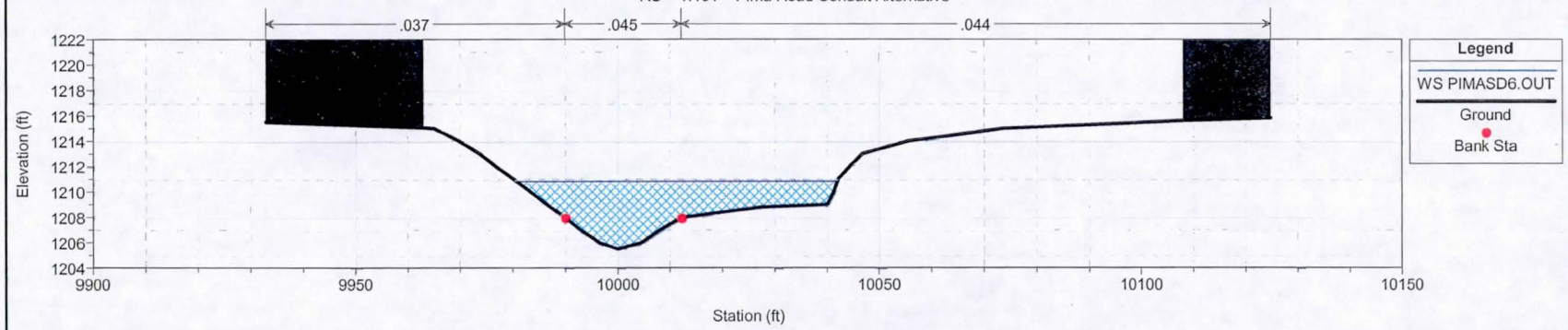
Granite Reef Wash Plan: Existing 1/26/2008

RS = 1.108 Apartment complex leasing office bridge outlet Pima Road Conduit Alternative



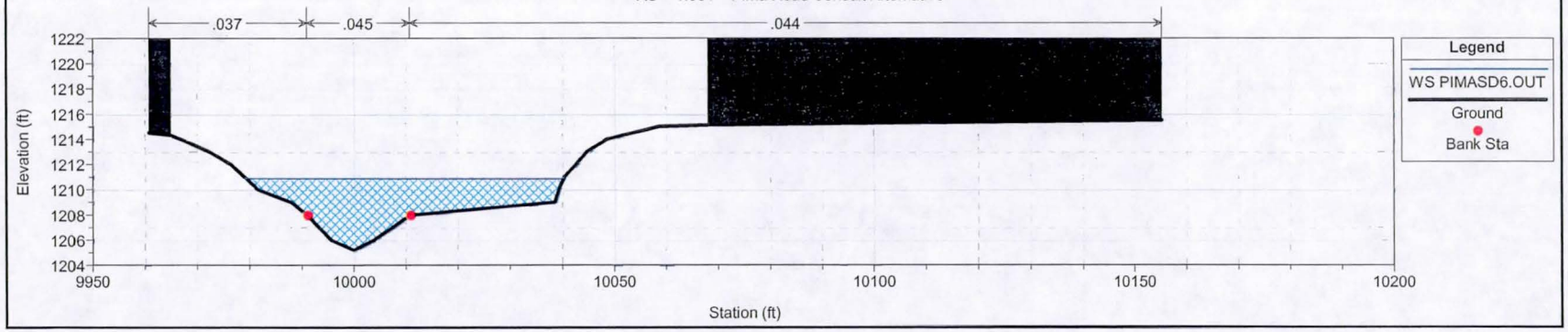
Granite Reef Wash Plan: Existing 1/26/2008

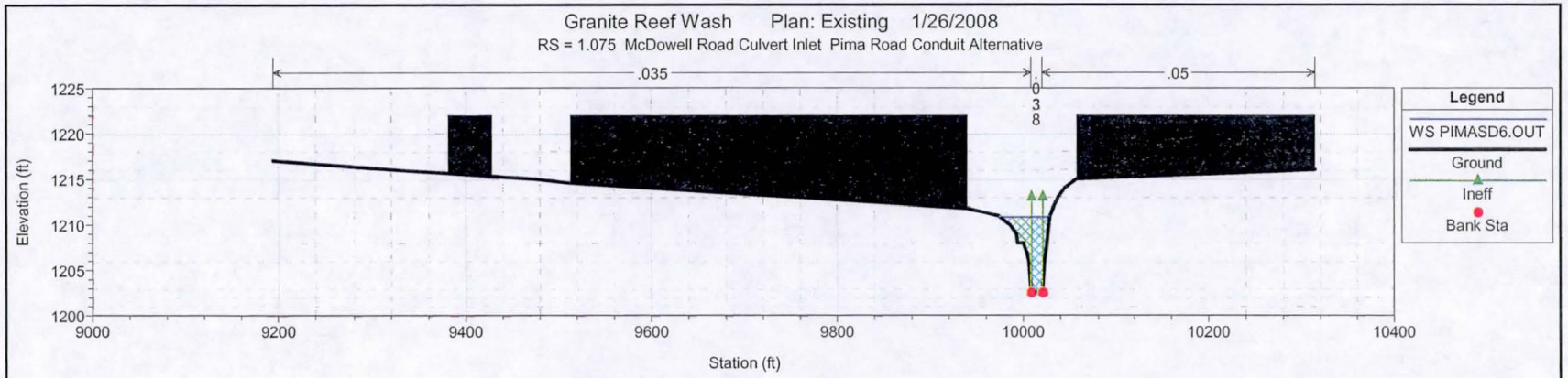
RS = 1.101 Pima Road Conduit Alternative

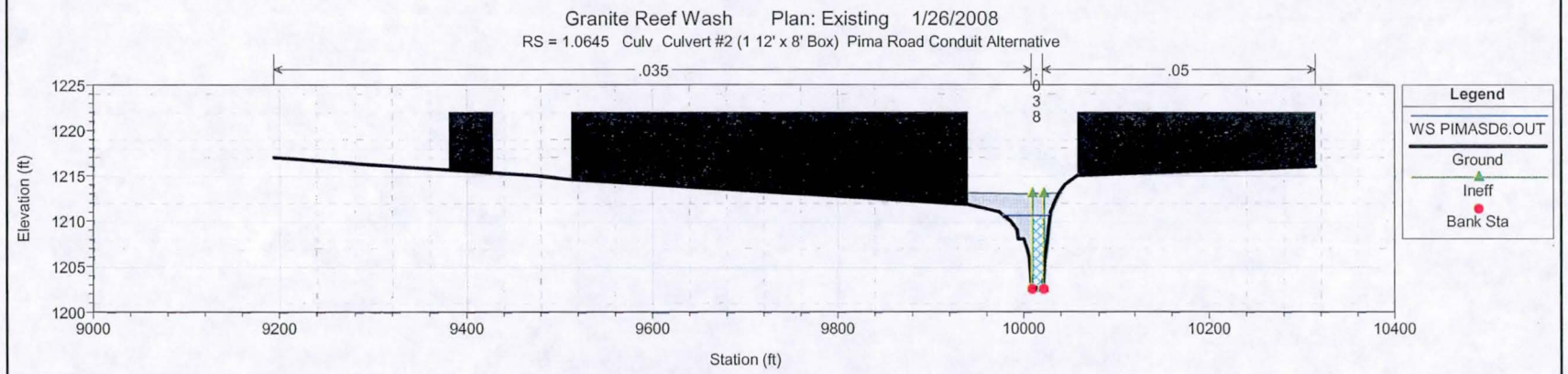


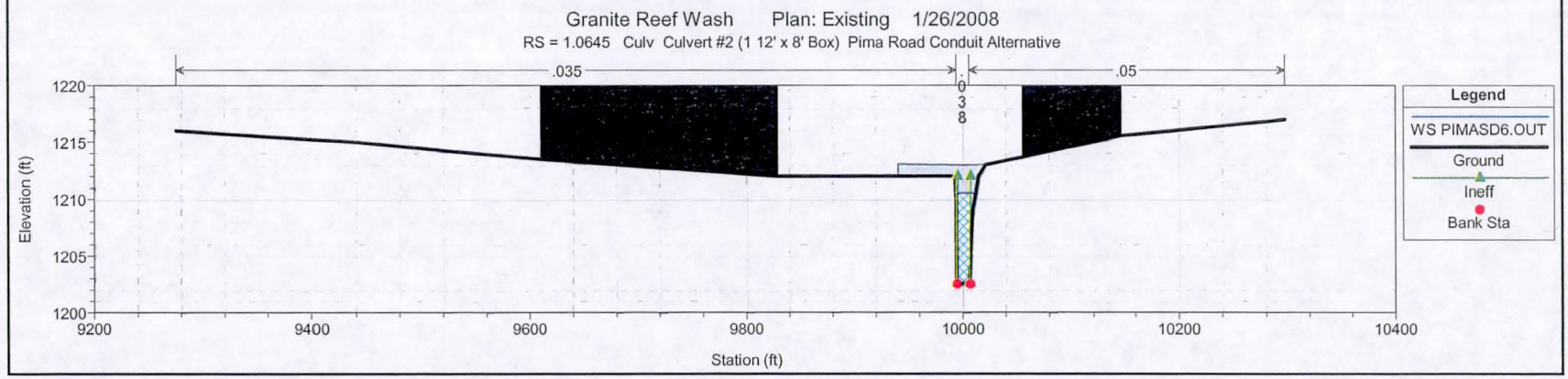
Granite Reef Wash Plan: Existing 1/26/2008

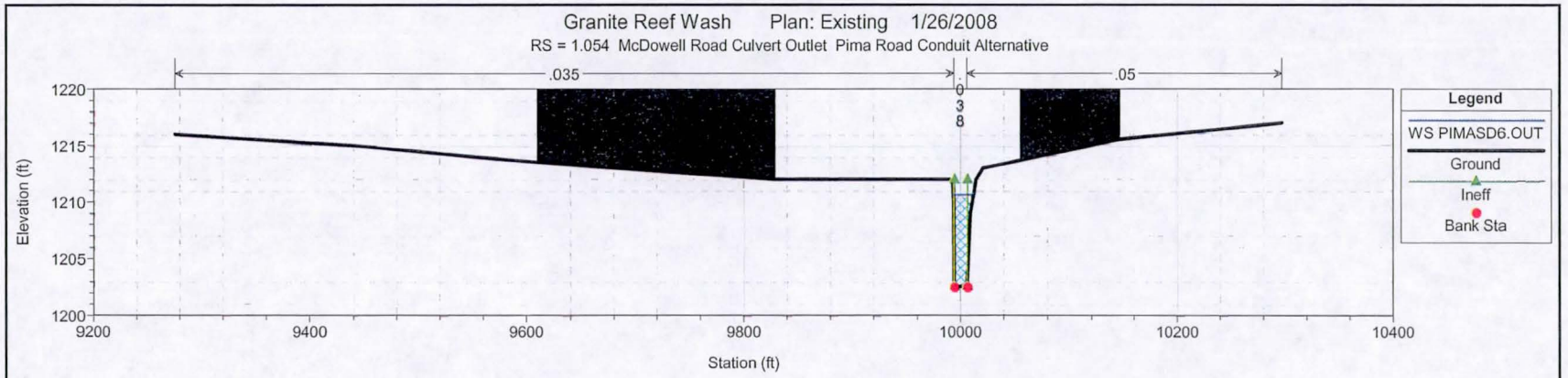
RS = 1.084 Pima Road Conduit Alternative

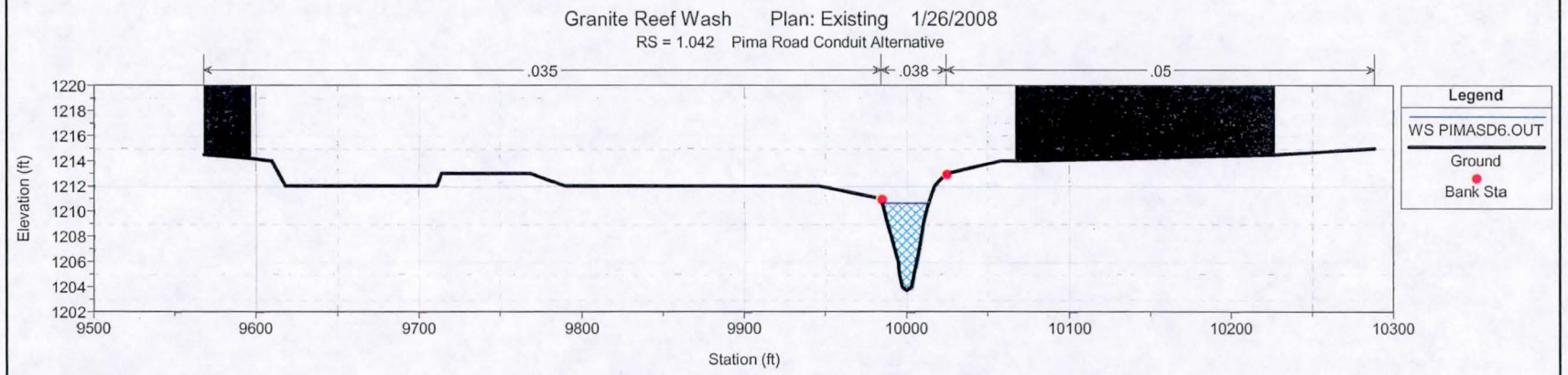


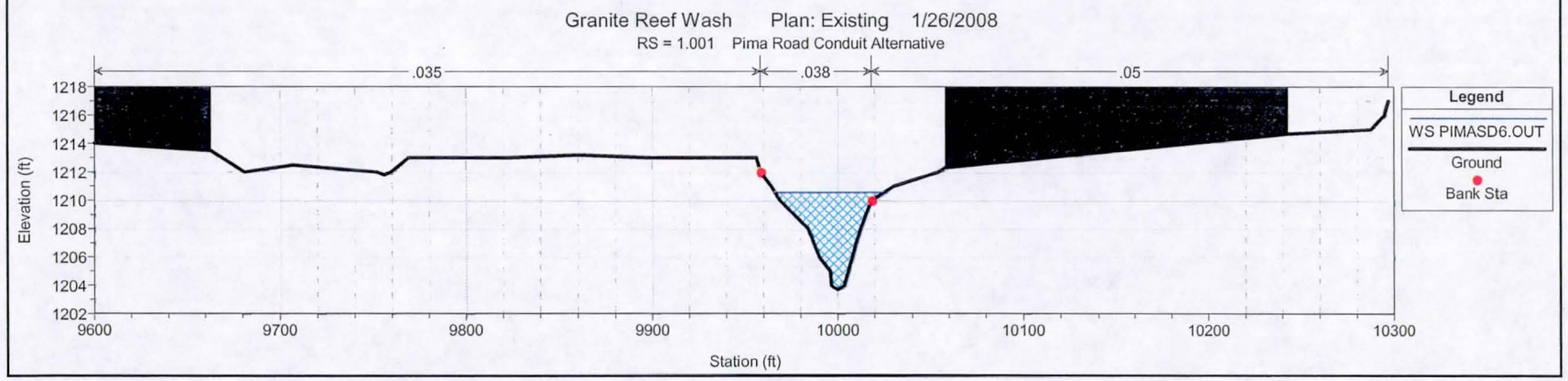

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.075 McDowell Road Culvert Inlet Pima Road Conduit Alternative
.035
.038
.05
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Ineff
Bank Sta

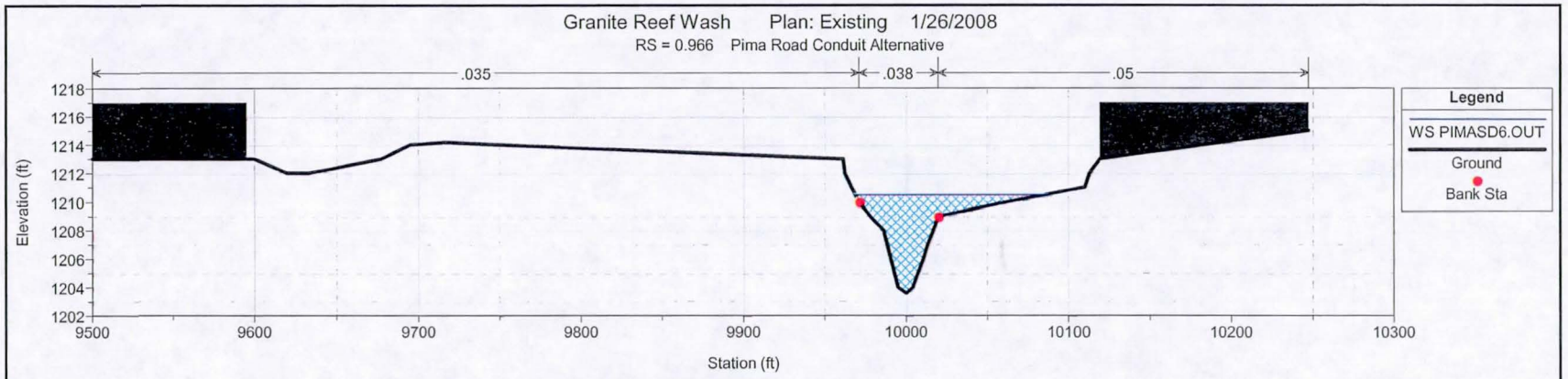

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.0645 Culv Culvert #2 (1 12' x 8' Box) Pima Road Conduit Alternative
.035
.038
.05
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Ineff
Bank Sta

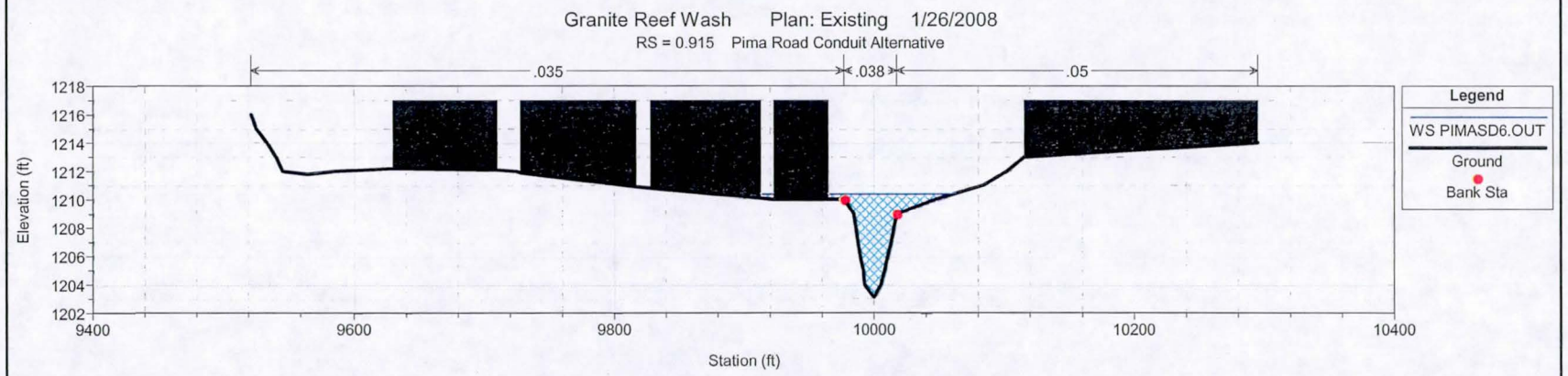

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.0645 Culv Culvert #2 (1 12' x 8' Box) Pima Road Conduit Alternative
.035
.038
.05
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Ineff
Bank Sta

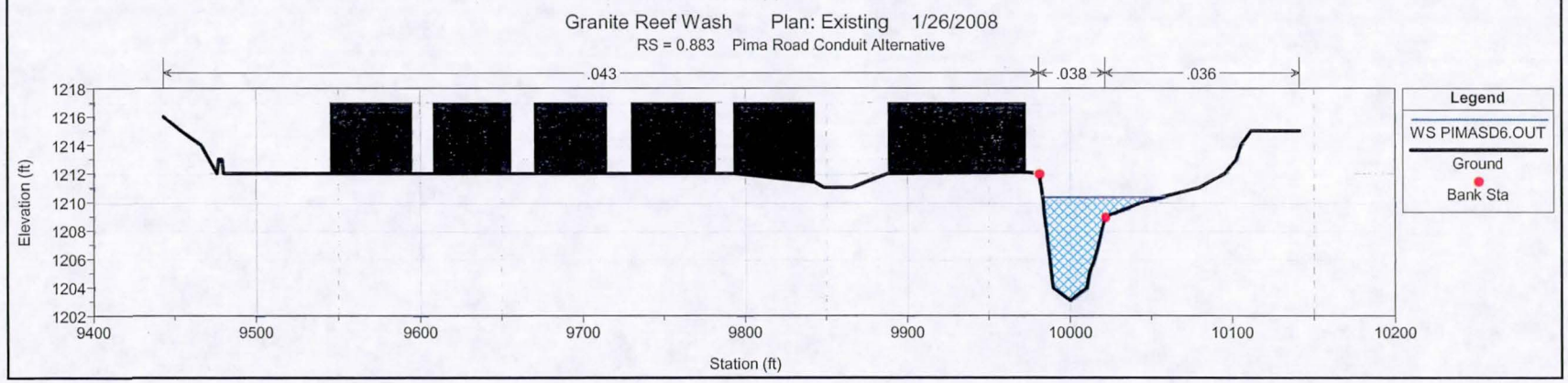

Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.054 McDowell Road Culvert Outlet Pima Road Conduit Alternative
.035
.038
.05
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Ineff
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.042 Pima Road Conduit Alternative
.035
.038
.05
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 1.001 Pima Road Conduit Alternative
.035
.038
.05
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta

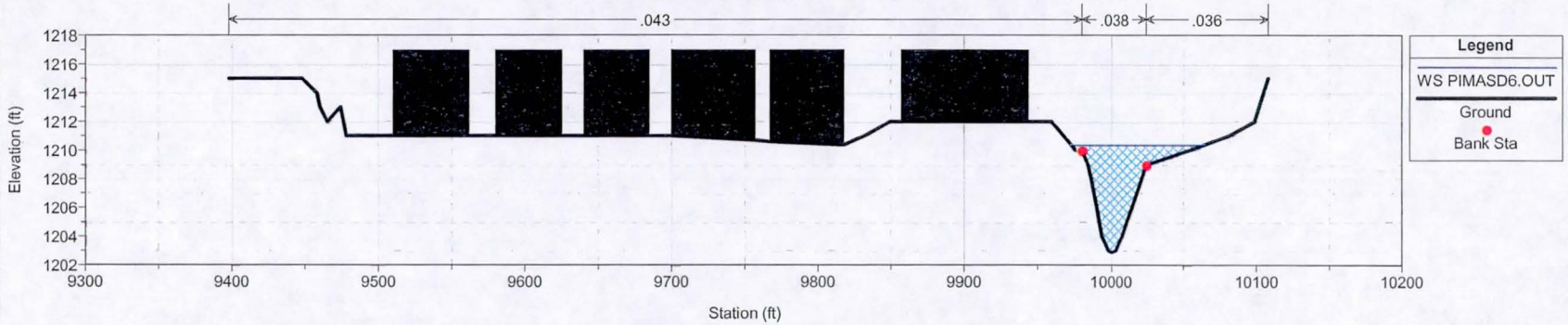

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.966 Pima Road Conduit Alternative
.035
.038
.05
Elevation (ft)
1218
1216
1214
1212
1210
1208
1206
1204
1202
9500
9600
9700
9800
9900
10000
10100
10200
10300
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.915 Pima Road Conduit Alternative
.035
.038
.05
Elevation (ft)
1218
1216
1214
1212
1210
1208
1206
1204
1202
9400
9600
9800
10000
10200
10400
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.883 Pima Road Conduit Alternative
.043
.038
.036
Elevation (ft)
1218
1216
1214
1212
1210
1208
1206
1204
1202
9400
9500
9600
9700
9800
9900
10000
10100
10200
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta

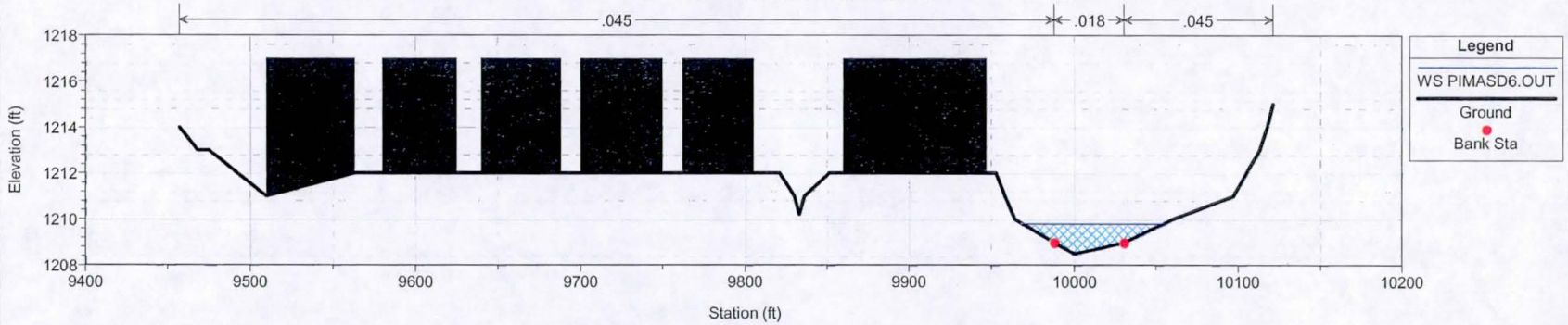
Granite Reef Wash Plan: Existing 1/26/2008

RS = 0.865 Downstream end of the earthen channel north of 84th place Pima Road Conduit Alternative



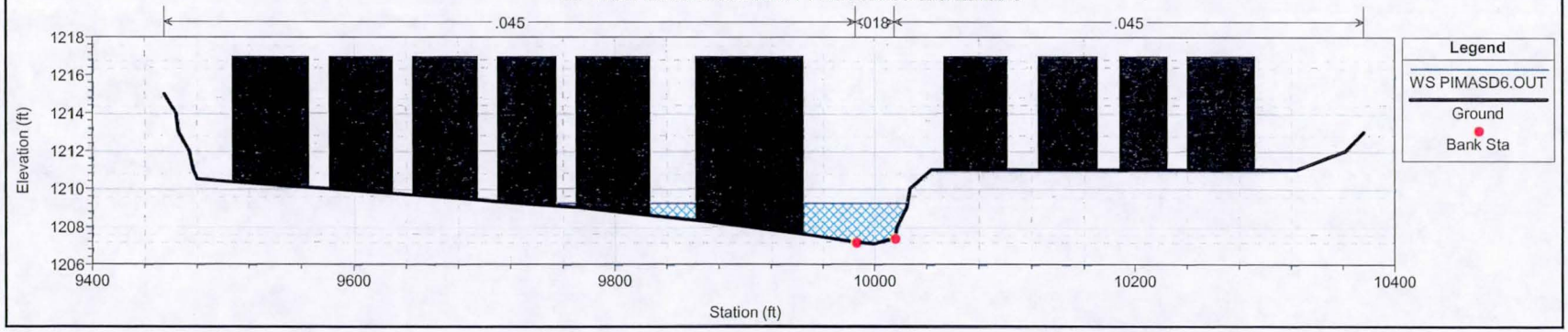
Granite Reef Wash Plan: Existing 1/26/2008

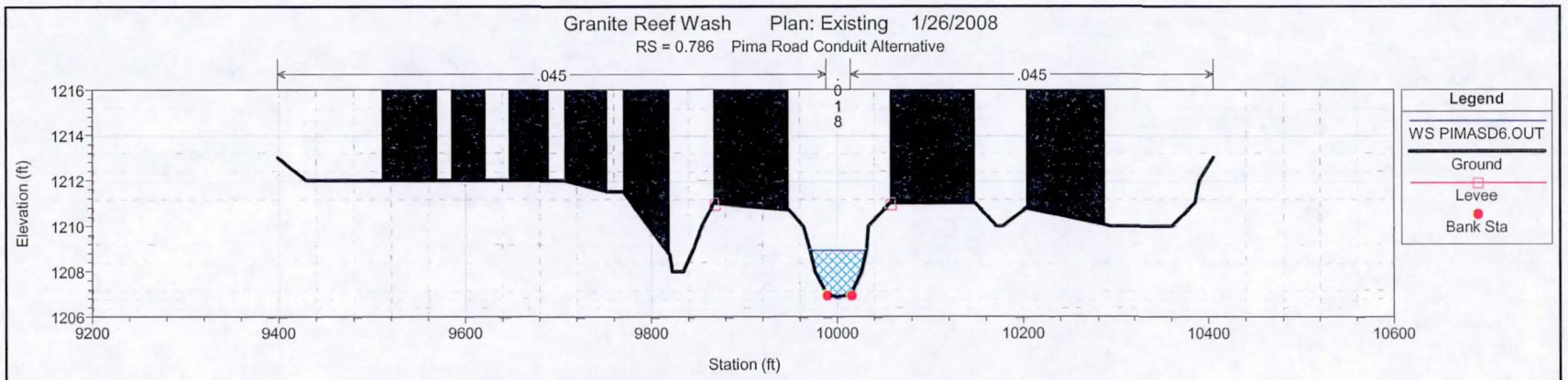
RS = 0.857 Pima Road Conduit Alternative

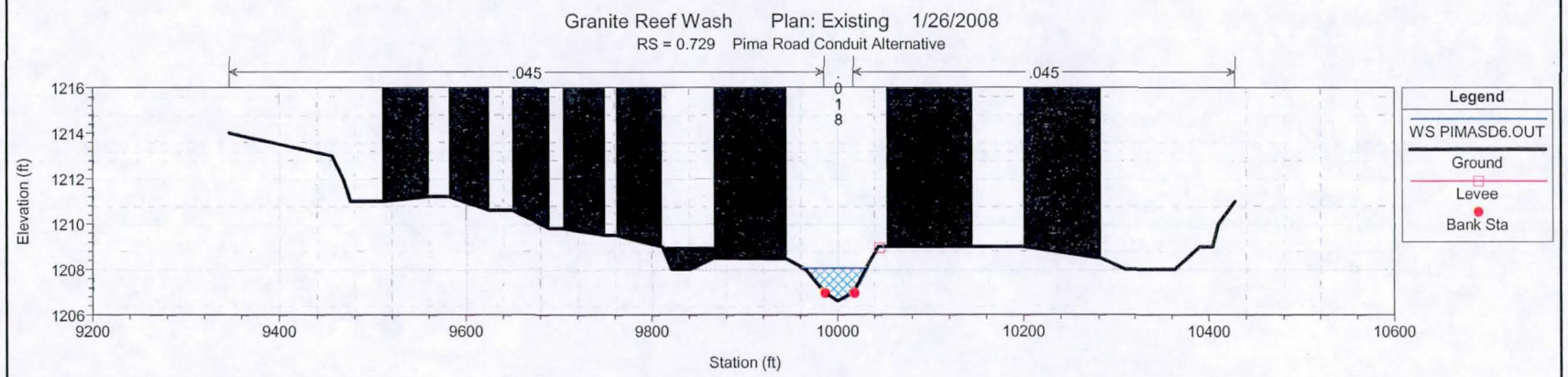


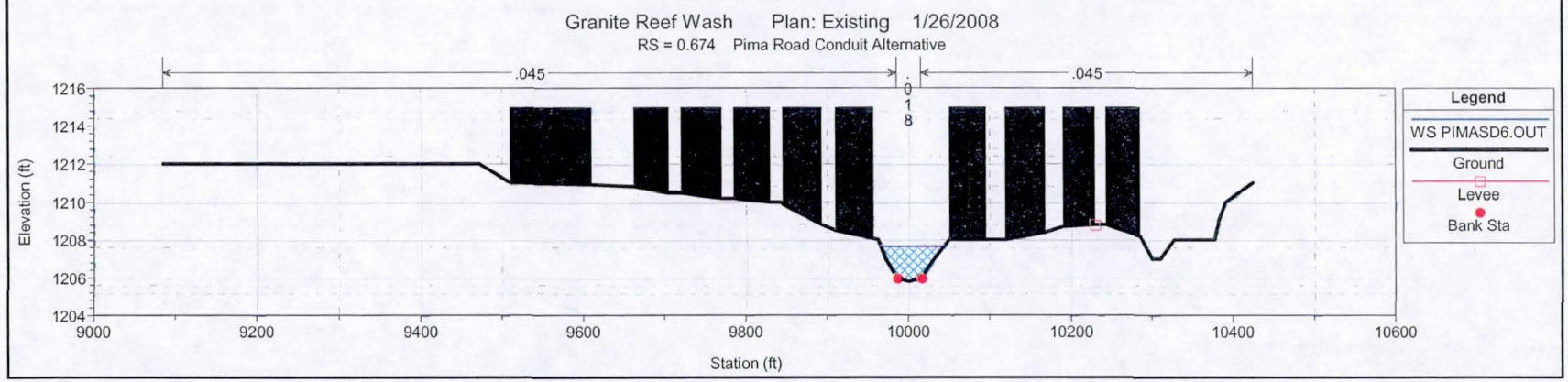
Granite Reef Wash Plan: Existing 1/26/2008

RS = 0.821 Belleview St & 84th Pl Pima Road Conduit Alternative



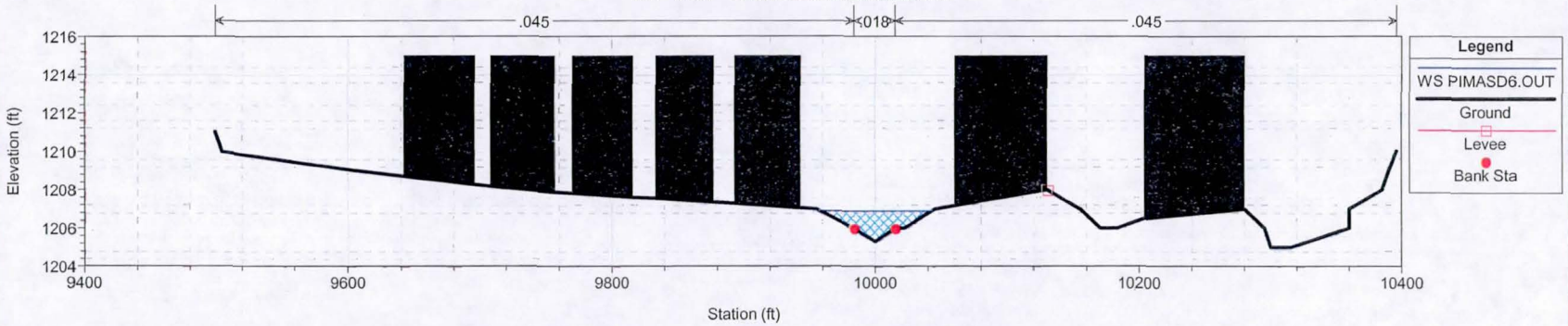

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.786 Pima Road Conduit Alternative
.045
.018
.045
Elevation (ft)
1216
1214
1212
1210
1208
1206
9200
9400
9600
9800
10000
10200
10400
10600
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Levee
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.729 Pima Road Conduit Alternative
.045
.018
.045
Elevation (ft)
1216
1214
1212
1210
1208
1206
9200
9400
9600
9800
10000
10200
10400
10600
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Levee
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.674 Pima Road Conduit Alternative
.045
.018
.045
Elevation (ft)
1216
1214
1212
1210
1208
1206
1204
9000
9200
9400
9600
9800
10000
10200
10400
10600
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Levee
Bank Sta

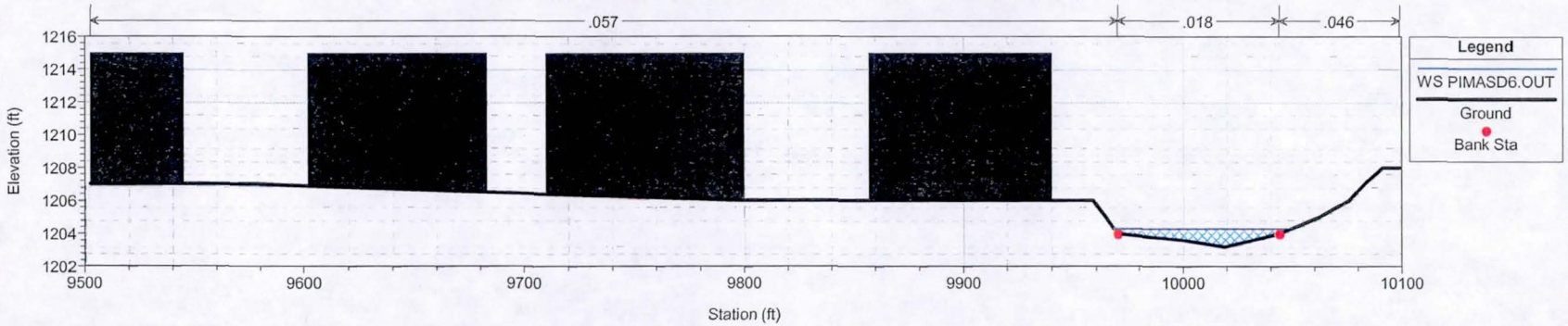
Granite Reef Wash Plan: Existing 1/26/2008

RS = 0.627 Pima Road Conduit Alternative



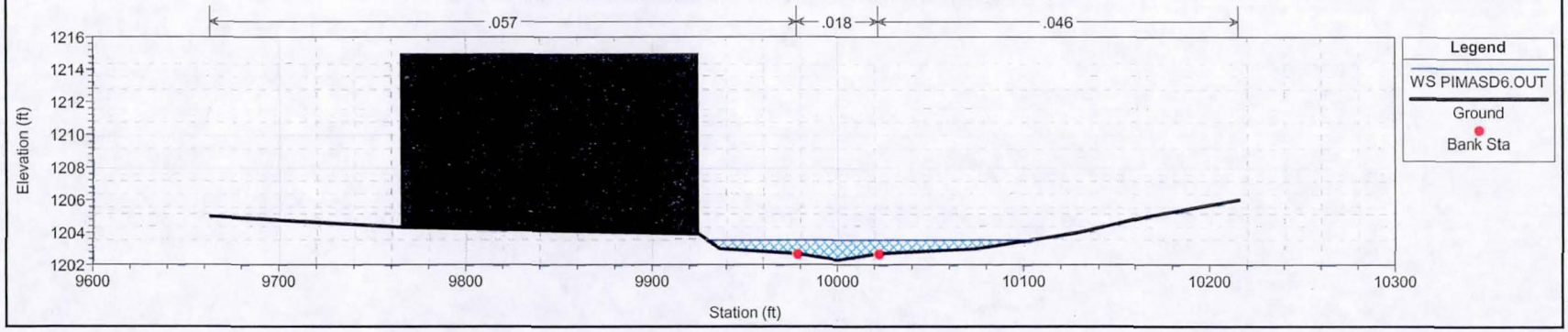
Granite Reef Wash Plan: Existing 1/26/2008

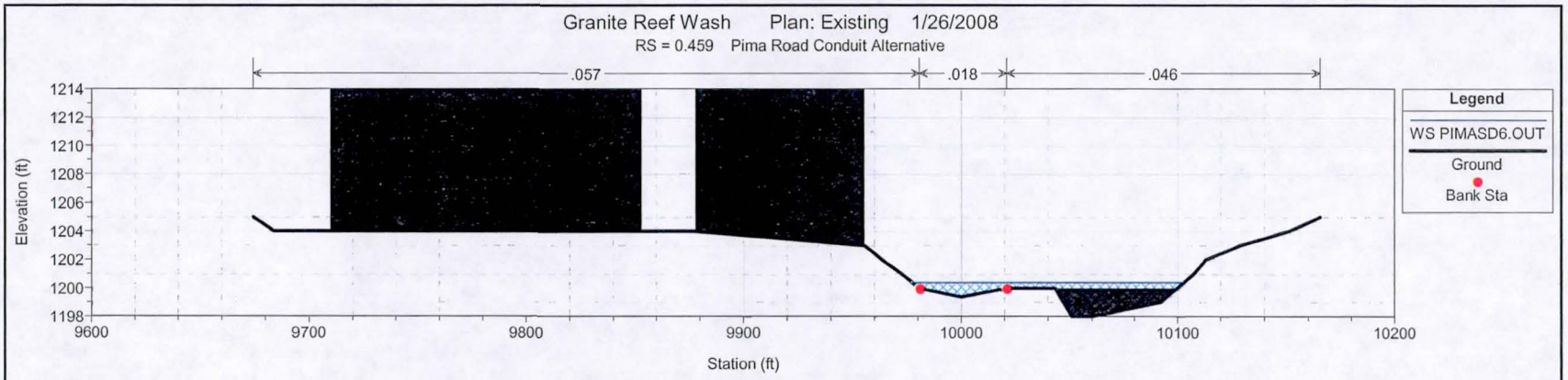
RS = 0.542 Downstream of 84th Pl & Granite Reef Rd Pima Road Conduit Alternative

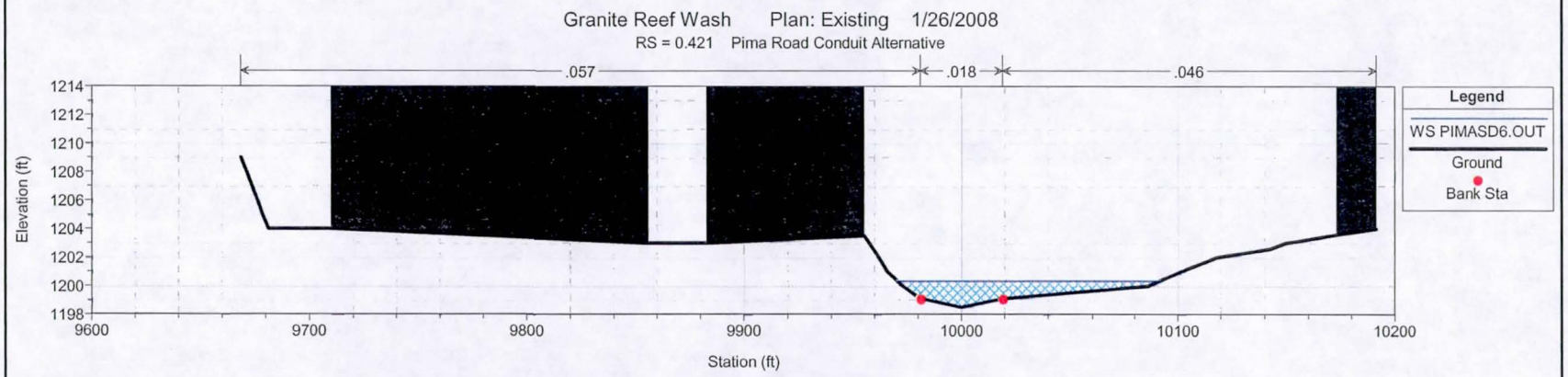


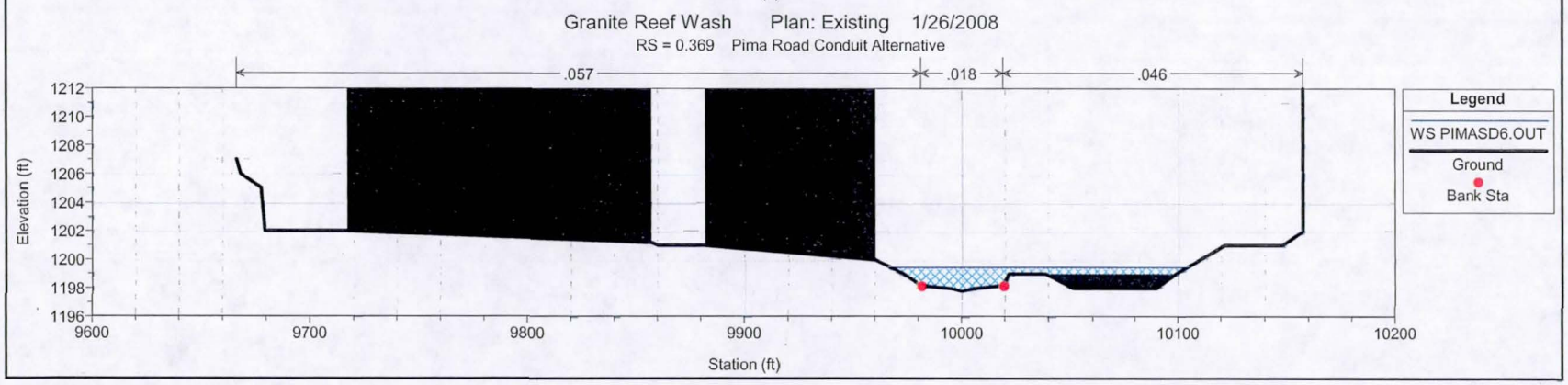
Granite Reef Wash Plan: Existing 1/26/2008

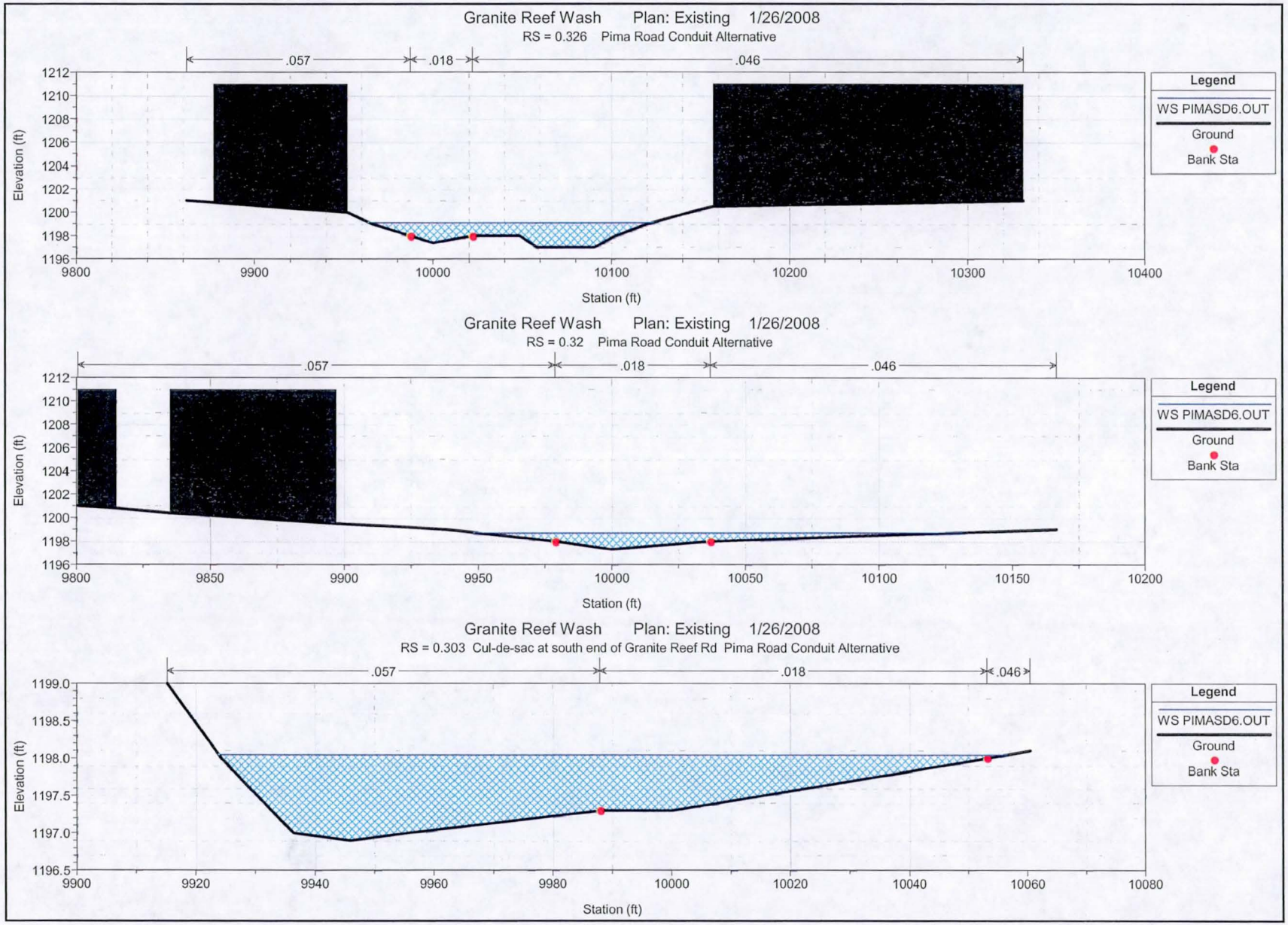
RS = 0.503 Roosevelt St & Granite Reef Rd Pima Road Conduit Alternative

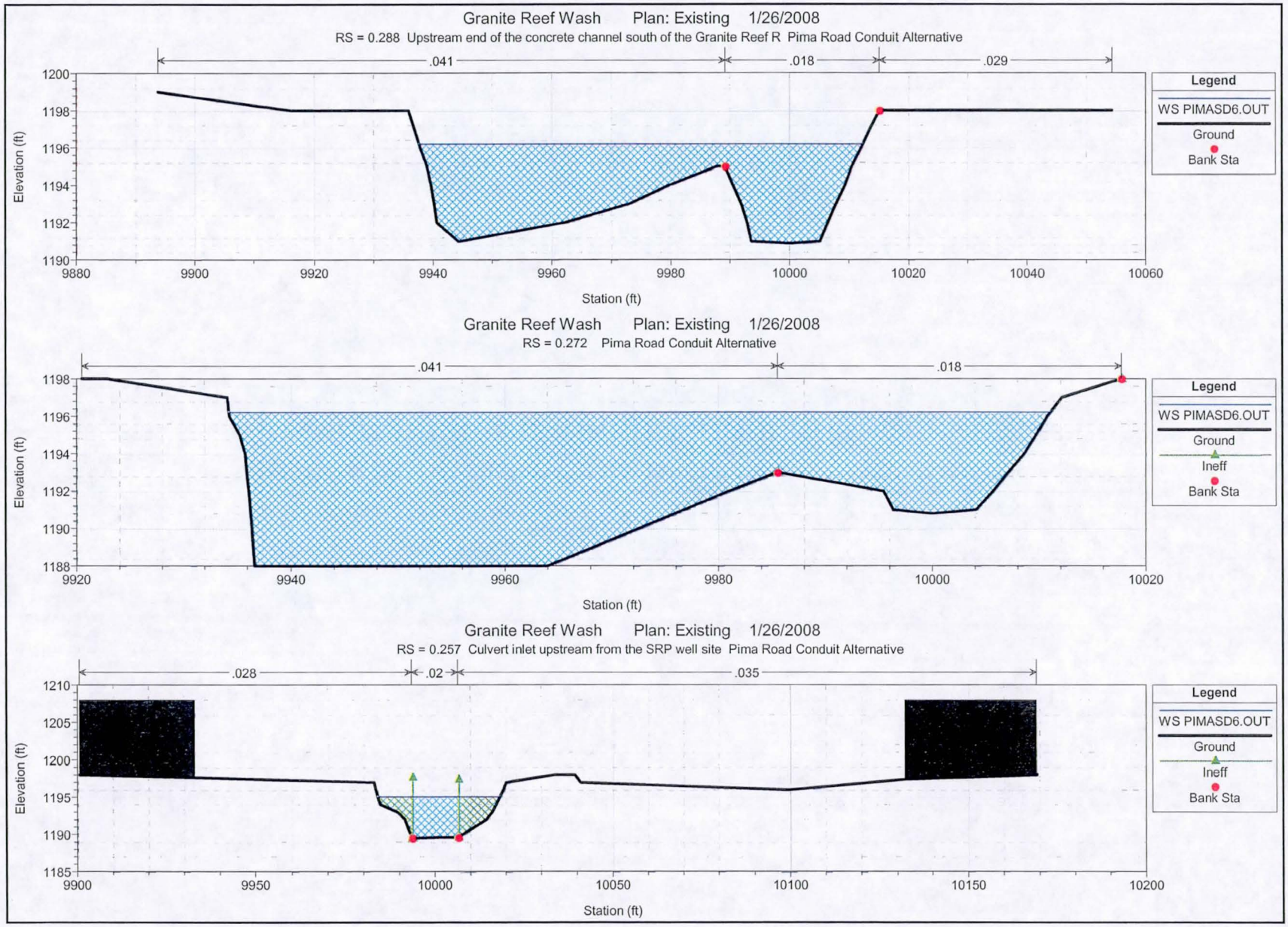


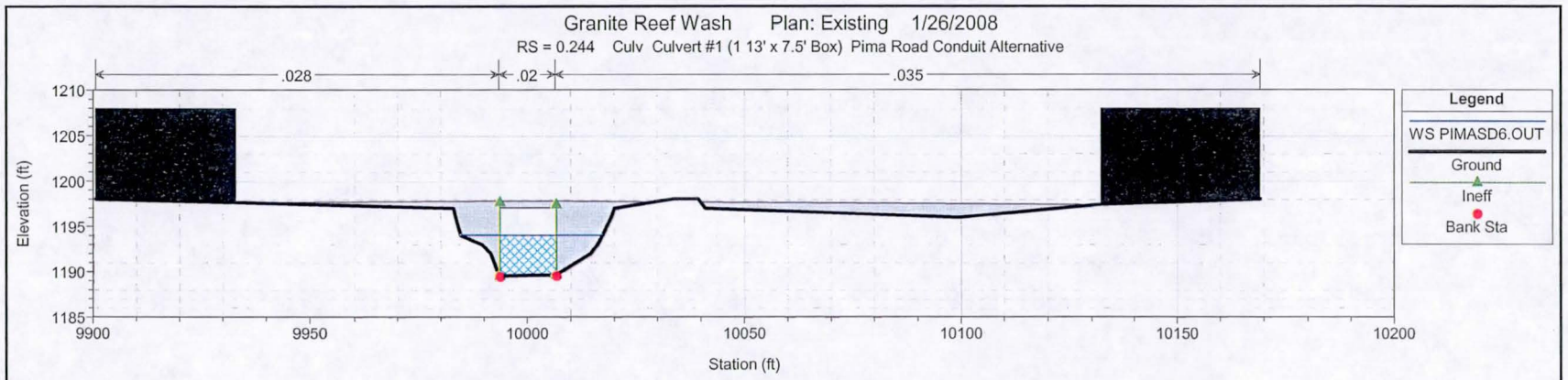

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.459 Pima Road Conduit Alternative
.057
.018
.046
Elevation (ft)
1214
1212
1210
1208
1206
1204
1202
1200
1198
9600
9700
9800
9900
10000
10100
10200
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta

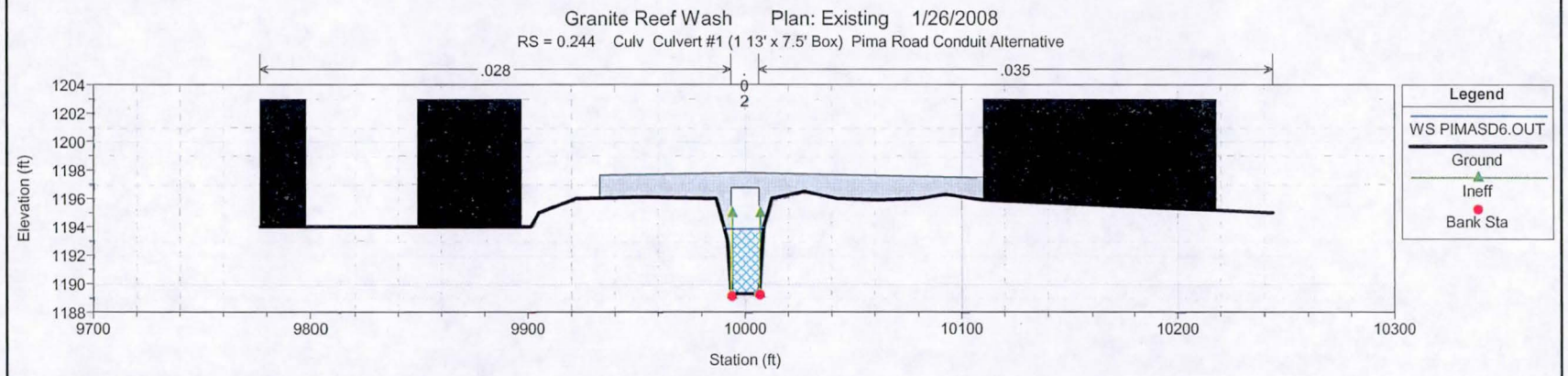

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.421 Pima Road Conduit Alternative
.057
.018
.046
Elevation (ft)
1214
1212
1210
1208
1206
1204
1202
1200
1198
9600
9700
9800
9900
10000
10100
10200
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta

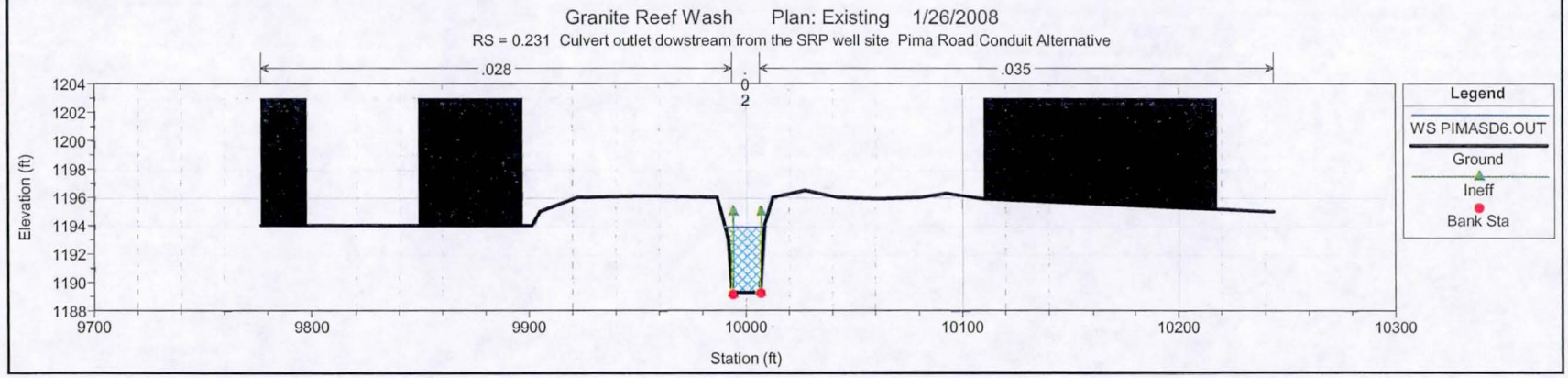

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.369 Pima Road Conduit Alternative
.057
.018
.046
Elevation (ft)
1212
1210
1208
1206
1204
1202
1200
1198
1196
9600
9700
9800
9900
10000
10100
10200
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.326 Pima Road Conduit Alternative
.057
.018
.046
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.32 Pima Road Conduit Alternative
.057
.018
.046
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.303 Cul-de-sac at south end of Granite Reef Rd Pima Road Conduit Alternative
.057
.018
.046
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.288 Upstream end of the concrete channel south of the Granite Reef R Pima Road Conduit Alternative
.041
.018
.029
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.272 Pima Road Conduit Alternative
.041
.018
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Ineff
Bank Sta
Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.257 Culvert inlet upstream from the SRP well site Pima Road Conduit Alternative
.028
.02
.035
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Ineff
Bank Sta

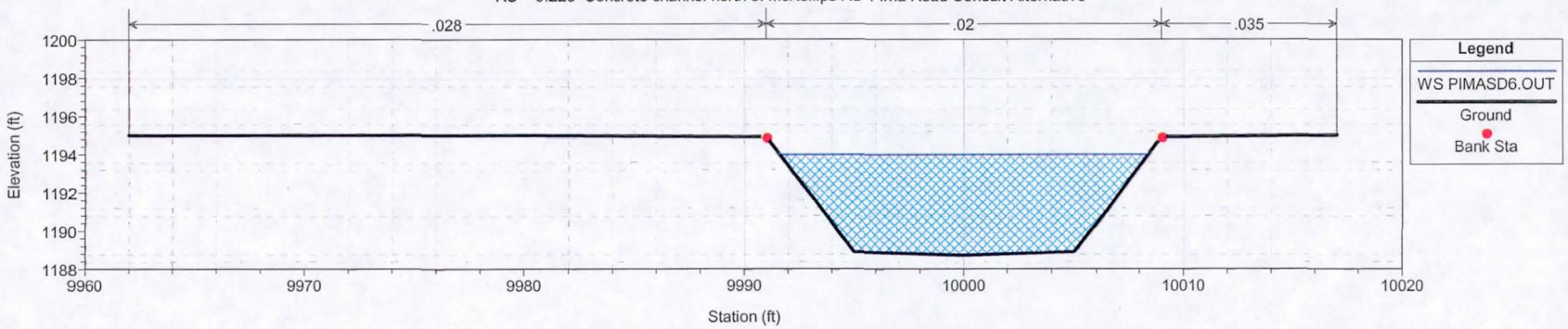

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.244 Culv Culvert #1 (1 13' x 7.5' Box) Pima Road Conduit Alternative
.028
.02
.035
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Ineff
Bank Sta

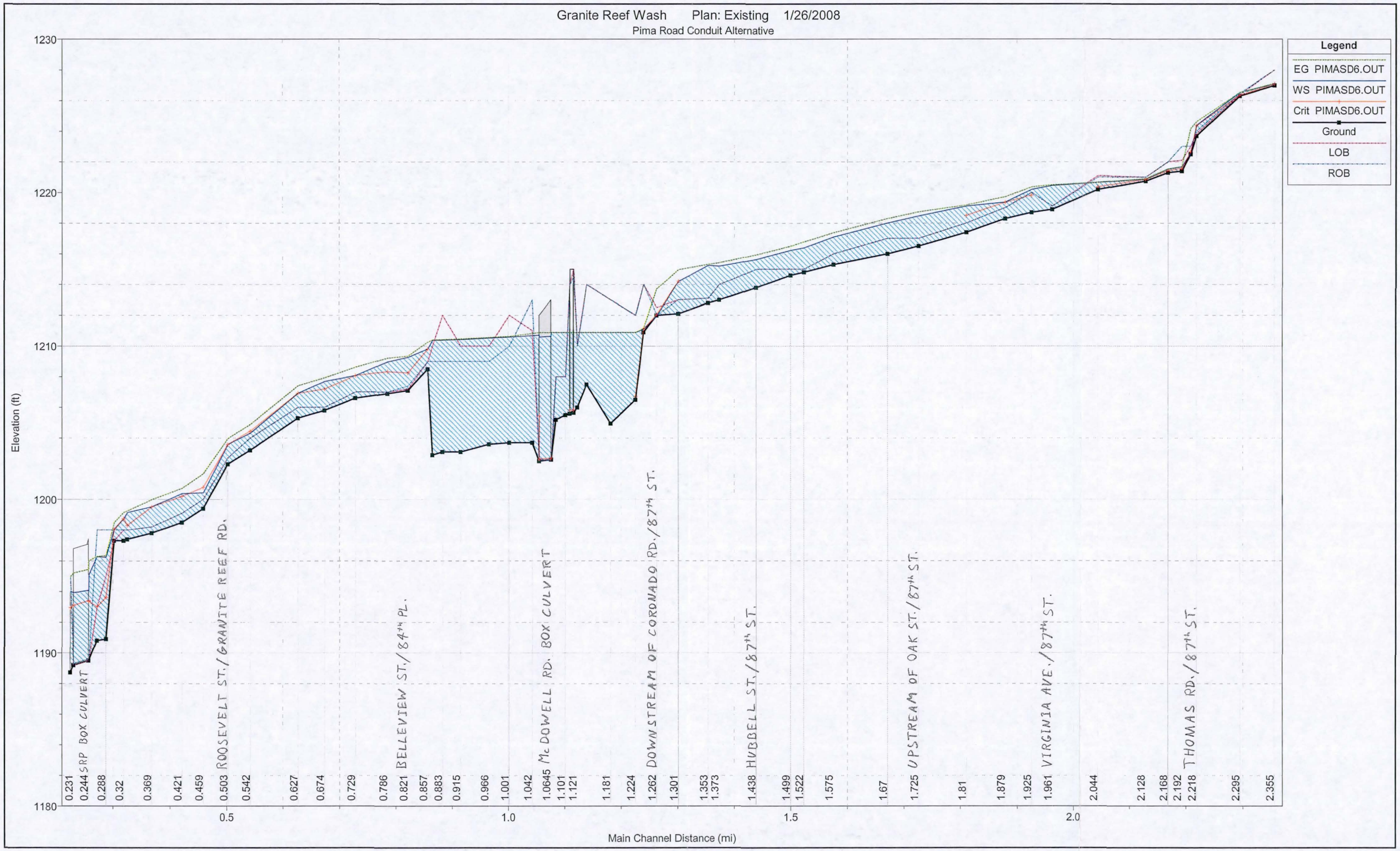

Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.244 Culv Culvert #1 (1 13' x 7.5' Box) Pima Road Conduit Alternative
.028
.02
.035
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Ineff
Bank Sta


Granite Reef Wash Plan: Existing 1/26/2008
RS = 0.231 Culvert outlet dowstream from the SRP well site Pima Road Conduit Alternative
.028
.02
.035
Elevation (ft)
Station (ft)
Legend
WS PIMASD6.OUT
Ground
Ineff
Bank Sta

Granite Reef Wash Plan: Existing 1/26/2008

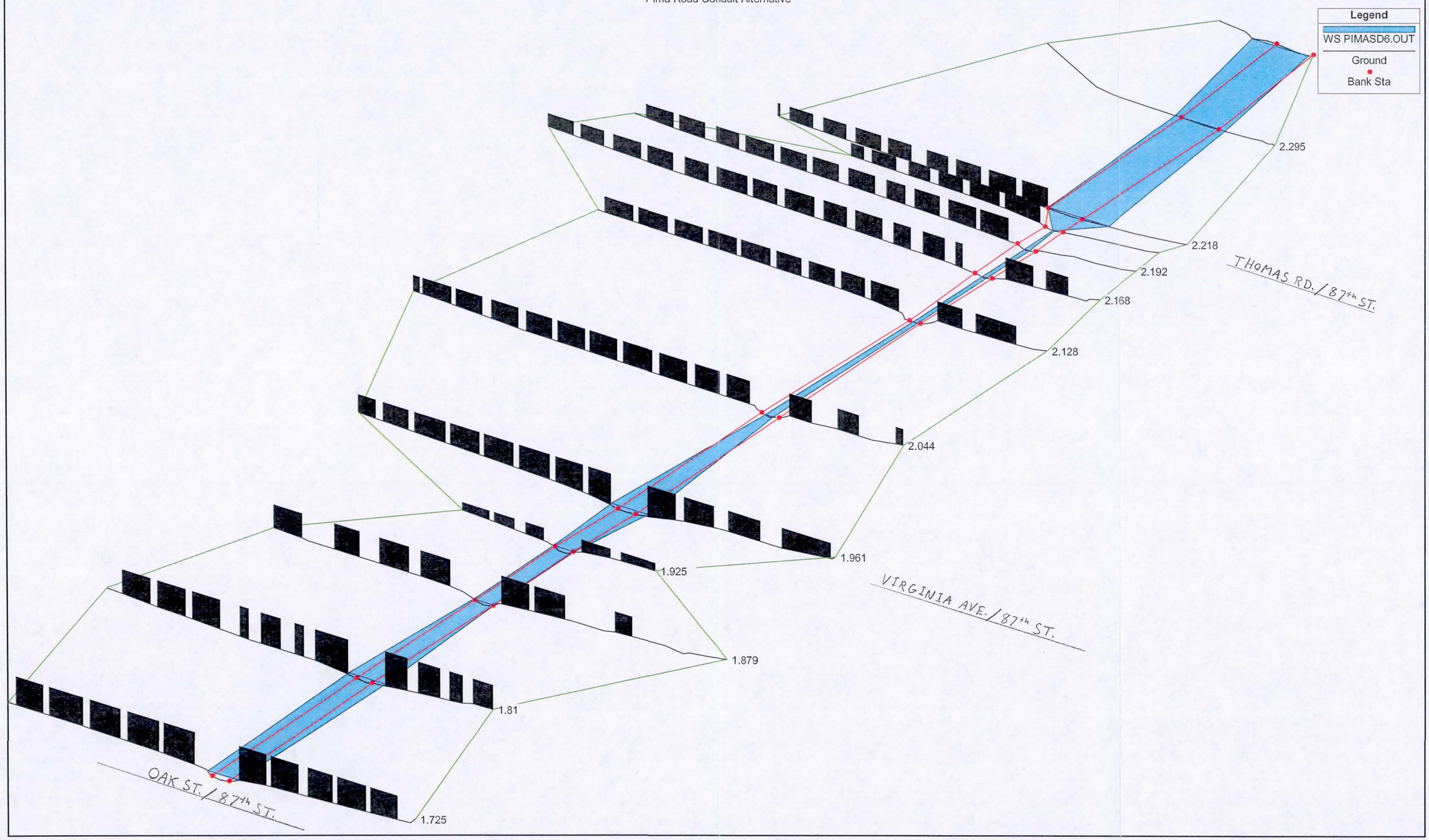
RS = 0.225 Concrete channel north of McKellips Rd Pima Road Conduit Alternative




Granite Reef Wash Plan: Existing 1/26/2008
Pima Road Conduit Alternative
Legend
EG PIMASD6.OUT
WS PIMASD6.OUT
Crit PIMASD6.OUT
Ground
LOB
ROB
Elevation (ft)
1230
1220
1210
1200
1190
1180
Main Channel Distance (mi)
0.5
1.0
1.5
2.0
0.231
0.244 SRP BOX CULVERT
0.288
0.32
0.369
0.421
0.459
0.503 ROOSEVELT ST./GRANITE REEF RD.
0.542
0.627
0.674
0.729
0.786
0.821 BELLEVIEW ST./84TH PL.
0.857
0.883
0.915
0.966
1.001
1.042
1.0645 Mc DOWELL RD. BOX CULVERT
1.101
1.121
1.181
1.224
1.262 DOWNSTREAM OF CORONADO RD./87TH ST.
1.301
1.353
1.373
1.438 HUBBELL ST./87TH ST.
1.499
1.522
1.575
1.67
1.725 UPSTREAM OF OAK ST./87TH ST.
1.81
1.879
1.925
1.961 VIRGINIA AVE./87TH ST.
2.044
2.128
2.168
2.192
2.218 THOMAS RD./87TH ST.
2.295
2.355

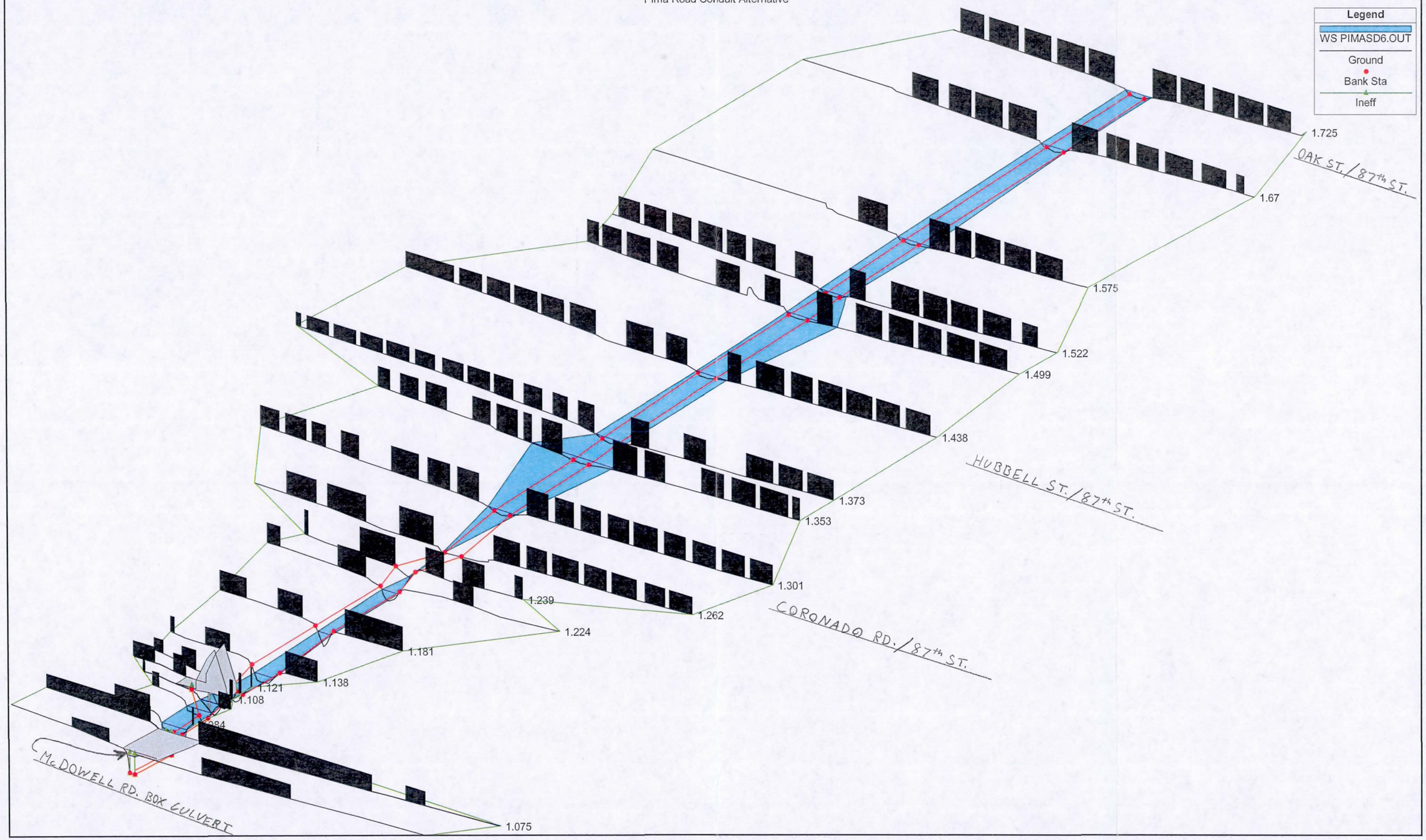
Granite Reef Wash Plan: Existing 1/26/2008

Pima Road Conduit Alternative



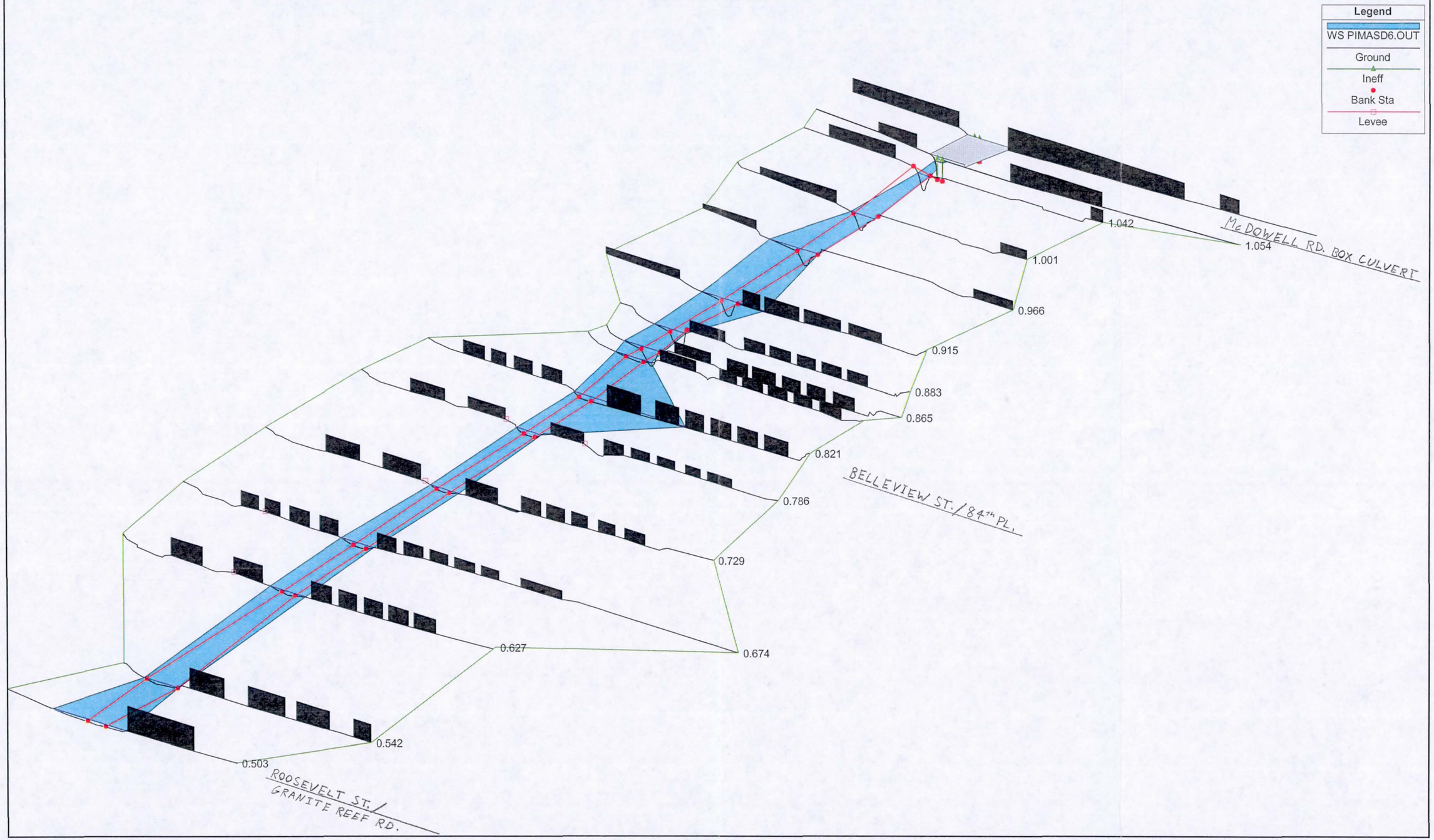
Granite Reef Wash Plan: Existing 1/26/2008

Pima Road Conduit Alternative



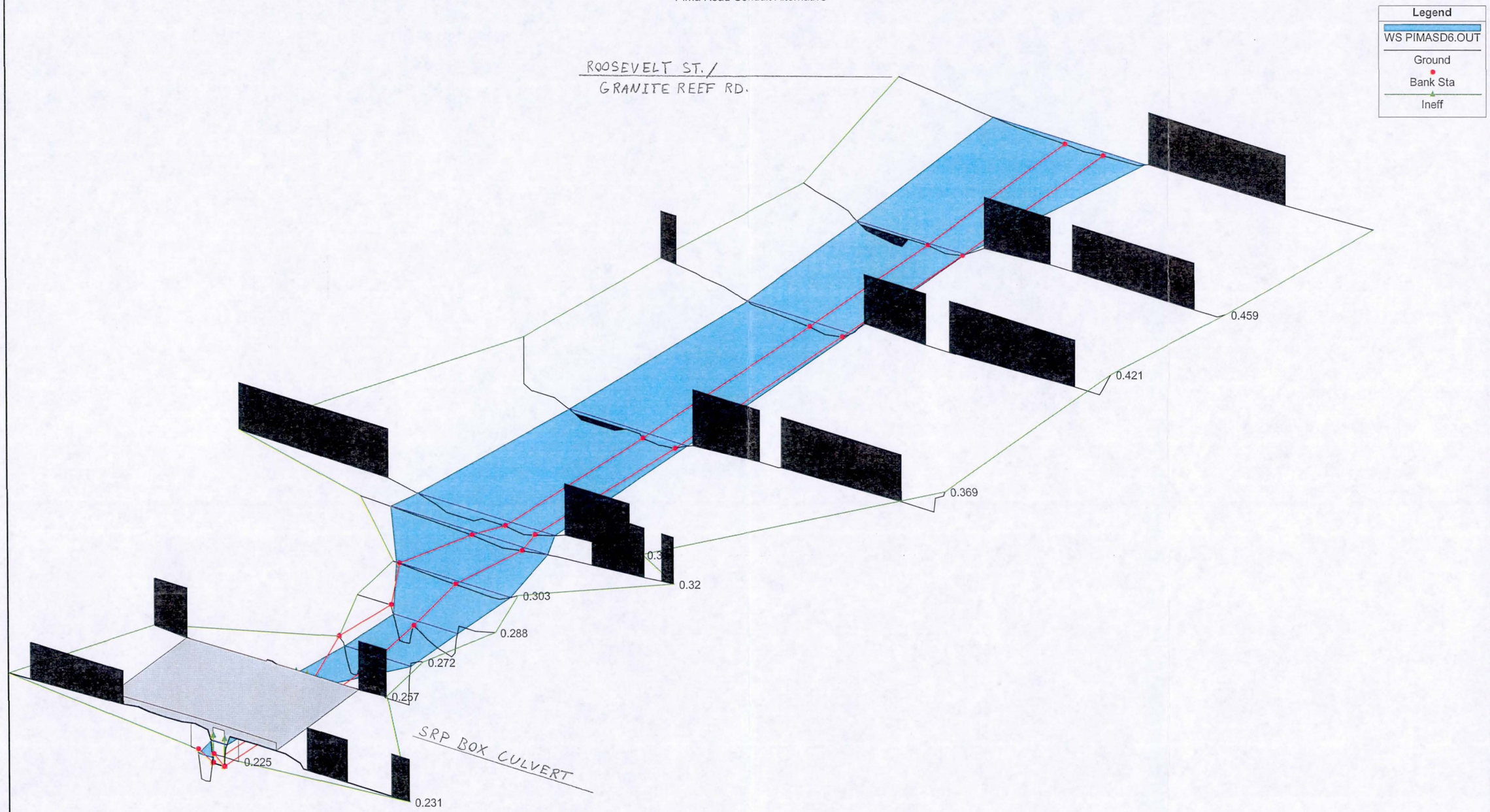
Granite Reef Wash Plan: Existing 1/26/2008

Pima Road Conduit Alternative



Granite Reef Wash Plan: Existing 1/26/2008

Pima Road Conduit Alternative



E. Cost Estimates

1. **Detention Basins Alternative**
2. **Alternate Flow Path – FCDMC 2002 Alternative Update**
3. **PRC Alternative**

1. Detention Basins Alternative

Estimated Implementation Cost

Detention Basin Alternative: Pima Park

Item No.	Item Description	Units	Unit Cost	Quantity	Cost
1	Excavation	CY	$6.00	11,639	$69,834
2	Turf Replacement/Irrigation	AC	$65,000.00	2.70	$175,500
4	Storm Drain	LF	$125.00	600	$75,000
5	Interception Structures	EA	$50,000.00	1	$50,000
6	Inlet/Outlet Structures	EA	$15,000.00	2	$30,000
7	Scupper/Weir Structure	LS	$100,000.00	1	$100,000
8	Utility Relocation	LS	$100,000.00	1	$100,000
9	Asphalt Removal/Replacement	SY	$20.00	1,089	$21,780
10	Curb/Gutter Remove/Replace	LF	$50.00	40	$2,000
11	Sidewalk Remove/Replace	SF	$75.00	22.2	$1,665
				Construction-Total	$625,779
				7% Mobilization	$43,805
				Sub-Total	$669,584
				30% Contingency	$200,875
				Sub-Total	$870,459
				Rights-of-way	$0
				Environmental Permitting	$100,000
				Aesthetics/Public Acceptance	$50,000
				Estimated Implementation Cost	**$1,020,459**

Estimated Implementation Cost

Detention Basin Alternative: Hohokam Elementary School

Item No.	Item Description	Units	Unit Cost	Quantity	Cost
1	Excavation	CY	$6.00	23,377	$140,262
2	Turf Replacement/Irrigation	AC	$65,000.00	5.09	$330,850
4	Storm Drain	LF	$125.00	2,300	$287,500
5	Interception Structures	EA	$25,000.00	10	$250,000
6	Inlet/Outlet Structures	EA	$15,000.00	2	$30,000
8	Utility Relocation	LS	$100,000.00	1	$100,000
9	Asphalt Removal/Replacement	SY	$20.00	4,844	$96,880
10	Curb/Gutter Remove/Replace	LF	$50.00	40	$2,000
11	Sidewalk Remove/Replace	SF	$75.00	22.2	$1,665
				Construction-Total	$1,239,157
				7% Mobilization	$86,741
				Sub-Total	$1,325,898
				30% Contingency	$397,769
				Sub-Total	$1,723,667
				Rights-of-way	$381,510
				Environmental Permitting	$100,000
				Aesthetics/Public Acceptance	$100,000
				Estimated Implementation Cost	**$2,305,177**

Estimated Implementation Cost

Detention Basin Alternative: Apache Park

Item No.	Item Description	Units	Unit Cost	Quantity	Cost
1	Excavation	CY	$6.00	43,327	$259,962
2	Turf Replacement/Irrigation	AC	$65,000.00	3.55	$230,750
4	Storm Drain	LF	$250.00	2,590	$647,500
5	Interception Structures	EA	$75,000.00	1	$75,000
6	Inlet/Outlet Structures	EA	$15,000.00	2	$30,000
8	Utility Relocation	LS	$100,000.00	1	$100,000
9	Asphalt Removal/Replacement	SY	$20.00	5,222	$104,440
10	Curb/Gutter Remove/Replace	LF	$50.00	40	$2,000
11	Sidewalk Remove/Replace	SF	$75.00	22.20	$1,665
				Construction-Total	$1,451,317
				7% Mobilization	$101,592
				Sub-Total	$1,552,909
				30% Contingency	$465,873
				Sub-Total	$2,018,782
				Rights-of-way	$266,123
				Environmental Permitting	$100,000
				Aesthetics/Public Acceptance	$150,000
				Estimated Implementation Cost	**$2,534,905**

2. Alternate Flow Path – FCDMC 2002 Alternative Update

Estimated Implementation Cost

Channel / Interceptor Alternative

Item No.	Item Description	Units	# of Dwellings to be Purchased	Unit Cost	Quantity	Cost
1	Excavation	C.Y.		$5.50	602,050	$3,311,275
2	Removal of Structures	EA.		$50,000.00	123	$6,150,000
3	Landscaping Costs	S.F.		$3.50	1,850,560	$6,476,960
4	Roadway Crossings (Arterial)	EA.		$50,000.00	2	$100,000
5	Road Crossing (Collector)	EA.		$20,000.00	2	$40,000
6	Roadway Re-Alignment	L.S.		$750,000.00	1	$750,000
7	Pavement Removal	S.Y.		$4.00	51,404	$205,616
8	Outlet Structures	EA.		$50,000.00	3	$150,000
9	Proposed RCB	L.S.		$1,150,000.00	1	$1,150,000
10	Right-of-Way (ROW) Acquisition					
	Developed Residential (Homes)*	L.S.	94	$28,734,125.00	1	$28,734,125
	Developed Residential (Townhouses)*	L.S.	2	$838,125.00	1	$838,125
	Developed Industrial	AC.		$335,000.00	6	$2,010,000
	Mobile Home Park	AC.		$135,000.00	6	$810,000
	Mobile Homes*	EA.	21	$50,000.00	21	$1,312,500
	Other Buildings	EA.	4	$115,000.00	4	$460,000
	Commercial/Industrial Buildings	EA.	2	$100,000.00	2	$200,000
	Undeveloped Commercial	AC.		$170,000.00	5	$850,000
	SRP-MIC Land (Section 12)	AC.		$335,000.00	20	$6,700,000
		Sub-Total	123			$60,248,601

25% Contingency	$15,062,150
Estimated Implementation Cost	**$75,310,751**

*Refer to the Property Acquistion table for the breakdown of individual home values. 25% was added to the Assessor's value to compensate for the actual value.

Note: All cost estimate tables were obtained from Alternative 1 (Watercourse Restoration) of the FCDMC's 2002 study on Granite Reef Wash. All information was updated to match current values.

Property Acquisition

Single Family, Townhouses, Mobile homes

Single Family Homes

	Address	Parcel No.	2008 Assessors Value (Full Cash Value)	Sales Price	Date Purchased	# of Dwellings per Bldg
8	8624 E Coronado Rd., Lot 1035	131-46-089	$266,600			1
9	8632 E Coronado Rd., Lot 1036	131-46-090-A	$267,200			1
10	8628 E Granada Rd.	131-46-065	$334,000			1
11	8622 E Granada Rd.	131-46-064	$245,500	$142,000	3/1/2003	1
12	8637 E Palm Ln.	131-46-021	$244,500			1
13	8633 E Palm Ln.	131-46-020	$230,000			1
14	8625 E Palm Ln.	131-46-019	$248,500			1
15	8638 E Palm Ln.	131-46-023	$251,000			1
16	8632 E Palm Ln.	131-46-024	$247,500			1
17	8628 E Palm Ln.	131-46-025	$261,000			1
18	8624 E Palm Ln.	131-46-026	$231,000			1
19	1834 N 87th St.	131-46-049	$248,000	$159,000	4/1/2004	1
20	8643 E Hubbel St.	131-46-048	$242,000			1
21	8637 E Hubbel St.	131-46-047	$244,500			1
22	8631 E Hubbel St.	131-46-046	$241,500			1
23	8650 E Hubbel St.	131-45-054	$248,500			1
24	2010 N 87th St.	131-45-055	$216,500			1
25	2018 N 87th St.	131-45-056	$233,000	$134,900	1/1/2000	1
26	2026 N 87th St.	131-45-057	$253,500	$147,000	7/1/2000	1
27	2032 N 87th St.	131-45-058	$262,500	$149,900	6/1/2001	1
28	8646 E Hubbel St.	131-45-053	$266,500			1
29	2017 N 86th Pl.	131-45-052	$239,500	$216,500	9/1/2004	1
30	2023 N 86th Pl.	131-45-051	$255,000	$132,900	10/1/1999	1
31	8646 E Dianna Dr.	131-45-050	$270,000			1
32	8640 E Dianna Dr.	131-45-049	$239,000			1
33	8649 E Holly St.	131-45-061	$223,500	$139,300	4/1/2001	1
34	8643 E Holly St.	131-45-062	$214,500	$159,900	6/1/2003	1
35	8639 E Holly St.	131-45-063	$240,500	$152,000	4/1/2002	1
36	8646 E Holly St.	131-45-097	$241,000			1
37	8642 E Holly St.	131-45-096	$256,500	$365,000	3/1/2006	1
38	8636 E Holly St.	131-45-095	$241,000			1
39	8654 E Cypress St.	131-48-012	$258,500			1
40	8601 E Oak St.	131-48-011	$262,500			1
41	8607 E Oak St.	131-48-010	$265,000			1
42	8613 E Oak St.	131-48-009	$285,000			1
43	8619 E Oak St.	131-48-008	$242,500			1
44	8625 E Oak St.	131-48-007	$262,000	$127,000	5/1/1999	1
45	8628 E Oak St.	131-42-094	$266,000	$168,000	2/1/2002	1
46	8622 E Oak St.	131-42-093	$264,500			1
47	8616 E Oak St.	131-42-092	$289,000			1
48	8619 E Vernon Ave.	131-42-086	$252,500			1
49	8625 E Vernon Ave.	131-42-085	$220,500			1
50	8631 E Vernon Ave.	131-42-084	$235,500			1
51	8701 E Vernon Ave.	131-42-083	$213,500			1
52	8707 E Vernon Ave.	131-42-082	$249,500	$247,500	1/1/2005	1
53	8713 E Vernon Ave.	131-42-081	$237,000	$100,000	4/1/1996	1
54	8717 E Vernon Ave.	131-42-080	$242,500			1
55	8720 E Vernon Ave.	131-42-079	$224,000	$142,000	5/1/2002	1
56	8716 E Vernon Ave.	131-42-078	$268,500			1
57	8710 E Vernon Ave.	131-42-077	$195,500			1
58	8702 E Vernon Ave.	131-42-076	$196,500			1
59	8632 E Vernon Ave.	131-42-075	$249,000	$151,000	7/1/2001	1
60	8626 E Vernon Ave.	131-42-074	$259,000			1
61	8633 E Sheridan St.	131-42-064	$225,500			1
62	8701 E Sheridan St.	131-42-063	$208,000	$139,900	8/1/2003	1
63	8707 E Sheridan St.	131-42-062	$230,000			1
64	8713 E Sheridan St.	131-42-061	$216,000	$85,000	9/1/1999	1
65	8717 E Sheridan St.	131-42-060	$276,500	$145,000	12/1/1998	1
66	8716 E Sheridan St.	131-42-059	$271,000			1
67	8710 E Sheridan St.	131-42-058	$202,500			1
68	8702 E Sheridan St.	131-42-057	$193,500			1
69	8701 E Lewis Ave.	131-42-049	$221,000			1
70	8707 E Lewis Ave.	131-42-048	$249,000			1
71	8712 E Lewis Ave.	131-42-046	$266,500	$199,000	5/1/2004	1
72	8702 E Lewis Ave.	131-42-045	$235,500			1
73	8701 E Wilshire Dr.	131-42-036	$236,500			1
74	8707 E Wilshire Dr.	131-42-035	$261,500	$102,000	12/1/1996	1

Channel/Interceptor Alternative
Cost Estimate

	Address	Parcel No.	2008 Assessors Value (Full Cash Value)	Sales Price	Date Purchased	# of Dwellings per Bldg
75	8708 E Wilshire Dr.	131-42-034	$257,000			1
76	8702 E Wilshire Dr.	131-42-033	$214,000	$320,000	12/1/2005	1
77	8701 E Virginia Ave.	131-42-002	$247,500			1
78	8709 E Virginia Ave.	131-42-001	$247,000	$152,590	1/1/2004	1
79	8702 E Virginia Ave.	131-41-135	$240,000			1
80	8708 E Virginia Ave.	131-41-136	$227,500	$69,000	2/1/1996	1
81	8714 E Virginia Ave.	131-41-137-B	$220,500	$89,300	7/1/1997	1
82	8701 E Cambridge Ave.	131-41-115	$220,500	$94,900	4/1/1997	1
83	8707 E Cambridge Ave.	131-41-114	$326,500			1
84	8708 E Cambridge Ave.	131-41-113	$294,500			1
85	8702 E Cambridge Ave.	131-41-112	$243,000	$292,000	6/1/2006	1
86	8701 E Windsor Ave.	131-41-090	$195,000			1
87	8707 E Windsor Ave.	131-41-089	$230,000	$159,900	10/1/2003	1
88	8713 E Windsor Ave.	131-41-088	$266,000			1
89	8710 E Windsor Ave.	131-41-087	$292,500			1
90	8702 E Windsor Ave.	131-41-086	$215,000	$152,000	11/1/2004	1
91	8701 E Roanoke Ave.	131-41-061	$206,500			1
92	8707 E Roanoke Ave.	131-41-060	$197,500	$113,000	9/1/2000	1
93	8711 E Roanoke Ave.	131-41-059	$256,500	$155,000	1/1/2004	1
94	8710 E Roanoke Ave.	131-41-058	$294,000	$142,500	2/1/2000	1
95	8702 E Roanoke Ave.	131-41-057	$215,000			1
96	8701 E Edgemont Ave.	131-41-030	$269,000	$316,000	10/1/2005	1
97	8709 E Edgemont Ave.	131-41-029	$217,000	$78,000	6/1/1998	1
700	No Assessors Information		$240,000			1
701	No Assessors Information		$240,000			1
702	No Assessors Information		$240,000			1
703	No Assessors Information		$240,000			1

Sub-Total	**$22,987,300**
25% Adjustment	**$28,734,125**

Adjustment based on comparison between Assessor's values and Zillow.com

Townhouses

	Address	Parcel No.	2008 Assessors Value (Full Cash Value)	Sales Price	Date Purchased	# of Dwellings per Bldg
	8521 E McDowell Rd., Lot I3	131-53-051	$102,500			1
	8521 E McDowell Rd., Lot B1	131-53-007	$102,500			1
	8521 E McDowell Rd., Lot B2	131-53-008	$79,000			1
	8521 E McDowell Rd., Lot B3	131-53-009	$102,500			1
	8521 E McDowell Rd., Lot A1	131-53-001	$102,500			1
	8521 E McDowell Rd., Lot A2	131-53-002	$79,000			1
	8521 E McDowell Rd., Lot A3	131-53-003	$102,500			1

Sub-Total	**$670,500**
25% Adjustment	**$838,125**

Adjustment based on comparison between Assessor's values and Zillow.com

Mobile Homes

	Address	Parcel No.	2008 Assessors Value (Full Cash Value)	Sales Price	Date Purchased	# of Mobile Homes
	Mobile Home Park		$50,000			21

Sub-Total	**$1,050,000**
25% Adjustment	**$1,312,500**

Adjustment based on comparison between Assessor's values and Zillow.com

Sub-Totals:	
Single Family Homes	**$22,987,300**
Townhouses	**$670,500**
Mobile Homes	**$1,050,000**
	x 25%
Total	**$30,884,750**

Note: Refer to FCDMC's 2002 study for additional ownership information. ID 700 and greater indicates one or several homes with no Assessors information. For Townhomes the Parcel No. and Address shown are for one building only.

3. PRC Alternative

Pima Road Conduit and Interception Structures
Quantities

Start	End	Direction	Section Size	Shape	No. of Barrels	D/S Fill Height	Conduit Costs: ADOT Table B-02.10	For average Use Table	Material	Reach Length (lf)	Total Conduit Length (lf)	ADOT Table B-02.10 (cy/lf)	Total Qty (cy)	Unit	Unit Cost ($/per)	Total
Osborn/86th	Osborn/87th	WE	10'x4'	Box	1	0	I	I	Concrete	540	540	1.102	595	cy	$425	$252,909
Osborn/87th	Osborn/Alley	WE	10'x5'	Box	1	1	I	I	Concrete	560	560	1.182	662	cy	$425	$281,316
Osborn/Alley	Osborn/Pima FR	WE	5'x6'	Box	1	3	I	I	Concrete	140	140	0.746	104	cy	$425	$44,387
Osborn/Pima FR	Fairmount Ave/Pima FR	SN	72	CIPP	2	3	n/a	n/a	Concrete	1,860	3,720	n/a	n/a	lf	$288	$1,071,360
Osborn/Pima FR	Earll/Pima FR	NS	72	CIPP	2	3	n/a	n/a	Concrete	1,230	2,460	n/a	n/a	lf	$288	$708,480
Earll/86th	Earll/Pima FR	WE	6'x4'	Box	1	0	I	I	Concrete	1,160	1,160	0.691	802	cy	$425	$340,663
Earll/Pima FR	Thomas/Pima	NS	102	CIPP	2	4	n/a	n/a	Concrete	1,310	2,620	n/a	n/a	lf	$408	$1,068,960
Thomas/87th	Thomas/Pima	WE	54	RCP	2	8	n/a	n/a	Concrete	255	510	n/a	n/a	lf	$270	$137,700
Thomas/Pima	McDowell/Pima	NS	120	CIPP	2	8	n/a	n/a	Concrete	5,280	10,560	n/a	n/a	lf	$480	$5,068,800
McDowell/Coronado	McDowell/Pima	WE	72	CIPP	2	16	n/a	n/a	Concrete	1,745	3,490	n/a	n/a	lf	$288	$1,005,120
McDowell/Pima	McKellips/Pima	NS	120	CIPP	2	15	n/a	n/a	Concrete	5,280	10,560	n/a	n/a	lf	$480	$5,068,800
McKellips/Pima	Salt River/Pima Align	NS	12'x16'	Box	1	12	V	IV	Concrete	4,550	4,550	3.165	14,401	cy	$425	$6,120,319
											40,870		16,564		Storm Drain:	$21,168,814

Interception Structures

		Qty (ea)	Unit	Unit Cost	Total
Salt River	CSA Penetration/Reconstruction	1	LS	$75,000	$75,000
	Outlet Structure	1	LS	$50,000	$50,000
	Flap Gate	1	LS	$25,000	$25,000
Pima Road at McKellips	Interception Structures	0	LS	$100,000	$0
Pima Road at McDowell	Drop Structure/Junction Structure	1	LS	$175,000	$175,000
Pima Road Conduit Appurtenances	Pipe Penetrations	330	EA	$750	$247,500
	Manholes	105	EA	$5,000	$525,000
McDowell/Coronado	Park Interception Structure	1	LS	$155,000	$155,000
	Junction Structure	1	LS	$45,000	$45,000
Thomas/87th	Transverse Grate/Curb Opening	1	LS	$75,000	$75,000
Thomas/Pima	Curb/Gutter Grates	1	LS	$210,000	$210,000
Earll/86th	Transverse Grates	1	LS	$75,000	$75,000
Earll/87th	Transverse Grates	1	LS	$125,000	$125,000
Earll/Alley	Channel Grates	6	LS	$15,000	$90,000
Earll/Pima Frontage Road	Transverse Grate Inlet	1	LS	$75,000	$75,000
	Junction Structure	1	LS	$50,000	$50,000
Osborne/86th	Curb/Gutter Grates	1	LS	$50,000	$50,000
	Transverse Grate	1	LS	$75,000	$75,000
Osborn/87th	Curb/Gutter Grates	1	LS	$25,000	$25,000
	Transverse Grate	1	LS	$25,000	$25,000
Osborn/Alley	Transverse Grates	1	LS	$25,000	$25,000
	Junction Structure	1	LS	$50,000	$50,000
Pima Frontage (Indian School to Osborn)	Transverse Grates	2	LS	$50,000	$100,000
Pima Frontage (Osborn to Earll)	Inverted Siphon	1	LS	$150,000	$150,000
				Structures:	$2,497,500

Unit Costs

CIPP Unit Cost ($/dia inch)	Class IV RCP Unit Cost ($/dia inch)	Structural Concrete Unit Cost ($/cy)	SRPMIC ROW Unit Cost ($/acres)
$4.00	$5.00	$425	$886,446

Right-of-way

Rights-of-Way Limits (SRPMIC)	Permanent Easement Area (acres)	Unit Cost ($/acres)	
From Earll to Roosevelt	4.85	$886,446	$4,297,920
From Roosevelt to Salt River	5.38	$886,446	$4,773,296
Total	10.23		$9,071,216

Cost Summary & Totals

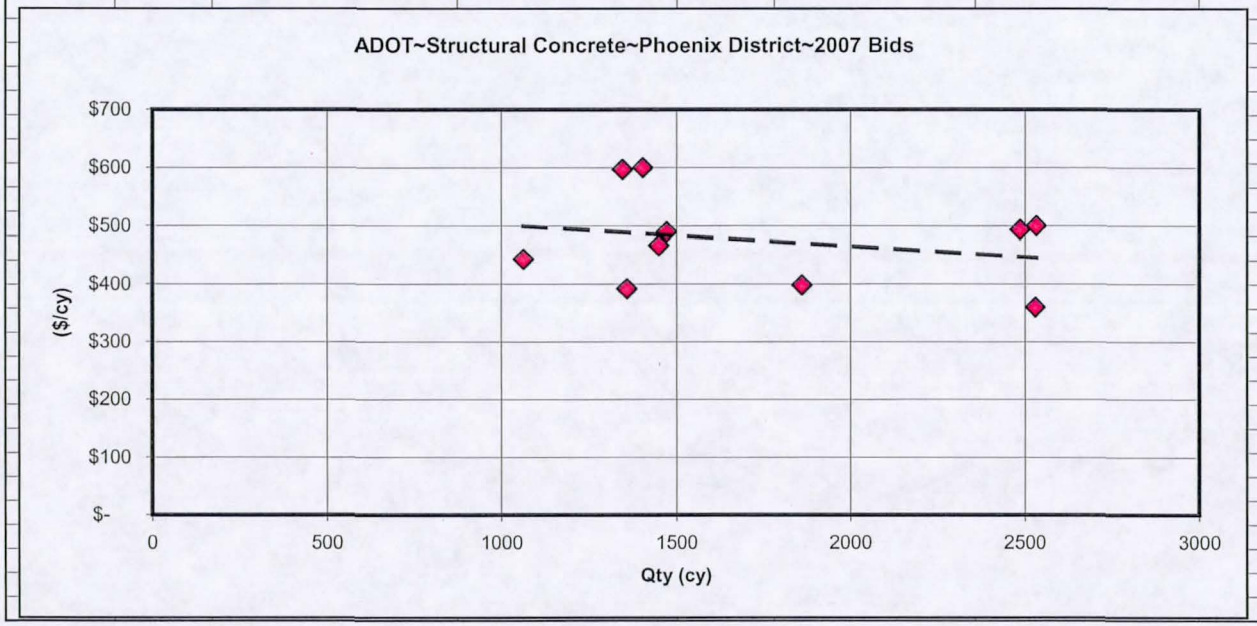
Storm Drain~Interception Structure Total		$23,666,314
Mobilization	7.00%	$1,656,642
Sub-Total		$25,322,956
Contingency	30.00%	$7,596,887
Sub-Total		$32,919,842
Design Engineering	6.50%	$2,139,790
Rights-of-way		$9,071,216
Grand Total		$44,130,848

Notes:
Interception Structure estimates anticipate:
~Pavement, curb, gutter and sidewalk removal/replacement
~Deep excavation shoring and protection
~Structural concrete
~Design of AASHTO loading grate support and fabrication
~Wall and floor thickness sized for momentum forces during large flows
~Thrust blocking
~Access barriers
~Maintenance Access
~Deep manholes
~First flush (small flows only) and sediment/debri capture
~Sound wall footing protection
~Utility protection/adjustments/encasement
~Traffic Control/Shoeflies

Unit Cost Research

ADOT Bid Tab Website: www.azdot.gov/e2c2/HistoricalPrice.aspx

Bid Date	Item#	Description	Project Name	Measure	Qty	State	Bidder1	Bidder2	Bidder3	Average Bid
3/16/2007	6010005	Structure Concrete (Class S) (F'c=4,500)	Shea Blvd - Loop 101	cu.yd.	1063	$ 450	$ 400	$ 410	$ 520	$ 443
3/16/2007	6010003	Structure Concrete (Class S) (F'c=3,500)	Shea Blvd - Loop 101	cu.yd.	1345	$ 400	$ 470	$ 550	$ 770	$ 597
2/16/2007	6010005	Structure Concrete (Class S) (F'c=4,500)	Jomax/Dixileta TI	cu.yd.	1358	$ 600	$ 350	$ 400	$ 425	$ 392
3/16/2007	6010003	Structure Concrete (Class S) (F'c=3,500)	Shea Blvd - Loop 101	cu.yd.	1403	$ 400	$ 470	$ 550	$ 780	$ 600
3/30/2007	6010005	Structure Concrete (Class S) (F'c=4,500)	SR 74 TI, Carefree Highway	cu.yd.	1449	$ 550	$ 400	$ 600	$ 400	$ 467
2/16/2007	6010005	Structure Concrete (Class S) (F'c=4,500)	Jomax/Dixileta TI	cu.yd.	1472	$ 700	$ 525	$ 470	$ 475	$ 490
2/16/2007	6010003	Structure Concrete (Class S) (F'c=3,500)	Jomax/Dixileta TI	cu.yd.	1861	$ 600	$ 360	$ 410	$ 425	$ 398
3/16/2007	6010005	Structure Concrete (Class S) (F'c=4,500)	Shea Blvd - Loop 101	cu.yd.	2486	$ 500	$ 430	$ 420	$ 630	$ 493
3/30/2007	6010003	Structure Concrete (Class S) (F'c=3,500)	SR 74 TI, Carefree Highway	cu.yd.	2530	$ 450	$ 280	$ 450	$ 350	$ 360
3/16/2007	6010005	Structure Concrete (Class S) (F'c=4,500)	Shea Blvd - Loop 101	cu.yd.	2533	$ 500	$ 430	$ 420	$ 650	$ 500
									Total Average:	$ 474
									Use Based on Proj. Qty.	$ 425



F. General Documentation and Correspondence

Jason Kelley

From: Amir Motamedi - FCDX [amm@mail.maricopa.gov]
Sent: Wednesday, November 21, 2007 3:02 PM
To: Strosnider, Scott
Cc: Jason Kelley; Afshin Ahouraiyan - FCDX; Julie Cox - FCDX; Thomas Loomis - FCDX
Subject: RE: Granite Reef Wash

Scott,

The Flood Control District will be formally adopting the NOAA 14 point rainfall data once the new Drainage Design Manuals for Maricopa County are adopted in early spring of 2008. With that in mind, Flood Control District has started using NOAA 14 on certain studies/designs with the expected completion dates scheduled after the above mentioned adoption date. This is also done on a case by case basis, to insure consistent design on the storm drainage systems (we don't want to change design parameters half way through construction of a channel).

Generally speaking, the end result of any hydrologic model should be calibrated and verified, regardless of rainfall data used. We usually do this by calibrating against actual events, or against other statistical and regression data. Even though we have no objection to your consultant investigating the effects of NOAA 14 on the design flows of the proposed storm drain system, we have very little data to calibrate and verify the "new" results.

Given the history of Granite Reef Wash hydrology and the many different peak discharges developed to date, and lack of certainty for these discharge estimates, it is our thought that generating new flows would not be very productive at this time, unless we have the data and the means to verify the new results.

Hope this answers your question, and please do not hesitate to contact me if I can be of any assistance.

Amir M. Motamedi, P.E.
Hydrology and Hydraulics Branch Manager
Flood Control District of Maricopa County
Tele:(602) 506-4871
Fax: (602) 506-4601
Web site: www.fcd.maricopa.gov

From: Strosnider, Scott [mailto:SStrosnider@Scottsdaleaz.gov]
Sent: Thursday, November 08, 2007 12:40 PM
To: Amir Motamedi - FCDX
Cc: Jason Kelley
Subject: Granite Reef Wash

Amir,

Quick question for you. Now that the district is accepting NOAA Atlas 14 rainfall data, should we update the Granite reef HEC-1 model from NOAA 2 to reflect the better rainfall data? I want to make sure the district is comfortable and accepting of this update before we do it.
Thank you,

Scott Strosnider, P.E., CFM
Sr. Stormwater Engineer
City of Scottsdale
7447 E. Indian School Road, Suite 205
Scottsdale, AZ 85251
(480) 312-7055
Fax: (480) 312-7971
SStrosnider@ScottsdaleAZ.gov
www.ScottsdaleAZ.gov

Flood Control District
of Maricopa County

INTEROFFICE MEMORANDUM

Date: July 20, 2007

To: Afshin Ahouraiyan, P.E.
Planning and Project Management Division

From: Julie Cox, Senior Hydrologist
Engineering Division

Subject: Granite Reef Wash HEC-1 Model Revisions by PSOMAS

I have reviewed the following items prepared and submitted by PSOMAS:

HEC-1 input and output files BASE6.DAT and BASE6.OUT, Excel spreadsheets, narrative descriptions of changes to the model and HEC-1 schematic changes to the model. My comments are listed below.

Hydrology/Hydraulics Comments

1. The warning message for the route RE03W states "FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT." The problem lies within the finite difference calculations of the kinematic wave routing method. Elimination of this warning message can be achieved by changing NDXMIN on the RK record. I recommend that the consultant use a value of 5 or greater for NDXMIN.

2. The warning message for sub-basins G04, D07, and C07 states "WARNING EXCESS AT PONDING LESS THAN 0 FOR PERIOD. EXCESS SET TO ZERO." This warning message is not an indication of model instability and can be disregarded.

3. Run the model with IO = 3. The warning message for multiple routings states "WARNING MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN __ AND __. THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS. THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH)."

I recommend that the consultant take the following steps to evaluate the warning messages:

a. Compare the routed peak discharge to the range listed in the warning message.
b. Compare the routed peak discharge to the inflow peak discharge to determine if an increase resulted due to the routing computations.

c. Plot the routed hydrograph and check for oscillations if either Item a. or b. above is a concern.

4. A 20% clogging factor was applied to the existing pipe flows. I recommend that the consultant model the existing pipe flows without applying a clogging factor. For the new (proposed) storm drain design, I recommend using an appropriate clogging factor for the inlets. This will entail changing DI/DQ records.

5. The PSOMAS report (when submitted) should state that HEC-1 Version 4.1 – June 1998 was used.

6. There are statements throughout the model that say "See the detention calculations in the Appendix", "See diversion calculation in Appendix D of Hydrology Report", and "The storage calculations can be found in the Appendix". Please modify the statements to say "See the ____ calculations in Appendix D of the Data Collection Notebook Granite Reef Wash Drainage Master Plan (Entellus April 2002).

7. Pipe routing RF05W is described as a 66" dia. (5.5' dia) RCP with a slope of 0.004 ft/ft. If this is correct, please change Fields 2 and 6 of the RK record to reflect this.

8. Both pipes RF05W and RF07W are reinforced concrete pipes. Why were different n values of 0.02 and 0.013 used? Please evaluate and change n values as necessary.

9. For pipe routings (examples RF07W and RE02W), I recommend that the consultant use kinematic wave rather than Muskingum-Cunge routing. Please use the RK record instead of the RD record.

10. Please check the rating table and input data for diversion DD13. At elevation 1234.98 ft in the rating table, the DQ record for Earll Drive is 3.0 cfs. I don't have the Flowmaster report to check, but I believe the entry in Column 2 of the DQ record in the model should be between 2.0 and 2.5 cfs.

11. Both the diversion and retrieval symbols show D01, rather than DD01, on Plate 4-2. Please change symbols to DD01. I believe the consultant already caught this.

Please stop by or call me at 602-506-8401 if you have any questions.

City of Scottsdale
Granite Reef Wash Drainage Study and Preliminary Design

Responses to FCDMC Review Comments for Base Hydrology
(Notes/Responses are in bold)

Note: The original model (GR6CIS.dat) was approved by the FCD. All updates/changes were based on the methods and procedures used in the *Data Collection Notebook Granite Reef Wash Drainage Master Plan* (April 2002).

1. The warning message for the route RE03W states "FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT." The problem lies within the finite difference calculations of the kinematic wave routing method. Elimination of this warning message can be achieved by changing NDXMIN on the RK record. I recommend that the consultant use a value of 5 or greater for NDXMIN. **Corrected. Warning message was resolved.**

2. The warning message for sub-basins G04, D07, and C07 states "WARNING EXCESS AT PONDING LESS THAN 0 FOR PERIOD. EXCESS SET TO ZERO." This warning message is not an indication of model instability and can be disregarded.

3. Run the model with IO = 3. The warning message for multiple routings states "WARNING MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN __ AND __. THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS. THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH)."

I recommend that the consultant take the following steps to evaluate the warning messages:

a. Compare the routed peak discharge to the range listed in the warning message.
b. Compare the routed peak discharge to the inflow peak discharge to determine if an increase resulted due to the routing computations.
c. Plot the routed hydrograph and check for oscillations if either Item a. or b. above is a concern. **Checked. Most routes were found to contain this message and have flows within the range. Only RC06 had an outflow larger than the inflow. The plot was checked and no oscillations were found.**

4. A 20% clogging factor was applied to the existing pipe flows. I recommend that the consultant model the existing pipe flows without applying a clogging factor. For the new (proposed) storm drain design, I recommend using an appropriate clogging factor for the inlets. This will entail changing DI/DQ records. **20% clogging factor was used in the original approved FCD model. Updated model was not changed.**

5. The PSOMAS report (when submitted) should state that HEC-1 Version 4.1 – June 1998 was used. **Will comply.**

6. There are statements throughout the model that say "See the detention calculations in the Appendix", "See diversion calculation in Appendix D of Hydrology Report", and "The storage calculations can be found in the Appendix". Please modify the statements to say "See the ____ calculations in Appendix D of the Data Collection Notebook Granite Reef Wash Drainage Master Plan (Entellus April 2002). **Complied. All mentioned statements were revised.**

7. Pipe routing RF05W is described as a 66" dia. (5.5' dia) RCP with a slope of 0.004 ft/ft. If this is correct, please change Fields 2 and 6 of the RK record to reflect this. **Corrected.**

8. Both pipes RF05W and RF07W are reinforced concrete pipes. Why were different n values of 0.02 and 0.013 used? Please evaluate and change n values as necessary. **Values were from original approved FCD model. Will change n value to 0.013.**

9. For pipe routings (examples RF07W and RE02W), I recommend that the consultant use kinematic wave rather than Muskingum-Cunge routing. Please use the RK record instead of the RD record. **Routing was based on original approved FCD model. Updated model was not changed.**

10. Please check the rating table and input data for diversion DD13. At elevation 1234.98 ft in the rating table, the DQ record for Earll Drive is 3.0 cfs. I don't have the Flowmaster report to check, but I believe the entry in Column 2 of the DQ record in the model should be between 2.0 and 2.5 cfs. **Corrected. 3.0 changed to 2.0 cfs.**

11. Both the diversion and retrieval symbols show D01, rather than DD01, on Plate 4-2. Please change symbols to DD01. I believe the consultant already caught this. **Corrected. D01 changed to DD01.**

G. Survey Field Notes

GRW SURVEY CONTROL

1CI1, 896809.959, 707517.516, 1219.461, 33ø27'55.08162"N, 111ø53'31.24288"W, 1121.982, GDACS CONTROL

COS 4254, 904931.6, 704986.8, 1238.13, 33ø29'15.427"N, 111ø54'01.097"W, 1140.71, 1/2"RB IN HOLE DOWN 0.4'

COS 4364, 899644.9, 704955.5, 1226.95, 33ø28'23.130"N, 111ø54'01.476"W, 1129.49, BCHH

COS 5014, 894356.7, 704906.0, 1202.64, 33ø27'30.818"N, 111ø54'02.070"W, 1105.14, COS BCHH

COS 5122, 891721.5, 707529.9, 1192.13, 33ø27'04.746"N, 111ø53'31.111"W, 1094.62, ADOT BCHH DOWN 0.5'

AVALON, 903335.996, 707387.696, 1231.520, 33ø28'59.63874"N, 111ø53'32.75715"W, 1134.083, 3" COS BC FLUSH w/PUNCH NO ID

GRW PANEL COORDINATES - COS GROUND

710,905731.282,702995.738,1241.503,MCS * 3/4" COTTON PICKER SPINDLE FL
711,905718.690,704990.349,1239.496,MCS * 3/4" COTTON PICKER SPINDLE FL
712,905690.791,707321.039,1237.684,MCS * 3/4" COTTON PICKER SPINDLE FL
715,903832.859,705255.150,1235.157,MCS * 3/4" COTTON PICKER SPINDLE FL
716,903833.750,702956.882,1236.154,MCS * 3/4" COTTON PICKER SPINDLE FL
717,902018.001,703046.912,1232.164,MCS * 3/4" COTTON PICKER SPINDLE FL
718,901996.164,705159.587,1231.893,MCS * 3/4" COTTON PICKER SPINDLE FL
719,901994.764,707279.919,1223.220,MCS * 3/4" COTTON PICKER SPINDLE FL
721,900326.954,706846.164,1218.431,MCS * 3/4" COTTON PICKER SPINDLE FL
723,898063.467,706749.856,1218.391,MCS * 3/4" COTTON PICKER SPINDLE FL
725,896046.010,706756.569,1215.003,MCS * 3/4" COTTON PICKER SPINDLE FL
727,893845.185,706781.137,1193.822,MCS * 3/4" COTTON PICKER SPINDLE FL
736,885174.330,708645.182,1190.756,MPK * MAGNAIL FL IN AC
735,885671.735,706769.265,1192.851,MPK * MAGNAIL FL IN AC
713,905718.535,708077.368,1236.826,MIR * 1/2" RB w/PUNCH FL
714,904029.690,707999.712,1234.152,MIR * 1/2" RB w/PUNCH FL
720,901945.660,708032.939,1210.995,MPK * MAGNAIL FL IN AC
722,900337.141,708634.453,1214.974,MNL * CONC NAIL FL IN CONC
724,898186.887,708641.789,1233.863,MNL * CONC NAIL FL IN CONC
726,895940.656,708587.722,1226.203,MPK * MAGNAIL FL IN AC
728,893838.954,708631.285,1193.960,MIR * 1/2" RB w/PUNCH FL
730,891689.816,708605.860,1194.677,MPK * MAGNAIL FL IN AC
731,889517.968,706752.162,1186.913,MIR * 1/2" RB w/PUNCH FL
729,891724.307,706810.235,1191.520,MPK * MAGNAIL FL IN AC
733,887373.884,706737.212,1180.105,MIR * 1/2" RB w/PUNCH FL
734,887379.125,708668.876,1158.265,MIR * 1/2" RB w/PUNCH FL
732,889535.396,708107.972,1191.599,MIR * 1/2" RB w/PUNCH FL
737,892681.451,702975.984,1190.786,MCS * 3/4" COTTON SPINDLE FL
738,892725.277,704762.354,1193.879,MCS * 3/4" COTTON SPINDLE FL
739,892704.315,706757.279,1191.884,MCS * 3/4" COTTON SPINDLE FL
740,891832.202,702255.653,1191.234,MPK * MAGNAIL FL IN AC
741,890592.377,702231.340,1188.172,MPK * MAGNAIL FL IN AC
742,889534.395,703478.742,1182.347,MIR * 1/2" RB w/PUNCH FL
743,889529.824,704859.577,1185.112,MIR * 1/2" RB w/PUNCH FL
744,888432.630,702183.441,1180.716,MPK * MAGNAIL FL IN AC
745,886351.988,702301.920,1178.455,MIR * 1/2" RB w/PUNCH FL
746,886549.235,702971.128,1172.992,MIR * 1/2" RB w/PUNCH FL
747,886596.827,704845.741,1170.739,MIR * 1/2" RB w/PUNCH FL
748,886736.935,706639.163,1153.423,MIR * 1/2" RB w/PUNCH FL

H. Electronic Files