2008P020

CMX

MEMORANDUM

May 8, 2008

Mr. Kenneth N. Rakestraw
Hydrologist
Engineering Division
Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, Arizona 85009

RE: **Arizona Grand Resort – Guadalupe FRS Emergency Spillway Analysis**
Revision of Hydraulic (HEC-RAS) Model and Storage Volume Comparison

Dear Mr. Rakestraw:

During a meeting held at the Flood Control District of Maricopa County (FCDMC) on April 15th, Greg Smith and Jacob Priego (CMX) introduced the right-of-way permit application for a proposed golf hole realignment at the Arizona Grand Resort. The proposed golf course modifications will alter the topography for portions of the existing golf course located within a watershed easement maintained by the FCDMC, including terrain located within the Guadalupe Flood Retarding Structure (FRS) reservoir area.

Near the conclusion of the April 15th meeting, it was noted that while the proposed elevation contours for the golf course modifications would result in a net increase to the FRS storage capacity measured to the top of the dam (1281.50 feet), there was a net decrease when assessing the storage capacity up to the emergency spillway crest elevation (1,274 feet).

Following the meeting with FCDMC, CMX coordinated a revision to the proposed elevation contours such that the resulting storage capacity upstream of and below the spillway crest would be equal to or greater than the existing-condition capacity. The purpose of this memorandum is to present revisions to the hydraulic analyses that were previously prepared for the Guadalupe FRS Spillway Analysis Report (CMX, April 2008), included in the original right-of-way permit packet. This memorandum and the revisions included herein serve as an addendum to the original Guadalupe FRS Spillway Analysis Report prepared in April of this year by CMX. This memorandum includes four attachments, which include the following information:

Attachment A.	Revised Hydraulic Models (HEC-RAS) Output and HEC-RAS Exhibit (Figure 3).
Attachment B.	Revised Storage Volume Comparison Calculations and Storage Volume Comparison Exhibit (Figure 4).
Attachment C.	Revised Grading Plan drawings GC01 (Golf Course Renovations (Hole #1)) and GC02 (Existing Golf Course (Hole #18)).
Attachment D.	CD Containing Revised Digital Files.

During the April 15th meeting, Mr. Dan Lawrence (FCDMC) indicated that it would be desirable for CMX to coordinate with the Hydrology and Hydraulics (H&H) Branch of the FCDMC to establish a tolerance between proposed elevation contours submitted in conjunction with the proposed golf course modifications, and the as-built elevations that will be surveyed in the field following construction. During a phone conversation held April 29th between yourself, Amir Motamedi (FCDMC H&H Branch), Michael Weinberg (CMX), and myself, we agreed that a reasonable tolerance of 0.5 feet was appropriate; that if elevation differences between the as-built and

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proposed conditions were less than or equal to this value, then new hydraulic and storage capacity analyses would not be required. Otherwise, a new hydraulic model and storage volume comparison would be generated based on the as-built information and submitted for approval.
Please note that CMX has indicated to the landscape architect, who will be responsible for in-field supervision of the work performed by the contractor, that the proposed elevation contours signify finished grade elevations, and that as-built elevations must match as near as possible the proposed elevation contours.

Lastly, during the meeting noted above, it was mentioned that the previous spillway report (Tetra Tech, 2002) had included an analysis to determine any negative impacts on the spillway approach section due to potential effects of momentum and super elevation caused by wave action generated by the proposed grading changes. After discussing this issue with you over the phone, we appreciate your feedback that because the currently proposed changes do not include any significant changes to the alignment of the spillway approach section, a momentum/super elevation analysis will not be required for the permit review performed by FCDMC.

The following sections provide descriptions and results based on the revised hydraulic analyses performed using the new proposed elevation contours.

HYDRAULIC MODEL (HEC-RAS)

As discussed above, an updated Proposed Conditions HEC-RAS model has been executed by CMX to reflect the revised proposed elevation contours. Two cross-sections not present in the original model have been added downstream of river station (RS) 1. These sections are labeled RS 0.9 and RS 0.8, bringing the total number of cross-sections to fifteen (15). Each of the sections was re-extracted using a digital surface representing the new proposed topography for the study area.

The results of the updated Proposed Conditions HEC-RAS model, as compared to the Base and Existing Conditions models are presented in Table 1. The information presented in Table 1 below represents an updated version of the information previously presented in Table 7-2 of the original Spillway Analysis Report prepared by CMX in April of this year.

TABLE 1
Water Surface Elevation (WSE) and Flow Velocity Comparisons (1)

HEC-RAS River Station	Base		Existing		Proposed	
	WSE	Flow Vel (ft/sec)	WSE	Flow Vel (ft/sec)	WSE	Flow Vel (ft/sec)
10	1,281.6	1.2	1,281.6	1.2	1,281.6	1.2
9	1,281.5	2.3	1,281.5	2.3	1,281.5	2.3
8	1,281.5	2.7	1,281.5	2.7	1,281.5	2.7
7	1,281.4	3.7	1,281.4	3.7	1,281.4	3.7
6.7			1,281.4	3.2	1,281.4	3.3
6.5			1,281.4	3.6	1,281.4	3.5
6	1,281	6.0	1,281	6.0	1,281	5.9
5	1,280.5	7.6	1,280.5	7.6	1,280.5	7.6
4	1,280	9.6	1,280	9.6	1,280	9.6
3	1,278.7	12.3	1,278.7	12.3	1,278.7	12.3
2	1,278	12.2	1,278	12.2	1,278	12.2
1.4			1,275.1	11.8	1,275.1	11.8
1	1,270.7	11.9	1,270.7	11.9	1,270.4	12.1
0.9			1,268.7	13.1	1,267.9	12.6
0.8			1,264.9	13.4	1,264.7	13.3

Note:
(1) WSE based on PMF Discharge = 11,545 cfs; Flow Vel is average channel velocity.

To provide a comparison of existing and proposed flow characteristics at the two additional cross-sections, RS 0.8 and RS 0.9, the Existing Conditions HEC-RAS model was also updated to include the new sections. All other cross-sections and input parameters for the Existing Conditions model remained the same as provided in the original Spillway Analysis Report. Output from the revised Existing Conditions HEC-RAS model is included within Attachment A.

STORAGE VOLUME COMPARISON

Based on the revised proposed elevation contours, an updated stage-storage relationship was developed for the area located within the boundary of the planned grading modifications (i.e. comparison boundary). This relationship was updated by finding the areas of each proposed contour located within the comparison boundary. Where a contour intersected the comparison boundary line, a polyline was drawn along the comparison boundary until meeting again with the contour at another location within the comparison boundary, thus forming a closed polyline for the contour. The stage-storage relationship was then computed using the average-end-area method, where the incremental volume between consecutive contours is computed as follows:

$$V_{inc} = (A_1 + A_2) / 2 * D$$

Where V_{inc} = incremental volume, ft^3.
A_1, A_2 = areas for consecutive contours, ft^2.
D = contour interval between consecutive contours, ft.

Cumulative volumes for each contour interval were then computed by summing the incremental volumes for the preceding contours, in this manner:

$$V_{cum\ n} = V_{inc\ 1} + V_{inc\ 2} + V_{inc\ 3} + \ldots + V_{inc\ n}$$

Where $V_{cum\ n}$ = cumulative volume at elevation n.
$V_{inc\ 1}$, $V_{inc\ 2}$, $V_{inc\ 3}$, ... = incremental volumes for consecutive elevation contours up to and including elevation n.

The cumulative storage volumes for the proposed conditions were then compared to existing condition values to determine the net increase or decrease in storage capacity at each contour interval.

A summary of the storage volume comparison based on average-end-area method is presented in Table 2. Detailed storage volume comparison calculations are presented in Attachment B, which represents a revised version of the calculations previously presented as Table C1 in the original Spillway Analysis Report (CMX, Apr 2008).

TABLE 2
Summary of Storage Volume Comparison Calculations (1)

Elevation (ft)	Cumulative Storage Volumes		
	Existing (ft^3)	Proposed (ft^3)	Proposed – Existing (2) (ft^3)
1,266	0	0	0
1,267	4,443	2,548	1,894
1,268	12,375	10,166	2,209
1,269	22,855	22,616	239
1,270	37,152	38,867	-1,715
1,271	56,461	58,457	-1,996
1,272	80,881	81,844	-962
1,273	109,872	108,540	1,331
1,274	142,104	137,644	4,459
1,275	177,143	168,954	8,190
1,276	215,009	203,365	11,644
1,277	255,510	240,678	14,832
1,278	298,362	279,686	18,677
1,279	343,170	320,829	22,341
1,280	389,748	364,064	25,684
1,281	438,147	409,542	28,605
1,282	487,885	456,786	31,099

Notes:
(1) Based on average-end-area method
(2) Positive values represent net increase to storage capacity; negative values represent net decrease.

Based on the results presented in Table 2, the proposed golf course grading modifications will cause a net increase to the existing FRS storage capacity of approximately 4,459 cubic feet (165 cubic yards) measured at the emergency spillway crest elevation (1,274 feet), and a net increase of approximately 29,852 cubic feet (1,106 cubic yards) measured at the top elevation of the FRS reservoir (1,281.5 feet). The latter estimate of net capacity increase at elevation 1,281.5 feet is based on the average between the storage volumes presented in Table 2 at elevations 1,281 feet and 1,282 feet.

The Storage Volume Comparison Exhibit, previously designated as Figure 4 in the Spillway Analysis Report, has been updated based on the revised proposed elevation contours, and is included within Attachment B. This figure shows the comparison boundary within which storage volume comparison calculations were confined.

CONCLUSIONS

The results of the revised Proposed Conditions HEC-RAS model indicate that the proposed elevation contours associated with the golf hole realignment project will not cause an increase to the water surface elevation or flow velocity of storm water discharge passing over the emergency spillway during the PMF storm event.

The results of the revised storage volume comparison indicate that the proposed golf course grading modifications will yield a net increase to the existing FRS storage capacity measured at the emergency spillway crest elevation, as well as a net increase to the overall storage capacity as evaluated at the top elevation of the reservoir.

Based on communication that we have had with you and Amir Motamedi, representatives of the H&H Branch of the FCDMC, CMX understands that 0.5 feet is an acceptable tolerance for the difference between the proposed elevation contours presented within the revised grading plan, sheet GC02, and the future as-built elevations that will be surveyed within the project limits. Following construction of the planned golf course modifications, a new hydraulic analysis for the spillway and FRS storage capacity need not be re-submitted, provided that the maximum difference between as-built elevations and proposed elevations within the project work limits is less than 0.5 feet. Should the maximum difference exceed the accepted tolerance, a new analysis shall be prepared to reflect as-built conditions.

REFERENCES

Communication between CMX and FCDMC representatives during April 15, 2008 meeting and subsequent email/phone correspondence.

CMX, April 2008. *Guadalupe FRS Spillway Analysis Report for Arizona Grand Resort.* Phoenix, Arizona.

We hope this information assists you in the review of the right-of-way permit application for the Arizona Grand Resort Golf Hole Realignment Project. Should you have any questions or require additional information please contact the undersigned at 602.567.1900.

Best regards,

CMX, L.L.C.

Ryan P. Harrell

Ryan Harrell, P.E.
Project Engineer

Registered Professional Engineer (Civil) CERTIFICATE NO. 47268 RYAN P. HARRELL Date Signed 5-08-08 ARIZONA, U.S.A.
Expires: 3/31/11

Michael Weinberg, P.E.
Drainage Group Manager

Registered Professional Engineer (Civil) CERTIFICATE NO. 36390 MICHAEL WEINBERG Date Signed 5/08/08 ARIZONA, U.S.A.

Enclosures

CC List:

Shelby Brown (FCDMC) for distribution to various review branches of the District
Nichole Spence-Gibson (ADWR)
Michael Weinberg (CMX)
Jacob Priego (CMX)
Greg Smith (CMX)
Stan Gray (Arizona Grand Resort)

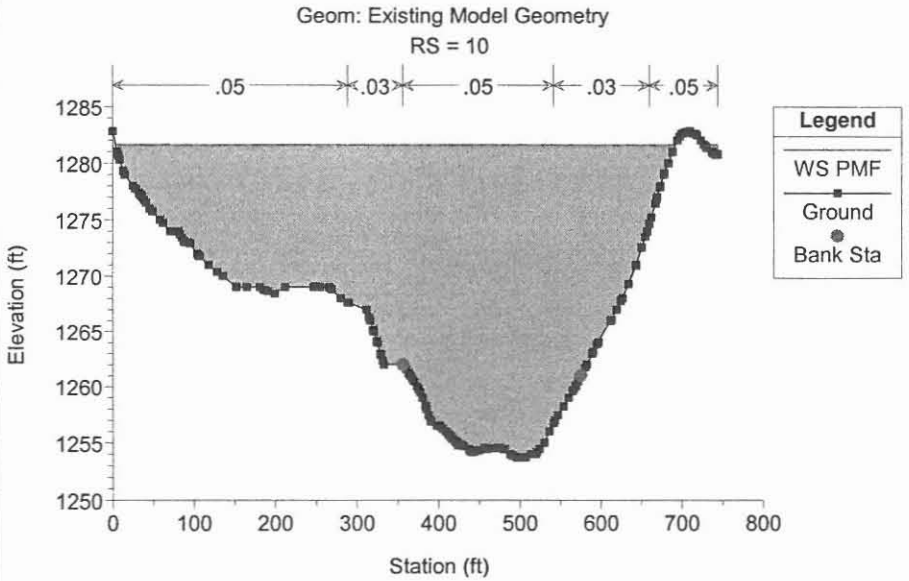
ATTACHMENT A

Revised Existing Conditions Hydraulic Model (HEC-RAS) Output

Revised Proposed Conditions Hydraulic Model (HEC-RAS) Output

Revised HEC-RAS Exhibit (Figure 3)

EXISTING CONDITIONS MODEL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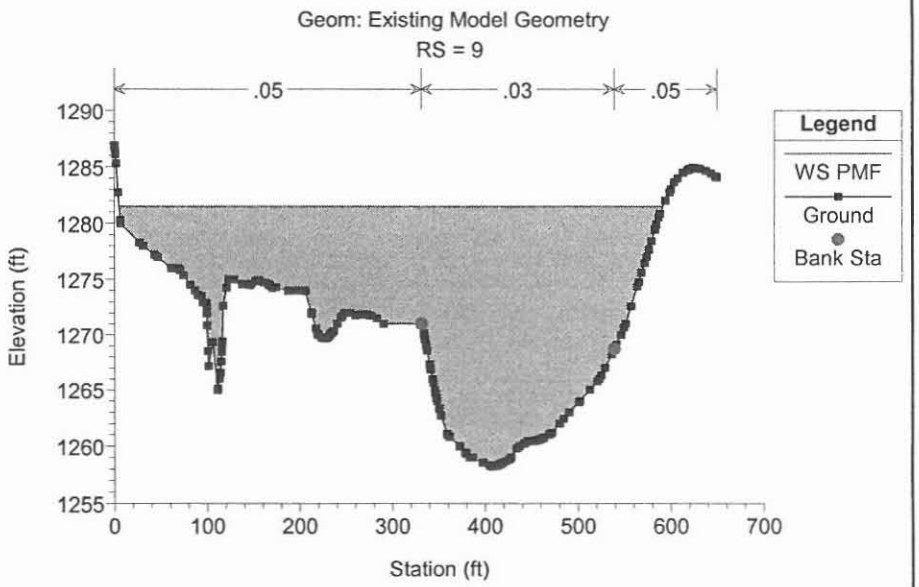
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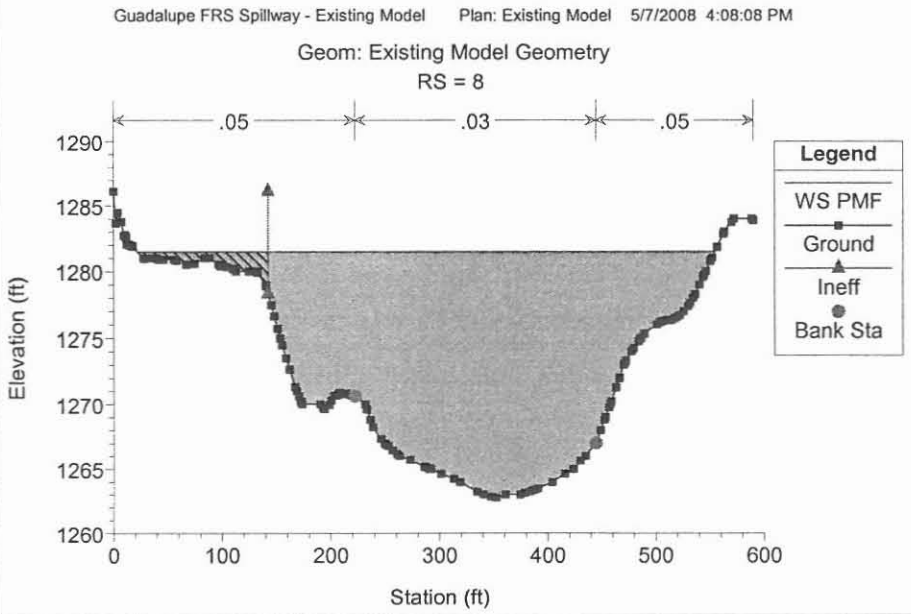
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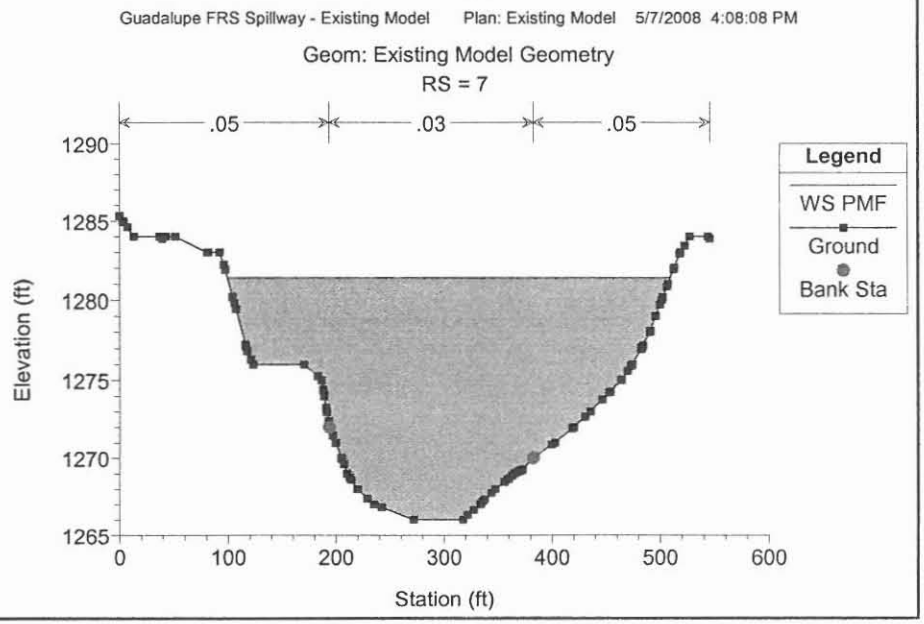
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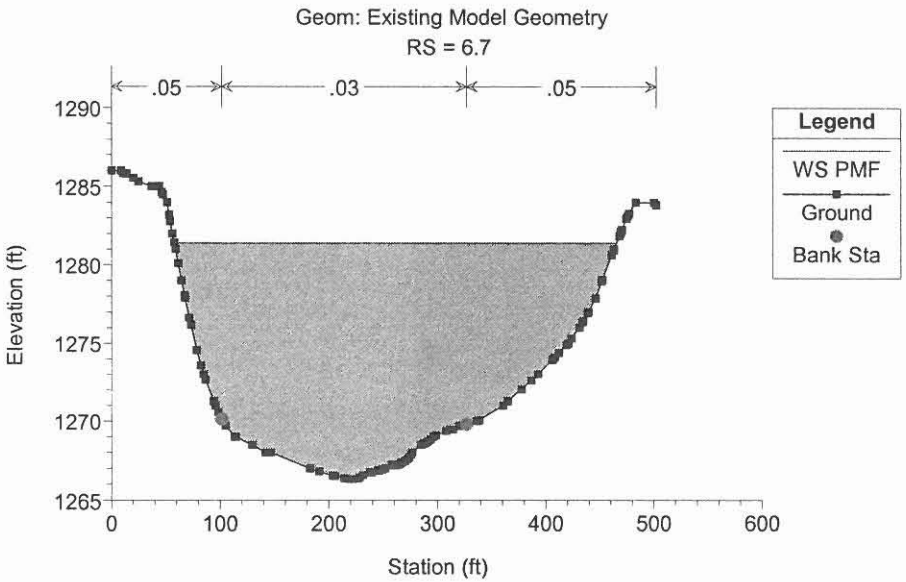
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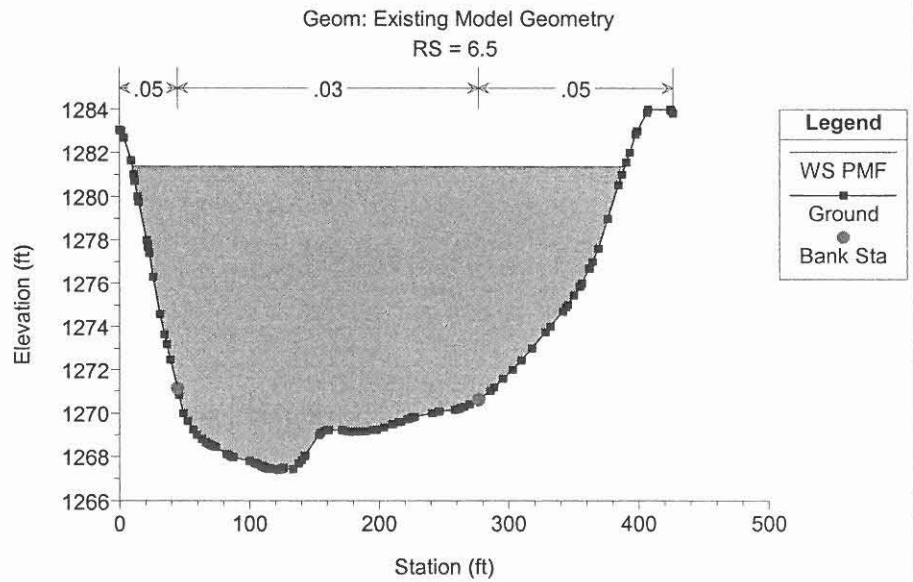
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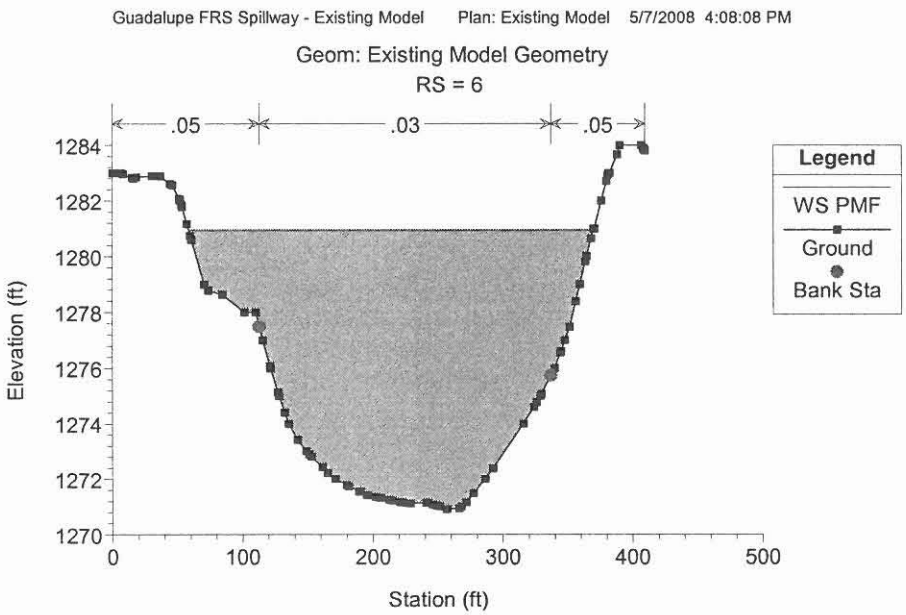
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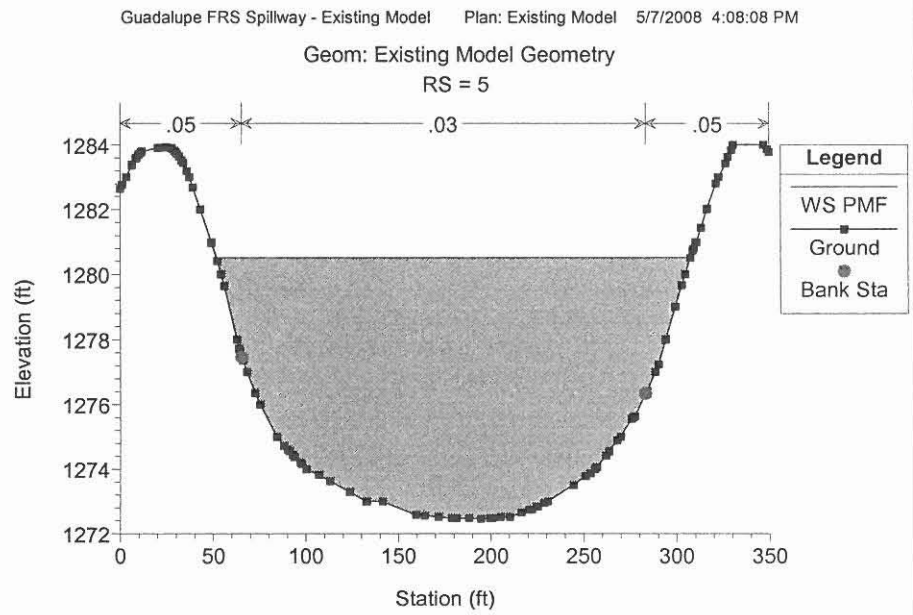
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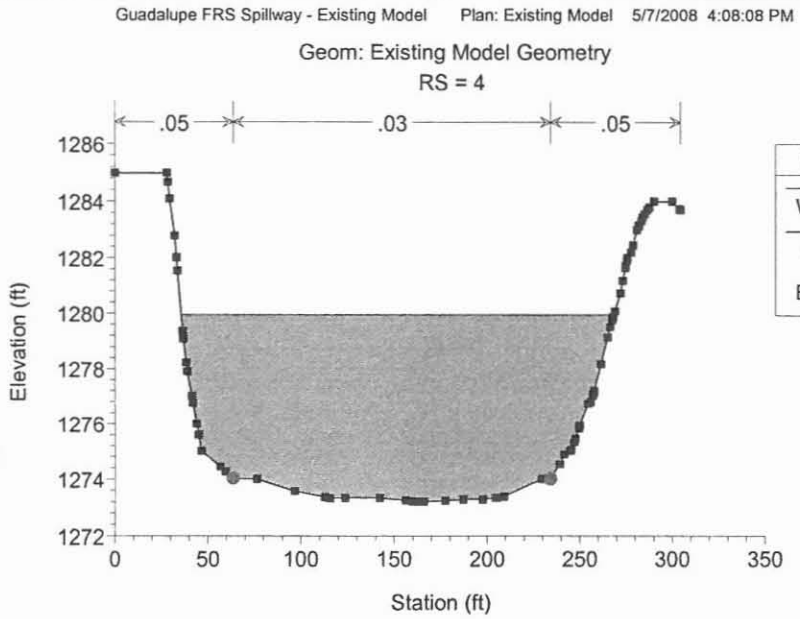
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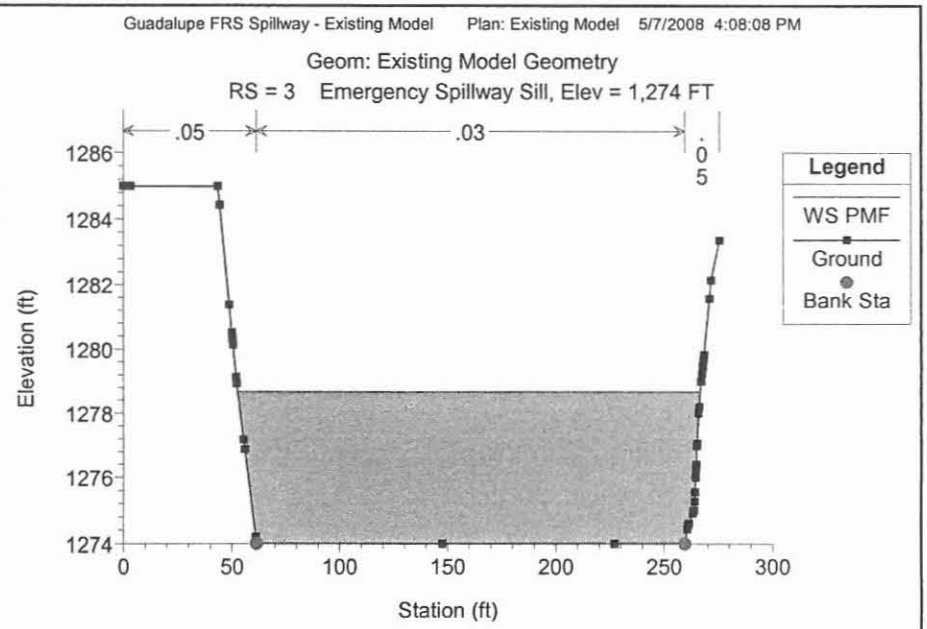
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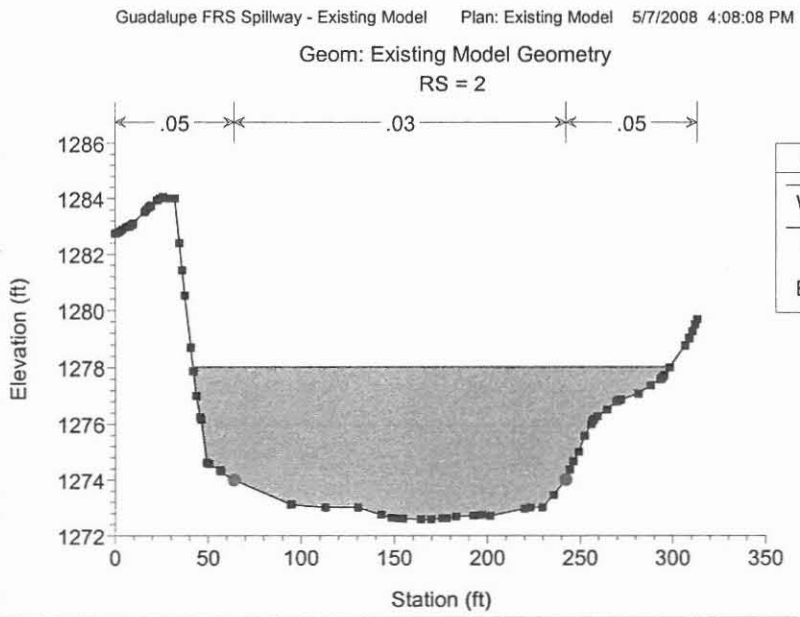
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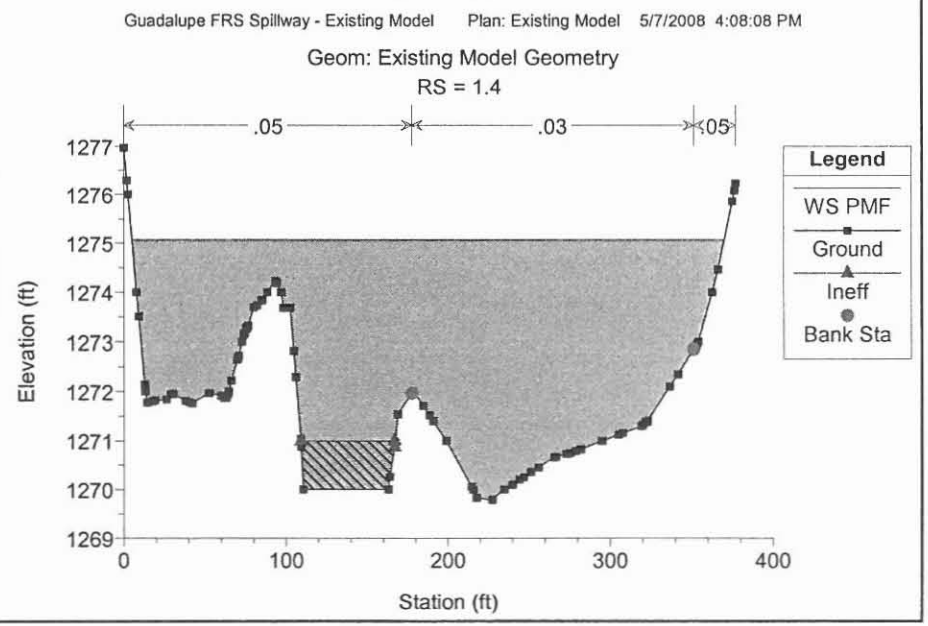
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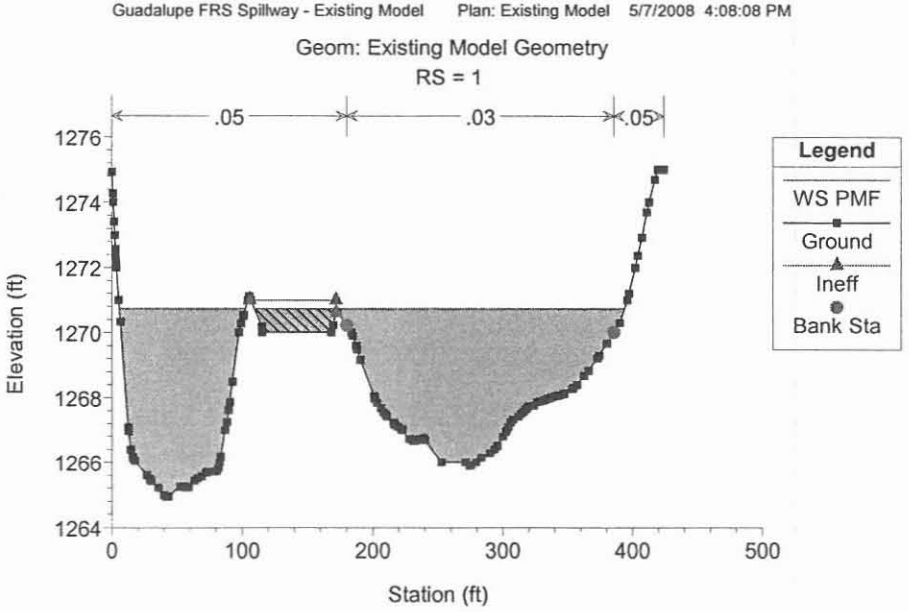
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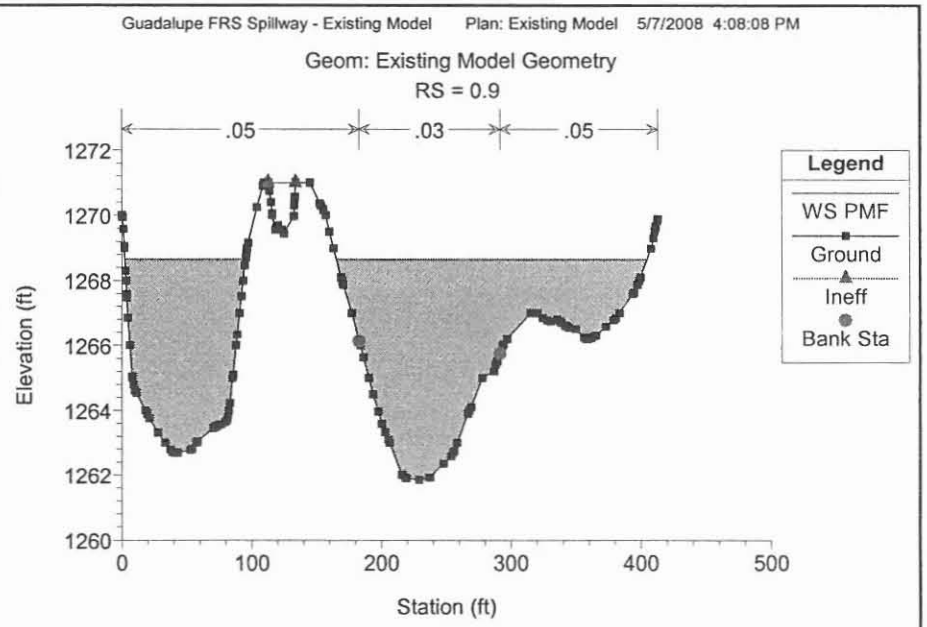
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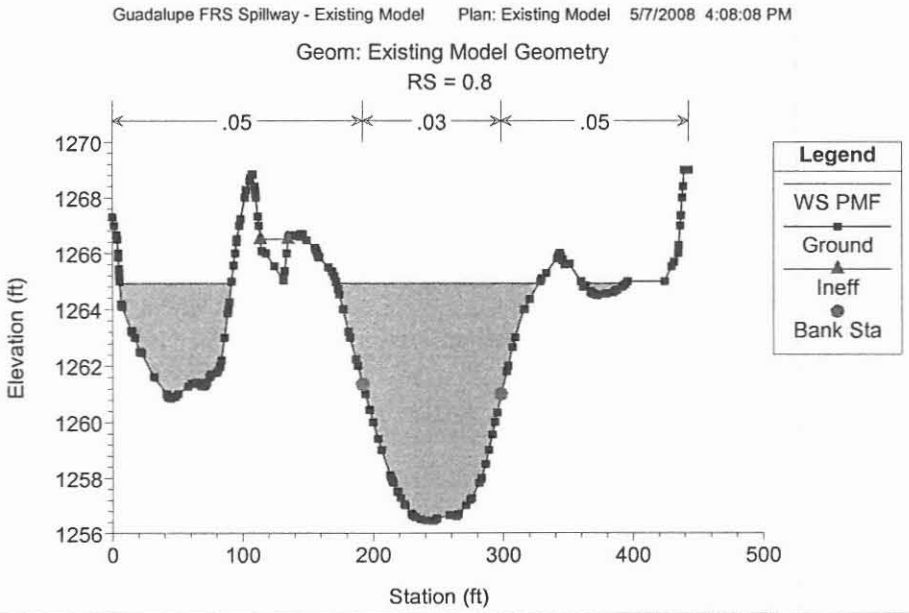
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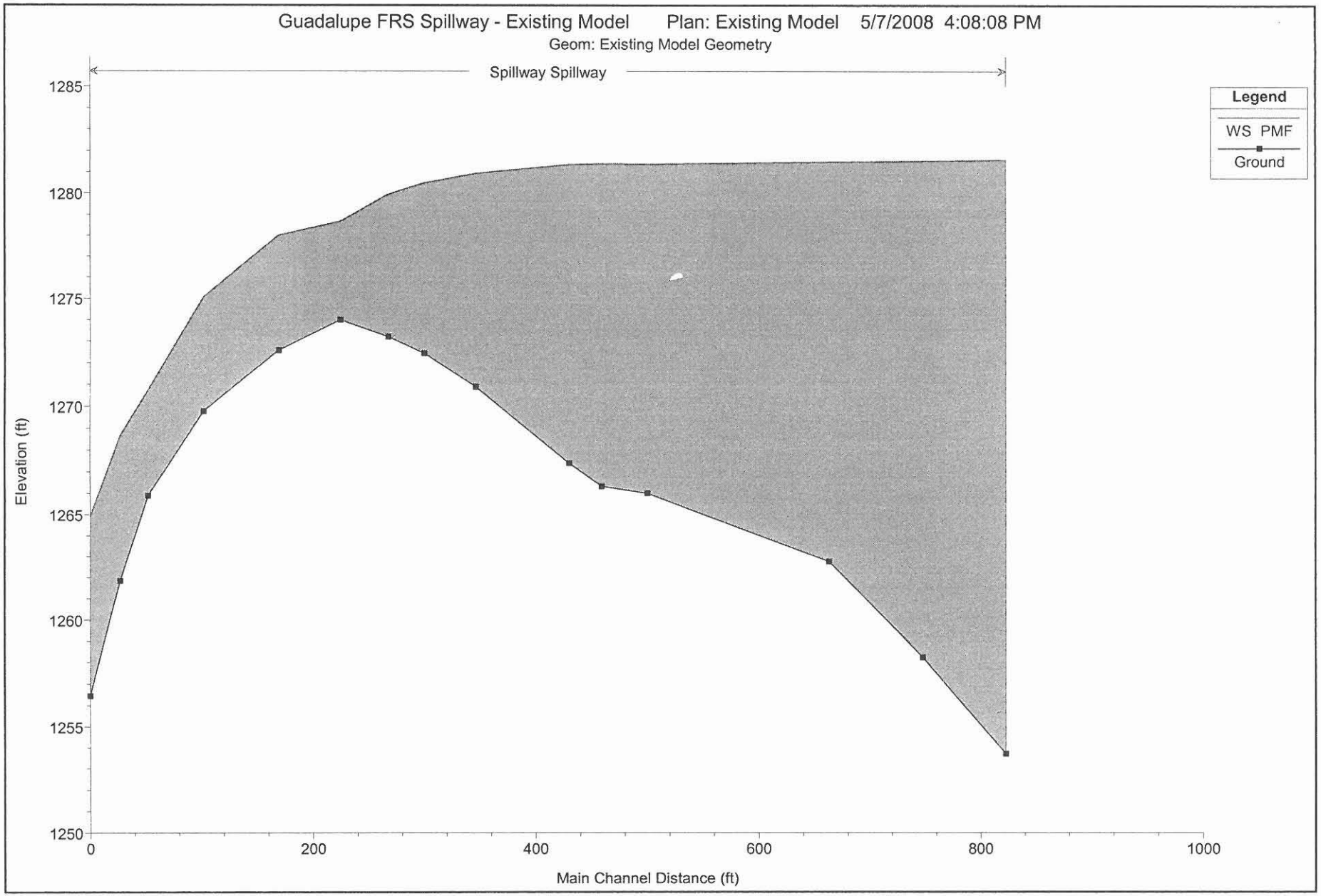
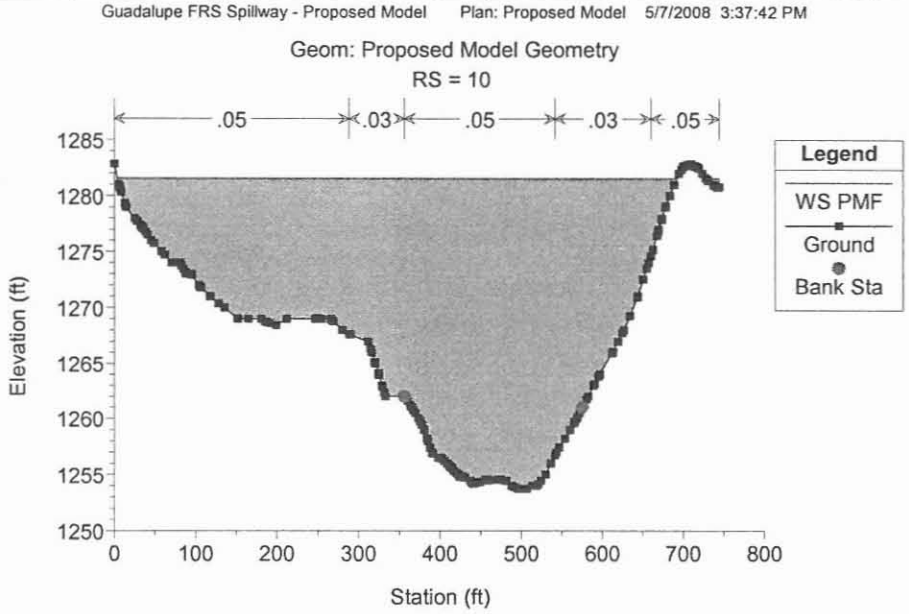
HEC-RAS Plan: Existing River: Spillway Reach: Spillway Profile: PMF

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)	
Spillway	10	PMF	11545.00	1253.71	1281.59	1260.41	1281.61	0.000018	1.20	10922.97	705.05	0.04
Spillway	9	PMF	11545.00	1258.24	1281.54	1266.10	1281.60	0.000041	2.30	7054.94	586.92	0.09
Spillway	8	PMF	11545.00	1262.77	1281.49	1269.20	1281.59	0.000072	2.73	5159.22	532.82	0.12
Spillway	7	PMF	11545.00	1266.00	1281.39	1272.35	1281.57	0.000167	3.70	4006.13	409.36	0.17
Spillway	6.7	PMF	11545.00	1266.33	1281.41	1272.17	1281.55	0.000130	3.21	4402.54	407.86	0.15
Spillway	6.5	PMF	11545.00	1267.40	1281.37	1273.22	1281.54	0.000180	3.56	3825.84	379.81	0.18
Spillway	6	PMF	11545.00	1270.90	1280.95	1276.86	1281.48	0.000848	5.95	2097.80	310.80	0.36
Spillway	5	PMF	11545.00	1272.45	1280.51	1278.06	1281.39	0.001791	7.59	1576.35	255.49	0.51
Spillway	4	PMF	11545.00	1273.20	1279.96	1278.45	1281.27	0.003083	9.55	1349.32	232.81	0.66
Spillway	3	PMF	11545.00	1274.00	1278.67	1278.67	1280.97	0.007854	12.27	968.08	213.94	1.00
Spillway	2	PMF	11545.00	1272.57	1278.02	1278.02	1280.22	0.007031	12.19	1048.43	256.67	0.96
Spillway	1.4	PMF	11545.00	1269.78	1275.07	1275.07	1276.79	0.008621	11.81	1264.88	364.98	1.03
Spillway	1	PMF	11545.00	1265.89	1270.73	1270.73	1272.60	0.012207	11.90	1089.83	381.32	1.17
Spillway	0.9	PMF	11545.00	1261.85	1268.66	1268.66	1270.62	0.007641	13.09	1244.34	332.27	1.00
Spillway	0.8	PMF	11545.00	1256.44	1264.93	1264.93	1267.41	0.005372	13.39	1104.66	276.21	0.88


Guadalupe FRS Spillway - Existing Model Plan: Existing Model 5/7/2008 4:08:08 PM
Geom: Existing Model Geometry
Spillway Spillway
Legend
WS PMF
Ground
Elevation (ft)
1285
1280
1275
1270
1265
1260
1255
1250
0
200
400
600
800
1000
Main Channel Distance (ft)

PROPOSED CONDITIONS MODEL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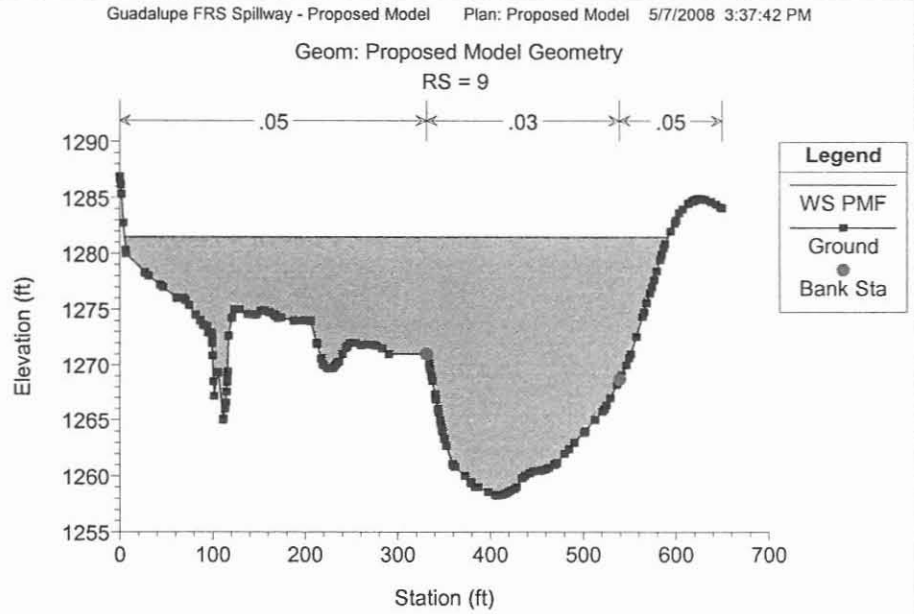
Geom: Proposed Model Geometry
RS = 10
.05
.03
.05
.03
.05
Legend
WS PMF
Ground
Bank Sta
Elevation (ft)
Station (ft)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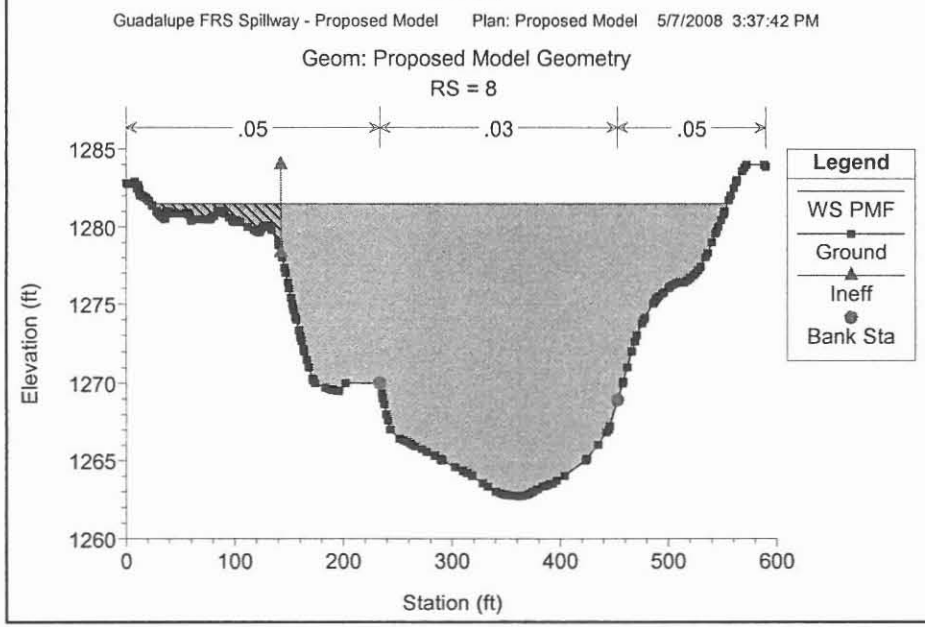
Geom: Proposed Model Geometry
RS = 9
.05
.03
.05
Legend
WS PMF
Ground
Bank Sta
Elevation (ft)
Station (ft)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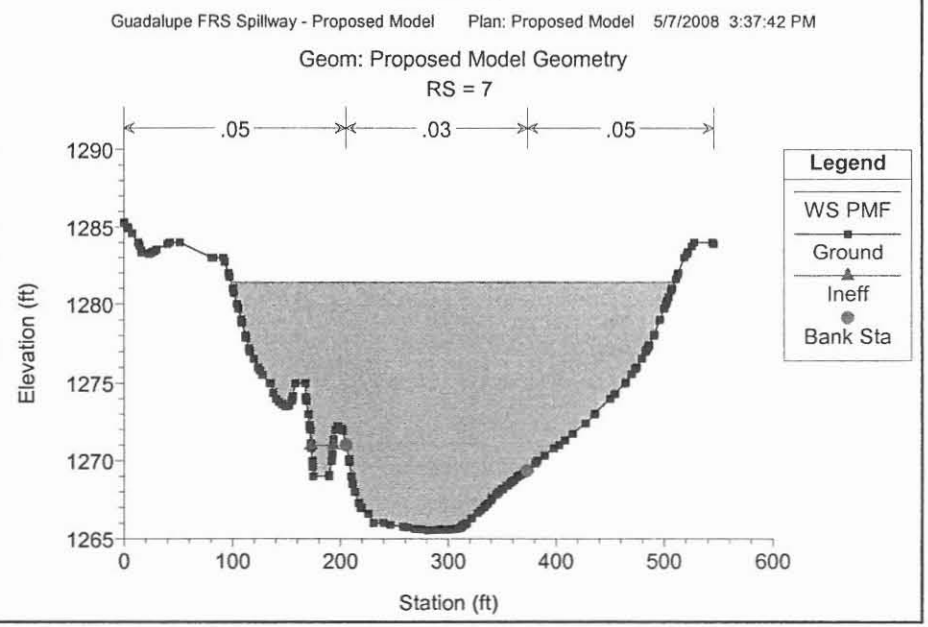
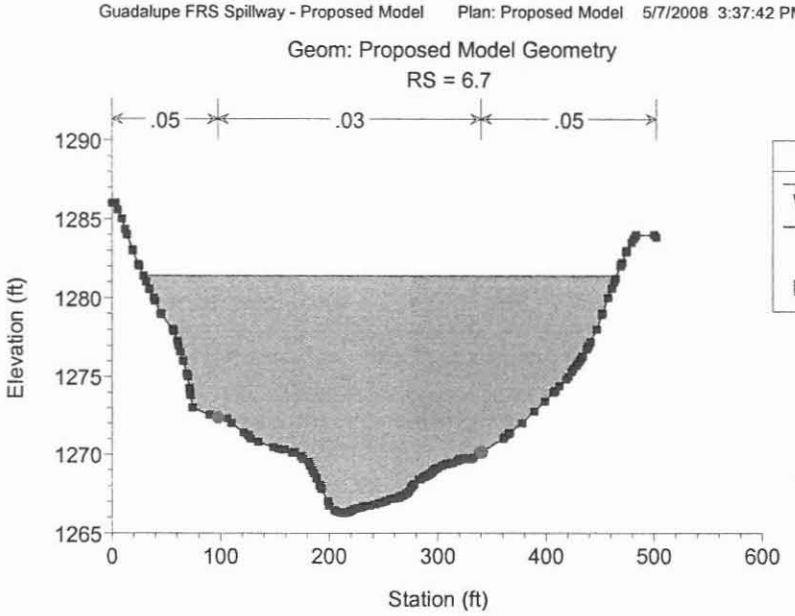
Geom: Proposed Model Geometry
RS = 8
.05
.03
.05
Legend
WS PMF
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Guadalupe FRS Spillway - Proposed Model Plan: Proposed Model 5/7/2008 3:37:42 PM
Geom: Proposed Model Geometry
RS = 7
.05
.03
.05
Legend
WS PMF
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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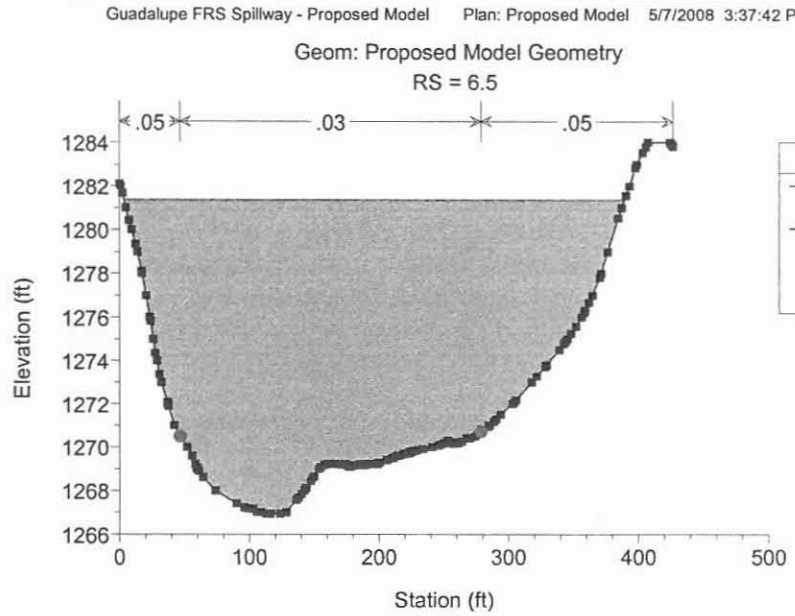
Geom: Proposed Model Geometry
RS = 6.7
.05
.03
.05
Legend
WS PMF
Ground
Bank Sta
Elevation (ft)
Station (ft)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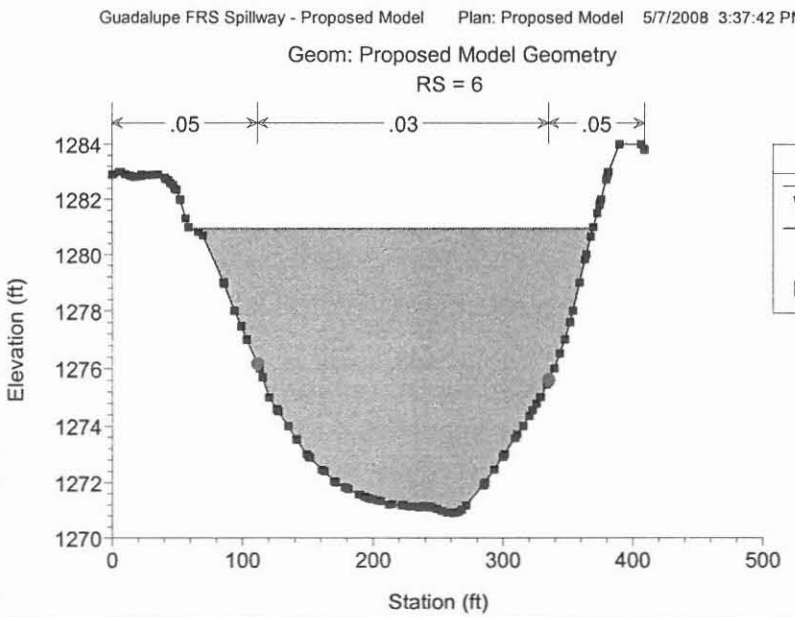
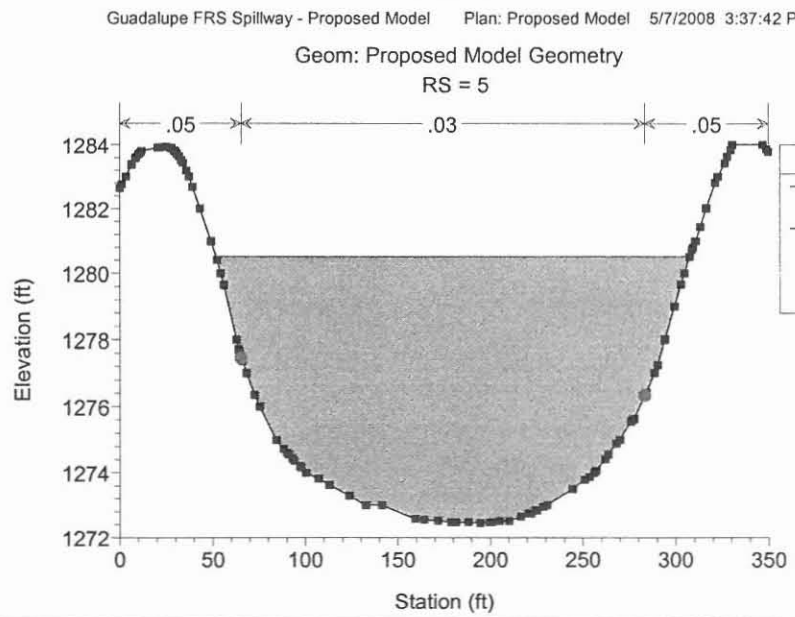
Geom: Proposed Model Geometry
RS = 6.5
.05
.03
.05
Legend
WS PMF
Ground
Bank Sta
Elevation (ft)
Station (ft)

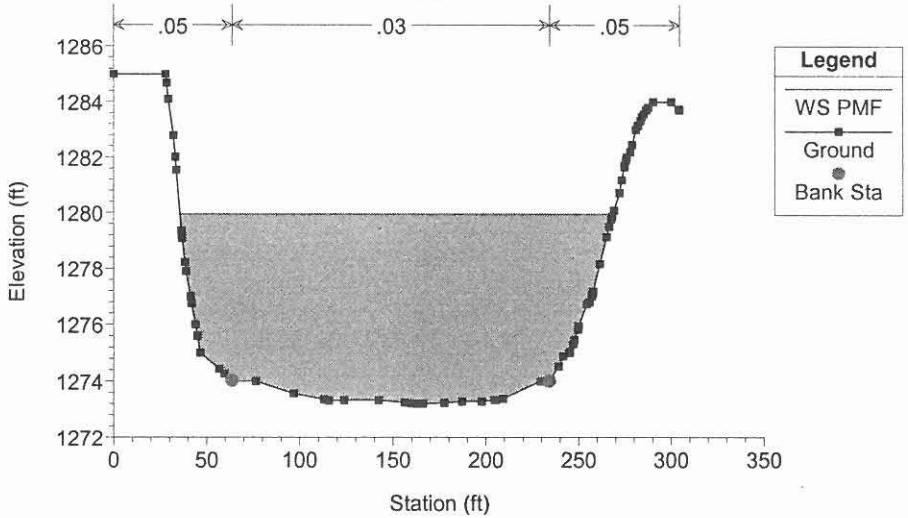

Guadalupe FRS Spillway - Proposed Model Plan: Proposed Model 5/7/2008 3:37:42 PM
Geom: Proposed Model Geometry
RS = 6
.05
.03
.05
Legend
WS PMF
Ground
Bank Sta
Elevation (ft)
Station (ft)


Guadalupe FRS Spillway - Proposed Model Plan: Proposed Model 5/7/2008 3:37:42 PM
Geom: Proposed Model Geometry
RS = 5
.05
.03
.05
Legend
WS PMF
Ground
Bank Sta
Elevation (ft)
Station (ft)

Guadalupe FRS Spillway - Proposed Model Plan: Proposed Model 5/7/2008 3:37:42 PM

Geom: Proposed Model Geometry

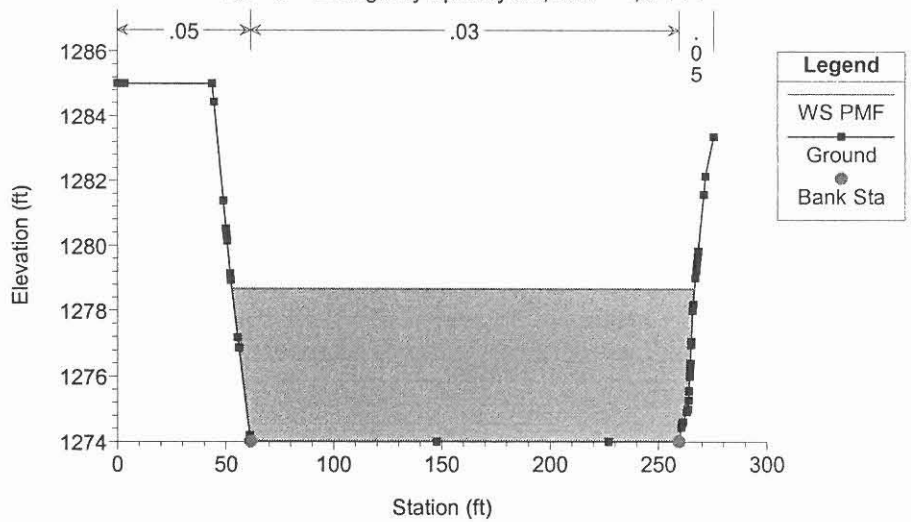
RS = 4



Guadalupe FRS Spillway - Proposed Model Plan: Proposed Model 5/7/2008 3:37:42 PM

Geom: Proposed Model Geometry

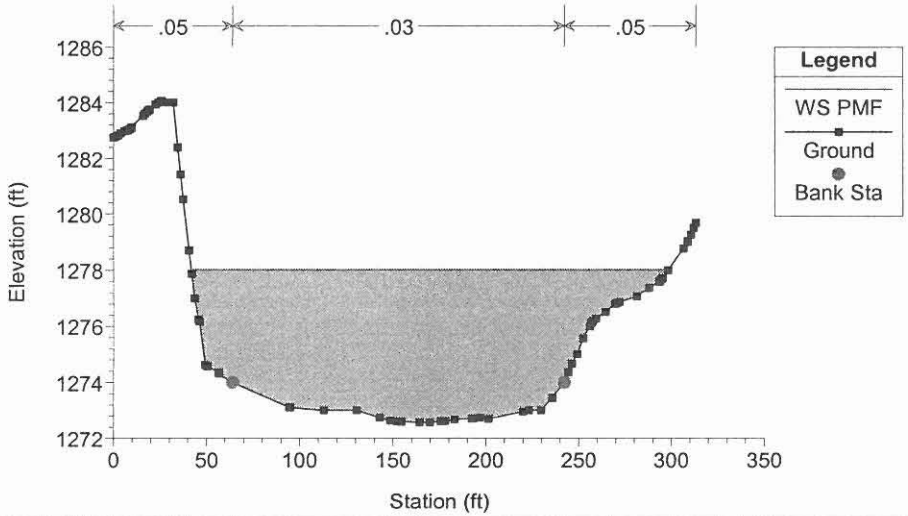
RS = 3 Emergency Spillway Sill, Elev = 1,274 FT



Guadalupe FRS Spillway - Proposed Model Plan: Proposed Model 5/7/2008 3:37:42 PM

Geom: Proposed Model Geometry

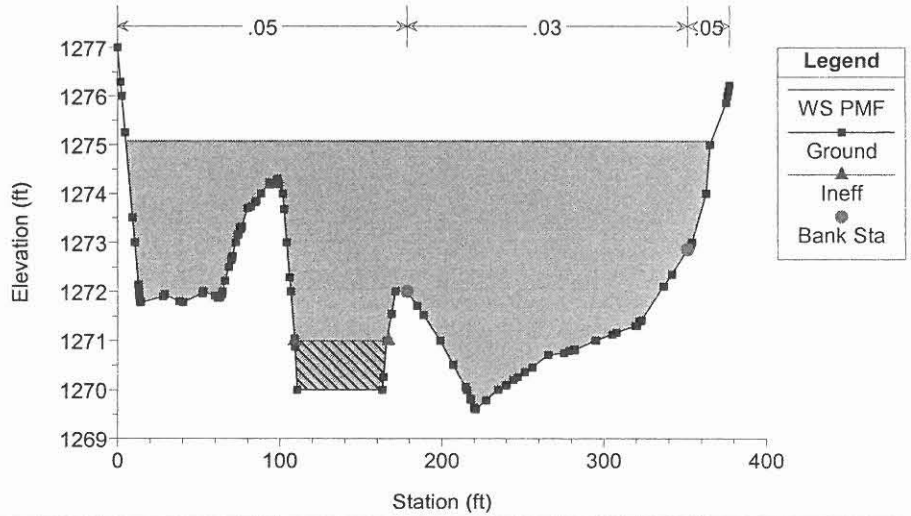
RS = 2



Guadalupe FRS Spillway - Proposed Model Plan: Proposed Model 5/7/2008 3:37:42 PM

Geom: Proposed Model Geometry

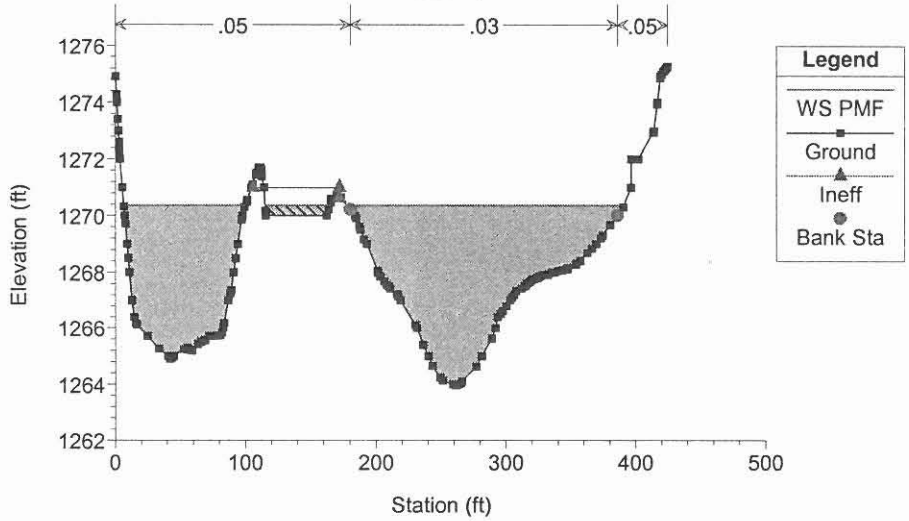
RS = 1.4



Guadalupe FRS Spillway - Proposed Model Plan: Proposed Model 5/7/2008 3:37:42 PM

Geom: Proposed Model Geometry

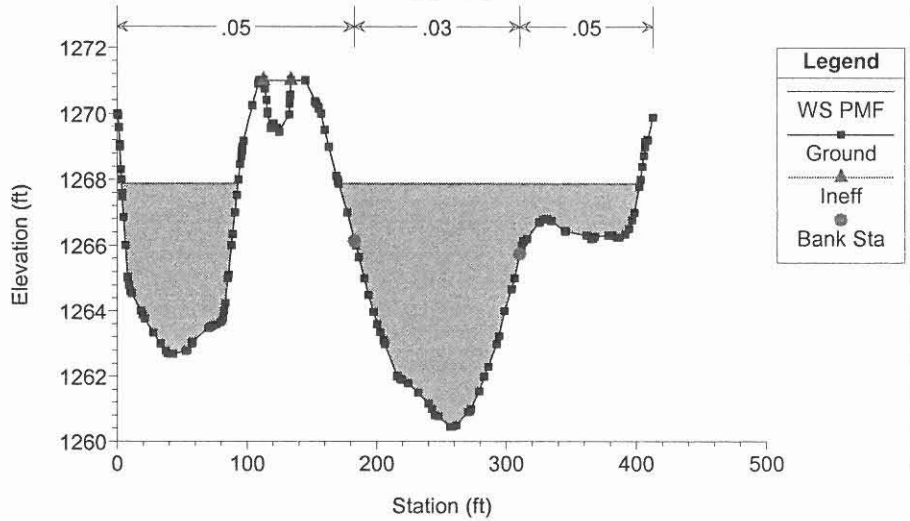
RS = 1



Guadalupe FRS Spillway - Proposed Model Plan: Proposed Model 5/7/2008 3:37:42 PM

Geom: Proposed Model Geometry

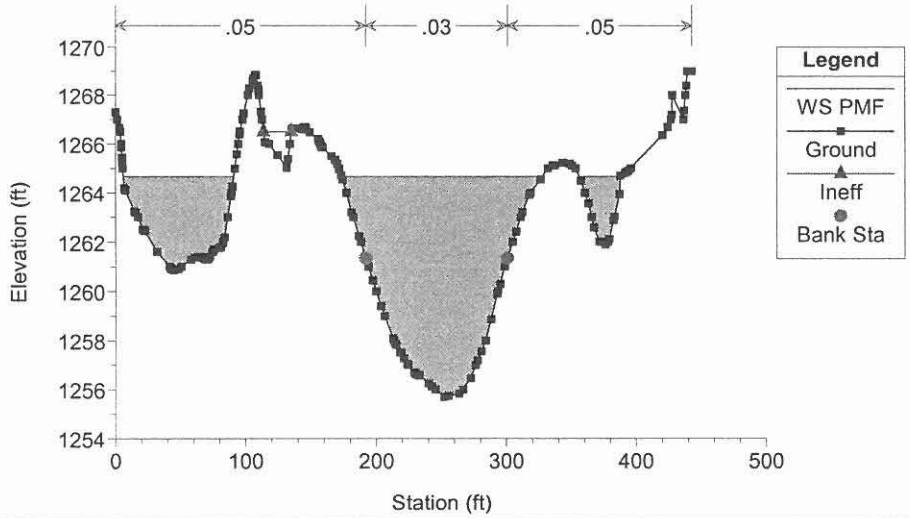
RS = 0.9



Guadalupe FRS Spillway - Proposed Model Plan: Proposed Model 5/7/2008 3:37:42 PM

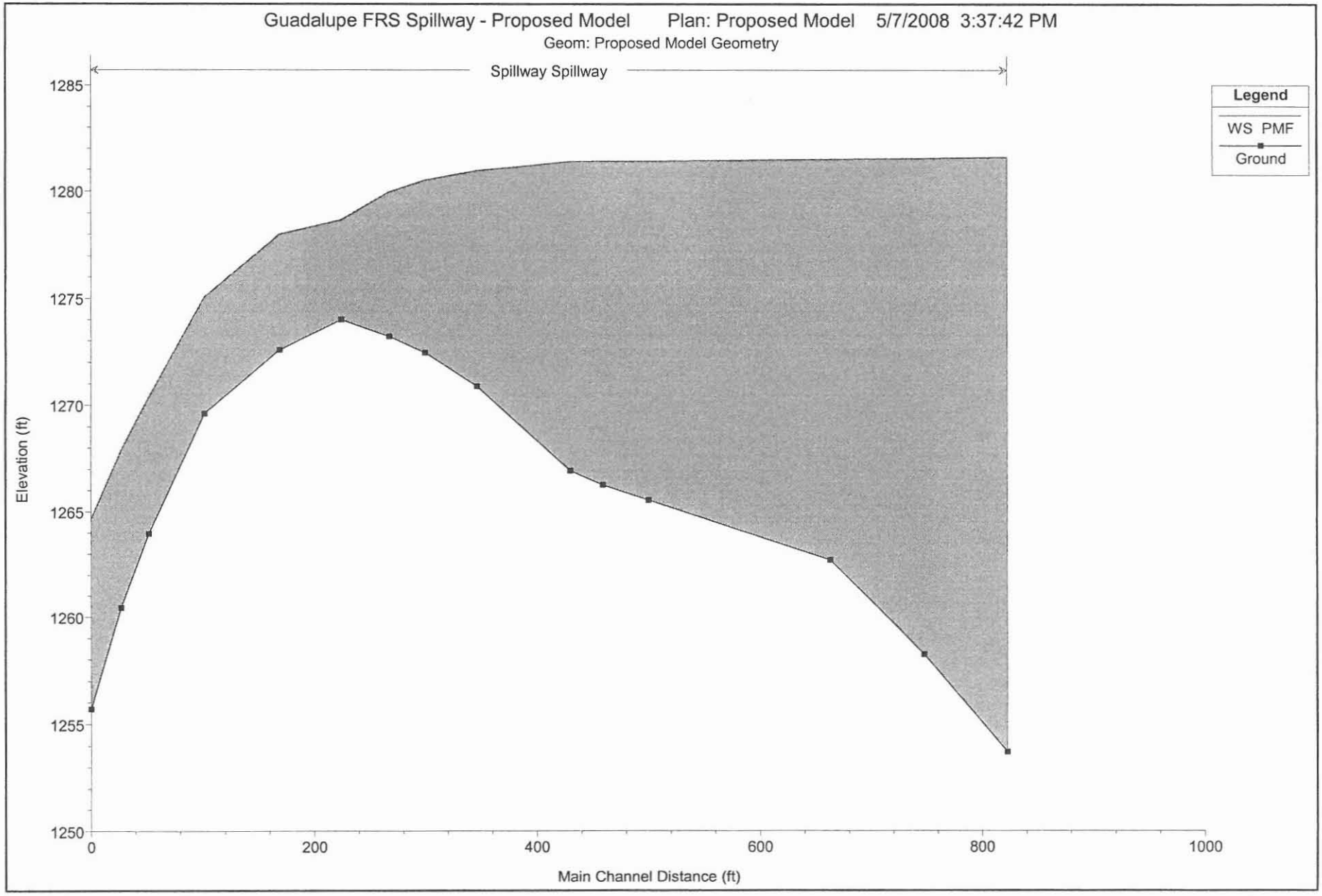
Geom: Proposed Model Geometry

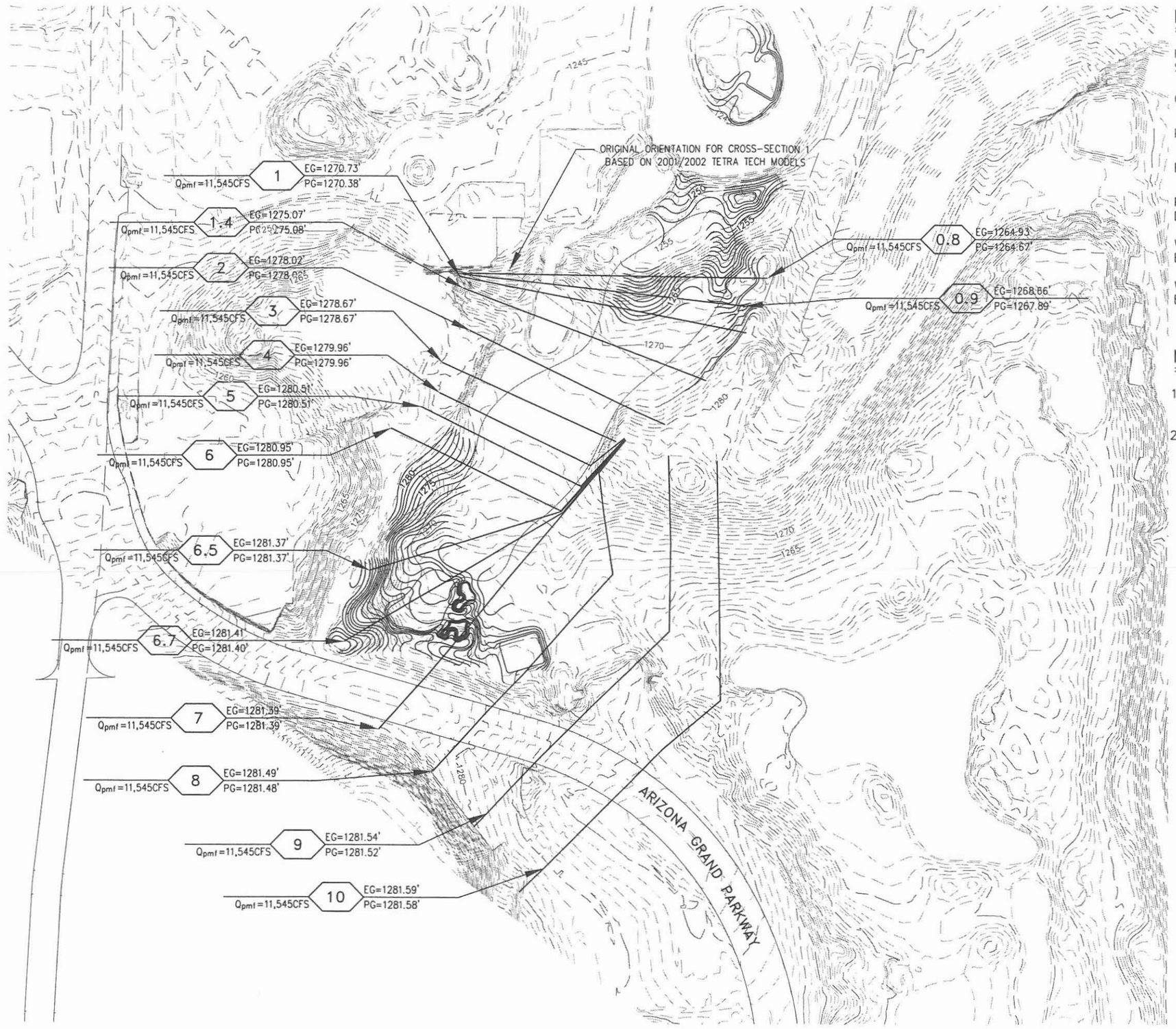
RS = 0.8



HEC-RAS Plan: Proposed River: Spillway Reach: Spillway Profile: PMF

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)	
Spillway	10	PMF	11545.00	1253.71	1281.58	1260.41	1281.60	0.000019	1.20	10915.48	704.82	0.04
Spillway	9	PMF	11545.00	1258.24	1281.52	1266.10	1281.59	0.000041	2.30	7048.64	586.85	0.09
Spillway	8	PMF	11545.00	1262.70	1281.48	1269.15	1281.58	0.000071	2.72	5194.36	532.44	0.12
Spillway	7	PMF	11545.00	1265.53	1281.39	1272.00	1281.56	0.000154	3.67	4259.10	410.25	0.17
Spillway	6.7	PMF	11545.00	1266.25	1281.40	1273.09	1281.55	0.000154	3.29	4271.21	437.06	0.16
Spillway	6.5	PMF	11545.00	1266.92	1281.37	1273.11	1281.54	0.000173	3.51	3900.63	386.15	0.17
Spillway	6	PMF	11545.00	1270.89	1280.95	1276.82	1281.48	0.000823	5.91	2109.52	308.99	0.36
Spillway	5	PMF	11545.00	1272.45	1280.51	1278.06	1281.39	0.001791	7.59	1576.35	255.49	0.51
Spillway	4	PMF	11545.00	1273.20	1279.96	1278.45	1281.27	0.003083	9.55	1349.32	232.81	0.66
Spillway	3	PMF	11545.00	1274.00	1278.67	1278.67	1280.97	0.007854	12.27	968.08	213.94	1.00
Spillway	2	PMF	11545.00	1272.57	1278.02	1278.02	1280.22	0.007031	12.19	1048.43	256.67	0.96
Spillway	1.4	PMF	11545.00	1269.60	1275.08	1275.08	1276.80	0.008614	11.84	1261.35	360.94	1.03
Spillway	1	PMF	11545.00	1263.96	1270.38	1270.38	1272.32	0.012051	12.10	1076.08	356.53	1.17
Spillway	0.9	PMF	11545.00	1260.44	1267.89	1267.89	1269.91	0.006773	12.64	1209.49	322.17	0.95
Spillway	0.8	PMF	11545.00	1255.70	1264.67	1264.67	1267.13	0.005424	13.33	1119.43	271.66	0.89


Guadalupe FRS Spillway - Proposed Model Plan: Proposed Model 5/7/2008 3:37:42 PM
Geom: Proposed Model Geometry
Spillway Spillway
Legend
WS PMF
Ground
Elevation (ft)
1285
1280
1275
1270
1265
1260
1255
1250
0
200
400
600
800
1000
Main Channel Distance (ft)



LEGEND

HEC RAS CROSS SECTION LABEL	1
CROSS SECTIONS	
PROPOSED CONTOURS	
EXISTING CONTOURS	
PROBABLE MAXIMUM FLOOD DISCHARGE	Qpmf
WATER SURFACE ELEVATION BASED ON EXISTING GROUND	EG=1270.73'
WATER SURFACE ELEVATION BASED ON PROPOSED GROUND	PG=1270.37'

NOTE

1. GOLF COURSE AT AZ GRAND FALLS WITHIN TOWNSHIP 1 SOUTH RANGE 4 EAST SECTION 5.
2. ELEVATIONS PRESENTED IN THIS FIGURE ARE BASED ON NAVD 1929.

N

75 0 75 150
SCALE FEET

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PHOENIX OFFICE
7740 N. 16TH ST. STE 100, PHOENIX, AZ
PH (602) 567-1900 FAX (602) 567-1901

ARIZONA GRAND RESORT
HOLE #18 REALIGNMENT
PHOENIX, ARIZONA

FIG 3: HEC-RAS EXHIBIT

CMX PROJ.	7434.02
DATE:	MAR 2008
SCALE:	1" = 150'
DRAWN BY:	JAR
CHECKED BY:	RH

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ATTACHMENT B

Revised Storage Volume Comparison Calculations
&
Revised Storage Volume Comparison Exhibit (Figure 4)

Table C1 : Storage Volume Comparison

Project: Arizona Grand Resort

Location: Phoenix, AZ

Prepared by: SVK

Date: 5/8/2008

Elevation	AREA			INCREMENTAL VOLUME			CUMULATIVE VOLUME		
	Proposed	Existing	Proposed- Existing[1]	Proposed	Existing	Proposed- Existing	Proposed	Existing	Proposed- Existing[1]
(ft)	(ft^2)	(ft^2)	(ft^2)	(ft^3)	(ft^3)	(ft^3)	(ft^3)	(ft^3)	(ft^3)
1266	2,228	86	2,143	0	0	0	0	0	0
1267	6,657	5,011	1,646	4,443	2,548	1,894	4,443	2,548	1,894
1268	9,208	10,225	-1,018	7,932	7,618	314	12,375	10,166	2,209
1269	11,752	14,673	-2,921	10,480	12,449	-1,969	22,855	22,616	239
1270	16,842	17,829	-987	14,297	16,251	-1,954	37,152	38,867	-1,715
1271	21,778	21,352	425	19,310	19,591	-281	56,461	58,457	-1,996
1272	27,062	25,421	1,641	24,420	23,387	1,033	80,881	81,844	-962
1273	30,918	27,972	2,946	28,990	26,696	2,294	109,872	108,540	1,331
1274	33,546	30,236	3,310	32,232	29,104	3,128	142,104	137,644	4,459
1275	36,533	32,382	4,151	35,040	31,309	3,730	177,143	168,954	8,190
1276	39,198	36,440	2,759	37,866	34,411	3,455	215,009	203,365	11,644
1277	41,804	38,187	3,617	40,501	37,313	3,188	255,510	240,678	14,832
1278	43,901	39,829	4,072	42,852	39,008	3,845	298,362	279,686	18,677
1279	45,715	42,459	3,257	44,808	41,144	3,664	343,170	320,829	22,341
1280	47,439	44,010	3,429	46,577	43,234	3,343	389,748	364,064	25,684
1281	49,359	46,946	2,413	48,399	45,478	2,921	438,147	409,542	28,605
1282	50,117	47,541	2,576	49,738	47,244	2,494	487,885	456,786	31,099
1283	51,051	48,612	2,440	50,584	48,076	2,508	538,470	504,862	33,607
TOTALS	565,110	529,211	35,898	538,470	504,862	33,607	538,470	504,862	33,607

Notes:

1. A positive value in the 'Proposed- Existing' column represents increase in storage area or storage volume under proposed conditions.
   Similarly, a negative value in the 'Proposed - Existing' column represents decrease in the storage area or storage volume under proposed conditions.

2. The stage-storage computations listed in this summary table are based on the average-end-area method, I.e. (Area 1 + Area 2) / 2 * (Contour Interval).

LEGEND

STORAGE VOLUME COMPARISON BOUNDARY

EXISTING CONTOURS

PROPOSED CONTOURS

NOTE:

PROPOSED TOPOGRAPHIC MODIFICATIONS RESULT IN NET CHANGES* TO THE FRS RESERVOIR STORAGE CAPACITY AS FOLLOWS:

ELEV (ft)	NET INCREASE TO FRS STORAGE CAPACITY** (CU.YD.)
1274	165
1281.5	1,106

* BASED UPON AVERAGE–END–AREA METHOD.

** CALCULATIONS BASED ON AREA LOCATED WITHIN THE STORAGE VOLUME COMPARISON BOUNDARY.

N

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ARIZONA GRAND RESORT
HOLE #18 REALIGNMENT
PHOENIX, ARIZONA

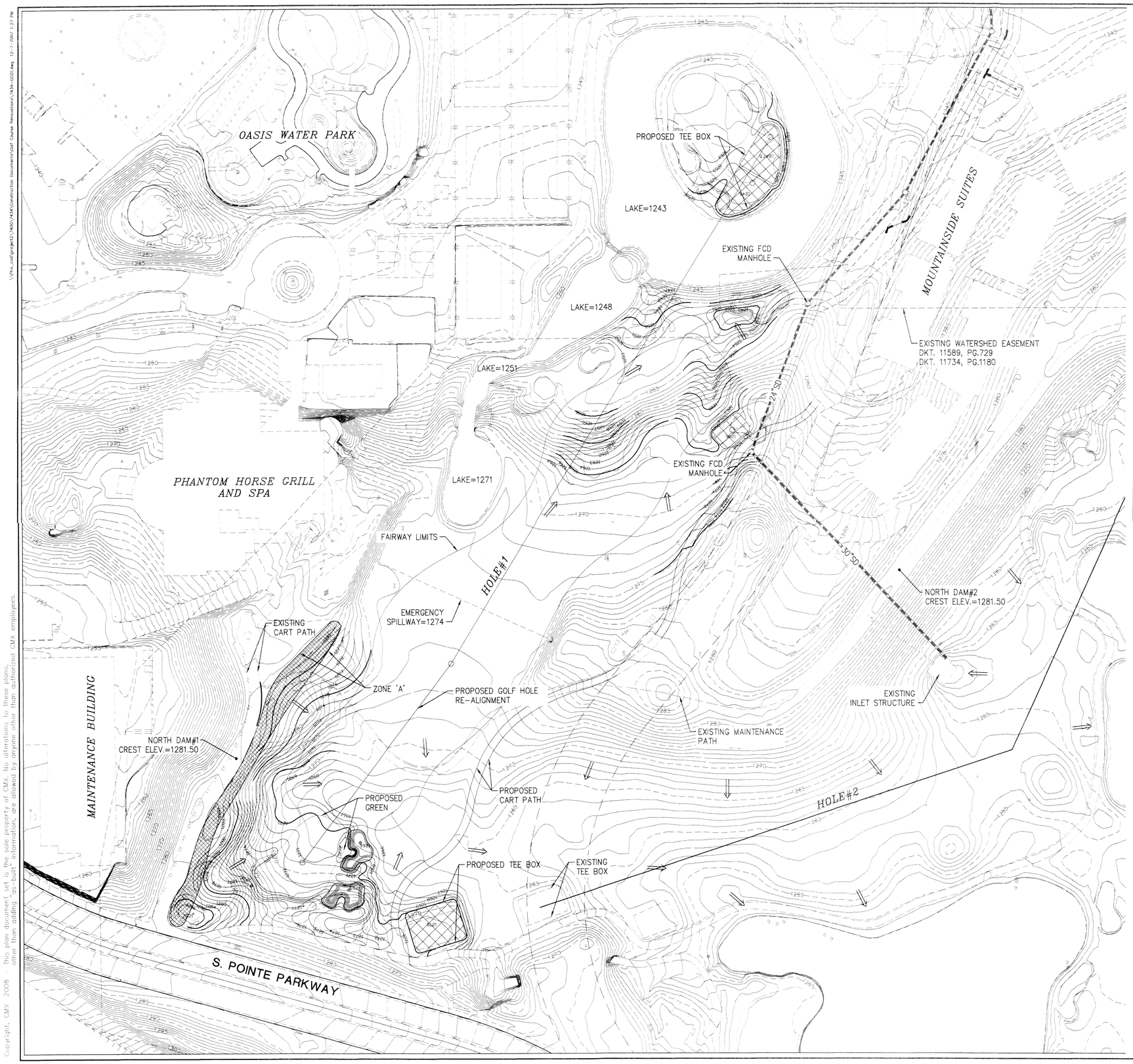
FIG 4: STORAGE VOLUME COMPARISON

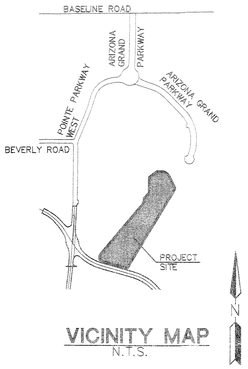
CMX PROJ. 7434.02
DATE: MAY 2008
SCALE: 1" = 150'
DRAWN BY: JAR
CHECKED BY: RH

W:\7400\7434\W-Res\W-Exhibits\Drg Rprt\Spillway Analysis\Sub-Update\F4-7434-VOL-COM-Ex.dwg 05-08-2008 - 11:10am

ATTACHMENT C

Revised Grading Plan drawings:
GC01 (Golf Course Renovations (Hole #1))
GC02 (Existing Golf Course (Hole #18))





VICINITY MAP
N.T.S.

GENERAL NOTES:

1. ALL MARICOPA COUNTY FLOOD CONTROL DISTRICT SURVEY MONUMENTS EITHER ADJACENT TO OR ON TOP OF THE DAM WHERE THE RENOVATIONS WILL TAKE PLACE ARE TO BE ADJUSTED AND COORDINATED WITH THE FLOOD CONTROL DISTRICT AND/OR THE ARIZONA DEPARTMENT OF WATER RESOURCES.

2. A PRECONDITION INSPECTION SHALL BE SCHEDULED BY THE CONTRACTOR TO INCLUDE OWNER, ENGINEER, FLOOD CONTROL DISTRICT & ARIZONA DEPARTMENT OF WATER RESOURCES PRIOR TO COMMENCEMENT OF WORK.

3. ALL CONSTRUCTION FILL SHOULD BE PLACED PER MAG SPEC. 211.

4. CONTRACTOR SHALL EXERCISE EXTREME CAUTION WHEN GRADING ADJACENT TO THE DAM. NO VIBRATORY ROLLERS WILL BE ALLOWED ADJACENT TO THE DAM. CONTRACTOR SHALL MAINTAIN A MINIMUM ONE FOOT CLEARANCE FROM THE GRADING SURFACE (CUT OR FILL) AND THE DAM CORE. CONTRACTOR TO STOP ALL OPERATIONS AND NOTIFY ENGINEER, FCD, ADWR IF DAM CORE IS EXPOSED.

5. REFER TO GOLF COURSE ARCHITECT PLANS FOR FINAL GRADING AND DETAILS. ALL MATERIALS AND SPECIFICATIONS RELATED TO THE GOLF COURSE SHALL BE IN ACCORDANCE WITH THE GOLF COURSE ARCHITECT PLANS AND SPECIFICATIONS. CONTRACTOR SHALL CONFORM TO BOTH GOLF COURSE ARCHITECT AND ENGINEER'S SPECIFICATIONS AND CONSTRUCTION QUALITY PLANS.

6. IF CONTRACTOR CANNOT GRADE TO PROPOSED CONTOUR ELEVATIONS AS SHOWN ON THE GOLF COURSE ARCHITECT PLANS, THE CONTRACTOR SHALL CONTACT ALL PARTIES FOR FURTHER DIRECTIONS PRIOR TO PROCEEDING FURTHER.

7. REFER TO GOLF COURSE ARCHITECT PLANS AND SPECIFICATIONS FOR DRAINAGE GRATES, PIPE SIZES/MATERIALS, OR SWALES PROPOSED. ALL IRRIGATION (ELECTRICAL IF NECESSARY) LINES PER GOLF COURSE ARCHITECT SUB-CONSULTANT. CONTRACTOR SHALL MAINTAIN THREE FOOT VERTICAL SEPARATION BETWEEN THE BOTTOM OF ANY UTILITY TRENCHES (INCLUDING, BUT NOT LIMITED TO, SITE DRAINAGE, ELECTRICAL, LIGHTING, AND IRRIGATION LINES), AND THE DAM CORE.

8. CONTRACTOR SHALL NOTIFY ALL PARTIES IF FIELD CONDITIONS DEVIATE FROM THE GOLF COURSE ARCHITECT PLANS AND ENGINEER DOCUMENTS.

ZONE 'A' – NO PRESSURIZED IRRIGATION LINES ALLOWED WITHIN THE AREA OUTLINED. CONTRACTOR SHALL MAINTAIN THREE FOOT VERTICAL SEPARATION BETWEEN THE BOTTOM OF ANY UTILITY TRENCH TO THE DAM CORE. CONTRACTOR SHALL NOTIFY ENGINEER IF CONFLICT EXISTS BETWEEN THE IRRIGATION PLANS AND THE FIELD CONDITIONS.

N

50 0 50 100
SCALE FEET

13085
GREGORY B. SMITH
Date Signed 05/02/08
ARIZONA U.S.A.
Expires 6/30/2008

ADWR APPROVAL BLOCK

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NEW YORK PENNSYLVANIA MEXICO

ARIZONA GRAND RESORT

8000 S. ARIZONA GRAND PARKWAY
PHOENIX, ARIZONA

GOLF COURSE RENOVATIONS (HOLE#1)

CMX PROJ: 7434.02 | DATE: 05/02/08 | SCALE: 1"=50'
DESIGNED: OTHERS | DRAWN: J.P. | APPROVED: G.B.S.
REV.

DWG. NO. GC01
SHT. 1 OF 2

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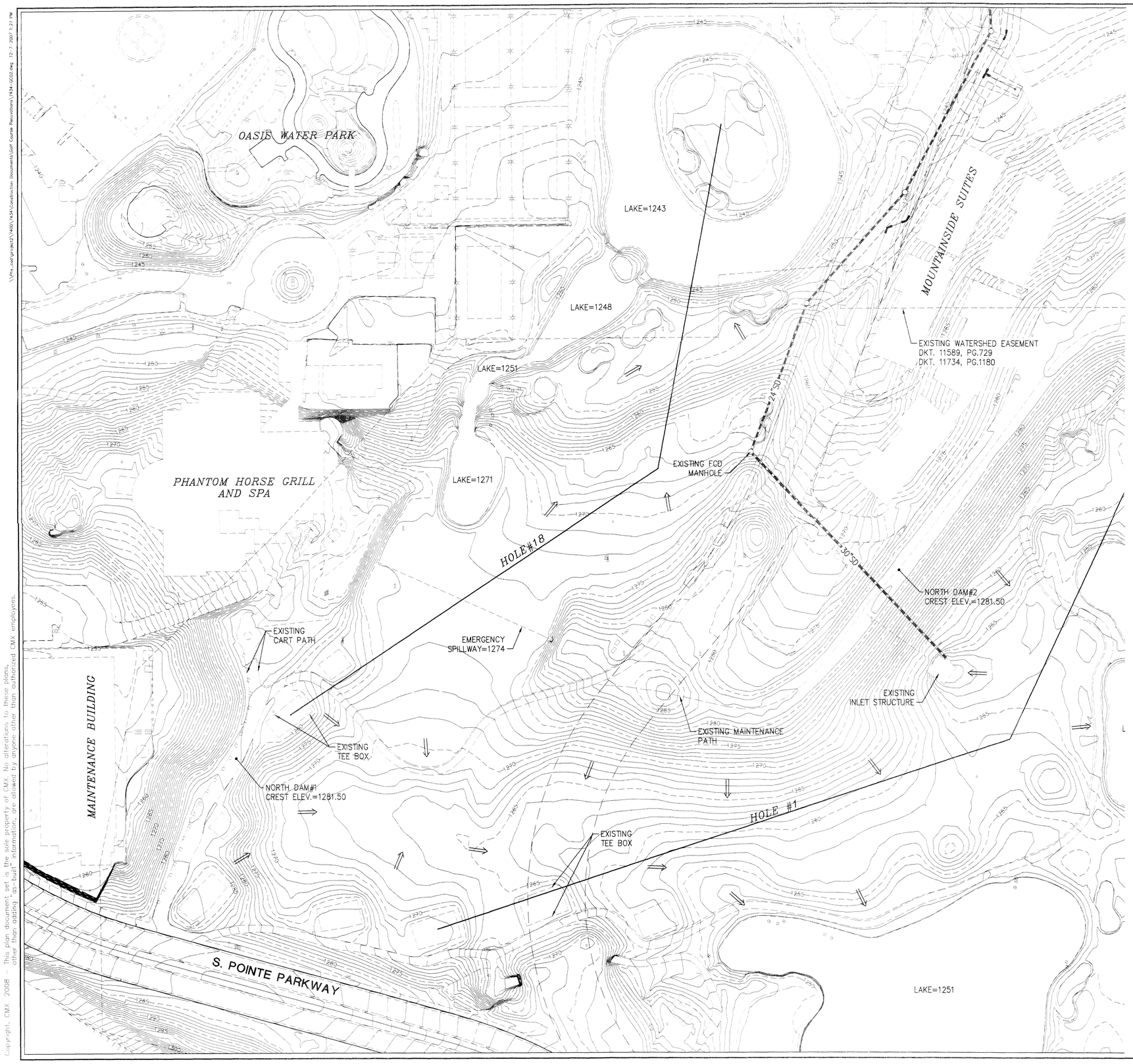
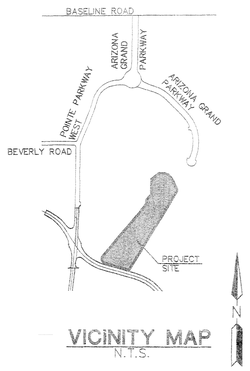
\\Phx_cot\projects\7400\7434\Construction Documents\Golf Course Renovations\7434-GC01.dwg 12-7-2007 1:27 PM





VICINITY MAP
N.T.S.

GENERAL NOTES:

1. EXISTING TOPOGRAPHY WAS FLOWN BY AERIAL MAPPING COMPANY, DATED 12-05-06.

N

50 0 50 100
SCALE FEET

13085
GREGORY B. SMITH
Date Signed 05/02/08
ARIZONA U.S.A.
Expires 6/30/2010

ADWR APPROVAL BLOCK

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ARIZONA GRAND RESORT

8000 S. ARIZONA GRAND PARKWAY
PHOENIX, ARIZONA

EXISTING GOLF COURSE (HOLE#18)

CMX PROJ: 7434.02	DATE: 05/02/08	SCALE: 1"=50'
DESIGNED: OTHERS	DRAWN: J.P.	APPROVED: G.B.S.
REV.		

DWG. NO. GC02

SHT. 2 OF 2

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ATTACHMENT D

CD CONTAINING REVISED DIGITAL FILES

HEC-RAS SUPPORTING FILES:
HEC-RAS Project Files
HEC-RAS Report Files
Digital Cross-section Locations-AutoCAD Drawing