US Army Corps of Engineers ®
Huntington District

MAJOR REHABILITATION REPORT: FULLY FUNDED COST, SCHEDULE, & RISK ANALYSIS

BOLIVAR DAM
SANDY CREEK OF THE TUSCARAWAS RIVER, OHIO

PREPARED BY: COST ENGINEERING SECTION, USACE, HUNTINGTON DISTRICT

AUGUST 2008

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1 TOTAL PROJECT COST SUMMARY

All costs are at the FY08 price level.

1.1 NON-FULLY FUNDED & FULLY FUNDED SUMMARIES BY FISCAL YEAR

Table 1. Fully Funding

Fully Funded Project Cost by Fiscal Year														
ACC NO.	ITEM DESCRIPTION	CONTINGENCY	TODAY'S COST	Actual Thru FY08	10/07 - 9/08 FY08	10/08 - 9/09 FY09	10/09 - 9/10 FY10	10/10 - 9/11 FY11	10/11 - 9/12 FY12	10/12 - 9/13 FY13	10/13 - 9/14 FY14	10/14 - 9/15 FY15	FULLY FUNDED
01	OMB FACTOR *2		1.000	1.000	1.000	1.050	1.073	1.095	1.117	1.139	1.162	1.185	
	Lands & Damages		$ 89,860.00	4,360.00	25,000.00	50,000.00	10,000.00	500.00	-	-	-	-	
	FULLY FUNDED	12.8%		4,360.00	25,000.00	52,480.00	10,726.91	547.61	-	-	-	-	$ 93,122.52
	Contingency		$ 11,470.74	-	3,354.02	6,708.04	1,341.61	67.00	-	-	-	-	
	FULLY FUNDED CONTINGENCY			-	3,354.02	7,040.76	1,439.13	73.47	-	-	-	-	$ 11,907.37
04	OMB FACTOR *2		1.000	1.000	1.000	1.050	1.073	1.095	1.117	1.139	1.162	1.185	
	Dams		$ 85,376,944.44	-	-	-	-	1,145,336.27	21,774,810.52	29,446,215.54	32,281,500.57	729,081.57	
	FULLY FUNDED	32.4%		-	-	-	-	1,254,382.57	24,325,121.38	33,552,917.59	37,519,296.74	864,326.38	$ 97,516,053.68
	Contingency		$ 27,648,105.08	-	-	-	-	370,900.81	7,051,461.65	9,535,736.69	10,453,903.28	236,102.66	
	FULLY FUNDED CONTINGENCY			-	-	-	-	406,217.13	7,077,343.43	10,065,633.54	12,150,000.03	279,099.44	$ 31,579,192.37
18	OMB FACTOR *2		1.000	1.000	1.000	1.050	1.073	1.095	1.117	1.139	1.162	1.185	
	Cultural Resource Preservation		$ 100,000.00	-	-	-	-	100,000.00	-	-	-	-	
	FULLY FUNDED	161.1%		-	-	-	-	109,521.77	-	-	-	-	$ 109,521.77
	Contingency		$ 161,083.50	-	-	-	-	161,083.50	-	-	-	-	
	FULLY FUNDED CONTINGENCY			-	-	-	-	176,421.51	-	-	-	-	$ 176,421.51
19	OMB FACTOR *2		1.000	1.000	1.000	1.050	1.073	1.095	1.117	1.139	1.162	1.185	
	Buildings, Grounds, & Utilities		$ 308,082.30	-	-	-	-	308,082.30	-	-	-	-	
	FULLY FUNDED	24.1%		-	-	-	-	337,417.19	-	-	-	-	$ 337,417.19
	Contingency		$ 74,249.32	-	-	-	-	74,249.32	-	-	-	-	
	FULLY FUNDED CONTINGENCY			-	-	-	-	81,319.17	-	-	-	-	$ 81,319.17
22	OMB FACTOR *2		1.000	1.000	1.000	1.050	1.073	1.095	1.117	1.139	1.162	1.185	
	Feasibility Studies		$ 1,782,424.00	1,782,424.00	-	-	-	-	-	-	-	-	
	FULLY FUNDED	0.0%		1,782,424.00	-	-	-	-	-	-	-	-	$ 1,782,424.00
	Contingency		$ -	-	-	-	-	-	-	-	-	-	
	FULLY FUNDED CONTINGENCY			-	-	-	-	-	-	-	-	-	$ -
30	OMB FACTOR *1		1.000	1.000	1.000	1.072	1.115	1.159	1.205	1.252	1.302	1.354	
	Planning, Engineering, & Design		$ 9,963,933.00	-	975,000.00	970,100.00	1,643,033.00	1,500,000.00	1,500,000.00	1,500,000.00	1,500,000.00	375,000.00	
	FULLY FUNDED	41.6%		-	975,000.00	1,040,142.30	1,832,379.99	1,738,047.24	1,807,027.47	1,878,450.66	1,953,096.52	507,868.43	$ 11,732,013.61
	Contingency		$ 4,144,541.34	-	405,555.50	403,517.32	683,759.50	623,931.53	623,931.53	623,931.53	623,931.53	155,982.88	
	FULLY FUNDED CONTINGENCY			-	405,555.50	432,651.72	762,186.44	722,948.32	751,640.95	781,349.73	812,399.01	211,250.50	$ 4,879,982.17
31	OMB FACTOR *1		1.000	1.000	1.000	1.072	1.115	1.159	1.205	1.252	1.302	1.354	
	Supervision & Administration		$ 6,433,877.01	-	-	-	-	116,586.39	1,833,110.79	2,208,466.17	2,421,112.54	54,681.12	
	FULLY FUNDED	36.4%		-	-	-	-	134,995.74	1,967,384.04	2,765,663.15	3,152,444.32	74,055.65	$ 8,094,542.89
	Contingency		$ 2,342,775.67	-	-	-	-	42,423.62	594,666.67	804,171.54	861,682.73	19,911.10	
	FULLY FUNDED CONTINGENCY			-	-	-	-	49,156.17	716,386.01	1,007,064.37	1,147,903.49	26,965.98	$ 2,947,476.01
Non-Fully Funded Cost w/o Contingency			$ 104,055,128.75	$ 1,786,792.00	$ 1,000,000.00	$ 1,020,100.00	$ 1,653,033.00	$ 3,170,424.96	$ 24,907,921.31	$ 33,154,681.71	$ 36,202,613.11	$ 1,150,762.69	
Fully Funded Cost w/o Contingency or Escalation Contingency				**$ 1,786,792.00**	**$ 1,000,000.00**	**$ 1,092,622.30**	**$ 1,643,106.90**	**$ 3,574,922.13**	**$ 28,099,532.90**	**$ 38,197,031.39**	**$ 42,624,037.50**	**$ 1,446,250.46**	**$ 119,665,095.66**
Non-Fully Funded Contingency			$ 34,382,225.65	$ -	$ 408,909.52	$ 410,225.36	$ 685,101.11	$ 1,272,655.86	$ 8,270,059.85	$ 10,963,839.77	$ 11,959,437.55	$ 411,996.65	
Fully Funded Contingency w/o Escalation Contingency				**$ -**	**$ 408,909.52**	**$ 439,692.48**	**$ 763,625.57**	**$ 1,436,135.77**	**$ 9,345,370.38**	**$ 12,654,047.65**	**$ 14,110,391.32**	**$ 518,115.92**	**$ 39,676,288.61**
Non-Fully Funded Cost			**$ 138,437,354.40**	**$ 1,786,792.00**	**$ 1,408,909.52**	**$ 1,430,325.36**	**$ 2,338,934.11**	**$ 4,443,080.83**	**$ 33,177,981.16**	**$ 44,118,521.47**	**$ 48,162,050.66**	**$ 1,570,759.34**	
Fully Funded Cost w/o Escalation Contingency				$ 1,786,792	$ 1,408,910	$ 1,532,315	$ 2,606,732	$ 5,011,058	$ 37,444,903	$ 50,851,079	$ 56,735,229	$ 1,964,366	$ 159,341,384
Escalation Contingency						$ -	$ -	$ 102,582	$ 1,437,932	$ 1,944,525	$ 2,131,758	$ 48,146	$ 5,664,944
Total Project Cost				**$ 1,786,792**	**$ 1,408,910**	**$ 1,532,315**	**$ 2,606,732**	**$ 5,113,640**	**$ 38,882,836**	**$ 52,795,604**	**$ 58,866,986**	**$ 2,012,512**	**$ 165,006,328**

Table 2. Total Project Cost Summary by Fiscal Year

Cost Type	Feature Account	PRIOR EXPENDITURES	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	PROJECT COST
Non-Fully Funded											
	01 Lands & Damages	$4,000	$28,000	$57,000	$11,000	$1,000	$0	$0	$0	$0	$101,000
	04 Dams	$0	$0	$0	$0	$1,516,000	$28,826,000	$38,982,000	$42,735,000	$965,000	$113,025,000
	18 Cultural Resource Preservation	$0	$0	$0	$0	$261,000	$0	$0	$0	$0	$261,000
	19 Buildings, Grounds, & Utilities	$0	$0	$0	$0	$382,000	$0	$0	$0	$0	$382,000
	22 Feasibility Studies	$1,782,000	$0	$0	$0	$0	$0	$0	$0	$0	$1,782,000
	30 Planning, Engineering, & Design	$0	$1,381,000	$1,374,000	$2,328,000	$2,124,000	$2,124,000	$2,124,000	$2,124,000	$531,000	$14,108,000
	31 Supervision & Administration	$0	$0	$0	$0	$159,000	$2,228,000	$3,013,000	$3,303,000	$75,000	$8,777,000
Non-Fully Funded Total		**$1,786,000**	**$1,409,000**	**$1,431,000**	**$2,339,000**	**$4,443,000**	**$33,178,000**	**$44,119,000**	**$48,162,000**	**$1,571,000**	**$138,437,000**
Fully Funded											
	01 Lands & Damages	$4,000	$28,000	$60,000	$12,000	$1,000	$0	$0	$0	$0	$105,000
	04 Dams	$0	$0	$0	$0	$1,661,000	$32,202,000	$44,419,000	$49,669,000	$1,144,000	$129,095,000
	18 Cultural Resource Preservation	$0	$0	$0	$0	$286,000	$0	$0	$0	$0	$286,000
	19 Buildings, Grounds, & Utilities	$0	$0	$0	$0	$419,000	$0	$0	$0	$0	$419,000
	22 Feasibility Studies	$1,782,000	$0	$0	$0	$0	$0	$0	$0	$0	$1,782,000
	30 Planning, Engineering, & Design	$0	$1,381,000	$1,473,000	$2,595,000	$2,461,000	$2,559,000	$2,660,000	$2,765,000	$719,000	$16,612,000
	31 Supervision & Administration	$0	$0	$0	$0	$184,000	$2,684,000	$3,773,000	$4,300,000	$101,000	$11,042,000
Fully Funded Total		**$1,786,000**	**$1,409,000**	**$1,533,000**	**$2,607,000**	**$5,012,000**	**$37,445,000**	**$50,852,000**	**$56,734,000**	**$1,964,000**	**$159,341,000**
Escalation Contingency		**$0**	**$0**	**$0**	**$0**	**$103,000**	**$1,438,000**	**$1,945,000**	**$2,132,000**	**$48,000**	**$5,665,000**
Total Project Cost Summary		**$1,787,000**	**$1,409,000**	**$1,532,000**	**$2,607,000**	**$5,114,000**	**$38,883,000**	**$52,796,000**	**$58,867,000**	**$2,013,000**	**$165,006,000**

1.2 TOTAL PROJECT COST SUMMARIES BY COST TYPE

Table 3. Total Project Cost Summaries by Cost Type

Cost Type	Feature Account		PRIOR EXPENDITURES	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	PROJECT COST
Non-Fully Funded												
	Construction Costs											
	04	Dams	$0	$0	$0	$0	$1,516,000	$28,826,000	$38,982,000	$42,735,000	$965,000	$113,025,000
	18	Cultural Resource Preservation	$0	$0	$0	$0	$261,000	$0	$0	$0	$0	$261,000
	19	Buildings, Grounds, & Utilities	$0	$0	$0	$0	$382,000	$0	$0	$0	$0	$382,000
	Construction Costs Total		**$0**	**$0**	**$0**	**$0**	**$2,159,000**	**$28,826,000**	**$38,982,000**	**$42,735,000**	**$965,000**	**$113,668,000**
	Associated Costs											
	01	Lands & Damages	$4,000	$28,000	$57,000	$11,000	$1,000	$0	$0	$0	$0	$101,000
	22	Feasibility Studies	$1,782,000	$0	$0	$0	$0	$0	$0	$0	$0	$1,782,000
	30	Planning, Engineering, & Desig	$0	$1,381,000	$1,374,000	$2,328,000	$2,124,000	$2,124,000	$2,124,000	$2,124,000	$531,000	$14,108,000
	31	Supervision & Administration	$0	$0	$0	$0	$159,000	$2,228,000	$3,013,000	$3,303,000	$75,000	$8,777,000
	Associated Costs Total		**$1,786,000**	**$1,409,000**	**$1,431,000**	**$2,339,000**	**$2,284,000**	**$4,352,000**	**$5,137,000**	**$5,427,000**	**$606,000**	**$24,769,000**
Non-Fully Funded Total			**$1,787,000**	**$1,409,000**	**$1,430,000**	**$2,339,000**	**$4,443,000**	**$33,178,000**	**$44,119,000**	**$48,162,000**	**$1,571,000**	**$138,437,000**
Fully Funded												
	Construction Costs											
	04	Dams	$0	$0	$0	$0	$1,661,000	$32,202,000	$44,419,000	$49,669,000	$1,144,000	$129,095,000
	18	Cultural Resource Preservation	$0	$0	$0	$0	$286,000	$0	$0	$0	$0	$286,000
	19	Buildings, Grounds, & Utilities	$0	$0	$0	$0	$419,000	$0	$0	$0	$0	$419,000
	Construction Costs Total		**$0**	**$0**	**$0**	**$0**	**$2,366,000**	**$32,202,000**	**$44,419,000**	**$49,669,000**	**$1,144,000**	**$129,800,000**
	Associated Costs											
	01	Lands & Damages	$4,000	$28,000	$60,000	$12,000	$1,000	$0	$0	$0	$0	$105,000
	22	Feasibility Studies	$1,782,000	$0	$0	$0	$0	$0	$0	$0	$0	$1,782,000
	30	Planning, Engineering, & Desig	$0	$1,381,000	$1,473,000	$2,595,000	$2,461,000	$2,559,000	$2,660,000	$2,765,000	$719,000	$16,612,000
	31	Supervision & Administration	$0	$0	$0	$0	$184,000	$2,684,000	$3,773,000	$4,300,000	$101,000	$11,042,000
	Associated Costs Total		**$1,786,000**	**$1,409,000**	**$1,533,000**	**$2,607,000**	**$2,646,000**	**$5,243,000**	**$6,433,000**	**$7,065,000**	**$820,000**	**$29,541,000**
	Escalation Contingency		**$0**	**$0**	**$0**	**$0**	**$103,000**	**$1,438,000**	**$1,945,000**	**$2,132,000**	**$48,000**	**$5,665,000**
Fully Funded Total			**$1,787,000**	**$1,409,000**	**$1,532,000**	**$2,607,000**	**$5,114,000**	**$38,883,000**	**$52,796,000**	**$58,867,000**	**$2,013,000**	**$165,006,000**

Table 4. Base Year Contingencies by Feature Account

Feature Account	Base Year Estimate	Base Year Contingency	% Contingency	Base Year Project Cost
01 Lands & Damages	$90,000	$11,000	12.8%	$101,000
04 Dams	$85,377,000	$27,648,000	32.4%	$113,025,000
18 Cultural Resource Preservation	$100,000	$161,000	161.1%	$261,000
19 Buildings, Grounds, & Utilities	$308,000	$74,000	24.1%	$382,000
22 Feasibility Studies	$1,782,000	$0	0.0%	$1,782,000
30 Planning, Engineering, & Design	$9,964,000	$4,145,000	41.6%	$14,109,000
31 Supervision & Administration	$6,434,000	$2,343,000	36.4%	$8,777,000
Grand Total	**$104,055,000**	**$34,382,000**	**33.0%**	**$138,437,000**

2 COST-SHARING SUMMARY

The cost sharing between the MWCD (Muskingum Watershed Conservancy District) and USACE is 23%. Since there are no LERRDs (Lands, Easements, Rights of Way, Relocations, and Disposal Areas), the local sponsor's minimum cash contribution of 5% does not apply here. The cost-sharing summary is in Table 4 below.

Table 5. Cost-Sharing Summary

	Prior	Remaining Costs								Total ($1000's)	Total Cost Share %
		FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15		
MWCD											
LERRDs											
Cash and Other Payments	411	324	352	600	1,176	8,943	12,143	13,539	463	37,951	*23.00%*
MWCD Total	**411**	**324**	**352**	**600**	**1,176**	**8,943**	**12,143**	**13,539**	**463**	**37,951**	*23.00%*
USACE	**1,376**	**1,085**	**1,180**	**2,007**	**3,938**	**29,940**	**40,653**	**45,328**	**1,550**	**127,055**	*77.00%*
Grand Total	**1,787**	**1,409**	**1,532**	**2,607**	**5,114**	**38,883**	**52,796**	**58,867**	**2,013**	**165,006**	*100.00%*

3 SCHEDULE

3.1 PDT SCHEDULE

The PDT schedule is managed by the Project Manager.

Activity ID	Activity Name	Original Duration	Remaining Duration	Physical % Complete	Start	Finish	Total Float
125381 BOLIVAR DAM, OH DAM SAFETY		**1903.0d**	**1379.0d**		**01-Mar-06 A**	**25-Sep-13**	**0.0d**
125381.Asset	**Dam Safety Asset**	**1903.0d**	**1379.0d**		**01-Mar-06 A**	**25-Sep-13**	**0.0d**
125381.Asset.1	**Rehabilitation Report**	**662.0d**	**138.0d**		**01-Mar-06 A**	**15-Oct-08**	**1241.0d**
A1420	Environmental Analysis	402.0d	24.0d	**80%**	01-Mar-06 A	2-May-08	1355.0d
A1450	Prepare Baseline Cost Estimate for Recommended Alternative	25.0d	19.0d	**0%**	21-Mar-08 A	**25-Apr-08**	0.0d
A1370	Prepare Draft Major Rehab Report	25.0d	19.0d	**25%**	24-Mar-08 A	**25-Apr-08**	0.0d
A1460	Team Review Draft Rehab Report	5.0d	5.0d	0%	**28-Apr-08**	2-May-08	0.0d
A1380	ITR Major Rehab Report - Final Review	10.0d	10.0d	0%	5-May-08	16-May-08	0.0d
A1480	Revise Report Per ITR Comments	10.0d	10.0d	0%	19-May-08	2-Jun-08	0.0d
A1820	Public Review of Draft Report/EA	22.0d	22.0d	0%	3-Jun-08	2-Jul-08	0.0d
A1490	Package Final Rehab Report/FONSI	5.0d	5.0d	0%	3-Jul-08	10-Jul-08	0.0d
A1400	Submit Major Rehab Report to LRD/HQ	1.0d	1.0d	0%	11-Jul-08	11-Jul-08	0.0d
A1400M	Submit MRR to LRD Milestone	0.0d	0.0d	0%		11-Jul-08	1307.0d
A1410	LRD/HQ Review of Rehab Report	44.0d	44.0d	0%	14-Jul-08	12-Sep-08	0.0d
A1500	Revise MRR Per LRD/HQ Comments	22.0d	22.0d	0%	15-Sep-08	15-Oct-08	0.0d
A1510	Approval of Final MRR	0.0d	0.0d	0%		15-Oct-08	0.0d
125381.Asset.30B00	**Design Documentation Report (DDR)**	**573.0d**	**407.0d**		**01-Aug-07 A**	**10-Nov-09**	**972.0d**
125381.Asset.30B00.30BA0	**Eng Analysis & Design**	**573.0d**	**407.0d**		**01-Aug-07 A**	**10-Nov-09**	**972.0d**
A1550	Identify & Evaluate Material Sources	314.0d	148.0d	**80%**	01-Aug-07 A	29-Oct-08	258.0d
A1630	Materials Write-up for DDR	250.0d	84.0d	**70%**	01-Aug-07 A	29-Jul-08	258.0d
A1570	Additional Surveying & Mapping	126.0d	64.0d	**10%**	02-Jan-08 A	30-Jun-08	229.0d
A1620	Prepare Final CWL	22.0d	22.0d	0%	1-Jul-08	31-Jul-08	1205.0d
A1840	Real Estate Review Final CWL	22.0d	22.0d	0%	1-Aug-08	2-Sep-08	1271.0d
A1860	Revise Real Estate Plan	88.0d	88.0d	0%	1-Aug-08	8-Dec-08	1205.0d
A1520	CADD Administration DDR	269.0d	269.0d	0%	16-Oct-08*	10-Nov-09	972.0d
A1530	Start of DDR Activities	0.0d	0.0d	0%	16-Oct-08		0.0d
A1540	Civil Site Layout	22.0d	22.0d	0%	16-Oct-08	17-Nov-08	133.0d
A1580	Prepare H&H Portion of Report	44.0d	44.0d	0%	16-Oct-08	18-Dec-08	160.0d
A1590	Perform DDR Drilling and Testing	110.0d	110.0d	0%	16-Oct-08	26-Mar-09	0.0d
A1600	HTRW Input to DDR	66.0d	66.0d	0%	16-Oct-08	22-Jan-09	103.0d
A1710	Write Civil Design Portion of DDR	49.0d	49.0d	0%	18-Nov-08	29-Jan-09	133.0d
A1640	Prepare Value Engineering Study / Team Response	10.0d	10.0d	0%	19-Dec-08	5-Jan-09	1187.0d
A1670	Perform Geotechnical Analysis & Design	80.0d	80.0d	0%	28-Jan-09	20-May-09	0.0d
A1660	Analysis & Design of Structural Components	20.0d	20.0d	0%	23-Apr-09	20-May-09	0.0d
A1680	Soils Write-up & Exhibits for DDR	40.0d	40.0d	0%	21-May-09	17-Jul-09	15.0d
A1700	Prepare Structural Design Portion of DDR	20.0d	20.0d	0%	21-May-09	18-Jun-09	0.0d
A1690	Prepare Quantity Estimate for DDR	15.0d	15.0d	0%	19-Jun-09	10-Jul-09	0.0d
A1560	Prepare Current Working Estimate	20.0d	20.0d	0%	13-Jul-09	7-Aug-09	0.0d
A1610	Design Construction Sequence	10.0d	10.0d	0%	27-Jul-09	7-Aug-09	1037.0d
A1720	Compile DDR for PDT Review	5.0d	5.0d	0%	10-Aug-09	14-Aug-09	0.0d
A1730	PDT Review of DDR	5.0d	5.0d	0%	17-Aug-09	21-Aug-09	0.0d
A1740	Revisions to DDR from PDT Review	10.0d	10.0d	0%	24-Aug-09	4-Sep-09	0.0d

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Activity ID	Activity Name	Original Duration	Remaining Duration	Physical % Complete	Start	Finish	Total Float
A1650	Technical Review Conference	10.0d	10.0d	0%	1-Sep-09	15-Sep-09	1011.0d
A1750	Reproduce DDR for ITR	5.0d	5.0d	0%	8-Sep-09	14-Sep-09	0.0d
A1760	ITR of DDR	15.0d	15.0d	0%	15-Sep-09	5-Oct-09	0.0d
A1770	Respond to & Revise ITR Comments	15.0d	15.0d	0%	6-Oct-09	27-Oct-09	0.0d
A1780	Backcheck ITR Comments	5.0d	5.0d	0%	28-Oct-09	3-Nov-09	972.0d
A1790	Compile & Reproduce Final DDR	5.0d	5.0d	0%	4-Nov-09	10-Nov-09	972.0d
A1800M	DDR Complete	0.0d	0.0d	0%		10-Nov-09	972.0d
125381.Asset.30B00.30BC0 Environmental		**209.0d**	**209.0d**		**16-Oct-08**	**14-Aug-09**	**0.0d**
DDR4170	Environmental Studies	209.0d	209.0d	0%	16-Oct-08*	14-Aug-09	0.0d
125381.Asset.30D00 Construction E&D		**1241.0d**	**1241.0d**		**16-Oct-08**	**25-Sep-13**	**0.0d**
125381.Asset.30D00.30DA0 Plans & Specs		**270.0d**	**270.0d**		**28-Oct-09**	**24-Nov-10**	**712.0d**
END5650	Start Plans & Specs	0.0d	0.0d	0%	28-Oct-09		0.0d
END5660	Prepare 50% Plans & Reproduce	30.0d	30.0d	0%	28-Oct-09	10-Dec-09	0.0d
END5670	Verify Survey Control of P&S	10.0d	10.0d	0%	28-Oct-09	10-Nov-09	972.0d
END5671	Design Review of 50% Plans	15.0d	15.0d	0%	11-Dec-09	4-Jan-10	0.0d
END5672	Submit CWL to Real Estate	1.0d	1.0d	0%	11-Dec-09	11-Dec-09	17.0d
ACQ1920	Acquire Real Estate/RE Interests	217.0d	217.0d	0%	14-Dec-09	22-Oct-10	17.0d
END5673	LE Coordinate Permits	88.0d	88.0d	0%	5-Jan-10	10-May-10	137.0d
END5675	Prepare 70% Plans & Reproduce	30.0d	30.0d	0%	5-Jan-10	17-Feb-10	0.0d
END5676	Design & ITR Review of 70% Plans	15.0d	15.0d	0%	18-Feb-10	10-Mar-10	0.0d
END5678	Respond to 70% Comments	10.0d	10.0d	0%	11-Mar-10	24-Mar-10	0.0d
END5677	Quantities for Bid Schedule	30.0d	30.0d	0%	25-Mar-10	5-May-10	0.0d
END5679	Prepare 90% Plans & Specs	30.0d	30.0d	0%	25-Mar-10	5-May-10	0.0d
END5680	Design Review 90% Plans & Specs	10.0d	10.0d	0%	6-May-10	19-May-10	0.0d
END5681	Prepare 100% Plans & Specs	30.0d	30.0d	0%	20-May-10	1-Jul-10	0.0d
END5674	Monument CWL / ROW	22.0d	22.0d	0%	2-Jul-10	3-Aug-10	790.0d
END5682	ITR Review of 100% Plans & Specs	15.0d	15.0d	0%	2-Jul-10	23-Jul-10	0.0d
END5683	Resolve ITR Comments to 100% Plans	10.0d	10.0d	0%	26-Jul-10	6-Aug-10	0.0d
END5684	Revise Plans & Specs per 100% ITR Review	10.0d	10.0d	0%	9-Aug-10	20-Aug-10	0.0d
END5721	Reproduction for BCOE Review	5.0d	5.0d	0%	23-Aug-10	27-Aug-10	0.0d
END5685	Backcheck 100% ITR Comments	5.0d	5.0d	0%	30-Aug-10	3-Sep-10	0.0d
END5720	BCOE Review	20.0d	20.0d	0%	7-Sep-10	4-Oct-10	0.0d
END5730	BCOE Review Complete	0.0d	0.0d	0%		4-Oct-10	747.0d
END5722	Resolve Comments fron BCOE Review	5.0d	5.0d	0%	5-Oct-10	12-Oct-10	0.0d
END5723	Revise Plans due to Comments from BCOE Review	15.0d	15.0d	0%	13-Oct-10	2-Nov-10	0.0d
END5724	Backcheck BCOE Comments with Revisions	4.0d	4.0d	0%	3-Nov-10	8-Nov-10	0.0d
END5705M	Complete Plans & Specs	0.0d	0.0d	0%		8-Nov-10	0.0d
END5725	Reproduce Final Plans & Specs	10.0d	10.0d	0%	9-Nov-10	23-Nov-10	0.0d
A1850	Certify Real Estate	5.0d	5.0d	0%	9-Nov-10	16-Nov-10	6.0d
END5726	Transmit Final Plans & Specs to CT	1.0d	1.0d	0%	24-Nov-10	24-Nov-10	0.0d
125381.Asset.30D00.30DF0 Cost Estimates		**42.0d**	**42.0d**		**1-Feb-11**	**31-Mar-11**	**626.0d**
END5980	Fair & Reasonable Contract Cost Est	42.0d	42.0d	0%	1-Feb-11	31-Mar-11	626.0d

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Activity ID	Activity Name	Original Duration	Remaining Duration	Physical % Complete	Start	Finish	Total Float
125381.Asset.30D00.30DK0	**All Other Studies**	**137.0d**	**137.0d**		**16-Oct-08**	**4-May-09**	**392.0d**
A2000	Preparation of PCA	66.0d	66.0d	0%	16-Oct-08	22-Jan-09	392.0d
A2010	Negotiate PCA	66.0d	66.0d	0%	23-Jan-09	27-Apr-09	392.0d
A1990	Execute PCA	5.0d	5.0d	0%	28-Apr-09	4-May-09	392.0d
125381.Asset.30D00.30DS0	**Construction - Contract A**	**646.0d**	**646.0d**		**26-Nov-10**	**21-Jun-13**	**66.0d**
CON590	Contract Award AOA	108.0d	108.0d	0%	26-Nov-10	2-May-11	0.0d
CON810	Award Contract	0.0d	0.0d	0%		2-May-11	604.0d
CON610	Issue NTP	1.0d	1.0d	0%	1-Jul-11	1-Jul-11	0.0d
CON595	Contractor Earnings	495.0d	495.0d	0%	5-Jul-11	21-Jun-13	0.0d
CON597	Contractor Earnings FY11	144.0d	144.0d	0%	5-Jul-11	31-Jan-12	167.0d
CON598	Contractor Earnings FY12	250.0d	250.0d	0%	1-Feb-12	29-Jan-13	167.0d
CON599	Contractor Earnings FY13	101.0d	101.0d	0%	30-Jan-13	21-Jun-13	0.0d
CON600M	Construction Complete Milestone	0.0d	0.0d	0%		21-Jun-13	66.0d
125381.Asset.30D00.30DV0	**E&D During Construction**	**556.0d**	**556.0d**		**5-Jul-11**	**18-Sep-13**	**5.0d**
END6330	E&D During Construction	495.0d	495.0d	0%	5-Jul-11	21-Jun-13	0.0d
END6332	E&D During Construction FY11	144.0d	144.0d	0%	5-Jul-11	31-Jan-12	167.0d
END6333	E&D During Construction FY12	250.0d	250.0d	0%	1-Feb-12	29-Jan-13	167.0d
END6334	E&D During Construction FY13	101.0d	101.0d	0%	30-Jan-13	21-Jun-13	0.0d
END6340	As Builts	61.0d	61.0d	0%	24-Jun-13	18-Sep-13	5.0d
125381.Asset.30D00.30F00	**Project Closeout**	**97.0d**	**97.0d**		**9-May-13**	**25-Sep-13**	**0.0d**
END6380	Final Inspection	10.0d	10.0d	0%	9-May-13	23-May-13	87.0d
END6500	OMRR&R Manual	42.0d	42.0d	0%	24-Jun-13	21-Aug-13	0.0d
END6510	Notice Of Compl/Assume O&M	4.0d	4.0d	0%	22-Aug-13	27-Aug-13	0.0d
END6370	Physical Closeout	1.0d	1.0d	0%	27-Aug-13	27-Aug-13	20.0d
END6410	Project Physically Complete	0.0d	0.0d	0%		27-Aug-13	20.0d
END6415	Contract Physical Completion	0.0d	0.0d	0%		27-Aug-13	20.0d
END6420	Fiscal Closeout	20.0d	20.0d	0%	28-Aug-13	25-Sep-13	0.0d
END6480	Project Fiscally Complete	0.0d	0.0d	0%		25-Sep-13	0.0d
END6421	Notice of Project Completion	0.0d	0.0d	0%		25-Sep-13	0.0d
125381.Asset.31000	**Supervision & Admin (S&A)**	**583.0d**	**583.0d**		**1-Mar-11**	**21-Jun-13**	**0.0d**
125381.Asset.31000.31A00	**Project Office S&A**	**583.0d**	**583.0d**		**1-Mar-11**	**21-Jun-13**	**0.0d**
125381.Asset.31000.31A00.31A10	**Project Office Operations**	**495.0d**	**495.0d**		**5-Jul-11**	**21-Jun-13**	**0.0d**
SNA6530	Proj Office Operations	495.0d	495.0d	0%	5-Jul-11	21-Jun-13	0.0d
125381.Asset.31000.31A00.31A20	**Project Office Other S&A**	**583.0d**	**583.0d**		**1-Mar-11**	**21-Jun-13**	**0.0d**
SNA6550	Proj Office Other S&A	583.0d	583.0d	0%	1-Mar-11	21-Jun-13	0.0d
125381.Asset.31000.31C00	**District Office S&A**	**495.0d**	**495.0d**		**5-Jul-11**	**21-Jun-13**	**0.0d**
125381.Asset.31000.31C00.31C10	**District Office Operations**	**495.0d**	**495.0d**		**5-Jul-11**	**21-Jun-13**	**0.0d**
SNA6570	Dist Office S&A Docs	495.0d	495.0d	0%	5-Jul-11	21-Jun-13	0.0d
SNA6580	Tech Mgmt by TM	495.0d	495.0d	0%	5-Jul-11	21-Jun-13	0.0d
125381.Asset.31000.31C00.31C20	**District Office Other S&A**	**495.0d**	**495.0d**		**5-Jul-11**	**21-Jun-13**	**0.0d**
SNA6590	Dist Office Other S&A	495.0d	495.0d	0%	5-Jul-11	21-Jun-13	0.0d

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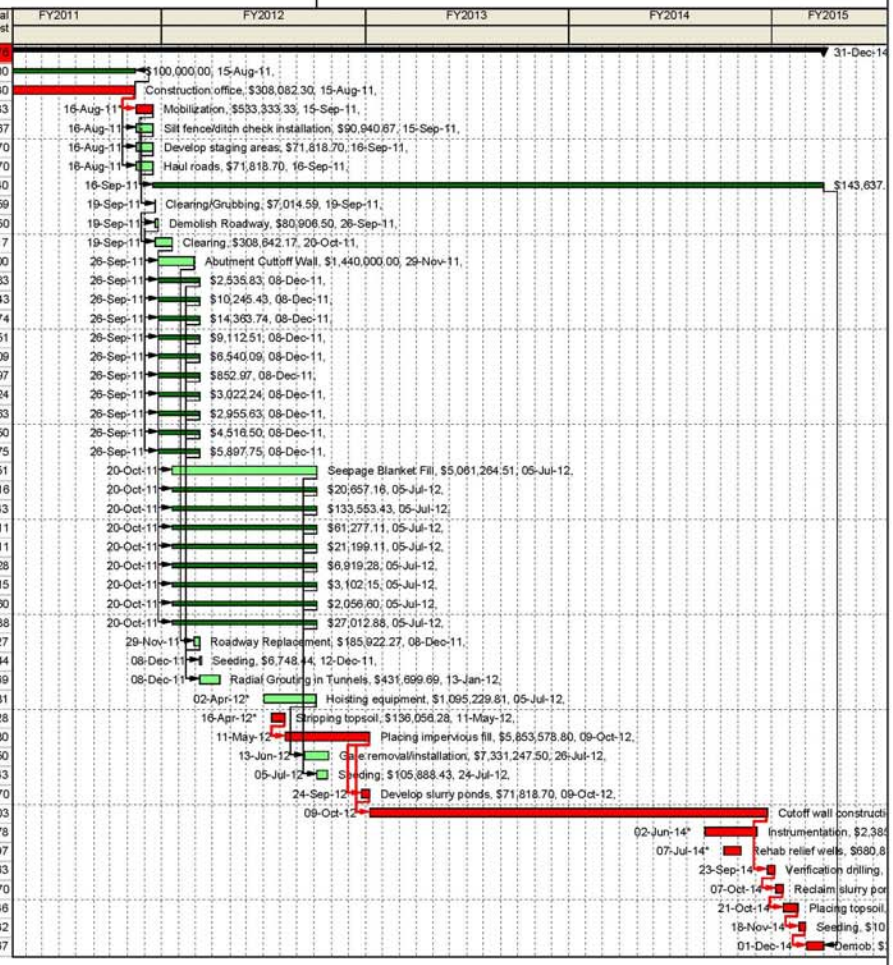
3.2 CONSTRUCTION SCHEDULE

Through coordination with the PDT, a construction schedule was developed to determine the most-likely sequence of work and construction duration.

Bolivar Dam Major Rehab - Baseline Cost Estimate | Multi-Curtain Layout | 26-Aug-08 09:22

Activity ID	Activity Name	Original Duration	Remaining Duration	Start	Finish	Budgeted Total Cost
BOLBL Bolivar Dam Major Rehab - Baseline Cost Estimate		1004d	1004d	03-Jan-11	31-Dec-14	$85,765,025.78
A1450	Cultural resource preservation	157d	157d	03-Jan-11	15-Aug-11	$100,000.00
A1460	Construction office	157d	157d	03-Jan-11	15-Aug-11	$308,082.30
A1000	Mobilization	22d	22d	16-Aug-11*	15-Sep-11	$533,333.33
A1370	Silt fence/ditch check installation	22d	22d	16-Aug-11	15-Sep-11	$90,940.67
A1380	Develop staging areas	23d	23d	16-Aug-11	16-Sep-11	$71,818.70
A1390	Haul roads	23d	23d	16-Aug-11	16-Sep-11	$71,818.70
A1430	Miscellaneous environmental protection	825d	825d	16-Sep-11	31-Dec-14	$143,637.40
A1070	Clearing/Grubbing	1d	1d	19-Sep-11	19-Sep-11	$7,014.59
A1150	Demolish Roadway	5d	5d	19-Sep-11	26-Sep-11	$80,906.50
A1230	Clearing	22d	22d	19-Sep-11	20-Oct-11	$308,642.17
A1080	Abutment Cuttoff Wall	44d	44d	26-Sep-11	29-Nov-11	$1,440,000.00
A1100	Remove and Replace Culvert, 12" CMP	51d	51d	26-Sep-11	08-Dec-11	$2,535.83
A1110	Remove and Replace Flag Pole	51d	51d	26-Sep-11	08-Dec-11	$10,245.43
A1120	Remove and Replace Monument	51d	51d	26-Sep-11	08-Dec-11	$14,363.74
A1130	Remove and Replace Chain Link Fence	51d	51d	26-Sep-11	08-Dec-11	$9,112.51
A1140	Remove and Replace Light Pole	51d	51d	26-Sep-11	08-Dec-11	$6,540.09
A1170	Storm Drain, 4" PVC	51d	51d	26-Sep-11	08-Dec-11	$852.97
A1180	Temporary Relocate/ Replace Sewer Line, 4" PVC	51d	51d	26-Sep-11	08-Dec-11	$3,022.24
A1190	Temporary Relocate/ Replace Water Line, 1" PE	51d	51d	26-Sep-11	08-Dec-11	$2,955.63
A1200	Temporary Relocate/ Replace UG Electric to Office	51d	51d	26-Sep-11	08-Dec-11	$4,516.50
A1210	Temporary Relocate/ Replace UG Telephone to Intake	51d	51d	26-Sep-11	08-Dec-11	$5,897.75
A1240	Seepage Blanket Fill	177d	177d	20-Oct-11	05-Jul-12	$5,061,264.51
A1260	16' x 6' deep x 4' Junction Box w/Cover	177d	177d	20-Oct-11	05-Jul-12	$20,657.16
A1270	54" BCCMP Outlet	177d	177d	20-Oct-11	05-Jul-12	$133,553.43
A1280	Extend 48" BCCMP	177d	177d	20-Oct-11	05-Jul-12	$61,277.11
A1290	Extend 36" BCCMP	177d	177d	20-Oct-11	05-Jul-12	$21,199.11
A1300	Flared End Section for 54" Pipe	177d	177d	20-Oct-11	05-Jul-12	$6,919.28
A1310	Flared End Section for 48" Pipe	177d	177d	20-Oct-11	05-Jul-12	$3,102.15
A1320	Flared End Section for 36" Pipe	177d	177d	20-Oct-11	05-Jul-12	$2,056.60
A1330	Stone Lined Outlet, 6" Topsize Stone	177d	177d	20-Oct-11	05-Jul-12	$27,012.88
A1160	Roadway Replacement	7d	7d	29-Nov-11	08-Dec-11	$185,922.27
A1090	Seeding	1d	1d	08-Dec-11	12-Dec-11	$6,748.44
A1220	Radial Grouting in Tunnels	24d	24d	08-Dec-11	13-Jan-12	$431,699.69
A1420	Hoisting equipment	66d	66d	02-Apr-12*	05-Jul-12	$1,095,229.81
A1010	Stripping topsoil	28d	28d	16-Apr-12*	11-May-12	$136,056.28
A1040	Placing impervious fill	157d	157d	11-May-12	09-Oct-12	$5,853,578.80
A1360	Gate removal/installation	30d	30d	13-Jun-12	26-Jul-12	$7,331,247.50
A1250	Seeding	12d	12d	05-Jul-12	24-Jul-12	$105,888.43
A1400	Develop slurry ponds	10d	10d	24-Sep-12	09-Oct-12	$71,818.70
A1050	Cutoff wall construction	1778d	1778d	09-Oct-12	23-Sep-14	$58,085,539.03
A1350	Instrumentation	66d	66d	02-Jun-14*	03-Sep-14	$2,385,922.78
A1340	Rehab relief wells	22d	22d	07-Jul-14*	05-Aug-14	$680,852.97
A1060	Verification drilling	10d	10d	23-Sep-14	06-Oct-14	$238,259.63
A1410	Reclaim slurry ponds	10d	10d	07-Oct-14	21-Oct-14	$71,818.70
A1020	Placing topsoil	28d	28d	21-Oct-14	17-Nov-14	$183,422.46
A1030	Seeding	12d	12d	18-Nov-14	29-Nov-14	$101,075.32
A1470	Demob	22d	22d	01-Dec-14	31-Dec-14	$266,666.67



Remaining Level of Effort | Actual Work | Critical Remaining W...
Actual Level of Effort | Remaining Work | Milestone

Page 1 of 1 | TASK filter: All Activities | (c) Primavera Systems, Inc.

4 COST & SCHEDULE RISK ANALYSIS (CSRA)

A Cost and Schedule Risk Analysis (CSRA) was performed on this project to more accurately identify risk and potential impacts to the project. This analysis required participation by entire PDT to identify the 80% confidence level project cost and contingencies.

The CSRA identified the following factors as major impacts for both the cost and schedule:

- **Funding** – The current fully-funded cost requires approximately $39M for FY12, $53M for FY13, and $59M for FY 14. If funding is capped and the project schedule is pushed out, costs will increase due to the longer construction schedule, escalation, and additional E&D & S&A.
- **Contract Acquisition** – Currently only a handful of contractors are capable of performing this type of construction in the United States. If the project is not competitively bid, or if there are not many bidders, project costs will increase due to a non-competitive market.
- **Scope Growth** – The current cost estimate is based on the current known conditions and quantities. Further engineering analysis may result in additional scope and increase costs.

Below is a brief step-by-step summary of the cost/schedule risk analysis process performed by the estimator:

1. In coordination with the PDT, a risk register was developed to identify the various risks associated with the project.
2. Upon completion of the risk register, a quantity analysis was performed with the PDT to establish a maximum/minimum range of possible quantity and schedule variations.
3. A cost analysis was also performed by the estimator taking into consideration the risks identified in the risk register, local economy, market conditions, contractor acquisition, etc.
4. The maximum costs/quantities and minimum costs/quantities were used to develop a maximum and minimum project cost; this established the upper and lower bounds of the distribution curve used to identify the 80% confidence level.
5. Each project component was then analyzed to determine what type of distribution curve would be used with each individual component. Some components were correlated with one another if costs for one feature were expected to rise with another. For example, the partial cutoff wall was positively correlated with E&D and S&A since a larger cutoff wall would more likely require additional E&D and S&A; in other words, as the cutoff wall costs increased, E&D and S&A costs increased as well.
6. Using the maximum and minimum project costs and durations, a risk analysis was performed with the Crystal Ball risk analysis software.

7. After the first trial was complete, the results were reviewed by the estimator and if necessary, adjusted and repeated.
8. From the risk analysis results, various reports were generated summarizing contingencies, durations, and identification of the project components causing the most variation in project costs and schedule.

Results of the cost and schedule risk analysis can be found on the next few pages. Tables 5 through 11 summarizes the project's contingencies at the 80% confidence level, Table 12 is a "tornado" chart identifying the project components causing the most variance, and Table 13 is an S-curve graph of the total project cost. Tables 14 and 15 summarize the schedule risk analysis and it's corresponding 80% confidence level and "tornado" chart.

The cost risk analysis report can be found in Tab A of this appendix. The schedule risk analysis report can be found in Tab B of this appendix.

Table 6. 01 Account Contingency Analysis

Most Likely Cost Estimate	$	96,482
Confidence Level	**Value**	**Contingency**
0%	$85,404	-11.5%
5%	$87,829	-9.0%
10%	$88,851	-7.9%
15%	$89,640	-7.1%
20%	$90,334	-6.4%
25%	$91,031	-5.6%
30%	$91,716	-4.9%
35%	$92,466	-4.2%
40%	$93,257	-3.3%
45%	$94,064	-2.5%
50%	$94,934	-1.6%
55%	$95,851	-0.7%
60%	$96,774	0.3%
65%	$97,775	1.3%
70%	$98,857	2.5%
75%	$100,026	3.7%
80%	$101,339	5.0%
85%	$102,819	6.6%
90%	$104,542	8.4%
95%	$106,824	10.7%
100%	$112,188	16.3%

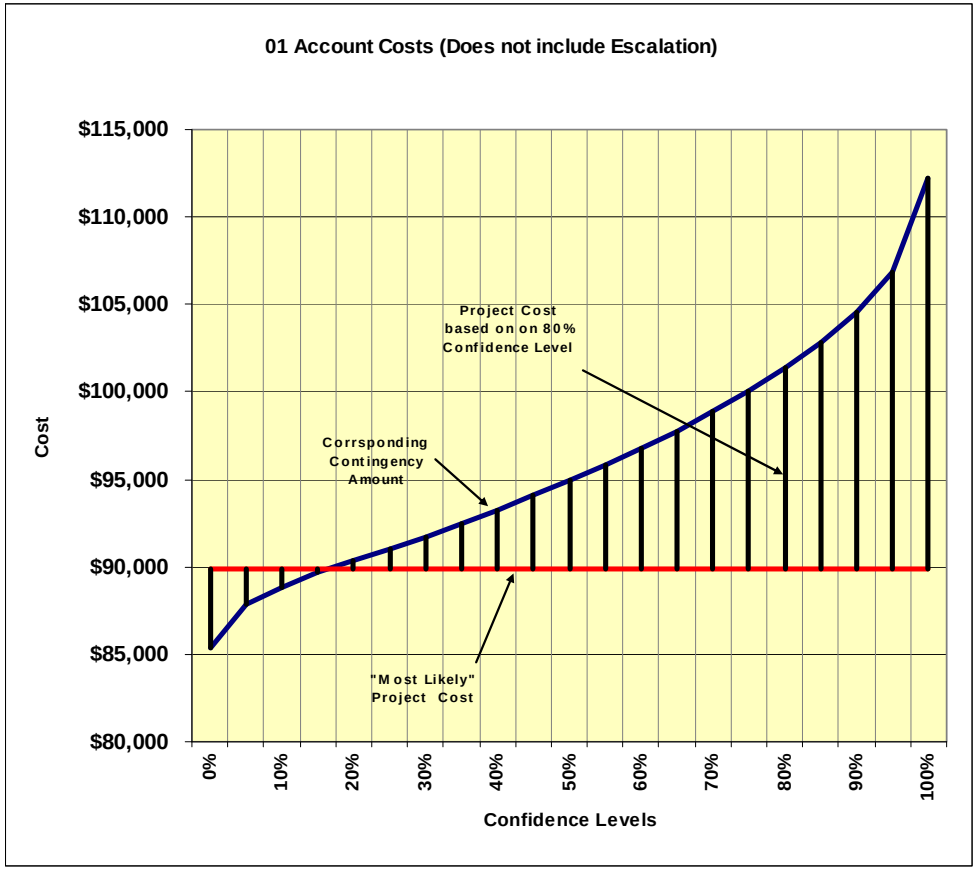


Table 7. 04 Account Contingency Analysis

Most Likely Cost Estimate	$ 85,376,944	
Confidence Level	**Value**	**Contingency**
0%	$80,560,163	-5.6%
5%	$87,038,588	1.9%
10%	$88,665,788	3.9%
15%	$90,088,468	5.5%
20%	$91,476,354	7.1%
25%	$92,898,684	8.8%
30%	$94,361,853	10.5%
35%	$95,822,774	12.2%
40%	$97,365,987	14.0%
45%	$98,974,663	15.9%
50%	$100,643,812	17.9%
55%	$102,379,635	19.9%
60%	$104,169,271	22.0%
65%	$106,151,742	24.3%
70%	$108,296,237	26.8%
75%	$110,501,284	29.4%
80%	$113,025,050	32.4%
85%	$115,926,342	35.8%
90%	$119,407,027	39.9%
95%	$123,953,184	45.2%
100%	$137,011,438	60.5%

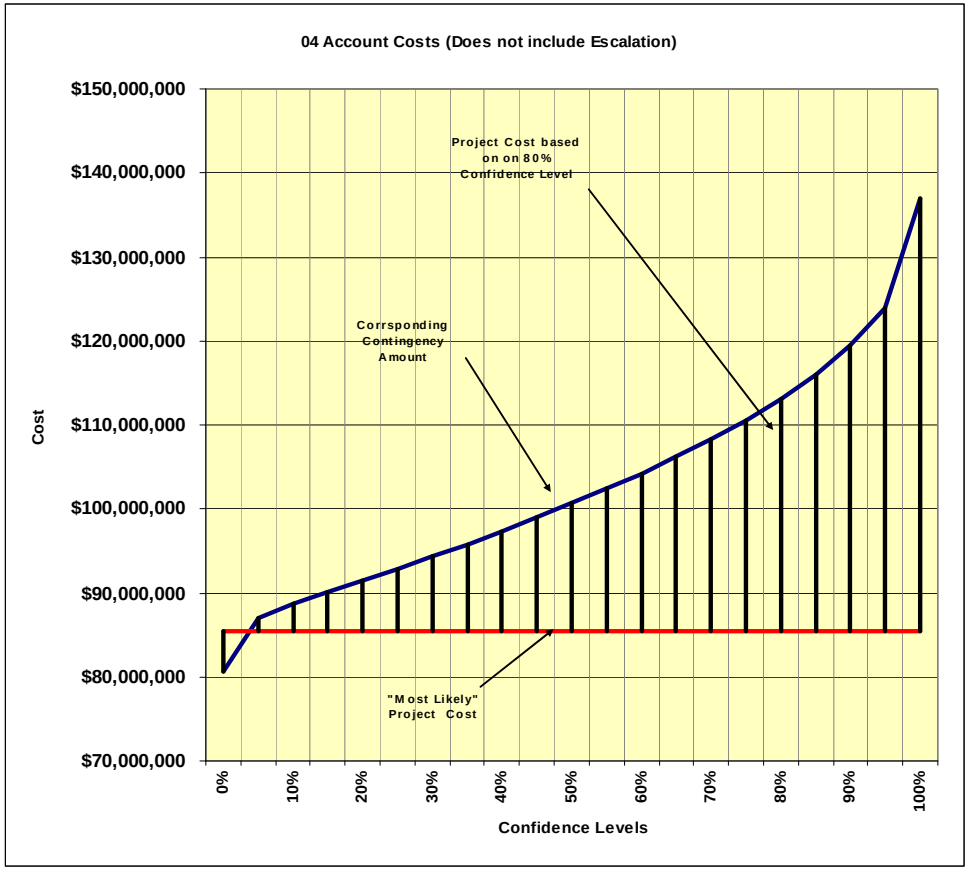


Table 8. 18 Account Contingency Analysis

Most Likely Cost Estimate	$ 155,399	
Confidence Level	**Value**	**Contingency**
0%	$100,005	-35.6%
5%	$109,840	-29.3%
10%	$119,907	-22.8%
15%	$129,696	-16.5%
20%	$140,152	-9.8%
25%	$150,409	-3.2%
30%	$160,470	3.3%
35%	$170,618	9.8%
40%	$180,492	16.1%
45%	$190,661	22.7%
50%	$200,665	29.1%
55%	$210,820	35.7%
60%	$220,897	42.1%
65%	$230,686	48.4%
70%	$240,821	55.0%
75%	$250,832	61.4%
80%	$261,084	68.0%
85%	$270,721	74.2%
90%	$280,611	80.6%
95%	$289,982	86.6%
100%	$299,997	93.1%

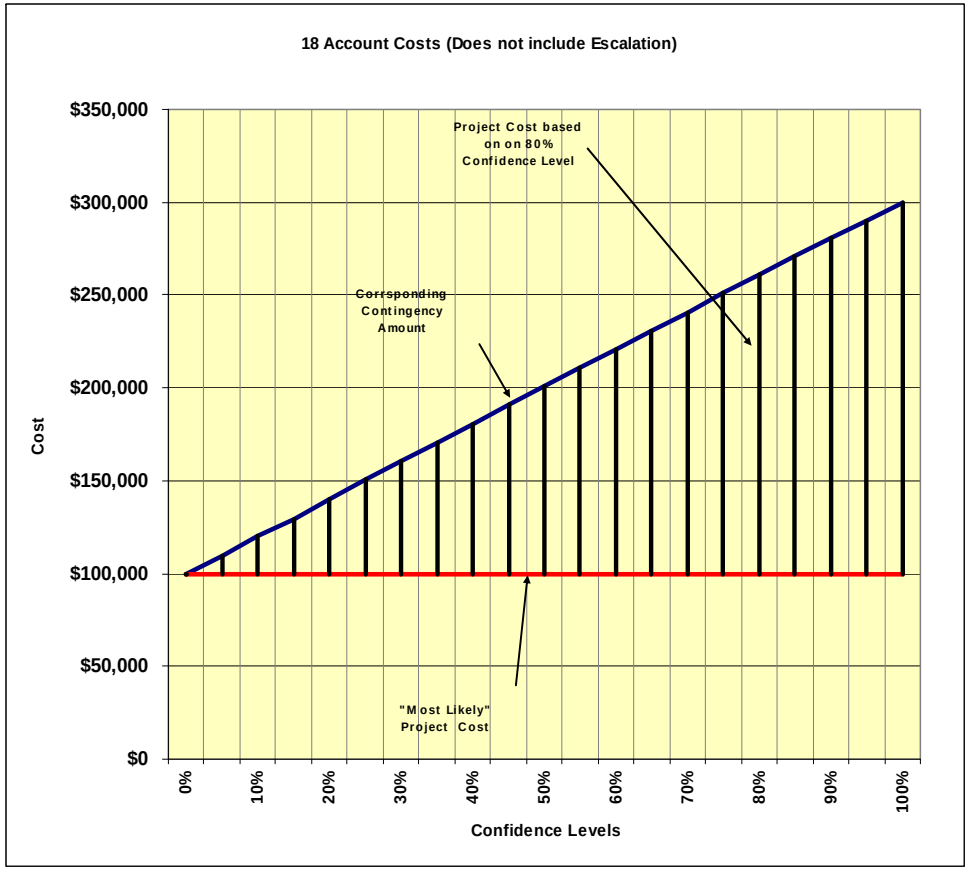


Table 9. 19 Account Contingency Analysis

Most Likely Cost Estimate	$	394,162
Confidence Level	**Value**	**Contingency**
0%	$278,452	-29.4%
5%	$294,121	-25.4%
10%	$300,828	-23.7%
15%	$306,132	-22.3%
20%	$310,386	-21.3%
25%	$314,827	-20.1%
30%	$319,657	-18.9%
35%	$324,571	-17.7%
40%	$329,762	-16.3%
45%	$335,120	-15.0%
50%	$340,634	-13.6%
55%	$346,587	-12.1%
60%	$352,725	-10.5%
65%	$359,066	-8.9%
70%	$366,273	-7.1%
75%	$373,765	-5.2%
80%	$382,332	-3.0%
85%	$391,854	-0.6%
90%	$403,461	2.4%
95%	$418,353	6.1%
100%	$453,830	15.1%

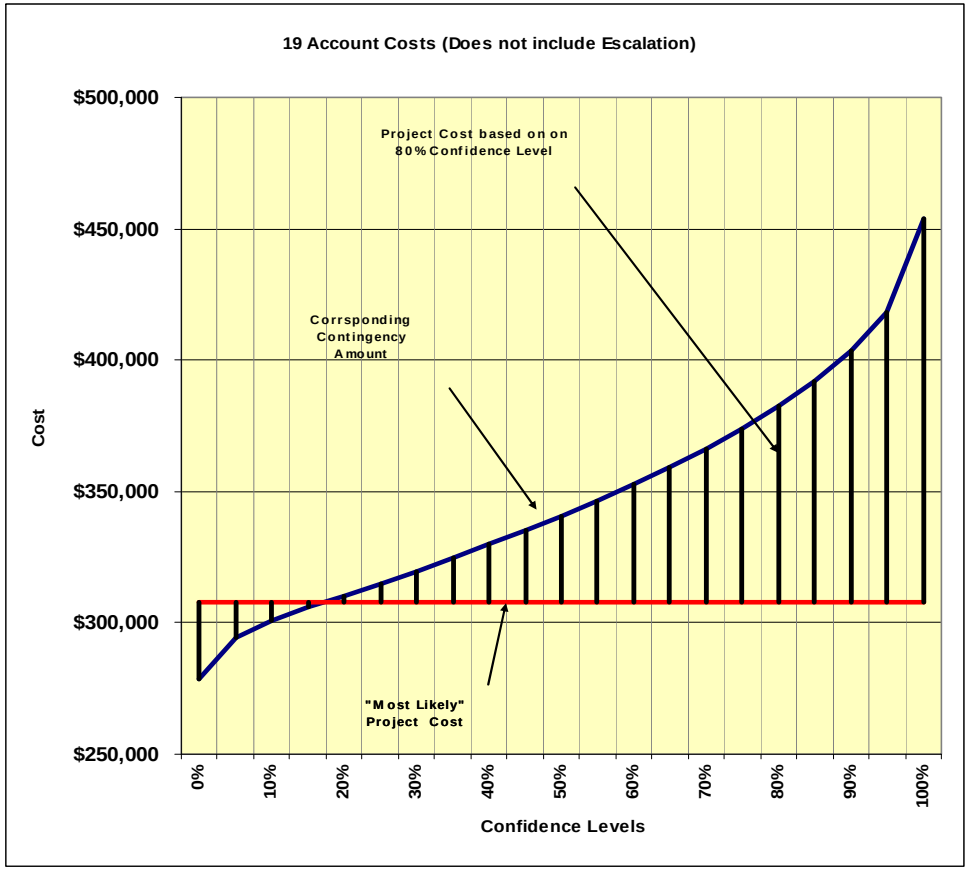


Table 10. 30 Account Contingency Analysis

Most Likely Cost Estimate	$	12,721,041
Confidence Level	**Value**	**Contingency**
0%	$9,594,310	-24.6%
5%	$9,975,605	-21.6%
10%	$10,177,801	-20.0%
15%	$10,392,851	-18.3%
20%	$10,610,498	-16.6%
25%	$10,834,273	-14.8%
30%	$11,071,507	-13.0%
35%	$11,304,334	-11.1%
40%	$11,551,998	-9.2%
45%	$11,819,610	-7.1%
50%	$12,088,666	-5.0%
55%	$12,369,755	-2.8%
60%	$12,677,244	-0.3%
65%	$12,990,027	2.1%
70%	$13,339,874	4.9%
75%	$13,709,244	7.8%
80%	$14,108,474	10.9%
85%	$14,576,027	14.6%
90%	$15,138,901	19.0%
95%	$15,862,415	24.7%
100%	$17,553,309	38.0%

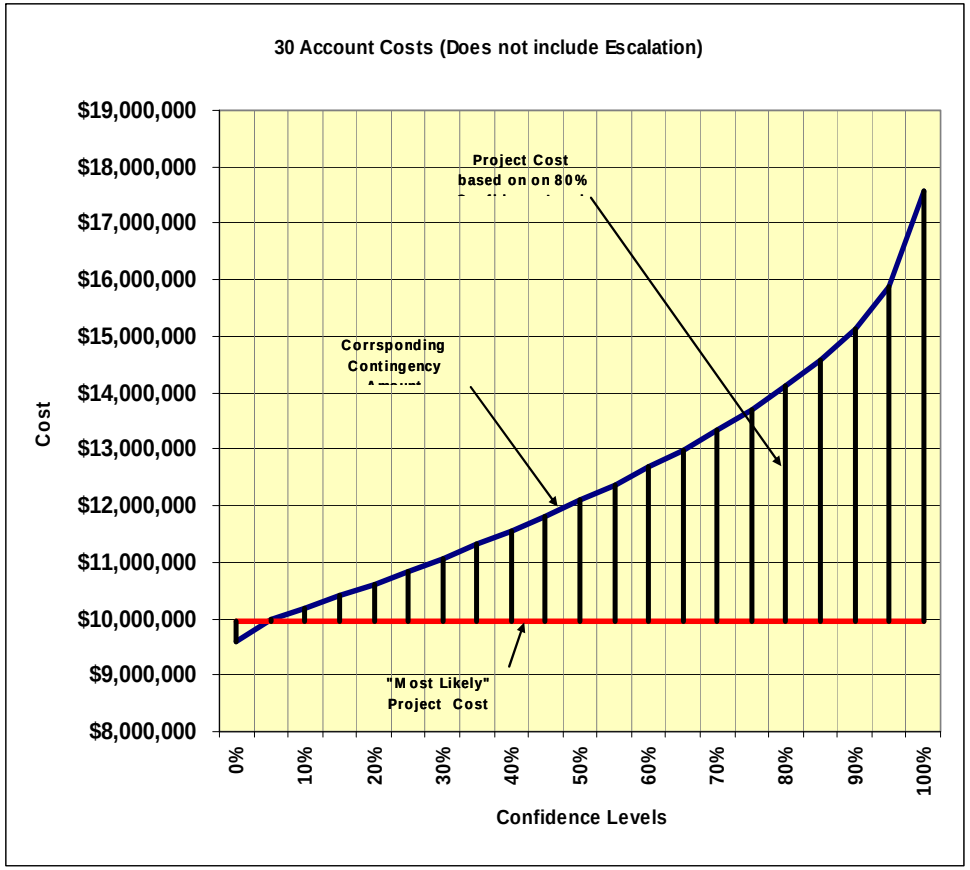


Table 11. 31 Account Contingency Analysis

31 Construction Management
Contingency Analysis

Most Likely Cost Estimate	$	6,433,877
Confidence Level	**Value**	**Contingency**
0%	$5,845,737	-9.1%
5%	$6,236,450	-3.1%
10%	$6,391,611	-0.7%
15%	$6,522,098	1.4%
20%	$6,649,728	3.4%
25%	$6,784,720	5.5%
30%	$6,922,860	7.6%
35%	$7,068,990	9.9%
40%	$7,218,827	12.2%
45%	$7,379,690	14.7%
50%	$7,538,773	17.2%
55%	$7,709,534	19.8%
60%	$7,895,109	22.7%
65%	$8,087,138	25.7%
70%	$8,306,243	29.1%
75%	$8,528,424	32.6%
80%	$8,776,653	36.4%
85%	$9,048,002	40.6%
90%	$9,388,347	45.9%
95%	$9,836,192	52.9%
100%	$10,856,877	68.7%

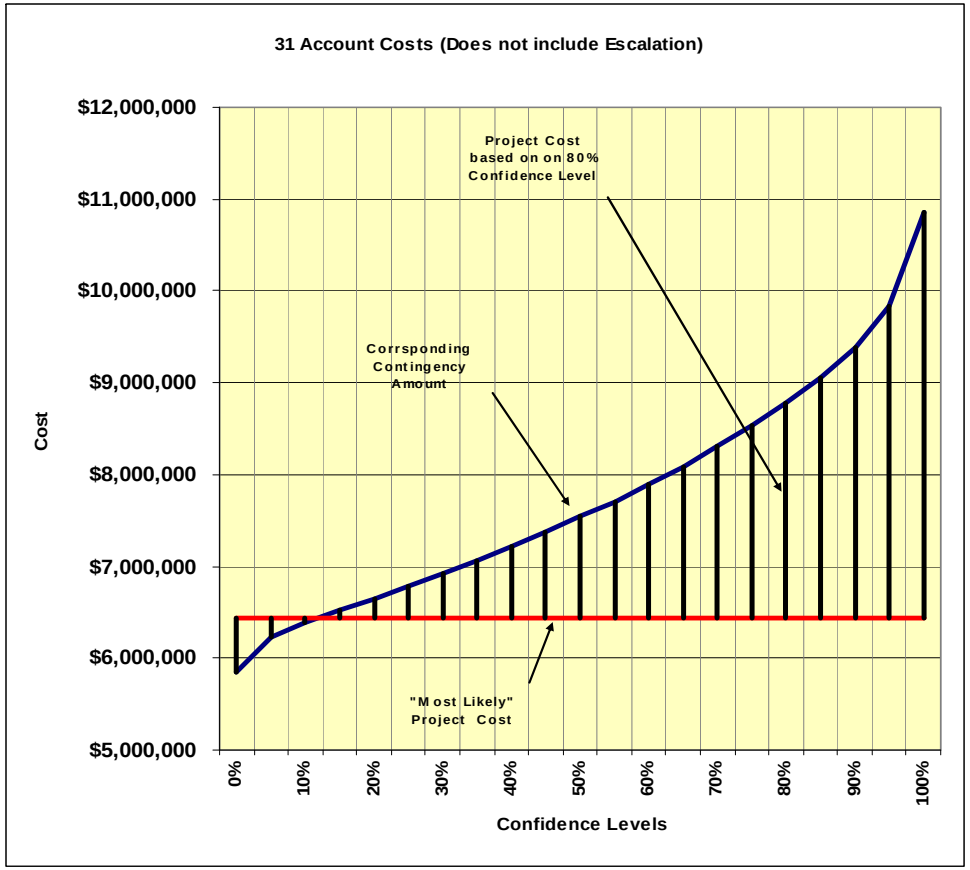


Table 12. Cost Sensitivity Chart

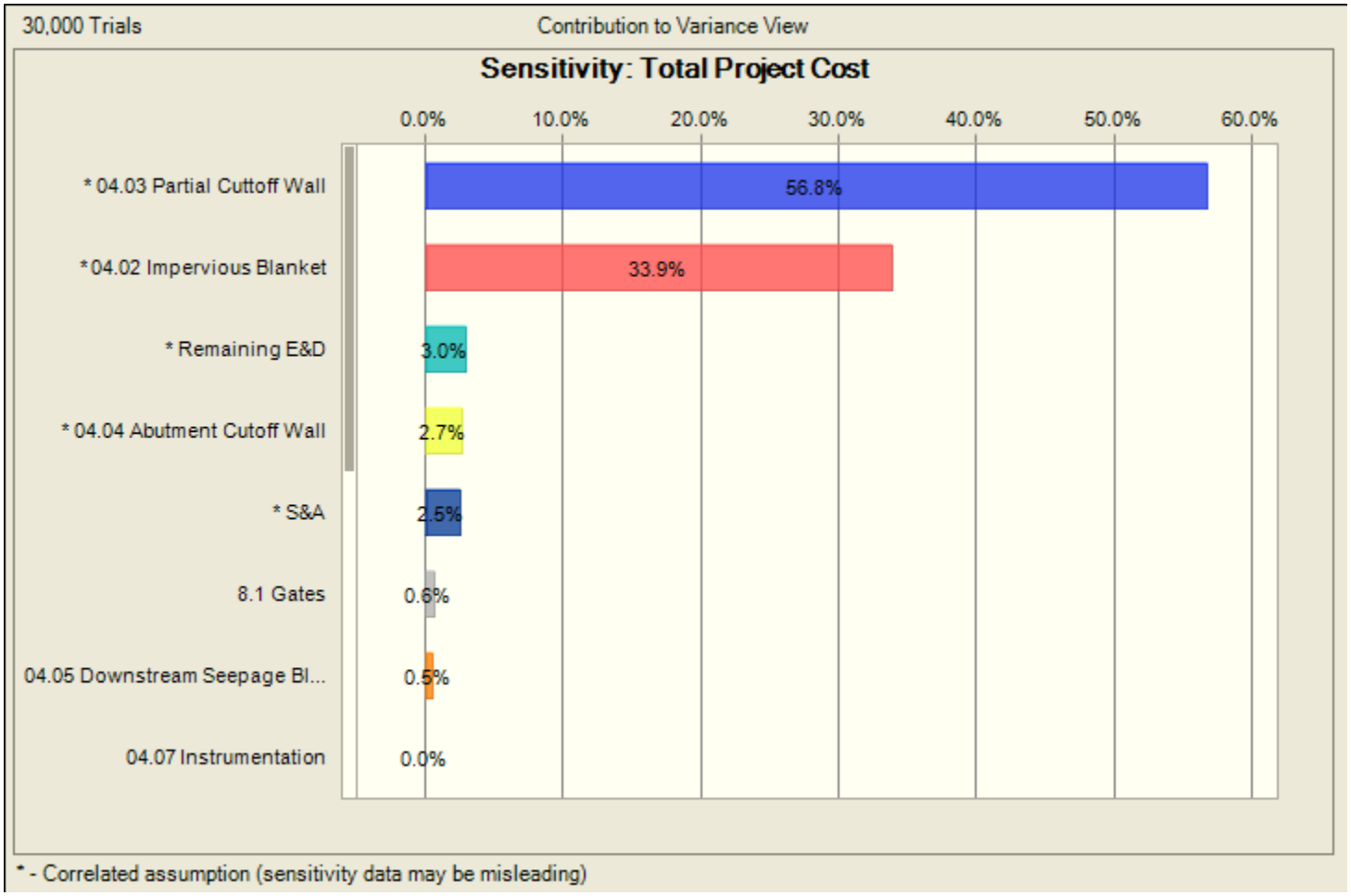
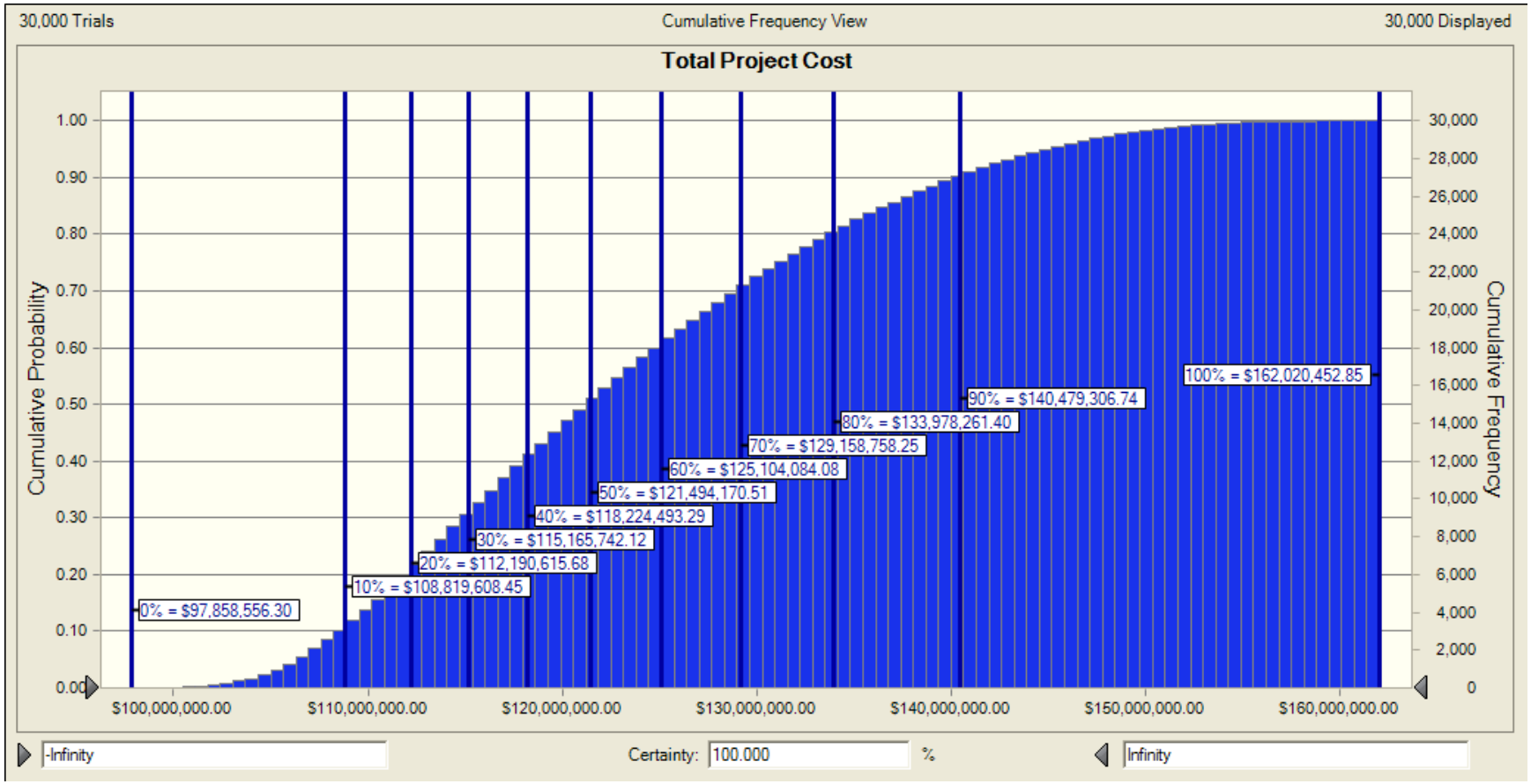
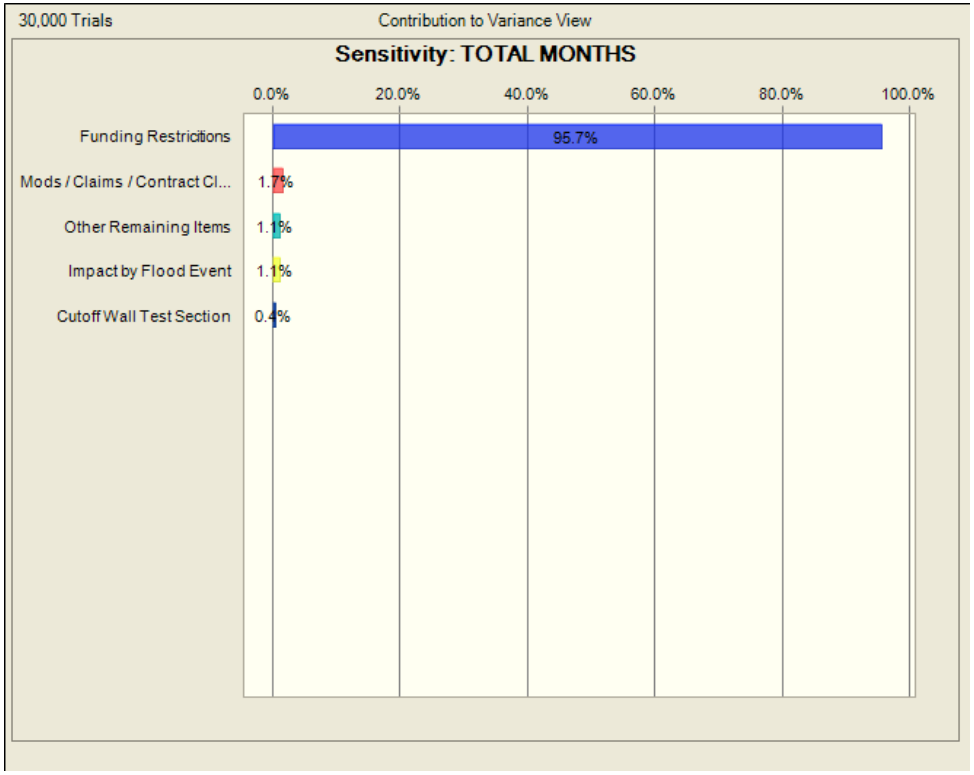


Table 13. S-Curve Chart



Tables 14 and 15. Schedule Confidence Level & Schedule Sensitivity Chart

Current Schedule	35.0 Months
Confidence Level	**Value (Total Months)**
0%	29.8 Months
10%	35.4 Months
20%	37.1 Months
30%	38.8 Months
40%	40.4 Months
50%	42.2 Months
60%	44.1 Months
70%	46.3 Months
80%	48.9 Months
90%	52.3 Months
100%	62.2 Months



TAB A

COST RISK ANALYSIS REPORT

Bolivar Major Rehab
Baseline Cost Estimate
Risk Register
August 2008

Risk Level

Likelihood of Occurrence	Negligible	Marginal	Significant	Critical	Crisis
Very Likely	Low	Moderate	High	High	High
Likely	Low	Moderate	High	High	High
Unlikely	Low	Low	Moderate	Moderate	High
Very Unlikely	Low	Low	Low	Low	High

Impact or Consequence of Occurrence

Low risk items not considered in risk analysis.

Risk No.	Macro WBS	Risk/Opportunity Event	Discussion and Concerns	Project Cost			Project Schedule			Correlation to Other(s)	Notes	Changes to Estimate Resulting from Risk	
				Likelihood*	Impact*	Risk Level*	Likelihood*	Impact*	Risk Level*			Maximum	Minimum
Internal Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)													
I-1	04 & 19 Accounts	Contract Acquistion	Due to specialty work for the main seepage barrier and abutment, contractor availability could be limited since only a handful of contractors are capable of constructing this type of wall.	Likely	Critical	High	Unlikely	Marginal	Low	All construction costs	Only 4-5 contractors perform this work in the US, if most are working on other large projects then the competition may be thin.	A 10% running percentage was added to the prime contractor to allow for a non-competitive atmosphere.	Adjustments were made to FOOH, HOOH, profit, and bond to account for a more competive atmosphere.
I-2a	04.3	Cutoff Wall Test Section	Have contractor construct a test section to determine efficiency/constructability of barrier. This could result in an increase in costs.	Very Likely	Marginal	Moderate	Very Likely	Marginal	Moderate	I-2b	Preferred method by PDT. Could delay project by one month.	Added an allowance based upon current cost per month to account for construction of a test section.	No changes since PDT felt like costs could only increase due to request.
I-2b	04.3	Cutoff Wall Test Section	Don't have contractor construct a test section to determine efficiency/constructability of barrier. If everything went well, costs could be lowered or costs could increasely vastly if things didn't go well. Construction of a test section would mitigate this risk item.	Unlikely	Critical	Moderate	Unlikely	Marginal	Low	I-2a	PDT assumed I-2a would be performed ; I-2b was mainly analyzed to confirm the need for a test section to see how the seepage barrier will perform and ensure it will function correctly.	Not considered since PDT felt like it would become a requirement.	Not considered since PDT felt like it would become a requirement.
I-3a	04.4.4.2	Left Abutment Test Section	Have contractor construct a test section to determine efficiency/constructability of barrier. Due to the smaller size of wall, it may or may not be beneficial to do a test section on the abutment wall.	Very Likely	Neglible	Low	Very Likely	Neglible	Low	I-3b/5/6	Preferred method by PDT.	Low risk item - not considered since associated costs are small in comparison with other major cost components.	Low risk item - not considered since associated costs are small in comparison with other major cost components.
I-3b	04.4.4.2	Left Abutment Test Section	Don't have contractor construct a test section to determine efficiency/constructability of barrier. If everything went well, costs could be lowered or costs could increasely vastly if things didn't go well. Construction of a test section would mitigate this risk item.	Unlikely	Critical	Moderate	Unlikely	Marginal	Low	I-3a/5/6	PDT assumed I-3a would be performed ; I-3b was mainly analyzed to confirm the need for a test section to see how the seepage barrier will perform and ensure it will function correctly.	Low risk item - not considered since associated costs are small in comparison with other major cost components.	Low risk item - not considered since associated costs are small in comparison with other major cost components.
I-4	04.4.4.22	Radial Grouting	Grout quantities could increase due to increased voids.	Likely	Marginal	Moderate	Likely	Marginal	Low		Work is assumed to be performed by a subcontractor and can be performed anytime during constrcution of main seepage barrier.	Doubled quantities to anticipate a worst-case scenario.	No changes since PDT felt like current plan is the minimum effort required.
I-5	04.4.4.2	Left Abutment Seepage Barrier (Type of Wall)	Currently, the wall is a cement/bentonite mixture. Upon further investigations, the type of wall could change.	Likely	Marginal	Moderate	Likely	Neglible	Low	I-3a/3b/6	Duration could extend but would not be critical due to main embankment wall construction.	Increased unit cost to $50/SF to allow for a different type of wall; current costs were $30/SF based upon recent costs for same type of work.	No changes to unit cost.
I-6	04.4.4.2	Left Abutment Seepage Barrier (Dimensions)	Currently, the wall is a cement/bentonite mixture. Upon further investigations, the size/depth of wall could change.	Likely	Marginal	Moderate	Likely	Neglible	Low	I-3a/3b/5	Duration could extend but would not be critical due to main embankment wall construction.	A maximum quantity was developed by the PDT and used. Costs were also varied based upon contractor assumptions, OH, profit, bond, etc.	A minimum quantity was developed by the PDT and used. Costs were also varied based upon contractor assumptions, OH, profit, bond, etc.
I-7	04.2	Impervious Blanket Material Availability	Is enough material available nearby for construction?	Unlikely	Significant	Moderate	Unlikely	Neglible	Low		Currently, a supplier exisits who stated that they could provide the material. Other alternate suppliers should be identified to mitigate risk.	Increased unit costs approximately 20% assuming material may come from an alternate source than currently assumed.	No changes to unit cost.
I-8	04.2	Impervious Blanket Size	If the cutoff wall is extended, the impervious blanket must be extended as well.	Likely	Marginal	Moderate	Likely	Marginal	Moderate	I-15	It is anticipated that the larger blanket size could still be managed in once construction season with additional labor and equipment.	A maximum quantity was developed by the PDT and used. Costs were also varied based upon contractor assumptions, OH, profit, bond, etc.	A minimum quantity was developed by the PDT and used. Costs were also varied based upon contractor assumptions, OH, profit, bond, etc.
I-9	04.5	Rehab Relief Wells & Instumentation	Further investigations and evaluations of the state-of-the-art instrumentation capabilities and confinement of current scope of work could cause an increase in scope and costs.	Likely	Marginal	Moderate	Likely	Neglible	Low		Duration could extend but would not be critical due to main embankment wall construction.	A maximum cost was determined in coordination with Geotech.	A minimum cost was determined in coordination with Geotech.
I-10	04 Account	Flood Event (Upstream Work)	A 5 to 10 year event could impact construction schedule due to risks involved with contractor working in the presence of high water and seepage.	Likely	Marginal	Moderate	Likely	Marginal	Moderate	I-7/15	Work on the left abutment could be performed but delays up to 2 months could be encountered.	An allowance for a 2-month weather delay was included as an overhead item for the prime contractor based on the high OH monthly rate.	The 2.5% for show-up time (running % on labor) was removed from the estimate.
I-11	04 Account	Flood Event (Downstream Work)	A 5-10 year storm event could cause "swampy" conditions downstream and affect contractor productivity.	Likely	Marginal	Moderate	Likely	Marginal	Moderate		Work on the left abutment could be performed but delays up to 2 months could be encountered.	An allowance for a 2-month weather delay was included as an overhead item for the prime contractor based on the high OH monthly rate. (Included with risk item above)	The 2.5% for show-up time (running % on labor) was removed from the estimate.
I-12	04.4	Flood Event (Left Abutment Work)	A 5 to 10 year event could impact construction schedule due to risks involved with contractor working in the presence of high water and seepage.	Very Unlikely	Marginal	Low	Very Unlikely	Marginal	Low	I-3a/3b/5/6	PDT felt that this would unlikely effect the schedule except in an extreme case.	Low risk item - not considered.	Low risk item - not considered.
I-13	04.8.1	Gates	Potential increase in costs due to embedded metals.	Likely	Marginal	Moderate	Likely	Neglible	Low		Costs could increase but duration is assumed to remain the same.	Increased unit costs per pound to account for additional embedded metals.	Used a lower quote obtained from an alternate source.
I-14	04.8.2	Hoisting Equipment	Additional scope of work associated with machinery not originally needing replaced.	Likely	Neglible	Low	Likely	Neglible	Low		Duration could extend but would not be critical due to main embankment wall construction.	Coordinated with PDT to determine a maximum cost.	Coordinated with PDT to determine a minimum cost.
I-15	04.3	Cutoff Wall	Quantity could be lower/higher dependent on further investigations on depth and length of wall.	Likely	Significant	High	Likely	Significant	High	I-1/7/15	Could add/remove time depending on the magnitude of quantity changes.	A maximum quantity was developed by the PDT and used. Costs were also varied based upon contractor assumptions, OH, profit, bond, etc.	A minimum quantity was developed by the PDT and used. Costs were also varied based upon contractor assumptions, OH, profit, bond, etc.
I-16	Construction Costs	Other Remaining Items	Variation in the smaller quantities and associated costs could vary from the current assumptions.	Likely	Neglible	Low	Likely	Neglible	Low		In order to consider contingencies on the smaller items, costs and quantity variations were incorporated into the maximum/minimum estimates.	A maximum quantity was developed by the PDT and used. Costs were also varied based upon contractor assumptions, OH, profit, bond, etc.	A minimum quantity was developed by the PDT and used. Costs were also varied based upon contractor assumptions, OH, profit, bond, etc.
I-17	Total Project	Scope Growth	In coordination with the PDT, quantities were varied to account for potential scope growth based upon the current situation and knowledge about the project.	Likely	Neglible	Low	Likely	Neglible	Low	Entire project	In order to consider contingencies on the smaller items, costs and quantity variations were incorporated into the maximum/minimum estimates.	A maximum quantity was developed by the PDT and used. Costs were also varied based upon contractor assumptions, OH, profit, bond, etc.	A minimum quantity was developed by the PDT and used. Costs were also varied based upon contractor assumptions, OH, profit, bond, etc.
I-18	Total Project	Fuel Costs	Due to the current market conditions, fuel costs are very volatile and highly unpredictable. If fuel costs continue to rise or fall, the project costs will also follow the same path.	Likely	Marginal	Moderate	Likely	Neglible	Low	Entire project		Assumed fuel was $5/gal, diesel off-road was $5.5/gal, & diesel on-road was $6/gal.	Assumed fuel was $5/gal, diesel off-road was $5.5/gal, & diesel on-road was $6/gal.

Risk No.	Macro WBS	Risk/Opportunity Event	Discussion and Concerns	Project Cost			Project Schedule			Correlation to Other(s)	Notes	Changes to Estimate Resulting from Risk	
				Likelihood*	Impact*	Risk Level*	Likelihood*	Impact*	Risk Level*			Maximum	Minimum
External Risks (External Risk Items are those that are generated, caused, or controlled exclusively outside the PDT's sphere of influence.)													
E-1	Total Project	Funding	Currently, funding for FY12, FY13, and FY14 are significant. An expected cap is somewhere between $20-$25M range. Longer project durations will result in futher E&D during construction.	Very Likely	Significant	High	Likely	Significant	High	I-15	If there is a funding cap, efficiency of seepage wall construction would lessen and dramatically increase the costs of the wall due to an additional 24 months of construction for the wall.	Construction of the cutoff wall was the major item affected by a funding cap. Methodology and rental of equipment was adjusted in the MII estimate to account for a longer construction schedule. E&D collected from PDT members averaged $1.5M per year. Assuming an additional 36 months for construction resulted in a $4.5M increase in E&D.	No changes except for the changes mentioned above which reduced the construction schedule due to the lower quantities and assuming no funding cap (estimated reduction is 4 months).
E-2	Construction Costs	Mapping	Newer mapping could change quantity of seepage blanket and impervious blankets.	Likely	Significant	High	Likely	Significant	High	All construction costs	Updated mapping could result in a larger/smaller blanket size. Current mapping lacks significant details to perform an accurate estimate of quantities.	A maximum quantity was developed by the PDT and used. Costs were also varied based upon contractor assumptions, OH, profit, bond, etc.	A minimum quantity was developed by the PDT and used. Costs were also varied based upon contractor assumptions, OH, profit, bond, etc.
E-3	Total Project	Mods / Claims / Contract Closeout	The potential for mods, claims, etc. are high for this type of work since it is a specialty and not more common work.	Likely	Significant	High	Likely	Significant	High	Entire project	An allowance for a 3-month delay included as runninger percentage.	An allowance for a 6-month delay .	Assumed a 2-month delay.

*Likelihood, Impact, and Risk Level to be verified through market research and analysis (conducted by cost engineer).

1. Risk/Opportunity identified with reference to the Risk Identification Checklist and through deliberation and study of the PDT.
2. Discussions and Concerns elaborates on Risk/Opportunity Events and includes any assumptions or findings (should contain information pertinent to eventual study and analysis of event's impact to project).
3. Likelihood is a measure of the probability of the event occurring --**Very Unlikely**, **Unlikely**, **Moderately Likely**, **Likely**, **Very Likely.** The likelihood of the event will be the same for both Cost and Schedule, regardless of impact.
4. Impact is a measure of the event's effect on project objectives with relation to scope, cost, and/or schedule --**Negligible**, **Marginal**, **Significant**, **Critical**, or **Crisis.** Impacts on Project Cost may vary in severity from impacts on Project Schedule.
5. Risk Level is the resultant of Likelihood and Impact**Low**, **Moderate**, or **High**. Refer to the matrix located at top of page.
6. Variance Distribution refers to the behavior of the individual risk item with respect to its potential effects on Project Cost and Schedule. For example, an item with clearly defined parameters and a solid most likely scenario would probably follow a triangular or normal distribution. A risk item for which the PDT has little data or probability of modeling with respect to effects on cost or schedule (i.e. "anyone's guess") would probably follow a uniform or discrete uniform distribution.
7. The responsibility or POC is the entity responsible as the Subject Matter Expert (SME) for action, monitoring, or information on the PDT for the identified risk or opportunity.
8. Correlation recognizes those risk events that may be related to one another. Care should be given to ensure the risks are handled correctly without a "double counting."
9. Affected Project Component identifies the specific item of the project to which the risk directly or strongly correlates.
10. Project Implications identifies whether or not the risk item affects project cost, project schedule, or both. The PDT is responsible for conducting studies for both Project Cost and for Project Schedule.
11. Results of the risk identification process are studied and further developed by the Cost Engineer, then analyzed through the Monte Carlo Analysis Method for Cost (Contingency) and Schedule (Escalation) Growth.

Assumptions for Minimum/Maximum Cost Estimates.

Changes to MII for Minimum Estimate

Adjusted quantities to minimum estimated for potential scope reductions.
Changed profit globally to 8% assuming a competitive bidding climate.
Assumed fuel was $3.6/gal, diesel off-road was $4/gal, & diesel on-road was $4.28/gal.
Adjusted 01 Account to $75k.
Assumed mob was $600k.
Adjusted costs of relief well rehabilitation to a minimum cost per discussion with Geotech.
Adjusted costs of instrumentation to a minimum cost per discussion with Geotech.
Adjusted environmental protection costs.
Adjusted SF costs for building.
Assumed E&D did not occur in FY15.
Assumed S&A was 7.5% of the minimum construction costs.
Assumed weather delays would impact project by adding a contractor markup of 1.5%.
Assumed mods/claims would impact project by adding a contractor markup of 4%.
Fully-funded costs to determine minimum escalation.

Changes to MII for Maximum Estimate

Adjusted quantities to maximum estimated for potential scope growth.
Changed profit globally to 10%
Added 10% running percentage to prime contractor's to account for a less competitive market or lack of contractors who will bid on the project.
Adjusted quotes in the vendors tab to account for inflation or higher-than-current-market conditions.
Assumed fuel was $5/gal, diesel off-road was $5.5/gal, & diesel on-road was $6/gal.
Adjusted 01 Account to $125k.
Assumed mob was $1M.
Adjusted partial cutoff wall for a 12-HR workday while changing OT markups, equipment rental, etc which nearly doubled construction calendar days.
Adjusted costs of relief well rehabilitation to a maximum cost per discussion with Geotech.
Adjusted costs of instrumentation to a maximum cost per discussion with Geotech.
Adjusted environmental protection costs.
Adjusted costs for cultural resources per discussions with PM-PD-R.
Adjusted SF costs for building.
Assumed E&D for an additional 3 years of construction at $1.5M more per year (based on information gathered from PDT).
Assumed S&A was 7.5% of the maximum construction costs.

Bolivar Dam - Rehab **JS** 24-Mar-08

Selected Alternative As Shown

Offset Cuttoff Wall Scheme & Abutment Cuttoff Wall

ITEM NO.	DESCRIPTION	UOM	QUANTITY	MIN QTY	MAX QTY
1	**Mobilization/Demobilization**				
2	**Impervious Blanket**				**Add'l 300'**
2.1	Impervious Material Fill	CY	**128,000**	**128,000**	**137,000**
2.2	1' Stripping	CY	**33,200**	**33,200**	**36,000**
2.3	1' Topsoil	CY	**33,200**	**33,200**	**36,000**
2.4	Seeding	AC	**21**	**21**	**25**
3	**Partial Cuttoff Wall**				**Add'l 300'**
3.1	Upstream Toe Cuttoff Wall	SF	**620,400**	**615,000**	**662,400**
3.2	Excavation for 3' Wide Cuttoff Wall, Earth	CY	**68,500**	**68,000**	**74,000**
3.3	Concrete for 3' Wide Cuttoff Wall	CY	**69,000**	**69,000**	**74,000**
3.4	Excavation Spoil (Swell Factor = 1.2)	CY	**82,200**	**82,000**	**88,000**
4	**Abutment Cutoff Wall**				
4.1	Clearing/Grubbing	AC	**0.5**	**0.5**	**1.0**
4.2	Abutment Cuttoff Wall	SF	**48,000**	**41,000**	**58,000**
4.3	Excavation for 3' Wide Cuttoff Wall, Earth	CY	**1,100**	**1,000**	**1,100**
4.4	Excavation for 3' Wide Cuttoff Wall, Rock	CY	**4,300**	**4,000**	**5,000**
4.5	Concrete for 3' Wide Cuttoff Wall	CY	**5,400**	**5,000**	**6,100**
4.6	Excavation Spoil (Swell Factor = 1.2)	CY	**6,400**	**6,000**	**8,000**
4.7	Seeding	AC	**0.5**	**0.5**	**1.0**
4.8	Remove and Replace Culvert, 12" CMP	LF	**40**	**0**	**40**
4.9	Remove and Replace Flag Pole	EA	**1**	**1**	**1**
4.10	Remove and Replace Monument	JOB	**1**	**1**	**1**
4.11	Remove and Replace Chain Link Fence	LF	**100**	**0**	**200**
4.12	Remove and Replace Light Pole	EA	**1**	**1**	**1**
4.15	Demolish Roadway	SY	**1,720**	**1,720**	**2,120**
4.16	Roadway Replacement	SY	**1,720**	**1,720**	**2,120**
4.17	Storm Drain, 4" PVC	LF	**20**	**20**	**40**
4.18	Temporary Relocate/ Replace Sewer Line, 4" PVC	LF	**20**	**20**	**40**
4.19	Temporary Relocate/ Replace Water Line, 1" PE	LF	**20**	**20**	**40**
4.20	Temporary Relocate/ Replace UG Electric to Office	LF	**20**	**20**	**40**
4.21	Temporary Relocate/ Replace UG Telephone to Intake	LF	**20**	**20**	**40**
4.22	Drilling, 1-7/8" Diameter Radial Grouting	LF	**1,440**	**1,440**	**2,880**
4.22	Portland Cement in Grout	CWT	**2,993**	**2,993**	**5,986**
4.22	Placing Grout	HR	**299**	**299**	**598**
4.22	Pressure Testing	HR	**23**	**23**	**46**

5	**Downstream Seepage Blanket**				
5.1	Clearing	AC	**22**	**22**	**30**
5.2	Seepage Blanket Fill	CY	**186,000**	**186,000**	**241,000**
5.3	Seeding	AC	**22**	**22**	**30**
5.4	16' x 6' deep x 4' Junction Box w/Cover	EA	**2**	**2**	**2**
5.5	54" BCCMP Outlet	LF	**500**	**450**	**600**
5.6	Extend 48" BCCMP	LF	**280**	**250**	**350**
5.7	Extend 36" BCCMP	LF	**130**	**100**	**160**
5.8	Flared End Section for 54" Pipe	EA	**2**	**2**	**2**
5.9	Flared End Section for 48" Pipe	EA	**1**	**1**	**1**
5.10	Flared End Section for 36" Pipe	EA	**1**	**1**	**1**
5.11	Stone Lined Outlet, 6" Topsize Stone	CY	**250**	**200**	**350**
6	**Rehab Relief Wells**	Job	**1**	**1**	**1**
7	**Instrumentation**	Job	**1**	**1**	**1**
8	**Mechanical/Electrical Upgrade**				
8.1	Gates	Job	**1**	**1**	**1**
8.2	Hoisting Equipment	Job	**1**	**1**	**1**
9	**Construction Office**	SF	**1,120**	**1,120**	**1,400**
9.1	Parking & Access Road Paving	SY	**200**	**200**	**300**
9.2	Fencing	LF	**280**	**280**	**350**
9.3	16' Gate	EA	**1**	**1**	**1**
10	**Environmental Protection**	Job	**1**	**1**	**1**
10.1	Silt Fence	LF	**14,500**	**14,500**	**18,000**
10.2	Ditch Checks	EA	**35**	**35**	**50**

1may08 quantity changes as a result of extending embankment seepage barrier and changing alignment of abutment cuttoff wall.

	Crystal Ball Data	"Most Likely" QTY	UOM	Cost	Unit Cost	Bounds Lower	Bounds Upper
01 Lands and Damages	**$89,868.00**						
Real Estate Investigations	89,868.00	1	LS	89,868.00	89,868.00	75,000.00	125,000.00
04 Dams	**$85,376,944.44**	1	LS				
04.01 Mobilization/Demobilization	800,000.00	1	LS	800,000.00	800,000.00	600,000.00	1,000,000.00
04.02 Impervious Blanket	6,274,132.86	128,000	CY	6,274,132.86	49.02	6,004,934.88	8,818,179.78
04.03 Partial Cuttoff Wall	58,323,798.66	620,400	SF	58,323,798.66	94.01	55,409,113.24	103,390,781.24
04.04 Abutment Cutoff Wall	2,212,334.17	60,200	SF	2,212,334.17	36.75	1,933,215.08	4,445,970.73
04.05 Downstream Seepage Blanket	5,751,572.83	186,000	CY	5,751,572.83	30.92	5,462,523.62	10,376,074.13
04.06 Rehab Relief Wells	680,852.97	1	LS	680,852.97	680,852.97	506,092.80	759,139.20
04.07 Instrumentation	2,385,922.78	1	LS	2,385,922.78	2,385,922.78	1,773,508.22	2,860,262.34
04.08 Mechanical/Electrical Upgrade							
8.1 Gates	7,331,247.50	1	LS	7,331,247.50	7,331,247.50	4,347,538.88	10,441,070.61
8.2 Hoisting Equipment	1,095,229.81	1	LS	1,095,229.81	1,095,229.81	966,753.37	1,526,452.70
04.09 Environmental Protection	234,578.07	1	LS	234,578.07	234,578.07	200,000.00	403,414.14
04.10 Miscellaneous	287,274.79	1	LS	287,274.79	287,274.79	250,000.00	350,000.00
18 Cultural Resources	**$100,000.00**						
Cultural Resources	100,000.00	1	LS	100,000.00	100,000.00	100,000.00	300,000.00
19 Buildings, Grounds, & Utilities	**$308,082.30**						
RE Building	308,082.30	1	LS	308,082.30	308,082.30	277,720.01	454,652.47
30 Planning, Engineering and Design	**$9,963,933.00**						
Remaining E&D	9,963,933.00	1	LS	9,963,933.00	9,963,933.00	9,588,933.00	17,588,933.00
31 Construction Management	**$6,433,877.01**						
S&A	6,433,877.01	1	LS	6,433,877.01	6,433,877.01	5,837,355.01	10,884,449.80
Total Project Cost	**$102,272,704.75**			**$102,272,704.75**		**93,332,688.11**	**173,724,380.14**

ENR Construction Cost Index History (1908-2008) as of 8/27/08

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL AVG	
1990	4680	4685	4691	4693	4707	4732	4734	4752	4774	4771	4787	4777	4732	
1991	4777	4773	4772	4766	4801	4818	4854	4892	4891	4892	4896	4889	4835	2.2%
1992	4888	4884	4927	4946	4965	4973	4992	5032	5042	5052	5058	5059	4985	3.1%
1993	5071	5070	5106	5167	5262	5260	5252	5230	5255	5264	5278	5310	5210	4.5%
1994	5336	5371	5381	5405	5405	5408	5409	5424	5437	5437	5439	5439	5408	3.8%
1995	5443	5444	5435	5432	5433	5432	5484	5506	5491	5511	5519	5524	5471	1.2%
1996	5523	5532	5537	5550	5572	5597	5617	5652	5683	5719	5740	5744	5620	2.7%
1997	5765	5769	5759	5799	5837	5860	5863	5854	5851	5848	5838	5858	5826	3.7%
1998	5852	5874	5875	5883	5881	5895	5921	5929	5963	5986	5995	5991	5920	1.6%
1999	6000	5992	5986	6008	6006	6039	6076	6091	6128	6134	6127	6127	6059	2.3%
2000	6130	6160	6202	6201	6233	6238	6225	6233	6224	6259	6266	6283	6221	2.7%
2001	6281	6272	6279	6286	6288	6318	6404	6389	6391	6397	6410	6390	6343	2.0%
2002	6462	6462	6502	6480	6512	6532	6605	6592	6589	6579	6578	6563	6538	3.1%
2003	6581	6640	6627	6635	6642	6694	6695	6733	6741	6771	6794	6782	6694	2.4%
2004	6825	6862	6957	7017	7065	7109	7126	7188	7298	7314	7312	7308	7115	6.3%
2005	7297	7298	7309	7355	7398	7415	7422	7479	7540r	7563	7630	7647	7446	4.7%
2006	7660	7689	7692	7695	7691	7700	7721	7722	7763	7883	7911	7888	7751	4.1%
2007	7880	7880	7856	7865	7942	7939	7959	8007	8050	8045	8092	8089	7966	2.8%
2008	8090	8094	8109	8112*	8141	8185	8293	8362						5.0%

4.1% 10-yr avg
2.4% 5-yr avg

	Cost	Start	Finish	Years	Esc/Yr	
Current Schedule	$ 102,272,705	1-Oct-08	21-Dec-14	3.11	4.10%	117,929,404.60
80% Conf. Level*	$ 102,272,705			4.28	4.10%	123,594,348.15

*From schedule risk analysis, 80% confidence level was 14 months more than current schedule.

5,664,943.55
Escalation Risk

Crystal Ball Report - Custom
Simulation started on 8/27/2008 at 15:41:27
Simulation stopped on 8/27/2008 at 15:41:42

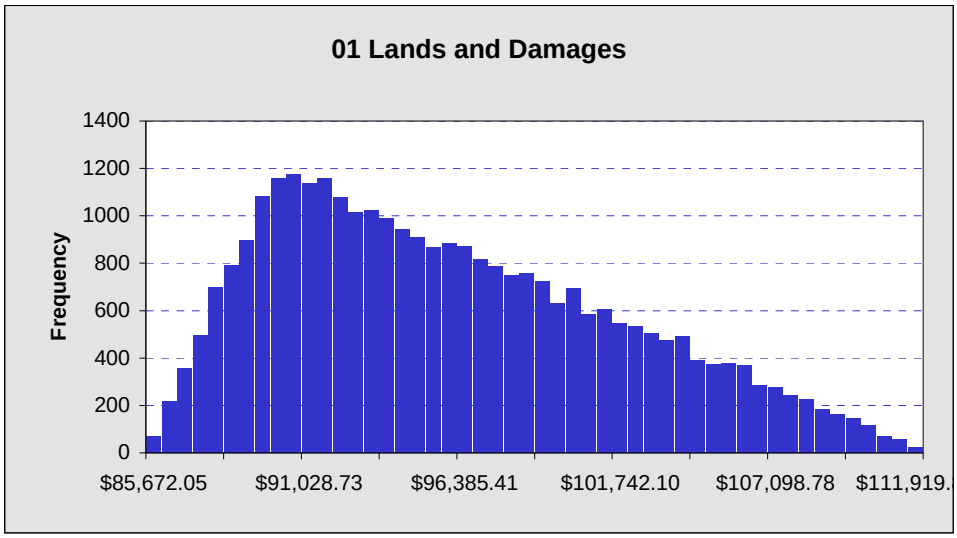
Run preferences:	
Number of trials run	30,000
Extreme speed	
Monte Carlo	
Seed	999
Precision control on	
Confidence level	95.00%
Run statistics:	
Total running time (sec)	15.74
Trials/second (average)	1,906
Random numbers per sec	30,488
Crystal Ball data:	
Assumptions	16
Correlations	3
Correlated groups	2
Decision variables	0
Forecasts	7

Forecasts

Worksheet: [Cost Risk Analysis.xls]Cost Risk Model

Forecast: 01 Lands and Damages **Cell: C5**

Summary:
Entire range is from $85,404.21 to $112,187.63
Base case is $89,868.00
After 30,000 trials, the std. error of the mean is $34.07



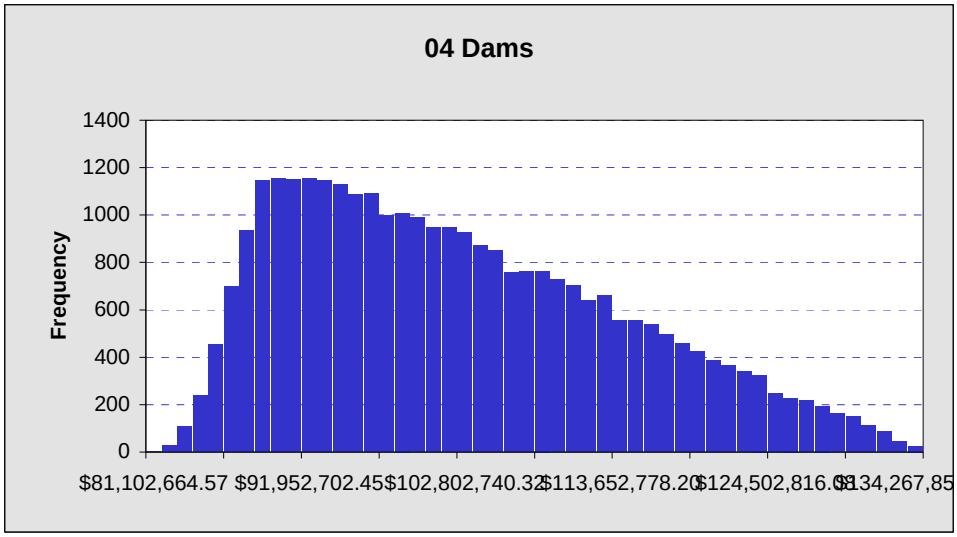
Statistics:	Forecast values
Trials	30,000
Mean	$95,859.91
Median	$94,933.73
Mode	---
Standard Deviation	$5,900.56
Variance	$34,816,577.76
Skewness	0.5076
Kurtosis	2.40
Coeff. of Variability	0.0616
Minimum	$85,404.21
Maximum	$112,187.63
Range Width	$26,783.41
Mean Std. Error	$34.07

Forecast: 01 Lands and Damages (cont'd) **Cell: C5**

Percentiles:	Forecast values
0%	$85,404.21
10%	$88,851.27
20%	$90,334.46
30%	$91,716.41
40%	$93,256.66
50%	$94,933.62
60%	$96,773.97
70%	$98,857.39
80%	$101,338.74
90%	$104,541.66
100%	$112,187.63

Forecast: 04 Dams **Cell: C8**

Summary:
Entire range is from $80,560,162.67 to $137,011,437.64
Base case is $85,376,944.44
After 30,000 trials, the std. error of the mean is $66,742.46



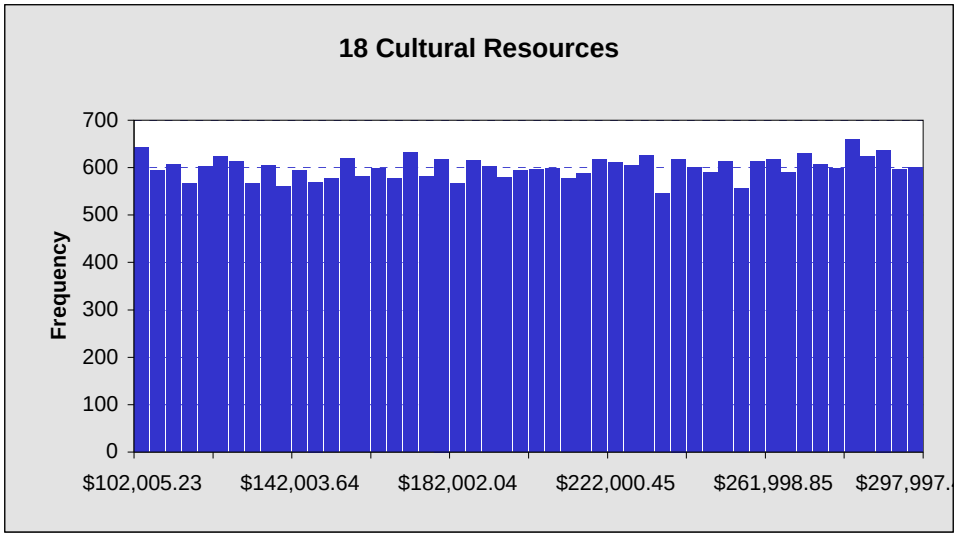
Statistics:	Forecast values
Trials	30,000
Mean	$102,441,979.59
Median	$100,643,829.91
Mode	---
Standard Deviation	$11,560,133.03
Variance	################
Skewness	0.5372
Kurtosis	2.46
Coeff. of Variability	0.1128
Minimum	$80,560,162.67
Maximum	$137,011,437.64
Range Width	$56,451,274.97
Mean Std. Error	$66,742.46

Forecast: 04 Dams (cont'd) **Cell: C8**

Percentiles:	Forecast values
0%	$80,560,162.67
10%	$88,665,788.32
20%	$91,476,353.97
30%	$94,361,853.01
40%	$97,365,986.76
50%	$100,643,811.74
60%	$104,169,271.15
70%	$108,296,237.17
80%	$113,025,049.52
90%	$119,407,027.34
100%	$137,011,437.64

Forecast: 18 Cultural Resources **Cell: C22**

Summary:
Entire range is from $100,005.31 to $299,997.34
Base case is $100,000.00
After 30,000 trials, the std. error of the mean is $334.81



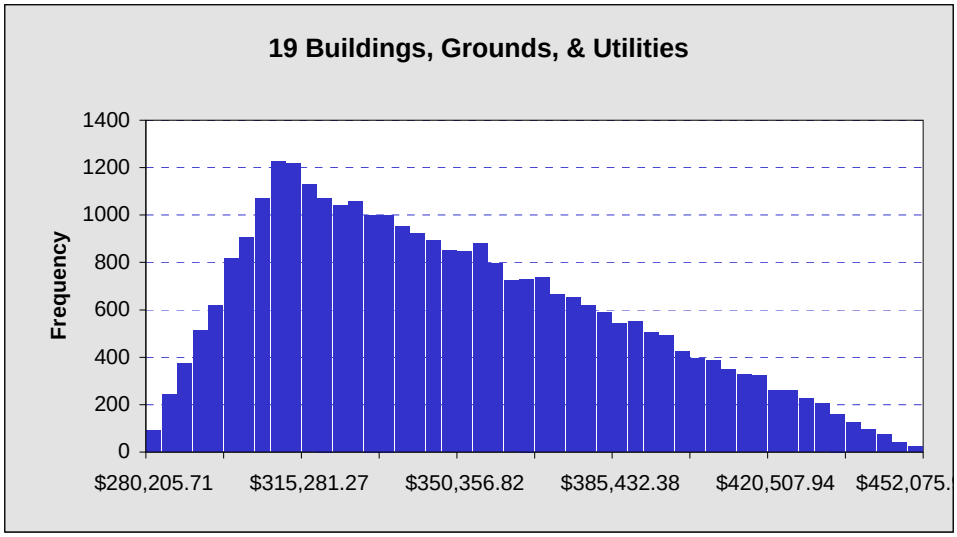
Statistics:	Forecast values
Trials	30,000
Mean	$200,483.49
Median	$200,670.89
Mode	---
Standard Deviation	$57,990.44
Variance	$3,362,890,664.49
Skewness	-0.0131
Kurtosis	1.79
Coeff. of Variability	0.2893
Minimum	$100,005.31
Maximum	$299,997.34
Range Width	$199,992.02
Mean Std. Error	$334.81

Forecast: 18 Cultural Resources (cont'd) **Cell: C22**

Percentiles:	Forecast values
0%	$100,005.31
10%	$119,906.96
20%	$140,152.09
30%	$160,470.38
40%	$180,491.67
50%	$200,665.18
60%	$220,897.22
70%	$240,821.03
80%	$261,083.50
90%	$280,611.27
100%	$299,997.34

Forecast: 19 Buildings, Grounds, & Utilities **Cell: C25**

Summary:
Entire range is from $278,451.93 to $453,829.72
Base case is $308,082.30
After 30,000 trials, the std. error of the mean is $222.61



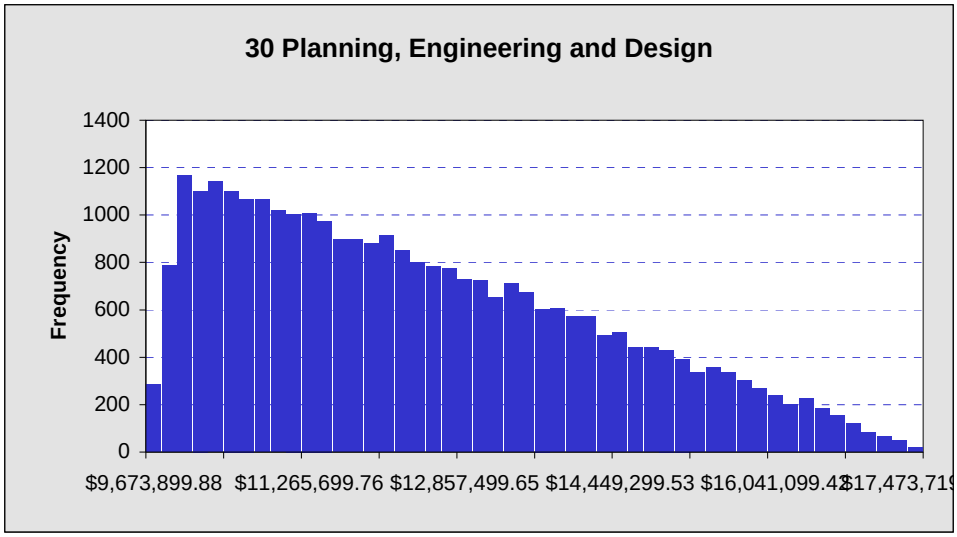
Statistics:	Forecast values
Trials	30,000
Mean	$346,623.57
Median	$340,635.59
Mode	---
Standard Deviation	$38,557.17
Variance	$1,486,655,350.68
Skewness	0.5029
Kurtosis	2.40
Coeff. of Variability	0.1112
Minimum	$278,451.93
Maximum	$453,829.72
Range Width	$175,377.79
Mean Std. Error	$222.61

Forecast: 19 Buildings, Grounds, & Utilities (cont'd) **Cell: C25**

Percentiles:	Forecast values
0%	$278,451.93
10%	$300,828.14
20%	$310,386.44
30%	$319,656.72
40%	$329,761.94
50%	$340,634.34
60%	$352,724.61
70%	$366,272.60
80%	$382,331.62
90%	$403,461.31
100%	$453,829.72

Forecast: 30 Planning, Engineering and Design **Cell: C28**

Summary:
Entire range is from $9,594,309.89 to $17,553,309.31
Base case is $9,963,933.00
After 30,000 trials, the std. error of the mean is $10,672.44



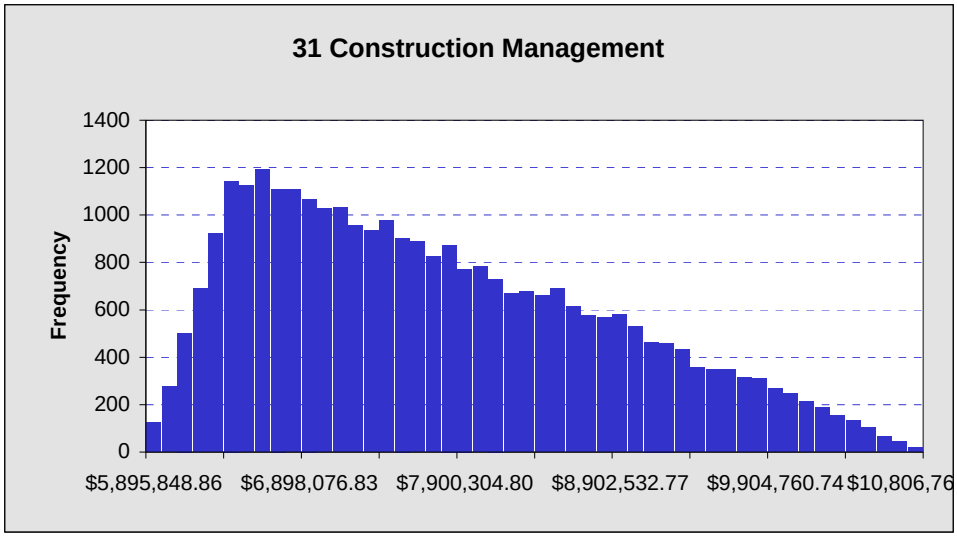
Statistics:	Forecast values
Trials	30,000
Mean	$12,396,048.53
Median	$12,088,722.61
Mode	---
Standard Deviation	$1,848,520.12
Variance	################
Skewness	0.5526
Kurtosis	2.39
Coeff. of Variability	0.1491
Minimum	$9,594,309.89
Maximum	$17,553,309.31
Range Width	$7,958,999.42
Mean Std. Error	$10,672.44

Forecast: 30 Planning, Engineering and Design (cont'd) **Cell: C28**

Percentiles:	Forecast values
0%	$9,594,309.89
10%	$10,177,800.61
20%	$10,610,497.83
30%	$11,071,507.48
40%	$11,551,998.16
50%	$12,088,666.07
60%	$12,677,244.47
70%	$13,339,874.04
80%	$14,108,474.34
90%	$15,138,900.90
100%	$17,553,309.31

Forecast: 31 Construction Management **Cell: C31**

Summary:
Entire range is from $5,845,737.46 to $10,856,877.31
Base case is $6,433,877.01
After 30,000 trials, the std. error of the mean is $6,500.00



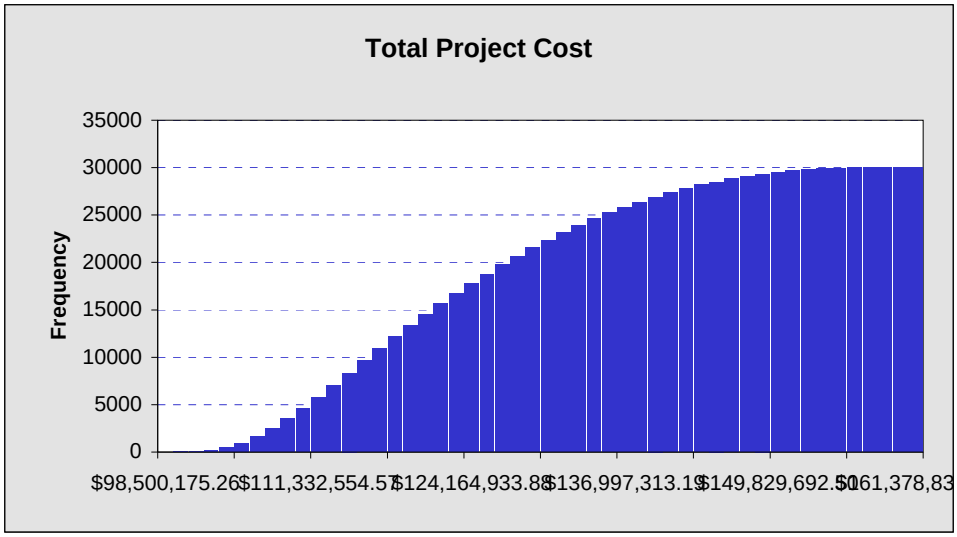
Statistics:	Forecast values
Trials	30,000
Mean	$7,725,159.38
Median	$7,538,844.20
Mode	---
Standard Deviation	$1,125,832.59
Variance	################
Skewness	0.5315
Kurtosis	2.39
Coeff. of Variability	0.1457
Minimum	$5,845,737.46
Maximum	$10,856,877.31
Range Width	$5,011,139.85
Mean Std. Error	$6,500.00

Forecast: 31 Construction Management (cont'd) **Cell: C31**

Percentiles:	Forecast values
0%	$5,845,737.46
10%	$6,391,610.97
20%	$6,649,728.12
30%	$6,922,860.37
40%	$7,218,827.24
50%	$7,538,773.45
60%	$7,895,109.07
70%	$8,306,243.21
80%	$8,776,652.67
90%	$9,388,346.58
100%	$10,856,877.31

Forecast: Total Project Cost **Cell: C34**

Summary:
Entire range is from $97,858,556.30 to $162,020,452.85
Base case is $102,272,704.75
After 30,000 trials, the std. error of the mean is $68,861.91



Statistics:	Forecast values
Trials	30,000
Mean	$123,206,154.46
Median	$121,494,246.05
Mode	---
Standard Deviation	$11,927,232.37
Variance	################
Skewness	0.4966
Kurtosis	2.52
Coeff. of Variability	0.0968
Minimum	$97,858,556.30
Maximum	$162,020,452.85
Range Width	$64,161,896.55
Mean Std. Error	$68,861.91

Forecast: Total Project Cost (cont'd) **Cell: C34**

Percentiles:	Forecast values
0%	$97,858,556.30
10%	$108,819,608.45
20%	$112,190,615.68
30%	$115,165,742.12
40%	$118,224,493.29
50%	$121,494,170.51
60%	$125,104,084.08
70%	$129,158,758.25
80%	$133,978,261.40
90%	$140,479,306.74
100%	$162,020,452.85

End of Forecasts

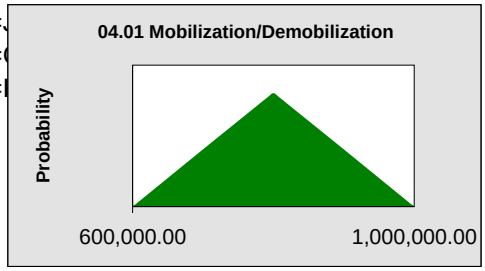
Assumptions

Worksheet: [Cost Risk Analysis.xls]Cost Risk Model

Assumption: 04.01 Mobilization/Demobilization **Cell: C9**

Triangular distribution with parameters:

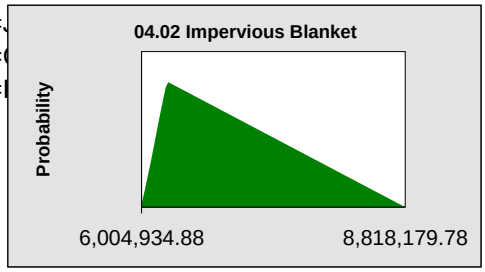
Minimum	600,000.00	(=
Likeliest	800,000.00	(=
Maximum	1,000,000.00	(=



Assumption: 04.02 Impervious Blanket **Cell: C10**

Triangular distribution with parameters:

Minimum	6,004,934.88	(=
Likeliest	6,274,132.86	(=
Maximum	8,818,179.78	(=

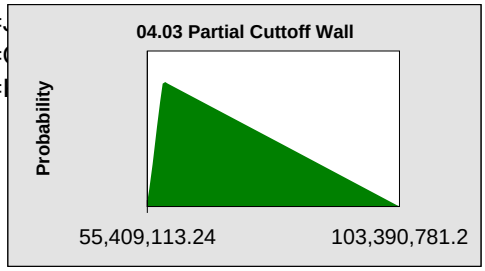


Correlated with:	Coefficient
04.03 Partial Cuttoff Wall (C11)	0.75

Assumption: 04.03 Partial Cuttoff Wall **Cell: C11**

Triangular distribution with parameters:

Minimum	55,409,113.24	(=
Likeliest	58,323,798.66	(=
Maximum	103,390,781.24	(=

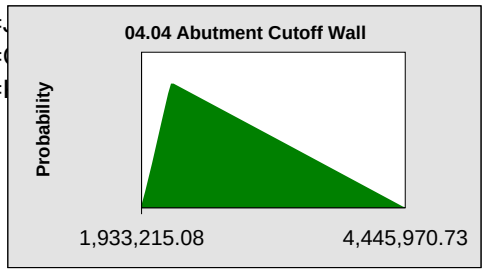


Correlated with:	Coefficient
04.02 Impervious Blanket (C10)	0.75

Assumption: 04.04 Abutment Cutoff Wall **Cell: C12**

Triangular distribution with parameters:

Minimum	1,933,215.08	(=
Likeliest	2,212,334.17	(=
Maximum	4,445,970.73	(=

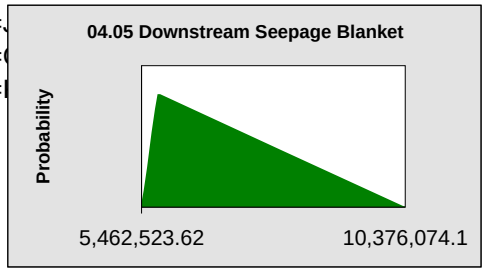


Correlated with:	Coefficient
S&A (C32)	0.68
Remaining E&D (C29)	0.68

Assumption: 04.05 Downstream Seepage Blanket **Cell: C13**

Triangular distribution with parameters:

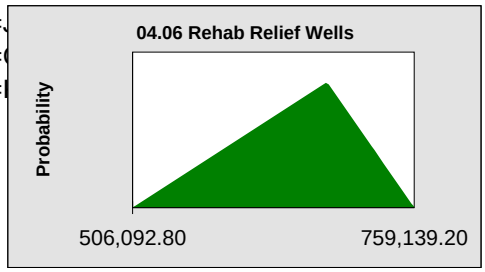
Minimum	5,462,523.62	(=
Likeliest	5,751,572.83	(=
Maximum	10,376,074.13	(=



Assumption: 04.06 Rehab Relief Wells **Cell: C14**

Triangular distribution with parameters:

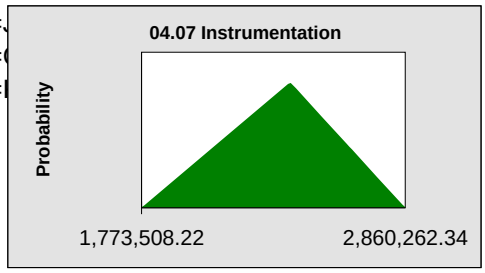
Minimum	506,092.80	(=
Likeliest	680,852.97	(=
Maximum	759,139.20	(=



Assumption: 04.07 Instrumentation **Cell: C15**

Triangular distribution with parameters:

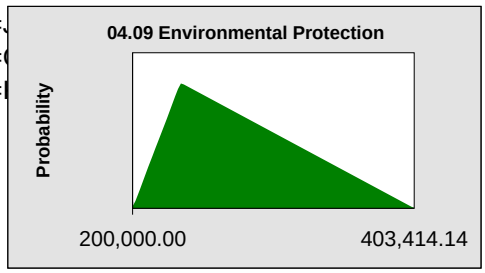
Minimum	1,773,508.22	(=
Likeliest	2,385,922.78	(=
Maximum	2,860,262.34	(=



Assumption: 04.09 Environmental Protection **Cell: C19**

Triangular distribution with parameters:

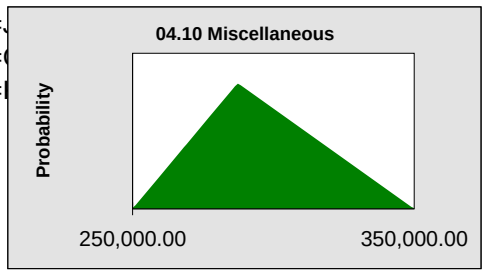
Minimum	200,000.00	(=
Likeliest	234,578.07	(=
Maximum	403,414.14	(=



Assumption: 04.10 Miscellaneous **Cell: C20**

Triangular distribution with parameters:

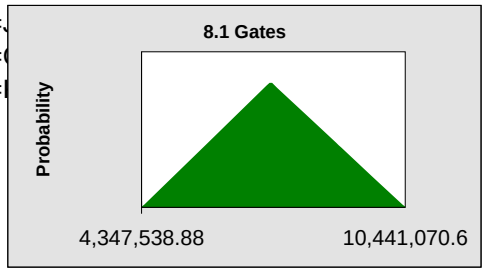
Minimum	250,000.00	(=
Likeliest	287,274.79	(=
Maximum	350,000.00	(=



Assumption: 8.1 Gates **Cell: C17**

Triangular distribution with parameters:

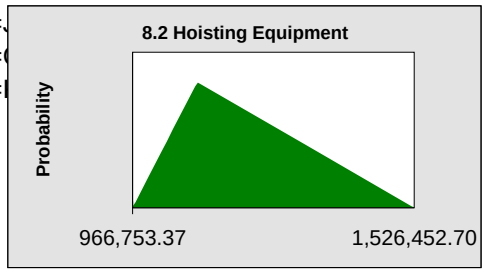
Minimum	4,347,538.88	(=
Likeliest	7,331,247.50	(=
Maximum	10,441,070.61	(=



Assumption: 8.2 Hoisting Equipment **Cell: C18**

Triangular distribution with parameters:

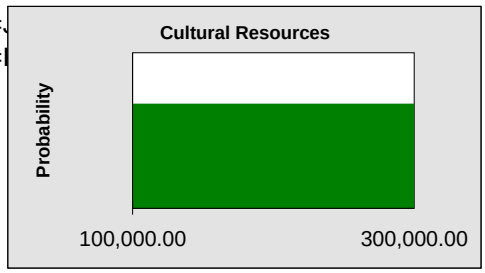
Minimum	966,753.37	(=
Likeliest	1,095,229.81	(=
Maximum	1,526,452.70	(=



Assumption: Cultural Resources **Cell: C23**

Uniform distribution with parameters:

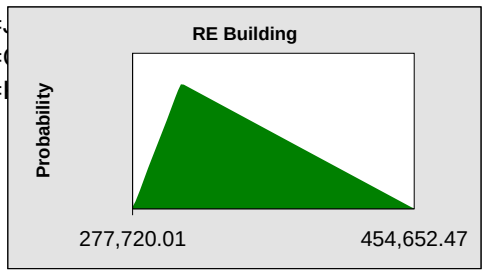
Minimum	100,000.00	(=
Maximum	300,000.00	(=



Assumption: RE Building **Cell: C26**

Triangular distribution with parameters:

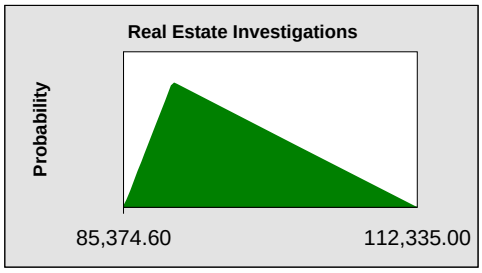
Minimum	277,720.01	(=
Likeliest	308,082.30	(=
Maximum	454,652.47	(=



Assumption: Real Estate Investigations **Cell: C6**

Triangular distribution with parameters:

Minimum	85,374.60
Likeliest	89,868.00
Maximum	112,335.00

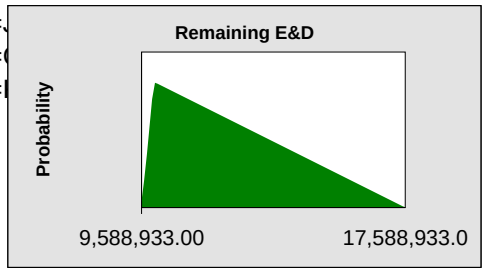


Assumption: Remaining E&D **Cell: C29**

Dustin L. Sawyers:
Correlated with 04.03
Factor is 0.68 which is the ratio of the partial cutoff wall costs to the other construction costs

Triangular distribution with parameters:

Minimum	9,588,933.00	(=
Likeliest	9,963,933.00	(=
Maximum	17,588,933.00	(=



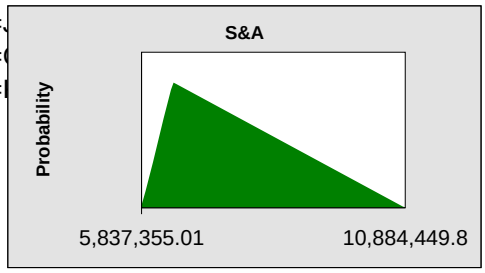
Correlated with:	Coefficient
04.04 Abutment Cutoff Wall (C12)	0.68

Assumption: S&A **Cell: C32**

Dustin L. Sawyers:
Correlated with 04.03
Factor is 0.68 which is the ratio of the partial cutoff wall costs to the other construction costs

Triangular distribution with parameters:

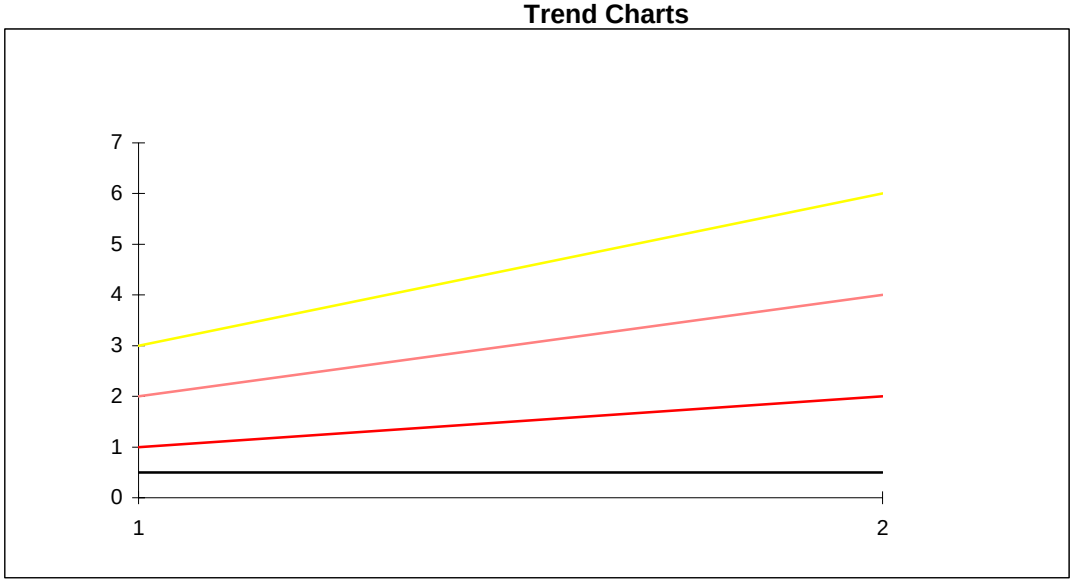
Minimum	5,837,355.01	(=
Likeliest	6,433,877.01	(=
Maximum	10,884,449.80	(=



Correlated with:	Coefficient
04.04 Abutment Cutoff Wall (C12)	0.68

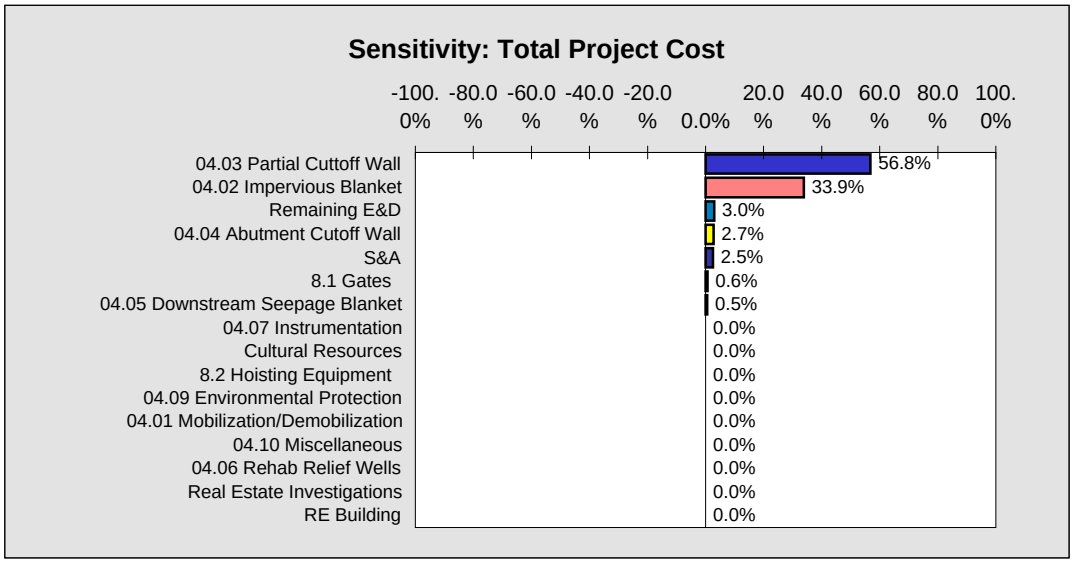
End of Assumptions

Trend Charts



End of Trend Charts

Sensitivity Charts



End of Sensitivity Charts

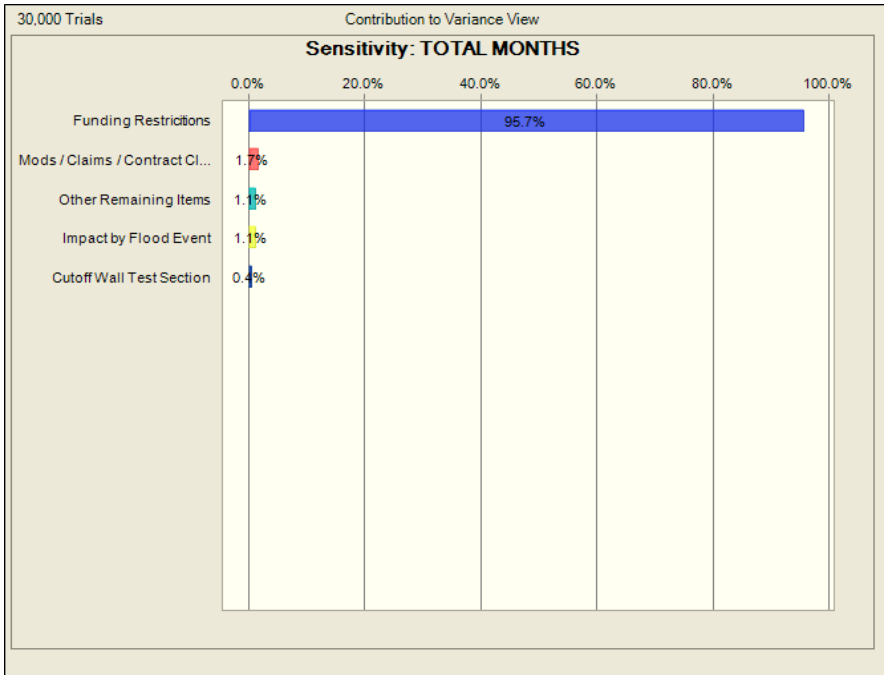
TAB B

SCHEDULE RISK ANALYSIS REPORT

Schedule Risk Model

Risk No.	Risk Event	Likelihood of Risk	Impact	Risk Level	Notes	Critcal Path items - MONTHS Low (20%)	Most Likely	High (80%)
Critical Path Items								
I-2a	Cutoff Wall Test Section	Very Likely	Marginal	Moderate	Preferred by PDT but could delay project by one month in order to study and validate the section.	0.0 Months	1.0 Months	2.0 Months
I-10, I-11, & I-12	Impact by Flood Event	Likely	Marginal	Moderate	Work on the left abutment could be performed but delays up to 2 months could be encountered due to a storm event.	1.0 Months	2.0 Months	4.0 Months
E-1	Funding Restricitions	Likely	Significant	High	If there is a funding cap, it would decrease the efficiency on construction of the seepage wall and increase costs of the wall due to an additional 24 months of construction. Current assumptions assume 2-shifts per day; if funding is capped, construction of partial cutoff wall is twice what it is currently. E&D and S&A would also be impacted due to the additional construction duration.	21.0 Months	25.0 Months	49.0 Months
E-4	Mods / Claims / Contract Closeout	Likely	Marginal	Moderate	The potential for mods, claims, etc. are high for this type of work since it is a specialty.	2.0 Months	3.0 Months	6.0 Months
I-16	Other Remaining Items	Likely	Neglible	Low	The partial cutoff wall is the major critical path item. Impacts to the other items are minimal in comparison since it can be performed well within the construction duration of the partial cutoff wall.	3.0 Months	4.0 Months	6.0 Months
TOTAL MONTHS						27.0 Months	35.0 Months	67.0 Months

Current Schedule	35.0 Months
Confidence Level	**Value (Total Months)**
0%	29.8 Months
10%	35.4 Months
20%	37.1 Months
30%	38.8 Months
40%	40.4 Months
50%	42.2 Months
60%	44.1 Months
70%	46.3 Months
80%	48.9 Months
90%	52.3 Months
100%	62.2 Months



Crystal Ball Report - Custom
Simulation started on 8/18/2008 at 9:59:54
Simulation stopped on 8/18/2008 at 10:00:05

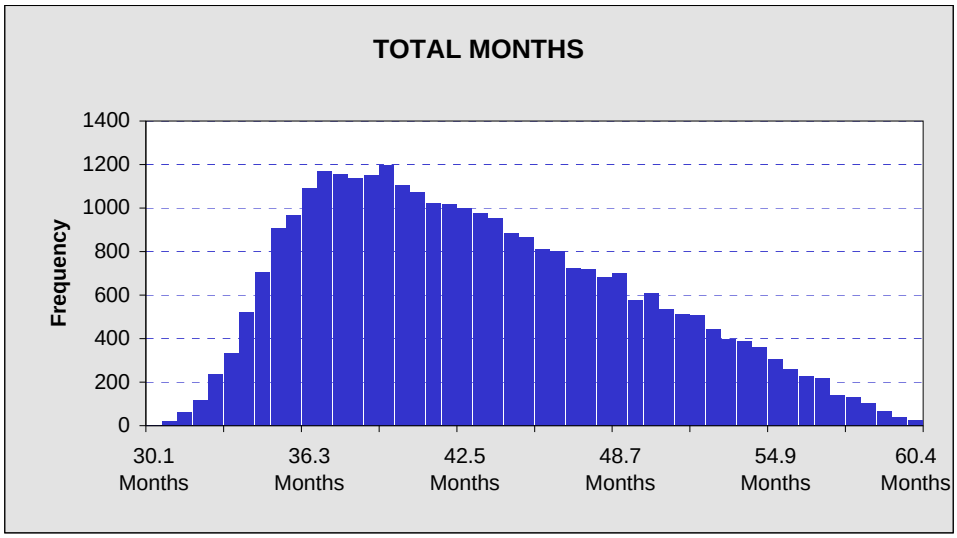
Run preferences:	
Number of trials run	30,000
Extreme speed	
Monte Carlo	
Seed	999
Precision control on	
Confidence level	95.00%
Run statistics:	
Total running time (sec)	11.99
Trials/second (average)	2,503
Random numbers per sec	12,516
Crystal Ball data:	
Assumptions	5
Correlations	0
Correlated groups	0
Decision variables	0
Forecasts	1

Forecasts

Worksheet: [Schedule Risk Analysis.xls]Schedule Risk Model

Forecast: TOTAL MONTHS **Cell: H10**

Summary:
Entire range is from 29.8 Months to 62.2 Months
Base case is 35.0 Months
After 30,000 trials, the std. error of the mean is 0.0 Months



Statistics:	Forecast values
Trials	30,000
Mean	43.0 Months
Median	42.2 Months
Mode	---
Standard Deviation	6.3 Months
Variance	40.0 Months
Skewness	0.4665
Kurtosis	2.42
Coeff. of Variability	0.1468
Minimum	29.8 Months
Maximum	62.2 Months
Range Width	32.4 Months
Mean Std. Error	0.0 Months

Forecast: TOTAL MONTHS (cont'd) **Cell: H10**

Percentiles:	Forecast values
0%	29.8 Months
10%	35.4 Months
20%	37.1 Months
30%	38.8 Months
40%	40.4 Months
50%	42.2 Months
60%	44.1 Months
70%	46.3 Months
80%	48.9 Months
90%	52.3 Months
100%	62.2 Months

End of Forecasts

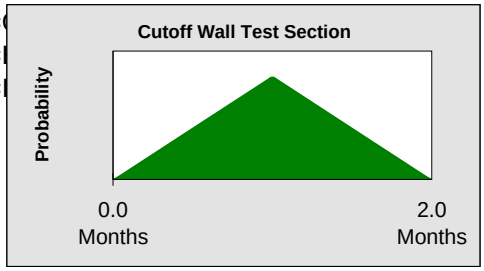
Assumptions

Worksheet: [Schedule Risk Analysis.xls]Schedule Risk Model

Assumption: Cutoff Wall Test Section **Cell: H5**

Triangular distribution with parameters:

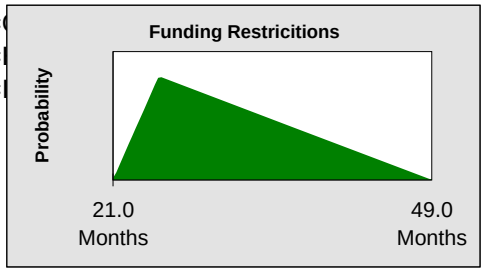
Minimum	0.0 Months	(=
Likeliest	1.0 Months	(=
Maximum	2.0 Months	(=



Assumption: Funding Restricitions **Cell: H7**

Triangular distribution with parameters:

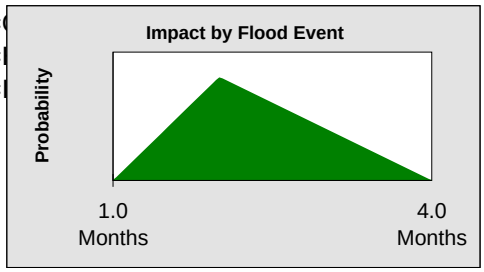
Minimum	21.0 Months	(=
Likeliest	25.0 Months	(=
Maximum	49.0 Months	(=



Assumption: Impact by Flood Event **Cell: H6**

Triangular distribution with parameters:

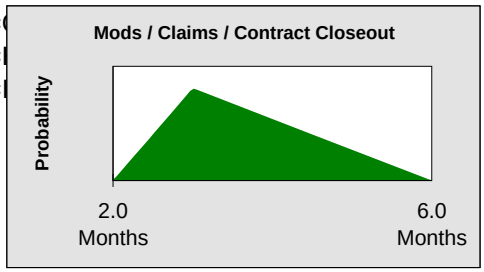
Minimum	1.0 Months	(=
Likeliest	2.0 Months	(=
Maximum	4.0 Months	(=



Assumption: Mods / Claims / Contract Closeout **Cell: H8**

Triangular distribution with parameters:

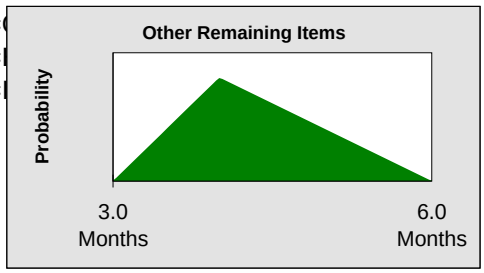
Minimum	2.0 Months	(=
Likeliest	3.0 Months	(=
Maximum	6.0 Months	(=



Assumption: Other Remaining Items **Cell: H9**

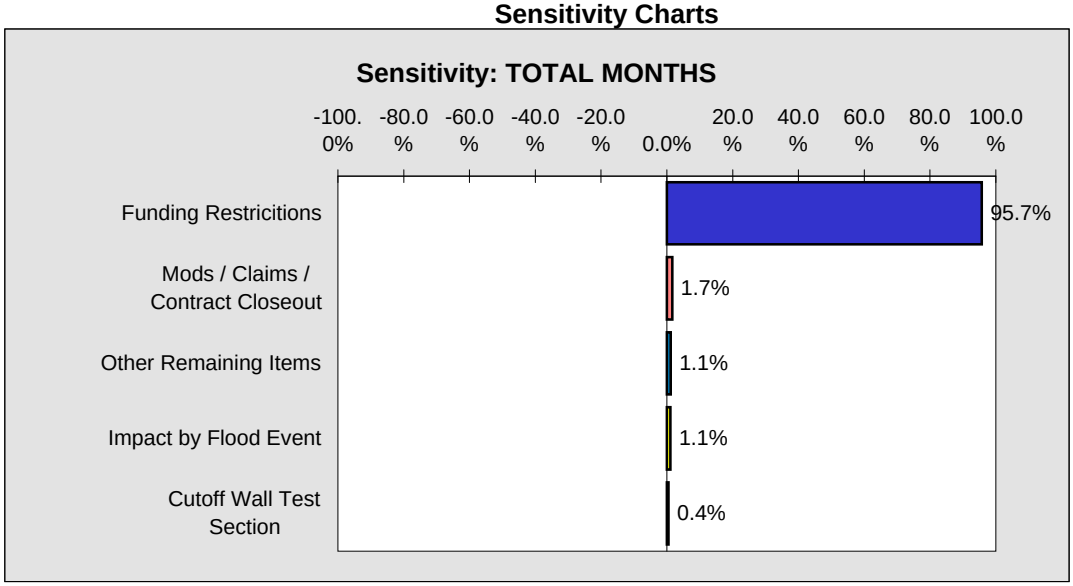
Triangular distribution with parameters:

Minimum	3.0 Months	(=
Likeliest	4.0 Months	(=
Maximum	6.0 Months	(=



End of Assumptions

Sensitivity Charts



End of Sensitivity Charts