

# Project No. 05337008.0000 City of Glendale By T.D. & C.R. Ckd: Y.W. & T.V. Date 12/20/11 Date: 12/22/11 Phase III Demonstration Testing for Cr(VI) Treatment 10-gpm WBA System

DESCRIPTION	QTY	UNIT MEAS.	UNIT COST	TOTAL COST	COMMENTS
Equipment					
CO2 Feed System	1	LS	\$ 80,000	\$ 80,000	Quote from TOMCO; 1.5 lb/hr PSF and (2) 380 lb cylinders
CO2 Feed Water Pump	2	EA	\$ 7,177	\$ 14,354	Quote from ITT; centrifugal; 2 gpm @ 80 psi; 1 duty/1 stdby
Static Mixer	1	EA	\$ 330	\$ 330	Quotes from Komax & EWS; 1-inch
Bag Filters	2	EA	\$ 1,800	\$ 3,600	Quotes from FSI & Ryan Herco; 1 duty/ 1 stdby
Ion Exchange Equipment	1	LS	\$ 7,400	\$ 7,400	Quotes from Siemens; incl. first fill of resin
Backwash Waste Tank	1	EA	\$ 7,700	\$ 7,700	Quotes from Core-Rosion; 2,000 gal
Discharge Pumps	2	EA	\$ 4,832	\$ 9,664	Quotes from ITT & Cortech 100 gpm @ 15 ft; 1 duty/ 1 stdby
Booster Pump	2	EA	\$ 6,079	\$ 12,158	Quote from Cortech, 10 gpm @ 15 ft; 1 duty/1 stdby
Acration Equipmont	1	15	\$ 12,000	\$ 42,000	Quote from Siemens for an aluminum forced draft aerator (65 gpm), including
	-	ES	\$ 42,000	\$ 42,000	blower, air distribution tray, and piping etc.
Exhaust Blowers	2	EA	\$ 34,874	\$ 69,748	Quote from EWS; 53 SCFM @ 2 psi; 1 duty/ 1 stdby
Off-Gas Treatment	1	LS	\$ 4,000	\$ 4,000	COSLITOM Glendale and quote from TIGG; 54 SCFM; (2) adsorbers in series; plus
Subtotal				\$ 251,000	Rounded up to \$1000
Subtotul				÷ 201,000	
Equipment Installation Cost	30%			\$ 75.300	Including tax, freight, installation and manufacturer services
	3070			÷ 73,500	
Equipment Concrete Pads	29	CY	\$ 1,250	\$ 35.967	
	27	0.	\$ 1,200	* 00,707	
Subtotal (Installed Equipment Costs)				\$ 363,000	Rounded up to \$1000
Subtotal (installed Equipment 665t5)				* 303,000	
					Division 1 requirements, including labor supervision, field offices, temporary
General Requirements	7.5%			\$ 27,225	utilities, health and safety, office supplies, clean up, photographs, survey, erosion
				•	control, coordination, testing services, and record documents
Earthwork	5%			\$ 18,150	Excavation, backfill, and fill required to construct project
Site Improvements	5%			\$ 18,150	Roadways, curb and gutter, sidewalk and landscaping
Valves, Piping, and Appurtenances	15%			\$ 55.000	Major system piping and valves
Electrical, Instrumentation and Controls	15%			\$ 55,000	PLC and SCADA equipment to control
Total Direct Costs				\$ 537.000	Rounded up to \$1000
	2004			* 107.400	Includes bonds, mobilization and demobilization, insurance, overhead and profit,
Contractor's Overnead and Profit	20%			\$ 107,400	and management reserves
Construction Total				\$ 644,000	Rounded up to \$1000
Project Level Allowance (contingency)	20%			\$ 128,800	Budget item to cover change orders due to unforeseen conditions
Engineering, Legal and Administrative	20%			\$ 128,800	Includes permits, legal fees and engineering fees for design and construction
Project Total				\$ 902,000	
-					
Low Estimate				\$ 631,000	-30%
High Estimate				\$ 1,353,000	+50%

Notes:

Client

Project

Item

1. This opinion of probable cost is based on AACE Class 5 estimate guidelines. The high and low estimates fall into the acceptable range. These estimates are generally used to compare alternatives.

2. Opinion of Probable Cost in 2011 dollars.



Client City of Glendale	
Project Phase III Demonstration Testing for Cr(VI) Treatment	
ltem 100-gpm WBA System	

Project No. 05337008.0000										
By T.D. & C.R.	Ckd: Y.W. & T.V.									
Date 12/20/11	Date: 12/22/11									

DESCRIPTION	QTY	UNIT MEAS.	COMMENTS							
Equipment										
CO2 Feed System	1	LS	\$	160,000	\$ 160,000	Quote from TOMCO; 15 lb/hr PSF and 6 ton storage				
CO2 Feed Water Pump	2	EA	\$	7,177	\$ 14,354	Quote from ITT; centrifugal; 15 gpm @ 80 psi; 1 duty/1 stdby				
Static Mixer	1	EA	\$	850	\$ 850	Quotes from Komax & EWS; 3-inch				
Bag Filters	2	EA	\$	4,300	\$ 8,600	Quotes from FSI & Ryan Herco; 1 duty/ 1 stdby				
Ion Exchange Equipment	1	LS	\$	93,000	\$ 93,000	Quotes from Siemens; incl. first fill of resin				
Backwash Waste Tank	1	EA	\$	52,000	\$ 52,000	Quotes from Superior & BH; 19,000 gal				
Discharge Pumps	2	EA	\$	4,832	\$ 9,664	Quotes from ITT & Cortech 100 gpm @ 15 ft; 1 duty/ 1 stdby				
Booster Pump	2	EA	\$	7,716	\$ 15,432	Quote from ITT, 100 gpm @ 15 ft; 1 duty/1 stdby				
Aeration Equipment	1	15	¢	12 000	\$ 42,000	Quote from Siemens for an aluminum forced draft aerator (65 gpm), including blower, air				
	'	EJ	Ŷ	42,000	\$ 42,000	distribution tray, and piping etc.				
Exhaust Blowers	2	EA	\$	34,753	\$ 69,505 \$ 11,000	Quote from EWS; 267 SCFM @ 2 psi; 1 duty/ 1 stdby				
on-Gas meannent	1	LJ	Ŷ	11,000	\$ 11,000	Quote from FIGG; 270 SCFW; (2) ausorbers in series with one neater				
Subtotal					\$ 477.000	Poundod un to \$1000				
Subiotal					\$ 477,000					
Equipment Installation Cost	200/				¢ 1/2 100	Including tax, freight, installation and manufacturer convisor				
Equipment installation Cost	3076				\$ 143,100	including tax, neight, installation and manufacturer services.				
Equipment Concrete Dad	54	CV	¢	1 250	¢ 70.525					
	00	CT	Ŷ	1,230	\$ 70,525					
Subtotal (Installed Equipment Casta)					¢ (01.000	Dounded up to \$1000				
Subtotal (Installed Equipment Costs)					\$ 091,000	Rounded up to \$1000				
						Division 1 requirements, including labor supervision, field offices, temperary utilities				
General Requirements	7.5%				\$ 51.825	health and safety office supplies clean up photographs survey erosion control				
						coordination, testing services, and record documents				
Earthwork	5%				\$ 34,550	Excavation, backfill, and fill required to construct project				
Site Improvements	5%				\$ 34,550	Roadways, curb and gutter, sidewalk and landscaping				
Valves, Piping, and Appurtenances	15%				\$ 104,000	Major system piping and valves				
Electrical, Instrumentation and Controls	15%				\$ 104,000	PLC and SCADA equipment to control				
Total Direct Costs					\$ 1,020,000	Rounded up to \$1000				
Contractor's Overboad and Profit	20%				\$ 204.000	Includes bonds, mobilization and demobilization, insurance, overhead and profit, and				
Contractor's Overnead and Front	2070				\$ 204,000	management reserves				
Construction Total					\$ 1,224,000	Rounded up to \$1000				
Project Level Allowance (contingency)	20%				\$ 244,800	Budget item to cover change orders due to unforeseen conditions				
Engineering, Legal and Administrative	20%				\$ 244,800	Includes permits, legal fees and engineering fees for design and construction				
Project Total					\$ 1,714,000					
Low Estimate					\$ 1,200,000	-30%				
High Estimate					\$ 2,571,000	+50%				

Notes:

1. This opinion of probable cost is based on AACE Class 5 estimate guidelines. The high and low estimates fall into the acceptable range. These estimates are generally used to compare alternatives.

2. Opinion of Probable Cost in 2011 dollars.



Item 500-gpm WBA System
Project Phase III Demonstration Testing for Cr(VI) Treatment
Client City of Glendale

Project No. 05337008	3.0000
By T.D. & C.R.	Ckd: Y.W. & T.V.
Date 12/20/11	Date: 12/22/11

DESCRIPTION	QTY	UNIT MEAS.	UN	IT COST	TOTA	L COST	COMMENTS
Equipment							
CO2 Feed System	1	LS	\$	190,000	\$	190,000	Quote from TOMCO; 75 lb/hr PSF and 14 ton storage
CO2 Feed Water Pump	2	EA	\$	7,608	\$	15,216	Quote from ITT; centrifugal; 75 gpm @ 80 psi; 1 duty/1 stdby
Static Mixers	1	EA	\$	2,200	\$	2,200	Quotes from Komax & EWS; 8-inch
Bag Filters	2	EA	\$	1,800	\$	3,600	Quotes from FSI & Ryan Herco; 1 duty/ 1 stdby
Ion Exchange Equipment	1	LS	\$	400,000	\$	400,000	Quotes from Siemens and Calgon; incl. first fill of resin
		<b>F</b> 1		400.000	*	100.000	
Backwash waste Lank	1	EA	\$	100,000	\$	100,000	Quotes from Superior & BH; 95,000 gai
Discharge Pumps	2	EA	\$	4,832	\$	9,664	Quotes from III & Cortech IOU gpm @ 15 ft; I duty/ I staby
Poostor Dump	2	EA	¢	10 022	¢	21.044	Quete from ITT_E00 and @ 15 ft 1 duty/1 stdby
	2	EA	Þ	10,923	\$	21,040	Quote Itoli 111, 500 gpin @ 15 it; 1 duty i staby
							Quote from Siemens for an aluminum forced draft aerator (500 gpm), including blower, air
Aeration Equipment	1	LS	\$	47,000	\$	47,000	distribution tray, and piping etc.
Exhaust Blowers	2	EA	\$	54,237	\$	108,474	Quotes from EWS & Yardley; 1,500 SCFM @ 5 psi; 1 duty/ 1 stdby
Off-Gas Treatment	1	LS	\$	27,000	\$	27,000	Quote from TIGG; 1,500 SCFM; (2) adsorbers in series with one heater
Subtotal					\$	925,000	Rounded up to \$1000
Equipment Installation Cost	30%				\$	277,500	Including tax, freight, installation and manufacturer services.
	450			4 050	*	100.050	
Equipment Concrete Pad	159	CY	\$	1,250	\$	199,058	
					*	1 100 000	
Subtotal (Installed Equipment Costs)					\$	1,402,000	Roundea up to \$1000
Conoral Poquiromonts	7 5%				¢	105 150	Division I requirements, including labor supervision, field offices, temporary utilities, nealth and safety, effice supplies, clean up, photographs, supply, crossion control, coordination
General Requirements	7.370				φ	103,130	testing services, and record documents
Farthwork	5%				\$	70.100	Excavation, backfill, and fill required to construct project
Site Improvements	5%				\$	70,100	Roadways, curb and gutter, sidewalk and landscaping
Valves, Piping, and Appurtenances	15%				\$	211.000	Major system piping and valves
Electrical, Instrumentation and Controls	15%				\$	211,000	PLC and SCADA equipment to control
Total Direct Costs					\$	2,069,000	Rounded up to \$1000
Contractor's Overboad and Brofit	200/				¢	412 000	Includes bonds, mobilization and demobilization, insurance, overhead and profit, and
	2076				¢	413,000	management reserves
Construction Total					\$	2,483,000	Rounded up to \$1000
Project Level Allowance (contingency)	20%				\$	496,600	Budget item to cover change orders due to unforeseen conditions
Engineering, Legal and Administrative	20%				\$	496,600	Includes permits, legal fees and engineering fees for design and construction
	l		<u> </u>				
Project Total					\$	3,477,000	
Low Estimate					\$	2,434,000	-30%
High Estimate			<u> </u>		\$	5,216,000	+50%

Notes:

1. This opinion of probable cost is based on AACE Class 5 estimate guidelines. The high and low estimates fall into the acceptable range. These estimates are generally used to compare alternatives.

2. Opinion of Probable Cost in 2011 dollars.



Client	City of Glendale
Project Pha	se III Demonstration Testing for Cr(VI) Treatment
Item	2000-gpm WBA System

Project No. 05337008.0000									
By T.D. & C.R. Ckd: Y.W. & T.V.									
Date 12/20/11	Date: 12/22/11								

DESCRIPTION	QTY	UNIT MEAS.	U	NIT COST	TOT	FAL COST	COMMENTS
Equipment							
CO2 Feed System	1	LS	\$	280,000	\$	280,000	Quote from TOMCO; 300 lb/hr and 50 ton storage
CO2 Feed Water Pump	2	EA	\$	8,705	\$	17,410	Quote from ITT; centrifugal; 305 gpm @ 80 psi; 1 duty/1 stdby
Static Mixer	1	EA	\$	4,200	\$	4,200	Quotes from Komax & EWS; 14-inch
Bag Filters	2	EA	\$	1,800	\$	3,600	Quotes from FSI & Ryan Herco; 1 duty/ 1 stdby
Ion Exchange Equipment	1	LS	\$	1,300,000	\$	1,300,000	Quotes from Siemens and Calgon; incl. first fill of resin
Backwash Waste Tank	1	EA	\$	150,000	\$	150,000	Quotes from Superior & BH; 189,000 gal
Discharge Pumps	2	EA	\$	4,832	\$	9,664	Quotes from ITT & Cortech 100 gpm @ 15 ft; 1 duty/ 1 stdby
Booster Pump	2	EA	\$	23,902	\$	47,804	Quote from Cortech, 2,000 gpm @ 15 ft; 1 duty/1 stdby
Aeration Equipment	1	15	\$	71 000	\$	71 000	Quote from Siemens for an aluminum forced draft aerator (2000 gpm), including
	'	ES	Ŷ	105.000	*	71,000	blower, air distribution tray, and piping etc.
Exhaust Blowers	2	EA	\$	135,000	\$	270,000	Quote from Yardley; 6,000 SCFM @ 5 psi; 1 duty/ 1 stdby
		LJ	Ŷ	95,000	\$	93,000	Quole from theg; 6,000 SCFW; (2) adsorbers in series with two t2kW fielders
Subtotal					¢	2 2/0 000	Pounded up to \$1000
Subtotal					\$	2,249,000	Rounded up to \$1000
Equipment Installation Cost	30%				¢	674 700	Including tay, freight installation and manufacturor services
Equipment installation Cost	3076				\$	074,700	including tax, neight, installation and manufacturer services.
Equipment Concrete Pad	264	CV	¢	1 250	¢	330 388	
	204	CI	φ	1,230	φ	330,300	
Subtatal (Installed Equipment Costs)					¢	3 255 000	Pounded up to \$1000
Subtotal (Installed Equipment Costs)					\$	3,233,000	Rounded up to \$1000
							Division 1 requirements, including labor supervision, field offices, temporary
General Requirements	7.5%				\$	244 125	utilities health and safety office supplies clean up photographs survey erosion
Conordi requironione	7.070				Ŷ	211,120	control, coordination, testing services, and record documents
Earthwork	5%				\$	162,750	Excavation, backfill, and fill required to construct project
Site Improvements	5%				\$	162,750	Roadways, curb and gutter, sidewalk and landscaping
Valves, Piping, and Appurtenances	15%				\$	489,000	Major system piping and valves
Electrical, Instrumentation and Controls	15%				\$	489,000	PLC and SCADA equipment to control
Total Direct Costs					\$	4.803.000	Rounded up to \$1000
	0.00/				*	0/0/00	Includes bonds, mobilization and demobilization, insurance, overhead and profit,
Contractor's Overhead and Profit	20%				\$	960,600	and management reserves
Construction Total					\$	5,764,000	Rounded up to \$1000
Project Level Allowance (contingency)	20%				\$	1,152,800	Budget item to cover change orders due to unforeseen conditions
Engineering, Legal and Administrative	20%				\$	1,152,800	Includes permits, legal fees and engineering fees for design and construction
Project Total					\$	8,070,000	
Low Estimate					\$	5,649,000	-30%
High Estimate					\$	12,105,000	+50%

Notes:

1. This opinion of probable cost is based on AACE Class 5 estimate guidelines. The high and low estimates fall into the acceptable range. These estimates are generally used to compare alternatives.

2. Opinion of Probable Cost in 2011 dollars.



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Flow Rate (gpm)

Number of lead/lag trains		2	2																	
									L	.ab									Field	
Sample Location	Cr(VI)	Total Cr	Alkalinity	Turbidity	Sulfate	Nitrate	Phosphat e	Total Iron	Silica	Uranium (water)	Uranium (solids)	Nitrosamin es	BNA SVOC	Aldehydes/ Ketones	Bac-T (E. coli, T coli and HPC)	TCLP (Metals)	CA WET (Metals)	рН	Temperat ure	Conducti vity
Raw	1	1	1												1			4	4	
After pH reduction	4	4	1	1	1	1	1	1	1	1		At start-up	At start-up	At start-up	1			s	S	1
Lead vessel 50% port <sup>1</sup>	8	8																		
Lead vessel effluent 1	8	8								1		At start-up	At start-up	At start-up				4	4	
Lag vessel 50% port <sup>1</sup>	8	8																		
Lag vessel effluent <sup>1</sup>	8	8								1		At start-up and monthly thereafter	At start-up and monthly thereafter	At start-up and monthly thereafter	/ 			4	4	
Combined IX effluent after pH	Ŭ	Ū						1				increation	increation	anorodator				Continuou	Continuou	-
increase	4	4	1	1	1	1	1	1	1						4			S	S	
Resin in lead vessel 1, 2											2									
Spent resin as residuals											At disposa	I				At disposal	At disposal			
Resin flush water as residuals <sup>3</sup>														At disposal						
Sum of samples (# per month)	41	41	3	2	2	2	2 2	2	2 2	3	2.2	2.3	2.3	2.8	3 10	0.2	2 0.2	12	12	2 1
MWH Quotes (\$/sample)	\$75	\$15	\$15		\$15	\$15	5 \$15	\$15	5 \$15	25	125	5 400	400	200	45		350	)		
Test America Quotes (\$/sample)	\$30	\$12	\$15	\$13	\$15	\$15	5 \$15	\$12	\$12	20		330	165	215	5 70	240	) 492			
Unit cost (\$/sample)	\$53	\$14	\$15	\$13	\$15	\$15	5 \$15	\$14	\$14	\$23	\$125	\$365	\$283	\$208	\$58	\$240	\$421			
Sample analysis cost (\$/year)	\$25,830	\$6,642	\$540	\$312	\$360	\$360	\$360	\$324	\$324	\$810	\$3,225	\$10,074	\$7,797	\$6,848	\$6,900	\$432	\$758			
Annual shipping fee	\$1,560	One ship	ment per we	eek, \$30 pe	r shipment.															
Sum of lab analysis cost (\$/year)	\$73,455	Average	of two quote	es, plus shi	oment.															
Field meters	\$2,000	portable	pH and con	ductivity me	eter															
Field analytical cost (without labor)	\$1,000	Estimate	for reagent	s and appa	ratus basec	l on experi	ience; not inc	luding labo	r for field a	nalysis										
Total analytical cost	\$74,455	Including	lab and fiel	d analysis d	costs; not in	cluding lat	oor and field	meters												

1. If there are multiple lead-lag trains, lead or lag vessels in each train should be monitored.

2. A composite of top, middle and bottom resin bed layers

3. Other analyses might be required by the sewer discharge permit.

4. Three samples are estimated to be collected per resin changeout event for resin flush water disposal.

BNA SVOC - base, neutral, acid semi-volatile organic compounds



Flow Rate (gpm)

Number of lead/lag trains

Number of lead/lag trains		1																		
									L	.ab									Field	
Sample Location	Cr(VI)	Total Cr	Alkalinity	Turbidity	Sulfate	Nitrate	Phosphat e	Total Iron	Silica	Uranium (water)	Uranium (solids)	Nitrosamin es	BNA SVOC	Aldehydes/ Ketones	Bac-T (E. coli, T coli and HPC)	TCLP (Metals)	CA WET (Metals)	рН	Temperat ure	Conducti vity
Raw	1	1	1												1			4	4	
After pH reduction	4	4	1	1	1	1	1	1	1	1		At start-up	At start-up	At start-up	1			S	S	1
Lead vessel 50% port <sup>1</sup>	4	4																		
Lead vessel effluent 1	4	4								1		At start-up	At start-up	At start-up				4	4	
Lag vessel 50% port <sup>1</sup>	4	4																		
I an vessel effluent <sup>1</sup>	4	4								1		At start-up and monthly thereafter	At start-up and monthly thereafter	At start-up and monthly thereafter	, 			4	4	
Combined IX effluent after pH	-	-										increation	increation	anorodator	-			Continuou	Continuou	
increase	4	4	1	1	1	1	1	1	1						4			S	s	
Resin in lead vessel 1, 2											1									
Spent resin as residuals											At disposal	I				At disposal	At disposal			
Resin flush water as residuals <sup>3</sup>														4						
Sum of samples (# per month)	25	25	i 3	2	2	2 2	2 2	2	2 2	3	1.2	2 1.4	1.4	1.9	10	0.2	0.2	12	12	. 1
MWH Quotes (\$/sample)	\$75	\$15	\$15		\$15	\$15	5 \$15	\$15	\$15	25	125	5 400	400	200	45		350			
Test America Quotes (\$/sample)	\$30	\$12	\$15	\$13	\$15	\$15	5 \$15	\$12	\$12	20		330	165	215	70	240	492			
Unit cost (\$/sample)	\$53	\$14	\$15	\$13	\$15	\$15	5 \$15	\$14	\$14	\$23	\$125	5 \$365	\$283	\$208	\$58	\$240	\$421			
Sample analysis cost (\$/year)	\$15,750	\$4,050	\$540	\$312	\$360	\$360	\$360	\$324	\$324	\$810	\$1,763	\$5,913	\$4,577	\$4,669	\$6,900	\$504	\$884			
Annual shipping fee	\$1,560	One ship	ment per we	eek, \$30 pe	r shipment.													-		
Sum of lab analysis cost (\$/year)	\$49,959	Average	of two quote	es, plus shi	oment.															
Field meters	\$2,000	portable	pH and con	ductivity me	ter															
Field analytical cost (without labor)	\$1,000	Estimate	for reagent	s and appa	ratus based	d on experi	ience; not ind	luding labo	r for field a	nalysis										
Total analytical cost	\$50,959	Including	lab and fiel	d analysis d	osts; not in	cluding lat	bor and field	meters												

\$50,959 Including lab and field analysis costs; not including labor and field meters

100

1. If there are multiple lead-lag trains, lead or lag vessels in each train should be monitored.

2. A composite of top, middle and bottom resin bed layers

3. Other analyses might be required by the sewer discharge permit.

4. Three samples are estimated to be collected per resin changeout event for resin flush water disposal.

BNA SVOC - base, neutral, acid semi-volatile organic compounds



Flow Rate (gpm)

Number of lead/lag trains

Number of lead/lag trains		1																		
									I	ab									Field	
Sample Location	Cr(VI)	Total Cr	Alkalinity	Turbidity	Sulfate	Nitrate	Phosphat e	Total Iron	Silica	Uranium (water)	Uranium (solids)	Nitrosamin es	BNA SVOC	Aldehydes/ Ketones	Bac-T (E. coli, T coli and HPC)	TCLP (Metals)	CA WET (Metals)	рН	Temperat ure	Conducti vity
Raw	1	1	1												1			4	4	
After pH reduction	4	4	1	1	1	1	1	1	1	1		At start-up	At start-up	At start-up	1			s	S	1
Lead vessel 50% port <sup>1</sup>	4	4																		
Lead vessel effluent 1	4	4								1		At start-up	At start-up	At start-up				4	4	
Lag vessel 50% port <sup>1</sup>	4	4																		
Lag vessel effluent <sup>1</sup>	4	4								1		At start-up and monthly thereafter	At start-up and monthly thereafter	At start-up and monthly thereafter	4			4	4	
Combined IX effluent after pH increase	4	4	1	1	1	1	1	1	1						4			Continuou s	Continuou s	
Resin in lead vessel 1, 2											1									
Spent resin as residuals											At disposa	I				At disposal	At disposal			
Resin flush water as residuals 3														4						
Sum of samples (# per month)	25	25	5 3	3 2	2	2 2	2 2	2	2 2	2 3	1.2	2 1.4	1 1.4	1.9	10	0.2	0.2	2 12	12	. 1
MWH Quotes (\$/sample)	\$75	\$15	5 \$15	5	\$15	5 \$15	5 \$15	\$15	5 \$15	5 25	125	5 400	400	200	45		350	)		
Test America Quotes (\$/sample)	\$30	\$12	2 \$15	5 \$13	\$15	\$15	5 \$15	\$12	2 \$12	2 20		330	165	215	70	240	492			
Unit cost (\$/sample)	\$53	\$14	\$15	5 \$13	\$15	\$15	5 \$15	\$14	4 \$14	\$23	\$125	5 \$365	5 \$283	\$208	\$58	\$240	\$421			
Sample analysis cost (\$/year)	\$15,750	\$4,050	\$540	\$312	\$360	\$360	\$360	\$324	\$324	\$810	\$1,763	\$5,913	\$4,577	\$4,669	\$6,900	\$504	\$884			
Annual shipping fee	\$1,560	One ship	oment per w	eek, \$30 pe	r shipment.															
Sum of lab analysis cost (\$/year)	\$49,959	\$49,959 Average of two quotes, plus shipment.																		
Field meters	\$2,000	\$2,000 portable pH and conductivity meter																		
Field analytical cost (without labor)	\$1,000	Estimate	for reagent	s and appa	ratus based	d on exper	ience; not ind	cluding labo	r for field a	nalysis										
Total analytical cost	\$50,959	Including	lab and fiel	d analysis d	costs; not in	cluding lat	oor and field	meters												

If there are multiple lead-lag trains, lead or lag vessels in each train should be monitored.

2. A composite of top, middle and bottom resin bed layers

3. Other analyses might be required by the sewer discharge permit.

4. Three samples are estimated to be collected per resin changeout event for resin flush water disposal.

500

BNA SVOC - base, neutral, acid semi-volatile organic compounds



Flow Rate (gpm)

Number of lead/lag trains

									l	ab									Field	
Sample Location	Cr(VI)	Total Cr	Alkalinity	Turbidity	Sulfate	Nitrate	Phosphat e	Total Iron	Silica	Uranium (water)	Uranium (solids)	Nitrosamin es	BNA SVOC	Aldehydes/ Ketones	Bac-T (E. coli, T coli and HPC)	TCLP (Metals)	CA WET (Metals)	рН	Temperat ure	Conducti vity
Raw	1	1	1												1			4	4	
After pH reduction	4	4	1	1	1	1	1	1	1	1		At start-up	At start-up	At start-up	1			s	s	1
Lead vessel 50% port 1	8	8																		
Lead vessel effluent 1	8	8								1		At start-up	At start-up	At start-up				4	4	
Lag vessel 50% port <sup>1</sup>	8	8																		
Lag vessel effluent <sup>1</sup>	8	8								1		At start-up and monthly thereafter	At start-up and monthly thereafter	At start-up and monthly thereafter	4			4	4	
Combined IX effluent after pH increase	4	4	1	1	1	1	1	1	1						4			Continuou s	Continuou s	
Resin in lead vessel 1, 2											2									
Spent resin as residuals											At disposal	I				At disposal	At disposal			
Resin flush water as residuals <sup>3</sup>														At disposal						
Sum of samples (# per month)	41	41	3	3 2	2	2	2 2	2	2	2 3	4.2	2.4	2.4	2.9	10	0.2	0.2	12	2 12	2 1
MWH Quotes (\$/sample)	\$75	\$15	\$15	5	\$15	\$15	\$15	\$15	\$15	25	125	5 400	400	200	45		350			
Test America Quotes (\$/sample)	\$30	\$12	\$15	\$13	\$15	\$15	\$15	\$12	\$12	20		330	165	215	5 70	240	492			
Unit cost (\$/sample)	\$53	\$14	\$15	5 \$13	\$15	\$15	5 \$15	\$14	\$14	\$23	\$125	\$365	\$283	\$208	\$58	\$240	\$421			
Sample analysis cost (\$/year)	\$25,830	\$6,642	\$540	\$312	\$360	\$360	\$360	\$324	\$324	\$810	\$6,263	\$10,293	\$7,967	\$7,159	\$6,900	\$504	\$884			
Annual shipping fee	\$1,560	One ship	ment per we	eek, \$30 pe	r shipment.															
Sum of lab analysis cost (\$/year)	\$77,391	Average	werage of two quotes, plus shipment.																	
Field meters	\$2,000	portable	pH and con	ductivity me	ter															
Field analytical cost (without labor)	\$1,000	Estimate	timate for reagents and apparatus based on experience; not including labor for field analysis																	
Total analytical cost	\$78,391	Including	lab and fiel	d analysis d	osts; not in	cluding lab	oor and field	meters												

1. If there are multiple lead-lag trains, lead or lag vessels in each train should be monitored.

2. A composite of top, middle and bottom resin bed layers

3. Other analyses might be required by the sewer discharge permit.

4. Three samples are estimated to be collected per resin changeout event for resin flush water disposal.

2,000

2

BNA SVOC - base, neutral, acid semi-volatile organic compounds



## Estimated WBA O&M Costs

(Resin Replacement and Spent Resin Disposal Based on Cr(VI) Treatment Target)

#### WBA System Size = 10 gpm

						Re	esin	Spent Re	esin &			Other				
Potential Cr(VI)					VPGAC	Re	eplacement	Wastewa	ater			Consumables		Maintenance	Lab and Field	
MCL (ppb)	Electricity*		Chemicals		Replacement	(Fr	resh Resin)	Disposa	I	Labor		(Bag Filters)		and Spare Parts	Analysis <sup>&amp;</sup>	Annual O&M
1	\$	6,000	\$	920	\$ 1,300	\$	6,000	\$	5,400	\$	50,000	\$6	60	\$ 3,630	\$ 74,000	\$ 147,000
2	\$	6,000	\$	920	\$ 1,300	\$	5,300	\$	5,200	\$	50,000	\$6	60	\$ 3,630	\$ 74,000	\$ 146,000
5	\$	6,000	\$	920	\$ 1,300	\$	4,600	\$	5,000	\$	50,000	\$6	60	\$ 3,630	\$ 74,000	\$ 146,000
10	\$	6,000	\$	920	\$ 1,300	\$	3,300	\$	4,600	\$	50,000	\$6	60	\$ 3,630	\$ 74,000	\$ 144,000
25	\$	6,000	\$	920	\$ 1,300	\$	1,300	\$	4,000	\$	50,000	\$6	60	\$ 3,630	\$ 74,000	\$ 141,000

\* Electricity includes approximately \$200 per year for aeration off-gas treatment.

& Lab and field analysis does not include cost for aeration off-gas analysis.

#### WBA System Size = 100 gpm

							Re	sin	Spen	nt Resin &			Other							
Potential Cr(VI)					٧P	GAC	Re	placement	Wast	tewater			Consumable	es	Ма	intenance	Lab ar	nd Field		
MCL (ppb)	Electr	icity*	Che	emicals	Re	placement	(Fr	esh Resin)	Disp	osal	Labor		(Bag Filters)	)	anc	d Spare Parts	Analys	sis <sup>&amp;</sup>	Ann	nual O&M
1	\$	12,400	\$	9,200	\$	11,800	\$	30,146	\$	21,600	\$	50,000	\$	130	\$	6,900	\$	51,000	\$	193,000
2	\$	12,400	\$	9,200	\$	11,800	\$	24,700	\$	18,300	\$	50,000	\$	130	\$	6,900	\$	51,000	\$	184,000
5	\$	12,400	\$	9,200	\$	11,800	\$	21,900	\$	16,700	\$	50,000	\$	130	\$	6,900	\$	51,000	\$	180,000
10	\$	12,400	\$	9,200	\$	11,800	\$	13,700	\$	11,800	\$	50,000	\$	130	\$	6,900	\$	51,000	\$	167,000
25	\$	12,400	\$	9,200	\$	11,800	\$	8,200	\$	8,500	\$	50,000	\$	130	\$	6,900	\$	51,000	\$	158,000

\* Electricity includes approximately \$700 per year for aeration off-gas treatment.

& Lab and field analysis does not include cost for aeration off-gas analysis.

#### WBA System Size = 500 gpm

							Res	sin	Spe	nt Resin &			Other							
Potential Cr(VI)					VPG	GAC	Rej	placement	Was	stewater			Consu	mables	Ма	intenance	Lab	and Field		
MCL (ppb)	Electric	ity*	Chem	nicals	Rep	lacement	(Fre	esh Resin)	Disp	posal	Labor		(Bag F	ilters)	an	d Spare Parts	Anal	ysis <sup>&amp;</sup>	Annu	al O&M
1	\$	60,500	\$	46,100	\$	49,500	\$	156,400	\$	109,100	\$	50,000	\$	510	\$	14,000	\$	51,000	\$	537,000
2	\$	60,500	\$	46,100	\$	49,500	\$	128,000	\$	89,900	\$	50,000	\$	510	\$	14,000	\$	51,000	\$	490,000
5	\$	60,500	\$	46,100	\$	49,500	\$	113,800	\$	80,300	\$	50,000	\$	510	\$	14,000	\$	51,000	\$	466,000
10	\$	60,500	\$	46,100	\$	49,500	\$	71,100	\$	51,500	\$	50,000	\$	510	\$	14,000	\$	51,000	\$	394,000
25	\$	60,500	\$	46,100	\$	49,500	\$	42,700	\$	32,300	\$	50,000	\$	510	\$	14,000	\$	51,000	\$	347,000

\* Electricity includes approximately \$11,000 per year for aeration off-gas treatment.

& Lab and field analysis does not include cost for aeration off-gas analysis.

#### WBA System Size = 2,000 gpm

							Re	sin	Spent Re	sin &			Other						
Potential Cr(VI)					٧P	GAC	Re	placement	Wastewa	er			Consumables	Ma	aintenance	Lab	and Field		
MCL (ppb)	Electr	ricity*	Che	micals	Re	placement	(Fr	resh Resin)	Disposal		Labor		(Bag Filters)	an	d Spare Parts	Ana	lysis <sup>&amp;</sup>	Ann	ual O&M
1	\$	194,800	\$	184,200	\$	168,500	\$	523,900	\$	363,900	\$	50,000	\$ 1,500	\$	32,600	\$	78,000	\$	1,597,000
2	\$	194,800	\$	184,200	\$	168,500	\$	428,700	\$	298,500	\$	50,000	\$ 1,500	\$	32,600	\$	78,000	\$	1,437,000
5	\$	194,800	\$	184,200	\$	168,500	\$	381,000	\$	265,500	\$	50,000	\$ 1,500	\$	32,600	\$	78,000	\$	1,356,000
10	\$	194,800	\$	184,200	\$	168,500	\$	238,100	\$	167,200	\$	50,000	\$ 1,500	\$	32,600	\$	78,000	\$	1,115,000
25	\$	194,800	\$	184,200	\$	168,500	\$	142,900	\$	101,700	\$	50,000	\$ 1,500	\$	32,600	\$	78,000	\$	954,000

\* Electricity includes approximately \$21,000 per year for aeration off-gas treatment.

& Lab and field analysis does not include cost for aeration off-gas analysis.



# Estimated WBA O&M Costs

# (Resin Replacement and Spent Resin Disposal Based on Cr(VI) Treatment Target)

Annual O&M Summary

WBA System		Po	oter	ntial Cr(VI) MCL,	pp	b	
Size (gpm)	1	2		5		10	25
10	\$ 147,000	\$ 146,000	\$	146,000	\$	144,000	\$ 141,000
100	\$ 193,000	\$ 184,000	\$	180,000	\$	167,000	\$ 158,000
500	\$ 537,000	\$ 490,000	\$	466,000	\$	394,000	\$ 347,000
2,000	\$ 1,597,000	\$ 1,437,000	\$	1,356,000	\$	1,115,000	\$ 954,000

### Net Present Value for 20 Years (Rounded to two significant figures)

WBA System		Po	oten	tial Cr(VI) MCL,	ppt	)	
Size (gpm)	1	2		5		10	25
10	\$ 2,500,000	\$ 2,400,000	\$	2,400,000	\$	2,400,000	\$ 2,400,000
100	\$ 3,200,000	\$ 3,100,000	\$	3,000,000	\$	2,800,000	\$ 2,800,000
500	\$ 9,000,000	\$ 8,200,000	\$	7,800,000	\$	6,600,000	\$ 5,800,000
2,000	\$ 27,000,000	\$ 24,000,000	\$	23,000,000	\$	19,000,000	\$ 16,000,000

20-year NPV O&M based on 2.5% inflation and a 4.5% discount rate.



Client City of Glendale
Project Phase III Demonstration Testing for Cr(VI) Treatment
Item 100-gpm RCF System

Project No. 05337008.0	0000									
By T.D. & Y.W.	Ckd: Y.W. & T.V.									
Date 12/9/11 Date: 1/18/12										

DESCRIPTION	QTY	UNIT MEAS.		UNIT COST		TOTAL COST	COMMENTS
Equipment	1						
FeSO <sub>4</sub> Feed System							
Storage Tank	1	FΔ	\$	2 700	\$	2 700	Quotes from Ryan Herco & Core Rosion: 100 gal PE, outdoor, incl. seismic
Metering Pumps	2	FΔ	\$	3 100	\$	6 200	Quotes from C.P. Crowley & HTP: 0.25 gph: 1 duty/1 stdby
Static Mixers	1	FΔ	\$	900	\$	900	Quotes from Komax & EWS: 3-inch
		L/	Ť	,00	¥	700	
Reduction Tanks							
Tanks	3	EA	\$	5.100	\$	15.300	Ouotes from Core-Rosion & Rvan Herco: 1,700 gal PE, outdoor, incl. seismic
Mixers	3	EA	\$	4,700	\$	14,100	Quotes from Core-Rosion & EWS: G = 60 per second
Aeration System							
Tank	1	EA	\$	3,600	\$	3,600	Quotes from Core-Rosion & Ryan Herco; 700 gal PE, outdoor, incl. seismic
Diffusers	1	LS	\$	400	\$	400	Based on previous project experience
Supply Blowers	2	EA	\$	30,300	\$	60,600	Quote from EWS; 53 SCFM @ 4 psi; 1 duty/ 1 stdby; incl. accessories
Exhaust Blowers	2	EA	\$	34,900	\$	69,800	Quote from EWS; 53 SCFM @ 2 psi; 1 duty/ 1 stdby; incl. accessories
Off Cas Treatment	1	15	4	4 000	4	4 000	Cost from Glendale and quotes from TIGG; 54 SCFM; (2) adsorbers in series
Oll-Gas fredillent		LS	¢	4,000	Ŷ	4,000	with one heater
Polymer Mixing Tank							
Rapid Mixing Tank	1	EA	\$	3,600	\$	3,600	Quotes from Core-Rosion & Ryan Herco; 700 gal PE, outdoor, incl. seismic
Mixer	1	EA	\$	3,700	\$	3,700	Quotes from Core-Rosion & EWS; G = 170 per second
Filters							
Filter Equipment (Pressure Filters)	1	15	\$	280.000	\$	280.000	Quotes from Coombs-Hopkins & Layne, including media; 3 gpm/sf, (2) 6.5 ft dia
riter Equipment (Fressure Filters)	1	LJ	Ψ	200,000	Ŷ	200,000	VPF, 1 duty/ 1 stdby
Filter Drawdown Transfer Pump	2	EA	\$	5,600	\$	11,200	Quotes from DTI and Cortech; 55 gpm @ 70 ft; 1 duty/ 1 stdby
Pumps							
Filter Feed Pumps (Progressive Cavity)	2	EA	\$	12,000	\$	24,000	Quotes from Cortech & Flow-Systems; 100 gpm @ 70 ft; 1 duty/ 1 stdby
Polymer Feed Systems							
Polymer Feed System (Coagulant Aid)	1	LS	\$	28,000	\$	28,000	Quotes from Siemens & C.P. Crowley
Polymer Feed System (Solids Settling Aid)	1	LS	\$	11,000	\$	11,000	Quotes from Siemens & C.P. Crowley
Filtrate Tank for Backwash	1	EA	\$	26,200	\$	26,200	Quotes from Core-Rosion & Ryan Herco; 12,500 gal PE, outdoor, incl. seismic
Backwash Pumps	2	EA	\$	8,900	\$	17,800	Quotes from ITT & Cortech; 600 gpm @ 50 ft; 1 duty/ 1stdby
Residuals Treatment System							
Gravity Thickener	2	EA	\$	32,000	\$	64,000	Quote from Plastic-Mart for 13,000-gallon cone bottom tank with stand.
Flo-Trend SludgeMate Container	2	EA	\$	14,200	\$	28,400	Quote from Flo-Trend for 6-CY SludgeMate container.
Pumps	1	LS	\$	10,000	\$	10,000	Includes all sludge pumps and recycle pumps, one duty and one standby.
Subtotal					\$	686,000	Rounded up to \$1000
Equipment Installation Cost	30%				\$	206,000	Including tax, freight, installation and manufacturer services.
Chemical Storage Containment	2	CY	\$	1,250	\$	2,500	
Equipment Concrete Pads	69	CY	\$	1,250	\$	86,250	
Subtotal (Installed Equipment Costs)					\$	981,000	Rounded up to \$1000
							Division 1 requirements, including labor supervision, field offices, temporary
General Requirements	7.5%				\$	73,575	utilities, health and safety, office supplies, clean up, photographs, survey,
í í							erosion control, coordination, testing services, and record documents
Farthwork	5%	1			\$	49 050	Excavation backfill and fill required to construct project
Site Improvements	5%	1			\$	49 050	Roadways, curb and gutter, sidewalk and landscaning
Valves Piping and Appurtenances	15%				\$	148 000	Major system pining and valves
Electrical Instrumentation and Controls	15%		-		ŝ	148,000	PLC and SCADA equipment to control
Elocation, instrumentation and controls	1070				Ŷ	110,000	
Total Direct Costs	1				\$	1 449 000	Rounded up to \$1000
	1		1		Ψ	1,117,000	1.0011000 up to \$1000



Contractor's Overhead and Profit	20%		\$ 289,800	Includes bonds, mobilization and demobilization, insurance, overhead and profit, and management reserves
Construction Total			\$ 1,739,000	Rounded up to \$1000
Project Level Allowance (contingency)	20%		\$ 347,800	Budget item to cover change orders due to unforeseen conditions
Engineering, Legal and Administrative	20%		\$ 347,800	Includes permits, legal fees and engineering fees for design and construction
Project Total			\$ 2,435,000	
Low Estimate			\$ 1,705,000	-30%
High Estimate			\$ 3,653,000	+50%

Notes:

This opinion of probable cost is based on AACE Class 5 estimate guidelines. The high and low estimates fall into the acceptable range. These estimates are generally used to compare alternatives.
 Opinion of Probable Cost in 2011 dollars.
 Costs for land or easements are not included.



Client City of Glendale
Project Phase III Demonstration Testing for Cr(VI) Treatment
Item 500-gpm RCF System

Project No. 05337008.0	0000
By T.D. & Y.W.	Ckd: Y.W. & T.V.
Date 12/9/11	Date: 1/18/12

DESCRIPTION	QTY	UNIT MEAS.		UNIT COST		TOTAL COST	COMMENTS
Equipment							
FeSO₄ Feed System							
Storage Tank	1	EA	\$	3,300	\$	3,300	Quotes from Core-Rosion & Ryan Herco; 500 gal PE, outdoor, incl. seismic
Metering Pumps	2	EA	\$	3,100	\$	6,200	Quotes from C.P. Crowley & HTP; 1.3 gph; 1 duty/ 1 stdby
Static Mixers	1	EA	\$	2,200	\$	2,200	Quotes from Komax & EWS; 8-inch
Deduction Tonko							
Reduction ranks	2	FΔ	¢	20.000	¢	60.000	Quates from Cara Dasian & Dvan Harca: 8 000 gal PE outdoor incl. saismic
I dTRS Mixers	3	FA	۰ ۲	8 800	\$	26 400	Quotes from Core-Rosion & Ryan Herco, 0,000 garr L, outdoor, mor. seisme
WINCIS	Ŭ		¥	0,001	÷	201102	
Aeration System		<u> </u>					
Tanks	1	EA	\$	6,300	\$	6,300	Quotes from Core-Rosion & Ryan Herco; 3000 gal PE, outdoor, incl. seismic
Diffusers	1	LS	\$	2,000	\$	2,000	Based on previous project experience
Supply Blowers	2	EA	\$	46,300	\$	92,600	Quote from EWS; 267 SCFM @ 7 psi; 1 duty/ 1 stdby; incl. accessories
Exhaust Blowers	2	EA	\$	34,800	\$	69,600	Quote from EWS; 267 SCFM @ 2 psi; 1 duty/ 1 stdby; incl. accessories
Off-Gas Treatment	1	LS	\$	15,100	\$	15,100	Quotes from Calgon and TIGG; 270 SCFM; (2) adsorbers in series with one
			-				heater
Polymer Miving Tank	1	1	-				
Panid Mixing Tank	1	FA	\$	6 700	\$	6 700	Quotos from Core-Rosion & Rvan Herco: 3000 gal PE, outdoor, incl. seismic
Mixers	1	EA	\$	4,400	\$	4,400	Ouotes from Core-Rosion & EWS: G = 170 per second
INIMOIS			÷	.,	*		
Filters	1	l					
							Quotes from Coombs-Hopkins & Layne, including media; 3 gpm/sf; Coombs-
Filter Equipment (Pressure Filters)	1	LS	\$	465,000	\$	465,000	Hopkins filters, 10' x 24' (4 cells, 3 duty/ 1 stdby); Layne filters, (2) 8" x 22', 1
							duty/ 1 stdby
Filter Drawdown Transfer Pump	2	EA	\$	4,800	\$	9,600	Quotes from ITT and Cortech; 150 gpm @ 70 ft; 1 duty/ 1 stdby
Pumps							
Filter Feed Pumps (Progressive Cavity)	2	EA	\$	38,000	\$	76,000	Quotes from Cortech & Flow-Systems; 500 gpm @ 70 ft; 1 duty/ 1 stdby
		1					
Polymer Feed Systems	1	10	¢	10 500	¢	10 500	
Polymer Feed Systems (Coaguiant Aid)	1	LS	\$	10,500	¢	10,500	Quotes from Siemens & C.P. Crowley
Polymer reed systems (solids setting Ald)	1	LJ	\$	11,400	\$	11,400	Quotes from Siemens & C.P. Growley
Filtrate Tank for Backwash	1	FA	\$	40.000	\$	40.000	Ouotos from Superior: 22 000 gal: 15 ft dia x 16 ft height
Backwash Pumps	2	EA	\$	14,300	\$	28,600	Ouotes from ITT & Cortech: 1.050 apm @ 50 ft; 1 duty/ 1stdby
Baandan - ange							
Residuals Treatment System							
Equalization Tank	1	ΕΛ	¢	121 000	¢	121 154	Adjusted installed costs from RS Means for 90,000-gal tank, which was divided
	I I	EA	2	121,000	Э	121,154	by 1.3 to exclude installation cost (assuming a installation cost of 30%).
Plata Cattlar	1	ΕΛ	¢	50 000	¢	59,000	Quote from Meurer Research, Inc. and Parkson for a system handles a 26-gpm
	I	EA	\$	000,40	¢	37,000	sludge flow.
Flo-Trend SludgeMate Container	3	EA	\$	25,900	\$	77,700	Quote from Flo-Trend for 15-CY SludgeMate container.
Pumps	1	LS	\$	15,000	\$	15,000	Includes all sludge pumps and recycle pumps, one duty and one standby.
					*	1 200 000	
Subtotal		1			\$	1,209,000	Rounded up to \$1000
E-winer ant Installation Cost	200/				¢	262.000	Including to relight installation and manufacturar convicas
	30%	1	-		\$	303,000	including tax, ifeight, installation and manufacturer services.
Chemical Storage Containment	6	CY	\$	1 250	\$	7 500	
Chemical Storage Containment		0.	Ψ	1,200	¥	1,000	
Equipment Concrete Pads	166	CY	\$	1,250	\$	207,500	
	1	l					
Subtotal (Installed Equipment Costs)					\$	1,787,000	Rounded up to \$1000
	Γ		Γ				Division 1 requirements, including labor supervision, field offices, temporary
General Requirements	7.5%				\$	134,025	utilities, health and safety, office supplies, clean up, photographs, survey,
							erosion control, coordination, testing services, and record documents
Earthwork	5%				\$	89,350	Excavation, backfill, and fill required to construct project
Site Improvements	5%				\$	89,350	Roadways, curb and gutter, sidewalk and landscaping
Valves, Piping, and Appurtenances	15%				\$	269,000	Major system piping and valves
Electrical, Instrumentation and Controls	15%				\$	269,000	PLC and SCADA equipment to control
Total Direct Costs					\$	2,638,000	Rounded up to \$1000



Client	Project No. 053370
City of Glendale	By T.D. & Y.W.
	Date 12/9/11
Project	
Phase III Demonstration Testing for Cr(VI)	
Treatment	
Item	
500-gpm RCF System	

Contractor's Overhead and Profit	20%		\$ 527,600	Includes bonds, mobilization and demobilization, insurance, overhead and profit, and management reserves
Construction Total			\$ 3,166,000	Rounded up to \$1000
Project Level Allowance (contingency)	20%		\$ 633,200	Budget item to cover change orders due to unforeseen conditions
Engineering, Legal and Administrative	20%		\$ 633,200	Includes permits, legal fees and engineering fees for design and construction
Project Total			\$ 4,433,000	
Low Estimate			\$ 3,103,000	-30%
High Estimate			\$ 6,650,000	+50%

Notes:

This opinion of probable cost is based on AACE Class 5 estimate guidelines. The high and low estimates fall into the acceptable range. These estimates are generally used to compare alternatives.
 Opinion of Probable Cost in 2011 dollars.
 Costs for land or easements are not included.



Client City of Glendale
Project Phase III Demonstration Testing for Cr(VI) Treatment
Item 2000-gpm RCF System

Project No. 05337008.0	0000
By T.D. & Y.W.	Ckd: Y.W. & T.V.
Date 12/9/11	Date: 1/18/12

Equipment         Image: Construction of the second system         Image: Construction of the system in the system	DESCRIPTION	QTY	UNIT MEAS.	U	NIT COST	TC	OTAL COST	COMMENTS
Color         Color         Color         Color           Singap Task         1         EA         \$ 5000 S         5.000 S         2000s from CP. Crowky MFP cp. ph           Singap Task         1         EA         \$ 4000 S         2000s from CP. Crowky MFP cp. ph           Singap Task         1         EA         \$ 4000 S         4.000 Duries from CP. Crowky MFP cp. ph           Singap Tasks         1         EA         \$ 4000 S         4.000 Duries from CP. Crowky MFP cp. ph           Singap Tasks         3         EA         \$ 4000 S         4.000 Duries from CP. Crowky MFP cp. ph           Singap Tasks         3         EA         \$ 4000 S         4.000 Duries from CP. Crowky MFP cp. ph           Anation System         3         EA         \$ 4000 S         8.000 S         5.000 S           Singap Tasks         2         EA         \$ 4400 S         3.4990 Duries from CP. Crowky MFP cp. 1001 Julty FIG. 4000 South for CP. Crowky MFP cp. 1001 Julty FIG. 4000 South for CP. Crowky MFP cp. 1000 South for CP. Crowky MFP cp. 100	Equipment	-	-					
Field, Ford System         Field         Ford         Ford         Source Trank           Matering Pumps         1         EA         5,500         Sources Trank         Construct Struct								
Strage Tank         1         EA         3         5,900         Stores from C-Posion & From Herce 2000 gd PE, outdoor, Incl. setmic Meeting Amps         2         EA         5,000         S 12000         Quotes from C-Posion & From Herce 2000 gd PE, outdoor, Incl. setmic Meeting Amps         2         EA         5,000         S 12000         Quotes from C-P. Consely & HTP = gg h           State Miners         1         EA         \$         22,000         \$         4,000         Quotes from C-P. Consely & HTP = gg h           Reduction Tanks         -	FeSO₄ Feed System			Γ				
Metering Pumps         2         EA         5         0.001         5         1.2000         Doubles from Crawky & HTP 5 aget           Site Mores         1         EA         5         4.200         5         4.200         Doubles from Craw & EWS. G = 60 per second           Reduction Tanks         -	Storage Tank	1	EA	\$	5,900	\$	5,900	Quotes from Core-Rosion & Ryan Herco; 2,000 gal PE, outdoor, incl. seismic
Slait Allows         1         EA         5         4.200         S         4.200         Judies from Komax & EWS: 14.inch           Reduction Tranks         -	Metering Pumps	2	EA	\$	6,000	\$	12,000	Quotes from C.P. Crowley & HTP; 5 gph
Reduction TanksImageImageImageImageImageMiners3EA\$22.50\$70.00Quotes from Care-Rosion & EWS. G = 60 per secondArration System1LS\$80.00\$80.00Based on preiotal spreiot experience and conversation within BlueleStapper Blowers2EA\$74.800\$140.00Stapper Blowers2EA\$74.800\$140.00Stapper Blowers20EA\$55.00\$20.00Of Cas Treatment11LS\$25.00\$25.00\$25.00Stapper Blowers200.00Stapper Blowers2EA\$17.00Quote from EVXS. 107.05CHM (2) addity flats (accessoatiesStapper Blowers200.00\$25.00Stapper Blowers2EA\$17.00Quote from EVXS. 107.05CHM (2) addity flats (accessoatiesStapper Blowers200.00Stapper Blowers2EA\$17.00Quote from EVXS. 107.05CHM (2) addity flats (accessoatiesStapper Blowers200.00Stapper Blowers2EA\$17.00Quote from EVXS. 07.00Stapper Blowers200.00Stapper Blowers3EA\$5.000\$10000Quotes from Tonka & Layne, including media. 3 graphs/: Tonka flats, (2) 10.1 day 1 staby2EA\$5.000\$10000Quotes from Tonka & Layne, including media. 3 graphs/: Tonka flats, (2) 10.1 day 1 staby2EA\$5.000\$10000Quotes from Tonka & Layne, including media. 3 graphs/: Tonka flats, (2) 10.1 day 1 staby2EA\$5.000\$10000Quotes from Cortech & Fl	Static Mixers	1	EA	\$	4,200	\$	4,200	Quotes from Komax & EWS; 14-inch
Reduction Tanks         Image: Constraint of the second secon								
Mixes         3         LA         3         21300         3         21300         Justa         Justa <thjusta< th=""></thjusta<>	Reduction Tanks		<b>F</b> A	<i>•</i>	00 500	*	70 500	
Arataon System         Image         Image         Image         Image         Image           Officient         1         1.5         \$         8.000         8.add on previous project separations with status           Officient         2         EA         \$         7.800         \$         1404.00           Supple Blowers         2         EA         \$         5.8500         \$         117.00           Ord Gas Treatment         1         1.5         \$         2.300         \$         2.5300           Palymer Miding Tanks         -         -         -         -         -         -           Wates         1         EA         \$         17.000         \$         17.000         Outlets from Core-Rosion & EWS. G = 170 per second           Wates         1         EA         \$         17.000         \$         17.000         Outlets from Core-Rosion & EWS. G = 170 per second           Filter Equipment (Pressure Filters)         1         LS         \$         19.000         \$         98.000         Outlets from Core-Rosion & EWS. G = 170 per second           Filter Equipment (Pressure Filters)         1         LS         \$         10.000         Outlets from Core-Rosion & EWS. G = 170 per second           Filter E	Mixers	3	ΕA	\$	23,500	\$	/0,500	Quotes from Core-Rosion & EWS; G = 60 per second
Diffusion         1         LS         \$         8.000         s         9.000         S         9.000<	Acration System							
Indust         1         Core         3         Core         Description of an operation operation of an operation operatex operation operatex opera	Diffusor	1	15	\$	8 000	¢	8 000	Pased on provious project experience and conversation w/ Brian Bubela
Jack Part Number         John	Supply Blowers	2	FA	\$	74 800	\$	149 600	Dased on previous project experience and conversation w brian based Ouote from FWS-1 070 SCFM @ 7 nsi-1 duty/1 stdby: incl. accessances
Diameter	Exhaust Blowers	2	FA	\$	58,500	\$	117,000	Ouote from FWS: 1,070 SCFM @ 2 psi; 1 duty/ 1 stdby; incl. accessables
OH: Gas Final ment         I         LS         \$         25,000         Nater         Nater           Polymer Muling Tanks         I         EA         \$         17,000         \$         17,000           Riters         I         EA         \$         17,000         \$         17,000         Subles from Core-Rosion & EWS: G = 170 per second           Filler Equipment (Pressure Filters)         1         EA         \$         17,000         \$         0uotes from Tonka & Layne, including media: 3 gen/sf. Tonka filters, (2) 10' x 24', 3 duly1 i stdby           Filler Fuendwawn Transfer Pump         2         EA         \$         5000         \$         10000         Ouotes from Tonka & Layne, including media: 3 gen/sf. Tonka filters, (2) 10' x 24', 3 duly1 i stdby           Pumps         I         LS         \$         984,000         Quotes from Tonka & Layne, including media: 3 gen/sf. Tonka filters, (2) 10' x 24', 3 duly1 i stdby           Pumps         I         LS         \$         165,000         Ouotes from Cortech & Flow-Systems: 1.000 gen @ 70 ft: 2 duly1 i stdby           Polymer Feed Systems (Coargulant Adr)         I         LS         \$         11,400         S         11,400         S         11,400         S         11,400         Duotes from Siemens & C P. Crowley         IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII		-	10	*	05,000	*	05 000	Quotes from Calgon & TIGG; 1070 SCFM; (2) adsorbers in series with one
Poymer Musing Tanks         Image: Constraint of the second s	Off-Gas Treatment	1	LS	\$	25,300	\$	25,300	heater
Polymer Mining TanksImage: Constraint of the constraint of								
Mixers         1         EA         \$ 17,00         \$ 17,00         Quotes from Core-Rosion & EWS. G = 170 per second           Fillers         I	Polymer Mixing Tanks							
Fillers     Image: Constraint of the second of	Mixers	1	EA	\$	17,000	\$	17,000	Quotes from Core-Rosion & EWS; G = 170 per second
Filter SImage: Control of the second se	l							
Filter Equipment (Pressure Filters)         1         LS         \$         984,000         \$         984,000         Coules from Tonka & Layne, including media: 3 gyms/st. Tonka filters, (2) 10 x 24: 3 duly / 1 stdby           Filter Drawdown Transfer Pump         2         EA         \$         5.000         \$         0.000e from Tonka & Layne, including media: 3 gyms/st. Tonka filters, (2) 10 x 24: 3 duly / 1 stdby           Pumps	Filters							
And equipment (result with a spectrum)         2         EA         5         10.003         12.1 cells per filter, 3 duy/1 stdby. Layne filters, (4) 10 x 24, 3 duy/1 stdby           Filter Drawdown Transfer Pump         2         EA         \$         5.000         \$         Duotes from ITT and Cortech: 150 gpm @ 70 ft: 1 duly/1 stdby           Pumps         -         <	Filter Fauipment (Pressure Filters)	1	LS.	\$	984,000	\$	984,000	Quotes from Tonka & Layne, including media; 3 gpm/sf; Tonka filters, (2) 10' x
Filter Drawdown Transfer Pump         2         EA         \$         5.000         \$         10.000         Duotes from IT and Cortech: 150 gpm @ 70 ft: 1 duly/ 1 stdby           Pumps		•		*	,01,000	÷	,01,011	42', 4 cells per filter, 3 duty / 1 stdby; Layne filters, (4) 10' x 24', 3 duty/ 1 stdby
PumpsImageImageImageImagePumps3EA\$ 55,000\$ 165,000Duoles from Cortech & Flow-Systems; 1,000 gpm @ 70 ft 2 dutyl 1 stdbyPolymer Feed Systems1LS\$ 10,500S 10,500Duoles from Slemens & C. P. CrowleyPolymer Feed Systems (Coaquiant Aid)1LS\$ 11,400S 10,500Duoles from Slemens & C. P. CrowleyPolymer Feed Systems (Solds Settling Aid)1LS\$ 11,400S 10,500Duoles from Slemens & C. P. CrowleyPolymer Feed Systems1EA\$ 50,000S 43,000Duoles from Superior: 30,250 qal: 18 ft dia x 16 ft heightBackwash Pumps2EA\$ 21,500\$ 43,000Duoles from RS Means for 280,000-gal tank, which was thidde by 1.3 to exclude installation cost (assuming a installation cost of 30%).Plate Settler1EA\$ 78,000\$ 78,000S 115,200Pumps1LS\$ 22,000\$ 22,000S 20,000Pumps1LS\$ 22,000\$ 22,000S 20,000Pumps1LS\$ 22,000\$ 22,000S 20,000Pumps1LS\$ 2,036,000Rounded up to \$1000Pumps1LS\$ 700\$ 115,000SubtotalCuel from Flo-Trend for 40-CY SludgeMate container.Pumps1LS\$ 2,036,000Reduction TanksEquilation Cost (30% of Equipment)30%-Stab140CY\$ 700Stab140 <td>Filter Drawdown Transfer Pump</td> <td>2</td> <td>EA</td> <td>\$</td> <td>5,000</td> <td>\$</td> <td>10,000</td> <td>Ouotes from ITT and Cortech; 150 gpm @ 70 ft; 1 duty/ 1 stdby</td>	Filter Drawdown Transfer Pump	2	EA	\$	5,000	\$	10,000	Ouotes from ITT and Cortech; 150 gpm @ 70 ft; 1 duty/ 1 stdby
Pumps         Image: Constraint of the second s								
Filler Feed Pumps (Progressive Cavity)         3         EA         \$         55.00         \$         165.000         Quotes from Cortech & Flow-Systems: 1.000 gm @ 70 ft: 2 du/yl 1 stddy           Polymer Feed Systems         Coaulant Aid)         1         LS         \$         10.000         Quotes from Siemens & C.P. Crowley           Polymer Feed Systems (Solids Settling Aid)         1         LS         \$         11.000         Quotes from Siemens & C.P. Crowley           Filtrate Tank for Backwash         1         EA         \$         50.000         Quotes from Superior: 30.250 gal: 18 ft dia x 16 ft height           Backwash Pumps         2         EA         \$         50.000         Quotes from Superior: 30.250 gal: 18 ft dia x 16 ft height           Backwash Pumps         2         EA         \$         50.000         Quotes from Superior: 30.250 gal: 18 ft dia x 16 ft height           Backwash Pumps         2         EA         \$         71.00         \$         137.385           Gelaization Tank         1         EA         \$         737.000         \$         737.385         Adjusted installation cost (assuming a installation cost of 30%). Oute from Hourer Research, Inc. and Parkson for a system handles a 88-gm Sudge fow.           Pumps         1         LS         \$         22.000         \$         22.000<	Pumps							
Polymer Feed SystemsImage: Control of the systems (Solids Settling Aid)Image: Control of the system (Solids Settling Ai	Filter Feed Pumps (Progressive Cavity)	3	EA	\$	55,000	\$	165,000	Quotes from Cortech & Flow-Systems; 1,000 gpm @ 70 ft; 2 duty/ 1 stdby
Polymer Feed Systems         Image: Comparison of Comp								
Polymer Feed Systems (Coaquiant Aid)       1       LS       \$       10,500       S       10,500       Subtract       Participation         Polymer Feed Systems (Solids Settling Aid)       1       LS       \$       11,400       \$       10,500       Subtract       Participation       Parindication       Participation <td>Polymer Feed Systems</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Polymer Feed Systems							
Polymer Feed Systems (Solids Settling Ald)       1       LS       \$       11,400       Cucles from Siemens & C.P. Crowley         Filtrate Tank for Backwash       1       EA       \$       50,000       \$       50,000       Quotes from Superior; 30,250 gal; 18 ft dia x 16 ft height         Backwash Pumps       2       EA       \$       21,500       \$       43,000       Quotes from Superior; 30,250 gal; 18 ft dia x 16 ft height         Backwash Pumps       2       EA       \$       21,500       \$       43,000       Quotes from Superior; 30,250 gal; 18 ft dia x 16 ft height         Backwash Pumps       2       EA       \$       21,500       \$       43,000       Quotes from Superior; 30,250 gal; 18 ft dia x 16 ft height         Residuals Treatment System	Polymer Feed Systems (Coagulant Aid)	1	LS	\$	10,500	\$	10,500	Quotes from Siemens & C.P. Crowley
Filtrate Tank for Backwash       I       EA       \$ 50,000       Superior: 30,250 gal: 18 ft dia x 16 ft height         Backwash Pumps       2       EA       \$ 21,500       \$ 43,000       Oucles from Superior: 30,250 gal: 18 ft dia x 16 ft height         Backwash Pumps       2       EA       \$ 21,500       \$ 43,000       Oucles from Superior: 30,250 gal: 18 ft dia x 16 ft height         Residuals Treatment System       2       EA       \$ 21,500       \$ 43,000       Oucles from SUperior: 30,250 gal: 18 ft dia x 16 ft height         Equalization Tank       1       EA       \$ 137,000       \$ 137,385       Adjusted installed costs from RS Means for 280,000-gal tank, which was divided by 1.3 to exclude installation cost (assuming a installation cost of 30%).         Plate Settler       1       EA       \$ 78,000       \$ 78,000       S 000e from Meurer Research, Inc. and Parkson for a system handles a 88-gpm sludge flow.         Flo-Trend SludgeMate Container       3       EA       \$ 38,400       \$ 115,200       Oucle from Flo-Trend for 40-CY SludgeMate container.         Pumps       1       LS       \$ 22,000       \$ 22,000       Route from Sludge flow.         Subtotal       5       611,000       Routed up to \$1000       Including tax, freight, installation and manufacturer services.         Subtotal       5       611,000       Reduction Tanks	Polymer Feed Systems (Solids Settling Aid)	1	LS	\$	11,400	\$	11,400	Quotes from Siemens & C.P. Crowley
HIT data for Backwash       I       EA       S 30,000       S 30,000       S 00,000       Quotes from SUpperfor. 30,200 quit: 16 truit at 16 it return         Backwash Pumps       2       EA       \$ 21,500       \$ 43,000       Quotes from ITT & Cortech; 1,450 gpm @ 50 ft; 1 duty/ 1stdby         Residuals Treatment System       2       EA       \$ 21,500       \$ 43,000       Quotes from ITT & Cortech; 1,450 gpm @ 50 ft; 1 duty/ 1stdby         Equalization Tank       1       EA       \$ 137,000       \$ 137,385       divided by 1.3 to exclude installation cost (assuming a installation cost of 30%).         Plate Settler       1       EA       \$ 78,000       \$ 78,000       Quote from Hourer Research, Inc. and Parkson for a system handles a 88-gpm sludge flow.         Pumps       1       LS       \$ 22,000       \$ 22,000       S 20,000       S cuoted from Floo Trend for 40-CY SludgeMate container.         Subtotal       -       -       -       -       -       -         Equipment Installation Cost (30% of Equipment)       30%       -       \$ 611,000       Includes sludge pumps and recycle pumps for equalization tank and plate settlers, one duty and one standby.         Stabtotal       -       -       -       -       -       -         Guident Tanks       140       CY       \$ 700       9 8,000	Elleste Terk for Dookwook	1	E A	¢	E0.000	¢	E0.000	Ourster from Commission 20 200 and 10 8 dia y 1/ 8 holists
Backward       Z <thz< th="">       Z       <thz< th="">       Z       <thz< th=""> <thz< td="" thz<=""><td>Fillfate Lank for Backwash Backwach Dumps</td><td>2</td><td>EA</td><td>¢</td><td>21 500</td><td>¢</td><td>13 000</td><td>Quotes from Superior; 30,250 gai; 18 ft dia X 16 ft neight</td></thz<></thz<></thz<></thz<>	Fillfate Lank for Backwash Backwach Dumps	2	EA	¢	21 500	¢	13 000	Quotes from Superior; 30,250 gai; 18 ft dia X 16 ft neight
Residuals Treatment System       Image: Constraint of the system         Equalization Tank       1       EA       \$ 137,000       \$ 137,385       Adjusted installed costs from RS Means for 280,000-gal tank, which was divided by 1.3 to exclude installation cost (assuming a installation cost of 30%).         Plate Settler       1       EA       \$ 78,000       \$ 78,000       Outle from Meurer Research, Inc. and Parkson for a system handles a 88-gpm sludge flow.         Flo-Trend SludgeMate Container       3       EA       \$ 38,400       \$ 115,200       Outle from Flo-Trend for 40-CY SludgeMate container.         Pumps       1       LS       \$ 22,000       \$ 22,000       S context of a system handles a 88-gpm sludge flow.         Subtotal       1       LS       \$ 22,000       \$ 22,000       S context of a system handles a 88-gpm sludge flow.         Subtotal       1       LS       \$ 22,000       \$ 22,000       S context of a system handles a 88-gpm sludge flow.         Subtotal       1       LS       \$ 22,000       \$ 22,000       S context of a system handles a 88-gpm sludge flow.         Subtotal       1       LS       \$ 22,000       \$ 22,000       Rounded up to \$1000         Equipment Installation Cost (30% of Equipment)       30% <t< td=""><td>DdCKWdSii Fuilips</td><td>۷.</td><td>Εn</td><td>Ŷ</td><td>21,300</td><td>Ŷ</td><td>43,000</td><td>Quotes from it is a contech; 1,450 qpm @ 50 n, i dutyr istuby</td></t<>	DdCKWdSii Fuilips	۷.	Εn	Ŷ	21,300	Ŷ	43,000	Quotes from it is a contech; 1,450 qpm @ 50 n, i dutyr istuby
Encode of recurrence year.       Image: Construction of year.       Adjusted installed costs from RS Means for 280,000-gal tank, which was divided by 1.3 to exclude installation cost of 30%).         Plate Settler       1       EA       \$ 78,000       \$ 78,000       Could from Meurer Research, Inc. and Parkson for a system handles a 88-gpm sludge flow.         Flo-Trend SludgeMate Container       3       EA       \$ 38,400       \$ 115,200       Quote from Flo-Trend for 40-CY SludgeMate container.         Pumps       1       LS       \$ 22,000       \$ 22,000       settlers, one duty and one standby.         Subtotal       -       -       -       -       -         Equipment Installation Cost (30% of Equipment)       30%       -       -       -         Stab       140       CY       \$ 700       \$ 98,000       Based on 2 ft slab or wall         Walls       155       CY       \$ 800       \$ 124,000       Based on 2 ft slab or wall         Adjusted Slab       140       CY       \$ 700       \$ 98,000       Based on 2 ft slab or wall         Adjusted Slab       140       CY       \$ 11,000       \$ 124,000       Based on 2 ft slab or wall         Adjusted installed cont if the cost if the cost of the metric in the cost of the metric in the cost of the metric in the cost of the metrin the cost of the metric in the cost of the metrin th	Residuals Treatment System							
Equalization Tank1EA\$137,000\$137,385divided by 1.3 to exclude installation cost (assuming a installation cost of 30%).Plate Settler1EA\$78,000\$78,000Cuole from Meurer Research, Inc. and Parkson for a system handles a 88-gpm sludge flow.Flo-Trend SludgeMate Container3EA\$38,400\$115,200Cuole from Flo-Trend for 40-CY SludgeMate container.Pumps1LS\$22,000\$22,000settlers, one duty and one standby.Current Sludge Installation Cost (30% of Equipment)30%SubtotalEquipment Installation Cost (30% of Equipment)30%Slab140CY\$700\$98,000Based on 2 ft slab or wallSlab140CY\$1,100\$154,000Based on 2 ft slab or wallAration TanksAration TanksAration TanksAration TanksAration TanksAration TanksAration TanksAration Tanks <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Adjusted installed costs from RS Means for 280,000-gal tank, which was</td></td<>								Adjusted installed costs from RS Means for 280,000-gal tank, which was
Plate Settler       1       EA       \$ 78,000       \$ 78,000       \$ 78,000       Sudge from Meurer Research, Inc. and Parkson for a system handles a 88-gpm sludge flow.         Flo-Trend SludgeMate Container       3       EA       \$ 38,400       \$ 115,200       Quote from Meurer Research, Inc. and Parkson for a system handles a 88-gpm sludge flow.         Pumps       1       LS       \$ 22,000       \$ 22,000       Sudge flow.         Subtotal	Equalization Tank	1	EA	\$	137,000	\$	137,385	divided by 1.3 to exclude installation cost (assuming a installation cost of 30%).
Plate Settler       1       EA       \$       78,000       \$       78,000       \$       78,000       \$       8uder kinn kar in basin a bist and space and space and suger and a bist and space and s								Ouote from Meurer Research. Inc. and Parkson for a system handles a 88-gnm
Flo-Trend SludgeMate Container       3       EA       \$ 38,400       \$ 115,200       Quote from Flo-Trend for 40-CY SludgeMate container.         Pumps       1       LS       \$ 22,000       \$ 22,000       Includes sludge pumps and recycle pumps for equalization tank and plate settlers, one duty and one standby.         Subtotal       Image: Nature of the settlers of the set	Plate Settler	1	EA	\$	78,000	\$	78,000	cludno flow
Pumps       1       LS       \$ 22,000       \$ 22,000       Reduct instruction to 01 biologitation tank and plate settlers, one duty and one standby.         Subtotal       2	Flo-Trend SludgeMate Container	3	FA	\$	38,400	\$	115,200	Ouote from Flo-Trend for 40-CY SludgeMate container
Pumps       1       LS       \$       22,000       \$       22,000       settlers, one duty and one standby.         Subtotal       Image: Constraint of the stand o				¥	001102	¥	110/201	Includes sludge numps and recycle numps for equalization tank and plate
Subtotal     \$ 2,036,000     Rounded up to \$1000       Equipment Installation Cost (30% of Equipment)     30%     \$ 611,000       Image: State of the equipment Installation Cost (30% of Equipment)     30%     \$ 611,000       Image: State of the equipment Installation Cost (30% of Equipment)     30%     \$ 611,000       Image: State of the equipment Installation Cost (30% of Equipment)     30%     \$ 611,000       Image: State of the equipment Installation Cost (30% of Equipment)     30%     \$ 611,000       Image: State of the equipment Installation Cost (30% of Equipment)     30%     \$ 611,000       Image: State of the equipment Installation Cost (30% of Equipment)     140     CY       Image: State of the equipment Installation Cost (30% of Equipment)     140     CY       Image: State of the equipment Installation Cost (30% of Equipment)     140     CY       Image: State of the equipment Installation Cost (30% of Equipment)     140     CY       Image: State of the equipment Installation Cost (30% of Equipment)     154,000       Image: State of the equipment Installation Cost (30% of Equipment)     154,000       Image: State of the equipment Installation Cost (30% of Equipment)     154,000       Image: State of the equipment Installation Cost (30% of Equipment)     154,000       Image: State of the equipment Installation Cost (30% of Equipment)     154,000       Image: State of the equipment Installatinsthe equipm	Pumps	1	LS	\$	22,000	\$	22,000	settlers one duty and one standby.
Subtotal       \$ 2,036,000       Rounded up to \$1000         Equipment Installation Cost (30% of Equipment)       30%       \$ 611,000       Including tax, freight, installation and manufacturer services.         Reduction Tanks       Image: Cost (Cost (								
Source     Source       Equipment Installation Cost (30% of Equipment)     30%     \$ 611,000       Reduction Tanks     Including tax, freight, installation and manufacturer services.       Slab     140     CY       Value     \$ 98,000       Based on 2 ft slab or wall       Walls     155       Elevated Slab     140       CY     \$ 1,100       Including a sub-tanks with shared walls       Elevated Slab     140       CY     \$ 1,000       Including a sub-tanks with shared walls       Elevated Slab     140       CY     \$ 1,000       Including a sub-tanks or wall       Including a sub-tanks with shared walls       Including a sub-tanks       Including a sub-tanks       Including a sub-tanks       Including a sub-tanks	Subtotal	1				\$	2.036.000	Rounded up to \$1000
Equipment Installation Cost (30% of Equipment)       30%       s       \$ 611,000       Including tax, freight, installation and manufacturer services.         Reduction Tanks       -       -       25 ft x 75 ft tank, including 3 sub-tanks with shared walls         Slab       140       CY       \$ 700       \$ 98,000       Based on 2 ft slab or wall         Walls       155       CY       \$ 8000       \$ 124,000       Based on 2 ft slab or wall; and 2 ft freeboard         Elevated Slab       140       CY       \$ 1,100       \$ 154,000       Based on 2 ft slab or wall; and 2 ft freeboard         Aeration Tanks       -       -       -       -       -						•		
Reduction Tanks     140     CY     \$ 700     \$ 98,000     Based on 2 ft slab or wall       Slab     140     CY     \$ 700     \$ 98,000     Based on 2 ft slab or wall       Walls     155     CY     \$ 800     \$ 124,000     Based on 2 ft slab or wall; and 2 ft freeboard       Elevated Slab     140     CY     \$ 1,100     \$ 124,000     Based on 2 ft slab or wall; and 2 ft freeboard       Aeration Tanks     10     CY     \$ 1,100     \$ 154,000     Based on 2 ft slab or wall	Equipment Installation Cost (30% of Equipment)	30%				\$	611,000	Including tax, freight, installation and manufacturer services.
Reduction Tanks     Image: Constraint of the state of the		1				_		
Slab         140         CY         \$ 700         \$ 98,000         Based on 2 ft slab or wall           Walls         155         CY         \$ 800         \$ 124,000         Based on 2 ft slab or wall; and 2 ft freeboard           Elevated Slab         140         CY         \$ 1,100         \$ 154,000         Based on 2 ft slab or wall; and 2 ft freeboard           Aeration Tanks         140         CY         \$ 1,100         \$ 154,000         Based on 2 ft slab or wall;	Reduction Tanks							25 ft x 75 ft tank, including 3 sub-tanks with shared walls
Walls         155         CY         \$ 800         \$ 124,000         Based on 2 ft slab or wall; and 2 ft freeboard           Elevated Slab         140         CY         \$ 1,100         \$ 154,000         Based on 2 ft slab or wall; and 2 ft freeboard           Aeration Tanks         Image: Comparison of the state of the st	Slab	140	CY	\$	700	\$	98,000	Based on 2 ft slab or wall
Elevated Slab         140         CY         \$ 1,100         \$ 154,000         Based on 2 ft slab or wall           Aeration Tanks	Walls	155	CY	\$	800	\$	124,000	Based on 2 ft slab or wall; and 2 ft freeboard
Aeration Tanks         15 ft x 15 ft tank	Elevated Slab	140	CY	\$	1,100	\$	154,000	Based on 2 ft slab or wall
Aeration Tanks	A DISTRICT							and another
Clash 17 CV Lé 700 Lé 11 000 IlPasod on 2 ft slab or wall	Aeration Lanks	17	CV.	¢	700	¢	11 000	15 ft X 15 ft tank
SIdD         17         C1         3         700         3         17,000         Dedset 0112 (15:dd) 01 wall           MixTure         25         C/V         €         290.01         €         28.000         Based on 2.8 tight on wall; and 2.8 fragehoard	SIAD	35		¢	800	¢	28,000	Based on 2 ft slab or wall: and 2 ft freehoard
waiis 33 C1 3 000 3 20,000 based on 21 isaab of waii, and 2 in receboard	Flevated Slab	17	CY	\$	1 100	\$	18 700	Based on 2 ft slab of wall.



Client City of Glendale
Project Phase III Demonstration Testing for Cr(VI) Treatment
Item 2000-gpm RCF System

Project No. 05337008.0	0000
By T.D. & Y.W.	Ckd: Y.W. & T.V.
Date 12/9/11	Date: 1/18/12

Denid Mining Tenks			-				1E A. JE A Jonel
Rapid Mixing Tanks	17	01/	¢	700	<u>^</u>	11.000	15 IL X 15 IL LATIK
SIAD	1/	CY	\$	700	\$	11,900	Based on 2 ft slab of Wall
Walls	35	CY	\$	800	\$	28,000	Based on 2 ft slab or wall; and 2 ft freeboard
Elevated Slab	1/	CY	\$	1,100	\$	18,700	Based on 2 ft slab or wall
Chemical Storage Containment	16	CY	\$	1,250	\$	20,000	
Equipment Concrete Pads	291	CY	\$	1,250	\$	363,750	
Subtotal (Installed Equipment Costs)					\$	3,524,000	Rounded up to \$1000
							Division 1 requirements, including labor supervision, field offices, temporary
General Requirements	7.5%				\$	264,300	utilities, health and safety, office supplies, clean up, photographs, survey,
							erosion control, coordination, testing services, and record documents
Earthwork	5%				\$	176,200	Excavation, backfill, and fill required to construct project
Site Improvements	E 0/				¢	176 200	Readways, such and auttor, sidewalk and landscaping
Sile improvements	576				Ŷ	170,200	Roadways, curb and guller, sidewark and landscaping
Valves, Piping, and Appurtenances	15%				\$	529,000	Major system piping and valves
Electrical, Instrumentation and Controls	15%				\$	529,000	PLC and SCADA equipment to control
Total Direct Costs					\$	5,199,000	Rounded up to \$1000
Contractoria Quertrand and Drafit	200/				¢	1 020 000	Includes bonds, mobilization and demobilization, insurance, overhead and
Contractor's Overnead and Profit	20%				2	1,039,800	profit, and management reserves
Construction Total					\$	6.238.800	
					*	0,000,000	
Project Level Allowance (contingency)	20%				\$	1 247 760	Budget item to cover change orders due to unforeseen conditions
Engineering Legal and Administrative	20%				\$	1 247 760	Includes nermits legal fees and engineering fees for design and construction
Engineering, Eeganana Aanimistative	2070		1		Ψ	1,217,700	no accession not regariles and engineering rees for accept and construction
Project Total			1		¢	8 735 000	
	-++		+		φ	0,133,000	
Low Ectimate	+ +		+		¢	6 115 000	20%
LUW ESIIIIdle					\$	0,113,000	-30 /0
High Estimate					\$	13,103,000	+50%

Notes:

This opinion of probable cost is based on AACE Class 5 estimate guidelines. The high and low estimates fall into the acceptable range. These estimates are generally used to compare alternatives.
 Opinion of Probable Cost in 2011 dollars.
 Costs for land or easements are not included.



### Estimated RCF Water Quality Monitoring (Number of Samples per Month)

Flow Rate (gpm)			100																
Number of Duty Filters						Lab	—			—				I		F	ield		
Sample Location	Total Fe	Cr(VI)		Total Cr	TSS	Silica		VOCs	Bac-T (E. Coli, T. Coli and HPC)	i TC' (Me	CLP etals)	CA V (Met	WET als)	Cr(VI)*	Ferrous	Total Fe	Turbidity	рН	Temperatur e
Raw		1	4	2	4		1							4		1	1 1	4	4
After ferrous addition																4 4	1	continuous	continuous
After 1st reduction tank																4 4	1	4	
After 2nd reduction tank																1 .	1	4	
After 3rd reduction tank			4					1								4 4	1	4	4
Aeration off gas (raw)								1											
Aeration off gas (after first VPGAC)						_	$\downarrow$	1									ļ	i	
Aeration off gas (after 2nd VPGAC)				<b> </b>		_	$\downarrow$	1									ļ	ļ	
Filter feed (after rapid mixing)				ļ		4	$\downarrow$	1	<u> </u>	<u> </u>								4	4
Filter effluent		4	4		4		$\downarrow$		<b></b>	$\perp$				4		4 4	1 continuous	1	1
Spent filter backwash		1	1	1	<u> </u>	1	$\downarrow$		<b></b>	$\perp$								I	
Supernatant from thickener		1	1	1	1	1	$\downarrow$		4	4				1		1	1 1	1	1
Thickened sludge		_		<b> </b>	<b>_</b>	1	$\downarrow$			╞									
Filtrate from dewatering container		1	1		1	1			4	4				1		1	1 1	1 1	1
Dewatered solid residuals						1	Ι			At (	disposal	At di	sposal			1			
Number of samples per month^		8	15	11	1	8	1	5	8	3	1		1	10	20	20	) 3	3 23	15
Unit cost (\$/sample)	\$	4 \$	53	\$ 14	\$ 1	5 \$ 1	4	\$ 110	\$ 58	\$	240	\$	421						
Sample analysis Cost (\$/year)	\$ 1,29	6\$	9,450	\$ 1,782	\$ 1,44	0 \$ 16:	2	\$ 6,600	\$ 5,520	\$	2,880	\$	5,052						
Shipping fee (\$/year)	\$ 1,56	0 One shi	ipment r	per week, \$3	0 per shipmer	nt													
Sum of lab analysis cost (\$/year)	\$ 35,74	2 Sample	analysi	is plus shippir	ng fee														
Field meters	\$ 6,00	0 Hach D	r 3800,	ب portable pH	meter and turl	bidity meter													
Field analysis cost	\$ 2,00	0 Estimat	e for rea	agents and a	pparatus base	ed on experience	e; r	not including la	ubor for field analy	ysis									
Total analysis cost	\$ 37,74	2 Includin	ıq lab ar	nd field analy	sis costs; not	including labor a	and	field meters											ļ

\* Only if influent Cr(VI) is greater than 10 ppb, which is the method detection limit for field analysis (Hach Method ).

Continuous monitoring indicates analyzed by online meter(s).

^ Assume TCLP and CA WET residuals analysis occur once a month, which is a conservative estimate.

TSS - total suspended solids; VOCs - volatile organic compounds; TCLP - toxicity characteristic leaching procedure; CA WET - California waste extraction test; VPGAC - vapor phase granular activated carbon



### Estimated RCF Water Quality Monitoring (Number of Samples per Month)

Flow Rate (gpm)			500	)																
Number of Duty Filter Cells			3	5			Lah				—				1			Field		
Sample Location	Total Fe	Cı	r(VI)	Total Cr	-	TSS	Silica	,	VOCs	Bac-T (E. Coli, T. Coli and HPC)	і Т (/	ГСLР Metals)	CA V (Met	WET tals)	Cr(VI)*	Ferrous	Total Fe	Turbidity	рН	Temperatur e
Raw		1	4	ŀ	4			1							4		1	1 1	4	4
After ferrous addition																	4	4	continuous	continuous
After 1st reduction tank																	4 .	4	4	
After 2nd reduction tank																	1	1	4	
After 3rd reduction tank			4	ŀ					1								4 .	4	4	4
Aeration off gas (raw)									1											
Aeration off gas (after first VPGAC)									1		Ļ									
Aeration off gas (after 2nd VPGAC)									1		L									
Filter feed (after rapid mixing)						4			1		┶								4	4
Filter effluent from each cell		4	4	ŀ	4						┶				4		4 4	4 continuous	1	1
Spent filter backwash		1	1		1	1					∔							_		
Supernatant from thickener		1	1		1	1		_		4	1				1		1	1 1	1	1
Thickened sludge		_				1					╇									
Filtrate from dewatering container		1	1		1	1				4	4				1		1	1 1	1	1
Dewatered solid residuals											А	At disposal	At di	isposal						
Number of samples per month <sup>^</sup>		16	23	3	19	8		1	5	8	3	1.5		1.5	18	2	8 2	8 3	3 25	17
Unit cost (\$/sample)	\$	14 \$	53	\$	14	\$ 15	\$ 14		\$ 110	\$ 58	\$	\$ 240	\$	421						
Sample analysis Cost (\$/year)	\$ 2,5	92 \$	14,490	\$ 3,0	78	\$ 1,440	\$ 162	2	\$ 6,600	\$ 5,520	¢,	\$ 4,320	\$	7,578						
Shipping fee (\$/year)	\$ 1,5	60 OI	ne shipment	per week,	\$30 j	per shipment														
Sum of lab analysis cost (\$/year)	\$ 47,3	40 Sa	ample analys	is plus ship	ping	j fee														
Field meters	\$ 6,0	00 Ha	ach Dr 3800,	portable p	Hm	eter and turbic	dity meter													
Field analysis cost	\$ 3,0	00 Es	stimate for re	eagents and	d app	paratus based	on experience	; n	ot including la	bor for field analy	ysi	s								
Total analysis cost	\$ 50.3	40 In	cluding lab a	nd field ana	alvsis	s costs: not in	cluding labor ar	nd	field meters											

\* Only if influent Cr(VI) is greater than 10 ppb, which is the method detection limit for field analysis (Hach Method ).

Continuous monitoring indicates analyzed by online meter(s).

^ Assume TCLP and CA WET residuals analysis occur three times every two months, which is a conservative estimate.

TSS - total suspended solids; VOCs - volatile organic compounds; TCLP - toxicity characteristic leaching procedure; CA WET - California waste extraction test; VPGAC - vapor phase granular activated carbon



### Estimated RCF Water Quality Monitoring (Number of Samples per Month)

Flow Rate (gpm)			2,000	)																
	T		3	,			Lab										F	Field		——
Sample Location	Total Fe	Cr	(VI)	Total C	)r	TSS	Silica	,	VOCs	Bac-T (E. Coli, T. Coli and HPC)	і ТС (М	CLP letals)	CA (Me	WET etals)	Cr(VI)*	Ferrous	Total Fe	Turbidity	рН	Temperatur e
Raw		1	4	ļ	4			1							4		1	1 1	4	4
After ferrous addition																	4 4	4	continuous	continuous
After 1st reduction tank																	4 4	4	4	
After 2nd reduction tank																	1 .	1	4	
After 3rd reduction tank			4	ŀ					1							4	4 4	4	4	4
Aeration off gas (raw)									1											
Aeration off gas (after first VPGAC)									1		$\perp$						 		ļ	
Aeration off gas (after 2nd VPGAC)									1		$\perp$								I	
Filter feed (after rapid mixing)						4	Ļ		1	<b>_</b>	$\bot$								4	4
Filter effluent from each cell		4	4	ļ	4	ļ					$\bot$				4		4 4	4 continuous	1	1
Spent filter backwash		1	1		1	1		_			$\perp$									<b>↓</b>
Supernatant from thickener		1	1		1	1	1			4	4				1		1 ·	1 1	1	1
Thickened sludge		$\rightarrow$				1					+									ļļ
Filtrate from dewatering container		1	1		1	1				4	4				1		1	1 1	1 1	1
Dewatered solid residuals											At	disposal	At d	lisposal			1			
Number of samples per month^		40	47	,	43	8	3	1	5	8	в	2		2	42	52	2 52	2 3	3 31	23
Unit cost (\$/sample)	\$	14 \$	53	\$	14	\$ 15	\$ 14	4	\$ 110	\$ 58	\$	240	\$	421						
Sample analysis Cost (\$/year)	\$ 6,48	30 \$	29,610	\$ 6	6,966	\$ 1,440	\$ 162	2	\$ 6,600	\$ 5,520	\$	5,760	\$	10,104						
Shipping fee (\$/year)	\$ 1,56	50 Or	ne shipment	per wee	k, \$30	per shipment		-												
Sum of lab analysis cost (\$/year)	\$ 74,20	)2 Sa	mple analys	is plus s	hippin	g fee														
Field meters	\$ 6,00	00 Ha	ich Dr 3800,	portable	e pH n	neter and turbin	dity meter													
Field analysis cost	\$ 5,00	00 Es	timate for re	agents a	and ap	paratus basec	d on experience	e; r	not including le	ubor for field analy	ysis									
Total analysis cost	\$ 79.20	)2 Inc	luding lab a	nd field a	analvs	is costs: not in	cluding labor a	nd	field meters											

\* Only if influent Cr(VI) is greater than 10 ppb, which is the method detection limit for field analysis (Hach Method ).

Continuous monitoring indicates analyzed by online meter(s).

^ Assume TCLP and CA WET residuals analysis occur twice every two months, which is a conservative estimate.

TSS - total suspended solids; VOCs - volatile organic compounds; TCLP - toxicity characteristic leaching procedure; CA WET - California waste extraction test; VPGAC - vapor phase granular activated carbon



# **Estimated RCF O&M Costs**

#### RCF System Size = 100 gpm

Influent Cr(VI)																		
Concentration	Residua	als					VPGAC		Filte	er Media	Ма	aintenance			Lab	and Field		
(ppb)	Disposa	al	Che	emicals	Labo	r	Replace	ment	Rep	placement	and	d Spare Parts	Ele	ctricity*	Ana	lysis <sup>&amp;</sup>	Annua	I O&M
5	\$	5,600	\$	1,600	\$	161,000	\$	1,200	\$	600	\$	9,800	\$	36,700	\$	37,700	\$	254,000
10	\$	10,600	\$	2,600	\$	161,000	\$	1,200	\$	600	\$	9,800	\$	36,700	\$	37,700	\$	260,000
25	\$	17,300	\$	4,000	\$	161,000	\$	1,200	\$	600	\$	9,800	\$	36,700	\$	37,700	\$	268,000
50	\$	34,000	\$	7,300	\$	161,000	\$	1,200	\$	600	\$	9,800	\$	36,700	\$	37,700	\$	288,000

\* Electricity includes approximately \$200 per year for aeration off-gas treatment.

& Lab and field analysis includes approximately \$4,000 per year for aeration off-gas analysis.

### RCF System Size = 500 gpm

Influent Cr(VI)																	
Concentration	Residua	ls					VPGAC	Filt	ter Media	Ма	intenance			Lab	and Field		
(ppb)	Disposa	ıl	Cher	nicals	Labo	r	Replacement	Re	placement	and	d Spare Parts	Ele	ectricity*	Ana	lysis <sup>&amp;</sup>	Annu	al O&M
5	\$	27,900	\$	7,900	\$	233,000	\$ 21,600	\$	2,500	\$	17,900	\$	99,000	\$	50,300	\$	460,000
10	\$	52,800	\$	13,000	\$	233,000	\$ 21,600	\$	2,500	\$	17,900	\$	99,000	\$	50,300	\$	490,000
25	\$	86,400	\$	19,800	\$	233,000	\$ 21,600	\$	2,500	\$	17,900	\$	99,000	\$	50,300	\$	531,000
50	\$	169,800	\$	36,700	\$	233,000	\$ 21,600	\$	2,500	\$	17,900	\$	99,000	\$	50,300	\$	631,000

\* Electricity includes approximately \$700 for aeration off-gas treatment.

& Lab and field analysis includes approximately \$4,000 per year for aeration off-gas analysis.

#### RCF System Size = 2,000 gpm

Influent Cr(VI)																		
Concentration	Residu	uals					VPGAC		Filte	er Media	Mai	ntenance			Lab	and Field		
(ppb)	Dispo	sal	Che	emicals	Labo	r	Replacemen	nt	Rep	lacement	and	Spare Parts	Ele	ctricity*	Ana	lysis <sup>&amp;</sup>	Ann	ual O&M
5	\$	111,500	\$	31,600	\$	377,000	\$ 6	60,000	\$	6,100	\$	35,200	\$	176,500	\$	79,200	\$	877,000
10	\$	211,100	\$	52,000	\$	377,000	\$6	60,000	\$	6,100	\$	35,200	\$	176,500	\$	79,200	\$	997,000
25	\$	345,500	\$	79,000	\$	377,000	\$6	50,000	\$	6,100	\$	35,200	\$	176,500	\$	79,200	\$	1,159,000
50	\$	679,200	\$	146,700	\$	377,000	\$6	50,000	\$	6,100	\$	35,200	\$	176,500	\$	79,200	\$	1,560,000

\* Electricity includes approximately \$2,800 for aeration off-gas treatment.

& Lab and field analysis includes approximately \$4,000 per year for aeration off-gas analysis.

### Annual O&M Summary

RCF System		Infl	uent Cr(VI) Co	onc	entration, ppt	)	
Size (gpm)	5		10		25		50
100	\$ 254,000	\$	260,000	\$	268,000	\$	288,000
500	\$ 460,000	\$	490,000	\$	531,000	\$	631,000
2,000	\$ 877,000	\$	997,000	\$	1,159,000	\$	1,560,000

### Net Present Value for 20 Years (Rounded to two significant figures)

RCF System		Infl	uent Cr(VI) C	onc	entration, ppl	2	
Size (gpm)	5		10		25		50
100	\$ 4,300,000	\$	4,400,000	\$	4,500,000	\$	4,800,000
500	\$ 7,700,000	\$	8,200,000	\$	8,900,000	\$	11,000,000
2,000	\$ 15,000,000	\$	17,000,000	\$	19,000,000	\$	26,000,000

20-year NPV O&M based on 2.5% inflation and a 4.5% discount rate