	B	C	D	E	F	G	H	I
103	Calculate Total Wastewater Volume per Backwash	304,760.63	gal	1153.64	m3			Use this volume to size backwash equalization basin
104	Include Air Scour Backwash?	Yes	Y/N					
105	Input Backwash Air Scour Loading Rate	2.00	scfm/sf	0.61	m/min	ALR		Typically 2 to 4 scfm/sf
106	Calculate Air Scour Blower Capacity per Blower	1,851.00	scfm	52.41	m3/min	ASBC		
107	Input Number of Air Scour Blowers	2.00	#			NASB		Typically 1 duty and 1 standby
108	Calculate Approximate Blower Outlet Gage Pressure at Standard Conditions	8.39	psig	57.87	kPa	BOP		Includes 1 psig of air piping losses, calculate actual. Typically, total ≤ 10 psig
109	Calculate Blower Horsepower at Standard Conditions (sea level, 20 deg C, 36% RH) per Blower	82.00	hp	61.15	kW	BHP		Revise for actual elevation and air temperature range. Warning... If Blower Horsepower exceeds 200, the Blower Building may be undersized.
110	Are filters covered?	No	Y/N					
111	Include Particle Counters?	Yes	Y/N					
112	Include a Combined FE Magmeter?	No	Y/N					
113	Input Depth of Burial	0.00	ft	0.00	mm	DB		
114	Input Cutback Slope	1.00	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
115	Input Over Excavation Depth	1.00	ft	304.80	mm	OEXD		
116	Mechanical Sizing Requirements:							
117	**Pipe Name**	**Input Velocity**	**Unit (English)**	**Input Velocity**	**Unit (Metric)**	**Standard Pipe Size**	**Unit (English)**	**Nominal Pipe Size**
118	Air Scour Pipe	2,500.00	fpm	762.00	m/s	12.00	in	300.00
119	Filter Influent Header Pipe	5.00	fps	1.52	m/s	96.00	in	2050.00
120	Filter Influent Pipe	3.00	fps	0.91	m/s	30.00	in	750.00
121	Filter Effluent Pipe	5.00	fps	1.52	m/s	24.00	in	600.00
122	Filter Control Valve Pipe	8.00	fps	2.44	m/s	18.00	in	450.00
123	Filter Effluent Header Pipe	5.00	fps	1.52	m/s	96.00	in	2050.00
124	Filter to Waste	5.00	fps	1.52	m/s	24.00	in	600.00
125	Backwash Supply Pipe	6.00	fps	1.83	m/s	42.00	in	1050.00
126	Backwash Waste Pipe	6.00	fps	1.83	m/s	42.00	in	1050.00
127								
128	Mechanical Material Requirements:							
129	**Pipe Name**	**Pipe ID**	**Installation Type**	**Pipe Material**	**Pipe Lining Material**	**Pipe Coating Material**	**Pipe Diameter**	**Pipe Length**
130	Air Scour Pipe	BAW	Exposed	316 SST	None	None	12.00	1645.09
131	Filter Influent Header Pipe	FIH	Buried	DI	Cement Mortar	Tape Coating	96.00	0.00
132	Filter Influent Pipe	FIH	Encased	DI	Cement Mortar	Fusion Bonded Epoxy	30.00	0.00
133	Filter Effluent Pipe	FE	Exposed	DI	Cement Mortar	Paint	24.00	382.84
134	Filter Effluent Pipe	FE	Encased	DI	Cement Mortar	Fusion Bonded Epoxy	24.00	382.84
135	Filter Control Valve Pipe	FCV	Exposed	DI	Cement Mortar	Paint	18.00	264.00
136	Filter Effluent Header Pipe	FEH	Encased	DI	Cement Mortar	Fusion Bonded Epoxy	96.00	432.75
137	Filter to Waste	FTW	Exposed	DI	Cement Mortar	Paint	24.00	209.88
138	Filter to Waste	FTW	Encased	DI	Cement Mortar	Fusion Bonded Epoxy	24.00	867.50
139	Backwash Supply Pipe	BWS	Exposed	DI	Cement Mortar	Paint	42.00	1048.46
140	Backwash Supply Pipe	BWS	Encased	DI	Cement Mortar	Fusion Bonded Epoxy	42.00	48.00
141	Backwash Waste Pipe	BWW	Encased	DI	Cement Mortar	Fusion Bonded Epoxy	42.00	10.00
142								
143	Electrical User Inputs and Sizing Requirements:							
144	Is this a "Critical" Facility (requiring standby power)?	Yes	Y/N					
145	Is there SWGR?	No						
146								**MCC**
147	**Item**	**Quantity**	**HP per Each**	**AFD's Required?**	**MCC Spaces for Motor Starters**	**MCC Spaces for AFD's less than 50hp)**	**MCC Spaces for Breakers**	**Total MCC Spaces**
148	Air Scour Blowers	2	82.00	No	6.00	0.00	0.00	
149	**User Defined Item #1**	0	0.00	No	0.00	0.00	0.00	
150	**User Defined Item #2**	0	0.00	No	0.00	0.00	0.00	

Exhibit R.11.b

	B	C	D	E	F	G	H	I
151	**User Defined Item #3**	**0**	**0.00**	**No**	0.00	0.00	0.00	
152	TOTAL		164.00		6.00	0.00	0.00	6.00
153								
154	Electrical Equipment Widths:							
155	**Equipment**	**Depth (ft)**						
156	MCC	1.67						
157	Small AFD's	0.00						
158	Large AFD's	0.00						
159	Switchgear	0.00						
160	Maximum Depth	1.67						
161								
162	Clear Distances:							
163	**Clear Distance**	**Width**	**Length**	**Comment**				
164	CD1		**3.00**	Clear Distance between wall and MCC	Typically 3 feet			
165	CD2		**1.00**	Clear Distance between MCC and Small AFD	Typically 1 foot			
166	CD3		**0.00**	Clear Distance between Small AFD and Large AFD	Typically Zero			
167	CD4		**0.00**	Clear Distance between Large AFD and Switchgear	Typically Zero			
168	CD5		**0.00**	Clear Distance between Switchgear and Contingency Space	Typically Zero			
169	CD6	**4.00**		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)				
170	CD7	**3.00**		Clear Distance in front of Equipment	Typicpally 3 feet			
171	Contingency Length		**0.00**	Contingency length	Typically Zero			
172								
173	Electric Room Length (ft):							
174	CD1	3.00						
175	MCC	11.67						
176	CD2	1.00						
177	Small AFD's	0.00						
178	CD3	0.00						
179	Large AFD's	0.00						
180	CD4	0.00						
181	Swithgear	0.00						
182	CD5	0.00						
183	Contingency	0.00						
184	Total Length	15.67						
185								
186	Electric Room Width (ft):							
187	CD6	0.00	If there is no switchgear, this distance will be Zero.					
188	Maximum Equipment Depth	1.67						
189	CD7	3.00						
190	Total Width	4.67						
191								
192	**COST TABLE FOR MEDIA:**	**Quantity (CF)**	**$/CF (Uninstalled Cost)**	**$/CF (Escalated and Installed Cost)**				
193	Silica Sand	20,350.92	15.00	***$ 22.11***				
194	Antracite Coal	101,754.58	20.00	***$ 29.49***				
195	Garnet Sand	0.00	45.00	***$ 66.34***				
196	GAC	0.00	45.00	***$ 66.34***				
197								
198	**Estimating Dimensions:**	**Value English**	**Unit (English)**	**Value Metric**	**Unit (Metric)**	**Name**	**Red Flags**	**Comment**
199	Backwash Supply Pipe Tee Length	5.50	ft	1676.40	mm	BWSTL		Lookup Value
200	Backwash Supply Pipe Tee Width	4.50	ft	1371.60	mm	BWSTW		Lookup Value
201	Backwash Supply Pipe Elbow Length	5.90	ft	1798.83	mm	BWSEL		Lookup Value
202	Backwash Supply Isolation Valve Length	1.25	ft	381.00	mm	BWSVL		Lookup Value
203	Backwash Supply - Flowmeter Reducer Length	8.00	ft	2438.40	mm	BWSFMRL		
204	Flowmeter Length	2.17	ft	660.40	mm	FML		Lookup Value
205	Filter Control Valve Length	0.67	ft	203.20	mm	FCVL		Lookup Value
206	Flowmeter - Filter Effluent Increaser Length	2.00	ft	609.60	mm	FMFERL		
207	Filter Effluent Pipe Tee Length	3.67	ft	1117.60	mm	FETL		Lookup Value
208	Filter Effluent Pipe Tee Width	2.83	ft	863.60	mm	FETW		Lookup Value
209	Filter Effluent Pipe Elbow Length	3.63	ft	1107.69	mm	FEEL		Lookup Value
210	Filter Effluent and Filter to Waste Isolation Valve Length	1.00	ft	304.80	mm	FEVL		Lookup Value
211	Filter Effluent Header Pipe Cross Length	11.00	ft	3352.80	mm	FEHCL		Lookup Value
212	Filter Effluent Header Pipe Cross Width	11.00	ft	3352.80	mm	FEHCW		Lookup Value
213	Filter to Waste Header Pipe Tee Length	3.67	ft	1117.60	mm	FTWHTL		Lookup Value
214	Filter to Waste Pipe Elbow Length	2.83	ft	863.60	mm	FTWEL		Lookup Value
215	Total Length of Individual Filter Piping	39.04	ft	11898.12	mm			
216	Filter (per Each):							
217	Slab on Grade (Includes Filter, Gulllet Channel, Filter Influent/Backwash Wastewater Channel):							
218	Length = IFL + FEWT	38.75	ft	11811.00	mm	FSOGL		
219	Width = IFW+GWT+GCW+(2*FI/BWCST)+FI/BWCW	40.50	ft	12344.40	mm	FSOGW		
220	Concrete Thickness	**24.00**	in	**551.18**	mm			Model based on 24"
221	Concrete Thickness	2.00	ft	609.60	mm	FSOGT		

	B	C	D	E	F	G	H	I
222	Pipe Gallery Wall:							
223	Length = IFL + FEWT	38.75	ft	11811.00	mm			
224	Height = FBD + FFD	24.08	ft	7339.58	mm			
225	Concrete Thickness	18.00	in	551.18	mm			Model based on 18"
226	Concrete Thickness	1.50	ft	457.20	mm	PGWT		
227	Gullet Wall:							
228	Length = IFL	37.25	ft	11353.80	mm			
229	Height = GCH	15.82	ft	4822.55	mm			
230	Concrete Thickness	14.00	in	500.38	mm			Model based on 14"
231	Concrete Thickness	1.17	ft	355.60	mm	GWT		
232	Filter Influent / Backwash Waste Channel Walls:							
233	Number of Walls (2 per filter)	2.00	#			#W		Fixed
234	Length = IFL + FEWT	38.75	ft	11811.00	mm			
235	Height = FBD	19.08	ft	5815.58	mm			
236	Concrete Thickness	18.00	in	500.38	mm			Model based on 18"
237	Concrete Thickness	1.50	ft	457.20	mm	FI/BWCST		
238	Filter Influent / Backwash Waste Channel Lower Elevated Slab:							
239	Length = IFL + FEWT	38.75	ft	11811.00	mm			
240	Width = FI/BWCW	5.00	ft	1524.00	mm			
241	Concrete Thickness	12.00	in	304.80	mm			Model based on 12"
242	Concrete Thickness	1.00	ft	304.80	mm	FICLEST		
243	Filter Influent / Backwash Waste Channel Upper Elevated Slab:							
244	Length = IFL + FEWT	38.75	ft	11811.00	mm			
245	Width = FI/BWCW + (2 * FI/BWCWT)	8.00	ft	2438.40	mm			
246	Concrete Thickness	9.00	in	228.60	mm			Model based on 9"
247	Concrete Thickness	0.75	ft	228.60	mm	FICUEST		
248	End Walls: (For Entire Filter Complex)							This accounts for common walls on individual filters
249	Number of Walls	22.00	#					
250	Width = PGWT + IFW + GWT + GCW + (2* FI/BWCWT) + FI/BWCW	40.50	ft	12344.40	mm			
251	Height = FBD	19.08	ft	5815.58	mm			
252	Concrete Thickness	18.00	in	500.38	mm			Model based on 18"
253	Concrete Thickness	1.50	ft	457.20	mm	FEWT		
254	Common Filter Influent Channel:							
255	Slab on Grade:							
256	Length = FI/BWCW + FI/BWCST	6.50	ft	1981.20	mm			
257	Width = 2*(FSOGW+PGWT)+FGW	118.80	ft	36211.26	mm			
258	Concrete Thickness	24.00	in	457.20	mm			Model based on 24"
259	Concrete Thickness	2.00	ft	609.60	mm	FISOGT		
260	Common Filter Influent Channel Wall:							
261	Length = 2*(FSOGW+PGWT)+FGW	118.80	ft	36211.26	mm			
262	Height = FICH	5.76	ft	1755.03	mm			
263	Concrete Thickness	18.00	in	457.20	mm			Model based on 18"
264	Concrete Thickness	1.50	ft	457.20	mm	FIWCST		
265	Common Filter Influent Channel Elevated Slab:							
266	Length = 2*(FSOGW+PGWT)+FGW	118.80	ft	36211.26	mm			
267	Width = FI/BWCW + FI/BWCWT + FEWT	8.00	ft	2438.40	mm			
268	Concrete Thickness	9.00	in	228.60	mm			Model based on 9"
269	Concrete Thickness	0.75	ft	228.60	mm	FICEST		
270	Filter Gallery:							
271	Slab on Grade:							
272	Length = (#TF/2*FSOGL)+SCW	450.25	ft	137236.20	mm			
273	Width = FGW + (2*PGWT)	37.80	ft	11522.46	mm			
274	Concrete Thickness = FEPHSS + 24	120.00	in	3048.00	mm			
275	Concrete Thickness	10.00	ft	3048.00	mm	FGSOGT		
276	Filter Gallery Elevated Slab:							
277	Length = (#TF/2*FSOGL)+SCW	450.25	ft	137236.20	mm			
278	Width = FGW+(2*PGWT)	37.80	ft	11522.46	mm			
279	Concrete Thickness	8.00	in	304.80	mm			Model based on 8"
280	Concrete Thickness	0.67	ft	203.20	mm	FGEST		
281	Blower Room:							
282	Slab on Grade:							
283	Length	20.00	ft	6096.00	mm			Fixed
284	Width = FSOGW	40.50	ft	12344.40	mm			
285	Concrete Thickness	12.00	in	609.60	mm			Model based on 24"
286	Concrete Thickness	1.00	ft	304.80	mm			
287	Walls:							
288	Height = FBD	19.08	ft	5815.58	mm			
289	Concrete Thickness	8.00	in	500.38	mm			Model based on 8"
290	Concrete Thickness	0.67	ft	203.20	mm			
291	Stair Case:							
292	Slab on Grade:							
293	Length	24.00	ft	7315.20	mm			Fixed
294	Width	24.00	ft	7315.20	mm	SCW		Fixed
295	Concrete Thickness	12.00	in	609.60	mm			Model based on 24"
296	Concrete Thickness	1.00	ft	304.80	mm			
297	Walls:							
298	Height = FBD	19.08	ft	5815.58	mm			
299	Concrete Thickness	8.00	in	203.20	mm			Model based on 8"
300	Concrete Thickness	0.67	ft	203.20	mm			
301	Electrical Room:							
302	Slab on Grade:							

	B	C	D	E	F	G	H	I
303	Length	17.00	ft	5181.60	mm			
304	Width	6.00	ft	1828.80	mm			
305	Concrete Thickness	12.00	in	304.80	mm			Model based on 12"
306	Concrete Thickness	1.00	ft	304.80	mm			
307	Walls:							
308	Height = FBD	10.00	ft	3048.00	mm			Fixed
309	Concrete Thickness	8.00	in	304.80	mm			Model based on 8"
310	Concrete Thickness	0.67	ft	203.20	mm			
311	Overall Dimensions:							
312	Total Filter SOG Length = (#TF/2*FSOGL)+FEWT+SCW+FI/BWCW+(2*FI/BWCST)+2(FSOGT)	432.75	ft	131902.20	mm	SOGL		
313	Total Filter SOG Width = 2*(FSOGW+FSOGT+PGWT)+FGW	118.80	ft	36211.26	mm	SOGW		
314	Total Filter Building Area	51412.14	sf	4776.34	m2	BA		
315	Blower Room Area	810.00	sf	75.25	m2	BRA		
316	Stair Case Area	576.00	sf	53.51	m2	SCA		
317	Electrical Room Area	102.00	sf	9.48	m2	ERA		
318	Total Building Area	52900.14	sf	4914.58	m2	TBA		
319	Filter Building Excavation Length	436.75	ft	133121.40	mm	EVD		
320	Filter Building Excavation Width	122.80	ft	37430.46	mm	EVD		
321	Stair Case Excavation Length	28.00	ft	8534.40	mm			
322	Stair Case Excavation Width	28.00	ft	8534.40	mm			
323	Blower Room Excavation Length	24.00	ft	7315.20	mm			
324	Blower Room Excavation Width	44.50	ft	13563.60	mm			
325	Electrical Room Excavation Length	21.00	ft	6400.80	mm			
326	Electrical Room Excavation Width	10.00	ft	3048.00	mm			
327	Filter Building Excavation Depth (DB + FGSOGT + FFD)	15.00	ft	4572.00	mm	EVD		
328	Stair Case Excavation Depth	15.00	ft	4572.00	mm			
329	Blower Room Excavation Depth	1.00	ft	304.80	mm			
330	Electrical Room Excavation Depth	1.00	ft	304.80	mm			
331								
332	**COST ESTIMATE**							
333	**Description**	**Quantity (English)**	**Unit (English)**	**Quantity (Metric)**	**Unit (Metric)**	**$/Unit**	**Total Cost**	**User Over-Write**
334	SITEWORK:							
335	Filters							
336	Excavation	38594.99	CY	29507.99	m3	$6.72	$259,477	
337	Imported Structural Backfill	3972.92	CY	3037.51	m3	$50.94	$202,387	
338	Native Backfill	4662.94	CY	3565.08	m3	$8.27	$38,541	
339	Haul Excess	33932.04	CY	25942.91	m3	$8.27	$280,458	
340	Stair Case:							
341	Excavation	1010.49	CY	772.57	m3	$6.72	$6,794	
342	Imported Structural Backfill	58.07	CY	44.40	m3	$50.94	$2,958	
343	Native Backfill	466.67	CY	356.79	m3	$8.27	$3,857	
344	Haul Excess	543.82	CY	415.78	m3	$8.27	$4,495	
345	Blower Room:							
346	Excavation	47.14	CY	36.04	m3	$6.72	$317	
347	Imported Structural Backfill	79.11	CY	60.48	m3	$50.94	$4,030	
348	Native Backfill	2.54	CY	1.94	m3	$8.27	$21	
349	Haul Excess	44.61	CY	34.10	m3	$8.27	$369	
350	Electrical Room:							
351	Excavation	10.00	CY	7.64	m3	$6.72	$67	
352	Imported Structural Backfill	15.56	CY	11.89	m3	$50.94	$792	
353	Native Backfill	1.15	CY	0.88	m3	$8.27	$9	
354	Haul Excess	8.85	CY	6.77	m3	$8.27	$73	
355	Allowance for Misc Items	5%				$804,645.08	$40,232	
356	Subtotal						$844,877	
357								
358	CONCRETE:							
359	Filters							
360	Foundation (Includes Filter, Gulllet Channel, Filter Influent/Backwash Wastewater Channel) (FSOGW * FSOGL * FOSGT) / 27 *#TF	2557.50	CY	1955.35	m3	$541.11	$1,383,878	
361	Pipe Gallery Wall	1140.46	CY	871.94	m3	$880.79	$1,004,505	
362	Gullet Wall	560.27	CY	428.35	m3	$880.79	$493,478	
363	Filter Influent / Backwash Waste Channel Walls	1807.30	CY	1381.78	m3	$880.79	$1,591,858	
364	Filter Influent / Backwash Waste Channel Lower Elevated Slab	157.87	CY	120.70	m3	$1,333.77	$210,562	
365	Filter Influent / Backwash Waste Channel Upper Elevated Slab	189.44	CY	144.84	m3	$1,333.77	$252,675	
366	End Walls	944.46	CY	722.09	m3	$880.79	$831,874	
367	Gullet Channel Fill	391.54	CY	299.35	m3	$416.36	$163,023	
368	Backwash Waste Channel Fill	391.54	CY	299.35	m3	$416.36	$163,023	
369	Common Filter Influent							
370	Slab on Grade	57.20	CY	43.73	m3	$490.62	$28,064	
371	Common Influent Channel Wall	76.01	CY	58.11	m3	$880.79	$66,947	
372	Common Influent Channel Elevated Slab	26.40	CY	20.18	m3	$1,333.77	$35,212	
373	Filter Gallery							
374	Slab on Grade	6304.06	CY	4819.80	m3	$490.62	$3,092,872	
375	Filter Gallery Elevated Slab	420.27	CY	321.32	m3	$1,333.77	$560,543	
376	Pipe Supports	14.67	CY	11.21	m3	$41.33		
377	Blower Room							
378	Slab on Grade	30.00	CY	22.94	m3	$490.62	$14,718	
379	Blower Room Walls	28.50	CY	21.79	m3	$880.79	$25,105	
380	Stair Case							
381	Slab on Grade	21.33	CY	16.31	m3	$490.62	$10,466	
382	Stair Case Walls	22.61	CY	17.29	m3	$880.79	$19,918	
383	Electrical Room							
384	Slab on Grade	3.78	CY	2.89	m3	$490.62	$1,853	
385	Electrical Room Walls	11.36	CY	8.68	m3	$880.79	$10,004	
386	Allowance for Misc Items	5%				$9,960,577.27	$498,029	
387	Subtotal						$10,458,606	
388								

	B	C	D	E	F	G	H	I
389	MASONRY:	High						
390	CMU Filter Building	0.00	SF	0.00	m2	$198.37	$0	
391	Blower Room	810.00	SF	75.25	m2	$198.37	$160,677	
392	Electrical Room	102.00	SF	9.48	m2	$198.37	$20,233	
393	Subtotal	912.00					$180,911	
394								
395	METALS:							
396	Metal Guardrail with Pickets	3069.00	LF	935.43	m	$91.60	$281,121	
397	Filter Access Hatch	20.25	SF	1.88	m2	$139.09	$2,817	
398	Stairs (FBD * 12/8)	29	Risers			$495.92	$14,382	
399	Allowance for Misc Items	10%				$298,318.67	$29,832	
400	Subtotal						$328,151	
401								
402	THERMAL & MOISTURE PROTECTION:							
403	Concrete Liner	0.00	SF	0.00	m2	$16.00	$0	
404	Allowance for Misc Items	10%				$0.00	$0	
405	Subtotal						$0	
406								
407	EQUIPMENT:							Budgetary Quote: (CPES will automatically add Installation Factor)
408	Fabricated Slide Gates, 42-inch	2	EA			$16,916.59	$33,833	
409	Underdrain - Leopold Type S	20,350.92	SF	1890.66	m2	$105.76	$2,152,356	
410	Wash Troughs							
411	Conventional	0.00	LF	0.00	m	$371.13	$0	
412	Media Retaining	1,716.00	LF	523.04	m	$841.56	$1,444,115	
413	Media							
414	Bottom Media - Sand (ES=0.55 UC=1.4)	20,350.92	CF	576.27	m3	$22.11	$450,038	
415	Middle Media - Anthracite (ES=1.1 UC=1.5)	0.00	CF	0.00	m3	$29.49	$0	
416	Top Media - Anthracite (ES=1.1 UC=1.5)	101,754.58	CF	2881.37	m3	$29.49	$3,000,254	
417	Air Scour Blowers (82 hp each)	2	EA			$143,943.69	$287,887	
418	Allowance for Misc Items	10%				$7,368,482.69	$736,848	
419	Subtotal						$8,105,331	
420								
421	INSTRUMENTS & CONTROLS:							
422	Instruments							
423	Filter Effluent Magmeter (24-inch)	22	EA			$31,422.24	$691,289	
424	Combined Filter Effluent Magmeter (96-inch)	0	EA			$108,659.86	$0	
425	Isolation Valve Actuators	132	EA			$6,409.82	$846,097	
426	Control Valve Actuators	22	EA			$6,409.82	$141,016	
427	Turbidimeters	22	EA			$4,956.21	$109,037	
428	Particle Counters	22	EA			$10,700.91	$235,420	
429	Level Transmitters	22	EA			$11,264.12	$247,811	
430	Differential Pressure Transmitters	22	EA			$11,264.12	$247,811	
431	Filter Influent Level Transmitter	2	EA			$11,264.12	$22,528	
432	Air Scour Differential Pressure Transmitter	2	EA			$11,264.12	$22,528	
433	Air Scour Discharge Pressure Indicator Transmitter	2	EA			$11,264.12	$22,528	
434	Number of Analog I/O Counts	182	EA			$264.27	$48,203	
435	Number of Digital I/O Counts	797	EA			$62.59	$49,872	
436	Number of PLC's	4	EA			$13,074.33	$52,297	
437	I&C Conduit & Wire	116,842.50	LF	35613.59	m	$12.06	$1,409,001	
438	Allowance for Misc Items	10%				$4,145,437.58	$414,544	
439	Subtotal						$4,559,981	
440								
441	CONVEYING SYSTEMS:							
442	Monorail Hoist (3 Ton)	1	EA			$4,091.32	$4,091	
443	Hoist Rail	551.55	LF	168.11	m	$41.33	$22,794	
444	Allowance for Misc Items	5%				$26,885.05	$1,344	
445	Subtotal						$28,229	
446								
447	MECHANICAL:							
448	Pipe							
449	Air Scour Pipe-BAW (12-inch , Exposed , 316 SST , None , None)	1,645.09	LF	501.42	m	$430.08	$707,526	
450	Filter Influent Header Pipe-FIH (96-inch , Buried , DI , Cement Mortar , Tape Coating)	0.00	LF	0.00	m	$832.31	$0	
451	Filter Influent Pipe-FIH (30-inch , Encased , DI , Cement Mortar , Fusion Bonded Epoxy)	0.00	LF	0.00	m	$260.10	$0	
452	Filter Effluent Pipe-FE (24-inch , Exposed , DI , Cement Mortar , Paint)	382.84	LF	116.69	m	$208.08	$79,660	
453	Filter Effluent Pipe-FE (24-inch , Encased , DI , Cement Mortar , Fusion Bonded Epoxy)	382.84	LF	116.69	m	$208.08	$79,660	
454	Filter Control Valve Pipe-FCV (18-inch , Exposed , DI , Cement Mortar , Paint)	264.00	LF	80.47	m	$156.06	$41,200	
455	Filter Effluent Header Pipe-FEH (96-inch , Encased , DI , Cement Mortar , Fusion Bonded Epoxy)	432.75	LF	131.90	m	$832.31	$360,184	
456	Filter to Waste-FTW (24-inch , Exposed , DI , Cement Mortar , Paint)	209.88	LF	63.97	m	$208.08	$43,672	
457	Filter to Waste-FTW (24-inch , Encased , DI , Cement Mortar , Fusion Bonded Epoxy)	867.50	LF	264.41	m	$208.08	$180,508	
458	Backwash Supply Pipe-BWS (42-inch , Exposed , DI , Cement Mortar , Paint)	1,048.46	LF	319.57	m	$364.14	$381,784	
459	Backwash Supply Pipe-BWS (42-inch , Encased , DI , Cement Mortar , Fusion Bonded Epoxy)	48.00	LF	14.63	m	$364.14	$17,479	
460	Backwash Waste Pipe-BWW (42-inch , Encased , DI , Cement Mortar , Fusion Bonded Epoxy)	10.00	LF	3.05	m	$364.14	$3,641	
461	Elbows							
462	Air Scour Pipe-BAW (12-inch , 316 SST)	88	EA			$2,536.64	$223,224	
463	Filter Influent Header Pipe-FIH (96-inch , DI)	0	EA			$17,469.08	$0	
464	Filter Influent Pipe-FIH (30-inch , DI)	0	EA			$5,459.09	$0	
465	Filter Effluent Pipe-FE (24-inch , DI)	22	EA			$4,367.27	$96,080	
466	Filter Effluent Pipe-FE (24-inch , DI)	22	EA			$4,367.27	$96,080	
467	Filter Control Valve Pipe-FCV (18-inch , DI)	0	EA			$3,275.45	$0	
468	Filter Effluent Header Pipe-FEH (96-inch , DI)	0	EA			$17,469.08	$0	
469	Filter to Waste-FTW (24-inch , DI)	24	EA			$4,367.27	$104,814	
470	Filter to Waste-FTW (24-inch , DI)	0	EA			$4,367.27	$0	

	B	C	D	E	F	G	H	I
471	Backwash Supply Pipe-BWS (42-inch , DI)	2	EA			$7,642.72	$15,285	
472	Backwash Supply Pipe-BWS (42-inch , DI)	2	EA			$7,642.72	$15,285	
473	Backwash Waste Pipe-BWW (42-inch , DI)	0	EA			$7,642.72	$0	
474	Tees							
475	Air Scour Pipe-BAW (12-inch , 316 SST)	22	EA			$3,525.06	$77,551	
476	Filter Influent Header Pipe-FIH (96-inch , DI)	0	EA			$29,006.98	$0	
477	Filter Influent Pipe-FIH (30-inch , DI)	0	EA			$9,064.68	$0	
478	Filter Effluent Pipe-FE (24-inch , DI)	22	EA			$7,251.74	$159,538	
479	Filter Effluent Pipe-FE (24-inch , DI)	0	EA			$7,251.74	$0	
480	Filter Control Valve Pipe-FCV (18-inch , DI)	0	EA			$5,438.81	$0	
481	Filter Effluent Header Pipe-FEH (96-inch , DI)	0	EA			$29,006.98	$0	
482	Filter to Waste-FTW (24-inch , DI)	0	EA			$7,251.74	$0	
483	Filter to Waste-FTW (24-inch , DI)	20	EA			$7,251.74	$145,035	
484	Backwash Supply Pipe-BWS (42-inch , DI)	24	EA			$12,690.55	$304,573	
485	Backwash Supply Pipe-BWS (42-inch , DI)	0	EA			$12,690.55	$0	
486	Backwash Waste Pipe-BWW (42-inch , DI)	0	EA			$12,690.55	$0	
487	Crosses							
488	Air Scour Pipe-BAW (12-inch , 316 SST)	11	EA			$4,700.08	$51,701	
489	Filter Influent Header Pipe-FIH (96-inch , DI)	0	EA			$38,675.97	$0	
490	Filter Influent Pipe-FIH (30-inch , DI)	0	EA			$12,086.24	$0	
491	Filter Effluent Pipe-FE (24-inch , DI)	0	EA			$9,668.99	$0	
492	Filter Effluent Pipe-FE (24-inch , DI)	0	EA			$9,668.99	$0	
493	Filter Control Valve Pipe-FCV (18-inch , DI)	0	EA			$7,251.74	$0	
494	Filter Effluent Header Pipe-FEH (96-inch , DI)	11	EA			$38,675.97	$425,436	
495	Filter to Waste-FTW (24-inch , DI)	0	EA			$9,668.99	$0	
496	Filter to Waste-FTW (24-inch , DI)	0	EA			$9,668.99	$0	
497	Backwash Supply Pipe-BWS (42-inch , DI)	0	EA			$16,920.74	$0	
498	Backwash Supply Pipe-BWS (42-inch , DI)	0	EA			$16,920.74	$0	
499	Backwash Waste Pipe-BWW (42-inch , DI)	0	EA			$16,920.74	$0	
500	Valves							
501	Air Scour Pipe-BAW (12-inch ,V500 - BFV)	22	EA			$10,632.76	$233,921	
502	Filter Influent Header Pipe-FIH (96-inch ,V500 - BFV)	0	EA			$85,062.12	$0	
503	Filter Influent Pipe-FIH (30-inch ,V500 - BFV)	22	EA			$26,581.91	$584,802	
504	Filter Effluent Pipe-FE (24-inch ,V500 - BFV)	22	EA			$21,265.53	$467,842	
505	Filter Effluent Pipe-FE (24-inch ,V500 - BFV)	0	EA			$21,265.53	$0	
506	Filter Control Valve Pipe-FCV (18-inch ,V500 - BFV)	22	EA			$15,949.15	$350,881	
507	Filter Effluent Header Pipe-FEH (96-inch ,V500 - BFV)	0	EA			$85,062.12	$0	
508	Filter to Waste-FTW (24-inch ,V500 - BFV)	22	EA			$21,265.53	$467,842	
509	Filter to Waste-FTW (24-inch ,V500 - BFV)	0	EA			$21,265.53	$0	
510	Backwash Supply Pipe-BWS (42-inch ,V500 - BFV)	22	EA			$37,214.68	$818,723	
511	Backwash Supply Pipe-BWS (42-inch ,V500 - BFV)	0	EA			$37,214.68	$0	
512	Backwash Waste Pipe-BWW (42-inch ,V500 - BFV)	22	EA			$37,214.68	$818,723	
513	Allowance for Misc Items	5%				$7,352,650.85	$367,633	
514	Subtotal						$7,720,283	
515								
516	ELECTRICAL:							
517	MCC's							
518	Sections	7	EA			$10,730.27	$75,112	
519	AFD's							
520	Air Scour Blowers (82 hp each)	0	EA			$19,618.40	$0	
521	Switchgear							
522	Units	0	EA			$49,359.23	$0	
523	Electrical Conduit & Wire	865.50	LF	263.80	m	$12.06	$10,437	
524	Allowance for Misc Items	5%				$85,548.92	$4,277	
525	Subtotal						$89,826	
526								
527	**USER DEFINED ESTIMATE ITEMS**	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
528	Item 1 Description	0.00		0.00		0.00	$0	
529	Item 2 Description	0.00		0.00		0.00	$0	
530	Item 3 Description	0.00		0.00		0.00	$0	
531	Item 4 Description	0.00		0.00		0.00	$0	
532	Item 5 Description	0.00		0.00		0.00	$0	
533	Item 6 Description	0.00		0.00		0.00	$0	
534	Item 7 Description	0.00		0.00		0.00	$0	
535	Item 8 Description	0.00		0.00		0.00	$0	
536	Item 9 Description	0.00		0.00		0.00	$0	
537	Item 10 Description	0.00		0.00		0.00	$0	
538	Item 11 Description	0.00		0.00		0.00	$0	
539	Item 12 Description	0.00		0.00		0.00	$0	
540	Item 13 Description	0.00		0.00		0.00	$0	
541	Item 14 Description	0.00		0.00		0.00	$0	
542	Item 15 Description	0.00		0.00		0.00	$0	
543	Subtotal						$0	
544								
545	Subtotal						$32,316,195.95	
546								
547	ALLOWANCES:		**User Override**					
548	Finishes Allowance	2.00%		$35,126,300	$702,526.00			
549	Mechanical Allowance	2.00%		$35,126,300	$702,526.00			
550	I&C Allowance	2.00%		$35,126,300	$702,526.00			
551	Electrical Allowance	2.00%		$35,126,300	$702,526.00			
552						Facility Cost Name		
553	Facility Cost	**160,000,000**	**GPD**	**$0.22**	**$35,126,300**	FLCFC01		
554	Facility Cost with Standard Additional Project Costs Added	**160,000,000**	**GPD**	**$0.27**	**$42,684,425**	FLCFC02		
555	Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**160,000,000**	**GPD**	**$0.46**	**$73,211,428**	FLCFC03		
556	Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**160,000,000**	**GPD**	**$0.38**	**$60,247,890**	FLCFC05		
557	Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**160,000,000**	**GPD**	**$0.46**	**$73,211,428**	FLCFC06		

Concrete Clearwell

Is This Facility Included in My Project? Yes

If this is a Seawater Desalination Application, the materials in contact with seawater need to be corrosion resistant.

Process User Inputs:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Red Flags	Comment
Is this a Seawater Desalination Application?	No	Y/N					
Has the USER Contacted Equipment Suppliers to Obtain Equipment Quotes?	No	Y/N					
Input Maximum Plant Flow Capacity	160.00	mgd	605.67	ML/d	Qmax		
Conversion of Maximum Flow	247.56	cfs	7.01	m3/s	Qmax, cfs		
Is Clearwell to Provide Contact Time for Pathogen Inactivation by Free Chlorine?	Yes	Y/N					
Input pH Exiting Clearwell	8.00	ph units					
Input Free Chlorine Residual Exiting Clearwell	2.00	mg/L					
Input Water Temperature at Maximum Flow	33.80	degrees F	1.00	degrees C			
Input Desired Giardia Log Inactivation	1.00	log					Valid Range: 0.0 to 4.0 log.
Calculate Required Giardia Inactivation CT	111.28	mg-min/L					
Input Desired Virus Log Inactivation	2.00	log					Valid Range: 0.0 to 5.0 log.
Calculate Required Virus Inactivation CT	5.87	mg-min/L					
Calculate Controlling Required Pathogen Inactivation CT	111.28	mg-min/L					
Do you have baffling?	Yes	Y/N					
Input Type of Baffling Material	Concrete	Type				OKAY	
Input Clearwell Short-Circuiting Factor	0.75	#				OKAY	0.1 = no clearwell baffling, short distance between inlet and outlet to clearwell, high inlet and outlet flow velocities. 0.3 = no clearwell baffling, relatively long distance between inlet and outlet. 0.5 = Baffled inlet or outlet with some internal baffling. 0.7 = Well baffled clearwell with inlet and outlet place opposite to each other.
Calculate T10 Detention Time	55.64	min					
Calculate Theoretical Detention Time	74.19	min					
Calculate Disinfection Contact Volume Required	8,243,006.19	gal	31203.17	m3			
Input Storage Volume for Plant Shutdown	3,333,333.33	gal	11,829.41	m3			
Input Backwash Storage Volume	305,000.00	gal	3,293.31	m3			
Input Storage Volume for Fire Protection		gal	0.00	m3			
Input Storage Volume for Peak Hour Flow		gal	0.00	m3			
Calculate Total Clearwell Volume	11,881,339.52	gal	44975.77	m3			
Conversion of Total Clearwell Volume	1,588,304.60	cf	44975.78	m3			
Input Number of Clearwells of Equal Size	2	#					
Input Clearwell Maximum Side Water Depth	15.00	ft	4,572.00	mm	SWD		
Input Clearwell Freeboard	3.00	ft	914.40	mm	FB		
Select Circular or Rectangular Type	Rectangular	Type					
If Rectangular, Input Length to Width Ratio	2.00	:1					
Input Depth of Clearwell Burial	15.00	ft	4,572.00	mm	DB		
Input Cutback Slope	1.50	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
Input Over Excavation Depth	1.00	ft	0.00	mm	OEXD		
For Circular Tank, Calculate Clearwell Diameter	0.00	ft	0.00	mm			
For Rectangular Tank, Calculate Clearwell Length	325.40	ft	99182.77	mm			
For Rectangular Tank, Calculate Clearwell Width	162.70	ft	49591.38	mm			

Estimating Dimensions (per trian):	Value English	Unit (English)	Value (Metric)	Unit (Metric)	Name	Red Flags	Comment
Circular Clearwell (per Each)							
Water Volume of Each Tank	0.00	gal	0.00	m3			
Diameter	0.00	ft	0.00	mm			
Height	0.00	ft	0.00	mm			
Total Volume of Each Tank (including Freeboard)	0.00	gal	0.00	m3			
Slab on Grade Thickness	20.00	in	508.00	mm			Model based on 12"
Slab on Grade Thickness	1.67	ft	508.00	mm			
Wall Thickness	18.00	in	457.20	mm			Model based on 12"
Wall Thickness	1.50	ft	457.20	mm			
Slab on Grade Diameter	0.00	ft	0.00	mm			
Excavation Diameter	0.00	ft	0.00	mm			
Excavation Depth	0.00	ft	0.00	mm			
Rectangular Clearwell (per Each)							
Width	162.70	ft	49591.38	mm			
Length	325.40	ft	99182.77	mm			
Height = SWD + FB	18.00	ft	5486.40	mm			
Slab on Grade Thickness	17.00	in	431.80	mm			Rule: SWD in inches + 2 inches
Slab on Grade Thickness	1.42	ft	431.80	mm			
Wall Thickness	15.00	in	381.00	mm	Rectangular Clearwell Wall Thickness Override (in):		Rule: SWD in inches
Wall Thickness	1.25	ft	381.00	mm			

Elevated Slab Thickness	15.00	in	381.00	mm			Model based on 12"
Elevated Slab Thickness	1.25	ft	381.00	mm			
Column Diameter	18.00	in	457.20	mm			Rule: 18" for SWD ≤ 30', 24" for SWD > 30'
Column Diameter	1.50	ft	457.20	mm			
Column Volume	31.81	cf	0.90	m3			
Column Volume	1.18	cy	0.90	m3			
Number of Columns (Each)	235.00	#					Rule: Columns on 15' centers
Slab on Grade Width	168.03	ft	51216.98	mm			
Slab on Grade Length	330.74	ft	100808.37	mm			
Excavation Width	172.03	ft	52436.18	mm			
Excavation Length	334.74	ft	102027.57	mm			
Excavation Depth	17.42	ft	5308.60	mm			

COST ESTIMATE

Description	Quantity (English)	Unit (English)	Quantity (Metric)	Unit (Metric)	$/Unit	Total Cost	User Over-Write
SITEWORK:							
Circular Clearwell							
Excavation	0	CY	0.00	m3	$6.72	$0	
Imported Structural Backfill	0	CY	0.00	m3	$50.94	$0	
Native Backfill	0	CY	0.00	m3	$8.27	$0	
Haul Excess	0	CY	0.00	m3	$8.27	$0	
Rectangular Clearwell							
Excavation	91,374	CY	69860.29	m3	$6.72	$614,313	
Imported Structural Backfill	8,531	CY	6522.64	m3	$50.94	$434,598	
Native Backfill	20,497	CY	15670.73	m3	$8.27	$169,410	
Haul Excess	70,877	CY	54189.56	m3	$8.27	$585,821	
Allowance for Misc Items	5%				$1,804,141.18	$90,207	
Subtotal						$1,894,348	
CONCRETE:							
Circular Clearwell							Budgetary Quote: (CPES will automatically add Installation Factor)
Prestressed Concrete Tank (11881340 gallons)	0	EA			$0.00	$0	
Rectangular Clearwell							
Foundation	5,832	CY	4458.85	m3	$541.11	$3,155,707	
Columns	277	CY	211.67	m3	$880.79	$243,850	
Walls	1,627	CY	1243.94	m3	$880.79	$1,433,063	
Elevated Slab	5,016	CY	3834.81	m3	$1,333.77	$6,689,826	
Concrete Baffling	6,530	CY	4992.51	m3	$880.79	$5,751,539	
Allowance for Misc Items	5%				$17,273,985.20	$863,699	
Subtotal						$18,137,684	
METALS & PLASTICS:							
Polypropylene Baffling	0	SF	0.00	m2	$13.91	$0	
Stainless Steel Baffling	0	SF	0.00	m2	$57.95	$0	
Allowance for Misc Items	5%				$0.00	$0	
Subtotal						$0	
THERMAL & MOISTURE PROTECTION:							
Concrete Liner	0	SF	0.00	m2	$16.00	$0	
Allowance for Misc Items	10%				$0.00	$0	
Subtotal						$0	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00		0.00		0.00	$0	
Item 2 Description	0.00		0.00		0.00	$0	
Item 3 Description	0.00		0.00		0.00	$0	
Item 4 Description	0.00		0.00		0.00	$0	
Item 5 Description	0.00		0.00		0.00	$0	
Item 6 Description	0.00		0.00		0.00	$0	
Item 7 Description	0.00		0.00		0.00	$0	
Item 8 Description	0.00		0.00		0.00	$0	
Item 9 Description	0.00		0.00		0.00	$0	
Item 10 Description	0.00		0.00		0.00	$0	
Item 11 Description	0.00		0.00		0.00	$0	
Item 12 Description	0.00		0.00		0.00	$0	
Item 13 Description	0.00		0.00		0.00	$0	
Item 14 Description	0.00		0.00		0.00	$0	
Item 15 Description	0.00		0.00		0.00	$0	
Subtotal						$0	
Subtotal						$20,032,033	
ALLOWANCES:		**User Override**					
Metals Allowance	1.00%		$21,539,820	$215,398			
Finishes Allowance	2.00%		$21,539,820	$430,796			
Equipment Allowance	1.00%		$21,539,820	$215,398			
I&C Allowance	2.00%		$21,539,820	$430,796			
Mechanical Allowance	5.00%		$21,539,820	$1,076,991			
Electrical Allowance	1.00%		$21,539,820	$215,398			
Facility Cost	**11,881,340**	**Gallons**	**$1.90**	**$22,616,811**			
Facility Cost with Standard Additional Project Costs Added	**11,881,340**	**Gallons**	**$2.31**	**$27,483,270**			
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**11,881,340**	**Gallons**	**$3.97**	**$47,138,726**			
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**11,881,340**	**Gallons**	**$3.26**	**$38,791,878**			
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**11,881,340**	**Gallons**	**$3.97**	**$47,138,726**			

Granular Media Filter Backwash Supply Pump Station

Is This Facility Included in My Project?   Yes

Notes to Designer:

This mini-model is based on development of either a submersible or vertical turbine pump station with pumps less than 100 and 1,000 HP each, respectively. For larger HP pumps, get project specific pump and AFD budget quotes.

Process User Inputs:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Comment	Red Flags
1.) Input Pump Station Type	Submersible	Type			TYP		
2.) Input Maximum Pump Station Flow	33.30	mgd	236.44	ML/d	Qmax		
3.) Input Number of Hours Per Day Backwash Supply Pump Station Operates	3.00	hrs					
Conversion of Maximum P.S. Flow from MGD to CFS	51.53	cfs	1459.03	L/s	Qmax, cfs		
Given: Pump Station Discharge Center Line = 0.00 ft							
4.) Input Maximum Suction Lift for Vertical Turbine Pump Station or Wetwell Operating Water Depth for Submersible Pump Station	12.00	ft	3,657.60	mm	MSL		
5.) Input Maximum Discharge Lift	40.00	ft	12,192.00	mm	MDL		
6.) Input Maximum Pump Station Yard Piping Discharge Header Velocity, and Individual Pump Discharge Lateral Velocity	5.00	fps	1.52	m/s	PSHV	Typically 2 - 7 fps	
Calculate I-P P.S. Discharge Header Pipe Size = [(Qmax, cfs/PSHV)*4/PI]^1/2*12	43.47	in	1104.06	mm	PSHD		
Use this Standard Diameter for Discharge Header Pipe Size	42.00	in	1066.80	mm	PSHDS		
Calculate Maximum PSHV using real pipe size = (Qmax, cfs * 4 / PI * 144) / PSHDS^2	5.36	fps	1.63	m/s	maxPSHV		
7.) Input Length of I-P Pump Station Force Main	250.00	ft	76,200.00	mm	LPSF	Confirm with Hydraulic Analysis	
8.) Input Equivalent Length of I-P Pump Station Force Main Minor Losses	50.00	ft	15,240.00	mm	MPSF	Preliminary assumption of MPSF = 50% * LPSF	
9.) Input Hazen Williams Pipe Friction Coefficient	120.00				HWFC	Typically HWFC =100	
Calculate Maximum High Service Water Forcemain Dynamic Headloss = (LPSF + MPSF) * 4.73 * (Q max, cfs)^1.85 / ((HWFC)^1.85 * (PSHDS / 12)^4.87	0.67	ft	202.83	mm	maxFMDH	Should be ≤ 25% of static lift. If > 25%, reduce velocity or increase static lift.	
Calculate Total Maximum Dynamic Headloss = MSL + MDL + maxFMDH	52.67	ft	16052.43	mm	maxTDH		
10.) Input Pump Efficiency	75.00%				PE	Typically 0.70 to 0.80	
Wetwell							
11.) Input Minimum Wet Well Detention Time	5.00	min				Typically minimum of 5 min for pump control	
Calculate Wetwell Operational Capacity (each)	115,630.21	gal	437.71	m3			

Input Pump Information	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	AFD? (Yes or No)	Calculate Individual Pump GPM	Calculate Individual Pump BHP
Active Pump # 1	17.00	mgd	68.14	ML/d	Yes	11805.56	209.34
Active Pump # 2	17.00	mgd	68.14	ML/d	Yes	11805.56	209.34
Active Pump # 3	0.00	mgd	0.00	ML/d	No	0.00	0.00
Active Pump # 4	0.00	mgd	0.00	ML/d	No	0.00	0.00
Active Pump # 5	0.00	mgd	0.00	ML/d	No	0.00	0.00
Active Pump # 6	0.00	mgd	0.00	ML/d	No	0.00	0.00
Active Pump # 7	0.00	mgd	0.00	ML/d	No	0.00	0.00
Active Pump # 8	0.00	mgd	0.00	ML/d	No	0.00	0.00
Active Pump # 9	0.00	mgd	0.00	ML/d	No	0.00	0.00
Active Pump # 10	0.00	mgd	0.00	ML/d	No	0.00	0.00
Calculate Total Active Pumps Capacity	34.00	mgd				23611.11	418.68
Calculate Standby Pump Capacity = Max Pump	17.00	mgd			Yes	11805.56	209.34
Calculate Total P.S. Capacity	51.00					35416.67	628.03
Calculate Total Number of Pumps (Active & Standby)	3.00						
Clearance Around Pumps (ft,)	3.50				**PC**	Fixed	

Process User Inputs:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Comment	Red Flags
Calculate Pump Station Dimensions Based on Hydraulic Institute Standards (based on Largest Capacity Pump):							
Calculate Distance from Inlet Pipe to Back Wall of Wet Well Behind Pumps	13.93	ft	4246.67	mm	A		
Calculate Distance from Pump Suction Centerline to Back Wall of Wet Well	2.36	ft	719.47	mm	B		
Calculate Distance from Wet Well Floor to Suction Bell	1.01	ft	308.76	mm	C		
Calculate Minimum Water Depth in Wet Well	8.28	ft	2524.38	mm	H		
Calculate Distance Between Pump Centerlines	5.00	ft	1524.00	mm	S		
Calculate Wet Well Width = S * (Total Number of Pumps)	15.00	ft	4572.00	mm	W		
Calculate Wet Well Length = Maximum of (PC * 2) or A	13.93	ft	4246.67	mm	LWW		
Wet Well Free Board	2.00	ft	609.60	mm	FB	Fixed	
Calculate Wet Well Side Water Depth = MSL + H - Discharge Flange -Elevated Slab - FB for Vertical Turbine or MSL for Submersible	12.00	ft	3657.60	mm			
Calculate Wet Well Water Volume	115,630.21	gal	437.71	m3	WWV		
Calculate Wet Well Volume to Largest Pump Capacity Ratio	9.79					Ratio should be 2 or greatee	
Wetwell Dimensions							
Calculate Pump Station Width	25.50	ft	7,772.40	mm	WWW		
Calculate Pump Station Length	50.51	ft	15,396.89	mm	WWL		
Calculate Wet Well Side Water Depth (based on pumps)	14.00	ft	4,267.20	mm	SWD		
Influent Pipe & Motorized Gate Valve:							
12.) Input Maximum Influent Pipe Velocity	4.00	fps	1.22	m/s	IPV	Typically 2 - 7 fps	

Calculate I-P P.S.Influent Pipe Size = [(Qmax, cfs/IPV)*4/PI]^1/2*12	48.60	in	1234.38	mm	IPD		
Use this Standard Diameter for I-P P.S. Influent Pipe, and Gate Valve	48.00	in	1219.20	mm	IPDS		
Discharge Header Pipe Vault:							
13.) Input Clear Distance Around Discharge Header Pipe	**3.00**	ft	**914.40**	mm	DPC	Typically > = 3'	
14.) Input Depth of Motor Control Center Equipment	**2.00**	ft	**609.60**	mm	MCC	Typically = 1' - 2.5'	
15.) Maximum Velocity Through Discharge Header within Pump Station and Downstream Flow Meter Vault	**12.00**	fps	**3.66**	m/s	PDHV	Valid Range: ≤ 15 fps	
Calculate Discharge Header Diameter within Pump Station =[(Qmax, cfs/PDHV)*4/PI]^1/2*12	28.06	in	712.67	mm	PDHD		
Use this Standard Diameter for Discharge Header Diameter within Pump Station	30.00	in	762.00	mm	FCVSD		
Pump Station Depth of Burial:							
16.) Input Pump Station Depth of Burial	**2.00**	ft	**609.60**	mm	DB		
17.) Input Cutback Slope	**1.00**	:1 (ft:ft)				Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.	
18.) Input Over Excavation Depth	**1.00**	ft	**0.00**	mm	OEXD		

Estimating Dimensions:	**Value English**	**Unit (English)**	**Name**	**Unit (Metric)**	**Name**	**Comment**	**Red Flags**
Wetwell:							
Width	25.50	ft	7772.40	mm	W		
Length = LWW	50.51	ft	15396.89	mm	LWW		
Wall Height = MSL + H	14.00	ft	4267.20	mm			
Slab on Grade Width	29.50	ft	8991.60	mm			
Slab on Grade Length	54.51	ft	16616.09	mm			
Slab on Grade Thickness	**12.00**	in	**304.80**	mm		Model based on 12"	
Slab on Grade Thickness	1.00	ft	304.80	mm			
Wall Thickness	**12.00**	in	**304.80**	mm	TWWW	Model based on 12"	
Wall Thickness	1.00	ft	304.80	mm			
Discharge Header Pipe Vault							
Width	25.50	ft	7772.40	mm			
Length = Discharge Header Pipe Diameter + (Clearance Around Pipe * 2) + Depth of Motor Control Center Equipment	11.50	ft	3505.20	mm	LDHPV		
Wall Height = Discharge Header Pipe Diameter + (Clearance Around Pipe * 2)	9.50	ft	2895.60	mm	HDHPV		
Slab on Grade Width	29.50	ft	8991.60	mm			
Slab on Grade Length	13.50	ft	4114.80	mm			
Slab on Grade Thickness	**12.00**	in	**304.80**	mm		Model based on 12"	
Slab on Grade Thickness	1.00	ft	304.80	mm			
Wall Thickness	**12.00**	in	**304.80**	mm		Model based on 12"	
Wall Thickness	1.00	ft	304.80	mm			
Operating Floor							
Width	25.50	ft	7772.40	mm			
Elevated Slab Width	27.50	ft	8382.00	mm			
Elevated Stab Length = LWW + LDPV + (TWWW * 3)	65.01	ft	19816.49	mm			
Elevated Slab Thickness	**12.00**	in	**304.80**	mm		Model based on 12"	
Elevated Slab Thickness	1.00	ft	304.80	mm			
Overall Dimensions:							
Building Width	27.50	ft	8382.00	mm			
Building Length	65.01	ft	19816.49	mm			
Building Depth	14.00	ft	4267.20	mm			
Excavation Width	29.50	ft	8991.60	mm			
Excavation Length	54.51	ft	16616.09	mm			
Excavation Depth	5.00	ft	1524.00	mm			

COST ESTIMATE

Description	**Quantity (English)**	**Unit (English)**	**Quantity (Metric)**	**Unit (Metric)**	**$/Unit**	**Total Cost**	**User Over-Write**
SITEWORK:							
Excavation	420.68	CY	321.63	m3	***$6.72***	$2,828	
Imported Structural Backfill	119.12	CY	91.08	m3	***$50.94***	$6,068	
Native Backfill	77.79	CY	59.48	m3	***$8.27***	$643	
Haul Excess	342.88	CY	262.15	m3	***$8.27***	$2,834	
Allowance for Misc Items	5%				$12,373.65	$619	
Subtotal						$12,992	
CONCRETE:							
Wet Well:							
Foundation	59.56	CY	45.54	m3	***$541.11***	$32,230	
Perimeter Walls	87.13	CY	66.61	m3	***$880.79***	$76,740	
Operating Floor:							
Elevated Slab (Including floor over Discharge Header Vault)	66.22	CY	50.63	m3	***$1,333.77***	$88,320	
Pump Pads	1.63	CY	1.25	m3	***$490.62***	$801	
Other Equipment Pads	1.00	CY	0.76	m3	***$490.62***	$491	
Discharge Pipe Vault:							
Slab on Grade	14.75	CY	11.28	m3	***$490.62***	$7,237	
Walls	19.88	CY	15.20	m3	***$880.79***	$17,510	
Allowance for Misc Items	5%				$223,328.29	$11,166	
Subtotal						$234,495	

MASONRY:	Moderate						
CMU Building	1787.91	SF	166.10	m2	*$165.31*	$295,551	
Subtotal						$295,551	
METALS:							
Checker Plate Over Intake Pipe Gate = (Diameter of Influent Pipe +2') * (2 Feet Wide) (sf)	12.00	SF	1.11	m2	*$90.92*	$1,091	
Checker Plate Over Discharge Pipe Header = ((Discharge Pipe Diameter * 2) * ("S" * Total Number of Pumps)	105.00	SF	9.75	m2	*$90.92*	$9,546	
Ladder	14.00	VLF	4.27	VLM	*$125.74*	$1,760	
Allowance for Misc Items	10%				$12,397.81	$1,240	
Subtotal						$13,638	
EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
Size of Sluice Gate (per side in inches)	48.00	in	1219.20	mm			
Sluice Gate	1.00	EA			***$12,484.16***	$12,484	
Pumps:							
Active Pump # 1	209.34	hp	156.11	kW	***$967.89***	$202,619	
Active Pump # 2	209.34	hp	156.11	kW	***$967.89***	$202,619	
Active Pump # 3	0.00	hp	0.00	kW	***$0.00***	$0	
Active Pump # 4	0.00	hp	0.00	kW	***$0.00***	$0	
Active Pump # 5	0.00	hp	0.00	kW	***$0.00***	$0	
Active Pump # 6	0.00	hp	0.00	kW	***$0.00***	$0	
Active Pump # 7	0.00	hp	0.00	kW	***$0.00***	$0	
Active Pump # 8	0.00	hp	0.00	kW	***$0.00***	$0	
Active Pump # 9	0.00	hp	0.00	kW	***$0.00***	$0	
Active Pump # 10	0.00	hp	0.00	kW	***$0.00***	$0	
Standby Pump	209.34	hp	156.11	kW	***$967.89***	$202,619	
AFD's							
Active Pump # 1	209.34	hp	156.11	kW	***$173.48***	$36,317	
Active Pump # 2	209.34	hp	156.11	kW	***$173.48***	$36,317	
Active Pump # 3	0.00	hp	0.00	kW	***$0.00***	$0	
Active Pump # 4	0.00	hp	0.00	kW	***$0.00***	$0	
Active Pump # 5	0.00	hp	0.00	kW	***$0.00***	$0	
Active Pump # 6	0.00	hp	0.00	kW	***$0.00***	$0	
Active Pump # 7	0.00	hp	0.00	kW	***$0.00***	$0	
Active Pump # 8	0.00	hp	0.00	kW	***$0.00***	$0	
Active Pump # 9	0.00	hp	0.00	kW	***$0.00***	$0	
Active Pump # 10	0.00	hp	0.00	kW	***$0.00***	$0	
Standby Pump	209.34	hp	156.11	kW	***$173.48***	$36,317	
Allowance for Misc Items	10%				$716,806.90	$71,681	
Subtotal						$800,972	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00		0.00		0.00	$0	
Item 2 Description	0.00		0.00		0.00	$0	
Item 3 Description	0.00		0.00		0.00	$0	
Item 4 Description	0.00		0.00		0.00	$0	
Item 5 Description	0.00		0.00		0.00	$0	
Item 6 Description	0.00		0.00		0.00	$0	
Item 7 Description	0.00		0.00		0.00	$0	
Item 8 Description	0.00		0.00		0.00	$0	
Item 9 Description	0.00		0.00		0.00	$0	
Item 10 Description	0.00		0.00		0.00	$0	
Item 11 Description	0.00		0.00		0.00	$0	
Item 12 Description	0.00		0.00		0.00	$0	
Item 13 Description	0.00		0.00		0.00	$0	
Item 14 Description	0.00		0.00		0.00	$0	
Item 15 Description	0.00		0.00		0.00	$0	
Subtotal						$0	
Subtotal						$1,357,647	
ALLOWANCES:		**User Override**					
Finishes Allowance	2.00%		$2,715,295	$54,306			
I&C Allowance	8.00%		$2,715,295	$217,224			
Mechanical Allowance	25.00%		$2,715,295	$678,824			
Electrical Allowance	15.00%		$2,715,295	$407,294			
Facility Cost	**628**	**Total Pump HP**	**$4,323.54**	**$2,715,295**			
Facility Cost with Standard Additional Project Costs Added	**628**	**Total Pump HP**	**$5,253.84**	**$3,299,545**			
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**628**	**Total Pump HP**	**$9,011.28**	**$5,659,310**			
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**628**	**Total Pump HP**	**$7,415.65**	**$4,657,216**			
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**628**	**Total Pump HP**	**$9,011.28**	**$5,659,310**			

Liquid Chemical Storage & Feed - (Aluminum Sulfate (Alum))
Located in Stand Alone Chemical Building

Is This Facility Included in My Project? Yes

Is the Facility Storage Only (no metering pumps)?	No	Y/N					
		Overwrite Value					
Select Chemical	Aluminum Sulfate (Alum)		Select "Other" from the drop down list if using a different chemical.				
Percent Active Chemical, % w/w	48.50%		This is the intended feed strength to the process. Inputting a value in the yellow cell overwrites the cell in column "C".				For Fluoride systems, concentration must include the Available Fluoride Ion (AFI) concentration. Typically 79.2% AFI for 23% as HFA. (e.g., 23% as HFA x 79.2% AFI = 18.22% as F)
Active Chemical Form for Dosage Basis	Al2(SO4)3-14H2O		Inputting a value in the yellow cell overwrites the cell in column "C".				
Bulk Chemical Specific Gravity	1.34		Inputting a value in the yellow cell overwrites the cell in column "C".				
Active lb/gal solution	5.42	lb/gal	649.90	kg/m3			

Process User Inputs:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Red Flags	Comment
FLOW AND CHEMICAL ADDITION							
Application #1							
1.) Minimum flow to application point	30.00	mgd	113.56	ML/d			Input the flow that the selected dose will be applied to.
2.) Average flow to application point	75.00	mgd	283.91	ML/d			Input the flow that the selected dose will be applied to.
3.) Maximum flow to applicatoin point	160.00	mgd	605.67	ML/d			Input the flow that the selected dose will be applied to.
4.) Minimum chemical addition	2.50	mg/L					Input the dose that corresponds to the flow input above.
5.) Average chemical addition	5.00	mg/L					Input the dose that corresponds to the flow input above.
6.) Maximum chemical addition	15.00	mg/L					Input the dose that corresponds to the flow input above.
7.) Input Number of Equal Simultaneous Application Points	4	#					
8.) Hours of addition per day	24.00	hr					Input the total number of hours that the chemical is fed during the day.
Application #2							
9.) Minimum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
10.) Average flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
11.) Maximum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
12.) Minimum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
13.) Average chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
14.) Maximum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
15.) Input Number of Equal Simultaneous Application Points	0	#					
16.) Hours of addition per day	0.00	hr					Input the total number of hours that the chemical is fed during the day.
Application #3							
17.) Minimum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
18.) Average flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
19.) Maximum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
20.) Minimum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
21.) Average chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
22.) Maximum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
23.) Input Number of Equal Simultaneous Application Points	0	#					
24.) Hours of addition per day	0.00	hr					Input the total number of hours that the chemical is fed during the day.
CHEMICAL QUANTITIES AND FLOW							
Application Point #1 Chemical Usage:							
Minimum as "dry" chemical	625.91	lb/d	283.91	kg/d			
Average as "dry" chemical	3,129.53	lb/d	1419.53	kg/d			
Maximum as "dry" chemical	20,028.96	lb/d	9084.98	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	1.20	gph	4.55	L/h			
Average at feed concentration	6.01	gph	22.75	L/h			
Maximum at feed concentration	38.47	gph	145.62	L/h			
Calculate Chemical Metering Pump Flow Turndown	32.00	:1				**Note: Pump turndown is > 20, proceed with the design with caution**	Should be < 20:1, If ≥ 20:1, proceed with caution.
Application Point #2 Chemical Usage:							
Minimum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Average as "dry" chemical	0.00	lb/d	0.00	kg/d			
Maximum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.00	gph	0.00	L/h			
Average at feed concentration	0.00	gph	0.00	L/h			
Maximum at feed concentration	0.00	gph	0.00	L/h			

Calculate Chemical Metering Pump Flow Turndown	0.00	:1					Should be < 20:1, If ≥ 20:1, proceed with caution.
Application Point #3 Chemical Usage:							
Minimum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Average as "dry" chemical	0.00	lb/d	0.00	kg/d			
Maximum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.00	gph	0.00	L/h			
Average at feed concentration	0.00	gph	0.00	L/h			
Maximum at feed concentration	0.00	gph	0.00	L/h			
Calculate Chemical Metering Pump Flow Turndown	0.00	:1					Should be < 20:1, If ≥ 20:1, proceed with caution.
Whole Plant Chemical Usage for Storage Calcs:							
Minimum	625.91	lb/d	283.91	kg/d			
Average	3,129.53	lb/d	1419.53	kg/d			
Maximum	20,028.96	lb/d	9084.98	kg/d			
Max Flow Average Dose Daily Usage	6,676.32	lb/d					
Whole Plant # of Days of Storage							
Maximum Flow and Average Dose	30.00	days					
CHEMICAL STORAGE INPUTS							
25.) Flow used to calculate storage requirements	**Maximum**	Type					
26.) Chemcial application used to calculate storage requirements	**Average**	Type					
27.) Input Minimum Number of Days of Storage	**30.00**	days					
Minimum Storage Volume	36,928.76	gal	139.79	m3			
28.) Choose Chemical Delivery Method	**Tank Truck**	Type					
Bulk Delivery Volume (Tank Truck, Totes, Drums)	4,024.02	gal	15.23	m3			Assumes 45,000 lb per Tank Truck.
Optional: Input Bulk Delivery Volume for Selected Delivery Method (overwrites above calculation)		gal		m3			Not typically used. Use with caution.
Calculate Bulk Delivery Volume * 1.5 (for Truck Delivery Only)	6,036.04	gal	22.85	m3			
Maximum of Above Delivery and Storage Volumes	4,936.66	cf	139.79	m3			
BULK TANKS:							
29.) Input Number of Tanks	**4**	#					
30.) Input Tank Diameter	**10.00**	ft	**3,048.00**	mm	BTD		Greater than 14' tank diameter will require on-site tank fabrication. Maximum diameter allowed for this model is 14'.
Calculate Liquid Height of Tanks	15.71	ft	4789.59	mm			
Use this Tank Height (Liquid Height * 1.2)	19.00	ft	5791.20	mm		**Verify tank height in relationship to the facility structure. Add more tanks or increase diameter if needed.**	Verify tank height within the facility. If indoors, typically 4' lower than the roof framing structure. Assumes extra 20% volume needed for each tank for head space and outlet connection elevation.
Calculate Usable Volume of Each Bulk Tank	9,302.38	gal	35.21	m3			Assumes 20% of the volume of each tank is not usable (needed for head space and outlet connection elevation).
Calculate Volume of Each Bulk Tank	11,162.85	gal	42.26	m3			
31.) Input Number of Rows of Tanks	**2**	#					
Calculate Number of Tanks per Row	2	#					
32.) Input Tank Material (FRP, PE (Polyethylene), PLS (Phenolic Lined Steel))	**FRP**	Type					Typically FRP
33.) Input Clear Distance Around BulkTanks, Day Tanks, Totes or Drums	**4.00**	ft	**1,219.20**	mm	CDT		Typically ≥ 3 ft
Calculate Actual Number of Days of Storage	30.23	days					For bulk tanks, assumes 20% of the volume of each tank is not usable (needed for head space and outlet connection elevation).
TOTES & DRUMS:							
Calculate Number of Totes or Drums	0	#					
34.) Input Number of Rows of Totes or Drums	**1**	#					
Calculate Number of Totes or Drums per Row	0	#					
Length of Each Tote	0.00	ft	0.00	mm			Fixed
Width of Each Tote	0.00	ft	0.00	mm			Fixed
Diameter of Each Drum	0.00	ft	0.00	mm			Fixed
DAY TANKS:							
35.) Are Day Tanks Required?	**Yes**	Y/N					Rule: Day Tanks are only available when the Delivery Method = "Tank Truck".
36.) Input Number of Day Tanks	**1**	#					Suggest 2 Day Tanks
Calculate Day Tank Volume based on Max. Flow/Dose (per tank)	3,692.88	gal	13.98	m3			
Convert Day Tank Volume (per each)	493.67	cf	13.98	m3			
Calculate Day Tank Diameter (per each)	7.00	ft	2133.60	mm	DTD		
Calculate Day Tank Height (per each)	14.00	ft	4267.20	mm			Assumption: H = 2 * D
TRANSFER & METERING PUMPS:							
Number of Transfer Pumps	2	#					Fixed
37.) Input Time to Fill Day Tank	**20.00**	min					Typically fill all day tanks in 20 min
Calculate Number of Active Metering Pumps	4	#					Rule: One active metering pump per each application point.
Calculate Number of Standby Metering Pumps	1	#					Rule: One standby metering pump per each application
38.) Input Number of Additional Standby Metering Pumps	**3**	#					
Calculate Total Number of Metering Pumps	8	#					
39.) Input Clear Distance Around Transfer and Metering Pumps	**4.00**	ft	**1,828.80**	mm	CDP		Typically ≥ 4 ft
Length of Transfer and Metering Pumps	3.00	ft	914.40	mm			Fixed. Conservatively assumes Pulsafeeder metering pump type.
FACILITY SIZING:							
40.) Is this Chemical Room Part of a Multiple Chemical Facility?	**Yes**	Y/N					
41.) Is this Chemical Room Considered the "Start Point" for this Chemical Facility?	**Yes**	Y/N					There should only be one "start point" per chemical facility. Recommend choosing the facility with the greatest width as the "start point"
42.) If this is Part of a Multiple Chemical Facility and is the "Start Point", Input the Summation of Total Number of Pumps from the Other Chemical Rooms Here	**18**	#					Total number of pumps is listed in row 114 of the liquid chemical facility, rows 140, 151, and 162 of the dry chemical facility, and row 122 of the potassium permanganate facility

43.) Input Common Chemical Access Corridor Width	8.00	ft	2,438.40	mm			Input zero if a corridor is not required. Assumes Chem facilities are in series. If Chem facilities are in parallel, input 1/2 total corridor width.
44.) Is Corridor Covered?	Yes	Y/N					
45.) Select Chemical Facility Covering	Building						
46.) Select Chemical Area for this Chemical	None						Only used to help CPES user organize chemicals when multiple chemical buildings are used. Has no impact on sizing calculations or cost.
CONTAINMENT AREA:							
Are Stairs Required into Containment Area?	Yes	Y/N					Typically not needed for tote and drum storage areas.
Is Grating Required in Containment Area?	Yes	Y/N					Typically not needed for tote and drum storage areas.
Width of Stair Access	4.00	ft	1219.20	mm	WS		Fixed
Calculate Containment Area Length	44.00	ft	13411.20	mm			
Calculate Containment Area Width	62.00	ft	18897.60	mm		**Note: verify that this dimension matches the Containment Area Width on the other chemical rooms in this facility. If not, input the larger value in the user overwrite on the room with the shorter dimension**	
47.) Optional: User Overwrite of Containment Area Width	62.00	ft	18,897.60	mm			
Calculate Fire Sprinkler Water Volume	10,912.00	gal	41.31	m3			Assumes 0.2 gpm/sf for 20 min if chemical installed inside a building. If chemical is outside or under a canopy, assume no fire sprinkler water volume.
Calculate 120% of One Storage Tank Volume	13,395.42	gal	50.71	m3			
Calculate 30% of All Tank Volume	13,395.42	gal	50.71	m3			
Calculate Maximum Volume + Fire Flow Volume	24,307.42	gal	92.01	m3			
Tank Pads Volume	942.48	cf	26.69	m3			
Tank Pads Volume	7,050.22	gal	26.69	m3			
Calculate Maximum Volume + Fire Flow Volume + Tank Pad Volume	31,357.65	gal	118.70	m3			
Calculate Maximum Volume + Fire Flow Volume + Tank Pad Volume	4,191.91	cf	118.70	m3			
Calculate Containment Wall Height (including freeboard)	2.25	ft	685.80	mm		**Note: verify that this dimension matches the Containment Wall Height on the other chemical rooms in this facility. If not, input the larger value in the user overwrite on the room with the shorter dimension**	120% of 1 tank volume or 30% of all tank volume whichever is greater + fire flow volume + 6" freeboard. Should be ≤ 4.5'.
48.) Optional: User Overwrite of Containment Wall Height	2.25	ft	685.80	mm			
49.) Input Depth of Burial	1.75	ft	533.40	mm	DB		
50.) Input Cutback Slope	1.00	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
51.) Input Over Excavation Depth	1.00	ft	0.00	mm	OEXD		

Mechanical Sizing Requirements:

Pipe Name	Input Velocity	Unit (English)	Input Velocity	Unit (Metric)	Standard Pipe Size	Unit (English)	Nominal Pipe Size
Chemical Transfer Pump Suction Header Piping	2.00	fps	0.61	m/s	6.50	in	150.00
Chemical Transfer Pump Discharge Header Piping	6.00	fps	1.83	m/s	4.00	in	100.00
Chemical Metering Pump Suction Header Piping	2.00	fps	0.61	m/s	1.00	in	25.00
Chemical Metering Pump Discharge Header Piping	6.00	fps	1.83	m/s	1.00	in	25.00

Mechanical Material Requirements:

Pipe Name	Pipe ID	Installation Type	Pipe Material	Pipe Lining Material	Pipe Coating Material	Pipe Length	# Elbows
Chemical Transfer Pump Suction Header Piping	CTSH	Exposed	PVC	NA	NA	44.00	8.00
Chemical Transfer Pump Discharge Header Piping	CTDH	Exposed	PVC	NA	NA	44.00	8.00
Chemical Metering Pump Suction Header Piping	LCSH	Exposed	PVC	NA	NA	106.00	32.00
Chemical Metering Pump Discharge Header Piping	LCDH	Exposed	PVC	NA	NA	106.00	32.00
						L+W	#MP*4

Electrical User Inputs and Sizing Requirements:

52.) Is this a "Critical" Facility (requiring standby power)?	No	Y/N	
53.) Is there SWGR?	No		

Electrical Equipment Lengths:

Item	Quantity	HP per Each	AFD's Required?	MCC Spaces for Motor Starters	MCC Spaces for AFD's less than 50hp)	MCC Spaces for Breakers	MCC Total MCC Spaces
Metering Pumps	26.00	0.50	No	52.00	0.00	0.00	
User Defined Item #1	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #2	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #3	0.00	0.00	No	0.00	0.00	0.00	
TOTAL		**13.00**		**52.00**	**0.00**	**0.00**	**52.00**

Electrical Equipment Widths:

Equipment	Depth (ft)
MCC	1.67
Small AFD's	0.00
Large AFD's	0.00
Switchgear	0.00
Maximum Depth	1.67

Clear Distances:

Clear Distance	Width	Length	Comment	
CD1		3.00	Clear Distance between wall and MCC	Typically 3 feet
CD2		1.00	Clear Distance between MCC and Small AFD	Typically 1 foot
CD3		0.00	Clear Distance between Small AFD and Large AFD	Typically Zero
CD4		0.00	Clear Distance between Large AFD and Switchgear	Typically Zero

CD5		0.00	Clear Distance between Switchgear and Contingency Space	Typically Zero			
CD6	4.00		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)				
CD7	3.00		Clear Distance in front of Equipment	Typipcally 3 feet			
Contingency Length		0.00	Contingency length	Typically Zero			
Electric Room Length (ft):							
CD1	3.00						
MCC	15.00						
CD2	1.00						
Small AFD's	0.00						
CD3	0.00						
Large AFD's	0.00						
CD4	0.00						
Swithgear	0.00						
CD5	0.00						
Contingency	0.00						
Total Length	19.00						
Electric Room Width (ft):							
CD6	0.00	If there is no switchgear, this distance will be Zero.					
Maximum Equipment Depth	1.67						
CD7	3.00						
Total Width	4.67						
COST TABLE FOR TANKS & PUMPS:	**Unit Cost**						
Tanks (Installed Cost per Gallon)							
FRP	***$2.37***						
Polyethylene (PE)	$ 2.25						
Phenolic Lined Steel (PLS)	***$6.41***						
Chemical Feed Pumps (Cost per Each)	***$10,658.90***						

Estimating Dimensions:	Value English	Unit (English)	Value (Metric)	Unit (Metric)	Name	Comment	Red Flags
Logic Tests ("1" = Yes, "0" = No):							
Is this Chemical Feed System Included?	1						
Is the Method of Delivery "Tank Truck"?	1						
Is Day Tank Required? (1 = Yes, 0 = No)	1						
Tank Truck without Day Tank (True or False)	FALSE						
Tank Truck with Day Tank (True or False)	TRUE						
Tank Truck without Day Tank (1 = Yes, 0 = No)	0					Tank Truck without Day Tank	
Tank Truck with Day Tank (1 = Yes, 0 = No)	1					Tank Truck without Day Tank	
Is the Method of Delivery "Tote"?	0					Tote	
Is the Method of Delivery "Drum"?	0					Drum	
Length of Module (Tank Truck)	44.00	ft	13411.20	mm			
Length of Module (Tote)	0.00	ft	0.00	mm			
Length of Module (Drum)	0.00	ft	0.00	mm			
Width of Module (Tank Truck without Transfer Pump and Day Tank)	0.00	ft	0.00	mm			
Width of Module (Tank Truck with Transfer Pump and Day Tank)	62.00	ft	18897.60	mm			
Width of Module (Tote)	0.00	ft	0.00	mm			
Width of Module (Drum)	0.00	ft	0.00	mm			
Area of Module	0.00	sf	0.00	m2			
Number of Bulk Tanks (each)	4	#					
Diameter of Bulk Tank	10.00	ft	3048.00	mm			
Volume of Each Bulk Tank	11162.85	gal	42.26	m3			
Bulk Tank Material	FRP	Type					
Number of Day Tanks (each)	1	#					
Diameter of Day Tank	7.00	ft					
Volume of Each Day Tank	4030.38	gal	15.26	m3			
Number of Transfer Pumps	2	#					
Transfer Pump Capacity (each)	201.52	gpm	0.00	l/min		Assume fill each tank in 20 min	
Number of Metering Pumps	8	#					
Module Covered? ("1" = YES, "0" = NO)	0						
If Module Exists, Is it Covered? ("1" = Yes, "0" = No)	0						
Containment Wall Height	2.25	ft	685.80	mm			
Slab on Grade Thickness	**9.00**	in	**228.60**	mm		Model based on 9"	
Slab on Grade Thickness	0.75	ft	228.60	mm			
Containment Wall Thickness	**8.00**	in	**203.20**	mm		Model based on 8"	
Containment Wall Thickness	0.67	ft	203.20	mm			
Tank Pad / Metering Pump Pad Height	**3.00**	ft	**914.40**	mm	EPH		
Corridor							
Length	44.00	ft	13411.20	mm			
Width	8.00	ft	2438.40	mm			
Area	352.00	sf	32.70	m2			
Corridor Covered? ("1" = YES, "0" = NO)	1						
Electrical Room:							
Slab on Grade:							
Length	20.33	ft	6197.60	mm			
Width	6.00	ft	1828.80	mm			
Concrete Thickness	**12.00**	in	**304.80**	mm		Model based on 12"	
Concrete Thickness	1.00	ft	304.80	mm			
Walls:							
Height = FBD	10.00	ft				Fixed	
Concrete Thickness	**8.00**	in	**203.20**	mm		Model based on 8"	
Concrete Thickness	0.67	ft	203.20	mm			
Overall Dimensions							
Containment Area Length	44.00	ft	13411.20	mm			
Containment Area Width	62.00	ft	18897.60	mm			
Containment Area	2728.00	sf	253.44	m2			
Corridor Area Length	44.00	ft	13411.20	mm			
Corridor Area Width	8.00	ft	2438.40	mm			
Corridor Area	352.00	sf	32.70	m2			
Electrical Area Length	20.33	ft	6197.60	mm			
Electrical Area Width	6.00	ft	1828.80	mm			
Electrical Room Area	122.00	sf	11.33	m2			
Chemical Facility Area	3202.00	sf	297.48	m2			
Covered Chemical Area (Building)	3202.00	sf	297.48	m2			
Covered Chemical Area (Canopy)	0.00	sf	0.00	m2			
Total Covered Area	3324.00	sf	308.81	m2			

Excavation Depth	3.50	ft	1066.80	mm			

COST ESTIMATE

Description	Quantity (English)	Unit (English)	Quantity (Metric)	Unit (Metric)	$/Unit	Total Cost	User Over-Write
SITEWORK:							
Excavation	522.81	CY	399.72	m3	*$6.72*	$3,515	
Imported Structural Backfill	237.19	CY	181.34	m3	*$50.94*	$12,083	
Native Backfill	51.72	CY	39.54	m3	*$8.27*	$427	
Haul Excess	471.09	CY	360.17	m3	*$8.27*	$3,894	
Allowance for Misc Items	5%				$19,918.69	$996	
Subtotal						$20,915	
CONCRETE:							
Slab on Grade	85.90	CY	65.68	m3	*$490.62*	$42,145	
Containment Walls	11.78	CY	9.00	m3	*$880.79*	$10,374	
Bulk Tank Pads	68.42	CY	52.31	m3	*$490.62*	$33,566	
Day Tank Pads	3.52	CY	2.69	m3	*$490.62*	$1,727	
Transfer Pump Pads	1.33	CY	1.02	m3	*$490.62*	$654	
Metering Pump Pads	5.33	CY	4.08	m3	*$490.62*	$2,617	
Corridor							
Slab on Grade	12.22	CY	9.34	m3	*$490.62*	$5,996	
Electrical Room							
Slab on Grade	4.52	CY	3.45	m3	*$490.62*	$2,217	
Allowance for Misc Items	5%				$99,295.66	$4,965	
Subtotal						$104,260	
MASONRY:	**Moderate**						
Chemical Building	3080.00	SF	286.14	m2	*$198.37*	$610,970	
Electrical Room	122.00	SF	11.33	m2	*$165.31*	$20,167	
Subtotal	3202.00					$631,137	
METALS:							
Canopy	0.00	SF	0.00	m2	*$41.80*	$0	
Metal Stairway	1	EA			$8,327.28	$8,327	
Grating	1	EA			$1,998.55	$1,999	
Allowance for Misc Items	10%				$10,325.82	$1,033	
Subtotal						$11,358	
EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
Bulk Tank	4	EA			*$26,489.89*	$105,960	
Day Tank	1	EA			*$11,442.30*	$11,442	
Transfer Pump	2	EA			*$10,658.90*	$21,318	
Metering Pump	8	EA			*$10,658.90*	$85,271	
Allowance for Misc Items	10%				$223,990.84	$22,399	
Subtotal						$246,390	
INSTRUMENTS & CONTROLS:							
Instruments							
Chemical Tank Radar Level Transmitters	4	EA			*$1,043.16*	$4,173	
Chemical Tank Beacons	4	EA			*$1,043.16*	$4,173	
Day Tank Differential Pressure Transmitter	1	EA			*$1,043.16*	$1,043	
Drum or Tote Weigh Scale	0	EA			*$1,390.89*	$0	
Metering Pump Discharge Pressure Switch	8	EA			*$695.44*	$5,564	
Magmeter	4	EA			*$695.44*	$2,782	
Sump Pump Float Switch	1	EA			*$347.72*	$348	
Eyewash	1	EA			*$1,043.16*	$1,043	
Number of Analog I/O Counts	21	EA			*$264.27*	$5,550	
Number of Digital I/O Counts	70	EA			*$62.59*	$4,381	
Number of Local Panels	1	EA			*$13,074.33*	$13,074	
Number of PLCs	1	EA			*$13,908.86*	$13,909	
I&C Conduit & Wire	1012.00	LF	308.46	m	*$12.06*	$12,204	
Allowance for Misc Items	10%				$68,242.47	$6,824	
Subtotal						$75,067	
MECHANICAL:							
Pipe							
Chemical Transfer Pump Suction Header Piping-CTSH (6.5-inch, Exposed, PVC)	44.00	LF	13.41	m	*$42.14*	$1,854	
Chemical Transfer Pump Discharge Header Piping-CTDH (4-inch, Exposed, PVC)	44.00	LF	13.41	m	*$28.95*	$1,274	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	106.00	LF	32.31	m	*$13.11*	$1,390	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	106.00	LF	32.31	m	*$13.11*	$1,390	
Elbows							
Chemical Transfer Pump Suction Header Piping-CTSH (6.5-inch, Exposed, PVC)	8	EA			*$146.80*	$1,174	
Chemical Transfer Pump Discharge Header Piping-CTDH (4-inch, Exposed, PVC)	8	EA			*$84.65*	$677	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	32	EA			*$10.06*	$322	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	32	EA			*$10.06*	$322	
Tees							
Chemical Transfer Pump Suction Header Piping-CTSH (6.5-inch, Exposed, PVC)	2	EA			*$218.62*	$437	
Chemical Transfer Pump Discharge Header Piping-CTDH (4-inch, Exposed, PVC)	2	EA			*$124.01*	$248	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	8	EA			*$10.47*	$84	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	8	EA			*$10.47*	$84	
End Caps							
Chemical Transfer Pump Suction Header Piping-CTSH (6.5-inch, Exposed, PVC)	2	EA			*$72.81*	$146	
Chemical Transfer Pump Discharge Header Piping-CTDH (4-inch, Exposed, PVC)	2	EA			*$42.28*	$85	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	2	EA			*$5.65*	$11	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	2	EA			*$5.65*	$11	
Valves							
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	4	EA			*$1,341.93*	$5,368	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	4	EA			*$757.94*	$3,032	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	16	EA			*$57.14*	$914	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC, V-902, Diaphragm)	16	EA			*$57.14*	$914	
Allowance for Misc Items	10%				$16,608.36	$1,661	
Subtotal						$21,397	
ELECTRICAL:							

# MCC Sections	9	#			$10,730.27	$96,572	
Switchgear	0	EA			$49,359.23	$0	
Adjustable Frequency Drives							
Metering Pumps	0	EA			$8,931.12	$0	
User Defined Item #1	0	EA			$8,865.56	$0	
User Defined Item #2	0	EA			$8,865.56	$0	
User Defined Item #3	0	EA			$8,865.56	$0	
Electrical Conduit & Wire	1144.00	LF	348.69	m	$12.06	$13,795	
Allowance for Misc Items	10%				$110,367.88	$11,037	
Subtotal						$121,405	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00				0.00	$0	
Item 2 Description	0.00				0.00	$0	
Item 3 Description	0.00				0.00	$0	
Item 4 Description	0.00				0.00	$0	
Item 5 Description	0.00				0.00	$0	
Item 6 Description	0.00				0.00	$0	
Item 7 Description	0.00				0.00	$0	
Item 8 Description	0.00				0.00	$0	
Item 9 Description	0.00				0.00	$0	
Item 10 Description	0.00				0.00	$0	
Item 11 Description	0.00				0.00	$0	
Item 12 Description	0.00				0.00	$0	
Item 13 Description	0.00				0.00	$0	
Item 14 Description	0.00				0.00	$0	
Item 15 Description	0.00				0.00	$0	
Subtotal						$0	
Subtotal						$1,231,929	
ALLOWANCES:		User Override					
Finishes Allowance	2.00%		$1,368,810	$27,376			
I&C Allowance	2.00%		$1,368,810	$27,376			
Mechanical Allowance	4.00%		$1,368,810	$54,752			
Electrical Allowance	2.00%		$1,368,810	$27,376			
					Facility Cost Name		
Facility Cost	**3,202**	**Building SF**	**$427.49**	**$1,368,810**	CFLFC01		
Facility Cost with Standard Additional Project Costs Added	**3,202**	**Building SF**	**$519.47**	**$1,663,337**	CFLFC02		
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**3,202**	**Building SF**	**$890.98**	**$2,852,921**	CFLFC03		
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**3,202**	**Building SF**	**$733.22**	**$2,347,755**	CFLFC05		
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**3,202**	**Building SF**	**$890.98**	**$2,852,921**	CFLFC06		

Liquid Chemical Storage & Feed - (Liquid Polymer)

Located in Chemical Building A

Is This Facility Included in My Project? Yes

Is the Facility Storage Only (no metering pumps)?	No	Y/N					
		Overwrite Value					
Select Chemical	Liquid Polymer		Select "Other" from the drop down list if using a different chemical.				
Percent Active Chemical, % w/w	100.00%		This is the intended feed strength to the process. Inputting a value in the yellow cell overwrites the cell in column "C".				For Fluoride systems, concentration must include the Available Fluoride Ion (AFI) concentration. Typically 79.2% AFI for 23% as HFA. (e.g., 23% as HFA x 79.2% AFI = 18.22% as F)
Active Chemical Form for Dosage Basis	Polymer		Inputting a value in the yellow cell overwrites the cell in column "C".				
Bulk Chemical Specific Gravity	1.10		Inputting a value in the yellow cell overwrites the cell in column "C".				
Active lb/gal solution	9.18	lb/gal	1100.00	kg/m3			
Process User Inputs:	**Value (English)**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Red Flags**	**Comment**
FLOW AND CHEMICAL ADDITION							
Application #1							
1.) Minimum flow to application point	30.00	mgd	113.56	ML/d			Input the flow that the selected dose will be applied to.
2.) Average flow to application point	75.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to.
3.) Maximum flow to applicatoin point	160.00	mgd	605.67	ML/d			Input the flow that the selected dose will be applied to.
4.) Minimum chemical addition	0.25	mg/L					Input the dose that corresponds to the flow input above.
5.) Average chemical addition	0.75	mg/L					Input the dose that corresponds to the flow input above.
6.) Maximum chemical addition	1.50	mg/L					Input the dose that corresponds to the flow input above.
7.) Input Number of Equal Simultaneous Application Points	4	#					
8.) Hours of addition per day	24.00	hr					Input the total number of hours that the chemical is fed during the day.
Application #2							
9.) Minimum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
10.) Average flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
11.) Maximum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
12.) Minimum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
13.) Average chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
14.) Maximum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
15.) Input Number of Equal Simultaneous Application Points	0	#					
16.) Hours of addition per day	0.00	hr					Input the total number of hours that the chemical is fed during the day.
Application #3							
17.) Minimum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
18.) Average flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
19.) Maximum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
20.) Minimum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
21.) Average chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
22.) Maximum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
23.) Input Number of Equal Simultaneous Application Points	0	#					
24.) Hours of addition per day	0.00	hr					Input the total number of hours that the chemical is fed during the day.
CHEMICAL QUANTITIES AND FLOW							
Application Point #1 Chemical Usage:							
Minimum as "dry" chemical	62.59	lb/d	28.39	kg/d			
Average as "dry" chemical	469.43	lb/d	212.93	kg/d			
Maximum as "dry" chemical	2,002.90	lb/d	908.50	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.07	gph	0.27	L/h			
Average at feed concentration	0.53	gph	2.02	L/h			
Maximum at feed concentration	2.27	gph	8.60	L/h			
Calculate Chemical Metering Pump Flow Turndown	32.00	:1				**Note: Pump turndown is > 20, proceed with the design with caution**	Should be < 20:1, If ≥ 20:1, proceed with caution.
Application Point #2 Chemical Usage:							
Minimum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Average as "dry" chemical	0.00	lb/d	0.00	kg/d			
Maximum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.00	gph	0.00	L/h			
Average at feed concentration	0.00	gph	0.00	L/h			
Maximum at feed concentration	0.00	gph	0.00	L/h			

Calculate Chemical Metering Pump Flow Turndown	0.00	:1					Should be < 20:1, If ≥ 20:1, proceed with caution.
Application Point #3 Chemical Usage:							
Minimum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Average as "dry" chemical	0.00	lb/d	0.00	kg/d			
Maximum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.00	gph	0.00	L/h			
Average at feed concentration	0.00	gph	0.00	L/h			
Maximum at feed concentration	0.00	gph	0.00	L/h			
Calculate Chemical Metering Pump Flow Turndown	0.00	:1					Should be < 20:1, If ≥ 20:1, proceed with caution.
Whole Plant Chemical Usage for Storage Calcs:							
Minimum	62.59	lb/d	28.39	kg/d			
Average	469.43	lb/d	212.93	kg/d			
Maximum	2,002.90	lb/d	908.50	kg/d			
Max Flow Average Dose Daily Usage	1,001.45	lb/d					
Whole Plant # of Days of Storage							
Maximum Flow and Average Dose	30.00	days					
CHEMICAL STORAGE INPUTS							
25.) Flow used to calculate storage requirements	Maximum	Type					
26.) Chemcial application used to calculate storage requirements	Average	Type					
27.) Input Minimum Number of Days of Storage	30.00	days					
Minimum Storage Volume	3,272.73	gal	12.39	m3			
28.) Choose Chemical Delivery Method	Tank Truck	Type					
Bulk Delivery Volume (Tank Truck, Totes, Drums)	4,901.99	gal	18.56	m3			Assumes 45,000 lb per Tank Truck.
Optional: Input Bulk Delivery Volume for Selected Delivery Method (overwrites above calculation)		gal		m3			Not typically used. Use with caution.
Calculate Bulk Delivery Volume * 1.5 (for Truck Delivery Only)	7,352.99	gal	27.83	m3			
Maximum of Above Delivery and Storage Volumes	982.95	cf	27.83	m3			
BULK TANKS:							
29.) Input Number of Tanks	1	#					
30.) Input Tank Diameter	10.00	ft	3,048.00	mm	BTD		Greater than 14' tank diameter will require on-site tank fabrication. Maximum diameter allowed for this model is 14'.
Calculate Liquid Height of Tanks	12.52	ft	3814.67	mm			
Use this Tank Height (Liquid Height * 1.2)	16.00	ft	4876.80	mm		**Verify tank height in relationship to the facility structure. Add more tanks or increase diameter if needed.**	Verify tank height within the facility. If indoors, typically 4' lower than the roof framing structure. Assumes extra 20% volume needed for each tank for head space and outlet connection elevation.
Calculate Usable Volume of Each Bulk Tank	7,833.58	gal	29.65	m3			Assumes 20% of the volume of each tank is not usable (needed for head space and outlet connection elevation).
Calculate Volume of Each Bulk Tank	9,400.30	gal	35.58	m3			
31.) Input Number of Rows of Tanks	1	#					
Calculate Number of Tanks per Row	1	#					
32.) Input Tank Material (FRP, PE (Polyethylene), PLS (Phenolic Lined Steel))	FRP	Type					Typically FRP
33.) Input Clear Distance Around BulkTanks, Day Tanks, Totes or Drums	4.00	ft	1,219.20	mm	CDT		Typically ≥ 3 ft
Calculate Actual Number of Days of Storage	71.81	days					For bulk tanks, assumes 20% of the volume of each tank is not usable (needed for head space and outlet connection elevation).
TOTES & DRUMS:							
Calculate Number of Totes or Drums	0	#					
34.) Input Number of Rows of Totes or Drums	1	#					
Calculate Number of Totes or Drums per Row	0	#					
Length of Each Tote	0.00	ft	0.00	mm			Fixed
Width of Each Tote	0.00	ft	0.00	mm			Fixed
Diameter of Each Drum	0.00	ft	0.00	mm			Fixed
DAY TANKS:							
35.) Are Day Tanks Required?	Yes	Y/N					Rule: Day Tanks are only available when the Delivery Method = "Tank Truck".
36.) Input Number of Day Tanks	1	#					Suggest 2 Day Tanks
Calculate Day Tank Volume based on Max. Flow/Dose (per tank)	218.18	gal	0.83	m3			
Convert Day Tank Volume (per each)	29.17	cf	0.83	m3			
Calculate Day Tank Diameter (per each)	3.00	ft	914.40	mm	DTD		
Calculate Day Tank Height (per each)	6.00	ft	1828.80	mm			Assumption: H = 2 * D
TRANSFER & METERING PUMPS:							
Number of Transfer Pumps	2	#					Fixed
37.) Input Time to Fill Day Tank	20.00	min					Typically fill all day tanks in 20 min
Calculate Number of Active Metering Pumps	4	#					Rule: One active metering pump per each application point.
Calculate Number of Standby Metering Pumps	1	#					Rule: One standby metering pump per each application
38.) Input Number of Additional Standby Metering Pumps	0	#					
Calculate Total Number of Metering Pumps	5	#					
39.) Input Clear Distance Around Transfer and Metering Pumps	4.00	ft	1,828.80	mm	CDP		Typically ≥ 4 ft
Length of Transfer and Metering Pumps	3.00	ft	914.40	mm			Fixed. Conservatively assumes Pulsafeeder metering pump type.
FACILITY SIZING:							
40.) Is this Chemical Room Part of a Multiple Chemical Facility?	Yes	Y/N					
41.) Is this Chemical Room Considered the "Start Point" for this Chemical Facility?	No	Y/N					There should only be one "start point" per chemical facility. Recommend choosing the facility with the greatest width as the "start point"
42.) If this is Part of a Multiple Chemical Facility and is the "Start Point", Input the Summation of Total Number of Pumps from the Other Chemical Rooms Here		#					Total number of pumps is listed in row 114 of the liquid chemical facility, rows 140, 151, and 162 of the dry chemical facility, and row 122 of the potassium permanganate facility

43.) Input Common Chemical Access Corridor Width	8.00	ft	2,438.40	mm			Input zero if a corridor is not required. Assumes Chem facilities are in series. If Chem facilities are in parallel, input 1/2 total corridor width.
44.) Is Corridor Covered?	Yes	Y/N					
45.) Select Chemical Facility Covering	Building						
46.) Select Chemical Area for this Chemical	A						Only used to help CPES user organize chemicals when multiple chemical buildings are used. Has no impact on sizing calculations or cost.
CONTAINMENT AREA:							
Are Stairs Required into Containment Area?	Yes	Y/N					Typically not needed for tote and drum storage areas.
Is Grating Required in Containment Area?	Yes	Y/N					Typically not needed for tote and drum storage areas.
Width of Stair Access	4.00	ft	1219.20	mm	WS		Fixed
Calculate Containment Area Length	29.00	ft	8839.20	mm			
Calculate Containment Area Width	62.00	ft	18897.60	mm		**Note: verify that this dimension matches the Containment Area Width on the other chemical rooms in this facility. If not, input the larger value in the user overwrite on the room with the shorter dimension**	
47.) Optional: User Overwrite of Containment Area Width	62.00	ft	18,897.60	mm			
Calculate Fire Sprinkler Water Volume	7,192.00	gal	27.22	m3			Assumes 0.2 gpm/sf for 20 min if chemical installed inside a building. If chemical is outside or under a canopy, assume no fire sprinkler water volume.
Calculate 120% of One Storage Tank Volume	11,280.36	gal	42.70	m3			
Calculate 30% of All Tank Volume	2,820.09	gal	10.68	m3			
Calculate Maximum Volume + Fire Flow Volume	18,472.36	gal	69.93	m3			
Tank Pads Volume	235.62	cf	6.67	m3			
Tank Pads Volume	1,762.56	gal	6.67	m3			
Calculate Maximum Volume + Fire Flow Volume + Tank Pad Volume	20,234.91	gal	76.60	m3			
Calculate Maximum Volume + Fire Flow Volume + Tank Pad Volume	2,705.01	cf	76.60	m3			
Calculate Containment Wall Height (including freeboard)	2.25	ft	685.80	mm		**Note: verify that this dimension matches the Containment Wall Height on the other chemical rooms in this facility. If not, input the larger value in the user overwrite on the room with the shorter dimension**	120% of 1 tank volume or 30% of all tank volume whichever is greater + fire flow volume + 6" freeboard. Should be ≤ 4.5'.
48.) Optional: User Overwrite of Containment Wall Height	2.25	ft	685.80	mm			
49.) Input Depth of Burial	1.75	ft	0.00	mm	DB		
50.) Input Cutback Slope	1.00	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
51.) Input Over Excavation Depth	1.00	ft	0.00	mm	OEXD		

Mechanical Sizing Requirements:

Pipe Name	Input Velocity	Unit (English)	Input Velocity	Unit (Metric)	Standard Pipe Size	Unit (English)	Nominal Pipe Size
Chemical Transfer Pump Suction Header Piping	2.00	fps	0.61	m/s	1.50	in	40.00
Chemical Transfer Pump Discharge Header Piping	6.00	fps	1.83	m/s	1.00	in	25.00
Chemical Metering Pump Suction Header Piping	2.00	fps	0.61	m/s	1.00	in	25.00
Chemical Metering Pump Discharge Header Piping	6.00	fps	1.83	m/s	1.00	in	25.00

Mechanical Material Requirements:

Pipe Name	Pipe ID	Installation Type	Pipe Material	Pipe Lining Material	Pipe Coating Material	Pipe Length	# Elbows
Chemical Transfer Pump Suction Header Piping	CTSH	Exposed	PVC	NA	NA	29.00	8.00
Chemical Transfer Pump Discharge Header Piping	CTDH	Exposed	PVC	NA	NA	29.00	8.00
Chemical Metering Pump Suction Header Piping	LCSH	Exposed	PVC	NA	NA	91.00	20.00
Chemical Metering Pump Discharge Header Piping	LCDH	Exposed	PVC	NA	NA	91.00	20.00
						L+W	#MP*4

Electrical User Inputs and Sizing Requirements:

52.) Is this a "Critical" Facility (requiring standby power)?	No	Y/N
53.) Is there SWGR?	No	

Electrical Equipment Lengths:

Item	Quantity	HP per Each	AFD's Required?	MCC Spaces for Motor Starters	MCC Spaces for AFD's less than 50hp)	MCC Spaces for Breakers	MCC Total MCC Spaces
Metering Pumps	0.00	0.50	No	0.00	0.00	0.00	
User Defined Item #1	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #2	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #3	0.00	0.00	No	0.00	0.00	0.00	
TOTAL		**0.00**		**0.00**	**0.00**	**0.00**	**0.00**

Electrical Equipment Widths:

Equipment	Depth (ft)
MCC	0.00
Small AFD's	0.00
Large AFD's	0.00
Switchgear	0.00
Maximum Depth	0.00

Clear Distances:

Clear Distance	Width	Length	Comment	
CD1		3.00	Clear Distance between wall and MCC	Typically 3 feet
CD2		1.00	Clear Distance between MCC and Small AFD	Typically 1 foot
CD3		0.00	Clear Distance between Small AFD and Large AFD	Typically Zero
CD4		0.00	Clear Distance between Large AFD and Switchgear	Typically Zero

CD5		0.00	Clear Distance between Switchgear and Contingency Space	Typically Zero			
CD6	4.00		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)				
CD7	3.00		Clear Distance in front of Equipment	Typipcally 3 feet			
Contingency Length		0.00	Contingency length	Typically Zero			
Electric Room Length (ft):							
CD1	3.00						
MCC	0.00						
CD2	1.00						
Small AFD's	0.00						
CD3	0.00						
Large AFD's	0.00						
CD4	0.00						
Swithgear	0.00						
CD5	0.00						
Contingency	0.00						
Total Length	0.00						
Electric Room Width (ft):							
CD6	0.00	If there is no switchgear, this distance will be Zero.					
Maximum Equipment Depth	0.00						
CD7	3.00						
Total Width	0.00						
COST TABLE FOR TANKS & PUMPS:	**Unit Cost**						
Tanks (Installed Cost per Gallon)							
FRP	***$2.42***						
Polyethylene (PE)	$ 2.25						
Phenolic Lined Steel (PLS)	***$6.41***						
Chemical Feed Pumps (Cost per Each)	***$10,658.90***						

Estimating Dimensions:	**Value English**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Comment**	**Red Flags**
Logic Tests ("1" = Yes, "0" = No):							
Is this Chemical Feed System Included?	1						
Is the Method of Delivery "Tank Truck"?	1						
Is Day Tank Required? (1 = Yes, 0 = No)	1						
Tank Truck without Day Tank (True or False)	FALSE						
Tank Truck with Day Tank (True or False)	TRUE						
Tank Truck without Day Tank (1 = Yes, 0 = No)	0					Tank Truck without Day Tank	
Tank Truck with Day Tank (1 = Yes, 0 = No)	1					Tank Truck without Day Tank	
Is the Method of Delivery "Tote"?	0					Tote	
Is the Method of Delivery "Drum"?	0					Drum	
Length of Module (Tank Truck)	29.00	ft	8839.20	mm			
Length of Module (Tote)	0.00	ft	0.00	mm			
Length of Module (Drum)	0.00	ft	0.00	mm			
Width of Module (Tank Truck without Transfer Pump and Day Tank)	0.00	ft	0.00	mm			
Width of Module (Tank Truck with Transfer Pump and Day Tank)	62.00	ft	18897.60	mm			
Width of Module (Tote)	0.00	ft	0.00	mm			
Width of Module (Drum)	0.00	ft	0.00	mm			
Area of Module	0.00	sf	0.00	m2			
Number of Bulk Tanks (each)	1	#					
Diameter of Bulk Tank	10.00	ft	3048.00	mm			
Volume of Each Bulk Tank	9400.30	gal	35.58	m3			
Bulk Tank Material	FRP	Type					
Number of Day Tanks (each)	1	#					
Diameter of Day Tank	3.00	ft					
Volume of Each Day Tank	317.26	gal	1.20	m3			
Number of Transfer Pumps	2	#					
Transfer Pump Capacity (each)	15.86	gpm	0.00	l/min		Assume fill each tank in 20 min	
Number of Metering Pumps	5	#					
Module Covered? ("1" = YES, "0" = NO)	0						
If Module Exists, Is it Covered? ("1" = Yes, "0" = No)	0						
Containment Wall Height	2.25	ft	685.80	mm			
Slab on Grade Thickness	**9.00**	in	**228.60**	mm		Model based on 9"	
Slab on Grade Thickness	0.75	ft	228.60	mm			
Containment Wall Thickness	**8.00**	in	**203.20**	mm		Model based on 8"	
Containment Wall Thickness	0.67	ft	203.20	mm			
Tank Pad / Metering Pump Pad Height	**3.00**	ft	**914.40**	mm	EPH		
Corridor							
Length	29.00	ft	8839.20	mm			
Width	8.00	ft	2438.40	mm			
Area	232.00	sf	21.55	m2			
Corridor Covered? ("1" = YES, "0" = NO)	1						
Electrical Room:							
Slab on Grade:							
Length	0.00	ft	0.00	mm			
Width	0.00	ft	0.00	mm			
Concrete Thickness	**12.00**	in	**304.80**	mm		Model based on 12"	
Concrete Thickness	1.00	ft	304.80	mm			
Walls:							
Height = FBD	10.00	ft				Fixed	
Concrete Thickness	**8.00**	in	**203.20**	mm		Model based on 8"	
Concrete Thickness	0.67	ft	203.20	mm			
Overall Dimensions							
Containment Area Length	29.00	ft	8839.20	mm			
Containment Area Width	62.00	ft	18897.60	mm			
Containment Area	1798.00	sf	167.04	m2			
Corridor Area Length	29.00	ft	8839.20	mm			
Corridor Area Width	8.00	ft	2438.40	mm			
Corridor Area	232.00	sf	21.55	m2			
Electrical Area Length	0.00	ft	0.00	mm			
Electrical Area Width	0.00	ft	0.00	mm			
Electrical Room Area	0.00	sf	0.00	m2			
Chemical Facility Area	2030.00	sf	188.59	m2			
Covered Chemical Area (Building)	2030.00	sf	188.59	m2			
Covered Chemical Area (Canopy)	0.00	sf	0.00	m2			
Total Covered Area	2030.00	sf	188.59	m2			

Excavation Depth	3.50	ft	1066.80	mm			
COST ESTIMATE							
Description	**Quantity (English)**	**Unit (English)**	**Quantity (Metric)**	**Unit (Metric)**	**$/Unit**	**Total Cost**	**User Over-Write**
SITEWORK:							
Excavation	345.03	CY	263.80	m3	$6.72	$2,320	
Imported Structural Backfill	150.37	CY	114.97	m3	$50.94	$7,660	
Native Backfill	44.92	CY	34.34	m3	$8.27	$371	
Haul Excess	300.12	CY	229.46	m3	$8.27	$2,481	
Allowance for Misc Items	5%				$12,831.58	$642	
Subtotal						$13,473	
CONCRETE:							
Slab on Grade	57.18	CY	43.72	m3	$490.62	$28,054	
Containment Walls	6.67	CY	5.10	m3	$880.79	$5,872	
Bulk Tank Pads	17.10	CY	13.08	m3	$490.62	$8,392	
Day Tank Pads	1.43	CY	1.09	m3	$490.62	$699	
Transfer Pump Pads	1.33	CY	1.02	m3	$490.62	$654	
Metering Pump Pads	3.33	CY	2.55	m3	$490.62	$1,635	
Corridor							
Slab on Grade	8.06	CY	6.16	m3	$490.62	$3,952	
Electrical Room							
Slab on Grade	0.00	CY	0.00	m3	$490.62	$0	
Allowance for Misc Items	5%				$49,259.06	$2,463	
Subtotal						$51,722	
MASONRY:	Moderate						
Chemical Building	2030.00	SF	188.59	m2	$198.37	$402,685	
Electrical Room	0.00	SF	0.00	m2	$165.31	$0	
Subtotal	2030.00					$402,685	
METALS:							
Canopy	0.00	SF	0.00	m2	$41.80	$0	
Metal Stairway	1	EA			$8,327.28	$8,327	
Grating	1	EA			$1,998.55	$1,999	
Allowance for Misc Items	10%				$10,325.82	$1,033	
Subtotal						$11,358	
EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
Bulk Tank	1	EA			$22,771.38	$22,771	
Day Tank	1	EA			$3,608.62	$3,609	
Transfer Pump	2	EA			$10,658.90	$21,318	
Metering Pump	5	EA			$10,658.90	$53,294	
Allowance for Misc Items	10%				$100,992.28	$10,099	
Subtotal						$111,092	
INSTRUMENTS & CONTROLS:							
Instruments							
Chemical Tank Radar Level Transmitters	1	EA			$1,043.16	$1,043	
Chemical Tank Beacons	1	EA			$1,043.16	$1,043	
Day Tank Differential Pressure Transmitter	1	EA			$1,043.16	$1,043	
Drum or Tote Weigh Scale	0	EA			$1,390.89	$0	
Metering Pump Discharge Pressure Switch	5	EA			$695.44	$3,477	
Magmeter	4	EA			$695.44	$2,782	
Sump Pump Float Switch	1	EA			$347.72	$348	
Eyewash	1	EA			$1,043.16	$1,043	
Number of Analog I/O Counts	14	EA			$264.27	$3,700	
Number of Digital I/O Counts	45	EA			$62.59	$2,817	
Number of Local Panels	1	EA			$13,074.33	$13,074	
Number of PLCs	1	EA			$13,908.86	$13,909	
I&C Conduit & Wire	406.00	LF	123.75	m	$12.06	$4,896	
Allowance for Misc Items	10%				$49,174.79	$4,917	
Subtotal						$54,092	
MECHANICAL:							
Pipe							
Chemical Transfer Pump Suction Header Piping-CTSH (1.5-inch, Exposed, PVC)	29.00	LF	8.84	m	$15.75	$457	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	29.00	LF	8.84	m	$13.11	$380	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	91.00	LF	27.74	m	$13.11	$1,193	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	91.00	LF	27.74	m	$13.11	$1,193	
Elbows							
Chemical Transfer Pump Suction Header Piping-CTSH (1.5-inch, Exposed, PVC)	8	EA			$22.49	$180	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	8	EA			$10.06	$80	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	20	EA			$10.06	$201	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	20	EA			$10.06	$201	
Tees							
Chemical Transfer Pump Suction Header Piping-CTSH (1.5-inch, Exposed, PVC)	2	EA			$29.39	$59	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	2	EA			$10.47	$21	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	5	EA			$10.47	$52	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	5	EA			$10.47	$52	
End Caps							
Chemical Transfer Pump Suction Header Piping-CTSH (1.5-inch, Exposed, PVC)	2	EA			$11.75	$24	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	2	EA			$5.65	$11	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	2	EA			$5.65	$11	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	2	EA			$5.65	$11	
Valves							
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	4	EA			$173.94	$696	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	4	EA			$57.14	$229	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	10	EA			$57.14	$571	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC, V-902, Diaphragm)	10	EA			$57.14	$571	
Allowance for Misc Items	10%				$5,357.86	$536	
Subtotal						$6,731	
ELECTRICAL:							

# MCC Sections	0	#			*$10,730.27*	$0	
Switchgear	0	EA			*$49,359.23*	$0	
Adjustable Frequency Drives							
Metering Pumps	0	EA			***$8,931.12***	$0	
User Defined Item #1	0	EA			***$8,865.56***	$0	
User Defined Item #2	0	EA			***$8,865.56***	$0	
User Defined Item #3	0	EA			***$8,865.56***	$0	
Electrical Conduit & Wire	0.00	LF	0.00	m	*$12.06*	$0	
Allowance for Misc Items	10%				$0.00	$0	
Subtotal						$0	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00				0.00	$0	
Item 2 Description	0.00				0.00	$0	
Item 3 Description	0.00				0.00	$0	
Item 4 Description	0.00				0.00	$0	
Item 5 Description	0.00				0.00	$0	
Item 6 Description	0.00				0.00	$0	
Item 7 Description	0.00				0.00	$0	
Item 8 Description	0.00				0.00	$0	
Item 9 Description	0.00				0.00	$0	
Item 10 Description	0.00				0.00	$0	
Item 11 Description	0.00				0.00	$0	
Item 12 Description	0.00				0.00	$0	
Item 13 Description	0.00				0.00	$0	
Item 14 Description	0.00				0.00	$0	
Item 15 Description	0.00				0.00	$0	
Subtotal						$0	
Subtotal						$651,153	
ALLOWANCES:		User Override					
Finishes Allowance	2.00%		$723,503	$14,470			
I&C Allowance	2.00%		$723,503	$14,470			
Mechanical Allowance	4.00%		$723,503	$28,940			
Electrical Allowance	2.00%		$723,503	$14,470			
					Facility Cost Name		
Facility Cost	**2,030**	**Building SF**	**$356.41**	**$723,503**	CFLFC01		
Facility Cost with Standard Additional Project Costs Added	**2,030**	**Building SF**	**$433.09**	**$879,179**	CFLFC02		
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**2,030**	**Building SF**	**$742.83**	**$1,507,950**	CFLFC03		
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**2,030**	**Building SF**	**$611.30**	**$1,240,937**	CFLFC05		
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**2,030**	**Building SF**	**$742.83**	**$1,507,950**	CFLFC06		

Liquid Chemical Storage & Feed - (Liquid Polymer)							
Located in Chemical Building A							
Is This Facility Included in My Project? Yes							
Is the Facility Storage Only (no metering pumps)?	**No**	Y/N					
		Overwrite Value					
Select Chemical	**Liquid Polymer**		Select "Other" from the drop down list if using a different chemical.				
Percent Active Chemical, % w/w	100.00%		This is the intended feed strength to the process. Inputting a value in the yellow cell overwrites the cell in column "C".				For Fluoride systems, concentration must include the Available Fluoride Ion (AFI) concentration. Typically 79.2% AFI for 23% as HFA. (e.g., 23% as HFA x 79.2% AFI = 18.22% as F)
Active Chemical Form for Dosage Basis	Polymer		Inputting a value in the yellow cell overwrites the cell in column "C".				
Bulk Chemical Specific Gravity	1.10		Inputting a value in the yellow cell overwrites the cell in column "C".				
Active lb/gal solution	9.18	lb/gal	1100.00	kg/m3			

Process User Inputs:	**Value (English)**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Red Flags**	**Comment**
FLOW AND CHEMICAL ADDITION							
Application #1							
1.) Minimum flow to application point	**30.00**	mgd	**56.78**	ML/d			Input the flow that the selected dose will be applied to.
2.) Average flow to application point	**75.00**	mgd	**283.91**	ML/d			Input the flow that the selected dose will be applied to.
3.) Maximum flow to applicatoin point	**160.00**	mgd	**605.67**	ML/d			Input the flow that the selected dose will be applied to.
4.) Minimum chemical addition	**0.05**	mg/L					Input the dose that corresponds to the flow input above.
5.) Average chemical addition	**0.10**	mg/L					Input the dose that corresponds to the flow input above.
6.) Maximum chemical addition	**0.25**	mg/L					Input the dose that corresponds to the flow input above.
7.) Input Number of Equal Simultaneous Application Points	**2**	#					
8.) Hours of addition per day	**24.00**	hr					Input the total number of hours that the chemical is fed during the day.
Application #2							
9.) Minimum flow to application point	**0.00**	mgd	**0.00**	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
10.) Average flow to application point	**0.00**	mgd	**0.00**	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
11.) Maximum flow to application point	**0.00**	mgd	**0.00**	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
12.) Minimum chemical addition	**0.00**	mg/L					Input the dose that corresponds to the flow input above.
13.) Average chemical addition	**0.00**	mg/L					Input the dose that corresponds to the flow input above.
14.) Maximum chemical addition	**0.00**	mg/L					Input the dose that corresponds to the flow input above.
15.) Input Number of Equal Simultaneous Application Points	**0**	#					
16.) Hours of addition per day	**0.00**	hr					Input the total number of hours that the chemical is fed during the day.
Application #3							
17.) Minimum flow to application point	**0.00**	mgd	**0.00**	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
18.) Average flow to application point	**0.00**	mgd	**0.00**	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
19.) Maximum flow to application point	**0.00**	mgd	**0.00**	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
20.) Minimum chemical addition	**0.00**	mg/L					Input the dose that corresponds to the flow input above.
21.) Average chemical addition	**0.00**	mg/L					Input the dose that corresponds to the flow input above.
22.) Maximum chemical addition	**0.00**	mg/L					Input the dose that corresponds to the flow input above.
23.) Input Number of Equal Simultaneous Application Points	**0**	#					
24.) Hours of addition per day	**0.00**	hr					Input the total number of hours that the chemical is fed during the day.
CHEMICAL QUANTITIES AND FLOW							
Application Point #1 Chemical Usage:							
Minimum as "dry" chemical	12.52	lb/d	5.68	kg/d			
Average as "dry" chemical	62.59	lb/d	28.39	kg/d			
Maximum as "dry" chemical	333.82	lb/d	151.42	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.03	gph	0.11	L/h			
Average at feed concentration	0.14	gph	0.54	L/h			
Maximum at feed concentration	0.76	gph	2.87	L/h			
Calculate Chemical Metering Pump Flow Turndown	26.67	:1				**Note: Pump turndown is > 20, proceed with the design with caution**	Should be < 20:1, If ≥ 20:1, proceed with caution.
Application Point #2 Chemical Usage:							
Minimum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Average as "dry" chemical	0.00	lb/d	0.00	kg/d			
Maximum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.00	gph	0.00	L/h			
Average at feed concentration	0.00	gph	0.00	L/h			
Maximum at feed concentration	0.00	gph	0.00	L/h			

Calculate Chemical Metering Pump Flow Turndown	0.00	:1					Should be < 20:1, If ≥ 20:1, proceed with caution.
Application Point #3 Chemical Usage:							
Minimum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Average as "dry" chemical	0.00	lb/d	0.00	kg/d			
Maximum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.00	gph	0.00	L/h			
Average at feed concentration	0.00	gph	0.00	L/h			
Maximum at feed concentration	0.00	gph	0.00	L/h			
Calculate Chemical Metering Pump Flow Turndown	0.00	:1					Should be < 20:1, If ≥ 20:1, proceed with caution.
Whole Plant Chemical Usage for Storage Calcs:							
Minimum	12.52	lb/d	5.68	kg/d			
Average	62.59	lb/d	28.39	kg/d			
Maximum	333.82	lb/d	151.42	kg/d			
Max Flow Average Dose Daily Usage	133.53	lb/d					
Whole Plant # of Days of Storage							
Maximum Flow and Average Dose	30.00	days					
CHEMICAL STORAGE INPUTS							
25.) Flow used to calculate storage requirements	**Maximum**	Type					
26.) Chemcial application used to calculate storage requirements	**Average**	Type					
27.) Input Minimum Number of Days of Storage	**30.00**	days					
Minimum Storage Volume	436.36	gal	1.65	m3			
28.) Choose Chemical Delivery Method	**Tote**	Type					
Bulk Delivery Volume (Tank Truck, Totes, Drums)	300.00	gal	1.14	m3			Assumes 300 gal per Tote.
Optional: Input Bulk Delivery Volume for Selected Delivery Method (overwrites above calculation)		gal		m3			Not typically used. Use with caution.
Bulk Delivery Volume	300.00	gal	1.14	m3			
Maximum of Above Delivery and Storage Volumes	58.33	cf	1.65	m3			
BULK TANKS:							
29.) Input Number of Tanks	**1**	#					
30.) Input Tank Diameter	**12.00**	ft	**3,657.60**	mm	BTD		Greater than 14' tank diameter will require on-site tank fabrication. Maximum diameter allowed for this model is 14'.
Calculate Liquid Height of Tanks	0.00	ft	0.00	mm			
Use this Tank Height (Liquid Height * 1.2)	0.00	ft	0.00	mm			Verify tank height within the facility. If indoors, typically 4' lower than the roof framing structure. Assumes extra 20% volume needed for each tank for head space and outlet connection elevation.
Calculate Usable Volume of Each Bulk Tank	0.00	gal	0.00	m3			Assumes 20% of the volume of each tank is not usable (needed for head space and outlet connection elevation).
Calculate Volume of Each Bulk Tank	0.00	gal	0.00	m3			
31.) Input Number of Rows of Tanks	**1**	#					
Calculate Number of Tanks per Row	1	#					
32.) Input Tank Material (FRP, PE (Polyethylene), PLS (Phenolic Lined Steel))	**FRP**	Type					Typically FRP
33.) Input Clear Distance Around BulkTanks, Day Tanks, Totes or Drums	**4.00**	ft	**1,219.20**	mm	CDT		Typically ≥ 3 ft
Calculate Actual Number of Days of Storage	41.25	days					For bulk tanks, assumes 20% of the volume of each tank is not usable (needed for head space and outlet connection elevation).
TOTES & DRUMS:							
Calculate Number of Totes or Drums	2	#					
34.) Input Number of Rows of Totes or Drums	**2**	#					
Calculate Number of Totes or Drums per Row	1	#					
Length of Each Tote	4.00	ft	1219.20	mm			Fixed
Width of Each Tote	4.00	ft	1219.20	mm			Fixed
Diameter of Each Drum	2.50	ft	762.00	mm			Fixed
DAY TANKS:							
35.) Are Day Tanks Required?	**No**	Y/N					Rule: Day Tanks are only available when the Delivery Method = "Tank Truck".
36.) Input Number of Day Tanks	**2**	#					Suggest 2 Day Tanks
Calculate Day Tank Volume based on Max. Flow/Dose (per tank)	0.00	gal	0.00	m3			
Convert Day Tank Volume (per each)	0.00	cf	0.00	m3			
Calculate Day Tank Diameter (per each)	0.00	ft	0.00	mm	DTD		
Calculate Day Tank Height (per each)	0.00	ft	0.00	mm			Assumption: H = 2 * D
TRANSFER & METERING PUMPS:							
Number of Transfer Pumps	0	#					Fixed
37.) Input Time to Fill Day Tank	**20.00**	min					Typically fill all day tanks in 20 min
Calculate Number of Active Metering Pumps	2	#					Rule: One active metering pump per each application point.
Calculate Number of Standby Metering Pumps	1	#					Rule: One standby metering pump per each application
38.) Input Number of Additional Standby Metering Pumps	**0**	#					
Calculate Total Number of Metering Pumps	3	#					
39.) Input Clear Distance Around Transfer and Metering Pumps	**4.00**	ft	**1,828.80**	mm	CDP		Typically ≥ 4 ft
Length of Transfer and Metering Pumps	3.00	ft	914.40	mm			Fixed. Conservatively assumes Pulsafeeder metering pump type.
FACILITY SIZING:							
40.) Is this Chemical Room Part of a Multiple Chemical Facility?	**Yes**	Y/N					
41.) Is this Chemical Room Considered the "Start Point" for this Chemical Facility?	**No**	Y/N					There should only be one "start point" per chemical facility. Recommend choosing the facility with the greatest width as the "start point"
42.) If this is Part of a Multiple Chemical Facility and is the "Start Point", Input the Summation of Total Number of Pumps from the Other Chemical Rooms Here		#					Total number of pumps is listed in row 114 of the liquid chemical facility, rows 140, 151, and 162 of the dry chemical facility, and row 122 of the potassium permanganate facility

43.) Input Common Chemical Access Corridor Width	8.00	ft	2,438.40	mm			Input zero if a corridor is not required. Assumes Chem facilities are in series. If Chem facilities are in parallel, input 1/2 total corridor width.
44.) Is Corridor Covered?	Yes	Y/N					
45.) Select Chemical Facility Covering	Building						
46.) Select Chemical Area for this Chemical	A						Only used to help CPES user organize chemicals when multiple chemical buildings are used. Has no impact on sizing calculations or cost.
CONTAINMENT AREA:							
Are Stairs Required into Containment Area?	Yes	Y/N					Typically not needed for tote and drum storage areas.
Is Grating Required in Containment Area?	Yes	Y/N					Typically not needed for tote and drum storage areas.
Width of Stair Access	4.00	ft	1219.20	mm	WS		Fixed
Calculate Containment Area Length	19.00	ft	5791.20	mm			
Calculate Containment Area Width	35.00	ft	10668.00	mm		**Note: verify that this dimension matches the Containment Area Width on the other chemical rooms in this facility. If not, input the larger value in the user overwrite on the room with the shorter dimension**	
47.) Optional: User Overwrite of Containment Area Width	35.00	ft	10,668.00	mm			
Calculate Fire Sprinkler Water Volume	2,660.00	gal	10.07	m3			Assumes 0.2 gpm/sf for 20 min if chemical installed inside a building. If chemical is outside or under a canopy, assume no fire sprinkler water volume.
Calculate 120% of One Storage Tank Volume	360.00	gal	1.36	m3			
Calculate 30% of All Tank Volume	180.00	gal	0.68	m3			
Calculate Maximum Volume + Fire Flow Volume	3,020.00	gal	11.43	m3			
Tank Pads Volume	150.00	cf	4.25	m3			
Tank Pads Volume	1,122.08	gal	4.25	m3			
Calculate Maximum Volume + Fire Flow Volume + Tank Pad Volume	4,142.08	gal	15.68	m3			
Calculate Maximum Volume + Fire Flow Volume + Tank Pad Volume	553.72	cf	15.68	m3			
Calculate Containment Wall Height (including freeboard)	2.25	ft	685.80	mm		**Note: verify that this dimension matches the Containment Wall Height on the other chemical rooms in this facility. If not, input the larger value in the user overwrite on the room with the shorter dimension**	120% of 1 tank volume or 30% of all tank volume whichever is greater + fire flow volume + 6" freeboard. Should be ≤ 4.5'.
48.) Optional: User Overwrite of Containment Wall Height	2.25	ft	2,438.40	mm			
49.) Input Depth of Burial	1.75	ft	0.00	mm	DB		
50.) Input Cutback Slope	1.00	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
51.) Input Over Excavation Depth	1.00	ft	0.00	mm	OEXD		
Mechanical Sizing Requirements:							
Pipe Name	**Input Velocity**	**Unit (English)**	**Input Velocity**	**Unit (Metric)**	**Standard Pipe Size**	**Unit (English)**	**Nominal Pipe Size**
Chemical Transfer Pump Suction Header Piping	2.00	fps	0.61	m/s	1.00	in	25.00
Chemical Transfer Pump Discharge Header Piping	6.00	fps	1.83	m/s	1.00	in	25.00
Chemical Metering Pump Suction Header Piping	2.00	fps	0.61	m/s	1.00	in	25.00
Chemical Metering Pump Discharge Header Piping	6.00	fps	1.83	m/s	1.00	in	25.00
Mechanical Material Requirements:							
Pipe Name	**Pipe ID**	**Installation Type**	**Pipe Material**	**Pipe Lining Material**	**Pipe Coating Material**	**Pipe Length**	**# Elbows**
Chemical Transfer Pump Suction Header Piping	CTSH	Exposed	PVC	NA	NA	0.00	0.00
Chemical Transfer Pump Discharge Header Piping	CTDH	Exposed	PVC	NA	NA	0.00	0.00
Chemical Metering Pump Suction Header Piping	LCSH	Exposed	PVC	NA	NA	54.00	12.00
Chemical Metering Pump Discharge Header Piping	LCDH	Exposed	PVC	NA	NA	54.00	12.00
						L+W	#MP*4
Electrical User Inputs and Sizing Requirements:							
52.) Is this a "Critical" Facility (requiring standby power)?	No	Y/N					
53.) Is there SWGR?	No						
Electrical Equipment Lengths:							**MCC**
Item	**Quantity**	**HP per Each**	**AFD's Required?**	**MCC Spaces for Motor Starters**	**MCC Spaces for AFD's less than 50hp)**	**MCC Spaces for Breakers**	**Total MCC Spaces**
Metering Pumps	0.00	0.50	No	0.00	0.00	0.00	
User Defined Item #1	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #2	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #3	0.00	0.00	No	0.00	0.00	0.00	
TOTAL		**0.00**		**0.00**	**0.00**	**0.00**	**0.00**
Electrical Equipment Widths:							
Equipment	**Depth (ft)**						
MCC	0.00						
Small AFD's	0.00						
Large AFD's	0.00						
Switchgear	0.00						
Maximum Depth	0.00						
Clear Distances:							
Clear Distance	**Width**	**Length**	**Comment**				
CD1		3.00	Clear Distance between wall and MCC	Typically 3 feet			
CD2		1.00	Clear Distance between MCC and Small AFD	Typically 1 foot			
CD3		0.00	Clear Distance between Small AFD and Large AFD	Typically Zero			
CD4		0.00	Clear Distance between Large AFD and Switchgear	Typically Zero			

CD5		0.00	Clear Distance between Switchgear and Contingency Space	Typically Zero			
CD6	4.00		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)				
CD7	3.00		Clear Distance in front of Equipment	Tyipcally 3 feet			
Contingency Length		0.00	Contingency length	Typically Zero			
Electric Room Length (ft):							
CD1	3.00						
MCC	0.00						
CD2	1.00						
Small AFD's	0.00						
CD3	0.00						
Large AFD's	0.00						
CD4	0.00						
Swithgear	0.00						
CD5	0.00						
Contingency	0.00						
Total Length	0.00						
Electric Room Width (ft):							
CD6	0.00	If there is no switchgear, this distance will be Zero.					
Maximum Equipment Depth	0.00						
CD7	3.00						
Total Width	0.00						
COST TABLE FOR TANKS & PUMPS:	**Unit Cost**						
Tanks (Installed Cost per Gallon)							
FRP	***$0.00***						
Polyethylene (PE)	$ 2.25						
Phenolic Lined Steel (PLS)	***$6.41***						
Chemical Feed Pumps (Cost per Each)	***$10,658.90***						

Estimating Dimensions:	Value English	Unit (English)	Value (Metric)	Unit (Metric)	Name	Comment	Red Flags
Logic Tests ("1" = Yes, "0" = No):							
Is this Chemical Feed System Included?	1						
Is the Method of Delivery "Tank Truck"?	0						
Is Day Tank Required? (1 = Yes, 0 = No)	0						
Tank Truck without Day Tank (True or False)	FALSE						
Tank Truck with Day Tank (True or False)	FALSE						
Tank Truck without Day Tank (1 = Yes, 0 = No)	0					Tank Truck without Day Tank	
Tank Truck with Day Tank (1 = Yes, 0 = No)	0					Tank Truck without Day Tank	
Is the Method of Delivery "Tote"?	1					Tote	
Is the Method of Delivery "Drum"?	0					Drum	
Length of Module (Tank Truck)	0.00	ft	0.00	mm			
Length of Module (Tote)	19.00	ft	5791.20	mm			
Length of Module (Drum)	0.00	ft	0.00	mm			
Width of Module (Tank Truck without Transfer Pump and Day Tank)	0.00	ft	0.00	mm			
Width of Module (Tank Truck with Transfer Pump and Day Tank)	0.00	ft	0.00	mm			
Width of Module (Tote)	35.00	ft	10668.00	mm			
Width of Module (Drum)	0.00	ft	0.00	mm			
Area of Module	0.00	sf	0.00	m2			
Number of Bulk Tanks (each)	0	#					
Diameter of Bulk Tank	12.00	ft	3657.60	mm			
Volume of Each Bulk Tank	0.00	gal	0.00	m3			
Bulk Tank Material	FRP	Type					
Number of Day Tanks (each)	0	#					
Diameter of Day Tank	0.00	ft					
Volume of Each Day Tank	0.00	gal	0.00	m3			
Number of Transfer Pumps	0	#					
Transfer Pump Capacity (each)	0.00	gpm	0.00	l/min		Assume fill each tank in 20 min	
Number of Metering Pumps	3	#					
Module Covered? ("1" = YES, "0" = NO)	0						
If Module Exists, Is it Covered? ("1" = Yes, "0" = No)	0						
Containment Wall Height	2.25	ft	685.80	mm			
Slab on Grade Thickness	**9.00**	in	**228.60**	mm		Model based on 9"	
Slab on Grade Thickness	0.75	ft	228.60	mm			
Containment Wall Thickness	**8.00**	in	**203.20**	mm		Model based on 8"	
Containment Wall Thickness	0.67	ft	203.20	mm			
Tank Pad / Metering Pump Pad Height	**3.00**	ft	**914.40**	mm	EPH		
Corridor							
Length	19.00	ft	5791.20	mm			
Width	8.00	ft	2438.40	mm			
Area	152.00	sf	14.12	m2			
Corridor Covered? ("1" = YES, "0" = NO)	1						
Electrical Room:							
Slab on Grade:							
Length	0.00	ft	0.00	mm			
Width	0.00	ft	0.00	mm			
Concrete Thickness	**12.00**	in	**304.80**	mm		Model based on 12"	
Concrete Thickness	1.00	ft	304.80	mm			
Walls:							
Height = FBD	10.00	ft				Fixed	
Concrete Thickness	**8.00**	in	**203.20**	mm		Model based on 8"	
Concrete Thickness	0.67	ft	203.20	mm			
Overall Dimensions							
Containment Area Length	19.00	ft	5791.20	mm			
Containment Area Width	35.00	ft	10668.00	mm			
Containment Area	665.00	sf	61.78	m2			
Corridor Area Length	19.00	ft	5791.20	mm			
Corridor Area Width	8.00	ft	2438.40	mm			
Corridor Area	152.00	sf	14.12	m2			
Electrical Area Length	0.00	ft	0.00	mm			
Electrical Area Width	0.00	ft	0.00	mm			
Electrical Room Area	0.00	sf	0.00	m2			
Chemical Facility Area	817.00	sf	75.90	m2			
Covered Chemical Area (Building)	817.00	sf	75.90	m2			
Covered Chemical Area (Canopy)	0.00	sf	0.00	m2			
Total Covered Area	817.00	sf	75.90	m2			

Excavation Depth	3.50	ft	1066.80	mm			
COST ESTIMATE							
Description	**Quantity (English)**	**Unit (English)**	**Quantity (Metric)**	**Unit (Metric)**	**$/Unit**	**Total Cost**	**User Over-Write**
SITEWORK:							
Excavation	150.12	CY	114.78	m3	*$6.72*	$1,009	
Imported Structural Backfill	60.52	CY	46.27	m3	*$50.94*	$3,083	
Native Backfill	28.13	CY	21.51	m3	*$8.27*	$232	
Haul Excess	121.99	CY	93.27	m3	*$8.27*	$1,008	
Allowance for Misc Items	5%				$5,332.99	$267	
Subtotal						$5,600	
CONCRETE:							
Slab on Grade	22.75	CY	17.39	m3	*$490.62*	$11,160	
Containment Walls	4.06	CY	3.10	m3	*$880.79*	$3,572	
Bulk Tank Pads	0.00	CY	0.00	m3	*$490.62*	$0	
Day Tank Pads	0.00	CY	0.00	m3	*$490.62*	$0	
Transfer Pump Pads	0.00	CY	0.00	m3	*$490.62*	$0	
Metering Pump Pads	2.00	CY	1.53	m3	*$490.62*	$981	
Corridor							
Slab on Grade	5.28	CY	4.04	m3	*$490.62*	$2,589	
Electrical Room							
Slab on Grade	0.00	CY	0.00	m3	*$490.62*	$0	
Allowance for Misc Items	5%				$18,302.71	$915	
Subtotal						$19,218	
MASONRY:	**High**						
Chemical Building	817.00	SF	75.90	m2	*$198.37*	$162,066	
Electrical Room	0.00	SF	0.00	m2	*$198.37*	$0	
Subtotal	817.00					$162,066	
METALS:							
Canopy	0.00	SF	0.00	m2	*$41.80*	$0	
Metal Stairway	1	EA			$8,327.28	$8,327	
Grating	1	EA			$1,998.55	$1,999	
Allowance for Misc Items	10%				$10,325.82	$1,033	
Subtotal						$11,358	
EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
Bulk Tank	0	EA			*$0.00*	$0	
Day Tank	0	EA			*$0.00*	$0	
Transfer Pump	0	EA			*$0.00*	$0	
Metering Pump	3	EA			*$10,658.90*	$31,977	
Allowance for Misc Items	10%				$31,976.69	$3,198	
Subtotal						$35,174	
INSTRUMENTS & CONTROLS:							
Instruments							
Chemical Tank Radar Level Transmitters	0	EA			*$1,043.16*	$0	
Chemical Tank Beacons	0	EA			*$1,043.16*	$0	
Day Tank Differential Pressure Transmitter	0	EA			*$1,043.16*	$0	
Drum or Tote Weigh Scale	2	EA			*$1,390.89*	$2,782	
Metering Pump Discharge Pressure Switch	3	EA			*$695.44*	$2,086	
Magmeter	2	EA			*$695.44*	$1,391	
Sump Pump Float Switch	1	EA			*$347.72*	$348	
Eyewash	1	EA			*$1,043.16*	$1,043	
Number of Analog I/O Counts	9	EA			*$264.27*	$2,378	
Number of Digital I/O Counts	21	EA			*$62.59*	$1,314	
Number of Local Panels	1	EA			*$13,074.33*	$13,074	
Number of PLCs	1	EA			*$13,908.86*	$13,909	
I&C Conduit & Wire	171.00	LF	52.12	m	*$12.06*	$2,062	
Allowance for Misc Items	10%				$40,387.94	$4,039	
Subtotal						$44,427	
MECHANICAL:							
Pipe							
Chemical Transfer Pump Suction Header Piping-CTSH (1-inch, Exposed, PVC)	0.00	LF	0.00	m	*$13.11*	$0	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	0.00	LF	0.00	m	*$13.11*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	54.00	LF	16.46	m	*$13.11*	$708	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	54.00	LF	16.46	m	*$13.11*	$708	
Elbows							
Chemical Transfer Pump Suction Header Piping-CTSH (1-inch, Exposed, PVC)	0	EA			*$10.06*	$0	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	0	EA			*$10.06*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	12	EA			*$10.06*	$121	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	12	EA			*$10.06*	$121	
Tees							
Chemical Transfer Pump Suction Header Piping-CTSH (1-inch, Exposed, PVC)	0	EA			*$10.47*	$0	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	0	EA			*$10.47*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	3	EA			*$10.47*	$31	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	3	EA			*$10.47*	$31	
End Caps							
Chemical Transfer Pump Suction Header Piping-CTSH (1-inch, Exposed, PVC)	0	EA			*$5.65*	$0	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	0	EA			*$5.65*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	2	EA			*$5.65*	$11	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	2	EA			*$5.65*	$11	
Valves							
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	0	EA			*$57.14*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	0	EA			*$57.14*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	6	EA			*$57.14*	$343	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC, V-902, Diaphragm)	6	EA			*$57.14*	$343	
Allowance for Misc Items	10%				$2,428.48	$243	
Subtotal						$2,671	
ELECTRICAL:							

# MCC Sections	0	#			*$10,730.27*	$0	
Switchgear	0	EA			*$49,359.23*	$0	
Adjustable Frequency Drives							
Metering Pumps	0	EA			***$8,931.12***	$0	
User Defined Item #1	0	EA			***$8,865.56***	$0	
User Defined Item #2	0	EA			***$8,865.56***	$0	
User Defined Item #3	0	EA			***$8,865.56***	$0	
Electrical Conduit & Wire	0.00	LF	0.00	m	*$12.06*	$0	
Allowance for Misc Items	10%				$0.00	$0	
Subtotal						$0	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00				0.00	$0	
Item 2 Description	0.00				0.00	$0	
Item 3 Description	0.00				0.00	$0	
Item 4 Description	0.00				0.00	$0	
Item 5 Description	0.00				0.00	$0	
Item 6 Description	0.00				0.00	$0	
Item 7 Description	0.00				0.00	$0	
Item 8 Description	0.00				0.00	$0	
Item 9 Description	0.00				0.00	$0	
Item 10 Description	0.00				0.00	$0	
Item 11 Description	0.00				0.00	$0	
Item 12 Description	0.00				0.00	$0	
Item 13 Description	0.00				0.00	$0	
Item 14 Description	0.00				0.00	$0	
Item 15 Description	0.00				0.00	$0	
Subtotal						$0	
Subtotal						$280,514	
ALLOWANCES:		User Override					
Finishes Allowance	2.00%		$311,682	$6,234			
I&C Allowance	2.00%		$311,682	$6,234			
Mechanical Allowance	4.00%		$311,682	$12,467			
Electrical Allowance	2.00%		$311,682	$6,234			
					Facility Cost Name		
Facility Cost	**817**	**Building SF**	**$381.50**	**$311,682**	CFLFC01		
Facility Cost with Standard Additional Project Costs Added	**817**	**Building SF**	**$463.58**	**$378,747**	CFLFC02		
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**817**	**Building SF**	**$795.13**	**$649,619**	CFLFC03		
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**817**	**Building SF**	**$654.33**	**$534,591**	CFLFC05		
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**817**	**Building SF**	**$795.13**	**$649,619**	CFLFC06		

Liquid Chemical Storage & Feed - (Sodium Hypochlorite)
Located in Chemical Building A
Is This Facility Included in My Project? No

Is the Facility Storage Only (no metering pumps)?	No	Y/N					
		Overwrite Value					
Select Chemical	Sodium Hypochlorite		Select "Other" from the drop down list if using a different chemical.				
Percent Active Chemical, % w/w	12.50%		This is the intended feed strength to the process. Inputting a value in the yellow cell overwrites the cell in column "C".				For Fluoride systems, concentration must include the Available Fluoride Ion (AFI) concentration. Typically 79.2% AFI for 23% as HFA. (e.g., 23% as HFA x 79.2% AFI = 18.22% as F)
Active Chemical Form for Dosage Basis	Cl2		Inputting a value in the yellow cell overwrites the cell in column "C".				
Bulk Chemical Specific Gravity	1.21		Inputting a value in the yellow cell overwrites the cell in column "C".				
Active lb/gal solution	1.26	lb/gal	151.25	kg/m3			
Process User Inputs:	**Value (English)**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Red Flags**	**Comment**
FLOW AND CHEMICAL ADDITION							
Application #1							
1.) Minimum flow to application point	30.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to.
2.) Average flow to application point	75.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to.
3.) Maximum flow to applicatoin point	160.00	mgd	605.67	ML/d			Input the flow that the selected dose will be applied to.
4.) Minimum chemical addition	1.00	mg/L					Input the dose that corresponds to the flow input above.
5.) Average chemical addition	1.50	mg/L					Input the dose that corresponds to the flow input above.
6.) Maximum chemical addition	2.00	mg/L					Input the dose that corresponds to the flow input above.
7.) Input Number of Equal Simultaneous Application Points	2	#					
8.) Hours of addition per day	24.00	hr					Input the total number of hours that the chemical is fed during the day.
Application #2							
9.) Minimum flow to application point	30.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
10.) Average flow to application point	75.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
11.) Maximum flow to application point	160.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
12.) Minimum chemical addition	1.00	mg/L					Input the dose that corresponds to the flow input above.
13.) Average chemical addition	1.50	mg/L					Input the dose that corresponds to the flow input above.
14.) Maximum chemical addition	2.00	mg/L					Input the dose that corresponds to the flow input above.
15.) Input Number of Equal Simultaneous Application Points	2	#					
16.) Hours of addition per day	24.00	hr					Input the total number of hours that the chemical is fed during the day.
Application #3							
17.) Minimum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
18.) Average flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
19.) Maximum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
20.) Minimum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
21.) Average chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
22.) Maximum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
23.) Input Number of Equal Simultaneous Application Points	0	#					
24.) Hours of addition per day	0.00	hr					Input the total number of hours that the chemical is fed during the day.
CHEMICAL QUANTITIES AND FLOW							
Application Point #1 Chemical Usage:							
Minimum as "dry" chemical	250.36	lb/d	113.56	kg/d			
Average as "dry" chemical	938.86	lb/d	425.86	kg/d			
Maximum as "dry" chemical	2,670.53	lb/d	1211.33	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	4.13	gph	15.64	L/h			
Average at feed concentration	15.50	gph	58.66	L/h			
Maximum at feed concentration	44.08	gph	166.85	L/h			
Calculate Chemical Metering Pump Flow Turndown	10.67	:1					Should be < 20:1, If ≥ 20:1, proceed with caution.
Application Point #2 Chemical Usage:							
Minimum as "dry" chemical	250.36	lb/d	113.56	kg/d			
Average as "dry" chemical	938.86	lb/d	425.86	kg/d			
Maximum as "dry" chemical	2,670.53	lb/d	1211.33	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	4.13	gph	15.64	L/h			
Average at feed concentration	15.50	gph	58.66	L/h			
Maximum at feed concentration	44.08	gph	166.85	L/h			
Calculate Chemical Metering Pump Flow Turndown	10.67	:1					Should be < 20:1, If ≥ 20:1, proceed with caution.
Application Point #3 Chemical Usage:							

Minimum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Average as "dry" chemical	0.00	lb/d	0.00	kg/d			
Maximum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.00	gph	0.00	L/h			
Average at feed concentration	0.00	gph	0.00	L/h			
Maximum at feed concentration	0.00	gph	0.00	L/h			
Calculate Chemical Metering Pump Flow Turndown	0.00	:1					Should be < 20:1, If ≥ 20:1, proceed with caution
Whole Plant Chemical Usage for Storage Calcs:							
Minimum	500.72	lb/d	227.12	kg/d			
Average	1,877.72	lb/d	851.72	kg/d			
Maximum	5,341.06	lb/d	2422.66	kg/d			
Max Flow Average Dose Daily Usage	4,005.79	lb/d					
Whole Plant # of Days of Storage							
Maximum Flow and Average Dose	30.00	days					
CHEMICAL STORAGE INPUTS							
25.) Flow used to calculate storage requirements	**Maximum**	Type					
26.) Chemcial application used to calculate storage requirements	**Average**	Type					
27.) Input Minimum Number of Days of Storage	**30.00**	days					
Minimum Storage Volume	95,206.61	gal	360.40	m3			
28.) Choose Chemical Delivery Method	**Tank Truck**	Type					
Bulk Delivery Volume (Tank Truck, Totes, Drums)	4,456.36	gal	16.87	m3			Assumes 45,000 lb per Tank Truck.
Optional: Input Bulk Delivery Volume for Selected Delivery Method (overwrites above calculation)		gal		m3			Not typically used. Use with caution.
Calculate Bulk Delivery Volume * 1.5 (for Truck Delivery Only)	6,684.54	gal	25.30	m3			
Maximum of Above Delivery and Storage Volumes	12,727.27	cf	360.40	m3			
BULK TANKS:							
29.) Input Number of Tanks	**3**	#					
30.) Input Tank Diameter	**10.00**	ft	**3,048.00**	mm	BTD		Greater than 14' tank diameter will require on-site tank fabrication. Maximum diameter allowed for this model is 14'.
Calculate Liquid Height of Tanks	54.02	ft	16464.15	mm			
Use this Tank Height (Liquid Height * 1.2)	65.00	ft	19812.00	mm		**Verify tank height in relationship to the facility structure. Add more tanks or increase diameter if needed.**	Verify tank height within the facility. If indoors, typically 4' lower than the roof framing structure. Assumes extra 20% volume needed for each tank for head space and outlet connection elevation.
Calculate Usable Volume of Each Bulk Tank	31,823.92	gal	120.47	m3			Assumes 20% of the volume of each tank is not usable (needed for head space and outlet connection elevation).
Calculate Volume of Each Bulk Tank	38,188.71	gal	144.56	m3			
31.) Input Number of Rows of Tanks	**2**	#					
Calculate Number of Tanks per Row	2	#					
32.) Input Tank Material (FRP, PE (Polyethylene), PLS (Phenolic Lined Steel))	**FRP**	Type					Typically FRP
33.) Input Clear Distance Around BulkTanks, Day Tanks, Totes or Drums	**4.00**	ft	**1,219.20**	mm	CDT		Typically ≥ 3 ft
Calculate Actual Number of Days of Storage	30.08	days					For bulk tanks, assumes 20% of the volume of each tank is not usable (needed for head space and outlet connection elevation).
TOTES & DRUMS:							
Calculate Number of Totes or Drums	0	#					
34.) Input Number of Rows of Totes or Drums	**1**	#					
Calculate Number of Totes or Drums per Row	0	#					
Length of Each Tote	0.00	ft	0.00	mm			Fixed
Width of Each Tote	0.00	ft	0.00	mm			Fixed
Diameter of Each Drum	0.00	ft	0.00	mm			Fixed
DAY TANKS:							
35.) Are Day Tanks Required?	**Yes**	Y/N					Rule: Day Tanks are only available when the Delivery Method = "Tank Truck".
36.) Input Number of Day Tanks	**2**	#					Suggest 2 Day Tanks
Calculate Day Tank Volume based on Max. Flow/Dose (per tank)	2,115.70	gal	8.01	m3			
Convert Day Tank Volume (per each)	282.83	cf	8.01	m3			
Calculate Day Tank Diameter (per each)	6.00	ft	1828.80	mm	DTD		
Calculate Day Tank Height (per each)	12.00	ft	3657.60	mm			Assumption: H = 2 * D
TRANSFER & METERING PUMPS:							
Number of Transfer Pumps	2	#					Fixed
37.) Input Time to Fill Day Tank	**20.00**	min					Typically fill all day tanks in 20 min
Calculate Number of Active Metering Pumps	4	#					Rule: One active metering pump per each application point.
Calculate Number of Standby Metering Pumps	2	#					Rule: One standby metering pump per each application
38.) Input Number of Additional Standby Metering Pumps	**2**	#					
Calculate Total Number of Metering Pumps	8	#					
39.) Input Clear Distance Around Transfer and Metering Pumps	**4.00**	ft	**1,828.80**	mm	CDP		Typically ≥ 4 ft
Length of Transfer and Metering Pumps	3.00	ft	914.40	mm			Fixed. Conservatively assumes Pulsafeeder metering pump type.
FACILITY SIZING:							
40.) Is this Chemical Room Part of a Multiple Chemical Facility?	**Yes**	Y/N					
41.) Is this Chemical Room Considered the "Start Point" for this Chemical Facility?	**No**	Y/N					There should only be one "start point" per chemical facility. Recommend choosing the facility with the greatest width as the "start point"
42.) If this is Part of a Multiple Chemical Facility and is the "Start Point", Input the Summation of Total Number of Pumps from the Other Chemical Rooms Here		#					Total number of pumps is listed in row 114 of the liquid chemical facility, rows 140, 151, and 162 of the dry chemical facility, and row 122 of the potassium permanganate facility

43.) Input Common Chemical Access Corridor Width	8.00	ft	2,438.40	mm			Input zero if a corridor is not required. Assumes Chem facilities are in series. If Chem facilities are in parallel, input 1/2 total corridor width.
44.) Is Corridor Covered?	Yes	Y/N					
45.) Select Chemical Facility Covering	Building						
46.) Select Chemical Area for this Chemical	A						Only used to help CPES user organize chemicals when multiple chemical buildings are used. Has no impact on sizing calculations or cost.
CONTAINMENT AREA:							
Are Stairs Required into Containment Area?	Yes	Y/N					Typically not needed for tote and drum storage areas.
Is Grating Required in Containment Area?	Yes	Y/N					Typically not needed for tote and drum storage areas.
Width of Stair Access	4.00	ft	1219.20	mm	WS		Fixed
Calculate Containment Area Length	44.00	ft	13411.20	mm			
Calculate Containment Area Width	62.00	ft	18897.60	mm		**Note: verify that this dimension matches the Containment Area Width on the other chemical rooms in this facility. If not, input the larger value in the user overwrite on the room with the shorter dimension**	
47.) Optional: User Overwrite of Containment Area Width	62.00	ft	18,897.60	mm			
Calculate Fire Sprinkler Water Volume	10,912.00	gal	41.31	m3			Assumes 0.2 gpm/sf for 20 min if chemical installed inside a building. If chemical is outside or under a canopy, assume no fire sprinkler water volume.
Calculate 120% of One Storage Tank Volume	45,826.45	gal	173.47	m3			
Calculate 30% of All Tank Volume	34,369.84	gal	130.10	m3			
Calculate Maximum Volume + Fire Flow Volume	56,738.45	gal	214.78	m3			
Tank Pads Volume	706.86	cf	20.02	m3			
Tank Pads Volume	5,287.67	gal	20.02	m3			
Calculate Maximum Volume + Fire Flow Volume + Tank Pad Volume	62,026.12	gal	234.79	m3			
Calculate Maximum Volume + Fire Flow Volume + Tank Pad Volume	8,291.69	cf	234.79	m3			
Calculate Containment Wall Height (including freeboard)	2.25	ft	685.80	mm		**Note: verify that this dimension matches the Containment Wall Height on the other chemical rooms in this facility. If not, input the larger value in the user overwrite on the room with the shorter dimension**	120% of 1 tank volume or 30% of all tank volume whichever is greater + fire flow volume + 6" freeboard. Should be ≤ 4.5'.
48.) Optional: User Overwrite of Containment Wall Height	2.25	ft	685.80	mm			
49.) Input Depth of Burial	1.75	ft	0.00	mm	DB		
50.) Input Cutback Slope	1.00	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
51.) Input Over Excavation Depth	1.00	ft	0.00	mm	OEXD		

Mechanical Sizing Requirements:

Pipe Name	Input Velocity	Unit (English)	Input Velocity	Unit (Metric)	Standard Pipe Size	Unit (English)	Nominal Pipe Size
Chemical Transfer Pump Suction Header Piping	2.00	fps	0.61	m/s	7.00	in	150.00
Chemical Transfer Pump Discharge Header Piping	6.00	fps	1.83	m/s	4.00	in	100.00
Chemical Metering Pump Suction Header Piping	2.00	fps	0.61	m/s	1.00	in	25.00
Chemical Metering Pump Discharge Header Piping	6.00	fps	1.83	m/s	1.00	in	25.00

Mechanical Material Requirements:

Pipe Name	Pipe ID	Installation Type	Pipe Material	Pipe Lining Material	Pipe Coating Material	Pipe Length	# Elbows
Chemical Transfer Pump Suction Header Piping	CTSH	Exposed	PVC	NA	NA	44.00	8.00
Chemical Transfer Pump Discharge Header Piping	CTDH	Exposed	PVC	NA	NA	44.00	8.00
Chemical Metering Pump Suction Header Piping	LCSH	Exposed	PVC	NA	NA	106.00	32.00
Chemical Metering Pump Discharge Header Piping	LCDH	Exposed	PVC	NA	NA	106.00	32.00
						L+W	#MP*4

Electrical User Inputs and Sizing Requirements:

52.) Is this a "Critical" Facility (requiring standby power)?	Yes	Y/N	
53.) Is there SWGR?	No		

Electrical Equipment Lengths:

Item	Quantity	HP per Each	AFD's Required?	MCC Spaces for Motor Starters	MCC Spaces for AFD's less than 50hp)	MCC Spaces for Breakers	MCC Total MCC Spaces
Metering Pumps	0.00	0.50	No	0.00	0.00	0.00	
User Defined Item #1	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #2	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #3	0.00	0.00	No	0.00	0.00	0.00	
TOTAL		**0.00**		**0.00**	**0.00**	**0.00**	**0.00**

Electrical Equipment Widths:

Equipment	Depth (ft)
MCC	0.00
Small AFD's	0.00
Large AFD's	0.00
Switchgear	0.00
Maximum Depth	0.00

Clear Distances:

Clear Distance	Width	Length	Comment	
CD1		3.00	Clear Distance between wall and MCC	Typically 3 feet
CD2		1.00	Clear Distance between MCC and Small AFD	Typically 1 foot
CD3		0.00	Clear Distance between Small AFD and Large AFD	Typically Zero
CD4		0.00	Clear Distance between Large AFD and Switchgear	Typically Zero

CD5		0.00	Clear Distance between Switchgear and Contingency Space	Typically Zero			
CD6	4.00		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)				
CD7	3.00		Clear Distance in front of Equipment	Tyipcally 3 feet			
Contingency Length		0.00	Contingency length	Typically Zero			
Electric Room Length (ft):							
CD1	3.00						
MCC	0.00						
CD2	1.00						
Small AFD's	0.00						
CD3	0.00						
Large AFD's	0.00						
CD4	0.00						
Swithgear	0.00						
CD5	0.00						
Contingency	0.00						
Total Length	0.00						
Electric Room Width (ft):							
CD6	0.00	If there is no switchgear, this distance will be Zero.					
Maximum Equipment Depth	0.00						
CD7	3.00						
Total Width	0.00						
COST TABLE FOR TANKS & PUMPS:	**Unit Cost**						
Tanks (Installed Cost per Gallon)							
FRP	***$2.19***						
Polyethylene (PE)	$ 2.25						
Phenolic Lined Steel (PLS)	***$6.41***						
Chemical Feed Pumps (Cost per Each)	***$10,658.90***						

Estimating Dimensions:	**Value English**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Comment**	**Red Flags**
Logic Tests ("1" = Yes, "0" = No):							
Is this Chemical Feed System Included?	1						
Is the Method of Delivery "Tank Truck"?	1						
Is Day Tank Required? (1 = Yes, 0 = No)	1						
Tank Truck without Day Tank (True or False)	FALSE						
Tank Truck with Day Tank (True or False)	TRUE						
Tank Truck without Day Tank (1 = Yes, 0 = No)	0					Tank Truck without Day Tank	
Tank Truck with Day Tank (1 = Yes, 0 = No)	1					Tank Truck without Day Tank	
Is the Method of Delivery "Tote"?	0					Tote	
Is the Method of Delivery "Drum"?	0					Drum	
Length of Module (Tank Truck)	44.00	ft	13411.20	mm			
Length of Module (Tote)	0.00	ft	0.00	mm			
Length of Module (Drum)	0.00	ft	0.00	mm			
Width of Module (Tank Truck without Transfer Pump and Day Tank)	0.00	ft	0.00	mm			
Width of Module (Tank Truck with Transfer Pump and Day Tank)	62.00	ft	18897.60	mm			
Width of Module (Tote)	0.00	ft	0.00	mm			
Width of Module (Drum)	0.00	ft	0.00	mm			
Area of Module	0.00	sf	0.00	m2			
Number of Bulk Tanks (each)	3	#					
Diameter of Bulk Tank	10.00	ft	3048.00	mm			
Volume of Each Bulk Tank	38188.71	gal	144.56	m3			
Bulk Tank Material	FRP	Type					
Number of Day Tanks (each)	2	#					
Diameter of Day Tank	6.00	ft					
Volume of Each Day Tank	2538.08	gal	9.61	m3			
Number of Transfer Pumps	2	#					
Transfer Pump Capacity (each)	253.81	gpm	0.00	l/min		Assume fill each tank in 20 min	
Number of Metering Pumps	8	#					
Module Covered? ("1" = YES, "0" = NO)	0						
If Module Exists, Is it Covered? ("1" = Yes, "0" = No)	0						
Containment Wall Height	2.25	ft	685.80	mm			
Slab on Grade Thickness	**9.00**	in	**228.60**	mm		Model based on 9"	
Slab on Grade Thickness	0.75	ft	228.60	mm			
Containment Wall Thickness	**8.00**	in	**203.20**	mm		Model based on 8"	
Containment Wall Thickness	0.67	ft	203.20	mm			
Tank Pad / Metering Pump Pad Height	**3.00**	ft	**914.40**	mm	EPH		
Corridor							
Length	44.00	ft	13411.20	mm			
Width	8.00	ft	2438.40	mm			
Area	352.00	sf	32.70	m2			
Corridor Covered? ("1" = YES, "0" = NO)	1						
Electrical Room:							
Slab on Grade:							
Length	0.00	ft	0.00	mm			
Width	0.00	ft	0.00	mm			
Concrete Thickness	**12.00**	in	**304.80**	mm		Model based on 12"	
Concrete Thickness	1.00	ft	304.80	mm			
Walls:							
Height = FBD	10.00	ft				Fixed	
Concrete Thickness	**8.00**	in	**203.20**	mm		Model based on 8"	
Concrete Thickness	0.67	ft	203.20	mm			
Overall Dimensions							
Containment Area Length	44.00	ft	13411.20	mm			
Containment Area Width	62.00	ft	18897.60	mm			
Containment Area	2728.00	sf	253.44	m2			
Corridor Area Length	44.00	ft	13411.20	mm			
Corridor Area Width	8.00	ft	2438.40	mm			
Corridor Area	352.00	sf	32.70	m2			
Electrical Area Length	0.00	ft	0.00	mm			
Electrical Area Width	0.00	ft	0.00	mm			
Electrical Room Area	0.00	sf	0.00	m2			
Chemical Facility Area	3080.00	sf	286.14	m2			
Covered Chemical Area (Building)	3080.00	sf	286.14	m2			
Covered Chemical Area (Canopy)	0.00	sf	0.00	m2			
Total Covered Area	3080.00	sf	286.14	m2			

Excavation Depth	3.50	ft	1066.80	mm			
COST ESTIMATE							
Description	**Quantity (English)**	**Unit (English)**	**Quantity (Metric)**	**Unit (Metric)**	**$/Unit**	**Total Cost**	**User Over-Write**
SITEWORK:							
Excavation	505.10	CY	386.18	m3	*$6.72*	$3,396	
Imported Structural Backfill	228.15	CY	174.43	m3	*$50.94*	$11,622	
Native Backfill	51.72	CY	39.54	m3	*$8.27*	$427	
Haul Excess	453.38	CY	346.63	m3	*$8.27*	$3,747	
Allowance for Misc Items	5%				$19,192.84	$960	
Subtotal						$20,152	
CONCRETE:							
Slab on Grade	83.71	CY	64.00	m3	*$490.62*	$41,069	
Containment Walls	8.33	CY	6.37	m3	*$880.79*	$7,340	
Bulk Tank Pads	51.31	CY	39.23	m3	*$490.62*	$25,175	
Day Tank Pads	5.82	CY	4.45	m3	*$490.62*	$2,854	
Transfer Pump Pads	1.33	CY	1.02	m3	*$490.62*	$654	
Metering Pump Pads	5.33	CY	4.08	m3	*$490.62*	$2,617	
Corridor							
Slab on Grade	12.22	CY	9.34	m3	*$490.62*	$5,996	
Electrical Room							
Slab on Grade	0.00	CY	0.00	m3	*$490.62*	$0	
Allowance for Misc Items	5%				$85,705.68	$4,285	
Subtotal						$89,991	
MASONRY:	**Moderate**						
Chemical Building	3080.00	SF	286.14	m2	*$198.37*	$610,970	
Electrical Room	0.00	SF	0.00	m2	*$165.31*	$0	
Subtotal	3080.00					$610,970	
METALS:							
Canopy	0.00	SF	0.00	m2	*$41.80*	$0	
Metal Stairway	1	EA			$8,327.28	$8,327	
Grating	1	EA			$1,998.55	$1,999	
Allowance for Misc Items	10%				$10,325.82	$1,033	
Subtotal						$11,358	
EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
Bulk Tank	3	EA			*$83,507.14*	$250,521	
Day Tank	2	EA			*$8,293.95*	$16,588	
Transfer Pump	2	EA			*$10,658.90*	$21,318	
Metering Pump	8	EA			*$10,658.90*	$85,271	
Allowance for Misc Items	10%				$373,698.30	$37,370	
Subtotal						$411,068	
INSTRUMENTS & CONTROLS:							
Instruments							
Chemical Tank Radar Level Transmitters	3	EA			*$1,043.16*	$3,129	
Chemical Tank Beacons	3	EA			*$1,043.16*	$3,129	
Day Tank Differential Pressure Transmitter	2	EA			*$1,043.16*	$2,086	
Drum or Tote Weigh Scale	0	EA			*$1,390.89*	$0	
Metering Pump Discharge Pressure Switch	8	EA			*$695.44*	$5,564	
Magmeter	4	EA			*$695.44*	$2,782	
Sump Pump Float Switch	1	EA			*$347.72*	$348	
Eyewash	1	EA			*$1,043.16*	$1,043	
Number of Analog I/O Counts	21	EA			*$264.27*	$5,550	
Number of Digital I/O Counts	68	EA			*$62.59*	$4,256	
Number of Local Panels	1	EA			*$13,074.33*	$13,074	
Number of PLCs	1	EA			*$13,908.86*	$13,909	
I&C Conduit & Wire	968.00	LF	295.05	m	*$12.06*	$11,673	
Allowance for Misc Items	10%				$66,543.53	$6,654	
Subtotal						$73,198	
MECHANICAL:							
Pipe							
Chemical Transfer Pump Suction Header Piping-CTSH (7-inch, Exposed, PVC)	44.00	LF	13.41	m	*$44.78*	$1,970	
Chemical Transfer Pump Discharge Header Piping-CTDH (4-inch, Exposed, PVC)	44.00	LF	13.41	m	*$28.95*	$1,274	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	106.00	LF	32.31	m	*$13.11*	$1,390	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	106.00	LF	32.31	m	*$13.11*	$1,390	
Elbows							
Chemical Transfer Pump Suction Header Piping-CTSH (7-inch, Exposed, PVC)	8	EA			*$159.23*	$1,274	
Chemical Transfer Pump Discharge Header Piping-CTDH (4-inch, Exposed, PVC)	8	EA			*$84.65*	$677	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	32	EA			*$10.06*	$322	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	32	EA			*$10.06*	$322	
Tees							
Chemical Transfer Pump Suction Header Piping-CTSH (7-inch, Exposed, PVC)	2	EA			*$237.54*	$475	
Chemical Transfer Pump Discharge Header Piping-CTDH (4-inch, Exposed, PVC)	2	EA			*$124.01*	$248	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	8	EA			*$10.47*	$84	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	8	EA			*$10.47*	$84	
End Caps							
Chemical Transfer Pump Suction Header Piping-CTSH (7-inch, Exposed, PVC)	2	EA			*$78.91*	$158	
Chemical Transfer Pump Discharge Header Piping-CTDH (4-inch, Exposed, PVC)	2	EA			*$42.28*	$85	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	2	EA			*$5.65*	$11	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	2	EA			*$5.65*	$11	
Valves							
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	4	EA			*$1,458.73*	$5,835	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	4	EA			*$757.94*	$3,032	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	16	EA			*$57.14*	$914	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC, V-902, Diaphragm)	16	EA			*$57.14*	$914	
Allowance for Misc Items	10%				$17,225.06	$1,723	
Subtotal						$22,192	
ELECTRICAL:							

# MCC Sections	0	#			*$10,730.27*	$0	
Switchgear	0	EA			*$49,359.23*	$0	
Adjustable Frequency Drives							
Metering Pumps	0	EA			***$8,931.12***	$0	
User Defined Item #1	0	EA			***$8,865.56***	$0	
User Defined Item #2	0	EA			***$8,865.56***	$0	
User Defined Item #3	0	EA			***$8,865.56***	$0	
Electrical Conduit & Wire	0.00	LF	0.00	m	*$12.06*	$0	
Allowance for Misc Items	10%				$0.00	$0	
Subtotal						$0	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00				0.00	$0	
Item 2 Description	0.00				0.00	$0	
Item 3 Description	0.00				0.00	$0	
Item 4 Description	0.00				0.00	$0	
Item 5 Description	0.00				0.00	$0	
Item 6 Description	0.00				0.00	$0	
Item 7 Description	0.00				0.00	$0	
Item 8 Description	0.00				0.00	$0	
Item 9 Description	0.00				0.00	$0	
Item 10 Description	0.00				0.00	$0	
Item 11 Description	0.00				0.00	$0	
Item 12 Description	0.00				0.00	$0	
Item 13 Description	0.00				0.00	$0	
Item 14 Description	0.00				0.00	$0	
Item 15 Description	0.00				0.00	$0	
Subtotal						$0	
Subtotal						$1,238,930	
ALLOWANCES:		User Override					
Finishes Allowance	2.00%		$1,376,588	$27,532			
I&C Allowance	2.00%		$1,376,588	$27,532			
Mechanical Allowance	4.00%		$1,376,588	$55,064			
Electrical Allowance	2.00%		$1,376,588	$27,532			
					Facility Cost Name		
Facility Cost	**3,080**	**Building SF**	**$446.94**	**$1,376,588**	CFLFC01		
Facility Cost with Standard Additional Project Costs Added	**3,080**	**Building SF**	**$543.11**	**$1,672,789**	CFLFC02		
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**3,080**	**Building SF**	**$931.54**	**$2,869,132**	CFLFC03		
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**3,080**	**Building SF**	**$766.59**	**$2,361,095**	CFLFC05		
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**3,080**	**Building SF**	**$931.54**	**$2,869,132**	CFLFC06		

On-Site Sodium Hypochlorite Generation

Is This Facility Included in My Project? Yes

Assumptions:
1. Generator & Day Tank Containment Area must be Covered; Salt Storage is Outside

Process User Inputs:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Red Flags	Comments
Flow Rates:							
1.) Input Plant Flow Minimum (mgd)	30.00	mgd	0.00	ML/d			
2.) Input Plant Flow Average (mgd)	75.00	mgd	0.00	ML/d			
3.) Input Plant Flow Maximum (mgd)	160.00	mgd	605.67	ML/d			
CHEMICAL SYSTEM DOSAGE INFORMATION:							
Percent Active Sodium Hypochlorite Generated	0.80%						Fixed
Generated Sodium Hypochlorite Specific Gravity	1.00						Fixed
Active Chemical Form for Dosage Basis	Cl2						
Active Chemical Concentration, lb/gallon	0.07						Fixed
4.) Input Chemical Doses:							
Minimum (mg/L)	2.00	mg/L					
Average (mg/L)	3.00	mg/L					
Maximum (mg/L)	4.00	mg/L					
5.) Input **% of Total Chlorine Dosage Applied Upstream of Rapid Mixing**	0.00%						
6.) Input **% of Total Chlorine Dosage Applied Upstream of Filtration**	0.00%						
7.) Input **% of Total Chlorine Dosage Applied Downstream of Filtration**	50.00%						
8.) Input **% of Total Chlorine Dosage Applied Downstream of Clearwell**	50.00%						
Calculate Number of Simultaneous Application Points	2.00	#					
Whole Plant Chemical Usage:							
Calculate **Minimum Sodium Hypochlorite** (lb/d)	500.72	lb/d	227.12	kg/d			
Calculate **Average Sodium Hypochlorite** (lb/d)	1,877.72	lb/d	851.72	kg/d			
Calculate **Maximum Sodium Hypochlorite** (lb/d)	5,341.06	lb/d	2422.66	kg/d			
9.) Input **Sodium Hypochlorite Generator Capacity** (lb/d, each)	2,000.00	lb/d	907.18	kg/d			ChlorTec Standard Sizes
Calculate **Number of Sodium Hypochlorite Generators** (each)	3.00	#					
Calculate **Generator Equipment Length** (each)	3.81	ft	1160.00	mm	GL		
Calculate **Generator Equipment Width** (each)	3.81	ft	1160.00	mm	GW		
Calculate **Transformer / Rectifier Length** (ft)	5.58	ft	1700.00	mm	TL		
Calculate **Transformer / Rectifier Width** (ft)	5.58	ft	1700.00	mm	TW		
10.) Input **Clear Distance Around Electrical Equipment** (ft)	4.00	ft	1,219.20	mm	CDEE		
Calculate **Minimum Salt** (lb/d)	1,752.53	lb/d	794.94	kg/d			
Calculate **Average Salt** (lb/d)	6,572.00	lb/d	2981.01	kg/d			
Calculate **Maximum Salt** (lb/d)	18,693.70	lb/d	8479.32	kg/d			
Calculate Annual Salt Use (Max Flow and Avg Dose) (tons/year)	731.06	tons/yr					
30% Brine Flow from Salt Saturator to Generator Feed Proportioning Pumping							
Calculate **Maximum 30% Brine Flow for Batch Production to Each Generator** (gpm)	1.94	gpm	0.12	L/s			
Calculate **Total 30% Brine Flow for Batch Production** (gpm)	5.82	gpm	0.37	L/s			
Softened Potable Water Flow from Flow Proportioning Pumping to Generators							
Calculate **Maximum Softened Potable Water Flow for Batch Production** (gpm each generator)	19.42	gpm	1.22	L/s			
Calculate **Total Softened Potable Water Flow for Batch Production** (gpm)	58.25	gpm	3.67	L/s			
3% Brine Flow to Generators							
Calculate **Maximum 3% Brine Flow For Batch Production to Each Generator** (gpm)	21.36	gpm	1.35	L/s			
Calculate **Total 3% Brine Flow for Batch Production** (gpm)	64.07	gpm	4.04	L/s			
Chemical Metering Rates:							
Upstream of Rapid Mixing							
Calculate **Minimum Sodium Hypochlorite** (gph)	0.00	gph	0.00	L/h			
Calculate **Average Sodium Hypochlorite** (gph)	0.00	gph	0.00	L/h			
Calculate **Maximum Sodium Hypochlorite** (gph)	0.00	gph	0.00	L/h			
Calculate **Chemical Metering Pump Flow Turndown**	0.00	#					Should be < 20, If > = 20, proceed with caution
Upstream of Filtration							
Calculate **Minimum Sodium Hypochlorite** (gph)	0.00	gph	0.00	L/h			
Calculate **Average Sodium Hypochlorite** (gph)	0.00	gph	0.00	L/h			
Calculate **Maximum Sodium Hypochlorite** (gph)	0.00	gph	0.00	L/h			

Calculate **Chemical Metering Pump Flow Turndown**	0.00	#					Should be < 20, If > = 20, proceed with caution
Downstream of Filtration							
Calculate **Minimum Sodium Hypochlorite** (gph)	156.25	gph	591.47	L/h			
Calculate **Average Sodium Hypochlorite** (gph)	585.94	gph	2218.01	L/h			
Calculate **Maximum Sodium Hypochlorite** (gph)	1,666.67	gph	6309.02	L/h			
Calculate **Chemical Metering Pump Flow Turndown**	10.67	#					Should be < 20, If > = 20, proceed with caution
Downstream of Clearwell							
Calculate **Minimum Sodium Hypochlorite** (gph)	156.25	gph	591.47	L/h			
Calculate **Average Sodium Hypochlorite** (gph)	585.94	gph	2218.01	L/h			
Calculate **Maximum Sodium Hypochlorite** (gph)	1,666.67	gph	6309.02	L/h			
Calculate **Chemical Metering Pump Flow Turndown**	10.67	#					Should be < 20, If > = 20, proceed with caution
Note to Designer: Review pump selection to accommodate Pump Discharge Back Pressure (psi)							
11.) Input Number of Days of Salt Storage at Average Flow/Dose (days)	**30.00**	days					
Calculate **Salt Storage Volume @ Avg. Flow/Dose** (gallons)	21,499.41	gal	81.38	m3			Assumes density of brine solution to be 70 lb/cf.
Calculate **Bulk Delivery Volume * 1.5** (gallons)	7,213.36	gal	27.31	m3			Assumes density of brine solution to be 70 lb/cf.
Maximum of Above 2 Volumes (gallons)	21,499.41	gal	81.38	m3			
SALT STORAGE/BRINE TANKS:							
12.) Input **Salt Storage/Brine Tank Volume** (gallons, each)	**11,300.00**	gal	42.78	m3			Bryneer Standard Sizes
Calculate **Number of Salt Storage/Brine Tanks** (each)	2.00	#					Typically, 2 minimum
Calculate **Height of Tanks** (ft)	22.83	ft	6958.58	mm			
Calculate **Diameter of Tanks** (ft)	12.00	ft	3657.60	mm	STD		
13.) Input **Clear Distance Around Brine Tanks, Generators, and Day Tanks** (ft)	**4.00**	ft	**1,219.20**	mm	CDT		
SODIUM HYPOCHLORITE DAY TANKS:							
Upstream of Rapid Mixing							
Calculate **Day Tank Volume** (per each, gallons)	0.00	gal	0.00	m3			
Convert **Day Tank Volume** (per each, cf)	0.00	cf	0.00	m3			
Calculate **Day Tank Diameter** (per each, ft)	0.00	ft	0.00	mm	DTD		
Calculate **Day Tank Height** (per each, ft)	0.00	ft	0.00	mm			Assumption: H = 2 * D
Upstream of Filtration							
Calculate **Day Tank Volume** (per each, gallons)	0.00	gal	0.00	m3			
Convert **Day Tank Volume** (per each, cf)	0.00	cf	0.00	m3			
Calculate **Day Tank Diameter** (per each, ft)	0.00	ft	0.00	mm	DTD		
Calculate **Day Tank Height** (per each, ft)	0.00	ft	0.00	mm			Assumption: H = 2 * D
Downstream of Filtration							
Calculate **Day Tank Volume** (per each, gallons)	40,000.00	gal	151.42	m3			
Convert **Day Tank Volume** (per each, cf)	5,347.22	cf	151.42	m3			
Calculate **Day Tank Diameter** (per each, ft)	15.04	ft	4585.12	mm	DTD		
Calculate **Day Tank Height** (per each, ft)	30.09	ft	9170.25	mm			Assumption: H = 2 * D
Downstream of Clearwell							
Calculate **Day Tank Volume** (per each, gallons)	40,000.00	gal	151.42	m3			
Convert **Day Tank Volume** (per each, cf)	5,347.22	cf	151.42	m3			
Calculate **Day Tank Diameter** (per each, ft)	15.04	ft	4585.12	mm	DTD		
Calculate **Day Tank Height** (per each, ft)	30.09	ft	9170.25	mm			Assumption: H = 2 * D
BRINE TRANSFER & METERING PUMPS:							
Calculate **Number of Brine Transfer Pumps** (each)	3	#					
Calculate **Number of Active Metering Pumps** (each)	2	#					Rule: One active metering pump per each application point.
14.) Input **Number of Standby Metering Pumps** (each)	**2**	#					
Calculate **Total Number of Metering Pumps** (each)	4	#					
15.) Input **Clear Distance Around Transfer and Metering Pumps**	**4.00**	ft	**1,219.20**	mm	CDP		
Length of Transfer and Metering Pumps (ft, Fixed)	3.00	ft	914.40	mm	LP		Fixed. Conservatively assumes Pulsafeeder metering pump type.
SODIUM HYPOCHLORITE CONTAINMENT AREA:							
Width of Stair Access (ft, fixed)	4.00	ft	1219.20	mm	WS		Fixed
Calculate **Containment Area Length** (ft)	80.55	ft	24550.57	mm	CAL		
Calculate **Containment Area Width** (ft)	34.04	ft	10376.32	mm	CAW		
Calculate **Fire Sprinkler Water Volume** (gal) (0.2 gpm/sf for 20 min.)	10,968.20	gal	41.52	m3			
Calculate **120% of One Storage Tank Volume** (gal)	48,000.00	gal	181.70	m3			
Calculate **30% of All Tank Volume** (gal)	24,000.00	gal	90.85	m3			
Maximum of Above 2 Volumes (gal)	48,000.00	gal	181.70	m3			
Calculate **Maximum Volume + Fire Flow Volume** (gal)	58,968.20	gal	223.22	m3			
Calculate **Maximum Volume + Fire Flow Volume** (cf)	7,882.90	cf	223.22	m3			

Calculate **Containment Wall Height (including 6" Freeboard)** (ft)	3.37	ft	1028.65	mm	CWH		120% of 1 tank volume or 30% of all tank volume whichever is greater + fire flow volume + 6" freeboard. Should be ≤ 4.5'.
SALT STORAGE AREA:							
Calculate **Salt Storage Area Length** (ft)	36.00	ft	10972.80	mm	SAL		
Calculate **Salt Storage Area Width** (ft)	20.00	ft	6096.00	mm	SAW		
Calculate **Salt Storage Area** (sf)	720.00	sf	66.89	m2			
GENERATOR RECTIFIER AREA:							
16.) Input Clear Distance Around Generator Rectifiers (ft)	**4.00**	ft	**1,219.20**	mm	CDR		
Calculate **Generator Rectifier Area Length** (ft)	32.73	ft	9976.80	mm	RRL		
Calculate **Generator Rectifier Area Width** (ft)	11.81	ft	3598.40	mm	RRW		
Calculate **Generator Rectifier Area** (sf)	386.43	sf	35.90	m2			

COST TABLE FOR TANKS AND PUMPS	**Unit Cost**
Tanks (Installed Cost per Gallon)	
FRP	
Polyethylene (PE)	*$ 2.50*
Phenolic Lined Steel (PLS)	*$ 6.77*
Chemical Feed Pumps (Cost per Each)	*$ 8,527.12*

Estimating Dimensions:	**Value English**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Red Flags**	**Comment**
Building:							
Length	80.55	ft	24550.57	mm	CAL		
Width	34.04	ft	10376.32	mm	CAW		
Area	2742.05	sf	254.74	m2			
Slab on Grade Length	84.55	ft	25769.77	mm			
Slab on Grade Width	38.04	ft	11595.52	mm			
Containment Wall Height	3.37	ft	1028.65	mm	CWH		
Slab on Grade Thickness	**12.00**	in	**304.80**	mm			Model based on 12"
Slab on Grade Thickness	1.00	ft	304.80	mm			
Containment Wall Thickness	**12.00**	in	**304.80**	mm			Model based on 12"
Containment Wall Thickness	1.00	ft	304.80	mm			
Generator / Rectifier Area:							
Length	32.73	ft	9976.80	mm	RRL		
Width	11.81	ft	3598.40	mm	RRW		
Area	386.43	sf	35.90	m2			
Slab on Grade Length	34.73	ft	10586.40	mm			
Slab on Grade Width	15.81	ft	4817.60	mm			
Slab on Grade Thickness	**12.00**	in	**304.80**	mm			Model based on 12"
Slab on Grade Thickness	1.00	ft	304.80	mm			
Salt Storage Slab:							
Length	36.00	ft	10972.80	mm	SAL		
Width	20.00	ft	6096.00	mm	SAW		
Slab on Grade Thickness	**12.00**	in	**304.80**	mm			Model based on 12"
Slab on Grade Thickness	1.00	ft	304.80	mm			
Overall Dimensions:							
Building:							
Excavation Length	88.55	ft	26988.97	mm			
Excavation Width	42.04	ft	12814.72	mm			
Excavation Depth	5.37	ft	1638.25	mm			
Generator / Rectifier Area:							
Excavation Length	38.73	ft	11805.60	mm			
Excavation Width	19.81	ft	6036.80	mm			
Excavation Depth	2.00	ft	609.60	mm			

COST ESTIMATE

Description	**Quantity (English)**	**Unit (English)**	**Quantity (Metric)**	**Unit (Metric)**	**$/Unit**	**Total Cost**	**User Over-Write**
SITEWORK:							
Building:							
Excavation	986.50	CY	754.24	m3	*$6.72*	$6,632	
Imported Structural Backfill	137.88	CY	105.42	m3	*$50.94*	$7,024	
Native Backfill	139.72	CY	106.83	m3	*$8.27*	$1,155	
Haul Excess	846.78	CY	647.41	m3	*$8.27*	$6,999	
Generator / Rectifier Room:							
Excavation	73.36	CY	56.08	m3	*$6.72*	$493	
Imported Structural Backfill	28.41	CY	21.72	m3	*$50.94*	$1,447	
Native Backfill	8.67	CY	6.63	m3	*$8.27*	$72	
Haul Excess	64.68	CY	49.45	m3	*$8.27*	$535	
Allowance for Misc Items	5%				$24,356.73	$1,218	
Subtotal						$25,575	
CONCRETE:							
Building Slab on Grade	119.13	CY	91.08	m3	*$490.62*	$58,445	
Generator / Rectifier Room	20.33	CY	15.55	m3	*$490.62*	$9,975	

Containment Walls	28.65	CY	21.90	m3	***$880.79***	$25,231	
Salt Storage Slab on Grade	26.67	CY	20.39	m3	***$490.62***	$13,083	
Allowance for Misc Items	5%				$106,734.76	$5,337	
Subtotal						$112,071	
MASONRY:	**High**						
CMU Building	3128.48	SF	290.65	m2	***$198.37***	$620,587	
Subtotal						$620,587	
EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
Sodium Hypochlorite Generators (2000 lb/day each)	3	EA			***$998,844.80***	$2,996,534	
Metering Pump	4	EA			***$10,658.90***	$42,636	
Day Tanks:							
Upstream of Rapid Mixing (0 gallons each)	0	EA			***$0.00***	$0	
Upstream of Filtration (0 gallons each)	0	EA			***$0.00***	$0	
Downstream of Filtration (40000 gallons each)	1	EA			***$76,391.01***	$76,391	
Downstream of Clearwell (40000 gallons each)	1	EA			***$76,391.01***	$76,391	
Allowance for Misc Items	10%				$3,191,952.00	$319,195	
Subtotal						$3,511,147	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00		0.00		0.00	$0	
Item 2 Description	0.00		0.00		0.00	$0	
Item 3 Description	0.00		0.00		0.00	$0	
Item 4 Description	0.00		0.00		0.00	$0	
Item 5 Description	0.00		0.00		0.00	$0	
Item 6 Description	0.00		0.00		0.00	$0	
Item 7 Description	0.00		0.00		0.00	$0	
Item 8 Description	0.00		0.00		0.00	$0	
Item 9 Description	0.00		0.00		0.00	$0	
Item 10 Description	0.00		0.00		0.00	$0	
Item 11 Description	0.00		0.00		0.00	$0	
Item 12 Description	0.00		0.00		0.00	$0	
Item 13 Description	0.00		0.00		0.00	$0	
Item 14 Description	0.00		0.00		0.00	$0	
Item 15 Description	0.00		0.00		0.00	$0	
Subtotal						$0	
Subtotal						$4,269,380	
ALLOWANCES:		**User Override**					
Finishes Allowance	2.00%		$5,473,564	$109,471			
I&C Allowance	5.00%		$5,473,564	$273,678			
Mechanical Allowance	10.00%		$5,473,564	$547,356			
Electrical Allowance	5.00%		$5,473,564	$273,678			
Facility Cost	**5,341**	**PPD**	**$1,024.81**	**$5,473,564**			
Facility Cost with Standard Additional Project Costs Added	**5,341**	**PPD**	**$1,245.32**	**$6,651,311**			
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**5,341**	**PPD**	**$2,135.94**	**$11,408,188**			
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**5,341**	**PPD**	**$1,757.73**	**$9,388,142**			
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**5,341**	**PPD**	**$2,135.94**	**$11,408,188**			

Liquid Chemical Storage & Feed - (Sodium Hydroxide (50%))
Located in Stand Alone Chemical Building
Is This Facility Included in My Project? Yes

Is the Facility Storage Only (no metering pumps)?	No	Y/N					
		Overwrite Value					
Select Chemical	Sodium Hydroxide (50%)		Select "Other" from the drop down list if using a different chemical.				
Percent Active Chemical, % w/w	50.00%		This is the intended feed strength to the process. Inputting a value in the yellow cell overwrites the cell in column "C".				For Fluoride systems, concentration must include the Available Fluoride Ion (AFI) concentration. Typically 79.2% AFI for 23% as HFA. (e.g., 23% as HFA x 79.2% AFI = 18.22% as F)
Active Chemical Form for Dosage Basis	NaOH		Inputting a value in the yellow cell overwrites the cell in column "C".				
Bulk Chemical Specific Gravity	1.54		Inputting a value in the yellow cell overwrites the cell in column "C".				
Active lb/gal solution	6.43	lb/gal	770.00	kg/m3			
Process User Inputs:	**Value (English)**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Red Flags**	**Comment**
FLOW AND CHEMICAL ADDITION							
Application #1							
1.) Minimum flow to application point	30.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to.
2.) Average flow to application point	75.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to.
3.) Maximum flow to applicatoin point	160.00	mgd	605.67	ML/d			Input the flow that the selected dose will be applied to.
4.) Minimum chemical addition	5.00	mg/L					Input the dose that corresponds to the flow input above.
5.) Average chemical addition	10.00	mg/L					Input the dose that corresponds to the flow input above.
6.) Maximum chemical addition	25.00	mg/L					Input the dose that corresponds to the flow input above.
7.) Input Number of Equal Simultaneous Application Points	1	#					
8.) Hours of addition per day	24.00	hr					Input the total number of hours that the chemical is fed during the day.
Application #2							
9.) Minimum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
10.) Average flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
11.) Maximum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
12.) Minimum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
13.) Average chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
14.) Maximum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
15.) Input Number of Equal Simultaneous Application Points	0	#					
16.) Hours of addition per day	0.00	hr					Input the total number of hours that the chemical is fed during the day.
Application #3							
17.) Minimum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
18.) Average flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
19.) Maximum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
20.) Minimum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
21.) Average chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
22.) Maximum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
23.) Input Number of Equal Simultaneous Application Points	0	#					
24.) Hours of addition per day	0.00	hr					Input the total number of hours that the chemical is fed during the day.
CHEMICAL QUANTITIES AND FLOW							
Application Point #1 Chemical Usage:							
Minimum as "dry" chemical	1,251.81	lb/d	567.81	kg/d			
Average as "dry" chemical	6,259.05	lb/d	2839.06	kg/d			
Maximum as "dry" chemical	33,381.60	lb/d	15141.64	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	8.12	gph	30.73	L/h			
Average at feed concentration	40.58	gph	153.63	L/h			
Maximum at feed concentration	216.45	gph	819.35	L/h			
Calculate Chemical Metering Pump Flow Turndown	26.67	:1				**Note: Pump turndown is > 20, proceed with the design with caution**	Should be < 20:1, If ≥ 20:1, proceed with caution.
Application Point #2 Chemical Usage:							
Minimum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Average as "dry" chemical	0.00	lb/d	0.00	kg/d			
Maximum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.00	gph	0.00	L/h			
Average at feed concentration	0.00	gph	0.00	L/h			
Maximum at feed concentration	0.00	gph	0.00	L/h			

Calculate Chemical Metering Pump Flow Turndown	0.00	:1					Should be < 20:1, If ≥ 20:1, proceed with caution.
Application Point #3 Chemical Usage:							
Minimum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Average as "dry" chemical	0.00	lb/d	0.00	kg/d			
Maximum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.00	gph	0.00	L/h			
Average at feed concentration	0.00	gph	0.00	L/h			
Maximum at feed concentration	0.00	gph	0.00	L/h			
Calculate Chemical Metering Pump Flow Turndown	0.00	:1					Should be < 20:1, If ≥ 20:1, proceed with caution.
Whole Plant Chemical Usage for Storage Calcs:							
Minimum	1,251.81	lb/d	567.81	kg/d			
Average	6,259.05	lb/d	2839.06	kg/d			
Maximum	33,381.60	lb/d	15141.64	kg/d			
Max Flow Average Dose Daily Usage	13,352.64	lb/d					
Whole Plant # of Days of Storage							
Maximum Flow and Average Dose	30.00	days					
CHEMICAL STORAGE INPUTS							
25.) Flow used to calculate storage requirements	**Maximum**	Type					
26.) Chemcial application used to calculate storage requirements	**Average**	Type					
27.) Input Minimum Number of Days of Storage	**30.00**	days					
Minimum Storage Volume	62,337.66	gal	235.97	m3			
28.) Choose Chemical Delivery Method	**Tank Truck**	Type					
Bulk Delivery Volume (Tank Truck, Totes, Drums)	3,501.42	gal	13.25	m3			Assumes 45,000 lb per Tank Truck.
Optional: Input Bulk Delivery Volume for Selected Delivery Method (overwrites above calculation)		gal		m3			Not typically used. Use with caution.
Calculate Bulk Delivery Volume * 1.5 (for Truck Delivery Only)	5,252.14	gal	19.88	m3			
Maximum of Above Delivery and Storage Volumes	8,333.33	cf	235.97	m3			
BULK TANKS:							
29.) Input Number of Tanks	**4**	#					
30.) Input Tank Diameter	**12.00**	ft	**3,657.60**	mm	BTD		Greater than 14' tank diameter will require on-site tank fabrication. Maximum diameter allowed for this model is 14'.
Calculate Liquid Height of Tanks	18.42	ft	5614.63	mm			
Use this Tank Height (Liquid Height * 1.2)	23.00	ft	7010.40	mm		**Verify tank height in relationship to the facility structure. Add more tanks or increase diameter if needed.**	Verify tank height within the facility. If indoors, typically 4' lower than the roof framing structure. Assumes extra 20% volume needed for each tank for head space and outlet connection elevation.
Calculate Usable Volume of Each Bulk Tank	16,215.51	gal	61.38	m3			Assumes 20% of the volume of each tank is not usable (needed for head space and outlet connection elevation).
Calculate Volume of Each Bulk Tank	19,458.62	gal	73.66	m3			
31.) Input Number of Rows of Tanks	**2**	#					
Calculate Number of Tanks per Row	2	#					
32.) Input Tank Material (FRP, PE (Polyethylene), PLS (Phenolic Lined Steel))	**FRP**	Type					Typically FRP
33.) Input Clear Distance Around BulkTanks, Day Tanks, Totes or Drums	**4.00**	ft	**1,219.20**	mm	CDT		Typically ≥ 3 ft
Calculate Actual Number of Days of Storage	31.21	days					For bulk tanks, assumes 20% of the volume of each tank is not usable (needed for head space and outlet connection elevation).
TOTES & DRUMS:							
Calculate Number of Totes or Drums	0	#					
34.) Input Number of Rows of Totes or Drums	**1**	#					
Calculate Number of Totes or Drums per Row	0	#					
Length of Each Tote	0.00	ft	0.00	mm			Fixed
Width of Each Tote	0.00	ft	0.00	mm			Fixed
Diameter of Each Drum	0.00	ft	0.00	mm			Fixed
DAY TANKS:							
35.) Are Day Tanks Required?	**No**	Y/N					Rule: Day Tanks are only available when the Delivery Method = "Tank Truck".
36.) Input Number of Day Tanks	**2**	#					Suggest 2 Day Tanks
Calculate Day Tank Volume based on Max Flow/Dose (per tank)	0.00	gal	0.00	m3			
Convert Day Tank Volume (per each)	0.00	cf	0.00	m3			
Calculate Day Tank Diameter (per each)	0.00	ft	0.00	mm	DTD		
Calculate Day Tank Height (per each)	0.00	ft	0.00	mm			Assumption: H = 2 * D
TRANSFER & METERING PUMPS:							
Number of Transfer Pumps	0	#					Fixed
37.) Input Time to Fill Day Tank	**20.00**	min					Typically fill all day tanks in 20 min
Calculate Number of Active Metering Pumps	1	#					Rule: One active metering pump per each application point.
Calculate Number of Standby Metering Pumps	1	#					Rule: One standby metering pump per each application
38.) Input Number of Additional Standby Metering Pumps	**0**	#					
Calculate Total Number of Metering Pumps	2	#					
39.) Input Clear Distance Around Transfer and Metering Pumps	**4.00**	ft	**1,828.80**	mm	CDP		Typically ≥ 4 ft
Length of Transfer and Metering Pumps	3.00	ft	914.40	mm			Fixed. Conservatively assumes Pulsafeeder metering pump type.
FACILITY SIZING:							
40.) Is this Chemical Room Part of a Multiple Chemical Facility?	**No**	Y/N					
41.) Is this Chemical Room Considered the "Start Point" for this Chemical Facility?	**No**	Y/N					There should only be one "start point" per chemical facility. Recommend choosing the facility with the greatest width as the "start point"
42.) If this is Part of a Multiple Chemical Facility and is the "Start Point", Input the Summation of Total Number of Pumps from the Other Chemical Rooms Here		#					Total number of pumps is listed in row 114 of the liquid chemical facility, rows 140, 151, and 162 of the dry chemical facility, and row 122 of the potassium permanganate facility

43.) Input Common Chemical Access Corridor Width	8.00	ft	2,438.40	mm			Input zero if a corridor is not required. Assumes Chem facilities are in series. If Chem facilities are in parallel, input 1/2 total corridor width.
44.) Is Corridor Covered?	Yes	Y/N					
45.) Select Chemical Facility Covering	Building						
46.) Select Chemical Area for this Chemical	None						Only used to help CPES user organize chemicals when multiple chemical buildings are used. Has no impact on sizing calculations or cost.
CONTAINMENT AREA:							
Are Stairs Required into Containment Area?	Yes	Y/N					Typically not needed for tote and drum storage areas.
Is Grating Required in Containment Area?	Yes	Y/N					Typically not needed for tote and drum storage areas.
Width of Stair Access	4.00	ft	1219.20	mm	WS		Fixed
Calculate Containment Area Length	36.00	ft	10972.80	mm			
Calculate Containment Area Width	62.00	ft	18897.60	mm			
47.) Optional: User Overwrite of Containment Area Width	62.00	ft	18,897.60	mm			
Calculate Fire Sprinkler Water Volume	8,928.00	gal	33.80	m3			Assumes 0.2 gpm/sf for 20 min if chemical installed inside a building. If chemical is outside or under a canopy, assume no fire sprinkler water volume.
Calculate 120% of One Storage Tank Volume	23,350.34	gal	88.39	m3			
Calculate 30% of All Tank Volume	23,350.34	gal	88.39	m3			
Calculate Maximum Volume + Fire Flow Volume	32,278.34	gal	122.19	m3			
Tank Pads Volume	1,357.17	cf	38.43	m3			
Tank Pads Volume	10,152.32	gal	38.43	m3			
Calculate Maximum Volume + Fire Flow Volume + Tank Pad Volume	42,430.66	gal	160.62	m3			
Calculate Maximum Volume + Fire Flow Volume + Tank Pad Volume	5,672.15	cf	160.62	m3			
Calculate Containment Wall Height (including freeboard)	2.25	ft	685.80	mm			120% of 1 tank volume or 30% of all tank volume whichever is greater + fire flow volume + 6" freeboard. Should be ≤ 4.5'.
48.) Optional: User Overwrite of Containment Wall Height	2.25	ft	2,438.40	mm			
49.) Input Depth of Burial	1.75	ft	0.00	mm	DB		
50.) Input Cutback Slope	1.00	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
51.) Input Over Excavation Depth	1.00	ft	0.00	mm	OEXD		

Mechanical Sizing Requirements:

Pipe Name	Input Velocity	Unit (English)	Input Velocity	Unit (Metric)	Standard Pipe Size	Unit (English)	Nominal Pipe Size
Chemical Transfer Pump Suction Header Piping	2.00	fps	0.61	m/s	1.00	in	25.00
Chemical Transfer Pump Discharge Header Piping	6.00	fps	1.83	m/s	1.00	in	25.00
Chemical Metering Pump Suction Header Piping	2.00	fps	0.61	m/s	1.00	in	25.00
Chemical Metering Pump Discharge Header Piping	6.00	fps	1.83	m/s	1.00	in	25.00

Mechanical Material Requirements:

Pipe Name	Pipe ID	Installation Type	Pipe Material	Pipe Lining Material	Pipe Coating Material	Pipe Length	# Elbows
Chemical Transfer Pump Suction Header Piping	CTSH	Exposed	PVC	NA	NA	0.00	0.00
Chemical Transfer Pump Discharge Header Piping	CTDH	Exposed	PVC	NA	NA	0.00	0.00
Chemical Metering Pump Suction Header Piping	LCSH	Exposed	PVC	NA	NA	98.00	8.00
Chemical Metering Pump Discharge Header Piping	LCDH	Exposed	PVC	NA	NA	98.00	8.00
						L+W	#MP*4

Electrical User Inputs and Sizing Requirements:

52.) Is this a "Critical" Facility (requiring standby power)?	No	Y/N	
53.) Is there SWGR?	No		

Electrical Equipment Lengths:

Item	Quantity	HP per Each	AFD's Required?	MCC Spaces for Motor Starters	MCC Spaces for AFD's less than 50hp)	MCC Spaces for Breakers	MCC Total MCC Spaces
Metering Pumps	2.00	0.50	No	4.00	0.00	0.00	
User Defined Item #1	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #2	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #3	0.00	0.00	No	0.00	0.00	0.00	
TOTAL		**1.00**		**4.00**	**0.00**	**0.00**	**4.00**

Electrical Equipment Widths:

Equipment	Depth (ft)
MCC	1.67
Small AFD's	0.00
Large AFD's	0.00
Switchgear	0.00
Maximum Depth	1.67

Clear Distances:

Clear Distance	Width	Length	Comment	
CD1		3.00	Clear Distance between wall and MCC	Typically 3 feet
CD2		1.00	Clear Distance between MCC and Small AFD	Typically 1 foot
CD3		0.00	Clear Distance between Small AFD and Large AFD	Typically Zero
CD4		0.00	Clear Distance between Large AFD and Switchgear	Typically Zero
CD5		0.00	Clear Distance between Switchgear and Contingency Space	Typically Zero
CD6	4.00		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)	
CD7	3.00		Clear Distance in front of Equipment	Typically 3 feet
Contingency Length		0.00	Contingency length	Typically Zero

Electric Room Length (ft):

CD1	3.00
MCC	8.33

CD2	1.00						
Small AFD's	0.00						
CD3	0.00						
Large AFD's	0.00						
CD4	0.00						
Swithgear	0.00						
CD5	0.00						
Contingency	0.00						
Total Length	12.33						
Electric Room Width (ft):							
CD6	0.00	If there is no switchgear, this distance will be Zero.					
Maximum Equipment Depth	1.67						
CD7	3.00						
Total Width	4.67						
COST TABLE FOR TANKS & PUMPS:	**Unit Cost**						
Tanks (Installed Cost per Gallon)							
FRP	***$2.26***						
Polyethylene (PE)	$ 2.25						
Phenolic Lined Steel (PLS)	***$6.41***						
Chemical Feed Pumps (Cost per Each)	***$10,658.90***						

Estimating Dimensions:	Value English	Unit (English)	Value (Metric)	Unit (Metric)	Name	Comment	Red Flags
Logic Tests ("1" = Yes, "0" = No):							
Is this Chemical Feed System Included?	1						
Is the Method of Delivery "Tank Truck"?	1						
Is Day Tank Required? (1 = Yes, 0 = No)	0						
Tank Truck without Day Tank (True or False)	TRUE						
Tank Truck with Day Tank (True or False)	FALSE						
Tank Truck without Day Tank (1 = Yes, 0 = No)	1					Tank Truck without Day Tank	
Tank Truck with Day Tank (1 = Yes, 0 = No)	0					Tank Truck without Day Tank	
Is the Method of Delivery "Tote"?	0					Tote	
Is the Method of Delivery "Drum"?	0					Drum	
Length of Module (Tank Truck)	36.00	ft	10972.80	mm			
Length of Module (Tote)	0.00	ft	0.00	mm			
Length of Module (Drum)	0.00	ft	0.00	mm			
Width of Module (Tank Truck without Transfer Pump and Day Tank)	62.00	ft	18897.60	mm			
Width of Module (Tank Truck with Transfer Pump and Day Tank)	0.00	ft	0.00	mm			
Width of Module (Tote)	0.00	ft	0.00	mm			
Width of Module (Drum)	0.00	ft	0.00	mm			
Area of Module	0.00	sf	0.00	m2			
Number of Bulk Tanks (each)	4	#					
Diameter of Bulk Tank	12.00	ft	3657.60	mm			
Volume of Each Bulk Tank	19458.62	gal	73.66	m3			
Bulk Tank Material	FRP	Type					
Number of Day Tanks (each)	0	#					
Diameter of Day Tank	0.00	ft					
Volume of Each Day Tank	0.00	gal	0.00	m3			
Number of Transfer Pumps	0	#					
Transfer Pump Capacity (each)	0.00	gpm	0.00	l/min		Assume fill each tank in 20 min	
Number of Metering Pumps	2	#					
Module Covered? ("1" = YES, "0" = NO)	0						
If Module Exists, Is it Covered? ("1" = Yes, "0" = No)	0						
Containment Wall Height	2.25	ft	685.80	mm			
Slab on Grade Thickness	**9.00**	in	**228.60**	mm		Model based on 9"	
Slab on Grade Thickness	0.75	ft	228.60	mm			
Containment Wall Thickness	**8.00**	in	**203.20**	mm		Model based on 8"	
Containment Wall Thickness	0.67	ft	203.20	mm			
Tank Pad / Metering Pump Pad Height	**3.00**	ft	**914.40**	mm	EPH		
Corridor							
Length	36.00	ft	10972.80	mm			
Width	8.00	ft	2438.40	mm			
Area	288.00	sf	26.76	m2			
Corridor Covered? ("1" = YES, "0" = NO)	1						
Electrical Room:							
Slab on Grade:							
Length	13.67	ft	4165.60	mm			
Width	6.00	ft	1828.80	mm			
Concrete Thickness	**12.00**	in	**304.80**	mm		Model based on 12"	
Concrete Thickness	1.00	ft	304.80	mm			
Walls:							
Height = FBD	10.00	ft				Fixed	
Concrete Thickness	**8.00**	in	**203.20**	mm		Model based on 8"	
Concrete Thickness	0.67	ft	203.20	mm			
Overall Dimensions							
Containment Area Length	36.00	ft	10972.80	mm			
Containment Area Width	62.00	ft	18897.60	mm			
Containment Area	2232.00	sf	207.36	m2			
Corridor Area Length	36.00	ft	10972.80	mm			
Corridor Area Width	8.00	ft	2438.40	mm			
Corridor Area	288.00	sf	26.76	m2			
Electrical Area Length	13.67	ft	4165.60	mm			
Electrical Area Width	6.00	ft	1828.80	mm			
Electrical Room Area	82.00	sf	7.62	m2			
Chemical Facility Area	2602.00	sf	241.73	m2			
Covered Chemical Area (Building)	2602.00	sf	241.73	m2			
Covered Chemical Area (Canopy)	0.00	sf	0.00	m2			
Total Covered Area	2684.00	sf	249.35	m2			
Excavation Depth	3.50	ft	1066.80	mm			

COST ESTIMATE

Description	Quantity (English)	Unit (English)	Quantity (Metric)	Unit (Metric)	$/Unit	Total Cost	User Over-Write
SITEWORK:							
Excavation	431.64	CY	330.01	m3	***$6.72***	$2,902	
Imported Structural Backfill	192.74	CY	147.36	m3	***$50.94***	$9,819	
Native Backfill	48.09	CY	36.77	m3	***$8.27***	$397	
Haul Excess	383.54	CY	293.24	m3	***$8.27***	$3,170	
Allowance for Misc Items	5%				$16,288.03	$814	
Subtotal						$17,102	
CONCRETE:							
Slab on Grade	71.38	CY	54.58	m3	***$490.62***	$35,022	

Containment Walls	10.89	CY	8.33	m3	*$880.79*	$9,591	
Bulk Tank Pads	89.36	CY	68.32	m3	*$490.62*	$43,842	
Day Tank Pads	0.00	CY	0.00	m3	*$490.62*	$0	
Transfer Pump Pads	0.00	CY	0.00	m3	*$490.62*	$0	
Metering Pump Pads	1.33	CY	1.02	m3	*$490.62*	$654	
Corridor							
Slab on Grade	10.00	CY	7.65	m3	*$490.62*	$4,906	
Electrical Room							
Slab on Grade	3.04	CY	2.32	m3	*$490.62*	$1,490	
Allowance for Misc Items	5%				$95,504.59	$4,775	
Subtotal						$100,280	
MASONRY:	**Moderate**						
Chemical Building	2520.00	SF	234.12	m2	*$198.37*	$499,885	
Electrical Room	82.00	SF	7.62	m2	*$165.31*	$13,555	
Subtotal	2602.00					$513,440	
METALS:							
Canopy	0.00	SF	0.00	m2	*$41.80*	$0	
Metal Stairway	1	EA			$8,327.28	$8,327	
Grating	1	EA			$1,998.55	$1,999	
Allowance for Misc Items	10%				$10,325.82	$1,033	
Subtotal						$11,358	
EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
Bulk Tank	4	EA			*$43,991.71*	$175,967	
Day Tank	0	EA			*$0.00*	$0	
Transfer Pump	0	EA			*$0.00*	$0	
Metering Pump	2	EA			*$10,658.90*	$21,318	
Allowance for Misc Items	10%				$197,284.63	$19,728	
Subtotal						$217,013	
INSTRUMENTS & CONTROLS:							
Instruments							
Chemical Tank Radar Level Transmitters	4	EA			*$1,043.16*	$4,173	
Chemical Tank Beacons	4	EA			*$1,043.16*	$4,173	
Day Tank Differential Pressure Transmitter	0	EA			*$1,043.16*	$0	
Drum or Tote Weigh Scale	0	EA			*$1,390.89*	$0	
Metering Pump Discharge Pressure Switch	2	EA			*$695.44*	$1,391	
Magmeter	1	EA			*$695.44*	$695	
Sump Pump Float Switch	1	EA			*$347.72*	$348	
Eyewash	1	EA			*$1,043.16*	$1,043	
Number of Analog I/O Counts	9	EA			*$264.27*	$2,378	
Number of Digital I/O Counts	24	EA			*$62.59*	$1,502	
Number of Local Panels	1	EA			*$13,074.33*	$13,074	
Number of PLCs	1	EA			*$13,908.86*	$13,909	
I&C Conduit & Wire	468.00	LF	142.65	m	*$12.06*	$5,644	
Allowance for Misc Items	10%				$48,329.88	$4,833	
Subtotal						$53,163	
MECHANICAL:							
Pipe							
Chemical Transfer Pump Suction Header Piping-CTSH (1-inch, Exposed, PVC)	0.00	LF	0.00	m	*$13.11*	$0	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	0.00	LF	0.00	m	*$13.11*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	98.00	LF	29.87	m	*$13.11*	$1,285	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	98.00	LF	29.87	m	*$13.11*	$1,285	
Elbows							
Chemical Transfer Pump Suction Header Piping-CTSH (1-inch, Exposed, PVC)	0	EA			*$10.06*	$0	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	0	EA			*$10.06*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	8	EA			*$10.06*	$80	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	8	EA			*$10.06*	$80	
Tees							
Chemical Transfer Pump Suction Header Piping-CTSH (1-inch, Exposed, PVC)	0	EA			*$10.47*	$0	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	0	EA			*$10.47*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	2	EA			*$10.47*	$21	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	2	EA			*$10.47*	$21	
End Caps							
Chemical Transfer Pump Suction Header Piping-CTSH (1-inch, Exposed, PVC)	0	EA			*$5.65*	$0	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	0	EA			*$5.65*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	2	EA			*$5.65*	$11	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	2	EA			*$5.65*	$11	
Valves							
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	0	EA			*$57.14*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	0	EA			*$57.14*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	4	EA			*$57.14*	$229	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC, V-902, Diaphragm)	4	EA			*$57.14*	$229	
Allowance for Misc Items	10%				$3,252.28	$325	
Subtotal						$3,578	
ELECTRICAL:							
# MCC Sections	5	#			*$10,730.27*	$53,651	
Switchgear	0	EA			*$49,359.23*	$0	
Adjustable Frequency Drives							
Metering Pumps	0	EA			*$8,931.12*	$0	
User Defined Item #1	0	EA			*$8,865.56*	$0	
User Defined Item #2	0	EA			*$8,865.56*	$0	
User Defined Item #3	0	EA			*$8,865.56*	$0	
Electrical Conduit & Wire	72.00	LF	21.95	m	*$12.06*	$868	
Allowance for Misc Items	10%				$54,519.59	$5,452	
Subtotal						$59,972	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00				0.00	$0	
Item 2 Description	0.00				0.00	$0	

Item 3 Description	0.00				0.00	$0	
Item 4 Description	0.00				0.00	$0	
Item 5 Description	0.00				0.00	$0	
Item 6 Description	0.00				0.00	$0	
Item 7 Description	0.00				0.00	$0	
Item 8 Description	0.00				0.00	$0	
Item 9 Description	0.00				0.00	$0	
Item 10 Description	0.00				0.00	$0	
Item 11 Description	0.00				0.00	$0	
Item 12 Description	0.00				0.00	$0	
Item 13 Description	0.00				0.00	$0	
Item 14 Description	0.00				0.00	$0	
Item 15 Description	0.00				0.00	$0	
Subtotal						$0	
Subtotal						$975,905	
ALLOWANCES:		User Override					
Finishes Allowance	2.00%		$1,084,339	$21,687			
I&C Allowance	2.00%		$1,084,339	$21,687			
Mechanical Allowance	4.00%		$1,084,339	$43,374			
Electrical Allowance	2.00%		$1,084,339	$21,687			
					Facility Cost Name		
Facility Cost	**2,602**	**Building SF**	**$416.73**	**$1,084,339**	CFLFC01		
Facility Cost with Standard Additional Project Costs Added	**2,602**	**Building SF**	**$506.40**	**$1,317,656**	CFLFC02		
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**2,602**	**Building SF**	**$868.57**	**$2,260,017**	CFLFC03		
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**2,602**	**Building SF**	**$714.77**	**$1,859,836**	CFLFC05		
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**2,602**	**Building SF**	**$868.57**	**$2,260,017**	CFLFC06		

Combination Wastewater Surge Basin and Floating Plate Decanter Clarification (Large System ≥ 5 MGD)

PROCESS DESIGN CRITERIA

Is This Facility Included in My Project? Yes

Process User Inputs:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Red Flags	Comment
Is System to Handle Granular Media Filter Backwash Wastewater?	Yes	Y/N					
Is System to Handle Clarification Chemical Sludge?	No	Y/N					
Granular Media Filtration Backwash Wastewater:							
Input Volume of Backwash Wastewater Per Backwash	186,000.00	gal	2,468.09	m3			
Input Volume of Filter Drain Down Per Backwash	37,000.00	gal	238.48	m3			Typically either difference between operating water surface and top of wash trough for surface wash; or difference between water surface and 6-inches above top of media for air scour.
Input Volume of Filter to Waste Per Backwash	84,000.00	gal	594.31	m3			Typically 15 to 30 minutes at design filtration rate.
Input Total Number of Filters	22.00	#					
Input Backwash Turnaround Time From Off-Line to Back On-Line	60.00	min					Typically 20 to 40 minutes
Calculate Maximum Number of Backwashes Feasible Per Day	24.00	#					Assumes only backwash 1 filter at a time. This is typical.
Input Design Maximum Number of Backwashes Per Filter Per Day	0.67	#					Typically 1 to 2
Calculate Design Maximum Number of Backwashes Per Day	14.67	#					
Input Design Maximum Number of Consecutive Backwashes	2.00	#					
Calculate Maximum Design Backwash Wastewater Batch Volume	614,000.00	gal	2324.24	m3			
Calculate Number of Daily Backwash Wastewater Batches Per Day	7.33	#					
Input Maximum Backwash Wastewater Flow Rate	33.30	mgd	236.69	ML/d			
Clarification Chemical Sludge (Not for Softening Applications):							
Input Plant Flow Rate	0.00	mgd		ML/d			
Input Raw Water Turbidity	2.00	NTU					
Input Fraction of Turbidity to Contribute to Solids	1.50	mg/L/NTU					Typically 1 to 2
Input Raw Water Color		CU					
Input Fraction of Color to Contribute to Solids	0.05	mg/L/CU					Typically 0.02 to 0.1
Input Alum Dose	5.00	mg/L					
Input Fraction of Alum to Contribute to Solids	0.44						Typical Value = 0.44 based on 3 waters of hydration for the most probable solid Al(OH)3.3H2O
Input Ferric Chloride Dose		mg/L					
Fraction of Ferric Chloride to Contribute to Solids	0.99						Typical Value = 0.99 based on 3 waters of hydration for the most probable solid Fe(OH)3.3H2O
Input Total Polymer Dose (coagulation, flocculation, filter aids)		mg/L					
Input Raw Water Iron		mg/L					
Input Iron Factor	2.00						Typical Value = 2
Input Raw Water Manganese		mg/L					
Input Manganese Factor	2.00						Typical Value = 2
Input PAC Dose		mg/L					
Calculate Solids Removed	0.00	mg/L					
Calculate Dry Residual Solids Produced	0.00	lb/d	0.00	kg/d			
Input % Dry Solids in Sludge Exiting Clarifier	0.25%						Typically 0.25% to 0.75%
Calculate Maximum Daily Volume of Clarification Sludge	0	gal	0.00	m3			
Input Number of Times Per Day Sludge Collection Equipment Operates	12.00	#					
Input Duration of Each Sludge Equipment Event in Minutes	60.00	min					
Calculate Clarification Sludge Volume Per Collection Event	0.00	gal	0.00	m3			
Calculate Clarification Sludge Flow Per Collection Event	0.00	gpm	0.00	m3/hr			
Calculate Combined Maximum Daily Volume of Wastewater	4,502,666.67	gal	17044.45	m3			
Calculate Combined Maximum Wastewater Episodic Batch Volume	614,000.00	gal	2324.24	m3			
Calculate Combined Maximum Wastewater Episodic Batch Flow Rate	23,126.04	gpm	5252.50	m3/hr			
Input Surge Basin Influent Velocity	5.00	fps	1.52	m/s			Typically 3 to 7 fps
Standard Diameter for Surge Basin Influent Pipe	48.00	in	1219.20	mm	IP		
Input Surge Basin Overflow Weir Head	1.00	ft	304.80	mm	OFH		
Calculate Surge Basin Over Flow Weir Length	15.47	ft	4716.17	mm	OFWL		
Calculate Overflow Weir Box Width	15.47	ft	4716.17	mm	OFBW		
Calculate Overflow Weir Box Length	6.00	ft	1828.80	mm	OFBL		
Floating Plate Decanter System Sizing:							
Will Backwash Equalization Basin contain Floating Decanters?	Yes	Y/N					
Will Backwash Equalization Basin contain Sludge Collectors?	Yes	Y/N					
Input Settling Time in Surge Basin Prior to Initiation of Decant Pumping	0.00	min					Typically 0 to 60 minutes
Input Plate Width	3.50	ft	304.80	mm	PW		Typically 3.5 feet
Input Plate Length	6.00	ft	304.80	mm	PL		Typically 6 feet
Plate Angle (fix @ 55 degrees)	55.00	degrees			PA		Fixed
Conversion of Plate Angle from Degrees to Radians	0.96	radians			PAR		
Effective Plate Area	95.00%				EPA		Typically 0.95
Calculate Projected Effective Plate Area (each) PEPA = PL * PW * cos PAR * EPA	11.44	sf	1.06	m2	PEPA		
Calculate Decanter Flow Rate	3,126.85	gpm	710.19	m3/hr	DFR		
Projected Plate Hydraulic Loading Rate	0.35	gpm/sf	0.75	m/h	HLR		Valid Range: < = 0.40 gpm/sf
Calculate Total Number of Plates #P = DFR / HLR / PEPA	790.00	#			#P		
Input Number of Decanter Units	10.00	#					Target 100-200 plates per decanter in next row
Calculate Number of Plates Per Decanter	79.00						Typically 100-200 plates per decanter

Input Number of Plate Rows per Decanter	**2.00**	#			6.8		Either 1 or 2
Calculate Number of Plates Per Row	40.00	#					Typically 50-100 plates per row
Calculate Floating Decanter Unit Width	13.50	ft	4114.80	mm			
Calculate Floating Decanter Unit Length	11.24	ft	3426.40	mm			Allow 2.024" per plate
Input Floating Decanter Travel	**15.00**	ft	**3,048.00**	mm	FDT		Typically 6 to 15 feet
Decanter Equipment Profile Depth	5.91	ft	1802.87	mm			Plate depth + 1 foot
Clear Depth Beneath Decanter in Low Position to Accommodate Sludge Collectors	3.00	ft	914.40	mm	CL		Fixed
Freeboard Above High Water Surface	**3.00**	ft	**914.40**	mm	FB		Typically 2 feet
Equalization Basin Sizing:							
Input Floating Decanter Distance from Back Wall of Surge Basin	**12.00**	ft		mm	FDBW		Typically 12 feet
Input Distance Between Floating Decanters and Surge Basin Side Walls	**4.00**	ft		mm	FDS		Typically 4 feet
If Floating Decanters are not included, Input Sidewater Depth in Equalization Basin	**15.00**	ft	**4,572.00**	mm			
Calculate Required Surge Basin Storage Area	5,471.99	sf	508.36	m2			
Input Surge Basin Length to Width Ratio	**2.00**	:1					typically 2:1 or 3:1
Calculate Surge Basin Depth at Basin Midpoint	26.91	ft	8203.67	mm	WHMP		
Input Number of Rows of Decanter Units	**2.00**	#					
Calculate Number of Decanter Units Per Row	5.00	#					
Calculate Surge Basin Minimum Width for Decanter Units	99.50						
Calculate Surge Basin Minimum Length for Decanter Units	54.48						
Calculate Surge Basin Width	52.31	ft	15943.10	mm	ISBW	**ERROR!! Change criteria to increase width**	
Calculate Surge Basin Length	104.61	ft	31886.19	mm	ISBL		
Input Slope of Surge Basin	**8.00%**						Typically zero slope or 8%
Calculate Surge Basin Depth at Basin Inlet	22.73	ft	6928.22	mm	WHI		
Calculate Surge Basin Depth at Basin Outlet	31.10	ft	9479.11	mm	WHO		
Submerged Traveling Sludge Collector Sizing:							
Input Number of Sludge Collectors	**3.00**	#					
Calculate Sludge Collector Width	16.60	ft	5060.37	mm	SCW		Acceptable range of values is 8' - 30'.
Calculate Required Sludge Collector Waste Pumping Capacity	450.00	gpm	102.21	m3/hr			Fix at 150 gpm per collector
Number of Submersible Sludge Collector Waste Pumps	2.00	#					Fix at 1 active and 1 standby
Input Sludge Collector Submersible Pump Total Dynamic Head	**60.00**	ft	**18,288.00**	mm			
Input Sludge Collector Submersible Pump Efficiency	**75.00%**						
Calculate Sludge Collector Submersible Pump Horsepower	9.09	hp	6.78	kW			
Equalization Basin Mixing:							
Will Submersible Mixers be included in Surge Basin without Floating Decanters & Traveling Sludge Collection?	**No**	Y/N					
Input Desired Mixing Intensity	**50.00**	sec-1					typically 50 sec-1
Input wire to water rapid mix energy input efficiency	**60.00%**				E		
Input Minimum Water Temperature	32.00	degrees F	**0.00**	degrees C			Valid Range: 0 - 40 deg C.
Dynamic (Absolute) Viscosity of Water	0.000037	lb•s/sf	0.001792	Pa•s			Reference: *Viscosity of Liquid Water in the Range -8°C to 150°C*, J. Phys. Chem. Ref. Data, Vol. 7, No. 3, 1978 (Eqn. 15).
Calculate Volume of Water to be Mixed	0.00	cf	0.00	m3	V		
Calculate Mixer Power	0.00	hp	0.00	kW	HP1		
Recycle Pumps							
Input Number of Decanter Submersible Duty Pumps	**2.00**	#					
Number of Standby Decant Submersible Pump	1.00	#					Fix at 1
Calculate Capacity of Decanter Submersible Pumps	1,563.43	gpm	355.09	m3/hr			
Input Decanter Submersible Pump Total Dynamic Head	**60.00**	ft	**18,288.00**	mm			
Input Decanter Submersible Pump Efficiency	**75.00%**						
Calculate Decanter Submersible Pump Horsepower	31.58	hp	23.55	kW			
Filter to Waste Basin Entry Air Gap							
Input Filter to Waste Basin Influent Air Gap Weir Head	**1.00**	ft	**304.80**	mm	H		For information the Filter Box Area (sf) is:
Input Filter to Waste Design Flow Rate	**12.38**	cfs	**0.66**	m3/s	FTWQ		
Calculate Filter to Waste Basin Influent Air Gap Weir Length	3.72	ft	1133.04	mm	WL		
Calculate Filter to Waste Influent Box Width	3.72	ft	1133.04	mm	FTWBW		
Calculate Filter to Waste Influent Box Length	6.00	ft	1828.80	mm	FTWBW		
Input Pumping Systems Pipe Support Height	**3.00**	ft	**914.40**	mm	PSH		Typically 3 Feet
Input Pumping Systems Pipe Depth of Cover	**5.00**	ft	**1,524.00**	mm	PDC		Typically 3 to 5 Feet
Are Pumping Facilities Covered?	**No**	Y/N					
Input Depth of Burial (as compared to the Surge Basin Depth at Basin Midpoint)	**15.00**	ft	**4,572.00**	mm	DB		Suggest choosing a depth of burial such that 3'-6" of wall remains above grade
Input Cutback Slope	**1.50**	:1 (ft:ft)					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
Input Over Excavation Depth	**1.00**	ft	**0.00**	mm	OEXD		

Mechanical Sizing Requirements:

Pipe Name	Input Velocity	Unit (English)	Input Velocity	Unit (Metric)	Standard Pipe Size	Unit (English)	Nominal Pipe Size
Backwash Waste	**7.00**	fps	**2.13**	m/s	42.00	1050.00	
Filter to Waste	**7.00**	fps	**2.13**	m/s	20.00	500.00	
Backwash Waste Recycle Header	**7.00**	fps	**2.13**	m/s	14.00	350.00	
Backwash Waste Recycle Lateral	**7.00**	fps	**2.13**	m/s	10.00	250.00	
Backwash Waste Sludge Header	**5.00**	fps	**1.52**	m/s	8.00	200.00	
Backwash Waste Sludge Lateral	**5.00**	fps	**1.52**	m/s	8.00	200.00	

Mechanical Material Requirements:

Pipe Name	Pipe ID	Installation Type	Pipe Material	Pipe Lining Material	Pipe Coating Material	Pipe Length	# Elbows

Backwash Waste	BWW	Encased	Steel	Cement Mortar	Fusion Bonded Epoxy	0.00	0.00
Filter to Waste	FTW	Encased	DI	Cement Mortar	Fusion Bonded Epoxy	0.00	0.00
Backwash Waste Recycle Header	BWRH	Exposed	Steel	Cement Mortar	Paint	26.15	1.00
Backwash Waste Recycle Header	BWRH	Encased	Steel	Cement Mortar	Fusion Bonded Epoxy	0.00	0.00
Backwash Waste Recycle Lateral	BWRL	Exposed	DI	Cement Mortar	Paint	95.74	6.00
Backwash Waste Sludge Header	BWSH	Exposed	Steel	Cement Mortar	Paint	26.15	1.00
Backwash Waste Sludge Header	BWSH	Encased	Steel	Cement Mortar	Fusion Bonded Epoxy	0.00	0.00
Backwash Waste Sludge Lateral	BWSL	Exposed	Steel	Cement Mortar	Paint	63.83	4.00

Electrical User Inputs and Sizing Requirements:

Is this a "Critical" Facility (requiring standby power)?	**Yes**	Y/N
Is there SWGR?	No	

Electrical Equipment Lengths:

Item	Quantity	HP per Each	AFD's Required?	MCC Spaces for Motor Starters	MCC Spaces for AFD's less than 50hp)	MCC Spaces for Breakers	MCC Total MCC Spaces
Basin Mixer	0.00	0.00	**Yes**	0.00	0.00	0.00	
Sludge Pumps (Active)	1.00	9.09	**No**	2.00	0.00	0.00	
Sludge Pumps (Standby)	1.00	9.09	**No**	2.00	0.00	0.00	
Traveling Solids Removal Mechanisms	3.00	1.00	**No**	6.00	0.00	0.00	
Recycle Pumps (Active)	2.00	31.58	**No**	6.00	0.00	0.00	
Recycle Pumps (Standby)	1.00	31.58	**No**	3.00	0.00	0.00	
TOTAL		**115.93**		**19.00**	**0.00**	**0.00**	**19.00**

Electrical Equipment Widths:

Equipment	Depth (ft)
MCC	1.67
Small AFD's	0.00
Large AFD's	0.00
Switchgear	0.00
Maximum Depth	**1.67**

Clear Distances:

Clear Distance	Width	Length	Comment	
CD1		**3.00**	Clear Distance between wall and MCC	Typically 3 feet
CD2		**1.00**	Clear Distance between MCC and Small AFD	Typically 1 foot
CD3		**0.00**	Clear Distance between Small AFD and Large AFD	Typically Zero
CD4		**0.00**	Clear Distance between Large AFD and Switchgear	Typically Zero
CD5		**0.00**	Clear Distance between Switchgear and Contingency Space	Typically Zero
CD6	**4.00**		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)	
CD7	**3.00**		Clear Distance in front of Equipment	Tyipcally 3 feet
Contingency Length		**0.00**	Contingency length	Typically Zero

Electric Room Length (ft):

CD1	3.00
MCC	13.33
CD2	1.00
Small AFD's	0.00
CD3	0.00
Large AFD's	0.00
CD4	0.00
Swithgear	0.00
CD5	0.00
Contingency	0.00
Total Length	**17.33**

Electric Room Width (ft):

CD6	0.00	If there is no switchgear, this distance will be Zero.
Maximum Equipment Depth	1.67	
CD7	3.00	
Total Width	**4.67**	

Estimating Dimensions:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Comment	Red Flags
Surge Basin:							
Width	55.81	ft	17009.90	mm	W		
Length	114.86	ft	35010.39	mm	L		
Wall Height - Inlet	22.73	ft	6928.22	mm	WHI		
Wall Height - Midpoint	26.91	ft	8203.67	mm	WHMP		
Wall Height at Midpoint Above Ground	11.91	ft	3631.67	mm			
Wall Height - Outlet	31.10	ft	9479.11	mm	WHO		
Influent Channel Width	5.00	ft	1524.00	mm	ICW		
Slab on Grade Width	59.81	ft	18229.10	mm			
Slab on Grade Length	119.23	ft	36341.45	mm			
Slab on Grade Thickness	**24.00**	in	**609.60**	mm		Model based on 32"	
Slab on Grade Thickness	2.00	ft	609.60	mm			
Influent Channel Wall Thickness	**21.00**	in	**533.40**	mm	TIW	Model based on 18"	
Influent Channel Wall Thickness	1.75	ft	533.40	mm			
Perimeter Wall Thickness	**21.00**	in	**533.40**	mm	TPW	Model based on 19"	
Perimeter Wall Thickness	1.75	ft	533.40	mm			

Backwash Recycle Sump:							
Width	15.00	ft	4572.00	mm			
Length	8.00	ft	2438.40	mm			
Wall Height	34.10	ft	10393.51	mm			
Slab on Grade Width	17.00	ft	5181.60	mm			
Slab on Grade Length	12.00	ft	3657.60	mm			
Slab on Grade Thickness	**24.00**	in	**609.60**	mm		Model based on 32"	
Slab on Grade Thickness	2.00	ft	609.60	mm			
Elevated Slab Width	18.50	ft	5638.80	mm			
Elevated Slab Length	11.50	ft	3505.20	mm			
Elevated Slab Thickness	**12.00**	in	**304.80**	mm		Model based on 10"	
Elevated Slab Thickness	1.00	ft	304.80	mm			
Wall Thickness	**21.00**	in	**533.40**	mm		Model based on 18"	
Wall Thickness	1.75	ft	533.40	mm			
Backwash Sludge Sump:							
Width	10.00	ft	3048.00	mm			
Length	8.00	ft	2438.40	mm			
Wall Height	34.10	ft	10393.51	mm			
Slab on Grade Width	12.00	ft	3657.60	mm			
Slab on Grade Length	12.00	ft	3657.60	mm			
Slab on Grade Thickness	**24.00**	in	**609.60**	mm		Model based on 32"	
Slab on Grade Thickness	2.00	ft	609.60	mm			
Elevated Slab Width	13.50	ft	4114.80	mm			
Elevated Slab Length	11.50	ft	3505.20	mm			
Elevated Slab Thickness	**12.00**	in	**304.80**	mm		Model based on 10"	
Elevated Slab Thickness	1.00	ft	304.80	mm			
Wall Thickness	**21.00**	in	**533.40**	mm		Model based on 18"	
Wall Thickness	1.75	ft	533.40	mm			
Dry Pit:							
Width	23.81	ft	7256.30	mm			
Length	8.00	ft	2438.40	mm			
Wall Height	34.10	ft	10393.51	mm			
Slab on Grade Width	25.81	ft	7865.90	mm			
Slab on Grade Length	12.00	ft	3657.60	mm			
Slab on Grade Thickness	**24.00**	in	**609.60**	mm		Model based on 32"	
Slab on Grade Thickness	2.00	ft	609.60	mm			
Elevated Slab Width	27.31	ft	8323.10	mm			
Elevated Slab Length	11.50	ft	3505.20	mm			
Elevated Slab Thickness	**12.00**	in	**304.80**	mm		Model based on 10"	
Elevated Slab Thickness	1.00	ft	304.80	mm			
Wall Thickness	**21.00**	in	**533.40**	mm		Model based on 18"	
Wall Thickness	1.75	ft	533.40	mm			
Pipe Vault:							
Width	55.81	ft	17009.90	mm			
Length	14.00	ft	4267.20	mm			`
Wall Height	19.91	ft	6070.07	mm			
Slab on Grade Width	56.81	ft	17314.70	mm			
Slab on Grade Length	14.00	ft	4267.20	mm			
Slab on Grade Thickness	**18.00**	in	**457.20**	mm			
Slab on Grade Thickness	1.50	ft	457.20	mm			
Wall Thickness	**12.00**	in	**304.80**	mm			
Wall Thickness	1.00	ft	304.80	mm			
Electrical Room:							
Width	4.67	ft	1422.40	mm			
Length	17.33	ft	5283.20	mm			
Slab on Grade Width	6.67	ft	2032.00	mm			
Slab on Grade Length	21.33	ft	6502.40	mm			
Slab on Grade Thickness	**12.00**	in	**304.80**	mm		Model based on 32"	
Slab on Grade Thickness	1.00	ft	304.80	mm			
Excavation Dimensions:							
Influent Channel, Surge Basin:							
Excavation Width	63.81	ft	19448.30	mm			
Excavation Length	123.23	ft	37560.65	mm			
Excavation Depth	19.00	ft	5791.20	mm			
Dry Pit, Backwash Waste Sludge Wet Well, & Backwash Waste Recycle Wet Well:							
Excavation Width	63.81	ft	19448.30	mm			
Excavation Length	16.00	ft	4876.80	mm			
Excavation Depth	25.18	ft	7676.25	mm			
Pipe Vault:							
Excavation Width	63.81	ft	19448.30	mm			
Excavation Length	14.00	ft	4267.20	mm			
Excavation Depth	8.50	ft	2590.80	mm			

COST ESTIMATE

Description	Quantity (English)	Unit (English)	Quantity (Metric)	Unit (Metric)	$/Unit	Total Cost	User Over-Write
SITEWORK:							
Excavation							
Influent Channel, Surge Basin & Decant Pump	9014.41	CY	6892.01	m3	*$6.72*	$60,605	
Dry Pit, Backwash Waste Sludge Wet Well, & Backwash Waste Recycle Wet Well	1697.98	CY	1298.20	m3	*$6.72*	$11,416	
Pipe Vault	521.33	CY	398.59	m3	*$6.72*	$3,505	

Imported Structural Backfill							
Influent Channel, Surge Basin & Decant Pump	582.44	CY	445.31	m3	$50.94	$29,670	
Dry Pit, Backwash Waste Sludge Wet Well, & Backwash Waste Recycle Wet Well	75.62	CY	57.82	m3	$50.94	$3,852	
Pipe Vault	66.17	CY	50.59	m3	$50.94	$3,371	
Native Backfill							
Influent Channel, Surge Basin & Decant Pump	2515.41	CY	1923.17	m3	$8.27	$20,791	
Dry Pit, Backwash Waste Sludge Wet Well, & Backwash Waste Recycle Wet Well	563.79	CY	431.05	m3	$8.27	$4,660	
Pipe Vault	184.25	CY	140.87	m3	$8.27	$1,523	
Haul Excess							
Influent Channel, Surge Basin & Decant Pump	6499.01	CY	4968.85	m3	$8.27	$53,716	
Dry Pit, Backwash Waste Sludge Wet Well, & Backwash Waste Recycle Wet Well	1134.19	CY	867.15	m3	$8.27	$9,374	
Pipe Vault	337.08	CY	257.72	m3	$8.27	$2,786	
Allowance for Misc Items	5%				$205,268.60	$10,263	
Subtotal						$215,532	
CONCRETE:							
Surge Basin:							
Foundation	528.21	CY	403.84	m3	$541.11	$285,816	
Perimeter Walls	502.88	CY	384.48	m3	$880.79	$442,938	
Influent Channel Wall	82.22	CY	62.86	m3	$880.79	$72,417	
Concrete Curb (8" X 8")	229.73	LF	70.02	m	$41.64	$9,565	
Backwash Recycle Sump:							
Slab on Grade	15.11	CY	11.55	m3	$490.62	$7,414	
Walls	83.99	CY	64.21	m3	$880.79	$73,974	
Elevated Slab	7.88	CY	6.02	m3	$1,333.77	$10,510	
Backwash Sludge Sump:							
Slab on Grade	10.67	CY	8.16	m3	$490.62	$5,233	
Walls	61.88	CY	47.31	m3	$880.79	$54,507	
Elevated Slab	5.75	CY	4.40	m3	$1,333.77	$7,669	
Dry Pit:							
Slab on Grade	22.94	CY	17.54	m3	$490.62	$11,254	
Walls	122.91	CY	93.97	m3	$880.79	$108,262	
Elevated Slab	11.63	CY	8.89	m3	$1,333.77	$15,513	
Pipe Vault:							
Lower Elevated Slab	44.18	CY	33.78	m3	$1,333.77	$58,930	
Upper Elevated Slab	44.18	CY	33.78	m3	$1,333.77	$58,930	
Walls	92.65	CY	70.84	m3	$880.79	$81,607	
Electrical Room Slab on Grade	5.27	CY	4.03	m3	$490.62	$2,584	
Allowance for Misc Items	5%				$1,307,121.61	$65,356	
Subtotal						$1,372,478	
MASONRY:	Moderate						
Pump Sumps and Pipe Vault	0.00	SF	0.00	m2	$165.31	$0	
Electrical Room	80.89	SF	7.51	m2	$165.31	$13,371	
Subtotal	80.89					$13,371	
METALS:							
Influent Channel:							
Grating	279.03	SF	25.92	m2	$90.92	$25,369	
Surge Basin:							
Grating	4.00	SF	0.37	m2	$90.92	$364	
Backwash Recycle Sump:							
Grating	4.00	SF	0.37	m2	$90.92	$364	
Backwash Sludge Sump:							
Grating	4.00	SF	0.37	m2	$90.92	$364	
Dry Pit:							
Ladder	34.10	VLF	10.39	VLM	$125.74	$4,288	
Pipe Vault:							
Grating	4.00	SF	0.37	m2	$90.92	$364	
Stairs	16.00	RISERS			$495.92	$7,935	
Allowance for Misc Items	10%				$39,046.33	$3,905	
Subtotal						$42,951	
DOORS & WINDOWS:							
Backwash Recycle Sump:							
Aluminum Access Hatch (10' x 5')	1.00	EA			$5,569.28	$5,569	
Backwash Sludge Sump:							
Aluminum Access Hatch (3' x 3')	1.00	EA			$1,389.82	$1,390	
Dry Pit:							
Aluminum Access Hatch (3' x 3')	1.00	EA			$1,389.82	$1,390	
Pipe Vault:							
Aluminum Access Hatch (3' x 3')	2.00	EA			$1,389.82	$2,780	
Allowance for Misc Items	5%				$11,128.57	$556	
Subtotal						$11,685	
EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
Floating Decanter Plate System	9039.85	SF	839.83	m2	$115.38	$1,042,990	
Traveling Solids Removal Mechanism	3.00	EA			$105,762.11	$317,286	
Washwater Decant Pump (Submersible Pump)	3.00	EA			$38,347.83	$115,043	
Sludge Pump (Submersible Pump)	2.00	EA			$17,560.95	$35,122	
Mixers	0.00	HP	0.00	kW	$2,499.83	$0	
Allowance for Misc Items	10%				$1,510,441.43	$151,044	
Subtotal						$1,661,486	
I&C:							
Instruments							
Backwash Waste Recycle Header Magmeter (BWRH, 14 inch)	1.00	EA			$18,661.80	$18,662	
Isolation Valve Actuators (Electric)	5.00	EA			$6,409.82	$32,049	
Level Transmitters	1.00	EA			$11,264.12	$11,264	
Number of Analog I/O Counts	6.00	EA			$264.27	$1,586	
Number of Digital I/O Counts	30.00	EA			$62.59	$1,878	
Number of Local Panels	1.00	EA			$13,074.33	$13,074	
Number of PLC's	1.00	EA			$13,908.86	$13,909	
I&C Conduit Wire	390.65	LF	119.07	m	$12.06	$4,711	
Allowance for Misc Items	5%				$97,132.34	$4,857	
Subtotal						$101,989	
MECHANICAL:							
Pipe:							
Backwash Waste (BWW, 42 inch, Steel)	0.00	LF	0.00	m	$970.77	$0	
Filter to Waste (FTW, 20 inch, DI)	0.00	LF	0.00	m	$173.40	$0	

Backwash Waste Recycle Header (BWRH, 14 inch, Steel)	26.15	LF	7.97	m	$323.59	$8,463	
Backwash Waste Recycle Header (BWRH, 14 inch, Steel)	0.00	LF	0.00	m	$323.59	$0	
Backwash Waste Recycle Lateral (BWRL, 10 inch, DI)	95.74	LF	29.18	m	$86.70	$8,301	
Backwash Waste Sludge Header (BWSH, 8 inch, Steel)	26.15	LF	7.97	m	$184.91	$4,836	
Backwash Waste Sludge Header (BWSH, 8 inch, Steel)	0.00	LF	0.00	m	$184.91	$0	
Backwash Waste Sludge Lateral (BWSL, 8 inch, Steel)	63.83	LF	19.46	m	$184.91	$11,803	
Elbows:							
Backwash Waste (BWW, 42 inch, Steel)	0.00	EA			$5,846.39	$0	
Filter to Waste (FTW, 20 inch, DI)	0.00	EA			$3,639.39	$0	
Backwash Waste Recycle Header (BWRH, 14 inch, Steel)	1.00	EA			$1,948.80	$1,949	
Backwash Waste Recycle Header (BWRH, 14 inch, Steel)	0.00	EA			$1,948.80	$0	
Backwash Waste Recycle Lateral (BWRL, 10 inch, DI)	6.00	EA			$1,819.70	$10,918	
Backwash Waste Sludge Header (BWSH, 8 inch, Steel)	1.00	EA			$1,113.60	$1,114	
Backwash Waste Sludge Header (BWSH, 8 inch, Steel)	0.00	EA			$1,113.60	$0	
Backwash Waste Sludge Lateral (BWSL, 8 inch, Steel)	4.00	EA			$1,113.60	$4,454	
Tee:							
Backwash Waste (BWW, 42 inch, Steel)	0.00	EA			$13,320.29	$0	
Filter to Waste (FTW, 20 inch, DI)	0.00	EA			$6,043.12	$0	
Backwash Waste Recycle Header (BWRH, 14 inch, Steel)	2.00	EA			$4,440.10	$8,880	
Backwash Waste Recycle Header (BWRH, 14 inch, Steel)	0.00	EA			$4,440.10	$0	
Backwash Waste Recycle Lateral (BWRL, 10 inch, DI)	0.00	EA			$3,021.56	$0	
Backwash Waste Sludge Header (BWSH, 8 inch, Steel)	1.00	EA			$2,537.20	$2,537	
Backwash Waste Sludge Header (BWSH, 8 inch, Steel)	0.00	EA			$2,537.20	$0	
Backwash Waste Sludge Lateral (BWSL, 8 inch, Steel)	0.00	EA			$2,537.20	$0	
Valves:							
Backwash Waste (BWW, 42 inch, Steel)	0.00	EA			$42,759.05	$0	
Filter to Waste (FTW, 20 inch, DI)	0.00	EA			$17,721.27	$0	
Backwash Waste Recycle Header (BWRH, 14 inch, Steel)	0.00	EA			$14,253.02	$0	
Backwash Waste Recycle Header (BWRH, 14 inch, Steel)	0.00	EA			$14,253.02	$0	
Backwash Waste Recycle Lateral (BWRL, 10 inch, DI)	3.00	EA			$8,860.64	$26,582	
Backwash Waste Sludge Header (BWSH, 8 inch, Steel)	0.00	EA			$8,144.58	$0	
Backwash Waste Sludge Header (BWSH, 8 inch, Steel)	0.00	EA			$8,144.58	$0	
Backwash Waste Sludge Lateral (BWSL, 8 inch, Steel)	2.00	EA			$8,144.58	$16,289	
Allowance for Misc Items	5%				$106,125.96	$5,306	
Subtotal						$111,432	
ELECTRICAL:							
# MCC Sections	8.00	EA			$10,730.27	$85,842	
Switchgear	0.00	EA			$49,359.23	$0	
Adjustable Frequency Drives							
Basin Mixer	0.00	EA			$8,865.56	$0	
Sludge Pumps (Active)	0.00	EA			$10,057.67	$0	
Sludge Pumps (Standby)	0.00	EA			$10,057.67	$0	
Recycle Pumps (Active)	0.00	EA			$13,007.28	$0	
Recycle Pumps (Standby)	0.00	EA			$13,007.28	$0	
Electrical Conduit & Wire	446.45	LF	136.08	m	$12.06	$5,384	
Allowance for Misc Items	5%				$91,225.92	$4,561	
Subtotal						$95,787	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00		0.00		0.00	$0	
Item 2 Description	0.00		0.00		0.00	$0	
Item 3 Description	0.00		0.00		0.00	$0	
Item 4 Description	0.00		0.00		0.00	$0	
Item 5 Description	0.00		0.00		0.00	$0	
Item 6 Description	0.00		0.00		0.00	$0	
Item 7 Description	0.00		0.00		0.00	$0	
Item 8 Description	0.00		0.00		0.00	$0	
Item 9 Description	0.00		0.00		0.00	$0	
Item 10 Description	0.00		0.00		0.00	$0	
Item 11 Description	0.00		0.00		0.00	$0	
Item 12 Description	0.00		0.00		0.00	$0	
Item 13 Description	0.00		0.00		0.00	$0	
Item 14 Description	0.00		0.00		0.00	$0	
Item 15 Description	0.00		0.00		0.00	$0	
Subtotal						$0	
Subtotal						$3,626,711.07	
ALLOWANCES:		**User Override**					
Finishes Allowance	2.00%		$4,168,633	$83,372.67			
I&C Allowance	3.00%		$4,168,633.42	$125,059.00			
Mechanical Allowance	5.00%		$4,168,633.42	$208,431.67			
Electrical Allowance	3.00%		$4,168,633.42	$125,059.00			
					Facility Cost Name		
Facility Cost	**4,502,667**	**Gallons**	**$0.93**	**$4,168,633**	SDLFC01		
Facility Cost with Standard Additional Project Costs Added	**4,502,667**	**Gallons**	**$1.13**	**$5,065,598**	SDLFC02		
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**4,502,667**	**Gallons**	**$1.93**	**$8,688,407**	SDLFC03		
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**4,502,667**	**Gallons**	**$1.59**	**$7,149,952**	SDLFC05		
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**4,502,667**	**Gallons**	**$1.93**	**$8,688,407**	SDLFC06		

Gravity Thickener

PROCESS DESIGN CRITERIA

Is This Facility Included in My Project? Yes

Process User Inputs:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Red Flags	Comment
Solids Production:							
Input Plant Flow Rate	160.00	mgd	605.67	ML/d			
Input Raw Water Turbidity	2.00	NTU					
Input Fraction of Turbidity to Contribute to Solids	1.00	mg/L/NTU					Typically 1 to 2
Input Raw Water Color	10.00	CU					
Input Fraction of Color to Contribute to Solids	0.05	mg/L/CU					Typically 0.02 to 0.1
Input Alum Dose	5.00						
Input Fraction of Alum to Contribute to Solids	0.44						Typical Value = 0.44 based on 3 waters of hydration for the most probable solid Al(OH)3.3H2O
Input Ferric Chloride Dose		mg/L					
Fraction of Ferric Chloride to Contribute to Solids	0.99						Typical Value = 0.99 based on 3 waters of hydration for the most probable solid Fe(OH)3.3H2O
Input Total Polymer Dose (coagulation, flocculation, filter aids)		mg/L					
Input Raw Water Iron		mg/L					
Input Iron Factor	2.00						Typical Value = 2
Input Raw Water Manganese		mg/L					
Input Manganese Factor	2.00						Typical Value = 2
Input PAC Dose		mg/L					
Input Carbonate Hardness Concentration to be Removed via Softening		mg/L as CaCO3					
Input Carbonate Hardness Factor (mg of softening solids produced per mg of hardness removed)	1.00						Typical Value: 1 for sodium hydroxide softening; 2 for lime softening.
Input Non-Carbonate Hardness Concentration to be Removed via Softening		mg/L as CaCO3					
Input Non-Carbonate Hardness Factor (mg of softening solids produced per mg of hardness removed)	1.00						Typical Value: 1 for sodium hydroxide softening; 1 for soda ash softening.
Calculate Solids Removed	4.70	mg/L					
Calculate Dry Residual Solids Produced	6,275.74	lb/d	2846.63	kg/d			
Optional: Input Daily Dry Solids Production (overwrites above calculations) (dry)		lb/d		kg/d			
Gravity Thickener Sizing & Sludge Storage:							
Input Number of On-Line Thickeners	1	#					
Input Number of Standby Thickeners	1	#					Typically 1
Input % Dry Solids in Sludge to Thickeners	1.00%						Typically 0.25% tyo 0.75%
Calculate Total Sludge Flow Rate	75,200.00	gpd	284.66	m3/d			
Calculate Sludge Flow to Each Thickener	75,200.00	gpd	284.66	m3/d			
Calculate Dry Solids Flow to Each Thickener	6,275.74	lb/d	2846.63	kg/d			
Input Thickener Hydraulic Loading Rate	300.00	gpd/sf	12.23	m/d			Typically 100 to 300 gpd/sf for metal salt coagulant sludges
Input Thickener Solids Loading Rate	10.00	lb/d/sf	48.82	kg/d/m2			Typically 5 to 10 lb/sf/d
Calculate Thickener Diameter, Each Based on Hydraulic Loading Rate	17.87	ft	5445.26	mm			
Calculate Thickener Diameter, Each Based on Solids Loading Rate	28.27	ft	8615.94	mm			
Calculate Thickener Diameter, Each (maximum of above)	28.27	ft	8615.94	mm			
Input Thickened Sludge % Dry Solids	0.25%						Typically 2% to 5% for metal salt coagulant sludges treated with polymer
Calculate Thickened Sludge Density	62.49	lb/cf	1000.98	kg/m3			Assumes density of dried solids of 145 lb/cf.
Input Days of Thickened Sludge Storage in Thickener	3.00	days					Typically 0 to 3 days (long weekend)
Calculate Thickened Sludge Storage Depth	192.03	ft	58531.91	mm			If Sludge Storage depth is greater than desired: 1.) Reduce days of storage or 2.) Decrease controlling thickener loading rate criteria input.
Calculate Total Thickened Sludge Storage Volume	901,518.10	gal	3412.62	m3			
Input Clear Water Depth Above Sludge Line	8.00	ft	2,438.40	mm			Typically 8 to 11 feet
Input Free Board	3.00	ft	914.40	mm			Typically 1 to 3 feet
Calculate Total Thickener Depth	203.03	ft	61884.71	mm			
Input Thickener Wall Height Above Grade	3.00	ft	914.40	mm			
Calculate Wall Burial Depth	200.03	ft	60970.31	mm	DB		
Gravity Thickener Peripheral Weir Launder Sizing:							
Calculate Total Flow Rate of all Thickeners	0.08	mgd	284.66	m3/d	QT		
Calculate Flow Rate of Each Active Thickener	0.08	mgd	284.66	m3/d	Q, mgd		
Convert Each Thickener Flow Rate	0.12	cfs	3.29	L/s	Q, cfs		
Input Velocity in Launder	5.00	fps	1.52	m/s	V		Typically < 5 fps
Calculate Area (Q, cfs / V)	0.02	sf	0.00	m2			
Launder Freeboard	1.00	ft	304.80	mm			Fixed
Input Launder Width	2.00	ft	609.60	mm			
Calculate Launder Height Excluding Freeboard	0.01	ft	3.55	mm			
Calculate Launder Height Including Freeboard	1.01	ft	308.35	mm			Should be ≤ 5 ft.
Thickened Sludge Pump Sizing:							
Calculate Thickened Sludge Flow from Each Thickener	300,506.03	gpd	1137.54	m3/d			
Calculate Thickener Decant Flow from Each Thickener	(225,306.03)	gpd	(852.88)	m3/d			
Number of Progressive Cavity Thickened Sludge Pumps per Thickener	2	#					Fixed: 1 duty and 1 standby
Calculate Number of Thickened Sludge Pumps	4	#					
Calculate Thickened Sludge Pump Capacity, Each	208.68	gpm	789.96	L/min			
Input Thickened Sludge Pump Total Dynamic Head (TDH)	60.00	ft	18,288.00	mm			

Calculate Thickened Sludge Pump Horsepower (each)	4.22	hp	3.14	kW			
Input Distance between Thickener and Sludge Pump Pad	**16.00**	ft	**4,876.80**	mm			Minimum of 10 ft
Input Sludge Pump Length (progressive cavity)	**8.50**	ft	**2,590.80**	mm			Typically 8.5 ft
Input Sludge Pump Width (progressive cavity)	**2.00**	ft	**609.60**	mm			Typically 2.0 ft
Input Stagger Distance Between Sludge Pump Centerlines - Length	**8.50**	ft	**2,590.80**	mm			Typically equal to sludge pump length
Input Distance Between Sludge Pump Centerlines (width) and Around Pumps for Access	**4.50**	ft	**1,371.60**	mm			Typically 4.5 ft for access
Include the Cost of a Building Over Sludge Pump Station?	**Yes**	Y/N					
Input Cutback Slope	**1.50**	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
Input Over Excavation Depth	**1.00**	ft	**0.00**	mm	OEXD		

Mechanical Sizing Requirements

Pipe Name	Input Velocity	Unit (English)	Input Velocity	Unit (Metric)	Standard Pipe Size	Unit (English)	Nominal Pipe Size
Unthickened Sludge Influent Pipe	**3.00**	fps	**0.91**	m/s	4.00	in	100.00
Decant Pipe	**5.00**	fps	**1.52**	m/s	4.00	in	100.00
Thickened Sludge Suction Pipe	**3.00**	fps	**0.91**	m/s	6.00	in	150.00
Thickened Sludge Discharge Pipe	**3.00**	fps	**0.91**	m/s	6.00	in	150.00

Mechanical Material Requirements

Pipe Name	Pipe ID	Installation Type	Pipe Material	Pipe Lining Material	Pipe Coating Material	Comments	Red Flags
Unthickened Sludge Influent Pipe	USP	Buried	DI	Cement Mortar	Tape Coating		
Unthickened Sludge Influent Pipe	USP	Encased	DI	Cement Mortar	Fusion Bonded Epoxy		
Unthickened Sludge Influent Pipe	USP	Submerged	DI	Cement Mortar	Fusion Bonded Epoxy		
Decant Pipe	DSP	Buried	DI	Cement Mortar	Tape Coating		
Decant Pipe	DSP	Exposed	DI	Cement Mortar	Paint		
Decant Pipe	DSP	Encased	DI	Cement Mortar	Fusion Bonded Epoxy		
Thickened Sludge Suction Pipe	TSSP	Encased	DI	Cement Mortar	Fusion Bonded Epoxy		
Thickened Sludge Suction Pipe	TSSP	Exposed	Steel	Cement Mortar	Paint		
Thickened Sludge Discharge Pipe	TSDP	Exposed	DI	Cement Mortar	Paint		

Electrical User Inputs and Sizing Requirements:

Is this a "Critical" Facility (requiring standby power)?	**Yes**	Y/N
Is there SWGR?	No	

Electrical Equipment Lengths

Item	Quantity	HP per Each	AFD's Required?	MCC Spaces for Motor Starters	MCC Spaces for AFD's less than 50hp)	MCC Spaces for Breakers	MCC Total MCC Spaces
Thickened Sludge Pumps (Active)	2.00	4.22	Yes	0.00	8.00	4.00	
Thickened Sludge Pumps (Standby)	2.00	4.22	No	4.00	0.00	0.00	
Gravity Thickener Rake Mechanism	2.00	1.00	No	4.00	0.00	0.00	
User Defined Item #1	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #2	0.00	0.00	No	0.00	0.00	0.00	
TOTAL		**18.9**		**8.00**	**8.00**	**4.00**	**20.00**

Electrical Equipment Widths:

Equipment	Depth (ft)
MCC	1.67
Small AFD's	0.00
Large AFD's	0.00
Switchgear	0.00
Maximum Depth	**1.67**

Clear Distances:

Clear Distance	Width	Length	Comment	
CD1		**3.00**	Clear Distance between wall and MCC	Typically 3 feet
CD2		**1.00**	Clear Distance between MCC and Small AFD	Typically 1 foot
CD3		**0.00**	Clear Distance between Small AFD and Large AFD	Typically Zero
CD4		**0.00**	Clear Distance between Large AFD and Switchgear	Typically Zero
CD5		**0.00**	Clear Distance between Switchgear and Contingency Space	Typically Zero
CD6	**4.00**		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)	
CD7	**3.00**		Clear Distance in front of Equipment	Tyipcally 3 feet
Contingency Length		**0.00**	Contingency length	Typically Zero

Electric Room Length (ft):

CD1	3.00
MCC	13.33
CD2	1.00
Small AFD's	0.00
CD3	0.00
Large AFD's	0.00
CD4	0.00
Swithgear	0.00
CD5	0.00
Contingency	0.00
Total Length	**17.33**

Electric Room Width (ft):							
CD6	0.00	If there is no switchgear, this distance will be Zerc					
Maximum Equipment Depth	1.67						
CD7	3.00						
Total Width	**4.67**						

Estimating Dimensions:	**Value English**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Red Flags**	**Comment**
Total Number of Thickeners	2.00	#					
Gravity Thickener (dimensions per each):							
Perimeter Wall Inside Diameter	28.27	ft	8615.94	mm			
Perimeter Wall Outside Diameter	30.27	ft	9225.54	mm			
Perimeter Wall Height	203.03	ft	61884.71	mm			
Wall Footer Thickness	**16.00**	in	**406.40**	mm			Model based on 16"
Wall Footer Thickness	1.33	ft	406.40	mm			
Slab on Grade Thickness	**6.00**	in	**152.40**	mm			Model based on 6"
Slab on Grade Thickness	0.50	ft	152.40	mm			
Center Cone Outside Diameter	6.17	ft	1879.60	mm			Fixed
Center Cone Inside Diameter	3.50	ft	1066.80	mm			Fixed
Center Cone Slab on Grade Thickness	**16.00**	in		mm			Model based on 16"
Center Cone Slab on Grade Thickness	1.33	ft	406.40	mm			
Center Cone Wall Height	**2.33**	ft	**59.18**	mm			Model based on 2.33'
Center Cone Wall Thickness	**16.00**	in	**406.40**	mm			Model based on 16"
Center Cone Wall Thickness	1.33	ft	406.40	mm			
Launder Elevated Slab Width	**2.00**	ft	**50.80**	mm			Model based on 2'
Launder Elevated Slab Thickness	**12.00**	in	**304.80**	mm			Model based on 12"
Launder Elevated Slab Thickness	1.00	ft	304.80	mm			
Launder Wall Diameter	24.27	ft	7396.74	mm			
Launder Wall Height	1.01	ft	308.35	mm			
Launder Wall Thickness	**8.00**	in	**203.20**	mm			Model based on 8"
Launder Wall Thickness	0.67	ft	203.20	mm			
Perimeter Wall Thickness	**12.00**	in	**304.80**	mm			Model based on 12"
Perimeter Wall Thickness	1.00	ft	304.80	mm			
Floor Slope Factor	1.03						Fixed
Side Slope Depth Factor	0.23						Fixed
Side Slope Factor	4.29						Fixed
Excavation Diameter	39.27	ft	11968.74	mm			
Cone Excavation Depth	6.57	ft	2003.22	mm			
Perimeter Wall Excavation Depth (Includes Over Excavation)	202.37	ft	61681.51	mm			
Thickened Sludge Pump Slab:							
Length	26.00	ft	7924.80	mm			Fixed
Width	30.50	ft	9296.40	mm			
Slab on Grade Length	28.00	ft	8534.40	mm			
Slab on Grade Width	32.50	ft	9906.00	mm			
Slab Thickness	**16.00**	in	**406.40**	mm			Model based on 16"
Slab Thickness	1.33	ft	406.40	mm			
Excavation Length	32.00	ft	9753.60	mm			
Excavation Width	36.50	ft	11125.20	mm			
Excavation Depth	3.33	ft	1016.00	mm			
Electrical Room:							
Length	17.33	ft	5283.20	mm			
Width	4.67	ft	1422.40	mm			
Slab on Grade Length	19.33	ft	5892.80	mm			
Slab on Grade Width	6.67	ft	2032.00	mm			
Slab on Grade Thickness	**18.00**	in	**457.20**	mm			Model based on 18"
Slab on Grade Thickness	1.50	ft	457.20	mm			
Excavation Length	23.33	ft	7112.00	mm			
Excavation Width	10.67	ft	3251.20	mm			
Excavation Depth	3.50	ft	1066.80	mm			

COST ESTIMATE

Description	**Quantity (English)**	**Unit (English)**	**Quantity (Metric)**	**Unit (Metric)**	**$/Unit**	**Total Cost**	**User Over-Write**
SITEWORK:							
Gravity Thickener:							
Excavation	334,898.77	CY	256048.49	m3	***$6.72***	$2,251,548	
Imported Structural Backfill	184.33	CY	140.93	m3	***$50.94***	$9,390	
Native Backfill	280,666.63	CY	214585.05	m3	***$8.27***	$2,319,790	
Haul Excess	54,232.14	CY	41463.45	m3	***$8.27***	$448,244	
Thickened Sludge Pump Slab:							
Excavation	208.86	CY	159.68	m3	***$8.33***	$1,739	
Imported Structural Backfill	100.94	CY	77.17	m3	***$50.94***	$5,142	
Native Backfill	42.28	CY	32.33	m3	***$8.27***	$349	
Haul Excess	166.58	CY	127.36	m3	***$8.27***	$1,377	
Electrical Room:							
Excavation	62.05	CY	47.44	m3	***$8.33***	$517	
Imported Structural Backfill	23.05	CY	17.62	m3	***$50.94***	$1,174	
Native Backfill	23.14	CY	17.69	m3	***$8.27***	$191	
Haul Excess	38.91	CY	29.75	m3	***$8.27***	$322	
Allowance for Misc Items	5%				$5,039,783.59	$251,989	
Subtotal						$5,291,773	
CONCRETE:							
Gravity Thickener:							
Wall Footers	51.65	CY	39.49	m3	***$541.11***	$27,950	
Slanted Slab on Grade	23.88	CY	18.26	m3	***$541.11***	$12,922	
Slanted Floor Grout (2" thick)	1,289.54	SF	119.80	m2	***$23.76***	$30,640	
Center Cone Slab on Grade	2.95	CY	2.26	m3	***$541.11***	$1,596	
Center Cone Walls	4.46	CY	3.41	m3	***$499.64***	$2,227	
Perimeter Walls	1,430.08	CY	1093.38	m3	***$707.82***	$1,012,239	
Launder Elevated Slab	13.16	CY	10.06	m3	***$832.73***	$10,956	
Launder Wall	3.81	CY	2.91	m3	***$832.73***	$3,172	
Concrete Fill	***2.19***	CY	1.68	m3	***$374.73***	$822	
Thickened Sludge Pump Slab:						$0	
Slab on Grade	44.94	CY	34.36	m3	***$490.62***	$22,047	
Electrical Room:						$0	
Slab on Grade	7.16	CY	5.47	m3	***$541.11***	$3,875	
Allowance for Misc Items	5%				$1,128,445.04	$56,422	

Subtotal						$1,184,867	
METALS:							
Gravity Thickener:							
Walkway Grating (3' wide, steel support beams supplied by mechanism mfr)	181.61	SF	16.87	m2	***$90.92***	$16,511	
Walkway Handrail	121.07	LF	36.90	m	***$90.92***	$11,007	
Stairway	9	Risers			***$495.92***	$4,463	
Allowance for Misc Items	10%				$31,981.92	$3,198	
Subtotal						$35,180	
MASONRY:	**High**						
Thickened Sludge Pump Building	793.00	SF	73.67	m2	***$198.37***	$157,305	
Electrical Room	80.89	SF	7.51	m2	***$198.37***	$16,046	
Subtotal	873.89					$173,351	
EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
Gravity Thickener Drive Mechanism (1 hp each)	2	EA			***$103,316.51***	$206,633	
Thickened Sludge Pumps (Active, Progressive Cavity Pumps 4 hp each)	2	EA			***$13,764.35***	$27,529	
Thickened Sludge Pumps (Standby, Progressive Cavity Pumps 4 hp each)	2	EA			***$13,764.35***	$27,529	
Allowance for Misc Items	10%				$234,161.73	$23,416	
Subtotal						$285,107	
I&C:							
Instruments							
Thickened Sludge Discharge Pipe Magmeter (TSDP, 6 inch)	2	EA			***$10,405.05***	$20,810	
Isolation Valve Actuators (Electric)	6	EA			***$6,409.82***	$38,459	
Level Transmitters	2	EA			***$10,730.27***	$21,461	
Number of Analog I/O Counts	5	EA			***$264.27***	$1,321	
Number of Digital I/O Counts	36	EA			***$62.59***	$2,253	
Number of Local Panels	2	EA			***$13,074.33***	$26,149	
Number of PLC's	1	EA			***$13,908.86***	$13,909	
I&C Conduit Wire	742.68	LF	226.37	m	***$12.06***	$8,956	
Allowance for Misc Items	5%				$133,317.58	$6,666	
Subtotal						$139,983	
MECHANICAL:							
Pipe:							
Unthickened Sludge Influent Pipe (USP, Buried, 4 inch, DI)	400.07	LF	121.94	m	***$34.68***	$13,874	
Unthickened Sludge Influent Pipe (USP, Encased, 4 inch, DI)	0.00	LF	0.00	m	***$34.68***	$0	
Unthickened Sludge Influent Pipe (USP, Submerged, 4 inch, DI)	34.27	LF	10.44	m	***$34.68***	$1,188	
Decant Pipe (DSP, Buried, 4 inch, DI)	7.33	LF	2.24	m	***$34.68***	$254	
Decant Pipe (DSP, Exposed, 4 inch, DI)	400.07	LF	121.94	m	***$34.68***	$13,874	
Decant Pipe (DSP, Encased, 4 inch, DI)	0.00	LF	0.00	m	***$34.68***	$0	
Thickened Sludge Suction Pipe (TSSP, Encased, 6 inch, DI)	60.27	LF	18.37	m	***$52.02***	$3,135	
Thickened Sludge Suction Pipe (TSSP, Exposed, 6 inch, Steel)	52.50	LF	16.00	m	***$138.68***	$7,281	
Thickened Sludge Discharge Pipe (TSDP, Exposed, 6 inch, DI)	48.00	LF	14.63	m	***$52.02***	$2,497	
Elbows:							
Unthickened Sludge Influent Pipe (USP, Buried, 4 inch, DI)	2	EA			***$727.88***	$1,456	
Unthickened Sludge Influent Pipe (USP, Encased, 4 inch, DI)	0	EA			***$727.88***	$0	
Unthickened Sludge Influent Pipe (USP, Submerged, 4 inch, DI)	6	EA			***$727.88***	$4,367	
Decant Pipe (DSP, Buried, 4 inch, DI)	0	EA			***$727.88***	$0	
Decant Pipe (DSP, Exposed, 4 inch, DI)	2	EA			***$727.88***	$1,456	
Decant Pipe (DSP, Encased, 4 inch, DI)	0	EA			***$727.88***	$0	
Thickened Sludge Suction Pipe (TSSP, Encased, 6 inch, DI)	0	EA			***$1,091.82***	$0	
Thickened Sludge Suction Pipe (TSSP, Exposed, 6 inch, Steel)	2	EA			***$835.20***	$1,670	
Thickened Sludge Discharge Pipe (TSDP, Exposed, 6 inch, DI)	2	EA			***$1,091.82***	$2,184	
End Caps:							
Unthickened Sludge Influent Pipe (USP, Buried, 4 inch, DI)	0	EA			***$180.64***	$0	
Unthickened Sludge Influent Pipe (USP, Encased, 4 inch, DI)	0	EA			***$180.64***	$0	
Unthickened Sludge Influent Pipe (USP, Submerged, 4 inch, DI)	0	EA			***$180.64***	$0	
Decant Pipe (DSP, Buried, 4 inch, DI)	0	EA			***$180.64***	$0	
Decant Pipe (DSP, Exposed, 4 inch, DI)	0	EA			***$180.64***	$0	
Decant Pipe (DSP, Encased, 4 inch, DI)	0	EA			***$180.64***	$0	
Thickened Sludge Suction Pipe (TSSP, Encased, 6 inch, DI)	4	EA			***$270.96***	$1,084	
Thickened Sludge Suction Pipe (TSSP, Exposed, 6 inch, Steel)	0	EA			***$270.96***	$0	
Thickened Sludge Discharge Pipe (TSDP, Exposed, 6 inch, DI)	2	EA			***$270.96***	$542	
Tee:							
Unthickened Sludge Influent Pipe (USP, Buried, 4 inch, DI)	0	EA			***$1,208.62***	$0	
Unthickened Sludge Influent Pipe (USP, Encased, 4 inch, DI)	0	EA			***$1,208.62***	$0	
Unthickened Sludge Influent Pipe (USP, Submerged, 4 inch, DI)	0	EA			***$1,208.62***	$0	
Decant Pipe (DSP, Buried, 4 inch, DI)	0	EA			***$1,208.62***	$0	
Decant Pipe (DSP, Exposed, 4 inch, DI)	2	EA			***$1,208.62***	$2,417	
Decant Pipe (DSP, Encased, 4 inch, DI)	0	EA			***$1,208.62***	$0	
Thickened Sludge Suction Pipe (TSSP, Encased, 6 inch, DI)	2	EA			***$1,812.94***	$3,626	
Thickened Sludge Suction Pipe (TSSP, Exposed, 6 inch, Steel)	2	EA			***$1,902.90***	$3,806	
Thickened Sludge Discharge Pipe (TSDP, Exposed, 6 inch, DI)	2	EA			***$1,812.94***	$3,626	
Valves:							
Unthickened Sludge Influent Pipe (USP, Buried, 4 inch, DI)	0	EA			***$3,544.25***	$0	
Unthickened Sludge Influent Pipe (USP, Encased, 4 inch, DI)	0	EA			***$3,544.25***	$0	
Unthickened Sludge Influent Pipe (USP, Submerged, 4 inch, DI)	2	EA			***$3,544.25***	$7,089	
Decant Pipe (DSP, Buried, 4 inch, DI)	0	EA			***$3,544.25***	$0	
Decant Pipe (DSP, Exposed, 4 inch, DI)	0	EA			***$3,544.25***	$0	
Decant Pipe (DSP, Encased, 4 inch, DI)	0	EA			***$3,544.25***	$0	
Thickened Sludge Suction Pipe (TSSP, Encased, 6 inch, DI)	0	EA			***$5,316.38***	$0	
Thickened Sludge Suction Pipe (TSSP, Exposed, 6 inch, Steel)	2	EA			***$6,108.44***	$12,217	
Thickened Sludge Discharge Pipe (TSDP, Exposed, 6 inch, DI)	2	EA			***$5,316.38***	$10,633	
Allowance for Misc Items	5%				$98,275.55	$4,914	
Subtotal						$103,189	
ELECTRICAL:							
# MCC Sections	8	EA			***$10,730.27***	$85,842	
Switchgear	0	EA			***$49,359.23***	$0	
Adjustable Frequency Drives							
Thickened Sludge Pumps (Active) (4 hp each)	2	EA			***$9,418.39***	$18,837	
Thickened Sludge Pumps (Standby) (4 hp each)	0	EA			***$9,418.39***	$0	
Gravity Thickener Rake Mechanism (1 hp each)	0	EA			***$8,996.69***	$0	
Electrical Conduit & Wire	204.54	LF	62.34	m	***$12.06***	$2,466	
Allowance for Misc Items	10%				$107,145.41	$10,715	
Subtotal						$117,860	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00		0.00		0.00	$0	
Item 2 Description	0.00		0.00		0.00	$0	
Item 3 Description	0.00		0.00		0.00	$0	
Item 4 Description	0.00		0.00		0.00	$0	
Item 5 Description	0.00		0.00		0.00	$0	
Item 6 Description	0.00		0.00		0.00	$0	

Item 7 Description	0.00		0.00		0.00	$0	
Item 8 Description	0.00		0.00		0.00	$0	
Item 9 Description	0.00		0.00		0.00	$0	
Item 10 Description	0.00		0.00		0.00	$0	
Item 11 Description	0.00		0.00		0.00	$0	
Item 12 Description	0.00		0.00		0.00	$0	
Item 13 Description	0.00		0.00		0.00	$0	
Item 14 Description	0.00		0.00		0.00	$0	
Item 15 Description	0.00		0.00		0.00	$0	
Subtotal						$0	
Subtotal						$7,331,310	
ALLOWANCES:		**User Override**					
Finishes Allowance	2.00%		$8,625,071	$172,501			
I&C Allowance	4.00%		$8,625,071	$345,003			
Mechanical Allowance	5.00%		$8,625,071	$431,254			
Electrical Allowance	4.00%		$8,625,071	$345,003			
					Facility Cost Name		
Facility Cost	**150,400**	**GPD**	**$57.35**	**$8,625,071**	SGTFC01		
Facility Cost with Standard Additional Project Costs Added	**150,400**	**GPD**	**$69.69**	**$10,480,927**	SGTFC02		
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**150,400**	**GPD**	**$119.53**	**$17,976,665**	SGTFC03		
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**150,400**	**GPD**	**$98.36**	**$14,793,540**	SGTFC05		
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**150,400**	**GPD**	**$119.53**	**$17,976,665**	SGTFC06		

Gravity Thickener

PROCESS DESIGN CRITERIA

Is This Facility Included in My Project? Yes

Process User Inputs:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Red Flags	Comment
Solids Production:							
Input Plant Flow Rate	160.00	mgd	605.67	ML/d			
Input Raw Water Turbidity	2.00	NTU					
Input Fraction of Turbidity to Contribute to Solids	1.00	mg/L/NTU					Typically 1 to 2
Input Raw Water Color	10.00	CU					
Input Fraction of Color to Contribute to Solids	0.05	mg/L/CU					Typically 0.02 to 0.1
Input Alum Dose	5.00						
Input Fraction of Alum to Contribute to Solids	0.44						Typical Value = 0.44 based on 3 waters of hydration for the most probable solid Al(OH)3.3H2O
Input Ferric Chloride Dose		mg/L					
Fraction of Ferric Chloride to Contribute to Solids	0.99						Typical Value = 0.99 based on 3 waters of hydration for the most probable solid Fe(OH)3.3H2O
Input Total Polymer Dose (coagulation, flocculation, filter aids)		mg/L					
Input Raw Water Iron		mg/L					
Input Iron Factor	2.00						Typical Value = 2
Input Raw Water Manganese		mg/L					
Input Manganese Factor	2.00						Typical Value = 2
Input PAC Dose		mg/L					
Input Carbonate Hardness Concentration to be Removed via Softening		mg/L as CaCO3					
Input Carbonate Hardness Factor (mg of softening solids produced per mg of hardness removed)	1.00						Typical Value: 1 for sodium hydroxide softening; 2 for lime softening.
Input Non-Carbonate Hardness Concentration to be Removed via Softening		mg/L as CaCO3					
Input Non-Carbonate Hardness Factor (mg of softening solids produced per mg of hardness removed)	1.00						Typical Value: 1 for sodium hydroxide softening; 1 for soda ash softening.
Calculate Solids Removed	4.70	mg/L					
Calculate Dry Residual Solids Produced	6,275.74	lb/d	2846.63	kg/d			
Optional: Input Daily Dry Solids Production (overwrites above calculations) (dry)		lb/d		kg/d			
Gravity Thickener Sizing & Sludge Storage:							
Input Number of On-Line Thickeners	1	#					
Input Number of Standby Thickeners	1	#					Typically 1
Input % Dry Solids in Sludge to Thickeners	0.25%						Typically 0.25% tyo 0.75%
Calculate Total Sludge Flow Rate	300,800.00	gpd	1138.65	m3/d			
Calculate Sludge Flow to Each Thickener	300,800.00	gpd	1138.65	m3/d			
Calculate Dry Solids Flow to Each Thickener	6,275.74	lb/d	2846.63	kg/d			
Input Thickener Hydraulic Loading Rate	300.00	gpd/sf	44,005.50	m/d			Typically 100 to 300 gpd/sf for metal salt coagulant sludges
Input Thickener Solids Loading Rate	10.00	lb/d/sf	4.54	kg/d/m2			Typically 5 to 10 lb/sf/d
Calculate Thickener Diameter, Each Based on Hydraulic Loading Rate	35.73	ft	10890.51	mm			
Calculate Thickener Diameter, Each Based on Solids Loading Rate	28.27	ft	8615.94	mm			
Calculate Thickener Diameter, Each (maximum of above)	35.73	ft	10890.51	mm			
Input Thickened Sludge % Dry Solids	4.00%						Typically 2% to 5% for metal salt coagulant sludges treated with polymer
Calculate Thickened Sludge Density	63.86	lb/cf	1022.86	kg/m3			Assumes density of dried solids of 145 lb/cf.
Input Days of Thickened Sludge Storage in Thickener	3.00	days					Typically 0 to 3 days (long weekend)
Calculate Thickened Sludge Storage Depth	7.35	ft	2240.73	mm			If Sludge Storage depth is greater than desired: 1.) Reduce days of storage or 2.) Decrease controlling thickener loading rate criteria input.
Calculate Total Thickened Sludge Storage Volume	55,139.52	gal	208.73	m3			
Input Clear Water Depth Above Sludge Line	10.00	ft	3,048.00	mm			Typically 8 to 11 feet
Input Free Board	3.00	ft	914.40	mm			Typically 1 to 3 feet
Calculate Total Thickener Depth	20.35	ft	6203.13	mm			
Input Thickener Wall Height Above Grade	1.00	ft	304.80	mm			
Calculate Wall Burial Depth	19.35	ft	5898.33	mm	DB		
Gravity Thickener Peripheral Weir Launder Sizing:							
Calculate Total Flow Rate of all Thickeners	0.30	mgd	1138.65	m3/d	QT		
Calculate Flow Rate of Each Active Thickener	0.30	mgd	1138.65	m3/d	Q, mgd		
Convert Each Thickener Flow Rate	0.47	cfs	13.18	L/s	Q, cfs		
Input Velocity in Launder	5.00	fps	1.52	m/s	V		Typically < 5 fps
Calculate Area (Q, cfs / V)	0.09	sf	0.01	m2			
Launder Freeboard	1.00	ft	304.80	mm			Fixed
Input Launder Width	2.00	ft	609.60	mm			
Calculate Launder Height Excluding Freeboard	0.05	ft	14.19	mm			
Calculate Launder Height Including Freeboard	1.05	ft	318.99	mm			Should be ≤ 5 ft.
Thickened Sludge Pump Sizing:							
Calculate Thickened Sludge Flow from Each Thickener	18,379.84	gpd	69.58	m3/d			
Calculate Thickener Decant Flow from Each Thickener	282,420.16	gpd	1069.08	m3/d			
Number of Progressive Cavity Thickened Sludge Pumps per Thickener	2	#					Fixed: 1 duty and 1 standby
Calculate Number of Thickened Sludge Pumps	4	#					
Calculate Thickened Sludge Pump Capacity, Each	12.76	gpm	48.32	L/min			
Input Thickened Sludge Pump Total Dynamic Head (TDH)	100.00	ft	30,480.00	mm			

Calculate Thickened Sludge Pump Horsepower (each)	0.43	hp	0.32	kW			
Input Distance between Thickener and Sludge Pump Pad	16.00	ft	4,876.80	mm			Minimum of 10 ft
Input Sludge Pump Length (progressive cavity)	8.50	ft	2,590.80	mm			Typically 8.5 ft
Input Sludge Pump Width (progressive cavity)	2.00	ft	609.60	mm			Typically 2.0 ft
Input Stagger Distance Between Sludge Pump Centerlines - Length	8.50	ft	2,590.80	mm			Typically equal to sludge pump length
Input Distance Between Sludge Pump Centerlines (width) and Around Pumps for Access	4.50	ft	1,371.60	mm			Typically 4.5 ft for access
Include the Cost of a Building Over Sludge Pump Station?	Yes	Y/N					
Input Cutback Slope	1.50	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
Input Over Excavation Depth	1.00	ft	0.00	mm	OEXD		

Mechanical Sizing Requirements

Pipe Name	Input Velocity	Unit (English)	Input Velocity	Unit (Metric)	Standard Pipe Size	Unit (English)	Nominal Pipe Size
Unthickened Sludge Influent Pipe	3.00	fps	0.91	m/s	6.00	in	150.00
Decant Pipe	5.00	fps	1.52	m/s	6.00	in	150.00
Thickened Sludge Suction Pipe	3.00	fps	0.91	m/s	2.00	in	50.00
Thickened Sludge Discharge Pipe	3.00	fps	0.91	m/s	2.00	in	50.00

Mechanical Material Requirements

Pipe Name	Pipe ID	Installation Type	Pipe Material	Pipe Lining Material	Pipe Coating Material	Comments	Red Flags
Unthickened Sludge Influent Pipe	USP	Buried	DI	Cement Mortar	Tape Coating		
Unthickened Sludge Influent Pipe	USP	Encased	DI	Cement Mortar	Fusion Bonded Epoxy		
Unthickened Sludge Influent Pipe	USP	Submerged	DI	Cement Mortar	Fusion Bonded Epoxy		
Decant Pipe	DSP	Buried	DI	Cement Mortar	Tape Coating		
Decant Pipe	DSP	Exposed	DI	Cement Mortar	Paint		
Decant Pipe	DSP	Encased	DI	Cement Mortar	Fusion Bonded Epoxy		
Thickened Sludge Suction Pipe	TSSP	Encased	DI	Cement Mortar	Fusion Bonded Epoxy		
Thickened Sludge Suction Pipe	TSSP	Exposed	Steel	Cement Mortar	Paint		
Thickened Sludge Discharge Pipe	TSDP	Exposed	DI	Cement Mortar	Paint		

Electrical User Inputs and Sizing Requirements:

Is this a "Critical" Facility (requiring standby power)?	No	Y/N
Is there SWGR?	No	

Electrical Equipment Lengths

Item	Quantity	HP per Each	AFD's Required?	MCC Spaces for Motor Starters	MCC Spaces for AFD's less than 50hp)	MCC Spaces for Breakers	MCC Total MCC Spaces
Thickened Sludge Pumps (Active)	2.00	0.43	Yes	0.00	6.00	4.00	
Thickened Sludge Pumps (Standby)	2.00	0.43	No	4.00	0.00	0.00	
Gravity Thickener Rake Mechanism	2.00	1.00	No	4.00	0.00	0.00	
User Defined Item #1	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #2	0.00	0.00	No	0.00	0.00	0.00	
TOTAL		**3.7**		**8.00**	**6.00**	**4.00**	**18.00**

Electrical Equipment Widths:

Equipment	Depth (ft)
MCC	1.67
Small AFD's	0.00
Large AFD's	0.00
Switchgear	0.00
Maximum Depth	**1.67**

Clear Distances:

Clear Distance	Width	Length	Comment	
CD1		3.00	Clear Distance between wall and MCC	Typically 3 feet
CD2		1.00	Clear Distance between MCC and Small AFD	Typically 1 foot
CD3		0.00	Clear Distance between Small AFD and Large AFD	Typically Zero
CD4		0.00	Clear Distance between Large AFD and Switchgear	Typically Zero
CD5		0.00	Clear Distance between Switchgear and Contingency Space	Typically Zero
CD6	4.00		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)	
CD7	3.00		Clear Distance in front of Equipment	Typically 3 feet
Contingency Length		0.00	Contingency length	Typically Zero

Electric Room Length (ft):

CD1	3.00
MCC	10.00
CD2	1.00
Small AFD's	0.00
CD3	0.00
Large AFD's	0.00
CD4	0.00
Swithgear	0.00
CD5	0.00
Contingency	0.00
Total Length	**14.00**

Electric Room Width (ft):							
CD6	0.00	If there is no switchgear, this distance will be Zerc					
Maximum Equipment Depth	1.67						
CD7	3.00						
Total Width	**4.67**						

Estimating Dimensions:	Value English	Unit (English)	Value (Metric)	Unit (Metric)	Name	Red Flags	Comment
Total Number of Thickeners	2.00	#					
Gravity Thickener (dimensions per each):							
Perimeter Wall Inside Diameter	35.73	ft	10890.51	mm			
Perimeter Wall Outside Diameter	37.73	ft	11500.11	mm			
Perimeter Wall Height	20.35	ft	6203.13	mm			
Wall Footer Thickness	**16.00**	in	**406.40**	mm			Model based on 16"
Wall Footer Thickness	1.33	ft	406.40	mm			
Slab on Grade Thickness	**6.00**	in	**152.40**	mm			Model based on 6"
Slab on Grade Thickness	0.50	ft	152.40	mm			
Center Cone Outside Diameter	6.17	ft	1879.60	mm			Fixed
Center Cone Inside Diameter	3.50	ft	1066.80	mm			Fixed
Center Cone Slab on Grade Thickness	**16.00**	in		mm			Model based on 16"
Center Cone Slab on Grade Thickness	1.33	ft	406.40	mm			
Center Cone Wall Height	**2.33**	ft	**59.18**	mm			Model based on 2.33'
Center Cone Wall Thickness	**16.00**	in	**406.40**	mm			Model based on 16"
Center Cone Wall Thickness	1.33	ft	406.40	mm			
Launder Elevated Slab Width	**2.00**	ft	**50.80**	mm			Model based on 2'
Launder Elevated Slab Thickness	**12.00**	in	**304.80**	mm			Model based on 12"
Launder Elevated Slab Thickness	1.00	ft	304.80	mm			
Launder Wall Diameter	31.73	ft	9671.31	mm			
Launder Wall Height	1.05	ft	318.99	mm			
Launder Wall Thickness	**8.00**	in	**203.20**	mm			Model based on 8"
Launder Wall Thickness	0.67	ft	203.20	mm			
Perimeter Wall Thickness	**12.00**	in	**304.80**	mm			Model based on 12"
Perimeter Wall Thickness	1.00	ft	304.80	mm			
Floor Slope Factor	1.03						Fixed
Side Slope Depth Factor	0.23						Fixed
Side Slope Factor	4.29						Fixed
Excavation Diameter	46.73	ft	14243.31	mm			
Cone Excavation Depth	7.44	ft	2268.07	mm			
Perimeter Wall Excavation Depth (Includes Over Excavation)	21.68	ft	6609.53	mm			
Thickened Sludge Pump Slab:							
Length	26.00	ft	7924.80	mm			Fixed
Width	30.50	ft	9296.40	mm			
Slab on Grade Length	28.00	ft	8534.40	mm			
Slab on Grade Width	32.50	ft	9906.00	mm			
Slab Thickness	**16.00**	in	**406.40**	mm			Model based on 16"
Slab Thickness	1.33	ft	406.40	mm			
Excavation Length	32.00	ft	9753.60	mm			
Excavation Width	36.50	ft	11125.20	mm			
Excavation Depth	3.33	ft	1016.00	mm			
Electrical Room:							
Length	14.00	ft	4267.20	mm			
Width	4.67	ft	1422.40	mm			
Slab on Grade Length	16.00	ft	4876.80	mm			
Slab on Grade Width	6.67	ft	2032.00	mm			
Slab on Grade Thickness	**18.00**	in	**457.20**	mm			Model based on 18"
Slab on Grade Thickness	1.50	ft	457.20	mm			
Excavation Length	20.00	ft	6096.00	mm			
Excavation Width	10.67	ft	3251.20	mm			
Excavation Depth	3.50	ft	1066.80	mm			

COST ESTIMATE

Description	Quantity (English)	Unit (English)	Quantity (Metric)	Unit (Metric)	$/Unit	Total Cost	User Over-Write
SITEWORK:							
Gravity Thickener:							
Excavation	7,733.79	CY	5912.91	m3	***$6.72***	$51,995	
Imported Structural Backfill	261.05	CY	199.58	m3	***$50.94***	$13,298	
Native Backfill	3,835.17	CY	2932.20	m3	***$8.27***	$31,699	
Haul Excess	3,898.62	CY	2980.71	m3	***$8.27***	$32,223	
Thickened Sludge Pump Slab:							
Excavation	208.86	CY	159.68	m3	***$8.33***	$1,739	
Imported Structural Backfill	100.94	CY	77.17	m3	***$50.94***	$5,142	
Native Backfill	42.28	CY	32.33	m3	***$8.27***	$349	
Haul Excess	166.58	CY	127.36	m3	***$8.27***	$1,377	
Electrical Room:							
Excavation	54.35	CY	41.55	m3	***$8.33***	$453	
Imported Structural Backfill	19.75	CY	15.10	m3	***$50.94***	$1,006	
Native Backfill	20.87	CY	15.96	m3	***$8.27***	$172	
Haul Excess	33.48	CY	25.60	m3	***$8.27***	$277	
Allowance for Misc Items	5%				$139,730.44	$6,987	
Subtotal						$146,717	
CONCRETE:							
Gravity Thickener:							
Wall Footers	64.39	CY	49.23	m3	***$541.11***	$34,841	
Slanted Slab on Grade	38.15	CY	29.17	m3	***$541.11***	$20,645	
Slanted Floor Grout (2" thick)	2,060.27	SF	191.41	m2	***$23.76***	$48,953	
Center Cone Slab on Grade	2.95	CY	2.26	m3	***$541.11***	$1,596	
Center Cone Walls	4.46	CY	3.41	m3	***$499.64***	$2,227	
Perimeter Walls	178.69	CY	136.62	m3	***$707.82***	$126,480	
Launder Elevated Slab	16.63	CY	12.71	m3	***$832.73***	$13,848	
Launder Wall	5.15	CY	3.94	m3	***$832.73***	$4,290	
Concrete Fill	***2.77***	CY	2.12	m3	***$374.73***	$1,039	
Thickened Sludge Pump Slab:						$0	
Slab on Grade	44.94	CY	34.36	m3	***$490.62***	$22,047	
Electrical Room:						$0	
Slab on Grade	5.93	CY	4.53	m3	***$541.11***	$3,207	
Allowance for Misc Items	5%				$279,172.59	$13,959	

Subtotal						$293,131	
METALS:							
Gravity Thickener:							
Walkway Grating (3' wide, steel support beams supplied by mechanism mfr)	226.38	SF	21.03	m2	*$90.92*	$20,582	
Walkway Handrail	150.92	LF	46.00	m	*$90.92*	$13,721	
Stairway	3	Risers			*$495.92*	$1,488	
Allowance for Misc Items	10%				$35,791.20	$3,579	
Subtotal						$39,370	
MASONRY:	**Moderate**						
Thickened Sludge Pump Building	793.00	SF	73.67	m2	*$165.31*	$131,087	
Electrical Room	65.33	SF	6.07	m2	*$165.31*	$10,800	
Subtotal	858.33					$141,887	
EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
Gravity Thickener Drive Mechanism (1 hp each)	2	EA			*$128,008.60*	$256,017	
Thickened Sludge Pumps (Active, Progressive Cavity Pumps 0 hp each)	2	EA			*$6,953.63*	$13,907	
Thickened Sludge Pumps (Standby, Progressive Cavity Pumps 0 hp each)	2	EA			*$6,953.63*	$13,907	
Allowance for Misc Items	10%				$269,924.46	$26,992	
Subtotal						$310,824	
I&C:							
Instruments							
Thickened Sludge Discharge Pipe Magmeter (TSDP, 2 inch)	2	EA			*$6,718.91*	$13,438	
Isolation Valve Actuators (Electric)	6	EA			*$6,409.82*	$38,459	
Level Transmitters	2	EA			*$10,730.27*	$21,461	
Number of Analog I/O Counts	5	EA			*$264.27*	$1,321	
Number of Digital I/O Counts	36	EA			*$62.59*	$2,253	
Number of Local Panels	2	EA			*$13,074.33*	$26,149	
Number of PLC's	1	EA			*$13,908.86*	$13,909	
I&C Conduit Wire	817.30	LF	249.11	m	*$12.06*	$9,856	
Allowance for Misc Items	5%				$126,845.19	$6,342	
Subtotal						$133,187	
MECHANICAL:							
Pipe:							
Unthickened Sludge Influent Pipe (USP, Buried, 6 inch, DI)	38.70	LF	11.80	m	*$52.02*	$2,013	
Unthickened Sludge Influent Pipe (USP, Encased, 6 inch, DI)	0.00	LF	0.00	m	*$52.02*	$0	
Unthickened Sludge Influent Pipe (USP, Submerged, 6 inch, DI)	37.73	LF	11.50	m	*$52.02*	$1,963	
Decant Pipe (DSP, Buried, 6 inch, DI)	4.00	LF	1.22	m	*$52.02*	$208	
Decant Pipe (DSP, Exposed, 6 inch, DI)	38.70	LF	11.80	m	*$52.02*	$2,013	
Decant Pipe (DSP, Encased, 6 inch, DI)	0.00	LF	0.00	m	*$52.02*	$0	
Thickened Sludge Suction Pipe (TSSP, Encased, 2 inch, DI)	67.73	LF	20.64	m	*$17.34*	$1,174	
Thickened Sludge Suction Pipe (TSSP, Exposed, 2 inch, Steel)	46.50	LF	14.17	m	*$46.23*	$2,150	
Thickened Sludge Discharge Pipe (TSDP, Exposed, 2 inch, DI)	48.00	LF	14.63	m	*$17.34*	$832	
Elbows:							
Unthickened Sludge Influent Pipe (USP, Buried, 6 inch, DI)	2	EA			*$1,091.82*	$2,184	
Unthickened Sludge Influent Pipe (USP, Encased, 6 inch, DI)	0	EA			*$1,091.82*	$0	
Unthickened Sludge Influent Pipe (USP, Submerged, 6 inch, DI)	6	EA			*$1,091.82*	$6,551	
Decant Pipe (DSP, Buried, 6 inch, DI)	0	EA			*$1,091.82*	$0	
Decant Pipe (DSP, Exposed, 6 inch, DI)	2	EA			*$1,091.82*	$2,184	
Decant Pipe (DSP, Encased, 6 inch, DI)	0	EA			*$1,091.82*	$0	
Thickened Sludge Suction Pipe (TSSP, Encased, 2 inch, DI)	0	EA			*$363.94*	$0	
Thickened Sludge Suction Pipe (TSSP, Exposed, 2 inch, Steel)	2	EA			*$278.40*	$557	
Thickened Sludge Discharge Pipe (TSDP, Exposed, 2 inch, DI)	2	EA			*$363.94*	$728	
End Caps:							
Unthickened Sludge Influent Pipe (USP, Buried, 6 inch, DI)	0	EA			*$270.96*	$0	
Unthickened Sludge Influent Pipe (USP, Encased, 6 inch, DI)	0	EA			*$270.96*	$0	
Unthickened Sludge Influent Pipe (USP, Submerged, 6 inch, DI)	0	EA			*$270.96*	$0	
Decant Pipe (DSP, Buried, 6 inch, DI)	0	EA			*$270.96*	$0	
Decant Pipe (DSP, Exposed, 6 inch, DI)	0	EA			*$270.96*	$0	
Decant Pipe (DSP, Encased, 6 inch, DI)	0	EA			*$270.96*	$0	
Thickened Sludge Suction Pipe (TSSP, Encased, 2 inch, DI)	4	EA			*$90.32*	$361	
Thickened Sludge Suction Pipe (TSSP, Exposed, 2 inch, Steel)	0	EA			*$90.32*	$0	
Thickened Sludge Discharge Pipe (TSDP, Exposed, 2 inch, DI)	2	EA			*$90.32*	$181	
Tee:							
Unthickened Sludge Influent Pipe (USP, Buried, 6 inch, DI)	0	EA			*$1,812.94*	$0	
Unthickened Sludge Influent Pipe (USP, Encased, 6 inch, DI)	0	EA			*$1,812.94*	$0	
Unthickened Sludge Influent Pipe (USP, Submerged, 6 inch, DI)	0	EA			*$1,812.94*	$0	
Decant Pipe (DSP, Buried, 6 inch, DI)	0	EA			*$1,812.94*	$0	
Decant Pipe (DSP, Exposed, 6 inch, DI)	2	EA			*$1,812.94*	$3,626	
Decant Pipe (DSP, Encased, 6 inch, DI)	0	EA			*$1,812.94*	$0	
Thickened Sludge Suction Pipe (TSSP, Encased, 2 inch, DI)	2	EA			*$604.31*	$1,209	
Thickened Sludge Suction Pipe (TSSP, Exposed, 2 inch, Steel)	2	EA			*$634.30*	$1,269	
Thickened Sludge Discharge Pipe (TSDP, Exposed, 2 inch, DI)	2	EA			*$604.31*	$1,209	
Valves:							
Unthickened Sludge Influent Pipe (USP, Buried, 6 inch, DI)	0	EA			*$5,316.38*	$0	
Unthickened Sludge Influent Pipe (USP, Encased, 6 inch, DI)	0	EA			*$5,316.38*	$0	
Unthickened Sludge Influent Pipe (USP, Submerged, 6 inch, DI)	2	EA			*$5,316.38*	$10,633	
Decant Pipe (DSP, Buried, 6 inch, DI)	0	EA			*$5,316.38*	$0	
Decant Pipe (DSP, Exposed, 6 inch, DI)	0	EA			*$5,316.38*	$0	
Decant Pipe (DSP, Encased, 6 inch, DI)	0	EA			*$5,316.38*	$0	
Thickened Sludge Suction Pipe (TSSP, Encased, 2 inch, DI)	0	EA			*$1,772.13*	$0	
Thickened Sludge Suction Pipe (TSSP, Exposed, 2 inch, Steel)	2	EA			*$2,036.15*	$4,072	
Thickened Sludge Discharge Pipe (TSDP, Exposed, 2 inch, DI)	2	EA			*$1,772.13*	$3,544	
Allowance for Misc Items	5%				$48,659.52	$2,433	
Subtotal						$51,092	
ELECTRICAL:							
# MCC Sections	6	EA			*$10,730.27*	$64,382	
Switchgear	0	EA			*$49,359.23*	$0	
Adjustable Frequency Drives							
Thickened Sludge Pumps (Active) (0 hp each)	2	EA			*$8,921.91*	$17,844	
Thickened Sludge Pumps (Standby) (0 hp each)	0	EA			*$8,921.91*	$0	
Gravity Thickener Rake Mechanism (1 hp each)	0	EA			*$8,996.69*	$0	
Electrical Conduit & Wire	219.46	LF	66.89	m	*$12.06*	$2,646	
Allowance for Misc Items	10%				$84,871.89	$8,487	
Subtotal						$93,359	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00		0.00		0.00	$0	
Item 2 Description	0.00		0.00		0.00	$0	
Item 3 Description	0.00		0.00		0.00	$0	
Item 4 Description	0.00		0.00		0.00	$0	
Item 5 Description	0.00		0.00		0.00	$0	
Item 6 Description	0.00		0.00		0.00	$0	

Item 7 Description	0.00		0.00		0.00	$0	
Item 8 Description	0.00		0.00		0.00	$0	
Item 9 Description	0.00		0.00		0.00	$0	
Item 10 Description	0.00		0.00		0.00	$0	
Item 11 Description	0.00		0.00		0.00	$0	
Item 12 Description	0.00		0.00		0.00	$0	
Item 13 Description	0.00		0.00		0.00	$0	
Item 14 Description	0.00		0.00		0.00	$0	
Item 15 Description	0.00		0.00		0.00	$0	
Subtotal						$0	
Subtotal						$1,209,569	
ALLOWANCES:		**User Override**					
Finishes Allowance	2.00%		$1,423,022	$28,460			
I&C Allowance	4.00%		$1,423,022	$56,921			
Mechanical Allowance	5.00%		$1,423,022	$71,151			
Electrical Allowance	4.00%		$1,423,022	$56,921			
					Facility Cost Name		
Facility Cost	**601,600**	**GPD**	**$2.37**	**$1,423,022**	SGTFC01		
Facility Cost with Standard Additional Project Costs Added	**601,600**	**GPD**	**$2.87**	**$1,729,214**	SGTFC02		
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**601,600**	**GPD**	**$4.93**	**$2,965,912**	SGTFC03		
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**601,600**	**GPD**	**$4.06**	**$2,440,738**	SGTFC05		
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**601,600**	**GPD**	**$4.93**	**$2,965,912**	SGTFC06		

Centrifuge Solids Dewatering Facility

Is This Facility Included in My Project? Yes

Process User Inputs:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Red Flags	Comment
Dry Solids Production							
Input Design Plant Flow Rate	160.00	mgd	605.67	ML/d			Enter plant flow rate for which dewatering equipment/system shall be sized.
Input Average Annual Plant Flow Rate	75.00	mgd	283.91	ML/d			Enter plant flow rate for calculating average annual production of solids.
Input Design Raw Water Turbidity	2.00	NTU					Enter raw water turbidity for which dewatering equipment/system shall be sized.
Input Average Annual Raw Water Turbidity	2.00	NTU					Enter raw water turbidity for calculating average annual production of solids.
Input Fraction of Turbidity to Contribute to Solids	1.00	mg/L/NTU					Typically 1 to 2
Input Design Raw Water Color	10.00	CU					Enter raw water color for which dewatering equipment/system shall be sized.
Input Average Annual Raw Water Color	10.00	CU					Enter raw water color for calculating average annual production of solids.
Input Fraction of Color to Contribute to Solids	0.05	mg/L/CU					Typically 0.02 to 0.1
Select Coagulant Used for Raw Water	Aluminum Sulfate	Type					
Input Design Coagulant Dose	5.00	mg/L					Enter coagulant dose for which dewatering equipment/system shall be sized.
Input Average Annual Coagulant Dose	5.00	mg/L					Enter coagulant dose for calculating average annual production of solids.
Fraction of Coagulant to Contribute to Solids	0.44						Typical Value = 0.44 based on 3 waters of hydration for the most probable solid Al(OH)3*3H2O.
Optional: Input Fraction of Coagulant to Contribute to Solids (overwrites above calculations)							
Input Total Design Polymer Dose (coagulation, flocculation, filter aids)		mg/L					Enter polymer dose for which dewatering equipment/system shall be sized.
Input Total Average Annual Polymer Dose (coagulation, flocculation, filter aids)		mg/L					Enter polymer dose for calculating average annual production of solids.
Input Design Raw Water Iron		mg/L					Enter raw water iron for which dewatering equipment/system shall be sized.
Input Average Annual Raw Water Iron		mg/L					Enter raw water iron for calculating average annual production of solids.
Input Iron Factor that Contrinbutes to Solids	2.00						Typical Value = 2
Input Design Raw Water Manganese		mg/L					Enter raw water manganese for which dewatering equipment/system shall be sized.
Input Average Annual Raw Water Manganese		mg/L					Enter raw water manganese for calculating average annual production of solids.
Input Manganese Factor that Contrinbutes to Solids	2.00						Typical Value = 2
Input Design PAC Dose		mg/L					Enter PAC dose for which dewatering equipment/system shall be sized.
Input Average Annual PAC Dose		mg/L					Enter PAC dose for calculating average annual production of solids.
Input Design Carbonate Hardness Concentration to be Removed via Softening		mg/L as CaCO3					Enter carbonate hardness removed for which dewatering equipment/system shall be sized.
Input Average Annual Carbonate Hardness Concentration to be Removed via Softening		mg/L as CaCO3					Enter carbonate hardness removed for calculating average annual production of solids.
Input Carbonate Hardness Factor that Contributes to Solids	1.00	(mg of softening solids produced per mg of hardness removed)					Typical Value: 1 for sodium hydroxide softening; 2 for lime softening.
Input Design Non-Carbonate Hardness Concentration to be Removed via Softening		mg/L as CaCO3					Enter non-carbonate hardness removed for which dewatering equipment/system shall be sized.
Input Average Annual Non-Carbonate Hardness Concentration to be Removed via Softening		mg/L as CaCO3					Enter non-carbonate hardness removed for calculating average annual production of solids.
Input Non-Carbonate Hardness Factor that Contributes to Solids	1.00	(mg of softening solids produced per mg of hardness removed)					Typical Value: 1 for sodium hydroxide softening; 1 for soda ash softening.
Calculate Design Solids Removed	4.70	mg/L					

Calculate Design Daily Dry Solids Production	9,093.41	lb/d	4124.70	kg/d			Calculated on a dry weight basis.
Optional: Input Design Daily Dry Solids Production (overwrites above calculations)	9,093.41	lb/d	8,688.53	kg/d			Overrides cell above. Calculated on a dry weight basis.
Calculate Average Annual Solids Removed	4.70	mg/L					
Calculate Average Annual Daily Dry Solids Production	3,535.83	lb/d	1603.83	kg/d			Calculated on a dry weight basis.
Optional: Input Average Annual Daily Dry Solids Production (overwrites above calculations)	3,535.83	lb/d	1,594.27	kg/d			Overrides cell above. Calculated on a dry weight basis.
Centrifuge Dewatering Sizing							
Input % Dry Solids in Sludge to Centrifuges	2.00%						Typically from Gravity Thickener at 2% to 5%
Input Number of Days per Week Centrifuges Will Be Operated	5.00	days					1 to 7, often 5 days
Input Number of Hours per Day Centrifuges Will Be Operated	8.00	hours					1 to 24, often 8 hours
Calculate Required Gravity Thickener Dry Solids Storage (dry)	24,249.09	lb	10999.20	kg			
Calculate Thickened Sludge Density	63.12	lb/cf	1011.07	kg/m3			Assumes density of dried solids of 145 lb/cf.
Calculate Required Gravity Thickener Sludge Storage Volume	19,208.99	cf	543.94	m3			
Calculate Required Gravity Thickener Sludge Storage Volume	143,693.22	gal	543.94	m3			For Information, see cell C34 in the Gravity Thickener model for the volume (in gallons) of sludge.
Calculate Required Centrifuge Dewatering Rate	157.16	gpm	35.70	m3/hr			
Input Number of Duty Centrifuges	2	#					Toggle number of duty centrifuges to select optimum centrifuge configuration.
Input Number of Standby Centrifuges	1	#					Typically 0 or 1.
Total Number of centrifuges	3	#					
Loading, hydraulic (each)	78.58	gpm	17.85	m3/hr			
Loading, dry solids (each)	795.67	lb/hr	360.91	kg/hr			
Centrifuge Selection							
Input Sludge Type	Alum						
Case No.	1.00						Number used for selection of centrifuge
Expected Feed Solids	2.5-3.5% DS						
Polymer Consumption	15-25 lb/ton DS						DS = dry solids
Cake Solids	18-23% DS						DS = dry solids
Capture Efficiency	95.00%	`					
Centrifuge Selection	3.00						Number used for selection of centrifuge
Model No. (Andritz)	D4						The service numbers for each model have a level of conservativism already in them.
Capacity	60	gpm	13.63	m3/hr			Contact Andritz for actual model selection. There are several versions of each model that changes the capacity ranges for each.
Bowl Diameter	16.92	in	429.77	mm			
Length	152.00	in	3860.80	mm			
Width	41.00	in	1041.40	mm			
Height	59.00	in	1498.60	mm			
Power, Main Drive	50.00	hp	37.28	kW			
Power, Back Drive	10.00	hp	7.46	kW			
Weight	7,094.00	lb	3217.78	kg			Be sure to provide access to the centrifuges on the second floor
Chemical Storage and Feed							
Input Chemical Name	Liquid Polymer	Type					Typically Liquid Polymer, but if Dry Polymer is used, use the Dry Polymer Model
Is this Chemical System to be Included?	Yes	Y/N					
Input Percent Active Chemical	40.00%						If Liquid Polymer, typically 30% to 50%
Input Bulk Chemical Specific Gravity	1.10	#					If Liquid Polymer, typically 1.1
Active Chemical Concentration, lb/gallon	3.67	lb/gal	440.00	kg/m3			
Choose Chemical Delivery Method	Tote	Type					
Bulk Delivery Volume (Tank Truck, Totes, Drums), gallons	300.00	gal	1.14	m3			
Input Number of Simultaneous Application Points	1	#					
CHEMICAL DOSES:							
Input Minimum Dose (per ton of dry solids)	15.00	lb/t	7.50	kg/t			Typically 5 to 15 lb dry polymer per ton of dry solids (2.5 to 7.5 kg/t).
Input Average Dose (per ton of dry solids)	20.00	lb/t	10.00	kg/t			Typically 10 to 20 lb dry polymer per ton of dry solids (5.0 to 10.0 kg/t).
Input Maximum Dose (per ton of dry solids)	25.00	lb/t	12.50	kg/t			Typically 15 to 25 lb dry polymer per ton of dry solids (7.5 to 12.5 kg/t).
Minimum Chemical Usage	95.48	lb/d	43.31	kg/d			Usage rate on operating days.
Average Chemical Usage	127.31	lb/d	57.75	kg/d			Usage rate on operating days.
Maximum Chemical Usage	159.13	lb/d	72.18	kg/d			Usage rate on operating days.
Chemical Metering Rates per Simultaneous Operating Pump:							
Minimum Rate	3.25	gph	12.30	L/h			Usage rate when operating.
Average Rate	4.33	gph	16.41	L/h			Usage rate when operating.
Maximum Rate	5.42	gph	20.51	L/h			Usage rate when operating.
Calculate Chemical Metering Pump Flow Turndown (should be < 20, if > 20, proceed with caution)	1.67	:1					Should be < 20, If ≥ 20, proceed with caution.
Input Number of Days of Storage at Avg. Flow/Dose for Chemical	30.00	days					Includes non-operating days.
Calculate Number of Operating Days of Storage	21.43	days					Includes only operating days.
Calculate Storage Volume for Pretreatment @ Avg. Flow/Dose	742.93	gal	2.81	m3			
Calculate Bulk Delivery Volume * 1.5 (for Truck Delivery Only)	0.00	gal	0.00	m3			
Maximum of Above Two Volumes	742.93	gal	2.81	m3			

Maximum Volume in	99.32	cf	2.81	m3			
BULK TANKS:							
Input Number of Tanks	1	#					
Input Tank Diameter	10.00	ft	3,048.00	mm			
Calculate Height of Tanks	0.00	ft	0.00	mm			
Use this Tank Height (Liquid Height * 1.2)	0.00	ft	0.00	mm			
Input Number of Rows of Tanks	1	#					
Calculate Number of Tanks per Row	0	#					
Input Tank Material (FRP, PE (Polyethylene), PLS (Phenolic Lined Steel))	FRP	Type					
Input Clear Distance Around BulkTanks, Totes or Drums	4.00	ft	1,219.20	mm	CDT		
TOTES & DRUMS:							
Calculate Number of Totes or Drums	3	each					
Will Totes or Drums be Stored by Stacking on Top of Each Other?	No	Y/N					
Input Number of Rows of Totes or Drum Pallets	1	#					
Calculate Number of Totes or Drum Pallets on Floor per Row	3.00	#					
Length of Each Tote	4.00	ft	1219.20	mm			Fixed
Width of Each Tote	4.00	ft	1219.20	mm			Fixed
Length and Width of Each Drum Pallet	5.00	ft	1524.00	mm			Fixed
CHEMICAL FEED SYSTEMS:							
Select Chemical Feed Method	Polymer Blend Unit	Type					If using polymer, a Polymer Blend Unit is recommended
Calculate Number of Active Chemical Feed Systems	1	#					
Input Number of Standby Chemical Feed Systems	1	#					
Calculate Total Number of Chemical Feed Systems	2	#					
Input Clear Distance Around Chemical Feed Systems	4.00	ft	1,219.20	mm			
Length of Chemical Feed Systems	2.50	ft	762.00	mm			
Width of Chemical Feed Systems	3.33	ft	1015.90	mm			
Width of Stair Access	3.50	ft	1066.80	mm			Fixed
CONTAINMENT AREA:							
Calculate Containment Area Internal Length	28.00	ft	8534.40	mm			
Calculate Containment Area Internal Width	26.00	ft	7924.80	mm			
Calculate Fire Sprinkler Water Volume (0.2 gpm/sf for 20 min.)	2,912.00	gal	11.02	m3			
Calculate 120% of One Storage Tank Volume	360.00	gal	1.36	m3			
Calculate 30% of All Tank Volume	90.00	gal	0.34	m3			
Maximum of Above Two Volumes	360.00	gal	1.36	m3			
Calculate Maximum Volume + Fire Flow Volume	3,272.00	gal	12.39	m3			
Calculate Maximum Volume + Fire Flow Volume	437.40	cf	12.39	m3			
Calculate Containment Wall Height (including 6" Freeboard)	1.10	ft	335.53	mm			
Dewatering Building							
Truck Lane Length	68.00	ft	20,726.40	mm	DWB-TLL		Typically 68 ft for full container truck or roll-off.
Truck Lane Width	20.00	ft	6,096.00	mm	DWB-TLW		Typically ≥ 16 ft for full container truck or roll-off.
First Floor Height	24.00	ft	7,315.20	mm	DWB-FFH		Typically ≥ 22 ft
Number of Truck Lanes	2.00	#					Typically 2.
Offset Between Centrifuges	5.00	ft	1,524.00	mm	CN-OS		Typically ≥ 4 ft for access.
Centrifuge Offset from Wall (width direction in relationship to the centrifuges)	5.00	ft	1,524.00	mm	CN-OEW		Typically ≥ 4 ft for access.
Centrifuge Offset from Wall (length direction in relationship to centrifuges)	17.00	ft	5,181.60	mm	CN-ONW		Typically = 17 ft for proper alignment over truck bays.
Input Stair Tread Width	3.50	ft	1,066.80	mm			Typically ≥ 3.5 ft.
Calculate Stairwell Width	8.00	ft	2438.40	mm	DWB-SW		
Calculate Stairwell Length	25.50	ft	7772.40	mm	DWB-SL		
Dewatering Building Width	71.25	ft	21717.00	mm	DWB-W		
Dewatering Building Length	72.83	ft	22199.60	mm	DWB-L		
Conveyor Equipment							
Centrifuge Conveyor Length	48.54	ft	14795.50	mm	CON-CNL		
Centrifuge Conveyor Width or Diameter	10.00	in	254.00	mm	CON-CNW		Verify with conveyor vendor
Conveyor Truck Lane Length	40.00	ft	12,192.00	mm	CON-TLL		Typically 40 ft
Calculate Conveyor Truck Lane Width	10.00	in	254.00	mm	CON-TLW		
% Dry Solids Capture by Centrifuge	95.00%						
Optional: Input % Dry Solids Capture by Centrifuge (overwrites above calculations)							Typically 90 to 98%.
% Dry Solids in Centrifuge Cake	18.00%						
Optional: Input % Dry Solids in Centrifuge Cake (overwrites above calculations)							Typically 15 to 25%.
Calculate the Centrifuge Dry Solids Production Rate (dry)	1,511.78	lb/hr	685.73	kg/hr			
Calculate the Cake Density	69.53	lb/cf	1113.75	kg/m3			Assumes density of dried solids of 145 lb/cf.
Calculate the Centrifuge Cake Solids Production Rate	8,398.77	lb/hr	3809.62	kg/hr			
Calculate Truck Loads	0.17	per hour					
Calculate the Centrifuge Cake Volume Production Rate	120.79	cf/hr	3.42	m3/hr			
Calculate Total Yearly Wet Mass of Sludge (per year)	8,758.72	tons	7945778.18	kg			
Calculate Total Design Yearly Wet Sludge Volume	9,331.22	cy	7134.23	m3			
Calculate Average Annual Wet Sludge Volume	3,628.30	cy	2774.03	m3			
Calculate Number of Gates per Truck Conveyor	6	#					Assumes 6 ft on center
Input Depth of Burial		ft	0.00	mm	DB		
Input Cutback Slope	1.00	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
Input Over Excavation Depth	1.00	ft	0.00	mm	OEXD		
Mechanical Sizing Requirements:							
Pipe Name	**Input Velocity**	**Unit (English)**	**Input Velocity**	**Unit (Metric)**	**Standard Pipe Size**	**Unit (English)**	**Nominal Pipe Size**

Centrifuge Feed Header	5.00	fps	1.52	m/s	4.00	in	100.00
Centrifuge Feed Lateral	5.00	fps	1.52	m/s	3.00	in	80.00
Centrifuge Drain Lateral/Header	5.00	fps	1.52	m/s	3.00	in	80.00
Centrifuge Decant Header	5.00	fps	1.52	m/s	4.00	in	100.00
Centrifuge Decant Lateral	5.00	fps	1.52	m/s	3.00	in	80.00

Mechanical Material Requirements:

Pipe Name	Pipe ID	Installation Type	Pipe Material	Pipe Lining Material	Pipe Coating Material	Comments	Red Flags
Centrifuge Feed Header	CFH	Exposed	DI	Cement Mortar	Tape Coating		
Centrifuge Feed Lateral	CFL	Exposed	Steel	Cement Mortar	Paint		
Centrifuge Drain Lateral/Header	CD	Exposed	Steel	Cement Mortar	Paint		
Centrifuge Decant Header	CDH	Exposed	Steel	Cement Mortar	Paint		
Centrifuge Decant Lateral	CDL	Exposed	Steel	Cement Mortar	Paint		

Electrical User Inputs and Sizing Requirements:

Is this a "Critical" Facility (requiring standby power)?	Yes	Y/N
Is there SWGR?	No	

Electrical Equipment Lengths:

Item	Quantity	HP per Each	AFD's Required?	MCC Spaces for Motor Starters	MCC Spaces for AFD's less than 50hp)	MCC Spaces for Breakers	MCC Total MCC Spaces
Centrifuges (Active)	2	50.00	No	6.00	0.00	0.00	
Centrifuges (Standby)	1	50.00	No	3.00	0.00	0.00	
Centrifuge Conveyor Belt	1	3.00	No	2.00	0.00	0.00	
Truck Conveyor Belt	2	3.00	No	4.00	0.00	0.00	
User Defined Item #1	0	0.00	No	0.00	0.00	0.00	
User Defined Item #2	0	0.00	No	0.00	0.00	0.00	
TOTAL		159.0		15.00	0.00	0.00	15.00

Electrical Equipment Widths:

Equipment	Depth (ft)
MCC	1.67
Small AFD's	0.00
Large AFD's	0.00
Switchgear	0.00
Maximum Depth	1.67

Clear Distances:

Clear Distance	Width	Length	Comment	
CD1		3.00	Clear Distance between wall and MCC	Typically 3 feet
CD2		1.00	Clear Distance between MCC and Small AFD	Typically 1 foot
CD3		0.00	Clear Distance between Small AFD and Large AFD	Typically Zero
CD4		0.00	Clear Distance between Large AFD and Switchgear	Typically Zero
CD5		0.00	Clear Distance between Switchgear and Contingency Space	Typically Zero
CD6	4.00		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)	
CD7	3.00		Clear Distance in front of Equipment	Tyipcally 3 feet
Contingency Length		0.00	Contingency length	Typically Zero

Electric Room Length (ft):

CD1	3.00
MCC	13.33
CD2	1.00
Small AFD's	0.00
CD3	0.00
Large AFD's	0.00
CD4	0.00
Swithgear	0.00
CD5	0.00
Contingency	0.00
Total Length	17.33

Electric Room Width (ft):

CD6	0.00	If there is no switchgear, this distance will be Zero.
Maximum Equipment Depth	1.67	
CD7	3.00	
Total Width	4.67	

Estimating Dimensions:	Value English	Unit (English)	Value (Metric)	Unit (Metric)	Name	Red Flags	Comment
Centrifuge Building							
Building Length	72.83	ft	22199.60	mm			
Building Width	71.25	ft	21717.00	mm			
Slab on Grade Length	76.83	ft	23418.80	mm			
Slab on Grade Width	75.25	ft	22936.20	mm			
Excavation Length	80.83	ft	24638.00	mm			
Excavation Width	79.25	ft	24155.40	mm			
Excavation Depth	3.50	ft	1066.80	mm			
Stair Height	24.00	ft	7315.20	mm			

Slab on Grade Thickness	18.00	in	457.20	mm			Model based on 18"
Slab on Grade Thickness	1.50	ft	457.20	mm			
Wall Thickness	12.00	in	304.80	mm			Model based on 12"
Wall Thickness	1.00	ft	304.80	mm			
Elevated Slab Thickness	12.00	in	304.80	mm			Model based on 12"
Elevated Slab Thickness	1.00	ft	304.80	mm			
Chemical Containment Wall Thickness	8.00	in	203.20	mm			
Chemical Containment Wall Thickness	0.67	ft	203.20	mm			

COST ESTIMATE

Description	Quantity (English)	Unit (English)	Quantity (Metric)	Unit (Metric)	$/Unit	Total Cost	User Over-Write
SITEWORK:							
Excavation	1011.41	CY	773.28	m3	$6.72	$6,800	
Imported Structural Backfill	474.52	CY	362.80	m3	$50.94	$24,173	
Native Backfill	72.63	CY	55.53	m3	$8.27	$600	
Haul Excess	938.78	CY	717.75	m3	$8.27	$7,759	
Allowance for Misc Items	5%				$39,332.25	$1,967	
Subtotal						$41,299	
CONCRETE:							
Centrifuge Building Slab on Grade	321.21	CY	245.58	m3	$490.62	$157,589	
Elevated Slab	203.02	CY	155.22	m3	$1,333.77	$270,781	
Equipment Pads	6.71	CY	5.13	m3	$490.62	$3,290	
Allowance for Misc Items	5%				$431,660.66	$21,583	
Subtotal						$453,244	
MASONRY:	Moderate						
CMU Building	10378.75	SF	964.22	m2	$165.31	$1,715,667	
Subtotal						$1,715,667	
METALS:							
Stairway	72	Risers			$495.92	$35,706	
Guardrail	291.33	LF	88.80	m	$27.82	$8,104	
Allowance for Misc Items	10%				$43,810.27	$4,381	
Subtotal						$48,191	
EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
Centrifuges	3	EA			$790,882.11	$2,372,646	
Liquid Polymer Feed System	2	EA			$8,727.54	$17,455	
Shaftless Screw Conveyer	128.54	ft	39.18	m	$2,884.42	$370,768	
Allowance for Misc Items	10%				$2,760,869.69	$276,087	
Subtotal						$3,036,957	Total Horsepower >>>>
							Percent On-Line Factor >>>>
I&C:							Effective On-Line Horsepower >>>>
Instruments							
Centrifuge Feed Header Magmeter (CFH, 4 inch)	1	EA			$5,118.41	$5,118	
Isolation Valve Actuators (Electric)	9	EA			$6,409.82	$57,688	
Slide Gate Actuators	14	EA			$2,781.77	$38,945	
Number of Analog I/O Counts	2	EA			$264.27	$529	
Number of Digital I/O Counts	138	EA			$62.59	$8,637	
Number of Local Panels	3	EA			$13,074.33	$39,223	
Number of PLC's	1	EA			$13,908.86	$13,909	
I&C Conduit Wire	2324.00	LF	708.36	m	$12.06	$28,025	
Allowance for Misc Items	5%				$192,074.47	$9,604	
Subtotal						$201,678	
							Percent On-Line Factor >>>>
CONVEYING SYSTEMS:							Effective On-Line Horsepower >>>>
Bridge Crane (8 Ton)	1	EA			$70,027.47	$70,027	
Bridge Crane Rail	145.67	LF	44.40	m	$36.37	$5,298	
Allowance for Misc Items	10%				$75,325.72	$7,533	
Subtotal						$82,858	
MECHANICAL:							
Pipe:							
Centrifuge Feed Header (CFH, DI, 4 inch, Exposed)	85.67	LF	26.11	m	$34.68	$2,971	
Centrifuge Feed Lateral (CFL, Steel, 3 inch, Exposed)	14.75	LF	4.50	m	$69.34	$1,023	
Centrifuge Drain Lateral/Header (CD, Steel, 3 inch, Exposed)	100.42	LF	30.61	m	$69.34	$6,963	
Centrifuge Decant Header (CDH, Steel, 4 inch, Exposed)	85.67	LF	26.11	m	$92.45	$7,920	
Centrifuge Decant Lateral (CDL, Steel, 3 inch, Exposed)	14.75	LF	4.50	m	$69.34	$1,023	
Elbows:							
Centrifuge Feed Header (CFH, DI, 4 inch)	3	EA			$727.88	$2,184	
Centrifuge Feed Lateral (CFL, Steel, 3 inch)	3	EA			$417.60	$1,253	
Centrifuge Drain Lateral/Header (CD, Steel, 3 inch)	3	EA			$417.60	$1,253	
Centrifuge Decant Header (CDH, Steel, 4 inch)	6	EA			$556.80	$3,341	
Centrifuge Decant Lateral (CDL, Steel, 3 inch)	3	EA			$417.60	$1,253	
End Caps:							
Centrifuge Feed Header (CFH, DI, 4 inch)	0	EA			$180.64	$0	
Centrifuge Feed Lateral (CFL, Steel, 3 inch)	0	EA			$135.48	$0	
Centrifuge Drain Lateral/Header (CD, Steel, 3 inch)	0	EA			$135.48	$0	
Centrifuge Decant Header (CDH, Steel, 4 inch)	0	EA			$180.64	$0	
Centrifuge Decant Lateral (CDL, Steel, 3 inch)	0	EA			$135.48	$0	
Tee:							
Centrifuge Feed Header (CFH, DI, 4 inch)	2	EA			$1,208.62	$2,417	
Centrifuge Feed Lateral (CFL, Steel, 3 inch)	0	EA			$951.45	$0	
Centrifuge Drain Lateral/Header (CD, Steel, 3 inch)	2	EA			$951.45	$1,903	
Centrifuge Decant Header (CDH, Steel, 4 inch)	2	EA			$1,268.60	$2,537	
Centrifuge Decant Lateral (CDL, Steel, 3 inch)	0	EA			$951.45	$0	
Valves:							
Centrifuge Feed Header (CFH, DI, 4 inch)	0	EA			$3,544.25	$0	
Centrifuge Feed Lateral (CFL, Steel, 3 inch)	3	EA			$3,054.22	$9,163	
Centrifuge Drain Lateral/Header (CD, Steel, 3 inch)	3	EA			$3,054.22	$9,163	
Centrifuge Decant Header (CDH, Steel, 4 inch)	0	EA			$4,072.29	$0	
Centrifuge Decant Lateral (CDL, Steel, 3 inch)	3	EA			$3,054.22	$9,163	

Slide Gates:						
Centrifuge Conveyor Solids Gates (10 in)	2	EA			*$985.05*	$1,970
Truck Conveyor Solids Gates (10 in)	12	EA			*$985.05*	$11,821
Allowance for Misc Items	5%				$77,318.46	$3,866
Subtotal						$81,184
ELECTRICAL:						
# MCC Sections	8	EA			*$10,730.27*	$85,842
Switchgear	0	EA			*$49,359.23*	$0
Adjustable Frequency Drives						
Centrifuges (Active) (50 hp each)	0	EA			***$15,422.17***	$0
Centrifuges (Standby) (50 hp each)	0	EA			***$15,422.17***	$0
Centrifuge Conveyor Belt (3 hp each)	0	EA			***$9,258.95***	$0
Truck Conveyor Belt (3 hp each)	0	EA			***$9,258.95***	$0
Electrical Conduit & Wire	581.00	LF	177.09	m	**$12.06**	$7,006
Allowance for Misc Items	10%				$92,848.41	$9,285
Subtotal						$102,133
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**
Item 1 Description	0.00		0.00		0.00	$0
Item 2 Description	0.00		0.00		0.00	$0
Item 3 Description	0.00		0.00		0.00	$0
Item 4 Description	0.00		0.00		0.00	$0
Item 5 Description	0.00		0.00		0.00	$0
Item 6 Description	0.00		0.00		0.00	$0
Item 7 Description	0.00		0.00		0.00	$0
Item 8 Description	0.00		0.00		0.00	$0
Item 9 Description	0.00		0.00		0.00	$0
Item 10 Description	0.00		0.00		0.00	$0
Item 11 Description	0.00		0.00		0.00	$0
Item 12 Description	0.00		0.00		0.00	$0
Item 13 Description	0.00		0.00		0.00	$0
Item 14 Description	0.00		0.00		0.00	$0
Item 15 Description	0.00		0.00		0.00	$0
Subtotal						$0
Subtotal						$5,763,212
ALLOWANCES:		**User Override**				
Finishes Allowance	2.00%		$6,333,199	$126,664		
I&C Allowance	2.00%		$6,333,199	$126,664		
Mechanical Allowance	3.00%		$6,333,199	$189,996		
Electrical Allowance	2.00%		$6,333,199	$126,664		
					Facility Cost Name	
Facility Cost	**9,093**	**Dry Pounds per Day**	**$696.46**	**$6,333,199**	SCEFC01	
Facility Cost with Standard Additional Project Costs Added	**9,093**	**Dry Pounds per Day**	**$846.32**	**$7,695,914**	SCEFC02	
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**9,093**	**Dry Pounds per Day**	**$1,451.59**	**$13,199,869**	SCEFC03	
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**9,093**	**Dry Pounds per Day**	**$1,194.55**	**$10,862,570**	SCEFC05	
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**9,093**	**Dry Pounds per Day**	**$1,451.59**	**$13,199,869**	SCEFC06	

Wet Pit Submersible Pump Station							
Is This Facility Included in My Project? No							
Notes to Designer:							
This Model is designed around the ITT Flygt Large Submersible Pump Design Recommendations with a maximum pump cycling of 5 starts per hour							
For applications with a discharge pressure over 250 feet, use the Vertical Turbine PS Model. Submersible pumps are used in applications with smaller heads							
If this is a Seawater Desalination Application, the materials in contact with seawater need to be corrosion resistant.							
Process User Inputs:	**Value (English)**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Comment**	**Red Flags**
Is this Facility Included in a Seawater Treatment Train?	**No**	Y/N					
Input Design Pump Station Inflow	**2.04**	mgd	**10.56**	ML/d			
Conversion of Design P.S. Flow from MGD to CFS	3.16	cfs	0.09	m3/s			
Input Average Pump Station Flow	**1.92**	mgd	**6.85**	ML/d			
Conversion of Average P.S. Flow from MGD to CFS	2.97	cfs	0.08	m3/s			
Input Maximum Water Temperature	50.00	degrees F	**10.00**	degrees C			
Calculate Maximum Vapor Pressure	0.40	ft	122.73	mm			
Input Pump Station Site Elevation	**750.00**	ft	**228.60**	m			
Calculate Atmospheric Pressure	33.02						
Mechanical Design Inputs:							
Pipe Name	**Input Velocity**	**Unit (English)**	**Input Velocity**	**Unit (Metric)**	**Standard Pipe Size**	**Unit (English)**	**Standard Pipe Size**
Discharge Lateral Pipe	**5.00**	fps	**1.52**	m/s	8.00	in	200.00
Discharge Header Pipe	**5.00**	fps	**1.52**	m/s	12.00	in	300.00
Pipe Name	**Pipe ID**	**Installation Type**	**Pipe Material**	**Pipe Lining Material**	**Pipe Coating Material**	**Pipe Diameter**	**Pipe Length**
Discharge Lateral Pipe	DIS	Exposed	Steel	Cement Mortar	Paint	8.00	64.00
Discharge Header Pipe	DIS	Exposed/Buried	Steel	Cement Mortar	Paint	12.00	22.42
Select Type of Pump Isolation Valve	**Butterfly Valve**	Type					
Select Type of Pump Control Valve	**Check Valve**	Type					
Calculate Pump Discharge Lateral Pipe Length	16.00	ft	4876.80	mm	DLPL		
Calculate Pump Discharge Lateral Pipe Headloss	0.91	ft	276.36	mm	DLPH	Assumes minor loss K value for Tee, Valve, Control Valve, Elbow, and Reducer	
Is Pump Station Discharge Pressure Known?	**Yes**	Y/N					
Input Actual Design Discharge Pressure	**50.00**	ft	**15,240.00**	mm			
Input Design Discharge WSEL		ft		mm	MaxDL		
Input Length of Pump Station Discharge Header and Pipeline		ft		mm	LPSDP	Confirm with Hydraulic Analysis	
Input Total Friction Coefficient, K for Discharge Header Minor Losses		ft		mm	MPSDF	Friction K values should be obtained from D.S. Miller Internal Flow System.	
Input Hazen Williams Friction Coefficient	**130.00**	C			HWFC	Consult Conveyance GTL, for appropriate C value	
Calculate Design Discharge Header & Pipeline Dynamic Headloss	0.02	ft	7.43	mm	maxDPDH		
Calculate Total Dynamic Head at Design Flow	50.00	ft	15240.00	mm	maxTDH		
Pump Selection Design Inputs:							
Input Number of Active Pumps	**3**	#			NAP	Should be 1,2,3,5, or 7 if there is a standby pump	
Include a Standby Pump?	**Yes**	Y/N					
Pump Efficiency	75.00%					Fixed	
Motor Efficiency	95.00%					Fixed	
AFD Efficiency	95.00%					Fixed	
Safety Margin Allocated in Pump Design Brake Horsepower	1.15					Fixed	
Input Pump Information	**Capacity (MGD)**	**AFD? (Yes or No)**	**Actual Individual Pump Sizing Flow (GPM)**	**Calculated Individual Pump BHP**	**Actual Individual Pump BHP**	**Pump?? ("1"= Yes, "0" = No)**	**Weir Pump Model Number**
Active Pump # 1	0.68	**Yes**	500	9.628026436	10	1.00	F500_HP10_C3152.181_MT
Active Pump # 2	0.68	**Yes**	500	9.628026436	10	1.00	F500_HP10_C3152.181_MT
Active Pump # 3	0.68	**Yes**	500	9.628026436	10	1.00	F500_HP10_C3152.181_MT
Active Pump # 4	0.00	**No**	0	0	-	0.00	#N/A
Active Pump # 5	0.00	**No**	0	0	-	0.00	#N/A
Active Pump # 6	0.00	**No**	0	0	-	0.00	#N/A
Active Pump # 7	0.00	**No**	0	0	-	0.00	#N/A
Calculate Standby Pump Capacity = Max Pump	0.68	**Yes**	500	9.628026436	10	1.00	F500_HP10_C3152.181_MT
Calculate Total Active Pump Capacity	2.04	4.00	1500	28.88407931	30	**User Override Pump Criteria (Pump 1)**	
Calculate Total P.S. Capacity	2.72	mgd	2000	38.51210574	40	**User Override Pump Criteria (Pump 2)**	
Calculate Total Number of Pumps (Active & Standby)	4.00	#			TNP	should be 2,3,4,6, or 8	
Recommended NPSHR Margin	1.50	#				Fixed - Verify Margin with Pump Manufacturer	
Calculate Minimum Submergence based on NPSHR Margin or HI Standards	0.99	ft	301.73	mm	mSUB	Calculated - Verify with Pump Manufacturer	
Calculate Pump Elevation based on Minimum Submergence Requirements	742.22	ft	226227.52	mm		Calculated	
Wet Well Design Calculations:							
Calculate Number of Wet Wells	1.00	#			NW		
Calculate Number of Pumps per Wet Well	4.00	#			PPW		

Calculate Conceptual Minimum Wet Well Volume	8,503.98	gal	32.19	m3	MWWV	Vreq=T*2*Q/4; T=12	
Calculate Distance From Wall to Baffles	41.70	in	1059.19	mm	WTB		
Calculate Conceptual Distance From Wall to Pump Center	65.70	in	1668.79	mm	PWFW	Greater than or equal to this value	
Calculate Distance Between Pump Shells	26.67	in	677.52	mm	DBPS		
Calculate Length From Wall to Pump Center	12.85	in	326.42	mm	PLFW	Less than or equal to this value	
Calculate Operational Wet Well Width	9.33	ft	2843.54	mm			
Calculate Operational Wet Well Length	13.87	ft	4228.45	mm	WWL		
Calculate Operational Wet Well Surface Area	129.42	sf	12.02	m2			
Calculate Minimum Operational Wet Well Depth	8.78	ft	2677.28	mm	OWWD		
Input Additional Storage Volume Requirements	0.00	gal		m3			
Input Wet Well Freeboard	2.00	ft		mm	WWFB	Typically 2 to 3 feet	
Calculate Required Wet Well Width	9.33	ft	2843.54	mm	WWW		
Calculate Total Required Wet Well Depth	14.78	ft	4506.08	mm	WWD		
Calculate Total Wet Well Volume	1,913.35	cf					
Calculate Total Wet Well Volume	14,312.88	gal			WWV		
Calculate Minimum Wet Well Low Operating Level Required	746.22	ft	227446.72	mm			
Calculate Maximum Wet Well High Operating Level Required	755.00	ft	230124.00	mm			
Does Wet Well Have a Liner?	No	Y/N					
Calculate Wet Well Liner Surface Area	0.00	sf	0.00	m2			

Pump Station Design User Inputs:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Comment	Red Flags
Input Lateral Pipe Distance from Wall to Valve	1.00	ft	100.00	mm	PDWV	Typically 1 foot	
Input Lateral Distance from Valve to Header	4.00	ft		mm	VTHD	Minimum 2 feet	
Input Clear Distance Width From Discharge Header to Wall	6.00	ft		mm	HTW	Minimum 6 feet	
Input Discharge Pipe Distance from Wet Well Ceiling	4.00	ft		mm	PDTC	Typically 4 feet	
Input Discharge Pipe Height From Operating Room Floor	1.00	ft		mm	HHTF	Typically 1-2 feet	
Input Clear Distance Length Discharge Header to Wall	3.00	ft		mm	CDHW	Typically 3-4 feet	
Calculate Vertical Lateral Pipe Length	8.45	ft			VLPL		
Is the Surge Protection Area Covered?	No	Y/N					
Input Cutback Slope	1.50	:1				Cutback slope should be 1:1 for depth of burial≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.	
Input Over Excavation Depth	1.00	ft	609.60	mm			
Electrical User Inputs and Sizing Requirements:							
Is this a "Critical" Facility (requiring standby power)?	No	Y/N					
Is there SWGR?	No						

Item	Quantity	HP per Each	AFD's Required?	MCC Spaces for Motor Starters	MCC Spaces for AFD's less than 50hp	MCC Spaces for Breakers	MCC Total MCC Spaces
Active Pump # 1	1.00	10.53	Yes	0.00	4.00	2.00	
Active Pump # 2	1.00	10.53	Yes	0.00	4.00	2.00	
Active Pump # 3	1.00	10.53	Yes	0.00	4.00	2.00	
Active Pump # 4	0.00	0.00	No	0.00	0.00	0.00	
Active Pump # 5	0.00	0.00	No	0.00	0.00	0.00	
Active Pump # 6	0.00	0.00	No	0.00	0.00	0.00	
Active Pump # 7	0.00	0.00	No	0.00	0.00	0.00	
Standby	1.00	10.53	Yes	0.00	4.00	2.00	
User Defined Item #1	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #2	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #3	0.00	0.00	No	0.00	0.00	0.00	
TOTAL		**42.11**		**0.00**	**16.00**	**8.00**	**24.00**

Electrical Equipment Lengths:

Equipment	Depth (ft)
MCC	1.67
Small AFD's	0.00
Large AFD's	0.00
Switchgear	0.00
Maximum Depth	**1.67**

Clear Distances:

Clear Distance	Width	Length	Comment	
CD1		3.00	Clear Distance between wall and MCC	Typically 3 feet
CD2		1.00	Clear Distance between MCC and Small AFD	Typically 1 foot
CD3		0.00	Clear Distance between Small AFD and Large AFD	Typically Zero
CD4		0.00	Clear Distance between Large AFD and Switchgear	Typically Zero
CD5		0.00	Clear Distance between Switchgear and Contingency Space	Typically Zero
CD6	4.00		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)	
CD7	3.00		Clear Distance in front of Equipment	Tyipcally 3 feet
Contingency Length		0.00	Contingency length	Typically Zero

Electric Room Width (ft):

CD1	3.00
MCC	10.00
CD2	1.00

Small AFD's	0.00						
CD3	0.00						
Large AFD's	0.00						
CD4	0.00						
Swithgear	0.00						
CD5	0.00						
Contingency	0.00						
Total Width	**14.00**				ERL		
Electric Room Length (ft):							
CD6	0.00					If there is no switchgear, this distance will be Zero.	
Maximum Equipment Depth	1.67						
CD7	3.00						
Total Length	**4.67**				ERW		
Stair Dimensions:							
Operating Room Floor Elevation	751.00	ft			OREL		
Hatch Access Elevation	758.00	ft			HAEL		
Total Stair Height	84.00	in			TSH		
Individual Step Height	**7.00**	in		Between 6 and 8 inche	ISTH		
Number of Steps	12.00				NS		
Last Step Height	7.00	in			LSH		
Step Width	**12.00**	in		Typically 12 inches	SW		
Step Length	4.00	ft		Fixed	SL		
Handrail Length	12.00	ft			HRL		
Handrail Height	4.00	ft		Fixed	HRH		
Hatch Access Dimensions:							
Is Hatch Access Area Covered?	**Yes**	Y/N					
Double Door Width	**5.00**	ft		Typically at least 5 feet	DDW		
Clear Distance From Doors to Steps	**2.00**	ft		Between 2 and 4 feet	DTSW		
Landing Platform Width	**6.00**	ft		At least 6 feet	LPW		
Landing Platform Length	**4.00**	ft		Typically 4 feet	LPL		
Total Area Required	261.03	sf					
Hatch Access Area Without Wet Well Ceiling	53.00	ft					
Hatch Length	2.69	ft			HL		
Hatch Width	3.85	ft			HW		
Access Hatch Length	2.00	ft		Fixed	AHL		
Access Hatch Width	1.50	ft		Fixed	AHW		
Influent Pipe and Baffle Dimensions:							
Inlet Pipe Diameter	**24.00**	in			IPD		
Influent Pipe Height From Floor	4.00	ft		measured from top of pipe	IPHF		
Influent Pipe Offset Distance	8.25	in			IPOD		
Baffle Clearance Height	24.55	in			BCH		
Baffle Length	2.00	ft		Fixed	BL		
Baffle Height	4.00	ft		Same as IPHF	BH		
Baffle Thickness	6.00	in		Fixed	BT		
Inlet Slope Width	49.50	in			ISW		
Inlet Slope Height	8.25	in			ISH		

Estimating Dimensions:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Comment	Red Flags
Mechanical Fitting Dimensions:							
Discharge Lateral Increaser Length	0.67	ft	203.20	mm	DLIL		
Pump Control Valve Length	2.04	ft	622.30	mm	PCVL		
Discharge Lateral Butterfly Valve Length	0.50	ft	152.40	mm	BFVL		
Discharge Lateral to Header Increaser Length	1.33	ft	406.40	mm	LHIL		
Magmeter Length	1.67	ft	508.00	mm	MML		
Operating Room Area:							
Slab On Grade							
Operating Room Floor Width	15.54	ft	4737.10	mm	ORFW		
Operating Room Floor Length	31.49	ft	9597.99	mm	ORFL		
Concrete Thickness	**12.00**	in	**457.20**	mm		Model based on 24"	
Concrete Thickness	1.00	ft	304.80	mm	ORFST		
Surge Protection Area:							
Slab on Grade							
Overall Surge Area Width	15.54	ft	4737.10	mm	SSOGW		
Overall Surge Area Length	7.87	ft	2399.50	mm	SSOGL		
Concrete Thickness	**12.00**	in	**609.60**	mm		Model based on 24"	
Concrete Thickness	1.00	ft	304.80	mm	SSOGT		
Electrical Room Area:							
Slab on Grade							
Electrical Room Width	16.00	ft	4876.80	mm	ESOGW		
Electrical Room Length	6.67	ft	2032.00	mm	ESOGL		
Concrete Thickness	**12.00**	in	**609.60**	mm		Model based on 24"	
Concrete Thickness	1.00	ft	304.80	mm	ESOGT		
Pump Station Wet Well:							
Floor Slab							
Wet Well Floor Slab Area	208.03	sf	19.33	m2			
Wet Well Floor Slab Thickness	**24.00**	in	**609.60**	mm		Model based on 24"	
Wet Well Floor Slab Thickness	2.00	ft	609.60	mm	WWFST		
Wet Well Walls							
Wet Well Width	9.33	ft	2843.54	mm	WWW		
Wet Well Length	13.87	ft	4228.45	mm	WWL		
Wet Well Depth	14.78	ft	4506.08	mm	WWD		
Wall Thickness	**18.00**	in	**304.80**	mm		Model based on 12"	
Wall Thickness	1.50	ft	457.20	mm	WWWT		
Elevated Ceiling Slab							
Wet Well Ceiling Area	208.03	sf	19.33	m2			
Elevated Slab Thickness	**12.00**	in	**304.80**	mm		Model based on 12"	

Elevated Slab Thickness	1.00	ft	304.80	mm	WWCT		
Hatch Access Room Area:							
Elevated Floor Slab							
Overall Hatch Access Area	261.03	sf	24.25	m2			
Overall Hatch Access Area New Concrete Required	53.00	sf	4.92	m2			
Concrete Thickness	**12.00**	in	**457.20**	mm			
Concrete Thickness	1.00	ft	304.80	mm	SOGT		
Overall Facility Dimensions:							
Operating Room Slab Length	31.49	ft	9597.99	mm			
Operating Room Slab WIdth	15.54	ft	4737.10	mm			
Operating Room Excavation Length	35.49	ft	10817.19	mm			
Operating Room Excavation Width	19.54	ft	5956.30	mm			
Operating Room Excavation Depth	1.00	ft	304.80	mm			
Wet Well Area	208.03	sf	19.33	m2			
Wet Well Excavation Length	20.87	ft	6362.05	mm			
Wet Well Excavation Width	16.33	ft	4977.14	mm			
Wet Well Excavation Depth	17.78	ft	5420.48	mm			
Surge Protection SOG Area	122.35	sf	11.37	m2			
Surge Protection Excavation Area	232.01	sf	21.55	m2			
Surge Protection Excavation Depth	2.00	ft	609.60	mm			
Electrical Room SOG Area	106.67	sf	9.91	m2			
Electrical Room Excavation Area	213.33	sf	19.82	m2			
Electrical Room Excavation Depth	2.00	ft	609.60	mm			
Hatch Access SOG Area	53.00	sf	4.92	m2			
Hatch Access Excavation Area	58.00	sf	5.39	m2			
Hatch Access Excavation Depth	2.00	ft	609.60	mm			

COST ESTIMATE

Description	Quantity (English)	Unit (English)	Quantity (Metric)	Unit (Metric)	$/Unit	Total Cost	User Over-Write
SITEWORK:							
Operating Room:							
Excavation	32.19	CY	24.61	m3	*$6.72*	$216	
Imported Structural Backfill	51.37	CY	39.28	m3	*$50.94*	$2,617	
Native Backfill	3.06	CY	2.34	m3	*$8.27*	$25	
Haul Excess	29.14	CY	22.28	m3	*$8.27*	$241	
Wet Well:							
Excavation	778.14	CY	594.93	m3	*$6.72*	$5,231	
Imported Structural Backfill	25.25	CY	19.30	m3	*$50.94*	$1,286	
Native Backfill	470.27	CY	359.55	m3	*$8.27*	$3,887	
Haul Excess	307.87	CY	235.38	m3	*$8.27*	$2,545	
Surge Protection:							
Excavation	26.83	CY	20.51	m3	*$6.72*	$180	
Imported Structural Backfill	17.19	CY	13.14	m3	*$50.94*	$875	
Native Backfill	6.77	CY	5.18	m3	*$8.27*	$56	
Haul Excess	20.06	CY	15.34	m3	*$8.27*	$166	
Hatch Access Room:							
Excavation	7.66	CY	5.85	m3	*$6.72*	$51	
Imported Structural Backfill	4.30	CY	3.28	m3	*$50.94*	$219	
Native Backfill	2.54	CY	1.94	m3	*$8.27*	$21	
Haul Excess	5.12	CY	3.91	m3	*$8.27*	$42	
Electrical Room:							
Excavation	24.97	CY	19.09	m3	*$6.72*	$168	
Imported Structural Backfill	15.80	CY	12.08	m3	*$50.94*	$805	
Native Backfill	6.49	CY	4.96	m3	*$8.27*	$54	
Haul Excess	18.48	CY	14.13	m3	*$8.27*	$153	
Allowance for Misc Items	5%				$18,839.13	$942	
Subtotal						$19,781	
CONCRETE:							
Operating Room							
Foundation	22.31	CY	17.06	m3	*$541.11*	$12,071	
Pipe Supports	0.44	CY	0.34	m3	*$490.62*	$218	
Electrical Room							
Foundation	3.95	CY	3.02	m3	*$541.11*	$2,138	
Surge Protection							
Foundation	4.53	CY	3.46	m3	*$541.11*	$2,452	
Pump Station Wet Well							
Floor Slab	15.41	CY	11.78	m3	*$490.62*	$7,560	
Wet Well Walls	43.04	CY	32.91	m3	*$880.79*	$37,910	
Ceiling Slab	7.70	CY	5.89	m3	*$1,333.77*	$10,276	
Pump Baffling	5.32	CY	4.07	m3	*$880.79*	$4,689	
Inlet Slope	0.73	CY	0.56	m3	*$490.62*	$357	
Pipe Support Fitting	3.82	CY	2.92	m3	*$490.62*	$1,872	
Hatch Access Room							
Foundation	1.96	CY	1.50	m3	*$198.37*	$389	
Allowance for Misc Items	5%				$79,933.88	$3,997	
Subtotal						$83,931	
MASONRY:	**Moderate**						
Operating Room	618.58	SF	57.47	m2	*$165.31*	$102,255	
Hatch Access Room	261.03	SF	24.25	m2	*$165.31*	$43,150	
Surge Building	0.00	SF	0.00	m2	*$165.31*	$0	
Electrical Room	106.67	SF	9.91	m2	*$165.31*	$17,633	
Subtotal	986.28					$163,037	
METALS:							
Pump Removal Hatches	44.43	SF	4.13	m2	*$160.25*	$7,120	
Stairs	20.00	Risers			*$495.92*	$9,918	
Access Hatch Ladder	14.78	VLF	4.51	VLM	*$141.02*	$2,085	
Allowance for Misc Items	10%				$19,123.17	$1,912	
Subtotal						$21,035	

THERMAL & MOISTURE PROTECTION:							
Wet Well Liner	0.00	SF	0.00	m2	**$16.00**	$0	
Allowance for Misc Items	10%				$0.00	$0	
Subtotal						$0	
EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
Pumps							
Active Pump # 1	1.00	EA			***$18,401.07***	$18,401	
Active Pump # 2	1.00	EA			***$18,401.07***	$18,401	
Active Pump # 3	1.00	EA			***$18,401.07***	$18,401	
Active Pump # 4	0.00	EA			***$0.00***	$0	
Active Pump # 5	0.00	EA			***$0.00***	$0	
Active Pump # 6	0.00	EA			***$0.00***	$0	
Active Pump # 7	0.00	EA			***$0.00***	$0	
Standby Pump	1.00	EA			***$18,401.07***	$18,401	
Allowance for Misc Items	10%				$73,604.27	$7,360	
Subtotal						$80,965	
INSTRUMENTATION & CONTROLS:							
Instruments							
Isolation Valve Actuators	5.00	EA			***$6,409.82***	$32,049	
Control Valve Actuators	4.00	EA			***$6,409.82***	$25,639	
Level Indicator Transmitters	2.00	EA			***$10,700.91***	$21,402	
Level Swithces	0.00	EA			***$11,264.12***	$0	
Pressure Indicator Transmitters	1.00	EA			***$11,264.12***	$11,264	
Pressure Switches	4.00	EA			***$11,264.12***	$45,056	
Number of Analog I/O Counts	21.60	EA			***$264.27***	$5,708	
Number of Digital I/O Counts	58.80	EA			***$62.59***	$3,680	
Number of PLC's	1.00	EA			***$13,074.33***	$13,074	
I&C Conduit & Wire	503.83	LF	153.57	m	***$12.06***	$6,076	
Allowance for Misc Items	10%				$163,949	$16,395	
Subtotal						$180,344	
MECHANICAL:							
Pipe:							
Discharge Lateral Pipe (8-inch,DIS, Exposed, Steel, Cement Mortar, Paint)	64.00	LF	19.51	m	***$237.74***	$15,215	
Discharge Header Pipe (12-inch,DIS, Exposed/Buried, Steel, Cement Mortar, Paint)	22.42	LF	6.83	m	***$365.78***	$8,200	
Elbows:							
Pump Discharge (6-inch)	4.00	EA			***$460.10***	$1,840	
Discharge Lateral Pipe (8-inch)	4.00	EA			***$720.42***	$2,882	
Discharge Header Pipe (12-inch)	2.00	EA			***$1,241.06***	$2,482	
Tees:							
Discharge Header Pipe (12-inch)	4.00	EA			***$2,361.54***	$9,446	
Valves:							
Discharge Lateral Isolation Valve (8-inch - Butterfly Valve)	4.00	EA			***$636.35***	$2,545	
Pump Control Valve (8-inch, Check Valve)	4.00	EA			***$4,282.77***	$17,131	
Discharge Header Isolation Valve (12-inch, BFV)	1.00	EA			***$2,170.32***	$2,170	
Air Release Vacuum Valves	1.00	EA			***$1,922.95***	$1,923	
Increasers:							
Pump Discharge to Discharge Lateral (6-inch to 8-inch)	4.00	EA			***$720.42***	$2,882	
Discharge Lateral to Discharge Header (8-inch to 12-inch)	4.00	EA			***$1,241.06***	$4,964	
Allowance for Misc Items	10%				$71,681.55	$7,168	
Subtotal						$78,850	
ELECTRICAL:							
MCC's							
Sections	6.00	EA			***$10,730.27***	$64,382	
AFD's							
Active Pump # 1	10.00	hp	7.46	kW	***$1,017.69***	$10,177	
Active Pump # 2	10.00	hp	7.46	kW	***$1,017.69***	$10,177	
Active Pump # 3	10.00	hp	7.46	kW	***$1,017.69***	$10,177	
Active Pump # 4	0.00	hp	0.00	kW	***$0.00***	$0	
Active Pump # 5	0.00	hp	0.00	kW	***$0.00***	$0	
Active Pump # 6	0.00	hp	0.00	kW	***$0.00***	$0	
Active Pump # 7	0.00	hp	0.00	kW	***$0.00***	$0	
Standby Pump	10.00	hp	7.46	kW	***$1,017.69***	$10,177	
Switchgear							
Units	0.00	EA			***$49,359.23***	$0	
Electrical Conduit & Wire	125.96	LF	38.39	m	***$12.06***	$1,519	
Allowance for Misc Items	5%				$106,608	$5,330	
Subtotal						$111,938	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00		0.00		0.00	$0	
Item 2 Description	0.00		0.00		0.00	$0	
Item 3 Description	0.00		0.00		0.00	$0	
Item 4 Description	0.00		0.00		0.00	$0	
Item 5 Description	0.00		0.00		0.00	$0	
Item 6 Description	0.00		0.00		0.00	$0	
Item 7 Description	0.00		0.00		0.00	$0	
Item 8 Description	0.00		0.00		0.00	$0	
Item 9 Description	0.00		0.00		0.00	$0	
Item 10 Description	0.00		0.00		0.00	$0	
Item 11 Description	0.00		0.00		0.00	$0	
Item 12 Description	0.00		0.00		0.00	$0	
Item 13 Description	0.00		0.00		0.00	$0	
Item 14 Description	0.00		0.00		0.00	$0	
Item 15 Description	0.00		0.00		0.00	$0	
Subtotal						$0	

Subtotal						$739,881	
ALLOWANCES:		**User Override**					
Finishes Allowance	5.00%		$948,566	$47,428			
I&C Allowance	2.00%		$948,566	$18,971			
Surge Allowance	5.00%		$948,566	$47,428			
Mechanical Allowance	5.00%		$948,566	$47,428			
Electrical Allowance	5.00%		$948,566	$47,428			
Facility Cost	**40**	**Total Pump HP**	**$23,714.15**	**$948,566**			
Facility Cost with Standard Additional Project Costs Added	**40**	**Total Pump HP**	**$28,816.72**	**$1,152,669**			
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**40**	**Total Pump HP**	**$49,425.84**	**$1,977,034**			
Facility Cost, Contractor Markups, and Location Adjustment Factor Adde (excluding ALL Additional Project Costs)	**40**	**Total Pump HP**	**$40,674.01**	**$1,626,960**			
Facility Cost with Standard Additional Project Costs, Contractor Markups and Location Adjustment Factor Added	**40**	**Total Pump HP**	**$49,425.84**	**$1,977,034**			

CH2M Parametric Engineering System (CPES)

FACILITIES LIFE CYCLE COST ANALYSIS MODULE

File Version: 9/21/2017

Linked to CPES Facilities File: C:\Users\lodell\Documents\CPES_Configurable\CPES Facilities PWB 160.xlsm

Project Name:	PWB Filtration Decision
Project Number:	699275
Project Manager:	Kelly Irving
Estimator:	Enoch Nicholson/Lee Odell
Project Description:	PWB Granular Media Filtration
Project Location (City):	Portland OR
Project Location (State):	OREGON
Project Location (Country):	USA
Cost Basis (Month/Year):	April/2018

Life Cycle Analysis:

i =	5.00%
n =	25 years
Annual Inflation:	3.00%

Item	Include? (Yes or No)	SCOPE OF PROJECT	Construction Cost	Annual O&M Cost (Year 1)	Life Cycle Cost (NPV)
	Yes	Flocculation: RapMix	$2,488,000	$182,000	$5,949,000
	Yes	Flocculation: Floc	$12,038,000	$124,000	$14,387,000
	Yes	DAF: DAF	$85,220,000	$2,873,000	$140,033,000
	No	Ozone Serpentine: Ozone	$0	$0	$0
	Yes	Filters: Filt	$55,945,000	$558,000	$66,584,000
	Yes	Concrete Clearwell: Clearwell	$36,021,000	$16,000	$36,311,000
	Yes	Liquid Chemical: Alum	$2,181,000	$681,000	$15,175,000
	Yes	Liquid Chemical: FAP	$497,000	$89,000	$2,184,000
	Yes	Liquid Chemical: CAP	$1,153,000	$641,000	$13,372,000
	No	Liquid Chemical: Hypo	$0	$0	$0
	Yes	On-Site Sodium Hypo: OSHG	$8,718,000	$642,000	$20,967,000
	Yes	Liquid Chemical: Caustic	$1,727,000	$2,902,000	$57,112,000
	Yes	Surge Basin-Decanter: BWSurge	$6,640,000	$154,000	$9,572,000
	Yes	Gravity Thickener: BWClar	$13,737,000	$27,000	$14,245,000
	Yes	Gravity Thickener: GravThick	$2,267,000	$27,000	$2,765,000
	Yes	WTP Centrifuge: Centrifuge	$10,087,000	$763,000	$24,636,000
	No	WPSPS: RecPS	$0	$0	$0
	Yes	Filter BW PS: BWPS	$4,325,000	$78,000	$5,802,000
		Additional Project Costs:			
		Biosolids Disposal	$0	$0	$0
		Standard Items	$52,319,000	$1,787,000	$86,416,000
		User Defined Items	$0	$0	$0
		Plant O&M Labor		$972,000	$18,532,000
TOTAL - Life Cycle Analysis		(Red Flag Items and Market Adjustment Factor are EXCLUDED)	$295,363,000	$12,516,000	$534,042,000
Construction Cost per GPD (based on Maximum Daily Flow Rate)			$2.57 / GPD		
Annual O&M Cost per 1,000 Gallons (based on Average Annual Daily Flow Rate)				$ 0.457	/ Thousand Gallons

CH2M Parametric Engineering System (CPES)

WTP LIFE CYCLE COST ANALYSIS
Summary of Annual O&M Costs (Year 1)

Project Name:	PWB Filtration Decision	Life Cycle Analysis:	
Project Number:	699275	i =	5.00%
Project Manager:	Kelly Irving	n =	25 years
Estimator:	Enoch Nicholson/Lee Odell	Annual Inflation:	3.00%
Project Description:	PWB Granular Media Filtration		
Project Location (City):	Portland OR		
Project Location (State):	OREGON		
Project Location (Country):	USA		
Cost Basis (Month/Year):	April/2018		

Item	Is This Facility Included in Project? (Yes or No)	SCOPE OF PROJECT	Labor	Equipment Power	Building Electrical	Chemicals	Sludge Disposal	Specialty Items	Repair & Maintenance	Replacement	Other	User Defined	Total
5	Yes	Flocculation	$0	$94,877	$173	$0	$0	$0	$51,660	$0	$29,342	$0	$176,052
5	Yes	Flocculation	$0	$11,431	$14,521	$0	$0	$0	$73,651	$0	$19,921	$0	$119,524
11	Yes	DAF	$0	$390,941	$0	$0	$0	$0	$1,932,702	$0	$464,728	$0	$2,788,371
16	No	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
12	Yes	Conventional/GAC Filter	$0	$0	$1,072	$0	$0	$0	$449,956	$0	$90,206	$0	$541,234
22	Yes	Concrete Tank 1	$0	$0	$0	$0	$0	$0	$12,280	$0	$2,456	$0	$14,736
24	Yes	Liquid Chemical	$0	$2,858	$3,763	$529,642	$0	$0	$14,599	$0	$110,172	$0	$661,034
24	Yes	Liquid Chemical	$0	$857	$960	$67,602	$0	$0	$2,084	$0	$14,301	$0	$85,805
24	Yes	Liquid Chemical	$0	$2,000	$2,386	$507,018	$0	$0	$6,582	$0	$103,597	$0	$621,584
24	No	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
20	Yes	On-Site Sodium Hypochlorite Generation	$0	$233,193	$3,676	$87,458	$0	$0	$194,917	$0	$103,849	$0	$623,092
24	Yes	Liquid Chemical	$0	$572	$3,058	$2,331,407	$0	$0	$12,858	$0	$469,579	$0	$2,817,474
27	Yes	Combination Wastewater Surge Basin & Floating Tube Decanter Clarification (Large System >= 5MGD)	$0	$21,433	$95	$0	$0	$0	$102,794	$0	$24,864	$0	$149,187
30	Yes	Gravity Thickener	$0	$2,858	$1,027	$0	$0	$0	$17,639	$0	$4,305	$0	$25,829
30	Yes	Gravity Thickener	$0	$857	$1,008	$0	$0	$0	$19,230	$0	$4,219	$0	$25,315
31	Yes	Centrifuge Solids Dewatering	$0	$8,859	$12,198	$46,039	$361,780	$0	$187,893	$0	$123,354	$0	$740,122
4	No	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
44	Yes	Granular Media Filter Backwash Supply Pump Station	$0	$14,860	$2,101	$0	$0	$0	$45,663	$0	$12,525	$0	$75,149
		Totals	$0	$785,596	$46,039	$3,569,166	$361,780	$0	$3,124,507	$0	$1,577,418	$0	$9,464,507
	Additional Project Costs:												
		Biosolids Disposal					$0					$0	$0
		Standard Items							$1,445,433	$0	$289,087	$0	$1,734,520
		User Defined Items		$0	$0	$0		$0	$0	$0	$0	$0	$0
	Plant O&M Labor		$942,720										$942,720
	TOTAL - O&M Cost		$942,720	$785,596	$46,039	$3,569,166	$361,780	$0	$4,569,940	$0	$1,866,504	$0	$12,141,747
	Percent of TOTAL Cost		7.8%	6.5%	0.4%	29.4%	3.0%	0.0%	37.6%	0.0%	15.4%	0.0%	100.0%

Item	Is This Facility Included in Project? (Yes or No)	SCOPE OF PROJECT	Labor	Equipment Power	Building Electrical	Chemicals	Sludge Disposal	Specialty Items	Repair & Maintenance	Replacement	Other	User Defined	Total

Item	Is This Facility Included in Project? (Yes or No)	SCOPE OF PROJECT	Labor	Equipment Power	Building Electrical	Chemicals	Sludge Disposal	Specialty Items	Repair & Maintenance	Replacement	Other	User Defined	Total

Flocculation (Horizontal Paddle Wheel Flocculation for Downstream Sedimentation)

Construction Cost:					**$2,487,894**	

Annual O&M Cost:

Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	332	65%	8,760	$ 0.06	$ 79,065	

Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	147	2.00	8,760	$ 0.06	$ 144	
Chemicals:					$ -	

Repair and Maintenance, and Replacement:	Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost
Maintenance & Repair Cost		$ 43,050
Replacement Cost	-	$ -

Other:	Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost	$ 122,258	20.0%	$ 24,452	

User Defined Annual O&M Items:	Annual Cost
Item 1	$ -
Item 2	$ -
Item 3	$ -
Item 4	$ -
Item 5	$ -
Item 6	$ -
Item 7	$ -
Item 8	$ -
Item 9	$ -
Item 10	$ -
Item 11	$ -
Item 12	$ -
Item 13	$ -
Item 14	$ -
Item 15	$ -

Subtotal Annual O&M Cost		$ 146,710
Contingency	20%	$ 29,342
Total Annual O&M Cost		$ 176,052

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$2,487,894		$2,487,894	
1	$181,333		$181,333	
2	$186,773		$186,773	
3	$192,377		$192,377	
4	$198,148		$198,148	
5	$204,092		$204,092	
6	$210,215		$210,215	
7	$216,522		$216,522	

8	$223,017		$223,017				
9	$229,708		$229,708				
10	$236,599		$236,599				
11	$243,697		$243,697				
12	$251,008		$251,008				
13	$258,538		$258,538				
14	$266,294		$266,294				
15	$274,283		$274,283				
16	$282,512		$282,512				
17	$290,987		$290,987				
18	$299,717		$299,717				
19	$308,708		$308,708				
20	$317,969		$317,969				
21	$327,508		$327,508				
22	$337,334		$337,334				
23	$347,454		$347,454				
24	$357,877		$357,877				
25	$368,613		$368,613				
26							
27							
28							
29							
30							
31							
32							
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46							
47							
48							
49							
50							
NPV			$5,948,657	$181,333			

Flocculation (Horizontal Paddle Wheel Flocculation for Downstream Sedimentation)

Construction Cost:					**$12,037,127**	
Annual O&M Cost:						
Power:	**Total HP**	**Average-to-Maximum Flow Factor**	**Annual Usage (Hours / Year)**	**$/kWh**	**Power Cost**	**Annual Usage Hours / Year (Over-write)**
Equipment Power	40	65%	8,760	$ 0.06	**$ 9,526**	
Other Electrical:	**Building Area (SF)**	**Watts / SF**	**Annual Usage (Hours / Year)**	**$/kWh**	**Other Electrical Cost**	**Annual Usage Hours / Year (Over-write)**
Building Electrical	12,356	2.00	8,760	$ 0.06	**$ 12,101**	
Chemicals:					$ -	
Repair and Maintenance, and Replacement:				**Replacement Included? (1 = "Yes", 0 = "No")**	**Annual Cost**	
Maintenance & Repair Cost					**$ 61,376**	
Replacement Cost				-	**$ -**	
Other:			**Total Annual O&M Cost**	**"Other" Percent**	**Other Cost**	**Other Cost Percent (Over-write)**
Other Cost			$ 83,002	20.0%	**$ 16,600**	
User Defined Annual O&M Items:					**Annual Cost**	
Item 1					**$ -**	
Item 2					**$ -**	
Item 3					**$ -**	
Item 4					**$ -**	
Item 5					**$ -**	
Item 6					**$ -**	
Item 7					**$ -**	
Item 8					**$ -**	
Item 9					**$ -**	
Item 10					**$ -**	
Item 11					**$ -**	
Item 12					**$ -**	
Item 13					**$ -**	
Item 14					**$ -**	
Item 15					**$ -**	
Subtotal Annual O&M Cost					**$ 99,603**	
Contingency				**20%**	**$ 19,921**	
Total Annual O&M Cost					**$ 119,524**	

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$12,037,127		$12,037,127	
1	$123,109		$123,109	
2	$126,802		$126,802	
3	$130,607		$130,607	
4	$134,525		$134,525	
5	$138,561		$138,561	
6	$142,717		$142,717	
7	$146,999		$146,999	

8	$151,409		$151,409				
9	$155,951		$155,951				
10	$160,630		$160,630				
11	$165,448		$165,448				
12	$170,412		$170,412				
13	$175,524		$175,524				
14	$180,790		$180,790				
15	$186,214		$186,214				
16	$191,800		$191,800				
17	$197,554		$197,554				
18	$203,481		$203,481				
19	$209,585		$209,585				
20	$215,873		$215,873				
21	$222,349		$222,349				
22	$229,019		$229,019				
23	$235,890		$235,890				
24	$242,967		$242,967				
25	$250,256		$250,256				
26							
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NPV			$14,386,676	$123,109			

DAF

Construction Cost:					$85,219,929	
Annual O&M Cost:						
Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	1,368	65%	8,760	$ 0.06	$ 325,784	
Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	-	2.00	8,760	$ 0.06	$ -	
Chemicals:					$ -	
Repair and Maintenance, and Replacement:				Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost	
Maintenance & Repair Cost					$ 1,610,585	
Replacement Cost				-	$ -	
Other:			Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost			$ 1,936,369	20.0%	$ 387,274	
User Defined Annual O&M Items:					Annual Cost	
Item 1					$ -	
Item 2					$ -	
Item 3					$ -	
Item 4					$ -	
Item 5					$ -	
Item 6					$ -	
Item 7					$ -	
Item 8					$ -	
Item 9					$ -	
Item 10					$ -	
Item 11					$ -	
Item 12					$ -	
Item 13					$ -	
Item 14					$ -	
Item 15					$ -	
Subtotal Annual O&M Cost					$ 2,323,642	
Contingency				20%	$ 464,728	
Total Annual O&M Cost					$ 2,788,371	

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$85,219,929		$85,219,929	
1	$2,872,022		$2,872,022	
2	$2,958,182		$2,958,182	
3	$3,046,928		$3,046,928	
4	$3,138,336		$3,138,336	
5	$3,232,486		$3,232,486	
6	$3,329,460		$3,329,460	
7	$3,429,344		$3,429,344	

8	$3,532,225		$3,532,225				
9	$3,638,191		$3,638,191				
10	$3,747,337		$3,747,337				
11	$3,859,757		$3,859,757				
12	$3,975,550		$3,975,550				
13	$4,094,816		$4,094,816				
14	$4,217,661		$4,217,661				
15	$4,344,191		$4,344,191				
16	$4,474,516		$4,474,516				
17	$4,608,752		$4,608,752				
18	$4,747,014		$4,747,014				
19	$4,889,425		$4,889,425				
20	$5,036,108		$5,036,108				
21	$5,187,191		$5,187,191				
22	$5,342,806		$5,342,806				
23	$5,503,091		$5,503,091				
24	$5,668,183		$5,668,183				
25	$5,838,229		$5,838,229				
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NPV			$140,032,690	$2,872,022			

Ozone - Serpentine

Construction Cost: $41,393,057

Annual O&M Cost:

Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	1,382	65%	8,760	$ 0.06	$ 329,118	

Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	4,880	2.00	8,760	$ 0.06	$ 4,779	

Liquid Chemicals:	Annual Usage (% of year)	Average-to-Maximum Flow Factor	Annual Usage (dry tons / year)	Cost ($/dry ton)	Chemical Cost
Liquid Oxygen	100%	65%	7,311	$ 126.22	$ 601,798

Repair and Maintenance, and Replacement:	Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost
Maintenance & Repair Cost		$ 847,437
Replacement Cost	-	$ -

Other:	Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost	$ 1,783,132	20.0%	$ 356,626	

User Defined Annual O&M Items:	Annual Cost
Item 1	$ -
Item 2	$ -
Item 3	$ -
Item 4	$ -
Item 5	$ -
Item 6	$ -
Item 7	$ -
Item 8	$ -
Item 9	$ -
Item 10	$ -
Item 11	$ -
Item 12	$ -
Item 13	$ -
Item 14	$ -
Item 15	$ -

Subtotal Annual O&M Cost		$ 2,139,758
Contingency	20%	$ 427,952
Total Annual O&M Cost		$ 2,567,710

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$41,393,057		$41,393,057	
1	$2,644,741		$2,644,741	

2	$2,724,083		$2,724,083				
3	$2,805,806		$2,805,806				
4	$2,889,980		$2,889,980				
5	$2,976,679		$2,976,679				
6	$3,065,979		$3,065,979				
7	$3,157,959		$3,157,959				
8	$3,252,698		$3,252,698				
9	$3,350,279		$3,350,279				
10	$3,450,787		$3,450,787				
11	$3,554,311		$3,554,311				
12	$3,660,940		$3,660,940				
13	$3,770,768		$3,770,768				
14	$3,883,891		$3,883,891				
15	$4,000,408		$4,000,408				
16	$4,120,420		$4,120,420				
17	$4,244,033		$4,244,033				
18	$4,371,354		$4,371,354				
19	$4,502,494		$4,502,494				
20	$4,637,569		$4,637,569				
21	$4,776,696		$4,776,696				
22	$4,919,997		$4,919,997				
23	$5,067,597		$5,067,597				
24	$5,219,625		$5,219,625				
25	$5,376,214		$5,376,214				
26							
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NPV			$91,868,144	$2,644,741			

Filters

Construction Cost:					**$55,944,199**	
Annual O&M Cost:						
Power:	**Total HP**	**Average-to-Maximum Flow Factor**	**Annual Usage (Hours / Year)**	**$/kWh**	**Power Cost**	**Annual Usage Hours / Year (Over-write)**
Equipment Power	-	65%	8,760	$ 0.06	$ -	
Other Electrical:	**Building Area (SF)**	**Watts / SF**	**Annual Usage (Hours / Year)**	**$/kWh**	**Other Electrical Cost**	**Annual Usage Hours / Year (Over-write)**
Building Electrical	912	2.00	8,760	$ 0.06	$ 893	
Chemicals:		**Annual Usage (tons)**	**Annual Facility Usage (% of year)**	**$/ton**	**Chemical Cost**	
GAC		-	100%	$ 3,251.28	$ -	
Total Chemical Cost					$ -	
Repair and Maintenance, and Replacement:				**Replacement Included? (1 = "Yes", 0 = "No")**	**Annual Cost**	
Maintenance & Repair Cost					$ 374,964	
Replacement Cost				-	$ -	
Other:			**Total Annual O&M Cost**	**"Other" Percent**	**Other Cost**	**Other Cost Percent (Over-write)**
Other Cost			$ 375,857	20.0%	$ 75,171	
User Defined Annual O&M Items:					**Annual Cost**	
Item 1					$ -	
Item 2					$ -	
Item 3					$ -	
Item 4					$ -	
Item 5					$ -	
Item 6					$ -	
Item 7					$ -	
Item 8					$ -	
Item 9					$ -	
Item 10					$ -	
Item 11					$ -	
Item 12					$ -	
Item 13					$ -	
Item 14					$ -	
Item 15					$ -	
Subtotal Annual O&M Cost					$ 451,028	
Contingency				20%	$ 90,206	
Total Annual O&M Cost					$ 541,234	

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$55,944,199		$55,944,199	
1	$557,471		$557,471	
2	$574,195		$574,195	
3	$591,421		$591,421	
4	$609,164		$609,164	
5	$627,438		$627,438	
6	$646,262		$646,262	
7	$665,649		$665,649	

8	$685,619		$685,619				
9	$706,187		$706,187				
10	$727,373		$727,373				
11	$749,194		$749,194				
12	$771,670		$771,670				
13	$794,820		$794,820				
14	$818,665		$818,665				
15	$843,225		$843,225				
16	$868,522		$868,522				
17	$894,577		$894,577				
18	$921,415		$921,415				
19	$949,057		$949,057				
20	$977,529		$977,529				
21	$1,006,855		$1,006,855				
22	$1,037,060		$1,037,060				
23	$1,068,172		$1,068,172				
24	$1,100,217		$1,100,217				
25	$1,133,224		$1,133,224				
26							
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NPV			$66,583,576	$557,471			

Concrete Tank

Construction Cost:					**$36,020,856**	
Annual O&M Cost:						
Power:	**Total HP**	**Average-to-Maximum Flow Factor**	**Annual Usage (Hours / Year)**	**$/kWh**	**Power Cost**	**Annual Usage Hours / Year (Over-write)**
Equipment Power	-	65%	8,760	$ 0.06	**$ -**	
Other Electrical:	**Building Area (SF)**	**Watts / SF**	**Annual Usage (Hours / Year)**	**$/kWh**	**Other Electrical Cost**	**Annual Usage Hours / Year (Over-write)**
Building Electrical	-	2.00	8,760	$ 0.06	**$ -**	
Chemicals:					$ -	
Repair and Maintenance, and Replacement:				**Replacement Included? (1 = "Yes", 0 = "No")**	**Annual Cost**	
Maintenance & Repair Cost					**$ 10,233**	
Replacement Cost				-	**$ -**	
Other:			**Total Annual O&M Cost**	**"Other" Percent**	**Other Cost**	**Other Cost Percent (Over-write)**
Other Cost			$ 10,233	20.0%	**$ 2,047**	
User Defined Annual O&M Items:					**Annual Cost**	
Item 1					**$ -**	
Item 2					**$ -**	
Item 3					**$ -**	
Item 4					**$ -**	
Item 5					**$ -**	
Item 6					**$ -**	
Item 7					**$ -**	
Item 8					**$ -**	
Item 9					**$ -**	
Item 10					**$ -**	
Item 11					**$ -**	
Item 12					**$ -**	
Item 13					**$ -**	
Item 14					**$ -**	
Item 15					**$ -**	
Subtotal Annual O&M Cost					**$ 12,280**	
Contingency				**20%**	**$ 2,456**	
Total Annual O&M Cost					**$ 14,736**	

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	**$36,020,856**		**$36,020,856**	
1	**$15,178**		**$15,178**	
2	**$15,633**		**$15,633**	
3	**$16,102**		**$16,102**	
4	**$16,585**		**$16,585**	
5	**$17,083**		**$17,083**	
6	**$17,595**		**$17,595**	
7	**$18,123**		**$18,123**	
8	**$18,667**		**$18,667**	
9	**$19,227**		**$19,227**	
10	**$19,803**		**$19,803**	
11	**$20,397**		**$20,397**	

12	$21,009		$21,009					
13	$21,640		$21,640					
14	$22,289		$22,289					
15	$22,958		$22,958					
16	$23,646		$23,646					
17	$24,356		$24,356					
18	$25,086		$25,086					
19	$25,839		$25,839					
20	$26,614		$26,614					
21	$27,412		$27,412					
22	$28,235		$28,235					
23	$29,082		$29,082					
24	$29,954		$29,954					
25	$30,853		$30,853					
26								
27								
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31								
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NPV			$36,310,522	$15,178				

Liquid Chemical Storage & Feed

Construction Cost: $2,180,047

Annual O&M Cost:

Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	10	65%	8,760	$ 0.06	$ 2,381	

Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	3,202	2.00	8,760	$ 0.06	$ 3,136	

Liquid Chemicals:	Annual Usage (% of year)	Average-to-Maximum Flow Factor	Annual Usage (dry tons / year)	Cost ($/dry ton)	Chemical Cost
Aluminum Sulfate (Alum)	100%	65%	1,218	$ 555.44	$ 441,368
Aqueous Ammonia	100%	65%	-	$ 1,208.65	$ -
Citric Acid	100%	65%	-	$ 3,204.91	$ -
Ferric Chloride	100%	65%	-	$ 1,003.69	$ -
Hydrofluorosilicic Acid	100%	65%	-	$ 500.72	$ -
Hyrogen Peroxide (35%)	100%	65%	-	$ 2,223.22	$ -
Liquid Polymer	100%	65%	-	$ 3,544.77	$ -
Sodium Bisulfite	100%	65%	-	$ 1,336.98	$ -
Sodium Hydroxide (25%)	100%	65%	-	$ 1,043.24	$ -
Sodium Hydroxide (50%)	100%	65%	-	$ 1,222.48	$ -
Sodium Hypochlorite (12.5%)	100%	65%	-	$ 2,205.88	$ -
Sulfuric Acid	100%	65%	-	$ 379.51	$ -
Other Chemical	100%	65%	-	$ -	$ -
Total Chemical Cost					$ 441,368

Repair and Maintenance, and Replacement:	Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost
Maintenance & Repair Cost		$ 12,166
Replacement Cost	-	$ -

Other:	Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost	$ 459,052	20.0%	$ 91,810	

User Defined Annual O&M Items:	Annual Cost
Item 1	$ -
Item 2	$ -
Item 3	$ -
Item 4	$ -
Item 5	$ -
Item 6	$ -
Item 7	$ -
Item 8	$ -
Item 9	$ -
Item 10	$ -
Item 11	$ -
Item 12	$ -
Item 13	$ -
Item 14	$ -
Item 15	$ -

Subtotal Annual O&M Cost		$ 550,862
Contingency	20%	$ 110,172
Total Annual O&M Cost		$ 661,034

Net Present Value (NPV) Calculation:

i = 5.00%

n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$2,180,047		$2,180,047	
1	$680,865		$680,865	
2	$701,291		$701,291	
3	$722,330		$722,330	
4	$744,000		$744,000	
5	$766,320		$766,320	
6	$789,310		$789,310	
7	$812,989		$812,989	
8	$837,379		$837,379	
9	$862,500		$862,500	
10	$888,375		$888,375	
11	$915,026		$915,026	
12	$942,477		$942,477	
13	$970,751		$970,751	
14	$999,874		$999,874	
15	$1,029,870		$1,029,870	
16	$1,060,766		$1,060,766	
17	$1,092,589		$1,092,589	
18	$1,125,367		$1,125,367	
19	$1,159,128		$1,159,128	
20	$1,193,902		$1,193,902	
21	$1,229,719		$1,229,719	
22	$1,266,610		$1,266,610	
23	$1,304,609		$1,304,609	
24	$1,343,747		$1,343,747	
25	$1,384,059		$1,384,059	
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NPV			$15,174,418	$680,865

Liquid Chemical Storage & Feed

Construction Cost:	**$496,403**

Annual O&M Cost:

Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	3	65%	8,760	$ 0.06	**$ 714**	

Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	817	2.00	8,760	$ 0.06	**$ 800**	

Liquid Chemicals:	Annual Usage (% of year)	Average-to-Maximum Flow Factor	Annual Usage (dry tons / year)	Cost ($/dry ton)	Chemical Cost
Aluminum Sulfate (Alum)	100%	65%	-	$ 555.44	$ -
Aqueous Ammonia	100%	65%	-	$ 1,208.65	$ -
Citric Acid	100%	65%	-	$ 3,204.91	$ -
Ferric Chloride	100%	65%	-	$ 1,003.69	$ -
Hydrofluorosilicic Acid	100%	65%	-	$ 500.72	$ -
Hyrogen Peroxide (35%)	100%	65%	-	$ 2,223.22	$ -
Liquid Polymer	100%	65%	24	$ 3,544.77	$ 56,335
Sodium Bisulfite	100%	65%	-	$ 1,336.98	$ -
Sodium Hydroxide (25%)	100%	65%	-	$ 1,043.24	$ -
Sodium Hydroxide (50%)	100%	65%	-	$ 1,222.48	$ -
Sodium Hypochlorite (12.5%)	100%	65%	-	$ 2,205.88	$ -
Sulfuric Acid	100%	65%	-	$ 379.51	$ -
Other Chemical	100%	65%	-	$ -	$ -
Total Chemical Cost					**$ 56,335**

Repair and Maintenance, and Replacement:	Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost
Maintenance & Repair Cost		**$ 1,737**
Replacement Cost	-	**$ -**

Other:	Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost	$ 59,587	20.0%	**$ 11,917**	

User Defined Annual O&M Items:	Annual Cost
Item 1	**$ -**
Item 2	**$ -**
Item 3	**$ -**
Item 4	**$ -**
Item 5	**$ -**
Item 6	**$ -**
Item 7	**$ -**
Item 8	**$ -**
Item 9	**$ -**
Item 10	**$ -**
Item 11	**$ -**
Item 12	**$ -**
Item 13	**$ -**
Item 14	**$ -**
Item 15	**$ -**

Subtotal Annual O&M Cost		**$ 71,504**
Contingency	**20%**	**$ 14,301**
Total Annual O&M Cost		**$ 85,805**

Net Present Value (NPV) Calculation:

i = 5.00%

n =	25			
Annual Inflation % =	3.00%			
Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$496,403		$496,403	
1	$88,379		$88,379	
2	$91,030		$91,030	
3	$93,761		$93,761	
4	$96,574		$96,574	
5	$99,471		$99,471	
6	$102,456		$102,456	
7	$105,529		$105,529	
8	$108,695		$108,695	
9	$111,956		$111,956	
10	$115,315		$115,315	
11	$118,774		$118,774	
12	$122,337		$122,337	
13	$126,007		$126,007	
14	$129,788		$129,788	
15	$133,681		$133,681	
16	$137,692		$137,692	
17	$141,822		$141,822	
18	$146,077		$146,077	
19	$150,459		$150,459	
20	$154,973		$154,973	
21	$159,622		$159,622	
22	$164,411		$164,411	
23	$169,343		$169,343	
24	$174,424		$174,424	
25	$179,656		$179,656	
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NPV			$2,183,125	$88,379

Liquid Chemical Storage & Feed

Construction Cost:		**$1,152,293**

Annual O&M Cost:

Power:	**Total HP**	**Average-to-Maximum Flow Factor**	**Annual Usage (Hours / Year)**	**$/kWh**	**Power Cost**	**Annual Usage Hours / Year (Over-write)**
Equipment Power	7	65%	8,760	$ 0.06	**$ 1,667**	

Other Electrical:	**Building Area (SF)**	**Watts / SF**	**Annual Usage (Hours / Year)**	**$/kWh**	**Other Electrical Cost**	**Annual Usage Hours / Year (Over-write)**
Building Electrical	2,030	2.00	8,760	$ 0.06	**$ 1,988**	

Liquid Chemicals:	**Annual Usage (% of year)**	**Average-to-Maximum Flow Factor**	**Annual Usage (dry tons / year)**	**Cost ($/dry ton)**	**Chemical Cost**
Aluminum Sulfate (Alum)	100%	65%	-	$ 555.44	$ -
Aqueous Ammonia	100%	65%	-	$ 1,208.65	$ -
Citric Acid	100%	65%	-	$ 3,204.91	$ -
Ferric Chloride	100%	65%	-	$ 1,003.69	$ -
Hydrofluorosilicic Acid	100%	65%	-	$ 500.72	$ -
Hyrogen Peroxide (35%)	100%	65%	-	$ 2,223.22	$ -
Liquid Polymer	100%	65%	183	$ 3,544.77	$ 422,515
Sodium Bisulfite	100%	65%	-	$ 1,336.98	$ -
Sodium Hydroxide (25%)	100%	65%	-	$ 1,043.24	$ -
Sodium Hydroxide (50%)	100%	65%	-	$ 1,222.48	$ -
Sodium Hypochlorite (12.5%)	100%	65%	-	$ 2,205.88	$ -
Sulfuric Acid	100%	65%	-	$ 379.51	$ -
Other Chemical	100%	65%	-	$ -	$ -
Total Chemical Cost					**$ 422,515**

Repair and Maintenance, and Replacement:	**Replacement Included? (1 = "Yes", 0 = "No")**	**Annual Cost**
Maintenance & Repair Cost		**$ 5,485**
Replacement Cost	-	**$ -**

Other:	**Total Annual O&M Cost**	**"Other" Percent**	**Other Cost**	**Other Cost Percent (Over-write)**
Other Cost	$ 431,656	20.0%	**$ 86,331**	

User Defined Annual O&M Items:	**Annual Cost**
Item 1	**$ -**
Item 2	**$ -**
Item 3	**$ -**
Item 4	**$ -**
Item 5	**$ -**
Item 6	**$ -**
Item 7	**$ -**
Item 8	**$ -**
Item 9	**$ -**
Item 10	**$ -**
Item 11	**$ -**
Item 12	**$ -**
Item 13	**$ -**
Item 14	**$ -**
Item 15	**$ -**

Subtotal Annual O&M Cost		**$ 517,987**
Contingency	**20%**	**$ 103,597**
Total Annual O&M Cost		**$ 621,584**

Net Present Value (NPV) Calculation:

i = 5.00%

n =	25			
Annual Inflation % =	3.00%			
Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$1,152,293		$1,152,293	
1	$640,232		$640,232	
2	$659,439		$659,439	
3	$679,222		$679,222	
4	$699,598		$699,598	
5	$720,586		$720,586	
6	$742,204		$742,204	
7	$764,470		$764,470	
8	$787,404		$787,404	
9	$811,026		$811,026	
10	$835,357		$835,357	
11	$860,418		$860,418	
12	$886,230		$886,230	
13	$912,817		$912,817	
14	$940,202		$940,202	
15	$968,408		$968,408	
16	$997,460		$997,460	
17	$1,027,384		$1,027,384	
18	$1,058,205		$1,058,205	
19	$1,089,952		$1,089,952	
20	$1,122,650		$1,122,650	
21	$1,156,330		$1,156,330	
22	$1,191,020		$1,191,020	
23	$1,226,750		$1,226,750	
24	$1,263,553		$1,263,553	
25	$1,301,459		$1,301,459	
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NPV			$13,371,166	$640,232

Liquid Chemical Storage & Feed

Construction Cost: $2,192,435

Annual O&M Cost:

Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	10	65%	8,760	$ 0.06	$ 2,381	

Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	3,080	2.00	8,760	$ 0.06	$ 3,016	

Liquid Chemicals:	Annual Usage (% of year)	Average-to-Maximum Flow Factor	Annual Usage (dry tons / year)	Cost ($/dry ton)	Chemical Cost
Aluminum Sulfate (Alum)	100%	65%	-	$ 555.44	$ -
Aqueous Ammonia	100%	65%	-	$ 1,208.65	$ -
Citric Acid	100%	65%	-	$ 3,204.91	$ -
Ferric Chloride	100%	65%	-	$ 1,003.69	$ -
Hydrofluorosilicic Acid	100%	65%	-	$ 500.72	$ -
Hyrogen Peroxide (35%)	100%	65%	-	$ 2,223.22	$ -
Liquid Polymer	100%	65%	-	$ 3,544.77	$ -
Sodium Bisulfite	100%	65%	-	$ 1,336.98	$ -
Sodium Hydroxide (25%)	100%	65%	-	$ 1,043.24	$ -
Sodium Hydroxide (50%)	100%	65%	-	$ 1,222.48	$ -
Sodium Hypochlorite (12.5%)	100%	65%	731	$ 2,205.88	$ 1,051,714
Sulfuric Acid	100%	65%	-	$ 379.51	$ -
Other Chemical	100%	65%	-	$ -	$ -
Total Chemical Cost					$ 1,051,714

Repair and Maintenance, and Replacement:	Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost
Maintenance & Repair Cost		$ 20,297
Replacement Cost	-	$ -

Other:	Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost	$ 1,077,409	20.0%	$ 215,482	

User Defined Annual O&M Items:	Annual Cost
Item 1	$ -
Item 2	$ -
Item 3	$ -
Item 4	$ -
Item 5	$ -
Item 6	$ -
Item 7	$ -
Item 8	$ -
Item 9	$ -
Item 10	$ -
Item 11	$ -
Item 12	$ -
Item 13	$ -
Item 14	$ -
Item 15	$ -

Subtotal Annual O&M Cost		$ 1,292,890
Contingency	20%	$ 258,578
Total Annual O&M Cost		$ 1,551,469

Net Present Value (NPV) Calculation:

i = 5.00%

n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$2,192,435		$2,192,435	
1	$1,598,013		$1,598,013	
2	$1,645,953		$1,645,953	
3	$1,695,332		$1,695,332	
4	$1,746,191		$1,746,191	
5	$1,798,577		$1,798,577	
6	$1,852,535		$1,852,535	
7	$1,908,111		$1,908,111	
8	$1,965,354		$1,965,354	
9	$2,024,315		$2,024,315	
10	$2,085,044		$2,085,044	
11	$2,147,595		$2,147,595	
12	$2,212,023		$2,212,023	
13	$2,278,384		$2,278,384	
14	$2,346,735		$2,346,735	
15	$2,417,137		$2,417,137	
16	$2,489,652		$2,489,652	
17	$2,564,341		$2,564,341	
18	$2,641,271		$2,641,271	
19	$2,720,509		$2,720,509	
20	$2,802,125		$2,802,125	
21	$2,886,188		$2,886,188	
22	$2,972,774		$2,972,774	
23	$3,061,957		$3,061,957	
24	$3,153,816		$3,153,816	
25	$3,248,431		$3,248,431	
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NPV			$32,690,631	$1,598,013

Sodium Hypochlorite

Construction Cost:					**$8,717,518**	

Annual O&M Cost:

Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	816	65%	8,760	$ 0.06	$ **194,327**	

Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	3,128	2.00	8,760	$ 0.06	$ **3,063**	

Chemicals:	Annual Usage (% of year)	Average-to-Maximum Flow Factor	Annual Usage (tons)	Cost ($/ton)	Chemical Cost
Salt	100%	65%	731	$ 152.86	$ 72,881

Repair and Maintenance, and Replacement:	Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost
Maintenance & Repair Cost		$ **162,430**
Replacement Cost	-	$ **-**

Other:	Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost	$ 432,702	20.0%	$ **86,540**	

User Defined Annual O&M Items:	Annual Cost
Item 1	$ -
Item 2	$ -
Item 3	$ -
Item 4	$ -
Item 5	$ -
Item 6	$ -
Item 7	$ -
Item 8	$ -
Item 9	$ -
Item 10	$ -
Item 11	$ -
Item 12	$ -
Item 13	$ -
Item 14	$ -
Item 15	$ -

Subtotal Annual O&M Cost		$ **519,243**
Contingency	**20%**	$ **103,849**
Total Annual O&M Cost		$ **623,092**

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$8,717,518		$8,717,518	
1	$641,784		$641,784	
2	$661,038		$661,038	
3	$680,869		$680,869	
4	$701,295		$701,295	
5	$722,334		$722,334	
6	$744,004		$744,004	

7	$766,324		$766,324				
8	$789,314		$789,314				
9	$812,993		$812,993				
10	$837,383		$837,383				
11	$862,504		$862,504				
12	$888,380		$888,380				
13	$915,031		$915,031				
14	$942,482		$942,482				
15	$970,756		$970,756				
16	$999,879		$999,879				
17	$1,029,875		$1,029,875				
18	$1,060,772		$1,060,772				
19	$1,092,595		$1,092,595				
20	$1,125,373		$1,125,373				
21	$1,159,134		$1,159,134				
22	$1,193,908		$1,193,908				
23	$1,229,725		$1,229,725				
24	$1,266,617		$1,266,617				
25	$1,304,615		$1,304,615				
26							
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NPV			$20,966,022	$641,784			

Liquid Chemical Storage & Feed

Construction Cost:					$1,726,982	
Annual O&M Cost:						
Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	2	65%	8,760	$ 0.06	$ 476	
Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	2,602	2.00	8,760	$ 0.06	$ 2,548	
Liquid Chemicals:	Annual Usage (% of year)	Average-to-Maximum Flow Factor	Annual Usage (dry tons / year)	Cost ($/dry ton)	Chemical Cost	
Aluminum Sulfate (Alum)	100%	65%	-	$ 555.44	$ -	
Aqueous Ammonia	100%	65%	-	$ 1,208.65	$ -	
Citric Acid	100%	65%	-	$ 3,204.91	$ -	
Ferric Chloride	100%	65%	-	$ 1,003.69	$ -	
Hydrofluorosilicic Acid	100%	65%	-	$ 500.72	$ -	
Hyrogen Peroxide (35%)	100%	65%	-	$ 2,223.22	$ -	
Liquid Polymer	100%	65%	-	$ 3,544.77	$ -	
Sodium Bisulfite	100%	65%	-	$ 1,336.98	$ -	
Sodium Hydroxide (25%)	100%	65%	-	$ 1,043.24	$ -	
Sodium Hydroxide (50%)	100%	65%	2,437	$ 1,222.48	$ 1,942,839	
Sodium Hypochlorite (12.5%)	100%	65%	-	$ 2,205.88	$ -	
Sulfuric Acid	100%	65%	-	$ 379.51	$ -	
Other Chemical	100%	65%	-	$ -	$ -	
Total Chemical Cost					$ 1,942,839	
Repair and Maintenance, and Replacement:				Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost	
Maintenance & Repair Cost					$ 10,715	
Replacement Cost				-	$ -	
Other:			Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost			$ 1,956,579	20.0%	$ 391,316	
User Defined Annual O&M Items:					Annual Cost	
Item 1					$ -	
Item 2					$ -	
Item 3					$ -	
Item 4					$ -	
Item 5					$ -	
Item 6					$ -	
Item 7					$ -	
Item 8					$ -	
Item 9					$ -	
Item 10					$ -	
Item 11					$ -	
Item 12					$ -	
Item 13					$ -	
Item 14					$ -	
Item 15					$ -	
Subtotal Annual O&M Cost					$ 2,347,895	
Contingency				20%	$ 469,579	
Total Annual O&M Cost					$ 2,817,474	

Net Present Value (NPV) Calculation:

i = 5.00%

n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$1,726,982		$1,726,982	
1	$2,901,998		$2,901,998	
2	$2,989,058		$2,989,058	
3	$3,078,730		$3,078,730	
4	$3,171,092		$3,171,092	
5	$3,266,225		$3,266,225	
6	$3,364,212		$3,364,212	
7	$3,465,138		$3,465,138	
8	$3,569,092		$3,569,092	
9	$3,676,165		$3,676,165	
10	$3,786,450		$3,786,450	
11	$3,900,043		$3,900,043	
12	$4,017,044		$4,017,044	
13	$4,137,556		$4,137,556	
14	$4,261,683		$4,261,683	
15	$4,389,533		$4,389,533	
16	$4,521,219		$4,521,219	
17	$4,656,856		$4,656,856	
18	$4,796,561		$4,796,561	
19	$4,940,458		$4,940,458	
20	$5,088,672		$5,088,672	
21	$5,241,332		$5,241,332	
22	$5,398,572		$5,398,572	
23	$5,560,529		$5,560,529	
24	$5,727,345		$5,727,345	
25	$5,899,165		$5,899,165	
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NPV			$57,111,850	$2,901,998

Large System Combination Wastewater Surge Basin and Floating Tube Decanter Clarification (>= 5 MGD)

Construction Cost:					$6,639,209	
Annual O&M Cost:						
Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	75	65%	8,760	$ 0.06	$ 17,861	
Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	81	2.00	8,760	$ 0.06	$ 79	
Chemicals:					$ -	
Repair and Maintenance, and Replacement:				Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost	
Maintenance & Repair Cost					$ 85,662	
Replacement Cost				-	$ -	
Other:			Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost			$ 103,602	20.0%	$ 20,720	
User Defined Annual O&M Items:					Annual Cost	
Item 1					$ -	
Item 2					$ -	
Item 3					$ -	
Item 4					$ -	
Item 5					$ -	
Item 6					$ -	
Item 7					$ -	
Item 8					$ -	
Item 9					$ -	
Item 10					$ -	
Item 11					$ -	
Item 12					$ -	
Item 13					$ -	
Item 14					$ -	
Item 15					$ -	
Subtotal Annual O&M Cost					$ 124,322	
Contingency				20%	$ 24,864	
Total Annual O&M Cost					$ 149,187	

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$6,639,209		$6,639,209	
1	$153,662		$153,662	
2	$158,272		$158,272	
3	$163,020		$163,020	
4	$167,911		$167,911	
5	$172,948		$172,948	
6	$178,137		$178,137	
7	$183,481		$183,481	
8	$188,985		$188,985	
9	$194,655		$194,655	
10	$200,495		$200,495	
11	$206,509		$206,509	
12	$212,705		$212,705	

13	$219,086		$219,086				
14	$225,658		$225,658				
15	$232,428		$232,428				
16	$239,401		$239,401				
17	$246,583		$246,583				
18	$253,981		$253,981				
19	$261,600		$261,600				
20	$269,448		$269,448				
21	$277,531		$277,531				
22	$285,857		$285,857				
23	$294,433		$294,433				
24	$303,266		$303,266				
25	$312,364		$312,364				
26							
27							
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NPV			$9,571,869.05	$153,662			

Gravity Thickener

Construction Cost:					$13,736,792	
Annual O&M Cost:						
Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	10	65%	8,760	$ 0.06	$ 2,381	
Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	874	2.00	8,760	$ 0.06	$ 856	
Chemicals:					$ -	
Repair and Maintenance, and Replacement:				Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost	
Maintenance & Repair Cost					$ 14,699	
Replacement Cost				-	$ -	
Other:			Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost			$ 17,937	20.0%	$ 3,587	
User Defined Annual O&M Items:					Annual Cost	
Item 1					$ -	
Item 2					$ -	
Item 3					$ -	
Item 4					$ -	
Item 5					$ -	
Item 6					$ -	
Item 7					$ -	
Item 8					$ -	
Item 9					$ -	
Item 10					$ -	
Item 11					$ -	
Item 12					$ -	
Item 13					$ -	
Item 14					$ -	
Item 15					$ -	
Subtotal Annual O&M Cost					$ 21,524	
Contingency				20%	$ 4,305	
Total Annual O&M Cost					$ 25,829	

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$13,736,792		$13,736,792	
1	$26,604		$26,604	
2	$27,402		$27,402	
3	$28,224		$28,224	
4	$29,071		$29,071	
5	$29,943		$29,943	
6	$30,841		$30,841	
7	$31,766		$31,766	

8	$32,719		$32,719					
9	$33,701		$33,701					
10	$34,712		$34,712					
11	$35,753		$35,753					
12	$36,826		$36,826					
13	$37,931		$37,931					
14	$39,069		$39,069					
15	$40,241		$40,241					
16	$41,448		$41,448					
17	$42,691		$42,691					
18	$43,972		$43,972					
19	$45,291		$45,291					
20	$46,650		$46,650					
21	$48,049		$48,049					
22	$49,491		$49,491					
23	$50,976		$50,976					
24	$52,505		$52,505					
25	$54,080		$54,080					
26								
27								
28								
29								
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NPV			$14,244,527	$26,604				

Gravity Thickener

Construction Cost:					**$2,266,389**	
Annual O&M Cost:						
Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	3	65%	8,760	$ 0.06	$ 714	
Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	858	2.00	8,760	$ 0.06	$ 840	
Chemicals:					$ -	
Repair and Maintenance, and Replacement:				Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost	
Maintenance & Repair Cost					$ 16,025	
Replacement Cost				-	$ -	
Other:			Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost			$ 17,580	20.0%	$ 3,516	
User Defined Annual O&M Items:					Annual Cost	
Item 1					$ -	
Item 2					$ -	
Item 3					$ -	
Item 4					$ -	
Item 5					$ -	
Item 6					$ -	
Item 7					$ -	
Item 8					$ -	
Item 9					$ -	
Item 10					$ -	
Item 11					$ -	
Item 12					$ -	
Item 13					$ -	
Item 14					$ -	
Item 15					$ -	
Subtotal Annual O&M Cost					$ 21,096	
Contingency				20%	$ 4,219	
Total Annual O&M Cost					$ 25,315	

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$2,266,389		$2,266,389	
1	$26,075		$26,075	
2	$26,857		$26,857	
3	$27,663		$27,663	
4	$28,492		$28,492	
5	$29,347		$29,347	
6	$30,228		$30,228	
7	$31,134		$31,134	

8	$32,069		$32,069					
9	$33,031		$33,031					
10	$34,021		$34,021					
11	$35,042		$35,042					
12	$36,093		$36,093					
13	$37,176		$37,176					
14	$38,291		$38,291					
15	$39,440		$39,440					
16	$40,623		$40,623					
17	$41,842		$41,842					
18	$43,097		$43,097					
19	$44,390		$44,390					
20	$45,722		$45,722					
21	$47,094		$47,094					
22	$48,506		$48,506					
23	$49,962		$49,962					
24	$51,461		$51,461					
25	$53,004		$53,004					
26								
27								
28								
29								
30								
31								
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49								
50								
NPV			$2,764,025	$26,075				

Centrifuge Solids Dewatering Facility

Does Your Project Include *Sludge Drying Beds* ? **No**

Construction Cost: **$10,086,624**

Annual O&M Cost:

Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	31	65%	8,760	$ 0.06	$ 7,383	

Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	10,379	2.00	8,760	$ 0.06	$ 10,165	

Chemicals:	Annual Usage (% of year)	Average-to-Maximum Flow Factor	Quantity (tons/year)	Unit Cost	$ -
Polymer	100%	65%	17	$ 3,544.77	$ 38,365

Sludge Disposal:	Average Annual Qty. (cy)	Unit Cost	Cost
Haul Sludge to Disposal Site	3,628	$ 8.09	$ 29,361
Dumping Charge	3,628	$ 75.00	$ 272,122
Total Disposal Cost			$ 301,484

Repair and Maintenance, and Replacement:	Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost
Maintenance & Repair Cost		$ 156,577
Replacement Cost	-	$ -

Other:	Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost	513,974	20.0%	$ 102,795	

User Defined Annual O&M Items:	Annual Cost
Item 1	$ -
Item 2	$ -
Item 3	$ -
Item 4	$ -
Item 5	$ -
Item 6	$ -
Item 7	$ -
Item 8	$ -
Item 9	$ -
Item 10	$ -
Item 11	$ -
Item 12	$ -
Item 13	$ -
Item 14	$ -
Item 15	$ -

Subtotal Annual O&M Cost		$	616,768
Contingency	20%	$	123,354
Total Annual O&M Cost		$	740,122

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$10,086,624		$10,086,624	
1	$762,326		$762,326	
2	$785,195		$785,195	
3	$808,751		$808,751	
4	$833,014		$833,014	
5	$858,004		$858,004	
6	$883,744		$883,744	
7	$910,257		$910,257	
8	$937,564		$937,564	
9	$965,691		$965,691	
10	$994,662		$994,662	
11	$1,024,502		$1,024,502	
12	$1,055,237		$1,055,237	
13	$1,086,894		$1,086,894	
14	$1,119,501		$1,119,501	
15	$1,153,086		$1,153,086	
16	$1,187,679		$1,187,679	
17	$1,223,309		$1,223,309	
18	$1,260,008		$1,260,008	
19	$1,297,808		$1,297,808	
20	$1,336,743		$1,336,743	
21	$1,376,845		$1,376,845	
22	$1,418,150		$1,418,150	
23	$1,460,695		$1,460,695	
24	$1,504,516		$1,504,516	
25	$1,549,651		$1,549,651	
26				
27				
28				
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NPV			$24,635,670	$762,326

Wet Pit Submersible Pump Station

Construction Cost:						$1,510,742	
Annual O&M Cost:							
Power:		Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power		30	65%	8,760	$ 0.06	$ 7,144	
Other Electrical:		Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical		986	2.00	8,760	$ 0.06	$ 966	
Chemicals:		Annual Usage (% of year)	Average-to-Maximum Flow Factor	Annual Usage (dry tons / year)	Cost ($/dry ton)	Chemical Cost	
Repair and Maintenance, and Replacement:					Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost	
Maintenance & Repair Cost						$ 4,174	
Replacement Cost					-	$ -	
Other:				Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost				$ 12,284	20.0%	$ 2,457	
User Defined Annual O&M Items:						Annual Cost	
Item 1						$ -	
Item 2						$ -	
Item 3						$ -	
Item 4						$ -	
Item 5						$ -	
Item 6						$ -	
Item 7						$ -	
Item 8						$ -	
Item 9						$ -	
Item 10						$ -	
Item 11						$ -	
Item 12						$ -	
Item 13						$ -	
Item 14						$ -	
Item 15						$ -	
Subtotal Annual O&M Cost						$ 14,741	
Contingency					20%	$ 2,948	
Total Annual O&M Cost						$ 17,689	

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$1,510,742		$1,510,742	
1	$18,220		$18,220	
2	$18,767		$18,767	
3	$19,330		$19,330	
4	$19,910		$19,910	
5	$20,507		$20,507	
6	$21,122		$21,122	
7	$21,756		$21,756	
8	$22,409		$22,409	
9	$23,081		$23,081	
10	$23,773		$23,773	

11	$24,486		$24,486				
12	$25,221		$25,221				
13	$25,978		$25,978				
14	$26,757		$26,757				
15	$27,560		$27,560				
16	$28,386		$28,386				
17	$29,238		$29,238				
18	$30,115		$30,115				
19	$31,019		$31,019				
20	$31,949		$31,949				
21	$32,908		$32,908				
22	$33,895		$33,895				
23	$34,912		$34,912				
24	$35,959		$35,959				
25	$37,038		$37,038				
26							
27							
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50							
NPV			$1,858,475	$18,220			

Granular Media Filter Backwash Supply Pump Station

Construction Cost:					$4,324,537	

Annual O&M Cost:						
Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	52	65%	8,760	$ 0.06	$ 12,384	
Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	1,788	2.00	8,760	$ 0.06	$ 1,751	
Chemicals:					$ -	

Repair and Maintenance, and Replacement:	Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost
Maintenance & Repair Cost		$ 38,052
Replacement Cost	-	$ -

Other:	Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost	$ 52,187	20.0%	$ 10,437	

User Defined Annual O&M Items:	Annual Cost
Item 1	$ -
Item 2	$ -
Item 3	$ -
Item 4	$ -
Item 5	$ -
Item 6	$ -
Item 7	$ -
Item 8	$ -
Item 9	$ -
Item 10	$ -
Item 11	$ -
Item 12	$ -
Item 13	$ -
Item 14	$ -
Item 15	$ -

Subtotal Annual O&M Cost		$ 62,624
Contingency	20%	$ 12,525
Total Annual O&M Cost		$ 75,149

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$4,324,537		$4,324,537	
1	$77,404		$77,404	
2	$79,726		$79,726	
3	$82,117		$82,117	
4	$84,581		$84,581	
5	$87,118		$87,118	
6	$89,732		$89,732	
7	$92,424		$92,424	
8	$95,197		$95,197	
9	$98,052		$98,052	
10	$100,994		$100,994	
11	$104,024		$104,024	
12	$107,145		$107,145	
13	$110,359		$110,359	

14	$113,670		$113,670				
15	$117,080		$117,080				
16	$120,592		$120,592				
17	$124,210		$124,210				
18	$127,936		$127,936				
19	$131,774		$131,774				
20	$135,728		$135,728				
21	$139,799		$139,799				
22	$143,993		$143,993				
23	$148,313		$148,313				
24	$152,763		$152,763				
25	$157,345		$157,345				
26							
27							
28							
29							
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49							
50							
NPV			$5,801,790	$77,404			

	A	B	C	D	E	F	G
1	***Global Life Cycle Data***						
2							
3							
4							
5	**Net Present Value Calculation Inputs:**						
6	Annual Discount Rate (i) :		5.00%				
7	Number of Years (n):		25	Valid Range: 1 to 50 years			
8	Annual Inflation Rate (%):		3.00%				
9							
10	**Annual O&M Cost Inputs:**						
11	Maximum Daily Plant Flow (mgd)		115.00				
12	Average Annual Daily Flow (mgd)		75.00				
13	Average-to-Maximum Flow Factor		65%				
14	**Power:**						
15	If Project in U.S., Select State Location:		OREGON		User Over-Ride		
16	Power Cost ($/kWh): (Note: "All-in" including usage, demand, TOU, and transmission charges)		$ 0.0559			Source for U.S. Power Costs	(Note: U.S. National Average is $0.0768/kW
17	Facility Electrical (Watts/SF):		2.00				
18	**Fuel:**						
19	Natural Gas:		$ 3.50	$/MMBTU			(Note: Units are $/1,000,000 BTU)
20	**Annual Plant Operating Usage**		Days per Year Used	Hour per Day Used	Annual Usage (hours / year)	Annual Usage (% of year)	
21	Annual Plant Operating Usage		365	24	8,760.00	100%	
22	**Maintenance, Repair, and Replacement Costs:**						
23	*Maintenance* and *Repair* Costs		Automatically Included				
24	Include *Replacement* Costs?		No				
25	**Chemical Costs:** ***(Please check with your local Chemical vendor to verify the default unit costs shown CPES)***						
26	Liquid Chemicals:	Default Costs ($/dry ton)	User Over-Ride	Cost Used in Life Cycle Cost Analysis			
27	Alum (48.5%)	$ 555.44		$ 555.44			
28	Aqueous Ammonia (29%)	$ 1,208.65		$ 1,208.65			
29	Ferric Chloride (40%)	$ 1,003.69		$ 1,003.69			
30	Hydrochloric Acid	$ 500.72		$ 500.72			
31	Hydrofluorosilicic Acid (18%)	$ 5,419.53		$ 5,419.53			
32	Hydrogen Peroxide (35%)	$ 2,223.22		$ 2,223.22			
33	Liquid Polymer	$ 3,544.77		$ 3,544.77			
34	Sodium Bilsulfite (40%)	$ 1,336.98		$ 1,336.98			
35	Sodium Hydroxide (25%)	$ 1,043.24		$ 1,043.24			
36	Sodium Hydroxide (50%)	$ 1,222.48		$ 1,222.48			
37	Sodium Hypochlorite (12.5%)	$ 2,205.88		$ 2,205.88			
38	Sulfuric Acid (93%)	$ 379.51		$ 379.51			
39	Other 1			$ -			
40	Other 2			$ -			
41	Other 3			$ -			
42	Other 4			$ -			
43	Liquid Chlorine	$ 128.20		$ 128.20			
44	Purate	$ 923.01		$ 923.01	Purate cost ranges from $150/ton for bulk delivery to $720/ton for totes.		
45	CO2	$ 165.21		$ 165.21			
46							
47	Dry Chemicals:	Default Costs ($/dry ton)	User Over-Ride	Cost Used in Life Cycle Cost Analysis			
48	Powdered Activated Carbon	$ 1,441.81		$ 1,441.81			
49	Calcium Hydroxide	$ 345.23		$ 345.23			
50	Sodium Bicarbonate	$ 777.73		$ 777.73			
51	Sodium Carbonate	$ 364.09		$ 364.09			
52	Polymer	$ 5,478.26		$ 5,478.26			
53	Potassium Permanganate	$ 5,419.17		$ 5,419.17			
54	Ammonium Sulfate	$ 2,574.66		$ 2,574.66			
55	Bayoxide (SORB33)	$ 287.40		$ 287.40			
56	Other 1			$ -			
57	Other 2			$ -			
58							
59	Specialty Chemicals:	Default Costs ($/dry ton)	User Over-Ride	Cost Used in Life Cycle Cost Analysis			
60	Liquid Oxygen	$ 126.22		$ 126.22			
61	GAC	$ 3,251.28		$ 3,251.28			
62	Sand	$ 181.61		$ 181.61			
63	IX TEA	$ 5,451.98		$ 5,451.98			
64	IX TPA	$ 8,505.08		$ 8,505.08			
65	IX Bifunctional	$ 54,519.77		$ 54,519.77			
66	Citric Acid	$ 3,204.91		$ 3,204.91			
67	Trisodium Phosphate	$ 3,461.31		$ 3,461.31			
68	Scale Inhibitor	$ 5,640.65		$ 5,640.65			
69	Sodium Tripolyphosphate	$ 3,974.09		$ 3,974.09			
70	Sodium EDTA	$ 1,752.52		$ 1,752.52			
71	Salt	$ 152.86		$ 152.86			
72	Resin ($/Gal for MIEX model)	$ 60.39		$ 60.39			
73							
74	Specialty Chemicals:	Default Costs	User Over-Ride	Cost Used in Life Cycle Cost Analysis			
75	GFH ($/ton)	$ 25,014.11		$ 25,014.11			

	A	B	C	D	E	F	G	H	I
76	Sybron Chemicals Inc., IONAC A-554 Strongly Basin Anion Ion Exchange Resin ($/cf)	$ 302.25		$ 302.25					
77	Membranes:	Default Cost ($/ea)	User Over-Ride	Cost Used in Life Cycle Cost Analysis					
78	Pressure:								
79	Memcor CP - L10	$ 1,276.60		$ 1,276.60					
80	Memcor CP - L20	$ 1,276.60		$ 1,276.60					
81	Norit	$ 2,102.64		$ 2,102.64					
82	Pall - 48 Module Rack	$ 1,538.36		$ 1,538.36					
83	Pall - 80 Module Rack	$ 1,538.36		$ 1,538.36					
84	Submerged:								
85	Memcor CS	$ 938.68		$ 938.68					
86	Zenon 1000	$ 1,089.67		$ 1,089.67					
87	Zenon 500	$ 1,353.20		$ 1,353.20					
88	SWRO & BWRO:								
89	Process Cartridge Filter Replacements	$ 16.52		$ 16.52					
90	CIP Filter Replacements	$ 16.52		$ 16.52					
91									
92	**Solids:**								
93	**Biosolids:**								
94	Biosolids Reuse or Disposal Technology	End-Use Technology Code							
95	1 = Class A - Composting (static pile, invessel, air dry)	8							
96	2 = Class A - Alkaline Stabilization								
97	3 = Class A - ATAD, TPAAD Advanced Digestion								
98	4 = Class A - Thermal Drying								
99	5 = Class B - Land Application (digested)								
100	6 = Class B - Land Application (alkaline stabilized)								
101	7 = Class B - Land Reclamation (alkaline stabilized)								
102	8 = Disposal - Landfill or Monofill								
103	9 = Disposal - Incineration								
104	Biosolids Unit Cost ($/US Dry Ton)	$ 100.00							
105	Percent Solids	20%							
106	Biosolids *CALCULATED* Unit Cost ($/WT)	$ 20.00							
107	Biosolids *USER OVER-RIDE* Unit Cost ($/WT)								
108	Biosolids Unit Cost Used in CPES ($/WT)	$ 20.00	8 = Disposal - Landfill or Monofill						
109	Haul Distance from Plant (Miles, Round Trip)	20							
110	Haulage *USER OVER-RIDE* Unit Cost ($/WT/mile)								
111	Haulage Cost ($/WT)	$ 2.40	Default haulage cost is $0.12/US wet tonne/mile						
112	**Trash Disposal:**								
113	Haul Distance from Plant (Miles, Round Trip)		20						
114	Disposal Cost ($/cy)		$ 75.00	Typical Range: $50 - $175 / CY					
115	Haul Cost ($/cy)		$ 8.09						
116	**Other Costs:**								
117	O&M Other Costs: Percent for Misc Annual Costs:		20.0%	Includes vehicles, lab tests, office equipment other required misc expenses, default of 20% from OM					
118	**O&M Cost Contingency:**								
119	O&M Cost Contingency		20.0%						
120									
121	**Overall Plant Labor:**								
122	Labor Calculation Method	User Defined							
123									
124									
125									
126									
127									
128									
129									
130	Overall Plant Labor:								
131	Supervisory Staff	Work Shift Scheme		User Defined Number of Personnel	User Defined Hours / Week	User Defined Weeks/Year	Hours / Year	Hourly Rate (Including Fringe Benefits)	Yearly Cost
132	Superintendent	1 8 hr shift 5 days per week		0	40	52	2,080	$ 50.00	$ 104,000
133	Assistant Superintendent	User Defined		0	40	52	-	$ 40.00	$ -
134	Plant Operator 1	2 Operators onsite at all times		0	40	52	17,520	$ 30.00	$ 525,600
135	Plant Operator 2	User Defined		0	40	52	-	$ 30.00	$ -
136	Plant Operator 3	User Defined		0	40	52	-	$ 30.00	$ -
137	Plant Maintenance Worker 1	1 8 hr shift 5 days per week		0	40	52	2,080	$ 25.00	$ 52,000
138	Plant Maintenance Worker 2	User Defined		0	40	52	-	$ 25.00	$ -
139	Plant Maintenance Worker 3	User Defined		0	40	52	-	$ 25.00	$ -
140	Clerical Worker	1 8 hr shift 5 days per week		0	40	52	2,080	$ 25.00	$ 52,000
141	Lab Technician	1 8 hr shift 5 days per week		0	40	52	2,080	$ 25.00	$ 52,000
142	Other			0	40	52	-	$ 25.00	$ -
143	Other			0	40	52	-	$ 25.00	$ -
144	Staff	User Defined		0	40	52	-	$ 25.00	$ -
145	Subtotal - Annual Labor Cost						25,840		$ 785,600
146	Contingency							20%	$ 157,120
147	TOTAL - Annual Labor Cost						25,840	$ 36.48	$ 942,720
148									
149	**LABOR Net Present Value (NPV) Calculation:**								
150									
151	i =	5%							
152	n =	25							
153	Annual Inflation % =	3.00%							
154									
155	Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost				
156	0	$0		$0					
157	1	$971,002		$971,002					
158	2	$1,000,132		$1,000,132					
159	3	$1,030,136		$1,030,136					
160	4	$1,061,040		$1,061,040					
161	5	$1,092,871		$1,092,871					

	A	B	C	D	E	F	G	H	I
162	6	$1,125,657		$1,125,657					
163	7	$1,159,427		$1,159,427					
164	8	$1,194,209		$1,194,209					
165	9	$1,230,036		$1,230,036					
166	10	$1,266,937		$1,266,937					
167	11	$1,304,945		$1,304,945					
168	12	$1,344,093		$1,344,093					
169	13	$1,384,416		$1,384,416					
170	14	$1,425,949		$1,425,949					
171	15	$1,468,727		$1,468,727					
172	16	$1,512,789		$1,512,789					
173	17	$1,558,173		$1,558,173					
174	18	$1,604,918		$1,604,918					
175	19	$1,653,065		$1,653,065					
176	20	$1,702,657		$1,702,657					
177	21	$1,753,737		$1,753,737					
178	22	$1,806,349		$1,806,349					
179	23	$1,860,539		$1,860,539					
180	24	$1,916,356		$1,916,356					
181	25	$1,973,846		$1,973,846					
182	26								
183	27								
184	28								
185	29								
186	30								
187	31								
188	32								
189	33								
190	34								
191	35								
192	36								
193	37								
194	38								
195	39								
196	40								
197	41								
198	42								
199	43								
200	44								
201	45								
202	46								
203	47								
204	48								
205	49								
206	50								
207	NPV			$18,531,642	$971,002				

ENVIRONMENTAL IMPACT CALCULATOR

Does your project span multiple U.S. states?	No	
	eGrid Region	Select state applicable to your project State
Select eGrid Region or State Where Electricity is Purchased	NWPP	OREGON
Region Name	WECC Northwest	Override
CO2 Emissions (lbs/MWh)[1]	842.58	
N2O Emissions (lbs/MWh)[1]	0.02	
CH4 Emissions (lbs/MWh)[1]	0.01	

Power Summary

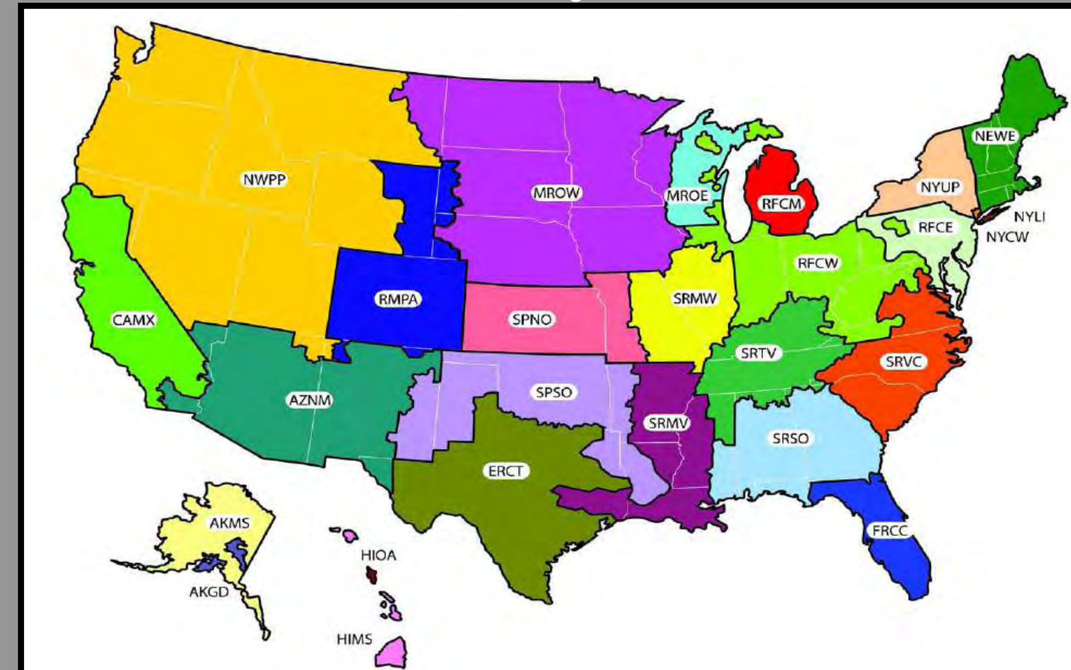
		Override
Total Horsepower (hp)	2,750.05	
Total Area of All Buildings (sf)	39,174.29	
Average to Maximum Flow Factor (%)	0.65	
Annual Plant Operating Hours (hr)	8,760.00	
Calculate Total Electricity Consumption (MWh/yr)	12,599.19	
Calculate Annual Emissions from Electricity Consumption (tons CO2/yr)	5,307.91	
Calculate Annual Emissions from Electricity Consumption (tons N20/yr)	0.10	
Convert N2O Into CO2 Equivalents for Annual Emissions (tons CO2e/yr)	30.13	
Calculate Annual Emissions from Electricity Consumption (tons CH4/yr)	0.08	
Convert CH4 Into CO2 Equivalents for Annual Emissions (tons CO2e/yr)	2.80	
Calculate Annual Emissions From Electrical Usage (tons CO2e/yr)	5,340.84	

1. U.S. Environmental Protection Agency. eGrid Ninth ed. 2010 data. Released 2/24/2014.Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html

Energy Price Summary

		Override
State Where Electricity is Purchased	OREGON	Override Options
Average Electrical Price (USD/kWh)[2]	$ 0.0559	0
Estimated Electrical Cost per Day (USD $)	$ 1,928	

eGrid Regions



2. U.S Energy Information Administration, Average Retail Price of Electricity to Ultimate Customers By End-Use, State, and Provider 2012. Released 11/8/2013. Available: http://www.eia.gov/electricity/data.cfm#sales

File Version: *9/21/2017*

Chemical Summary

If using either of these chemicals, input additional information in cells bx10 and by10

	Sodium Hypochlorite	Alum	Ferric Chloride	Sulfuric Acid	Hydrofluorosilicic Acid	Sodium Hydroxide	Aqueous Ammonia	Liquid Polymer	Hydrogen Peroxide
Total Chemical Usage (dry tons/yr)	0.00	1,218.43	0.00	0.00	0.00	2,436.86	0.00	223.73	0.00
Calculate Annual Emissions from Chemical Production (tons CO2)		336.29				3,353.11		465.80	
Chemical Delivery Vehicle Type	Tanker	Tanker				Tanker		Tanker	
Size of Chemical Delivery (lbs/load)	40,000.00	40,000.00				40,000.00		40,000.00	
If Using Totes, Drums, or Supersacks, Input Number Per Delivery								4.0	
Calculate Number of Deliveries per year	0.00	126.00				244.00		11.00	
Transportation Distance for Delivery (Miles/Delivery)	50.0	50.0				50.0		50.0	
Calculate Total Miles Traveled by Delivery Vehicles	0.00	12,600.00				24,400.00		1,100.00	
Delivery Vehicle Fuel Economy (mpg)	8.90	8.90				8.90		8.90	
Emissions for Transportation (tons CO2/gal)	0.01	0.01				0.01		0.01	
Calculate Annual Emissions for Transportation (tons CO2/yr)	0.00	15.54				30.10		1.36	
Emissions for Transportation (tons N2O/mile)	0.00	0.00				0.00		0.00	
Emissions for Transportation (tons CH4/mile)	0.00	0.00				0.00		0.00	
Convert N2O Into CO2 Equivalents for Annual Emissions (tons CO2e/yr)	0.00	0.26				0.50		0.02	
Convert CH4 Into CO2 Equivalents for Annual Emissions (tons CO2e/yr)	0.00	0.01				0.03		0.00	
Calculate Annual Emissions from Chemical Transportation (tons CO2)	0.00	15.54				30.10		1.36	
Calculate Total Annual Emissions from Chemical Usage (tons CO2)		351.83				3,383.21		467.16	

	Sodium Bisulfite	Powdered Activated Carbon	Calcium Hydroxide	Sodium Bicarbonate	Sodium Carbonate	Potassium Permanganate	Ammonium Sulfate	Other 1	Other 2	Liquid Oxygen	GAC	Sand
Total Chemical Usage (dry tons/yr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calculate Annual Emissions from Chemical Production (tons CO2)												
Chemical Delivery Vehicle Type												
Size of Chemical Delivery (lbs/load)												
If Using Totes, Drums, or Supersacks, Input Number Per Delivery												
Calculate Number of Deliveries per year												
Transportation Distance for Delivery (Miles/Delivery)												
Calculate Total Miles Traveled by Delivery Vehicles												
Delivery Vehicle Fuel Economy (mpg)												
Emissions for Transportation (tons CO2/gal)												
Calculate Annual Emissions for Transportation (tons CO2/yr)												
Emissions for Transportation (tons N2O/mile)												
Emissions for Transportation (tons CH4/mile)												
Convert N2O Into CO2 Equivalents for Annual Emissions (tons CO2e/yr)												
Convert CH4 Into CO2 Equivalents for Annual Emissions (tons CO2e/yr)												
Calculate Annual Emissions from Chemical Transportation (tons CO2)												
Calculate Total Annual Emissions from Chemical Usage (tons CO2)												

	Citric Acid	Trisodium Phosphate	Sodium Tripolyphosphate	Sodium EDTA	Salt	Purate	GFH / Resin Replacements (cf/yr)	CO2	Scale Inhibitor	Hydrochloric Acid	Other Liquid CIP Chem1	Other Liquid CIP Chem2	Other Dry Chem CIP 1	Other Pretreat Chem 1	Other Pretreat Chem 2
Total Chemical Usage (dry tons/yr)	0.00	0.00	0.00	0.00	731.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calculate Annual Emissions from Chemical Production (tons CO2)					16.16										
Chemical Delivery Vehicle Type					Tanker										
Size of Chemical Delivery (lbs/load)					40,000.00										
If Using Totes, Drums, or Supersacks, Input Number Per Delivery															
Calculate Number of Deliveries per year					37.00										
Transportation Distance for Delivery (Miles/Delivery)					50.0										
Calculate Total Miles Traveled by Delivery Vehicles					3,700.00										
Delivery Vehicle Fuel Economy (mpg)					8.90										
Emissions for Transportation (tons CO2/gal)					0.01										
Calculate Annual Emissions for Transportation (tons CO2/yr)					4.56										
Emissions for Transportation (tons N2O/mile)					0.00										
Emissions for Transportation (tons CH4/mile)					0.00										
Convert N2O Into CO2 Equivalents for Annual Emissions (tons CO2e/yr)					0.08										
Convert CH4 Into CO2 Equivalents for Annual Emissions (tons CO2e/yr)					0.00										
Calculate Annual Emissions from Chemical Transportation (tons CO2)					4.56										
Calculate Total Annual Emissions from Chemical Usage (tons CO2)					20.72										

	Sodium Hypochlorite	Alum	Ferric Chloride	Sulfuric Acid	Hydrofluorosilicic Acid	Sodium Hydroxide	Aqueous Ammonia	Liquid Polymer	Hydrogen Peroxide	Sodium Bisulfite	Powdered Activated Carbon	Calcium Hydroxide	Sodium Bicarbonate	Sodium Carbonate	Potassium Permanganate
Wet Density (lbs/gal)	10.0914	11.1756	11.9262	15.2622	10.0914	12.8436	7.7562	9.174	9.4242	10.842					
% Active Chemical	0.125	0.485	0.4	0.93	0.18	0.5	0.19	1	0.35	0.4					
Dry Density (lbs/cf)											35	30	60	65	100

	Ammonium Sulfate	Other 1	Other 2	Liquid Oxygen	GAC	Sand	Citric Acid	Trisodium Phosphate	Sodium Tripolyphosphate	Sodium EDTA	Number of Membrane Elements	Cartridge Replacements	Sludge (cy/year)	Liquid Chlorine Cylinders	Salt
Wet Density (lbs/gal)							13.8444								
% Active Chemical				1											
Dry Density (lbs/cf)	60				28	99		60	60	54					80

	Purate	Lamps	Ballasts	Sleeves	Intensity Sensors	GFH / Resin Replacements	CO2	Membrane Type	Scale Inhibitor	CIP Cartridge	Hydrochloric Acid	Other Liquid CIP Chem1	Other Liquid CIP Chem2	Other Dry Chem CIP 1	Other Pretreat Chem 1	Other Pretreat Chem 2
Wet Density (lbs/gal)	11.43						6.43		9.17		3.67					
% Active Chemical	1						1		1		0.37					
Dry Density (lbs/cf)																

Construction Summary

	Concrete (cy)	Excavation (cy)	Structural Backfill (cy)	Native Backfill (cy)	Haul Excess (cy)	Steel Process Piping (lbs)	Iron Process Piping (lbs)
Total Quantity Used	58,556.36	529,699.42	19,730.56	331,653.53	198,045.88	88,063.26	574,315.32
Input Load Factor		Low	Low	Low			
Calculate Gallons of Diesel Consumed based on Quantity Used (gal)		11,477.78	427.53	7,186.43			
Calculate CO2 Emissions based on Consumption (tons CO2)		127.12	4.73	79.59			
Calculate CH4 Emissions based on Consumption (tons CH4)		0.02	0.00	0.01			
Calculate N2O Emissions based on Consumption (tons N2O)		0.00	0.00	0.00			
Convert CH4 Into CO2 Equivalents for Emissions (tons CO2e)		0.37	0.01	0.23			
Convert N2O Into CO2 Equivalents for Emissions (tons CO2e)		0.39	0.01	0.25			
Calculate Emissions from Construction Quantities (tons CO2e)	2,195.86	127.88	4.76	80.07		228.08	554.21
Select Vehicle Capacity (cy)	7.85	10.00	10.00	10.00	10.00	40,000.00	40,000.00
Calculate Number of Vehicle Trips per year	7,462.00	52,970.00	1,974.00	33,166.00	19,805.00	3.00	15.00
Input Transportation Distance for Delivery (Miles/Delivery)	50.00	20.00	20.00	20.00	20.00	20.00	20.00
Calculate Total Miles Traveled by Construction Vehicles	373,100.00	1,059,400.00	39,480.00	663,320.00	396,100.00	60.00	300.00
Vehicle Fuel Economy (mpg)	8.90	8.90	8.90	8.90	8.90	8.90	8.90
Emissions for Transportation (tons CO2/ gal)	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Calculate Emissions for Transportation (tons CO2)	460.25	1,306.87	48.70	818.27	488.63	0.07	0.37
Emissions for Transportation (tons N2O/ mile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emissions for Transportation (tons CH4/ mile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Convert N2O Into CO2 Equivalents for Emissions (tons CO2e)	7.65	21.71	0.81	13.59	8.12	0.00	0.01
Convert CH4 Into CO2 Equivalents for Emissions (tons CO2e)	0.43	1.23	0.05	0.77	0.46	0.00	0.00
Calculate Total Emissions from Transportation (tons CO2e)	468.33	1,329.81	49.56	832.63	497.20	0.08	0.38
Calculate Total Emissions from Construction Quantities (tons CO2e)	2,664.19	1,457.69	54.32	912.70	497.20	228.16	554.59

Load factor guide for excavation and backfill:

High - Most pipeline applications in hard rocky material. Digging 90-95% of the daily work schedule

Medium - Most residential sewer applications in natural bed clay. Digging 60-85% of the daily work schedule. Most log loading applications.

Low - Most utility, urban applications in sandy loam. Digging less than 50% of daily work schedule. Scrap handling applications.

WTP Solids Summary

Solids Handling Emissions from WTP sludge

	Sludge (cy/year)	
Are the Solids Produced in a WTP or WWTP?	**WTP**	
Quantity of Sludge Produced Annually (cy/yr)	3,628.30	
Input % Dry Solids in Dewatered Sludge	**20.00%**	***Typically 15 to 25%.***
Weight of Sludge (lbs/cy)	1,901.43	***Assumption:*** Density of dried solids of 145 lb/cf.
Vehicle Hauling Capacity (cy)	**10.00**	
Calculate Number of Hauls per year	362.83	
Transportation Distance for Hauling (Miles/Delivery)	**20.00**	
Calculate Total Miles Traveled by Hauling Vehicles	14,513.19	
Hauling Vehicle Fuel Economy (mpg)	8.90	
Emissions for Transportation (tons CO2/ gal)	0.01	
Calculate Annual Emissions for Transportation (tons CO2/yr)	17.90	
Emissions for Transportation (tons N2O/ mile)	0.00	
Emissions for Transportation (tons CH4/ mile)	0.00	
Convert N2O Into CO2 Equivalents for Annual Emissions (tons CO2e/yr)	0.30	
Convert CH4 Into CO2 Equivalents for Annual Emissions (tons CO2e/yr)	0.02	
Calculate Annual Emissions from Solids Transportation (tons CO2)	18.22	

Membrane Filtration Cost Estimate

CH2M Parametric Engineering System (CPES)

FACILITIES DESIGN & CONSTRUCTION COST MODULE

File Version: 1/26/2018

Project Capacity: >>>	150.00	Project Unit: >>>	MGD	(For example: MGD, HP, GPM…)

Project Name:	PWB Filtration Decision
Project Number:	699275
Project Manager:	Kelly Irving
Estimator:	Enoch Nicholson/Lee Odell
Project Description:	PWB Membrane Filtration
Project Location (City):	Portland OR
Project Location (State):	OREGON
Project Location (Country):	USA
Cost Basis (Month/Year):	April/2018

Roundup to the nearest: $10,000

Item	Include? (Yes or No)	SCOPE OF PROJECT		Cost
	Yes	Flocculation: RapMix		$1,910,000
	Yes	Flocculation: Floc		$8,890,000
	No	DAF: DAF		$0
	No	Ozone Serpentine: Ozone		$0
	No	Filters: Filt		$0
	Yes	Concrete Clearwell: Clearwell		$31,540,000
	Yes	Liquid Chemical: Alum		$1,250,000
	Yes	Liquid Chemical: FAP		$320,000
	Yes	Liquid Chemical: CAP		$620,000
	Yes	Liquid Chemical: Hypo		$1,130,000
	Yes	On-Site Sodium Hypo: OSHG		$5,490,000
	Yes	Liquid Chemical: Caustic		$430,000
	Yes	Surge Basin-Decanter: BWSurge		$2,620,000
	Yes	Gravity Thickener: BWClar		$6,150,000
	Yes	Gravity Thickener: GravThick		$2,370,000
	Yes	WTP Centrifuge: Centrifuge		$7,710,000
	Yes	WPSPS: RecPS		$1,250,000
	Yes	Pall - Large: Membrane		$124,490,000
SUBTOTAL - PROJECT COST				$196,170,000
ADDITIONAL PROJECT COSTS:				
Demolition:		0.00%		$0
Overall Sitework:		5.00%		$9,810,000
Plant Computer System:		5.00%		$9,810,000
Yard Electrical:		4.00%		$7,850,000
Yard Piping:		7.50%		$14,720,000
UD #1 Default Description		0.00%	$0	$0

	A	B	C	D	E
47	UD #2 Default Description		0.00%		$0
48	UD #3 Default Description		0.00%		$0
49	SUBTOTAL with Additional Project Costs				$238,360,000
50					
51	RED FLAGS:				
52	1	Rock Excavation			
53	2	Pile Foundations			
54	3	Seismic Foundations			
55	4	Dewatering Conditions			
56	5	Wetlands Mitigation			
57	6	Weather Impacts			
58	7	Depth of Structures			
59	8	Local Building Code Restrictions			
60	9	Coatings or Finishes			
61	10	Building or Architectural Considerations			
62	11	Client Material Preferences			
63	12	Client Equipment Preferences			
64	13	Piping Galleries, Piping Trenches, Piping Racks			
65	14	Yard Piping Complexity			
66	15	Existing Site Utilities (New, Retrofit, and Complexity)			
67	16	I & C Automation (New or Retrofit)			
68	17	Electrical Feed (New or Retrofit)			
69	18	Electrical Distribution			
70	19	Shoring			
71	20	Contamination			
72	21	User Defined Red Flag 1			
73	22	User Defined Red Flag 2			
74	23	User Defined Red Flag 3			
75	24	User Defined Red Flag 4			
76	25	User Defined Red Flag 5			
77	26	User Defined Red Flag 6			
78	27	User Defined Red Flag 7			
79	TOTAL - RED FLAGS				$0
80					
81	SUBTOTAL - PROJECT COST with Additional Project Costs and Red Flag Costs				$238,360,000
82					
83	TAX:		0.00%	$0	$0
84	SUBTOTAL with Tax				$238,360,000
85					
86	CONTRACTOR MARKUPS:				
87	Overhead (includes General Conditions and General Administrative Costs)		14.00%	$238,360,000	$33,380,000
88	Subtotal				$271,740,000
89	Profit		5.00%	$271,740,000	$13,590,000
90	Subtotal				$285,330,000
91	Mob/Bonds/Insurance		3.50%	$285,330,000	$9,990,000
92	Subtotal				$295,320,000
93	Contingency		40.00%	$295,320,000	$118,130,000
94	SUBTOTAL with Markups				$413,450,000

	A	B	C	D	E
95					
96	***LOCATION ADJUSTMENT FACTOR***		**100**	**$413,450,000**	**$413,450,000**
97	***SUBTOTAL - with Local Adjustment Factor***				**$413,450,000**
98					
99	***MARKET ADJUSTMENT FACTOR***		**0.00%**	**$413,450,000**	**$0**
100	***SUBTOTAL - CONSTRUCTION COST with Market Adjustment Factor***				**$413,450,000**
101	***Your CPES Estimate MUST be reviewed by a Process person AND an Estimator:***				
102	***Name of Process Reviewer***			**Odell, Lee**	
103	***Name of Estimator Reviewer***				
104	***MAXIMUM CONSTRUCTION COST***				**$413,450,000**
105					
106	***NON-CONSTRUCTION COSTS:***				
107	***Permitting:***		**0.00%**	**$413,450,000**	**$0**
108	***Engineering:***		**0.00%**	**$413,450,000**	**$0**
109	***Services During Construction:***		**0.00%**	**$413,450,000**	**$0**
110	***Commissioning & Startup:***		**0.00%**	**$413,450,000**	**$0**
111	***Land / ROW:***		**$0.00**		**$0**
112	***Legal / Admin:***		**$0.00**		**$0**
113	***Other Default Description***		**$0.00**		**$0**
114	***SUBTOTAL - Non-Construction Costs***				**$0**
115					
116	***TOTAL - CAPITAL COST***				**$413,450,000**
117					
118	***Currency Conversion of TOTAL CAPITAL COST:***				
119		***Currency***	***Unit of Measure***	***Conversion Rate***	***Converted Amount***
120		**None**	**U.S. Dollar**	**1**	**413,450,000**

	B	C	D	E	F	G	H	I
1	***Flocculation (Horizontal Paddle Wheel Flocculation for Downstream Sedimentation)***							
2								
3	**Is This Facility Included in My Project? Yes**							
4	Assumptions:							
5								
6	Based on Denver Water Reuse Project							
7	2 Basins @ 15 MGD each							
8	***If this is a Seawater Desalination Application, the materials in contact with seawater need to be corrosion resistant.***							
9	***NOTE TO USER: The Lamella Plate Clarifier should be sized before working on the Flocculation model.***							
10								
11	**Process User Inputs**	**Value (English)**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Red Flags**	**Comment**
12	Is this a Seawater Desalination Application?	No	Y/N					
13	Has the USER Contacted Equipment Suppliers to Obtain Equipment Quotes?	No	Y/N					
14	Input Total Flocculation Flow Rate	160.00	mgd	567.81	ML/d			
15	Conversion of Total Flocculation Flow Rate	111,111.11	gpm	7,010.02	L/s			
16	Conversion of Total Flocculation Flow Rate	247.56	cfs	7.01	m3/s			
17	Input Number of Active Flocculation Trains	3	#					
18	Input Number of Standby Flocculation Trains	1	#					Typically 0.
19	Calculate Total Number of Flocculation Trains	4	#			NT		
20	Input Flocculation Detention Time	0.50	min					
21	Input Number of Flocculation Basin Stages per Train	1	#			NFS		Valid Range: 1 - 6.
22	Calculate Flocculation Basin Water Volume per Train	2,475.57	cf	70.10	m3			
23	Calculate Flocculation Stage Water Volume	2,475.57	cf	70.10	m3			
24	Select Flocculation Baffle Type	O/U	Type					
25	Input Flocculation Basin Influent Weir Head, If Serpentine Baffling Selected	1.00	ft	304.80	mm			
26	Calculate Flocculation Basin Influent Weir Length	0.00	ft	0.00	mm	WL		
27	Input Internal Flocculation Basin / Stage Width per Train = Lamella Plate Clarifier Train Width (W)	15.00	ft	4,572.00	mm	IBW		The Flocculation Basin / Stage Width should equal the Clarifier Stage Width. For information, the DAF Clarifier Stage Width can be found in the DAF model cell C25. Lamella Clarifier Width can be found in cell C46 of the Lamella Clarifier model.
28	Calculate Stage Length	12.85	ft	3,915.67	mm	SL		
29	Calculate Side Water Depth	12.85	ft	3,915.67	mm	SWD		Equal to Stage Length.
30	Input Flocculator Equipment Type	VT	Type					For VP and VT, the flocculation stage length must be less than 20-feet.
31	Calculate Horizontal Paddle Wheel Flocc Pedestal Height	0.00	ft	0.00	mm	FPH		
32	Number of Baffle Walls per Train	0	#					
33	Include Influent Channel?	Yes	Y/N					
34	Input Influent Channel Width	5.00	ft	1,524.00	mm	ICW		Valid Range: ≥ 3 ft.
35	Calculate Internal Flocculation Basin Length per Train	12.85	ft	3,915.67	mm	IBL		
36	Input Basin Freeboard	3.00	ft	609.60	mm	FB		Valid Range: 1-3 ft.
37	Calculate Basin Depth	15.85	ft	4,830.07	mm			Flocculation Basin BD should be less than or equal to lamella clarifier BD. If not, add more trains and / or more stages
38	Input Perimeter Operator Deck Walkway Width	6.00	ft	1,524.00	mm	WWW		Typically 4 to 8 ft.
39	Input Central Operator Deck Walkway Width	10.00	ft	1,828.80	mm	WWWC		Typically 8 to 12 ft.
40	Include Building over Basin?	No	Y/N					
41	Input Structure Depth of Burial	6.00	ft	0.00	mm			
42	Input Cutback Slope	1.50	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
43	Input Over Excavation Depth	1.00	ft	0.00	mm			
44	For Horizontal Paddle Wheel, Input Number of Reels per Stage	6	#			NRS		
45	Calculate Number of Flocculation Basin Pedestal Supports	0						
46	Distance between Reel and Pedestal	0.00	in	0.00	mm			
47	Conversion from Inches to Feet	0.00	ft	0.00	mm	RPW		
48	Width of Pedestal	0.00	in	0.00	mm			
49	Conversion from Inches to Feet	0.00	ft	0.00	mm	PW		
50	Calculate Reel Length	0.00	ft	0.00	mm	RL		Valid Range: 6 to 20 ft.
51	Calculate Reel Diameter	0.00	ft	0.00	mm	RD		
52	For Vertical Paddle Wheel or Vertical Turbine, Calculate Number of Mixers per Stage	1	#					
53	For Vertical Paddle Wheel or Vertical Turbine, Calculate Number of Mixers per Train	1	#					
54	For Vertical Paddle Wheel or Vertical Turbine, Calculate Total Number of Mixers per All Trains	4	#					
55	For Vertical Paddle Wheel or Vertical Turbine, Calculate Mixer Diameter, Each	9.00	ft	2,743.20	mm	MD		
56	For Vertical Paddle Wheel or Vertical Turbine, Calculate Distance Between Mixers	3.00	ft	914.40	mm	DBM		
57	Input Stage 1 Velocity Gradient	700.00	sec-1					
58	Input Stage 2 Velocity Gradient	40.00	sec-1					
59	Input Stage 3 Velocity Gradient	20.00	sec-1					
60	Input Stage 4 Velocity Gradient	0.00	sec-1					
61	Input Stage 5 Velocity Gradient	0.00	sec-1					
62	Input Stage 6 Velocity Gradient	0.00	sec-1					
63	Input Wire to Water Flocculation Energy Input Efficiency	75.00%						
64	Input min water temperature	33.80	degrees F	1.00	degrees C			Valid Range: 0 - 40 deg C.

	B	C	D	E	F	G	H	I
65	Dynamic (Absolute) Viscosity of Water	0.000037	lb•s/sf	0.001792	Pa•s			Reference: *Viscosity of Liquid Water in the Range -8°C to 150°C*, J. Phys. Chem. Ref. Data, Vol. 7, No. 3, 1978 (Eqn. 15).
66	Calculate Stage 1 Power per Mixer	111.00	hp	82.77	kW			
67	Calculate Stage 2 Power per Mixer	0.00	hp	0.00	kW			
68	Calculate Stage 3 Power per Mixer	0.00	hp	0.00	kW			
69	Calculate Stage 4 Power per Mixer	0.00	hp	0.00	kW			
70	Calculate Stage 5 Power per Mixer	0.00	hp	0.00	kW			
71	Calculate Stage 6 Power per Mixer	0.00	hp	0.00	kW			
72								
73	Electrical User Inputs and Sizing Requirements:							
74	Is this a "Critical" Facility (requiring standby power)?	Yes	Y/N					
75	Is there SWGR?	No						
76								MCC
77	**Item**	**Quantity**	**HP per Each**	**AFD's Required?**	**MCC Spaces for Motor Starters**	**MCC Spaces for AFD's less than 50hp)**	**MCC Spaces for Breakers**	**Total MCC Spaces**
78	Flocculation Mixers Stage 1 (total facility)	4.00	111.00	Yes	0.00	0.00	12.00	
79	Flocculation Mixers Stage 2 (total facility)	0.00	0.00	Yes	0.00	0.00	0.00	
80	Flocculation Mixers Stage 3 (total facility)	0.00	0.00	Yes	0.00	0.00	0.00	
81	Flocculation Mixers Stage 4 (total facility)	0.00	0.00	No	0.00	0.00	0.00	
82	Flocculation Mixers Stage 5 (total facility)	0.00	0.00	No	0.00	0.00	0.00	
83	Flocculation Mixers Stage 6 (total facility)	0.00	0.00	No	0.00	0.00	0.00	
84	User Defined Item #1	0.00	0.00	No	0.00	0.00	0.00	
85	User Defined Item #2	0.00	0.00	No	0.00	0.00	0.00	
86	User Defined Item #3	0.00	0.00	No	0.00	0.00	0.00	
87	**TOTAL**		**444.00**		**0.00**	**0.00**	**12.00**	**12.00**
88								
89	Electrical Equipment Widths:							
90	**Equipment**	**Depth (ft)**						
91	MCC	1.67						
92	Small AFD's	2.08						
93	Large AFD's	0.00						
94	Switchgear	0.00						
95	**Maximum Depth**	**2.08**						
96								
97	Clear Distances:							
98	**Clear Distance**	**Width**	**Length**	**Comment**				
99	CD1		3.00	Clear Distance between wall and MCC	Typically 3 feet			
100	CD2		1.00	Clear Distance between MCC and Small AFD	Typically 1 foot			
101	CD3		0.00	Clear Distance between Small AFD and Large AFD	Typically Zero			
102	CD4		0.00	Clear Distance between Large AFD and Switchgear	Typically Zero			
103	CD5		0.00	Clear Distance between Switchgear and Contingency Space	Typically Zero			
104	CD6	4.00		Clear Distance behind Switchgear (If				
105	CD7	3.00		Clear Distance in front of Equipment	Typically 3 feet			
106	Contingency Length		0.00	Contingency length	Typically Zero			
107								
108	Electric Room Length (ft):							
109	CD1	3.00						
110	MCC	11.67						
111	CD2	1.00						
112	Small AFD's	13.32						
113	CD3	0.00						
114	Large AFD's	0.00						
115	CD4	0.00						
116	Swithgear	0.00						
117	CD5	0.00						
118	Contingency	0.00						
119	**Total Length**	**28.99**						
120								
121	Electric Room Width (ft):							
122	CD6	0.00	If there is no switchgear, this distance will be Zero.					
123	Maximum Equipment Depth	2.08						
124	CD7	3.00						
125	**Total Width**	**5.08**						
126								
127	**Estimating Dimensions (per trian):**	**Value English**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Red Flags**	**Comment**
128								
129	Influent Channel:							
130	Slab on Grade:							Use Wall Thickness Spreadsheet to Adjust Based on Overall Wall Height and Depth of Burial
131	Concrete Thickness	24.00	in	609.60	mm			Model based on 24"
132	Concrete Thickness	2.00	ft	609.60	mm	TICS0G		
133	SOG Length	8.50	ft	2,590.80	mm			
134	SOG Width	71.50	ft	21,793.20	mm			
135	Channel Walls:							Use Wall Thickness Spreadsheet to Adjust Based on Overall Wall Height and Depth of Burial
136	Concrete Thickness	18.00	in	457.20	mm			Model based on 18"
137	Concrete Thickness	1.50	ft	457.20	mm	TWIC		
138	Wall Length	135.00	ft	41,148.00	mm			
139	Wall Height	15.85	ft	4,830.07	mm			
140	Elevated Slab:							
141	Concrete Thickness	12.00	in	304.80	mm			Model based on 12"
142	Concrete Thickness	1.00	ft	304.80	mm			

	B	C	D	E	F	G	H	I
143	Elevated Slab Length	8.00	ft	2,438.40	mm			
144	Elevated Slab Width	67.50	ft	20,574.00	mm			
145								
146	Flocculation Basin:							
147	Slab on Grade:							Use Wall Thickness Spreadsheet to Adjust Based on Overall Wall Height and Depth of Burial
148	Concrete Thickness	24.00	in	609.60	mm			Model based on 24"
149	Concrete Thickness	2.00	ft	609.60	mm	TFBSOG		
150	SOG Length	14.35	ft	4,372.87	mm			
151	SOG Width	71.50	ft	21,793.20	mm			
152	Basin Walls:							Use Wall Thickness Spreadsheet to Adjust Based on Overall Wall Height and Depth of Burial
153	Concrete Thickness	18.00	in	457.20	mm			Model based on 18"
154	Concrete Thickness	1.50	ft	457.20	mm	TWFB		
155	Wall Length	89.23	ft	27,198.37	mm			If flocc basin shares a common wall with downstream facility, then common wall is counted with downstream facility.
156	Wall Height	15.85	ft	4,830.07	mm			
157	Baffle Walls:							
158	Concrete Thickness	12.00	in	304.80	mm			Model based on 12"
159	Concrete Thickness	1.00	ft	304.80	mm	BWTF		
160	Wall Width per Train	15.00	ft	4,572.00	mm	BWL		
161	Quantity of Over Baffle Walls per Train	0	#					
162	Quantity of Under Baffle Walls per Train	0	#					
163	Quantity of Under Baffle Walls per Train	0	#					
164	Over Baffle Wall Length per Facility	0.00	ft	0.00	mm			
165	Under Baffle Wall Length per Facility	0.00	ft	0.00	mm			
166	Serpentine Baffle Wall Length per Facility	0.00	ft	0.00	mm			
167	Over Baffle Wall Height	10.85	ft	3,306.07	mm			Assumes top of wall 2 ft below WSE.
168	Under Baffle Wall Height	14.85	ft	4,525.27	mm			Assumes bottom of wall 1 ft above basin floor.
169	Serpentine Baffle Wall Height	0.00	ft	0.00	mm			
170	Elevated Slab:							
171	Concrete Thickness	12.00	in	304.80	mm			Model based on 12"
172	Concrete Thickness	1.00	ft	304.80	mm	TESLC		
173	Center Walkway:							
174	Elevated Slab Width	10.00	ft	3,048.00	mm			
175	Elevated Slab Length per 2 Trains	6.85	ft	2,086.87	mm			
176	Elevated Slab Length per Facility	20.54	ft	6,260.62	mm			
177	Perimeter and Baffle Wall Walkway:							
178	Elevated Slab Width at Perimeter	7.50	ft	2,286.00	mm			Includes basin wall thickness.
179	Elevated Slab Length at Perimeter per Facility	81.19	ft	24,747.75	mm			
180	Elevated Slab Width at Baffle Wall	6.00	ft	1,828.80	mm			For VP and VT flocc basin mixing only.
181	Elevated Slab Length at Baffle Wall per Facility	0.00	ft	0.00	mm			For VP and VT flocc basin mixing only.
182								
183	Electrical Room Slab on Grade:							
184	Concrete Thickness	12.00	in	304.80	mm			Model based on 12"
185	Concrete Thickness	1.00	ft	304.80	mm			
186								
187	Overall Dimensions:							
188	Total Basin/Building Length	20.85	ft	6,354.07	mm	TBL		
189	Total Basin/Building Width	67.50	ft	20,574.00	mm	TBW		
190	SOG Length	22.85	ft	6,963.67	mm			
191	SOG Width	71.50	ft	21,793.20	mm			
192	Electrical Room Length	28.99	ft	8,835.14	mm			
193	Electrical Room Width	5.08	ft	1,549.40	mm			
194	Excavation Length	26.85	ft	8,182.87	mm			
195	Excavation Width	75.50	ft	23,012.40	mm			
196	Excavation Depth	9.00	ft	2,743.20	mm			
197								
198								
199	**Description**	**Quantity (English)**	**Unit (English)**	**Quantity (Metric)**	**Unit (Metric)**	**$/Unit**	**Total Cost**	**User Over-Write**
200								
201	SITEWORK:							
202	Excavation	1,273	CY	972.93	m3	*$6.72*	$8,555	
203	Imported Structural Backfill	150	CY	114.79	m3	*$50.94*	$7,649	
204	Native Backfill	461	CY	352.12	m3	*$8.27*	$3,807	
205	Haul Excess	812	CY	620.81	m3	*$8.27*	$6,711	
206	Allowance for Misc Items	5%				$26,721.89	$1,336	
207	Subtotal						$28,058	
208								
209	CONCRETE:							
210	Influent Channel:							
211	Foundation	45	CY	34.42	m3	*$541.11*	$24,360	
212	Walls	119	CY	90.87	m3	*$880.79*	$104,682	
213	Elevated Slab	20	CY	15.29	m3	*$1,333.77*	$26,675	
214	Flocc Basin							
215	Foundation	76	CY	58.09	m3	*$541.11*	$41,116	
216	Basin Walls	79	CY	60.06	m3	*$880.79*	$69,194	
217	Over Baffle Wall	0	CY	0.00	m3	*$880.79*	$0	
218	Under Baffle Wall	0	CY	0.00	m3	*$880.79*	$0	
219	Serpentine Baffle Wall	0	CY	0.00	m3	*$880.79*	$0	
220	Elevated Slab	25	CY	19.18	m3	*$1,333.77*	$33,464	
221	Flocc Bearing Supports	0	EA			$0.00	$0	
222	Electrical Room							

	B	C	D	E	F	G	H	I
223	Slab on Grade	5	CY	4.17	m3	*$490.62*	$2,677	
224	Allowance for Misc Items	5%				$302,168.22	$15,108	
225	Subtotal						$317,277	
226								
227	MASONRY:	High						
228	CMU Building	0	SF	0.00	m2	*$198.37*	$0	
229	Electrical Room	147	SF	13.69	m2	*$198.37*	$29,229	
230	Subtotal	147					$29,229	
231								
232	METALS:							
233	Aluminum Handrail	276	LF	84.27	m	*$90.92*	$25,136	
234	Stairs (1 set per basin)	65	RISERS			*$495.92*	$32,274	
235	Allowance for Misc Items	10%				$57,410.27	$5,741	
236	Subtotal						$63,151	
237								
238	WOODS & PLASTICS:							
239	FRP Weir	60	LF	18.29	m	$41.64	$2,498	
240	FRP Ladder	8	EA			$1,715.48	$13,724	
241	Allowance for Misc Items	5%				$16,222.01	$811	
242	Subtotal						$17,033	
243								
244	THERMAL & MOISTURE PROTECTION:							
245	Concrete Liner	0	SF	0.00	m2	**$16.00**	$0	
246	Allowance for Misc Items	10%				$0.00	$0	
247	Subtotal						$0	
248								
249	DOORS & WINDOWS:							
250	Stainless Steel Door (2' x 2') for O/U Baffling	0	EA			$1,332.36	$0	
251	Stainless Steel Door (7' x 2.5') for O/U Baffling	0	EA			$5,829.09	$0	
252	Stainless Steel Door (2' x 2') for Serpentine Baffling	0	EA			$1,332.36	$0	
253	Allowance for Misc Items	5%				$0.00	$0	
254	Subtotal						$0	
255								
256	EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
257	Horizontal Paddle Wheel Flocculation Mechanism (Paddles & Drives)	0	LF	0.00	m	***$0.00***	$0	
258	Vertical Paddle Wheel Flocculation Mechanism (Paddles & Drives)	4	EA			***$0.00***	$0	
259	Vertical Turbine Flocculation Mechanism (Turbines & Drives)	444	hp	331.09	kW	***$1,534.78***	$681,443	
260	Vertical Turbine Flocculator VFD's	444	hp	331.09	kW	***$558.32***	$247,894	
261	Fabricated Slide Gate	4	EA			***$9,614.74***	$38,459	
262	Allowance for Misc Items	10%				$967,795.48	$96,780	
263	Subtotal						$1,064,575	
264								
265	ELECTRICAL:							
266	*MCC's*							
267	Sections	7	EA			***$10,730.27***	$75,112	
268	*AFD's*							
269	Flocculation Mixers Stage 1 (total facility) (111 hp each)	4	EA			***$23,421.23***	$93,685	
270	Flocculation Mixers Stage 2 (total facility) (0 hp each)	0	EA			***$8,865.56***	$0	
271	Flocculation Mixers Stage 3 (total facility) (0 hp each)	0	EA			***$8,865.56***	$0	
272	Flocculation Mixers Stage 4 (total facility) (0 hp each)	0	EA			***$8,865.56***	$0	
273	Flocculation Mixers Stage 5 (total facility) (0 hp each)	0	EA			***$8,865.56***	$0	
274	Flocculation Mixers Stage 6 (total facility) (0 hp each)	0	EA			***$8,865.56***	$0	
275	*Switchgear*							
276	Units	0	EA			***$49,359.23***	$0	
277	Electrical Conduit & Wire	572	LF	174.35	m	***$12.06***	$6,898	
278	Allowance for Misc Items	10%				$175,694.53	$17,569	
279	Subtotal						$193,264	
280								
281	INSTRUMENTS & CONTROLS:							
282	Instruments							
283	Level Switch	4	EA			***$695.44***	$2,782	
284	Number of Analog I/O Counts	10	EA			***$264.27***	$2,537	
285	Number of Digital I/O Counts	24	EA			***$62.59***	$1,502	
286	Number of PLC's	1	EA			***$13,074.33***	$13,074	
287	I&C Conduit & Wire	1,080	LF	329.18	m	***$12.06***	$13,024	
288	Allowance for Misc Items	10%				$32,918.93	$3,292	
289	Subtotal						$36,211	
290								
291	**USER DEFINED ESTIMATE ITEMS:**	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
292	Item 1 Description	0.00		0.00		0.00	$0	
293	Item 2 Description	0.00		0.00		0.00	$0	
294	Item 3 Description	0.00		0.00		0.00	$0	
295	Item 4 Description	0.00		0.00		0.00	$0	
296	Item 5 Description	0.00		0.00		0.00	$0	
297	Item 6 Description	0.00		0.00		0.00	$0	
298	Item 7 Description	0.00		0.00		0.00	$0	
299	Item 8 Description	0.00		0.00		0.00	$0	
300	Item 9 Description	0.00		0.00		0.00	$0	
301	Item 10 Description	0.00		0.00		0.00	$0	
302	Item 11 Description	0.00		0.00		0.00	$0	
303	Item 12 Description	0.00		0.00		0.00	$0	
304	Item 13 Description	0.00		0.00		0.00	$0	
305	Item 14 Description	0.00		0.00		0.00	$0	
306	Item 15 Description	0.00		0.00		0.00	$0	
307	Subtotal						$0	
308								
309	Subtotal						$1,748,798	
310								
311	ALLOWANCES:		**User Override**					
312	Finishes Allowance	2.00%		$1,900,867	$38,017			
313	I&C Allowance	2.00%		$1,900,867	$38,017			
314	Mechanical Allowance	2.00%		$1,900,867	$38,017			
315	Electrical Allowance	2.00%		$1,900,867	$38,017			
316						Facility Cost Name		
317	Facility Cost	**160,000,000**	**GPD**	**$0.01**	**$1,900,867**	FCPFC01		
318	Facility Cost with Standard Additional Project Costs Added	**160,000,000**	**GPD**	**$0.01**	**$2,309,684**	FCPFC02		

	B	C	D	E	F	G	H	I
319	Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**160,000,000**	**GPD**	**$0.03**	**$4,006,289**	FCPFC03		
320	Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**160,000,000**	**GPD**	**$0.02**	**$3,297,171**	FCPFC05		
321	Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**160,000,000**	**GPD**	**$0.03**	**$4,006,289**	FCPFC06		

	B	C	D	E	F	G	H	I
1	***Flocculation (Horizontal Paddle Wheel Flocculation for Downstream Sedimentation)***							
2								
3	**Is This Facility Included in My Project? Yes**							
4	Assumptions:							
5								
6	Based on Denver Water Reuse Project							
7	2 Basins @ 15 MGD each							
8	***If this is a Seawater Desalination Application, the materials in contact with seawater need to be corrosion resistant.***							
9	***NOTE TO USER: The Lamella Plate Clarifier should be sized before working on the Flocculation model.***							
10								
11	**Process User Inputs**	**Value (English)**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Red Flags**	**Comment**
12	Is this a Seawater Desalination Application?	**No**	Y/N					
13	Has the USER Contacted Equipment Suppliers to Obtain Equipment Quotes?	**No**	Y/N					
14	Input Total Flocculation Flow Rate	**160.00**	mgd	**567.81**	ML/d			
15	Conversion of Total Flocculation Flow Rate	111,111.11	gpm	7,010.02	L/s			
16	Conversion of Total Flocculation Flow Rate	247.56	cfs	7.01	m3/s			
17	Input Number of Active Flocculation Trains	**4**	#					
18	Input Number of Standby Flocculation Trains	**0**	#					Typically 0.
19	Calculate Total Number of Flocculation Trains	4	#			NT		
20	Input Flocculation Detention Time	**30.00**	min					
21	Input Number of Flocculation Basin Stages per Train	**3**	#			NFS		Valid Range: 1 - 6.
22	Calculate Flocculation Basin Water Volume per Train	111,400.47	cf	3,154.51	m3			
23	Calculate Flocculation Stage Water Volume	37,133.49	cf	1,051.50	m3			
24	Select Flocculation Baffle Type	**O/U**	Type					
25	Input Flocculation Basin Influent Weir Head, If Serpentine Baffling Selected	**1.00**	ft	**304.80**	mm			
26	Calculate Flocculation Basin Influent Weir Length	0.00	ft	0.00	mm	WL		
27	Input Internal Flocculation Basin / Stage Width per Train = Lamella Plate Clarifier Train Width (W)	**40.00**	ft	**7,620.00**	mm	IBW		The Flocculation Basin / Stage Width should equal the Clarifier Stage Width. For information, the DAF Clarifier Stage Width can be found in the DAF model cell C25. Lamella Clarifier Width can be found in cell C46 of the Lamella Clarifier model.
28	Calculate Stage Length	30.47	ft	9,286.84	mm	SL		
29	Calculate Side Water Depth	30.47	ft	9,286.84	mm	SWD		Equal to Stage Length.
30	Input Flocculator Equipment Type	**HP**	Type					For VP and VT, the flocculation stage length must be less than 20-feet.
31	Calculate Horizontal Paddle Wheel Flocc Pedestal Height	15.23	ft	4,643.42	mm	FPH		
32	Number of Baffle Walls per Train	2	#					
33	Include Influent Channel?	**Yes**	Y/N					
34	Input Influent Channel Width	**5.00**	ft	**1,524.00**	mm	ICW		Valid Range: ≥ 3 ft.
35	Calculate Internal Flocculation Basin Length per Train	93.41	ft	28,470.11	mm	IBL		
36	Input Basin Freeboard	**3.00**	ft	**609.60**	mm	FB		Valid Range: 1-3 ft.
37	Calculate Basin Depth	33.47	ft	10,201.24	mm			Flocculation Basin BD should be less than or equal to lamella clarifier BD. If not, add more trains and / or more stages
38	Input Perimeter Operator Deck Walkway Width	**6.00**	ft	**1,524.00**	mm	WWW		Typically 4 to 8 ft.
39	Input Central Operator Deck Walkway Width	**10.00**	ft	**1,828.80**	mm	WWWC		Typically 8 to 12 ft.
40	Include Building over Basin?	**Yes**	Y/N					
41	Input Structure Depth of Burial	**6.00**	ft	**0.00**	mm			
42	Input Cutback Slope	**1.50**	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
43	Input Over Excavation Depth	**1.00**	ft	**0.00**	mm			
44	For Horizontal Paddle Wheel, Input Number of Reels per Stage	**6**	#			NRS		
45	Calculate Number of Flocculation Basin Pedestal Supports	7						
46	Distance between Reel and Pedestal	3.00	in	76.20	mm			
47	Conversion from Inches to Feet	0.25	ft	76.20	mm	RPW		
48	Width of Pedestal	12.00	in	304.80	mm			
49	Conversion from Inches to Feet	1.00	ft	304.80	mm	PW		
50	Calculate Reel Length	5.00	ft	1,524.00	mm	RL	**Warning! Reel length outside valid range.**	Valid Range: 6 to 20 ft.
51	Calculate Reel Diameter	28.47	ft	8,677.24	mm	RD		
52	For Vertical Paddle Wheel or Vertical Turbine, Calculate Number of Mixers per Stage	0	#					
53	For Vertical Paddle Wheel or Vertical Turbine, Calculate Number of Mixers per Train	0	#					
54	For Vertical Paddle Wheel or Vertical Turbine, Calculate Total Number of Mixers per All Trains	0	#					
55	For Vertical Paddle Wheel or Vertical Turbine, Calculate Mixer Diameter, Each	0.00	ft	0.00	mm	MD		
56	For Vertical Paddle Wheel or Vertical Turbine, Calculate Distance Between Mixers	0.00	ft	0.00	mm	DBM		
57	Input Stage 1 Velocity Gradient	**60.00**	sec-1					
58	Input Stage 2 Velocity Gradient	**40.00**	sec-1					
59	Input Stage 3 Velocity Gradient	**20.00**	sec-1					
60	Input Stage 4 Velocity Gradient	**0.00**	sec-1					
61	Input Stage 5 Velocity Gradient	**0.00**	sec-1					
62	Input Stage 6 Velocity Gradient	**0.00**	sec-1					
63	Input Wire to Water Flocculation Energy Input Efficiency	**75.00%**						

	B	C	D	E	F	G	H	I
64	Input min water temperature	32.00	degrees F	0.00	degrees C			Valid Range: 0 - 40 deg C.
65	Dynamic (Absolute) Viscosity of Water	0.000037	lb•s/sf	0.001792	Pa•s			Reference: *Viscosity of Liquid Water in the Range -8°C to 150°C*, J. Phys. Chem. Ref. Data, Vol. 7, No. 3, 1978 (Eqn. 15).
66	Calculate Stage 1 Power per Mixer	13.00	hp	9.69	kW			
67	Calculate Stage 2 Power per Mixer	6.00	hp	4.47	kW			
68	Calculate Stage 3 Power per Mixer	2.00	hp	1.49	kW			
69	Calculate Stage 4 Power per Mixer	0.00	hp	0.00	kW			
70	Calculate Stage 5 Power per Mixer	0.00	hp	0.00	kW			
71	Calculate Stage 6 Power per Mixer	0.00	hp	0.00	kW			
72								
73	Electrical User Inputs and Sizing Requirements:							
74	Is this a "Critical" Facility (requiring standby power)?	Yes	Y/N					
75	Is there SWGR?	No						
76								MCC
77	**Item**	**Quantity**	**HP per Each**	**AFD's Required?**	**MCC Spaces for Motor Starters**	**MCC Spaces for AFD's less than 50hp)**	**MCC Spaces for Breakers**	**Total MCC Spaces**
78	Flocculation Mixers Stage 1 (total facility)	4.00	13.00	Yes	0.00	16.00	8.00	
79	Flocculation Mixers Stage 2 (total facility)	4.00	6.00	Yes	0.00	16.00	8.00	
80	Flocculation Mixers Stage 3 (total facility)	4.00	2.00	Yes	0.00	12.00	8.00	
81	Flocculation Mixers Stage 4 (total facility)	0.00	0.00	No	0.00	0.00	0.00	
82	Flocculation Mixers Stage 5 (total facility)	0.00	0.00	No	0.00	0.00	0.00	
83	Flocculation Mixers Stage 6 (total facility)	0.00	0.00	No	0.00	0.00	0.00	
84	User Defined Item #1	0.00	0.00	No	0.00	0.00	0.00	
85	User Defined Item #2	0.00	0.00	No	0.00	0.00	0.00	
86	User Defined Item #3	0.00	0.00	No	0.00	0.00	0.00	
87	**TOTAL**		**84.00**		**0.00**	**44.00**	**24.00**	**68.00**
88								
89	Electrical Equipment Widths:							
90	**Equipment**	**Depth (ft)**						
91	MCC	1.67						
92	Small AFD's	0.00						
93	Large AFD's	0.00						
94	Switchgear	0.00						
95	**Maximum Depth**	**1.67**						
96								
97	Clear Distances:							
98	**Clear Distance**	**Width**	**Length**	**Comment**				
99	CD1		3.00	Clear Distance between wall and MCC	Typically 3 feet			
100	CD2		1.00	Clear Distance between MCC and Small AFD	Typically 1 foot			
101	CD3		0.00	Clear Distance between Small AFD and Large AFD	Typically Zero			
102	CD4		0.00	Clear Distance between Large AFD and Switchgear	Typically Zero			
103	CD5		0.00	Clear Distance between Switchgear and Contingency Space	Typically Zero			
104	CD6	4.00		Clear Distance behind Switchgear (If				
105	CD7	3.00		Clear Distance in front of Equipment	Typically 3 feet			
106	Contingency Length		0.00	Contingency length	Typically Zero			
107								
108	Electric Room Length (ft):							
109	CD1	3.00						
110	MCC	20.00						
111	CD2	1.00						
112	Small AFD's	0.00						
113	CD3	0.00						
114	Large AFD's	0.00						
115	CD4	0.00						
116	Swithgear	0.00						
117	CD5	0.00						
118	Contingency	0.00						
119	**Total Length**	**24.00**						
120								
121	Electric Room Width (ft):							
122	CD6	0.00	If there is no switchgear, this distance will be Zero.					
123	Maximum Equipment Depth	1.67						
124	CD7	3.00						
125	**Total Width**	**4.67**						
126								
127	**Estimating Dimensions (per trian):**	**Value English**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Red Flags**	**Comment**
128								
129	Influent Channel:							
130	Slab on Grade:							Use Wall Thickness Spreadsheet to Adjust Based on Overall Wall Height and Depth of Burial
131	Concrete Thickness	24.00	in	609.60	mm			Model based on 24"
132	Concrete Thickness	2.00	ft	609.60	mm	TICS0G		
133	SOG Length	8.50	ft	2,590.80	mm			
134	SOG Width	171.50	ft	52,273.20	mm			
135	Channel Walls:							Use Wall Thickness Spreadsheet to Adjust Based on Overall Wall Height and Depth of Burial
136	Concrete Thickness	18.00	in	457.20	mm			Model based on 18"
137	Concrete Thickness	1.50	ft	457.20	mm	TWIC		
138	Wall Length	335.00	ft	102,108.00	mm			
139	Wall Height	33.47	ft	10,201.24	mm			
140	Elevated Slab:							
141	Concrete Thickness	12.00	in	304.80	mm			Model based on 12"

	B	C	D	E	F	G	H	I
142	Concrete Thickness	1.00	ft	304.80	mm			
143	Elevated Slab Length	8.00	ft	2,438.40	mm			
144	Elevated Slab Width	167.50	ft	51,054.00	mm			
145								
146	Flocculation Basin:							
147	Slab on Grade:							Use Wall Thickness Spreadsheet to Adjust Based on Overall Wall Height and Depth of Burial
148	Concrete Thickness	24.00	in	609.60	mm			Model based on 24"
149	Concrete Thickness	2.00	ft	609.60	mm	TFBSOG		
150	SOG Length	94.91	ft	28,927.31	mm			
151	SOG Width	171.50	ft	52,273.20	mm			
152	Basin Walls:							Use Wall Thickness Spreadsheet to Adjust Based on Overall Wall Height and Depth of Burial
153	Concrete Thickness	18.00	in	457.20	mm			Model based on 18"
154	Concrete Thickness	1.50	ft	457.20	mm	TWFB		
155	Wall Length	492.03	ft	149,970.56	mm			If flocc basin shares a common wall with downstream facility, then common wall is counted with downstream facility.
156	Wall Height	33.47	ft	10,201.24	mm			
157	Baffle Walls:							
158	Concrete Thickness	12.00	in	304.80	mm			Model based on 12"
159	Concrete Thickness	1.00	ft	304.80	mm	BWTF		
160	Wall Width per Train	40.00	ft	12,192.00	mm	BWL		
161	Quantity of Over Baffle Walls per Train	1	#					
162	Quantity of Under Baffle Walls per Train	1	#					
163	Quantity of Under Baffle Walls per Train	0	#					
164	Over Baffle Wall Length per Facility	160.00	ft	48,768.00	mm			
165	Under Baffle Wall Length per Facility	160.00	ft	48,768.00	mm			
166	Serpentine Baffle Wall Length per Facility	0.00	ft	0.00	mm			
167	Over Baffle Wall Height	28.47	ft	8,677.24	mm			Assumes top of wall 2 ft below WSE.
168	Under Baffle Wall Height	32.47	ft	9,896.44	mm			Assumes bottom of wall 1 ft above basin floor.
169	Serpentine Baffle Wall Height	0.00	ft	0.00	mm			
170	Elevated Slab:							
171	Concrete Thickness	12.00	in	304.80	mm			Model based on 12"
172	Concrete Thickness	1.00	ft	304.80	mm	TESLC		
173	Center Walkway:							
174	Elevated Slab Width	10.00	ft	3,048.00	mm			
175	Elevated Slab Length per 2 Trains	87.41	ft	26,641.31	mm			
176	Elevated Slab Length per Facility	262.22	ft	79,923.94	mm			
177	Perimeter and Baffle Wall Walkway:							
178	Elevated Slab Width at Perimeter	7.50	ft	2,286.00	mm			Includes basin wall thickness.
179	Elevated Slab Length at Perimeter per Facility	342.31	ft	104,336.63	mm			
180	Elevated Slab Width at Baffle Wall	0.00	ft	0.00	mm			For VP and VT flocc basin mixing only.
181	Elevated Slab Length at Baffle Wall per Facility	0.00	ft	0.00	mm			For VP and VT flocc basin mixing only.
182								
183	Electrical Room Slab on Grade:							
184	Concrete Thickness	12.00	in	304.80	mm			Model based on 12"
185	Concrete Thickness	1.00	ft	304.80	mm			
186								
187	Overall Dimensions:							
188	Total Basin/Building Length	101.41	ft	30,908.51	mm	TBL		
189	Total Basin/Building Width	167.50	ft	51,054.00	mm	TBW		
190	SOG Length	103.41	ft	31,518.11	mm			
191	SOG Width	171.50	ft	52,273.20	mm			
192	Electrical Room Length	24.00	ft	7,315.20	mm			
193	Electrical Room Width	4.67	ft	1,422.40	mm			
194	Excavation Length	107.41	ft	32,737.31	mm			
195	Excavation Width	175.50	ft	53,492.40	mm			
196	Excavation Depth	9.00	ft	2,743.20	mm			
197								
198								
199	**Description**	**Quantity (English)**	**Unit (English)**	**Quantity (Metric)**	**Unit (Metric)**	**$/Unit**	**Total Cost**	**User Over-Write**
200								
201	SITEWORK:							
202	Excavation	8,463	CY	6,470.49	m3	$6.72	$56,898	
203	Imported Structural Backfill	1,396	CY	1,067.53	m3	$50.94	$71,129	
204	Native Backfill	1,273	CY	973.34	m3	$8.27	$10,522	
205	Haul Excess	7,190	CY	5,497.15	m3	$8.27	$59,427	
206	Allowance for Misc Items	5%				$197,976.24	$9,899	
207	Subtotal						$207,875	
208								
209	CONCRETE:							
210	Influent Channel:							
211	Foundation	108	CY	82.56	m3	$541.11	$58,429	
212	Walls	623	CY	476.23	m3	$880.79	$548,636	
213	Elevated Slab	50	CY	37.94	m3	$1,333.77	$66,194	
214	Flocc Basin							
215	Foundation	1,206	CY	921.79	m3	$541.11	$652,388	
216	Basin Walls	915	CY	699.46	m3	$880.79	$805,806	
217	Over Baffle Wall	169	CY	128.98	m3	$880.79	$148,592	
218	Under Baffle Wall	192	CY	147.11	m3	$880.79	$169,470	
219	Serpentine Baffle Wall	0	CY	0.00	m3	$880.79	$0	
220	Elevated Slab	127	CY	97.45	m3	$1,333.77	$170,001	
221	Flocc Bearing Supports	84	EA			$1,879.41	$157,871	

	B	C	D	E	F	G	H	I
222	Electrical Room							
223	Slab on Grade	4	CY	3.17	m3	$490.62	$2,035	
224	Allowance for Misc Items	5%				$2,779,422.33	$138,971	
225	Subtotal						$2,918,393	
226								
227	MASONRY:	High						
228	CMU Building	16,985	SF	1,578.00	m2	$198.37	$3,369,358	
229	Electrical Room	112	SF	10.41	m2	$198.37	$22,217	
230	Subtotal	17,097					$3,391,575	
231								
232	METALS:							
233	Aluminum Handrail	944	LF	287.81	m	$90.92	$85,849	
234	Stairs (1 set per basin)	171	RISERS			$495.92	$84,708	
235	Allowance for Misc Items	10%				$170,557.69	$17,056	
236	Subtotal						$187,613	
237								
238	WOODS & PLASTICS:							
239	FRP Weir	160	LF	48.77	m	$41.64	$6,662	
240	FRP Ladder	8	EA			$3,623.13	$28,985	
241	Allowance for Misc Items	5%				$35,646.88	$1,782	
242	Subtotal						$37,429	
243								
244	THERMAL & MOISTURE PROTECTION:							
245	Concrete Liner	0	SF	0.00	m2	$16.00	$0	
246	Allowance for Misc Items	10%				$0.00	$0	
247	Subtotal						$0	
248								
249	DOORS & WINDOWS:							
250	Stainless Steel Door (2' x 2') for O/U Baffling	8	EA			$1,332.36	$10,659	
251	Stainless Steel Door (7' x 2.5') for O/U Baffling	8	EA			$5,829.09	$46,633	
252	Stainless Steel Door (2' x 2') for Serpentine Baffling	0	EA			$1,332.36	$0	
253	Allowance for Misc Items	5%				$57,291.66	$2,865	
254	Subtotal						$60,156	
255								
256	EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
257	Horizontal Paddle Wheel Flocculation Mechanism (Paddles & Drives)	480	LF	146.30	m	$1,716.25	$823,801	
258	Vertical Paddle Wheel Flocculation Mechanism (Paddles & Drives)	0	EA			$0.00	$0	
259	Vertical Turbine Flocculation Mechanism (Turbines & Drives)	0	hp	0.00	kW	$0.00	$0	
260	Vertical Turbine Flocculator VFD's	0	hp	0.00	kW	$0.00	$0	
261	Fabricated Slide Gate	4	EA			$9,614.74	$38,459	
262	Allowance for Misc Items	10%				$862,259.99	$86,226	
263	Subtotal						$948,486	
264								
265	ELECTRICAL:							
266	*MCC's*							
267	Sections	12	EA			$10,730.27	$128,763	
268	*AFD's*							
269	Flocculation Mixers Stage 1 (total facility) (13 hp each)	4	EA			$10,570.28	$42,281	
270	Flocculation Mixers Stage 2 (total facility) (6 hp each)	4	EA			$9,652.35	$38,609	
271	Flocculation Mixers Stage 3 (total facility) (2 hp each)	4	EA			$9,127.82	$36,511	
272	Flocculation Mixers Stage 4 (total facility) (0 hp each)	0	EA			$8,865.56	$0	
273	Flocculation Mixers Stage 5 (total facility) (0 hp each)	0	EA			$8,865.56	$0	
274	Flocculation Mixers Stage 6 (total facility) (0 hp each)	0	EA			$8,865.56	$0	
275	*Switchgear*							
276	Units	0	EA			$49,359.23	$0	
277	Electrical Conduit & Wire	4,116	LF	1,254.56	m	$12.06	$49,635	
278	Allowance for Misc Items	10%				$295,799.75	$29,580	
279	Subtotal						$325,380	
280								
281	INSTRUMENTS & CONTROLS:							
282	Instruments							
283	Level Switch	4	EA			$695.44	$2,782	
284	Number of Analog I/O Counts	29	EA			$264.27	$7,611	
285	Number of Digital I/O Counts	72	EA			$62.59	$4,506	
286	Number of PLC's	1	EA			$13,074.33	$13,074	
287	I&C Conduit & Wire	5,360	LF	1,633.73	m	$12.06	$64,636	
288	Allowance for Misc Items	10%				$92,609.62	$9,261	
289	Subtotal						$101,871	
290								
291	**USER DEFINED ESTIMATE ITEMS:**	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
292	Item 1 Description	0.00		0.00		0.00	$0	
293	Item 2 Description	0.00		0.00		0.00	$0	
294	Item 3 Description	0.00		0.00		0.00	$0	
295	Item 4 Description	0.00		0.00		0.00	$0	
296	Item 5 Description	0.00		0.00		0.00	$0	
297	Item 6 Description	0.00		0.00		0.00	$0	
298	Item 7 Description	0.00		0.00		0.00	$0	
299	Item 8 Description	0.00		0.00		0.00	$0	
300	Item 9 Description	0.00		0.00		0.00	$0	
301	Item 10 Description	0.00		0.00		0.00	$0	
302	Item 11 Description	0.00		0.00		0.00	$0	
303	Item 12 Description	0.00		0.00		0.00	$0	
304	Item 13 Description	0.00		0.00		0.00	$0	
305	Item 14 Description	0.00		0.00		0.00	$0	
306	Item 15 Description	0.00		0.00		0.00	$0	
307	Subtotal						$0	
308								
309	Subtotal						$8,178,779	
310								
311	ALLOWANCES:		**User Override**					
312	Finishes Allowance	2.00%		$8,889,977	$177,800			
313	I&C Allowance	2.00%		$8,889,977	$177,800			
314	Mechanical Allowance	2.00%		$8,889,977	$177,800			
315	Electrical Allowance	2.00%		$8,889,977	$177,800			
316						Facility Cost Name		
317	Facility Cost	**160,000,000**	**GPD**	**$0.06**	**$8,889,977**	FCPFC01		
318	Facility Cost with Standard Additional Project Costs Added	**160,000,000**	**GPD**	**$0.07**	**$10,801,931**	FCPFC02		

	B	C	D	E	F	G	H	I
319	Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**160,000,000**	**GPD**	**$0.12**	**$18,736,610**	FCPFC03		
320	Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**160,000,000**	**GPD**	**$0.10**	**$15,420,208**	FCPFC05		
321	Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**160,000,000**	**GPD**	**$0.12**	**$18,736,610**	FCPFC06		

	B	C	D	E	F	G	H	I
1	***Dissolved Air Flotation***							
2								
3	**Is This Facility Included in My Project? No**							
4	***Assumptions:***							
5								
6	***1.) High-rate DAF based on Infilco Degremont AquaDAF.***							
7	***2.) Conventional DAF based on Parkson DAF.***							
8	***3.) Precede DAF with Flocculation with equal basin width to DAF.***							
9	***4.) Default System includes Mechanical Float Skimming.***							
10	***If this is a Seawater Desalination Application, the materials in contact with seawater need to be corrosion resistant.***							
11	**Process User Inputs**	**Value (English)**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Red Flags**	**Comment**
12	DAF SYSTEM SIZING							
13	1.) Is this a Seawater Desalination Application?	**No**	Y/N					
14	2.) Has the USER Contacted Equipment Suppliers to Obtain Equipment Quotes?	**No**	Y/N					Fixed
15	3.) Input Total Plant Flow	**160.00**	mgd	**567.81**	ML/d	Q		
16	Conversion of Total Plant Flow from MGD to GPM	111,111.11	gpm	25,236.08	m3/hr	QM		
17	4.) Input DAF Type	**Conventional**	Type			DTYP		Conventional OR High Rate
18	5.) Input Flotation Zone Surface Loading Rate	**10.00**	gpm/sf	**24.45**	m/h	FSLR		Typically, 4 to 6 gpm/sf for Conventional & 10 to 12 gpm/sf for High Rate
19	6.) Input Flotation Zone Side Water Depth	**15.00**	ft	**4,572.00**	mm	SWD		Typically 10 to 15 feet
20	Calculate Total Surface Area of Flotation Zone per Train = QM/FSLR	11,111.11	sf	1,032.26	m2	FZA		
21	7.) For Conventional DAF, Select Single Train Flotation Area from Standard Sizes	**1,395.00**	sf	129.60	m2	SCTS		
22	8.) For High Rate DAF, Select Single Train Flotation Area from Standard Sizes	**717.00**	sf	66.61	m2	SHTS		
23	Calculate Number of Trains	8	#			NT		
24	Calculate Length of Flotation Zone	46.50	ft	14,173.20	mm	FZL		
25	Calculate Width of Flotation Zone	30.00	ft	9,144.00	mm	FZW		
26	Calculate Capacity of Each Train	13,888.89	gpm	3,154.51	m3/hr	QTM		
27	9.) Input Influent Channel, Contact Zone, and Effluent Channel Velocity	**0.50**	fps	**0.15**	m/s	VEL		Typically < 0.5 fps
28	Calculate Influent Channel, Contact Zone, and Effluent Channel Length = QTM/7.48/60/VEL/FZW OR 3	3.00	ft	914.40	mm	ICL, CZLB, SBL, ECL		
29	Calculate Contact Zone Under Baffle Entry Opening Height = QTM/7.48/60/VEL/FZW OR 3	3.00	ft	914.40	mm	CZEH		
30	Calculate Contact Zone Top Length = sin(15)/cos(15)*(CZBH - CZEH) + CZLB	5.55	ft	1,690.27	mm	CZLT		
31	Effluent Collection System Plenum Height for High Rate DAF	0.00	ft	0.00	mm	PH		
32	10.) Input Effluent Collection Lateral Velocity for Conventional DAF	**2.50**	fps	**0.76**	m/s	ECVEL		Typically 2.5 fps or less
33	Number of Effluent Collection Laterals for Conventional DAF	8.00	#			NCL		
34	Calculate Effluent Collection Lateral Pipe Diameter for Conventional DAF Train	17.00	in	431.80	mm	CLD		2.5 feet lower than effluent weir
35	Calculate Effluent Collection Lateral Spacing for Conventional DAF Train	3.34	ft	1,018.03	mm	CLSP		2.5 feet lower than effluent weir
36	Calculate Contact Zone 75-Degree Exit Baffle Height =	12.50	ft	3,810.00	mm	CZBH		2.5 feet lower than effluent weir
37	Calculate Float Weir Height = SWD+PH+0.5	15.50	ft	4,724.40	mm	FWH		0.5 feet higher than effluent weir
38	Sludge Float Trough Width	1.50	ft	457.20	mm	FTW		
39	Calculate Sludge Float Trough Depth	7.00	ft	2,133.60	mm	FTD		Based on hydraulic float removal at 3 fps
40	Calculate Recycle Pumping & Compressor Gallery Length	17.58	ft	5,359.40	mm	GL		
41	11.) Input Freeboard	**3.00**	ft	**1,219.20**	mm	FB		Typically 2 to 4 feet
42	Calculate Basin Depth BD = SWD+PH+FB	18.00	ft	5,486.40	mm	BD		
43	12.) Input Structure Depth of Burial	**0.00**	ft	**1,828.80**	mm	DB		
44	13.) Is the Basin Covered?	**No**	Y/N					
45	SATURATED AIR RECYCLE SYSTEM SIZING							
46	14.) Input Grams of Air per Cubic Meter Water Treated	**10.00**	g/m3			ALR		Typically 8 to 10 g/m3
47	15.) Input Air Saturation Recycle Stream Pressure	**85.00**	psig	**586.05**	kPa	RSP		Typically 60 to 90 psig
48	Conversion of Air Saturation Recycle Stream Pressure from PSIG to kPA	586.06	kPa			RSPM		
49	16.) Input Maximum Water Temperature	68.00	degrees F	**20.00**	degrees C	WT		Valid Range: 0 - 40 deg C. Warmer water requires greater recycle ratio for a given air loading rate and recycle stream pressure.
50	Dynamic (Absolute) Viscosity of Water	0.000021	lb•s/sf	0.001002	Pa•s			Reference: *Viscosity of Liquid Water in the Range -8°C to 150°C*, J. Phys. Chem. Ref. Data, Vol. 7, No. 3, 1978 (Eqn. 15).
51	Calculate Air Dissolution at Recycle Stream Pressure & Water Temperature	117.21	mg/L			AD		See Data from air dissolution graphs worksheet
52	Calculate Air Saturation Recycle Stream Ratio = ALR/AD	0.09				ARR		
53	Calculate Number of Packed Saturators	8.00	#			#S		Equals Number of Trains
54	17.) Input Saturator Surface Loading Rate	**34.00**	gpm/sf	**83.12**	m/h			Typically 34 gpm/sf
55	18.) Input Saturator Packing Depth	**4.00**	ft	**1,219.20**	mm			Typically 4 feet or 0 feet, if No Packing
56	19.) Input Saturator Bottom Pool Depth	**3.00**	ft	**914.40**	mm			Typically 3 feet
57	20.) Input Saturator Freeboard Above Packing	**3.00**	ft	**914.40**	mm			Typically 3 feet
58	21.) Input Saturator Clear Height Above Deck	**3.00**	ft	**914.40**	mm			Typically 3 feet
59	22.) Input Saturator Inlet Velocity	**5.00**	fps	**1.52**	m/s			Typically 5 fps
60	23.) Input Saturator Outlet Velocity	**2.50**	fps	**0.76**	m/s			Typically 2.5 fps
61	Calculate Saturator Diameter	6.66	ft	2,030.39	mm	SD		
62	Calculate Saturator Height	13.00	ft	3,962.40	mm	SH		
63	Calculate Saturator Inlet Header Diameter	9.84	in	249.91	mm	SIHD		
64	Calculate Saturator Inlet Lateral Diameter	6.96	in	176.72	mm	SILD		
65	Calculate Saturator Outlet Header Diameter	13.91	in	353.43	mm	SOHD		
66	Calculate Saturator Outlet Half-Lateral Diameter	9.84	in	249.91	mm	SOHLD		
67	Calculate Number of Saturator Sub-Laterals	5.00	#			NSL		
68	Calculate Saturator Sub Lateral Diameter	6.22	in	158.06	mm	SOSLD		
69	Calculate Saturator Outlet Nozzle Header Diameter	4.92	in	124.96	mm	SODH		
70	Calculate Number of Recycle Pumps	8.00	#			#RP		Equals Number of Trains

	B	C	D	E	F	G	H	I
71	Calculate Recycle Pump Capacity, each = QTM*ARR	1,184.94	gpm	269.13	m3/hr	RPC		
72	Calculate Recycle Pump Power, each = RPC*RSP/1714/0.75	79.00	hp	58.91	kW	RPP		
73	24.) Select Standard Recycle Pump Horsepower	55.00	hp	41.01	kW			Based on ITT Goulds Model 3196 Horizontal End Suction Centifugal Pump
74	Calculate Recycle Pump Suction Diameter	8.00	in	203.20	mm	RPS		
75	Calculate Recycle Pump Discharge Diameter	6.00	in	152.40	mm	RPD		
76	Calculate Recycle Pump Length	5.58	ft	1,701.80	mm	RPL		
77	Calculate Recycle Pump Width	2.00	ft	609.60	mm	RPW		
78	Calculate Recycle Pump Height	3.25	ft	990.60	mm	RPH		
79	Calculate Number of Compressors	2.00	#			#C		1 Duty and 1 Standby
80	25.) Input Compressor Inlet Air Density	0.08	lb/cf	1.28	kg/m3	IAD		0.075 for Dry Air @ Sea Level and 70 deg F
81	Calculate Compressor Capacity, each = AD*Q*ARR*8.3454/1440/IAD	115.91	icfm	3.28	m3/min	CC		
82	26.) Select Standard Rotary Screw Compressor Capacity	116.00	scfm	3.28	m3/min			Based on Gardner Denver Rotary Screw Compressor
83	Calculate Compressor Power	30.00	hp	22.37	kW	CHP		
84	Calculate Compressor Length	3.96	ft	1,206.50	mm	CL		
85	Calculate Compressor Width	2.46	ft	749.30	mm	CW		
86	Calculate Compressor Height	5.42	ft	1,651.00	mm	CH		
87	27.) Input Minimum Number of DAF Trains On-Line to Size Compressor Receiver Storage Volume	1.00	#			MDT		
88	28.) Input Maximum Number of Compressor Motor Starts per Hour	3.00	#			MMS		Typically 3 to 4
89	Calculate Minimum Compressed Air Use	14.49	icfm	0.41	m3/min	MCA		
90	29.) Input Compressed Air Density	0.63	lb/cf	10.09	kg/m3	CAD		0.626 for Dry Air @ 120 psig and 120 deg F
91	Calculate Minimum Receiver Storage Volume for 125 psig/120 deg F Air	1,926.79	gal	7.29	m3	TRSV		Calculated
92	Calculate Number of Receivers	2.00	#			#R		1 Duty and 1 Standby
93	30.) Select Standard Receiver Volume	2,180.00	gal	8.25	m3	SRSV		
94	Calculate Receiver Storage Diameter, each	5.00	ft	1,524.00	mm	RSD		
95	Calculate Receiver Storage Height w/1-Foot Stand, each	6.00	ft	1,828.80	mm	RSH		
96	Calculate Receiver Storage Length, each	16.00	ft	4,876.80	mm	RSL		
97	**(1) PARKSON CONVENTIONAL DAF SINGLE TRAIN STANDARD FLOTATION AREA (SF)**	**(2) Flotation Basin Width (ft)**	**(3) Flotation Basin Length (ft)**	**(4) Budget Quote**	**(5) Number of Saturator Outlet Quarter Laterals**	**(6) Number of 14-inch Perforated Effluent Collection Laterals on 4-foot Centers**	**(1) IDI High Rate AQUADAF Single Train Standard Flotation Area (SF)**	**(2) Flotation Basin Width (ft)**
98	720	24	30	$ 376,505.00	3.0	8.0	65	8.0
99	920	27	34	$ 455,513.00	4.0	8.0	110	12.0
100	1040	29	36	$ 502,918.00	4.0	8.0	162	16.0
101	1150	30	38.5	$ 546,372.00	4.0	8.0	222	20.0
102	1395	30	46.5	$ 643,157.00	4.0	8.0	292	24.0
103							369	28.0
104							463	32.0
105							581	36.0
106							717	40.0
107	**Process User Inputs**	**Value (English)**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Red Flags**	**Comment**
108	Estimating Dimensions (per Train):							
109	DAF Basin							
110	Slab on Grade:							
111	Concrete Thickness	24.00	in	609.60	mm			Model based on18"
112	Concrete Thickness	2.00	ft	609.60	mm	TLCS0G		
113	SOG Width (2 + PWLC + FZW + PWLC + 2)	38.00	ft	11,582.40	mm	WLCSOG		Assumes no common wall
114	SOG Length (IWLC + CL + IWLC + CL + CZBH/2*SIN15 + FZL + IWLC + STW + IWLC + CL + IWLC + CL + PWLC + 2)	74.31	ft	22,651.00	mm	LLCSOG		
115	Perimeter Walls:							
116	Concrete Thickness	24.00	in	609.60	mm			Model based on 16"
117	Concrete Thickness	2.00	ft	609.60	mm	PWLC		
118	Wall Length = (L + L + W)	178.63	ft	54,446.00	mm			
119	Wall Height = BD	18.00	ft	5,486.40	mm			
120	Internal Walls:							
121	Concrete Thickness	15.00	in	381.00	mm			Model based on 12"
122	Concrete Thickness	1.25	ft	381.00	mm	IWLC		
123	Wall Length = (5 * FZW)	150.00	ft	45,720.00	mm			
124	Wall Height = BD - FB	15.00	ft	4,572.00	mm			
125	Elevated Slab:							
126	Concrete Thickness	18.00	in	457.20	mm			Model based on 12"
127	Concrete Thickness	1.50	ft	457.20	mm	TESLC		
128	Elevated Slab Length = (L + L + W + W)	212.63	ft	64,809.20	mm			Assumes Perimeter Walkway on all 4 sides
129	Elevated Slab Width	6.00	ft	1,828.80	mm	TESIC		Fixed
130								
131	Gallery							
132	Slab on Grade:							
133	Concrete Thickness	24.00	in	609.60	mm			Model based on 18"
134	Concrete Thickness	2.00	ft	609.60	mm	TECS0G		
135	SOG Width (Match DAF Basin)	38.00	ft	11,582.40	mm	WECSOG		
136	SOG Length (2 + TWEC + GL + TWEC + 2)	25.58	ft	7,797.80	mm	LECSOG		
137	Walls:							
138	Concrete Thickness	24.00	in	609.60	mm			Model based on 16"
139	Concrete Thickness	2.00	ft	609.60	mm	TWEC		
140	Wall Length = (GL + W + GL)	65.17	ft	19,862.80	mm			
141	Wall Height = BD	18.00	ft	5,486.40	mm			
142	Elevated Slab:							
143	Concrete Thickness	15.00	in	381.00	mm			Model based on 12"
144	Concrete Thickness	1.25	ft	381.00	mm	TESEC		
145	Elevated Slab Width (Match DAF Basin)	34.00	ft	10,363.20	mm			

	B	C	D	E	F	G	H	I
146	Elevated Slab Length (TWEC + GL + TWEC)	21.58	ft	6,578.60	mm	TESIC		
147								
148	Overall Dimensions:							
149	SOG Width	38.00	ft	11,582.40	mm	SOGW		
150	SOG Length	99.90	ft	30,448.80	mm	SOGL		
151	Building Width (SOGW - 4)	34.00	ft	10,363.20	mm			
152	Building Length (SOGL - 4)	95.90	ft	29,229.60	mm			
153	Excavation Width	42.00	ft	12,801.60	mm			
154	Excavation Length	103.90	ft	31,668.00	mm			
155	Excavation Depth (DB + TLCSOG + 1)	3.00	ft	914.40	mm			
156								
157								
158	**Description**	**Quantity (English)**	**Unit (English)**	**Quantity (Metric)**	**Unit (Metric)**	**$/Unit**	**Total Cost**	**User Over-Write**
159	SITEWORK:							
160	Excavation	4,780.05	CY	3,654.61	m3	*$6.72*	$32,137	
161	Imported Structural Backfill	1,292.95	CY	988.53	m3	*$50.94*	$65,865	
162	Native Backfill	389.06	CY	297.46	m3	*$8.27*	$3,216	
163	Haul Excess	4,390.99	CY	3,357.16	m3	*$8.27*	$36,293	
164	Allowance for Misc Items	5%				$137,510.04	$6,876	
165	Subtotal						$144,386	
166								
167	CONCRETE:							
168	*DAF Basin:*							
169	Foundation	1,673.45	CY	1,279.44	m3	*$541.11*	$905,512	
170	Perimeter Walls	1,905.37	CY	1,456.76	m3	*$880.79*	$1,678,238	
171	Internal Walls	833.33	CY	637.13	m3	*$1,333.77*	$1,111,472	
172	Elevated Slab	567.01	CY	433.51	m3	*$490.62*	$278,184	
173	*Gallery:*							
174	Foundation	576.10	CY	440.46	m3	*$541.11*	$311,730	
175	Walls	695.11	CY	531.45	m3	*$880.79*	$612,249	
176	Elevated Slab	271.79	CY	207.80	m3	*$1,333.77*	$362,505	
177	Allowance for Misc Items	5%				$5,259,890.81	$262,995	
178	Subtotal						$5,522,885	
179								
180	MASONRY:	High						
181	CMU Building	0.00	SF	0.00	m2	*$198.37*	$0	
182	Subtotal						$0	
183								
184	METALS:							
185	Aluminum Handrail	1,023.18	LF	311.87	m	*$90.92*	$93,026	
186	Additional Handrail with NO Building	735.80	LF	224.27	m	*$90.92*	$66,897	
187	Aluminum Grating	360.00	SF	33.45	m2	*$90.92*	$32,731	
188	Stairs (1 per basin)	216.00	RISERS			*$495.92*	$107,118	
189	Allowance for Misc Items	10%				$299,771.53	$29,977	
190	Subtotal						$329,749	
191								
192	WOODS & PLASTICS:							
193	FRP Ladder	16.00	EA			*$1,757.20*	$28,115	
194	Allowance for Misc Items	5%				$28,115.24	$1,406	
195	Subtotal						$29,521	
196								
197	THERMAL & MOISTURE PROTECTION:							
198	Concrete Liner	0.00	SF	0.00	m2	**$16.00**	$0	
199	Allowance for Misc Items	10%				$0.00	$0	
200	Subtotal						$0	
201								
202	EQUIPMENT:							
203								**Budgetary Quote: (CPES will automatically add Installation Factor)**
204	Conventional DAF Equipment Scope of Supply per DAF Unit	8.00	EA			***$1,236,757.07***	$9,894,057	
205	Single Train Flotation Area (sf):	1,395.00						
206	Surface Skimmer, 304 SS reciprocating type mechanisms and							
207	Sludge Beach, 304SS with mounting hardware.							
208	Air Dispersion System, SCH 10 304SS vertical riser with isolation valves and lateral header with nozzles, for 10% recycle @ design flow.							
209	Recycle Pumps, base mounted Goulds Model 3196, suction and discharge wafer style isolation valves, check valves and magnetic flow meter with transmitter, One installed spare.							
210	Underflow Collection Pipes, SCH 80 PVC with 304 SS support brackets.							
211	Effluent Level Control Weir, FRP or SS with mounting hardware							
212	Sludge hopper spray system with spray nozzles and auto valve.							
213	Packed Tower Saturator with level control valve, outlet with isolation valve, air pressure controls and air filters with isolation valving.							
214	Duplex Screw Compressor and air receiver, each @ 100% of air required.							
215	Control Panel with PLC for process control and HOA operations.							
216	Lot of Isolation Valves, Anchors and Fasteners for supplied equipment.							
217	Submittals, Startup Services and IOM Manual							
218								
219	High Rate DAF Equipment Scope of Supply per DAF Unit	8.00	EA			***$0.00***	$0	
220	Single Train Flotation Area (sf):	717.00						
221	Mechanical sludge scraper system.							
222	Sludge Beach, 304SS with mounting hardware.							
223	Air Dispersion System, SCH 10 304SS vertical riser with isolation valves and lateral header with nozzles, for 10% recycle @ design flow.							
224	Recycle Pump, vertical turbine pumps per unit with VFD, butterfly isolation and check valves.							
225	Aluminum false flooring and support columns.							

	B	C	D	E	F	G	H	I
226	Effluent Level Control Weir, FRP or SS with mounting hardware							
227	Sludge hopper spray system with spray nozzles and auto valve.							
228	Unpacked Saturator with level control valve, outlet with isolation valve, air pressure controls and air filters with isolation valving.							
229	Rotary Screw Compressor and air receiver system.							
230	Control Panel with PLC for process control and HOA operations.							
231	Lot of Isolation Valves, Anchors and Fasteners for supplied equipment.							
232	Submittals, Startup Services and IOM Manual							
233	Allowance for Misc Items	10%				$9,894,056.60	$989,406	
234	Subtotal						$10,883,462	
235								
236	INSTRUMENTS & CONTROLS:							
237	Turbidimeters	8.00	EA			*$11,714.68*	$93,717	
238	Allowance for Misc Items	5%				$93,717.45	$4,686	
239	Subtotal						$98,403	
240								
241	MECHANICAL:							
242	Mud Valves	24.00	EA			*$2,252.82*	$54,068	
243	Allowance for Misc Items	10%				$54,067.76	$5,407	
244	Subtotal						$59,475	
245								
246	**USER DEFINED ESTIMATE ITEMS:**	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
247	Item 1 Description	0.00		0.00		0.00	$0	
248	Item 2 Description	0.00		0.00		0.00	$0	
249	Item 3 Description	0.00		0.00		0.00	$0	
250	Item 4 Description	0.00		0.00		0.00	$0	
251	Item 5 Description	0.00		0.00		0.00	$0	
252	Item 6 Description	0.00		0.00		0.00	$0	
253	Item 7 Description	0.00		0.00		0.00	$0	
254	Item 8 Description	0.00		0.00		0.00	$0	
255	Item 9 Description	0.00		0.00		0.00	$0	
256	Item 10 Description	0.00		0.00		0.00	$0	
257	Item 11 Description	0.00		0.00		0.00	$0	
258	Item 12 Description	0.00		0.00		0.00	$0	
259	Item 13 Description	0.00		0.00		0.00	$0	
260	Item 14 Description	0.00		0.00		0.00	$0	
261	Item 15 Description	0.00		0.00		0.00	$0	
262	Subtotal						$0	
263								
264	Subtotal						$17,067,881	
265								
266	ALLOWANCES:		**User Override**					
267	Finishes Allowance	2.00%		$20,318,906	$406,378			
268	I&C Allowance	4.00%		$20,318,906	$812,756			
269	Mechanical Allowance	6.00%		$20,318,906	$1,219,134	Includes Drain, USL, SA (Sample) piping		
270	Electrical Allowance	4.00%		$20,318,906	$812,756			
271						Facility Cost Name		
272	**Facility Cost**	**160,000,000**	**GPD**	**$0.13**	**$20,318,906**	CDFFC01		
273	**Facility Cost with Standard Additional Project Costs Added**	**160,000,000**	**GPD**	**$0.15**	**$24,688,863**	CDFFC02		
274	**Facility Cost with Standard Additional Project Costs and Contractor Markups Added**	**160,000,000**	**GPD**	**$0.27**	**$42,824,344**	CDFFC03		
275	**Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)**	**160,000,000**	**GPD**	**$0.22**	**$35,244,385**	CDFFC05		
276	**Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added**	**160,000,000**	**GPD**	**$0.27**	**$42,824,344**	CDFFC06		

Me

Pall Microfiltraion - Large Systems Greater Than 5 mgd

Is This Facility Included in My Project? Yes

Assumptions:

Applicable for Pall 8-inch Rack Systems, Pall 12-inch Rack Systems, Pall 48 Module Racks and Pall 80 Module Racks

Process User Inputs:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Comment	Red Flags	User Comments
Input Pressurized Membrane Type	Pall - 12 inch Rack Train	Type				Select "48 Module Rack" or "80 Module Rack" only for applications with < 5 mgd. Select "8-inch Rack" or "12-inch Rack" for applications > 5 mgd.		
Input Design Water Temperature	37.40	degrees F	3.00	degrees C				
Input Permeate Capacity (at Design Water Temperature)	160.00	mgd	567.81	ML/d				
Input Instantaneous Flux Rate (at Design Water Temperature)	53.00	gfd	89.98	Lmh		Should be endorsed by Senior Technical Consultant		
Input % of Feedflow Recirculation	3.00%					Should be endorsed by Senior Technical Consultant. Typically 0%. Pall is the only mfr to practice recirculation. Applicable range: 10% - 25%	OKAY	
Input Feedwater Recovery at Design Flow	97.00%					Typically 15 to 40 minutes		
Calculate Numer of Equal Capacity Subsystems	6.00	#				Maximum capacity per subsystem is 30 mgd		
Capacity of Each Subsystem	26.67	mgd	100.94	ML/d				
Treatment Trains per Subsystem:							Sizing Calculations per Subsystem	
Input Active Membrane Trains	9.00	#						
Input Number of Arrays per Skid	1.00	#				Pall - Multiple Rack Train: 1-3, Other Pall Selections: 1	OKAY	
Calculate Suggested Number of Standby Membrane Treatment Trains	1.00	#						
Input Number of Standby Membrane Treatment Trains	1.00	#						
Calculate Total Number of Membrane Treatment Trains	10.00	#						
Membrane Module Area	538.00	sf	49.98	m2		look up table		
Calculate Total Number of Membrane Modules	1,053.00	#						
Calculate Total Number of Membrane Modules per TreatmentTrain	117.00	#				Valid Ranges: 48 Module Rack 28 to 48, 80 Module Rack 48 to 80, 8-inch Rack 20 to 104, 12-inch Rack 20 to 132	OKAY	
Calculate Potential Number of Open Spaces for Future Membrane Modules per Cassette/Rack	15.00	#						
Calculate Percent Available Capacity Expansion on Existing Cassettes/Racks	12.82%							
Input Number of Spaces Reserved for Future Membrane Train	1.00	#				Suggest minimum 10% excess space for future expansion by either adding modules to existing trains, or space for a new train		
Calculate Total Number of Membrane Modules	1,170.00	#						
Calculate Total Installed Membrane Area	629,460.00	sf	58478.75	m2				
System Productivity Information:								
Calculate Minutes per Day Available for Filtration/Backwash Cycles	1,393.00	min						
Calculate Number of Filter/Backwash Cycles per Rack per Day	45.98	#						
Calculate Filtration Duration	28.63	min						
Calculate System On-line Factor	91.41%							
Calculate Gross Filtrate Production	27.31	mgd	103.40	ML/d				
Calculate Filtrate Flow Rate per Membrane Module	19.80	gpm	0.00	Lmh				
Backwash Information:								
Input Air Only Duration	0.00	min				Typical Range: 0.25 to 0.5		
Input Simultaneous Air + Reverse Filtration Duration	1.00	min				Typical Range: 0.5 to 1.5		
Input Feed Flush Duration	0.50	min				Typical Range: 0.25 to 0.75		
Pnuematic Valve Open and Close Time	10.00	sec				Fixed		
Air Flow per Membrane Module	3.00	scfm	0.08	m3/min		Look up table		This should be a user input witrh a default value of 3
RF Flow per Membrane Module	8.00	gpm	30.28	L/min		Fixed		This should be a user input with a default value of 8
FF Flow per Membrane Module	18.00	gpm	68.14	L/min		Fixed		This should be a user input with a default value of 18.
Calculate Feed to Waste per Module per Backwash Event	8.00	gal	30.28	L				
Calculate Filtrate to Waste per Module per Backwash Event	9.00	gal	34.07	L				
Calculate Total Water per Module per Backwash Event	17.00	gal	64.35	L				
Total Backwash Duration	1.67	min						
Chemically Enhanced Backwash (CEB) or Enhanced Flux Maintenance (EFM) Information:								
Input CEB/EFM Frequency	2.00	days				Typically 7 days, can be as often as 0.5 days		
Input CEB/EFM Duration	30.00	min				Typically 15 - 30 min		
Input Drain and Rinse Time	0.00	min				Typically 15 - 30 min		
Input Filtrate Used per Membrane Module	20.00	gal	75.71	L		Obtain from membrane manufacturer. Default is 20		
Pnuematic Valve Open and Close Time	10.00	sec				Fixed		
Is CEB/EFM Heated?	Yes	Y/N				Only Pall provides heated CEB/EFM	OKAY	
Is Sodium Hypochlorite CEB/EFM Conducted?	Yes	Y/N				Used for Organic Foulants		
Input Concentration of Sodium Hypochlorite for CEB/EFM	500.00	mg/L				Typically 50 - 500 mg/L		
Input Total Time of Backpulsing per Sodium Hypochlorite CEB/EFM	2.00	min				Typically 2 min		Doesn't apply for Pall systems
Is Citric Acid CEB/EFM Conducted?	No	Y/N				Used for Inorganic Foulants		
Input Concentration of Citric Acid for CEB/EFM	5,000.00	mg/L				Typically 5,000 - 20,000 mg/L		
Input Total Time of Backpulsing per Citric Acid CEB/EFM	2.00	min				Typically 2 min		Doesn't apply for Pall systems
Calculate Number of CEB/EFM Tanks Required	1.00	#			NCEBT			
Clean-In-Place (CIP) Information:								
Input CIP Frequency (both NaOCl/NaOH and Acid)	30.00	days				Should be endorsed by Senior Technical Consultant		
Input Sodium Hypochlorite/Sodium Hydroxide Duration	180.00	min				Typically 3 hours		
Input NaOCl/NaOH Filtrate Used per Membrane Module	20.00	gal	75.71	L		Typically 3 gpm/module		
Input Citric Acid Duration	180.00	min				Typically 2 hours		
Input Citric Acid Filtrate Used per Membrane Module	20.00	gal	75.71	L		Typically 3 gpm/module		
Integrity Testing Cycle Information:								

Input Integrity Test Frequency	1.00	days				Typical Range: 0.33 to 6	
Input Integrity Test Duration	20.00	min				Typical Range: 15 to 30 minutes	
Pnuematic Valve Open and Close Time	10.00	sec				Fixed	
Average Daily Operating Mode Times:							
Calculate Permeating Time per Day	1,316.36	min					
Calculate Air Only Time Total per Day (min)	0.00	min					
Calculate Simulatenous Air and Reverse Filtration Total Time Per Day	45.98	min					
Calculate Feed Flush Total Time per Day	22.99	min					
Calculate AS Valve Open/Close Time per Day	15.33	min					
Calculate CEB/EFM Time Total per Day	15.00	min					
Calculate CEB/EFM Valve Open/Close Time per Day	15.00	min					
Calculate Total Clean-In-Place Time per Day	12.00	min					
Calculate Integrity Testing Time per Day	20.00	min					
Calculate Integrity Testing Valve Open/Close Time per Day	0.33	min					
Calculate Daily Flows per Membrane Module:							
Calculate Total Gross Membrane Filtrate	26,065.85	gpd	98669.99	L/d			
Calculate Total Membrane Filtrate to Waste	617.85	gpd	2338.81	L/d			
Calculate Total Net Membrane Filtrate	25,448.01	gpd	96331.18	L/d			
Calculate Total Membrane Feed to Waste	413.83	gpd	1566.51	L/d			
Calculate Total Membrane Waste	1,031.68	gpd	3905.33	L/d			
Calculate Total Membrane Feed	26,479.68	gpd	100236.51	L/d			
Calculate Total Daily Feed Volume	27.88	mgd	105.55	ML/d			
Input Minimum Design Water Temperature	37.40	degrees F	3.00	degrees C			
Calculate Finished Water Capacity at Minimum Water Temperature	160.00	mgd	605.67	ML/d		Verify this is sufficient to meet cold water demands, if not increase design finished water capacity	
Calculate AS Time Total per Day	45.98	min	45.98				
Input Feed Forward/ Inst. Permeate Flow Ratio	1.00					Typical Range: 0.5 to 1.5	
Reverse Filtration (RF) Cycle Information:							
Input RF Frequency	0.50	hours				Typical Range: 0.25 to 0.75	
Input RF Duration	0.25	min				Typical Range: 0.25 to 0.5	
Pnuematic Valve Open or Closure Time	10.00	sec				Fixed	
RF Rate/Inst. Permeate Flow Rate	0.91					Look up table	
Membrane Train Dimensions:							
Train Length	33.21	ft	10121.90	mm	MTL	Look up table	
Train Width	5.92	ft	1803.40	mm	MTW	Look up table	
Train Height	11.50	ft	3505.20	mm	MTH	Look up table	
Membrane Train Concrete Pad Length	34.21	ft	10426.70	mm			
Membrane Train Concrete Pad Width	6.92	ft	2108.20	mm			
Clear Distance from Wall to End of Membrane Train	3.00	ft	914.40	mm	MTCD1	Look up table	
Clear Distance Between Membrane Trains Side by Side	3.00	ft	914.40	mm	MTCD2	Look up table	
Clear Distance above Top of Train	1.00	ft	304.80	mm	MTCH	Look up table	
Calculate Total Liquid Volume per Train	2,461.00	gal	9.32	m3		Look up table	
Membrane Train Pipe Trench Area Requirements							
Calculate Membrane Influent Header Diameter	42.00	in	1066.80	mm	FWIH		
Calculate Reverse Filtration Header Diameter	10.00	in	254.00	mm			
Calculate CIP Header Diameter	14.00	in	355.60	mm			
Calculate Backpulse Air Header Diameter	6.00	in	152.40	mm			
Calculate Common Permeate Header Diameter	42.00	in	1066.80	mm	MIH		
Calculate Backwash Waste Pipe Diameter	14.00	in	355.60	mm	SBWW		
Input Clear Distance Between Pipe Headers and Pipe Trench Walls	1.00	ft	304.80	mm		Typically 1 foot	
Input Clear Distance Between Stacked CIP and Backpulse Air Headers and Adjacent Pipe	3.00	ft	914.40	mm		Typically 2*max pipe diameter	**OKAY**
Input Clear Distance Between Pipe Headers and Pipe Trench Bottom	0.50	ft	152.40	mm		Typically 0.5 foot	
Input Clear Distance Between Pipe Headers and Top of Pipe Trench	1.00	ft	304.80	mm		Typically 1 foot	
Calculate Membrane Train Effluent Pipe Trench Width	0.00	ft	0.00	mm	PTW1	Not used for Pall Systems	
Calculate Membrane Train Effluent Pipe Trench Depth	0.00	ft	0.00	mm	PTD1	Not used for Pall Systems	
Calculate Membrane Train Influent Pipe Trench Width	18.17	ft	5537.20	mm	PTW2		
Calculate Membrane Train Influent Pipe Trench Depth	18.67	ft	5689.60	mm	PTD2		
Strainers:							**Sizing Calculations per Subsystem**
Are Strainers Included with this Facility?	Yes	Y/N					
Input Number of Equal Capacity Active Strainers	4.00	#				Per subsystem	**OKAY**
Input Number of Standby Strainers	1.00	#				Per subsystem	**OKAY**
Calculate Maximum Capacity per Strainer	5,082.86	gpm	320.68	L/s			
Input Strainer Inlet Size	24.00	in	609.60	mm			
Calculate Maximum Strainer Inlet Velocity	3.60	fps	1.10	m/s		Target velocity between 6 and 10 fps	**ERROR! - Reselect Number of Strainers and/or Strainer Size to Meet Velocity Criteria Between 6 and 10 fps**
Calculate Minimum Flow per Strainer	8,460.27	gpm	533.76	L/s		Based on 6 fps minimum for effective strainer performance	
Calculate Stainer Height	11.08	ft	3378.19	mm	STH	Look up table	
Calculate Strainer Length	4.50	ft	1371.60	mm	STL	look up table	
Calculate Strainer Width	4.17	ft	1270.01	mm	STW	look up table	
Input Clear Distance Between Strainers	4.00	ft	1,219.20	mm	STCD	Typically ≥ 4 ft	
Input Clear Distance Between Pipe Trench and Feed Pumps or Pipe Trench and Strainers	6.00	ft	1,828.80	mm	D1	Typically ≥ 6 ft	
Feed Pumps:							**Sizing Calculations per Subsystem**
Are Feed Pumps Included with this Facility?	Yes	Y/N					
Feed Pump Type	Horizontal Centrifugal	Type				Fixed	
If No Strainers, Input Number of Active Feed Pumps		#				Per subsystem	
If No Strainers, Input Number of Standby Feed Pumps		#				Per subsystem	
Number of Active Feed Pumps	4.00	#					
Number of Standby Feed Pumps	1.00	#					
Calculate Membrane Feed Pump Flow Rate (each)	4,990.53	gpm	314.85	L/s		Calculated based on required feed flow rate, including recirculation flow	

Average Headloss through Membrane Treatment	16.00	psi	110.32	kPa		Look up table		
Maximum Headloss through Membrane Treatment	40.00	psi	275.79	kPa		Look up table		
Input Feed Pump Efficiency	80.00%							
Input Motor Efficiency of Feed Pump	95.00%							
Is Adjustable Frequency Drive (AFD) Used?	Yes	Y/N						
Input AFD Efficiency	98.00%							
Input Safety Margin Allocated in Pump Design Brake Horsepower	1.15							
Calculate Wire to Water Efficiency for Feed Pumps	74.48%							
Input Feed Pump TDH	102.30	ft	31.18	m		TDH is the sum of the permeate discharge pressure leaving the facility plus pipe losses (3.87 ft) plus losses across the membrane (92.43 ft) and the strainer (9.25 ft) minus the influent pressure to the facility		Pasco feed pumps are at intake, not in the membrane building. They have a design TDH of 205 ft with a static head of 80 ft.
Calculate Feed Pump Brake Horsepower (each)	190.00	hp	141.68	kW				
Calculate Average Motor Power Consumption for Feed Pump (each)	79.26	hp	59.11	kW				
Calculate Average Motor Power Consumption for Feed Pump (All ACTIVE)	317.06	hp	236.43	kW		Based on active pumps		
Calculate Feed Pump Pad Length	10.95	ft	3338.66	mm	FPL			
Calculate Feed Pump Pad Width	5.66	ft	1725.17	mm	FPW			
Calculate Feed Pump Height	5.09	ft	1551.90	mm	FPH			
Input Clear Distance Between Feed Pumps or Between Feed Pump and Strainer	6.00	ft	1,828.80	mm	FPCD	Typically ≥ 4 ft		
Strainer/Feed Pump Pipe Trench Area Requirements								
Calculate Strainer Influent Header Diameter	42.00	in	1066.80	mm	FWIH			
Calculate Strainer Effluent Header Diameter	42.00	in	1066.80	mm	MIH			
Calculate Reverse Filtration Header Diameter	10.00	in	254.00	mm				
Calculate Strainer Backwash Waste Pipe Diameter	4.00	in	101.60	mm	SBWW			
Input Clear Distance Between Pipe Headers and Pipe Trench Walls	1.00	ft	304.80	mm		Typically 1 foot		
Input Clear Distance Between Pipe Headers and Pipe Trench Bottom	0.50	ft	152.40	mm		Typically 0.5 foot		
Input Clear Distance Between Pipe Headers and Top of Pipe Trench	1.00	ft	304.80	mm		Typically 1 foot		
Input Clear Distance Between Feed Water Pipe Trench and Wall	8.00	ft	2,438.40	mm	D2	Typically greater than 8 ft for access		
Calculate Minimum Strainer Effluent Pipe Trench Width	8.17	ft	2489.20	mm	PTW3			
Calculate Minimum Strainer Effluent Pipe Trench Depth	5.00	ft	1524.00	mm	PTD3			
Calculate Minimum Strainer Influent Pipe Trench Width	5.50	ft	1676.40	mm	PTW4			
Calculate Minimum Strainer Influent Pipe Trench Depth	5.00	ft	1524.00	mm	PTD4			
Calculate Minimum Gallery Pipe Trench Width	6.83	ft	2082.80	mm	PTW5			
Calculate Minimum Gallery Pipe Trench Depth	5.00	ft	1524.00	mm	PTD5			
Blowers:							**Sizing Calculations per Subsystem**	
Calculate Instantaneous Air Flow per Treatment Train	351.00	scfm	9.94	m3/min				
Number of Air Scour Blowers	2.00	#			NASB	1 duty and 1 standby		
Approximate Blower Outlet Gage Pressure at Standard Conditions	13.00	psig	89.63	kPa	BOP	Fixed		
Determine PD Blower Model Number (Sutorbuilt, Legend Series, LP)	7HP					Look up table		
Determine Blower Horsepower at Standard Conditions	33.10	hp	24.68	kW		Look up table		
Calculate Blower Height	2.63	ft	800.10	mm	BLH			
Calculate Blower Pad Length	6.51	ft	1984.38	mm	BLL			
Calculate Blower Pad Width	10.69	ft	3257.55	mm	BLW	includes space for inlet and outlet silencers		
Input Clear Distance Between Blowers	4.00	ft	1,219.20	mm	BCD	Typically ≥ 4 ft		
Reverse Filtration System:							**Sizing Calculations per Subsystem**	
Reverse Filtration Pumps								
Number of Active Reverse Filtration Pumps	1.00	#				Fixed		
Input Number of Standby Reverse Filtration Pumps	1.00	#				Typically 1		
Calculate Total Number of Reverse Filtration Pumps	2.00	#			NRFP			
Calculate RF Flowrate	936.00	gpm	59.05	L/s				
Input Reverse Filtration Pump Efficiency	75.00%							
Input Motor Efficiency of Reverse Filtration Pump	95.00%							
Is Adjustable Frequency Drive (AFD) Used?	Yes	Y/N						
Input AFD Efficiency	98.00%							
Input Safety Margin Allocated in Pump Design Brake Horsepower	1.15							
Calculate Wire to Water Efficiency for Reverse Filtration Pumps	69.83%							
Input Reverse Filtration Pump TDH	115.00	ft	35.05	m		TDH is the sum of the backwash waste discharge pressure leaving the facility plus pipe losses (24 ft) plus losses across the membrane (92.43 ft) minus the permeate pressure leaving the facility		
Calculate Reverse Filtration Pump Brake Horsepower (each)	50.00	hp	37.28	kW				
Calculate Average Motor Power Consumption for Reverse Filtration Pump (each)	51.44	hp	38.36	kW				
Calculate Reverse Filtration Pump Pad Length	7.96	ft	2427.26	mm	RFPL			
Calculate Reverse Filtration Pump Pad Width	3.67	ft	1118.62	mm	RFPW			
Calculate Reverse Filtration Pump Pad Height	3.61	ft	1099.24	mm	RFPH			
Input Clear Distance Between Reverse Filtration Pumps	4.00	ft	1,219.20	mm	RFPCD			
Reverse Filtration Supply Tank								
Is a Tank Included as Part of the Reverse Filtration System?	No	Y/N				Default is Yes	**OKAY**	
Calculate Volume of Reverse Filtration Tank	0.00	gal	0.00	m3		20% over the liquid volume of a membrane train		
Calculate Volume of Reverse Filtration Tank	0.00	cf	0.00	m3				
Number of Reverse Filtration Tanks of Equal Size	0.00	#				Fixed		
Input Reverse Filtration Tank Freeboard	3.00	ft	609.60	mm	FB	Typically 2 feet		
Input Tank Type ("Circular" or "Rectangular")	Circular	Type				Typically a circular tank		
Input Height to Width Ratio or Height to Diameter Ratio	1.20							
Input Length to Width Ratio	1.00							
For Circular Tank, Calculate Flushing Tank Diameter	0.00	ft	0.00	mm	FTL & FTW			
For Circular Tank, Calculate Flushing Tank Side Water Depth	0.00	ft	0.00	mm	SWD			
For Circular Tank, Calculate Flushing Tank Total Height	0.00	ft	0.00	mm	FTH			
For Rectangular Tank, Calculate Flushing Tank Length	0.00	ft	0.00	mm	FTL			
For Rectangular Tank, Calculate Flushing Tank Width	0.00	ft	0.00	mm	FTW			
For Rectangular Tank, Calculate Flushing Tank Side Water Depth	0.00	ft	0.00	mm	SWD			
For Rectangular Tank, Calculate Flushing Tank Total Height	0.00	ft	0.00	mm	FTH			
Pneumatic Actuator Compressors:								
Total Required Hourly Air Volume (@ 80 psi, 21.1 deg C)	100.55	cf/hr	2.85	m3/hr		Based on assumed valve usage		
Optional: Input Hourly Air Volume if Known (@ 80 psi, 21.1 deg C)		cf/hr	0.00	m3/hr		This overwrites previous calculated volume		
Calculate Total Design Hourly Air Volume (@ 80 psi, 21.1 deg C)	201.11	cf/hr	5.69	m3/hr		Volume multiplied by two to allow capacity for MIT		
Input Max Operational Temperature	100.40	degrees F	38.00	degrees C				
Input Min Operational Temperature	50.00	degrees F	10.00	degrees C				
Design Temperature for Valves	69.98	degrees F	21.10	degrees C		21.1 degrees C		
Max Operational Pressure	125.00	psi	861.84	kPa		Fixed		
Min Operational Pressure	85.00	psi	586.05	kPa		Fixed		
Select Compressor Model	D 5.0 hp	Type				"S" indicates Simplex Compressor, "D" indicates Duplex Compressor		
Volume of Receiver	120.00	gal	0.45	m3		Look up table		
Calculate Operational Volume at Max Temp, Max Press (@ 80 psi, 21.1 deg C)	23.70	cf	0.67	m3				
Calculate Operational Volume at Min Temp, Max Press (@ 80 psi, 21.1 deg C)	26.05	cf	0.74	m3				
Calculate Max Number of Starts Required, per hour	8.48					Should be less than 3 per hour	**Error: Choose Larger Compressor**	

Calculate Max Air Flowrate	501.66	scfm	14.21	m3/min		Flowrate multiplied by two to allow capacity for MIT, for informational purposes only		
Compressor Model, Gardener Denver	H5MTOIID-12					Look up table		
Compressor Pressurization Rate (@ 100 psi)	31.20	scfm	0.88	m3/min		Look up table		
Maximum Duration of Compressor Operation to Pressurize Tank	0.83	min						
Compressor Horsepower	5.00	hp	3.73	kW		Look up table		
Calculate Effective Compressor Horsepower	0.07	hp	0.05	kW				
Calculate Compressor Pad Length	7.08	ft	2159.00	mm	CL	Look up table		
Calculate Compressor Pad Width	3.42	ft	1041.40	mm	CW	Look up table		
Calculate Compressor Height	4.63	ft	1409.70	mm	CH	Look up table		
Clean-In-Place System:								
Calculate Number of CIP Systems Required	6.00	#				Includes CIP/Neutralization Tanks and Pumps		
Calculate Number of Chemical Cleans per Year	13.00	#						
Sodium Hypochlorite								
Will Sodium Hypochlorite be Used for Membrane Cleaning?	**Yes**	Y/N				Used to Remove Inorganic Foulants		These inputs should be with the other cleaning inputs
Input Concentration of Sodium Hypochlorite for Membrane Cleaning	**0.10%**					Typically 2%		
Input Number of Cleaning Segments Same Sodium Hypochlorite Solution Used	**1.00**					If unknown, use 1		
Calculate Annual Weight of Sodium Hypochlorite Used for Membrane Cleaning (100%)	16,273.53	lb	7381.55	kg				
Calculate Volume of BP Solution for Sodium Hypochlorite CEB	140,400.00	gpd	531471.82	L/d				
Calculate Sodium Hypochlorite Required for CEB	464.13	gpd	1756.93	L/d				
Calculate Annual Weight of Sodium Hypochlorite Required for CEB (100%)	213,834.18	lb	96993.55	kg				
Calculate Number of CIP Tanks Required	1.00	#						
Citric Acid								
Will Citric Acid be Used for Membrane Cleaning?	**Yes**	Y/N				Used to Remove Inorganic Foulants		These inputs should be with the other cleaning inputs
Input Concentration of Citric Acid for Membrane Cleaning	**2.00%**					Typically 2%		
Input Number of Consecutive Trains Cleaned with Same Citric Acid Solution	**1.00**	#				If unknown, use 1		
Calculate Annual Weight of Citric Acid Used for Membrane Cleaning (100%)	325,470.60	lb	147630.98	kg				
Calculate Volume of BP Solution for Citric Acid CEB	0.00	gpd	0.00	L/d				
Calculate Citric Acid Required for CEB	0.00	gpd	0.00	L/d				
Calculate Annual Weight of Citric Acid Required for CEB (100%)	0.00	lb	0.00	kg				
Calculate Number of CIP Tanks Required	1.00	#						
Sodium Bisulfite						Used for Sodium Hypochlorite Neutralization		
Calculate Annual Weight of Sodium Bisulfite (100%)	22,747.97	lb	10318.31	kg				
Sodium Hydroxide						Used for Acid Neutralization. Pall and Norit may also use to increase the pH of the Sodium Hypochlorite CIP		
Calculate Annual Weight of Sodium Hydroxide (100%)	203,292.07	lb	92211.73	kg				
Other Chemical								
Input Other Chemical's Name	**Phosphoric Acid**	Type						
Will this Chemical be Used for Membrane Cleaning?	**No**	Y/N						
Input Equivalent Weight of Chemical	**64.04**	mg/mg				calculate by dividing the molar mass of the chemical by the number of charges in ionic form		
Which chemical does this replace of the above choices?	**Citric Acid**	Type						
Input Concentration of Chemical	**2.00%**							
Input Number of Consecutive Trains Cleaned with Same Citric Acid Solution	**1.00**	#				If unknown, use 1		
Calculate Annual Weight of Chemical Used for Membrane Cleaning (100%)	0.00	lb	0.00	kg				
CIP/Neutralization Tank Sizing:							**Sizing Calculations per Subsystem**	
Ratio of CIP/Neutralization Tank to Membrane Train Volume	1.00					Look up table		
Calculate CIP Tank Size	2,500.00	gal	9.46	m3		Typically 2,500 to 3,000 gal, each		2479.72
Calculate Number of CEB/EFM Tanks	1.00	#			NCEBT			
Calculate Number of CIP Tanks	3.00	#			NCIPT	Includes CEB/EFM and CIP tanks		
Input Diameter of CIP Tanks	**7.50**	ft	**2.29**	m	CIPTD	Typically 7.5 ft diameter		
Calculate CIP Tank Height	7.56	ft	2305.74	mm				
Use this Tank Height	8.00	ft	2438.40	mm	CIPTH			
Is Neutralization Tank Included?	**Yes**	Y/N						
Calculate Number of Neutralization Tanks	1.00	#						
Calculate Neutralization Tank Size	7,500.00	gal	28.39	m3		Typically 3 to 4 times the CIP tank		
Input Diameter of Neutralization Tanks	**10.00**	ft	**3.05**	m	NTD	Typically 10 ft diameter		
Calculate Neutralization Tank Height	12.77	ft	3890.94	mm				
Use this Tank Height	13.00	ft	3962.40	mm	NTH			
Input Minimum Clear Distance Around CEB/CIP/Neutralization Tanks	**5.00**	ft	**1,524.00**	mm	D3	Typically ≥ 5 ft		

Cleaning Chemicals Storage Area Calculations:

Chemical	Sodium Hypochlorite	Citric Acid	Sodium Bisulfite	Sodium Hydroxide	Phosphoric Acid	
Is this Chemical Used for CEB?	Yes	No	NA	NA	NA	
Is this Chemical Used CIP?	Yes	Yes	Yes	Yes	No	
Equivalent Weight of Chemical	74.45	64.04	104.07	40.00	64.04	
Percent Active Chemical	13%	50%	38%	**50.00%**	**50.00%**	
Bulk Chemical Specific Gravity	1.21	1.24	1.30	1.54	1.24	
Active Chemical Concentration, lb/gallon	1.26	5.17	4.12	6.43	5.17	
Choose Chemical Delivery Method	Tank Truck	Tank Truck	Tote	Tank Truck	Tank Truck	
Bulk Delivery Volume (Tank Truck, Totes, Drums), gallons	4,456.36	4,348.54	300.00	3,501.42	4,348.54	
Input Number of Days of CEB Storage (days)	30.00	30.00	30.00	30.00	30.00	
Calculate Storage Volume for CEB @ Avg. Flow/Dose (gallons)	13,923.97	0.00	N/A	N/A	N/A	
Input Number Full Facility Chemical Cleans to Store On-site	1.00	1.00	1.00	1.00	1.00	
Calculate **Storage Volume for Chemical Cleaning** (gallons)	991.74	4,838.71	424.45	2,433.54	0.00	
Calculate Total Storage Required for CEB & CIP (gallons)	14,915.70	4,838.71	424.45	2,433.54	0.00	
Calculate Bulk Delivery Volume * 1.5 (gallons)	6,684.54	6,522.81	300.00	5,252.14	6,522.81	
Maximum of Above 2 Volumes (gallons)	14,915.70	6,522.81	424.45	5,252.14	6,522.81	
Maximum Volume in (cf)	1,993.94	871.97	56.74	702.11	871.97	
Calculate Number of Totes or Drums (each)	0.00	0.00	2.00	0.00	0.00	
BULK TANKS:						
Input Number of Tanks (each)	2.00	1.00		1.00	1.00	
Input Tank Diameter (ft)	10.00	10.00		10.00	10.00	BTD Greater than 14' tank diameter will require on-site tank fabrication. Maximum diameter allowed for this model is 14'.
Calculate Height of Tanks (ft)	12.69	11.10		8.94	11.10	
Use this Tank Height (Liquid Height * 1.1) (ft)	**14.00**	**13.00**		**10.00**	**13.00**	
Input Number of Rows of Tanks (each)	1.00	1.00		1.00	1.00	
Calculate Number of Tanks per Row	2.00	1.00		1.00	0.00	
Input Tank Material (FRP, PE-Polyethylene, PLS-Phenolic Lined Steel)	FRP	FRP		FRP	FRP	
Input Clear Distance Around BulkTanks, Totes, or Drums (CDT)	4.00	4.00	4.00	4.00	4.00	
TOTES & DRUMS:						
Input Number of Rows of Totes or Drums (each)			2.00			
Calculate Number of Totes or Drums per Row			1.00			
Length of Each Tote (ft, Fixed)			4.00			Fixed
Width of Each Tote (ft, Fixed)			4.00			Fixed
Diameter of Each Drum (ft, Fixed)			2.50			Fixed
METERING PUMPS:						

Calculate Number of Active CEB Metering Pumps (each)	1.00	0.00				Rule: One active metering pump per application point.		
Calculate Number of Standby CEB Metering Pumps (each)	1.00	0.00				Rule: One standby metering pump per application point		
Calculate Total Number of CEB Metering Pumps (each)	2.00	0.00						
Calculate CEB Metering Pump Design Capacity (gph)	0.32	0.79						
Calculate Number of Active CIP Metering Pumps (each)	1.00	1.00	1.00	1.00	0.00	Rule: One active metering pump per application point.		
Calculate Number of Standby CIP Metering Pumps (each)	1.00	1.00	1.00	1.00	0.00	Rule: One standby metering pump per application point		
Calculate Total Number of CIP Metering Pumps (each)	2.00	2.00	2.00	2.00	0.00			
Calculate CEB Metering Pump Design Capacity (gph)	247.93	1,209.68	106.11	608.39	0.00			
Input Clear Distance Around Metering Pumps	3.00	ft	914.40	mm	CHCD	Typically ≥ 3 ft		
Length of Metering Pumps	3.00	ft	914.40	mm	CHPL	Conservatively assumes Pulsafeeder metering pump type.		
Width of Metering Pumps	1.50	ft	457.20	mm	CHPW	Conservatively assumes Pulsafeeder metering pump type.		
Width of Stair Access	3.50	ft	1066.80	mm	WS			
Input Common Chemical Access Corridor Width	8.00	ft	2,438.40	mm		Typically ≥ 6 ft		
CONTAINMENT AREA:								
Calculate Containment Area Length (ft)	32.00	18.00	12.00	18.00	0.00	80		
Calculate Containment Area Width (ft)	41.50	27.50	24.50	27.50	0.00			
Calculate Fire Sprinkler Water Volume (gal) (0.2 gpm/sf for 20 min.)	5,312.00	1,980.00	1,176.00	1,980.00	0.00			
Calculate 120% of One Storage Tank Volume (gal)	9,870.31	9,165.29	360.00	7,050.22	9,165.29			
Calculate 30% of All Tank Volume (gal)	4,935.16	2,291.32	180.00	1,762.56	2,291.32			
Maximum of Above 2 Volumes (gal)	9,870.31	9,165.29	360.00	7,050.22	9,165.29			
Calculate Maximum Volume + Fire Flow Volume (gal)	15,182.31	11,145.29	1,536.00	9,030.22	9,165.29			
Calculate Maximum Volume + Fire Flow Volume (cf)	2,029.58	1,489.91	205.33	1,207.17	1,225.22			
Calculate Containment Wall Height (including 6" Freeboard) (ft)	2.03	3.51	1.20	2.94	0.00	120% of 1 tank volume or 30% of all tank volume whichever is greater + fire flow volume + 6" freeboard. Should be ≤ 4.5'.		
Cleaning Solution Recirculation Pumps Sizing:								
Number of Active Cleaning Solution Recirculation Pumps per Chemical	1.00	#				Fixed		Pasco has 2 pumps, 1 for recirculation, one for CIP drain. Circulation pump is sized for 434 gpm @ 70 ft (15 hp). Drain is sized for 310 gpm @ 70 ft (7.5 hp).
Input Number of Standby Cleaning Solution Recirculation Pumps per Chemical	0.00	#				Typically 1		
Calculate Total Number of Cleaning Solution Recirculation Pumps	2.00	#			NCIPP			
Ratio of Cleaning Solution Flux to Instantaneous Flux	3.00					Look up table		
Calculate CIP Flowrate	2,340.00	gpm	147.63	L/s				
Input Cleaning Solution Recirculation Pump Efficiency	75.00%							
Input Motor Efficiency of Cleaning Solution Recirculation Pump	95.00%							
Is Adjustable Frequency Drive (AFD) Used?	No	Y/N						
Input AFD Efficiency	98.00%							
Input Safety Margin Allocated in Pump Design Brake Horsepower	1.15							
Calculate Wire to Water Efficiency for Cleaning Solution Recirculation Pumps	71.25%							
Input Cleaning Solution Recirculation Pump TDH	24.00	ft	7.32	m		TDH is greater than or equal to pipe losses (5.06 ft)		
Calculate Cleaning Solution Recirculation Pump Horsepower (each)	22.00	hp	16.41	kW				
Calculate Average Motor Power Consumption for Cleaning Solution Recirculation Pump (each)	19.90	hp	14.84	kW				
Calculate Cleaning Solution Recirculation Pump Pad Length	7.38	ft	2248.52	mm	CPL			
Calculate Cleaning Solution Recirculation Pump Pad Width	3.67	ft	1118.62	mm	CPW			
Calculate Cleaning Solution Recirculation Pump Pad Height	3.32	ft	1010.86	mm	CPH			
Input Clear Distance Between CIP/Neutralization Pumps	4.00	ft	1,219.20	mm	CPCD			
Neutralized Chemical Transfer Pump Sizing:								
Number of Active Neutralized Chemical Transfer Pumps	1.00	#				Fixed		
Input Number of Standby Neutralized Chemical Transfer Pumps per Chemical	0.00	#				Typically 0		
Calculate Total Number of Neutralized Chemical Transfer Pumps	1.00	#			NCEBP			
Input Neutralized Chemical Transfer Pump Flowrate	310.00	gpm	19.56	L/s		Based on how fast the tank (2644 gal) should be drained. Typically 30 to 120 minutes		
Input Neutralized Chemical Transfer Pump TDH	70.00	ft	21.34	m		TDH is the sum of the backwash waste discharge pressure leaving the facility plus pipe losses (2.07 ft)		
Input Neutralized Chemical Transfer Pump Efficiency	70.00%							
Input Motor Efficiency of Neutralized Chemical Transfer Pump	95.00%							
Is Adjustable Frequency Drive (AFD) Used?	No	Y/N						
Input AFD Efficiency	100.00%							
Input Safety Margin Allocated in Pump Design Brake Horsepower	1.15							
Calculate Wire to Water Efficiency for Neutralized Chemical Transfer Pumps	66.50%							
Calculate Neutralized Chemical Transfer Pump Horsepower (each)	10.00	hp	7.46	kW				
Calculate Average Motor Power Consumption for Neutralized Chemical Transfer Pump (each)	8.24	hp	6.14	kW				
Calculate Neutralized Chemical Transfer Pump Pad Length	6.81	ft	2076.86	mm	CBPL			
Calculate Neutralized Chemical Transfer Pump Pad Width	3.67	ft	1118.62	mm	CBPW			
Calculate Neutralized Chemical Transfer Pump Pad Height	3.04	ft	925.97	mm	CBPH			
CIP Heater Sizing:								
Will a Heater be Used to Increase Temperature of CIP Cleaning Solution?	Yes	Y/N				Norit does not use heater, Suggest adding heater when design water temperature is below 20 deg C		
Input Minimum Initial Cleaning Solution Temperature	64.40	degrees F	18.00	degrees C		Based on Makeup Water Temperature		
Input Maximum Target Cleaning Solution Temperature	98.60	degrees F	37.00	degrees C		Check with MFR		
Total Number of Hours Required to Heat Cleaning Solution	4.00	hr				look up table		
Calculate CIP Heater Size (each)	65.35	kW				Includes a safety margin of 1.25		Pasco 62.5 kW.
Calculate Total Time per Year CIP Heater is Operating	520.00	hours/yr						
Calculate Effective Horsepower of CIP Heater (each)	5.20	hp	3.88	kW		Average HP of CIP heater assuming constant operation		
Calculate Total Number of CIP/CEB Heaters	3.00	#						
Is Membrane Facility inside a CMU Building?	Yes	Y/N						
Do you have Particle Counters?	Yes	Y/N						
Do you have a Combined Permeate Header Magmeter?	No	Y/N						
Input Facility Depth of Burial	0.00	ft		mm	DB			
Input Cutback Slope	1.50	:1 (ft:ft)				Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.	**Notice! Cutback slope of 1:1 is recommended for depth of burial < 5 ft.**	
Input Over Excavation Depth	1.00	ft	304.80	mm	OEXD			
People Spaces:								
Are Other People Spaces (office, control room, lab) to be Included?	No	Y/N						
Input Space Requirements for Control Room	0.00	sf	13.94	m2				
Input Number of Offices Desired	0.00	#				Assumes 100 sf of office space per office		
Calculate Space Requirements for Offices	0.00	sf	0.00	m2				
Input Space Requirements for Storage Room	0.00	sf	13.94	m2				
Input Space Requirements for Wet Laboratory	0.00	sf	23.23	m2				
Input Space Requirements for Restrooms	0.00	sf	23.23	m2				
Input Space Requirements for Other Rooms	0.00	sf	13.94	m2		Includes conference room, break room and other spaces		

Input Length to Width Ratio for Control Room	0.00	#				Should be equal to the ratios for the storage room and other rooms	
Calculate Control Room Length	0.00	ft	0.00	mm			
Calculate Control Room Width	0.00	ft	0.00	mm			
Input Length to Width Ratio for Office Space	2.00	#				Should be equal to the ratios for the Laboratory and restrooms	
Calculate Office Space Length	0.00	ft	0.00	mm			
Calculate Office Space Width	0.00	ft	0.00	mm			
Input Length to Width Ratio for Storage Room	1.50	#				Should be equal to the ratios for the control room and other rooms	**Ratios for Control Room, Storage Room and Other Spaces should be Equal**
Calculate Storage Room Length	0.00	ft	0.00	mm			
Calculate Storage Room Width	0.00	ft	0.00	mm			
Input Length to Width Ratio for Laboratory Room	2.00	#				Should be equal to the ratios for the office space and restrooms	**OKAY**
Calculate Laboratory Room Length	0.00	ft	0.00	mm			
Calculate Laboratory Room Width	0.00	ft	0.00	mm			
Input Length to Width Ratio for Restrooms	2.00					Should be equal to the ratios for the office space and the laboratory	
Calculate Restrooms Length	0.00	ft	0.00	mm			
Calculate Restrooms Width	0.00	ft	0.00	mm			
Input Length to Width Ratio for Other Rooms	1.50					Should be equal to the ratios for the control room and storage room	
Calculate Other Rooms Length	0.00	ft	0.00	mm			
Calculate Other Rooms Width	0.00	ft	0.00	mm			
Calculations for Each Side of the Hallway							
Calculate Other Spaces Length	0.00	ft	0.00	mm			
Calculate Other Spaces Width	0.00	ft	0.00	mm			
Input Hallway Width	5.00	ft	1,524.00	mm		Typically 4 to 6 feet	
Calculate Hallway Length	0.00	ft	0.00	mm			
Calculate Hallway Area	0.00	sf	0.00	m2			

Flowrates for Mechanical User Inputs:

Number of Equal Capacity Membrane Subsystems	6.00	#		
Calculate Number of Active MF Trains (per Subsystem)	9.00	#		
Calculate Number of Standby MF Trains (per Subsystem)	1.00	#		
Calculate Total Number of MF Trains (per Subsystem)	10.00	#		
Calculate Feed Flow per Train	3.19	mgd	12.09	ML/d
Calculate Permeate Flow per Train	3.10	mgd	11.73	ML/d
Calculate Reverse Filtration Flow per Train	1.35	mgd	5.10	ML/d
Calculate CIP Supply and Return Flow Per Train	3.37	mgd	12.76	ML/d
Calculate Feedwater Influent Flow	29.28	mgd	110.83	ML/d
Calculate Feed Pump Discharge Flow	7.19	mgd	27.20	ML/d
Calculate Strainer Influent Flow	7.32	mgd	27.71	ML/d
Calculate Strainer Effluent Flow	6.97	mgd	26.39	ML/d
Calculate Membrane Influent Flow	28.75	mgd	108.81	ML/d
Calculate Membrane Filtrate Flow	26.67	mgd	100.94	ML/d
Calculate Air Scour Flow	351.00	scfm	9.94	m3/min
Calculate Membrane Backwash Waste Flow Rate	1.35	mgd	5.10	ML/d

Mechanical Sizing Requirements:

Pipe Name	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Standard Pipe Size	Unit (English)	Nominal Pipe Size	Unit (Metric)
Feed Water Inlet Header	5.00	fps	1.52	m/s	42.00	in	1050.00	mm
Feed Pump Suction Lateral	7.00	fps	2.13	m/s	18.00	in	450.00	mm
Feed Pump Discharge Lateral	10.00	fps	3.05	m/s	16.00	in	400.00	mm
Strainer Effluent Lateral	8.00	fps	2.44	m/s	16.00	in	400.00	mm
Strainer Effluent Common Header	5.00	fps	1.52	m/s	42.00	in	1050.00	mm
Membrane Influent Common Header	5.00	fps	1.52	m/s	42.00	in	1050.00	mm
Membrane Influent Lateral	7.00	fps	2.13	m/s	12.00	in	300.00	mm
Membrane Filtrate Lateral	7.00	fps	2.13	m/s	12.00	in	300.00	mm
Common Membrane Filtrate/Permeate Header	5.00	fps	1.52	m/s	42.00	in	1050.00	mm
Reverse Filtration Header	5.00	fps	1.52	m/s	10.00	in	250.00	mm
Reverse Filtration Lateral	5.00	fps	1.52	m/s	10.00	in	250.00	mm
Backwash Waste Header	6.00	fps	1.83	m/s	14.00	in	350.00	mm
Backwash Waste Lateral	3.00	fps	0.91	m/s	12.00	in	300.00	mm
CIP Supply/Return Header	5.00	fps	1.52	m/s	14.00	in	350.00	mm
CIP Supply/Return Lateral	5.00	fps	1.52	m/s	14.00	in	350.00	mm
Air Scour Header	50.00	fps	15.24	m/s	6.00	in	150.00	mm
Air Scour Lateral	50.00	fps	15.24	m/s	6.00	in	150.00	mm
Strainer Inlet/Outlet (TO VERIFY SIZING)	0.60	fps	0.18	m/s	24.00	in	600.00	mm
Strainer Backwash Waste	6.18	fps	1.88	m/s	4.00	in	100.00	mm
Membrane Integrity Test Piping					2.00	in	50.00	mm
Membrane Influent Lateral (TO VERIFY SIZING)	6.10	fps	1.86	m/s	12.00	in	300.00	mm
Reverse Filtration Lateral (TO VERIFY SIZING)	3.82	fps	1.17	m/s	10.00	in	250.00	mm
Permeate Discharge Lateral (TO VERIFY SIZING)	6.10	fps	1.86	m/s	12.00	in	300.00	mm
Backwash Waste Lateral (TO VERIFY SIZING)	2.66	fps	0.81	m/s	12.00	in	300.00	mm

Pipe Name	Pipe ID	Installation Type	Pipe Material	Pipe Lining Material	Pipe Coating Material	Pipe Length to First Train, ft	Pipe Length for Subsequent Trains, ft	# Elbows
Feed Water Inlet Header	FWIH	Exposed	Steel	Cement Mortar	Paint	342.30	0.00	0.00
Feed Pump Suction Lateral	FPSL	Exposed	Steel	Cement Mortar	Paint	21.32	21.32	0.00
Feed Pump Discharge Lateral	FPDL	Exposed	Steel	Cement Mortar	Paint	8.00	8.00	0.00
Strainer Effluent Lateral	SEL	Exposed	Steel	Cement Mortar	Paint	17.62	17.62	1.00
Strainer Effluent Common Header	SECH	Exposed	Steel	Cement Mortar	Paint	411.30	0.00	0.00
Membrane Influent Common Header	MIH	Exposed	SST	None	None	570.50	0.00	0.00
Membrane Influent Lateral	MIL	Exposed	SST	None	None	45.12	45.12	1.00
Membrane Filtrate Lateral	MFL	Exposed	SST	None	None	36.62	36.62	1.00
Common Membrane Filtrate/Permeate Header	CMFPH	Exposed	SST	None	None	630.50	0.00	0.00
Reverse Filtration Header	RFH	Exposed	SST	None	None	654.57	0.00	8.00
Reverse Filtration Lateral	RFL	Exposed	SST	None	None	48.62	48.62	1.00
Backwash Waste Header	BWW	Exposed	DI	Cement Mortar	Paint	630.50	0.00	0.00
Backwash Waste Lateral	BWWL	Exposed	DI	Cement Mortar	Paint	44.28	44.28	1.00
CIP Supply/Return Header	CIPH	Exposed	PVC	None	None	16228.52	0.00	72.00
CIP Supply/Return Lateral	CIPL	Exposed	PVC	None	None	45.03	45.03	8.00
Air Scour Header	BPA	Exposed	SST	None	None	881.38	0.00	12.00
Air Scour Lateral	BPAL	Exposed	SST	None	None	37.03	37.03	1.00
Strainer Backwash Waste	SBWW	Exposed	Steel	Cement Mortar	Paint	361.80	10.00	30.00
Membrane Integrity Test Piping	MIT	Exposed	SST	None	None	630.50	36.62	69.00

Electrical User Inputs and Sizing Requirements:

Is this a "Critical" Facility (requiring standby power)?	Yes	Y/N
Is there SWGR?	No	Y/N

Pneumatic Actuator Sizing

Valve Size (in)	Number of Valve Strokes/hr	Air Volume Storage Required (in3)	Max Number of Simultaneous Valves in Operation	Air Flowrate Required (scfm)
4.00	156.00	2808.00	78.00	26.53
6.00	5.94	106.95	25.00	8.50
8.00	0.00	0.00	0.00	0.00
10.00	52.00	2080.00	3.00	2.27
12.00	176.00	7040.00	133.00	100.53
14.00	1056.00	126720.00	4.00	9.07
16.00	20.00	4000.00	20.00	75.59
18.00	5.00	1000.00	5.00	18.90
20.00	60.00	30000.00	1.00	9.45

Electrical Equipment Lengths:

Item	Quantity	HP per Each	AFD's Required?	MCC: MCC Spaces for Motor Starters	MCC Spaces for AFD's less than 50hp)	MCC Spaces for Breakers	Total MCC Spaces	Number of MCC Sections for Motors, AFD's, & Breakers
Feed Pump (Active)	24.00	190.00	Yes	0.00	0.00	120.00		
Feed Pump (Standby)	6.00	190.00	Yes	0.00	0.00	30.00		

Reverse Filtration Pump (Active)	6.00	50.00	Yes	0.00	36.00	12.00		
Reverse Filtration Pump (Standby)	6.00	50.00	Yes	0.00	36.00	12.00		
Cleaning Solution Recirculation Pump (Active)	6.00	22.00	No	18.00	0.00	0.00		
Cleaning Solution Recirculation Pump (Standby)	0.00	22.00	No	0.00	0.00	0.00		
Neutralized Chemical Transfer Pump (Active)	6.00	10.00	No	12.00	0.00	0.00		
Neutralized Chemical Transfer Pump (Standby)	0.00	10.00	No	0.00	0.00	0.00		
Blower (Active)	6.00	33.10	**Yes**	0.00	36.00	12.00		
Blower (Standby)	6.00	33.10	**Yes**	0.00	36.00	12.00		
Compressor	6.00	5.00	**No**	12.00	0.00	0.00		
CIP Heater	18.00	87.64	**No**	54.00	0.00	0.00		
CEB Metering Pumps (Active)	1.00	1.00	**No**	2.00	0.00	0.00		
CEB Metering Pumps (Standby)	1.00	1.00	**No**	2.00	0.00	0.00		
CIP Metering Pumps (Active)	4.00	1.00	**No**	8.00	0.00	0.00		
CIP Metering Pumps (Standby)	4.00	1.00	**No**	8.00	0.00	0.00		
TOTAL		**8506.68**		**116.00**	**144.00**	**198.00**	**458.00**	**39.00**
Total Effective Load	6863.08							

Electrical Equipment Widths:

Equipment	Depth (ft)
MCC	1.67
Small AFD's	2.08
Large AFD's	0.00
Switchgear	0.00
Maximum Depth	**2.08**

Clear Distances:

Clear Distance	Width	Length	Comment	
CD1		**3.00**	Clear Distance between wall and MCC	Typically 3 feet
CD2		**1.00**	Clear Distance between MCC and Small AFD	Typically 1 foot
CD3		**0.00**	Clear Distance between Small AFD and Large AFD	Typically Zero
CD4		**0.00**	Clear Distance between Large AFD and Switchgear	Typically Zero
CD5		**0.00**	Clear Distance between Switchgear and Contingency Space	Typically Zero
CD6	**4.00**		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)	
CD7	**3.00**		Clear Distance in front of Equipment	Typically 3 feet
Contingency Length		**0.00**	Contingency length	Typically Zero

Electric Room Length (ft):

CD1	3.00
MCC	75.00
CD2	1.00
Small AFD's	139.86
CD3	0.00
Large AFD's	0.00
CD4	0.00
Swithgear	0.00
CD5	0.00
Contingency	0.00
Total Length	**75.00**

Electric Room Width (ft):

CD6	0.00	If there is no switchgear, this distance will be Zero.
Maximum Equipment Depth	2.08	
CD7	3.00	
Total Width	**8.33**	

FACILITY DIMENSION CALCULATIONS FOR CHEMICAL ROOM:

Estimating Calculations for Chemical Room	Sodium Hypochlorite	Citric Acid	Sodium Bisulfite	Sodium Hydroxide	Phosphoric Acid	
Logic Tests ("1" = Yes, "0" = No):						
Is "Other" Chemical Used for CIP? (1 = Yes, 0 = No)	0	0	0	0	0	
If "Other" Chemical is Used, Which Chemical Does it Replace for CIP? (0 = Replaced Chemical)	1	1	1	1	0	
Is this Chemical Feed System Included for CEB?	1	0	0	0	0	1
If Other Chemical is used, is this Chemical Feed System Included for CIP?	1	1	1	1	0	4
Is the Method of Delivery "Tank Truck"?	1	1	0	1	1	
Number of Bulk Tanks (each)	2	1	0	1	0	
Diameter of Bulk Tank (ft)	10.00	10.00	10.00	10.00	10.00	
Height of Bulk Tank (ft)	14.00	13.00	0.00	10.00	13.00	
Volume of Each Bulk Tank (gallons)	8225.26	7637.74	0.00	5875.19	7637.74	
Bulk Tank Material	FRP	FRP	FRP	FRP	FRP	
Length of Module (Tank Truck) (ft)	32.00	18.00	0.00	18.00	0.00	
Length of Module (Tote) (ft)	0.00	0.00	12.00	0.00	0.00	
Length of Module (Drum) (ft)	0.00	0.00	0.00	0.00	0.00	
Width of Module (Tank Truck) (ft)	41.50	27.50	0.00	27.50	0.00	
Width of Module (Tote) (ft)	0.00	0.00	24.50	0.00	0.00	
Width of Module (Drum) (ft)	0.00	0.00	0.00	0.00	0.00	
Area of Module (SF)	1328.00	495.00	294.00	495.00	0.00	
Number of Bulk Tanks (each)	2.00	1.00	0.00	1.00	0.00	
Diameter of Bulk Tank (ft)	10.00	10.00	0.00	10.00	0.00	
Volume of Each Bulk Tank (gal)	7457.85	4838.71	0.00	2433.54	0.00	
Bulk Tank Material	FRP	FRP	NA	FRP	FRP	
Total Number of Metering Pumps (CEP + CIP)	4.00	2.00	2.00	2.00	0.00	
Containment Wall Height (ft)	2.03	3.51	1.20	2.94	0.00	

Slab on Grade Thickness	**9.00**	in	**228.60**	mm		Model based on 9"
Slab on Grade Thickness	0.75	ft	228.60	mm		
Containment Wall Thickness	**8.00**	in	**203.20**	mm		Model based on 8"
Containment Wall Thickness	0.67	ft	203.20	mm		
Chemical Room Corridor						
Chemical Room Corridor Length	80.00	ft	24384.00	mm		
Chemical Room Corridor Width	8.00	ft	2438.40	mm		
Chemical Room Corridor Area	640.00	sf	59.46	m2		
Chemical Room Overall Dimensions (Including Corridor):						
Total Chemical Room Length	80.00	ft	24384.00	mm		
Total Chemical Room Width (for purposes of calculating Excavation) (Feet)	49.50	ft	15087.60	mm		
Chemical Room Excavation Length	84.00	ft	25603.20	mm		
Chemical Room Excavation Width	53.50	ft	16306.80	mm		
Chemical Room Excavation Depth	0.75	ft	228.60	mm		
Total Chemical Room Area	3960.00	sf	367.90	m2		

Estimating Dimensions:	Value English	Unit (English)	Value Metric	Unit (Metric)	Name	Comment	Red Flags	User Comments
Equipment Quantities per Membrane Subsystem								
Number of Membrane Trains	11.00	#				per Subsystem		
Number of Strainers	5.00	#				per Subsystem		
Number of Feed Pumps	5.00	#				per Subsystem		
Number of CIP Recirculation Pumps	2.00	#				per Subsystem		
Number of Neutralized Chemical Transfer Pumps	1.00	#				per Subsystem		

Number of CIP Tanks	3.00	#				per Subsystem
Number of Reverse Filtration Pumps	2.00	#				per Subsystem
Number of Blowers	2.00	#				per Subsystem
Number of Compressors	1.00	#				per Subsystem
Building Width Dimensions						
Membrane Building Wall Width	1.00	ft	304.80	mm		
Membrane Train Clear Distance	3.00	ft	0.91	m		assumes 0.5 ft space between train pad and trench and between trench and wall
Membrane Train Effluent Pipe Trench Width	0.00	ft	0.00	m	PTW1	
Membrane Train Length	33.21	ft	10.12	m		
Membrane Train Concrete Pad Length	34.21	ft	10.43	m		
Pipe Gallery Width	18.67	ft	5.69	m		assumes 0.5 ft space between train pad and trench
Membrane Train Influent Pipe Trench Width	18.17	ft	5.54	m	PTW2	
Clear Distance Between Wall and Equipment, Between Trenches, Between Equipment, or Between Wall and Trench	8.00	ft	2.44	m		
Strainer Effluent Pipe Trench Width	8.17	ft	2.49	m	PTW3	
Clear Distance Between Trench and Equipment	6.00	ft	1828.80	mm	D1	
Feed Pump Length	10.95	ft	3.34	m		
Strainer Influent Pipe Trench Width	5.50	ft	1676.40	mm	PTW4	
Electrical Room Width	8.33	ft	2540.00	mm		
Strainer Length	4.50	ft	1371.60	mm		
Reverse Filtration Pump Length	7.96	ft	2427.26	mm		
Reverse Filtration Tank Diameter/Length	0.00	ft	0.00	m		
Clear Distance Between Wall and Equipment, or Between Equipment	5.00	ft	1524.00	mm		
CIP/CEB/EFM Tank Diameter	7.50	ft	2.29	m		
CIP Chemical Neutralization Tank Diameter	10.00	ft	3.05	m		
Pipe Gallery Width	4.67	ft	1422.40	mm		
CIP Pump Length	7.38	ft	2248.52	mm		
Neutralized Chemical Pump Length	6.81	ft	2076.86	mm		
Blower Clear Distance	4.00	ft	1219.20	mm		
Blower Width	10.69	ft	3.26	m		
Chemical Pump Width	3.00	ft	914.40	mm		
Clear Distance Around Chemical Pumps	3.00	ft	914.40	mm		
Compressor Length	7.08	ft	2159.00	mm		
Blower Room Width	162.13	ft	49.42	m		
Building Length Dimensions						
Membrane Train Width	5.92	ft	1803.40	mm		
Membrane Train Concrete Pad Width	6.92	ft	2108.20	mm		
Membrane Train Clear Distance	3.00	ft	914.40	mm		
CIP Pipe Gallery Width	5.83	ft	1778.00	mm		
Clear Distance Between Equipment or Between Equipment and Wall	10.00	ft	3048.00	mm		Fixed
Blower Length	6.51	ft	1984.38	mm		
Compressor Width	3.42	ft	1041.40	mm		
Feed Pump Width	5.66	ft	1725.17	mm		
Feed Pump Clear Distance	6.00	ft	1828.80	mm		
Strainer Width	4.17	ft	1270.01	mm		
Strainer Clear Distance	4.00	ft	1219.20	mm		
Minimum Gallery Pipe Trench Width	6.83	ft	2.08	m	PTW5	
Reverse Filtration Pump Clear Distance	4.00	ft	1219.20	mm		
Reverse Filtration Pump Width	3.67	ft	1118.62	mm		
Reverse Filtration Tank Diameter/Width	0.00	ft	0.00	m		
Clear Distance Between CIP Pumps	4.00	ft	1219.20	mm		
CIP Pump Width	3.67	ft	1118.62	mm		
Neutralized Chemical Pump Width	3.67	ft	1118.62	mm		
Chemical Pump Length	3.00	ft	914.40	mm		
Electrical Room Length	75.00	ft	22.86	m		
Blower Room Length	28.10	ft	8.57	m		
Building Height Dimensions						
Membrane Train Height	11.50	ft	3.51	m		
Clear Height Above Membrane Trains	1.00	ft	304.80	mm		
Feed Pump Height	5.09	ft	1551.90	mm		
Strainer Height	11.08	ft	3.38	m		
Reverse Filtration Pump Height	3.61	ft	1099.24	mm		
Reverse Filtration Tank Height	0.00	ft	0.00	m		
CIP Pump Height	3.32	ft	1010.86	mm		
Neutralized Chemical Pump Height	3.04	ft	925.97	mm		
CIP Tank Height	8.00	ft	2.44	m		
CIP Chemicals Neutralization Tank Height	13.00	ft	3.96	m		
Blower Height	2.63	ft	800.10	mm		
Compressor Height	4.63	ft	1409.70	mm		
Chemical Pump Height	4.00	ft	1219.20	mm		
Membrane Train Effluent Pipe Trench Depth	0.00	ft	0.00	mm	PTD1	
Membrane Train Influent Pipe Trench Depth	18.67	ft	5689.60	mm	PTD2	
Strainer Effluent Pipe Trench Depth	5.00	ft	1524.00	mm	PTD3	
Strainer Influent Pipe Trench Depth	5.00	ft	1524.00	mm	PTD4	
Minimum Gallery Pipe Trench Depth	5.00	ft	1524.00	mm	PTD5	
Slab on Grade Thickness	1.00	ft	304.80	mm		
Equipment Pad Thickness	1.00	ft	304.80	mm		
Membrane Building Calculations						
Membrane Building Width Dimension Alt #4	70.38	ft	21.45	m		
Membrane Building Width Dimension Alt #1	110.50	ft	33.68	m		
Membrane Building Width Dimension Alt #2	96.01	ft	29.26	m		
Membrane Building Length Dimension Alt #5	690.50	ft	210.46	m		
Membrane Building Length Dimension Alt #1	124.08	ft	37.82	m		
Membrane Building Length Dimension Alt #2	114.17	ft	34.80	m		
Membrane Building Width (Excavation Purposes)	50.21	ft	15.30	m		
Membrane Building Length (Excavation Purposes)	690.50	ft	210.46	m		
CIP Area Calculations						
CIP Area Width	199.26	ft	60.74	m		
CIP Area Length	55.00	ft	16.76	m		
CIP Area	10959.42	sf	1018.16	m2		
Feed Pumps and Strainers Area Calculations						
Feed Pumps and Strainers Area Width	361.80	ft	110.28	m		
Feed Pumps and Strainers Area Length	63.12	ft	19.24	m		
Feed Pumps and Strainers Area	22836.91	sf	2121.62	m2		
Feed Pumps and Strainers Area Width (Excavation Purposes)	361.80	ft	110.28	m		
Feed Pumps and Strainers Area Length (Excavation Purposes)	43.45	ft	13.24	m		
Reverse Filtration Area Calculations						
Reverse Filtration System Area Width	116.04	ft	35.37	m		
Reverse Filtration System Area Length	19.96	ft	6.08	m		
Reverse Filtration System Area	2316.56	sf	215.22	m2		

Reverse Filtration Area Width (Excavation Purposes)	116.04	ft	35.37	m		
Reverse Filtration Area Length (Excavation Purposes)	19.96	ft	6.08	m		
Facility Dimensions						
Membrane Building Width	70.38	ft	21.45	m	MBW	
Membrane Building Length	690.50	ft	210.46	m	MBL	
Membrane Building Area	48593.94	sf	4514.52	m2		
Feed Pumps and Strainer Area Width	361.80	ft	110.28	m	FPSAW	
Feed Pumps and Strainer Area Length	63.12	ft	19.24	m	FPSAL	
Feed Pumps and Strainer Area	22836.91	sf	2121.62	m2		
Reverse Filtration System Area Width	116.04	ft	35.37	m	RFAW	
Reverse Fitlration System Area Length	19.96	ft	6.08	m	RFAL	
Reverse Filtration System Area	2316.56	sf	215.22	m2		
CIP Area Width	199.26	ft	60.74	m	CAW	
CIP Area Length	55.00	ft	16.76	m	CAL	
CIP Area	10959.42	sf	1018.16	m2		
Blower Room Width	162.13	ft	49.42	m	BRW	
Blower Room Length	28.10	ft	8.57	m	BRL	
Blower Room Area	4556.39	sf	423.30	m2		
Electric Room Width	8.33	ft	2.54	m	ERW	
Electric Room Length	75.00	ft	22.86	m	ERL	
Electric Room Area	625.00	sf	58.06	m2		
People Spaces Area Width	0.00	ft	0.00	m	PSAW	
People Spaces Area Length	0.00	ft	0.00	m	PSAL	
People Spaces Building Area	0.00	sf	0.00	m2		
CIP Chemicals Storage Area Width	80.00	ft	24.38	m	CCSAW	
CIP Chemicals Storage Area Length	49.50	ft	15.09	m	CCSAL	
CIP Chemicals Storage Area	3960.00	sf	367.90	m2		
Calculations for Pipe Trenches						
Membrane Effluent Pipe Trench 1 Length	80.08	ft	24.41	m		
Membrane Effluent Pipe Trench 1 Width	0.00	ft	0.00	m		
Membrane Effluent Pipe Trench 1 Wall Height	0.00	ft	0.00	mm		
Membrane Influent Pipe Trench 2 Length	8.00	ft	2.44	m		
Membrane Influent Pipe Trench 2 Width	18.17	ft	5.54	m		
Membrane Influent Pipe Trench 2 Wall Height	18.67	ft	5689.60	mm		
Strainer Effluent Pipe Trench 3 Length	361.80	ft	110.28	m		
Strainer Effluent Pipe Trench 3 Width	8.17	ft	2.49	m		
Strainer Effluent Pipe Trench 3 Wall Height	5.00	ft	1524.00	mm		
Strainer Influent Pipe Trench 4 Length	361.80	ft	110.28	m		
Strainer Influent Pipe Trench 4 Width	5.50	ft	1676.40	mm		
Strainer Influent Pipe Trench 4 Wall Height	5.00	ft	1524.00	mm		
Building Excavation Dimensions						
Membrane Building Excavation Width	54.21	ft	16.52	m		
Membrane Building Excavation Length	694.50	ft	211.68	m		
Feed Pump and Strainer Area Excavation Width	365.80	ft	111.50	m		
Feed Pump and Strainer Area Excavation Length	47.45	ft	14.46	m		
Reverse Filtration System Area Excavation Width	120.04	ft	36.59	m		
Reverse Filtration System Area Excavation Length	23.96	ft	7.30	m		
CIP Area Excavation Width	203.26	ft	61.95	m		
CIP Area Excavation Length	59.00	ft	17.98	m		
Blower Room Excavation Width	166.13	ft	50.63	m		
Blower Room Excavation Length	32.10	ft	9.79	m		
Electric Room Excavation Width	12.33	ft	3.76	m		
Electric Room Excavation Length	79.00	ft	24.08	m		
People Spaces Excavation Width	4.00	ft	1.22	m		
People Spaces Excavation Length	4.00	ft	1.22	m		
CIP Chemicals Storage Area Excavation Width	84.00	ft	25.60	m		
CIP Chemicals Storage Area Excavation Length	53.50	ft	16.31	m		
Facility Excavation Depth	2.00	ft	609.60	mm		
Slab on Grade Thickness	**12.00**	in	**304.80**	mm		Model based on 12"
Slab on Grade Thickness	1.00	ft	304.80	mm		
Membrane Building Wall Thickness	**12.00**	in	**304.80**	mm	MBWW	Model based on 12"
Membrane Building Wall Thickness	1.00	ft	304.80	mm	MBWW	
Elevated Slab Thickness	**12.00**	in	**304.80**	mm		Model based on 12"
Elevated Slab Thickness	1.00	ft	304.80	mm		
Input Equipment Pad Thickness	**1.00**	ft	**304.80**	mm		
Input Chemical Bulk Storage Pad Thickness	**3.00**	ft	**914.40**	mm		
COST TABLE FOR TANKS & PUMPS:	**Unit Cost**					
Tanks (Installed Cost per Gallon)						
FRP	*$ 4.25*					
Polyethylene (PE)	*$ 2.25*					
Phenolic Lined Steel (PLS)	*$ 6.41*					
Chemical Feed Pumps (Cost per Each)	*$ 10,658.90*	*40E*				

COST ESTIMATE

Description	Quantity (English)	Unit (English)	Quantity (Metric)	Unit (Metric)	$/Unit	Total Cost	User Over-Write	Reference
SITEWORK:								
Membrane Building Excavation	3309.71	CY	2530.45	m3	*$6.72*	$22,251		*02E*
Membrane Building Imported Structural Backfill	2788.72	CY	2132.13	m3	*$50.94*	$142,062		*02SB*
Membrane Building Native Backfill	166.38	CY	127.21	m3	*$8.27*	$1,375		*02B*
Membrane Building Haul Excess	3143.33	CY	2403.25	m3	*$8.27*	$25,981		*02HE*
Membrane Feed/Effluent Pipe Trench Area Excavation	679.85	CY	519.79	m3	*$6.72*	$4,571		*02E*
Membrane Feed/Effluent Pipe Trench Area Imported Structural Backfill	10.77	CY	8.23	m3	*$50.94*	$548		*02SB*
Membrane Feed/Effluent Pipe Trench Area Native Backfill	506.53	CY	387.27	m3	*$8.27*	$4,187		*02B*
Membrane Feed/Effluent Pipe Trench Area Haul Excess	173.32	CY	132.51	m3	*$8.27*	$1,433		*02HE*
Strainer Inlet/Outlet Pipe Trench Area Excavation	2172.41	CY	1660.92	m3	*$6.72*	$14,605		*02E*
Strainer Inlet/Outlet Pipe Trench Area Imported Structural Backfill	294.80	CY	225.39	m3	*$50.94*	$15,018		*02SB*
Strainer Inlet/Outlet Pipe Trench Area Native Backfill	1023.98	CY	782.89	m3	*$8.27*	$8,463		*02B*
Strainer Inlet/Outlet Pipe Trench Area Haul Excess	1148.42	CY	878.03	m3	*$8.27*	$9,492		*02HE*
Feed Pump and Strainer Area Excavation	1542.97	CY	1179.68	m3	*$6.72*	$10,373		*02E*
Feed Pump and Strainer Area Imported Structural Backfill	1285.82	CY	983.08	m3	*$50.94*	$65,502		*02SB*
Feed Pump and Strainer Area Native Backfill	91.83	CY	70.21	m3	*$8.27*	$759		*02B*
Feed Pump and Strainer Area Haul Excess	1451.13	CY	1109.47	m3	*$8.27*	$11,994		*02HE*
Reverse Filtration System Area Excavation	274.49	CY	209.86	m3	*$6.72*	$1,845		*02E*
Reverse Filtration System Area Imported Structural Backfill	213.08	CY	162.91	m3	*$50.94*	$10,855		*02SB*
Reverse Filtration System Area Native Backfill	32.00	CY	24.47	m3	*$8.27*	$264		*02B*
Reverse Filtration System Area Haul Excess	242.49	CY	185.40	m3	*$8.27*	$2,004		*02HE*

CIP Area Excavation	1060.20	CY	810.58	m3	*$6.72*	$7,128		02E
CIP Area Imported Structural Backfill	888.33	CY	679.18	m3	*$50.94*	$45,253		02SB
CIP Area Native Backfill	58.28	CY	44.56	m3	*$8.27*	$482		02B
CIP Area Haul Excess	1001.92	CY	766.03	m3	*$8.27*	$8,281		02HE
Blower Room Excavation	491.80	CY	376.01	m3	*$6.72*	$3,306		02E
Blower Room Imported Structural Backfill	395.06	CY	302.04	m3	*$50.94*	$20,125		02SB
Blower Room Native Backfill	44.05	CY	33.68	m3	*$8.27*	$364		02B
Blower Room Haul Excess	447.75	CY	342.33	m3	*$8.27*	$3,701		02HE
Electric Room Excavation	103.57	CY	79.18	m3	*$6.72*	$696		02E
Electric Room Imported Structural Backfill	72.17	CY	55.18	m3	*$50.94*	$3,677		02SB
Electric Room Native Backfill	20.30	CY	15.52	m3	*$8.27*	$168		02B
Electric Room Haul Excess	83.27	CY	63.66	m3	*$8.27*	$688		02HE
People Spaces Excavation	3.32	CY	2.54	m3	*$6.72*	$22		02E
People Spaces Imported Structural Backfill	1.19	CY	0.91	m3	*$50.94*	$60		02SB
People Spaces Native Backfill	1.78	CY	1.36	m3	*$8.27*	$15		02B
People Spaces Haul Excess	1.54	CY	1.18	m3	*$8.27*	$13		02HE
Chemical Room Excavation	144.63	CY	110.57	m3	*$6.72*	$972		02E
Chemical Room Imported Structural Backfill	166.44	CY	127.26	m3	*$50.94*	$8,479		02SB
Chemical Room Native Backfill	4.30	CY	3.29	m3	*$8.27*	$36		02B
Chemical Room Haul Excess	140.33	CY	107.29	m3	*$8.27*	$1,160		02HE
Allowance for Misc Items	5%				$458,208.21	$22,910		
Subtotal						$481,119		
CONCRETE:								
Membrane Building Slab on Grade	1856.28	CY	1419.23	m3	*$490.62*	$910,723		03S
Feed Pump and Strainer Area Slab on Grade	877.44	CY	670.85	m3	*$490.62*	$430,484		03S
Reverse Filtration System Area Slab on Grade	96.02	CY	73.41	m3	*$490.62*	$47,109		03S
CIP Area Slab on Grade	424.89	CY	324.85	m3	*$490.62*	$208,456		03S
Blower Room Slab on Grade	182.99	CY	139.91	m3	*$490.62*	$89,780		03S
Electric Room Slab on Grade	29.47	CY	22.53	m3	*$490.62*	$14,458		03S
People Spaces Slab on Grade	0.15	CY	0.11	m3	*$490.62*	$73		03S
CIP Chemical Room Slab on Grade	117.31	CY	89.69	m3	*$490.62*	$57,552		03S
Membrane Effluent Pipe Trench #1 Walls	0.00	CY	0.00	m3	*$880.79*	$0		03W
Membrane Influent Pipe Trench #2 Walls	11.06	CY	8.46	m3	*$880.79*	$9,743		03W
Strainer Effluent Pipe Trench #3 Walls	134.00	CY	102.45	m3	*$880.79*	$118,026		03W
Strainer Effluent Pipe Trench #4 Walls	134.00	CY	102.45	m3	*$880.79*	$118,026		03W
CIP Chemical Room Containment Walls:								
Sodium Hypochlorite	3.63	CY	2.78	m3	*$880.79*	$3,197		03W
Citric Acid	2.25	CY	1.72	m3	*$880.79*	$1,979		03W
Sodium Bisulfite	1.80	CY	1.38	m3	*$880.79*	$1,588		03W
Sodium Hydroxide	2.25	CY	1.72	m3	*$880.79*	$1,979		03W
Phosphoric Acid	0.00	CY	0.00	m3	*$880.79*	$0		03W
Pump Pads:								
Feed Pumps	14.74	CY	11.27	m3	*$490.62*	$7,233		03P
Reverse Filtration Pumps	3.10	CY	2.37	m3	*$490.62*	$1,521		03P
Cleaning Solution Recirculation Pumps	2.90	CY	2.22	m3	*$490.62*	$1,422		03P
Neutralized Chemical Transfer Pumps	1.35	CY	1.03	m3	*$490.62*	$663		03P
Blower and Compressor Pads:								
Blowers	6.50	CY	4.97	m3	*$490.62*	$3,190		03P
Compressors	1.32	CY	1.01	m3	*$490.62*	$649		03P
Liquid CIP Chemical Transfer Pumps Pads:								
Sodium Hypochlorite	2.22	CY	1.70	m3	*$490.62*	$1,090		03P
Citric Acid	2.22	CY	1.70	m3	*$490.62*	$1,090		03P
Sodium Bisulfite	2.22	CY	1.70	m3	*$490.62*	$1,090		03P
Sodium Hydroxide	2.22	CY	1.70	m3	*$490.62*	$1,090		03P
Phosphoric Acid	0.00	CY	0.00	m3	*$490.62*	$0		03P
Tank Pads:								
CIP / Chemical Neutralization Tanks	37.83	CY	28.92	m3	*$490.62*	$18,560		03P
Reverse Filtration Tank	0.00	CY	0.00	m3	*$490.62*	$0		03P
Sodium Hypochlorite	21.12	CY	16.15	m3	*$490.62*	$10,361		03P
Citric Acid	10.56	CY	8.07	m3	*$490.62*	$5,181		03P
Sodium Bisulfite	0.00	CY	0.00	m3	*$490.62*	$0		03P
Sodium Hydroxide	10.56	CY	8.07	m3	*$490.62*	$5,181		03P
Phosphoric Acid	0.00	CY	0.00	m3	*$490.62*	$0		03P
Allowance for Misc Items	5%				$2,071,495.11	$103,575		
Subtotal						$2,175,070		
MASONRY:	**High**							
CMU Building	93848.22	SF	8718.78	m2	*$198.37*	$18,616,378		04BH
Subtotal						$18,616,378		
METALS:								
Membrane Effluent Pipe Trench #1 Grating	0.00	SF	0.00	m2	*$90.92*	$0		05G
Membrane Influent Pipe Trench #2 Grating	145.33	SF	13.50	m2	*$90.92*	$13,213		05G
Strainer Effluent Pipe Trench #3 Grating	2954.70	SF	274.50	m2	*$90.92*	$268,636		05G
Strainer Effluent Pipe Trench #4 Grating	1989.90	SF	184.87	m2	*$90.92*	$180,918		05G
Stairs to Access Chemical Rooms	4.00	EA			$8,327.28	$33,309		
Grating for Wet Well in CIP Chemical Containment Rooms	4.00	EA			$1,669.06	$6,676		
Allowance for Misc Items	5%				$502,752.61	$25,138		
Subtotal						$527,890		
DOORS & WINDOWS:								
Roll-Up Door	2.00	EA			$5,400.90	$10,802		
Single Entry Door (4' wide)	7.00	EA			*$2,082.51*	$14,578		08FD
Double Entry Door (6' wide)	1.00	EA			*$2,082.51*	$2,083		08FD
Allowance for Misc Items	10%				$27,461.89	$2,746		
Subtotal						$30,208		
EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**	
Membrane Equipment (Pall - 12 inch Rack Train)	3776760.00	SF	350872.49	m2	*$17.81*	$67,276,604		40E
Includes:								
Microfiltration modules								
Permeate pumps								
Air blowers								
Reverse Filtration Pumps								
CIP tanks and pumps								
Neutralization pump and tank								
Interconnecting piping								
Pilot plant								
Control system								
Pumps:								
Feed Pump (Active) (4991 gpm each, 190 hp each)	24.00	EA			$242,409.03			40E
Feed Pump (Standby) (4991 gpm each, 190 hp each)	6.00	EA			$242,409.03			40E
Reverse Filtration Pump (Active) (936 gpm each, 50 hp each)	6.00	EA			$97,251.76			40E
Reverse Filtration Pump (Standby) (936 gpm each, 50 hp each)	6.00	EA			$97,251.76			40E
Cleaning Solution Recirculation Pump (Active) (22 hp each)	6.00	EA			$128,763.21			40E
Cleaning Solution Recirculation Pump (Standby) (22 hp each)	0.00	EA			$128,763.21			40E
CIP Tank (2500 gallons each)	18.00	EA			$6,407.05			
Air Scour Blower (Active) (351 scfm each)	6.00	EA						
Air Scour Blower (Standby) (351 scfm each)	6.00	EA						
Neutralized Chemical Transfer Pump (Active) (10 hp each)	6.00	EA			$3,446.79			
Neutralized Chemical Transfer Pump (Standby) (10 hp each)	0.00	EA			$3,446.79			

Strainers (Active)	24.00	EA			$132,820.76			40E
Strainers (Standby)	6.00	EA			$132,820.76			40E
Compressor (Active) (5hp)	6.00	EA			$24,035.80			40E
CIP Heater (65 kw each)	18.00	EA			$14,307.02			
Reverse Filtration Tank (0 gal each)	0.00	EA			***$0.00***	$0		
Chemical Storage Area:								
Sodium Hypochlorite								
Bulk Tank (10'diameter, 14' high, FRP, 8225 gal each)	2.00	EA			***$15,829.11***	$31,658		
Metering Pump	4.00	EA			***$10,658.90***	$42,636		
Citric Acid								
Bulk Tank (10'diameter, 13' high, FRP, 7638 gal each)	1.00	EA			***$14,862.23***	$14,862		
Metering Pump	2.00	EA			***$10,658.90***	$21,318		
Sodium Bisulfite								
Bulk Tank (None)	0.00	EA			***$0.00***	$0		
Metering Pump	2.00	EA			***$10,658.90***	$21,318		
Sodium Hydroxide								
Bulk Tank (10'diameter, 10' high, FRP, 5875 gal each)	1.00	EA			***$11,961.59***	$11,962		
Metering Pump	2.00	EA			***$10,658.90***	$21,318		
Phosphoric Acid								
Bulk Tank (10'diameter, 13' high, FRP, 7638 gal each)	0.00	EA			***$14,862.23***	$0		
Metering Pump	0.00	EA			***$10,658.90***	$0		
Allowance for Misc Items	4%				$67,441,674.61	$2,697,667		
Subtotal						$70,139,342		
I&C:								
Instruments								
Feed Water Inlet Header Magmeter (FWIH, 42 inch)	6.00	EA			$45,061.33	$270,368		
Reverse Filtration Header Magmeter (RFH, 10 inch)	6.00	EA			$7,680.41	$46,082		
Common Membrane Filtrate/Permeate Header Magmeter (CMFPH, 42 inch)	0.00	EA			$45,061.33	$0		
CIP Supply/Return Header Magmeter (CIPH, 14 inch)	1.00	EA			$8,487.92	$8,488		
Air Scour Header Magmeter (BPA, 6 inch)	6.00	EA			$7,977.22	$47,863		
Isolation Valve Actuators (Electric)	25.00	EA				$0		
Isolation Valve Actuators (Pneumatic)	465.00	EA				$0		
Turbidimeters	10.00	EA				$0		
Particle Counters	10.00	EA				$0		
Level Transmitters	18.00	EA				$0		
Differential Pressure Transmitters	10.00	EA				$0		
Air Scour Differential Pressure Transmitter	2.00	EA				$0		
Air Scour Discharge Pressure Indicator Transmitter	2.00	EA				$0		
Air Scour Blowoff Valve	1.00	EA				$0		
CIP Chemical Tank Radar Level Transmitters	4.00	EA			*$1,043.16*	$4,173		
CIP Chemical Tank Beacons	4.00	EA			*$1,043.16*	$4,173		
CIP Chemical Day Tank Differential Pressure Transmitter	0.00	EA			*$1,043.16*	$0		
CIP Chemical Drum or Tote Weigh Scale	1.00	EA			*$1,390.89*	$1,391		
CIP Chemical Metering Pump Discharge Pressure Switch	10.00	EA			*$695.44*	$6,954		
CIP Chemical Magmeter	10.00	EA			*$695.44*	$6,954		
CIP Chemical Sump Pump Float Switch	4.00	EA			*$347.72*	$1,391		
CIP Chemical Eyewash	4.00	EA			*$1,043.16*	$4,173		
Number of Analog I/O Counts	173.00	EA				$0		
Number of Digital I/O Counts	234.00	EA				$0		
Number of Local Panels	10.00	EA				$0		
Number of PLC's	2.00	EA				$0		
I&C Conduit Wire	568352.92	LF	173233.97	m	*$12.06*	$6,853,756		
Allowance for Misc Items	5%				$7,255,766.19	$362,788		
Subtotal						$7,618,554		
CONVEYING SYSTEMS:								
Monorail Hoist	2	EA			***$4,091.32***	$8,183		14MH
Hoist Rail	615	LF	187.50	m	***$41.33***	$25,422		14MR
Allowance for Misc Items	10%				$33,604.56	$3,360		
Subtotal						$36,965		
MECHANICAL:								
Pipe:								
Feed Water Inlet Header (FWIH, 42 inch, Steel)	342.30	LF	104.33	m	*$970.77*	$332,293		
Feed Pump Suction Lateral (FPSL, 18 inch, Steel)	106.59	LF	32.49	m	*$416.04*	$44,347		
Feed Pump Discharge Lateral (FPDL, 16 inch, Steel)	40.00	LF	12.19	m	*$369.82*	$14,793		
Strainer Effluent Lateral (SEL, 16 inch, Steel)	88.12	LF	26.86	m	*$369.82*	$32,590		
Strainer Effluent Common Header (SECH, 42 inch, Steel)	411.30	LF	125.36	m	*$970.77*	$399,276		
Membrane Influent Common Header (MIH, 42 inch, SST)	570.50	LF	173.89	m	*$1,532.93*	$874,534		
Membrane Influent Lateral (MIL, 12 inch, SST)	2977.70	LF	907.60	m	*$437.98*	$1,304,169		
Membrane Filtrate Lateral (MFL, 12 inch, SST)	2416.70	LF	736.61	m	*$437.98*	$1,058,463		
Common Membrane Filtrate/Permeate Header (CMFPH, 42 inch, SST)	630.50	LF	192.18	m	*$1,532.93*	$966,510		
Reverse Filtration Header (RFH, 10 inch, SST)	654.57	LF	199.51	m	*$364.98*	$238,905		
Reverse Filtration Lateral (RFL, 10 inch, SST)	583.40	LF	177.82	m	*$364.98*	$212,931		
Backwash Waste Header (BWW, 14 inch, DI)	630.50	LF	192.18	m	*$121.38*	$76,530		
Backwash Waste Lateral (BWWL, 12 inch, DI)	531.40	LF	161.97	m	*$104.04*	$55,287		
CIP Supply/Return Header (CIPH, 14 inch, PVC)	16228.52	LF	4946.45	m	*$125.96*	$2,044,131		
CIP Supply/Return Lateral (CIPL, 14 inch, PVC)	540.40	LF	164.71	m	*$125.96*	$68,068		
Air Scour Header (BPA, 6 inch, SST)	881.38	LF	268.64	m	*$218.99*	$193,012		
Strainer Backwash Waste (SBWW, 4 inch, Steel)	661.80	LF	201.72	m	*$92.45*	$61,186		
Membrane Integrity Test Piping (MIT, 2 inch, SST)	3047.20	LF	928.79	m	*$73.00*	$222,435		
Elbows:								
Feed Water Inlet Header (FWIH, 42 inch, Steel)	0.00	EA			*$5,846.39*	$0		
Feed Pump Suction Lateral (FPSL, 18 inch, Steel)	0.00	EA			*$2,505.60*	$0		
Feed Pump Discharge Lateral (FPDL, 16 inch, Steel)	0.00	EA			*$2,227.20*	$0		
Strainer Effluent Lateral (SEL, 16 inch, Steel)	5.00	EA			*$2,227.20*	$11,136		
Strainer Effluent Common Header (SECH, 42 inch, Steel)	0.00	EA			*$5,846.39*	$0		
Membrane Influent Common Header (MIH, 42 inch, SST)	0.00	EA			*$7,959.34*	$0		
Membrane Influent Lateral (MIL, 12 inch, SST)	66.00	EA			*$2,274.10*	$150,090		
Membrane Filtrate Lateral (MFL, 12 inch, SST)	66.00	EA			*$2,274.10*	$150,090		
Common Membrane Filtrate/Permeate Header (CMFPH, 42 inch, SST)	0.00	EA			*$7,959.34*	$0		
Reverse Filtration Header (RFH, 10 inch, SST)	88.00	EA			*$1,895.08*	$166,767		
Reverse Filtration Lateral (RFL, 10 inch, SST)	11.00	EA			*$1,895.08*	$20,846		
Backwash Waste Header (BWW, 14 inch, DI)	0.00	EA			*$2,547.57*	$0		
Backwash Waste Lateral (BWWL, 12 inch, DI)	11.00	EA			*$2,183.63*	$24,020		
CIP Supply/Return Header (CIPH, 14 inch, PVC)	72.00	EA			*$503.43*	$36,247		
CIP Supply/Return Lateral (CIPL, 14 inch, PVC)	528.00	EA			*$503.43*	$265,810		
Air Scour Header (BPA, 6 inch, SST)	12.00	EA			*$1,137.05*	$13,645		
Strainer Backwash Waste (SBWW, 4 inch, Steel)	30.00	EA			*$556.80*	$16,704		
Membrane Integrity Test Piping (MIT, 2 inch, SST)	69.00	EA			*$379.02*	$26,152		
Tee:								
Feed Water Inlet Header (FWIH, 42 inch, Steel)	30.00	EA			*$13,320.29*	$399,609		
Feed Pump Suction Lateral (FPSL, 18 inch, Steel)	0.00	EA			*$5,708.70*	$0		
Feed Pump Discharge Lateral (FPDL, 16 inch, Steel)	0.00	EA			*$5,074.40*	$0		
Strainer Effluent Lateral (SEL, 16 inch, Steel)	0.00	EA			*$5,074.40*	$0		
Strainer Effluent Common Header (SECH, 42 inch, Steel)	36.00	EA			*$13,320.29*	$479,530		
Membrane Influent Common Header (MIH, 42 inch, SST)	66.00	EA			*$11,160.02*	$736,561		
Membrane Influent Lateral (MIL, 12 inch, SST)	0.00	EA			*$3,188.58*	$0		
Membrane Filtrate Lateral (MFL, 12 inch, SST)	0.00	EA			*$3,188.58*	$0		
Common Membrane Filtrate/Permeate Header (CMFPH, 42 inch, SST)	66.00	EA			*$11,160.02*	$736,561		
Reverse Filtration Header (RFH, 10 inch, SST)	66.00	EA			*$2,657.15*	$175,372		
Reverse Filtration Lateral (RFL, 10 inch, SST)	0.00	EA			*$2,657.15*	$0		
Backwash Waste Header (BWW, 14 inch, DI)	11.00	EA			*$4,230.18*	$46,532		

Backwash Waste Lateral (BWWL, 12 inch, DI)	0.00	EA			*$3,625.87*	$0		
CIP Supply/Return Header (CIPH, 14 inch, PVC)	312.00	EA			*$779.06*	$243,066		
CIP Supply/Return Lateral (CIPL, 14 inch, PVC)	0.00	EA			*$779.06*	$0		
Air Scour Header (BPA, 6 inch, SST)	72.00	EA			*$1,594.29*	$114,789		
Strainer Backwash Waste (SBWW, 4 inch, Steel)	30.00	EA			*$1,268.60*	$38,058		
Membrane Integrity Test Piping (MIT, 2 inch, SST)	72.00	EA			*$531.43*	$38,263		
Valves:								
Feed Water Inlet Header (FWIH, 42 inch, STL)	0.00	EA			*$42,759.05*	$0		
Feed Pump Suction Lateral (FPSL, 18 inch, STL)	5.00	EA			*$18,325.31*	$91,627		
Feed Pump Discharge Lateral (FPDL, 16 inch, STL)	15.00	EA			*$16,289.16*	$244,337		
Strainer Effluent Lateral (SEL, 16 inch, STL)	5.00	EA			*$16,289.16*	$81,446		
Strainer Effluent Common Header (SECH, 42 inch, STL)	0.00	EA			*$42,759.05*	$0		
Membrane Influent Common Header (MIH, 42 inch, SST)	0.00	EA			*$37,214.68*	$0		
Membrane Influent Lateral (MIL, 12 inch, SST)	66.00	EA			*$10,632.76*	$701,762		
Membrane Filtrate Lateral (MFL, 12 inch, SST)	66.00	EA			*$10,632.76*	$701,762		
Common Membrane Filtrate/Permeate Header (CMFPH, 42 inch, SST)	0.00	EA			*$37,214.68*	$0		
Reverse Filtration Header (RFH, 10 inch, SST)	3.00	EA			*$8,860.64*	$26,582		
Reverse Filtration Lateral (RFL, 10 inch, SST)	11.00	EA			*$8,860.64*	$97,467		
Backwash Waste Header (BWW, 14 inch, DI)	0.00	EA			*$12,404.89*	$0		
Backwash Waste Lateral (BWWL, 12 inch, DI)	11.00	EA			*$10,632.76*	$116,960		
CIP Supply/Return Header (CIPH, 14 inch, PVC)	0.00	EA			*$12,404.89*	$0		
CIP Supply/Return Lateral (CIPL, 14 inch, PVC)	264.00	EA			*$12,404.89*	$3,274,892		
Air Scour Header (BPA, 6 inch, SST)	24.00	EA			*$5,316.38*	$127,593		
Strainer Backwash Waste (SBWW, 4 inch, STL)	30.00	EA			*$4,072.29*	$122,169		
Membrane Integrity Test Piping (MIT, 2 inch, SST)	78.00	EA				$0		
Allowance for Misc Items	2%				$17,675,905.08	$353,518		
Subtotal						$18,029,423		
ELECTRICAL:								
# MCC Sections	45.00	EA			$10,730.27	$482,862		***26MCC***
Switchgear	0.00	EA			$4,935.92	$0		***26SG***
Adjustable Frequency Drives								
Feed Pump (Active) (190 hp each)	24.00	EA			***$33,780.67***	$810,736		
Feed Pump (Standby) (190 hp each)	6.00	EA			***$33,780.67***	$202,684		
Cleaning Solution Recirculation Pump (Active) (22 hp each)	0.00	EA			***$15,422.17***	$0		
Cleaning Solution Recirculation Pump (Standby) (22 hp each)	0.00	EA			***$15,422.17***	$0		
Neutralized Chemical Transfer Pump (Active) (10 hp each)	0.00	EA			***$11,750.46***	$0		
Neutralized Chemical Transfer Pump (Standby) (10 hp each)	0.00	EA			***$11,750.46***	$0		
Blower (Active) (33 hp each)	6.00	EA			***$10,176.88***	$61,061		
Blower (Standby) (33 hp each)	6.00	EA			***$10,176.88***	$61,061		
Compressor (5 hp each)	0.00	EA			***$13,206.03***	$0		
CIP Heater (88 hp each)	0.00	EA			***$13,206.03***	$0		
CIP Metering Pumps (Active) (1 hp each)	0.00	EA			***$9,521.22***	$0		
CIP Metering Pumps (Standby) (1 hp each)	0.00	EA			***$20,357.66***	$0		
Electrical Conduit & Wire	5620.86	LF	1713.24	m	*$12.06*	$67,782		
Allowance for Misc Items	10%				$1,686,186.60	$168,619		
Subtotal						$1,854,805		
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**		
Item 1 Description	0.00		0.00		0.00	$0		
Item 2 Description	0.00		0.00		0.00	$0		
Item 3 Description	0.00		0.00		0.00	$0		
Item 4 Description	0.00		0.00		0.00	$0		
Item 5 Description	0.00		0.00		0.00	$0		
Item 6 Description	0.00		0.00		0.00	$0		
Item 7 Description	0.00		0.00		0.00	$0		
Item 8 Description	0.00		0.00		0.00	$0		
Item 9 Description	0.00		0.00		0.00	$0		
Item 10 Description	0.00		0.00		0.00	$0		
Item 11 Description	0.00		0.00		0.00	$0		
Item 12 Description	0.00		0.00		0.00	$0		
Item 13 Description	0.00		0.00		0.00	$0		
Item 14 Description	0.00		0.00		0.00	$0		
Item 15 Description	0.00		0.00		0.00	$0		
Subtotal						$0		
Subtotal						$119,509,755		
ALLOWANCES:		**User Override**						
Finishes Allowance	2.00%		$124,489,328	$2,489,787				
I&C Allowance	1.00%		$124,489,328	$1,244,893				
Mechanical Allowance	0.00%		$124,489,328	$0				
Electrical Allowance	1.00%		$124,489,328	$1,244,893				
					Facility Cost Name			
Facility Cost	**160,000,000**	**GPD**	**$0.78**	**$124,489,328**				
Facility Cost with Standard Additional Project Costs Added	**160,000,000**	**GPD**	**$0.95**	**$151,263,068**				
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**160,000,000**	**GPD**	**$1.64**	**$262,375,045**				
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**160,000,000**	**GPD**	**$1.35**	**$215,934,354**				
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**160,000,000**	**GPD**	**$1.64**	**$262,375,045**				

	B	C	D	E	F	G	H	I
1	***Ozone - Serpentine***							
2	**PROCESS DESIGN CRITERIA**							
3	**Is This Facility Included in My Project? No**							
4	**Type of Feed Gas: Delivered LOX**							
5	**Type of Dissolution: Diffused Bubble**							
6	**Type of Contactor: Serpentine**							
7	**Number of parallel trains or contactors: Minimum of 2**							
8								
9	**Process User Inputs:**	**Value (English)**	**Value (English)**	**Value (Metric)**	**Value (Metric)**	**Name**	**Red Flags**	**Comment**
10	1.) Input Summer Maximum Plant Flow Rate	**160.00**	mgd	**567.81**	ML/d			
11	2.) Input Winter Maximum Plant Flow Rate	**100.00**	mgd	**378.54**	ML/d			
12	3.) Input Maximum Oxidation Flow Rate	**160.00**	mgd	**567.81**	ML/d			
13	4.) Input Number of Contactors	**2**	each	2.00	each			Typically 2 minimum.
14								
15	**Process User Inputs:**	**Value (English)**	**Value (English)**	**Value (English)**	**Unit (English)**	**Value (Metric)**	**Value (Metric)**	**Value (Metric)**
16	Ozone Chemistry and Contactor Sizing:	**Summer**	**Winter**	**Oxidation**		**Summer**	**Winter**	**Oxidation**
17	4.) Input Water Temperature	77.00	42.80	42.80	degrees F	**25.00**	**6.00**	**6.00**
18	Calculate Maximum Plant Flow Rate	160.00	100.00	160.00	mgd	605.67	378.54	605.67
19	5.) Input Ozone Immediate Demand	**0.40**	**0.40**	**1.00**	mg/L	0.40	0.40	1.00
20	6.) Input Ozone Residual Development to Ozone Transferred Ratio	**0.40**	**0.40**	**0.40**	Slope development line	0.40	0.40	0.40
21	Calculate Ozone Residual Intercept	-0.16	-0.16	-0.40	mg/L	-0.16	-0.16	-0.40
22	7.) Input Ozone Residual Decay Rate	**0.30**	**0.15**	**0.15**	1/min	0.30	0.15	0.15
23	8.) Input Ozone Transfer Efficiency	**95.00%**	**95.00%**	**95.00%**		95.00%	95.00%	95.00%
24	9.) Input Hydraulic Retention Time for Disinfection Cell at Max Flow	**5.00**	8.00	5.00	minutes	5.00	8.00	5.00
25	10.) Input Short Circuiting Factor for Disinfection Cell	**0.60**				0.60	0.00	0.00
26	Calculate T10 Time for Disinfection Cell	3.00	4.80	3.00	minutes	3.00	4.80	3.00
27	Calculate Disinfection Cell Water Volume, Each Train	37,133.49	37,133.49	37,133.49	cf	1,051.50	1,051.50	1,051.50
28	Calculate Required Disinfection Contactor Water Volume, Each Train	37,133.49			cf	1,051.50		
29	11.) Input Hydraulic Retention Time for AOP Contactor at Max Flow	**5.00**	8.00	5.00	minutes	5.00	8.00	5.00
30	12.) Input Short Circuiting Factor for AOP Contactor	**0.60**	0.60	0.60		0.60	0.60	0.60
31	Calculate T10 Time for AOP Contactor	3.00	4.80	3.00	minutes	3.00	4.80	3.00
32	Calculate AOP Contactor Water Volume, Each Train	37,133.49	37,133.49	37,133.49	cf	1,051.50	1,051.50	1,051.50
33	Calculate Required AOP Contactor Water Volume, Each Train	37,133.49			cf	1,051.50		
34	13.) Input Desired Cryptosporidium Log Inactivation	**0.0**	**0.0**	**0.0**	-log	0.00	0.00	0.00
35	Calculate Required Cryptosporidium Inactivation CT	0.00	0.00	0.00	mg-min/L	0.00	0.00	0.00
36	14.) Input Desired Giardia Log Inactivation	**0.0**	**0.0**	**0.0**	-log	0.00	0.00	0.00
37	Calculate Required Giardia Inactivation CT	0.00	0.00	0.00	mg-min/L	0.00	0.00	0.00
38	15.) Input Desired Virus Log Inactivation	**0.0**	**0.0**	**0.0**	-log	0.00	0.00	0.00
39	Calculate Required Virus Inactivation CT	0.00	0.00	0.00	mg-min/L	0.00	0.00	0.00
40	Calculate Controlling Required Pathogen Inactivation CT	0.00	0.00	0.00	mg-min/L	0.00	0.00	0.00
41	16.) Input Design Applied Ozone Dose	**1.50**	**1.50**	**3.00**	mg/L	1.50	1.50	3.00
42	Calculate Transferred Ozone Dose	1.43	1.43	2.85	mg/L	1.43	1.43	2.85
43	Calculate Ozone Generation Capacity	2,002.90	1,251.81	4,005.79	lb/d	908.50	567.81	1,817.00
44	17.) Input if Hydrogen Peroxide required	**No**	**No**	**No**	Y/N	No	No	No
45	Calculate Initial Residual in Disinfection Contactor	0.41	0.41	0.74	mg-min/L	0.41	0.41	0.74
46	Calculate End Residual in Disinfection Contactor	0.09	0.12	0.35	mg-min/L	0.09	0.12	0.35
47	Calculate CT Achieved in Disinfection Contactor	0.27	0.59	1.05	mg-min/L	0.27	0.59	1.05
48	Calculate Initial Residual in AOP Contactor	0.09	0.12	0.35	mg-min/L	0.09	0.12	0.35
49	Calculate End Residual in AOP Contactor	0.02	0.04	0.17	mg-min/L	0.02	0.04	0.17
50	Calculate CT Achieved in AOP Contactor	0.06	0.18	0.50	mg-min/L	0.06	0.18	0.50
51	Calculate Total CT Achieved in Full Contactor	0.34	0.77	1.54	mg-min/L	0.34	0.77	1.54
52	**Process User Inputs:**	**Value (English)**	**Value (English)**	**Value (Metric)**	**Value (Metric)**	**Name**	**Red Flags**	**Comment**
53	18.) Input Contactor Side Water Depth	**20.00**	ft	**6,096.00**	mm	SWD		Typically 20 ft for Good Transfer Efficiency
54	Distance from Top of SWD to Roof of Building	3.00	ft		mm	FB		Fixed
55	19.) Input Desired AOP Contactor Length to Width Ratio	**20.00**						Typically 20 to 40:1 to Promote Plug Flow
56	20.) Input Odd Number of Passes, Minimum 3 Passes	**3**	#			NP		
57	Calculate Pass Water Width	9.64	ft	2,936.76	mm	SPW		
58	Calculate Pass Water Length	64.23	ft	19,578.37	mm	SPL		
59	Calculate Contactor Water Width	31.25	ft	9,523.50	mm	CW		

	B	C	D	E	F	G	H	I
60	Calculate Injection Cell Length	12.33	ft	3,758.11	mm	ICL		
61	Calculate Disinfection Cell Water Length	59.42	ft	18,112.11	mm	DCL		
62	Calculate Upflow Cell Water Length Required	9.90	ft	3,018.69	mm	UCL		
63	Calculate Overflow Channel Length	10.00	ft	3,048.00	mm	OFL		
64	Calculate Effluent Weir Distance from Contactor Outlet	9.64	ft	2,936.76	mm	EWCL		
65	Calculate Effluent Weir Head	2.46	ft	749.74	mm	WH		
66	Ozone Generation and Off-Gas Destruction Sizing:							
67	Calculate Ozone Design Dose	3.00	mg/L	3.00	mg/L			Maximum of Design Applied Ozone Dose
68	Calculate Design Daily Ozone Generation Capacity	4,005.79	lb/d	1,817.00	kg/d			Maximum of Ozone Generation Capacity
69	21.) Input Design Ozone Weight Percent	10%						Either 10% or 12%
70	Calculate Design Daily Oxygen Usage	40,057.92	lb/d	18,169.97	kg/d			
71	Calculate Ozone Generation Capacity at 10% Weight	4,005.79	lb/d	1,817.00	kg/d			
72	Standby Ozone Generation Capacity Provided at 10% Weight	0%						Fixed
73	Calculate Ozone Generation Capacity at 8% Weight	6,409.27	lb/d	2,907.19	kg/d			
74	Standby Ozone Capacity Provided at 8% Weight	60%						Fixed
75	Convert Design Daily Oxygen Usage from lb/d to scfm	335.00	scfm	9.49	m3/min			Assumes gaseous oxygen density of 0.08304 lb/ft3 at standard conditions of 1 atm and 20 deg C.
76	Calculate Number of Porous Plate Dome Diffusers for Dissolution	335.00	#					Based on 1 scfm per 7-inch diameter Sanitaire Ozone dome diffuser at 20-inch water headloss.
77	Calculate Minimum Area Required to Accommodate Diffusers	770.49	sf	71.58	m2			Based on 1 diffuser per 2.3 square foot (i.e., spacing at 18 inches)
78	22.) Input Number of Active Ozone Generators	2	#					
79	23.) Input Number of Standby Ozone Generators	1	#					Typically 1 or Rely on Higher Production Capacity at Lower Ozone Concentration
80	Calculate Design Ozone Generator Capacity, Each	2,002.90	lb/d	908.50	kg/d			
81	Calculate Total Number of Generators	3	#					
82	24.) Select Ozone Cooling Water System	Closed Loop					**Open loop is not acceptable**	
83	25.) Input Ozone Generator and Power Supply Unit Energy Consumption	4.70	kWh/lb	10.36	kWh/kg			Typically 4.5 to 7 kWh/lb
84	26.) Input Ozone Generator and Power Supply Unit Energy Consumption Conversion to Waste Heat	85%						Typically 85% to 95%
85	Calculate Maximum Waste Heat Generation Rate	60,705.24	BTU/min	25,618.97	kWh/d			
86	27.) Input Design Temperature Rise for Heat Rejection Water	7.50	degrees F	-13.61	degrees C			Typically 5 to 10 deg F
87	28.) Input Heat Exchanger Efficiency	90%						Typically 70% to 90%
88	Calculate Preliminary Heat Rejection Water Flow Rate	1,077.64	gpm	67.99	L/s			Confirm cooling water requirement with ozone generator supplier or specify refrigerant chiller system.
89	Calculate Preliminary Cooling Pump Horsepower, Each	9.72	hp	7.25	kW			Assume 25 ft TDH and 70% pump efficiency
90	29.) Input Design Days of Liquid Oxygen Storage at Design Ozone Weight Percent	30.00	days					
91	Calculate Total Liquid Oxygen Storage	1,201,737.60	lb	545,099.01	kg			
92	Convert Total Liquid Oxygen Storage from lb to gallons	126,232.94	gal	477,843.67	L			
93	Calculate Minimum Days of Liquid Oxygen Storage at 10% Ozone	30.00	days					
94	Calculate Minimum Days of Liquid Oxygen Storage at 8% Ozone	15.00	days					
95	30.) Input Number of Liquid Oxygen Storage Tanks	3	#					Typically 2 or More
96	Calculate Volume of Liquid Oxygen Storage Tank, Each	42,077.65	gal	159,281.22	L			
97	31.) Input Liquid Oxygen Storage Tank, Diameter	12.00	ft	3,657.60	mm	DLOX		Typically 14' or Less
98	32.) Indicate Orientation of LOX Tank	Horizontal						Use Horizontal Only if There is an Aesthetic Concern
99	Calculate Liquid Oxygen Storage Tank Length/Height	49.74	ft	15,159.41	mm	LLOX		
100	Calculate Number of Liquid Oxygen Vaporizers	3	#			#VP		Fixed to Equal Number of Tanks, Minimum of 2
101	Liquid Oxygen Vaporizer Footprint, each	24.00	sf	2.23	m2	VPFP		Fixed
102	Number of Active Thermal Catalytic Ozone Destructors	2	#					Fixed to Equal Number of Contactors
103	33.) Input Number of Standby Thermal Catalytic Ozone Destructors	1	#					
104	34.) Input Design Ozone Weight % in Ozone Off-Gas to Thermal Catalytic Ozone Destructors	2.40%						Typically assume worst case ozone transfer efficiency to contactor and highest ozone production concentration in the feed gas. If 80% transfer worst case at 12% ozone concentration, then (1-0.8)*0.12*100 = 2.4%.
105	35.) Do Destruct Units Need Enclosure for Noise Concerns?	Yes						Locate Indoors if Noise is a Concern

	B	C	D	E	F	G	H	I
106	Calculate Capacity of Thermal Catalytic Ozone Destructor, Each	230.31	scfm	6.52	m3/min			Assumes 110% of the gas flow at 8% ozone by weight. Assumes gaseous oxygen density of 0.08304 lb/ft3 at standard conditions of 1 atm and 20 deg C.
107	36.) Input Cooling Water Flow per Generator - value to come from Vendor	700.00	gpm	44.16	L/s			
108	37.) Input Cooling Water Flow per PSU - value to come from Vendor	20.00	gpm	1.26	L/s			
109	Calculate Cooling Pump Horsepower, Each	6.49	hp	4.84	kW			Assume 25 ft TDH and 70% pump efficiency
110	38.) Input Distance from LOX Pad to Generation Room	20.00	ft	6,096.00	mm			
111	39.) Input Distance from Generation Room to Upstream End of Contactor	150.00	ft	45,720.00	mm			
112	40.) Input Distance from Middle of Contactor to Destruct Room	50.00	ft	15,240.00	mm			
113	41.) Input Ozone Generation Bldg Depth of Burial	0.00	ft	914.40	mm			
114	42.) Input Ozone Generation Bldg Cutback Slope	1.00	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
115	43.) Input Ozone Generation Bldg Over Excavation Depth	1.00	ft	609.60	mm			
116	44.) Input LOX Pad Depth of Burial	0.00	ft	609.60	mm			
117	45.) Input LOX Pad Cutback Slope	1.00	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
118	46.) Input LOX Pad Over Excavation Depth	1.00	ft	609.60	mm			
119	47.) Input Ozone Contactor Depth of Burial	10.00	ft	3,048.00	mm			
120	48.) Input Ozone Contactor Cutback Slope	1.50	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
121	49.) Input Ozone Contactor Over Excavation Depth	1.00	ft	609.60	mm			
122								
123	**Mechanical Sizing Requirements:**							
124	**Pipe Name**	**Input Velocity (fps, fpm)**				**Standard Pipe Size (inches)**	**Nominal Pipe Size (mm)**	**Name**
125	Influent Pipe	5.00	fps	1.52	m/s	72.00	1800.00	75.32316612
126	Effluent Pipe	5.00	fps	1.52	m/s	72.00	1800.00	
127	Overflow Pipe	5.00	fps	1.52	m/s	96.00	2050.00	
128	Total LOX Pipe	2.00	fps	0.61	m/s	1.50	40.00	
129	Total GOX Pipe Upstream of PRV	1,800.00	fpm	9.14	m/s	3.00	80.00	
130	Total GOX Pipe Downstream of PRV	1,800.00	fpm	9.14	m/s	6.00	150.00	
131	Individual GOX Pipe Downstream of PRV	1,800.00	fpm	9.14	m/s	4.00	100.00	
132	Nitrogen	1,800.00	fpm	9.14	m/s	1.00	25.00	
133	Header Ozone Gas PIpe	1,800.00	fpm	9.14	m/s	6.00	150.00	
134	Individual Ozone Generator Gas Pipe	1,900.00	fpm	9.65	m/s	4.00	100.00	
135	Individual Ozone Contactor Gas Pipe	1,800.00	fpm	9.14	m/s	4.00	100.00	
136	Ozone Off-Gas Pipe per Train	1,800.00	fpm	9.14	m/s	6.00	150.00	
137	Ozone Off-Gas Pipe Combined	1,800.00	fpm	9.14	m/s	8.00	200.00	
138	Ozone Off-Gas Pipe per Destruct Unit	1,800.00	fpm	9.14	m/s	6.00	150.00	
139	Total Cooling Water Pipe (open loop)	7.00	fps	2.13	m/s	8.00	200.00	
140	Individual Skid Cooling Water Pipe (open loop)	7.00	fps	2.13	m/s	6.00	150.00	
141	Total Cooling Water Pipe (closed loop)	7.00	fps	2.13	m/s	12.00	300.00	
142	Individual Generator Cooling Water Pipe (closed loop)	7.00	fps	2.13	m/s	8.00	200.00	
143	Individual PSU Cooling Water Pipe (closed loop)	7.00	fps	2.13	m/s	1.50	40.00	
144								
145	**Mechanical Material Requirements:** **Note to User: Only piping, valves, and fittings outside of Ozone Supplier Skids are summarized below.**							

	B	C	D	E	F	G	H	I
146	**Pipe Name**	**Pipe ID**	**Installation Type**	**Pipe Material**	**Pipe Lining Material**	**Pipe Coating Material**	**Comments**	**Red Flags**
147	Influent Pipe	OZI	**Buried**	**Steel**	**Cement Mortar**	**Cement Mortar**		
148	Effluent Pipe	OZW	**Buried**	**Steel**	**Cement Mortar**	**Cement Mortar**		
149	Overflow Pipe	OF	**Buried**	**Steel**	**Cement Mortar**	**Cement Mortar**		
150	LOX Pipe	LOX	Exposed	Copper	NA	NA		
151	Total GOX Pipe Upstream of PRV	GOX	Exposed	**304 SST**	NA	NA		
152	Total GOX Pipe Downstream of PRV	GOX	Exposed	**316 SST**	NA	NA		
153	Individual GOX Pipe Downstream of PRV	GOX	Exposed	**316 SST**	NA	NA		
154	Header Ozone Gas PIpe	O3	Exposed	316 SST	NA	NA		
155	Individual Ozone Generator Gas Pipe	O3	Exposed	316 SST	NA	NA		
156	Individual Ozone Contactor Gas Pipe	O3	Exposed	316 SST	NA	NA		
157	Nitrogen	N2	Exposed	Copper	NA	NA		
158	Ozone Off-Gas Pipe per Train	OZG	Exposed	316 SST	NA	NA		
159	Ozone Off-Gas Pipe Combined	OZG	Exposed	316 SST	NA	NA		
160	Ozone Off-Gas Pipe per Destruct Unit	OZG	Exposed	316 SST	NA	NA		
161	Total Cooling Water Pipe (open loop)	CWS/CWR	**Buried**	**Steel**	**Cement Mortar**	**Cement Mortar**		
162	Individual Skid Cooling Water Pipe (open loop)	CWS/CWR	Exposed	**Steel**	**Cement Mortar**	**Cement Mortar**		
163	Total Cooling Water Pipe (closed loop)	GCWS/GCWR	Exposed	304 SST	NA	NA		
164	Individual Generator Cooling Water Pipe (closed loop)	GCWS/GCWR	Exposed	304 SST	NA	NA		
165	Individual PSU Cooling Water Pipe (closed loop)	GCWS/GCWR	Exposed	304 SST	NA	NA		
166								
167	Electrical User Inputs and Sizing Requirements:							
168	50.) Is this a "Critical" Facility (requiring standby power)?	**Yes**	Y/N					
169	51.) Is there SWGR?	No						
170								
171	Electrical Equipment Lengths:							**MCC**
172	**Item**	**Quantity**	**HP per Each**	**AFD's Required?**	**MCC Spaces for Motor Starters**	**MCC Spaces for AFD's less than 50hp)**	**MCC Spaces for Breakers**	**Total MCC Spaces**
173	Ozone Generators/Destruct (Active)	2.00	525.99	**No**	24.00	0.00	0.00	
174	Ozone Generators/Destruct (Standby)	1.00	525.99	**No**	12.00	0.00	0.00	
175	Cooling Water Pumps (Active)	2.00	6.49	**No**	4.00	0.00	0.00	
176	Cooling Water Pumps (Standby)	1.00	6.49	**No**	2.00	0.00	0.00	
177	TOTAL		**1597.46**		**42.00**	**0.00**	**0.00**	**42.00**
178								
179	Electrical Equipment Widths:							
180	**Equipment**	**Depth (ft)**						
181	MCC	1.67						
182	Small AFD's	0.00						
183	Large AFD's	0.00						
184	Switchgear	0.00						
185	Maximum Depth	**1.67**						
186								
187	Clear Distances:							
188	**Clear Distance**	**Width**	**Length**	**Comment**				
189	CD1		**3.00**	Clear Distance between wall and MCC	Typically 3 feet			
190	CD2		**1.00**	Clear Distance between MCC and Small AFD	Typically 1 foot			
191	CD3		**0.00**	Clear Distance between Small AFD and Large AFD	Typically Zero			
192	CD4		**0.00**	Clear Distance between Large AFD and Switchgear	Typically Zero			
193	CD5		**0.00**	Clear Distance between Switchgear and Contingency Space	Typically Zero			
194	CD6	**4.00**		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)				
195	CD7	**3.00**		Clear Distance in front of Equipment	Typically 3 feet			
196	Contingency Length		**0.00**	Contingency length	Typically Zero			
197								
198	Electric Room Length (ft):							
199	CD1	3.00						
200	MCC	16.67						
201	CD2	1.00						
202	Small AFD's	0.00						
203	CD3	0.00						
204	Large AFD's	0.00						
205	CD4	0.00						
206	Swithgear	0.00						
207	CD5	0.00						
208	Contingency	0.00						
209	Total Length	**20.67**						
210								
211	Electric Room Width (ft):							
212	CD6	0.00	If there is no switchgear, this distance will be Zero.					
213	Maximum Equipment Depth	1.67						
214	CD7	3.00						
215	Total Width	**4.67**						
216								
217	**Estimating Dimensions:**	**Value English**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Comment**	**Red Flags**
218	**Ozone Contactor Facility:**							
219	Basin Width	66.82	ft	20366.78	mm	Total BW		
220	Basin Length	163.56	ft	49853.10	mm	BL		

	B	C	D	E	F	G	H	I
221	Basin Divider Wall Length	150.56	ft	45890.70	mm			
222	Walls							
223	Perimeter and Divider Wall Height (Walls 11, 12, 13, 14) (SWD + FB)	23.00	ft	7010.40	mm	PDWH		
224	Wall 1 Height (SWD)	20.00	ft	6096.00	mm	CIWH-1		
225	Wall 2 Height (SWD - 3)	17.00	ft	5181.60	mm	CIWH-2		
226	Wall 3 Height (SWD + FB - 4)	19.00	ft	5791.20	mm	CIWH-3		
227	Wall 4 Height (SWD - 3)	17.00	ft	5181.60	mm	CIWH-4		
228	Wall 5 Height (SWD + FB)	23.00	ft	7010.40	mm	CIWH-5		
229	Wall 6 Height (SWD + FB)	23.00	ft	7010.40	mm	CIWH-6		
230	Wall 7 Height (SWD + FB)	23.00	ft	7010.40	mm	CIWH-7		
231	Wall 8 Height (SWD + FB)	23.00	ft	7010.40	mm	CIWH-8		
232	Wall 9 Height (SWD + FB)	23.00	ft	7010.40	mm	CIWH-9		
233	Wall 10 Height (SWD + FB)	23.00	ft	7010.40	mm	CIWH-10		
234	Wall 15 Height (SWD - WH)	17.54	ft	5346.26	mm	CIWH-15		
235	Perimeter Wall Thickness (Walls 11, 12, 13)	**1.50**	ft	**457.20**	mm	WPT	Model based on 1.5'	
236	Wall 1 Thickness	**1.00**	ft	**304.80**	mm	W1T		
237	Wall 2 Thickness	**1.33**	ft	**405.38**	mm	W2T	Model based on 1.33'	
238	Wall 3 Thickness	**1.17**	ft	**356.62**	mm	W3T	Model based on 1.17'	
239	Wall 4 Thickness	**1.33**	ft	**405.38**	mm	W4T	Model based on 1.33'	
240	Wall 5 Thickness	**1.17**	ft	**356.62**	mm	W5T	Model based on 1.17'	
241	Wall 6 Thickness	**1.33**	ft	**405.38**	mm	W6T	Model based on 1.33'	
242	Wall 7 Thickness	**1.17**	ft	**356.62**	mm	W7T	Model based on 1.17'	
243	Wall 8 Thickness	**1.33**	ft	**405.38**	mm	W8T	Model based on 1.33'	
244	Wall 9 Thickness	**1.00**	ft	**304.80**	mm	W9T		
245	Wall 10 Thickness	**1.00**	ft	**304.80**	mm	W10T		
246	Wall 15 Thickness	**1.17**	ft	**356.62**	mm	W15T	Model based on 1.17'	
247	Contactor Divider Walls 14 Thickness	**1.33**	ft	**405.38**	mm	W14T	Model based on 1.33'	
248	Wall 1 Length	31.25	ft	9523.50	mm	W1L		
249	Wall 2 Length	31.25	ft	9523.50	mm	W2L		
250	Wall 3 Length	31.25	ft	9523.50	mm	W3L		
251	Wall 4 Length	31.25	ft	9523.50	mm	W4L		
252	Wall 5 Length (ft)	76.21	ft	23228.36	mm	W5L		
253	Wall 6 Length (ft)	54.60	ft	16641.62	mm	W6L		
254	Wall 7 Length	54.60	ft	16641.62	mm	W7L		
255	Wall 8 Length	54.60	ft	16641.62	mm	W8L		
256	Wall 9 Length	54.60	ft	16641.62	mm	W9L		
257	Wall 10 Length	54.60	ft	16641.62	mm	W10L		
258	Wall 15 Length	9.64	ft	2936.76	mm	W15L		
259	Slab on Grade							
260	Slab on Grade Width	70.82	ft	21585.98	mm			
261	Slab on Grade Length	167.56	ft	51072.30	mm			
262	Slab on Grade Thickness	**18.00**	in	**457.20**	mm		Model based on 18"	
263	Slab on Grade Thickness	1.50	ft	457.20	mm	SOGT		
264	Elevated Slab							
265	Elevated Slab Thickness	**12.00**	in	**304.80**	mm		Model based on 12"	
266	Elevated Slab Thickness	1.00	ft	304.80	mm	ESLBT		
267	Excavation							
268	Excavation Width	74.82	ft	22805.18	mm			
269	Excavation Length	171.56	ft	52291.50	mm			
270	Excavation Depth	12.50	ft	3810.00	mm			
271								
272	Ozone Generator Building:							
273	Ozone Generator Width	**8.00**	ft	**2,438.40**	mm	WOG	Model is based on 8'	
274	Ozone Generator Length	**16.00**	ft	**4,876.80**	mm	LOG	Model is based on 16'	
275	Clear Distance Around Ozone Generators	**10.00**	ft	**3,048.00**	mm	CDG	Model is based on 10'	
276	Number of Ozone Generators	3.00		3.00			Input	
277	Closed Loop Cooling Skid Length	**10.00**	ft	**3,048.00**	mm	LOC	Model is based on 10'	
278	Closed Loop Cooling Skid Width	**8.00**	ft	**2,438.40**	mm	WOC	Model is based on 8'	
279	Wall Height	12.50	ft	3810.00	mm			
280	Building Width	64.00	ft	19507.20	mm	GBW		
281	Building Length	56.00	ft	17068.80	mm	GBL		
282	Building Area	3584.00	sf	332.96	m2			
283	Slab on Grade Thickness	**12.00**	in	**304.80**	mm		Model based on 12"	
284	Slab on Grade Thickness	1.00	ft	304.80	mm	TGB		
285	Excavation							
286	Excavation Width	68.00	ft	20726.40	mm			
287	Excavation Length	60.00	ft	18288.00	mm			
288	Excavation Depth	2.00	ft	609.60	mm			
289								
290	**Ozone Destruct Room (attached to Ozone Generation Building):**							
291	Width	20.00	ft	6096.00	mm	DBW	Fixed	
292	Length	36.00	ft	10972.80	mm	DBL		
293	Height	12.50	ft	3810.00	mm		Fixed	
294	Slab on Grade Thickness	12.00	in	304.80	mm		Model based on 12"	
295	Slab on Grade Thickness	1.00	ft	304.80	mm			
296	Indoor Ozone Destruct Building Area	720.00	sf	66.89	m2			
297	Excavation							
298	Excavation Width	24.00	ft	7315.20	mm			
299	Excavation Length	40.00	ft	12192.00	mm			
300	Excavation Depth	2.00	ft	609.60	mm			
301								
302	**Electrical Room (in Ozone Generation Building:**							
303	Width	4.67	ft	1422.40	mm	ERW	Fixed	
304	Length	20.67	ft	6299.20	mm	ERL		

	B	C	D	E	F	G	H	I
305	Height	12.50	ft	3810.00	mm		Fixed	
306	Slab on Grade Thickness	12.00	in	304.80	mm		Model based on 12"	
307	Slab on Grade Thickness	1.00	ft	304.80	mm			
308	Indoor Electrical Room Area	96.44	sf	8.96	m2			
309	Excavation							
310	Excavation Width	8.67	ft	2641.60	mm			
311	Excavation Length	24.67	ft	7518.40	mm			
312	Excavation Depth	2.00	ft	609.60	mm			
313								
314	**Outdoor Ozone Destruct Pad:**							
315	Width	0.00	ft	0.00	mm	DBW	Fixed	
316	Length	0.00	ft	0.00	mm	DBL		
317	Slab on Grade Thickness	**12.00**	in	**304.80**	mm		Model based on 12"	
318	Slab on Grade Thickness	0.00	ft	0.00	mm	SOG2		
319								
320	LOX Tank Pad: Horizontal Tanks							
321	Clear Distance Around Tanks	**6.00**	ft	**1,828.80**	mm	CDT	Model is based on 6'	
322	LOX Vaporizer Length & Clear Distance	**14.00**	ft	**4,267.20**	mm		Model is based on 14'	
323	Width	60.00	ft	18288.00	mm	LPW		
324	Length	75.74	ft	23084.21	mm	LPL		
325	Area of Tank Pad	4544.14	sf	422.16	m2			
326	Allowance for Other Equipment (additional 10% area)	454.41	sf	42.22	m2			
327	Total Pad Area	4998.55	sf	464.38	m2			
328	Slab on Grade Thickness	**12.00**	in	**304.80**	mm		Model based on 12"	
329	Slab on Grade Thickness	1.00	ft	304.80	mm	TLOX		
330	Excavation							
331	Excavation Width	64.00	ft	19507.20	mm			
332	Excavation Length	79.74	ft	24303.41	mm			
333	Excavation Depth	2.00	ft	609.60	mm			
334								
335	**COST ESTIMATE**							
336	**Description**	**Quantity (English)**	**Unit (English)**	**Quantity (Metric)**	**Unit (Metric)**	**$/Unit**	**Total Cost**	**User Over-Write**
337								
338	SITEWORK:							
339	Ozone Generator Building							
340	Excavation	359.73	CY	275.03	m3	*$6.72*	$2,418	
341	Imported Structural Backfill	302.22	CY	231.07	m3	*$50.94*	$15,396	
342	Native Backfill	18.96	CY	14.50	m3	*$8.27*	$157	
343	Haul Excess	340.76	CY	260.53	m3	*$8.27*	$2,817	
344	Ozone Destruct Room							
345	Excavation	90.26	CY	69.01	m3	*$6.72*	$607	
346	Imported Structural Backfill	71.11	CY	54.37	m3	*$50.94*	$3,623	
347	Native Backfill	9.48	CY	7.25	m3	*$8.27*	$78	
348	Haul Excess	80.78	CY	61.76	m3	*$8.27*	$668	
349	LOX Tank Pad							
350	Excavation	447.22	CY	341.92	m3	*$6.72*	$3,007	
351	Imported Structural Backfill	378.01	CY	289.01	m3	*$50.94*	$19,256	
352	Native Backfill	21.29	CY	16.28	m3	*$8.27*	$176	
353	Haul Excess	425.92	CY	325.64	m3	*$8.27*	$3,520	
354	Ozone Contactor							
355	Excavation	9051.14	CY	6920.10	m3	*$6.72*	$60,851	
356	Imported Structural Backfill	950.83	CY	726.96	m3	*$50.94*	$48,437	
357	Native Backfill	2138.72	CY	1635.17	m3	*$8.27*	$17,677	
358	Haul Excess	6912.43	CY	5284.93	m3	*$8.27*	$57,133	
359	Electrical Room							
360	Excavation	23.27	CY	17.79	m3	*$6.72*	$156	
361	Imported Structural Backfill	15.84	CY	12.11	m3	*$50.94*	$807	
362	Native Backfill	4.94	CY	3.78	m3	*$8.27*	$41	
363	Haul Excess	18.33	CY	14.01	m3	*$8.27*	$151	
364	Allowance for Misc Items	5%				$236,975.89	$11,849	
365	Subtotal						$248,825	
366								
367	CONCRETE:							
368	Contactor Basin:							
369	Foundation	659.26	CY	504.04	m3	*$541.11*	$356,728	
370	Perimeter Walls	588.75	CY	450.13	m3	*$880.79*	$518,566	
371	Divider Wall	170.58	CY	130.42	m3	*$880.79*	$150,245	
372	Wall 1	46.29	CY	35.39	m3	*$880.79*	$40,771	
373	Wall 2	52.33	CY	40.01	m3	*$880.79*	$46,092	
374	Wall 3	51.45	CY	39.34	m3	*$880.79*	$45,317	
375	Wall 4	52.33	CY	40.01	m3	*$880.79*	$46,092	
376	Wall 5	151.91	CY	116.14	m3	*$880.79*	$133,800	
377	Wall 6	123.72	CY	94.59	m3	*$880.79*	$108,968	
378	Wall 7	0.00	CY	0.00	m3	*$880.79*	$0	
379	Wall 8	0.00	CY	0.00	m3	*$880.79*	$0	
380	Wall 9	0.00	CY	0.00	m3	*$880.79*	$0	
381	Wall 10	0.00	CY	0.00	m3	*$880.79*	$0	
382	Wall 15	14.65	CY	11.20	m3	*$880.79*	$12,901	
383	Elevated Roof Slab	404.78	CY	309.48	m3	*$1,333.77*	$539,884	
384								
385	Ozone Destruct Pad:							
386	Slab on Grade	26.67	CY	20.39	m3	*$490.62*	$13,083	
387	Ozone Generator Building:							
388	Slab on Grade	132.74	CY	101.49	m3	*$490.62*	$65,125	
389	Electrical Room:							
390	Slab on Grade	3.57	CY	2.73	m3	*$490.62*	$1,752	
391	LOX Tank and Vaporizer Pad:							
392	Slab on Grade	185.13	CY	141.54	m3	*$490.62*	$90,828	
393								
394	Allowance for Misc Items	5%				$2,170,152.97	$108,508	
395	Subtotal						$2,278,661	
396								

	B	C	D	E	F	G	H	I
397	MASONRY:	High						
398	Ozone Generator/ Building (incl Elec Room)	3680.44	SF	341.92	m2	*$198.37*	$730,078	
399	Ozone Destruct Building	720.00	SF	66.89	m2	*$198.37*	$142,824	
400	Subtotal	4400.44					$872,902	
401								
402	METALS:							
403	Handrail	488.76	LF	148.97	m	*$90.92*	$44,437	
404	Perforated Plate in Inlet Cell	618.89	SF	57.50	m2	*$108.25*	$66,998	
405	Perforated Plates in Serpentine Cells	770.80	SF	71.61	m2	*$108.25*	$83,443	
406	3' x 3' SS Air Tight Checker Plate Covers Over Inlet Cells	4.00	EA			*$1,798.69*	$7,195	
407	3' x 3' SS Air Tight Checker Plate Covers Over Contactor Cells	6.00	EA			*$1,798.69*	$10,792	
408	Ladder	10.00	EA			*$1,915.27*	$19,153	
409	Stairway	39	Risers			*$495.92*	$19,341	
410	Allowance for Misc Items	10%				$251,358.33	$25,136	
411	Subtotal						$276,494	
412								
413	EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
414	Ozone System (Including Ozone Generators, Diffusion System, Instrumentation & Valves, Ozone Destruct Units, and Cooling System for Closed Loop System)	6008.69	lb/d	2725.50	kg/d	***$1,810.82***	$10,880,670	
415	LOX Tanks and Vaporizers	126233	gal	477843.67	L	***$44.62***	$5,632,532	
416	Cooling Pumps for Open Loop Cooling System (Note: Cooling Pumps are included in OSS scope for Closed Loop system) (9.72 hp each)	2	EA			***$15,753.71***	$31,507	
417	Gates at Inlet	2	EA			***$9,614.74***	$19,229	
418	Gates at Outlet	2	EA			***$9,614.74***	$19,229	
419	Allowance for Misc Items	10%				$16,583,168.99	$1,658,317	
420	Subtotal						$18,241,486	
421								
422	INSTRUMENTS & CONTROLS:							
423	Instruments							
424	Inlet and Outlet Isolation Gate Actuator	4	EA			***$6,409.82***	$25,639	
425	Level Transmitters	2	EA			***$11,264.12***	$22,528	
426	Open Loop Cooling Water Flowmeters	1	EA			***$6,954.43***	$6,954	
427	Ozone Residual Analyzers	4	EA			***$6,954.43***	$27,818	
428	Pressure Transmitters (LOX)	3	EA					
429	Level Transmitters (LOX)	3	EA					
430	Isolation Valve Actuators (LOX)	3	EA					
431	Isolation Valve Actuators (GOX)	4	EA					
432	Control Valve Actuators (GOX)	3	EA					
433	Temperature Transmitters (GOX)	4	EA					
434	Pressure Transmitters (GOX)	1	EA					
435	Dewpoint Analyzers (GOX)	1	EA					
436	Flowmeter (GOX)	3	EA					
437	Dewpoint Analyzers (Nitrogen)	1	EA					
438	Nitrogen Compressor	2	EA					
439	Control Valve Actuators (Nitrogen)	1	EA					
440	Pressure Transmitters (Nitrogen)	1	EA					
441	Temperature Transmitters (Ozone)	3	EA					
442	Isolation Valve Actuators (Ozone)	3	EA					
443	Ozone Concentration Analyzers (Ozone)	3	EA					
444	Flowmeter (Ozone)	2	EA					
445	Control Valve Actuators (Ozone)	2	EA					
446	Ozone Concentration Analyzers (Off-gas)	4	EA					
447	Control Valve Actuators (Off-gas)	3	EA					
448	Isolation Valve Actuators (Off-gas)	3	EA					
449	Temperature Transmitters (Off-gas)	6	EA					
450	Pressure Differential Transmitters (Off-gas)	3	EA					
451	Destruct Blower	3	EA					
452	Closed Loop Cooling Water Pumps	3	EA					
453	Isolation Valve Actuators (Closed Loop Cooling)	6	EA					
454	Temperature Transmitters (Closed Loop Cooling)	6	EA					
455	Flowmeters (Closed Loop Cooling)	6	EA					
456	Ambient Ozone Analyzers	2	EA					
457	Ambient Oxygen Analyzers	1	EA					
458	Number of Analog I/O Counts	139	EA			***$264.27***	$36,786	
459	Number of Digital I/O Counts	143	EA			***$62.59***	$8,938	
460	Number of Local Panels	1	EA			***$13,074.33***	$13,074	

	B	C	D	E	F	G	H	I
461	Number of PLC's	1	EA					
462	I&C Conduit & Wire	6,998	LF	2133.08	m	$12.06	$84,392	
463	Allowance for Misc Items	5%				$226,130.09	$11,307	
464	Subtotal						$237,437	
465								
466	MECHANICAL:							
467	Pipe:							
468	Influent Pipe-OZI (72-inch, Buried, Steel)	0.00	LF	0.00	m	$1,506.86	$0	
469	Effluent Pipe-OZW (72-inch, Buried, Steel)	0.00	LF	0.00	m	$1,506.86	$0	
470	Overflow Pipe-OF (96-inch, Buried, Steel)	0.00	LF	0.00	m	$2,009.15	$0	
471	LOX Pipe-LOX (1.5-inch, Exposed, Copper)	114.00	LF	34.75	m	$105.58	$12,036	
472	Total GOX Pipe Upstream of PRV-GOX (3-inch, Exposed, 304 SST)	62.00	LF	18.90	m	$109.49	$6,789	
473	Total GOX Pipe Downstream of PRV-GOX (6-inch, Exposed, 316 SST)	123.00	LF	37.49	m	$215.04	$26,450	
474	Individual GOX Pipe Downstream of PRV-GOX (4-inch, Exposed, 316 SST)	99.00	LF	30.18	m	$143.36	$14,193	
475	Header Ozone Gas PIpe-O3 (1-inch, Exposed, 316 SST)	51.00	LF	15.54	m	$35.84	$1,828	
476	Individual Ozone Generator Gas Pipe-O3 (6-inch, Exposed, 316 SST)	153.00	LF	46.63	m	$215.04	$32,901	
477	Individual Ozone Contactor Gas Pipe-O3 (4-inch, Exposed, 316 SST)	313.33	LF	95.50	m	$143.36	$44,920	
478	Nitrogen-N2 (4-inch, Exposed, Copper)	36.00	LF	10.97	m	$281.55	$10,136	
479	Ozone Off-Gas Pipe per Train-OZG (6-inch, Exposed, 316 SST)	100.00	LF	30.48	m	$215.04	$21,504	
480	Ozone Off-Gas Pipe Combined-OZG (8-inch, Exposed, 316 SST)	10.00	LF	3.05	m	$286.72	$2,867	
481	Ozone Off-Gas Pipe per Destruct Unit-OZG (6-inch, Exposed, 316 SST)	45.00	LF	13.72	m	$215.04	$9,677	
482	Total Cooling Water Pipe (open loop)-CWS/CWR (8-inch, Buried, Steel)	230.82	LF	70.35	m	$167.43	$38,646	
483	Individual Skid Cooling Water Pipe (open loop)-CWS/CWR (6-inch, Exposed, Steel)	70.00	LF	21.34	m	$125.57	$8,790	
484	Total Cooling Water Pipe (closed loop)-GCWS/GCWR (12-inch, Exposed, 304 SST)	88.00	LF	26.82	m	$437.98	$38,542	
485	Individual Generator Cooling Water Pipe (closed loop)-GCWS/GCWR (8-inch, Exposed, 304 SST)	123.00	LF	37.49	m	$291.99	$35,914	
486	Individual PSU Cooling Water Pipe (closed loop)-GCWS/GCWR (1.5-inch, Exposed, 304 SST)	108.00	LF	32.92	m	$54.75	$5,913	
487	Elbows							
488	LOX Pipe-LOX (1.5-inch, Exposed, Copper)	30.00	EA			$284.26	$8,528	
489	Total GOX Pipe Upstream of PRV-GOX (3-inch, Exposed, 304 SST)	3.00	EA			$568.52	$1,706	
490	Total GOX Pipe Downstream of PRV-GOX (6-inch, Exposed, 316 SST)	10.00	EA			$1,268.32	$12,683	
491	Individual GOX Pipe Downstream of PRV-GOX (4-inch, Exposed, 316 SST)	3.00	EA			$845.55	$2,537	
492	Header Ozone Gas PIpe-O3 (1-inch, Exposed, 316 SST)	1.00	EA			$211.39	$211	
493	Individual Ozone Generator Gas Pipe-O3 (6-inch, Exposed, 316 SST)	3.00	EA			$1,268.32	$3,805	
494	Individual Ozone Contactor Gas Pipe-O3 (4-inch, Exposed, 316 SST)	10.00	EA			$845.55	$8,455	
495	Nitrogen-N2 (4-inch, Exposed, Copper)	2.00	EA			$758.03	$1,516	
496	Ozone Off-Gas Pipe per Train-OZG (6-inch, Exposed, 316 SST)	6.00	EA			$1,268.32	$7,610	
497	Ozone Off-Gas Pipe per Destruct Unit-OZG (6-inch, Exposed, 316 SST)	9.00	EA			$1,268.32	$11,415	
498	Total Cooling Water Pipe (open loop)-CWS/CWR (8-inch, Buried, Steel)	2.00	EA			$1,113.60	$2,227	
499	Individual Skid Cooling Water Pipe (open loop)-CWS/CWR (6-inch, Exposed, Steel)	3.00	EA			$835.20	$2,506	
500	Individual Generator Cooling Water Pipe (closed loop)-GCWS/GCWR (8-inch, Exposed, 304 SST)	12.00	EA			$1,516.07	$18,193	
501	Individual PSU Cooling Water Pipe (closed loop)-GCWS/GCWR (1.5-inch, Exposed, 304 SST)	12.00	EA			$284.26	$3,411	
502	Tees							
503	LOX Pipe-LOX (1.5-inch, Exposed, Copper)	3.00	EA			$398.57	$1,196	
504	Total GOX Pipe Upstream of PRV-GOX (3-inch, Exposed, 304 SST)	4.00	EA			$797.14	$3,189	
505	Total GOX Pipe Downstream of PRV-GOX (6-inch, Exposed, 316 SST)	5.00	EA			$1,762.53	$8,813	
506	Header Ozone Gas PIpe-O3 (1-inch, Exposed, 316 SST)	5.00	EA			$293.76	$1,469	
507	Ozone Off-Gas Pipe Combined-OZG (8-inch, Exposed, 316 SST)	5.00	EA			$2,350.04	$11,750	
508	Total Cooling Water Pipe (open loop)-CWS/CWR (8-inch, Buried, Steel)	2.00	EA			$2,537.20	$5,074	
509	Total Cooling Water Pipe (closed loop)-GCWS/GCWR (12-inch, Exposed, 304 SST)	12.00	EA			$3,188.58	$38,263	
510	Individual Generator Cooling Water Pipe (closed loop)-GCWS/GCWR (8-inch, Exposed, 304 SST)	6.00	EA			$2,125.72	$12,754	
511	Crosses							
512	End Caps							
513	Valves							
514	Total Cooling Water Pipe (open loop)-CWS/CWR (8-inch, Buried, Steel)	4.00	EA			$8,144.58	$32,578	
515	Wall Pipes:							
516	Influent Pipe-OZI (72-inch, Buried, Steel)	2.00	EA			$15,068.63	$30,137	
517	Effluent Pipe-OZW (72-inch, Buried, Steel)	2.00	EA			$15,068.63	$30,137	
518	Overflow Pipe-OF (96-inch, Buried, Steel)	1.00	EA			$20,091.51	$20,092	
519	Total GOX Pipe Downstream of PRV-GOX (6-inch, Exposed, 316 SST)	1.00	EA			$2,150.42	$2,150	
520	Individual Ozone Contactor Gas Pipe-O3 (4-inch, Exposed, 316 SST)	2.00	EA			$1,433.61	$2,867	
521	Ozone Off-Gas Pipe Combined-OZG (8-inch, Exposed, 316 SST)	1.00	EA			$2,867.23	$2,867	

	B	C	D	E	F	G	H	I
522	Total Cooling Water Pipe (open loop)-CWS/CWR (8-inch, Buried, Steel)	1.00	EA			*$1,674.29*	$1,674	
523	Allowance for Misc Items	10%				$600,920.09	$60,092	
524	Subtotal						$661,012	
525								
526	ELECTRICAL:							
527	# MCC Sections	10.00	EA			*$10,730.27*	$107,303	
528	Switchgear	0.00	EA			*$49,359.23*	$0	
529	Adjustable Frequency Drives							
530	Ozone Generators/Destruct (Active) (526 hp each)	0.00	EA			***$77,840.33***	$0	
531	Ozone Generators/Destruct (Standby) (526 hp each)	0.00	EA			***$77,840.33***	$0	
532	Cooling Water Pumps (Active) (6 hp each)	0.00	EA			***$9,717.06***	$0	
533	Cooling Water Pumps (Standby) (6 hp each)	0.00	EA			***$9,717.06***	$0	
534	Electrical Conduit & Wire	981.36	LF	299.12	m	*$12.06*	$11,834	
535	Allowance for Misc Items	10%				$119,136.88	$11,914	
536	Subtotal						$131,051	
537								
538	**USER DEFINED ESTIMATE ITEMS:**	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
539	Item 1 Description	0.00		0.00		0.00	$0	
540	Item 2 Description	0.00		0.00		0.00	$0	
541	Item 3 Description	0.00		0.00		0.00	$0	
542	Item 4 Description	0.00		0.00		0.00	$0	
543	Item 5 Description	0.00		0.00		0.00	$0	
544	Item 6 Description	0.00		0.00		0.00	$0	
545	Item 7 Description	0.00		0.00		0.00	$0	
546	Item 8 Description	0.00		0.00		0.00	$0	
547	Item 9 Description	0.00		0.00		0.00	$0	
548	Item 10 Description	0.00		0.00		0.00	$0	
549	Item 11 Description	0.00		0.00		0.00	$0	
550	Item 12 Description	0.00		0.00		0.00	$0	
551	Item 13 Description	0.00		0.00		0.00	$0	
552	Item 14 Description	0.00		0.00		0.00	$0	
553	Item 15 Description	0.00		0.00		0.00	$0	
554	Subtotal						$0	
555								
556	Subtotal						$22,947,867	
557								
558	ALLOWANCES:		**User Override**					
559	Finishes Allowance	2.00%		$24,943,334	$498,866.68			
560	I&C Allowance	2.00%		$24,943,333.77	$498,866.68			
561	Mechanical Allowance	2.00%		$24,943,333.77	$498,866.68			
562	Electrical Allowance	2.00%		$24,943,333.77	$498,866.68			
563								
564	**Facility Cost**	**4,006**	**lb/d Ozone**	**$6,227**	**$24,943,334**			
565	**Facility Cost with Standard Additional Project Costs Added**	**4,006**	**lb/d Ozone**	**$7,566**	**$30,307,861**			
566	**Facility Cost with Standard Additional Project Costs and Contractor Markups Added**	**4,006**	**lb/d Ozone**	**$13,124**	**$52,570,838**			
567	**Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)**	**4,006**	**lb/d Ozone**	**$10,801**	**$43,265,738**			
568	**Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added**	**4,006**	**lb/d Ozone**	**$13,124**	**$52,570,838**			

	B	C	D	E	F	G	H	I
1	***Filters***							
2								
3	**Is This Facility Included in My Project? No**							
4	Assumptions:							
5								
6	Based on Denver Water Reuse Project							
7	2 Basins @ 15 MGD each							
8	***If this is a Seawater Desalination Application, the materials in contact with seawater need to be corrosion resistant.***							
9	FILTER PARAMETRIC DESIGN APPROACH							
10	BASIS: DENVER REUSE PLANT, HDPE DUAL LATERAL UNDERDRAIN WITH MEDIA SUPPORT CAP, FRONT FLUME, & CONSTANT EFFLUENT FLOW CONTROL							
11								
12								
13	**Process User Inputs:**	**Value (English)**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Red Flags**	**Comment**
14	Is this a Seawater Desalination Application?	**No**	Y/N					
15	Has the USER Contacted Equipment Suppliers to Obtain Equipment Quotes?	**No**	Y/N				Fixed	
16	Input Filtration System Maximum Design Flow Rate	**160.00**	mgd	**567.81**	ML/d	Q		
17	Input Filtration System Minimum Design Flow Rate	**15.00**	mgd	**56.78**	ML/d			
18	Select HDPE Underdrain System Type	**LS**	Type			UT		LSL = Leopold Type SL; LS = Leopold Type S; TLP = Tetra Type LP; NP = IDI or GF Nozzle/Plenum Type
19	Calculate Underdrain Profile Depth	1.08	ft	329.18	mm	UPD		LSL = 0.67 ft; LS = 1.08 ft; TLP = 0.75 ft; NP = 2.5625.
20	Input Bottom Media Effective Size	**0.60**	mm			BMES		
21	Input Bottom Media Uniformity Coefficient	**1.40**	#			BMUC		
22	Input Bottom Media Depth	**0.00**	in		mm	BMD		
23	Select Bottom Media Material	**Sand**	Type					
24	Input Middle Media Effective Size	**1.10**	mm			MMES		
25	Input Middle Media Uniformity Coefficient	**1.50**	#			MMUC		
26	Input Middle Media Depth	**0.00**	in	**0.00**	mm	MMD		
27	Select Middle Media Material	**Anthracite**	Type					
28	Input Top Media Effective Size	**1.10**	mm			TMES		
29	Input Top Media Uniformity Coefficient	**1.50**	#			TMUC		
30	Input Top Media Depth	**84.00**	in	**2,133.60**	mm	TMD		
31	Select Top Media Material	**GAC**	Type					
32	Calculate Total Media Depth	7.00	ft	2133.60	mm	MD		
33	Input GAC Replacement Frequency, if Applicable (number per year)	**0.00**	#					
34	Input GAC Apparent Density (Bulk Density), if Applicable	**29.00**	lb/cf	**464.54**	kg/m3			Typically about 29 lb/cf for most GAC products.
35	Input Maximum Design Filtration Hydraulic Loading Rate	**10.00**	gpm/sf	**24.45**	m/h	FHLR		Typical Range: 3 - 10 gpm/sf
36	Input Minimum Design Filtration Hydraulic Loading Rate	**2.00**	gpm/sf	**4.89**	m/h			
37	Calculate Active Filter Area	11,111.11	sf	1032.26	m2	AFA		
38	Calculate Emtpy Bed Contact Time at Maximum Design Filtration Hydraulic Loading Rage	5.24	min			EBCT		
39	Calculate Emtpy Bed Contact Time at Minimum Design Filtration Hydraulic Loading Rage	55.85	min			EBCT		
40	Input Number of Active Filters with Maximum Design Flow Rate	**6**	#			#AF		Typical Range: ≥ 3.
41	Calculate Individual Filter Area	1,851.85	sf	172.04	m2	IFA		
42	Calculate Individual Filter Dimension in Direction of Underdrain Lateral	30.00	ft	9144.00	mm	IFW		For Leopold Type SL (LSL), IFW < 16 ft; For Leopold Type S (LS), IFW < 48 ft; For Tetra Type LP (TLP), IFW < 30 ft.
43	Optionial: Input Individual Filter Dimension in Direction of Underdrain Lateral (overwrites above calculation)	**30.00**	ft	**9,144.00**	mm		**Warning! Input an overide only when matching existing filter dimensions or accomodating site constraints.**	Only enter override value when matching existing conditions or accomodating site constraints.
44	Calculate Individual Filter Dimension Perpendicular to Underdrain Lateral	61.75	ft	18821.40	mm	IFL		
45	Input Number of Standby Filters with Maximum Design Flow Rate	**2**	#			#SF		Typically 1 minimum
46	Calculate Total Number of Filters	8	#			#TF		Should be even number. If not, add active or standby filter
47	Input Desired Filter Bed Expansion During Backwash	**25.00%**				BEX		Typically 20-30%.
48	Calculate Media Expansion Depth	1.40	ft	426.72	mm	EXD		
49	Input Maximum Water Temperature	77.00	degrees F	**25.00**	degrees C	MWT		
50	Input Maximum Backwash Supply Hydraulic Loading Rate	**25.00**	gpm/sf	**61.12**	m/h	BWSHLR		Calculate from CH2M Backwash Rate Program
51	Calculate Maximum Backwash Supply Flow Rate	66.69	mgd	252.45	ML/d	BWSFR		
52	Input Filter Media Clean Bed Head Loss at Maximum Design Filtration Hydraulic Loading Rate	**2.50**	ft	**762.00**	mm	CBH		Calculate from CH2M HILL Clean Bed Head Loss Program
53	Input Underdrain Head Loss at Maximum Design Filtration Hydraulic Loading Rate	**0.50**	ft	**152.40**	mm	UDH		Determine from CH2M HILL Filter Design Guide. Typically 1-foot

	B	C	D	E	F	G	H	I
54	Input Filter Effluent Piping Head Loss from Seal Weir Back to Filter Box with FE FCV 80% Open	1.50	ft	457.20	mm	FPH		Calculate from WinHydro. Typically 2 to 4 feet
55	Input Filter Influent/Backwash Wastewater Gullet Channel Width	5.00	ft	5.00	mm	GCW		Typically 4 ft. minimum for access
56	Input Filter Influent Channel / Backwash Wastewater Channel Width	5.00	ft	5.00	mm	FI/BWCW		Typically 4 ft. minimum for access
57	Calcualte Filter Influent Isolation Gate Width	42.00	in	1066.80	mm			Typically requires 9 inches of concrete on both sides of gate.
58	Calculate Number of Isolation Gates	2	#					
59	Input Distance from Bottom of Wash Trough to Top of Expanded Media	12.00	in	304.80	mm	DTM		Typically 3 inches minimum
60	Input % Area of Wash Trough Coverage per Filter	25.00%				WT%A		Typically 25%
61	Calculate Wash Trough Coverage per Filter = IFW * IFL * WT%A / 100	463.13	sf	43.03	m2	WTC		
62	Input Wash Trough Width	3.00	ft	914.40	mm	WTW		Typically 1.5 ft minimum
63	Select Wash Trough Type	Media Retaining	Type			WTYP		Conventional or Media Retaining Type
64	Calculate Number of Wash Troughs per Filter	5	#			#WT		
65	Calculate Depth of Wash Trough	2.47	ft	752.51	mm	WTD		Includes 0.25 feet freeboard and 0.25 feet trough bottom thickness
66	Calculate Distance Between Troughs	9.35	ft	2849.88	mm	DBT		Full Size Space between each trough, and Half Size Space between each end trough and wall.
67	Calculate Distance from Top of Media to Top of Trough	5.22	ft	1590.71	mm	TMTT		
68	Calculate Ratio Distance Between Troughs: Distance from Top of Media to Top of Trough	1.79	:1			RATIO		Typically between 1.0 to 2.0 (If error, change percent coverage or trough width)
69	Select Backwash Design Basis	Time	Type					Time = Based off backwash duration. Filter Box Volumes = Based off # of filter vessel volumes for BW cycle.
70	Input Backwash Duration	8.00	min					Typically 8 to 30 minutes.
71	Input Number of Filter Box Volumes per Backwash	3.00	#					Typically target at least 3 filter box volumes.
72	Calculate Typical Backwash Volume per Event	370,500.00	gal	1402.50	m3			
73	Calculate Backwash Duration		min					Typically 8 to 30 minutes.
74	Calculate Number of Filter Box Volumes per Backwash	2.19	#				**Warning! Consider increasing BW duration.**	Typically target at least 3 filter box volumes.
75	Include Filter Drain-Down?	Yes	Y/N					
76	Calculate Filter Drain-Down Volume per Event	66,232.14	gal	250.72	m3			
77	Input Distance from Top of Wash Trough to Top of Gullet Channel Wall	4.00	ft	1,219.20	mm	DTG		Typically 0.5 to 6 feet
78	Input Terminal Filter Head Loss Build-Up	10.00	ft	3,048.00	mm	THL		Typically 8 to 12 feet, confirm with hydraulic analysis
79	Input Freeboard Above Operating Water Surface	3.00	ft	914.40	mm	FB		Typically 1 to 3 feet
80	Calculate Gullet Channel Height	17.30	ft	5272.69	mm	GCH		
81	Calculate Gullet Channel Fill Height	1.58	ft	481.58	mm	GCF		
82	Calculate Filter Box Depth Based on Filter Seal Weir Set at the Same Elevation as the Top of the Filter Underdrain	20.08	ft	6120.38	mm	FBD		Setting Seal Weir and Top of Underdrain at Same Elevation Assures No Negative Pressure & Filter Air Binding
83	Calculate Backwash Waste Channel Height	11.80	ft	3596.29	mm	BWWCH		
84	Calculate Backwash Waste Channel Fill Height	1.58	ft	481.58	mm	BWWCF		
85	Calculate Filter Influent Channel Height	7.28	ft	2219.29	mm	FICH		Assumes top of filter influent valve = top of gullet channel
86	Input Filter Seal Weir Head	1.50	ft	1.00	mm	SWH		Typically < 2 feet
87	Calculate Filter Seal Weir Length	40.47	ft	12334.13	mm	SWL		Typically Use Trough Style Weirs to Reduce Area of Seal Weir Box
88	Input Length of Each Seal Weir Trough	5.00	ft	1,524.00	mm	SWTL		Typically < 20 feet to avoid intermediate structural support
89	Calculate Number of Seal Weir Troughs	4	#			#SWT		
90	Input Seal Weir Trough Width	2.00	ft	609.60	mm	SWTW		Typically 1.5 ft minimum
91	Calculate Depth of Wash Trough	5.87	ft	1787.73	mm	SWTD		Includes 0.25 feet freeboard and 0.25 feet trough bottom thickness
92	Calculate Seal Weir Box Width	16.00	ft	4876.80	mm	SWBW		
93	Calculate Seal Weir Box Depth	27.87	ft	8493.33	mm	SWBD		
94	Calculate Filter Flume Depth Below Underdrain Floor	6.50	ft	1981.20	mm	FFD		
95	Input Clear Distance Between Filter Effluent Piping in Gallery for Access	12.00	ft	3,657.60	mm	GCD1		Typically 8 ft minimum
96	Input Clear Distance Between Filter Effluent Piping & Filter Box in Gallery for Access	4.00	ft	1,828.80	mm	GCD2		Typically 3 ft minimum
97	Input Clear Distance Between Filter Effluent Piping & Filter End Wall for Access	6.00	ft	6.00	mm	GCD3		Typically 6 ft minimum
98	Calculate Filter Gallery Width	43.34	ft	13209.52	mm	FGW		
99	Input Clear Distance Between Filter Effluent Piping & Gallery Floor	2.00	ft	609.60	mm	GCD4		Typically 1 to 3 feet
100	Include Filter to Waste?	Yes	Y/N					
101	Input Filter to Waste Duration	15.00	min					Typically 10 to 30 minutes
102	Calculate Filter to Waste Volume per Event	277,777.78	gal	1051.50	m3			

	B	C	D	E	F	G	H	I
103	Calculate Total Wastewater Volume per Backwash	714,509.92	gal	2704.71	m3			Use this volume to size backwash equalization basin
104	Include Air Scour Backwash?	**Yes**	Y/N					
105	Input Backwash Air Scour Loading Rate	**2.00**	scfm/sf	0.61	m/min	ALR		Typically 2 to 4 scfm/sf
106	Calculate Air Scour Blower Capacity per Blower	3,705.00	scfm	104.91	m3/min	ASBC		
107	Input Number of Air Scour Blowers	**2.00**	#			NASB		Typically 1 duty and 1 standby
108	Calculate Approximate Blower Outlet Gage Pressure at Standard Conditions	8.39	psig	57.87	kPa	BOP		Includes 1 psig of air piping losses, calculate actual. Typically, total ≤ 10 psig
109	Calculate Blower Horsepower at Standard Conditions (sea level, 20 deg C, 36% RH) per Blower	164.00	hp	122.29	kW	BHP		Revise for actual elevation and air temperature range. Warning... If Blower Horsepower exceeds 200, the Blower Building may be undersized.
110	Are filters covered?	**No**	Y/N					
111	Include Particle Counters?	**Yes**	Y/N					
112	Include a Combined FE Magmeter?	**No**	Y/N					
113	Input Depth of Burial	**0.00**	ft	**0.00**	mm	DB		
114	Input Cutback Slope	**1.00**	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
115	Input Over Excavation Depth	**1.00**	ft	**304.80**	mm	OEXD		
116	Mechanical Sizing Requirements:							
117	**Pipe Name**	**Input Velocity**	**Unit (English)**	**Input Velocity**	**Unit (Metric)**	**Standard Pipe Size**	**Unit (English)**	**Nominal Pipe Size**
118	Air Scour Pipe	**2,500.00**	fpm	**762.00**	m/s	18.00	in	450.00
119	Filter Influent Header Pipe	**5.00**	fps	**1.52**	m/s	96.00	in	2050.00
120	Filter Influent Pipe	**3.00**	fps	**0.91**	m/s	54.00	in	1350.00
121	Filter Effluent Pipe	**5.00**	fps	**1.52**	m/s	42.00	in	1050.00
122	Filter Control Valve Pipe	**8.00**	fps	**2.44**	m/s	36.00	in	900.00
123	Filter Effluent Header Pipe	**5.00**	fps	**1.52**	m/s	96.00	in	2050.00
124	Filter to Waste	**5.00**	fps	**1.52**	m/s	42.00	in	1050.00
125	Backwash Supply Pipe	**6.00**	fps	**1.83**	m/s	60.00	in	1500.00
126	Backwash Waste Pipe	**6.00**	fps	**1.83**	m/s	60.00	in	1500.00
127								
128	Mechanical Material Requirements:							
129	**Pipe Name**	**Pipe ID**	**Installation Type**	**Pipe Material**	**Pipe Lining Material**	**Pipe Coating Material**	**Pipe Diameter**	**Pipe Length**
130	Air Scour Pipe	BAW	Exposed	**316 SST**	**None**	**None**	18.00	792.35
131	Filter Influent Header Pipe	FIH	Buried	**DI**	**Cement Mortar**	**Tape Coating**	96.00	0.00
132	Filter Influent Pipe	FIH	Encased	**DI**	**Cement Mortar**	**Fusion Bonded Epoxy**	54.00	0.00
133	Filter Effluent Pipe	FE	Exposed	**DI**	**Cement Mortar**	**Paint**	42.00	173.35
134	Filter Effluent Pipe	FE	Encased	**DI**	**Cement Mortar**	**Fusion Bonded Epoxy**	42.00	173.35
135	Filter Control Valve Pipe	FCV	Exposed	**DI**	**Cement Mortar**	**Paint**	36.00	192.00
136	Filter Effluent Header Pipe	FEH	Encased	**DI**	**Cement Mortar**	**Fusion Bonded Epoxy**	96.00	259.50
137	Filter to Waste	FTW	Exposed	**DI**	**Cement Mortar**	**Paint**	42.00	80.32
138	Filter to Waste	FTW	Encased	**DI**	**Cement Mortar**	**Fusion Bonded Epoxy**	42.00	542.00
139	Backwash Supply Pipe	BWS	Exposed	**DI**	**Cement Mortar**	**Paint**	60.00	594.40
140	Backwash Supply Pipe	BWS	Encased	**DI**	**Cement Mortar**	**Fusion Bonded Epoxy**	60.00	48.00
141	Backwash Waste Pipe	BWW	Encased	**DI**	**Cement Mortar**	**Fusion Bonded Epoxy**	60.00	10.00
142								
143	Electrical User Inputs and Sizing Requirements:							
144	Is this a "Critical" Facility (requiring standby power)?	**Yes**	Y/N					
145	Is there SWGR?	No						
146								**MCC**
147	**Item**	**Quantity**	**HP per Each**	**AFD's Required?**	**MCC Spaces for Motor Starters**	**MCC Spaces for AFD's less than 50hp)**	**MCC Spaces for Breakers**	**Total MCC Spaces**
148	Air Scour Blowers	2	164.00	**No**	12.00	0.00	0.00	
149	**User Defined Item #1**	**0**	**0.00**	**No**	0.00	0.00	0.00	
150	**User Defined Item #2**	**0**	**0.00**	**No**	0.00	0.00	0.00	

	B	C	D	E	F	G	H	I
151	**User Defined Item #3**	**0**	**0.00**	**No**	0.00	0.00	0.00	
152	TOTAL		328.00		12.00	0.00	0.00	12.00
153								
154	Electrical Equipment Widths:							
155	**Equipment**	**Depth (ft)**						
156	MCC	1.67						
157	Small AFD's	0.00						
158	Large AFD's	0.00						
159	Switchgear	0.00						
160	Maximum Depth	1.67						
161								
162	Clear Distances:							
163	**Clear Distance**	**Width**	**Length**	**Comment**				
164	CD1		**3.00**	Clear Distance between wall and MCC	Typically 3 feet			
165	CD2		**1.00**	Clear Distance between MCC and Small AFD	Typically 1 foot			
166	CD3		**0.00**	Clear Distance between Small AFD and Large AFD	Typically Zero			
167	CD4		**0.00**	Clear Distance between Large AFD and Switchgear	Typically Zero			
168	CD5		**0.00**	Clear Distance between Switchgear and Contingency Space	Typically Zero			
169	CD6	**4.00**		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)				
170	CD7	**3.00**		Clear Distance in front of Equipment	Tyipcally 3 feet			
171	Contingency Length		**0.00**	Contingency length	Typically Zero			
172								
173	Electric Room Length (ft):							
174	CD1	3.00						
175	MCC	11.67						
176	CD2	1.00						
177	Small AFD's	0.00						
178	CD3	0.00						
179	Large AFD's	0.00						
180	CD4	0.00						
181	Swithgear	0.00						
182	CD5	0.00						
183	Contingency	0.00						
184	Total Length	15.67						
185								
186	Electric Room Width (ft):							
187	CD6	0.00	If there is no switchgear, this distance will be Zero.					
188	Maximum Equipment Depth	1.67						
189	CD7	3.00						
190	Total Width	4.67						
191								
192	**COST TABLE FOR MEDIA:**	**Quantity (CF)**	**$/CF (Uninstalled Cost)**	**$/CF (Escalated and Installed Cost)**				
193	Silica Sand	0.00	15.00	***$ 22.11***				
194	Antracite Coal	0.00	20.00	***$ 29.49***				
195	Garnet Sand	0.00	45.00	***$ 66.34***				
196	GAC	103,740.00	45.00	***$ 66.34***				
197								
198	**Estimating Dimensions:**	**Value English**	**Unit (English)**	**Value Metric**	**Unit (Metric)**	**Name**	**Red Flags**	**Comment**
199	Backwash Supply Pipe Tee Length	7.50	ft	2286.00	mm	BWSTL		Lookup Value
200	Backwash Supply Pipe Tee Width	6.25	ft	1905.00	mm	BWSTW		Lookup Value
201	Backwash Supply Pipe Elbow Length	8.17	ft	2489.96	mm	BWSEL		Lookup Value
202	Backwash Supply Isolation Valve Length	1.67	ft	508.00	mm	BWSVL		Lookup Value
203	Backwash Supply - Flowmeter Reducer Length	8.00	ft	2438.40	mm	BWSFMRL		
204	Flowmeter Length	3.83	ft	1168.40	mm	FML		Lookup Value
205	Filter Control Valve Length	1.25	ft	381.00	mm	FCVL		Lookup Value
206	Flowmeter - Filter Effluent Increaser Length	2.00	ft	609.60	mm	FMFERL		
207	Filter Effluent Pipe Tee Length	5.50	ft	1676.40	mm	FETL		Lookup Value
208	Filter Effluent Pipe Tee Width	4.50	ft	1371.60	mm	FETW		Lookup Value
209	Filter Effluent Pipe Elbow Length	5.90	ft	1798.83	mm	FEEL		Lookup Value
210	Filter Effluent and Filter to Waste Isolation Valve Length	1.25	ft	381.00	mm	FEVL		Lookup Value
211	Filter Effluent Header Pipe Cross Length	11.00	ft	3352.80	mm	FEHCL		Lookup Value
212	Filter Effluent Header Pipe Cross Width	11.00	ft	3352.80	mm	FEHCW		Lookup Value
213	Filter to Waste Header Pipe Tee Length	5.50	ft	1676.40	mm	FTWHTL		Lookup Value
214	Filter to Waste Pipe Elbow Length	4.50	ft	1371.60	mm	FTWEL		Lookup Value
215	Total Length of Individual Filter Piping	59.90	ft	18258.79	mm			
216	Filter (per Each):							
217	Slab on Grade (Includes Filter, Gulllet Channel, Filter Influent/Backwash Wastewater Channel):							
218	Length = IFL + FEWT	63.25	ft	19278.60	mm	FSOGL		
219	Width = IFW+GWT+GCW+(2*FI/BWCST)+FI/BWCW	45.67	ft	13919.20	mm	FSOGW		
220	Concrete Thickness	**24.00**	in	**551.18**	mm			Model based on 24"
221	Concrete Thickness	2.00	ft	609.60	mm	FSOGT		

	B	C	D	E	F	G	H	I
222	Pipe Gallery Wall:							
223	Length = IFL + FEWT	63.25	ft	19278.60	mm			
224	Height = FBD + FFD	26.58	ft	8101.58	mm			
225	Concrete Thickness	**18.00**	in	**551.18**	mm			Model based on 18"
226	Concrete Thickness	1.50	ft	457.20	mm	PGWT		
227	Gullet Wall:							
228	Length = IFL	61.75	ft	18821.40	mm			
229	Height = GCH	17.30	ft	5272.69	mm			
230	Concrete Thickness	**14.00**	in	**500.38**	mm			Model based on 14"
231	Concrete Thickness	1.17	ft	355.60	mm	GWT		
232	Filter Influent / Backwash Waste Channel Walls:							
233	Number of Walls (2 per filter)	2.00	#			#W		Fixed
234	Length = IFL + FEWT	63.25	ft	19278.60	mm			
235	Height = FBD	20.08	ft	6120.38	mm			
236	Concrete Thickness	**18.00**	in	**500.38**	mm			Model based on 18"
237	Concrete Thickness	1.50	ft	457.20	mm	FI/BWCST		
238	Filter Influent / Backwash Waste Channel Lower Elevated Slab:							
239	Length = IFL + FEWT	63.25	ft	19278.60	mm			
240	Width = FI/BWCW	5.00	ft	1524.00	mm			
241	Concrete Thickness	**12.00**	in	**304.80**	mm			Model based on 12"
242	Concrete Thickness	1.00	ft	304.80	mm	FICLEST		
243	Filter Influent / Backwash Waste Channel Upper Elevated Slab:							
244	Length = IFL + FEWT	63.25	ft	19278.60	mm			
245	Width = FI/BWCW + (2 * FI/BWCWT)	8.00	ft	2438.40	mm			
246	Concrete Thickness	**9.00**	in	**228.60**	mm			Model based on 9"
247	Concrete Thickness	0.75	ft	228.60	mm	FICUEST		
248	End Walls: (For Entire Filter Complex)							This accounts for common walls on individual filters
249	Number of Walls	8.00	#					
250	Width = PGWT + IFW + GWT + GCW + (2* FI/BWCWT) + FI/BWCW	45.67	ft	13919.20	mm			
251	Height = FBD	20.08	ft	6120.38	mm			
252	Concrete Thickness	**18.00**	in	**500.38**	mm			Model based on 18"
253	Concrete Thickness	1.50	ft	457.20	mm	FEWT		
254	Common Filter Influent Channel:							
255	Slab on Grade:							
256	Length = FI/BWCW + FI/BWCST	6.50	ft	1981.20	mm			
257	Width = 2*(FSOGW+PGWT)+FGW	137.67	ft	41962.32	mm			
258	Concrete Thickness	**24.00**	in	**457.20**	mm			Model based on 24"
259	Concrete Thickness	2.00	ft	609.60	mm	FISOGT		
260	Common Filter Influent Channel Wall:							
261	Length = 2*(FSOGW+PGWT)+FGW	137.67	ft	41962.32	mm			
262	Height = FICH	7.28	ft	2219.29	mm			
263	Concrete Thickness	**18.00**	in	**457.20**	mm			Model based on 18"
264	Concrete Thickness	1.50	ft	457.20	mm	FIWCST		
265	Common Filter Influent Channel Elevated Slab:							
266	Length = 2*(FSOGW+PGWT)+FGW	137.67	ft	41962.32	mm			
267	Width = FI/BWCW + FI/BWCWT + FEWT	8.00	ft	2438.40	mm			
268	Concrete Thickness	**9.00**	in	**228.60**	mm			Model based on 9"
269	Concrete Thickness	0.75	ft	228.60	mm	FICEST		
270	Filter Gallery:							
271	Slab on Grade:							
272	Length = (#TF/2*FSOGL)+SCW	277.00	ft	84429.60	mm			
273	Width = FGW + (2*PGWT)	46.34	ft	14123.92	mm			
274	Concrete Thickness = FEPHSS + 24	120.00	in	3048.00	mm			
275	Concrete Thickness	10.00	ft	3048.00	mm	FGSOGT		
276	Filter Gallery Elevated Slab:							
277	Length = (#TF/2*FSOGL)+SCW	277.00	ft	84429.60	mm			
278	Width = FGW+(2*PGWT)	46.34	ft	14123.92	mm			
279	Concrete Thickness	**8.00**	in	**304.80**	mm			Model based on 8"
280	Concrete Thickness	0.67	ft	203.20	mm	FGEST		
281	Blower Room:							
282	Slab on Grade:							
283	Length	20.00	ft	6096.00	mm			Fixed
284	Width = FSOGW	45.67	ft	13919.20	mm			
285	Concrete Thickness	**12.00**	in	**609.60**	mm			Model based on 24"
286	Concrete Thickness	1.00	ft	304.80	mm			
287	Walls:							
288	Height = FBD	20.08	ft	6120.38	mm			
289	Concrete Thickness	**8.00**	in	**500.38**	mm			Model based on 8"
290	Concrete Thickness	0.67	ft	203.20	mm			
291	Stair Case:							
292	Slab on Grade:							
293	Length	24.00	ft	7315.20	mm			Fixed
294	Width	24.00	ft	7315.20	mm	SCW		Fixed
295	Concrete Thickness	**12.00**	in	**609.60**	mm			Model based on 24"
296	Concrete Thickness	1.00	ft	304.80	mm			
297	Walls:							
298	Height = FBD	20.08	ft	6120.38	mm			
299	Concrete Thickness	**8.00**	in	**203.20**	mm			Model based on 8"
300	Concrete Thickness	0.67	ft	203.20	mm			
301	Electrical Room:							
302	Slab on Grade:							

	B	C	D	E	F	G	H	I
303	Length	17.00	ft	5181.60	mm			
304	Width	6.00	ft	1828.80	mm			
305	Concrete Thickness	12.00	in	304.80	mm			Model based on 12"
306	Concrete Thickness	1.00	ft	304.80	mm			
307	Walls:							
308	Height = FBD	10.00	ft	3048.00	mm			Fixed
309	Concrete Thickness	8.00	in	304.80	mm			Model based on 8"
310	Concrete Thickness	0.67	ft	203.20	mm			
311	Overall Dimensions:							
312	Total Filter SOG Length = (#TF/2*FSOGL)+FEWT+SCW+FI/BWCW+(2*FI/BWCST)+2(FSOGT)	259.50	ft	79095.60	mm	SOGL		
313	Total Filter SOG Width = 2*(FSOGW+FSOGT+PGWT)+FGW	137.67	ft	41962.32	mm	SOGW		
314	Total Filter Building Area	35725.80	sf	3319.04	m2	BA		
315	Blower Room Area	913.33	sf	84.85	m2	BRA		
316	Stair Case Area	576.00	sf	53.51	m2	SCA		
317	Electrical Room Area	102.00	sf	9.48	m2	ERA		
318	Total Building Area	37317.13	sf	3466.87	m2	TBA		
319	Filter Building Excavation Length	263.50	ft	80314.80	mm	EVD		
320	Filter Building Excavation Width	141.67	ft	43181.52	mm	EVD		
321	Stair Case Excavation Length	28.00	ft	8534.40	mm			
322	Stair Case Excavation Width	28.00	ft	8534.40	mm			
323	Blower Room Excavation Length	24.00	ft	7315.20	mm			
324	Blower Room Excavation Width	49.67	ft	15138.40	mm			
325	Electrical Room Excavation Length	21.00	ft	6400.80	mm			
326	Electrical Room Excavation Width	10.00	ft	3048.00	mm			
327	Filter Building Excavation Depth (DB + FGSOGT + FFD)	16.50	ft	5029.20	mm	EVD		
328	Stair Case Excavation Depth	16.50	ft	5029.20	mm			
329	Blower Room Excavation Depth	1.00	ft	304.80	mm			
330	Electrical Room Excavation Depth	1.00	ft	304.80	mm			
331								
332	**COST ESTIMATE**							
333	**Description**	**Quantity (English)**	**Unit (English)**	**Quantity (Metric)**	**Unit (Metric)**	**$/Unit**	**Total Cost**	**User Over-Write**
334	SITEWORK:							
335	Filters							
336	Excavation	30126.38	CY	23033.27	m3	*$6.72*	$202,542	
337	Imported Structural Backfill	2765.22	CY	2114.16	m3	*$50.94*	$140,865	
338	Native Backfill	4085.48	CY	3123.57	m3	*$8.27*	$33,768	
339	Haul Excess	26040.90	CY	19909.70	m3	*$8.27*	$215,236	
340	Stair Case:							
341	Excavation	1169.03	CY	893.79	m3	*$6.72*	$7,859	
342	Imported Structural Backfill	58.07	CY	44.40	m3	*$50.94*	$2,958	
343	Native Backfill	564.67	CY	431.72	m3	*$8.27*	$4,667	
344	Haul Excess	604.36	CY	462.07	m3	*$8.27*	$4,995	
345	Blower Room:							
346	Excavation	52.50	CY	40.14	m3	*$6.72*	$353	
347	Imported Structural Backfill	88.30	CY	67.51	m3	*$50.94*	$4,498	
348	Native Backfill	2.73	CY	2.09	m3	*$8.27*	$23	
349	Haul Excess	49.77	CY	38.05	m3	*$8.27*	$411	
350	Electrical Room:							
351	Excavation	10.00	CY	7.64	m3	*$6.72*	$67	
352	Imported Structural Backfill	15.56	CY	11.89	m3	*$50.94*	$792	
353	Native Backfill	1.15	CY	0.88	m3	*$8.27*	$9	
354	Haul Excess	8.85	CY	6.77	m3	*$8.27*	$73	
355	Allowance for Misc Items	5%				$619,117.21	$30,956	
356	Subtotal						$650,073	
357								
358	CONCRETE:							
359	Filters							
360	Foundation (Includes Filter, Gulllet Channel, Filter Influent/Backwash Wastewater Channel) (FSOGW * FSOGL * FOSGT) / 27 *#TF	1711.65	CY	1308.65	m3	*$541.11*	$926,186	
361	Pipe Gallery Wall	747.19	CY	571.27	m3	*$880.79*	$658,123	
362	Gullet Wall	369.26	CY	282.32	m3	*$880.79*	$325,238	
363	Filter Influent / Backwash Waste Channel Walls	1128.94	CY	863.14	m3	*$880.79*	$994,365	
364	Filter Influent / Backwash Waste Channel Lower Elevated Slab	93.70	CY	71.64	m3	*$1,333.77*	$124,979	
365	Filter Influent / Backwash Waste Channel Upper Elevated Slab	112.44	CY	85.97	m3	*$1,333.77*	$149,975	
366	End Walls	407.55	CY	311.59	m3	*$880.79*	$358,967	
367	Gullet Channel Fill	144.54	CY	110.51	m3	*$416.36*	$60,182	
368	Backwash Waste Channel Fill	144.54	CY	110.51	m3	*$416.36*	$60,182	
369	Common Filter Influent							
370	Slab on Grade	66.29	CY	50.68	m3	*$490.62*	$32,521	
371	Common Influent Channel Wall	111.38	CY	85.15	m3	*$880.79*	$98,101	
372	Common Influent Channel Elevated Slab	30.59	CY	23.39	m3	*$1,333.77*	$40,805	
373	Filter Gallery							
374	Slab on Grade	4753.97	CY	3634.67	m3	*$490.62*	$2,332,375	
375	Filter Gallery Elevated Slab	316.93	CY	242.31	m3	*$1,333.77*	$422,712	
376	Pipe Supports	10.00	CY	7.65	m3	*$41.33*		
377	Blower Room							
378	Slab on Grade	33.83	CY	25.86	m3	*$490.62*	$16,596	
379	Blower Room Walls	32.56	CY	24.89	m3	*$880.79*	$28,677	
380	Stair Case							
381	Slab on Grade	21.33	CY	16.31	m3	*$490.62*	$10,466	
382	Stair Case Walls	23.80	CY	18.20	m3	*$880.79*	$20,962	
383	Electrical Room							
384	Slab on Grade	3.78	CY	2.89	m3	*$490.62*	$1,853	
385	Electrical Room Walls	11.36	CY	8.68	m3	*$880.79*	$10,004	
386	Allowance for Misc Items	5%				$6,673,267.63	$333,663	
387	Subtotal						$7,006,931	
388								

	B	C	D	E	F	G	H	I
389	MASONRY:	High						
390	CMU Filter Building	0.00	SF	0.00	m2	$198.37	$0	
391	Blower Room	913.33	SF	84.85	m2	$198.37	$181,175	
392	Electrical Room	102.00	SF	9.48	m2	$198.37	$20,233	
393	Subtotal	1,015.33					$201,409	
394								
395	METALS:							
396	Metal Guardrail with Pickets	1590.67	LF	484.84	m	$91.60	$145,705	
397	Filter Access Hatch	42.25	SF	3.93	m2	$139.09	$5,876	
398	Stairs (FBD * 12/8)	30	Risers			$495.92	$14,878	
399	Allowance for Misc Items	10%				$166,459.14	$16,646	
400	Subtotal						$183,105	
401								
402	THERMAL & MOISTURE PROTECTION:							
403	Concrete Liner	0.00	SF	0.00	m2	$16.00	$0	
404	Allowance for Misc Items	10%				$0.00	$0	
405	Subtotal						$0	
406								
407	EQUIPMENT:							Budgetary Quote: (CPES will automatically add Installation Factor)
408	Fabricated Slide Gates, 42-inch	2	EA			$16,916.59	$33,833	
409	Underdrain - Leopold Type S	14,820.00	SF	1376.82	m2	$105.76	$1,567,394	
410	Wash Troughs							
411	Conventional	0.00	LF	0.00	m	$371.13	$0	
412	Media Retaining	1,246.67	LF	379.98	m	$841.56	$1,049,143	
413	Media							
414	Bottom Media - Sand (ES=0.6 UC=1.4)	0.00	CF	0.00	m3	$22.11	$0	
415	Middle Media - Anthracite (ES=1.1 UC=1.5)	0.00	CF	0.00	m3	$29.49	$0	
416	Top Media - GAC (ES=1.1 UC=1.5)	103,740.00	CF	2937.59	m3	$66.34	$6,882,286	
417	Air Scour Blowers (164 hp each)	2	EA			$175,429.57	$350,859	
418	Allowance for Misc Items	10%				$9,883,516.31	$988,352	
419	Subtotal						$10,871,868	
420								
421	INSTRUMENTS & CONTROLS:							
422	Instruments							
423	Filter Effluent Magmeter (42-inch)	8	EA			$50,731.65	$405,853	
424	Combined Filter Effluent Magmeter (96-inch)	0	EA			$108,659.86	$0	
425	Isolation Valve Actuators	48	EA			$6,409.82	$307,672	
426	Control Valve Actuators	8	EA			$6,409.82	$51,279	
427	Turbidimeters	8	EA			$4,956.21	$39,650	
428	Particle Counters	8	EA			$10,700.91	$85,607	
429	Level Transmitters	8	EA			$11,264.12	$90,113	
430	Differential Pressure Transmitters	8	EA			$11,264.12	$90,113	
431	Filter Influent Level Transmitter	2	EA			$11,264.12	$22,528	
432	Air Scour Differential Pressure Transmitter	2	EA			$11,264.12	$22,528	
433	Air Scour Discharge Pressure Indicator Transmitter	2	EA			$11,264.12	$22,528	
434	Number of Analog I/O Counts	82	EA			$264.27	$21,564	
435	Number of Digital I/O Counts	293	EA			$62.59	$18,326	
436	Number of PLC's	2	EA			$13,074.33	$26,149	
437	I&C Conduit & Wire	26,469.00	LF	8067.75	m	$12.06	$319,189	
438	Allowance for Misc Items	10%				$1,523,099.29	$152,310	
439	Subtotal						$1,675,409	
440								
441	CONVEYING SYSTEMS:							
442	Monorail Hoist (3 Ton)	1	EA			$4,091.32	$4,091	
443	Hoist Rail	397.17	LF	121.06	m	$41.33	$16,414	
444	Allowance for Misc Items	5%				$20,505.01	$1,025	
445	Subtotal						$21,530	
446								
447	MECHANICAL:							
448	Pipe							
449	Air Scour Pipe-BAW (18-inch , Exposed , 316 SST , None , None)	792.35	LF	241.51	m	$645.13	$511,168	
450	Filter Influent Header Pipe-FIH (96-inch , Buried , DI , Cement Mortar , Tape Coating)	0.00	LF	0.00	m	$832.31	$0	
451	Filter Influent Pipe-FIH (54-inch , Encased , DI , Cement Mortar , Fusion Bonded Epoxy)	0.00	LF	0.00	m	$468.18	$0	
452	Filter Effluent Pipe-FE (42-inch , Exposed , DI , Cement Mortar , Paint)	173.35	LF	52.84	m	$364.14	$63,124	
453	Filter Effluent Pipe-FE (42-inch , Encased , DI , Cement Mortar , Fusion Bonded Epoxy)	173.35	LF	52.84	m	$364.14	$63,124	
454	Filter Control Valve Pipe-FCV (36-inch , Exposed , DI , Cement Mortar , Paint)	192.00	LF	58.52	m	$312.12	$59,927	
455	Filter Effluent Header Pipe-FEH (96-inch , Encased , DI , Cement Mortar , Fusion Bonded Epoxy)	259.50	LF	79.10	m	$832.31	$215,986	
456	Filter to Waste-FTW (42-inch , Exposed , DI , Cement Mortar , Paint)	80.32	LF	24.48	m	$364.14	$29,248	
457	Filter to Waste-FTW (42-inch , Encased , DI , Cement Mortar , Fusion Bonded Epoxy)	542.00	LF	165.20	m	$364.14	$197,363	
458	Backwash Supply Pipe-BWS (60-inch , Exposed , DI , Cement Mortar , Paint)	594.40	LF	181.17	m	$520.20	$309,205	
459	Backwash Supply Pipe-BWS (60-inch , Encased , DI , Cement Mortar , Fusion Bonded Epoxy)	48.00	LF	14.63	m	$520.20	$24,969	
460	Backwash Waste Pipe-BWW (60-inch , Encased , DI , Cement Mortar , Fusion Bonded Epoxy)	10.00	LF	3.05	m	$520.20	$5,202	
461	Elbows							
462	Air Scour Pipe-BAW (18-inch , 316 SST)	32	EA			$3,804.96	$121,759	
463	Filter Influent Header Pipe-FIH (96-inch , DI)	0	EA			$17,469.08	$0	
464	Filter Influent Pipe-FIH (54-inch , DI)	0	EA			$9,826.36	$0	
465	Filter Effluent Pipe-FE (42-inch , DI)	8	EA			$7,642.72	$61,142	
466	Filter Effluent Pipe-FE (42-inch , DI)	8	EA			$7,642.72	$61,142	
467	Filter Control Valve Pipe-FCV (36-inch , DI)	0	EA			$6,550.90	$0	
468	Filter Effluent Header Pipe-FEH (96-inch , DI)	0	EA			$17,469.08	$0	
469	Filter to Waste-FTW (42-inch , DI)	10	EA			$7,642.72	$76,427	
470	Filter to Waste-FTW (42-inch , DI)	0	EA			$7,642.72	$0	

	B	C	D	E	F	G	H	I
471	Backwash Supply Pipe-BWS (60-inch , DI)	2	EA			*$10,918.17*	$21,836	
472	Backwash Supply Pipe-BWS (60-inch , DI)	2	EA			*$10,918.17*	$21,836	
473	Backwash Waste Pipe-BWW (60-inch , DI)	0	EA			*$10,918.17*	$0	
474	Tees							
475	Air Scour Pipe-BAW (18-inch , 316 SST)	8	EA			*$5,287.59*	$42,301	
476	Filter Influent Header Pipe-FIH (96-inch , DI)	0	EA			*$29,006.98*	$0	
477	Filter Influent Pipe-FIH (54-inch , DI)	0	EA			*$16,316.42*	$0	
478	Filter Effluent Pipe-FE (42-inch , DI)	8	EA			*$12,690.55*	$101,524	
479	Filter Effluent Pipe-FE (42-inch , DI)	0	EA			*$12,690.55*	$0	
480	Filter Control Valve Pipe-FCV (36-inch , DI)	0	EA			*$10,877.62*	$0	
481	Filter Effluent Header Pipe-FEH (96-inch , DI)	0	EA			*$29,006.98*	$0	
482	Filter to Waste-FTW (42-inch , DI)	0	EA			*$12,690.55*	$0	
483	Filter to Waste-FTW (42-inch , DI)	6	EA			*$12,690.55*	$76,143	
484	Backwash Supply Pipe-BWS (60-inch , DI)	10	EA			*$18,129.36*	$181,294	
485	Backwash Supply Pipe-BWS (60-inch , DI)	0	EA			*$18,129.36*	$0	
486	Backwash Waste Pipe-BWW (60-inch , DI)	0	EA			*$18,129.36*	$0	
487	Crosses							
488	Air Scour Pipe-BAW (18-inch , 316 SST)	4	EA			*$7,050.12*	$28,200	
489	Filter Influent Header Pipe-FIH (96-inch , DI)	0	EA			*$38,675.97*	$0	
490	Filter Influent Pipe-FIH (54-inch , DI)	0	EA			*$21,755.23*	$0	
491	Filter Effluent Pipe-FE (42-inch , DI)	0	EA			*$16,920.74*	$0	
492	Filter Effluent Pipe-FE (42-inch , DI)	0	EA			*$16,920.74*	$0	
493	Filter Control Valve Pipe-FCV (36-inch , DI)	0	EA			*$14,503.49*	$0	
494	Filter Effluent Header Pipe-FEH (96-inch , DI)	4	EA			*$38,675.97*	$154,704	
495	Filter to Waste-FTW (42-inch , DI)	0	EA			*$16,920.74*	$0	
496	Filter to Waste-FTW (42-inch , DI)	0	EA			*$16,920.74*	$0	
497	Backwash Supply Pipe-BWS (60-inch , DI)	0	EA			*$24,172.48*	$0	
498	Backwash Supply Pipe-BWS (60-inch , DI)	0	EA			*$24,172.48*	$0	
499	Backwash Waste Pipe-BWW (60-inch , DI)	0	EA			*$24,172.48*	$0	
500	Valves							
501	Air Scour Pipe-BAW (18-inch ,V500 - BFV)	8	EA			*$15,949.15*	$127,593	
502	Filter Influent Header Pipe-FIH (96-inch ,V500 - BFV)	0	EA			*$85,062.12*	$0	
503	Filter Influent Pipe-FIH (54-inch ,V500 - BFV)	8	EA			*$47,847.44*	$382,780	
504	Filter Effluent Pipe-FE (42-inch ,V500 - BFV)	8	EA			*$37,214.68*	$297,717	
505	Filter Effluent Pipe-FE (42-inch ,V500 - BFV)	0	EA			*$37,214.68*	$0	
506	Filter Control Valve Pipe-FCV (36-inch ,V500 - BFV)	8	EA			*$31,898.29*	$255,186	
507	Filter Effluent Header Pipe-FEH (96-inch ,V500 - BFV)	0	EA			*$85,062.12*	$0	
508	Filter to Waste-FTW (42-inch ,V500 - BFV)	8	EA			*$37,214.68*	$297,717	
509	Filter to Waste-FTW (42-inch ,V500 - BFV)	0	EA			*$37,214.68*	$0	
510	Backwash Supply Pipe-BWS (60-inch ,V500 - BFV)	8	EA			*$53,163.82*	$425,311	
511	Backwash Supply Pipe-BWS (60-inch ,V500 - BFV)	0	EA			*$53,163.82*	$0	
512	Backwash Waste Pipe-BWW (60-inch ,V500 - BFV)	8	EA			*$53,163.82*	$425,311	
513	Allowance for Misc Items	5%				$4,639,239.64	$231,962	
514	Subtotal						$4,871,202	
515								
516	ELECTRICAL:							
517	MCC's							
518	Sections	7	EA			***$10,730.27***	$75,112	
519	AFD's							
520	Air Scour Blowers (164 hp each)	0	EA			***$30,371.24***	$0	
521	Switchgear							
522	Units	0	EA			***$49,359.23***	$0	
523	Electrical Conduit & Wire	519.00	LF	158.19	m	*$12.06*	$6,259	
524	Allowance for Misc Items	5%				$81,370.48	$4,069	
525	Subtotal						$85,439	
526								
527	**USER DEFINED ESTIMATE ITEMS**	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
528	Item 1 Description	0.00		0.00		0.00	$0	
529	Item 2 Description	0.00		0.00		0.00	$0	
530	Item 3 Description	0.00		0.00		0.00	$0	
531	Item 4 Description	0.00		0.00		0.00	$0	
532	Item 5 Description	0.00		0.00		0.00	$0	
533	Item 6 Description	0.00		0.00		0.00	$0	
534	Item 7 Description	0.00		0.00		0.00	$0	
535	Item 8 Description	0.00		0.00		0.00	$0	
536	Item 9 Description	0.00		0.00		0.00	$0	
537	Item 10 Description	0.00		0.00		0.00	$0	
538	Item 11 Description	0.00		0.00		0.00	$0	
539	Item 12 Description	0.00		0.00		0.00	$0	
540	Item 13 Description	0.00		0.00		0.00	$0	
541	Item 14 Description	0.00		0.00		0.00	$0	
542	Item 15 Description	0.00		0.00		0.00	$0	
543	Subtotal						$0	
544								
545	Subtotal						$25,566,965.67	
546								
547	ALLOWANCES:		**User Override**					
548	Finishes Allowance	2.00%		$27,790,180	$555,803.60			
549	Mechanical Allowance	2.00%		$27,790,180	$555,803.60			
550	I&C Allowance	2.00%		$27,790,180	$555,803.60			
551	Electrical Allowance	2.00%		$27,790,180	$555,803.60			
552						Facility Cost Name		
553	Facility Cost	**160,000,000**	**GPD**	**$0.17**	**$27,790,180**	FLCFC01		
554	Facility Cost with Standard Additional Project Costs Added	**160,000,000**	**GPD**	**$0.21**	**$33,766,974**	FLCFC02		
555	Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**160,000,000**	**GPD**	**$0.37**	**$58,570,882**	FLCFC03		
556	Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**160,000,000**	**GPD**	**$0.30**	**$48,203,767**	FLCFC05		
557	Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**160,000,000**	**GPD**	**$0.37**	**$58,570,882**	FLCFC06		

Concrete Clearwell

Is This Facility Included in My Project? Yes

If this is a Seawater Desalination Application, the materials in contact with seawater need to be corrosion resistant.

Process User Inputs:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Red Flags	Comment
Is this a Seawater Desalination Application?	No	Y/N					
Has the USER Contacted Equipment Suppliers to Obtain Equipment Quotes?	No	Y/N					
Input Maximum Plant Flow Capacity	160.00	mgd	567.81	ML/d	Qmax		
Conversion of Maximum Flow	247.56	cfs	7.01	m3/s	Qmax, cfs		
Is Clearwell to Provide Contact Time for Pathogen Inactivation by Free Chlorine?	Yes	Y/N					
Input pH Exiting Clearwell	8.00	ph units					
Input Free Chlorine Residual Exiting Clearwell	2.00	mg/L					
Input Water Temperature at Maximum Flow	33.80	degrees F	1.00	degrees C			
Input Desired Giardia Log Inactivation	1.00	log					Valid Range: 0.0 to 4.0 log.
Calculate Required Giardia Inactivation CT	111.28	mg-min/L					
Input Desired Virus Log Inactivation	2.00	log					Valid Range: 0.0 to 5.0 log.
Calculate Required Virus Inactivation CT	5.87	mg-min/L					
Calculate Controlling Required Pathogen Inactivation CT	111.28	mg-min/L					
Do you have baffling?	Yes	Y/N					
Input Type of Baffling Material	Concrete	Type				OKAY	
Input Clearwell Short-Circuiting Factor	0.50	#				OKAY	0.1 = no clearwell baffling, short distance between inlet and outlet to clearwell, high inlet and outlet flow velocities. 0.3 = no clearwell baffling, relatively long distance between inlet and outlet. 0.5 = Baffled inlet or outlet with some internal baffling. 0.7 = Well baffled clearwell with inlet and outlet place opposite to each other.
Calculate T10 Detention Time	55.64	min					
Calculate Theoretical Detention Time	111.28	min					
Calculate Disinfection Contact Volume Required	12,364,509.29	gal	46804.76	m3			
Input Storage Volume for Plant Shutdown	3,333,333.33	gal	11,829.41	m3			
Input Backwash Storage Volume	715,000.00	gal	3,293.31	m3			
Input Storage Volume for Fire Protection		gal	0.00	m3			
Input Storage Volume for Peak Hour Flow		gal	0.00	m3			
Calculate Total Clearwell Volume	16,412,842.62	gal	62129.37	m3			
Conversion of Total Clearwell Volume	2,194,078.65	cf	62129.40	m3			
Input Number of Clearwells of Equal Size	2	#					
Input Clearwell Maximum Side Water Depth	15.00	ft	4,572.00	mm	SWD		
Input Clearwell Freeboard	3.00	ft	914.40	mm	FB		
Select Circular or Rectangular Type	Rectangular	Type					
If Rectangular, Input Length to Width Ratio	2.00	:1					
Input Depth of Clearwell Burial	15.00	ft	4,572.00	mm	DB		
Input Cutback Slope	1.50	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
Input Over Excavation Depth	1.00	ft	0.00	mm	OEXD		
For Circular Tank, Calculate Clearwell Diameter	0.00	ft	0.00	mm			
For Rectangular Tank, Calculate Clearwell Length	382.46	ft	116572.32	mm			
For Rectangular Tank, Calculate Clearwell Width	191.23	ft	58286.16	mm			

Estimating Dimensions (per trian):	Value English	Unit (English)	Value (Metric)	Unit (Metric)	Name	Red Flags	Comment
Circular Clearwell (per Each)							
Water Volume of Each Tank	0.00	gal	0.00	m3			
Diameter	0.00	ft	0.00	mm			
Height	0.00	ft	0.00	mm			
Total Volume of Each Tank (including Freeboard)	0.00	gal	0.00	m3			
Slab on Grade Thickness	20.00	in	508.00	mm			Model based on 12"
Slab on Grade Thickness	1.67	ft	508.00	mm			
Wall Thickness	18.00	in	457.20	mm			Model based on 12"
Wall Thickness	1.50	ft	457.20	mm			
Slab on Grade Diameter	0.00	ft	0.00	mm			
Excavation Diameter	0.00	ft	0.00	mm			
Excavation Depth	0.00	ft	0.00	mm			
Rectangular Clearwell (per Each)							
Width	191.23	ft	58286.16	mm			
Length	382.46	ft	116572.32	mm			
Height = SWD + FB	18.00	ft	5486.40	mm			
Slab on Grade Thickness	17.00	in	431.80	mm			Rule: SWD in inches + 2 inches
Slab on Grade Thickness	1.42	ft	431.80	mm			
Wall Thickness	15.00	in	381.00	mm	Rectangular Clearwell Wall Thickness Override (in):		Rule: SWD in inches
Wall Thickness	1.25	ft	381.00	mm			

Description	Quantity (English)	Unit (English)	Quantity (Metric)	Unit (Metric)	$/Unit	Total Cost	User Over-Write
Elevated Slab Thickness	15.00	in	381.00	mm			Model based on 12"
Elevated Slab Thickness	1.25	ft	381.00	mm			
Column Diameter	18.00	in	457.20	mm			Rule: 18" for SWD ≤ 30', 24" for SWD > 30'
Column Diameter	1.50	ft	457.20	mm			
Column Volume	31.81	cf	0.90	m3			
Column Volume	1.18	cy	0.90	m3			
Number of Columns (Each)	325.00	#					Rule: Columns on 15' centers
Slab on Grade Width	196.56	ft	59911.76	mm			
Slab on Grade Length	387.79	ft	118197.92	mm			
Excavation Width	200.56	ft	61130.96	mm			
Excavation Length	391.79	ft	119417.12	mm			
Excavation Depth	17.42	ft	5308.60	mm			
COST ESTIMATE							
SITEWORK:							
Circular Clearwell							
Excavation	0	CY	0.00	m3	*$6.72*	$0	
Imported Structural Backfill	0	CY	0.00	m3	*$50.94*	$0	
Native Backfill	0	CY	0.00	m3	*$8.27*	$0	
Haul Excess	0	CY	0.00	m3	*$8.27*	$0	
Rectangular Clearwell							
Excavation	121,339	CY	92770.65	m3	*$6.72*	$815,774	
Imported Structural Backfill	11,641	CY	8900.26	m3	*$50.94*	$593,017	
Native Backfill	23,958	CY	18317.04	m3	*$8.27*	$198,018	
Haul Excess	97,382	CY	74453.60	m3	*$8.27*	$804,887	
Allowance for Misc Items	5%				$2,411,695.24	$120,585	
Subtotal						$2,532,280	
CONCRETE:							
Circular Clearwell							**Budgetary Quote: (CPES will automatically add Installation Factor)**
Prestressed Concrete Tank (16412843 gallons)	0	EA			*$0.00*	$0	
Rectangular Clearwell							
Foundation	7,999	CY	6115.54	m3	*$541.11*	$4,328,207	
Columns	383	CY	292.73	m3	*$880.79*	$337,240	
Walls	1,912	CY	1462.04	m3	*$880.79*	$1,684,319	
Elevated Slab	6,905	CY	5279.42	m3	*$1,333.77*	$9,209,955	
Concrete Baffling	9,795	CY	7488.76	m3	*$880.79*	$8,627,308	
Allowance for Misc Items	5%				$24,187,028.83	$1,209,351	
Subtotal						$25,396,380	
METALS & PLASTICS:							
Polypropylene Baffling	0	SF	0.00	m2	*$13.91*	$0	
Stainless Steel Baffling	0	SF	0.00	m2	*$57.95*	$0	
Allowance for Misc Items	5%				$0.00	$0	
Subtotal						$0	
THERMAL & MOISTURE PROTECTION:							
Concrete Liner	0	SF	0.00	m2	**$16.00**	$0	
Allowance for Misc Items	10%				$0.00	$0	
Subtotal						$0	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00		0.00		0.00	$0	
Item 2 Description	0.00		0.00		0.00	$0	
Item 3 Description	0.00		0.00		0.00	$0	
Item 4 Description	0.00		0.00		0.00	$0	
Item 5 Description	0.00		0.00		0.00	$0	
Item 6 Description	0.00		0.00		0.00	$0	
Item 7 Description	0.00		0.00		0.00	$0	
Item 8 Description	0.00		0.00		0.00	$0	
Item 9 Description	0.00		0.00		0.00	$0	
Item 10 Description	0.00		0.00		0.00	$0	
Item 11 Description	0.00		0.00		0.00	$0	
Item 12 Description	0.00		0.00		0.00	$0	
Item 13 Description	0.00		0.00		0.00	$0	
Item 14 Description	0.00		0.00		0.00	$0	
Item 15 Description	0.00		0.00		0.00	$0	
Subtotal						$0	
Subtotal						$27,928,660	
ALLOWANCES:		**User Override**					
Metals Allowance	1.00%		$30,030,817	$300,308			
Finishes Allowance	2.00%		$30,030,817	$600,616			
Equipment Allowance	1.00%		$30,030,817	$300,308			
I&C Allowance	2.00%		$30,030,817	$600,616			
Mechanical Allowance	5.00%		$30,030,817	$1,501,541			
Electrical Allowance	1.00%		$30,030,817	$300,308			
Facility Cost	**16,412,843**	**Gallons**	**$1.92**	**$31,532,358**			
Facility Cost with Standard Additional Project Costs Added	**16,412,843**	**Gallons**	**$2.33**	**$38,313,977**			
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**16,412,843**	**Gallons**	**$4.05**	**$66,457,937**			
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**16,412,843**	**Gallons**	**$3.33**	**$54,694,804**			
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**16,412,843**	**Gallons**	**$4.05**	**$66,457,937**			

Liquid Chemical Storage & Feed - (Aluminum Sulfate (Alum))
Located in Stand Alone Chemical Building

Is This Facility Included in My Project? Yes

Is the Facility Storage Only (no metering pumps)?	No	Y/N					
		Overwrite Value					
Select Chemical	Aluminum Sulfate (Alum)		Select "Other" from the drop down list if using a different chemical.				
Percent Active Chemical, % w/w	48.50%		This is the intended feed strength to the process. Inputting a value in the yellow cell overwrites the cell in column "C".				For Fluoride systems, concentration must include the Available Fluoride Ion (AFI) concentration. Typically 79.2% AFI for 23% as HFA. (e.g., 23% as HFA x 79.2% AFI = 18.22% as F)
Active Chemical Form for Dosage Basis	Al2(SO4)3-14H2O		Inputting a value in the yellow cell overwrites the cell in column "C".				
Bulk Chemical Specific Gravity	1.34		Inputting a value in the yellow cell overwrites the cell in column "C".				
Active lb/gal solution	5.42	lb/gal	649.90	kg/m3			

Process User Inputs:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Red Flags	Comment
FLOW AND CHEMICAL ADDITION							
Application #1							
1.) Minimum flow to application point	15.00	mgd	56.78	ML/d			Input the flow that the selected dose will be applied to.
2.) Average flow to application point	90.00	mgd	283.91	ML/d			Input the flow that the selected dose will be applied to.
3.) Maximum flow to applicatoin point	160.00	mgd	567.81	ML/d			Input the flow that the selected dose will be applied to.
4.) Minimum chemical addition	2.50	mg/L					Input the dose that corresponds to the flow input above.
5.) Average chemical addition	5.00	mg/L					Input the dose that corresponds to the flow input above.
6.) Maximum chemical addition	15.00	mg/L					Input the dose that corresponds to the flow input above.
7.) Input Number of Equal Simultaneous Application Points	3	#					
8.) Hours of addition per day	24.00	hr					Input the total number of hours that the chemical is fed during the day.
Application #2							
9.) Minimum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
10.) Average flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
11.) Maximum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
12.) Minimum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
13.) Average chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
14.) Maximum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
15.) Input Number of Equal Simultaneous Application Points	0	#					
16.) Hours of addition per day	0.00	hr					Input the total number of hours that the chemical is fed during the day.
Application #3							
17.) Minimum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
18.) Average flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
19.) Maximum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
20.) Minimum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
21.) Average chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
22.) Maximum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
23.) Input Number of Equal Simultaneous Application Points	0	#					
24.) Hours of addition per day	0.00	hr					Input the total number of hours that the chemical is fed during the day.
CHEMICAL QUANTITIES AND FLOW							
Application Point #1 Chemical Usage:							
Minimum as "dry" chemical	312.95	lb/d	141.95	kg/d			
Average as "dry" chemical	3,755.43	lb/d	1703.43	kg/d			
Maximum as "dry" chemical	20,028.96	lb/d	9084.98	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.80	gph	3.03	L/h			
Average at feed concentration	9.62	gph	36.40	L/h			
Maximum at feed concentration	51.29	gph	194.15	L/h			
Calculate Chemical Metering Pump Flow Turndown	64.00	:1				**Note: Pump turndown is > 20, proceed with the design with caution**	Should be < 20:1, If ≥ 20:1, proceed with caution.
Application Point #2 Chemical Usage:							
Minimum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Average as "dry" chemical	0.00	lb/d	0.00	kg/d			
Maximum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.00	gph	0.00	L/h			
Average at feed concentration	0.00	gph	0.00	L/h			
Maximum at feed concentration	0.00	gph	0.00	L/h			

Calculate Chemical Metering Pump Flow Turndown	0.00	:1					Should be < 20:1, If ≥ 20:1, proceed with caution.
Application Point #3 Chemical Usage:							
Minimum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Average as "dry" chemical	0.00	lb/d	0.00	kg/d			
Maximum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.00	gph	0.00	L/h			
Average at feed concentration	0.00	gph	0.00	L/h			
Maximum at feed concentration	0.00	gph	0.00	L/h			
Calculate Chemical Metering Pump Flow Turndown	0.00	:1					Should be < 20:1, If ≥ 20:1, proceed with caution.
Whole Plant Chemical Usage for Storage Calcs:							
Minimum	312.95	lb/d	141.95	kg/d			
Average	3,755.43	lb/d	1703.43	kg/d			
Maximum	20,028.96	lb/d	9084.98	kg/d			
Max Flow Average Dose Daily Usage	6,676.32	lb/d					
Whole Plant # of Days of Storage							
Maximum Flow and Average Dose	30.00	days					
CHEMICAL STORAGE INPUTS							
25.) Flow used to calculate storage requirements	**Maximum**	Type					
26.) Chemcial application used to calculate storage requirements	**Average**	Type					
27.) Input Minimum Number of Days of Storage	**30.00**	days					
Minimum Storage Volume	36,928.76	gal	139.79	m3			
28.) Choose Chemical Delivery Method	**Tank Truck**	Type					
Bulk Delivery Volume (Tank Truck, Totes, Drums)	4,024.02	gal	15.23	m3			Assumes 45,000 lb per Tank Truck.
Optional: Input Bulk Delivery Volume for Selected Delivery Method (overwrites above calculation)		gal		m3			Not typically used. Use with caution.
Calculate Bulk Delivery Volume * 1.5 (for Truck Delivery Only)	6,036.04	gal	22.85	m3			
Maximum of Above Delivery and Storage Volumes	4,936.66	cf	139.79	m3			
BULK TANKS:							
29.) Input Number of Tanks	**4**	#					
30.) Input Tank Diameter	**10.00**	ft	**3,048.00**	mm	BTD		Greater than 14' tank diameter will require on-site tank fabrication. Maximum diameter allowed for this model is 14'.
Calculate Liquid Height of Tanks	15.71	ft	4789.59	mm			
Use this Tank Height (Liquid Height * 1.2)	19.00	ft	5791.20	mm		**Verify tank height in relationship to the facility structure. Add more tanks or increase diameter if needed.**	Verify tank height within the facility. If indoors, typically 4' lower than the roof framing structure. Assumes extra 20% volume needed for each tank for head space and outlet connection elevation.
Calculate Usable Volume of Each Bulk Tank	9,302.38	gal	35.21	m3			Assumes 20% of the volume of each tank is not usable (needed for head space and outlet connection elevation).
Calculate Volume of Each Bulk Tank	11,162.85	gal	42.26	m3			
31.) Input Number of Rows of Tanks	**2**	#					
Calculate Number of Tanks per Row	2	#					
32.) Input Tank Material (FRP, PE (Polyethylene), PLS (Phenolic Lined Steel))	**FRP**	Type					Typically FRP
33.) Input Clear Distance Around BulkTanks, Day Tanks, Totes or Drums	**4.00**	ft	**1,219.20**	mm	CDT		Typically ≥ 3 ft
Calculate Actual Number of Days of Storage	30.23	days					For bulk tanks, assumes 20% of the volume of each tank is not usable (needed for head space and outlet connection elevation).
TOTES & DRUMS:							
Calculate Number of Totes or Drums	0	#					
34.) Input Number of Rows of Totes or Drums	**1**	#					
Calculate Number of Totes or Drums per Row	0	#					
Length of Each Tote	0.00	ft	0.00	mm			Fixed
Width of Each Tote	0.00	ft	0.00	mm			Fixed
Diameter of Each Drum	0.00	ft	0.00	mm			Fixed
DAY TANKS:							
35.) Are Day Tanks Required?	**Yes**	Y/N					Rule: Day Tanks are only available when the Delivery Method = "Tank Truck".
36.) Input Number of Day Tanks	**1**	#					Suggest 2 Day Tanks
Calculate Day Tank Volume based on Max. Flow/Dose (per tank)	3,692.88	gal	13.98	m3			
Convert Day Tank Volume (per each)	493.67	cf	13.98	m3			
Calculate Day Tank Diameter (per each)	7.00	ft	2133.60	mm	DTD		
Calculate Day Tank Height (per each)	14.00	ft	4267.20	mm			Assumption: H = 2 * D
TRANSFER & METERING PUMPS:							
Number of Transfer Pumps	2	#					Fixed
37.) Input Time to Fill Day Tank	**20.00**	min					Typically fill all day tanks in 20 min
Calculate Number of Active Metering Pumps	3	#					Rule: One active metering pump per each application point.
Calculate Number of Standby Metering Pumps	1	#					Rule: One standby metering pump per each application
38.) Input Number of Additional Standby Metering Pumps	**3**	#					
Calculate Total Number of Metering Pumps	7	#					
39.) Input Clear Distance Around Transfer and Metering Pumps	**4.00**	ft	**1,828.80**	mm	CDP		Typically ≥ 4 ft
Length of Transfer and Metering Pumps	3.00	ft	914.40	mm			Fixed. Conservatively assumes Pulsafeeder metering pump type.
FACILITY SIZING:							
40.) Is this Chemical Room Part of a Multiple Chemical Facility?	**Yes**	Y/N					
41.) Is this Chemical Room Considered the "Start Point" for this Chemical Facility?	**Yes**	Y/N					There should only be one "start point" per chemical facility. Recommend choosing the facility with the greatest width as the "start point"
42.) If this is Part of a Multiple Chemical Facility and is the "Start Point", Input the Summation of Total Number of Pumps from the Other Chemical Rooms Here	**17**	#					Total number of pumps is listed in row 114 of the liquid chemical facility, rows 140, 151, and 162 of the dry chemical facility, and row 122 of the potassium permanganate facility

43.) Input Common Chemical Access Corridor Width	8.00	ft	2,438.40	mm			Input zero if a corridor is not required. Assumes Chem facilities are in series. If Chem facilities are in parallel, input 1/2 total corridor width.
44.) Is Corridor Covered?	Yes	Y/N					
45.) Select Chemical Facility Covering	Building						
46.) Select Chemical Area for this Chemical	None						Only used to help CPES user organize chemicals when multiple chemical buildings are used. Has no impact on sizing calculations or cost.
CONTAINMENT AREA:							
Are Stairs Required into Containment Area?	Yes	Y/N					Typically not needed for tote and drum storage areas.
Is Grating Required in Containment Area?	Yes	Y/N					Typically not needed for tote and drum storage areas.
Width of Stair Access	4.00	ft	1219.20	mm	WS		Fixed
Calculate Containment Area Length	39.00	ft	11887.20	mm			
Calculate Containment Area Width	62.00	ft	18897.60	mm		**Note: verify that this dimension matches the Containment Area Width on the other chemical rooms in this facility. If not, input the larger value in the user overwrite on the room with the shorter dimension**	
47.) Optional: User Overwrite of Containment Area Width	62.00	ft	18,897.60	mm			
Calculate Fire Sprinkler Water Volume	9,672.00	gal	36.61	m3			Assumes 0.2 gpm/sf for 20 min if chemical installed inside a building. If chemical is outside or under a canopy, assume no fire sprinkler water volume.
Calculate 120% of One Storage Tank Volume	13,395.42	gal	50.71	m3			
Calculate 30% of All Tank Volume	13,395.42	gal	50.71	m3			
Calculate Maximum Volume + Fire Flow Volume	23,067.42	gal	87.32	m3			
Tank Pads Volume	942.48	cf	26.69	m3			
Tank Pads Volume	7,050.22	gal	26.69	m3			
Calculate Maximum Volume + Fire Flow Volume + Tank Pad Volume	30,117.65	gal	114.01	m3			
Calculate Maximum Volume + Fire Flow Volume + Tank Pad Volume	4,026.14	cf	114.01	m3			
Calculate Containment Wall Height (including freeboard)	2.25	ft	685.80	mm		**Note: verify that this dimension matches the Containment Wall Height on the other chemical rooms in this facility. If not, input the larger value in the user overwrite on the room with the shorter dimension**	120% of 1 tank volume or 30% of all tank volume whichever is greater + fire flow volume + 6" freeboard. Should be ≤ 4.5'.
48.) Optional: User Overwrite of Containment Wall Height	2.25	ft	685.80	mm			
49.) Input Depth of Burial	1.75	ft	533.40	mm	DB		
50.) Input Cutback Slope	1.00	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
51.) Input Over Excavation Depth	1.00	ft	0.00	mm	OEXD		

Mechanical Sizing Requirements:

Pipe Name	Input Velocity	Unit (English)	Input Velocity	Unit (Metric)	Standard Pipe Size	Unit (English)	Nominal Pipe Size
Chemical Transfer Pump Suction Header Piping	2.00	fps	0.61	m/s	6.50	in	150.00
Chemical Transfer Pump Discharge Header Piping	6.00	fps	1.83	m/s	4.00	in	100.00
Chemical Metering Pump Suction Header Piping	2.00	fps	0.61	m/s	1.00	in	25.00
Chemical Metering Pump Discharge Header Piping	6.00	fps	1.83	m/s	1.00	in	25.00

Mechanical Material Requirements:

Pipe Name	Pipe ID	Installation Type	Pipe Material	Pipe Lining Material	Pipe Coating Material	Pipe Length	# Elbows
Chemical Transfer Pump Suction Header Piping	CTSH	Exposed	PVC	NA	NA	39.00	8.00
Chemical Transfer Pump Discharge Header Piping	CTDH	Exposed	PVC	NA	NA	39.00	8.00
Chemical Metering Pump Suction Header Piping	LCSH	Exposed	PVC	NA	NA	101.00	28.00
Chemical Metering Pump Discharge Header Piping	LCDH	Exposed	PVC	NA	NA	101.00	28.00
						L+W	#MP*4

Electrical User Inputs and Sizing Requirements:

52.) Is this a "Critical" Facility (requiring standby power)?	No	Y/N	
53.) Is there SWGR?	No		

Electrical Equipment Lengths:

Item	Quantity	HP per Each	AFD's Required?	MCC Spaces for Motor Starters	MCC Spaces for AFD's less than 50hp)	MCC Spaces for Breakers	MCC Total MCC Spaces
Metering Pumps	24.00	0.50	No	48.00	0.00	0.00	
User Defined Item #1	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #2	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #3	0.00	0.00	No	0.00	0.00	0.00	
TOTAL		**12.00**		**48.00**	**0.00**	**0.00**	**48.00**

Electrical Equipment Widths:

Equipment	Depth (ft)
MCC	1.67
Small AFD's	0.00
Large AFD's	0.00
Switchgear	0.00
Maximum Depth	1.67

Clear Distances:

Clear Distance	Width	Length	Comment	
CD1		3.00	Clear Distance between wall and MCC	Typically 3 feet
CD2		1.00	Clear Distance between MCC and Small AFD	Typically 1 foot
CD3		0.00	Clear Distance between Small AFD and Large AFD	Typically Zero
CD4		0.00	Clear Distance between Large AFD and Switchgear	Typically Zero

CD5		0.00	Clear Distance between Switchgear and Contingency Space	Typically Zero			
CD6	4.00		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)				
CD7	3.00		Clear Distance in front of Equipment	Typically 3 feet			
Contingency Length		0.00	Contingency length	Typically Zero			
Electric Room Length (ft):							
CD1	3.00						
MCC	13.33						
CD2	1.00						
Small AFD's	0.00						
CD3	0.00						
Large AFD's	0.00						
CD4	0.00						
Swithgear	0.00						
CD5	0.00						
Contingency	0.00						
Total Length	17.33						
Electric Room Width (ft):							
CD6	0.00	If there is no switchgear, this distance will be Zero.					
Maximum Equipment Depth	1.67						
CD7	3.00						
Total Width	4.67						
COST TABLE FOR TANKS & PUMPS:	**Unit Cost**						
Tanks (Installed Cost per Gallon)							
FRP	***$2.37***						
Polyethylene (PE)	$ 2.25						
Phenolic Lined Steel (PLS)	***$6.41***						
Chemical Feed Pumps (Cost per Each)	***$10,658.90***						
Estimating Dimensions:	**Value English**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Comment**	**Red Flags**
Logic Tests ("1" = Yes, "0" = No):							
Is this Chemical Feed System Included?	1						
Is the Method of Delivery "Tank Truck"?	1						
Is Day Tank Required? (1 = Yes, 0 = No)	1						
Tank Truck without Day Tank (True or False)	FALSE						
Tank Truck with Day Tank (True or False)	TRUE						
Tank Truck without Day Tank (1 = Yes, 0 = No)	0					Tank Truck without Day Tank	
Tank Truck with Day Tank (1 = Yes, 0 = No)	1					Tank Truck without Day Tank	
Is the Method of Delivery "Tote"?	0					Tote	
Is the Method of Delivery "Drum"?	0					Drum	
Length of Module (Tank Truck)	39.00	ft	11887.20	mm			
Length of Module (Tote)	0.00	ft	0.00	mm			
Length of Module (Drum)	0.00	ft	0.00	mm			
Width of Module (Tank Truck without Transfer Pump and Day Tank)	0.00	ft	0.00	mm			
Width of Module (Tank Truck with Transfer Pump and Day Tank)	62.00	ft	18897.60	mm			
Width of Module (Tote)	0.00	ft	0.00	mm			
Width of Module (Drum)	0.00	ft	0.00	mm			
Area of Module	0.00	sf	0.00	m2			
Number of Bulk Tanks (each)	4	#					
Diameter of Bulk Tank	10.00	ft	3048.00	mm			
Volume of Each Bulk Tank	11162.85	gal	42.26	m3			
Bulk Tank Material	FRP	Type					
Number of Day Tanks (each)	1	#					
Diameter of Day Tank	7.00	ft					
Volume of Each Day Tank	4030.38	gal	15.26	m3			
Number of Transfer Pumps	2	#					
Transfer Pump Capacity (each)	201.52	gpm	0.00	l/min		Assume fill each tank in 20 min	
Number of Metering Pumps	7	#					
Module Covered? ("1" = YES, "0" = NO)	0						
If Module Exists, Is it Covered? ("1" = Yes, "0" = No)	0						
Containment Wall Height	2.25	ft	685.80	mm			
Slab on Grade Thickness	**9.00**	in	**228.60**	mm		Model based on 9"	
Slab on Grade Thickness	0.75	ft	228.60	mm			
Containment Wall Thickness	**8.00**	in	**203.20**	mm		Model based on 8"	
Containment Wall Thickness	0.67	ft	203.20	mm			
Tank Pad / Metering Pump Pad Height	**3.00**	ft	**914.40**	mm	EPH		
Corridor							
Length	39.00	ft	11887.20	mm			
Width	8.00	ft	2438.40	mm			
Area	312.00	sf	28.99	m2			
Corridor Covered? ("1" = YES, "0" = NO)	1						
Electrical Room:							
Slab on Grade:							
Length	18.67	ft	5689.60	mm			
Width	6.00	ft	1828.80	mm			
Concrete Thickness	**12.00**	in	**304.80**	mm		Model based on 12"	
Concrete Thickness	1.00	ft	304.80	mm			
Walls:							
Height = FBD	10.00	ft				Fixed	
Concrete Thickness	**8.00**	in	**203.20**	mm		Model based on 8"	
Concrete Thickness	0.67	ft	203.20	mm			
Overall Dimensions							
Containment Area Length	39.00	ft	11887.20	mm			
Containment Area Width	62.00	ft	18897.60	mm			
Containment Area	2418.00	sf	224.64	m2			
Corridor Area Length	39.00	ft	11887.20	mm			
Corridor Area Width	8.00	ft	2438.40	mm			
Corridor Area	312.00	sf	28.99	m2			
Electrical Area Length	18.67	ft	5689.60	mm			
Electrical Area Width	6.00	ft	1828.80	mm			
Electrical Room Area	112.00	sf	10.41	m2			
Chemical Facility Area	2842.00	sf	264.03	m2			
Covered Chemical Area (Building)	2842.00	sf	264.03	m2			
Covered Chemical Area (Canopy)	0.00	sf	0.00	m2			
Total Covered Area	2954.00	sf	274.44	m2			

Excavation Depth	3.50	ft	1066.80	mm			
COST ESTIMATE							
Description	**Quantity (English)**	**Unit (English)**	**Quantity (Metric)**	**Unit (Metric)**	**$/Unit**	**Total Cost**	**User Over-Write**
SITEWORK:							
Excavation	468.00	CY	357.82	m3	*$6.72*	$3,146	
Imported Structural Backfill	210.52	CY	160.95	m3	*$50.94*	$10,724	
Native Backfill	49.45	CY	37.81	m3	*$8.27*	$409	
Haul Excess	418.55	CY	320.01	m3	*$8.27*	$3,459	
Allowance for Misc Items	5%				$17,738.77	$887	
Subtotal						$18,626	
CONCRETE:							
Slab on Grade	76.83	CY	58.74	m3	*$490.62*	$37,693	
Containment Walls	11.22	CY	8.58	m3	*$880.79*	$9,884	
Bulk Tank Pads	68.42	CY	52.31	m3	*$490.62*	$33,566	
Day Tank Pads	3.52	CY	2.69	m3	*$490.62*	$1,727	
Transfer Pump Pads	1.33	CY	1.02	m3	*$490.62*	$654	
Metering Pump Pads	4.67	CY	3.57	m3	*$490.62*	$2,290	
Corridor							
Slab on Grade	10.83	CY	8.28	m3	*$490.62*	$5,315	
Electrical Room							
Slab on Grade	4.15	CY	3.17	m3	*$490.62*	$2,035	
Allowance for Misc Items	5%				$93,164.25	$4,658	
Subtotal						$97,822	
MASONRY:	**Moderate**						
Chemical Building	2730.00	SF	253.63	m2	*$198.37*	$541,542	
Electrical Room	112.00	SF	10.41	m2	*$165.31*	$18,514	
Subtotal	2842.00					$560,056	
METALS:							
Canopy	0.00	SF	0.00	m2	*$41.80*	$0	
Metal Stairway	1	EA			$8,327.28	$8,327	
Grating	1	EA			$1,998.55	$1,999	
Allowance for Misc Items	10%				$10,325.82	$1,033	
Subtotal						$11,358	
EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
Bulk Tank	4	EA			*$26,489.89*	$105,960	
Day Tank	1	EA			*$11,442.30*	$11,442	
Transfer Pump	2	EA			*$10,658.90*	$21,318	
Metering Pump	7	EA			*$10,658.90*	$74,612	
Allowance for Misc Items	10%				$213,331.94	$21,333	
Subtotal						$234,665	
INSTRUMENTS & CONTROLS:							
Instruments							
Chemical Tank Radar Level Transmitters	4	EA			*$1,043.16*	$4,173	
Chemical Tank Beacons	4	EA			*$1,043.16*	$4,173	
Day Tank Differential Pressure Transmitter	1	EA			*$1,043.16*	$1,043	
Drum or Tote Weigh Scale	0	EA			*$1,390.89*	$0	
Metering Pump Discharge Pressure Switch	7	EA			*$695.44*	$4,868	
Magmeter	3	EA			*$695.44*	$2,086	
Sump Pump Float Switch	1	EA			*$347.72*	$348	
Eyewash	1	EA			*$1,043.16*	$1,043	
Number of Analog I/O Counts	18	EA			*$264.27*	$4,757	
Number of Digital I/O Counts	64	EA			*$62.59*	$4,006	
Number of Local Panels	1	EA			*$13,074.33*	$13,074	
Number of PLCs	1	EA			*$13,908.86*	$13,909	
I&C Conduit & Wire	819.00	LF	249.63	m	*$12.06*	$9,876	
Allowance for Misc Items	10%				$63,355.86	$6,336	
Subtotal						$69,691	
MECHANICAL:							
Pipe							
Chemical Transfer Pump Suction Header Piping-CTSH (6.5-inch, Exposed, PVC)	39.00	LF	11.89	m	*$42.14*	$1,644	
Chemical Transfer Pump Discharge Header Piping-CTDH (4-inch, Exposed, PVC)	39.00	LF	11.89	m	*$28.95*	$1,129	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	101.00	LF	30.78	m	*$13.11*	$1,324	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	101.00	LF	30.78	m	*$13.11*	$1,324	
Elbows							
Chemical Transfer Pump Suction Header Piping-CTSH (6.5-inch, Exposed, PVC)	8	EA			*$146.80*	$1,174	
Chemical Transfer Pump Discharge Header Piping-CTDH (4-inch, Exposed, PVC)	8	EA			*$84.65*	$677	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	28	EA			*$10.06*	$282	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	28	EA			*$10.06*	$282	
Tees							
Chemical Transfer Pump Suction Header Piping-CTSH (6.5-inch, Exposed, PVC)	2	EA			*$218.62*	$437	
Chemical Transfer Pump Discharge Header Piping-CTDH (4-inch, Exposed, PVC)	2	EA			*$124.01*	$248	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	7	EA			*$10.47*	$73	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	7	EA			*$10.47*	$73	
End Caps							
Chemical Transfer Pump Suction Header Piping-CTSH (6.5-inch, Exposed, PVC)	2	EA			*$72.81*	$146	
Chemical Transfer Pump Discharge Header Piping-CTDH (4-inch, Exposed, PVC)	2	EA			*$42.28*	$85	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	2	EA			*$5.65*	$11	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	2	EA			*$5.65*	$11	
Valves							
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	4	EA			*$1,341.93*	$5,368	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	4	EA			*$757.94*	$3,032	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	14	EA			*$57.14*	$800	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC, V-902, Diaphragm)	14	EA			*$57.14*	$800	
Allowance for Misc Items	10%				$16,147.28	$1,615	
Subtotal						$20,535	
ELECTRICAL:							

# MCC Sections	8	#			*$10,730.27*	$85,842	
Switchgear	0	EA			*$49,359.23*	$0	
Adjustable Frequency Drives							
Metering Pumps	0	EA			***$8,931.12***	$0	
User Defined Item #1	0	EA			***$8,865.56***	$0	
User Defined Item #2	0	EA			***$8,865.56***	$0	
User Defined Item #3	0	EA			***$8,865.56***	$0	
Electrical Conduit & Wire	936.00	LF	285.29	m	*$12.06*	$11,287	
Allowance for Misc Items	10%				$97,129.35	$9,713	
Subtotal						$106,842	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00				0.00	$0	
Item 2 Description	0.00				0.00	$0	
Item 3 Description	0.00				0.00	$0	
Item 4 Description	0.00				0.00	$0	
Item 5 Description	0.00				0.00	$0	
Item 6 Description	0.00				0.00	$0	
Item 7 Description	0.00				0.00	$0	
Item 8 Description	0.00				0.00	$0	
Item 9 Description	0.00				0.00	$0	
Item 10 Description	0.00				0.00	$0	
Item 11 Description	0.00				0.00	$0	
Item 12 Description	0.00				0.00	$0	
Item 13 Description	0.00				0.00	$0	
Item 14 Description	0.00				0.00	$0	
Item 15 Description	0.00				0.00	$0	
Subtotal						$0	
Subtotal						$1,119,596	
ALLOWANCES:		User Override					
Finishes Allowance	2.00%		$1,243,995	$24,880			
I&C Allowance	2.00%		$1,243,995	$24,880			
Mechanical Allowance	4.00%		$1,243,995	$49,760			
Electrical Allowance	2.00%		$1,243,995	$24,880			
					Facility Cost Name		
Facility Cost	**2,842**	**Building SF**	**$437.72**	**$1,243,995**	CFLFC01		
Facility Cost with Standard Additional Project Costs Added	**2,842**	**Building SF**	**$531.86**	**$1,511,540**	CFLFC02		
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**2,842**	**Building SF**	**$922.54**	**$2,621,858**	CFLFC03		
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**2,842**	**Building SF**	**$759.25**	**$2,157,786**	CFLFC05		
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**2,842**	**Building SF**	**$922.54**	**$2,621,858**	CFLFC06		

Liquid Chemical Storage & Feed - (Liquid Polymer)

Located in Chemical Building A

Is This Facility Included in My Project? Yes

Is the Facility Storage Only (no metering pumps)?	No	Y/N					
		Overwrite Value					
Select Chemical	Liquid Polymer		Select "Other" from the drop down list if using a different chemical.				
Percent Active Chemical, % w/w	100.00%		This is the intended feed strength to the process. Inputting a value in the yellow cell overwrites the cell in column "C".				For Fluoride systems, concentration must include the Available Fluoride Ion (AFI) concentration. Typically 79.2% AFI for 23% as HFA. (e.g., 23% as HFA x 79.2% AFI = 18.22% as F)
Active Chemical Form for Dosage Basis	Polymer		Inputting a value in the yellow cell overwrites the cell in column "C".				
Bulk Chemical Specific Gravity	1.10		Inputting a value in the yellow cell overwrites the cell in column "C".				
Active lb/gal solution	9.18	lb/gal	1100.00	kg/m3			
Process User Inputs:	**Value (English)**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Red Flags**	**Comment**
FLOW AND CHEMICAL ADDITION							
Application #1							
1.) Minimum flow to application point	15.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to.
2.) Average flow to application point	90.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to.
3.) Maximum flow to applicatoin point	160.00	mgd	567.81	ML/d			Input the flow that the selected dose will be applied to.
4.) Minimum chemical addition	0.25	mg/L					Input the dose that corresponds to the flow input above.
5.) Average chemical addition	0.75	mg/L					Input the dose that corresponds to the flow input above.
6.) Maximum chemical addition	1.50	mg/L					Input the dose that corresponds to the flow input above.
7.) Input Number of Equal Simultaneous Application Points	3	#					
8.) Hours of addition per day	24.00	hr					Input the total number of hours that the chemical is fed during the day.
Application #2							
9.) Minimum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
10.) Average flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
11.) Maximum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
12.) Minimum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
13.) Average chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
14.) Maximum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
15.) Input Number of Equal Simultaneous Application Points	0	#					
16.) Hours of addition per day	0.00	hr					Input the total number of hours that the chemical is fed during the day.
Application #3							
17.) Minimum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
18.) Average flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
19.) Maximum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
20.) Minimum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
21.) Average chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
22.) Maximum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
23.) Input Number of Equal Simultaneous Application Points	0	#					
24.) Hours of addition per day	0.00	hr					Input the total number of hours that the chemical is fed during the day.
CHEMICAL QUANTITIES AND FLOW							
Application Point #1 Chemical Usage:							
Minimum as "dry" chemical	31.30	lb/d	14.20	kg/d			
Average as "dry" chemical	563.31	lb/d	255.52	kg/d			
Maximum as "dry" chemical	2,002.90	lb/d	908.50	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.05	gph	0.18	L/h			
Average at feed concentration	0.85	gph	3.23	L/h			
Maximum at feed concentration	3.03	gph	11.47	L/h			
Calculate Chemical Metering Pump Flow Turndown	64.00	:1				**Note: Pump turndown is > 20, proceed with the design with caution**	Should be < 20:1, If ≥ 20:1, proceed with caution.
Application Point #2 Chemical Usage:							
Minimum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Average as "dry" chemical	0.00	lb/d	0.00	kg/d			
Maximum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.00	gph	0.00	L/h			
Average at feed concentration	0.00	gph	0.00	L/h			
Maximum at feed concentration	0.00	gph	0.00	L/h			

Calculate Chemical Metering Pump Flow Turndown	0.00	:1					Should be < 20:1, If ≥ 20:1, proceed with caution.
Application Point #3 Chemical Usage:							
Minimum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Average as "dry" chemical	0.00	lb/d	0.00	kg/d			
Maximum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.00	gph	0.00	L/h			
Average at feed concentration	0.00	gph	0.00	L/h			
Maximum at feed concentration	0.00	gph	0.00	L/h			
Calculate Chemical Metering Pump Flow Turndown	0.00	:1					Should be < 20:1, If ≥ 20:1, proceed with caution.
Whole Plant Chemical Usage for Storage Calcs:							
Minimum	31.30	lb/d	14.20	kg/d			
Average	563.31	lb/d	255.52	kg/d			
Maximum	2,002.90	lb/d	908.50	kg/d			
Max Flow Average Dose Daily Usage	1,001.45	lb/d					
Whole Plant # of Days of Storage							
Maximum Flow and Average Dose	30.00	days					
CHEMICAL STORAGE INPUTS							
25.) Flow used to calculate storage requirements	**Maximum**	Type					
26.) Chemcial application used to calculate storage requirements	**Average**	Type					
27.) Input Minimum Number of Days of Storage	**30.00**	days					
Minimum Storage Volume	3,272.73	gal	12.39	m3			
28.) Choose Chemical Delivery Method	**Tank Truck**	Type					
Bulk Delivery Volume (Tank Truck, Totes, Drums)	4,901.99	gal	18.56	m3			Assumes 45,000 lb per Tank Truck.
Optional: Input Bulk Delivery Volume for Selected Delivery Method (overwrites above calculation)		gal		m3			Not typically used. Use with caution.
Calculate Bulk Delivery Volume * 1.5 (for Truck Delivery Only)	7,352.99	gal	27.83	m3			
Maximum of Above Delivery and Storage Volumes	982.95	cf	27.83	m3			
BULK TANKS:							
29.) Input Number of Tanks	**1**	#					
30.) Input Tank Diameter	**10.00**	ft	**3,048.00**	mm	BTD		Greater than 14' tank diameter will require on-site tank fabrication. Maximum diameter allowed for this model is 14'.
Calculate Liquid Height of Tanks	12.52	ft	3814.67	mm			
Use this Tank Height (Liquid Height * 1.2)	16.00	ft	4876.80	mm		**Verify tank height in relationship to the facility structure. Add more tanks or increase diameter if needed.**	Verify tank height within the facility. If indoors, typically 4' lower than the roof framing structure. Assumes extra 20% volume needed for each tank for head space and outlet connection elevation.
Calculate Usable Volume of Each Bulk Tank	7,833.58	gal	29.65	m3			Assumes 20% of the volume of each tank is not usable (needed for head space and outlet connection elevation).
Calculate Volume of Each Bulk Tank	9,400.30	gal	35.58	m3			
31.) Input Number of Rows of Tanks	**1**	#					
Calculate Number of Tanks per Row	1	#					
32.) Input Tank Material (FRP, PE (Polyethylene), PLS (Phenolic Lined Steel))	**FRP**	Type					Typically FRP
33.) Input Clear Distance Around BulkTanks, Day Tanks, Totes or Drums	**4.00**	ft	**1,219.20**	mm	CDT		Typically ≥ 3 ft
Calculate Actual Number of Days of Storage	71.81	days					For bulk tanks, assumes 20% of the volume of each tank is not usable (needed for head space and outlet connection elevation).
TOTES & DRUMS:							
Calculate Number of Totes or Drums	0	#					
34.) Input Number of Rows of Totes or Drums	**1**	#					
Calculate Number of Totes or Drums per Row	0	#					
Length of Each Tote	0.00	ft	0.00	mm			Fixed
Width of Each Tote	0.00	ft	0.00	mm			Fixed
Diameter of Each Drum	0.00	ft	0.00	mm			Fixed
DAY TANKS:							
35.) Are Day Tanks Required?	**Yes**	Y/N					Rule: Day Tanks are only available when the Delivery Method = "Tank Truck".
36.) Input Number of Day Tanks	**1**	#					Suggest 2 Day Tanks
Calculate Day Tank Volume based on Max. Flow/Dose (per tank)	218.18	gal	0.83	m3			
Convert Day Tank Volume (per each)	29.17	cf	0.83	m3			
Calculate Day Tank Diameter (per each)	3.00	ft	914.40	mm	DTD		
Calculate Day Tank Height (per each)	6.00	ft	1828.80	mm			Assumption: H = 2 * D
TRANSFER & METERING PUMPS:							
Number of Transfer Pumps	2	#					Fixed
37.) Input Time to Fill Day Tank	**20.00**	min					Typically fill all day tanks in 20 min
Calculate Number of Active Metering Pumps	3	#					Rule: One active metering pump per each application point.
Calculate Number of Standby Metering Pumps	1	#					Rule: One standby metering pump per each application
38.) Input Number of Additional Standby Metering Pumps	**0**	#					
Calculate Total Number of Metering Pumps	4	#					
39.) Input Clear Distance Around Transfer and Metering Pumps	**4.00**	ft	**1,828.80**	mm	CDP		Typically ≥ 4 ft
Length of Transfer and Metering Pumps	3.00	ft	914.40	mm			Fixed. Conservatively assumes Pulsafeeder metering pump type.
FACILITY SIZING:							
40.) Is this Chemical Room Part of a Multiple Chemical Facility?	**Yes**	Y/N					
41.) Is this Chemical Room Considered the "Start Point" for this Chemical Facility?	**No**	Y/N					There should only be one "start point" per chemical facility. Recommend choosing the facility with the greatest width as the "start point"
42.) If this is Part of a Multiple Chemical Facility and is the "Start Point", Input the Summation of Total Number of Pumps from the Other Chemical Rooms Here		#					Total number of pumps is listed in row 114 of the liquid chemical facility, rows 140, 151, and 162 of the dry chemical facility, and row 122 of the potassium permanganate facility

43.) Input Common Chemical Access Corridor Width	**8.00**	ft	**2,438.40**	mm			Input zero if a corridor is not required. Assumes Chem facilities are in series. If Chem facilities are in parallel, input 1/2 total corridor width.
44.) Is Corridor Covered?	**Yes**	Y/N					
45.) Select Chemical Facility Covering	**Building**						
46.) Select Chemical Area for this Chemical	**A**						Only used to help CPES user organize chemicals when multiple chemical buildings are used. Has no impact on sizing calculations or cost.
CONTAINMENT AREA:							
Are Stairs Required into Containment Area?	**Yes**	Y/N					Typically not needed for tote and drum storage areas.
Is Grating Required in Containment Area?	**Yes**	Y/N					Typically not needed for tote and drum storage areas.
Width of Stair Access	4.00	ft	1219.20	mm	WS		Fixed
Calculate Containment Area Length	24.00	ft	7315.20	mm			
Calculate Containment Area Width	62.00	ft	18897.60	mm		**Note: verify that this dimension matches the Containment Area Width on the other chemical rooms in this facility. If not, input the larger value in the user overwrite on the room with the shorter dimension**	
47.) Optional: User Overwrite of Containment Area Width	**62.00**	ft	**18,897.60**	mm			
Calculate Fire Sprinkler Water Volume	5,952.00	gal	22.53	m3			Assumes 0.2 gpm/sf for 20 min if chemical installed inside a building. If chemical is outside or under a canopy, assume no fire sprinkler water volume.
Calculate 120% of One Storage Tank Volume	11,280.36	gal	42.70	m3			
Calculate 30% of All Tank Volume	2,820.09	gal	10.68	m3			
Calculate Maximum Volume + Fire Flow Volume	17,232.36	gal	65.23	m3			
Tank Pads Volume	235.62	cf	6.67	m3			
Tank Pads Volume	1,762.56	gal	6.67	m3			
Calculate Maximum Volume + Fire Flow Volume + Tank Pad Volume	18,994.91	gal	71.90	m3			
Calculate Maximum Volume + Fire Flow Volume + Tank Pad Volume	2,539.25	cf	71.90	m3			
Calculate Containment Wall Height (including freeboard)	2.25	ft	685.80	mm		**Note: verify that this dimension matches the Containment Wall Height on the other chemical rooms in this facility. If not, input the larger value in the user overwrite on the room with the shorter dimension**	120% of 1 tank volume or 30% of all tank volume whichever is greater + fire flow volume + 6" freeboard. Should be ≤ 4.5'.
48.) Optional: User Overwrite of Containment Wall Height	**2.25**	ft	**685.80**	mm			
49.) Input Depth of Burial	**1.75**	ft	**0.00**	mm	DB		
50.) Input Cutback Slope	**1.00**	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
51.) Input Over Excavation Depth	**1.00**	ft	**0.00**	mm	OEXD		

Mechanical Sizing Requirements:

Pipe Name	Input Velocity	Unit (English)	Input Velocity	Unit (Metric)	Standard Pipe Size	Unit (English)	Nominal Pipe Size
Chemical Transfer Pump Suction Header Piping	**2.00**	fps	**0.61**	m/s	1.50	in	40.00
Chemical Transfer Pump Discharge Header Piping	**6.00**	fps	**1.83**	m/s	1.00	in	25.00
Chemical Metering Pump Suction Header Piping	**2.00**	fps	**0.61**	m/s	1.00	in	25.00
Chemical Metering Pump Discharge Header Piping	**6.00**	fps	**1.83**	m/s	1.00	in	25.00

Mechanical Material Requirements:

Pipe Name	Pipe ID	Installation Type	Pipe Material	Pipe Lining Material	Pipe Coating Material	Pipe Length	# Elbows
Chemical Transfer Pump Suction Header Piping	CTSH	Exposed	PVC	NA	NA	24.00	8.00
Chemical Transfer Pump Discharge Header Piping	CTDH	Exposed	PVC	NA	NA	24.00	8.00
Chemical Metering Pump Suction Header Piping	LCSH	Exposed	PVC	NA	NA	86.00	16.00
Chemical Metering Pump Discharge Header Piping	LCDH	Exposed	PVC	NA	NA	86.00	16.00
						L+W	#MP*4

Electrical User Inputs and Sizing Requirements:

52.) Is this a "Critical" Facility (requiring standby power)?	**No**	Y/N	
53.) Is there SWGR?	No		

Electrical Equipment Lengths:

Item	Quantity	HP per Each	AFD's Required?	MCC Spaces for Motor Starters	MCC Spaces for AFD's less than 50hp)	MCC Spaces for Breakers	MCC Total MCC Spaces
Metering Pumps	0.00	0.50	No	0.00	0.00	0.00	
User Defined Item #1	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #2	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #3	0.00	0.00	No	0.00	0.00	0.00	
TOTAL		**0.00**		**0.00**	**0.00**	**0.00**	**0.00**

Electrical Equipment Widths:

Equipment	Depth (ft)
MCC	0.00
Small AFD's	0.00
Large AFD's	0.00
Switchgear	0.00
Maximum Depth	0.00

Clear Distances:

Clear Distance	Width	Length	Comment	
CD1		3.00	Clear Distance between wall and MCC	Typically 3 feet
CD2		1.00	Clear Distance between MCC and Small AFD	Typically 1 foot
CD3		0.00	Clear Distance between Small AFD and Large AFD	Typically Zero
CD4		0.00	Clear Distance between Large AFD and Switchgear	Typically Zero

CD5		0.00	Clear Distance between Switchgear and Contingency Space	Typically Zero			
CD6	4.00		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)				
CD7	3.00		Clear Distance in front of Equipment	Typically 3 feet			
Contingency Length		0.00	Contingency length	Typically Zero			
Electric Room Length (ft):							
CD1	3.00						
MCC	0.00						
CD2	1.00						
Small AFD's	0.00						
CD3	0.00						
Large AFD's	0.00						
CD4	0.00						
Swithgear	0.00						
CD5	0.00						
Contingency	0.00						
Total Length	0.00						
Electric Room Width (ft):							
CD6	0.00	If there is no switchgear, this distance will be Zero.					
Maximum Equipment Depth	0.00						
CD7	3.00						
Total Width	0.00						
COST TABLE FOR TANKS & PUMPS:	**Unit Cost**						
Tanks (Installed Cost per Gallon)							
FRP	***$2.42***						
Polyethylene (PE)	$ 2.25						
Phenolic Lined Steel (PLS)	***$6.41***						
Chemical Feed Pumps (Cost per Each)	***$10,658.90***						

Estimating Dimensions:	Value English	Unit (English)	Value (Metric)	Unit (Metric)	Name	Comment	Red Flags
Logic Tests ("1" = Yes, "0" = No):							
Is this Chemical Feed System Included?	1						
Is the Method of Delivery "Tank Truck"?	1						
Is Day Tank Required? (1 = Yes, 0 = No)	1						
Tank Truck without Day Tank (True or False)	FALSE						
Tank Truck with Day Tank (True or False)	TRUE						
Tank Truck without Day Tank (1 = Yes, 0 = No)	0					Tank Truck without Day Tank	
Tank Truck with Day Tank (1 = Yes, 0 = No)	1					Tank Truck without Day Tank	
Is the Method of Delivery "Tote"?	0					Tote	
Is the Method of Delivery "Drum"?	0					Drum	
Length of Module (Tank Truck)	24.00	ft	7315.20	mm			
Length of Module (Tote)	0.00	ft	0.00	mm			
Length of Module (Drum)	0.00	ft	0.00	mm			
Width of Module (Tank Truck without Transfer Pump and Day Tank)	0.00	ft	0.00	mm			
Width of Module (Tank Truck with Transfer Pump and Day Tank)	62.00	ft	18897.60	mm			
Width of Module (Tote)	0.00	ft	0.00	mm			
Width of Module (Drum)	0.00	ft	0.00	mm			
Area of Module	0.00	sf	0.00	m2			
Number of Bulk Tanks (each)	1	#					
Diameter of Bulk Tank	10.00	ft	3048.00	mm			
Volume of Each Bulk Tank	9400.30	gal	35.58	m3			
Bulk Tank Material	FRP	Type					
Number of Day Tanks (each)	1	#					
Diameter of Day Tank	3.00	ft					
Volume of Each Day Tank	317.26	gal	1.20	m3			
Number of Transfer Pumps	2	#					
Transfer Pump Capacity (each)	15.86	gpm	0.00	l/min		Assume fill each tank in 20 min	
Number of Metering Pumps	4	#					
Module Covered? ("1" = YES, "0" = NO)	0						
If Module Exists, Is it Covered? ("1" = Yes, "0" = No)	0						
Containment Wall Height	2.25	ft	685.80	mm			
Slab on Grade Thickness	**9.00**	in	**228.60**	mm		Model based on 9"	
Slab on Grade Thickness	0.75	ft	228.60	mm			
Containment Wall Thickness	**8.00**	in	**203.20**	mm		Model based on 8"	
Containment Wall Thickness	0.67	ft	203.20	mm			
Tank Pad / Metering Pump Pad Height	**3.00**	ft	**914.40**	mm	EPH		
Corridor							
Length	24.00	ft	7315.20	mm			
Width	8.00	ft	2438.40	mm			
Area	192.00	sf	17.84	m2			
Corridor Covered? ("1" = YES, "0" = NO)	1						
Electrical Room:							
Slab on Grade:							
Length	0.00	ft	0.00	mm			
Width	0.00	ft	0.00	mm			
Concrete Thickness	**12.00**	in	**304.80**	mm		Model based on 12"	
Concrete Thickness	1.00	ft	304.80	mm			
Walls:							
Height = FBD	10.00	ft				Fixed	
Concrete Thickness	**8.00**	in	**203.20**	mm		Model based on 8"	
Concrete Thickness	0.67	ft	203.20	mm			
Overall Dimensions							
Containment Area Length	24.00	ft	7315.20	mm			
Containment Area Width	62.00	ft	18897.60	mm			
Containment Area	1488.00	sf	138.24	m2			
Corridor Area Length	24.00	ft	7315.20	mm			
Corridor Area Width	8.00	ft	2438.40	mm			
Corridor Area	192.00	sf	17.84	m2			
Electrical Area Length	0.00	ft	0.00	mm			
Electrical Area Width	0.00	ft	0.00	mm			
Electrical Room Area	0.00	sf	0.00	m2			
Chemical Facility Area	1680.00	sf	156.08	m2			
Covered Chemical Area (Building)	1680.00	sf	156.08	m2			
Covered Chemical Area (Canopy)	0.00	sf	0.00	m2			
Total Covered Area	1680.00	sf	156.08	m2			

Excavation Depth	3.50	ft	1066.80	mm			
COST ESTIMATE							
Description	**Quantity (English)**	**Unit (English)**	**Quantity (Metric)**	**Unit (Metric)**	**$/Unit**	**Total Cost**	**User Over-Write**
SITEWORK:							
Excavation	291.68	CY	223.00	m3	*$6.72*	$1,961	
Imported Structural Backfill	124.44	CY	95.14	m3	*$50.94*	$6,339	
Native Backfill	42.65	CY	32.61	m3	*$8.27*	$352	
Haul Excess	249.03	CY	190.40	m3	*$8.27*	$2,058	
Allowance for Misc Items	5%				$10,711.16	$536	
Subtotal						$11,247	
CONCRETE:							
Slab on Grade	48.34	CY	36.96	m3	*$490.62*	$23,716	
Containment Walls	6.11	CY	4.67	m3	*$880.79*	$5,383	
Bulk Tank Pads	17.10	CY	13.08	m3	*$490.62*	$8,392	
Day Tank Pads	1.43	CY	1.09	m3	*$490.62*	$699	
Transfer Pump Pads	1.33	CY	1.02	m3	*$490.62*	$654	
Metering Pump Pads	2.67	CY	2.04	m3	*$490.62*	$1,308	
Corridor							
Slab on Grade	6.67	CY	5.10	m3	*$490.62*	$3,271	
Electrical Room							
Slab on Grade	0.00	CY	0.00	m3	*$490.62*	$0	
Allowance for Misc Items	5%				$43,422.92	$2,171	
Subtotal						$45,594	
MASONRY:	**Moderate**						
Chemical Building	1680.00	SF	156.08	m2	*$198.37*	$333,256	
Electrical Room	0.00	SF	0.00	m2	*$165.31*	$0	
Subtotal	1680.00					$333,256	
METALS:							
Canopy	0.00	SF	0.00	m2	*$41.80*	$0	
Metal Stairway	1	EA			$8,327.28	$8,327	
Grating	1	EA			$1,998.55	$1,999	
Allowance for Misc Items	10%				$10,325.82	$1,033	
Subtotal						$11,358	
EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
Bulk Tank	1	EA			*$22,771.38*	$22,771	
Day Tank	1	EA			*$3,608.62*	$3,609	
Transfer Pump	2	EA			*$10,658.90*	$21,318	
Metering Pump	4	EA			*$10,658.90*	$42,636	
Allowance for Misc Items	10%				$90,333.38	$9,033	
Subtotal						$99,367	
INSTRUMENTS & CONTROLS:							
Instruments							
Chemical Tank Radar Level Transmitters	1	EA			*$1,043.16*	$1,043	
Chemical Tank Beacons	1	EA			*$1,043.16*	$1,043	
Day Tank Differential Pressure Transmitter	1	EA			*$1,043.16*	$1,043	
Drum or Tote Weigh Scale	0	EA			*$1,390.89*	$0	
Metering Pump Discharge Pressure Switch	4	EA			*$695.44*	$2,782	
Magmeter	3	EA			*$695.44*	$2,086	
Sump Pump Float Switch	1	EA			*$347.72*	$348	
Eyewash	1	EA			*$1,043.16*	$1,043	
Number of Analog I/O Counts	11	EA			*$264.27*	$2,907	
Number of Digital I/O Counts	39	EA			*$62.59*	$2,441	
Number of Local Panels	1	EA			*$13,074.33*	$13,074	
Number of PLCs	1	EA			*$13,908.86*	$13,909	
I&C Conduit & Wire	288.00	LF	87.78	m	*$12.06*	$3,473	
Allowance for Misc Items	10%				$45,192.60	$4,519	
Subtotal						$49,712	
MECHANICAL:							
Pipe							
Chemical Transfer Pump Suction Header Piping-CTSH (1.5-inch, Exposed, PVC)	24.00	LF	7.32	m	*$15.75*	$378	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	24.00	LF	7.32	m	*$13.11*	$315	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	86.00	LF	26.21	m	*$13.11*	$1,128	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	86.00	LF	26.21	m	*$13.11*	$1,128	
Elbows							
Chemical Transfer Pump Suction Header Piping-CTSH (1.5-inch, Exposed, PVC)	8	EA			*$22.49*	$180	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	8	EA			*$10.06*	$80	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	16	EA			*$10.06*	$161	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	16	EA			*$10.06*	$161	
Tees							
Chemical Transfer Pump Suction Header Piping-CTSH (1.5-inch, Exposed, PVC)	2	EA			*$29.39*	$59	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	2	EA			*$10.47*	$21	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	4	EA			*$10.47*	$42	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	4	EA			*$10.47*	$42	
End Caps							
Chemical Transfer Pump Suction Header Piping-CTSH (1.5-inch, Exposed, PVC)	2	EA			*$11.75*	$24	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	2	EA			*$5.65*	$11	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	2	EA			*$5.65*	$11	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	2	EA			*$5.65*	$11	
Valves							
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	4	EA			*$173.94*	$696	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	4	EA			*$57.14*	$229	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	8	EA			*$57.14*	$457	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC, V-902, Diaphragm)	8	EA			*$57.14*	$457	
Allowance for Misc Items	10%				$4,896.78	$490	
Subtotal						$6,079	
ELECTRICAL:							

# MCC Sections	0	#			*$10,730.27*	$0	
Switchgear	0	EA			*$49,359.23*	$0	
Adjustable Frequency Drives							
Metering Pumps	0	EA			***$8,931.12***	$0	
User Defined Item #1	0	EA			***$8,865.56***	$0	
User Defined Item #2	0	EA			***$8,865.56***	$0	
User Defined Item #3	0	EA			***$8,865.56***	$0	
Electrical Conduit & Wire	0.00	LF	0.00	m	*$12.06*	$0	
Allowance for Misc Items	10%				$0.00	$0	
Subtotal						$0	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00				0.00	$0	
Item 2 Description	0.00				0.00	$0	
Item 3 Description	0.00				0.00	$0	
Item 4 Description	0.00				0.00	$0	
Item 5 Description	0.00				0.00	$0	
Item 6 Description	0.00				0.00	$0	
Item 7 Description	0.00				0.00	$0	
Item 8 Description	0.00				0.00	$0	
Item 9 Description	0.00				0.00	$0	
Item 10 Description	0.00				0.00	$0	
Item 11 Description	0.00				0.00	$0	
Item 12 Description	0.00				0.00	$0	
Item 13 Description	0.00				0.00	$0	
Item 14 Description	0.00				0.00	$0	
Item 15 Description	0.00				0.00	$0	
Subtotal						$0	
Subtotal						$556,613	
ALLOWANCES:		User Override					
Finishes Allowance	2.00%		$618,459	$12,369			
I&C Allowance	2.00%		$618,459	$12,369			
Mechanical Allowance	4.00%		$618,459	$24,738			
Electrical Allowance	2.00%		$618,459	$12,369			
					Facility Cost Name		
Facility Cost	**1,680**	**Building SF**	**$368.13**	**$618,459**	CFLFC01		
Facility Cost with Standard Additional Project Costs Added	**1,680**	**Building SF**	**$447.30**	**$751,470**	CFLFC02		
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**1,680**	**Building SF**	**$775.88**	**$1,303,471**	CFLFC03		
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**1,680**	**Building SF**	**$638.54**	**$1,072,755**	CFLFC05		
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**1,680**	**Building SF**	**$775.88**	**$1,303,471**	CFLFC06		

Liquid Chemical Storage & Feed - (Liquid Polymer)

Located in Chemical Building A

Is This Facility Included in My Project? Yes

Is the Facility Storage Only (no metering pumps)?	**No**	Y/N					
		Overwrite Value					
Select Chemical	**Liquid Polymer**		Select "Other" from the drop down list if using a different chemical.				
Percent Active Chemical, % w/w	100.00%		This is the intended feed strength to the process. Inputting a value in the yellow cell overwrites the cell in column "C".				For Fluoride systems, concentration must include the Available Fluoride Ion (AFI) concentration. Typically 79.2% AFI for 23% as HFA. (e.g., 23% as HFA x 79.2% AFI = 18.22% as F)
Active Chemical Form for Dosage Basis	Polymer		Inputting a value in the yellow cell overwrites the cell in column "C".				
Bulk Chemical Specific Gravity	1.10		Inputting a value in the yellow cell overwrites the cell in column "C".				
Active lb/gal solution	9.18	lb/gal	1100.00	kg/m3			
Process User Inputs:	**Value (English)**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Red Flags**	**Comment**
FLOW AND CHEMICAL ADDITION							
Application #1							
1.) Minimum flow to application point	**15.00**	mgd	**56.78**	ML/d			Input the flow that the selected dose will be applied to.
2.) Average flow to application point	**90.00**	mgd	**283.91**	ML/d			Input the flow that the selected dose will be applied to.
3.) Maximum flow to applicatoin point	**160.00**	mgd	**567.81**	ML/d			Input the flow that the selected dose will be applied to.
4.) Minimum chemical addition	**0.05**	mg/L					Input the dose that corresponds to the flow input above.
5.) Average chemical addition	**0.10**	mg/L					Input the dose that corresponds to the flow input above.
6.) Maximum chemical addition	**0.25**	mg/L					Input the dose that corresponds to the flow input above.
7.) Input Number of Equal Simultaneous Application Points	**2**	#					
8.) Hours of addition per day	**24.00**	hr					Input the total number of hours that the chemical is fed during the day.
Application #2							
9.) Minimum flow to application point	**0.00**	mgd	**0.00**	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
10.) Average flow to application point	**0.00**	mgd	**0.00**	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
11.) Maximum flow to application point	**0.00**	mgd	**0.00**	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
12.) Minimum chemical addition	**0.00**	mg/L					Input the dose that corresponds to the flow input above.
13.) Average chemical addition	**0.00**	mg/L					Input the dose that corresponds to the flow input above.
14.) Maximum chemical addition	**0.00**	mg/L					Input the dose that corresponds to the flow input above.
15.) Input Number of Equal Simultaneous Application Points	**0**	#					
16.) Hours of addition per day	**0.00**	hr					Input the total number of hours that the chemical is fed during the day.
Application #3							
17.) Minimum flow to application point	**0.00**	mgd	**0.00**	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
18.) Average flow to application point	**0.00**	mgd	**0.00**	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
19.) Maximum flow to application point	**0.00**	mgd	**0.00**	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
20.) Minimum chemical addition	**0.00**	mg/L					Input the dose that corresponds to the flow input above.
21.) Average chemical addition	**0.00**	mg/L					Input the dose that corresponds to the flow input above.
22.) Maximum chemical addition	**0.00**	mg/L					Input the dose that corresponds to the flow input above.
23.) Input Number of Equal Simultaneous Application Points	**0**	#					
24.) Hours of addition per day	**0.00**	hr					Input the total number of hours that the chemical is fed during the day.
CHEMICAL QUANTITIES AND FLOW							
Application Point #1 Chemical Usage:							
Minimum as "dry" chemical	6.26	lb/d	2.84	kg/d			
Average as "dry" chemical	75.11	lb/d	34.07	kg/d			
Maximum as "dry" chemical	333.82	lb/d	151.42	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.01	gph	0.05	L/h			
Average at feed concentration	0.17	gph	0.65	L/h			
Maximum at feed concentration	0.76	gph	2.87	L/h			
Calculate Chemical Metering Pump Flow Turndown	53.33	:1				**Note: Pump turndown is > 20, proceed with the design with caution**	Should be < 20:1, If ≥ 20:1, proceed with caution.
Application Point #2 Chemical Usage:							
Minimum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Average as "dry" chemical	0.00	lb/d	0.00	kg/d			
Maximum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.00	gph	0.00	L/h			
Average at feed concentration	0.00	gph	0.00	L/h			
Maximum at feed concentration	0.00	gph	0.00	L/h			

Calculate Chemical Metering Pump Flow Turndown	0.00	:1				Should be < 20:1, If ≥ 20:1, proceed with caution.
Application Point #3 Chemical Usage:						
Minimum as "dry" chemical	0.00	lb/d	0.00	kg/d		
Average as "dry" chemical	0.00	lb/d	0.00	kg/d		
Maximum as "dry" chemical	0.00	lb/d	0.00	kg/d		
Chemical Metering Rates per Simultaneously Operating Pump						
Minimum at feed concentration	0.00	gph	0.00	L/h		
Average at feed concentration	0.00	gph	0.00	L/h		
Maximum at feed concentration	0.00	gph	0.00	L/h		
Calculate Chemical Metering Pump Flow Turndown	0.00	:1				Should be < 20:1, If ≥ 20:1, proceed with caution.
Whole Plant Chemical Usage for Storage Calcs:						
Minimum	6.26	lb/d	2.84	kg/d		
Average	75.11	lb/d	34.07	kg/d		
Maximum	333.82	lb/d	151.42	kg/d		
Max Flow Average Dose Daily Usage	133.53	lb/d				
Whole Plant # of Days of Storage						
Maximum Flow and Average Dose	30.00	days				
CHEMICAL STORAGE INPUTS						
25.) Flow used to calculate storage requirements	**Maximum**	Type				
26.) Chemcial application used to calculate storage requirements	**Average**	Type				
27.) Input Minimum Number of Days of Storage	**30.00**	days				
Minimum Storage Volume	436.36	gal	1.65	m3		
28.) Choose Chemical Delivery Method	**Tote**	Type				
Bulk Delivery Volume (Tank Truck, Totes, Drums)	300.00	gal	1.14	m3		Assumes 300 gal per Tote.
Optional: Input Bulk Delivery Volume for Selected Delivery Method (overwrites above calculation)		gal		m3		Not typically used. Use with caution.
Bulk Delivery Volume	300.00	gal	1.14	m3		
Maximum of Above Delivery and Storage Volumes	58.33	cf	1.65	m3		
BULK TANKS:						
29.) Input Number of Tanks	**1**	#				
30.) Input Tank Diameter	**12.00**	ft	**3,657.60**	mm	BTD	Greater than 14' tank diameter will require on-site tank fabrication. Maximum diameter allowed for this model is 14'.
Calculate Liquid Height of Tanks	0.00	ft	0.00	mm		
Use this Tank Height (Liquid Height * 1.2)	0.00	ft	0.00	mm		Verify tank height within the facility. If indoors, typically 4' lower than the roof framing structure. Assumes extra 20% volume needed for each tank for head space and outlet connection elevation.
Calculate Usable Volume of Each Bulk Tank	0.00	gal	0.00	m3		Assumes 20% of the volume of each tank is not usable (needed for head space and outlet connection elevation).
Calculate Volume of Each Bulk Tank	0.00	gal	0.00	m3		
31.) Input Number of Rows of Tanks	**1**	#				
Calculate Number of Tanks per Row	1	#				
32.) Input Tank Material (FRP, PE (Polyethylene), PLS (Phenolic Lined Steel))	**FRP**	Type				Typically FRP
33.) Input Clear Distance Around BulkTanks, Day Tanks, Totes or Drums	**4.00**	ft	**1,219.20**	mm	CDT	Typically ≥ 3 ft
Calculate Actual Number of Days of Storage	41.25	days				For bulk tanks, assumes 20% of the volume of each tank is not usable (needed for head space and outlet connection elevation).
TOTES & DRUMS:						
Calculate Number of Totes or Drums	2	#				
34.) Input Number of Rows of Totes or Drums	**2**	#				
Calculate Number of Totes or Drums per Row	1	#				
Length of Each Tote	4.00	ft	1219.20	mm		Fixed
Width of Each Tote	4.00	ft	1219.20	mm		Fixed
Diameter of Each Drum	2.50	ft	762.00	mm		Fixed
DAY TANKS:						
35.) Are Day Tanks Required?	**No**	Y/N				Rule: Day Tanks are only available when the Delivery Method = "Tank Truck".
36.) Input Number of Day Tanks	**2**	#				Suggest 2 Day Tanks
Calculate Day Tank Volume based on Max Flow/Dose (per tank)	0.00	gal	0.00	m3		
Convert Day Tank Volume (per each)	0.00	cf	0.00	m3		
Calculate Day Tank Diameter (per each)	0.00	ft	0.00	mm	DTD	
Calculate Day Tank Height (per each)	0.00	ft	0.00	mm		Assumption: H = 2 * D
TRANSFER & METERING PUMPS:						
Number of Transfer Pumps	0	#				Fixed
37.) Input Time to Fill Day Tank	**20.00**	min				Typically fill all day tanks in 20 min
Calculate Number of Active Metering Pumps	2	#				Rule: One active metering pump per each application point.
Calculate Number of Standby Metering Pumps	1	#				Rule: One standby metering pump per each application
38.) Input Number of Additional Standby Metering Pumps	**0**	#				
Calculate Total Number of Metering Pumps	3	#				
39.) Input Clear Distance Around Transfer and Metering Pumps	**4.00**	ft	**1,828.80**	mm	CDP	Typically ≥ 4 ft
Length of Transfer and Metering Pumps	3.00	ft	914.40	mm		Fixed. Conservatively assumes Pulsafeeder metering pump type.
FACILITY SIZING:						
40.) Is this Chemical Room Part of a Multiple Chemical Facility?	**Yes**	Y/N				
41.) Is this Chemical Room Considered the "Start Point" for this Chemical Facility?	**No**	Y/N				There should only be one "start point" per chemical facility. Recommend choosing the facility with the greatest width as the "start point"
42.) If this is Part of a Multiple Chemical Facility and is the "Start Point", Input the Summation of Total Number of Pumps from the Other Chemical Rooms Here		#				Total number of pumps is listed in row 114 of the liquid chemical facility, rows 140, 151, and 162 of the dry chemical facility, and row 122 of the potassium permanganate facility

43.) Input Common Chemical Access Corridor Width	8.00	ft	2,438.40	mm			Input zero if a corridor is not required. Assumes Chem facilities are in series. If Chem facilities are in parallel, input 1/2 total corridor width.
44.) Is Corridor Covered?	Yes	Y/N					
45.) Select Chemical Facility Covering	Building						
46.) Select Chemical Area for this Chemical	A						Only used to help CPES user organize chemicals when multiple chemical buildings are used. Has no impact on sizing calculations or cost.
CONTAINMENT AREA:							
Are Stairs Required into Containment Area?	Yes	Y/N					Typically not needed for tote and drum storage areas.
Is Grating Required in Containment Area?	Yes	Y/N					Typically not needed for tote and drum storage areas.
Width of Stair Access	4.00	ft	1219.20	mm	WS		Fixed
Calculate Containment Area Length	19.00	ft	5791.20	mm			
Calculate Containment Area Width	35.00	ft	10668.00	mm		**Note: verify that this dimension matches the Containment Area Width on the other chemical rooms in this facility. If not, input the larger value in the user overwrite on the room with the shorter dimension**	
47.) Optional: User Overwrite of Containment Area Width	35.00	ft	10,668.00	mm			
Calculate Fire Sprinkler Water Volume	2,660.00	gal	10.07	m3			Assumes 0.2 gpm/sf for 20 min if chemical installed inside a building. If chemical is outside or under a canopy, assume no fire sprinkler water volume.
Calculate 120% of One Storage Tank Volume	360.00	gal	1.36	m3			
Calculate 30% of All Tank Volume	180.00	gal	0.68	m3			
Calculate Maximum Volume + Fire Flow Volume	3,020.00	gal	11.43	m3			
Tank Pads Volume	150.00	cf	4.25	m3			
Tank Pads Volume	1,122.08	gal	4.25	m3			
Calculate Maximum Volume + Fire Flow Volume + Tank Pad Volume	4,142.08	gal	15.68	m3			
Calculate Maximum Volume + Fire Flow Volume + Tank Pad Volume	553.72	cf	15.68	m3			
Calculate Containment Wall Height (including freeboard)	2.25	ft	685.80	mm		**Note: verify that this dimension matches the Containment Wall Height on the other chemical rooms in this facility. If not, input the larger value in the user overwrite on the room with the shorter dimension**	120% of 1 tank volume or 30% of all tank volume whichever is greater + fire flow volume + 6" freeboard. Should be ≤ 4.5'.
48.) Optional: User Overwrite of Containment Wall Height	2.25	ft	2,438.40	mm			
49.) Input Depth of Burial	1.75	ft	0.00	mm	DB		
50.) Input Cutback Slope	1.00	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
51.) Input Over Excavation Depth	1.00	ft	0.00	mm	OEXD		
Mechanical Sizing Requirements:							
Pipe Name	**Input Velocity**	**Unit (English)**	**Input Velocity**	**Unit (Metric)**	**Standard Pipe Size**	**Unit (English)**	**Nominal Pipe Size**
Chemical Transfer Pump Suction Header Piping	2.00	fps	0.61	m/s	1.00	in	25.00
Chemical Transfer Pump Discharge Header Piping	6.00	fps	1.83	m/s	1.00	in	25.00
Chemical Metering Pump Suction Header Piping	2.00	fps	0.61	m/s	1.00	in	25.00
Chemical Metering Pump Discharge Header Piping	6.00	fps	1.83	m/s	1.00	in	25.00
Mechanical Material Requirements:							
Pipe Name	**Pipe ID**	**Installation Type**	**Pipe Material**	**Pipe Lining Material**	**Pipe Coating Material**	**Pipe Length**	**# Elbows**
Chemical Transfer Pump Suction Header Piping	CTSH	Exposed	PVC	NA	NA	0.00	0.00
Chemical Transfer Pump Discharge Header Piping	CTDH	Exposed	PVC	NA	NA	0.00	0.00
Chemical Metering Pump Suction Header Piping	LCSH	Exposed	PVC	NA	NA	54.00	12.00
Chemical Metering Pump Discharge Header Piping	LCDH	Exposed	PVC	NA	NA	54.00	12.00
						L+W	#MP*4
Electrical User Inputs and Sizing Requirements:							
52.) Is this a "Critical" Facility (requiring standby power)?	No	Y/N					
53.) Is there SWGR?	No						
Electrical Equipment Lengths:							**MCC**
Item	**Quantity**	**HP per Each**	**AFD's Required?**	**MCC Spaces for Motor Starters**	**MCC Spaces for AFD's less than 50hp)**	**MCC Spaces for Breakers**	**Total MCC Spaces**
Metering Pumps	0.00	0.50	No	0.00	0.00	0.00	
User Defined Item #1	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #2	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #3	0.00	0.00	No	0.00	0.00	0.00	
TOTAL		**0.00**		**0.00**	**0.00**	**0.00**	**0.00**
Electrical Equipment Widths:							
Equipment	**Depth (ft)**						
MCC	0.00						
Small AFD's	0.00						
Large AFD's	0.00						
Switchgear	0.00						
Maximum Depth	0.00						
Clear Distances:							
Clear Distance	**Width**	**Length**	**Comment**				
CD1		3.00	Clear Distance between wall and MCC	Typically 3 feet			
CD2		1.00	Clear Distance between MCC and Small AFD	Typically 1 foot			
CD3		0.00	Clear Distance between Small AFD and Large AFD	Typically Zero			
CD4		0.00	Clear Distance between Large AFD and Switchgear	Typically Zero			

CD5		0.00	Clear Distance between Switchgear and Contingency Space	Typically Zero			
CD6	4.00		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)				
CD7	3.00		Clear Distance in front of Equipment	Tyipcally 3 feet			
Contingency Length		0.00	Contingency length	Typically Zero			
Electric Room Length (ft):							
CD1	3.00						
MCC	0.00						
CD2	1.00						
Small AFD's	0.00						
CD3	0.00						
Large AFD's	0.00						
CD4	0.00						
Swithgear	0.00						
CD5	0.00						
Contingency	0.00						
Total Length	0.00						
Electric Room Width (ft):							
CD6	0.00	If there is no switchgear, this distance will be Zero.					
Maximum Equipment Depth	0.00						
CD7	3.00						
Total Width	0.00						
COST TABLE FOR TANKS & PUMPS:	**Unit Cost**						
Tanks (Installed Cost per Gallon)							
FRP	***$0.00***						
Polyethylene (PE)	$ 2.25						
Phenolic Lined Steel (PLS)	***$6.41***						
Chemical Feed Pumps (Cost per Each)	***$10,658.90***						
Estimating Dimensions:	**Value English**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Comment**	**Red Flags**
Logic Tests ("1" = Yes, "0" = No):							
Is this Chemical Feed System Included?	1						
Is the Method of Delivery "Tank Truck"?	0						
Is Day Tank Required? (1 = Yes, 0 = No)	0						
Tank Truck without Day Tank (True or False)	FALSE						
Tank Truck with Day Tank (True or False)	FALSE						
Tank Truck without Day Tank (1 = Yes, 0 = No)	0					Tank Truck without Day Tank	
Tank Truck with Day Tank (1 = Yes, 0 = No)	0					Tank Truck without Day Tank	
Is the Method of Delivery "Tote"?	1					Tote	
Is the Method of Delivery "Drum"?	0					Drum	
Length of Module (Tank Truck)	0.00	ft	0.00	mm			
Length of Module (Tote)	19.00	ft	5791.20	mm			
Length of Module (Drum)	0.00	ft	0.00	mm			
Width of Module (Tank Truck without Transfer Pump and Day Tank)	0.00	ft	0.00	mm			
Width of Module (Tank Truck with Transfer Pump and Day Tank)	0.00	ft	0.00	mm			
Width of Module (Tote)	35.00	ft	10668.00	mm			
Width of Module (Drum)	0.00	ft	0.00	mm			
Area of Module	0.00	sf	0.00	m2			
Number of Bulk Tanks (each)	0	#					
Diameter of Bulk Tank	12.00	ft	3657.60	mm			
Volume of Each Bulk Tank	0.00	gal	0.00	m3			
Bulk Tank Material	FRP	Type					
Number of Day Tanks (each)	0	#					
Diameter of Day Tank	0.00	ft					
Volume of Each Day Tank	0.00	gal	0.00	m3			
Number of Transfer Pumps	0	#					
Transfer Pump Capacity (each)	0.00	gpm	0.00	l/min		Assume fill each tank in 20 min	
Number of Metering Pumps	3	#					
Module Covered? ("1" = YES, "0" = NO)	0						
If Module Exists, Is it Covered? ("1" = Yes, "0" = No)	0						
Containment Wall Height	2.25	ft	685.80	mm			
Slab on Grade Thickness	**9.00**	in	**228.60**	mm		Model based on 9"	
Slab on Grade Thickness	0.75	ft	228.60	mm			
Containment Wall Thickness	**8.00**	in	**203.20**	mm		Model based on 8"	
Containment Wall Thickness	0.67	ft	203.20	mm			
Tank Pad / Metering Pump Pad Height	**3.00**	ft	**914.40**	mm	EPH		
Corridor							
Length	19.00	ft	5791.20	mm			
Width	8.00	ft	2438.40	mm			
Area	152.00	sf	14.12	m2			
Corridor Covered? ("1" = YES, "0" = NO)	1						
Electrical Room:							
Slab on Grade:							
Length	0.00	ft	0.00	mm			
Width	0.00	ft	0.00	mm			
Concrete Thickness	**12.00**	in	**304.80**	mm		Model based on 12"	
Concrete Thickness	1.00	ft	304.80	mm			
Walls:							
Height = FBD	10.00	ft				Fixed	
Concrete Thickness	**8.00**	in	**203.20**	mm		Model based on 8"	
Concrete Thickness	0.67	ft	203.20	mm			
Overall Dimensions							
Containment Area Length	19.00	ft	5791.20	mm			
Containment Area Width	35.00	ft	10668.00	mm			
Containment Area	665.00	sf	61.78	m2			
Corridor Area Length	19.00	ft	5791.20	mm			
Corridor Area Width	8.00	ft	2438.40	mm			
Corridor Area	152.00	sf	14.12	m2			
Electrical Area Length	0.00	ft	0.00	mm			
Electrical Area Width	0.00	ft	0.00	mm			
Electrical Room Area	0.00	sf	0.00	m2			
Chemical Facility Area	817.00	sf	75.90	m2			
Covered Chemical Area (Building)	817.00	sf	75.90	m2			
Covered Chemical Area (Canopy)	0.00	sf	0.00	m2			
Total Covered Area	817.00	sf	75.90	m2			

Excavation Depth	3.50	ft	1066.80	mm			
COST ESTIMATE							
Description	**Quantity (English)**	**Unit (English)**	**Quantity (Metric)**	**Unit (Metric)**	**$/Unit**	**Total Cost**	**User Over-Write**
SITEWORK:							
Excavation	150.12	CY	114.78	m3	*$6.72*	$1,009	
Imported Structural Backfill	60.52	CY	46.27	m3	*$50.94*	$3,083	
Native Backfill	28.13	CY	21.51	m3	*$8.27*	$232	
Haul Excess	121.99	CY	93.27	m3	*$8.27*	$1,008	
Allowance for Misc Items	5%				$5,332.99	$267	
Subtotal						$5,600	
CONCRETE:							
Slab on Grade	22.75	CY	17.39	m3	*$490.62*	$11,160	
Containment Walls	4.06	CY	3.10	m3	*$880.79*	$3,572	
Bulk Tank Pads	0.00	CY	0.00	m3	*$490.62*	$0	
Day Tank Pads	0.00	CY	0.00	m3	*$490.62*	$0	
Transfer Pump Pads	0.00	CY	0.00	m3	*$490.62*	$0	
Metering Pump Pads	2.00	CY	1.53	m3	*$490.62*	$981	
Corridor							
Slab on Grade	5.28	CY	4.04	m3	*$490.62*	$2,589	
Electrical Room							
Slab on Grade	0.00	CY	0.00	m3	*$490.62*	$0	
Allowance for Misc Items	5%				$18,302.71	$915	
Subtotal						$19,218	
MASONRY:	**High**						
Chemical Building	817.00	SF	75.90	m2	*$198.37*	$162,066	
Electrical Room	0.00	SF	0.00	m2	*$198.37*	$0	
Subtotal	817.00					$162,066	
METALS:							
Canopy	0.00	SF	0.00	m2	*$41.80*	$0	
Metal Stairway	1	EA			$8,327.28	$8,327	
Grating	1	EA			$1,998.55	$1,999	
Allowance for Misc Items	10%				$10,325.82	$1,033	
Subtotal						$11,358	
EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
Bulk Tank	0	EA			*$0.00*	$0	
Day Tank	0	EA			*$0.00*	$0	
Transfer Pump	0	EA			*$0.00*	$0	
Metering Pump	3	EA			*$10,658.90*	$31,977	
Allowance for Misc Items	10%				$31,976.69	$3,198	
Subtotal						$35,174	
INSTRUMENTS & CONTROLS:							
Instruments							
Chemical Tank Radar Level Transmitters	0	EA			*$1,043.16*	$0	
Chemical Tank Beacons	0	EA			*$1,043.16*	$0	
Day Tank Differential Pressure Transmitter	0	EA			*$1,043.16*	$0	
Drum or Tote Weigh Scale	2	EA			*$1,390.89*	$2,782	
Metering Pump Discharge Pressure Switch	3	EA			*$695.44*	$2,086	
Magmeter	2	EA			*$695.44*	$1,391	
Sump Pump Float Switch	1	EA			*$347.72*	$348	
Eyewash	1	EA			*$1,043.16*	$1,043	
Number of Analog I/O Counts	9	EA			*$264.27*	$2,378	
Number of Digital I/O Counts	21	EA			*$62.59*	$1,314	
Number of Local Panels	1	EA			*$13,074.33*	$13,074	
Number of PLCs	1	EA			*$13,908.86*	$13,909	
I&C Conduit & Wire	171.00	LF	52.12	m	*$12.06*	$2,062	
Allowance for Misc Items	10%				$40,387.94	$4,039	
Subtotal						$44,427	
MECHANICAL:							
Pipe							
Chemical Transfer Pump Suction Header Piping-CTSH (1-inch, Exposed, PVC)	0.00	LF	0.00	m	*$13.11*	$0	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	0.00	LF	0.00	m	*$13.11*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	54.00	LF	16.46	m	*$13.11*	$708	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	54.00	LF	16.46	m	*$13.11*	$708	
Elbows							
Chemical Transfer Pump Suction Header Piping-CTSH (1-inch, Exposed, PVC)	0	EA			*$10.06*	$0	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	0	EA			*$10.06*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	12	EA			*$10.06*	$121	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	12	EA			*$10.06*	$121	
Tees							
Chemical Transfer Pump Suction Header Piping-CTSH (1-inch, Exposed, PVC)	0	EA			*$10.47*	$0	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	0	EA			*$10.47*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	3	EA			*$10.47*	$31	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	3	EA			*$10.47*	$31	
End Caps							
Chemical Transfer Pump Suction Header Piping-CTSH (1-inch, Exposed, PVC)	0	EA			*$5.65*	$0	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	0	EA			*$5.65*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	2	EA			*$5.65*	$11	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	2	EA			*$5.65*	$11	
Valves							
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	0	EA			*$57.14*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	0	EA			*$57.14*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	6	EA			*$57.14*	$343	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC, V-902, Diaphragm)	6	EA			*$57.14*	$343	
Allowance for Misc Items	10%				$2,428.48	$243	
Subtotal						$2,671	
ELECTRICAL:							

# MCC Sections	0	#			*$10,730.27*	$0	
Switchgear	0	EA			*$49,359.23*	$0	
Adjustable Frequency Drives							
Metering Pumps	0	EA			***$8,931.12***	$0	
User Defined Item #1	0	EA			***$8,865.56***	$0	
User Defined Item #2	0	EA			***$8,865.56***	$0	
User Defined Item #3	0	EA			***$8,865.56***	$0	
Electrical Conduit & Wire	0.00	LF	0.00	m	*$12.06*	$0	
Allowance for Misc Items	10%				$0.00	$0	
Subtotal						$0	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00				0.00	$0	
Item 2 Description	0.00				0.00	$0	
Item 3 Description	0.00				0.00	$0	
Item 4 Description	0.00				0.00	$0	
Item 5 Description	0.00				0.00	$0	
Item 6 Description	0.00				0.00	$0	
Item 7 Description	0.00				0.00	$0	
Item 8 Description	0.00				0.00	$0	
Item 9 Description	0.00				0.00	$0	
Item 10 Description	0.00				0.00	$0	
Item 11 Description	0.00				0.00	$0	
Item 12 Description	0.00				0.00	$0	
Item 13 Description	0.00				0.00	$0	
Item 14 Description	0.00				0.00	$0	
Item 15 Description	0.00				0.00	$0	
Subtotal						$0	
Subtotal						$280,514	
ALLOWANCES:		User Override					
Finishes Allowance	2.00%		$311,682	$6,234			
I&C Allowance	2.00%		$311,682	$6,234			
Mechanical Allowance	4.00%		$311,682	$12,467			
Electrical Allowance	2.00%		$311,682	$6,234			
					Facility Cost Name		
Facility Cost	**817**	**Building SF**	**$381.50**	**$311,682**	CFLFC01		
Facility Cost with Standard Additional Project Costs Added	**817**	**Building SF**	**$463.54**	**$378,715**	CFLFC02		
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**817**	**Building SF**	**$804.05**	**$656,905**	CFLFC03		
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**817**	**Building SF**	**$661.73**	**$540,632**	CFLFC05		
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**817**	**Building SF**	**$804.05**	**$656,905**	CFLFC06		

Liquid Chemical Storage & Feed - (Aluminum Sulfate (Alum))

Located in Chemical Building A

Is This Facility Included in My Project? Yes

Is the Facility Storage Only (no metering pumps)?	No	Y/N					
		Overwrite Value					
Select Chemical	Aluminum Sulfate (Alum)		Select "Other" from the drop down list if using a different chemical.				
Percent Active Chemical, % w/w	48.50%		This is the intended feed strength to the process. Inputting a value in the yellow cell overwrites the cell in column "C".				For Fluoride systems, concentration must include the Available Fluoride Ion (AFI) concentration. Typically 79.2% AFI for 23% as HFA. (e.g., 23% as HFA x 79.2% AFI = 18.22% as F)
Active Chemical Form for Dosage Basis	Al2(SO4)3-14H2O		Inputting a value in the yellow cell overwrites the cell in column "C".				
Bulk Chemical Specific Gravity	1.34		Inputting a value in the yellow cell overwrites the cell in column "C".				
Active lb/gal solution	5.42	lb/gal	649.90	kg/m3			
Process User Inputs:	**Value (English)**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Red Flags**	**Comment**
FLOW AND CHEMICAL ADDITION							
Application #1							
1.) Minimum flow to application point	15.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to.
2.) Average flow to application point	90.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to.
3.) Maximum flow to applicatoin point	160.00	mgd	567.81	ML/d			Input the flow that the selected dose will be applied to.
4.) Minimum chemical addition	1.00	mg/L					Input the dose that corresponds to the flow input above.
5.) Average chemical addition	1.50	mg/L					Input the dose that corresponds to the flow input above.
6.) Maximum chemical addition	2.00	mg/L					Input the dose that corresponds to the flow input above.
7.) Input Number of Equal Simultaneous Application Points	2	#					
8.) Hours of addition per day	24.00	hr					Input the total number of hours that the chemical is fed during the day.
Application #2							
9.) Minimum flow to application point	15.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
10.) Average flow to application point	90.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
11.) Maximum flow to application point	150.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
12.) Minimum chemical addition	1.00	mg/L					Input the dose that corresponds to the flow input above.
13.) Average chemical addition	1.50	mg/L					Input the dose that corresponds to the flow input above.
14.) Maximum chemical addition	2.00	mg/L					Input the dose that corresponds to the flow input above.
15.) Input Number of Equal Simultaneous Application Points	2	#					
16.) Hours of addition per day	24.00	hr					Input the total number of hours that the chemical is fed during the day.
Application #3							
17.) Minimum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
18.) Average flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
19.) Maximum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
20.) Minimum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
21.) Average chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
22.) Maximum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
23.) Input Number of Equal Simultaneous Application Points	0	#					
24.) Hours of addition per day	0.00	hr					Input the total number of hours that the chemical is fed during the day.
CHEMICAL QUANTITIES AND FLOW							
Application Point #1 Chemical Usage:							
Minimum as "dry" chemical	125.18	lb/d	56.78	kg/d			
Average as "dry" chemical	1,126.63	lb/d	511.03	kg/d			
Maximum as "dry" chemical	2,670.53	lb/d	1211.33	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.48	gph	1.82	L/h			
Average at feed concentration	4.33	gph	16.38	L/h			
Maximum at feed concentration	10.26	gph	38.83	L/h			
Calculate Chemical Metering Pump Flow Turndown	21.33	:1				**Note: Pump turndown is > 20, proceed with the design with caution**	Should be < 20:1, If ≥ 20:1, proceed with caution.
Application Point #2 Chemical Usage:							
Minimum as "dry" chemical	125.18	lb/d	56.78	kg/d			
Average as "dry" chemical	1,126.63	lb/d	511.03	kg/d			
Maximum as "dry" chemical	2,503.62	lb/d	1135.62	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.48	gph	1.82	L/h			
Average at feed concentration	4.33	gph	16.38	L/h			
Maximum at feed concentration	9.62	gph	36.40	L/h			

Calculate Chemical Metering Pump Flow Turndown	20.00	:1					Should be < 20:1, If ≥ 20:1, proceed with caution.
Application Point #3 Chemical Usage:							
Minimum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Average as "dry" chemical	0.00	lb/d	0.00	kg/d			
Maximum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.00	gph	0.00	L/h			
Average at feed concentration	0.00	gph	0.00	L/h			
Maximum at feed concentration	0.00	gph	0.00	L/h			
Calculate Chemical Metering Pump Flow Turndown	0.00	:1					Should be < 20:1, If ≥ 20:1, proceed with caution.
Whole Plant Chemical Usage for Storage Calcs:							
Minimum	250.36	lb/d	113.56	kg/d			
Average	2,253.26	lb/d	1022.06	kg/d			
Maximum	5,174.15	lb/d	2346.95	kg/d			
Max Flow Average Dose Daily Usage	3,880.61	lb/d					
Whole Plant # of Days of Storage							
Maximum Flow and Average Dose	30.00	days					
CHEMICAL STORAGE INPUTS							
25.) Flow used to calculate storage requirements	**Maximum**	Type					
26.) Chemcial application used to calculate storage requirements	**Average**	Type					
27.) Input Minimum Number of Days of Storage	**30.00**	days					
Minimum Storage Volume	21,464.84	gal	81.25	m3			
28.) Choose Chemical Delivery Method	**Tank Truck**	Type					
Bulk Delivery Volume (Tank Truck, Totes, Drums)	4,024.02	gal	15.23	m3			Assumes 45,000 lb per Tank Truck.
Optional: Input Bulk Delivery Volume for Selected Delivery Method (overwrites above calculation)		gal		m3			Not typically used. Use with caution.
Calculate Bulk Delivery Volume * 1.5 (for Truck Delivery Only)	6,036.04	gal	22.85	m3			
Maximum of Above Delivery and Storage Volumes	2,869.43	cf	81.25	m3			
BULK TANKS:							
29.) Input Number of Tanks	**3**	#					
30.) Input Tank Diameter	**10.00**	ft	**3,048.00**	mm	BTD		Greater than 14' tank diameter will require on-site tank fabrication. Maximum diameter allowed for this model is 14'.
Calculate Liquid Height of Tanks	12.18	ft	3711.93	mm			
Use this Tank Height (Liquid Height * 1.2)	15.00	ft	4572.00	mm		**Verify tank height in relationship to the facility structure. Add more tanks or increase diameter if needed.**	Verify tank height within the facility. If indoors, typically 4' lower than the roof framing structure. Assumes extra 20% volume needed for each tank for head space and outlet connection elevation.
Calculate Usable Volume of Each Bulk Tank	7,343.98	gal	27.80	m3			Assumes 20% of the volume of each tank is not usable (needed for head space and outlet connection elevation).
Calculate Volume of Each Bulk Tank	8,812.78	gal	33.36	m3			
31.) Input Number of Rows of Tanks	**2**	#					
Calculate Number of Tanks per Row	2	#					
32.) Input Tank Material (FRP, PE (Polyethylene), PLS (Phenolic Lined Steel))	**FRP**	Type					Typically FRP
33.) Input Clear Distance Around BulkTanks, Day Tanks, Totes or Drums	**4.00**	ft	**1,219.20**	mm	CDT		Typically ≥ 3 ft
Calculate Actual Number of Days of Storage	30.79	days					For bulk tanks, assumes 20% of the volume of each tank is not usable (needed for head space and outlet connection elevation).
TOTES & DRUMS:							
Calculate Number of Totes or Drums	0	#					
34.) Input Number of Rows of Totes or Drums	**1**	#					
Calculate Number of Totes or Drums per Row	0	#					
Length of Each Tote	0.00	ft	0.00	mm			Fixed
Width of Each Tote	0.00	ft	0.00	mm			Fixed
Diameter of Each Drum	0.00	ft	0.00	mm			Fixed
DAY TANKS:							
35.) Are Day Tanks Required?	**Yes**	Y/N					Rule: Day Tanks are only available when the Delivery Method = "Tank Truck".
36.) Input Number of Day Tanks	**2**	#					Suggest 2 Day Tanks
Calculate Day Tank Volume based on Max. Flow/Dose (per tank)	477.00	gal	1.81	m3			
Convert Day Tank Volume (per each)	63.77	cf	1.81	m3			
Calculate Day Tank Diameter (per each)	4.00	ft	1219.20	mm	DTD		
Calculate Day Tank Height (per each)	8.00	ft	2438.40	mm			Assumption: H = 2 * D
TRANSFER & METERING PUMPS:							
Number of Transfer Pumps	2	#					Fixed
37.) Input Time to Fill Day Tank	**20.00**	min					Typically fill all day tanks in 20 min
Calculate Number of Active Metering Pumps	4	#					Rule: One active metering pump per each application point.
Calculate Number of Standby Metering Pumps	2	#					Rule: One standby metering pump per each application
38.) Input Number of Additional Standby Metering Pumps	**2**	#					
Calculate Total Number of Metering Pumps	8	#					
39.) Input Clear Distance Around Transfer and Metering Pumps	**4.00**	ft	**1,828.80**	mm	CDP		Typically ≥ 4 ft
Length of Transfer and Metering Pumps	3.00	ft	914.40	mm			Fixed. Conservatively assumes Pulsafeeder metering pump type.
FACILITY SIZING:							
40.) Is this Chemical Room Part of a Multiple Chemical Facility?	**Yes**	Y/N					
41.) Is this Chemical Room Considered the "Start Point" for this Chemical Facility?	**No**	Y/N					There should only be one "start point" per chemical facility. Recommend choosing the facility with the greatest width as the "start point"
42.) If this is Part of a Multiple Chemical Facility and is the "Start Point", Input the Summation of Total Number of Pumps from the Other Chemical Rooms Here		#					Total number of pumps is listed in row 114 of the liquid chemical facility, rows 140, 151, and 162 of the dry chemical facility, and row 122 of the potassium permanganate facility

43.) Input Common Chemical Access Corridor Width	8.00	ft	2,438.40	mm			Input zero if a corridor is not required. Assumes Chem facilities are in series. If Chem facilities are in parallel, input 1/2 total corridor width.
44.) Is Corridor Covered?	Yes	Y/N					
45.) Select Chemical Facility Covering	Building						
46.) Select Chemical Area for this Chemical	A						Only used to help CPES user organize chemicals when multiple chemical buildings are used. Has no impact on sizing calculations or cost.
CONTAINMENT AREA:							
Are Stairs Required into Containment Area?	Yes	Y/N					Typically not needed for tote and drum storage areas.
Is Grating Required in Containment Area?	Yes	Y/N					Typically not needed for tote and drum storage areas.
Width of Stair Access	4.00	ft	1219.20	mm	WS		Fixed
Calculate Containment Area Length	44.00	ft	13411.20	mm			
Calculate Containment Area Width	62.00	ft	18897.60	mm		**Note: verify that this dimension matches the Containment Area Width on the other chemical rooms in this facility. If not, input the larger value in the user overwrite on the room with the shorter dimension**	
47.) Optional: User Overwrite of Containment Area Width	62.00	ft	18,897.60	mm			
Calculate Fire Sprinkler Water Volume	10,912.00	gal	41.31	m3			Assumes 0.2 gpm/sf for 20 min if chemical installed inside a building. If chemical is outside or under a canopy, assume no fire sprinkler water volume.
Calculate 120% of One Storage Tank Volume	10,575.33	gal	40.03	m3			
Calculate 30% of All Tank Volume	7,931.50	gal	30.02	m3			
Calculate Maximum Volume + Fire Flow Volume	21,487.33	gal	81.34	m3			
Tank Pads Volume	706.86	cf	20.02	m3			
Tank Pads Volume	5,287.67	gal	20.02	m3			
Calculate Maximum Volume + Fire Flow Volume + Tank Pad Volume	26,775.00	gal	101.35	m3			
Calculate Maximum Volume + Fire Flow Volume + Tank Pad Volume	3,579.30	cf	101.35	m3			
Calculate Containment Wall Height (including freeboard)	2.25	ft	685.80	mm		**Note: verify that this dimension matches the Containment Wall Height on the other chemical rooms in this facility. If not, input the larger value in the user overwrite on the room with the shorter dimension**	120% of 1 tank volume or 30% of all tank volume whichever is greater + fire flow volume + 6" freeboard. Should be ≤ 4.5'.
48.) Optional: User Overwrite of Containment Wall Height	2.25	ft	685.80	mm			
49.) Input Depth of Burial	1.75	ft	0.00	mm	DB		
50.) Input Cutback Slope	1.00	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
51.) Input Over Excavation Depth	1.00	ft	0.00	mm	OEXD		

Mechanical Sizing Requirements:

Pipe Name	Input Velocity	Unit (English)	Input Velocity	Unit (Metric)	Standard Pipe Size	Unit (English)	Nominal Pipe Size
Chemical Transfer Pump Suction Header Piping	2.00	fps	0.61	m/s	3.50	in	80.00
Chemical Transfer Pump Discharge Header Piping	6.00	fps	1.83	m/s	2.00	in	50.00
Chemical Metering Pump Suction Header Piping	2.00	fps	0.61	m/s	1.00	in	25.00
Chemical Metering Pump Discharge Header Piping	6.00	fps	1.83	m/s	1.00	in	25.00

Mechanical Material Requirements:

Pipe Name	Pipe ID	Installation Type	Pipe Material	Pipe Lining Material	Pipe Coating Material	Pipe Length	# Elbows
Chemical Transfer Pump Suction Header Piping	CTSH	Exposed	PVC	NA	NA	44.00	8.00
Chemical Transfer Pump Discharge Header Piping	CTDH	Exposed	PVC	NA	NA	44.00	8.00
Chemical Metering Pump Suction Header Piping	LCSH	Exposed	PVC	NA	NA	106.00	32.00
Chemical Metering Pump Discharge Header Piping	LCDH	Exposed	PVC	NA	NA	106.00	32.00
						L+W	#MP*4

Electrical User Inputs and Sizing Requirements:

52.) Is this a "Critical" Facility (requiring standby power)?	Yes	Y/N	
53.) Is there SWGR?	No		

Electrical Equipment Lengths:

Item	Quantity	HP per Each	AFD's Required?	MCC Spaces for Motor Starters	MCC Spaces for AFD's less than 50hp)	MCC Spaces for Breakers	MCC Total MCC Spaces
Metering Pumps	0.00	0.50	No	0.00	0.00	0.00	
User Defined Item #1	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #2	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #3	0.00	0.00	No	0.00	0.00	0.00	
TOTAL		**0.00**		**0.00**	**0.00**	**0.00**	**0.00**

Electrical Equipment Widths:

Equipment	Depth (ft)
MCC	0.00
Small AFD's	0.00
Large AFD's	0.00
Switchgear	0.00
Maximum Depth	0.00

Clear Distances:

Clear Distance	Width	Length	Comment	
CD1		3.00	Clear Distance between wall and MCC	Typically 3 feet
CD2		1.00	Clear Distance between MCC and Small AFD	Typically 1 foot
CD3		0.00	Clear Distance between Small AFD and Large AFD	Typically Zero
CD4		0.00	Clear Distance between Large AFD and Switchgear	Typically Zero

CD5		0.00	Clear Distance between Switchgear and Contingency Space	Typically Zero			
CD6	4.00		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)				
CD7	3.00		Clear Distance in front of Equipment	Typically 3 feet			
Contingency Length		0.00	Contingency length	Typically Zero			
Electric Room Length (ft):							
CD1	3.00						
MCC	0.00						
CD2	1.00						
Small AFD's	0.00						
CD3	0.00						
Large AFD's	0.00						
CD4	0.00						
Swithgear	0.00						
CD5	0.00						
Contingency	0.00						
Total Length	0.00						
Electric Room Width (ft):							
CD6	0.00	If there is no switchgear, this distance will be Zero.					
Maximum Equipment Depth	0.00						
CD7	3.00						
Total Width	0.00						
COST TABLE FOR TANKS & PUMPS:	**Unit Cost**						
Tanks (Installed Cost per Gallon)							
FRP	***$2.44***						
Polyethylene (PE)	$ 2.25						
Phenolic Lined Steel (PLS)	***$6.41***						
Chemical Feed Pumps (Cost per Each)	***$10,658.90***						

Estimating Dimensions:	Value English	Unit (English)	Value (Metric)	Unit (Metric)	Name	Comment	Red Flags
Logic Tests ("1" = Yes, "0" = No):							
Is this Chemical Feed System Included?	1						
Is the Method of Delivery "Tank Truck"?	1						
Is Day Tank Required? (1 = Yes, 0 = No)	1						
Tank Truck without Day Tank (True or False)	FALSE						
Tank Truck with Day Tank (True or False)	TRUE						
Tank Truck without Day Tank (1 = Yes, 0 = No)	0					Tank Truck without Day Tank	
Tank Truck with Day Tank (1 = Yes, 0 = No)	1					Tank Truck without Day Tank	
Is the Method of Delivery "Tote"?	0					Tote	
Is the Method of Delivery "Drum"?	0					Drum	
Length of Module (Tank Truck)	44.00	ft	13411.20	mm			
Length of Module (Tote)	0.00	ft	0.00	mm			
Length of Module (Drum)	0.00	ft	0.00	mm			
Width of Module (Tank Truck without Transfer Pump and Day Tank)	0.00	ft	0.00	mm			
Width of Module (Tank Truck with Transfer Pump and Day Tank)	62.00	ft	18897.60	mm			
Width of Module (Tote)	0.00	ft	0.00	mm			
Width of Module (Drum)	0.00	ft	0.00	mm			
Area of Module	0.00	sf	0.00	m2			
Number of Bulk Tanks (each)	3	#					
Diameter of Bulk Tank	10.00	ft	3048.00	mm			
Volume of Each Bulk Tank	8812.78	gal	33.36	m3			
Bulk Tank Material	FRP	Type					
Number of Day Tanks (each)	2	#					
Diameter of Day Tank	4.00	ft					
Volume of Each Day Tank	752.02	gal	2.85	m3			
Number of Transfer Pumps	2	#					
Transfer Pump Capacity (each)	75.20	gpm	0.00	l/min		Assume fill each tank in 20 min	
Number of Metering Pumps	8	#					
Module Covered? ("1" = YES, "0" = NO)	0						
If Module Exists, Is it Covered? ("1" = Yes, "0" = No)	0						
Containment Wall Height	2.25	ft	685.80	mm			
Slab on Grade Thickness	**9.00**	in	**228.60**	mm		Model based on 9"	
Slab on Grade Thickness	0.75	ft	228.60	mm			
Containment Wall Thickness	**8.00**	in	**203.20**	mm		Model based on 8"	
Containment Wall Thickness	0.67	ft	203.20	mm			
Tank Pad / Metering Pump Pad Height	**3.00**	ft	**914.40**	mm	EPH		
Corridor							
Length	44.00	ft	13411.20	mm			
Width	8.00	ft	2438.40	mm			
Area	352.00	sf	32.70	m2			
Corridor Covered? ("1" = YES, "0" = NO)	1						
Electrical Room:							
Slab on Grade:							
Length	0.00	ft	0.00	mm			
Width	0.00	ft	0.00	mm			
Concrete Thickness	**12.00**	in	**304.80**	mm		Model based on 12"	
Concrete Thickness	1.00	ft	304.80	mm			
Walls:							
Height = FBD	10.00	ft				Fixed	
Concrete Thickness	**8.00**	in	**203.20**	mm		Model based on 8"	
Concrete Thickness	0.67	ft	203.20	mm			
Overall Dimensions							
Containment Area Length	44.00	ft	13411.20	mm			
Containment Area Width	62.00	ft	18897.60	mm			
Containment Area	2728.00	sf	253.44	m2			
Corridor Area Length	44.00	ft	13411.20	mm			
Corridor Area Width	8.00	ft	2438.40	mm			
Corridor Area	352.00	sf	32.70	m2			
Electrical Area Length	0.00	ft	0.00	mm			
Electrical Area Width	0.00	ft	0.00	mm			
Electrical Room Area	0.00	sf	0.00	m2			
Chemical Facility Area	3080.00	sf	286.14	m2			
Covered Chemical Area (Building)	3080.00	sf	286.14	m2			
Covered Chemical Area (Canopy)	0.00	sf	0.00	m2			
Total Covered Area	3080.00	sf	286.14	m2			

Excavation Depth	3.50	ft	1066.80	mm			
COST ESTIMATE							
Description	**Quantity (English)**	**Unit (English)**	**Quantity (Metric)**	**Unit (Metric)**	**$/Unit**	**Total Cost**	**User Over-Write**
SITEWORK:							
Excavation	505.10	CY	386.18	m3	*$6.72*	$3,396	
Imported Structural Backfill	228.15	CY	174.43	m3	*$50.94*	$11,622	
Native Backfill	51.72	CY	39.54	m3	*$8.27*	$427	
Haul Excess	453.38	CY	346.63	m3	*$8.27*	$3,747	
Allowance for Misc Items	5%				$19,192.84	$960	
Subtotal						$20,152	
CONCRETE:							
Slab on Grade	83.71	CY	64.00	m3	*$490.62*	$41,069	
Containment Walls	8.33	CY	6.37	m3	*$880.79*	$7,340	
Bulk Tank Pads	51.31	CY	39.23	m3	*$490.62*	$25,175	
Day Tank Pads	3.72	CY	2.85	m3	*$490.62*	$1,827	
Transfer Pump Pads	1.33	CY	1.02	m3	*$490.62*	$654	
Metering Pump Pads	5.33	CY	4.08	m3	*$490.62*	$2,617	
Corridor							
Slab on Grade	12.22	CY	9.34	m3	*$490.62*	$5,996	
Electrical Room							
Slab on Grade	0.00	CY	0.00	m3	*$490.62*	$0	
Allowance for Misc Items	5%				$84,678.13	$4,234	
Subtotal						$88,912	
MASONRY:	**Moderate**						
Chemical Building	3080.00	SF	286.14	m2	*$198.37*	$610,970	
Electrical Room	0.00	SF	0.00	m2	*$165.31*	$0	
Subtotal	3080.00					$610,970	
METALS:							
Canopy	0.00	SF	0.00	m2	*$41.80*	$0	
Metal Stairway	1	EA			$8,327.28	$8,327	
Grating	1	EA			$1,998.55	$1,999	
Allowance for Misc Items	10%				$10,325.82	$1,033	
Subtotal						$11,358	
EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
Bulk Tank	3	EA			*$21,531.87*	$64,596	
Day Tank	2	EA			*$4,525.86*	$9,052	
Transfer Pump	2	EA			*$10,658.90*	$21,318	
Metering Pump	8	EA			*$10,658.90*	$85,271	
Allowance for Misc Items	10%				$180,236.30	$18,024	
Subtotal						$198,260	
INSTRUMENTS & CONTROLS:							
Instruments							
Chemical Tank Radar Level Transmitters	3	EA			*$1,043.16*	$3,129	
Chemical Tank Beacons	3	EA			*$1,043.16*	$3,129	
Day Tank Differential Pressure Transmitter	2	EA			*$1,043.16*	$2,086	
Drum or Tote Weigh Scale	0	EA			*$1,390.89*	$0	
Metering Pump Discharge Pressure Switch	8	EA			*$695.44*	$5,564	
Magmeter	4	EA			*$695.44*	$2,782	
Sump Pump Float Switch	1	EA			*$347.72*	$348	
Eyewash	1	EA			*$1,043.16*	$1,043	
Number of Analog I/O Counts	21	EA			*$264.27*	$5,550	
Number of Digital I/O Counts	68	EA			*$62.59*	$4,256	
Number of Local Panels	1	EA			*$13,074.33*	$13,074	
Number of PLCs	1	EA			*$13,908.86*	$13,909	
I&C Conduit & Wire	968.00	LF	295.05	m	*$12.06*	$11,673	
Allowance for Misc Items	10%				$66,543.53	$6,654	
Subtotal						$73,198	
MECHANICAL:							
Pipe							
Chemical Transfer Pump Suction Header Piping-CTSH (3.5-inch, Exposed, PVC)	44.00	LF	13.41	m	*$26.31*	$1,158	
Chemical Transfer Pump Discharge Header Piping-CTDH (2-inch, Exposed, PVC)	44.00	LF	13.41	m	*$18.39*	$809	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	106.00	LF	32.31	m	*$13.11*	$1,390	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	106.00	LF	32.31	m	*$13.11*	$1,390	
Elbows							
Chemical Transfer Pump Suction Header Piping-CTSH (3.5-inch, Exposed, PVC)	8	EA			*$72.22*	$578	
Chemical Transfer Pump Discharge Header Piping-CTDH (2-inch, Exposed, PVC)	8	EA			*$34.92*	$279	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	32	EA			*$10.06*	$322	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	32	EA			*$10.06*	$322	
Tees							
Chemical Transfer Pump Suction Header Piping-CTSH (3.5-inch, Exposed, PVC)	2	EA			*$105.08*	$210	
Chemical Transfer Pump Discharge Header Piping-CTDH (2-inch, Exposed, PVC)	2	EA			*$48.31*	$97	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	8	EA			*$10.47*	$84	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	8	EA			*$10.47*	$84	
End Caps							
Chemical Transfer Pump Suction Header Piping-CTSH (3.5-inch, Exposed, PVC)	2	EA			*$36.17*	$72	
Chemical Transfer Pump Discharge Header Piping-CTDH (2-inch, Exposed, PVC)	2	EA			*$17.86*	$36	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	2	EA			*$5.65*	$11	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	2	EA			*$5.65*	$11	
Valves							
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	4	EA			*$641.14*	$2,565	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	4	EA			*$290.74*	$1,163	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	16	EA			*$57.14*	$914	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC, V-902, Diaphragm)	16	EA			*$57.14*	$914	
Allowance for Misc Items	10%				$10,441.32	$1,044	
Subtotal						$13,452	
ELECTRICAL:							

# MCC Sections	0	#			*$10,730.27*	$0	
Switchgear	0	EA			*$49,359.23*	$0	
Adjustable Frequency Drives							
Metering Pumps	0	EA			***$8,931.12***	$0	
User Defined Item #1	0	EA			***$8,865.56***	$0	
User Defined Item #2	0	EA			***$8,865.56***	$0	
User Defined Item #3	0	EA			***$8,865.56***	$0	
Electrical Conduit & Wire	0.00	LF	0.00	m	*$12.06*	$0	
Allowance for Misc Items	10%				$0.00	$0	
Subtotal						$0	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00				0.00	$0	
Item 2 Description	0.00				0.00	$0	
Item 3 Description	0.00				0.00	$0	
Item 4 Description	0.00				0.00	$0	
Item 5 Description	0.00				0.00	$0	
Item 6 Description	0.00				0.00	$0	
Item 7 Description	0.00				0.00	$0	
Item 8 Description	0.00				0.00	$0	
Item 9 Description	0.00				0.00	$0	
Item 10 Description	0.00				0.00	$0	
Item 11 Description	0.00				0.00	$0	
Item 12 Description	0.00				0.00	$0	
Item 13 Description	0.00				0.00	$0	
Item 14 Description	0.00				0.00	$0	
Item 15 Description	0.00				0.00	$0	
Subtotal						$0	
Subtotal						$1,016,303	
ALLOWANCES:		User Override					
Finishes Allowance	2.00%		$1,129,225	$22,585			
I&C Allowance	2.00%		$1,129,225	$22,585			
Mechanical Allowance	4.00%		$1,129,225	$45,169			
Electrical Allowance	2.00%		$1,129,225	$22,585			
					Facility Cost Name		
Facility Cost	**3,080**	**Building SF**	**$366.63**	**$1,129,225**	CFLFC01		
Facility Cost with Standard Additional Project Costs Added	**3,080**	**Building SF**	**$445.48**	**$1,372,086**	CFLFC02		
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**3,080**	**Building SF**	**$772.72**	**$2,379,968**	CFLFC03		
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**3,080**	**Building SF**	**$635.94**	**$1,958,711**	CFLFC05		
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**3,080**	**Building SF**	**$772.72**	**$2,379,968**	CFLFC06		

On-Site Sodium Hypochlorite Generation

Is This Facility Included in My Project? Yes

Assumptions:
1. Generator & Day Tank Containment Area must be Covered; Salt Storage is Outside

Process User Inputs:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Red Flags	Comments
Flow Rates:							
1.) Input Plant Flow Minimum (mgd)	15.00	mgd	0.00	ML/d			
2.) Input Plant Flow Average (mgd)	90.00	mgd	0.00	ML/d			
3.) Input Plant Flow Maximum (mgd)	160.00	mgd	567.81	ML/d			
CHEMICAL SYSTEM DOSAGE INFORMATION:							
Percent Active Sodium Hypochlorite Generated	0.80%						Fixed
Generated Sodium Hypochlorite Specific Gravity	1.00						Fixed
Active Chemical Form for Dosage Basis	Cl2						
Active Chemical Concentration, lb/gallon	0.07						Fixed
4.) Input Chemical Doses:							
Minimum (mg/L)	2.00	mg/L					
Average (mg/L)	3.00	mg/L					
Maximum (mg/L)	4.00	mg/L					
5.) Input **% of Total Chlorine Dosage Applied Upstream of Rapid Mixing**	0.00%						
6.) Input **% of Total Chlorine Dosage Applied Upstream of Filtration**	0.00%						
7.) Input **% of Total Chlorine Dosage Applied Downstream of Filtration**	50.00%						
8.) Input **% of Total Chlorine Dosage Applied Downstream of Clearwell**	50.00%						
Calculate Number of Simultaneous Application Points	2.00	#					
Whole Plant Chemical Usage:							
Calculate **Minimum Sodium Hypochlorite** (lb/d)	250.36	lb/d	113.56	kg/d			
Calculate **Average Sodium Hypochlorite** (lb/d)	2,253.26	lb/d	1022.06	kg/d			
Calculate **Maximum Sodium Hypochlorite** (lb/d)	5,341.06	lb/d	2422.66	kg/d			
9.) Input **Sodium Hypochlorite Generator Capacity** (lb/d, each)	2,000.00	lb/d	907.18	kg/d			ChlorTec Standard Sizes
Calculate **Number of Sodium Hypochlorite Generators** (each)	3.00	#					
Calculate **Generator Equipment Length** (each)	3.81	ft	1160.00	mm	GL		
Calculate **Generator Equipment Width** (each)	3.81	ft	1160.00	mm	GW		
Calculate **Transformer / Rectifier Length** (ft)	5.58	ft	1700.00	mm	TL		
Calculate **Transformer / Rectifier Width** (ft)	5.58	ft	1700.00	mm	TW		
10.) Input **Clear Distance Around Electrical Equipment** (ft)	4.00	ft	1,219.20	mm	CDEE		
Calculate **Minimum Salt** (lb/d)	876.27	lb/d	397.47	kg/d			
Calculate **Average Salt** (lb/d)	7,886.40	lb/d	3577.21	kg/d			
Calculate **Maximum Salt** (lb/d)	18,693.70	lb/d	8479.32	kg/d			
Calculate Annual Salt Use (Max Flow and Avg Dose) (tons/year)	731.06	tons/yr					
30% Brine Flow from Salt Saturator to Generator Feed Proportioning Pumping							
Calculate **Maximum 30% Brine Flow for Batch Production to Each Generator** (gpm)	1.94	gpm	0.12	L/s			
Calculate **Total 30% Brine Flow for Batch Production** (gpm)	5.82	gpm	0.37	L/s			
Softened Potable Water Flow from Flow Proportioning Pumping to Generators							
Calculate **Maximum Softened Potable Water Flow for Batch Production** (gpm each generator)	19.42	gpm	1.22	L/s			
Calculate **Total Softened Potable Water Flow for Batch Production** (gpm)	58.25	gpm	3.67	L/s			
3% Brine Flow to Generators							
Calculate **Maximum 3% Brine Flow For Batch Production to Each Generator** (gpm)	21.36	gpm	1.35	L/s			
Calculate **Total 3% Brine Flow for Batch Production** (gpm)	64.07	gpm	4.04	L/s			
Chemical Metering Rates:							
Upstream of Rapid Mixing							
Calculate **Minimum Sodium Hypochlorite** (gph)	0.00	gph	0.00	L/h			
Calculate **Average Sodium Hypochlorite** (gph)	0.00	gph	0.00	L/h			
Calculate **Maximum Sodium Hypochlorite** (gph)	0.00	gph	0.00	L/h			
Calculate **Chemical Metering Pump Flow Turndown**	0.00	#					Should be < 20, If > = 20, proceed with caution
Upstream of Filtration							
Calculate **Minimum Sodium Hypochlorite** (gph)	0.00	gph	0.00	L/h			
Calculate **Average Sodium Hypochlorite** (gph)	0.00	gph	0.00	L/h			
Calculate **Maximum Sodium Hypochlorite** (gph)	0.00	gph	0.00	L/h			

Calculate **Chemical Metering Pump Flow Turndown**	0.00	#					Should be < 20, If > = 20, proceed with caution
Downstream of Filtration							
Calculate **Minimum Sodium Hypochlorite** (gph)	78.13	gph	295.74	L/h			
Calculate **Average Sodium Hypochlorite** (gph)	703.13	gph	2661.62	L/h			
Calculate **Maximum Sodium Hypochlorite** (gph)	1,666.67	gph	6309.02	L/h			
Calculate **Chemical Metering Pump Flow Turndown**	21.33	#				**ERROR!! 'Should be less than 20. If greater than or equal to 20 proceed with caution**	Should be < 20, If > = 20, proceed with caution
Downstream of Clearwell							
Calculate **Minimum Sodium Hypochlorite** (gph)	78.13	gph	295.74	L/h			
Calculate **Average Sodium Hypochlorite** (gph)	703.13	gph	2661.62	L/h			
Calculate **Maximum Sodium Hypochlorite** (gph)	1,666.67	gph	6309.02	L/h			
Calculate **Chemical Metering Pump Flow Turndown**	21.33	#				**ERROR!! 'Should be less than 20. If greater than or equal to 20 proceed with caution**	Should be < 20, If > = 20, proceed with caution
Note to Designer: Review pump selection to accommodate Pump Discharge Back Pressure (psi)							
11.) Input Number of Days of Salt Storage at Average Flow/Dose (days)	**30.00**	days					
Calculate **Salt Storage Volume @ Avg. Flow/Dose** (gallons)	25,799.29	gal	97.66	m3			Assumes density of brine solution to be 70 lb/cf.
Calculate **Bulk Delivery Volume * 1.5** (gallons)	7,213.36	gal	27.31	m3			Assumes density of brine solution to be 70 lb/cf.
Maximum of Above 2 Volumes (gallons)	25,799.29	gal	97.66	m3			
SALT STORAGE/BRINE TANKS:							
12.) Input **Salt Storage/Brine Tank Volume** (gallons, each)	**11,300.00**	gal	42.78	m3			Bryneer Standard Sizes
Calculate **Number of Salt Storage/Brine Tanks** (each)	3.00	#					Typically, 2 minimum
Calculate **Height of Tanks** (ft)	22.83	ft	6958.58	mm			
Calculate **Diameter of Tanks** (ft)	12.00	ft	3657.60	mm	STD		
13.) Input **Clear Distance Around Brine Tanks, Generators, and Day Tanks** (ft)	**4.00**	ft	**1,219.20**	mm	CDT		
SODIUM HYPOCHLORITE DAY TANKS:							
Upstream of Rapid Mixing							
Calculate **Day Tank Volume** (per each, gallons)	0.00	gal	0.00	m3			
Convert **Day Tank Volume** (per each, cf)	0.00	cf	0.00	m3			
Calculate **Day Tank Diameter** (per each, ft)	0.00	ft	0.00	mm	DTD		
Calculate **Day Tank Height** (per each, ft)	0.00	ft	0.00	mm			Assumption: H = 2 * D
Upstream of Filtration							
Calculate **Day Tank Volume** (per each, gallons)	0.00	gal	0.00	m3			
Convert **Day Tank Volume** (per each, cf)	0.00	cf	0.00	m3			
Calculate **Day Tank Diameter** (per each, ft)	0.00	ft	0.00	mm	DTD		
Calculate **Day Tank Height** (per each, ft)	0.00	ft	0.00	mm			Assumption: H = 2 * D
Downstream of Filtration							
Calculate **Day Tank Volume** (per each, gallons)	40,000.00	gal	151.42	m3			
Convert **Day Tank Volume** (per each, cf)	5,347.22	cf	151.42	m3			
Calculate **Day Tank Diameter** (per each, ft)	15.04	ft	4585.12	mm	DTD		
Calculate **Day Tank Height** (per each, ft)	30.09	ft	9170.25	mm			Assumption: H = 2 * D
Downstream of Clearwell							
Calculate **Day Tank Volume** (per each, gallons)	40,000.00	gal	151.42	m3			
Convert **Day Tank Volume** (per each, cf)	5,347.22	cf	151.42	m3			
Calculate **Day Tank Diameter** (per each, ft)	15.04	ft	4585.12	mm	DTD		
Calculate **Day Tank Height** (per each, ft)	30.09	ft	9170.25	mm			Assumption: H = 2 * D
BRINE TRANSFER & METERING PUMPS:							
Calculate **Number of Brine Transfer Pumps** (each)	4	#					
Calculate **Number of Active Metering Pumps** (each)	2	#					Rule: One active metering pump per each application point.
14.) Input **Number of Standby Metering Pumps** (each)	**2**	#					
Calculate **Total Number of Metering Pumps** (each)	4	#					
15.) Input **Clear Distance Around Transfer and Metering Pumps**	**4.00**	ft	**1,219.20**	mm	CDP		
Length of Transfer and Metering Pumps (ft, Fixed)	3.00	ft	914.40	mm	LP		Fixed. Conservatively assumes Pulsafeeder metering pump type.
SODIUM HYPOCHLORITE CONTAINMENT AREA:							
Width of Stair Access (ft, fixed)	4.00	ft	1219.20	mm	WS		Fixed
Calculate **Containment Area Length** (ft)	80.55	ft	24550.57	mm	CAL		
Calculate **Containment Area Width** (ft)	34.04	ft	10376.32	mm	CAW		
Calculate **Fire Sprinkler Water Volume** (gal) (0.2 gpm/sf for 20 min.)	10,968.20	gal	41.52	m3			

Calculate **120% of One Storage Tank Volume** (gal)	48,000.00	gal	181.70	m3			
Calculate **30% of All Tank Volume** (gal)	24,000.00	gal	90.85	m3			
Maximum of Above 2 Volumes (gal)	48,000.00	gal	181.70	m3			
Calculate **Maximum Volume + Fire Flow Volume** (gal)	58,968.20	gal	223.22	m3			
Calculate **Maximum Volume + Fire Flow Volume** (cf)	7,882.90	cf	223.22	m3			
Calculate **Containment Wall Height (including 6" Freeboard)** (ft)	3.37	ft	1028.65	mm	CWH		120% of 1 tank volume or 30% of all tank volume whichever is greater + fire flow volume + 6" freeboard. Should be ≤ 4.5'.
SALT STORAGE AREA:							
Calculate **Salt Storage Area Length** (ft)	52.00	ft	15849.60	mm	SAL		
Calculate **Salt Storage Area Width** (ft)	20.00	ft	6096.00	mm	SAW		
Calculate **Salt Storage Area** (sf)	1,040.00	sf	96.62	m2			
GENERATOR RECTIFIER AREA:							
16.) Input Clear Distance Around Generator Rectifiers (ft)	**4.00**	ft	**1,219.20**	mm	CDR		
Calculate **Generator Rectifier Area Length** (ft)	32.73	ft	9976.80	mm	RRL		
Calculate **Generator Rectifier Area Width** (ft)	11.81	ft	3598.40	mm	RRW		
Calculate **Generator Rectifier Area** (sf)	386.43	sf	35.90	m2			
COST TABLE FOR TANKS AND PUMPS	**Unit Cost**						
Tanks (Installed Cost per Gallon)							
FRP							
Polyethylene (PE)	***$ 2.50***						
Phenolic Lined Steel (PLS)	***$ 6.77***						
Chemical Feed Pumps (Cost per Each)	***$ 8,527.12***						

Estimating Dimensions:	**Value English**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Red Flags**	**Comment**
Building:							
Length	80.55	ft	24550.57	mm	CAL		
Width	34.04	ft	10376.32	mm	CAW		
Area	2742.05	sf	254.74	m2			
Slab on Grade Length	84.55	ft	25769.77	mm			
Slab on Grade Width	38.04	ft	11595.52	mm			
Containment Wall Height	3.37	ft	1028.65	mm	CWH		
Slab on Grade Thickness	**12.00**	in	**304.80**	mm			Model based on 12"
Slab on Grade Thickness	1.00	ft	304.80	mm			
Containment Wall Thickness	**12.00**	in	**304.80**	mm			Model based on 12"
Containment Wall Thickness	1.00	ft	304.80	mm			
Generator / Rectifier Area:							
Length	32.73	ft	9976.80	mm	RRL		
Width	11.81	ft	3598.40	mm	RRW		
Area	386.43	sf	35.90	m2			
Slab on Grade Length	34.73	ft	10586.40	mm			
Slab on Grade Width	15.81	ft	4817.60	mm			
Slab on Grade Thickness	**12.00**	in	**304.80**	mm			Model based on 12"
Slab on Grade Thickness	1.00	ft	304.80	mm			
Salt Storage Slab:							
Length	52.00	ft	15849.60	mm	SAL		
Width	20.00	ft	6096.00	mm	SAW		
Slab on Grade Thickness	**12.00**	in	**304.80**	mm			Model based on 12"
Slab on Grade Thickness	1.00	ft	304.80	mm			
Overall Dimensions:							
Building:							
Excavation Length	88.55	ft	26988.97	mm			
Excavation Width	42.04	ft	12814.72	mm			
Excavation Depth	5.37	ft	1638.25	mm			
Generator / Rectifier Area:							
Excavation Length	38.73	ft	11805.60	mm			
Excavation Width	19.81	ft	6036.80	mm			
Excavation Depth	2.00	ft	609.60	mm			

COST ESTIMATE

Description	**Quantity (English)**	**Unit (English)**	**Quantity (Metric)**	**Unit (Metric)**	**$/Unit**	**Total Cost**	**User Over-Write**
SITEWORK:							
Building:							
Excavation	986.50	CY	754.24	m3	***$6.72***	$6,632	
Imported Structural Backfill	137.88	CY	105.42	m3	***$50.94***	$7,024	
Native Backfill	139.72	CY	106.83	m3	***$8.27***	$1,155	
Haul Excess	846.78	CY	647.41	m3	***$8.27***	$6,999	
Generator / Rectifier Room:							
Excavation	73.36	CY	56.08	m3	***$6.72***	$493	

Imported Structural Backfill	28.41	CY	21.72	m3	*$50.94*	$1,447	
Native Backfill	8.67	CY	6.63	m3	*$8.27*	$72	
Haul Excess	64.68	CY	49.45	m3	*$8.27*	$535	
Allowance for Misc Items	5%				$24,356.73	$1,218	
Subtotal						$25,575	
CONCRETE:							
Building Slab on Grade	119.13	CY	91.08	m3	*$490.62*	$58,445	
Generator / Rectifier Room	20.33	CY	15.55	m3	*$490.62*	$9,975	
Containment Walls	28.65	CY	21.90	m3	*$880.79*	$25,231	
Salt Storage Slab on Grade	38.52	CY	29.45	m3	*$490.62*	$18,898	
Allowance for Misc Items	5%				$112,549.47	$5,627	
Subtotal						$118,177	
MASONRY:	**High**						
CMU Building	3128.48	SF	290.65	m2	*$198.37*	$620,587	
Subtotal						$620,587	
EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
Sodium Hypochlorite Generators (2000 lb/day each)	3	EA			*$998,844.80*	$2,996,534	
Metering Pump	4	EA			*$10,658.90*	$42,636	
Day Tanks:							
Upstream of Rapid Mixing (0 gallons each)	0	EA			*$0.00*	$0	
Upstream of Filtration (0 gallons each)	0	EA			*$0.00*	$0	
Downstream of Filtration (40000 gallons each)	1	EA			*$76,391.01*	$76,391	
Downstream of Clearwell (40000 gallons each)	1	EA			*$76,391.01*	$76,391	
Allowance for Misc Items	10%				$3,191,952.00	$319,195	
Subtotal						$3,511,147	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00		0.00		0.00	$0	
Item 2 Description	0.00		0.00		0.00	$0	
Item 3 Description	0.00		0.00		0.00	$0	
Item 4 Description	0.00		0.00		0.00	$0	
Item 5 Description	0.00		0.00		0.00	$0	
Item 6 Description	0.00		0.00		0.00	$0	
Item 7 Description	0.00		0.00		0.00	$0	
Item 8 Description	0.00		0.00		0.00	$0	
Item 9 Description	0.00		0.00		0.00	$0	
Item 10 Description	0.00		0.00		0.00	$0	
Item 11 Description	0.00		0.00		0.00	$0	
Item 12 Description	0.00		0.00		0.00	$0	
Item 13 Description	0.00		0.00		0.00	$0	
Item 14 Description	0.00		0.00		0.00	$0	
Item 15 Description	0.00		0.00		0.00	$0	
Subtotal						$0	
Subtotal						$4,275,485	
ALLOWANCES:		**User Override**					
Finishes Allowance	2.00%		$5,481,391	$109,628			
I&C Allowance	5.00%		$5,481,391	$274,070			
Mechanical Allowance	10.00%		$5,481,391	$548,139			
Electrical Allowance	5.00%		$5,481,391	$274,070			
Facility Cost	**5,341**	**PPD**	**$1,026.27**	**$5,481,391**			
Facility Cost with Standard Additional Project Costs Added	**5,341**	**PPD**	**$1,246.99**	**$6,660,266**			
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**5,341**	**PPD**	**$2,162.99**	**$11,552,640**			
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**5,341**	**PPD**	**$1,780.14**	**$9,507,809**			
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**5,341**	**PPD**	**$2,162.99**	**$11,552,640**			

Liquid Chemical Storage & Feed - (Aluminum Sulfate (Alum))

Located in Stand Alone Chemical Building

Is This Facility Included in My Project? Yes

Is the Facility Storage Only (no metering pumps)?	No	Y/N					
		Overwrite Value					
Select Chemical	Aluminum Sulfate (Alum)		Select "Other" from the drop down list if using a different chemical.				
Percent Active Chemical, % w/w	48.50%		This is the intended feed strength to the process. Inputting a value in the yellow cell overwrites the cell in column "C".				For Fluoride systems, concentration must include the Available Fluoride Ion (AFI) concentration. Typically 79.2% AFI for 23% as HFA. (e.g., 23% as HFA x 79.2% AFI = 18.22% as F)
Active Chemical Form for Dosage Basis	Al2(SO4)3-14H2O		Inputting a value in the yellow cell overwrites the cell in column "C".				
Bulk Chemical Specific Gravity	1.34		Inputting a value in the yellow cell overwrites the cell in column "C".				
Active lb/gal solution	5.42	lb/gal	649.90	kg/m3			

Process User Inputs:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Red Flags	Comment
FLOW AND CHEMICAL ADDITION							
Application #1							
1.) Minimum flow to application point	15.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to.
2.) Average flow to application point	90.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to.
3.) Maximum flow to applicatoin point	160.00	mgd	567.81	ML/d			Input the flow that the selected dose will be applied to.
4.) Minimum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
5.) Average chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
6.) Maximum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
7.) Input Number of Equal Simultaneous Application Points	1	#					
8.) Hours of addition per day	24.00	hr					Input the total number of hours that the chemical is fed during the day.
Application #2							
9.) Minimum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
10.) Average flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
11.) Maximum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
12.) Minimum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
13.) Average chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
14.) Maximum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
15.) Input Number of Equal Simultaneous Application Points	0	#					
16.) Hours of addition per day	0.00	hr					Input the total number of hours that the chemical is fed during the day.
Application #3							
17.) Minimum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
18.) Average flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
19.) Maximum flow to application point	0.00	mgd	0.00	ML/d			Input the flow that the selected dose will be applied to. Enter 0 if Unit Process is not Included.
20.) Minimum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
21.) Average chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
22.) Maximum chemical addition	0.00	mg/L					Input the dose that corresponds to the flow input above.
23.) Input Number of Equal Simultaneous Application Points	0	#					
24.) Hours of addition per day	0.00	hr					Input the total number of hours that the chemical is fed during the day.
CHEMICAL QUANTITIES AND FLOW							
Application Point #1 Chemical Usage:							
Minimum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Average as "dry" chemical	0.00	lb/d	0.00	kg/d			
Maximum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.00	gph	0.00	L/h			
Average at feed concentration	0.00	gph	0.00	L/h			
Maximum at feed concentration	0.00	gph	0.00	L/h			
Calculate Chemical Metering Pump Flow Turndown	#DIV/0!	:1				#DIV/0!	Should be < 20:1, If ≥ 20:1, proceed with caution.
Application Point #2 Chemical Usage:							
Minimum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Average as "dry" chemical	0.00	lb/d	0.00	kg/d			
Maximum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.00	gph	0.00	L/h			
Average at feed concentration	0.00	gph	0.00	L/h			
Maximum at feed concentration	0.00	gph	0.00	L/h			
Calculate Chemical Metering Pump Flow Turndown	0.00	:1					Should be < 20:1, If ≥ 20:1, proceed with caution.
Application Point #3 Chemical Usage:							

Minimum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Average as "dry" chemical	0.00	lb/d	0.00	kg/d			
Maximum as "dry" chemical	0.00	lb/d	0.00	kg/d			
Chemical Metering Rates per Simultaneously Operating Pump:							
Minimum at feed concentration	0.00	gph	0.00	L/h			
Average at feed concentration	0.00	gph	0.00	L/h			
Maximum at feed concentration	0.00	gph	0.00	L/h			
Calculate Chemical Metering Pump Flow Turndown	0.00	:1					Should be < 20:1. If ≥ 20:1, proceed with caution.
Whole Plant Chemical Usage for Storage Calcs:							
Minimum	0.00	lb/d	0.00	kg/d			
Average	0.00	lb/d	0.00	kg/d			
Maximum	0.00	lb/d	0.00	kg/d			
Max Flow Average Dose Daily Usage	0.00	lb/d					
Whole Plant # of Days of Storage							
Maximum Flow and Average Dose	#DIV/0!	days					
CHEMICAL STORAGE INPUTS							
25.) Flow used to calculate storage requirements	Maximum	Type					
26.) Chemcial application used to calculate storage requirements	Average	Type					
27.) Input Minimum Number of Days of Storage	30.00	days					
Minimum Storage Volume	0.00	gal	0.00	m3			
28.) Choose Chemical Delivery Method	Tank Truck	Type					
Bulk Delivery Volume (Tank Truck, Totes, Drums)	4,024.02	gal	15.23	m3			Assumes 45,000 lb per Tank Truck.
Optional: Input Bulk Delivery Volume for Selected Delivery Method (overwrites above calculation)		gal		m3			Not typically used. Use with caution.
Calculate Bulk Delivery Volume * 1.5 (for Truck Delivery Only)	6,036.04	gal	22.85	m3			
Maximum of Above Delivery and Storage Volumes	806.90	cf	22.85	m3			
BULK TANKS:							
29.) Input Number of Tanks	1	#					
30.) Input Tank Diameter	12.00	ft	3,657.60	mm	BTD		Greater than 14' tank diameter will require on-site tank fabrication. Maximum diameter allowed for this model is 14'.
Calculate Liquid Height of Tanks	7.13	ft	2174.62	mm			
Use this Tank Height (Liquid Height * 1.2)	9.00	ft	2743.20	mm			Verify tank height within the facility. If indoors, typically 4' lower than the roof framing structure. Assumes extra 20% volume needed for each tank for head space and outlet connection elevation.
Calculate Usable Volume of Each Bulk Tank	6,345.20	gal	24.02	m3			Assumes 20% of the volume of each tank is not usable (needed for head space and outlet connection elevation).
Calculate Volume of Each Bulk Tank	7,614.24	gal	28.82	m3			
31.) Input Number of Rows of Tanks	1	#					
Calculate Number of Tanks per Row	1	#					
32.) Input Tank Material (FRP, PE (Polyethylene), PLS (Phenolic Lined Steel))	FRP	Type					Typically FRP
33.) Input Clear Distance Around BulkTanks, Day Tanks, Totes or Drums	4.00	ft	1,219.20	mm	CDT		Typically ≥ 3 ft
Calculate Actual Number of Days of Storage	#DIV/0!	days					For bulk tanks, assumes 20% of the volume of each tank is not usable (needed for head space and outlet connection elevation).
TOTES & DRUMS:							
Calculate Number of Totes or Drums	0	#					
34.) Input Number of Rows of Totes or Drums	1	#					
Calculate Number of Totes or Drums per Row	0	#					
Length of Each Tote	0.00	ft	0.00	mm			Fixed
Width of Each Tote	0.00	ft	0.00	mm			Fixed
Diameter of Each Drum	0.00	ft	0.00	mm			Fixed
DAY TANKS:							
35.) Are Day Tanks Required?	No	Y/N					Rule: Day Tanks are only available when the Delivery Method = "Tank Truck".
36.) Input Number of Day Tanks	2	#					Suggest 2 Day Tanks
Calculate Day Tank Volume based on Max Flow/Dose (per tank)	0.00	gal	0.00	m3			
Convert Day Tank Volume (per each)	0.00	cf	0.00	m3			
Calculate Day Tank Diameter (per each)	0.00	ft	0.00	mm	DTD		
Calculate Day Tank Height (per each)	0.00	ft	0.00	mm			Assumption: H = 2 * D
TRANSFER & METERING PUMPS:							
Number of Transfer Pumps	0	#					Fixed
37.) Input Time to Fill Day Tank	20.00	min					Typically fill all day tanks in 20 min
Calculate Number of Active Metering Pumps	1	#					Rule: One active metering pump per each application point.
Calculate Number of Standby Metering Pumps	1	#					Rule: One standby metering pump per each application
38.) Input Number of Additional Standby Metering Pumps	0	#					
Calculate Total Number of Metering Pumps	2	#					
39.) Input Clear Distance Around Transfer and Metering Pumps	4.00	ft	1,828.80	mm	CDP		Typically ≥ 4 ft
Length of Transfer and Metering Pumps	3.00	ft	914.40	mm			Fixed. Conservatively assumes Pulsafeeder metering pump type.
FACILITY SIZING:							
40.) Is this Chemical Room Part of a Multiple Chemical Facility?	No	Y/N					
41.) Is this Chemical Room Considered the "Start Point" for this Chemical Facility?	No	Y/N					There should only be one "start point" per chemical facility. Recommend choosing the facility with the greatest width as the "start point"
42.) If this is Part of a Multiple Chemical Facility and is the "Start Point", Input the Summation of Total Number of Pumps from the Other Chemical Rooms Here		#					Total number of pumps is listed in row 114 of the liquid chemical facility, rows 140, 151, and 162 of the dry chemical facility, and row 122 of the potassium permanganate facility

43.) Input Common Chemical Access Corridor Width	8.00	ft	2,438.40	mm			Input zero if a corridor is not required. Assumes Chem facilities are in series. If Chem facilities are in parallel, input 1/2 total corridor width.
44.) Is Corridor Covered?	Yes	Y/N					
45.) Select Chemical Facility Covering	Building						
46.) Select Chemical Area for this Chemical	None						Only used to help CPES user organize chemicals when multiple chemical buildings are used. Has no impact on sizing calculations or cost.
CONTAINMENT AREA:							
Are Stairs Required into Containment Area?	Yes	Y/N					Typically not needed for tote and drum storage areas.
Is Grating Required in Containment Area?	Yes	Y/N					Typically not needed for tote and drum storage areas.
Width of Stair Access	4.00	ft	1219.20	mm	WS		Fixed
Calculate Containment Area Length	20.00	ft	6096.00	mm			
Calculate Containment Area Width	35.00	ft	10668.00	mm			
47.) Optional: User Overwrite of Containment Area Width	35.00	ft	10,668.00	mm			
Calculate Fire Sprinkler Water Volume	2,800.00	gal	10.60	m3			Assumes 0.2 gpm/sf for 20 min if chemical installed inside a building. If chemical is outside or under a canopy, assume no fire sprinkler water volume.
Calculate 120% of One Storage Tank Volume	9,137.09	gal	34.59	m3			
Calculate 30% of All Tank Volume	2,284.27	gal	8.65	m3			
Calculate Maximum Volume + Fire Flow Volume	11,937.09	gal	45.19	m3			
Tank Pads Volume	339.29	cf	9.61	m3			
Tank Pads Volume	2,538.08	gal	9.61	m3			
Calculate Maximum Volume + Fire Flow Volume + Tank Pad Volume	14,475.17	gal	54.79	m3			
Calculate Maximum Volume + Fire Flow Volume + Tank Pad Volume	1,935.05	cf	54.79	m3			
Calculate Containment Wall Height (including freeboard)	2.25	ft	685.80	mm			120% of 1 tank volume or 30% of all tank volume whichever is greater + fire flow volume + 6" freeboard. Should be ≤ 4.5'.
48.) Optional: User Overwrite of Containment Wall Height	2.25	ft	2,438.40	mm			
49.) Input Depth of Burial	1.75	ft	0.00	mm	DB		
50.) Input Cutback Slope	1.00	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
51.) Input Over Excavation Depth	1.00	ft	0.00	mm	OEXD		

Mechanical Sizing Requirements:

Pipe Name	Input Velocity	Unit (English)	Input Velocity	Unit (Metric)	Standard Pipe Size	Unit (English)	Nominal Pipe Size
Chemical Transfer Pump Suction Header Piping	2.00	fps	0.61	m/s	1.00	in	25.00
Chemical Transfer Pump Discharge Header Piping	6.00	fps	1.83	m/s	1.00	in	25.00
Chemical Metering Pump Suction Header Piping	2.00	fps	0.61	m/s	1.00	in	25.00
Chemical Metering Pump Discharge Header Piping	6.00	fps	1.83	m/s	1.00	in	25.00

Mechanical Material Requirements:

Pipe Name	Pipe ID	Installation Type	Pipe Material	Pipe Lining Material	Pipe Coating Material	Pipe Length	# Elbows
Chemical Transfer Pump Suction Header Piping	CTSH	Exposed	PVC	NA	NA	0.00	0.00
Chemical Transfer Pump Discharge Header Piping	CTDH	Exposed	PVC	NA	NA	0.00	0.00
Chemical Metering Pump Suction Header Piping	LCSH	Exposed	PVC	NA	NA	55.00	8.00
Chemical Metering Pump Discharge Header Piping	LCDH	Exposed	PVC	NA	NA	55.00	8.00
						L+W	#MP*4

Electrical User Inputs and Sizing Requirements:

52.) Is this a "Critical" Facility (requiring standby power)?	No	Y/N	
53.) Is there SWGR?	No		

Electrical Equipment Lengths:

Item	Quantity	HP per Each	AFD's Required?	MCC Spaces for Motor Starters	MCC Spaces for AFD's less than 50hp)	MCC Spaces for Breakers	MCC Total MCC Spaces
Metering Pumps	2.00	0.50	No	4.00	0.00	0.00	
User Defined Item #1	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #2	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #3	0.00	0.00	No	0.00	0.00	0.00	
TOTAL		**1.00**		**4.00**	**0.00**	**0.00**	**4.00**

Electrical Equipment Widths:

Equipment	Depth (ft)
MCC	1.67
Small AFD's	0.00
Large AFD's	0.00
Switchgear	0.00
Maximum Depth	1.67

Clear Distances:

Clear Distance	Width	Length	Comment	
CD1		3.00	Clear Distance between wall and MCC	Typically 3 feet
CD2		1.00	Clear Distance between MCC and Small AFD	Typically 1 foot
CD3		0.00	Clear Distance between Small AFD and Large AFD	Typically Zero
CD4		0.00	Clear Distance between Large AFD and Switchgear	Typically Zero
CD5		0.00	Clear Distance between Switchgear and Contingency Space	Typically Zero
CD6	4.00		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)	
CD7	3.00		Clear Distance in front of Equipment	Typically 3 feet
Contingency Length		0.00	Contingency length	Typically Zero

Electric Room Length (ft):

CD1	3.00
MCC	8.33

CD2	1.00						
Small AFD's	0.00						
CD3	0.00						
Large AFD's	0.00						
CD4	0.00						
Swithgear	0.00						
CD5	0.00						
Contingency	0.00						
Total Length	12.33						
Electric Room Width (ft):							
CD6	0.00	If there is no switchgear, this distance will be Zero.					
Maximum Equipment Depth	1.67						
CD7	3.00						
Total Width	4.67						
COST TABLE FOR TANKS & PUMPS:	**Unit Cost**						
Tanks (Installed Cost per Gallon)							
FRP	***$2.50***						
Polyethylene (PE)	$ 2.25						
Phenolic Lined Steel (PLS)	***$6.41***						
Chemical Feed Pumps (Cost per Each)	***$10,658.90***						

Estimating Dimensions:	**Value English**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Comment**	**Red Flags**
Logic Tests ("1" = Yes, "0" = No):							
Is this Chemical Feed System Included?	1						
Is the Method of Delivery "Tank Truck"?	1						
Is Day Tank Required? (1 = Yes, 0 = No)	0						
Tank Truck without Day Tank (True or False)	TRUE						
Tank Truck with Day Tank (True or False)	FALSE						
Tank Truck without Day Tank (1 = Yes, 0 = No)	1					Tank Truck without Day Tank	
Tank Truck with Day Tank (1 = Yes, 0 = No)	0					Tank Truck without Day Tank	
Is the Method of Delivery "Tote"?	0					Tote	
Is the Method of Delivery "Drum"?	0					Drum	
Length of Module (Tank Truck)	20.00	ft	6096.00	mm			
Length of Module (Tote)	0.00	ft	0.00	mm			
Length of Module (Drum)	0.00	ft	0.00	mm			
Width of Module (Tank Truck without Transfer Pump and Day Tank)	35.00	ft	10668.00	mm			
Width of Module (Tank Truck with Transfer Pump and Day Tank)	0.00	ft	0.00	mm			
Width of Module (Tote)	0.00	ft	0.00	mm			
Width of Module (Drum)	0.00	ft	0.00	mm			
Area of Module	0.00	sf	0.00	m2			
Number of Bulk Tanks (each)	1	#					
Diameter of Bulk Tank	12.00	ft	3657.60	mm			
Volume of Each Bulk Tank	7614.24	gal	28.82	m3			
Bulk Tank Material	FRP	Type					
Number of Day Tanks (each)	0	#					
Diameter of Day Tank	0.00	ft					
Volume of Each Day Tank	0.00	gal	0.00	m3			
Number of Transfer Pumps	0	#					
Transfer Pump Capacity (each)	0.00	gpm	0.00	l/min		Assume fill each tank in 20 min	
Number of Metering Pumps	2	#					
Module Covered? ("1" = YES, "0" = NO)	0						
If Module Exists, Is it Covered? ("1" = Yes, "0" = No)	0						
Containment Wall Height	2.25	ft	685.80	mm			
Slab on Grade Thickness	**9.00**	in	**228.60**	mm		Model based on 9"	
Slab on Grade Thickness	0.75	ft	228.60	mm			
Containment Wall Thickness	**8.00**	in	**203.20**	mm		Model based on 8"	
Containment Wall Thickness	0.67	ft	203.20	mm			
Tank Pad / Metering Pump Pad Height	**3.00**	ft	**914.40**	mm	EPH		
Corridor							
Length	20.00	ft	6096.00	mm			
Width	8.00	ft	2438.40	mm			
Area	160.00	sf	14.86	m2			
Corridor Covered? ("1" = YES, "0" = NO)	1						
Electrical Room:							
Slab on Grade:							
Length	13.67	ft	4165.60	mm			
Width	6.00	ft	1828.80	mm			
Concrete Thickness	**12.00**	in	**304.80**	mm		Model based on 12"	
Concrete Thickness	1.00	ft	304.80	mm			
Walls:							
Height = FBD	10.00	ft				Fixed	
Concrete Thickness	**8.00**	in	**203.20**	mm		Model based on 8"	
Concrete Thickness	0.67	ft	203.20	mm			
Overall Dimensions							
Containment Area Length	20.00	ft	6096.00	mm			
Containment Area Width	35.00	ft	10668.00	mm			
Containment Area	700.00	sf	65.03	m2			
Corridor Area Length	20.00	ft	6096.00	mm			
Corridor Area Width	8.00	ft	2438.40	mm			
Corridor Area	160.00	sf	14.86	m2			
Electrical Area Length	13.67	ft	4165.60	mm			
Electrical Area Width	6.00	ft	1828.80	mm			
Electrical Room Area	82.00	sf	7.62	m2			
Chemical Facility Area	942.00	sf	87.51	m2			
Covered Chemical Area (Building)	942.00	sf	87.51	m2			
Covered Chemical Area (Canopy)	0.00	sf	0.00	m2			
Total Covered Area	1024.00	sf	95.13	m2			
Excavation Depth	3.50	ft	1066.80	mm			

COST ESTIMATE

Description	**Quantity (English)**	**Unit (English)**	**Quantity (Metric)**	**Unit (Metric)**	**$/Unit**	**Total Cost**	**User Over-Write**
SITEWORK:							
Excavation	168.78	CY	129.04	m3	***$6.72***	$1,135	
Imported Structural Backfill	69.78	CY	53.35	m3	***$50.94***	$3,555	
Native Backfill	28.58	CY	21.85	m3	***$8.27***	$236	
Haul Excess	140.19	CY	107.19	m3	***$8.27***	$1,159	
Allowance for Misc Items	5%				$6,084.29	$304	
Subtotal						$6,389	
CONCRETE:							
Slab on Grade	24.85	CY	19.00	m3	***$490.62***	$12,190	

Containment Walls	6.11	CY	4.67	m3	*$880.79*	$5,383	
Bulk Tank Pads	22.34	CY	17.08	m3	*$490.62*	$10,960	
Day Tank Pads	0.00	CY	0.00	m3	*$490.62*	$0	
Transfer Pump Pads	0.00	CY	0.00	m3	*$490.62*	$0	
Metering Pump Pads	1.33	CY	1.02	m3	*$490.62*	$654	
Corridor							
Slab on Grade	5.56	CY	4.25	m3	*$490.62*	$2,726	
Electrical Room							
Slab on Grade	3.04	CY	2.32	m3	*$490.62*	$1,490	
Allowance for Misc Items	5%				$33,402.61	$1,670	
Subtotal						$35,073	
MASONRY:	**Moderate**						
Chemical Building	860.00	SF	79.90	m2	*$198.37*	$170,596	
Electrical Room	82.00	SF	7.62	m2	*$165.31*	$13,555	
Subtotal	942.00					$184,151	
METALS:							
Canopy	0.00	SF	0.00	m2	*$41.80*	$0	
Metal Stairway	1	EA			$8,327.28	$8,327	
Grating	1	EA			$1,998.55	$1,999	
Allowance for Misc Items	10%				$10,325.82	$1,033	
Subtotal						$11,358	
EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
Bulk Tank	1	EA			*$19,003.28*	$19,003	
Day Tank	0	EA			*$0.00*	$0	
Transfer Pump	0	EA			*$0.00*	$0	
Metering Pump	2	EA			*$10,658.90*	$21,318	
Allowance for Misc Items	10%				$40,321.07	$4,032	
Subtotal						$44,353	
INSTRUMENTS & CONTROLS:							
Instruments							
Chemical Tank Radar Level Transmitters	1	EA			*$1,043.16*	$1,043	
Chemical Tank Beacons	1	EA			*$1,043.16*	$1,043	
Day Tank Differential Pressure Transmitter	0	EA			*$1,043.16*	$0	
Drum or Tote Weigh Scale	0	EA			*$1,390.89*	$0	
Metering Pump Discharge Pressure Switch	2	EA			*$695.44*	$1,391	
Magmeter	1	EA			*$695.44*	$695	
Sump Pump Float Switch	1	EA			*$347.72*	$348	
Eyewash	1	EA			*$1,043.16*	$1,043	
Number of Analog I/O Counts	5	EA			*$264.27*	$1,321	
Number of Digital I/O Counts	17	EA			*$62.59*	$1,064	
Number of Local Panels	1	EA			*$13,074.33*	$13,074	
Number of PLCs	1	EA			*$13,908.86*	$13,909	
I&C Conduit & Wire	140.00	LF	42.67	m	*$12.06*	$1,688	
Allowance for Misc Items	10%				$36,620.35	$3,662	
Subtotal						$40,282	
MECHANICAL:							
Pipe							
Chemical Transfer Pump Suction Header Piping-CTSH (1-inch, Exposed, PVC)	0.00	LF	0.00	m	*$13.11*	$0	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	0.00	LF	0.00	m	*$13.11*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	55.00	LF	16.76	m	*$13.11*	$721	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	55.00	LF	16.76	m	*$13.11*	$721	
Elbows							
Chemical Transfer Pump Suction Header Piping-CTSH (1-inch, Exposed, PVC)	0	EA			*$10.06*	$0	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	0	EA			*$10.06*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	8	EA			*$10.06*	$80	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	8	EA			*$10.06*	$80	
Tees							
Chemical Transfer Pump Suction Header Piping-CTSH (1-inch, Exposed, PVC)	0	EA			*$10.47*	$0	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	0	EA			*$10.47*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	2	EA			*$10.47*	$21	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	2	EA			*$10.47*	$21	
End Caps							
Chemical Transfer Pump Suction Header Piping-CTSH (1-inch, Exposed, PVC)	0	EA			*$5.65*	$0	
Chemical Transfer Pump Discharge Header Piping-CTDH (1-inch, Exposed, PVC)	0	EA			*$5.65*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC)	2	EA			*$5.65*	$11	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC)	2	EA			*$5.65*	$11	
Valves							
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	0	EA			*$57.14*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	0	EA			*$57.14*	$0	
Chemical Metering Pump Suction Header Piping-LCSH (1-inch, Exposed, PVC, V-902, Diaphragm)	4	EA			*$57.14*	$229	
Chemical Metering Pump Discharge Header Piping-LCDH (1-inch, Exposed, PVC, V-902, Diaphragm)	4	EA			*$57.14*	$229	
Allowance for Misc Items	10%				$2,124.73	$212	
Subtotal						$2,337	
ELECTRICAL:							
# MCC Sections	5	#			*$10,730.27*	$53,651	
Switchgear	0	EA			*$49,359.23*	$0	
Adjustable Frequency Drives							
Metering Pumps	0	EA			*$8,931.12*	$0	
User Defined Item #1	0	EA			*$8,865.56*	$0	
User Defined Item #2	0	EA			*$8,865.56*	$0	
User Defined Item #3	0	EA			*$8,865.56*	$0	
Electrical Conduit & Wire	40.00	LF	12.19	m	*$12.06*	$482	
Allowance for Misc Items	10%				$54,133.70	$5,413	
Subtotal						$59,547	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00				0.00	$0	
Item 2 Description	0.00				0.00	$0	

Item 3 Description	0.00				0.00	$0	
Item 4 Description	0.00				0.00	$0	
Item 5 Description	0.00				0.00	$0	
Item 6 Description	0.00				0.00	$0	
Item 7 Description	0.00				0.00	$0	
Item 8 Description	0.00				0.00	$0	
Item 9 Description	0.00				0.00	$0	
Item 10 Description	0.00				0.00	$0	
Item 11 Description	0.00				0.00	$0	
Item 12 Description	0.00				0.00	$0	
Item 13 Description	0.00				0.00	$0	
Item 14 Description	0.00				0.00	$0	
Item 15 Description	0.00				0.00	$0	
Subtotal						$0	
Subtotal						$383,490	
ALLOWANCES:		User Override					
Finishes Allowance	2.00%		$426,100	$8,522			
I&C Allowance	2.00%		$426,100	$8,522			
Mechanical Allowance	4.00%		$426,100	$17,044			
Electrical Allowance	2.00%		$426,100	$8,522			
					Facility Cost Name		
Facility Cost	**942**	**Building SF**	**$452.34**	**$426,100**	CFLFC01		
Facility Cost with Standard Additional Project Costs Added	**942**	**Building SF**	**$549.62**	**$517,741**	CFLFC02		
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**942**	**Building SF**	**$953.35**	**$898,053**	CFLFC03		
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**942**	**Building SF**	**$784.60**	**$739,097**	CFLFC05		
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**942**	**Building SF**	**$953.35**	**$898,053**	CFLFC06		

Combination Wastewater Surge Basin and Floating Plate Decanter Clarification (Large System ≥ 5 MGD)

PROCESS DESIGN CRITERIA

Is This Facility Included in My Project? Yes

Process User Inputs:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Red Flags	Comment
Is System to Handle Granular Media Filter Backwash Wastewater?	Yes	Y/N					
Is System to Handle Clarification Chemical Sludge?	Yes	Y/N					
Granular Media Filtration Backwash Wastewater:							
Input Volume of Backwash Wastewater Per Backwash	371,000.00	gal	2,468.09	m3			
Input Volume of Filter Drain Down Per Backwash	67,000.00	gal	238.48	m3			Typically either difference between operating water surface and top of wash trough for surface wash; or difference between water surface and 6-inches above top of media for air scour.
Input Volume of Filter to Waste Per Backwash	278,000.00	gal	594.31	m3			Typically 15 to 30 minutes at design filtration rate.
Input Total Number of Filters	8.00	#					
Input Backwash Turnaround Time From Off-Line to Back On-Line	60.00	min					Typically 20 to 40 minutes
Calculate Maximum Number of Backwashes Feasible Per Day	24.00	#					Assumes only backwash 1 filter at a time. This is typical.
Input Design Maximum Number of Backwashes Per Filter Per Day	1.00	#					Typically 1 to 2
Calculate Design Maximum Number of Backwashes Per Day	8.00	#					
Input Design Maximum Number of Consecutive Backwashes	2.00	#					
Calculate Maximum Design Backwash Wastewater Batch Volume	1,432,000.00	gal	5420.71	m3			
Calculate Number of Daily Backwash Wastewater Batches Per Day	4.00	#					
Input Maximum Backwash Wastewater Flow Rate	66.69	mgd	236.69	ML/d			
Clarification Chemical Sludge (Not for Softening Applications):							
Input Plant Flow Rate	0.00	mgd		ML/d			
Input Raw Water Turbidity	5.00	NTU					
Input Fraction of Turbidity to Contribute to Solids	1.50	mg/L/NTU					Typically 1 to 2
Input Raw Water Color		CU					
Input Fraction of Color to Contribute to Solids	0.05	mg/L/CU					Typically 0.02 to 0.1
Input Alum Dose	5.00	mg/L					
Input Fraction of Alum to Contribute to Solids	0.44						Typical Value = 0.44 based on 3 waters of hydration for the most probable solid Al(OH)3.3H2O
Input Ferric Chloride Dose		mg/L					
Fraction of Ferric Chloride to Contribute to Solids	0.99						Typical Value = 0.99 based on 3 waters of hydration for the most probable solid Fe(OH)3.3H2O
Input Total Polymer Dose (coagulation, flocculation, filter aids)		mg/L					
Input Raw Water Iron		mg/L					
Input Iron Factor	2.00						Typical Value = 2
Input Raw Water Manganese		mg/L					
Input Manganese Factor	2.00						Typical Value = 2
Input PAC Dose		mg/L					
Calculate Solids Removed	9.70	mg/L					
Calculate Dry Residual Solids Produced	0.00	lb/d	0.00	kg/d			
Input % Dry Solids in Sludge Exiting Clarifier	0.25%						Typically 0.25% to 0.75%
Calculate Maximum Daily Volume of Clarification Sludge	0	gal	0.00	m3			
Input Number of Times Per Day Sludge Collection Equipment Operates	12.00	#					
Input Duration of Each Sludge Equipment Event in Minutes	60.00	min					
Calculate Clarification Sludge Volume Per Collection Event	0.00	gal	0.00	m3			
Calculate Clarification Sludge Flow Per Collection Event	0.00	gpm	0.00	m3/hr			
Calculate Combined Maximum Daily Volume of Wastewater	5,728,000.00	gal	21682.84	m3			
Calculate Combined Maximum Wastewater Episodic Batch Volume	1,432,000.00	gal	5420.71	m3			
Calculate Combined Maximum Wastewater Episodic Batch Flow Rate	46,312.50	gpm	10518.71	m3/hr			
Input Surge Basin Influent Velocity	5.00	fps	1.52	m/s			Typically 3 to 7 fps
Standard Diameter for Surge Basin Influent Pipe	66.00	in	1676.40	mm	IP		
Input Surge Basin Overflow Weir Head	1.00	ft	304.80	mm	OFH		
Calculate Surge Basin Over Flow Weir Length	30.99	ft	9444.65	mm	OFWL		
Calculate Overflow Weir Box Width	30.99	ft	9444.65	mm	OFBW		
Calculate Overflow Weir Box Length	6.00	ft	1828.80	mm	OFBL		
Floating Plate Decanter System Sizing:							
Will Backwash Equalization Basin contain Floating Decanters?	No	Y/N					
Will Backwash Equalization Basin contain Sludge Collectors?	No	Y/N					
Input Settling Time in Surge Basin Prior to Initiation of Decant Pumping	0.00	min					Typically 0 to 60 minutes
Input Plate Width	3.50	ft	304.80	mm	PW		Typically 3.5 feet
Input Plate Length	6.00	ft	304.80	mm	PL		Typically 6 feet
Plate Angle (fix @ 55 degrees)	55.00	degrees			PA		Fixed
Conversion of Plate Angle from Degrees to Radians	0.96	radians			PAR		
Effective Plate Area	95.00%				EPA		Typically 0.95
Calculate Projected Effective Plate Area (each) PEPA = PL * PW * cos PAR * EPA	11.44	sf	1.06	m2	PEPA		
Calculate Decanter Flow Rate	3,977.78	gpm	903.45	m3/hr	DFR		
Projected Plate Hydraulic Loading Rate	0.35	gpm/sf	0.75	m/h	HLR		Valid Range: < = 0.40 gpm/sf
Calculate Total Number of Plates #P = DFR / HLR / PEPA	1,000.00	#			#P		
Input Number of Decanter Units	2.00	#				Add More Decanter Units	Target 100-200 plates per decanter in next row
Calculate Number of Plates Per Decanter	500.00						Typically 100-200 plates per decanter

Input Number of Plate Rows per Decanter	**2.00**	#			42.5		Either 1 or 2
Calculate Number of Plates Per Row	250.00	#					Typically 50-100 plates per row
Calculate Floating Decanter Unit Width	0.00	ft	0.00	mm			
Calculate Floating Decanter Unit Length	0.00	ft	0.00	mm			Allow 2.024" per plate
Input Floating Decanter Travel	**15.00**	ft	**3,048.00**	mm	FDT		Typically 6 to 15 feet
Decanter Equipment Profile Depth	0.00	ft	0.00	mm			Plate depth + 1 foot
Clear Depth Beneath Decanter in Low Position to Accommodate Sludge Collectors	3.00	ft	914.40	mm	CL		Fixed
Freeboard Above High Water Surface	**3.00**	ft	**914.40**	mm	FB		Typically 2 feet
Equalization Basin Sizing:							
Input Floating Decanter Distance from Back Wall of Surge Basin	**12.00**	ft		mm	FDBW		Typically 12 feet
Input Distance Between Floating Decanters and Surge Basin Side Walls	**4.00**	ft		mm	FDS		Typically 4 feet
If Floating Decanters are not included, Input Sidewater Depth in Equalization Basin	**15.00**	ft	**4,572.00**	mm			
Calculate Required Surge Basin Storage Area	12,762.04	sf	1185.63	m2			
Input Surge Basin Length to Width Ratio	**2.00**	:1					typically 2:1 or 3:1
Calculate Surge Basin Depth at Basin Midpoint	18.00	ft	5486.40	mm	WHMP		
Input Number of Rows of Decanter Units	**2.00**	#					
Calculate Number of Decanter Units Per Row	1.00	#					
Calculate Surge Basin Minimum Width for Decanter Units	0.00						
Calculate Surge Basin Minimum Length for Decanter Units	32.00						
Calculate Surge Basin Width	79.88	ft	24347.81	mm	ISBW		
Calculate Surge Basin Length	159.76	ft	48695.63	mm	ISBL		
Input Slope of Surge Basin	**8.00%**						Typically zero slope or 8%
Calculate Surge Basin Depth at Basin Inlet	11.61	ft	3538.57	mm	WHI		
Calculate Surge Basin Depth at Basin Outlet	24.39	ft	7434.23	mm	WHO		
Submerged Traveling Sludge Collector Sizing:							
Input Number of Sludge Collectors	**3.00**	#					
Calculate Sludge Collector Width	0.00	ft	0.00	mm	SCW		Acceptable range of values is 8' - 30'.
Calculate Required Sludge Collector Waste Pumping Capacity	0.00	gpm	0.00	m3/hr			Fix at 150 gpm per collector
Number of Submersible Sludge Collector Waste Pumps	2.00	#					Fix at 1 active and 1 standby
Input Sludge Collector Submersible Pump Total Dynamic Head	**60.00**	ft	**18,288.00**	mm			
Input Sludge Collector Submersible Pump Efficiency	**75.00%**						
Calculate Sludge Collector Submersible Pump Horsepower	0.00	hp	0.00	kW			
Equalization Basin Mixing:							
Will Submersible Mixers be included in Surge Basin without Floating Decanters & Traveling Sludge Collection?	**No**	Y/N					
Input Desired Mixing Intensity	**50.00**	sec-1					typically 50 sec-1
Input wire to water rapid mix energy input efficiency	**60.00%**				E		
Input Minimum Water Temperature	32.00	degrees F	**0.00**	degrees C			Valid Range: 0 - 40 deg C.
Dynamic (Absolute) Viscosity of Water	0.000037	lb•s/sf	0.001792	Pa•s			Reference: *Viscosity of Liquid Water in the Range -8°C to 150°C*, J. Phys. Chem. Ref. Data, Vol. 7, No. 3, 1978 (Eqn. 15).
Calculate Volume of Water to be Mixed	0.00	cf	0.00	m3	V		
Calculate Mixer Power	0.00	hp	0.00	kW	HP1		
Recycle Pumps							
Input Number of Decanter Submersible Duty Pumps	**2.00**	#					
Number of Standby Decant Submersible Pump	1.00	#					Fix at 1
Calculate Capacity of Decanter Submersible Pumps	1,988.89	gpm	451.73	m3/hr			
Input Decanter Submersible Pump Total Dynamic Head	**50.00**	ft	**15,240.00**	mm			
Input Decanter Submersible Pump Efficiency	**75.00%**						
Calculate Decanter Submersible Pump Horsepower	33.48	hp	24.97	kW			
Filter to Waste Basin Entry Air Gap							
Input Filter to Waste Basin Influent Air Gap Weir Head	**1.00**	ft	**304.80**	mm	H		For information the Filter Box Area (sf) is:
Input Filter to Waste Design Flow Rate	**41.26**	cfs	**0.66**	m3/s	FTWQ		
Calculate Filter to Waste Basin Influent Air Gap Weir Length	12.39	ft	3776.80	mm	WL		
Calculate Filter to Waste Influent Box Width	12.39	ft	3776.80	mm	FTWBW		
Calculate Filter to Waste Influent Box Length	6.00	ft	1828.80	mm	FTWBW		
Input Pumping Systems Pipe Support Height	**3.00**	ft	**914.40**	mm	PSH		Typically 3 Feet
Input Pumping Systems Pipe Depth of Cover	**5.00**	ft	**1,524.00**	mm	PDC		Typically 3 to 5 Feet
Are Pumping Facilities Covered?	**No**	Y/N					
Input Depth of Burial (as compared to the Surge Basin Depth at Basin Midpoint)	**15.00**	ft	**4,572.00**	mm	DB		Suggest choosing a depth of burial such that 3'-6" of wall remains above grade
Input Cutback Slope	**1.50**	:1 (ft:ft)					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
Input Over Excavation Depth	**1.00**	ft	**0.00**	mm	OEXD		

Mechanical Sizing Requirements:

Pipe Name	Input Velocity	Unit (English)	Input Velocity	Unit (Metric)	Standard Pipe Size	Unit (English)	Nominal Pipe Size
Backwash Waste	**7.00**	fps	**2.13**	m/s	54.00	1350.00	
Filter to Waste	**7.00**	fps	**2.13**	m/s	36.00	900.00	
Backwash Waste Recycle Header	**7.00**	fps	**2.13**	m/s	16.00	400.00	
Backwash Waste Recycle Lateral	**7.00**	fps	**2.13**	m/s	12.00	300.00	
Backwash Waste Sludge Header	**5.00**	fps	**1.52**	m/s	0.00	#N/A	
Backwash Waste Sludge Lateral	**5.00**	fps	**1.52**	m/s	0.00	#N/A	

Mechanical Material Requirements:

Pipe Name	Pipe ID	Installation Type	Pipe Material	Pipe Lining Material	Pipe Coating Material	Pipe Length	# Elbows
Backwash Waste	BWW	Encased	Steel	Cement Mortar	Fusion Bonded Epoxy	0.00	0.00
Filter to Waste	FTW	Encased	DI	Cement Mortar	Fusion Bonded Epoxy	0.00	0.00
Backwash Waste Recycle Header	BWRH	Exposed	Steel	Cement Mortar	Paint	39.94	1.00

Backwash Waste Recycle Header	BWRH	Encased	Steel	Cement Mortar	Fusion Bonded Epoxy	0.00	0.00
Backwash Waste Recycle Lateral	BWRL	Exposed	DI	Cement Mortar	Paint	69.00	6.00
Backwash Waste Sludge Header	BWSH	Exposed	Steel	Cement Mortar	Paint	39.94	1.00
Backwash Waste Sludge Header	BWSH	Encased	Steel	Cement Mortar	Fusion Bonded Epoxy	0.00	0.00
Backwash Waste Sludge Lateral	BWSL	Exposed	Steel	Cement Mortar	Paint	46.00	4.00
Electrical User Inputs and Sizing Requirements:							
Is this a "Critical" Facility (requiring standby power)?	Yes	Y/N					
Is there SWGR?	No						
Electrical Equipment Lengths:							MCC
Item	**Quantity**	**HP per Each**	**AFD's Required?**	**MCC Spaces for Motor Starters**	**MCC Spaces for AFD's less than 50hp)**	**MCC Spaces for Breakers**	**Total MCC Spaces**
Basin Mixer	0.00	0.00	**Yes**	0.00	0.00	0.00	
Sludge Pumps (Active)	1.00	0.00	**No**	2.00	0.00	0.00	
Sludge Pumps (Standby)	1.00	0.00	**No**	2.00	0.00	0.00	
Traveling Solids Removal Mechanisms	3.00	1.00	**No**	6.00	0.00	0.00	
Recycle Pumps (Active)	2.00	33.48	**No**	6.00	0.00	0.00	
Recycle Pumps (Standby)	1.00	33.48	**No**	3.00	0.00	0.00	
TOTAL		**103.45**		**19.00**	**0.00**	**0.00**	**19.00**
Electrical Equipment Widths:							
Equipment	**Depth (ft)**						
MCC	1.67						
Small AFD's	0.00						
Large AFD's	0.00						
Switchgear	0.00						
Maximum Depth	**1.67**						
Clear Distances:							
Clear Distance	**Width**	**Length**	**Comment**				
CD1		**3.00**	Clear Distance between wall and MCC	Typically 3 feet			
CD2		**1.00**	Clear Distance between MCC and Small AFD	Typically 1 foot			
CD3		**0.00**	Clear Distance between Small AFD and Large AFD	Typically Zero			
CD4		**0.00**	Clear Distance between Large AFD and Switchgear	Typically Zero			
CD5		**0.00**	Clear Distance between Switchgear and Contingency Space	Typically Zero			
CD6	**4.00**		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)				
CD7	**3.00**		Clear Distance in front of Equipment	Tyipcally 3 feet			
Contingency Length		**0.00**	Contingency length	Typically Zero			
Electric Room Length (ft):							
CD1	3.00						
MCC	13.33						
CD2	1.00						
Small AFD's	0.00						
CD3	0.00						
Large AFD's	0.00						
CD4	0.00						
Swithgear	0.00						
CD5	0.00						
Contingency	0.00						
Total Length	**17.33**						
Electric Room Width (ft):							
CD6	0.00	If there is no switchgear, this distance will be Zero.					
Maximum Equipment Depth	1.67						
CD7	3.00						
Total Width	**4.67**						
Estimating Dimensions:	**Value (English)**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Comment**	**Red Flags**
Surge Basin:							
Width	83.38	ft	25414.61	mm	W		
Length	170.01	ft	51819.83	mm	L		
Wall Height - Inlet	11.61	ft	3538.57	mm	WHI		
Wall Height - Midpoint	18.00	ft	5486.40	mm	WHMP		
Wall Height at Midpoint Above Ground	3.00	ft	914.40	mm			
Wall Height - Outlet	24.39	ft	7434.23	mm	WHO		
Influent Channel Width	5.00	ft	1524.00	mm	ICW		
Slab on Grade Width	87.38	ft	26633.81	mm			
Slab on Grade Length	174.56	ft	53204.59	mm			
Slab on Grade Thickness	**24.00**	in	**609.60**	mm		Model based on 32"	
Slab on Grade Thickness	2.00	ft	609.60	mm			
Influent Channel Wall Thickness	**21.00**	in	**533.40**	mm	TIW	Model based on 18"	
Influent Channel Wall Thickness	1.75	ft	533.40	mm			
Perimeter Wall Thickness	**21.00**	in	**533.40**	mm	TPW	Model based on 19"	
Perimeter Wall Thickness	1.75	ft	533.40	mm			
Backwash Recycle Sump:							
Width	15.00	ft	4572.00	mm			
Length	8.00	ft	2438.40	mm			
Wall Height	27.39	ft	8348.63	mm			

Slab on Grade Width	17.00	ft	5181.60	mm			
Slab on Grade Length	12.00	ft	3657.60	mm			
Slab on Grade Thickness	24.00	in	609.60	mm		Model based on 32"	
Slab on Grade Thickness	2.00	ft	609.60	mm			
Elevated Slab Width	18.50	ft	5638.80	mm			
Elevated Slab Length	11.50	ft	3505.20	mm			
Elevated Slab Thickness	12.00	in	304.80	mm		Model based on 10"	
Elevated Slab Thickness	1.00	ft	304.80	mm			
Wall Thickness	21.00	in	533.40	mm		Model based on 18"	
Wall Thickness	1.75	ft	533.40	mm			
Backwash Sludge Sump:							
Width	0.00	ft	0.00	mm			
Length	0.00	ft	0.00	mm			
Wall Height	0.00	ft	0.00	mm			
Slab on Grade Width	2.00	ft	609.60	mm			
Slab on Grade Length	4.00	ft	1219.20	mm			
Slab on Grade Thickness	24.00	in	609.60	mm		Model based on 32"	
Slab on Grade Thickness	2.00	ft	609.60	mm			
Elevated Slab Width	3.50	ft	1066.80	mm			
Elevated Slab Length	3.50	ft	1066.80	mm			
Elevated Slab Thickness	12.00	in	304.80	mm		Model based on 10"	
Elevated Slab Thickness	1.00	ft	304.80	mm			
Wall Thickness	21.00	in	533.40	mm		Model based on 18"	
Wall Thickness	1.75	ft	533.40	mm			
Dry Pit:							
Width	0.00	ft	0.00	mm			
Length	0.00	ft	0.00	mm			
Wall Height	0.00	ft	0.00	mm			
Slab on Grade Width	2.00	ft	609.60	mm			
Slab on Grade Length	4.00	ft	1219.20	mm			
Slab on Grade Thickness	24.00	in	609.60	mm		Model based on 32"	
Slab on Grade Thickness	2.00	ft	609.60	mm			
Elevated Slab Width	3.50	ft	1066.80	mm			
Elevated Slab Length	3.50	ft	1066.80	mm			
Elevated Slab Thickness	12.00	in	304.80	mm		Model based on 10"	
Elevated Slab Thickness	1.00	ft	304.80	mm			
Wall Thickness	21.00	in	533.40	mm		Model based on 18"	
Wall Thickness	1.75	ft	533.40	mm			
Pipe Vault:							
Width	83.38	ft	25414.61	mm			
Length	14.00	ft	4267.20	mm			
Wall Height	11.00	ft	3352.80	mm			
Slab on Grade Width	84.38	ft	25719.41	mm			
Slab on Grade Length	14.00	ft	4267.20	mm			
Slab on Grade Thickness	18.00	in	457.20	mm			
Slab on Grade Thickness	1.50	ft	457.20	mm			
Wall Thickness	12.00	in	304.80	mm			
Wall Thickness	1.00	ft	304.80	mm			
Electrical Room:							
Width	4.67	ft	1422.40	mm			
Length	17.33	ft	5283.20	mm			
Slab on Grade Width	6.67	ft	2032.00	mm			
Slab on Grade Length	21.33	ft	6502.40	mm			
Slab on Grade Thickness	12.00	in	304.80	mm		Model based on 32"	
Slab on Grade Thickness	1.00	ft	304.80	mm			
Excavation Dimensions:							
Influent Channel, Surge Basin:							
Excavation Width	91.38	ft	27853.01	mm			
Excavation Length	178.56	ft	54423.79	mm			
Excavation Depth	19.00	ft	5791.20	mm			
Dry Pit, Backwash Waste Sludge Wet Well, & Backwash Waste Recycle Wet Well:							
Excavation Width	91.38	ft	27853.01	mm			
Excavation Length	8.00	ft	2438.40	mm			
Excavation Depth	27.39	ft	8348.63	mm			
Pipe Vault:							
Excavation Width	91.38	ft	27853.01	mm			
Excavation Length	14.00	ft	4267.20	mm			
Excavation Depth	8.50	ft	2590.80	mm			

COST ESTIMATE

Description	Quantity (English)	Unit (English)	Quantity (Metric)	Unit (Metric)	$/Unit	Total Cost	User Over-Write
SITEWORK:							
Excavation							
Influent Channel, Surge Basin & Decant Pump	16917.94	CY	12934.70	m3	$6.72	$113,741	
Dry Pit, Backwash Waste Sludge Wet Well, & Backwash Waste Recycle Wet Well	1204.07	CY	920.58	m3	$6.72	$8,095	
Pipe Vault	719.43	CY	550.04	m3	$6.72	$4,837	
Imported Structural Backfill							
Influent Channel, Surge Basin & Decant Pump	1208.64	CY	924.07	m3	$50.94	$61,570	
Dry Pit, Backwash Waste Sludge Wet Well, & Backwash Waste Recycle Wet Well	54.15	CY	41.40	m3	$50.94	$2,759	
Pipe Vault	94.77	CY	72.45	m3	$50.94	$4,828	
Native Backfill							

Influent Channel, Surge Basin & Decant Pump	3623.22	CY	2770.15	m3	$8.27	$29,947	
Dry Pit, Backwash Waste Sludge Wet Well, & Backwash Waste Recycle Wet Well	333.44	CY	254.93	m3	$8.27	$2,756	
Pipe Vault	239.59	CY	183.18	m3	$8.27	$1,980	
Haul Excess							
Influent Channel, Surge Basin & Decant Pump	13294.72	CY	10164.55	m3	$8.27	$109,885	
Dry Pit, Backwash Waste Sludge Wet Well, & Backwash Waste Recycle Wet Well	870.63	CY	665.65	m3	$8.27	$7,196	
Pipe Vault	479.84	CY	366.86	m3	$8.27	$3,966	
Allowance for Misc Items	5%				$351,558.52	$17,578	
Subtotal						$369,136	
CONCRETE:							
Surge Basin:							
Foundation	1129.84	CY	863.83	m3	$541.11	$611,365	
Perimeter Walls	381.34	CY	291.56	m3	$880.79	$335,883	
Influent Channel Wall	62.74	CY	47.97	m3	$880.79	$55,262	
Concrete Curb (8" X 8")	340.03	LF	103.64	m	$41.64	$14,157	
Backwash Recycle Sump:							
Slab on Grade	15.11	CY	11.55	m3	$490.62	$7,414	
Walls	67.46	CY	51.58	m3	$880.79	$59,420	
Elevated Slab	7.88	CY	6.02	m3	$1,333.77	$10,510	
Backwash Sludge Sump:							
Slab on Grade	0.00	CY	0.00	m3	$490.62	$0	
Walls	0.00	CY	0.00	m3	$880.79	$0	
Elevated Slab	0.00	CY	0.00	m3	$1,333.77	$0	
Dry Pit:							
Slab on Grade	0.59	CY	0.45	m3	$490.62	$291	
Walls	0.00	CY	0.00	m3	$880.79	$0	
Elevated Slab	0.45	CY	0.35	m3	$1,333.77	$605	
Pipe Vault:							
Lower Elevated Slab	65.63	CY	50.18	m3	$1,333.77	$87,535	
Upper Elevated Slab	65.63	CY	50.18	m3	$1,333.77	$87,535	
Walls	73.64	CY	56.30	m3	$880.79	$64,865	
Electrical Room Slab on Grade	5.27	CY	4.03	m3	$490.62	$2,584	
Allowance for Misc Items	5%				$1,337,426.53	$66,871	
Subtotal						$1,404,298	
MASONRY:	Moderate						
Pump Sumps and Pipe Vault	0.00	SF	0.00	m2	$165.31	$0	
Electrical Room	80.89	SF	7.51	m2	$165.31	$13,371	
Subtotal	80.89					$13,371	
METALS:							
Influent Channel:							
Grating	416.91	SF	38.73	m2	$90.92	$37,904	
Surge Basin:							
Grating	4.00	SF	0.37	m2	$90.92	$364	
Backwash Recycle Sump:							
Grating	4.00	SF	0.37	m2	$90.92	$364	
Backwash Sludge Sump:							
Grating	0.00	SF	0.00	m2	$90.92	$0	
Dry Pit:							
Ladder	27.39	VLF	8.35	VLM	$125.74	$3,444	
Pipe Vault:							
Grating	4.00	SF	0.37	m2	$90.92	$364	
Stairs	16.00	RISERS			$495.92	$7,935	
Allowance for Misc Items	10%				$50,374.19	$5,037	
Subtotal						$55,412	
DOORS & WINDOWS:							
Backwash Recycle Sump:							
Aluminum Access Hatch (10' x 5')	1.00	EA			$5,569.28	$5,569	
Backwash Sludge Sump:							
Aluminum Access Hatch (3' x 3')	0.00	EA			$1,389.82	$0	
Dry Pit:							
Aluminum Access Hatch (3' x 3')	0.00	EA			$1,389.82	$0	
Pipe Vault:							
Aluminum Access Hatch (3' x 3')	2.00	EA			$1,389.82	$2,780	
Allowance for Misc Items	5%				$8,348.93	$417	
Subtotal						$8,766	
EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
Floating Decanter Plate System	0.00	SF	0.00	m2	$115.38	$0	
Traveling Solids Removal Mechanism	0.00	EA			$105,762.11	$0	
Washwater Decant Pump (Submersible Pump)	3.00	EA			$40,102.39	$120,307	
Sludge Pump (Submersible Pump)	0.00	EA			$0.00	$0	
Mixers	0.00	HP	0.00	kW	$2,499.83	$0	
Allowance for Misc Items	10%				$120,307.18	$12,031	
Subtotal						$132,338	
I&C:							
Instruments							
Backwash Waste Recycle Header Magmeter (BWRH, 16 inch)	1.00	EA			$20,596.57	$20,597	
Isolation Valve Actuators (Electric)	5.00	EA			$6,409.82	$32,049	
Level Transmitters	1.00	EA			$11,264.12	$11,264	
Number of Analog I/O Counts	6.00	EA			$264.27	$1,586	
Number of Digital I/O Counts	30.00	EA			$62.59	$1,878	
Number of Local Panels	1.00	EA			$13,074.33	$13,074	
Number of PLC's	1.00	EA			$13,908.86	$13,909	
I&C Conduit Wire	583.67	LF	177.90	m	$12.06	$7,038	
Allowance for Misc Items	5%				$101,394.75	$5,070	
Subtotal						$106,464	
MECHANICAL:							
Pipe:							
Backwash Waste (BWW, 54 inch, Steel)	0.00	LF	0.00	m	$1,248.13	$0	
Filter to Waste (FTW, 36 inch, DI)	0.00	LF	0.00	m	$312.12	$0	
Backwash Waste Recycle Header (BWRH, 16 inch, Steel)	39.94	LF	12.17	m	$369.82	$14,771	
Backwash Waste Recycle Header (BWRH, 16 inch, Steel)	0.00	LF	0.00	m	$369.82	$0	
Backwash Waste Recycle Lateral (BWRL, 12 inch, DI)	69.00	LF	21.03	m	$104.04	$7,179	
Backwash Waste Sludge Header (BWSH, 0 inch, Steel)	39.94	LF	12.17	m	$0.00	$0	
Backwash Waste Sludge Header (BWSH, 0 inch, Steel)	0.00	LF	0.00	m	$0.00	$0	
Backwash Waste Sludge Lateral (BWSL, 0 inch, Steel)	46.00	LF	14.02	m	$0.00	$0	

Elbows:							
Backwash Waste (BWW, 54 inch, Steel)	0.00	EA			*$7,516.79*	$0	
Filter to Waste (FTW, 36 inch, DI)	0.00	EA			*$6,550.90*	$0	
Backwash Waste Recycle Header (BWRH, 16 inch, Steel)	1.00	EA			*$2,227.20*	$2,227	
Backwash Waste Recycle Header (BWRH, 16 inch, Steel)	0.00	EA			*$2,227.20*	$0	
Backwash Waste Recycle Lateral (BWRL, 12 inch, DI)	6.00	EA			*$2,183.63*	$13,102	
Backwash Waste Sludge Header (BWSH, 0 inch, Steel)	1.00	EA			*$0.00*	$0	
Backwash Waste Sludge Header (BWSH, 0 inch, Steel)	0.00	EA			*$0.00*	$0	
Backwash Waste Sludge Lateral (BWSL, 0 inch, Steel)	4.00	EA			*$0.00*	$0	
Tee:							
Backwash Waste (BWW, 54 inch, Steel)	0.00	EA			*$17,126.09*	$0	
Filter to Waste (FTW, 36 inch, DI)	0.00	EA			*$10,877.62*	$0	
Backwash Waste Recycle Header (BWRH, 16 inch, Steel)	2.00	EA			*$5,074.40*	$10,149	
Backwash Waste Recycle Header (BWRH, 16 inch, Steel)	0.00	EA			*$5,074.40*	$0	
Backwash Waste Recycle Lateral (BWRL, 12 inch, DI)	0.00	EA			*$3,625.87*	$0	
Backwash Waste Sludge Header (BWSH, 0 inch, Steel)	1.00	EA			*$0.00*	$0	
Backwash Waste Sludge Header (BWSH, 0 inch, Steel)	0.00	EA			*$0.00*	$0	
Backwash Waste Sludge Lateral (BWSL, 0 inch, Steel)	0.00	EA			*$0.00*	$0	
Valves:							
Backwash Waste (BWW, 54 inch, Steel)	0.00	EA			*$54,975.93*	$0	
Filter to Waste (FTW, 36 inch, DI)	0.00	EA			*$31,898.29*	$0	
Backwash Waste Recycle Header (BWRH, 16 inch, Steel)	0.00	EA			*$16,289.16*	$0	
Backwash Waste Recycle Header (BWRH, 16 inch, Steel)	0.00	EA			*$16,289.16*	$0	
Backwash Waste Recycle Lateral (BWRL, 12 inch, DI)	3.00	EA			*$10,632.76*	$31,898	
Backwash Waste Sludge Header (BWSH, 0 inch, Steel)	0.00	EA			*$0.00*	$0	
Backwash Waste Sludge Header (BWSH, 0 inch, Steel)	0.00	EA			*$0.00*	$0	
Backwash Waste Sludge Lateral (BWSL, 0 inch, Steel)	2.00	EA			*$0.00*	$0	
Allowance for Misc Items	5%				$79,325.47	$3,966	
Subtotal						$83,292	
ELECTRICAL:							
# MCC Sections	8.00	EA			*$10,730.27*	$85,842	
Switchgear	0.00	EA			*$49,359.23*	$0	
Adjustable Frequency Drives							
Basin Mixer	0.00	EA			***$8,865.56***	$0	
Sludge Pumps (Active)	0.00	EA			***$8,865.56***	$0	
Sludge Pumps (Standby)	0.00	EA			***$8,865.56***	$0	
Recycle Pumps (Active)	0.00	EA			***$13,256.25***	$0	
Recycle Pumps (Standby)	0.00	EA			***$13,256.25***	$0	
Electrical Conduit & Wire	667.05	LF	203.32	m	*$12.06*	$8,044	
Allowance for Misc Items	5%				$93,886.09	$4,694	
Subtotal						$98,580	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00		0.00		0.00	$0	
Item 2 Description	0.00		0.00		0.00	$0	
Item 3 Description	0.00		0.00		0.00	$0	
Item 4 Description	0.00		0.00		0.00	$0	
Item 5 Description	0.00		0.00		0.00	$0	
Item 6 Description	0.00		0.00		0.00	$0	
Item 7 Description	0.00		0.00		0.00	$0	
Item 8 Description	0.00		0.00		0.00	$0	
Item 9 Description	0.00		0.00		0.00	$0	
Item 10 Description	0.00		0.00		0.00	$0	
Item 11 Description	0.00		0.00		0.00	$0	
Item 12 Description	0.00		0.00		0.00	$0	
Item 13 Description	0.00		0.00		0.00	$0	
Item 14 Description	0.00		0.00		0.00	$0	
Item 15 Description	0.00		0.00		0.00	$0	
Subtotal						$0	
Subtotal						$2,271,658.21	
ALLOWANCES:		**User Override**					
Finishes Allowance	2.00%		$2,611,101	$52,222.03			
I&C Allowance	3.00%		$2,611,101.39	$78,333.04			
Mechanical Allowance	5.00%		$2,611,101.39	$130,555.07			
Electrical Allowance	3.00%		$2,611,101.39	$78,333.04			
					Facility Cost Name		
Facility Cost	**5,728,000**	**Gallons**	**$0.46**	**$2,611,101**	SDLFC01		
Facility Cost with Standard Additional Project Costs Added	**5,728,000**	**Gallons**	**$0.55**	**$3,172,667**	SDLFC02		
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**5,728,000**	**Gallons**	**$0.96**	**$5,503,185**	SDLFC03		
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**5,728,000**	**Gallons**	**$0.79**	**$4,529,115**	SDLFC05		
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**5,728,000**	**Gallons**	**$0.96**	**$5,503,185**	SDLFC06		

Gravity Thickener

PROCESS DESIGN CRITERIA

Is This Facility Included in My Project? Yes

Process User Inputs:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Red Flags	Comment
Solids Production:							
Input Plant Flow Rate	160.00	mgd	567.81	ML/d			
Input Raw Water Turbidity	10.00	NTU					
Input Fraction of Turbidity to Contribute to Solids	1.00	mg/L/NTU					Typically 1 to 2
Input Raw Water Color		CU					
Input Fraction of Color to Contribute to Solids	0.05	mg/L/CU					Typically 0.02 to 0.1
Input Alum Dose							
Input Fraction of Alum to Contribute to Solids	0.44						Typical Value = 0.44 based on 3 waters of hydration for the most probable solid Al(OH)3.3H2O
Input Ferric Chloride Dose		mg/L					
Fraction of Ferric Chloride to Contribute to Solids	0.99						Typical Value = 0.99 based on 3 waters of hydration for the most probable solid Fe(OH)3.3H2O
Input Total Polymer Dose (coagulation, flocculation, filter aids)		mg/L					
Input Raw Water Iron		mg/L					
Input Iron Factor	2.00						Typical Value = 2
Input Raw Water Manganese		mg/L					
Input Manganese Factor	2.00						Typical Value = 2
Input PAC Dose		mg/L					
Input Carbonate Hardness Concentration to be Removed via Softening		mg/L as CaCO3					
Input Carbonate Hardness Factor (mg of softening solids produced per mg of hardness removed)	1.00						Typical Value: 1 for sodium hydroxide softening; 2 for lime softening.
Input Non-Carbonate Hardness Concentration to be Removed via Softening		mg/L as CaCO3					
Input Non-Carbonate Hardness Factor (mg of softening solids produced per mg of hardness removed)	1.00						Typical Value: 1 for sodium hydroxide softening; 1 for soda ash softening.
Calculate Solids Removed	10.00	mg/L					
Calculate Dry Residual Solids Produced	13,352.64	lb/d	6056.66	kg/d			
Optional: Input Daily Dry Solids Production (overwrites above calculations) (dry)	6,487.17	lb/d	2,973.24	kg/d			
Gravity Thickener Sizing & Sludge Storage:							
Input Number of On-Line Thickeners	3	#					
Input Number of Standby Thickeners	1	#					Typically 1
Input % Dry Solids in Sludge to Thickeners	0.01%						Typically 0.25% tyo 0.75%
Calculate Total Sludge Flow Rate	5,725,070.96	gpd	21671.75	m3/d			
Calculate Sludge Flow to Each Thickener	1,908,356.99	gpd	7223.92	m3/d			
Calculate Dry Solids Flow to Each Thickener	2,162.39	lb/d	980.84	kg/d			
Input Thickener Hydraulic Loading Rate	300.00	gpd/sf	12.23	m/d			Typically 100 to 300 gpd/sf for metal salt coagulant sludges
Input Thickener Solids Loading Rate	10.00	lb/d/sf	48.82	kg/d/m2			Typically 5 to 10 lb/sf/d
Calculate Thickener Diameter, Each Based on Hydraulic Loading Rate	90.00	ft	27430.85	mm			
Calculate Thickener Diameter, Each Based on Solids Loading Rate	16.59	ft	5057.51	mm			
Calculate Thickener Diameter, Each (maximum of above)	90.00	ft	27430.85	mm			
Input Thickened Sludge % Dry Solids	0.25%						Typically 2% to 5% for metal salt coagulant sludges treated with polymer
Calculate Thickened Sludge Density	62.49	lb/cf	1000.98	kg/m3			Assumes density of dried solids of 145 lb/cf.
Input Days of Thickened Sludge Storage in Thickener	3.00	days					Typically 0 to 3 days (long weekend)
Calculate Thickened Sludge Storage Depth	6.53	ft	1989.70	mm			If Sludge Storage depth is greater than desired: 1.) Reduce days of storage or 2.) Decrease controlling thickener loading rate criteria input.
Calculate Total Thickened Sludge Storage Volume	931,890.47	gal	3527.59	m3			
Input Clear Water Depth Above Sludge Line	8.00	ft	2,438.40	mm			Typically 8 to 11 feet
Input Free Board	3.00	ft	914.40	mm			Typically 1 to 3 feet
Calculate Total Thickener Depth	17.53	ft	5342.50	mm			
Input Thickener Wall Height Above Grade	3.00	ft	914.40	mm			
Calculate Wall Burial Depth	14.53	ft	4428.10	mm	DB		
Gravity Thickener Peripheral Weir Launder Sizing:							
Calculate Total Flow Rate of all Thickeners	5.73	mgd	21671.75	m3/d	QT		
Calculate Flow Rate of Each Active Thickener	1.91	mgd	7223.92	m3/d	Q, mgd		
Convert Each Thickener Flow Rate	2.95	cfs	83.61	L/s	Q, cfs		
Input Velocity in Launder	5.00	fps	1.52	m/s	V		Typically < 5 fps
Calculate Area (Q, cfs / V)	0.59	sf	0.05	m2			
Launder Freeboard	1.00	ft	304.80	mm			Fixed
Input Launder Width	2.00	ft	609.60	mm			
Calculate Launder Height Excluding Freeboard	0.30	ft	90.00	mm			
Calculate Launder Height Including Freeboard	1.30	ft	394.80	mm			Should be ≤ 5 ft.
Thickened Sludge Pump Sizing:							
Calculate Thickened Sludge Flow from Each Thickener	103,543.39	gpd	391.95	m3/d			
Calculate Thickener Decant Flow from Each Thickener	1,804,813.60	gpd	6831.96	m3/d			
Number of Progressive Cavity Thickened Sludge Pumps per Thickener	2	#					Fixed: 1 duty and 1 standby
Calculate Number of Thickened Sludge Pumps	8	#					
Calculate Thickened Sludge Pump Capacity, Each	71.91	gpm	272.19	L/min			
Input Thickened Sludge Pump Total Dynamic Head (TDH)	60.00	ft	18,288.00	mm			

Calculate Thickened Sludge Pump Horsepower (each)	1.45	hp	1.08	kW			
Input Distance between Thickener and Sludge Pump Pad	16.00	ft	4,876.80	mm			Minimum of 10 ft
Input Sludge Pump Length (progressive cavity)	8.50	ft	2,590.80	mm			Typically 8.5 ft
Input Sludge Pump Width (progressive cavity)	2.00	ft	609.60	mm			Typically 2.0 ft
Input Stagger Distance Between Sludge Pump Centerlines - Length	8.50	ft	2,590.80	mm			Typically equal to sludge pump length
Input Distance Between Sludge Pump Centerlines (width) and Around Pumps for Access	4.50	ft	1,371.60	mm			Typically 4.5 ft for access
Include the Cost of a Building Over Sludge Pump Station?	Yes	Y/N					
Input Cutback Slope	1.50	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
Input Over Excavation Depth	1.00	ft	0.00	mm	OEXD		

Mechanical Sizing Requirements

Pipe Name	Input Velocity	Unit (English)	Input Velocity	Unit (Metric)	Standard Pipe Size	Unit (English)	Nominal Pipe Size
Unthickened Sludge Influent Pipe	3.00	fps	0.91	m/s	14.00	in	350.00
Decant Pipe	5.00	fps	1.52	m/s	12.00	in	300.00
Thickened Sludge Suction Pipe	3.00	fps	0.91	m/s	4.00	in	100.00
Thickened Sludge Discharge Pipe	3.00	fps	0.91	m/s	4.00	in	100.00

Mechanical Material Requirements:

Pipe Name	Pipe ID	Installation Type	Pipe Material	Pipe Lining Material	Pipe Coating Material	Comments	Red Flags
Unthickened Sludge Influent Pipe	USP	Buried	DI	Cement Mortar	Tape Coating		
Unthickened Sludge Influent Pipe	USP	Encased	DI	Cement Mortar	Fusion Bonded Epoxy		
Unthickened Sludge Influent Pipe	USP	Submerged	DI	Cement Mortar	Fusion Bonded Epoxy		
Decant Pipe	DSP	Buried	DI	Cement Mortar	Tape Coating		
Decant Pipe	DSP	Exposed	DI	Cement Mortar	Paint		
Decant Pipe	DSP	Encased	DI	Cement Mortar	Fusion Bonded Epoxy		
Thickened Sludge Suction Pipe	TSSP	Encased	DI	Cement Mortar	Fusion Bonded Epoxy		
Thickened Sludge Suction Pipe	TSSP	Exposed	Steel	Cement Mortar	Paint		
Thickened Sludge Discharge Pipe	TSDP	Exposed	DI	Cement Mortar	Paint		

Electrical User Inputs and Sizing Requirements:

Is this a "Critical" Facility (requiring standby power)?	Yes	Y/N
Is there SWGR?	No	

Electrical Equipment Lengths:

Item	Quantity	HP per Each	AFD's Required?	MCC Spaces for Motor Starters	MCC Spaces for AFD's less than 50hp)	MCC Spaces for Breakers	MCC Total MCC Spaces
Thickened Sludge Pumps (Active)	4.00	1.45	Yes	0.00	12.00	8.00	
Thickened Sludge Pumps (Standby)	4.00	1.45	No	8.00	0.00	0.00	
Gravity Thickener Rake Mechanism	4.00	1.00	No	8.00	0.00	0.00	
User Defined Item #1	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #2	0.00	0.00	No	0.00	0.00	0.00	
TOTAL		**15.6**		**16.00**	**12.00**	**8.00**	**36.00**

Electrical Equipment Widths:

Equipment	Depth (ft)
MCC	1.67
Small AFD's	0.00
Large AFD's	0.00
Switchgear	0.00
Maximum Depth	**1.67**

Clear Distances:

Clear Distance	Width	Length	Comment	
CD1		3.00	Clear Distance between wall and MCC	Typically 3 feet
CD2		1.00	Clear Distance between MCC and Small AFD	Typically 1 foot
CD3		0.00	Clear Distance between Small AFD and Large AFD	Typically Zero
CD4		0.00	Clear Distance between Large AFD and Switchgear	Typically Zero
CD5		0.00	Clear Distance between Switchgear and Contingency Space	Typically Zero
CD6	4.00		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)	
CD7	3.00		Clear Distance in front of Equipment	Tyipcally 3 feet
Contingency Length		0.00	Contingency length	Typically Zero

Electric Room Length (ft):

CD1	3.00
MCC	15.00
CD2	1.00
Small AFD's	0.00
CD3	0.00
Large AFD's	0.00
CD4	0.00
Swithgear	0.00
CD5	0.00
Contingency	0.00
Total Length	**19.00**

Electric Room Width (ft):

CD6	0.00	If there is no switchgear, this distance will be Zero
Maximum Equipment Depth	1.67	
CD7	3.00	

Total Width	**4.67**						
Estimating Dimensions:	**Value English**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Red Flags**	**Comment**
Total Number of Thickeners	4.00	#					
Gravity Thickener (dimensions per each):							
Perimeter Wall Inside Diameter	90.00	ft	27430.85	mm			
Perimeter Wall Outside Diameter	92.00	ft	28040.45	mm			
Perimeter Wall Height	17.53	ft	5342.50	mm			
Wall Footer Thickness	**16.00**	in	**406.40**	mm			Model based on 16"
Wall Footer Thickness	1.33	ft	406.40	mm			
Slab on Grade Thickness	**6.00**	in	**152.40**	mm			Model based on 6"
Slab on Grade Thickness	0.50	ft	152.40	mm			
Center Cone Outside Diameter	6.17	ft	1879.60	mm			Fixed
Center Cone Inside Diameter	3.50	ft	1066.80	mm			Fixed
Center Cone Slab on Grade Thickness	**16.00**	in		mm			Model based on 16"
Center Cone Slab on Grade Thickness	1.33	ft	406.40	mm			
Center Cone Wall Height	**2.33**	ft	**59.18**	mm			Model based on 2.33'
Center Cone Wall Thickness	**16.00**	in	**406.40**	mm			Model based on 16"
Center Cone Wall Thickness	1.33	ft	406.40	mm			
Launder Elevated Slab Width	**2.00**	ft	**50.80**	mm			Model based on 2'
Launder Elevated Slab Thickness	**12.00**	in	**304.80**	mm			Model based on 12"
Launder Elevated Slab Thickness	1.00	ft	304.80	mm			
Launder Wall Diameter	86.00	ft	26211.65	mm			
Launder Wall Height	1.30	ft	394.80	mm			
Launder Wall Thickness	**8.00**	in	**203.20**	mm			Model based on 8"
Launder Wall Thickness	0.67	ft	203.20	mm			
Perimeter Wall Thickness	**12.00**	in	**304.80**	mm			Model based on 12"
Perimeter Wall Thickness	1.00	ft	304.80	mm			
Floor Slope Factor	1.03						Fixed
Side Slope Depth Factor	0.23						Fixed
Side Slope Factor	4.29						Fixed
Excavation Diameter	101.00	ft	30783.65	mm			
Cone Excavation Depth	13.76	ft	4194.00	mm			
Perimeter Wall Excavation Depth (Includes Over Excavation)	16.86	ft	5139.30	mm			
Thickened Sludge Pump Slab:							
Length	26.00	ft	7924.80	mm			Fixed
Width	56.50	ft	17221.20	mm			
Slab on Grade Length	28.00	ft	8534.40	mm			
Slab on Grade Width	58.50	ft	17830.80	mm			
Slab Thickness	**16.00**	in	**406.40**	mm			Model based on 16"
Slab Thickness	1.33	ft	406.40	mm			
Excavation Length	32.00	ft	9753.60	mm			
Excavation Width	62.50	ft	19050.00	mm			
Excavation Depth	3.33	ft	1016.00	mm			
Electrical Room:							
Length	19.00	ft	5791.20	mm			
Width	4.67	ft	1422.40	mm			
Slab on Grade Length	21.00	ft	6400.80	mm			
Slab on Grade Width	6.67	ft	2032.00	mm			
Slab on Grade Thickness	**18.00**	in	**457.20**	mm			Model based on 18"
Slab on Grade Thickness	1.50	ft	457.20	mm			
Excavation Length	25.00	ft	7620.00	mm			
Excavation Width	10.67	ft	3251.20	mm			
Excavation Depth	3.50	ft	1066.80	mm			

COST ESTIMATE

Description	**Quantity (English)**	**Unit (English)**	**Quantity (Metric)**	**Unit (Metric)**	**$/Unit**	**Total Cost**	**User Over-Write**
SITEWORK:							
Gravity Thickener:							
Excavation	39,735.64	CY	30380.08	m3	***$6.72***	$267,146	
Imported Structural Backfill	2,438.74	CY	1864.55	m3	***$50.94***	$124,233	
Native Backfill	10,022.85	CY	7663.02	m3	***$8.27***	$82,842	
Haul Excess	29,712.79	CY	22717.06	m3	***$8.27***	$245,585	
Thickened Sludge Pump Slab:							
Excavation	341.88	CY	261.38	m3	***$8.33***	$2,847	
Imported Structural Backfill	172.84	CY	132.15	m3	***$50.94***	$8,805	
Native Backfill	58.33	CY	44.60	m3	***$8.27***	$482	
Haul Excess	283.54	CY	216.78	m3	***$8.27***	$2,344	
Electrical Room:							
Excavation	65.90	CY	50.39	m3	***$8.33***	$549	
Imported Structural Backfill	24.69	CY	18.88	m3	***$50.94***	$1,258	
Native Backfill	24.27	CY	18.56	m3	***$8.27***	$201	
Haul Excess	41.63	CY	31.83	m3	***$8.27***	$344	
Allowance for Misc Items	5%				$736,633.77	$36,832	
Subtotal						$773,465	
CONCRETE:							
Gravity Thickener:							
Wall Footers	313.99	CY	240.06	m3	***$541.11***	$169,902	
Slanted Slab on Grade	484.11	CY	370.13	m3	***$541.11***	$261,954	
Slanted Floor Grout (2" thick)	26,141.88	SF	2428.66	m2	***$23.76***	$621,144	
Center Cone Slab on Grade	5.90	CY	4.51	m3	***$541.11***	$3,192	
Center Cone Walls	8.92	CY	6.82	m3	***$499.64***	$4,455	
Perimeter Walls	750.49	CY	573.79	m3	***$707.82***	$531,212	
Launder Elevated Slab	83.77	CY	64.05	m3	***$832.73***	$69,759	
Launder Wall	34.56	CY	26.42	m3	***$832.73***	$28,780	
Concrete Fill	***13.96***	CY	10.67	m3	***$374.73***	$5,232	
Thickened Sludge Pump Slab:						$0	
Slab on Grade	80.89	CY	61.84	m3	***$490.62***	$39,685	
Electrical Room:						$0	
Slab on Grade	7.78	CY	5.95	m3	***$541.11***	$4,209	
Allowance for Misc Items	5%				$1,739,525.57	$86,976	
Subtotal						$1,826,502	
METALS:							
Gravity Thickener:							

Walkway Grating (3' wide, steel support beams supplied by mechanism mfr)	1,103.95	SF	102.56	m2	$90.92	$100,370	
Walkway Handrail	735.97	LF	224.32	m	$90.92	$66,913	
Stairway	18	Risers			$495.92	$8,927	
Allowance for Misc Items	10%				$176,209.03	$17,621	
Subtotal						$193,830	
MASONRY:	High						
Thickened Sludge Pump Building	1469.00	SF	136.47	m2	$198.37	$291,401	
Electrical Room	88.67	SF	8.24	m2	$198.37	$17,589	
Subtotal	1557.67					$308,989	
EQUIPMENT:							Budgetary Quote: (CPES will automatically add Installation Factor)
Gravity Thickener Drive Mechanism (1 hp each)	4	EA			$307,565.41	$1,230,262	
Thickened Sludge Pumps (Active, Progressive Cavity Pumps 1 hp each)	4	EA			$8,793.65	$35,175	
Thickened Sludge Pumps (Standby, Progressive Cavity Pumps 1 hp each)	4	EA			$8,793.65	$35,175	
Allowance for Misc Items	10%				$1,265,436.23	$126,544	
Subtotal						$1,427,154	
I&C:							
Instruments							
Thickened Sludge Discharge Pipe Magmeter (TSDP, 4 inch)	4	EA			$8,561.98	$34,248	
Isolation Valve Actuators (Electric)	12	EA			$6,409.82	$76,918	
Level Transmitters	4	EA			$10,730.27	$42,921	
Number of Analog I/O Counts	10	EA			$264.27	$2,643	
Number of Digital I/O Counts	72	EA			$62.59	$4,506	
Number of Local Panels	4	EA			$13,074.33	$52,297	
Number of PLC's	1	EA			$13,908.86	$13,909	
I&C Conduit Wire	4559.85	LF	1389.84	m	$12.06	$54,987	
Allowance for Misc Items	5%				$282,429.32	$14,121	
Subtotal						$296,551	
MECHANICAL:							
Pipe:							
Unthickened Sludge Influent Pipe (USP, Buried, 14 inch, DI)	58.11	LF	17.71	m	$121.38	$7,054	
Unthickened Sludge Influent Pipe (USP, Encased, 14 inch, DI)	0.00	LF	0.00	m	$121.38	$0	
Unthickened Sludge Influent Pipe (USP, Submerged, 14 inch, DI)	191.99	LF	58.52	m	$121.38	$23,304	
Decant Pipe (DSP, Buried, 12 inch, DI)	20.00	LF	6.10	m	$104.04	$2,081	
Decant Pipe (DSP, Exposed, 12 inch, DI)	58.11	LF	17.71	m	$104.04	$6,046	
Decant Pipe (DSP, Encased, 12 inch, DI)	0.00	LF	0.00	m	$104.04	$0	
Thickened Sludge Suction Pipe (TSSP, Encased, 4 inch, DI)	243.99	LF	74.37	m	$34.68	$8,462	
Thickened Sludge Suction Pipe (TSSP, Exposed, 4 inch, Steel)	99.00	LF	30.18	m	$92.45	$9,153	
Thickened Sludge Discharge Pipe (TSDP, Exposed, 4 inch, DI)	96.00	LF	29.26	m	$34.68	$3,329	
Elbows:							
Unthickened Sludge Influent Pipe (USP, Buried, 14 inch, DI)	4	EA			$2,547.57	$10,190	
Unthickened Sludge Influent Pipe (USP, Encased, 14 inch, DI)	0	EA			$2,547.57	$0	
Unthickened Sludge Influent Pipe (USP, Submerged, 14 inch, DI)	12	EA			$2,547.57	$30,571	
Decant Pipe (DSP, Buried, 12 inch, DI)	0	EA			$2,183.63	$0	
Decant Pipe (DSP, Exposed, 12 inch, DI)	4	EA			$2,183.63	$8,735	
Decant Pipe (DSP, Encased, 12 inch, DI)	0	EA			$2,183.63	$0	
Thickened Sludge Suction Pipe (TSSP, Encased, 4 inch, DI)	0	EA			$727.88	$0	
Thickened Sludge Suction Pipe (TSSP, Exposed, 4 inch, Steel)	4	EA			$556.80	$2,227	
Thickened Sludge Discharge Pipe (TSDP, Exposed, 4 inch, DI)	4	EA			$727.88	$2,912	
End Caps:							
Unthickened Sludge Influent Pipe (USP, Buried, 14 inch, DI)	0	EA			$632.25	$0	
Unthickened Sludge Influent Pipe (USP, Encased, 14 inch, DI)	0	EA			$632.25	$0	
Unthickened Sludge Influent Pipe (USP, Submerged, 14 inch, DI)	0	EA			$632.25	$0	
Decant Pipe (DSP, Buried, 12 inch, DI)	0	EA			$541.93	$0	
Decant Pipe (DSP, Exposed, 12 inch, DI)	0	EA			$541.93	$0	
Decant Pipe (DSP, Encased, 12 inch, DI)	0	EA			$541.93	$0	
Thickened Sludge Suction Pipe (TSSP, Encased, 4 inch, DI)	8	EA			$180.64	$1,445	
Thickened Sludge Suction Pipe (TSSP, Exposed, 4 inch, Steel)	0	EA			$180.64	$0	
Thickened Sludge Discharge Pipe (TSDP, Exposed, 4 inch, DI)	4	EA			$180.64	$723	
Tee:							
Unthickened Sludge Influent Pipe (USP, Buried, 14 inch, DI)	0	EA			$4,230.18	$0	
Unthickened Sludge Influent Pipe (USP, Encased, 14 inch, DI)	0	EA			$4,230.18	$0	
Unthickened Sludge Influent Pipe (USP, Submerged, 14 inch, DI)	0	EA			$4,230.18	$0	
Decant Pipe (DSP, Buried, 12 inch, DI)	0	EA			$3,625.87	$0	
Decant Pipe (DSP, Exposed, 12 inch, DI)	4	EA			$3,625.87	$14,503	
Decant Pipe (DSP, Encased, 12 inch, DI)	0	EA			$3,625.87	$0	
Thickened Sludge Suction Pipe (TSSP, Encased, 4 inch, DI)	4	EA			$1,208.62	$4,834	
Thickened Sludge Suction Pipe (TSSP, Exposed, 4 inch, Steel)	4	EA			$1,268.60	$5,074	
Thickened Sludge Discharge Pipe (TSDP, Exposed, 4 inch, DI)	4	EA			$1,208.62	$4,834	
Valves:							
Unthickened Sludge Influent Pipe (USP, Buried, 14 inch, DI)	0	EA			$12,404.89	$0	
Unthickened Sludge Influent Pipe (USP, Encased, 14 inch, DI)	0	EA			$12,404.89	$0	
Unthickened Sludge Influent Pipe (USP, Submerged, 14 inch, DI)	4	EA			$12,404.89	$49,620	
Decant Pipe (DSP, Buried, 12 inch, DI)	0	EA			$10,632.76	$0	
Decant Pipe (DSP, Exposed, 12 inch, DI)	0	EA			$10,632.76	$0	
Decant Pipe (DSP, Encased, 12 inch, DI)	0	EA			$10,632.76	$0	
Thickened Sludge Suction Pipe (TSSP, Encased, 4 inch, DI)	0	EA			$3,544.25	$0	
Thickened Sludge Suction Pipe (TSSP, Exposed, 4 inch, Steel)	4	EA			$4,072.29	$16,289	
Thickened Sludge Discharge Pipe (TSDP, Exposed, 4 inch, DI)	4	EA			$3,544.25	$14,177	
Allowance for Misc Items	5%				$225,562.69	$11,278	
Subtotal						$236,841	
ELECTRICAL:							
# MCC Sections	9	EA			$10,730.27	$96,572	
Switchgear	0	EA			$49,359.23	$0	
Adjustable Frequency Drives							
Thickened Sludge Pumps (Active) (1 hp each)	4	EA			$9,056.04	$36,224	
Thickened Sludge Pumps (Standby) (1 hp each)	0	EA			$9,056.04	$0	
Gravity Thickener Rake Mechanism (1 hp each)	0	EA			$8,996.69	$0	
Electrical Conduit & Wire	1023.97	LF	312.11	m	$12.06	$12,348	
Allowance for Misc Items	10%				$145,144.61	$14,514	
Subtotal						$159,659	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00		0.00		0.00	$0	
Item 2 Description	0.00		0.00		0.00	$0	
Item 3 Description	0.00		0.00		0.00	$0	
Item 4 Description	0.00		0.00		0.00	$0	
Item 5 Description	0.00		0.00		0.00	$0	
Item 6 Description	0.00		0.00		0.00	$0	
Item 7 Description	0.00		0.00		0.00	$0	
Item 8 Description	0.00		0.00		0.00	$0	
Item 9 Description	0.00		0.00		0.00	$0	
Item 10 Description	0.00		0.00		0.00	$0	
Item 11 Description	0.00		0.00		0.00	$0	

Item 12 Description	0.00		0.00		0.00	$0	
Item 13 Description	0.00		0.00		0.00	$0	
Item 14 Description	0.00		0.00		0.00	$0	
Item 15 Description	0.00		0.00		0.00	$0	
Subtotal						$0	
Subtotal						$5,222,992	
ALLOWANCES:		**User Override**					
Finishes Allowance	2.00%		$6,144,696	$122,894			
I&C Allowance	4.00%		$6,144,696	$245,788			
Mechanical Allowance	5.00%		$6,144,696	$307,235			
Electrical Allowance	4.00%		$6,144,696	$245,788			
					Facility Cost Name		
Facility Cost	**7,633,428**	**GPD**	**$0.80**	**$6,144,696**	SGTFC01		
Facility Cost with Standard Additional Project Costs Added	**7,633,428**	**GPD**	**$0.98**	**$7,466,227**	SGTFC02		
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**7,633,428**	**GPD**	**$1.70**	**$12,950,628**	SGTFC03		
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**7,633,428**	**GPD**	**$1.40**	**$10,658,352**	SGTFC05		
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**7,633,428**	**GPD**	**$1.70**	**$12,950,628**	SGTFC06		

Gravity Thickener

PROCESS DESIGN CRITERIA

Is This Facility Included in My Project? Yes

Process User Inputs:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Red Flags	Comment
Solids Production:							
Input Plant Flow Rate	160.00	mgd	605.67	ML/d			
Input Raw Water Turbidity	10.00	NTU					
Input Fraction of Turbidity to Contribute to Solids	1.00	mg/L/NTU					Typically 1 to 2
Input Raw Water Color		CU					
Input Fraction of Color to Contribute to Solids	0.05	mg/L/CU					Typically 0.02 to 0.1
Input Alum Dose							
Input Fraction of Alum to Contribute to Solids	0.44						Typical Value = 0.44 based on 3 waters of hydration for the most probable solid Al(OH)3.3H2O
Input Ferric Chloride Dose		mg/L					
Fraction of Ferric Chloride to Contribute to Solids	0.99						Typical Value = 0.99 based on 3 waters of hydration for the most probable solid Fe(OH)3.3H2O
Input Total Polymer Dose (coagulation, flocculation, filter aids)		mg/L					
Input Raw Water Iron		mg/L					
Input Iron Factor	2.00						Typical Value = 2
Input Raw Water Manganese		mg/L					
Input Manganese Factor	2.00						Typical Value = 2
Input PAC Dose		mg/L					
Input Carbonate Hardness Concentration to be Removed via Softening		mg/L as CaCO3					
Input Carbonate Hardness Factor (mg of softening solids produced per mg of hardness removed)	1.00						Typical Value: 1 for sodium hydroxide softening; 2 for lime softening.
Input Non-Carbonate Hardness Concentration to be Removed via Softening		mg/L as CaCO3					
Input Non-Carbonate Hardness Factor (mg of softening solids produced per mg of hardness removed)	1.00						Typical Value: 1 for sodium hydroxide softening; 1 for soda ash softening.
Calculate Solids Removed	10.00	mg/L					
Calculate Dry Residual Solids Produced	13,352.64	lb/d	6056.66	kg/d			
Optional: Input Daily Dry Solids Production (overwrites above calculations) (dry)	21,179.93	lb/d	9,534.17	kg/d			
Gravity Thickener Sizing & Sludge Storage:							
Input Number of On-Line Thickeners	1	#					
Input Number of Standby Thickeners	1	#					Typically 1
Input % Dry Solids in Sludge to Thickeners	0.25%						Typically 0.25% tyo 0.75%
Calculate Total Sludge Flow Rate	1,015,166.71	gpd	3842.82	m3/d			
Calculate Sludge Flow to Each Thickener	1,015,166.71	gpd	3842.82	m3/d			
Calculate Dry Solids Flow to Each Thickener	21,179.93	lb/d	9607.05	kg/d			
Input Thickener Hydraulic Loading Rate	300.00	gpd/sf	44,005.50	m/d			Typically 100 to 300 gpd/sf for metal salt coagulant sludges
Input Thickener Solids Loading Rate	10.00	lb/d/sf	4.54	kg/d/m2			Typically 5 to 10 lb/sf/d
Calculate Thickener Diameter, Each Based on Hydraulic Loading Rate	65.64	ft	20006.82	mm			
Calculate Thickener Diameter, Each Based on Solids Loading Rate	51.93	ft	15828.23	mm			
Calculate Thickener Diameter, Each (maximum of above)	65.64	ft	20006.82	mm			
Input Thickened Sludge % Dry Solids	4.00%						Typically 2% to 5% for metal salt coagulant sludges treated with polymer
Calculate Thickened Sludge Density	63.86	lb/cf	1022.86	kg/m3			Assumes density of dried solids of 145 lb/cf.
Input Days of Thickened Sludge Storage in Thickener	3.00	days					Typically 0 to 3 days (long weekend)
Calculate Thickened Sludge Storage Depth	7.35	ft	2240.73	mm			If Sludge Storage depth is greater than desired: 1.) Reduce days of storage or 2.) Decrease controlling thickener loading rate criteria input.
Calculate Total Thickened Sludge Storage Volume	186,089.78	gal	704.43	m3			
Input Clear Water Depth Above Sludge Line	10.00	ft	3,048.00	mm			Typically 8 to 11 feet
Input Free Board	3.00	ft	914.40	mm			Typically 1 to 3 feet
Calculate Total Thickener Depth	20.35	ft	6203.13	mm			
Input Thickener Wall Height Above Grade	1.00	ft	304.80	mm			
Calculate Wall Burial Depth	19.35	ft	5898.33	mm	DB		
Gravity Thickener Peripheral Weir Launder Sizing:							
Calculate Total Flow Rate of all Thickeners	1.02	mgd	3842.82	m3/d	QT		
Calculate Flow Rate of Each Active Thickener	1.02	mgd	3842.82	m3/d	Q, mgd		
Convert Each Thickener Flow Rate	1.57	cfs	44.48	L/s	Q, cfs		
Input Velocity in Launder	5.00	fps	1.52	m/s	V		Typically < 5 fps
Calculate Area (Q, cfs / V)	0.31	sf	0.03	m2			
Launder Freeboard	1.00	ft	304.80	mm			Fixed
Input Launder Width	2.00	ft	609.60	mm			
Calculate Launder Height Excluding Freeboard	0.16	ft	47.87	mm			
Calculate Launder Height Including Freeboard	1.16	ft	352.67	mm			Should be ≤ 5 ft.
Thickened Sludge Pump Sizing:							
Calculate Thickened Sludge Flow from Each Thickener	62,029.93	gpd	234.81	m3/d			
Calculate Thickener Decant Flow from Each Thickener	953,136.78	gpd	3608.02	m3/d			
Number of Progressive Cavity Thickened Sludge Pumps per Thickener	2	#					Fixed: 1 duty and 1 standby
Calculate Number of Thickened Sludge Pumps	4	#					
Calculate Thickened Sludge Pump Capacity, Each	43.08	gpm	163.06	L/min			
Input Thickened Sludge Pump Total Dynamic Head (TDH)	100.00	ft	30,480.00	mm			

Calculate Thickened Sludge Pump Horsepower (each)	1.45	hp	1.08	kW				
Input Distance between Thickener and Sludge Pump Pad	16.00	ft	4,876.80	mm				Minimum of 10 ft
Input Sludge Pump Length (progressive cavity)	8.50	ft	2,590.80	mm				Typically 8.5 ft
Input Sludge Pump Width (progressive cavity)	2.00	ft	609.60	mm				Typically 2.0 ft
Input Stagger Distance Between Sludge Pump Centerlines - Length	8.50	ft	2,590.80	mm				Typically equal to sludge pump length
Input Distance Between Sludge Pump Centerlines (width) and Around Pumps for Access	4.50	ft	1,371.60	mm				Typically 4.5 ft for access
Include the Cost of a Building Over Sludge Pump Station?	Yes	Y/N						
Input Cutback Slope	1.50	:1						Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
Input Over Excavation Depth	1.00	ft	0.00	mm	OEXD			

Mechanical Sizing Requirements

Pipe Name	Input Velocity	Unit (English)	Input Velocity	Unit (Metric)	Standard Pipe Size	Unit (English)		Nominal Pipe Size
Unthickened Sludge Influent Pipe	3.00	fps	0.91	m/s	10.00	in		250.00
Decant Pipe	5.00	fps	1.52	m/s	8.00	in		200.00
Thickened Sludge Suction Pipe	3.00	fps	0.91	m/s	4.00	in		100.00
Thickened Sludge Discharge Pipe	3.00	fps	0.91	m/s	4.00	in		100.00

Mechanical Material Requirements:

Pipe Name	Pipe ID	Installation Type	Pipe Material	Pipe Lining Material	Pipe Coating Material	Comments	Red Flags
Unthickened Sludge Influent Pipe	USP	Buried	DI	Cement Mortar	Tape Coating		
Unthickened Sludge Influent Pipe	USP	Encased	DI	Cement Mortar	Fusion Bonded Epoxy		
Unthickened Sludge Influent Pipe	USP	Submerged	DI	Cement Mortar	Fusion Bonded Epoxy		
Decant Pipe	DSP	Buried	DI	Cement Mortar	Tape Coating		
Decant Pipe	DSP	Exposed	DI	Cement Mortar	Paint		
Decant Pipe	DSP	Encased	DI	Cement Mortar	Fusion Bonded Epoxy		
Thickened Sludge Suction Pipe	TSSP	Encased	DI	Cement Mortar	Fusion Bonded Epoxy		
Thickened Sludge Suction Pipe	TSSP	Exposed	Steel	Cement Mortar	Paint		
Thickened Sludge Discharge Pipe	TSDP	Exposed	DI	Cement Mortar	Paint		

Electrical User Inputs and Sizing Requirements:

Is this a "Critical" Facility (requiring standby power)?	No	Y/N
Is there SWGR?	No	

Electrical Equipment Lengths:

Item	Quantity	HP per Each	AFD's Required?	MCC Spaces for Motor Starters	MCC Spaces for AFD's less than 50hp)	MCC Spaces for Breakers	MCC Total MCC Spaces
Thickened Sludge Pumps (Active)	2.00	1.45	Yes	0.00	6.00	4.00	
Thickened Sludge Pumps (Standby)	2.00	1.45	No	4.00	0.00	0.00	
Gravity Thickener Rake Mechanism	2.00	1.00	No	4.00	0.00	0.00	
User Defined Item #1	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #2	0.00	0.00	No	0.00	0.00	0.00	
TOTAL		**7.8**		**8.00**	**6.00**	**4.00**	**18.00**

Electrical Equipment Widths:

Equipment	Depth (ft)
MCC	1.67
Small AFD's	0.00
Large AFD's	0.00
Switchgear	0.00
Maximum Depth	**1.67**

Clear Distances:

Clear Distance	Width	Length	Comment	
CD1		3.00	Clear Distance between wall and MCC	Typically 3 feet
CD2		1.00	Clear Distance between MCC and Small AFD	Typically 1 foot
CD3		0.00	Clear Distance between Small AFD and Large AFD	Typically Zero
CD4		0.00	Clear Distance between Large AFD and Switchgear	Typically Zero
CD5		0.00	Clear Distance between Switchgear and Contingency Space	Typically Zero
CD6	4.00		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)	
CD7	3.00		Clear Distance in front of Equipment	Typipcally 3 feet
Contingency Length		0.00	Contingency length	Typically Zero

Electric Room Length (ft):

CD1	3.00
MCC	10.00
CD2	1.00
Small AFD's	0.00
CD3	0.00
Large AFD's	0.00
CD4	0.00
Swithgear	0.00
CD5	0.00
Contingency	0.00
Total Length	**14.00**

Electric Room Width (ft):

CD6	0.00	If there is no switchgear, this distance will be Zero
Maximum Equipment Depth	1.67	
CD7	3.00	

Total Width	**4.67**						

Estimating Dimensions:	Value English	Unit (English)	Value (Metric)	Unit (Metric)	Name	Red Flags	Comment
Total Number of Thickeners	2.00	#					
Gravity Thickener (dimensions per each):							
Perimeter Wall Inside Diameter	65.64	ft	20006.82	mm			
Perimeter Wall Outside Diameter	67.64	ft	20616.42	mm			
Perimeter Wall Height	20.35	ft	6203.13	mm			
Wall Footer Thickness	**16.00**	in	**406.40**	mm			Model based on 16"
Wall Footer Thickness	1.33	ft	406.40	mm			
Slab on Grade Thickness	**6.00**	in	**152.40**	mm			Model based on 6"
Slab on Grade Thickness	0.50	ft	152.40	mm			
Center Cone Outside Diameter	6.17	ft	1879.60	mm			Fixed
Center Cone Inside Diameter	3.50	ft	1066.80	mm			Fixed
Center Cone Slab on Grade Thickness	**16.00**	in		mm			Model based on 16"
Center Cone Slab on Grade Thickness	1.33	ft	406.40	mm			
Center Cone Wall Height	**2.33**	ft	**59.18**	mm			Model based on 2.33'
Center Cone Wall Thickness	**16.00**	in	**406.40**	mm			Model based on 16"
Center Cone Wall Thickness	1.33	ft	406.40	mm			
Launder Elevated Slab Width	**2.00**	ft	**50.80**	mm			Model based on 2'
Launder Elevated Slab Thickness	**12.00**	in	**304.80**	mm			Model based on 12"
Launder Elevated Slab Thickness	1.00	ft	304.80	mm			
Launder Wall Diameter	61.64	ft	18787.62	mm			
Launder Wall Height	1.16	ft	352.67	mm			
Launder Wall Thickness	**8.00**	in	**203.20**	mm			Model based on 8"
Launder Wall Thickness	0.67	ft	203.20	mm			
Perimeter Wall Thickness	**12.00**	in	**304.80**	mm			Model based on 12"
Perimeter Wall Thickness	1.00	ft	304.80	mm			
Floor Slope Factor	1.03						Fixed
Side Slope Depth Factor	0.23						Fixed
Side Slope Factor	4.29						Fixed
Excavation Diameter	76.64	ft	23359.62	mm			
Cone Excavation Depth	10.92	ft	3329.56	mm			
Perimeter Wall Excavation Depth (Includes Over Excavation)	21.68	ft	6609.53	mm			
Thickened Sludge Pump Slab:							
Length	26.00	ft	7924.80	mm			Fixed
Width	30.50	ft	9296.40	mm			
Slab on Grade Length	28.00	ft	8534.40	mm			
Slab on Grade Width	32.50	ft	9906.00	mm			
Slab Thickness	**16.00**	in	**406.40**	mm			Model based on 16"
Slab Thickness	1.33	ft	406.40	mm			
Excavation Length	32.00	ft	9753.60	mm			
Excavation Width	36.50	ft	11125.20	mm			
Excavation Depth	3.33	ft	1016.00	mm			
Electrical Room:							
Length	14.00	ft	4267.20	mm			
Width	4.67	ft	1422.40	mm			
Slab on Grade Length	16.00	ft	4876.80	mm			
Slab on Grade Width	6.67	ft	2032.00	mm			
Slab on Grade Thickness	**18.00**	in	**457.20**	mm			Model based on 18"
Slab on Grade Thickness	1.50	ft	457.20	mm			
Excavation Length	20.00	ft	6096.00	mm			
Excavation Width	10.67	ft	3251.20	mm			
Excavation Depth	3.50	ft	1066.80	mm			

COST ESTIMATE

Description	Quantity (English)	Unit (English)	Quantity (Metric)	Unit (Metric)	$/Unit	Total Cost	User Over-Write
SITEWORK:							
Gravity Thickener:							
Excavation	16,737.29	CY	12796.58	m3	*$6.72*	$112,526	
Imported Structural Backfill	702.14	CY	536.83	m3	*$50.94*	$35,768	
Native Backfill	6,289.84	CY	4808.93	m3	*$8.27*	$51,987	
Haul Excess	10,447.45	CY	7987.65	m3	*$8.27*	$86,351	
Thickened Sludge Pump Slab:							
Excavation	208.86	CY	159.68	m3	*$8.33*	$1,739	
Imported Structural Backfill	100.94	CY	77.17	m3	*$50.94*	$5,142	
Native Backfill	42.28	CY	32.33	m3	*$8.27*	$349	
Haul Excess	166.58	CY	127.36	m3	*$8.27*	$1,377	
Electrical Room:							
Excavation	54.35	CY	41.55	m3	*$8.33*	$453	
Imported Structural Backfill	19.75	CY	15.10	m3	*$50.94*	$1,006	
Native Backfill	20.87	CY	15.96	m3	*$8.27*	$172	
Haul Excess	33.48	CY	25.60	m3	*$8.27*	$277	
Allowance for Misc Items	5%				$297,148.31	$14,857	
Subtotal						$312,006	
CONCRETE:							
Gravity Thickener:							
Wall Footers	115.43	CY	88.25	m3	*$541.11*	$62,459	
Slanted Slab on Grade	128.76	CY	98.45	m3	*$541.11*	$69,674	
Slanted Floor Grout (2" thick)	6,953.20	SF	645.97	m2	*$23.76*	$165,211	
Center Cone Slab on Grade	2.95	CY	2.26	m3	*$541.11*	$1,596	
Center Cone Walls	4.46	CY	3.41	m3	*$499.64*	$2,227	
Perimeter Walls	320.34	CY	244.92	m3	*$707.82*	$226,742	
Launder Elevated Slab	30.55	CY	23.36	m3	*$832.73*	$25,440	
Launder Wall	11.06	CY	8.46	m3	*$832.73*	$9,214	
Concrete Fill	*5.09*	CY	3.89	m3	*$374.73*	$1,908	
Thickened Sludge Pump Slab:						$0	
Slab on Grade	44.94	CY	34.36	m3	*$490.62*	$22,047	
Electrical Room:						$0	
Slab on Grade	5.93	CY	4.53	m3	*$541.11*	$3,207	
Allowance for Misc Items	5%				$589,726.58	$29,486	
Subtotal						$619,213	
METALS:							
Gravity Thickener:							

Walkway Grating (3' wide, steel support beams supplied by mechanism mfr)	405.84	SF	37.70	m2	$90.92	$36,898	
Walkway Handrail	270.56	LF	82.47	m	$90.92	$24,599	
Stairway	3	Risers			$495.92	$1,488	
Allowance for Misc Items	10%				$62,984.04	$6,298	
Subtotal						$69,282	
MASONRY:	Moderate						
Thickened Sludge Pump Building	793.00	SF	73.67	m2	$165.31	$131,087	
Electrical Room	65.33	SF	6.07	m2	$165.31	$10,800	
Subtotal	858.33					$141,887	
EQUIPMENT:							Budgetary Quote: (CPES will automatically add Installation Factor)
Gravity Thickener Drive Mechanism (1 hp each)	2	EA			$226,972.46	$453,945	
Thickened Sludge Pumps (Active, Progressive Cavity Pumps 1 hp each)	2	EA			$8,789.61	$17,579	
Thickened Sludge Pumps (Standby, Progressive Cavity Pumps 1 hp each)	2	EA			$8,789.61	$17,579	
Allowance for Misc Items	10%				$471,524.13	$47,152	
Subtotal						$536,256	
I&C:							
Instruments							
Thickened Sludge Discharge Pipe Magmeter (TSDP, 4 inch)	2	EA			$8,561.98	$17,124	
Isolation Valve Actuators (Electric)	6	EA			$6,409.82	$38,459	
Level Transmitters	2	EA			$10,730.27	$21,461	
Number of Analog I/O Counts	5	EA			$264.27	$1,321	
Number of Digital I/O Counts	36	EA			$62.59	$2,253	
Number of Local Panels	2	EA			$13,074.33	$26,149	
Number of PLC's	1	EA			$13,908.86	$13,909	
I&C Conduit Wire	1116.39	LF	340.28	m	$12.06	$13,463	
Allowance for Misc Items	5%				$134,138.07	$6,707	
Subtotal						$140,845	
MECHANICAL:							
Pipe:							
Unthickened Sludge Influent Pipe (USP, Buried, 10 inch, DI)	38.70	LF	11.80	m	$86.70	$3,356	
Unthickened Sludge Influent Pipe (USP, Encased, 10 inch, DI)	0.00	LF	0.00	m	$86.70	$0	
Unthickened Sludge Influent Pipe (USP, Submerged, 10 inch, DI)	67.64	LF	20.62	m	$86.70	$5,864	
Decant Pipe (DSP, Buried, 8 inch, DI)	4.67	LF	1.42	m	$69.36	$324	
Decant Pipe (DSP, Exposed, 8 inch, DI)	38.70	LF	11.80	m	$69.36	$2,684	
Decant Pipe (DSP, Encased, 8 inch, DI)	0.00	LF	0.00	m	$69.36	$0	
Thickened Sludge Suction Pipe (TSSP, Encased, 4 inch, DI)	97.64	LF	29.76	m	$34.68	$3,386	
Thickened Sludge Suction Pipe (TSSP, Exposed, 4 inch, Steel)	49.50	LF	15.09	m	$92.45	$4,576	
Thickened Sludge Discharge Pipe (TSDP, Exposed, 4 inch, DI)	48.00	LF	14.63	m	$34.68	$1,665	
Elbows:							
Unthickened Sludge Influent Pipe (USP, Buried, 10 inch, DI)	2	EA			$1,819.70	$3,639	
Unthickened Sludge Influent Pipe (USP, Encased, 10 inch, DI)	0	EA			$1,819.70	$0	
Unthickened Sludge Influent Pipe (USP, Submerged, 10 inch, DI)	6	EA			$1,819.70	$10,918	
Decant Pipe (DSP, Buried, 8 inch, DI)	0	EA			$1,455.76	$0	
Decant Pipe (DSP, Exposed, 8 inch, DI)	2	EA			$1,455.76	$2,912	
Decant Pipe (DSP, Encased, 8 inch, DI)	0	EA			$1,455.76	$0	
Thickened Sludge Suction Pipe (TSSP, Encased, 4 inch, DI)	0	EA			$727.88	$0	
Thickened Sludge Suction Pipe (TSSP, Exposed, 4 inch, Steel)	2	EA			$556.80	$1,114	
Thickened Sludge Discharge Pipe (TSDP, Exposed, 4 inch, DI)	2	EA			$727.88	$1,456	
End Caps:							
Unthickened Sludge Influent Pipe (USP, Buried, 10 inch, DI)	0	EA			$451.61	$0	
Unthickened Sludge Influent Pipe (USP, Encased, 10 inch, DI)	0	EA			$451.61	$0	
Unthickened Sludge Influent Pipe (USP, Submerged, 10 inch, DI)	0	EA			$451.61	$0	
Decant Pipe (DSP, Buried, 8 inch, DI)	0	EA			$361.29	$0	
Decant Pipe (DSP, Exposed, 8 inch, DI)	0	EA			$361.29	$0	
Decant Pipe (DSP, Encased, 8 inch, DI)	0	EA			$361.29	$0	
Thickened Sludge Suction Pipe (TSSP, Encased, 4 inch, DI)	4	EA			$180.64	$723	
Thickened Sludge Suction Pipe (TSSP, Exposed, 4 inch, Steel)	0	EA			$180.64	$0	
Thickened Sludge Discharge Pipe (TSDP, Exposed, 4 inch, DI)	2	EA			$180.64	$361	
Tee:							
Unthickened Sludge Influent Pipe (USP, Buried, 10 inch, DI)	0	EA			$3,021.56	$0	
Unthickened Sludge Influent Pipe (USP, Encased, 10 inch, DI)	0	EA			$3,021.56	$0	
Unthickened Sludge Influent Pipe (USP, Submerged, 10 inch, DI)	0	EA			$3,021.56	$0	
Decant Pipe (DSP, Buried, 8 inch, DI)	0	EA			$2,417.25	$0	
Decant Pipe (DSP, Exposed, 8 inch, DI)	2	EA			$2,417.25	$4,834	
Decant Pipe (DSP, Encased, 8 inch, DI)	0	EA			$2,417.25	$0	
Thickened Sludge Suction Pipe (TSSP, Encased, 4 inch, DI)	2	EA			$1,208.62	$2,417	
Thickened Sludge Suction Pipe (TSSP, Exposed, 4 inch, Steel)	2	EA			$1,268.60	$2,537	
Thickened Sludge Discharge Pipe (TSDP, Exposed, 4 inch, DI)	2	EA			$1,208.62	$2,417	
Valves:							
Unthickened Sludge Influent Pipe (USP, Buried, 10 inch, DI)	0	EA			$8,860.64	$0	
Unthickened Sludge Influent Pipe (USP, Encased, 10 inch, DI)	0	EA			$8,860.64	$0	
Unthickened Sludge Influent Pipe (USP, Submerged, 10 inch, DI)	2	EA			$8,860.64	$17,721	
Decant Pipe (DSP, Buried, 8 inch, DI)	0	EA			$7,088.51	$0	
Decant Pipe (DSP, Exposed, 8 inch, DI)	0	EA			$7,088.51	$0	
Decant Pipe (DSP, Encased, 8 inch, DI)	0	EA			$7,088.51	$0	
Thickened Sludge Suction Pipe (TSSP, Encased, 4 inch, DI)	0	EA			$3,544.25	$0	
Thickened Sludge Suction Pipe (TSSP, Exposed, 4 inch, Steel)	2	EA			$4,072.29	$8,145	
Thickened Sludge Discharge Pipe (TSDP, Exposed, 4 inch, DI)	2	EA			$3,544.25	$7,089	
Allowance for Misc Items	5%				$88,137.95	$4,407	
Subtotal						$92,545	
ELECTRICAL:							
# MCC Sections	6	EA			$10,730.27	$64,382	
Switchgear	0	EA			$49,359.23	$0	
Adjustable Frequency Drives							
Thickened Sludge Pumps (Active) (1 hp each)	2	EA			$9,055.75	$18,111	
Thickened Sludge Pumps (Standby) (1 hp each)	0	EA			$9,055.75	$0	
Gravity Thickener Rake Mechanism (1 hp each)	0	EA			$8,996.69	$0	
Electrical Conduit & Wire	279.28	LF	85.12	m	$12.06	$3,368	
Allowance for Misc Items	10%				$85,860.92	$8,586	
Subtotal						$94,447	

USER DEFINED ESTIMATE ITEMS:	QUANT (ENGLISH)	UNIT (ENGLISH)	QUANT (METRIC)	UNIT (METRIC)	$/UNIT	TOTAL COST	
Item 1 Description	0.00		0.00		0.00	$0	
Item 2 Description	0.00		0.00		0.00	$0	
Item 3 Description	0.00		0.00		0.00	$0	
Item 4 Description	0.00		0.00		0.00	$0	
Item 5 Description	0.00		0.00		0.00	$0	
Item 6 Description	0.00		0.00		0.00	$0	
Item 7 Description	0.00		0.00		0.00	$0	
Item 8 Description	0.00		0.00		0.00	$0	
Item 9 Description	0.00		0.00		0.00	$0	
Item 10 Description	0.00		0.00		0.00	$0	
Item 11 Description	0.00		0.00		0.00	$0	

Item 12 Description	0.00		0.00		0.00	$0	
Item 13 Description	0.00		0.00		0.00	$0	
Item 14 Description	0.00		0.00		0.00	$0	
Item 15 Description	0.00		0.00		0.00	$0	
Subtotal						$0	
Subtotal						$2,006,481	
ALLOWANCES:		**User Override**					
Finishes Allowance	2.00%		$2,360,566	$47,211			
I&C Allowance	4.00%		$2,360,566	$94,423			
Mechanical Allowance	5.00%		$2,360,566	$118,028			
Electrical Allowance	4.00%		$2,360,566	$94,423			
					Facility Cost Name		
Facility Cost	**2,030,333**	**GPD**	**$1.16**	**$2,360,566**	SGTFC01		
Facility Cost with Standard Additional Project Costs Added	**2,030,333**	**GPD**	**$1.41**	**$2,868,250**	SGTFC02		
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**2,030,333**	**GPD**	**$2.45**	**$4,975,154**	SGTFC03		
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**2,030,333**	**GPD**	**$2.02**	**$4,094,546**	SGTFC05		
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**2,030,333**	**GPD**	**$2.45**	**$4,975,154**	SGTFC06		

Centrifuge Solids Dewatering Facility

Is This Facility Included in My Project? Yes

Process User Inputs:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Red Flags	Comment
Dry Solids Production							
Input Design Plant Flow Rate	160.00	mgd	605.67	ML/d			Enter plant flow rate for which dewatering equipment/system shall be sized.
Input Average Annual Plant Flow Rate	90.00	mgd	340.69	ML/d			Enter plant flow rate for calculating average annual production of solids.
Input Design Raw Water Turbidity		NTU					Enter raw water turbidity for which dewatering equipment/system shall be sized.
Input Average Annual Raw Water Turbidity		NTU					Enter raw water turbidity for calculating average annual production of solids.
Input Fraction of Turbidity to Contribute to Solids	1.00	mg/L/NTU					Typically 1 to 2
Input Design Raw Water Color		CU					Enter raw water color for which dewatering equipment/system shall be sized.
Input Average Annual Raw Water Color		CU					Enter raw water color for calculating average annual production of solids.
Input Fraction of Color to Contribute to Solids	0.05	mg/L/CU					Typically 0.02 to 0.1
Select Coagulant Used for Raw Water	Ferric Chloride	Type					
Input Design Coagulant Dose		mg/L					Enter coagulant dose for which dewatering equipment/system shall be sized.
Input Average Annual Coagulant Dose		mg/L					Enter coagulant dose for calculating average annual production of solids.
Fraction of Coagulant to Contribute to Solids	0.99						Typical Value = 0.99 based on 3 waters of hydration for the most probable solid Fe(OH)3*3H2O.
Optional: Input Fraction of Coagulant to Contribute to Solids (overwrites above calculations)							
Input Total Design Polymer Dose (coagulation, flocculation, filter aids)		mg/L					Enter polymer dose for which dewatering equipment/system shall be sized.
Input Total Average Annual Polymer Dose (coagulation, flocculation, filter aids)		mg/L					Enter polymer dose for calculating average annual production of solids.
Input Design Raw Water Iron		mg/L					Enter raw water iron for which dewatering equipment/system shall be sized.
Input Average Annual Raw Water Iron		mg/L					Enter raw water iron for calculating average annual production of solids.
Input Iron Factor that Contrinbutes to Solids	2.00						Typical Value = 2
Input Design Raw Water Manganese		mg/L					Enter raw water manganese for which dewatering equipment/system shall be sized.
Input Average Annual Raw Water Manganese		mg/L					Enter raw water manganese for calculating average annual production of solids.
Input Manganese Factor that Contrinbutes to Solids	2.00						Typical Value = 2
Input Design PAC Dose		mg/L					Enter PAC dose for which dewatering equipment/system shall be sized.
Input Average Annual PAC Dose		mg/L					Enter PAC dose for calculating average annual production of solids.
Input Design Carbonate Hardness Concentration to be Removed via Softening		mg/L as CaCO3					Enter carbonate hardness removed for which dewatering equipment/system shall be sized.
Input Average Annual Carbonate Hardness Concentration to be Removed via Softening		mg/L as CaCO3					Enter carbonate hardness removed for calculating average annual production of solids.
Input Carbonate Hardness Factor that Contributes to Solids	1.00	(mg of softening solids produced per mg of hardness removed)					Typical Value: 1 for sodium hydroxide softening; 2 for lime softening.
Input Design Non-Carbonate Hardness Concentration to be Removed via Softening		mg/L as CaCO3					Enter non-carbonate hardness removed for which dewatering equipment/system shall be sized.
Input Average Annual Non-Carbonate Hardness Concentration to be Removed via Softening		mg/L as CaCO3					Enter non-carbonate hardness removed for calculating average annual production of solids.
Input Non-Carbonate Hardness Factor that Contributes to Solids	1.00	(mg of softening solids produced per mg of hardness removed)					Typical Value: 1 for sodium hydroxide softening; 1 for soda ash softening.
Calculate Design Solids Removed	0.00	mg/L					
Calculate Design Daily Dry Solids Production	19,301.34	lb/d	8754.94	kg/d			Calculated on a dry weight basis.
Optional: Input Design Daily Dry Solids Production (overwrites above calculations)	19,301.34	lb/d	8,688.53	kg/d			Overrides cell above. Calculated on a dry weight basis.
Calculate Average Annual Solids Removed	0.00	mg/L					

Calculate Average Annual Daily Dry Solids Production	3,569.76	lb/d	1619.22	kg/d	Calculated on a dry weight basis.
Optional: Input Average Annual Daily Dry Solids Production (overwrites above calculations)	3,569.76	lb/d	1,648.47	kg/d	Overrides cell above. Calculated on a dry weight basis.
Centrifuge Dewatering Sizing					
Input % Dry Solids in Sludge to Centrifuges	2.00%				Typically from Gravity Thickener at 2% to 5%
Input Number of Days per Week Centrifuges Will Be Operated	5.00	days			1 to 7, often 5 days
Input Number of Hours per Day Centrifuges Will Be Operated	8.00	hours			1 to 24, often 8 hours
Calculate Required Gravity Thickener Dry Solids Storage (dry)	51,470.24	lb	23346.51	kg	
Calculate Thickened Sludge Density	63.12	lb/cf	1011.07	kg/m3	Assumes density of dried solids of 145 lb/cf.
Calculate Required Gravity Thickener Sludge Storage Volume	40,772.30	cf	1154.54	m3	
Calculate Required Gravity Thickener Sludge Storage Volume	304,997.99	gal	1154.54	m3	For Information, see cell C34 in the Gravity Thickener model for the volume (in gallons) of sludge.
Calculate Required Centrifuge Dewatering Rate	333.59	gpm	75.77	m3/hr	
Input Number of Duty Centrifuges	2	#			Toggle number of duty centrifuges to select optimum centrifuge configuration.
Input Number of Standby Centrifuges	1	#			Typically 0 or 1.
Total Number of centrifuges	3	#			
Loading, hydraulic (each)	166.80	gpm	37.88	m3/hr	
Loading, dry solids (each)	1,688.87	lb/hr	766.06	kg/hr	
Centrifuge Selection					
Input Sludge Type	Alum				
Case No.	1.00				Number used for selection of centrifuge
Expected Feed Solids	2.5-3.5% DS				
Polymer Consumption	15-25 lb/ton DS				DS = dry solids
Cake Solids	18-23% DS				DS = dry solids
Capture Efficiency	95.00%	`			
Centrifuge Selection	5.00				Number used for selection of centrifuge
Model No. (Andritz)	D6				The service numbers for each model have a level of conservativism already in them.
Capacity	105	gpm	23.85	m3/hr	Contact Andritz for actual model selection. There are several versions of each model that changes the capacity ranges for each.
Bowl Diameter	23.23	in	590.04	mm	
Length	208.00	in	5283.20	mm	
Width	63.00	in	1600.20	mm	
Height	69.00	in	1752.60	mm	
Power, Main Drive	200.00	hp	149.14	kW	
Power, Back Drive	30.00	hp	22.37	kW	
Weight	22,050.00	lb	10001.71	kg	Be sure to provide access to the centrifuges on the second floor
Chemical Storage and Feed					
Input Chemical Name	Liquid Polymer	Type			Typically Liquid Polymer, but if Dry Polymer is used, use the Dry Polymer Model
Is this Chemical System to be Included?	Yes	Y/N			
Input Percent Active Chemical	40.00%				If Liquid Polymer, typically 30% to 50%
Input Bulk Chemical Specific Gravity	1.10	#			If Liquid Polymer, typically 1.1
Active Chemical Concentration, lb/gallon	3.67	lb/gal	440.00	kg/m3	
Choose Chemical Delivery Method	Tote	Type			
Bulk Delivery Volume (Tank Truck, Totes, Drums), gallons	300.00	gal	1.14	m3	
Input Number of Simultaneous Application Points	1	#			
CHEMICAL DOSES:					
Input Minimum Dose (per ton of dry solids)	15.00	lb/t	7.50	kg/t	Typically 5 to 15 lb dry polymer per ton of dry solids (2.5 to 7.5 kg/t).
Input Average Dose (per ton of dry solids)	20.00	lb/t	10.00	kg/t	Typically 10 to 20 lb dry polymer per ton of dry solids (5.0 to 10.0 kg/t).
Input Maximum Dose (per ton of dry solids)	25.00	lb/t	12.50	kg/t	Typically 15 to 25 lb dry polymer per ton of dry solids (7.5 to 12.5 kg/t).
Minimum Chemical Usage	202.66	lb/d	91.93	kg/d	Usage rate on operating days.
Average Chemical Usage	270.22	lb/d	122.57	kg/d	Usage rate on operating days.
Maximum Chemical Usage	337.77	lb/d	153.21	kg/d	Usage rate on operating days.
Chemical Metering Rates per Simultaneous Operating Pump:					
Minimum Rate	6.90	gph	26.12	L/h	Usage rate when operating.
Average Rate	9.20	gph	34.82	L/h	Usage rate when operating.
Maximum Rate	11.50	gph	43.53	L/h	Usage rate when operating.
Calculate Chemical Metering Pump Flow Turndown (should be < 20, if > 20, proceed with caution)	1.67	:1			Should be < 20, If ≥ 20, proceed with caution.
Input Number of Days of Storage at Avg. Flow/Dose for Chemical	30.00	days			Includes non-operating days.
Calculate Number of Operating Days of Storage	21.43	days			Includes only operating days.
Calculate Storage Volume for Pretreatment @ Avg. Flow/Dose	1,576.92	gal	5.97	m3	
Calculate Bulk Delivery Volume * 1.5 (for Truck Delivery Only)	0.00	gal	0.00	m3	
Maximum of Above Two Volumes	1,576.92	gal	5.97	m3	
Maximum Volume in	210.80	cf	5.97	m3	
BULK TANKS:					
Input Number of Tanks	1	#			
Input Tank Diameter	10.00	ft	3,048.00	mm	
Calculate Height of Tanks	0.00	ft	0.00	mm	
Use this Tank Height (Liquid Height * 1.2)	0.00	ft	0.00	mm	
Input Number of Rows of Tanks	1	#			

Calculate Number of Tanks per Row	0	#					
Input Tank Material (FRP, PE (Polyethylene), PLS (Phenolic Lined Steel))	FRP	Type					
Input Clear Distance Around BulkTanks, Totes or Drums	4.00	ft	1,219.20	mm	CDT		
TOTES & DRUMS:							
Calculate Number of Totes or Drums	6	each					
Will Totes or Drums be Stored by Stacking on Top of Each Other?	No	Y/N					
Input Number of Rows of Totes or Drum Pallets	1	#					
Calculate Number of Totes or Drum Pallets on Floor per Row	6.00	#					
Length of Each Tote	4.00	ft	1219.20	mm			Fixed
Width of Each Tote	4.00	ft	1219.20	mm			Fixed
Length and Width of Each Drum Pallet	5.00	ft	1524.00	mm			Fixed
CHEMICAL FEED SYSTEMS:							
Select Chemical Feed Method	Polymer Blend Unit	Type					If using polymer, a Polymer Blend Unit is recommended
Calculate Number of Active Chemical Feed Systems	1	#					
Input Number of Standby Chemical Feed Systems	1	#					
Calculate Total Number of Chemical Feed Systems	2	#					
Input Clear Distance Around Chemical Feed Systems	4.00	ft	1,219.20	mm			
Length of Chemical Feed Systems	2.50	ft	762.00	mm			
Width of Chemical Feed Systems	3.33	ft	1015.90	mm			
Width of Stair Access	3.50	ft	1066.80	mm			Fixed
CONTAINMENT AREA:							
Calculate Containment Area Internal Length	52.00	ft	15849.60	mm			
Calculate Containment Area Internal Width	26.00	ft	7924.80	mm			
Calculate Fire Sprinkler Water Volume (0.2 gpm/sf for 20 min.)	5,408.00	gal	20.47	m3			
Calculate 120% of One Storage Tank Volume	360.00	gal	1.36	m3			
Calculate 30% of All Tank Volume	90.00	gal	0.34	m3			
Maximum of Above Two Volumes	360.00	gal	1.36	m3			
Calculate Maximum Volume + Fire Flow Volume	5,768.00	gal	21.83	m3			
Calculate Maximum Volume + Fire Flow Volume	771.07	cf	21.83	m3			
Calculate Containment Wall Height (including 6" Freeboard)	1.07	ft	326.23	mm			
Dewatering Building							
Truck Lane Length	68.00	ft	20,726.40	mm	DWB-TLL		Typically 68 ft for full container truck or roll-off.
Truck Lane Width	20.00	ft	6,096.00	mm	DWB-TLW		Typically ≥ 16 ft for full container truck or roll-off.
First Floor Height	24.00	ft	7,315.20	mm	DWB-FFH		Typically ≥ 22 ft
Number of Truck Lanes	2.00	#					Typically 2.
Offset Between Centrifuges	5.00	ft	1,524.00	mm	CN-OS		Typically ≥ 4 ft for access.
Centrifuge Offset from Wall (width direction in relationship to the centrifuges)	5.00	ft	1,524.00	mm	CN-OEW		Typically ≥ 4 ft for access.
Centrifuge Offset from Wall (length direction in relationship to centrifuges)	17.00	ft	5,181.60	mm	CN-ONW		Typically = 17 ft for proper alignment over truck bays.
Input Stair Tread Width	3.50	ft	1,066.80	mm			Typically ≥ 3.5 ft.
Calculate Stairwell Width	8.00	ft	2438.40	mm	DWB-SW		
Calculate Stairwell Length	25.50	ft	7772.40	mm	DWB-SL		
Dewatering Building Width	76.75	ft	23393.40	mm	DWB-W		
Dewatering Building Length	89.17	ft	27178.00	mm	DWB-L		
Conveyor Equipment							
Centrifuge Conveyor Length	53.13	ft	16192.50	mm	CON-CNL		
Centrifuge Conveyor Width or Diameter	10.00	in	254.00	mm	CON-CNW		Verify with conveyor vendor
Conveyor Truck Lane Length	40.00	ft	12,192.00	mm	CON-TLL		Typically 40 ft
Calculate Conveyor Truck Lane Width	10.00	in	254.00	mm	CON-TLW		
% Dry Solids Capture by Centrifuge	95.00%						
Optional: Input % Dry Solids Capture by Centrifuge (overwrites above calculations)							Typically 90 to 98%.
% Dry Solids in Centrifuge Cake	18.00%						
Optional: Input % Dry Solids in Centrifuge Cake (overwrites above calculations)							Typically 15 to 25%.
Calculate the Centrifuge Dry Solids Production Rate (dry)	3,208.85	lb/hr	1455.51	kg/hr			
Calculate the Cake Density	69.53	lb/cf	1113.75	kg/m3			Assumes density of dried solids of 145 lb/cf.
Calculate the Centrifuge Cake Solids Production Rate	17,826.93	lb/hr	8086.16	kg/hr			
Calculate Truck Loads	0.37	per hour					
Calculate the Centrifuge Cake Volume Production Rate	256.39	cf/hr	7.26	m3/hr			
Calculate Total Yearly Wet Mass of Sludge (per year)	18,590.94	tons	16865419.34	kg			
Calculate Total Design Yearly Wet Sludge Volume	19,806.11	cy	15142.86	m3			
Calculate Average Annual Wet Sludge Volume	3,663.12	cy	2800.65	m3			
Calculate Number of Gates per Truck Conveyor	6	#					Assumes 6 ft on center
Input Depth of Burial		ft	0.00	mm	DB		
Input Cutback Slope	1.00	:1					Cutback slope should be 1:1 for depth of burial ≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.
Input Over Excavation Depth	1.00	ft	0.00	mm	OEXD		

Mechanical Sizing Requirements:

Pipe Name	Input Velocity	Unit (English)	Input Velocity	Unit (Metric)	Standard Pipe Size	Unit (English)	Nominal Pipe Size
Centrifuge Feed Header	5.00	fps	1.52	m/s	6.00	in	150.00
Centrifuge Feed Lateral	5.00	fps	1.52	m/s	4.00	in	100.00
Centrifuge Drain Lateral/Header	5.00	fps	1.52	m/s	4.00	in	100.00
Centrifuge Decant Header	5.00	fps	1.52	m/s	6.00	in	150.00
Centrifuge Decant Lateral	5.00	fps	1.52	m/s	4.00	in	100.00

Mechanical Material Requirements:

Pipe Name	Pipe ID	Installation Type	Pipe Material	Pipe Lining Material	Pipe Coating Material	Comments	Red Flags
Centrifuge Feed Header	CFH	Exposed	DI	Cement Mortar	Tape Coating		
Centrifuge Feed Lateral	CFL	Exposed	Steel	Cement Mortar	Paint		
Centrifuge Drain Lateral/Header	CD	Exposed	Steel	Cement Mortar	Paint		

Centrifuge Decant Header	CDH	Exposed	Steel	Cement Mortar	Paint		
Centrifuge Decant Lateral	CDL	Exposed	Steel	Cement Mortar	Paint		

Electrical User Inputs and Sizing Requirements:

Is this a "Critical" Facility (requiring standby power)?	Yes	Y/N
Is there SWGR?	No	

Electrical Equipment Lengths:

Item	Quantity	HP per Each	AFD's Required?	MCC Spaces for Motor Starters	MCC Spaces for AFD's less than 50hp)	MCC Spaces for Breakers	MCC Total MCC Spaces
Centrifuges (Active)	2	200.00	No	12.00	0.00	0.00	
Centrifuges (Standby)	1	200.00	No	6.00	0.00	0.00	
Centrifuge Conveyor Belt	1	3.00	No	2.00	0.00	0.00	
Truck Conveyor Belt	2	3.00	No	4.00	0.00	0.00	
User Defined Item #1	0	0.00	No	0.00	0.00	0.00	
User Defined Item #2	0	0.00	No	0.00	0.00	0.00	
TOTAL		**609.0**		**24.00**	**0.00**	**0.00**	**24.00**

Electrical Equipment Widths:

Equipment	Depth (ft)
MCC	1.67
Small AFD's	0.00
Large AFD's	0.00
Switchgear	0.00
Maximum Depth	**1.67**

Clear Distances:

Clear Distance	Width	Length	Comment	
CD1		**3.00**	Clear Distance between wall and MCC	Typically 3 feet
CD2		**1.00**	Clear Distance between MCC and Small AFD	Typically 1 foot
CD3		**0.00**	Clear Distance between Small AFD and Large AFD	Typically Zero
CD4		**0.00**	Clear Distance between Large AFD and Switchgear	Typically Zero
CD5		**0.00**	Clear Distance between Switchgear and Contingency Space	Typically Zero
CD6	**4.00**		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)	
CD7	**3.00**		Clear Distance in front of Equipment	Tyipcally 3 feet
Contingency Length		**0.00**	Contingency length	Typically Zero

Electric Room Length (ft):

CD1	3.00
MCC	13.33
CD2	1.00
Small AFD's	0.00
CD3	0.00
Large AFD's	0.00
CD4	0.00
Swithgear	0.00
CD5	0.00
Contingency	0.00
Total Length	**17.33**

Electric Room Width (ft):

CD6	0.00	If there is no switchgear, this distance will be Zero.
Maximum Equipment Depth	1.67	
CD7	3.00	
Total Width	**4.67**	

Estimating Dimensions:	Value English	Unit (English)	Value (Metric)	Unit (Metric)	Name	Red Flags	Comment
Centrifuge Building							
Building Length	89.17	ft	27178.00	mm			
Building Width	76.75	ft	23393.40	mm			
Slab on Grade Length	93.17	ft	28397.20	mm			
Slab on Grade Width	80.75	ft	24612.60	mm			
Excavation Length	97.17	ft	29616.40	mm			
Excavation Width	84.75	ft	25831.80	mm			
Excavation Depth	3.50	ft	1066.80	mm			
Stair Height	24.00	ft	7315.20	mm			
Slab on Grade Thickness	**18.00**	in	**457.20**	mm			Model based on 18"
Slab on Grade Thickness	1.50	ft	457.20	mm			
Wall Thickness	**12.00**	in	**304.80**	mm			Model based on 12"
Wall Thickness	1.00	ft	304.80	mm			
Elevated Slab Thickness	**12.00**	in	**304.80**	mm			Model based on 12"
Elevated Slab Thickness	1.00	ft	304.80	mm			
Chemical Containment Wall Thickness	**8.00**	in	**203.20**	mm			
Chemical Containment Wall Thickness	0.67	ft	203.20	mm			

COST ESTIMATE

Description	Quantity (English)	Unit (English)	Quantity (Metric)	Unit (Metric)	$/Unit	Total Cost	User Over-Write
SITEWORK:							
Excavation	1288.02	CY	984.76	m3	*$6.72*	$8,659	
Imported Structural Backfill	609.99	CY	466.37	m3	*$50.94*	$31,074	

Native Backfill	82.54	CY	63.10	m3	*$8.27*	$682	
Haul Excess	1205.49	CY	921.66	m3	*$8.27*	$9,964	
Allowance for Misc Items	5%				$50,379.26	$2,519	
Subtotal						$52,898	
CONCRETE:							
Centrifuge Building Slab on Grade	417.96	CY	319.55	m3	***$490.62***	$205,056	
Elevated Slab	265.90	CY	203.30	m3	***$1,333.77***	$354,652	
Equipment Pads	12.73	CY	9.73	m3	***$490.62***	$6,246	
Allowance for Misc Items	5%				$565,954.44	$28,298	
Subtotal						$594,252	
MASONRY:	**Moderate**						
CMU Building	13687.08	SF	1271.57	m2	*$165.31*	$2,262,553	
Subtotal						$2,262,553	
METALS:							
Stairway	72	Risers			*$495.92*	$35,706	
Guardrail	356.67	LF	108.71	m	*$27.82*	$9,922	
Allowance for Misc Items	10%				$45,627.69	$4,563	
Subtotal						$50,190	
EQUIPMENT:							**Budgetary Quote: (CPES will automatically add Installation Factor)**
Centrifuges	3	EA			***$939,649.32***	$2,818,948	
Liquid Polymer Feed System	2	EA			***$11,347.52***	$22,695	
Shaftless Screw Conveyer	133.13	ft	40.58	m	***$2,884.42***	$383,989	
Allowance for Misc Items	10%				$3,225,631.55	$322,563	
Subtotal						$3,548,195	Total Horsepower >>>>
							Percent On-Line Factor >>>>
I&C:							Effective On-Line Horsepower >>>>
Instruments							
Centrifuge Feed Header Magmeter (CFH, 6 inch)	1	EA			$5,118.41	$5,118	
Isolation Valve Actuators (Electric)	9	EA			***$6,409.82***	$57,688	
Slide Gate Actuators	14	EA			$2,781.77	$38,945	
Number of Analog I/O Counts	2	EA			$264.27	$529	
Number of Digital I/O Counts	138	EA			$62.59	$8,637	
Number of Local Panels	3	EA			$13,074.33	$39,223	
Number of PLC's	1	EA			$13,908.86	$13,909	
I&C Conduit Wire	2716.00	LF	827.84	m	$12.06	$32,752	
Allowance for Misc Items	5%				$196,801.59	$9,840	
Subtotal						$206,642	
							Percent On-Line Factor >>>>
CONVEYING SYSTEMS:							Effective On-Line Horsepower >>>>
Bridge Crane (8 Ton)	1	EA			*$70,027.47*	$70,027	
Bridge Crane Rail	178.33	LF	54.36	m	*$36.37*	$6,486	
Allowance for Misc Items	10%				$76,513.89	$7,651	
Subtotal						$84,165	
MECHANICAL:							
Pipe:							
Centrifuge Feed Header (CFH, DI, 6 inch, Exposed)	99.33	LF	30.28	m	*$52.02*	$5,167	
Centrifuge Feed Lateral (CFL, Steel, 4 inch, Exposed)	17.25	LF	5.26	m	*$92.45*	$1,595	
Centrifuge Drain Lateral/Header (CD, Steel, 4 inch, Exposed)	116.58	LF	35.53	m	*$92.45*	$10,779	
Centrifuge Decant Header (CDH, Steel, 6 inch, Exposed)	99.33	LF	30.28	m	*$138.68*	$13,776	
Centrifuge Decant Lateral (CDL, Steel, 4 inch, Exposed)	17.25	LF	5.26	m	*$92.45*	$1,595	
Elbows:							
Centrifuge Feed Header (CFH, DI, 6 inch)	3	EA			*$1,091.82*	$3,275	
Centrifuge Feed Lateral (CFL, Steel, 4 inch)	3	EA			*$556.80*	$1,670	
Centrifuge Drain Lateral/Header (CD, Steel, 4 inch)	3	EA			*$556.80*	$1,670	
Centrifuge Decant Header (CDH, Steel, 6 inch)	6	EA			*$835.20*	$5,011	
Centrifuge Decant Lateral (CDL, Steel, 4 inch)	3	EA			*$556.80*	$1,670	
End Caps:							
Centrifuge Feed Header (CFH, DI, 6 inch)	0	EA			*$270.96*	$0	
Centrifuge Feed Lateral (CFL, Steel, 4 inch)	0	EA			*$180.64*	$0	
Centrifuge Drain Lateral/Header (CD, Steel, 4 inch)	0	EA			*$180.64*	$0	
Centrifuge Decant Header (CDH, Steel, 6 inch)	0	EA			*$270.96*	$0	
Centrifuge Decant Lateral (CDL, Steel, 4 inch)	0	EA			*$180.64*	$0	
Tee:							
Centrifuge Feed Header (CFH, DI, 6 inch)	2	EA			*$1,812.94*	$3,626	
Centrifuge Feed Lateral (CFL, Steel, 4 inch)	0	EA			*$1,268.60*	$0	
Centrifuge Drain Lateral/Header (CD, Steel, 4 inch)	2	EA			*$1,268.60*	$2,537	
Centrifuge Decant Header (CDH, Steel, 6 inch)	2	EA			*$1,902.90*	$3,806	
Centrifuge Decant Lateral (CDL, Steel, 4 inch)	0	EA			*$1,268.60*	$0	
Valves:							
Centrifuge Feed Header (CFH, DI, 6 inch)	0	EA			*$5,316.38*	$0	
Centrifuge Feed Lateral (CFL, Steel, 4 inch)	3	EA			*$4,072.29*	$12,217	
Centrifuge Drain Lateral/Header (CD, Steel, 4 inch)	3	EA			*$4,072.29*	$12,217	
Centrifuge Decant Header (CDH, Steel, 6 inch)	0	EA			*$6,108.44*	$0	
Centrifuge Decant Lateral (CDL, Steel, 4 inch)	3	EA			*$4,072.29*	$12,217	
Slide Gates:							
Centrifuge Conveyor Solids Gates (10 in)	2	EA			*$985.05*	$1,970	
Truck Conveyor Solids Gates (10 in)	12	EA			*$985.05*	$11,821	
Allowance for Misc Items	5%				$106,619.21	$5,331	
Subtotal						$111,950	
ELECTRICAL:							
# MCC Sections	8	EA			*$10,730.27*	$85,842	
Switchgear	0	EA			*$49,359.23*	$0	
Adjustable Frequency Drives							
Centrifuges (Active) (200 hp each)	0	EA			***$35,092.00***	$0	
Centrifuges (Standby) (200 hp each)	0	EA			***$35,092.00***	$0	
Centrifuge Conveyor Belt (3 hp each)	0	EA			***$9,258.95***	$0	
Truck Conveyor Belt (3 hp each)	0	EA			***$9,258.95***	$0	
Electrical Conduit & Wire	679.00	LF	206.96	m	**$12.06**	$8,188	
Allowance for Misc Items	10%				$94,030.19	$9,403	
Subtotal						$103,433	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00		0.00		0.00	$0	

Item 2 Description	0.00		0.00		0.00	$0	
Item 3 Description	0.00		0.00		0.00	$0	
Item 4 Description	0.00		0.00		0.00	$0	
Item 5 Description	0.00		0.00		0.00	$0	
Item 6 Description	0.00		0.00		0.00	$0	
Item 7 Description	0.00		0.00		0.00	$0	
Item 8 Description	0.00		0.00		0.00	$0	
Item 9 Description	0.00		0.00		0.00	$0	
Item 10 Description	0.00		0.00		0.00	$0	
Item 11 Description	0.00		0.00		0.00	$0	
Item 12 Description	0.00		0.00		0.00	$0	
Item 13 Description	0.00		0.00		0.00	$0	
Item 14 Description	0.00		0.00		0.00	$0	
Item 15 Description	0.00		0.00		0.00	$0	
Subtotal						$0	
Subtotal						$7,014,279	
ALLOWANCES:		**User Override**					
Finishes Allowance	2.00%		$7,707,999	$154,160			
I&C Allowance	2.00%		$7,707,999	$154,160			
Mechanical Allowance	3.00%		$7,707,999	$231,240			
Electrical Allowance	2.00%		$7,707,999	$154,160			
					Facility Cost Name		
Facility Cost	**19,301**	**Dry Pounds per Day**	**$399.35**	**$7,707,999**	SCEFC01		
Facility Cost with Standard Additional Project Costs Added	**19,301**	**Dry Pounds per Day**	**$485.24**	**$9,365,747**	SCEFC02		
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**19,301**	**Dry Pounds per Day**	**$841.68**	**$16,245,462**	SCEFC03		
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**19,301**	**Dry Pounds per Day**	**$692.70**	**$13,369,996**	SCEFC05		
Facility Cost with Standard Additional Project Costs, Contractor Markups, and Location Adjustment Factor Added	**19,301**	**Dry Pounds per Day**	**$841.68**	**$16,245,462**	SCEFC06		

Wet Pit Submersible Pump Station

Is This Facility Included in My Project? Yes

Notes to Designer:

This Model is designed around the ITT Flygt Large Submersible Pump Design Recommendations with a maximum pump cycling of 5 starts per hour

For applications with a discharge pressure over 250 feet, use the Vertical Turbine PS Model. Submersible pumps are used in applications with smaller heads

If this is a Seawater Desalination Application, the materials in contact with seawater need to be corrosion resistant.

Process User Inputs:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Comment	Red Flags
Is this Facility Included in a Seawater Treatment Train?	No	Y/N					
Input Design Pump Station Inflow	3.91	mgd	20.19	ML/d			
Conversion of Design P.S. Flow from MGD to CFS	6.05	cfs	0.17	m3/s			
Input Average Pump Station Flow	2.85	mgd	15.84	ML/d			
Conversion of Average P.S. Flow from MGD to CFS	4.42	cfs	0.13	m3/s			
Input Maximum Water Temperature	50.00	degrees F	10.00	degrees C			
Calculate Maximum Vapor Pressure	0.40	ft	122.73	mm			
Input Pump Station Site Elevation	750.00	ft	228.60	m			
Calculate Atmospheric Pressure	33.02						
Mechanical Design Inputs:							
Pipe Name	**Input Velocity**	**Unit (English)**	**Input Velocity**	**Unit (Metric)**	**Standard Pipe Size**	**Unit (English)**	**Standard Pipe Size**
Discharge Lateral Pipe	5.00	fps	1.52	m/s	10.00	in	250.00
Discharge Header Pipe	5.00	fps	1.52	m/s	16.00	in	400.00
Pipe Name	**Pipe ID**	**Installation Type**	**Pipe Material**	**Pipe Lining Material**	**Pipe Coating Material**	**Pipe Diameter**	**Pipe Length**
Discharge Lateral Pipe	DIS	Exposed	Steel	Cement Mortar	Paint	10.00	64.00
Discharge Header Pipe	DIS	Exposed/Buried	Steel	Cement Mortar	Paint	16.00	31.11
Select Type of Pump Isolation Valve	Butterfly Valve	Type					
Select Type of Pump Control Valve	Check Valve	Type					
Calculate Pump Discharge Lateral Pipe Length	16.00	ft	4876.80	mm	DLPL		
Calculate Pump Discharge Lateral Pipe Headloss	1.34	ft	407.13	mm	DLPH	Assumes minor loss K value for Tee, Valve, Control Valve, Elbow, and Reducer	
Is Pump Station Discharge Pressure Known?	Yes	Y/N					
Input Actual Design Discharge Pressure	50.00	ft	15,240.00	mm			
Input Design Discharge WSEL		ft		mm	MaxDL		
Input Length of Pump Station Discharge Header and Pipeline		ft		mm	LPSDP	Confirm with Hydraulic Analysis	
Input Total Friction Coefficient, K for Discharge Header Minor Losses		ft		mm	MPSDF	Friction K values should be obtained from D.S. Miller Internal Flow System.	
Input Hazen Williams Friction Coefficient	130.00	C			HWFC	Consult Conveyance GTL, for appropriate C value	
Calculate Design Discharge Header & Pipeline Dynamic Headloss	0.03	ft	8.13	mm	maxDPDH		
Calculate Total Dynamic Head at Design Flow	50.00	ft	15240.00	mm	maxTDH		
Pump Selection Design Inputs:							
Input Number of Active Pumps	3	#			NAP	Should be 1,2,3,5, or 7 if there is a standby pump	
Include a Standby Pump?	Yes	Y/N					
Pump Efficiency	75.00%					Fixed	
Motor Efficiency	95.00%					Fixed	
AFD Efficiency	95.00%					Fixed	
Safety Margin Allocated in Pump Design Brake Horsepower	1.15					Fixed	
Input Pump Information	**Capacity (MGD)**	**AFD? (Yes or No)**	**Actual Individual Pump Sizing Flow (GPM)**	**Calculated Individual Pump BHP**	**Actual Individual Pump BHP**	**Pump?? ("1"= Yes, "0" = No)**	**Weir Pump Model Number**
Active Pump # 1	1.30	Yes	1000	18.44999955	25	1.00	F1000_HP25_C3201.180_MT
Active Pump # 2	1.30	Yes	1000	18.44999955	25	1.00	F1000_HP25_C3201.180_MT
Active Pump # 3	1.30	Yes	1000	18.44999955	25	1.00	F1000_HP25_C3201.180_MT
Active Pump # 4	0.00	No	0	0	-	0.00	#N/A
Active Pump # 5	0.00	No	0	0	-	0.00	#N/A
Active Pump # 6	0.00	No	0	0	-	0.00	#N/A
Active Pump # 7	0.00	No	0	0	-	0.00	#N/A
Calculate Standby Pump Capacity = Max Pump	1.30	Yes	1000	18.44999955	25	1.00	F1000_HP25_C3201.180_MT
Calculate Total Active Pump Capacity	3.91	4.00	3000	55.34999864	75	**User Override Pump Criteria (Pump 1)**	
Calculate Total P.S. Capacity	5.21	mgd	4000	73.79999818	100	**User Override Pump Criteria (Pump 2)**	
Calculate Total Number of Pumps (Active & Standby)	4.00	#			TNP	should be 2,3,4,6, or 8	
Recommended NPSHR Margin	1.50	#				Fixed - Verify Margin with Pump Manufacturer	
Calculate Minimum Submergence based on NPSHR Margin or HI Standards	1.34	ft	408.77	mm	mSUB	Calculated - Verify with Pump Manufacturer	
Calculate Pump Elevation based on Minimum Submergence Requirements	742.21	ft	226225.90	mm		Calculated	
Wet Well Design Calculations:							
Calculate Number of Wet Wells	1.00	#			NW		
Calculate Number of Pumps per Wet Well	4.00	#			PPW		

Calculate Conceptual Minimum Wet Well Volume	16,296.00	gal	61.69	m3	MWWV	Vreq=T*2*Q/4; T=12	
Calculate Distance From Wall to Baffles	50.68	in	1287.16	mm	WTB		
Calculate Conceptual Distance From Wall to Pump Center	87.20	in	2214.95	mm	PWFW	Greater than or equal to this value	
Calculate Distance Between Pump Shells	37.45	in	951.29	mm	DBPS		
Calculate Length From Wall to Pump Center	18.16	in	461.15	mm	PLFW	Less than or equal to this value	
Calculate Operational Wet Well Width	12.12	ft	3694.50	mm			
Calculate Operational Wet Well Length	19.70	ft	6005.03	mm	WWL		
Calculate Operational Wet Well Surface Area	238.80	sf	22.19	m2			
Calculate Minimum Operational Wet Well Depth	9.12	ft	2780.50	mm	OWWD		
Input Additional Storage Volume Requirements	0.00	gal		m3			
Input Wet Well Freeboard	2.00	ft		mm	WWFB	Typically 2 to 3 feet	
Calculate Required Wet Well Width	12.12	ft	3694.50	mm	WWW		
Calculate Total Required Wet Well Depth	15.12	ft	4609.30	mm	WWD		
Calculate Total Wet Well Volume	3,611.28	cf					
Calculate Total Wet Well Volume	27,014.26	gal			WWV		
Calculate Minimum Wet Well Low Operating Level Required	746.21	ft	227445.10	mm			
Calculate Maximum Wet Well High Operating Level Required	755.33	ft	230225.60	mm			
Does Wet Well Have a Liner?	No	Y/N					
Calculate Wet Well Liner Surface Area	0.00	sf	0.00	m2			

Pump Station Design User Inputs:	Value (English)	Unit (English)	Value (Metric)	Unit (Metric)	Name	Comment	Red Flags
Input Lateral Pipe Distance from Wall to Valve	1.00	ft	100.00	mm	PDWV	Typically 1 foot	
Input Lateral Distance from Valve to Header	4.00	ft		mm	VTHD	Minimum 2 feet	
Input Clear Distance Width From Discharge Header to Wall	6.00	ft		mm	HTW	Minimum 6 feet	
Input Discharge Pipe Distance from Wet Well Ceiling	4.00	ft		mm	PDTC	Typically 4 feet	
Input Discharge Pipe Height From Operating Room Floor	1.00	ft		mm	HHTF	Typically 1-2 feet	
Input Clear Distance Length Discharge Header to Wall	3.00	ft		mm	CDHW	Typically 3-4 feet	
Calculate Vertical Lateral Pipe Length	8.62	ft			VLPL		
Is the Surge Protection Area Covered?	No	Y/N					
Input Cutback Slope	1.50	:1				Cutback slope should be 1:1 for depth of burial≤ 5 ft, and at least 1.5:1 for depth of burial > 5 ft.	
Input Over Excavation Depth	1.00	ft	609.60	mm			
Electrical User Inputs and Sizing Requirements:							
Is this a "Critical" Facility (requiring standby power)?	No	Y/N					
Is there SWGR?	No						

Item	Quantity	HP per Each	AFD's Required?	MCC Spaces for Motor Starters	MCC Spaces for AFD's less than 50hp)	MCC Spaces for Breakers	MCC Total MCC Spaces
Active Pump # 1	1.00	26.32	Yes	0.00	6.00	2.00	
Active Pump # 2	1.00	26.32	Yes	0.00	6.00	2.00	
Active Pump # 3	1.00	26.32	Yes	0.00	6.00	2.00	
Active Pump # 4	0.00	0.00	No	0.00	0.00	0.00	
Active Pump # 5	0.00	0.00	No	0.00	0.00	0.00	
Active Pump # 6	0.00	0.00	No	0.00	0.00	0.00	
Active Pump # 7	0.00	0.00	No	0.00	0.00	0.00	
Standby	1.00	26.32	Yes	0.00	6.00	2.00	
User Defined Item #1	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #2	0.00	0.00	No	0.00	0.00	0.00	
User Defined Item #3	0.00	0.00	No	0.00	0.00	0.00	
TOTAL		**105.26**		**0.00**	**24.00**	**8.00**	**32.00**

Electrical Equipment Lengths:

Equipment	Depth (ft)
MCC	1.67
Small AFD's	0.00
Large AFD's	0.00
Switchgear	0.00
Maximum Depth	**1.67**

Clear Distances:

Clear Distance	Width	Length	Comment	
CD1		3.00	Clear Distance between wall and MCC	Typically 3 feet
CD2		1.00	Clear Distance between MCC and Small AFD	Typically 1 foot
CD3		0.00	Clear Distance between Small AFD and Large AFD	Typically Zero
CD4		0.00	Clear Distance between Large AFD and Switchgear	Typically Zero
CD5		0.00	Clear Distance between Switchgear and Contingency Space	Typically Zero
CD6	4.00		Clear Distance behind Switchgear (If there is no Switchgear, this distance will be Zero)	
CD7	3.00		Clear Distance in front of Equipment	Tyipcally 3 feet
Contingency Length		0.00	Contingency length	Typically Zero

Electric Room Width (ft):

CD1	3.00
MCC	11.67
CD2	1.00

Small AFD's	0.00						
CD3	0.00						
Large AFD's	0.00						
CD4	0.00						
Swithgear	0.00						
CD5	0.00						
Contingency	0.00						
Total Width	**15.67**				ERL		
Electric Room Length (ft):							
CD6	0.00					If there is no switchgear, this distance will be Zero.	
Maximum Equipment Depth	1.67						
CD7	3.00						
Total Length	**4.67**				ERW		
Stair Dimensions:							
Operating Room Floor Elevation	751.00	ft			OREL		
Hatch Access Elevation	758.33	ft			HAEL		
Total Stair Height	88.00	in			TSH		
Individual Step Height	**7.00**	in		Between 6 and 8 inche	ISTH		
Number of Steps	13.00				NS		
Last Step Height	4.00	in			LSH		
Step Width	**12.00**	in		Typically 12 inches	SW		
Step Length	4.00	ft		Fixed	SL		
Handrail Length	13.00	ft			HRL		
Handrail Height	4.00	ft		Fixed	HRH		
Hatch Access Dimensions:							
Is Hatch Access Area Covered?	**Yes**	Y/N					
Double Door Width	**5.00**	ft		Typically at least 5 feet	DDW		
Clear Distance From Doors to Steps	**2.00**	ft		Between 2 and 4 feet	DTSW		
Landing Platform Width	**6.00**	ft		At least 6 feet	LPW		
Landing Platform Length	**4.00**	ft		Typically 4 feet	LPL		
Total Area Required	396.27	sf					
Hatch Access Area Without Wet Well Ceiling	53.00	ft					
Hatch Length	3.44	ft			HL		
Hatch Width	4.85	ft			HW		
Access Hatch Length	2.00	ft		Fixed	AHL		
Access Hatch Width	1.50	ft		Fixed	AHW		
Influent Pipe and Baffle Dimensions:							
Inlet Pipe Diameter	**24.00**	in			IPD		
Influent Pipe Height From Floor	4.00	ft		measured from top of pipe	IPHF		
Influent Pipe Offset Distance	11.64	in			IPOD		
Baffle Clearance Height	29.54	in			BCH		
Baffle Length	2.00	ft		Fixed	BL		
Baffle Height	4.00	ft		Same as IPHF	BH		
Baffle Thickness	6.00	in		Fixed	BT		
Inlet Slope Width	69.84	in			ISW		
Inlet Slope Height	11.64	in			ISH		
Estimating Dimensions:	**Value (English)**	**Unit (English)**	**Value (Metric)**	**Unit (Metric)**	**Name**	**Comment**	**Red Flags**
Mechanical Fitting Dimensions:							
Discharge Lateral Increaser Length	0.67	ft	203.20	mm	DLIL		
Pump Control Valve Length	2.42	ft	736.60	mm	PCVL		
Discharge Lateral Butterfly Valve Length	0.67	ft	203.20	mm	BFVL		
Discharge Lateral to Header Increaser Length	2.00	ft	609.60	mm	LHIL		
Magmeter Length	2.00	ft	609.60	mm	MML		
Operating Room Area:							
Slab On Grade							
Operating Room Floor Width	16.42	ft	5003.80	mm	ORFW		
Operating Room Floor Length	40.71	ft	12408.23	mm	ORFL		
Concrete Thickness	**12.00**	in	**457.20**	mm		Model based on 24"	
Concrete Thickness	1.00	ft	304.80	mm	ORFST		
Surge Protection Area:							
Slab on Grade							
Overall Surge Area Width	16.42	ft	5003.80	mm	SSOGW		
Overall Surge Area Length	10.18	ft	3102.06	mm	SSOGL		
Concrete Thickness	**12.00**	in	**609.60**	mm		Model based on 24"	
Concrete Thickness	1.00	ft	304.80	mm	SSOGT		
Electrical Room Area:							
Slab on Grade							
Electrical Room Width	17.67	ft	5384.80	mm	ESOGW		
Electrical Room Length	6.67	ft	2032.00	mm	ESOGL		
Concrete Thickness	**12.00**	in	**609.60**	mm		Model based on 24"	
Concrete Thickness	1.00	ft	304.80	mm	ESOGT		
Pump Station Wet Well:							
Floor Slab							
Wet Well Floor Slab Area	343.27	sf	31.89	m2			
Wet Well Floor Slab Thickness	**24.00**	in	**609.60**	mm		Model based on 24"	
Wet Well Floor Slab Thickness	2.00	ft	609.60	mm	WWFST		
Wet Well Walls							
Wet Well Width	12.12	ft	3694.50	mm	WWW		
Wet Well Length	19.70	ft	6005.03	mm	WWL		
Wet Well Depth	15.12	ft	4609.30	mm	WWD		
Wall Thickness	**18.00**	in	**304.80**	mm		Model based on 12"	
Wall Thickness	1.50	ft	457.20	mm	WWWT		
Elevated Ceiling Slab							
Wet Well Ceiling Area	343.27	sf	31.89	m2			
Elevated Slab Thickness	**12.00**	in	**304.80**	mm		Model based on 12"	

Elevated Slab Thickness	1.00	ft	304.80	mm	WWCT		
Hatch Access Room Area:							
Elevated Floor Slab							
Overall Hatch Access Area	396.27	sf	36.81	m2			
Overall Hatch Access Area New Concrete Required	53.00	sf	4.92	m2			
Concrete Thickness	**12.00**	in	**457.20**	mm			
Concrete Thickness	1.00	ft	304.80	mm	SOGT		
Overall Facility Dimensions:							
Operating Room Slab Length	40.71	ft	12408.23	mm			
Operating Room Slab WIdth	16.42	ft	5003.80	mm			
Operating Room Excavation Length	44.71	ft	13627.43	mm			
Operating Room Excavation Width	20.42	ft	6223.00	mm			
Operating Room Excavation Depth	1.00	ft	304.80	mm			
Wet Well Area	343.27	sf	31.89	m2			
Wet Well Excavation Length	26.70	ft	8138.63	mm			
Wet Well Excavation Width	19.12	ft	5828.10	mm			
Wet Well Excavation Depth	18.12	ft	5523.70	mm			
Surge Protection SOG Area	167.08	sf	15.52	m2			
Surge Protection Excavation Area	289.45	sf	26.89	m2			
Surge Protection Excavation Depth	2.00	ft	609.60	mm			
Electrical Room SOG Area	117.78	sf	10.94	m2			
Electrical Room Excavation Area	231.11	sf	21.47	m2			
Electrical Room Excavation Depth	2.00	ft	609.60	mm			
Hatch Access SOG Area	53.00	sf	4.92	m2			
Hatch Access Excavation Area	58.00	sf	5.39	m2			
Hatch Access Excavation Depth	2.00	ft	609.60	mm			

COST ESTIMATE

Description	Quantity (English)	Unit (English)	Quantity (Metric)	Unit (Metric)	$/Unit	Total Cost	User Over-Write
SITEWORK:							
Operating Room:							
Excavation	41.92	CY	32.05	m3	*$6.72*	$282	
Imported Structural Backfill	67.62	CY	51.70	m3	*$50.94*	$3,444	
Native Backfill	3.62	CY	2.77	m3	*$8.27*	$30	
Haul Excess	38.30	CY	29.28	m3	*$8.27*	$317	
Wet Well:							
Excavation	1047.38	CY	800.78	m3	*$6.72*	$7,042	
Imported Structural Backfill	37.82	CY	28.92	m3	*$50.94*	$1,927	
Native Backfill	592.47	CY	452.97	m3	*$8.27*	$4,897	
Haul Excess	454.91	CY	347.80	m3	*$8.27*	$3,760	
Surge Protection:							
Excavation	32.48	CY	24.83	m3	*$6.72*	$218	
Imported Structural Backfill	21.44	CY	16.39	m3	*$50.94*	$1,092	
Native Backfill	7.56	CY	5.78	m3	*$8.27*	$62	
Haul Excess	24.92	CY	19.05	m3	*$8.27*	$206	
Hatch Access Room:							
Excavation	7.66	CY	5.85	m3	*$6.72*	$51	
Imported Structural Backfill	4.30	CY	3.28	m3	*$50.94*	$219	
Native Backfill	2.54	CY	1.94	m3	*$8.27*	$21	
Haul Excess	5.12	CY	3.91	m3	*$8.27*	$42	
Electrical Room:							
Excavation	26.74	CY	20.45	m3	*$6.72*	$180	
Imported Structural Backfill	17.12	CY	13.09	m3	*$50.94*	$872	
Native Backfill	6.76	CY	5.17	m3	*$8.27*	$56	
Haul Excess	19.98	CY	15.28	m3	*$8.27*	$165	
Allowance for Misc Items	5%				$24,883.36	$1,244	
Subtotal						$26,128	
CONCRETE:							
Operating Room							
Foundation	31.35	CY	23.97	m3	*$541.11*	$16,962	
Pipe Supports	0.58	CY	0.44	m3	*$490.62*	$283	
Electrical Room							
Foundation	4.36	CY	3.34	m3	*$541.11*	$2,360	
Surge Protection							
Foundation	6.19	CY	4.73	m3	*$541.11*	$3,348	
Pump Station Wet Well							
Floor Slab	25.43	CY	19.44	m3	*$490.62*	$12,475	
Wet Well Walls	58.51	CY	44.74	m3	*$880.79*	$51,536	
Ceiling Slab	12.71	CY	9.72	m3	*$1,333.77*	$16,957	
Pump Baffling	6.65	CY	5.09	m3	*$880.79*	$5,858	
Inlet Slope	2.06	CY	1.57	m3	*$490.62*	$1,011	
Pipe Support Fitting	8.60	CY	6.57	m3	*$490.62*	$4,218	
Hatch Access Room							
Foundation	1.96	CY	1.50	m3	*$198.37*	$389	
Allowance for Misc Items	5%				$115,397.65	$5,770	
Subtotal						$121,168	
MASONRY:	**Moderate**						
Operating Room	866.78	SF	80.53	m2	*$165.31*	$143,283	
Hatch Access Room	396.27	SF	36.81	m2	*$165.31*	$65,506	
Surge Building	0.00	SF	0.00	m2	*$165.31*	$0	
Electrical Room	117.78	SF	10.94	m2	*$165.31*	$19,469	
Subtotal	1380.83					$228,259	
METALS:							
Pump Removal Hatches	69.74	SF	6.48	m2	***$160.25***	$11,176	
Stairs	20.00	Risers			***$495.92***	$9,918	
Access Hatch Ladder	15.12	VLF	4.61	VLM	***$141.02***	$2,132	
Allowance for Misc Items	10%				$23,227.14	$2,323	
Subtotal						$25,550	

THERMAL & MOISTURE PROTECTION:							
Wet Well Liner	0.00	SF	0.00	m2	$16.00	$0	
Allowance for Misc Items	10%				$0.00	$0	
Subtotal						$0	
EQUIPMENT:							Budgetary Quote: (CPES will automatically add Installation Factor)
Pumps							
Active Pump # 1	1.00	EA			$32,263.02	$32,263	
Active Pump # 2	1.00	EA			$32,263.02	$32,263	
Active Pump # 3	1.00	EA			$32,263.02	$32,263	
Active Pump # 4	0.00	EA			$0.00	$0	
Active Pump # 5	0.00	EA			$0.00	$0	
Active Pump # 6	0.00	EA			$0.00	$0	
Active Pump # 7	0.00	EA			$0.00	$0	
Standby Pump	1.00	EA			$32,263.02	$32,263	
Allowance for Misc Items	10%				$129,052.08	$12,905	
Subtotal						$141,957	
INSTRUMENTATION & CONTROLS:							
Instruments							
Isolation Valve Actuators	5.00	EA			$6,409.82	$32,049	
Control Valve Actuators	4.00	EA			$6,409.82	$25,639	
Level Indicator Transmitters	2.00	EA			$10,700.91	$21,402	
Level Swithces	0.00	EA			$11,264.12	$0	
Pressure Indicator Transmitters	1.00	EA			$11,264.12	$11,264	
Pressure Switches	4.00	EA			$11,264.12	$45,056	
Number of Analog I/O Counts	21.60	EA			$264.27	$5,708	
Number of Digital I/O Counts	58.80	EA			$62.59	$3,680	
Number of PLC's	1.00	EA			$13,074.33	$13,074	
I&C Conduit & Wire	651.35	LF	198.53	m	$12.06	$7,855	
Allowance for Misc Items	10%				$165,728	$16,573	
Subtotal						$182,301	
MECHANICAL:							
Pipe:							
Discharge Lateral Pipe (10-inch,DIS, Exposed, Steel, Cement Mortar, Paint)	64.00	LF	19.51	m	$301.76	$19,313	
Discharge Header Pipe (16-inch,DIS, Exposed/Buried, Steel, Cement Mortar, Paint)	31.11	LF	9.48	m	$493.82	$15,364	
Elbows:							
Pump Discharge (6-inch)	4.00	EA			$460.10	$1,840	
Discharge Lateral Pipe (10-inch)	4.00	EA			$980.74	$3,923	
Discharge Header Pipe (16-inch)	2.00	EA			$1,761.70	$3,523	
Tees:							
Discharge Header Pipe (16-inch)	4.00	EA			$3,386.13	$13,545	
Valves:							
Discharge Lateral Isolation Valve (10-inch - Butterfly Valve)	4.00	EA			$1,302.01	$5,208	
Pump Control Valve (10-inch, Check Valve)	4.00	EA			$6,214.71	$24,859	
Discharge Header Isolation Valve (16-inch, BFV)	1.00	EA			$4,514.81	$4,515	
Air Release Vacuum Valves	1.00	EA			$1,922.95	$1,923	
Increasers:							
Pump Discharge to Discharge Lateral (6-inch to 10-inch)	4.00	EA			$980.74	$3,923	
Discharge Lateral to Discharge Header (10-inch to 16-inch)	4.00	EA			$1,761.70	$7,047	
Allowance for Misc Items	10%				$104,982.35	$10,498	
Subtotal						$115,481	
ELECTRICAL:							
MCC's							
Sections	7.00	EA			$10,730.27	$75,112	
AFD's							
Active Pump # 1	25.00	hp	18.64	kW	$485.75	$12,144	
Active Pump # 2	25.00	hp	18.64	kW	$485.75	$12,144	
Active Pump # 3	25.00	hp	18.64	kW	$485.75	$12,144	
Active Pump # 4	0.00	hp	0.00	kW	$0.00	$0	
Active Pump # 5	0.00	hp	0.00	kW	$0.00	$0	
Active Pump # 6	0.00	hp	0.00	kW	$0.00	$0	
Active Pump # 7	0.00	hp	0.00	kW	$0.00	$0	
Standby Pump	25.00	hp	18.64	kW	$485.75	$12,144	
Switchgear							
Units	0.00	EA			$49,359.23	$0	
Electrical Conduit & Wire	162.84	LF	49.63	m	$12.06	$1,964	
Allowance for Misc Items	5%				$125,651	$6,283	
Subtotal						$131,934	
USER DEFINED ESTIMATE ITEMS:	**QUANT (ENGLISH)**	**UNIT (ENGLISH)**	**QUANT (METRIC)**	**UNIT (METRIC)**	**$/UNIT**	**TOTAL COST**	
Item 1 Description	0.00		0.00		0.00	$0	
Item 2 Description	0.00		0.00		0.00	$0	
Item 3 Description	0.00		0.00		0.00	$0	
Item 4 Description	0.00		0.00		0.00	$0	
Item 5 Description	0.00		0.00		0.00	$0	
Item 6 Description	0.00		0.00		0.00	$0	
Item 7 Description	0.00		0.00		0.00	$0	
Item 8 Description	0.00		0.00		0.00	$0	
Item 9 Description	0.00		0.00		0.00	$0	
Item 10 Description	0.00		0.00		0.00	$0	
Item 11 Description	0.00		0.00		0.00	$0	
Item 12 Description	0.00		0.00		0.00	$0	
Item 13 Description	0.00		0.00		0.00	$0	
Item 14 Description	0.00		0.00		0.00	$0	
Item 15 Description	0.00		0.00		0.00	$0	
Subtotal						$0	

Subtotal						$972,776	
ALLOWANCES:		**User Override**					
Finishes Allowance	5.00%		$1,247,149	$62,357			
I&C Allowance	2.00%		$1,247,149	$24,943			
Surge Allowance	5.00%		$1,247,149	$62,357			
Mechanical Allowance	5.00%		$1,247,149	$62,357			
Electrical Allowance	5.00%		$1,247,149	$62,357			
Facility Cost	**100**	**Total Pump HP**	**$12,471.49**	**$1,247,149**			
Facility Cost with Standard Additional Project Costs Added	**100**	**Total Pump HP**	**$15,153.71**	**$1,515,371**			
Facility Cost with Standard Additional Project Costs and Contractor Markups Added	**100**	**Total Pump HP**	**$26,285.04**	**$2,628,504**			
Facility Cost, Contractor Markups, and Location Adjustment Factor Added (excluding ALL Additional Project Costs)	**100**	**Total Pump HP**	**$21,632.56**	**$2,163,256**			
Facility Cost with Standard Additional Project Costs, Contractor Markups and Location Adjustment Factor Added	**100**	**Total Pump HP**	**$26,285.04**	**$2,628,504**			

CH2M Parametric Engineering System (CPES)

FACILITIES LIFE CYCLE COST ANALYSIS MODULE

File Version: 9/21/2017

Linked to CPES Facilities File: C:\Users\lodell\Documents\PWB\Filtration\160mgdfiles\PWB Membrane Filtration CPES Facilities_160MGD.xlsm

Project Name:	***PWB Filtration Decision***
Project Number:	***699275***
Project Manager:	***Kelly Irving***
Estimator:	***Enoch Nicholson/Lee Odell***
Project Description:	***PWB Membrane Filtration***
Project Location (City):	***Portland OR***
Project Location (State):	***OREGON***
Project Location (Country):	***USA***
Cost Basis (Month/Year):	***April/2018***

Life Cycle Analysis:

i =	***5.00%***
n =	***25 years***
Annual Inflation:	***3.00%***

Item	Include? (Yes or No)	SCOPE OF PROJECT	Construction Cost	Annual O&M Cost (Year 1)	Life Cycle Cost (NPV)
	Yes	Flocculation: RapMix	$3,062,000	$208,000	$7,020,000
	Yes	Flocculation: Floc	$14,319,000	$131,000	$16,817,000
	No	DAF: DAF	$0	$0	$0
	No	Ozone Serpentine: Ozone	$0	$0	$0
	No	Filters: Filt	$0	$0	$0
	Yes	Concrete Clearwell: Clearwell	$50,789,000	$22,000	$51,196,000
	Yes	Liquid Chemical: Alum	$2,004,000	$710,000	$15,538,000
	Yes	Liquid Chemical: FAP	$503,000	$93,000	$2,263,000
	Yes	Liquid Chemical: CAP	$997,000	$668,000	$13,729,000
	Yes	Liquid Chemical: Hypo	$1,819,000	$421,000	$9,846,000
	Yes	On-Site Sodium Hypo: OSHG	$8,829,000	$662,000	$21,454,000
	Yes	Liquid Chemical: Caustic	$687,000	$6,000	$789,000
	Yes	Surge Basin-Decanter: BWSurge	$4,206,000	$36,000	$4,875,000
	Yes	Gravity Thickener: BWClar	$9,898,000	$116,000	$12,109,000
	Yes	Gravity Thickener: GravThick	$3,803,000	$45,000	$4,650,000
	Yes	WTP Centrifuge: Centrifuge	$12,416,000	$913,000	$29,826,000
	Yes	WPSPS: RecPS	$2,009,000	$41,000	$2,785,000
	Yes	Pall - Large: Membrane	$200,512,000	$12,612,000	$441,205,000
		Additional Project Costs:			
		Biosolids Disposal	$0	$0	$0
		Standard Items	$67,955,000	$2,321,000	$112,244,000
		User Defined Items	$0	$0	$0
		Plant O&M Labor		$972,000	$18,532,000
TOTAL - Life Cycle Analysis *(Red Flag Items and Market Adjustment Factor are EXCLUDED)*			$383,808,000	$19,977,000	$764,878,000
Construction Cost per GPD (based on Maximum Daily Flow Rate)			$3.49 / GPD		
Annual O&M Cost per 1,000 Gallons (based on Average Annual Daily Flow Rate)				$ 0.730 / Thousand Gallons	

CH2M Parametric Engineering System (CPES)

WTP LIFE CYCLE COST ANALYSIS
Summary of Annual O&M Costs (Year 1)

Project Name:	PWB Filtration Decision	Life Cycle Analysis:	
Project Number:	699275	i =	5.00%
Project Manager:	Kelly Irving	n =	25 years
Estimator:	Enoch Nicholson/Lee Odell	Annual Inflation:	3.00%
Project Description:	PWB Membrane Filtration		
Project Location (City):	Portland OR		
Project Location (State):	OREGON		
Project Location (Country):	USA		
Cost Basis (Month/Year):	April/2018		

Item	Is This Facility Included in Project? (Yes or No)	SCOPE OF PROJECT	Labor	Equipment Power	Building Electrical	Chemicals	Sludge Disposal	Specialty Items	Repair & Maintenance	Replacement	Other	User Defined	Total
5	Yes	Flocculation	$0	$99,489	$173	$0	$0	$0	$68,139	$0	$33,560	$0	$201,360
5	Yes	Flocculation	$0	$25,096	$20,093	$0	$0	$0	$60,708	$0	$21,180	$0	$127,077
11	No	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
16	No	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
12	No	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
22	Yes	Concrete Tank 1	$0	$0	$0	$0	$0	$0	$17,243	$0	$3,449	$0	$20,691
24	Yes	Liquid Chemical	$0	$2,689	$3,340	$553,717	$0	$0	$14,004	$0	$114,750	$0	$688,499
24	Yes	Liquid Chemical	$0	$896	$960	$70,675	$0	$0	$2,099	$0	$14,926	$0	$89,557
24	Yes	Liquid Chemical	$0	$1,793	$1,974	$530,065	$0	$0	$5,930	$0	$107,952	$0	$647,714
24	Yes	Liquid Chemical	$0	$2,988	$3,620	$321,848	$0	$0	$11,831	$0	$68,057	$0	$408,344
20	Yes	On-Site Sodium Hypochlorite Generation	$0	$243,792	$3,676	$91,433	$0	$0	$196,311	$0	$107,042	$0	$642,254
24	Yes	Liquid Chemical	$0	$598	$1,107	$0	$0	$0	$2,647	$0	$870	$0	$5,222
27	Yes	Combination Wastewater Surge Basin & Floating Tube Decanter Clarification (Large System >= 5MGD)	$0	$20,017	$95	$0	$0	$0	$8,246	$0	$5,672	$0	$34,030
30	Yes	Gravity Thickener	$0	$2,988	$1,831	$0	$0	$0	$88,928	$0	$18,749	$0	$112,496
30	Yes	Gravity Thickener	$0	$1,494	$1,008	$0	$0	$0	$33,415	$0	$7,183	$0	$43,100
31	Yes	Centrifuge Solids Dewatering	$0	$33,462	$16,086	$102,162	$365,252	$0	$221,092	$0	$147,611	$0	$885,664
4	Yes	Wet Pit Submersible Pump Station	$0	$22,407	$1,623	$0	$0	$0	$8,846	$0	$6,575	$0	$39,451
34	Yes	Pall Micro Filtration - Small Systems: .5 - 5 mgd	$0	$2,502,457	$110,294	$748,485	$0	$2,352,997	$4,489,302	$0	$2,040,707	$0	$12,244,241
		Totals	$0	$2,960,165	$165,881	$2,418,384	$365,252	$2,352,997	$5,228,739	$0	$2,698,284	$0	$16,189,701
		Additional Project Costs:											
		Biosolids Disposal					$0					$0	$0
		Standard Items							$1,877,529	$0	$375,506	$0	$2,253,035
		User Defined Items		$0	$0	$0		$0	$0	$0	$0	$0	$0
		Plant O&M Labor	$942,720										$942,720
		TOTAL - O&M Cost	$942,720	$2,960,165	$165,881	$2,418,384	$365,252	$2,352,997	$7,106,268	$0	$3,073,789	$0	$19,385,456
		Percent of TOTAL Cost	4.9%	15.3%	0.9%	12.5%	1.9%	12.1%	36.7%	0.0%	15.9%	0.0%	100.0%

Item	Is This Facility Included in Project? (Yes or No)	SCOPE OF PROJECT	Labor	Equipment Power	Building Electrical	Chemicals	Sludge Disposal	Specialty Items	Repair & Maintenance	Replacement	Other	User Defined	Total

Item	Is This Facility Included in Project? (Yes or No)	SCOPE OF PROJECT	Labor	Equipment Power	Building Electrical	Chemicals	Sludge Disposal	Specialty Items	Repair & Maintenance	Replacement	Other	User Defined	Total

Flocculation (Horizontal Paddle Wheel Flocculation for Downstream Sedimentation)

Construction Cost:					**$3,061,676**	
Annual O&M Cost:						
Power:	**Total HP**	**Average-to-Maximum Flow Factor**	**Annual Usage (Hours / Year)**	**$/kWh**	**Power Cost**	**Annual Usage Hours / Year (Over-write)**
Equipment Power	333	68%	8,760	$ 0.06	**$ 82,907**	
Other Electrical:	**Building Area (SF)**	**Watts / SF**	**Annual Usage (Hours / Year)**	**$/kWh**	**Other Electrical Cost**	**Annual Usage Hours / Year (Over-write)**
Building Electrical	147	2.00	8,760	$ 0.06	**$ 144**	
Chemicals:					$ -	
Repair and Maintenance, and Replacement:				**Replacement Included? (1 = "Yes", 0 = "No")**	**Annual Cost**	
Maintenance & Repair Cost					**$ 56,782**	
Replacement Cost				-	**$ -**	
Other:			**Total Annual O&M Cost**	**"Other" Percent**	**Other Cost**	**Other Cost Percent (Over-write)**
Other Cost			$ 139,833	20.0%	**$ 27,967**	
User Defined Annual O&M Items:					**Annual Cost**	
Item 1					**$ -**	
Item 2					**$ -**	
Item 3					**$ -**	
Item 4					**$ -**	
Item 5					**$ -**	
Item 6					**$ -**	
Item 7					**$ -**	
Item 8					**$ -**	
Item 9					**$ -**	
Item 10					**$ -**	
Item 11					**$ -**	
Item 12					**$ -**	
Item 13					**$ -**	
Item 14					**$ -**	
Item 15					**$ -**	
Subtotal Annual O&M Cost					**$ 167,800**	
Contingency				**20%**	**$ 33,560**	
Total Annual O&M Cost					**$ 201,360**	

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$3,061,676		$3,061,676	
1	$207,401		$207,401	
2	$213,623		$213,623	
3	$220,032		$220,032	
4	$226,633		$226,633	
5	$233,432		$233,432	
6	$240,435		$240,435	
7	$247,648		$247,648	

8	$255,077		$255,077				
9	$262,729		$262,729				
10	$270,611		$270,611				
11	$278,730		$278,730				
12	$287,092		$287,092				
13	$295,704		$295,704				
14	$304,575		$304,575				
15	$313,713		$313,713				
16	$323,124		$323,124				
17	$332,818		$332,818				
18	$342,802		$342,802				
19	$353,086		$353,086				
20	$363,679		$363,679				
21	$374,589		$374,589				
22	$385,827		$385,827				
23	$397,402		$397,402				
24	$409,324		$409,324				
25	$421,604		$421,604				
26							
27							
28							
29							
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50							
NPV			$7,019,940	$207,401			

Flocculation (Horizontal Paddle Wheel Flocculation for Downstream Sedimentation)

Construction Cost:		$14,318,845

Annual O&M Cost:

Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	84	68%	8,760	$ 0.06	$ 20,914	

Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	17,097	2.00	8,760	$ 0.06	$ 16,744	
Chemicals:					$ -	

Repair and Maintenance, and Replacement:	Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost
Maintenance & Repair Cost		$ 50,590
Replacement Cost	-	$ -

Other:	Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost	$ 88,248	20.0%	$ 17,650	

User Defined Annual O&M Items:	Annual Cost
Item 1	$ -
Item 2	$ -
Item 3	$ -
Item 4	$ -
Item 5	$ -
Item 6	$ -
Item 7	$ -
Item 8	$ -
Item 9	$ -
Item 10	$ -
Item 11	$ -
Item 12	$ -
Item 13	$ -
Item 14	$ -
Item 15	$ -

Subtotal Annual O&M Cost		$ 105,898
Contingency	20%	$ 21,180
Total Annual O&M Cost		$ 127,077

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$14,318,845		$14,318,845	
1	$130,890		$130,890	
2	$134,816		$134,816	
3	$138,861		$138,861	
4	$143,027		$143,027	
5	$147,317		$147,317	
6	$151,737		$151,737	
7	$156,289		$156,289	

8	$160,978		$160,978				
9	$165,807		$165,807				
10	$170,781		$170,781				
11	$175,905		$175,905				
12	$181,182		$181,182				
13	$186,617		$186,617				
14	$192,216		$192,216				
15	$197,982		$197,982				
16	$203,922		$203,922				
17	$210,039		$210,039				
18	$216,340		$216,340				
19	$222,831		$222,831				
20	$229,516		$229,516				
21	$236,401		$236,401				
22	$243,493		$243,493				
23	$250,798		$250,798				
24	$258,322		$258,322				
25	$266,071		$266,071				
26							
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NPV			$16,816,882	$130,890			

DAF

Construction Cost:					$32,727,111	
Annual O&M Cost:						
Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	684	68%	8,760	$ 0.06	$ 170,296	
Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	-	2.00	8,760	$ 0.06	$ -	
Chemicals:					$ -	
Repair and Maintenance, and Replacement:				Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost	
Maintenance & Repair Cost					$ 565,135	
Replacement Cost				-	$ -	
Other:			Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost			$ 735,431	20.0%	$ 147,086	
User Defined Annual O&M Items:					Annual Cost	
Item 1					$ -	
Item 2					$ -	
Item 3					$ -	
Item 4					$ -	
Item 5					$ -	
Item 6					$ -	
Item 7					$ -	
Item 8					$ -	
Item 9					$ -	
Item 10					$ -	
Item 11					$ -	
Item 12					$ -	
Item 13					$ -	
Item 14					$ -	
Item 15					$ -	
Subtotal Annual O&M Cost					$ 882,517	
Contingency				20%	$ 176,503	
Total Annual O&M Cost					$ 1,059,020	

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$32,727,111		$32,727,111	
1	$1,090,791		$1,090,791	
2	$1,123,515		$1,123,515	
3	$1,157,220		$1,157,220	
4	$1,191,937		$1,191,937	
5	$1,227,695		$1,227,695	
6	$1,264,526		$1,264,526	
7	$1,302,462		$1,302,462	

8	$1,341,535		$1,341,535					
9	$1,381,781		$1,381,781					
10	$1,423,235		$1,423,235					
11	$1,465,932		$1,465,932					
12	$1,509,910		$1,509,910					
13	$1,555,207		$1,555,207					
14	$1,601,863		$1,601,863					
15	$1,649,919		$1,649,919					
16	$1,699,417		$1,699,417					
17	$1,750,399		$1,750,399					
18	$1,802,911		$1,802,911					
19	$1,856,999		$1,856,999					
20	$1,912,709		$1,912,709					
21	$1,970,090		$1,970,090					
22	$2,029,193		$2,029,193					
23	$2,090,068		$2,090,068					
24	$2,152,770		$2,152,770					
25	$2,217,354		$2,217,354					
26								
27								
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NPV			$53,544,944	$1,090,791				

Ozone - Serpentine

Construction Cost:					**$40,175,553**	
Annual O&M Cost:						
Power:	**Total HP**	**Average-to-Maximum Flow Factor**	**Annual Usage (Hours / Year)**	**$/kWh**	**Power Cost**	**Annual Usage Hours / Year (Over-write)**
Equipment Power	1,362	68%	8,760	$ 0.06	**$ 339,098**	
Other Electrical:	**Building Area (SF)**	**Watts / SF**	**Annual Usage (Hours / Year)**	**$/kWh**	**Other Electrical Cost**	**Annual Usage Hours / Year (Over-write)**
Building Electrical	4,400	2.00	8,760	$ 0.06	**$ 4,309**	
Liquid Chemicals:	**Annual Usage (% of year)**	**Average-to-Maximum Flow Factor**	**Annual Usage (dry tons / year)**	**Cost ($/dry ton)**	**Chemical Cost**	
Liquid Oxygen	100%	68%	7,311	$ 126.22	**$ 629,152**	
Repair and Maintenance, and Replacement:				**Replacement Included? (1 = "Yes", 0 = "No")**	**Annual Cost**	
Maintenance & Repair Cost					**$ 849,911**	
Replacement Cost				-	**$ -**	
Other:			**Total Annual O&M Cost**	**"Other" Percent**	**Other Cost**	**Other Cost Percent (Over-write)**
Other Cost			$ 1,822,471	20.0%	**$ 364,494**	
User Defined Annual O&M Items:					**Annual Cost**	
Item 1					**$ -**	
Item 2					**$ -**	
Item 3					**$ -**	
Item 4					**$ -**	
Item 5					**$ -**	
Item 6					**$ -**	
Item 7					**$ -**	
Item 8					**$ -**	
Item 9					**$ -**	
Item 10					**$ -**	
Item 11					**$ -**	
Item 12					**$ -**	
Item 13					**$ -**	
Item 14					**$ -**	
Item 15					**$ -**	
Subtotal Annual O&M Cost					**$ 2,186,965**	
Contingency				**20%**	**$ 437,393**	
Total Annual O&M Cost					**$ 2,624,359**	

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$40,175,553		$40,175,553	
1	$2,703,089		$2,703,089	

2	$2,784,182		$2,784,182				
3	$2,867,707		$2,867,707				
4	$2,953,739		$2,953,739				
5	$3,042,351		$3,042,351				
6	$3,133,621		$3,133,621				
7	$3,227,630		$3,227,630				
8	$3,324,459		$3,324,459				
9	$3,424,193		$3,424,193				
10	$3,526,918		$3,526,918				
11	$3,632,726		$3,632,726				
12	$3,741,708		$3,741,708				
13	$3,853,959		$3,853,959				
14	$3,969,578		$3,969,578				
15	$4,088,665		$4,088,665				
16	$4,211,325		$4,211,325				
17	$4,337,665		$4,337,665				
18	$4,467,795		$4,467,795				
19	$4,601,829		$4,601,829				
20	$4,739,884		$4,739,884				
21	$4,882,080		$4,882,080				
22	$5,028,542		$5,028,542				
23	$5,179,399		$5,179,399				
24	$5,334,781		$5,334,781				
25	$5,494,824		$5,494,824				
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NPV			$91,764,225	$2,703,089			

Filters

Construction Cost:		**$44,760,891**

Annual O&M Cost:

Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	-	68%	8,760	$ 0.06	$ -	

Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	1,015	2.00	8,760	$ 0.06	$ 994	

Chemicals:	Annual Usage (tons)	Annual Facility Usage (% of year)	$/ton	Chemical Cost
GAC	-	100%	$ 3,251.28	$ -
Total Chemical Cost				$ -

Repair and Maintenance, and Replacement:	Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost
Maintenance & Repair Cost		$ 506,544
Replacement Cost	-	$ -

Other:	Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost	$ 507,538	20.0%	$ 101,508	

User Defined Annual O&M Items:	Annual Cost
Item 1	$ -
Item 2	$ -
Item 3	$ -
Item 4	$ -
Item 5	$ -
Item 6	$ -
Item 7	$ -
Item 8	$ -
Item 9	$ -
Item 10	$ -
Item 11	$ -
Item 12	$ -
Item 13	$ -
Item 14	$ -
Item 15	$ -

Subtotal Annual O&M Cost		$ 609,046
Contingency	20%	$ 121,809
Total Annual O&M Cost		$ 730,855

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$44,760,891		$44,760,891	
1	$752,781		$752,781	
2	$775,365		$775,365	
3	$798,625		$798,625	
4	$822,584		$822,584	
5	$847,262		$847,262	
6	$872,680		$872,680	
7	$898,860		$898,860	

8	$925,826		$925,826				
9	$953,601		$953,601				
10	$982,209		$982,209				
11	$1,011,675		$1,011,675				
12	$1,042,025		$1,042,025				
13	$1,073,286		$1,073,286				
14	$1,105,484		$1,105,484				
15	$1,138,649		$1,138,649				
16	$1,172,808		$1,172,808				
17	$1,207,993		$1,207,993				
18	$1,244,232		$1,244,232				
19	$1,281,559		$1,281,559				
20	$1,320,006		$1,320,006				
21	$1,359,606		$1,359,606				
22	$1,400,395		$1,400,395				
23	$1,442,406		$1,442,406				
24	$1,485,679		$1,485,679				
25	$1,530,249		$1,530,249				
26							
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50							
NPV			$59,127,777	$752,781			

Concrete Tank

Construction Cost:					**$50,788,316**	
Annual O&M Cost:						
Power:	**Total HP**	**Average-to-Maximum Flow Factor**	**Annual Usage (Hours / Year)**	**$/kWh**	**Power Cost**	**Annual Usage Hours / Year (Over-write)**
Equipment Power	-	68%	8,760	$ 0.06	**$ -**	
Other Electrical:	**Building Area (SF)**	**Watts / SF**	**Annual Usage (Hours / Year)**	**$/kWh**	**Other Electrical Cost**	**Annual Usage Hours / Year (Over-write)**
Building Electrical	-	2.00	8,760	$ 0.06	**$ -**	
Chemicals:					$ -	
Repair and Maintenance, and Replacement:				**Replacement Included? (1 = "Yes", 0 = "No")**	**Annual Cost**	
Maintenance & Repair Cost					**$ 14,369**	
Replacement Cost				-	**$ -**	
Other:			**Total Annual O&M Cost**	**"Other" Percent**	**Other Cost**	**Other Cost Percent (Over-write)**
Other Cost			$ 14,369	20.0%	**$ 2,874**	
User Defined Annual O&M Items:					**Annual Cost**	
Item 1					**$ -**	
Item 2					**$ -**	
Item 3					**$ -**	
Item 4					**$ -**	
Item 5					**$ -**	
Item 6					**$ -**	
Item 7					**$ -**	
Item 8					**$ -**	
Item 9					**$ -**	
Item 10					**$ -**	
Item 11					**$ -**	
Item 12					**$ -**	
Item 13					**$ -**	
Item 14					**$ -**	
Item 15					**$ -**	
Subtotal Annual O&M Cost					**$ 17,243**	
Contingency				**20%**	**$ 3,449**	
Total Annual O&M Cost					**$ 20,691**	

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$50,788,316		$50,788,316	
1	$21,312		$21,312	
2	$21,951		$21,951	
3	$22,610		$22,610	
4	$23,288		$23,288	
5	$23,987		$23,987	
6	$24,706		$24,706	
7	$25,448		$25,448	
8	$26,211		$26,211	
9	$26,997		$26,997	
10	$27,807		$27,807	
11	$28,642		$28,642	

12	$29,501		$29,501				
13	$30,386		$30,386				
14	$31,297		$31,297				
15	$32,236		$32,236				
16	$33,203		$33,203				
17	$34,199		$34,199				
18	$35,225		$35,225				
19	$36,282		$36,282				
20	$37,371		$37,371				
21	$38,492		$38,492				
22	$39,647		$39,647				
23	$40,836		$40,836				
24	$42,061		$42,061				
25	$43,323		$43,323				
26							
27							
28							
29							
30							
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NPV			$51,195,057	$21,312			

Liquid Chemical Storage & Feed

Construction Cost:	**$2,003,670**

Annual O&M Cost:

Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	9	68%	8,760	$ 0.06	$ 2,241	

Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	2,842	2.00	8,760	$ 0.06	$ 2,783	

Liquid Chemicals:	Annual Usage (% of year)	Average-to-Maximum Flow Factor	Annual Usage (dry tons / year)	Cost ($/dry ton)	Chemical Cost
Aluminum Sulfate (Alum)	100%	68%	1,218	$ 555.44	$ 461,431
Aqueous Ammonia	100%	68%	-	$ 1,208.65	$ -
Citric Acid	100%	68%	-	$ 3,204.91	$ -
Ferric Chloride	100%	68%	-	$ 1,003.69	$ -
Hydrofluorosilicic Acid	100%	68%	-	$ 500.72	$ -
Hyrogen Peroxide (35%)	100%	68%	-	$ 2,223.22	$ -
Liquid Polymer	100%	68%	-	$ 3,544.77	$ -
Sodium Bisulfite	100%	68%	-	$ 1,336.98	$ -
Sodium Hydroxide (25%)	100%	68%	-	$ 1,043.24	$ -
Sodium Hydroxide (50%)	100%	68%	-	$ 1,222.48	$ -
Sodium Hypochlorite (12.5%)	100%	68%	-	$ 2,205.88	$ -
Sulfuric Acid	100%	68%	-	$ 379.51	$ -
Other Chemical	100%	68%	-	$ -	$ -
Total Chemical Cost					**$ 461,431**

Repair and Maintenance, and Replacement:	Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost
Maintenance & Repair Cost		$ 11,670
Replacement Cost	-	$ -

Other:	Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost	$ 478,125	20.0%	$ 95,625	

User Defined Annual O&M Items:	Annual Cost
Item 1	$ -
Item 2	$ -
Item 3	$ -
Item 4	$ -
Item 5	$ -
Item 6	$ -
Item 7	$ -
Item 8	$ -
Item 9	$ -
Item 10	$ -
Item 11	$ -
Item 12	$ -
Item 13	$ -
Item 14	$ -
Item 15	$ -

Subtotal Annual O&M Cost		$ 573,749
Contingency	20%	$ 114,750
Total Annual O&M Cost		$ 688,499

Net Present Value (NPV) Calculation:

i = 5.00%

n =	25			
Annual Inflation % =	3.00%			
Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$2,003,670		$2,003,670	
1	$709,154		$709,154	
2	$730,429		$730,429	
3	$752,342		$752,342	
4	$774,912		$774,912	
5	$798,159		$798,159	
6	$822,104		$822,104	
7	$846,767		$846,767	
8	$872,170		$872,170	
9	$898,335		$898,335	
10	$925,286		$925,286	
11	$953,044		$953,044	
12	$981,635		$981,635	
13	$1,011,084		$1,011,084	
14	$1,041,417		$1,041,417	
15	$1,072,659		$1,072,659	
16	$1,104,839		$1,104,839	
17	$1,137,984		$1,137,984	
18	$1,172,124		$1,172,124	
19	$1,207,288		$1,207,288	
20	$1,243,506		$1,243,506	
21	$1,280,812		$1,280,812	
22	$1,319,236		$1,319,236	
23	$1,358,813		$1,358,813	
24	$1,399,577		$1,399,577	
25	$1,441,565		$1,441,565	
26				
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NPV			$15,537,935	$709,154

Liquid Chemical Storage & Feed

Construction Cost:					**$502,018**	
Annual O&M Cost:						
Power:	**Total HP**	**Average-to-Maximum Flow Factor**	**Annual Usage (Hours / Year)**	**$/kWh**	**Power Cost**	**Annual Usage Hours / Year (Over-write)**
Equipment Power	3	68%	8,760	$ 0.06	**$ 747**	
Other Electrical:	**Building Area (SF)**	**Watts / SF**	**Annual Usage (Hours / Year)**	**$/kWh**	**Other Electrical Cost**	**Annual Usage Hours / Year (Over-write)**
Building Electrical	817	2.00	8,760	$ 0.06	**$ 800**	
Liquid Chemicals:	**Annual Usage (% of year)**	**Average-to-Maximum Flow Factor**	**Annual Usage (dry tons / year)**	**Cost ($/dry ton)**	**Chemical Cost**	
Aluminum Sulfate (Alum)	100%	68%	-	$ 555.44	$ -	
Aqueous Ammonia	100%	68%	-	$ 1,208.65	$ -	
Citric Acid	100%	68%	-	$ 3,204.91	$ -	
Ferric Chloride	100%	68%	-	$ 1,003.69	$ -	
Hydrofluorosilicic Acid	100%	68%	-	$ 500.72	$ -	
Hyrogen Peroxide (35%)	100%	68%	-	$ 2,223.22	$ -	
Liquid Polymer	100%	68%	24	$ 3,544.77	$ 58,896	
Sodium Bisulfite	100%	68%	-	$ 1,336.98	$ -	
Sodium Hydroxide (25%)	100%	68%	-	$ 1,043.24	$ -	
Sodium Hydroxide (50%)	100%	68%	-	$ 1,222.48	$ -	
Sodium Hypochlorite (12.5%)	100%	68%	-	$ 2,205.88	$ -	
Sulfuric Acid	100%	68%	-	$ 379.51	$ -	
Other Chemical	100%	68%	-	$ -	$ -	
Total Chemical Cost					**$ 58,896**	
Repair and Maintenance, and Replacement:				**Replacement Included? (1 = "Yes", 0 = "No")**	**Annual Cost**	
Maintenance & Repair Cost					**$ 1,749**	
Replacement Cost				-	**$ -**	
Other:			**Total Annual O&M Cost**	**"Other" Percent**	**Other Cost**	**Other Cost Percent (Over-write)**
Other Cost			$ 62,192	20.0%	**$ 12,438**	
User Defined Annual O&M Items:					**Annual Cost**	
Item 1					**$ -**	
Item 2					**$ -**	
Item 3					**$ -**	
Item 4					**$ -**	
Item 5					**$ -**	
Item 6					**$ -**	
Item 7					**$ -**	
Item 8					**$ -**	
Item 9					**$ -**	
Item 10					**$ -**	
Item 11					**$ -**	
Item 12					**$ -**	
Item 13					**$ -**	
Item 14					**$ -**	
Item 15					**$ -**	
Subtotal Annual O&M Cost					**$ 74,631**	
Contingency				**20%**	**$ 14,926**	
Total Annual O&M Cost					**$ 89,557**	
Net Present Value (NPV) Calculation:						
i = 5.00%						

n =	25			
Annual Inflation % =	3.00%			
Year	**Default Cost**	**User Over-Ride**	**Cost Used in NPV Calculation**	**Adjusted Annual O&M Cost**
0	$502,018		$502,018	
1	$92,244		$92,244	
2	$95,011		$95,011	
3	$97,861		$97,861	
4	$100,797		$100,797	
5	$103,821		$103,821	
6	$106,936		$106,936	
7	$110,144		$110,144	
8	$113,448		$113,448	
9	$116,852		$116,852	
10	$120,357		$120,357	
11	$123,968		$123,968	
12	$127,687		$127,687	
13	$131,517		$131,517	
14	$135,463		$135,463	
15	$139,527		$139,527	
16	$143,713		$143,713	
17	$148,024		$148,024	
18	$152,465		$152,465	
19	$157,039		$157,039	
20	$161,750		$161,750	
21	$166,602		$166,602	
22	$171,600		$171,600	
23	$176,748		$176,748	
24	$182,051		$182,051	
25	$187,512		$187,512	
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NPV			**$2,262,496**	**$92,244**

Liquid Chemical Storage & Feed

Construction Cost:						$996,135	
Annual O&M Cost:							
Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)	
Equipment Power	6	68%	8,760	$ 0.06	$ 1,494		
Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)	
Building Electrical	1,680	2.00	8,760	$ 0.06	$ 1,645		
Liquid Chemicals:	Annual Usage (% of year)	Average-to-Maximum Flow Factor	Annual Usage (dry tons / year)	Cost ($/dry ton)	Chemical Cost		
Aluminum Sulfate (Alum)	100%	68%	-	$ 555.44	$ -		
Aqueous Ammonia	100%	68%	-	$ 1,208.65	$ -		
Citric Acid	100%	68%	-	$ 3,204.91	$ -		
Ferric Chloride	100%	68%	-	$ 1,003.69	$ -		
Hydrofluorosilicic Acid	100%	68%	-	$ 500.72	$ -		
Hyrogen Peroxide (35%)	100%	68%	-	$ 2,223.22	$ -		
Liquid Polymer	100%	68%	183	$ 3,544.77	$ 441,720		
Sodium Bisulfite	100%	68%	-	$ 1,336.98	$ -		
Sodium Hydroxide (25%)	100%	68%	-	$ 1,043.24	$ -		
Sodium Hydroxide (50%)	100%	68%	-	$ 1,222.48	$ -		
Sodium Hypochlorite (12.5%)	100%	68%	-	$ 2,205.88	$ -		
Sulfuric Acid	100%	68%	-	$ 379.51	$ -		
Other Chemical	100%	68%	-	$ -	$ -		
Total Chemical Cost					$ 441,720		
Repair and Maintenance, and Replacement:				Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost		
Maintenance & Repair Cost					$ 4,941		
Replacement Cost				-	$ -		
Other:			Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)	
Other Cost			$ 449,801	20.0%	$ 89,960		
User Defined Annual O&M Items:					Annual Cost		
Item 1					$ -		
Item 2					$ -		
Item 3					$ -		
Item 4					$ -		
Item 5					$ -		
Item 6					$ -		
Item 7					$ -		
Item 8					$ -		
Item 9					$ -		
Item 10					$ -		
Item 11					$ -		
Item 12					$ -		
Item 13					$ -		
Item 14					$ -		
Item 15					$ -		
Subtotal Annual O&M Cost					$ 539,761		
Contingency				20%	$ 107,952		
Total Annual O&M Cost					$ 647,714		
Net Present Value (NPV) Calculation:							
i =	5.00%						

n =	25			
Annual Inflation % =	3.00%			
Year	**Default Cost**	**User Over-Ride**	**Cost Used in NPV Calculation**	**Adjusted Annual O&M Cost**
0	$996,135		$996,135	
1	$667,145		$667,145	
2	$687,159		$687,159	
3	$707,774		$707,774	
4	$729,007		$729,007	
5	$750,878		$750,878	
6	$773,404		$773,404	
7	$796,606		$796,606	
8	$820,504		$820,504	
9	$845,119		$845,119	
10	$870,473		$870,473	
11	$896,587		$896,587	
12	$923,485		$923,485	
13	$951,189		$951,189	
14	$979,725		$979,725	
15	$1,009,117		$1,009,117	
16	$1,039,390		$1,039,390	
17	$1,070,572		$1,070,572	
18	$1,102,689		$1,102,689	
19	$1,135,770		$1,135,770	
20	$1,169,843		$1,169,843	
21	$1,204,938		$1,204,938	
22	$1,241,086		$1,241,086	
23	$1,278,319		$1,278,319	
24	$1,316,668		$1,316,668	
25	$1,356,168		$1,356,168	
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NPV			$13,728,651	$667,145

Liquid Chemical Storage & Feed

Construction Cost:					$1,818,813	
Annual O&M Cost:						
Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	10	68%	8,760	$ 0.06	$ 2,490	
Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	3,080	2.00	8,760	$ 0.06	$ 3,016	
Liquid Chemicals:	Annual Usage (% of year)	Average-to-Maximum Flow Factor	Annual Usage (dry tons / year)	Cost ($/dry ton)	Chemical Cost	
Aluminum Sulfate (Alum)	100%	68%	708	$ 555.44	$ 268,207	
Aqueous Ammonia	100%	68%	-	$ 1,208.65	$ -	
Citric Acid	100%	68%	-	$ 3,204.91	$ -	
Ferric Chloride	100%	68%	-	$ 1,003.69	$ -	
Hydrofluorosilicic Acid	100%	68%	-	$ 500.72	$ -	
Hyrogen Peroxide (35%)	100%	68%	-	$ 2,223.22	$ -	
Liquid Polymer	100%	68%	-	$ 3,544.77	$ -	
Sodium Bisulfite	100%	68%	-	$ 1,336.98	$ -	
Sodium Hydroxide (25%)	100%	68%	-	$ 1,043.24	$ -	
Sodium Hydroxide (50%)	100%	68%	-	$ 1,222.48	$ -	
Sodium Hypochlorite (12.5%)	100%	68%	-	$ 2,205.88	$ -	
Sulfuric Acid	100%	68%	-	$ 379.51	$ -	
Other Chemical	100%	68%	-	$ -	$ -	
Total Chemical Cost					$ 268,207	
Repair and Maintenance, and Replacement:				Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost	
Maintenance & Repair Cost					$ 9,859	
Replacement Cost				-	$ -	
Other:			Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost			$ 283,572	20.0%	$ 56,714	
User Defined Annual O&M Items:					Annual Cost	
Item 1					$ -	
Item 2					$ -	
Item 3					$ -	
Item 4					$ -	
Item 5					$ -	
Item 6					$ -	
Item 7					$ -	
Item 8					$ -	
Item 9					$ -	
Item 10					$ -	
Item 11					$ -	
Item 12					$ -	
Item 13					$ -	
Item 14					$ -	
Item 15					$ -	
Subtotal Annual O&M Cost					$ 340,287	
Contingency				20%	$ 68,057	
Total Annual O&M Cost					$ 408,344	
Net Present Value (NPV) Calculation:						
i =	5.00%					

n =	25			
Annual Inflation % =	3.00%			

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$1,818,813		$1,818,813	
1	$420,594		$420,594	
2	$433,212		$433,212	
3	$446,208		$446,208	
4	$459,595		$459,595	
5	$473,382		$473,382	
6	$487,584		$487,584	
7	$502,211		$502,211	
8	$517,278		$517,278	
9	$532,796		$532,796	
10	$548,780		$548,780	
11	$565,243		$565,243	
12	$582,201		$582,201	
13	$599,667		$599,667	
14	$617,657		$617,657	
15	$636,186		$636,186	
16	$655,272		$655,272	
17	$674,930		$674,930	
18	$695,178		$695,178	
19	$716,033		$716,033	
20	$737,514		$737,514	
21	$759,640		$759,640	
22	$782,429		$782,429	
23	$805,902		$805,902	
24	$830,079		$830,079	
25	$854,981		$854,981	
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NPV			$9,845,885	$420,594

Sodium Hypochlorite

Construction Cost:						$8,828,729

Annual O&M Cost:

Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	816	68%	8,760	$ 0.06	$ 203,160	

Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	3,128	2.00	8,760	$ 0.06	$ 3,063	

Chemicals:	Annual Usage (% of year)	Average-to-Maximum Flow Factor	Annual Usage (tons)	Cost ($/ton)	Chemical Cost
Salt	100%	68%	731	$ 152.86	$ 76,194

Repair and Maintenance, and Replacement:	Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost
Maintenance & Repair Cost		$ 163,592
Replacement Cost	-	$ -

Other:	Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost	$ 446,010	20.0%	$ 89,202	

User Defined Annual O&M Items:	Annual Cost
Item 1	$ -
Item 2	$ -
Item 3	$ -
Item 4	$ -
Item 5	$ -
Item 6	$ -
Item 7	$ -
Item 8	$ -
Item 9	$ -
Item 10	$ -
Item 11	$ -
Item 12	$ -
Item 13	$ -
Item 14	$ -
Item 15	$ -

Subtotal Annual O&M Cost		$ 535,212
Contingency	20%	$ 107,042
Total Annual O&M Cost		$ 642,254

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$8,828,729		$8,828,729	
1	$661,522		$661,522	
2	$681,368		$681,368	
3	$701,809		$701,809	
4	$722,863		$722,863	
5	$744,549		$744,549	
6	$766,885		$766,885	

7	$789,892		$789,892				
8	$813,589		$813,589				
9	$837,996		$837,996				
10	$863,136		$863,136				
11	$889,030		$889,030				
12	$915,701		$915,701				
13	$943,172		$943,172				
14	$971,467		$971,467				
15	$1,000,611		$1,000,611				
16	$1,030,630		$1,030,630				
17	$1,061,549		$1,061,549				
18	$1,093,395		$1,093,395				
19	$1,126,197		$1,126,197				
20	$1,159,983		$1,159,983				
21	$1,194,782		$1,194,782				
22	$1,230,626		$1,230,626				
23	$1,267,545		$1,267,545				
24	$1,305,571		$1,305,571				
25	$1,344,738		$1,344,738				
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NPV			$21,453,928	$661,522			

Liquid Chemical Storage & Feed

Construction Cost: $686,308

Annual O&M Cost:

Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	2	68%	8,760	$ 0.06	$ 498	

Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	942	2.00	8,760	$ 0.06	$ 923	

Liquid Chemicals:	Annual Usage (% of year)	Average-to-Maximum Flow Factor	Annual Usage (dry tons / year)	Cost ($/dry ton)	Chemical Cost
Aluminum Sulfate (Alum)	100%	68%	-	$ 555.44	$ -
Aqueous Ammonia	100%	68%	-	$ 1,208.65	$ -
Citric Acid	100%	68%	-	$ 3,204.91	$ -
Ferric Chloride	100%	68%	-	$ 1,003.69	$ -
Hydrofluorosilicic Acid	100%	68%	-	$ 500.72	$ -
Hyrogen Peroxide (35%)	100%	68%	-	$ 2,223.22	$ -
Liquid Polymer	100%	68%	-	$ 3,544.77	$ -
Sodium Bisulfite	100%	68%	-	$ 1,336.98	$ -
Sodium Hydroxide (25%)	100%	68%	-	$ 1,043.24	$ -
Sodium Hydroxide (50%)	100%	68%	-	$ 1,222.48	$ -
Sodium Hypochlorite (12.5%)	100%	68%	-	$ 2,205.88	$ -
Sulfuric Acid	100%	68%	-	$ 379.51	$ -
Other Chemical	100%	68%	-	$ -	$ -
Total Chemical Cost					$ -

Repair and Maintenance, and Replacement:	Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost
Maintenance & Repair Cost		$ 2,206
Replacement Cost	-	$ -

Other:	Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost	$ 3,626	20.0%	$ 725	

User Defined Annual O&M Items:	Annual Cost
Item 1	$ -
Item 2	$ -
Item 3	$ -
Item 4	$ -
Item 5	$ -
Item 6	$ -
Item 7	$ -
Item 8	$ -
Item 9	$ -
Item 10	$ -
Item 11	$ -
Item 12	$ -
Item 13	$ -
Item 14	$ -
Item 15	$ -

Subtotal Annual O&M Cost		$ 4,351
Contingency	20%	$ 870
Total Annual O&M Cost		$ 5,222

Net Present Value (NPV) Calculation:

i = 5.00%

n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$686,308		$686,308	
1	$5,378		$5,378	
2	$5,540		$5,540	
3	$5,706		$5,706	
4	$5,877		$5,877	
5	$6,053		$6,053	
6	$6,235		$6,235	
7	$6,422		$6,422	
8	$6,615		$6,615	
9	$6,813		$6,813	
10	$7,018		$7,018	
11	$7,228		$7,228	
12	$7,445		$7,445	
13	$7,668		$7,668	
14	$7,898		$7,898	
15	$8,135		$8,135	
16	$8,379		$8,379	
17	$8,631		$8,631	
18	$8,890		$8,890	
19	$9,156		$9,156	
20	$9,431		$9,431	
21	$9,714		$9,714	
22	$10,005		$10,005	
23	$10,305		$10,305	
24	$10,615		$10,615	
25	$10,933		$10,933	
26				
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NPV			$788,954	$5,378

Large System Combination Wastewater Surge Basin and Floating Tube Decanter Clarification (>= 5 MGD)

Construction Cost:					**$4,205,630**	
Annual O&M Cost:						
Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	67	68%	8,760	$ 0.06	$ 16,681	
Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	81	2.00	8,760	$ 0.06	$ 79	
Chemicals:					$ -	
Repair and Maintenance, and Replacement:				Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost	
Maintenance & Repair Cost					$ 6,872	
Replacement Cost				-	$ -	
Other:			Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost			$ 23,632	20.0%	$ 4,726	
User Defined Annual O&M Items:					Annual Cost	
Item 1					$ -	
Item 2					$ -	
Item 3					$ -	
Item 4					$ -	
Item 5					$ -	
Item 6					$ -	
Item 7					$ -	
Item 8					$ -	
Item 9					$ -	
Item 10					$ -	
Item 11					$ -	
Item 12					$ -	
Item 13					$ -	
Item 14					$ -	
Item 15					$ -	
Subtotal Annual O&M Cost					$ 28,359	
Contingency				20%	$ 5,672	
Total Annual O&M Cost					$ 34,030	

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$4,205,630		$4,205,630	
1	$35,051		$35,051	
2	$36,103		$36,103	
3	$37,186		$37,186	
4	$38,301		$38,301	
5	$39,450		$39,450	
6	$40,634		$40,634	
7	$41,853		$41,853	
8	$43,109		$43,109	
9	$44,402		$44,402	
10	$45,734		$45,734	
11	$47,106		$47,106	
12	$48,519		$48,519	

13	$49,975		$49,975				
14	$51,474		$51,474				
15	$53,018		$53,018				
16	$54,609		$54,609				
17	$56,247		$56,247				
18	$57,934		$57,934				
19	$59,672		$59,672				
20	$61,463		$61,463				
21	$63,306		$63,306				
22	$65,206		$65,206				
23	$67,162		$67,162				
24	$69,177		$69,177				
25	$71,252		$71,252				
26							
27							
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49							
50							
NPV			$4,874,585.60	$35,051			

Gravity Thickener

Construction Cost:					$9,897,096	
Annual O&M Cost:						
Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	10	68%	8,760	$ 0.06	$ 2,490	
Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	1,558	2.00	8,760	$ 0.06	$ 1,526	
Chemicals:					$ -	
Repair and Maintenance, and Replacement:				Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost	
Maintenance & Repair Cost					$ 74,106	
Replacement Cost				-	$ -	
Other:			Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost			$ 78,122	20.0%	$ 15,624	
User Defined Annual O&M Items:					Annual Cost	
Item 1					$ -	
Item 2					$ -	
Item 3					$ -	
Item 4					$ -	
Item 5					$ -	
Item 6					$ -	
Item 7					$ -	
Item 8					$ -	
Item 9					$ -	
Item 10					$ -	
Item 11					$ -	
Item 12					$ -	
Item 13					$ -	
Item 14					$ -	
Item 15					$ -	
Subtotal Annual O&M Cost					$ 93,746	
Contingency				20%	$ 18,749	
Total Annual O&M Cost					$ 112,496	

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$9,897,096		$9,897,096	
1	$115,871		$115,871	
2	$119,347		$119,347	
3	$122,927		$122,927	
4	$126,615		$126,615	
5	$130,413		$130,413	
6	$134,326		$134,326	
7	$138,355		$138,355	

8	$142,506		$142,506				
9	$146,781		$146,781				
10	$151,185		$151,185				
11	$155,720		$155,720				
12	$160,392		$160,392				
13	$165,204		$165,204				
14	$170,160		$170,160				
15	$175,265		$175,265				
16	$180,523		$180,523				
17	$185,938		$185,938				
18	$191,516		$191,516				
19	$197,262		$197,262				
20	$203,180		$203,180				
21	$209,275		$209,275				
22	$215,553		$215,553				
23	$222,020		$222,020				
24	$228,681		$228,681				
25	$235,541		$235,541				
26							
27							
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50							
NPV			$12,108,494	$115,871			

Gravity Thickener

Construction Cost:						$3,802,100	
Annual O&M Cost:							
Power:		Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power		5	68%	8,760	$ 0.06	$ 1,245	
Other Electrical:		Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical		858	2.00	8,760	$ 0.06	$ 840	
Chemicals:						$ -	
Repair and Maintenance, and Replacement:					Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost	
Maintenance & Repair Cost						$ 27,846	
Replacement Cost					-	$ -	
Other:				Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost				$ 29,931	20.0%	$ 5,986	
User Defined Annual O&M Items:						Annual Cost	
Item 1						$ -	
Item 2						$ -	
Item 3						$ -	
Item 4						$ -	
Item 5						$ -	
Item 6						$ -	
Item 7						$ -	
Item 8						$ -	
Item 9						$ -	
Item 10						$ -	
Item 11						$ -	
Item 12						$ -	
Item 13						$ -	
Item 14						$ -	
Item 15						$ -	
Subtotal Annual O&M Cost						$ 35,917	
Contingency					20%	$ 7,183	
Total Annual O&M Cost						$ 43,100	

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$3,802,100		$3,802,100	
1	$44,393		$44,393	
2	$45,725		$45,725	
3	$47,097		$47,097	
4	$48,510		$48,510	
5	$49,965		$49,965	
6	$51,464		$51,464	
7	$53,008		$53,008	

8	$54,598		$54,598				
9	$56,236		$56,236				
10	$57,923		$57,923				
11	$59,661		$59,661				
12	$61,451		$61,451				
13	$63,294		$63,294				
14	$65,193		$65,193				
15	$67,149		$67,149				
16	$69,163		$69,163				
17	$71,238		$71,238				
18	$73,375		$73,375				
19	$75,577		$75,577				
20	$77,844		$77,844				
21	$80,179		$80,179				
22	$82,585		$82,585				
23	$85,062		$85,062				
24	$87,614		$87,614				
25	$90,242		$90,242				
26							
27							
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NPV			$4,649,350	$44,393			

Centrifuge Solids Dewatering Facility

Does Your Project Include *Sludge Drying Beds*?	**No**						
Construction Cost:						**$12,415,066**	
Annual O&M Cost:							
Power:		**Total HP**	**Average-to-Maximum Flow Factor**	**Annual Usage (Hours / Year)**	**$/kWh**	**Power Cost**	**Annual Usage Hours / Year (Over-write)**
Equipment Power		112	68%	8,760	$ 0.06	**$ 27,885**	
Other Electrical:		**Building Area (SF)**	**Watts / SF**	**Annual Usage (Hours / Year)**	**$/kWh**	**Other Electrical Cost**	**Annual Usage Hours / Year (Over-write)**
Building Electrical		13,687	2.00	8,760	$ 0.06	**$ 13,405**	
Chemicals:		**Annual Usage (% of year)**	**Average-to-Maximum Flow Factor**	**Quantity (tons/year)**	**Unit Cost**	$ -	
Polymer		100%	68%	35	$ 3,544.77	**$ 85,135**	
Sludge Disposal:				**Average Annual Qty. (cy)**	**Unit Cost**	**Cost**	
Haul Sludge to Disposal Site				3,663	$ 8.09	$ 29,643	
Dumping Charge				3,663	$ 75.00	$ 274,734	
Total Disposal Cost						**$ 304,377**	
Repair and Maintenance, and Replacement:					**Replacement Included? (1 = "Yes", 0 = "No")**	**Annual Cost**	
Maintenance & Repair Cost						**$ 184,244**	
Replacement Cost					-	**$ -**	
Other:				**Total Annual O&M Cost**	**"Other" Percent**	**Other Cost**	**Other Cost Percent (Over-write)**
Other Cost				615,044	20.0%	**$ 123,009**	
User Defined Annual O&M Items:						**Annual Cost**	
Item 1						**$ -**	
Item 2						**$ -**	
Item 3						**$ -**	
Item 4						**$ -**	
Item 5						**$ -**	
Item 6						**$ -**	
Item 7						**$ -**	
Item 8						**$ -**	
Item 9						**$ -**	
Item 10						**$ -**	
Item 11						**$ -**	
Item 12						**$ -**	
Item 13						**$ -**	
Item 14						**$ -**	
Item 15						**$ -**	

Subtotal Annual O&M Cost		$	738,053
Contingency	20%	$	147,611
Total Annual O&M Cost		$	885,664

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$12,415,066		$12,415,066	
1	$912,234		$912,234	
2	$939,601		$939,601	
3	$967,789		$967,789	
4	$996,823		$996,823	
5	$1,026,727		$1,026,727	
6	$1,057,529		$1,057,529	
7	$1,089,255		$1,089,255	
8	$1,121,933		$1,121,933	
9	$1,155,591		$1,155,591	
10	$1,190,258		$1,190,258	
11	$1,225,966		$1,225,966	
12	$1,262,745		$1,262,745	
13	$1,300,627		$1,300,627	
14	$1,339,646		$1,339,646	
15	$1,379,836		$1,379,836	
16	$1,421,231		$1,421,231	
17	$1,463,868		$1,463,868	
18	$1,507,784		$1,507,784	
19	$1,553,017		$1,553,017	
20	$1,599,608		$1,599,608	
21	$1,647,596		$1,647,596	
22	$1,697,024		$1,697,024	
23	$1,747,934		$1,747,934	
24	$1,800,372		$1,800,372	
25	$1,854,384		$1,854,384	
26				
27				
28				
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NPV			$29,825,121	$912,234

Wet Pit Submersible Pump Station

Construction Cost:					**$2,008,749**	

Annual O&M Cost:

Power:	Total HP	Average-to-Maximum Flow Factor	Annual Usage (Hours / Year)	$/kWh	Power Cost	Annual Usage Hours / Year (Over-write)
Equipment Power	75	68%	8,760	$ 0.06	$ 18,673	

Other Electrical:	Building Area (SF)	Watts / SF	Annual Usage (Hours / Year)	$/kWh	Other Electrical Cost	Annual Usage Hours / Year (Over-write)
Building Electrical	1,381	2.00	8,760	$ 0.06	$ 1,353	

Chemicals:	Annual Usage (% of year)	Average-to-Maximum Flow Factor	Annual Usage (dry tons / year)	Cost ($/dry ton)	Chemical Cost

Repair and Maintenance, and Replacement:	Replacement Included? (1 = "Yes", 0 = "No")	Annual Cost
Maintenance & Repair Cost		$ 7,371
Replacement Cost	-	$ -

Other:	Total Annual O&M Cost	"Other" Percent	Other Cost	Other Cost Percent (Over-write)
Other Cost	$ 27,397	20.0%	$ 5,479	

User Defined Annual O&M Items:	Annual Cost
Item 1	$ -
Item 2	$ -
Item 3	$ -
Item 4	$ -
Item 5	$ -
Item 6	$ -
Item 7	$ -
Item 8	$ -
Item 9	$ -
Item 10	$ -
Item 11	$ -
Item 12	$ -
Item 13	$ -
Item 14	$ -
Item 15	$ -

Subtotal Annual O&M Cost		$ 32,876
Contingency	20%	$ 6,575
Total Annual O&M Cost		$ 39,451

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost
0	$2,008,749		$2,008,749	
1	$40,635		$40,635	
2	$41,854		$41,854	
3	$43,109		$43,109	
4	$44,403		$44,403	
5	$45,735		$45,735	
6	$47,107		$47,107	
7	$48,520		$48,520	
8	$49,975		$49,975	
9	$51,475		$51,475	
10	$53,019		$53,019	

11	$54,610		$54,610				
12	$56,248		$56,248				
13	$57,935		$57,935				
14	$59,673		$59,673				
15	$61,464		$61,464				
16	$63,307		$63,307				
17	$65,207		$65,207				
18	$67,163		$67,163				
19	$69,178		$69,178				
20	$71,253		$71,253				
21	$73,391		$73,391				
22	$75,592		$75,592				
23	$77,860		$77,860				
24	$80,196		$80,196				
25	$82,602		$82,602				
26							
27							
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NPV			$2,784,264	$40,635			

Pall Membrane Filtration - Large Systems: > 5 mgd

Construction Cost:					**$200,511,590**	
Annual O&M Cost:						
Power:	**Total HP (All Subsystems)**	**Average-to-Maximum Flow Factor**	**Annual Usage (Hours / Year)**	**$/kWh**	**Power Cost**	**Annual Usage Hours / Year (Over-write)**
Equipment Power	8,376	68%	8,760	$ 0.06	$ **2,085,380**	
Other Electrical:	**Building Area (SF)**	**Watts / SF**	**Annual Usage (Hours / Year)**	**$/kWh**	**Other Electrical Cost**	**Annual Usage Hours / Year (Over-write)**
Building Electrical	93,848	2.00	8,760	$ 0.06	$ **91,912**	
Chemicals:	**Annual Usage (% of year)**	**Average-to-Maximum Flow Factor**	**Annual Usage (dry tons / year)**	**Cost ($/dry ton)**	**Chemical Cost**	
Citric Acid	100%	68%	162.7	$ 3,204.91	$ 355,604	
Sodium Hydroxide	100%	68%	101.6	$ 1,222.48	$ 84,723	
Sodium Hypochlorite	100%	68%	115.1	$ 2,205.88	$ 173,042	
Sodium Bilsulfite	100%	68%	11.4	$ 1,336.98	$ 10,368	
Total Chemicals					$ **623,738**	
Specialty Items:				**Number per Relacement**	**Cost**	
Membrane Elements				7,020	$ **1,960,831**	
Input **Membrane Replacement Frequency** (yrs)	**7**	**Typically 5 to 10 years**				
Input **Membrane Module Cost**	$ **2,500.00**					
Repair and Maintenance, and Replacement:				**Replacement Included? (1 = "Yes", 0 = "No")**	**Annual Cost**	
Maintenance & Repair Cost					$ **3,741,085**	
Replacement Cost				-	$ **-**	
Other:			**Total Annual O&M Cost**	**"Other" Percent**	**Other Cost**	**Other Cost Percent (Over-write)**
Other Cost			$ 8,502,945	20.0%	$ **1,700,589**	
User Defined Annual O&M Items:					**Annual Cost**	
Item 1					$ -	
Item 2					$ -	
Item 3					$ -	
Item 4					$ -	
Item 5					$ -	
Item 6					$ -	
Item 7					$ -	
Item 8					$ -	
Item 9					$ -	
Item 10					$ -	
Item 11					$ -	
Item 12					$ -	
Item 13					$ -	
Item 14					$ -	
Item 15					$ -	
Subtotal Annual O&M Cost					$ **10,203,534**	
Contingency				**20%**	$ **2,040,707**	
Total Annual O&M Cost					$ **12,244,241**	

Net Present Value (NPV) Calculation:

i =	5.00%
n =	25
Annual Inflation % =	3.00%

Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost			
0	$200,511,590		$200,511,590				
1	$12,611,568		$12,611,568				
2	$12,989,916		$12,989,916				
3	$13,379,613		$13,379,613				
4	$13,781,001		$13,781,001				
5	$14,194,431		$14,194,431				
6	$14,620,264		$14,620,264				
7	$15,058,872		$15,058,872				
8	$15,510,638		$15,510,638				
9	$15,975,958		$15,975,958				
10	$16,455,236		$16,455,236				
11	$16,948,893		$16,948,893				
12	$17,457,360		$17,457,360				
13	$17,981,081		$17,981,081				
14	$18,520,513		$18,520,513				
15	$19,076,129		$19,076,129				
16	$19,648,413		$19,648,413				
17	$20,237,865		$20,237,865				
18	$20,845,001		$20,845,001				
19	$21,470,351		$21,470,351				
20	$22,114,462		$22,114,462				
21	$22,777,896		$22,777,896				
22	$23,461,232		$23,461,232				
23	$24,165,069		$24,165,069				
24	$24,890,021		$24,890,021				
25	$25,636,722		$25,636,722				
26							
27							
28							
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NPV			$441,204,367	$12,611,568			
Calculate Cost for Membrane Replacement:							
Calculate **Current Cost of Membrane Replacement**	$17,550,000		**Membrane Replacement #**	**Year of Replacement**	**Cost of Membrane Replacement at Time of Replacement**	**Cost of Membrane Replacement at End of Life Cycle**	
Calculate **Number of Membrane Replacements (should be < = 10)**	3		1	7	$17,550,000	$42,236,168	
			2	14	$17,550,000	$30,016,456	
			3	21	$17,550,000	$21,332,135	
			4	0	$0	$0	
			5	0	$0	$0	
			6	0	$0	$0	
			7	0	$0	$0	
			8	0	$0	$0	
			9	0	$0	$0	
			10	0	$0	$0	
					Total	$93,584,758	
					Annualized Cost	**$1,960,831**	

	A	B	C	D	E	F
1	***Global Life Cycle Data***					
2						
3						
4						
5	**Net Present Value Calculation Inputs:**					
6	Annual Discount Rate (i) :		5.00%			
7	Number of Years (n):		25	Valid Range: 1 to 50 years		
8	Annual Inflation Rate (%):		3.00%			
9						
10	**Annual O&M Cost Inputs:**					
11	Maximum Daily Plant Flow (mgd)		110.00			
12	Average Annual Daily Flow (mgd)		75.00			
13	Average-to-Maximum Flow Factor		68%			
14	**Power:**					
15	If Project in U.S., Select State Location:		OREGON		User Over-Ride	
16	Power Cost ($/kWh): (Note: "All-in" including usage, demand, TOU, and transmission charges)		$ 0.0559			Source for U.S. Power Costs
17	Facility Electrical (Watts/SF):		2.00			
18	**Fuel:**					
19	Natural Gas:		$ 3.50	$/MMBTU		
20	**Annual Plant Operating Usage**		Days per Year Used	Hour per Day Used	Annual Usage (hours / year)	Annual Usage (% of year)
21	Annual Plant Operating Usage		365	24	8,760.00	100%
22	**Maintenance, Repair, and Replacement Costs:**					
23	*Maintenance* and *Repair* Costs		Automatically Included			
24	Include *Replacement* Costs?		No			

(Note: U.S. National Average is $0.0768/kW

(Note: Units are $/1,000,000 BTU)

25 **Chemical Costs:** ***(Please check with your local Chemical vendor to verify the default unit costs shown CPES)***

	Liquid Chemicals:	Default Costs ($/dry ton)	User Over-Ride	Cost Used in Life Cycle Cost Analysis	
27	Alum (48.5%)	$ 555.44		$ 555.44	
28	Aqueous Ammonia (29%)	$ 1,208.65		$ 1,208.65	
29	Ferric Chloride (40%)	$ 1,003.69		$ 1,003.69	
30	Hydrochloric Acid	$ 500.72		$ 500.72	
31	Hydrofluorosilicic Acid (18%)	$ 5,419.53		$ 5,419.53	
32	Hydrogen Peroxide (35%)	$ 2,223.22		$ 2,223.22	
33	Liquid Polymer	$ 3,544.77		$ 3,544.77	
34	Sodium Bilsulfite (40%)	$ 1,336.98		$ 1,336.98	
35	Sodium Hydroxide (25%)	$ 1,043.24		$ 1,043.24	
36	Sodium Hydroxide (50%)	$ 1,222.48		$ 1,222.48	
37	Sodium Hypochlorite (12.5%)	$ 2,205.88		$ 2,205.88	
38	Sulfuric Acid (93%)	$ 379.51		$ 379.51	
39	Other 1			$ -	
40	Other 2			$ -	
41	Other 3			$ -	
42	Other 4			$ -	
43	Liquid Chlorine	$ 128.20		$ 128.20	
44	Purate	$ 923.01		$ 923.01	Purate cost ranges from $150/ton for bulk delivery to $720/ton for totes.
45	CO2	$ 165.21		$ 165.21	
46					

	Dry Chemicals:	Default Costs ($/dry ton)	User Over-Ride	Cost Used in Life Cycle Cost Analysis
48	Powdered Activated Carbon	$ 1,441.81		$ 1,441.81
49	Calcium Hydroxide	$ 345.23		$ 345.23
50	Sodium Bicarbonate	$ 777.73		$ 777.73
51	Sodium Carbonate	$ 364.09		$ 364.09
52	Polymer	$ 5,478.26		$ 5,478.26
53	Potassium Permanganate	$ 5,419.17		$ 5,419.17
54	Ammonium Sulfate	$ 2,574.66		$ 2,574.66
55	Bayoxide (SORB33)	$ 287.40		$ 287.40
56	Other 1			$ -
57	Other 2			$ -
58				

	Specialty Chemicals:	Default Costs ($/dry ton)	User Over-Ride	Cost Used in Life Cycle Cost Analysis
60	Liquid Oxygen	$ 126.22		$ 126.22
61	GAC	$ 3,251.28		$ 3,251.28
62	Sand	$ 181.61		$ 181.61
63	IX TEA	$ 5,451.98		$ 5,451.98
64	IX TPA	$ 8,505.08		$ 8,505.08
65	IX Bifunctional	$ 54,519.77		$ 54,519.77
66	Citric Acid	$ 3,204.91		$ 3,204.91
67	Trisodium Phosphate	$ 3,461.31		$ 3,461.31
68	Scale Inhibitor	$ 5,640.65		$ 5,640.65
69	Sodium Tripolyphosphate	$ 3,974.09		$ 3,974.09
70	Sodium EDTA	$ 1,752.52		$ 1,752.52
71	Salt	$ 152.86		$ 152.86
72	Resin ($/Gal for MIEX model)	$ 60.39		$ 60.39
73				

	Specialty Chemicals:	Default Costs	User Over-Ride	Cost Used in Life Cycle Cost Analysis
75	GFH ($/ton)	$ 25,014.11		$ 25,014.11

	A	B	C	D	E	F	G	H	I
76	Sybron Chemicals Inc., IONAC A-554 Strongly Basin Anion Ion Exchange Resin ($/cf)	$ 302.25		$ 302.25					
77	Membranes:	Default Cost ($/ea)	User Over-Ride	Cost Used in Life Cycle Cost Analysis					
78	Pressure:								
79	Memcor CP - L10	$ 1,276.60		$ 1,276.60					
80	Memcor CP - L20	$ 1,276.60		$ 1,276.60					
81	Norit	$ 2,102.64		$ 2,102.64					
82	Pall - 48 Module Rack	$ 1,538.36		$ 1,538.36					
83	Pall - 80 Module Rack	$ 1,538.36		$ 1,538.36					
84	Submerged:								
85	Memcor CS	$ 938.68		$ 938.68					
86	Zenon 1000	$ 1,089.67		$ 1,089.67					
87	Zenon 500	$ 1,353.20		$ 1,353.20					
88	SWRO & BWRO:								
89	Process Cartridge Filter Replacements	$ 16.52		$ 16.52					
90	CIP Filter Replacements	$ 16.52		$ 16.52					
91									
92	**Solids:**								
93	**Biosolids:**								
94	Biosolids Reuse or Disposal Technology	End-Use Technology Code							
95	1 = Class A - Composting (static pile, invessel, air dry)	1							
96	2 = Class A - Alkaline Stabilization								
97	3 = Class A - ATAD, TPAAD Advanced Digestion								
98	4 = Class A - Thermal Drying								
99	5 = Class B - Land Application (digested)								
100	6 = Class B - Land Application (alkaline stabilized)								
101	7 = Class B - Land Reclamation (alkaline stabilized)								
102	8 = Disposal - Landfill or Monofill								
103	9 = Disposal - Incineration								
104	Biosolids Unit Cost ($/US Dry Ton)	$ 250.00							
105	Percent Solids	80%							
106	Biosolids *CALCULATED* Unit Cost ($/WT)	$ 200.00							
107	Biosolids *USER OVER-RIDE* Unit Cost ($/WT)								
108	Biosolids Unit Cost Used in CPES ($/WT)	$ 200.00	1 = Class A - Composting (static pile, invessel, air dry)						
109	Haul Distance from Plant (Miles, Round Trip)	20							
110	Haulage *USER OVER-RIDE* Unit Cost ($/WT/mile)								
111	Haulage Cost ($/WT)	$ 2.40	Default haulage cost is $0.12/US wet tonne/mile						
112	**Trash Disposal:**								
113	Haul Distance from Plant (Miles, Round Trip)		20						
114	Disposal Cost ($/cy)		$ 75.00	Typical Range: $50 - $175 / CY					
115	Haul Cost ($/cy)		$ 8.09						
116	**Other Costs:**								
117	O&M Other Costs: Percent for Misc Annual Costs:		20.0%	Includes vehicles, lab tests, office equipment other required misc expenses, default of 20% from OM					
118	**O&M Cost Contingency:**								
119	O&M Cost Contingency		20.0%						
120									
121	**Overall Plant Labor:**								
122	Labor Calculation Method	User Defined							
123									
124									
125									
126									
127									
128									
129									
130	Overall Plant Labor:								
131	Supervisory Staff	Work Shift Scheme		User Defined Number of Personnel	User Defined Hours / Week	User Defined Weeks/Year	Hours / Year	Hourly Rate (Including Fringe Benefits)	Yearly Cost
132	Superintendent	1 8 hr shift 5 days per week			40	52	2,080	$ 50.00	$ 104,000
133	Assistant Superintendent	User Defined		0	40	52	-	$ 40.00	$ -
134	Plant Operator 1	2 Operators onsite at all times		0	40	52	17,520	$ 30.00	$ 525,600
135	Plant Operator 2	User Defined		0	40	52	-	$ 30.00	$ -
136	Plant Operator 3	User Defined		0	40	52	-	$ 30.00	$ -
137	Plant Maintenance Worker 1	1 8 hr shift 5 days per week		0	40	52	2,080	$ 25.00	$ 52,000
138	Plant Maintenance Worker 2	User Defined		0	40	52	-	$ 25.00	$ -
139	Plant Maintenance Worker 3	User Defined		0	40	52	-	$ 25.00	$ -
140	Clerical Worker	1 8 hr shift 5 days per week		0	40	52	2,080	$ 25.00	$ 52,000
141	Lab Technician	1 8 hr shift 5 days per week		0	40	52	2,080	$ 25.00	$ 52,000
142	Other			0	40	52	-	$ 25.00	$ -
143	Other			0	40	52	-	$ 25.00	$ -
144	Staff	User Defined		0	40	52	-	$ 25.00	$ -
145	Subtotal - Annual Labor Cost						25,840		$ 785,600
146	Contingency							20%	$ 157,120
147	TOTAL - Annual Labor Cost						25,840	$ 36.48	$ 942,720
148									
149	**LABOR Net Present Value (NPV) Calculation:**								
150									
151	i =	5%							
152	n =	25							
153	Annual Inflation % =	3.00%							
154									
155	Year	Default Cost	User Over-Ride	Cost Used in NPV Calculation	Adjusted Annual O&M Cost				
156	0	$0		$0					
157	1	$971,002		$971,002					
158	2	$1,000,132		$1,000,132					
159	3	$1,030,136		$1,030,136					
160	4	$1,061,040		$1,061,040					
161	5	$1,092,871		$1,092,871					

	A	B	C	D	E	F	G	H	I
162	6	$1,125,657		$1,125,657					
163	7	$1,159,427		$1,159,427					
164	8	$1,194,209		$1,194,209					
165	9	$1,230,036		$1,230,036					
166	10	$1,266,937		$1,266,937					
167	11	$1,304,945		$1,304,945					
168	12	$1,344,093		$1,344,093					
169	13	$1,384,416		$1,384,416					
170	14	$1,425,949		$1,425,949					
171	15	$1,468,727		$1,468,727					
172	16	$1,512,789		$1,512,789					
173	17	$1,558,173		$1,558,173					
174	18	$1,604,918		$1,604,918					
175	19	$1,653,065		$1,653,065					
176	20	$1,702,657		$1,702,657					
177	21	$1,753,737		$1,753,737					
178	22	$1,806,349		$1,806,349					
179	23	$1,860,539		$1,860,539					
180	24	$1,916,356		$1,916,356					
181	25	$1,973,846		$1,973,846					
182	26								
183	27								
184	28								
185	29								
186	30								
187	31								
188	32								
189	33								
190	34								
191	35								
192	36								
193	37								
194	38								
195	39								
196	40								
197	41								
198	42								
199	43								
200	44								
201	45								
202	46								
203	47								
204	48								
205	49								
206	50								
207	NPV			$18,531,642	$971,002				

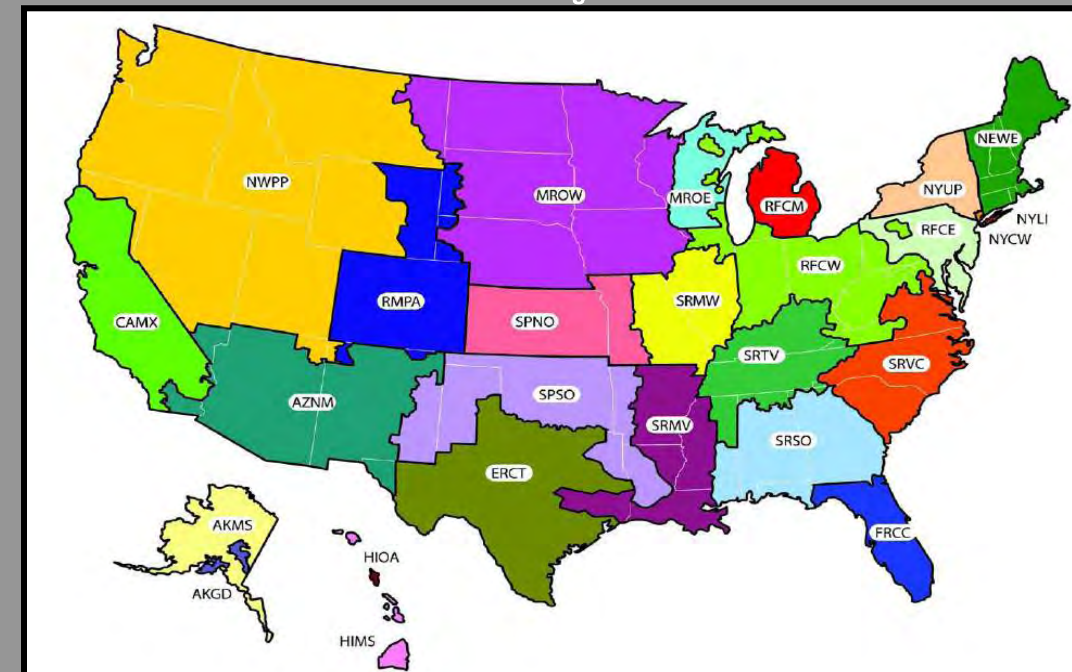
ENVIRONMENTAL IMPACT CALCULATOR

Does your project span multiple U.S. states?	No	
	eGrid Region	Select state applicable to your project State
Select eGrid Region or State Where Electricity is Purchased	NWPP	OREGON
Region Name	WECC Northwest	Override
CO2 Emissions (lbs/MWh)[1]	842.58	
N2O Emissions (lbs/MWh)[1]	0.02	
CH4 Emissions (lbs/MWh)[1]	0.01	

Energy Price Summary

		Override
State Where Electricity is Purchased	OREGON	Override Options
Average Electrical Price (USD/kWh)[2]	$ 0.0559	0
Estimated Electrical Cost per Day (USD $)	$ 7,185	

eGrid Regions



Power Summary

		Override
Total Horsepower (hp)	9,832.75	
Total Area of All Buildings (sf)	139,766.50	
Average to Maximum Flow Factor (%)	0.68	
Annual Plant Operating Hours (hr)	8,760.00	
Calculate Total Electricity Consumption (MWh/yr)	46,945.44	
Calculate Annual Emissions from Electricity Consumption (tons CO2/yr)	19,777.65	
Calculate Annual Emissions from Electricity Consumption (tons N20/yr)	0.38	
Convert N2O Into CO2 Equivalents for Annual Emissions (tons CO2e/yr)	112.27	
Calculate Annual Emissions from Electricity Consumption (tons CH4/yr)	0.31	
Convert CH4 Into CO2 Equivalents for Annual Emissions (tons CO2e/yr)	10.43	
Calculate Annual Emissions From Electrical Usage (tons CO2e/yr)	19,900.34	

1. U.S. Environmental Protection Agency. eGrid Ninth ed. 2010 data. Released 2/24/2014.Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html

2. U.S Energy Information Administration, Average Retail Price of Electricity to Ultimate Customers By End-Use, State, and Provider 2012. Released 11/8/2013. Available: http://www.eia.gov/electricity/data.cfm#sales

File Version: *9/21/2017*

Chemical Summary

If using either of these chemicals, input additional information in cells bx10 and by10

	Sodium Hypochlorite	Alum	Ferric Chloride	Sulfuric Acid	Hydrofluorosilicic Acid	Sodium Hydroxide	Aqueous Ammonia	Liquid Polymer	Hydrogen Peroxide	Sodium Bisulfite	Powdered Activated Carbon	Calcium Hydroxide
Total Chemical Usage (dry tons/yr)	115.05	1,926.64	0.00	0.00	0.00	101.65	0.00	242.36	0.00	11.37	0.00	0.00
Calculate Annual Emissions from Chemical Production (tons CO2)	122.53	531.75				139.86		504.59		11.37		
Chemical Delivery Vehicle Type	Tanker	Tanker				Tanker		Tanker		Tanker		
Size of Chemical Delivery (lbs/load)	40,000.00	40,000.00				40,000.00		40,000.00		40,000.00		
If Using Totes, Drums, or Supersacks, Input Number Per Delivery												
Calculate Number of Deliveries per year	46.00	199.00				10.00		12.00		1.00		
Transportation Distance for Delivery (Miles/Delivery)	50.0	50.0				50.0		50.0		50.0		
Calculate Total Miles Traveled by Delivery Vehicles	4,600.00	19,900.00				1,000.00		1,200.00		100.00		
Delivery Vehicle Fuel Economy (mpg)	8.90	8.90				8.90		8.90		8.90		
Emissions for Transportation (tons CO2/gal)	0.01	0.01				0.01		0.01		0.01		
Calculate Annual Emissions for Transportation (tons CO2/yr)	5.67	24.55				1.23		1.48		0.12		
Emissions for Transportation (tons N2O/mile)	0.00	0.00				0.00		0.00		0.00		
Emissions for Transportation (tons CH4/mile)	0.00	0.00				0.00		0.00		0.00		
Convert N2O Into CO2 Equivalents for Annual Emissions (tons CO2e/yr)	0.09	0.41				0.02		0.02		0.00		
Convert CH4 Into CO2 Equivalents for Annual Emissions (tons CO2e/yr)	0.01	0.02				0.00		0.00		0.00		
Calculate Annual Emissions from Chemical Transportation (tons CO2)	5.67	24.55				1.23		1.48		0.12		
Calculate Total Annual Emissions from Chemical Usage (tons CO2)	128.21	556.30				141.10		506.07		11.50		

	Sodium Bicarbonate	Sodium Carbonate	Potassium Permanganate	Ammonium Sulfate	Other 1	Other 2	Liquid Oxygen	GAC	Sand	Citric Acid	Trisodium Phosphate	Sodium Tripolyphosphate
Total Chemical Usage (dry tons/yr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	162.74	0.00	0.00
Calculate Annual Emissions from Chemical Production (tons CO2)										162.74		
Chemical Delivery Vehicle Type										Tanker		
Size of Chemical Delivery (lbs/load)										40,000.00		
If Using Totes, Drums, or Supersacks, Input Number Per Delivery												
Calculate Number of Deliveries per year										1.00		
Transportation Distance for Delivery (Miles/Delivery)										50.0		
Calculate Total Miles Traveled by Delivery Vehicles										100.00		
Delivery Vehicle Fuel Economy (mpg)										8.90		
Emissions for Transportation (tons CO2/gal)										0.01		
Calculate Annual Emissions for Transportation (tons CO2/yr)										0.12		
Emissions for Transportation (tons N2O/mile)										0.00		
Emissions for Transportation (tons CH4/mile)										0.00		
Convert N2O Into CO2 Equivalents for Annual Emissions (tons CO2e/yr)										0.00		
Convert CH4 Into CO2 Equivalents for Annual Emissions (tons CO2e/yr)										0.00		
Calculate Annual Emissions from Chemical Transportation (tons CO2)										0.12		
Calculate Total Annual Emissions from Chemical Usage (tons CO2)										162.86		

	Sodium EDTA	Salt	Purate	GFH / Resin Replacements (cf/yr)	CO2	Scale Inhibitor	Hydrochloric Acid	Other Liquid CIP Chem1	Other Liquid CIP Chem2	Other Dry Chem CIP 1	Other Pretreat Chem 1	Other Pretreat Chem 2
Total Chemical Usage (dry tons/yr)	0.00	731.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calculate Annual Emissions from Chemical Production (tons CO2)		16.16										
Chemical Delivery Vehicle Type		Tanker										
Size of Chemical Delivery (lbs/load)		40,000.00										
If Using Totes, Drums, or Supersacks, Input Number Per Delivery												
Calculate Number of Deliveries per year		37.00										
Transportation Distance for Delivery (Miles/Delivery)		50.0										
Calculate Total Miles Traveled by Delivery Vehicles		3,700.00										
Delivery Vehicle Fuel Economy (mpg)		8.90										
Emissions for Transportation (tons CO2/gal)		0.01										
Calculate Annual Emissions for Transportation (tons CO2/yr)		4.56										
Emissions for Transportation (tons N2O/mile)		0.00										
Emissions for Transportation (tons CH4/mile)		0.00										
Convert N2O Into CO2 Equivalents for Annual Emissions (tons CO2e/yr)		0.08										
Convert CH4 Into CO2 Equivalents for Annual Emissions (tons CO2e/yr)		0.00										
Calculate Annual Emissions from Chemical Transportation (tons CO2)		4.56										
Calculate Total Annual Emissions from Chemical Usage (tons CO2)		20.72										

	Sodium Hypochlorite	Alum	Ferric Chloride	Sulfuric Acid	Hydrofluorosilicic Acid	Sodium Hydroxide	Aqueous Ammonia	Liquid Polymer	Hydrogen Peroxide	Sodium Bisulfite	Powdered Activated Carbon	Calcium Hydroxide	Sodium Bicarbonate	Sodium Carbonate	Potassium Permanganate	Ammonium Sulfate
Wet Density (lbs/gal)	10.0914	11.1756	11.9262	15.2622	10.0914	12.8436	7.7562	9.174	9.4242	10.842						
% Active Chemical	0.125	0.485	0.4	0.93	0.18	0.5	0.19	1	0.35	0.4						
Dry Density (lbs/cf)											35	30	60	65	100	60

	Other 1	Other 2	Liquid Oxygen	GAC	Sand	Citric Acid	Trisodium Phosphate	Sodium Tripolyphosphate	Sodium EDTA	Number of Membrane Elements	Cartridge Replacements	Sludge (cy/year)	Liquid Chlorine Cylinders	Salt
Wet Density (lbs/gal)						13.8444								
% Active Chemical			1											
Dry Density (lbs/cf)				28	99		60	60	54					80

	Purate	Lamps	Ballasts	Sleeves	Intensity Sensors	GFH / Resin Replacements	CO2	Membrane Type	Scale Inhibitor	CIP Cartridge	Hydrochloric Acid	Other Liquid CIP Chem1	Other Liquid CIP Chem2	Other Dry Chem CIP 1	Other Pretreat Chem 1	Other Pretreat Chem 2
Wet Density (lbs/gal)	11.43						6.43		9.17		3.67					
% Active Chemical	1						1		1		0.37					
Dry Density (lbs/cf)																

Construction Summary

	Concrete (cy)	Excavation (cy)	Structural Backfill (cy)	Native Backfill (cy)	Haul Excess (cy)	Steel Process Piping (lbs)	Iron Process Piping (lbs)
Total Quantity Used	42,701.61	232,540.85	26,948.14	51,720.29	180,820.57	735,381.81	97,892.97
Input Load Factor		Low	Low	Low			
Calculate Gallons of Diesel Consumed based on Quantity Used (gal)		5,038.81	583.93	1,120.70			
Calculate CO2 Emissions based on Consumption (tons CO2)		55.80	6.47	12.41			
Calculate CH4 Emissions based on Consumption (tons CH4)		0.01	0.00	0.00			
Calculate N2O Emissions based on Consumption (tons N2O)		0.00	0.00	0.00			
Convert CH4 Into CO2 Equivalents for Emissions (tons CO2e)		0.16	0.02	0.04			
Convert N2O Into CO2 Equivalents for Emissions (tons CO2e)		0.17	0.02	0.04			
Calculate Emissions from Construction Quantities (tons CO2e)	1,601.31	56.14	6.51	12.49		1,904.64	94.47
Select Vehicle Capacity (cy)	7.85	10.00	10.00	10.00	10.00	40,000.00	40,000.00
Calculate Number of Vehicle Trips per year	5,442.00	23,255.00	2,695.00	5,173.00	18,083.00	19.00	3.00
Input Transportation Distance for Delivery (Miles/Delivery)	50.00	20.00	20.00	20.00	20.00	20.00	20.00
Calculate Total Miles Traveled by Construction Vehicles	272,100.00	465,100.00	53,900.00	103,460.00	361,660.00	380.00	60.00
Vehicle Fuel Economy (mpg)	8.90	8.90	8.90	8.90	8.90	8.90	8.90
Emissions for Transportation (tons CO2/gal)	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Calculate Emissions for Transportation (tons CO2)	335.66	573.75	66.49	127.63	446.14	0.47	0.07
Emissions for Transportation (tons N2O/mile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emissions for Transportation (tons CH4/mile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Convert N2O Into CO2 Equivalents for Emissions (tons CO2e)	5.58	9.53	1.10	2.12	7.41	0.01	0.00
Convert CH4 Into CO2 Equivalents for Emissions (tons CO2e)	0.31	0.54	0.06	0.12	0.42	0.00	0.00
Calculate Total Emissions from Transportation (tons CO2e)	341.55	583.81	67.66	129.87	453.97	0.48	0.08
Calculate Total Emissions from Construction Quantities (tons CO2e)	1,942.86	639.95	74.16	142.35	453.97	1,905.12	94.54

Load factor guide for excavation and backfill:

High - Most pipeline applications in hard rocky material. Digging 90-95% of the daily work schedule

Medium - Most residential sewer applications in natural bed clay. Digging 60-85% of the daily work schedule. Most log loading applications.

Low - Most utility, urban applications in sandy loam. Digging less than 50% of daily work schedule. Scrap handling applications.

WTP Solids Summary

Solids Handling Emissions from WTP sludge

	Sludge (cy/year)	
Are the Solids Produced in a WTP or WWTP?	**WTP**	
Quantity of Sludge Produced Annually (cy/yr)	3,663.12	
Input % Dry Solids in Dewatered Sludge	**20.00%**	***Typically 15 to 25%.***
Weight of Sludge (lbs/cy)	1,901.43	***Assumption:*** Density of dried solids of 145 lb/cf.
Vehicle Hauling Capacity (cy)	**10.00**	
Calculate Number of Hauls per year	366.31	
Transportation Distance for Hauling (Miles/Delivery)	**20.00**	
Calculate Total Miles Traveled by Hauling Vehicles	14,652.47	
Hauling Vehicle Fuel Economy (mpg)	8.90	
Emissions for Transportation (tons CO2/ gal)	0.01	
Calculate Annual Emissions for Transportation (tons CO2/yr)	18.08	
Emissions for Transportation (tons N2O/ mile)	0.00	
Emissions for Transportation (tons CH4/ mile)	0.00	
Convert N2O Into CO2 Equivalents for Annual Emissions (tons CO2e/yr)	0.30	
Convert CH4 Into CO2 Equivalents for Annual Emissions (tons CO2e/yr)	0.02	
Calculate Annual Emissions from Solids Transportation (tons CO2)	18.39	

Supporting Documents

Preliminary Geotechnical Study
The purpose of this study was to assist with the site evaluation and suitability of Carpenter Lane for future development by performing a preliminary geotechnical evaluation of the site. This report summarizes RhinoOne Geotechnical's field exploration, laboratory testing, preliminary geotechnical engineering analysis and design criteria recommended to be used during development of the proposed project.

Carpenter lane Site Evaluation
The purpose of this study was to provide a multi-disciplinary site assessment of the Carpenter Lane site and to identify the feasibility of redeveloping it. The objectives of this site evaluation were to research, identify, and document the existing site conditions and perform a general site investigation, cultural resource assessment, and environmental investigations of the site. This included on-site and desktop review for Phase I environmental site assessment, endangered species assessment, and wetland delineation for the purpose of identifying environmental permits that may be required to develop the site and estimated permitting schedule.

Preliminary Geotechnical Study

Preliminary Geotechnical Study

Portland Water Bureau – Filtration Plant Design Support
Site at SE Carpenter Lane and SE Dodge Park Boulevard
Gresham, Oregon

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SUPPORTING DATA

1.0 INTRODUCTION

The City of Portland Water Bureau (PWB) is in the process of planning significant upgrades to its water supply system. This includes the implementation of a filtration treatment plant. One of the more suitable sites the Filtration Plant may be located is an approximately 93.5 acre site at the eastern dead-end of SE Carpenter Lane near SE Dodge Park Boulevard outside Gresham, Oregon. This report presents the results of Rhino One Geotechnical's (ROG) preliminary geotechnical engineering study for the Carpenter Lane site and supports the site selection process for the proposed PWB Bull Run Filtration project. A Site Plan is provided on Figure 1 of Appendix A.

The purpose of this study is to assist with the site selection and suitability of this site for future development. This report provides a summary of our field exploration, laboratory testing, preliminary geotechnical engineering analysis and design criteria to be used during the development of the proposed project.

2.0 SITE CONDITIONS

Site geology and subsurface conditions for the site were evaluated based on a review of geologic and hazard mapping reports, site reconnaissance, previous subsurface explorations, and explorations conducted for this study. Geologic mapping of the site was evaluated by an Oregon Certified Engineering Geologist (CEG). Figure 2 of Appendix A, Site Exploration Plan, shows the project site with the approximate location of our borings and test pits completed for this study.

Geologic Mapping

The site is located just west of the Sandy River drainage near the foothills of the Cascade Mountains. The site is located on Ancient River Rock deposits between Boring Lava basalt flows to the west and the foothills of the Cascade Mountain Range to the east. The site is approximately 600 feet above the Sandy River. An ancient river terrace is located roughly 300 feet down the steep valley walls just east of the site, before dropping down another 300 feet to the current Sandy River floodplain. The area is part of the larger Puget Sound-Willamette Valley physiographic province, a tectonically active lowland situated between the Coast Range to the west and the Cascade Mountains to the east (Orr and Orr, 1999)[1].

The Ancient River Rock unit consists of sandstones, siltstones and conglomerates created from sediment deposits from ancient rivers which flowed through the region. Basement rock in the vicinity of the site are similar to those exposed in the adjacent Boring Lavas and foothills of the Cascade Mountains, which primarily consist of the Miocene (20 million to 10 million years before present) Columbia River Basalt Group (CRBG). The CRBG consists of thick flows of basalt which have been folded and faulted from the compressional tectonics of the region.

Field Explorations

The subsurface exploration program consisted of drilling three (3) borings and excavating nine (9) test pits. The borings were drilled using a truck-mounted drill rig operated by Western States Soil Conservation, Inc. of Hubbard, Oregon on February 19 and 20, 2018. Borings (B-1 to B-3) were drilled at the approximate locations shown on the Site Exploration Plan (Figure 2). The borings were advanced using mud-rotary drilling techniques and were drilled to depths between 51.5 and 100.2 feet below ground surface (BGS). Standard Penetration Test (SPT) soil samples were obtained at regular 5-foot intervals to a depth of 100 feet using a 140-pound Automatic Hammer. Uncorrected blow counts from the SPT sampling are reported on the boring logs. Corrected blow counts [$(N1)_{60}$] were used for our analysis unless otherwise noted.

[1] Orr, E.L. and Orr, W.N. (1999). *Geology of Oregon*. Kendall/Hunt Publishing, Iowa. Page 254.

The test pits were excavated using an extended-reach backhoe operated by Dan J. Fischer Excavating Inc. of North Plains, Oregon on February 23, 2018. The test pits (TP-1 to TP-9) were excavated at the approximate locations shown on the Site Exploration Plan (Figure 2). The test pits were excavated using a 24-inch wide bucket and were each excavated to a depth of 11 feet BGS. Bulk soil samples were obtained at periodic intervals from the excavated materials. A pocket penetrometer was used intermittently in order to estimate the unconfined compressive strength of the soil. The pocket penetrometer (PP) readings are reported on the test pit logs.

The subsurface materials encountered were logged and field classified in general accordance with the Manual-Visual Classification Method (American Society for Testing and Materials (ASTM) D 2488). The SPT samples were collected at desired depths and packaged in moisture-tight bags. The soil samples were reviewed in the laboratory in order to supplement field classifications. Interpreted boring logs and test pit logs are presented in Appendix B.

Subsurface Conditions

The site is currently an operating commercial plant and tree nursery. The site is generally flat to rolling with a slight knoll located near the existing water tanks at the south-center of the property. A dirt/gravel road network provides access to the site for all-terrain vehicles. Adjacent to the property, the land slopes gently to the west and south. However, the approximate 2100-feet long northeast facing property line lies at the top of a steep slope dropping approximately 300 feet down to SE Dodge Park Boulevard over a horizontal distance of approximately 200 feet.

Topsoil was encountered in each of the borings and test pits to depths ranging between 1.5 to 2 feet BGS. The topsoil consists of very soft to stiff silty clay with some sand. This is the till zone for the nursery. The topsoil is underlain by red-brown to brown silty clay with trace fine sand to sandy silt with clay (alluvium) to depths between 21 to 40 feet BGS. The clay is generally medium stiff to stiff with medium to high plasticity, while the silt is generally soft and interbedded with clay. Sands with silts (decomposed sedimentary rocks) were observed below the clay and silt layers to the maximum depth explored of 100.2 feet BGS. The sands are arranged in layers of silty sand to sands with silt and are generally loose to very dense with increasing density with depth. Between depths of 65 feet and 75 feet BGS, the sands are described as relict coarse sands and gravel. Below a depth of 75 feet, the sands are described as decomposed conglomerate.

Groundwater

Information provided by the US Geological Survey (USGS) *Estimated Depth to Groundwater Study of the Portland Metro Area*[2], along with a review of existing well logs and previous geotechnical investigations in the area, indicate the groundwater table is most likely at a depth of greater than 150-feet. Perched groundwater was observed in each of the borings at depths between 25 feet and 33 feet BGS. Seepage was also observed in TP-2 and TP-4 between depths of 6.5 to 8 feet.

[2] US Geological Survey (USGS). *Estimated Depth to Ground Water in the Portland, Oregon Area*. Accessed from website http://or.water.usgs.gov/projs_dir/puz/ on March 22, 2018.

Laboratory Testing

Laboratory tests were conducted on selected soil samples in accordance with standard ASTM methods. The tests conducted include:

- Natural moisture content of selected samples obtained from the borings in general accordance with guidelines presented in ASTM D2216.
- Atterberg Limits of selected samples obtained from the borings in general accordance with guidelines presented in ASTM D4318.
- Grain Size analysis of selected samples obtained from the borings in general accordance with guidelines presented in ASTM D1140.

The results of these tests are presented on the boring and test pit logs and in Appendix B. The following table summarizes pertinent laboratory tests.

Table 1 Laboratory Test Results

Boring Number and Depth (feet)	Percent Silt and Clay (< #200 Sieve)	Atterberg Limits
B-2 at 5 – 6.5	89.5	
B-2 at 10 – 11.5	91.8	Liquid Limit = 49.3 Plastic Limit = 27.8 Plasticity Index = 22
B-2 at 15 – 16.5	98.0	
B-2 at 20 – 21.5	97.7	Liquid Limit = 50.8 Plastic Limit = 29.3 Plasticity Index = 22
B-2 at 25 – 26.5	95.7	
B-2 at 30 – 31.5	96.2	Liquid Limit = 58.0 Plastic Limit = 27.7 Plasticity Index = 30
B-2 at 35 – 36.5	74.1	
B-2 at 50 – 51.5	26.8	
B-2 at 55 – 56.5	53.9	Liquid Limit = 38 Plastic Limit = 29.7 Plasticity Index = 8
B-2 at 60 – 61.5	53.7	
B-2 at 70 – 71.5	28.8	
B-2 at 80 – 81.5	29.1	
B-2 at 90 – 91.5	29.0	

3.0 DISCUSSION

The explored site is one of the proposed sites for the construction of a new Water Filtration Plant. At this point, PWB has not selected a preferred site or the location of facilities on the selected sites. We understand that the major work items for the proposed project may consists of a water Filtration Plant, two- or more water reservoirs and water conveyance pipelines in and out of the plant. Other miscellaneous support structures may also be required. The water reservoirs would be approximately 12- to 15- million gallon and will most likely be located underground. These reservoirs will have a width and length of 300- to 400- feet with a depth of 15- to 20- feet. We have provided general recommendations on the following pages. Please note that these recommendations will need to be modified with better subsurface characterization and analysis when the site is selected and the type and location of the facilities are better defined.

American Society of Civil Engineers (ASCE) 7-10 Seismic Design Criteria and Seismic Hazards

The Filtration Plant qualifies as an "Essential Facility" in accordance with ORS 455.447. PWB will decide the seismic resiliency level required for this Filtration Plant. This section provides the basic seismic design criteria in accordance with the 2014 Oregon Structural Specialty Code (2014 OSSC) which is based on the 2012 International Building Code (2012 IBC). The seismic design parameters in accordance with ASCE 7-10 are summarized in the Table below.

Table 2 ASCE 7-10 (2012 IBC) Seismic Design Parameters

	Short Period	1 Second
Maximum Credible Earthquake Spectral Acceleration (g)	$S_s = 0.802$	$S_1 = 0.346$
Site Class	E	
Site Coefficient	$F_a = 1.138$	$F_v = 2.618$
Adjusted Spectral Acceleration (g)	$S_{MS} = 0.912$	$S_{M1} = 0.905$
Design Spectral Response Acceleration Parameters (g)	$S_{DS} = 0.608$	$S_{D1} = 0.603$
Mapped PGA (g)	0.339	
F_{PGA}	1.084	
PGA_M (g)	0.367	

Liquefaction

A liquefaction analysis was completed using the mapped value of peak ground acceleration (PGA) adjusted for site effects, PGA_M of 0.367g. Groundwater was assumed at 25 feet BGS. The on-site soils show low to moderate liquefaction potential. This is in the zone between 25 to 45 feet where very loose to loose sands were encountered in boring B-1. The associated vertical settlements were calculated to be on the order of 2- to 6- inches. More refined testing and analysis should be performed during the design stage of the project.

Slope Stability Analysis / Lateral Spreading

The site is generally flat to rolling with a slight knoll located near the existing water tanks at the south-center of the property. Adjacent to the property, the land slopes gently to the west and south. However, the approximate 2100-feet long northeast facing property line lies at the top of a steep slope dropping approximately 300 feet down to SE Dodge Park Boulevard over a horizontal distance of approximately 200 feet. This is the slopes along which the pipelines will ingress and egress the site. Oregon's Department of Geology and Mineral Industries (DOGAMI) has mapped numerous landslides on this slope. The mapped landslides are located both below Dodge Park Blvd and crossing Dodge Park Blvd. The pipeline should be designed assuming it is within an active slope. Detailed subsurface characterization and analysis will be required along this slope to evaluate global slope stability and lateral spreading. The factors of safety are generally recommended to be 1.5 and 1.1 under static and seismic loading conditions, respectively.

For the rest of the site, slope stability and lateral spreading risks are low. The impacts of liquefaction will therefore primarily be vertical settlement and loss of support during a design seismic event. If these are a concern, we recommend that consideration should be given to support the structures on deep foundations.

Soil Profile

Based on the three borings advanced during this study, we developed a preliminary subsurface profile that can be used for preliminary geotechnical analysis. The upper layer is red-brown to brown silty clay with trace fine sand to sandy silt with clay (alluvium) to depths between 21 to 40 feet BGS. The clay is generally medium stiff to stiff with medium to high plasticity, while the silt is generally soft and interbedded with clay. Sands with silts (decomposed sedimentary rocks) were observed below the clay and silt layers to the maximum depth explored of 100.2 feet BGS. The sands are arranged in layers of silty sand to sands with silt and are generally loose to very dense with increasing density with depth. Between depths of 65 feet and 75 feet BGS, the sands are described as relict coarse sands and gravel. Below a depth of 75 feet, the sands are described as decomposed conglomerate. Our interpreted soil profile is provided in Table 3 below:

Table 3 Preliminary Recommended Soil Parameters

Depth (feet)	Soil	Average $(N1)_{60}$	Total Unit Weight (pcf)	Angle of Internal Friction (degree)	Undrained Cohesion (psf)
0 - 10	Medium Stiff to stiff silty Clay	9	115	-	1,000
10 - 25	Stiff Clay	13	115	-	1,250
25 - 45	Loose to Medium Dense Sand/soft sandy Silt	3 to 22	115	28	250
45 -55	Dense Sand	30	130	38	-
55 - 71	Loose to medium Dense silty Sand	10	115	32	250
71 -75	Medium Dense Sand	15	115	35	-
75 - 100	Very Dense silty Sand with gravel	>50	135	40	-
This profile is based on three widely scattered borings across the site. Additional borings will be required at each structure to evaluate site-specific soil profiles					

Preliminary geotechnical design recommendations for shallow foundations, deep foundation, and temporary shoring are provided in Section 4 of the report.

4.0 PRELIMINARY GEOTECHNICAL DESIGN RECOMMENDATIONS

Spread Footings

Isolated spread/mat footings should be at least 24 inches wide, and the bottom of footings should be at least 24 inches below the lowest adjacent exterior grade.

An 8-inch thick layer of granular material should be installed on the footing subgrade to prevent disturbance since soft soils are present at the subgrade. Footings bearing on the 8 inch granular pad placed on firm subgrade should be sized for an allowable bearing capacity of 2,000 pounds per square foot (psf). This is a net bearing pressure. The weight of the footing and overlying backfill can be disregarded in calculating footing sizes. The recommended allowable bearing pressure applies to the total of dead plus long-term-live loads and may be increased by one-third for short-term loads, such as those resulting from wind or seismic forces.

Based on our analysis, total post-construction settlement was calculated to be less than 1 inch, with post construction differential settlement of less than 0.5 inch over a 20-foot span, for maximum column and perimeter footing loads of less than 100 kips and 5 kips per linear foot. Please note that the preliminary analysis indicates that soils below the groundwater table are susceptible to liquefaction. Post-liquefaction settlements are discussed above. It is likely that structures founded on these shallow footing may be damaged during the design seismic event.

Lateral loads on footings can be resisted by passive earth pressure on the sides of the structures and by friction at the base of the footings. A nominal passive earth pressure of 300 pounds per cubic foot (pcf) may be used for footings confined by the existing structural fills. Adjacent floor slabs, pavements, or the upper 12-inch depth of adjacent unpaved areas should not be considered when calculating passive resistance. For footings in contact with native soils or fill, use a coefficient of friction equal to 0.45 when calculating resistance to sliding. These numbers do not include a factor of safety.

Deep Foundation Recommendations:

As discussed above, there is a potentially liquefiable layer between the depths of 25 to 45 feet. The associated post-liquefaction settlements are on the order of 2- to 6- inches. This liquefaction potential should be confirmed by further exploration and testing once the project footprint is established. Deep foundations like driven pipe piles, H-piles or drilled auger cast piles can be used to support the proposed structures. The preliminary capacities of these piles can be determined using the soil profile provided in Table 3. The capacities of these piles should be developed below the depth of liquefaction which is calculated to be 45 feet. Pile capacities will be evaluated later as the design moves further.

Retaining Wall Design Recommendations

It is possible that retaining walls will be required for the underground structures. These walls would be on the order of 10- to 20- feet deep. Our retaining wall design recommendations are based on the following assumptions: (1) the walls consist of conventional, cantilevered retaining walls; (2) the walls are less than 20 feet in height; (3) the backfill is drained; and (4) the backfill has a slope flatter than 4H: 1V. Review of our recommendations will be required if the retaining wall design criteria for the project varies from these assumptions.

Unrestrained site walls which retain native soils should be designed to resist active fluid unit weight of 40 pounds per cubic foot (pcf) where supporting slopes are flatter than 4H: 1V. This value should be increased to 60 pcf for 2H: 1V slopes. We do not recommend slopes steeper than 2H: 1V. The active fluid unit weight shall be increased to 60 pcf for restrained walls with slopes flatter than 4H: 1V. This value should be increased to 80 pcf for 2H: 1V slope. For embedded building walls, a superimposed seismic lateral force calculation is based on a dynamic force of $11H^2$ pounds per lineal foot of wall, where H is the height of the wall in feet, and applied at 0.6H from the base of the wall. If surcharges (e.g., slopes steeper than 4H:1V, foundations, vehicles, etc.) are located within a horizontal distance from the back of a wall equal to twice the height of the wall, then additional pressures will need to be accounted for in the wall design. Use Figure 3 to calculate the magnitude of these surcharges. The wall footings should be designed in accordance with the guidelines provided in the “Spread Footing Design Recommendation” section of this report.

The design parameters provided assume back-of-wall drains will be installed to prevent buildup of hydrostatic pressures behind all walls. A minimum 12 inch wide zone of drain rock, extending from the base of the wall to within 6 inches of finished grade, should be placed against the back of all retaining walls. Perforated collector pipes should be embedded at the base of the drain rock. The perforated collector pipes should discharge at an appropriate location away from the base of the wall. The backfill material placed behind the walls and extending a horizontal distance equal to at least the height of the retaining wall should consist of granular retaining wall backfill material meeting specifications provided in City of Portland Standard Construction Specifications (SCS) 510.12. We recommend the select granular wall backfill be separated from general fill, native soil and/or topsoil using a geotextile fabric that meets the requirements provided in SCS 2320.20 for drainage geotextiles. The wall backfill should be compacted to a minimum of 92 percent of the maximum dry density, as determined by ASTM D 1557. Backfill placed within 3 feet of the wall should be compacted in lifts less than 6 inches thick using hand-operated tamping equipment (e.g., jumping jack or vibratory plate compactors).

Temporary Shoring Design Parameters

Subsurface conditions at the project site show predominately fine to coarse sands, clays, silts and gravels to the depths explored. Excavations in these soils may be readily accomplished with conventional earthwork equipment. We understand that cuts on the order of 15 to 20 feet may be required for the construction of underground reservoirs.

Trench cuts should stand vertical to a depth of approximately 4 feet – provided no groundwater seepage is present in the trench walls. Open excavation may be used to excavate trenches with depths between 4 and 8 feet with the walls of the excavation cut at a slope of 1H:1V – provided groundwater seepage is not present and with the understanding some sloughing may occur. The trenches should be flattened to 1.5H: 1V if excessive sloughing occurs or seepage is present. Deeper cuts can be attempted at slopes of 2H: 1V or flatter slopes. If these are not feasible than temporary shoring will be required.

Temporary shoring can be cantilever or may include one or more level of tiebacks. These shoring and excavations should be designed by a Licensed Engineer registered in the state of Oregon and constructed in accordance with applicable Occupational Safety and Health Administration (OSHA) and state regulations.

Figure 4 provides pressure diagrams for the design of the shoring systems. For a cantilever type shoring system, use an active equivalent fluid weight (EFW) of 35 pounds per cubic feet (pcf) and a passive EFW of 300 pcf. Neglect the upper 2 feet of soils immediately below the base of excavation when calculating passive resistance. The passive pressure should be applied to 2 x Diameter of the piles for passive resistance calculations. These values are nominal values and do not contain a factor of safety.

For one or more levels of tieback type shoring, use the pressure diagram shown on Figure 4. The maximum pressure ordinate is on the order of 30H where H is the depth of excavation. Use an EFW of 300 pcf for passive resistance. Neglect the top 2 feet in calculation of passive resistance. The passive pressure should be applied to 2 x Diameter of the piles for passive resistance calculations. The soldier piles should be embedded a minimum of 10 feet below the base of excavation. Use ultimate bond strength of 10 psi for the preliminary design of tiebacks. The contractor should design the actual bond length of tiebacks based on the required loads provided in the plans. The bond zone should be behind a line drawn at 45 degrees to the horizontal starting at a distance of H/4 from the base of the excavation (no-bond zone). The minimum unbound zone should be 10 feet for bar anchors and 15 feet for strand anchors. For shoring locations where traffic may be present, use a minimum of 2 feet of traffic surcharge load. Additional surcharge loading may be required if cranes or other construction loads are present behind the shoring. Figure 3 can be used to calculate the surcharge loads on the shoring system.

Pavement Design Recommendations

Our pavement recommendations are based on the following assumptions.

- A resilient modulus of 4,500 psi for the native site soils.
- A resilient modulus of 20,000 psi estimated for the base rock.
- Initial and terminal serviceability index of 4.2 and 2.5, respectively.
- Reliability and standard deviation of 85% and 0.45, respectively.

- Structural coefficient of 0.42 and 0.10 for the asphalt and base rock, respectively.
- We assumed several Equivalent Single Axle Loads (ESALs) for pavement design. The actual ESALs should be selected based on traffic levels anticipated as the project moves forward.

If any of these assumptions are incorrect, contact our office with the appropriate information so we may revise the pavement designs. Pavement designs were based on the 1993 AASHTO pavement design equations. The development of pavement designs for the project pavements are in general accordance with the design guidelines and procedures of the American Association of State Highway and Transportation Officials (AASHTO) and the Oregon Department of Transportation (ODOT) Pavement Design Manual. Summary of our pavement design recommendations are in the table below.

Table 4 Minimum Pavement Sections

Traffic Loading (ESALs)	Asphalt Cement Concrete (inch)	Aggregate Base Rock (inch)
10,000	3	8
50,000	4	10
100,000	4.5	12
250,000	5.5	12
500,000	6	15
1,000,000	7	15

The thicknesses shown in Table 4 are intended to be minimum acceptable values.

The asphalt cement (AC) binder should be PG 64-22 Performance Grade Asphalt Cement according to SCS 00744.11 – Asphalt Cement and Additives. The AC should consist of dense graded Level 3, 1/2-inch hot mix asphalt. The minimum lift thicknesses should be 2.0 inches. The AC should conform to SCS 00744.13 and be compacted to 91% of Rice Density of the mix, as determined in accordance with ASTM D 2041.

The pavement subgrade should be prepared in accordance with the “Site Preparation” and “Structural Fill” sections of this report.

5.0 PERTINENT CONSTRUCTION RECOMMENDATIONS

The construction should be carried out as indicated in accordance with the City of Portland Standard Construction Specifications, 2010 version (COP – SCS). We have assumed that final project specifications will be standalone specifications in “CSI” format.

We understand that the major work items for the proposed project may consists of a water Filtration Plant, two- or more water reservoirs and water conveyance pipelines in and out of the Filtration Plant. Other miscellaneous support structures may also be required. The water reservoirs would be approximately 12- to 15- million gallon and will most likely be located underground. These reservoirs will have width and length of 300- to 400- feet with a depth of 15- to 20- feet. Site access roads and parking areas may also be part of the project.

Site Preparation Fill Materials

The existing near-surface root zone should be stripped and removed from the project site in all proposed building, fill, and pavement areas and for a 5-foot margin around such areas. We anticipate an average stripping depth of 1 to 2 feet with some localized deeper areas. The actual stripping depth should be based on field observations at the time of construction. Stripped material should be transported off site for disposal or stockpiled for use in landscaped areas.

Trees and shrubs should be removed from all pavement and improvement areas. In addition, root balls should be grubbed out to the depth of the roots, which could exceed 3 feet BGS. Depending on the methods used to remove the root balls, considerable disturbance and loosening of the subgrade could occur during site grubbing. We recommend soil disturbed during grubbing operations be removed to expose firm undisturbed subgrade. The resulting excavations should be backfilled with structural fill.

Demolition should include removal of existing improvements throughout the project site. Underground utility lines, vaults, basement walls, or tanks should also be removed or grouted full if left in place. The voids resulting from removal of footings, buried tanks, etc. or loose soil in utility lines should be backfilled with compacted structural fill. The base of these excavations should be excavated to firm subgrade before filling with sides sloped at a minimum of 1H: 1V to allow for uniform compaction.

Following stripping and prior to placing fill, pavement, or building improvements, the exposed subgrade should be evaluated by proof rolling. The subgrade should be proof rolled with a fully loaded dump truck or similar heavy rubber-tire construction equipment to identify soft, loose, or unsuitable areas. Soft or loose zones identified during the field evaluation should be compacted to an unyielding condition or be excavated and replaced with structural fill.

Wet-Weather/Wet-Soil Conditions

Trafficability on the near-surface soils may be difficult during or after extended wet periods or when the moisture content of the surface soil is more than a few percentage points above optimum. Soils which have been disturbed during site-preparation activities, or soft or loose zones identified during probing or proof-rolling, should be removed and replaced with compacted structural fill.

Track-mounted excavating equipment may be required during wet weather. The thickness of the granular material for haul roads and staging areas will depend on the amount and type of construction traffic. A 12- to 18-inch-thick mat of imported granular material is normally sufficient for light staging areas. The granular mat for haul roads and areas with repeated heavy-construction traffic typically needs to be increased to between 18- and 24-inches. The actual thickness of haul roads and staging areas should be based on the contractor’s approach to site development and the amount and type of construction traffic. The imported granular material should be placed in one lift over the prepared, undisturbed subgrade and compacted using a smooth-drum, non-vibratory roller. Additionally, a geotextile fabric should be placed as a barrier between the subgrade and imported granular material in areas of repeated construction traffic. The imported granular material should be 4- to 6-inch-minus pit run rock with less than 10% passing a U.S. Standard Number 200 sieve. Note that the thicknesses may need to be adjusted based on the performance of the site during construction.

Structural Fills

Fills should be placed over subgrade prepared in conformance with the previous section of this report. Material used as structural fill should be free of organic matter or other unsuitable materials and should meet the requirements of SCS 00330.12 – Borrow Material and SCS 00330.13 – Selected General Backfill, depending upon the application. Discussion of these materials is in the following sections.

Native Soils

The moisture content of the native soils in the upper 20 feet is on the order of 35 to 45 percent. Proper moisture conditioning for structural fill will require large areas and dry summer weather. We recommend that these soils not be used as structural fills unless they are amended by cement and or lime.

Imported Granular Fills

Imported granular material should be pit or quarry run rock, crushed rock, or crushed gravel and sand and should meet the specifications provided in SCS SS 00330.14 – Selected Granular Backfill, and SCS SS 00330.15 – Selected Stone Backfill. The imported granular material should be fairly well graded between coarse and fine material and have less than 5% by weight passing the U.S. Standard No. 200 Sieve.

Imported granular material should be placed in lifts with a maximum non-compacted thickness of 8 to 12 inches and be compacted to at least 95% of the maximum dry density, as determined by ASTM D 1557. During the wet season or when wet subgrade conditions exist, the initial lift should be approximately 18 inches in non-compacted thickness and should be compacted with a smooth-drum roller without using vibratory action.

Where imported granular material is placed over wet or soft soil subgrades, we recommend a geotextile be placed as a barrier between the subgrade and imported granular material. The geotextile should meet SCS 2320.20 for soil separation and/or stabilization. The geotextile should be installed in conformance with SCS 00350.40 – Geosynthetic Construction.

Trench Backfill

Trench backfill placed beneath, adjacent to, and for at least 2 feet above utility lines (e.g., the pipe zone) should consist of well-graded, granular material with a maximum particle size of 1.5 inches, have less than 10% by weight passing the U.S. Standard No. 200 Sieve, and meet SCS 405.12 - Pipe Zone Bedding. The pipe zone backfill should be compacted to at least 90% of the maximum dry density, as determined by ASTM D 1557 or as required by the pipe manufacturer or local building department.

Within roadway alignments or beneath building pads, the remainder of the trench backfill should consist of well-graded, granular material with a maximum particle size of 2.5 inches, have less than 10% by weight passing the U.S. Standard No. 200 Sieve, and meet SCS SS 405.14 - Trench Backfill, Class B. This material should be compacted to at least 92% of the maximum dry density as determined by ASTM D 1557, or as required by the pipe manufacturer or local building department. The upper 2-feet of the trench backfill should be compacted to at least 95% of the maximum dry density as determined by ASTM D 1557.

Outside of structural improvement areas (e.g., roadway alignments or building pads), trench backfill placed above the pipe zone may consist of general fill materials free of organics and materials over 6 inches in size, and meet SCS SS 405.14 - Trench Backfill, Class A, C, or D. This general trench backfill should be compacted to at least 90% of the maximum dry density, as determined by ASTM D 1557 or as required by the pipe manufacturer or local building department.

Retaining Wall Backfill

Backfill material placed behind retaining walls and extending a horizontal distance of 0.5H, where H is the height of the retaining wall, should consist of select granular material meeting SCS 510.12 –

Granular Wall Backfill. We recommend the select granular wall backfill be separated from general fill, native soil and/or topsoil using a geotextile fabric that meets the requirements provided in SCS 2320.20 for drainage geotextiles. The geotextile should be installed in conformance with SCS 00350.40 – Geosynthetic Construction.

Trench Drain and Retaining Wall Drain Backfill

Backfill for subsurface trench drains and for a minimum 1-foot-wide zone against the back of retaining walls should consist of drain rock meeting the specifications provided in SCS 00430.11 – Granular Drain Backfill Material. A pre-fabricated drain board can be substituted for the drain rock. The drain rock should be wrapped in a geotextile fabric meeting the specifications provided in SCS 2320.20 for soil separation and/or stabilization. The geotextile should be installed in conformance with SCS SS 00350.40 – Geosynthetic Construction.

Floor Slab Base Rock

Base aggregate for floor slabs should be clean, crushed rock or crushed gravel. The base aggregate should contain no deleterious materials, meet specifications provided in SCS 02630.10 – Dense Graded Aggregate 1”-0”, and have less than 5% by weight passing the U.S. Standard No. 200 Sieve. The imported granular material should be placed in one lift and compacted to at least 95% of the maximum dry density, as determined by ASTM D 1557.

Pavement Base Aggregate

Imported base aggregate for roads and parking lots should be clean, crushed rock or crushed gravel. The base aggregate should meet the gradation defined in SCS 02630.10 – Dense Graded Aggregate 1”-0,” with the exception that the aggregate should have less than 5% passing a U.S. Standard No. 200 Sieve. The base aggregate should be compacted to at least 95% of the maximum dry density, as determined by ASTM D 1557.

Recycled Concrete, Asphalt and Base Rock

Asphalt pavement, concrete, and base rock from the existing site improvements can be used in general structural fills, provided no particles greater than 6 inches are present. It also must be thoroughly mixed with soil, sand or gravel such that there are no voids between the fragments. In addition, these materials should not be contaminated as determined by PWB’s environmental consultant. Since this fill is made of non-homogeneous materials, the acceptance of this fill will be based on visuals observation and proof-rolling.

Drainage Considerations

Surface and Subsurface Drainage Requirements

The Contractor shall be made responsible for temporary drainage of surface water and groundwater as necessary to prevent standing water and/or erosion at the working surface. We recommend removing only the foliage necessary for construction to help minimize erosion.

The ground surface around the structures should be sloped to create a minimum gradient of 2% away from the building foundations for a distance of at least 5 feet. Surface water should be directed away from all buildings into drainage swales or into a storm drainage system. “Trapped” planting areas should not be created next to any building without providing means for drainage. The roof downspouts should discharge onto splash blocks or pavement surfaces which direct water away from the buildings, or into smooth-walled underground drain lines that carry the water to appropriate discharge locations at least 10 feet away from any buildings.

Foundation Drains

We recommend foundation drains around the perimeter foundations of all new structures. The foundation drains should be at least 12 inches below the base of the slab. The foundation drain should consist of perforated collector pipes embedded in a minimum 2-foot-wide zone of angular drain rock. The drain rock should meet specifications provided in the "Structural Fill" section of this report. The drain rock should be wrapped in a geotextile fabric. The collector pipes should discharge at an appropriate location away from the base of the footings. Unless measures are taken to prevent backflow into the wall's drainage system, the discharge pipe should not be tied directly into storm water drain system.

6.0 LIMITATIONS

This report has been prepared for the exclusive use of the addressee, and their engineers, for aiding in the design and construction of the proposed project. This report is preliminary in nature and should not be relied for the final design of the facilities. Additional field exploration, testing and analysis will be required if this site is selected as the preferred site.

The opinions, comments, and conclusions presented in this report were based upon information derived from our literature review, field investigation, and laboratory testing. Conditions between or beyond our exploratory borings may vary from those encountered. Unanticipated soil conditions and seasonal soil moisture variations are commonly encountered and cannot be fully determined by merely taking soil samples or soil borings. Such variations may result in changes to our recommendations and may require additional expenditures be made to attain a properly constructed project. Therefore, some contingency fund is recommended to accommodate such potential extra costs.

7.0 RESTRICTIONS

This report is for the exclusive use of the client for design of the development, as described in our proposal for this particular project, and is not to be relied upon by other parties. It is not to be photographed, photocopied, or similarly reproduced, in total or in part, without the expressed written consent of the client and ROG.

Sincerely,
RhinoOne Geotechnical

Christina Hemberry, PE
Geotechnical Engineer

Rajiv Ali, PE GE
Principal Geotechnical Engineer

APPENDIX A

Figures

RhinoOne GEOTECHNICAL

4610 NE 77th Avenue, Suite 126
Vancouver, Washington 98662
360-258-1738

FUTURE FILTRATION PLANT

PORTLAND WATER BUREAU

35320 SE CARPENTER LANE, GRESHAM, OREGON 97080

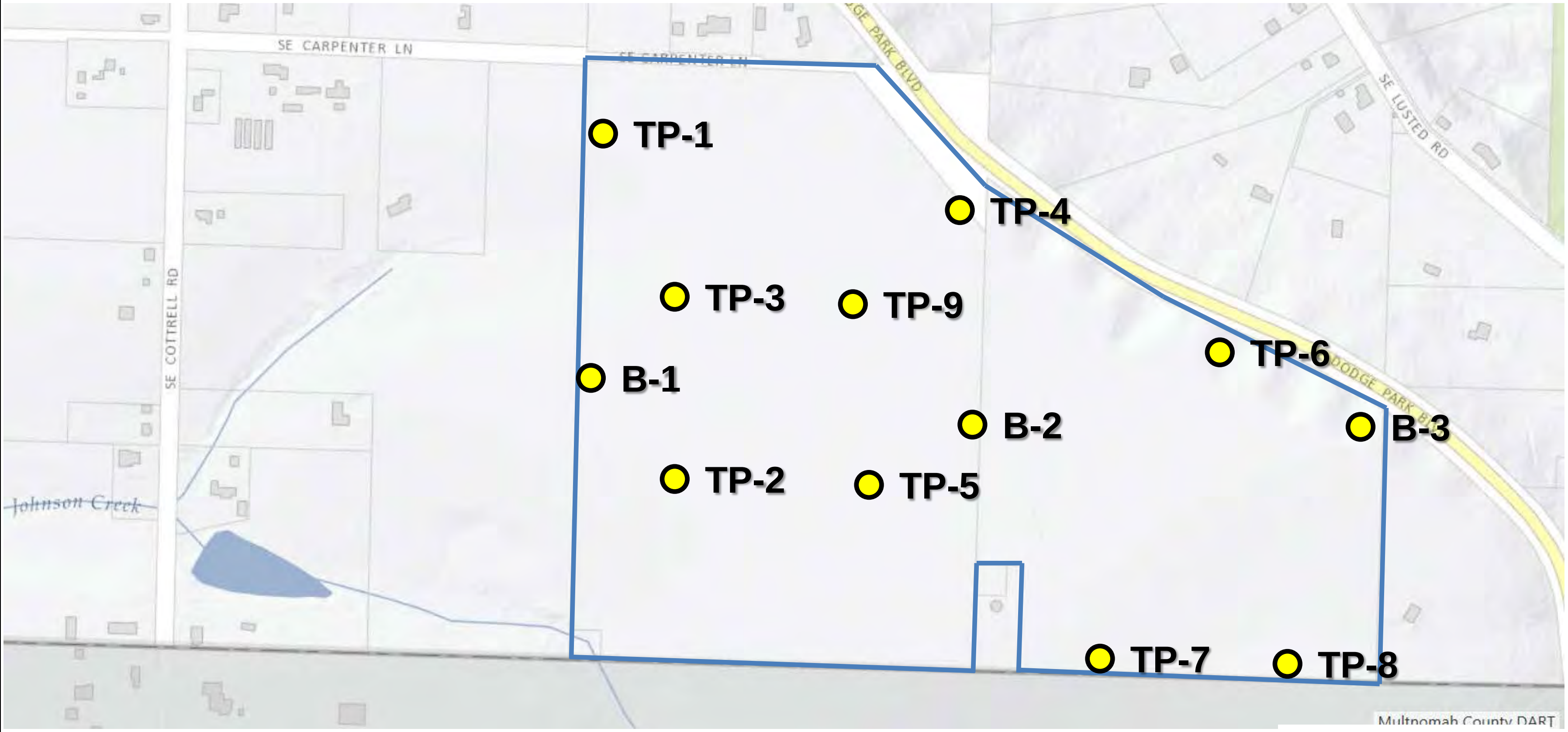
PROJECT

HDR-2018-008

FIGURE 1 - SITE LOCATION MAP

DATE

MAY 2018



Legend:

B-1

Boring Number and Approximate Location

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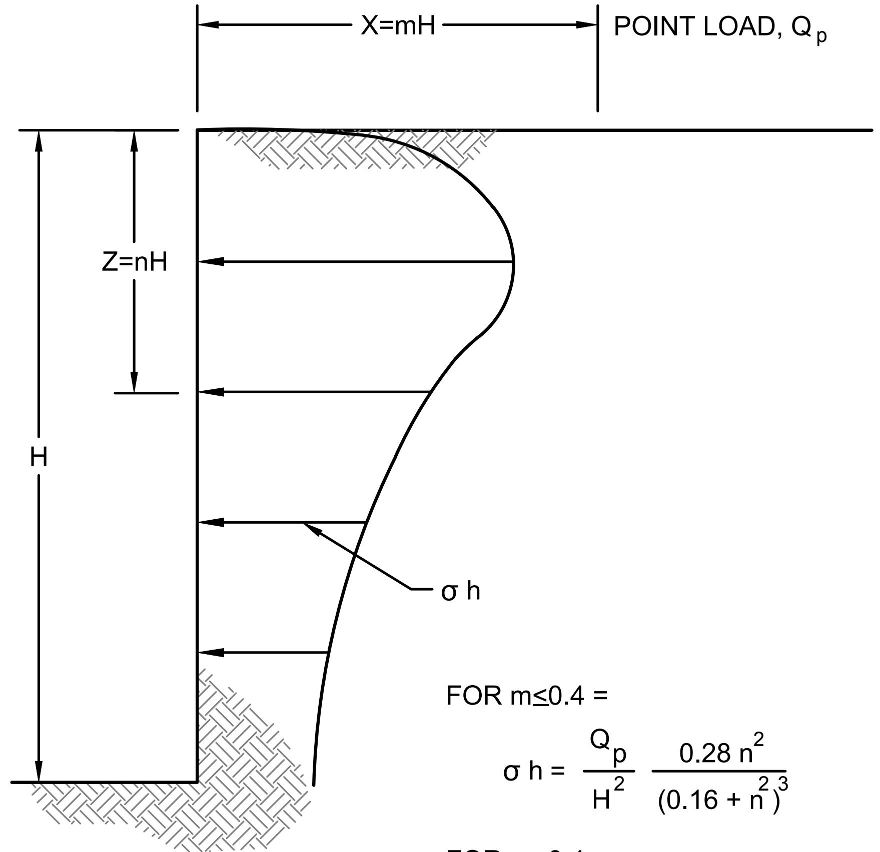
Vancouver, Washington 98662
360-258-1738

Future Filtration Plant
Portland Water Bureau
35320 SE Carpenter Lane, Gresham, Oregon

Project Number:
HDR-2018-008

Figure 2 – Site Exploration Plan

Date:
May 2018

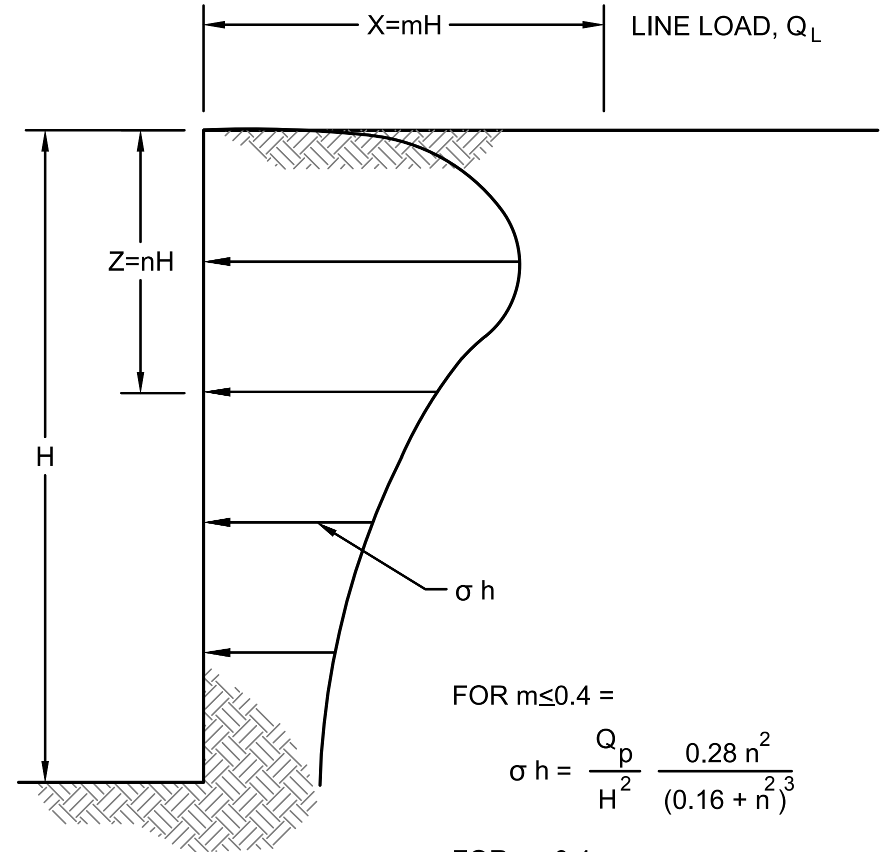


FOR m≤0.4 =

$$\sigma h = \frac{Q_p}{H^2}\,\frac{0.28\,n^2}{(0.16 + n^2)^3}$$

FOR m>0.4 =

$$\sigma h = \frac{Q_p}{H^2}\,\frac{1.77\,m^2 n^2}{(m^2 + n^2)^3}$$



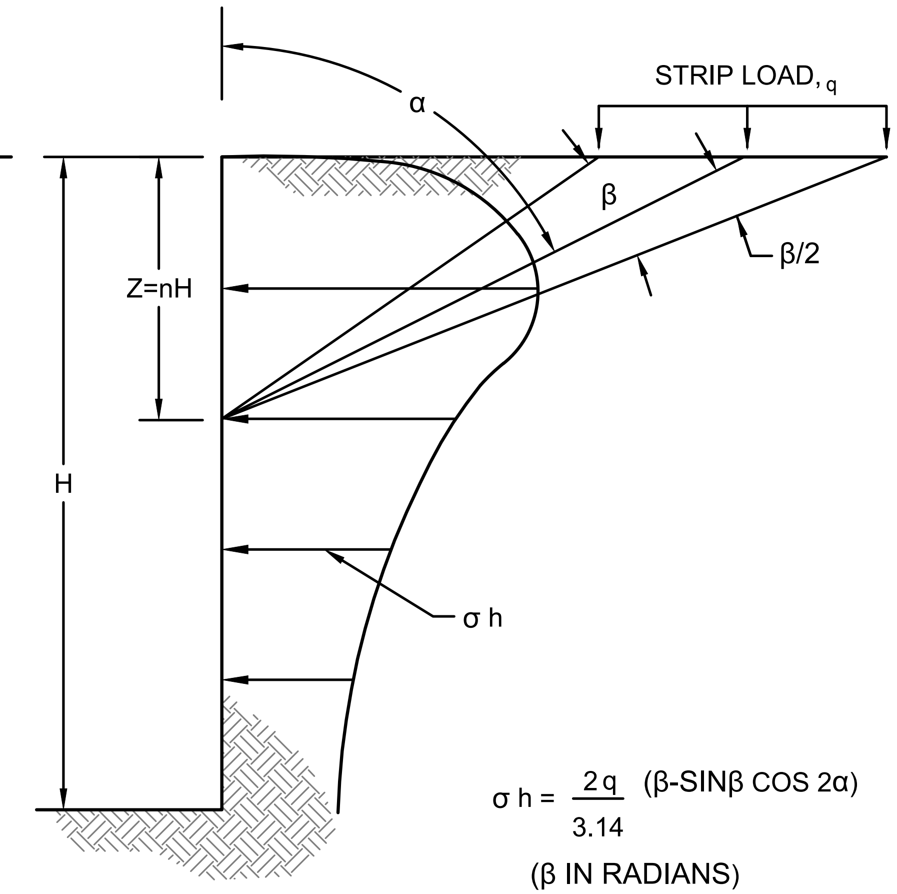
FOR m≤0.4 =

$$\sigma h = \frac{Q_p}{H^2}\,\frac{0.28\,n^2}{(0.16 + n^2)^3}$$

FOR m>0.4 =

$$\sigma h = \frac{Q_L}{H}\,\frac{1.28\,m^2 n}{(m^2 + n^2)^2}$$

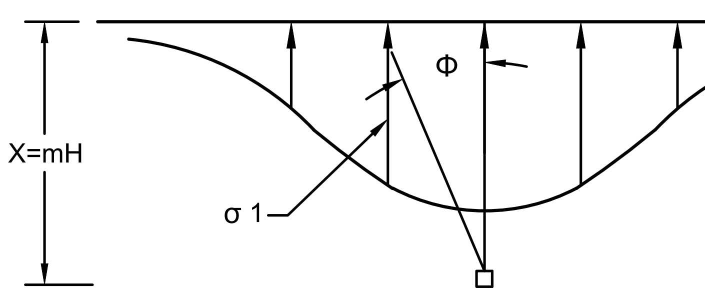
LINE LOAD PARALLEL TO WALL



$$\sigma h = \frac{2\,q}{3.14}\,(\beta - \text{SIN}\beta\ \text{COS}\ 2\alpha)$$

(β IN RADIANS)

STRIP LOAD PARALLEL TO WALL



$$\sigma' h = \sigma h\ \text{COS}^2(1.1\Phi)$$

DISTRIBUTION OF HORIZONTAL PRESSURES

VERTICAL POINT LOAD

NOTES:

1. THESE GUIDELINES APPLY TO RIGID WALLS.
2. PRINCIPLE OF SUPERPOSITION CAN BE USED FOR DIFFERENT LOAD COMBINATIONS.
3. THESE VALUES ARE NOMINAL (UN-FACTORED).

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FUTURE FILTRATION PLANT

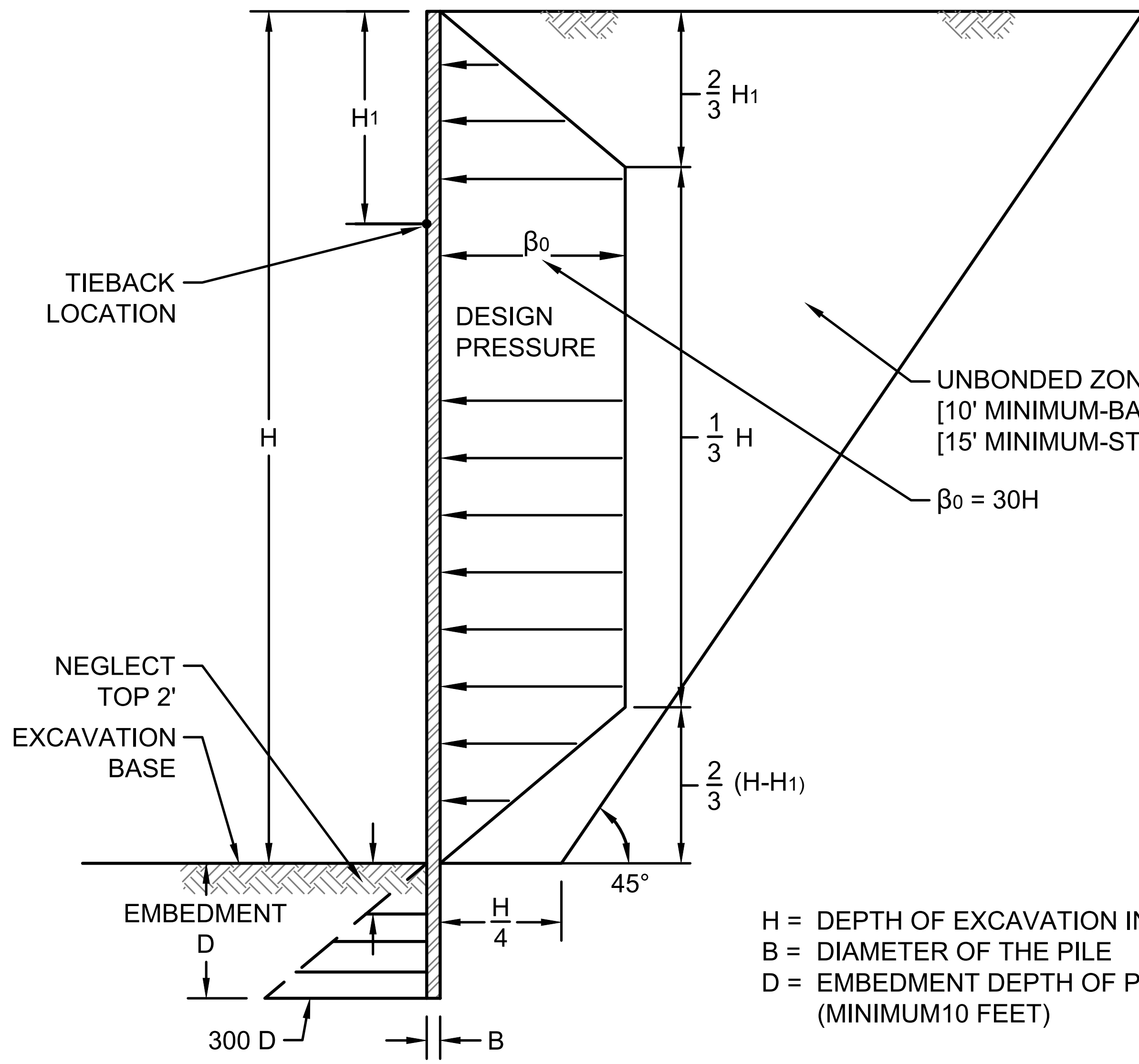
PORTLAND WATER BUREAU

35320 SE CARPENTER LANE, GRESHAM, OREGON 97080

FIGURE 3 - SURCHARGE INDUCED LATERAL EARTH PRESSURES

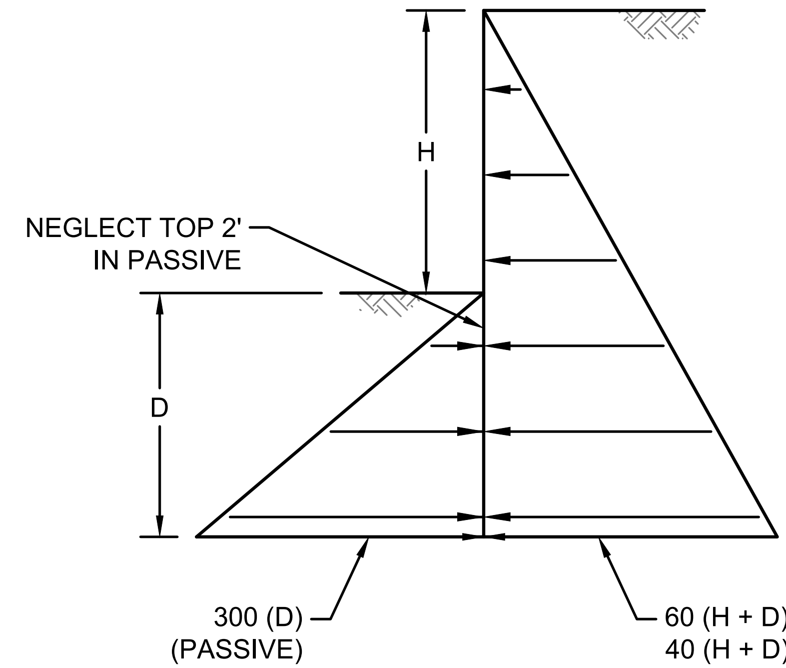
PROJECT: **HDR-2018-008**

DATE: **MAY 2018**



H = DEPTH OF EXCAVATION IN FEET
B = DIAMETER OF THE PILE
D = EMBEDMENT DEPTH OF PILE (MINIMUM10 FEET)

PRESSURE DIAGRAM W/ ONE LEVEL TO TIEBACK



CANTILEVER WALL

NOTES:

1. SURCHARGE LOADS ASSOCIATED WITH CONSTRUCTION ACTIVITIES AND TRAFFIC OR ADJACENT STRUCTURES SHOULD BE ADDED TO THE EARTH PRESSURE SHOWN ABOVE. FOR TRAFFIC SURCHARGE ADD 2' OF SOILS.
2. TIEBACKS SHOULD BE STRESSED TO 80 PERCENT OF DESIGN LOAD.
3. THE LATERAL EARTH PRESSURES ARE NOMINAL (UN-FACTORED).
4. FOR PILE EMBEDMENT DESIGN USE SKIN FRICTION = 0.4 ksf. END BEARING = 4 ksf.
5. PASSIVE RESISTANCE CAN BE APPLIED OVER 2 TIMES THE WIDTH OF THE SOLDIER PILE.

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PORTLAND WATER BUREAU
35320 SE CARPENTER LANE, GRESHAM, OREGON 97080

FIGURE 4 - PRESSURE DIAGRAM FOR SHORING DESIGN

PROJECT
HDR-2018-008

DATE
MAY 2018

APPENDIX B

Summary Boring Logs and Test Pit Logs
Laboratory Testing

RhinoOne GEOTECHNICAL	Future Filtration Plant Portland Water Bureau SE Carpenter Lane, Gresham, Oregon	**Boring Number:** **B-1**
Project: PWB Filtration Plant	Driller: Western States Soil Conservation	
Project Number: HDR-2018-008	Date: February 20, 2018	
Drilling Method: Mud Rotary	Elevation: Approximately 707 feet	
Diameter: 4-inches / Water Level: 25 feet	Logged by: Peter H	

Sample No.	Sample Type	Recovery (%)	RQD (%)	Blow Count per 6 inches	Blows/Foot (N)	Water Table	Depth (ft BGS)	Graphic Log		Materials Description	Moisture (%)	Remarks
							0		TP	Soft, dark brown, silty CLAY with sand (Till Zone)		
									CH-MH	Medium stiff, red-brown, silty CLAY; moist, medium to high plasticity (Native)		
							5					
1		100		3-3-4	7						34.9	
							10			Becomes stiff		
2		100		3-5-7	12						34.6	
							15			Becomes CLAY with trace coarse sand		
3		100		4-6-7	13						31.7	
							20					
4		100		3-4-5	9						32.0	
						▼	25		SM	Loose, brown with light grey, silty fine SAND with some clay; wet, interbedded layers of silty clay Becomes grey, silty fine to coarse SAND		
5		100		3-4-3	7						40.8	
							30		SP	Very loose, ash grey, SAND with some silt and trace coarse gravel; wet		
6		100		0-0-1	1						77.9	

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\HDR-2018-008 PWB Filtration.log Date: 3/22/2018

RhinoOne GEOTECHNICAL	**Future Filtration Plant** **Portland Water Bureau** **SE Carpenter Lane, Gresham, Oregon**	**Boring Number:** **B-1**
Project: PWB Filtration Plant	Driller: Western States Soil Conservation	
Project Number: HDR-2018-008	Date: February 20, 2018	
Drilling Method: Mud Rotary	Elevation: Approximately 707 feet	
Diameter: 4-inches / Water Level: 25 feet	Logged by: Peter H	

Sample No.	Sample Type	Recovery (%)	RQD (%)	Blow Count per 6 inches	Blows/Foot (N)	Water Table	Depth (ft BGS)	Graphic Log		Materials Description	Moisture (%)	Remarks
7		100		3-4-5	9		35		SP	Becomes loose, SAND with some silt and fine gravel, relic coarse sands and gravels	50.7	
8		100		8-12-19	31		40		SM	Dense, grey, silty SAND with some gravel; wet	25.7	
									SP	Very dense, grey, SAND with some silt and gravel		
9		78		24-50/3"	50/3"		45				19.4	
10		100		3-5-6	11		50		ML	Stiff, brown, sandy SILT; wet	53.4	
										Boring terminated at 51.5 feet BGS; backfilled with bentonite chips		
							55					
							60					
							65					

RhinoOne GEOTECHNICAL

Future Filtration Plant
Portland Water Bureau
SE Carpenter Lane, Gresham, Oregon

Project: PWB Filtration Plant	Driller: Western States Soil Conservation	**Boring Number: B-2**
Project Number: HDR-2018-008	Date: February 19, 2018	
Drilling Method: Mud Rotary	Elevation: Approximately 730 feet	
Diameter: 4-inches / Water Level: 33 feet	Logged by: Peter H	

Sample No.	Sample Type	Recovery (%)	RQD (%)	Blow Count per 6 inches	Blows/Foot (N)	Water Table	Depth (ft BGS)	Graphic Log		Materials Description	Moisture (%)	Remarks
							0		TP	Soft, dark brown, silty CLAY with sand (Till Zone)		
									CH-MH	Medium stiff, red-brown, silty CLAY with trace coarse sand; moist, medium plasticity (Native)		
1		100		1-2-3	5		5				40.3	89.5% Fines
							10		CH	Stiff, red-brown, CLAY; moist, high plasticity		
2		100		2-4-5	9						38.5	LL = 49.3 PI = 22 91.8% Fines
3		100		3-4-5	9		15				38.6	98.0% Fines
4		100		3-5-7	12		20				35.0	LL = 50.8 PI = 22 97.7% Fines
5		100		3-4-7	11		25			Becomes grey with red, CLAY with trace coarse sand	31.1	95.7% Fines
6		100		4-7-7	14		30			Becomes brown, CLAY, heavy grey mottling, relict sands	32.0	LL = 58.0 PI = 30 96.2% Fines
						▼			MH	Soft, brown, fine to coarse sandy SILT with some clay; wet, interbedded layers of clay		

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RhinoOne GEOTECHNICAL

Future Filtration Plant
Portland Water Bureau
SE Carpenter Lane, Gresham, Oregon

Boring Number: B-2

Project: PWB Filtration Plant	Driller: Western States Soil Conservation
Project Number: HDR-2018-008	Date: February 19, 2018
Drilling Method: Mud Rotary	Elevation: Approximately 730 feet
Diameter: 4-inches / Water Level: 33 feet	Logged by: Peter H

Sample No.	Sample Type	Recovery (%)	RQD (%)	Blow Count per 6 inches	Blows/Foot (N)	Water Table	Depth (ft BGS)	Graphic Log		Materials Description	Moisture (%)	Remarks
7		100		2-1-2	3		35		MH	Soft, brown, fine to coarse sandy SILT with some clay; wet, interbedded layers of clay	71.7	74.1% Fines
8		100		3-7-8	15		40		SM	Medium dense, grey, silty fine to coarse SAND; wet	62.4	
9		100		8-9-23	32		45			Becomes dense, silty SAND with trace gravel; moist to wet	26.1	
									SP	Dense, grey, SAND with some silt and gravel; wet		
10		82		30-22-11	33		50				18.9	26.8% Fines
11		100		5-3-6	9		55		MH-CH	Medium stiff, grey, clayey SILT with some sand and gravel; wet, medium plasticity	50.3	LL = 38 PI = 8 53.9% Fines
									SM	Loose, red-brown, silty fine to coarse SAND; wet		
12		100		2-2-3	5		60				81.3	53.7% Fines
13		100		3-8-12	20		65			Becomes medium dense, relict coarse sands and gravels	62.5	

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RhinoOne GEOTECHNICAL	Future Filtration Plant Portland Water Bureau SE Carpenter Lane, Gresham, Oregon	Boring Number: B-2
Project: PWB Filtration Plant	Driller: Western States Soil Conservation	
Project Number: HDR-2018-008	Date: February 19, 2018	
Drilling Method: Mud Rotary	Elevation: Approximately 730 feet	
Diameter: 4-inches / Water Level: 33 feet	Logged by: Peter H	

Sample No.	Sample Type	Recovery (%)	RQD (%)	Blow Count per 6 inches	Blows/Foot (N)	Water Table	Depth (ft BGS)	Graphic Log		Materials Description	Moisture (%)	Remarks
14		100		6-7-12	19		70		SM	Medium dense, red-brown, silty SAND; wet, relict coarse sands and gravels	61.3	28.8% Fines
									SP	Medium dense, red-brown, fine to coarse SAND with some silt; wet		
15		100		14-25-50	75		75		SM	Very dense, grey, silty SAND; moist, decomposed conglomerate	38.6	
16		100		15-29-50/4"	79/10"		80				32.8	29.1% Fines
17		100		17-33-50/5"	83/11"		85				29.4	
18		100		25-50/2"	50/2"		90			Becomes silty SAND with some gravel	25.5	29.0% Fines
19		100		50/4"	50/4"		95				20.7	
20		100		50/3"	50/3"		100			Boring terminated at 100.2 feet BGS; backfilled with bentonite/grout mix, top 5 feet was backfilled with bentonite chips	15.6	

RhinoOne GEOTECHNICAL

Future Filtration Plant
Portland Water Bureau
SE Carpenter Lane, Gresham, Oregon

Boring Number: B-3

Project: PWB Filtration Plant	Driller: Western States Soil Conservation
Project Number: HDR-2018-008	Date: February 20, 2018
Drilling Method: Mud Rotary	Elevation: Approximately 738 feet
Diameter: 4-inches; Water Level: 25 feet	Logged by: Peter H

Sample No.	Sample Type	Recovery (%)	RQD (%)	Blow Count per 6 inches	Blows/Foot (N)	Water Table	Depth (ft BGS)	Graphic Log		Materials Description	Moisture (%)	Remarks
							0		TP	Soft, dark brown, silty CLAY with sand (Till Zone)		
									CH	Stiff, red-brown, silty CLAY; moist, medium plasticity (Native)		
							5					
1		100		4-6-8	14						33.9	
							10			Becomes CLAY		
2		100		2-4-5	9						42.2	
							15					
3		100		3-3-6	9						37.9	
							20			Becomes very soft		
4		100		0-1-2	3				SM	Very loose, grey, silty SAND; wet, some relict gravels	68.6	
						▼	25			Becomes silty fine to coarse SAND with some gravel		
5		100		1-0-1	1						79.0	
							30			Becomes loose		
6		100		2-2-3	5						70.0	

RhinoOne GEOTECHNICAL	Future Filtration Plant Portland Water Bureau SE Carpenter Lane, Gresham, Oregon	Boring Number: B-3
Project: PWB Filtration Plant	Driller: Western States Soil Conservation	
Project Number: HDR-2018-008	Date: February 20, 2018	
Drilling Method: Mud Rotary	Elevation: Approximately 738 feet	
Diameter: 4-inches / Water Level: 25 feet	Logged by: Peter H	

Sample No.	Sample Type	Recovery (%)	RQD (%)	Blow Count per 6 inches	Blows/Foot (N)	Water Table	Depth (ft BGS)	Graphic Log		Materials Description	Moisture (%)	Remarks
7		100		12-8-8	16		35		SM	Medium dense, grey, silty fine to coarse SAND with some gravel; wet	39.3	
8		100		10-8-8	16		40			Becomes grey-brown, silty SAND	23.2	
9		100		2-1-2	3		45		ML	Soft, grey-brown, fine sandy SILT; wet	65.2	
10		100		21-36-49	85		50		SM	Very dense, grey, silty SAND with some fine gravel; moist to wet	37.7	
										Boring terminated at 51.5 feet BGS; backfilled with bentonite chips		
							55					
							60					
							65					

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RhinoOne GEOTECHNICAL

Future Filtration Plant
Portland Water Bureau
SE Carpenter Lane, Gresham, Oregon

Boring Number: TP-1

Project: PWB Filtration Plant	Driller: Dan Fischer Excavating
Project Number: HDR-2018-008	Date: February 23, 2018
Drilling Method: Deere 35C Excavator	Elevation: Approximately 712 feet
Diameter: 24-inches; Water Level: Not Encountered	Logged by: Peter H

Sample No.	Sample Type	Recovery (%)	RQD (%)	Blow Count per 6 inches	Blows/Foot (N)	Water Table	Depth (ft BGS)	Graphic Log	Materials Description	Moisture (%)	Remarks
						GWT not encountered	0	TP	Medium stiff, brown, silty CLAY with some sand; moist, fine to coarse sands, medium plasticity (Till Zone)		PP=0.75 tsf
								CH-MH	Medium stiff, red-brown, silty CLAY with trace fine sand; moist, high plasticity (Native)		
1	☒	100					2			32.4	PP=1.0 tsf
									Becomes very stiff, silty CLAY		
2	☒	100					4			29.8	PP=3.25 tsf
							6				
3	☒	100					8			33.7	
4	☒	100					10			33.5	
									Test pit terminated at 11.0 feet BGS; backfilled with excavated material and lightly compacted		
							12				

RhinoOne GEOTECHNICAL

Future Filtration Plant
Portland Water Bureau
SE Carpenter Lane, Gresham, Oregon

Boring Number: TP-2

Project: PWB Filtration Plant	Driller: Dan Fischer Excavating
Project Number: HDR-2018-008	Date: February 23, 2018
Drilling Method: Deere 35C Excavator	Elevation: Approximately 716 feet
Diameter: 24-inches / Water Level: Not Encountered	Logged by: Peter H

Sample No.	Sample Type	Recovery (%)	RQD (%)	Blow Count per 6 inches	Blows/Foot (N)	Water Table	Depth (ft BGS)	Moisture (%)	Remarks
						GWT not encountered	0		PP=0.25 tsf
									PP=1.75 tsf
1	☒	100					2	30.5	PP=1.75 tsf
									PP=3.25 tsf
2	☒	100					4	31.9	
							6		Moderate seepage from 6.5 to 8.5 ft; soils are not saturated
3	☒	100					8	30.9	
							10		
4	☒	100						34.2	
							12		

Depth (ft BGS)	USCS	Materials Description
0 – 1.2	TP	Very soft to soft, brown, silty CLAY with some sand; moist, medium plasticity (Till Zone)
1.2 – 11.0	CH-MH	Stiff, brown, silty CLAY with trace fine sand; moist, high plasticity, fine to coarse sands (Native)
~3.6		Becomes very stiff, red-brown, silty CLAY with trace sand
11.0		Test pit terminated at 11.0 feet BGS; backfilled with excavated material and lightly compacted

RhinoOne GEOTECHNICAL

Future Filtration Plant
Portland Water Bureau
SE Carpenter Lane, Gresham, Oregon

Boring Number:

TP-3

Project: PWB Filtration Plant	Driller: Dan Fischer Excavating
Project Number: HDR-2018-008	Date: February 23, 2018
Drilling Method: Deere 35C Excavator	Elevation: Approximately 708 feet
Diameter: 24-inches / Water Level: Not Encountered	Logged by: Peter H

Sample No.	Sample Type	Recovery (%)	RQD (%)	Blow Count per 6 inches	Blows/Foot (N)	Water Table	Depth (ft BGS)	Graphic Log		Materials Description	Moisture (%)	Remarks
						GWT not encountered	0		TP	Stiff, brown, silty CLAY with some sand; moist, medium plasticity, fine to coarse sands (Till Zone)		
1		100									28.8	PP=0.75 tsf
2		100							CH-MH	Very soft to soft, brown, silty CLAY with some sand; moist to wet, medium plasticity (Native)	28.7	PP=0.25 tsf
							2			Becomes stiff		PP=1.75 tsf
										Becomes very stiff, silty CLAY, high plasticity		PP=3.5 tsf
							4					
3		100									29.4	
							6					
							8					
4		100									34.5	
							10					
										Test pit terminated at 11.0 feet BGS; backfilled with excavated material and lightly compacted		
							12					

RhinoOne GEOTECHNICAL	Future Filtration Plant Portland Water Bureau SE Carpenter Lane, Gresham, Oregon	Boring Number: TP-4
Project: PWB Filtration Plant	Driller: Dan Fischer Excavating	
Project Number: HDR-2018-008	Date: February 23, 2018	
Drilling Method: Deere 35C Excavator	Elevation: Approximately 722 feet	
Diameter: 24-inches / Water Level: Not Encountered	Logged by: Peter H	

Sample No.	Sample Type	Recovery (%)	RQD (%)	Blow Count per 6 inches	Blows/Foot (N)	Water Table	Depth (ft BGS)	Graphic Log		Materials Description	Moisture (%)	Remarks
						GWT not encountered	0		TP	Stiff, brown, silty CLAY with some sand; moist, medium plasticity (Till Zone)		
1	☒	100									24.9	PP=1.5 tsf
									CH-MH	Stiff, red-brown, sandy silty CLAY; moist, medium plasticity (Native)		PP=1.5 tsf
							2			Becomes medium stiff to stiff, moist to wet		
2	☒	100									35.6	PP=1.0 tsf
										Becomes very stiff, silty CLAY; moist, high plasticity		
							4					
							6					
3	☒	100									32.0	PP=2.5 tsf
							8					Light seepage from 8 to 9 ft
							10					
4	☒	100									33.6	
										Test pit terminated at 11.0 feet BGS; backfilled with excavated material and lightly compacted		
							12					

RhinoOne GEOTECHNICAL

Future Filtration Plant
Portland Water Bureau
SE Carpenter Lane, Gresham, Oregon

Boring Number:

TP-5

Project: PWB Filtration Plant	Driller: Dan Fischer Excavating
Project Number: HDR-2018-008	Date: February 23, 2018
Drilling Method: Deere 35C Excavator	Elevation: Approximately 727 feet
Diameter: 24-inches; Water Level: Not Encountered	Logged by: Peter H

Sample No.	Sample Type	Recovery (%)	RQD (%)	Blow Count per 6 inches	Blows/Foot (N)	Water Table	Depth (ft BGS)	Graphic Log		Materials Description	Moisture (%)	Remarks
						GWT not encountered	0		TP	Medium stiff, brown, silty CLAY with some sand; moist, medium plasticity, fine to coarse sands (Till Zone)		PP=0.75 tsf
									CH-MH	Medium stiff, brown, silty CLAY with trace sand; moist, high plasticity (Native)		
1	⊠	100					2				33.1	PP=0.75 tsf
										Becomes very stiff, red-brown		
2	⊠	100					4				25.8	PP=2.5 tsf
							6					
							8					
3	⊠	100									34.5	
							10					
4	⊠	100									36.9	
										Test pit terminated at 11.0 feet BGS; backfilled with excavated material and lightly compacted		
							12					

RhinoOne GEOTECHNICAL		Future Filtration Plant Portland Water Bureau SE Carpenter Lane, Gresham, Oregon	Boring Number: TP-6
Project: PWB Filtration Plant		Driller: Dan Fischer Excavating	
Project Number: HDR-2018-008		Date: February 23, 2018	
Drilling Method: Deere 35C Excavator		Elevation: Approximately 733 feet	
Diameter: 24-inches	Water Level: Not Encountered	Logged by: Peter H	

Sample No.	Sample Type	Recovery (%)	RQD (%)	Blow Count per 6 inches	Blows/Foot (N)	Water Table	Depth (ft BGS)	Graphic Log	USCS	Materials Description	Moisture (%)	Remarks
						GWT not encountered	0		TP	Stiff, dark brown, silty CLAY with some sand; moist, medium to high plasticity (Till Zone)		PP=1.25 tsf
									CH-MH	Stiff, brown, silty CLAY; moist, high plasticity (Native)		PP=1.25 tsf
							2					
1	☒	100									30.2	PP=1.75 tsf
										Becomes very stiff		PP=3.25 tsf
							4			Becomes red-brown, blocky		
2	☒	100									30.0	
							6					
							8					
3	☒	100									35.1	
							10					
4	☒	100									34.1	
										Test pit terminated at 11.0 feet BGS; backfilled with excavated material and lightly compacted		
							12					

RhinoOne GEOTECHNICAL

Future Filtration Plant
Portland Water Bureau
SE Carpenter Lane, Gresham, Oregon

Boring Number:

TP-7

Project: PWB Filtration Plant	Driller: Dan Fischer Excavating
Project Number: HDR-2018-008	Date: February 23, 2018
Drilling Method: Deere 35C Excavator	Elevation: Approximately 738 feet
Diameter: 24-inches / Water Level: Not Encountered	Logged by: Peter H

Sample No.	Sample Type	Recovery (%)	RQD (%)	Blow Count per 6 inches	Blows/Foot (N)	Water Table	Depth (ft BGS)	Graphic Log		Materials Description	Moisture (%)	Remarks
						GWT not encountered	0		TP	Stiff, dark brown, silty CLAY with some sand; moist, medium to high plasticity (Till Zone)		
1	☒	100									27.5	PP=1.25 tsf
									CH-MH	Stiff, brown, silty CLAY with trace sand; moist, high plasticity (Native)		
							2			Becomes very stiff		PP=2.25 tsf
2	☒	100									30.3	PP=3.5 tsf
							4					
							6					
							8					
3	☒	100									32.7	
							10					
4	☒	100									35.6	
										Test pit terminated at 11.0 feet BGS; backfilled with excavated material and lightly compacted		
							12					

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\HDR-2018-008 PWB FP test pits.log Date: 3/22/2018

RhinoOne GEOTECHNICAL

Future Filtration Plant
Portland Water Bureau
SE Carpenter Lane, Gresham, Oregon

Boring Number: TP-8

Project: PWB Filtration Plant	Driller: Dan Fischer Excavating
Project Number: HDR-2018-008	Date: February 23, 2018
Drilling Method: Deere 35C Excavator	Elevation: Approximately 722 feet
Diameter: 24-inches; Water Level: Not Encountered	Logged by: Peter H

Sample No.	Sample Type	Recovery (%)	RQD (%)	Blow Count per 6 inches	Blows/Foot (N)	Water Table	Depth (ft BGS)	Graphic Log	Materials Description	Moisture (%)	Remarks
						GWT not encountered	0	TP	Stiff, dark brown, silty CLAY with some sand; moist, medium to high plasticity (Till Zone)		PP=1.25 tsf
								CH-MH	Stiff, brown, silty CLAY with trace sand; moist, high plasticity (Native)		
1	⊠	100					2			30.3	PP=1.75 tsf
									Becomes very stiff		PP=2.75 tsf
2	⊠	100					4			36.5	PP=3.75 tsf
							6				
3	⊠	100					8			67.0	
							10				
4	⊠	100								35.7	
									Test pit terminated at 11.0 feet BGS; backfilled with excavated material and lightly compacted		
							12				

RhinoOne GEOTECHNICAL	**Future Filtration Plant** **Portland Water Bureau** **SE Carpenter Lane, Gresham, Oregon**	**Boring Number:** **TP-9**
Project: PWB Filtration Plant	Driller: Dan Fischer Excavating	
Project Number: HDR-2018-008	Date: February 23, 2018	
Drilling Method: Deere 35C Excavator	Elevation: Approximately 717 feet	
Diameter: 24-inches / Water Level: Not Encountered	Logged by: Peter H	

Sample No.	Sample Type	Recovery (%)	RQD (%)	Blow Count per 6 inches	Blows/Foot (N)	Water Table	Depth (ft BGS)	Graphic Log		Materials Description	Moisture (%)	Remarks
							0		TP	Very stiff, brown, silty CLAY with some sand; damp, medium plasticity, fine to coarse sands (Till Zone)		
1		100				GWT not encountered						PP=2.5 tsf
									CH-MH	Stiff, brown, silty CLAY with trace sand; moist, high plasticity (Native)		PP=1.75 tsf
2		100					2			Becomes very stiff, silty CLAY; damp to moist	28.2	PP=3.5 tsf
							4					
3		100								Becomes red-brown	29.8	PP=3.5 tsf
							6					
							8					
4		100									33.8	PP=2.5 tsf
							10					
5		100									34.2	
										Test pit terminated at 11.0 feet BGS; backfilled with excavated material and lightly compacted		
							12					

MATERIALS TESTING & INSPECTION

MATERIAL FINER THAN THE #200 SIEVE - SOIL

❑ Environmental Services ❑ Geotechnical Engineering ❑ Construction Materials Testing ❑ Special Inspections

Rajiv Ali
Rhino One Geotechnical
4610 Northeast 77th Avenue, Suite 126
Vancouver, WA 98662

Phone: 360-258-1738
Fax:
Other: E-REPORTS ONLY

Project: **PWB Filtration Plant**
Permit #: **HDR-2017-008**
Project Manager: **Karrie Eixenberger**
Lab Technician: **Mitchell Eixenberger**
Test Date: **3-16-18**

As requested MTI has performed wash sieve testing on the sample referenced below. The testing was performed in accordance with current standards indicated below. The results obtained in our laboratory were as follows:

Source:	Borings							
Date Obtained:	2-20-18							
Sample ID:	See below							
Sampling and Preparation:	ASTM D75:	X	AASHTO T2:		ASTM D421:	X	AASHTO T87:	
Test Standard:	ASTM D1140:	X						

Sample ID	% Passing #200 Sieve
B-2 @5 – 6.5 ft	89.5
B-2 @ 10 – 11.5 ft	91.8
B-2 @ 15 – 16.5 ft	98.0
B-2 @ 20 – 21.5 ft	97.7
B-2 @ 25 – 26.5 ft	95.7
B-2 @ 30 – 31.5 ft	96.2
B-2 @35 – 36.5 ft	74.1
B-2 @ 50 – 51.5 ft	26.8
B-2 @ 55 – 56.5 ft	53.9
B-2 @ 60 – 61.5 ft	53.7
B-2 @ 70 – 71.5 ft	28.8
B-2 @ 80 – 81.5 ft	29.1
B-2 @ 90 – 91.5 ft	29.0

If there are questions concerning this report (*18-1017* 200 Washes), please contact the project manager at (503) 747-7159.

Respectfully submitted,
MATERIALS TESTING & INSPECTION, INC.

cc: Christina Hemberry, Rhino One Geotechnical;

MATERIALS TESTING & INSPECTION

ATTERBERG LIMITS

❑ Environmental Services ❑ Geotechnical Engineering ❑ Construction Materials Testing ❑ Special Inspections

Rajiv Ali
Rhino One Geotechnical
4610 Northeast 77th Avenue, Suite 126
Vancouver, WA 98662

Phone: 360-258-1738
Fax:
Other: E-REPORTS ONLY

Project: **PWB Filtration Plant**
Permit #: **HDR-2017-008**
Project Manager: **Karrie Eixenberger**
Lab Technician: **Karrie Eixenberger**
Test Date: **3-16-18**

As requested MTI has performed Atterberg limits testing on the sample referenced below. The testing was performed in accordance with current standards indicated below. The results obtained in our laboratory are as follows:

Source and Description:	Borings							
Date Obtained:	2-20-18							
Sample ID:	See below							
Sampling and Preparation:	ASTM D75:	X	AASHTO T2:		ASTM D421:		AASHTO T87:	
Test Standard:	ASTM D4318:	X	AASHTO T89/90:					

Sample ID	B-2 @10-11.5 ft	B-2 @20-21.5 ft	B-2 @30-31.5 ft	B-2 @55-56.5ft
Liquid Limit	49.3	50.8	58.0	38
Plastic Limit	27.8	29.3	27.7	29.7
Plasticity Index	22	22	30	8
Classification	CH	MH	CH	ML

If there are questions concerning this report (*18-1017* Atterbergs), please contact the project manager at (503) 747-7159.

Respectfully submitted,
MATERIALS TESTING & INSPECTION, INC.

cc: Christina Hemberry, Rhino One Geotechnical;

RhinoOne GEOTECHNICAL

Project Name:	PWB Filtration Plant	Tested By:	**RA**
Project Number:	HDR-2018-008	Laboratory No:	**2018-00049**
Date	21-Feb-18		

OVEN DRY MOISTURE CONTENT - ASTM D 2216

Sample ID:	B-1	B-1	B-1	B-1	B-1	B-1	B-1	B-1	B-1	B-1	B-2
Depth:	5-6.5	10.0-11.5	15-16.5	20.0-21.5	25-26.5	30.0-31.5	35-36.5	40.0-41.5	45-46.5	50.0-51.5	5-6.5
Tare Number:	001	002	013	015	016	026	018	006	005	025	004
Weight of Tare (Wt.):	51.25	51.58	50.26	51.55	51.66	51.42	51.58	51.12	51.72	51.55	51.36
Weight of Tare + Wet Soil:	166.2	172.31	189.34	190.2	184.58	183.13	151.19	173.53	162.81	157.67	161.68
Weight of Tare + Dry Soil:	136.48	141.27	155.88	156.58	146.05	125.46	117.67	148.5	144.78	120.73	129.97
Weight of Dry Soil:	85.23	89.69	105.62	105.03	94.39	74.04	66.09	97.38	93.06	69.18	78.61
Weight of water:	29.72	31.04	33.46	33.62	38.53	57.67	33.52	25.03	18.03	36.94	31.71
Water Content (%):	34.9%	34.6%	31.7%	32.0%	40.8%	77.9%	50.7%	25.7%	19.4%	53.4%	40.3%
Soil Description:											

Project Name: PWB Filtration Plant

Project Number: HDR-2018-008

Date 21-Feb-18

Tested By: **RA**

Laboratory No: **2018-00049**

OVEN DRY MOISTURE CONTENT - ASTM D 2216

Sample ID:	B-2	B-2	B-2	B-2	B-2	B-2	B-2	B-2	B-2	B-2	
Depth:	10.0-11.5	15-16.5	20.0-21.5	25-26.5	30.0-31.5	35-36.5	40.0-41.5	45-46.5	50.0-51.5	55-46.5	
Tare Number:	008	019	020	021	022	023	027	009	011	003	
Weight of Tare (Wt.):	51.82	51.37	51.76	51.01	51.79	51.7	51.54	51.49	51.61	51.25	
Weight of Tare + Wet Soil:	165.69	169.43	159.04	152.28	185.11	160.46	159.47	156.53	153.32	151.06	
Weight of Tare + Dry Soil:	134.01	136.55	131.23	128.23	152.77	115.03	117.98	134.8	137.14	117.65	
Weight of Dry Soil:	82.19	85.18	79.47	77.22	100.98	63.33	66.44	83.31	85.53	66.4	
Weight of water:	31.68	32.88	27.81	24.05	32.34	45.43	41.49	21.73	16.18	33.41	
Water Content (%):	38.5%	38.6%	35.0%	31.1%	32.0%	71.7%	62.4%	26.1%	18.9%	50.3%	
Soil Description:											

RhinoOne GEOTECHNICAL

Project Name:	PWB Filtration Plant	Tested By:	**RA**
Project Number:	HDR-2018-008	Laboratory No:	**2018-00049**
Date	21-Feb-18		

OVEN DRY MOISTURE CONTENT - ASTM D 2216

Sample ID:	B-2	B-2	B-2	B-2	B-2	B-2	B-2	B-2	B-2			
Depth:	60.0-51.5	65-66.5	70.0-71.5	75-76.5	80.0-81.5	85-86.5	90.0-91.5	95-96.5	100.0-101.5			
Tare Number:	014	024	028	029	030	012	032	031	007			
Weight of Tare (Wt.):	51.22	51.66	51.48	51.55	51.68	51.54	51.45	51.68	51.72			
Weight of Tare + Wet Soil:	164.53	211.38	176	186.52	188.56	213.32	175.5	208.12	157.85			
Weight of Tare + Dry Soil:	113.73	149.95	128.68	148.93	154.75	176.52	150.28	181.25	143.5			
Weight of Dry Soil:	62.51	98.29	77.2	97.38	103.07	124.98	98.83	129.57	91.78			
Weight of water:	50.8	61.43	47.32	37.59	33.81	36.8	25.22	26.87	14.35			
Water Content (%):	81.3%	62.5%	61.3%	38.6%	32.8%	29.4%	25.5%	20.7%	15.6%			
Soil Description:												

RhinoOne GEOTECHNICAL

Project Name:	PWB Filtration Plant	Tested By:	**RA**
Project Number:	HDR-2018-008	Laboratory No:	**2018-00049B**
Date	21-Feb-18		

OVEN DRY MOISTURE CONTENT - ASTM D 2216

Sample ID:	B-3	B-3	B-3	B-3	B-3	B-3	B-3	B-3	B-3	B-3	
Depth:	5-6.5	10.0-11.5	15-16.5	20.0-21.5	25-26.5	30.0-31.5	35-36.5	40.0-41.5	45-46.5	50.0-51.5	
Tare Number:	001	002	013	015	016	026	018	006	005	025	
Weight of Tare (Wt.):	51.25	51.58	50.26	51.55	51.66	51.42	51.58	51.12	51.72	51.55	
Weight of Tare + Wet Soil:	188.26	158.19	151.92	164.67	164.81	153.78	157.92	153.66	160.21	165.94	
Weight of Tare + Dry Soil:	153.54	126.56	123.96	118.64	114.86	111.64	127.92	134.32	117.41	134.64	
Weight of Dry Soil:	102.29	74.98	73.7	67.09	63.2	60.22	76.34	83.2	65.69	83.09	
Weight of water:	34.72	31.63	27.96	46.03	49.95	42.14	30	19.34	42.8	31.3	
Water Content (%):	33.9%	42.2%	37.9%	68.6%	79.0%	70.0%	39.3%	23.2%	65.2%	37.7%	
Soil Description:											

Project Name: PWB Filtration Plant
Project Number: HDR-2018-008
Date 24-Feb-18

Tested By: **RA**
Laboratory No: **2018-00049C**

OVEN DRY MOISTURE CONTENT - ASTM D 2216

Sample ID:	TP-1	TP-1	TP-1	TP-1	TP-2	TP-2	TP-2	TP-2	TP-3	TP-3	TP-3	TP-3
Depth:	2-2.5	4-4.5	7.5-8	10-10.5	2-2.5	4-4.5	7.5-8	10.5-11	0.5-1	1.5-2	4-4.5	9.5-10
Tare Number:	001	002	013	015	016	026	018	006	005	025	004	036
Weight of Tare (Wt.):	51.25	51.58	50.26	51.55	51.66	51.42	51.58	51.12	51.72	51.55	51.36	51.07
Weight of Tare + Wet Soil:	165.11	156.34	152.07	164.72	188.34	153.96	157.57	175.47	151.8	152.66	152	174.52
Weight of Tare + Dry Soil:	137.25	132.27	126.41	136.34	156.37	129.17	132.58	143.77	129.41	130.14	129.13	142.83
Weight of Dry Soil:	86	80.69	76.15	84.79	104.71	77.75	81	92.65	77.69	78.59	77.77	91.76
Weight of water:	27.86	24.07	25.66	28.38	31.97	24.79	24.99	31.7	22.39	22.52	22.87	31.69
Water Content (%):	32.4%	29.8%	33.7%	33.5%	30.5%	31.9%	30.9%	34.2%	28.8%	28.7%	29.4%	34.5%
Soil Description:												

RhinoOne GEOTECHNICAL

Project Name: PWB Filtration Plant
Project Number: HDR-2018-008
Date 24-Feb-18

Tested By: **RA**
Laboratory No: **2018-00049C**

OVEN DRY MOISTURE CONTENT - ASTM D 2216

Sample ID:	TP-4	TP-4	TP-4	TP-4	TP-5	TP-5	TP-5	TP-5	TP-6	TP-6	TP-6	TP-6
Depth:	0.5-1	2.5-3.0	7.0-7.5	10.5-11	2-2.5	4-4.5	8-8.5	10-10.5	2-2.5	4-4.5	7.5-8.0	10-10.5
Tare Number:	008	019	020	021	022	023	027	009	011	003	038	017
Weight of Tare (Wt.):	51.82	51.37	51.76	51.01	51.79	51.7	51.54	51.49	51.61	51.25	51.57	51.63
Weight of Tare + Wet Soil:	162.69	167.34	162.97	165.03	157.4	150.1	200.59	161.09	159.7	153.58	166.8	153.87
Weight of Tare + Dry Soil:	140.62	136.88	135.98	136.36	131.13	129.94	162.36	131.52	134.62	129.98	136.89	127.89
Weight of Dry Soil:	88.8	85.51	84.22	85.35	79.34	78.24	110.82	80.03	83.01	78.73	85.32	76.26
Weight of water:	22.07	30.46	26.99	28.67	26.27	20.16	38.23	29.57	25.08	23.6	29.91	25.98
Water Content (%):	24.9%	35.6%	32.0%	33.6%	33.1%	25.8%	34.5%	36.9%	30.2%	30.0%	35.1%	34.1%
Soil Description:												

RhinoOne GEOTECHNICAL

Project Name:	PWB Filtration Plant	Tested By:	**RA**
Project Number:	HDR-2018-008	Laboratory No:	**2018-00049C**
Date	24-Feb-18		

OVEN DRY MOISTURE CONTENT - ASTM D 2216

Sample ID:	TP-7	TP-7	TP-7	TP-7	TP-8	TP-8	TP-8	TP-8	TP-9	TP-9	TP-9	TP-9
Depth:	0.5-1	2.5-3.0	8-8.5	10.5-11	2-2.5	4-4.5	7.5-8	10.5-11	2-2.5	4-4.5	8 - 8.5	9.5-10
Tare Number:	014	024	028	029	030	012	032	031	007	033	010	034
Weight of Tare (Wt.):	51.22	51.66	51.48	51.55	51.68	51.54	51.45	51.68	51.72	50.87	51.56	51.92
Weight of Tare + Wet Soil:	153.54	150.8	152.26	153.63	154.01	156.46	183.43	175.6	182.81	165.23	197.06	174.21
Weight of Tare + Dry Soil:	131.47	127.72	127.43	126.82	130.21	128.39	130.46	142.97	153.98	138.98	160.3	143.02
Weight of Dry Soil:	80.25	76.06	75.95	75.27	78.53	76.85	79.01	91.29	102.26	88.11	108.74	91.1
Weight of water:	22.07	23.08	24.83	26.81	23.8	28.07	52.97	32.63	28.83	26.25	36.76	31.19
Water Content (%):	27.5%	30.3%	32.7%	35.6%	30.3%	36.5%	67.0%	35.7%	28.2%	29.8%	33.8%	34.2%
Soil Description:												

Carpenter Lane Site Evaluation

CARPENTER LANE SITE EVALUATION

Prepared for:

PORTLAND WATER BUREAU
FROM FOREST TO FAUCET

City of Portland Water Bureau
1120 SW 5th Avenue #600
Portland, OR 97204

Prepared by:

AKANA
Plan + Design + Engineer + Manage

6400 SE Lake Road, Suite 270
Portland, OR 97222

1.0 INTRODUCTION/BACKGROUND

Akana was contracted by HDR Engineers Inc., to provide multi-disciplinary site assessment of City of Portland Water Bureau (PWB) Carpenter Lane Site herein referred to as the Subject property in unincorporated southeastern Multnomah County. PWB sought to conduct the evaluation of the site in order to identify the feasibility of redeveloping PWB owned Subject Property for the future PWB treatment plant as mandated by the EPA. The scope of the project was based on Akana's scope of work provided by HDR Engineers dated December 2017.

2.0 PURPOSE/OBJECTIVE

The objectives of this site evaluation are to research, identify and document the existing site conditions of PWB Subject Property. The scope of this analysis is limited to existing utilities as part of the general site investigation, cultural resource assessment, and environmental investigations of the site including on-site and desktop review for Phase I environmental site assessment, endangered species assessment, and wetland delineation for the purpose of identifying environmental permits that may be required to develop the site and estimated permitting schedule.

3.0 RESULTS AND FINDINGS

3.1 General Site Investigations

The following results outline the location of existing utilities on and adjacent to the Subject Property. The information was collected by on-site investigation and from utility providers for this area. See Appendix A for figures of the sites existing utilities.

Potable Water: The Subject Property is located within the Pleasant Home Water District. Pleasant Home Water District owns two lots along the southern boundary of the property. Two large water storage tanks are present on these lots. A water transmission line runs from these tanks northeast through the site within an easement. A request to Pleasant Home Water District was made for all available information on water transmission line and they advised minimal information could be provided at this stage of planning. There may be a connecting line running north through the site connecting to Carpenter Lane. Potable water is available to the site by an existing 12" water main at Carpenter Lane.

Wastewater: The Subject Property is located within unincorporated Multnomah County. Wastewater service is not provided within this area. The closest sanitary sewer system available would be within the Gresham urban boundary approximately 3.5 miles west of the site. The area is currently serviced by individual septic systems.

Natural Gas: Natural gas is available along Carpenter Lane though NW Natural. The gas line runs along the north side of the right of way.

Power: Power is provided in the area by Portland General Electric (PGE). There are power poles located along Carpenter Lane to the north, Dodge Park Boulevard, to the east and along the west side of the property. Service within the immediate area is single phase service providing between 50 and 100 amps. Three phase power or additional capacity needs would be determined based on the preliminary design with PGE.

Roadway: The Subject Property is currently accessed by SE Carpenter Lane. SE Carpenter Lane is a local road consisting of two 8' travel lanes and no shoulder. The asphalt appears to be in fair condition with some existing cracks and potholes. North and east of the property is bordered by Dodge Park Boulevard, however, the site sits approximately 30 feet higher in elevation than the roadway. The existing terrain is wooded and at a steep slope along the entire length of the roadway. Additional investigation would be required to determine if an access road along Dodge Park Boulevard would be possible.

Utilities / Agency Contact Information:

Water, Pleasant Home Water District - Cassandra Lashbaugh (503) 201-4341

Gas, NW Natural - Bruce Dobbs (503) 226-4211 ext. 2378

Power, PGE - Gresham Office (503) 228-6322

3.2 Cultural Resources Assessment

Akana subcontracted Harris Environmental Group, Inc. (Harris Environmental) to perform a cultural resources assessment of the Subject Property. The assessment consisted of background research with the Oregon State Historic Preservation Office (SHPO) and consultation with historic maps and aerial photographs, as well as a site visit to assess the potential for extant archaeological or historical resources within the Subject Property.

The Subject Property is located in northwestern Oregon, in the eastern portion of Multnomah County in an area characterized by extensive agricultural and moderate residential development. It is located at the eastern terminus of Carpenter Lane, on a terrace above the Sandy River to the north/northeast. The Subject Property consists of approximately 108 acres of cultivated farmland that is currently owned by PWB who leases the land to Surface Nursery as a tree farm. It is characterized by plowed agricultural fields, which have been planted in rows of saplings, left unplanted or lightly covered with grassy ground cover.

Background research revealed that the Subject Property has not been previously surveyed for cultural materials, and no sites are previously recorded within a one-mile (1.6 km) radius. General Land Office (GLO) maps show no historic properties within the boundaries of the Subject Property. Aerial photomaps revealed the presence of two structures within the Subject Property in the mid-20th century: one along the central portion of the western boundary and one in the northern portion where Carpenter Lane turns south. Later photographs reveal the presence of a third structure in the southern portion, to the immediate north of the water tower that borders the project area to the south. None of these structures are extant.

One feature of interest was identified during the background research- a trolley line corridor located directly adjacent to the northeastern and eastern side of the project area. The corridor of the trolley line that extended from Montavilla, through Gresham and to the Bull Run River was located in or near the road prism of Dodge Park Boulevard. The 1914 historical topographic map shows a railroad symbol at this location. This trolley line may have local significance to the area.

Following the background research, Harris Environmental archaeologist Dana L. Holschuh performed a site visit and assessment at the Subject Property on January 12th, 2018. This visit included a limited pedestrian survey, consisting of 5 parallel transects across the project area. All exposed soils were inspected for integrity and cultural materials. No subsurface testing was undertaken as part of this site visit and assessment. No cultural materials were observed, and soil on-site matched the descriptions given by the NRCS soil survey (2018). Soils are interpreted to be largely intact but have been heavily impacted by agricultural plowing.

Based on the results of both background research and the site visit, it is the opinion of Harris Environmental that the Subject Property has a low to moderate likelihood of containing intact archaeological and/or historical resources. One feature of interest, the historic trolley line corridor, was identified, and no sensitive areas were identified. Harris Environmental recommends a formal survey be conducted, which will include subsurface testing and additional research.

3.3 Environmental Investigations

3.3.A - Phase I Environmental Site Assessment

Summary- The Subject Property is currently owned by PWB and located approximately four miles east of US 26 at the south-eastern end of Carpenter Lane, with a physical address of 35050 SE Carpenter Lane, Gresham, OR 97080. Land/Lease ownership, titles, and rights of way were not reviewed during the Phase I. The site coordinates are Latitude 45.466068 degrees north and Longitude -122.298133 degrees west. Legal property descriptions as provided by the Multnomah County Appraisal District are provided in Appendix A of the Phase I site assessment report included in this report as Appendix C.

The Subject Property consists of 108 acres of predominantly undeveloped agricultural and densely forested land. The northern portion of the Subject Property is densely forested along the south side of Dodge Park Boulevard. The central portion of the Subject Property has been mostly cleared and is currently being used for agricultural uses and nursery operation by Surface Nursery. Groundwater flow direction typically mimics surface topography that slopes gently to the southeast for the eastern half and southwest for the western half of the Subject Property.

The Subject Property is accessed through a controlled entry point for the Surface Nursery, Inc. operation at the western end of Carpenter Lane. Clearings have been made for vehicle access along the Subject Property's northern, eastern, western and southern boundaries. Multiple unpaved access roads are located through the middle of the Subject Property to support nursery and agricultural operations. A seven foot tall wire metal perimeter fence surrounds the Subject Property on the north and western sides. The fence consists of cut down sections of treated wood power poles, steel wire grid, barbed wire strands on the top and bottom, and a shade cloth visual barrier. The fence is used to keep out the wild herds of elk and deer that inhabit the local area of the Subject Property. Historical aerial photo records show that a single family residential structure and adjacent agricultural structure (barn) was historically located on the west-central border of the Subject Property. Based on historical aerial photographs, these structures are assumed to have been removed at an unknown date during the mid to late 1970's. No other paved roads, structures or improvements were observed on the Subject Property during site reconnaissance.

The Subject Property lies at an elevation of 741 feet above mean sea level as determined from the 2014 USGS topographic map provided on Figure 3-1. The general topographic gradient at the Subject Property ranges from approximately 650 feet at the southwest corner to 750 feet along the eastern boundary.

Phase I Findings and Conclusions

Subject Property - Akana personnel observed four separate locations of discarded debris on the Subject Property, these locations can be seen in Figure 2-1 of Appendix C in this report. The debris piles are considered *de minimis* conditions and are categorized as Areas of Potential Concern (AOPC). AOPC #1 is located in the north-central portion of the Subject Property on the north side of the metal fence; at this location a pile of discarded used tires was abandoned. AOPC #2 is also located in the north-central portion of the Subject Property on the south side of the grove of trees where the site nursery operations stages trailers for planting. This area was observed on the northern edge of the cultivated agricultural field and consists of a pile of discarded and treated wooden utility poles. The wooden poles have heavy odor of creosote from wood preservation chemical treatment. AOPC #3 was observed on the west-central border of the Subject Property and consists of a variety of discarded debris including two abandoned trucks, abandoned oil containing tractor and truck parts, construction and plastic debris, and one steel 55 gallon drum labeled “Flammable Liquid”. The soil around and under the empty drum did not show signs of staining and did not have a strong petroleum odor. AOPC #4 is located roughly 100 feet to the south of AOPC #3 on the western boundary and consists of a large burn pile in the same area of the historical agricultural structure identified in historical aerial photographs before 1973. During the site visit it was observed that the burn pile contained what appeared as nursery operation discarded trees and shrubs, and it was documented that some household debris including furniture had been discarded in the burn pile, and/or previously burned at the site.

During the course of the site reconnaissance and desktop review of the Subject Property, this assessment has determined that active agricultural activities have been continually ongoing on the majority of the land dating back to at least 1925. Agricultural activities refer to the cultivation of the soil, crops, trees and shrubs, with the lands often being treated annually with synthetic fertilizers, herbicides, and pesticides to aid in the cultivation process. Surface Nursery, Inc., the Subject Property’s current tenant, informed Akana that they keep records of chemical applications on the Subject Property lands, and that they do not store the chemicals on the Subject Property, but they are instead stored at an offsite facility. All current and historically cultivated areas are considered a Recognized Environmental Concern (REC) for the purpose of this report. There are two primary environmental concerns associated with historical and active agricultural activities on the property. The first concern is the potential for the cultivated soils to contain elevated levels of agrochemicals and associated metals. The second environmental concern is the potential of Contaminant of Potential Concern (COPC) associated with agricultural activities to migrate onto offsite properties.

Area Properties- The Subject Property is bound to the north by Dodge Park Boulevard with undeveloped forest. To the east is Dodge Park Boulevard and to the south is a parcel of private property that is used for grazing and some agriculture uses. There are two single family residences located to the east and southeast of the Subject Property, with one of the residences listed as having a Leaking Underground Storage Tanks (LUST) that was documented to be removed and cleaned up in 2004. Agricultural fields and the Pleasant Home Water District drinking water storage tanks are located on the adjacent properties to the south. An additional agricultural field with active shrub nursery operations separated by a dirt access road is located to the west of the Subject Property. Multiple single family residences are located at the northwest corner of the Subject property at the end of paved section of SE Carpenter Lane.

De Minimis Conditions- Akana observed multiple large refuse piles consisting of empty hazardous material barrels, mechanical equipment, abandoned vehicles, scrap building supplies, metal and plastic, household furnishings, and various other discarded items on a burn pile. These areas did not show evidence of soil staining, contamination, noxious or petroleum odors that would represent a REC and was identified at AOPC #1, 2, 3, 4; all these are considered to be housekeeping issues that meets the definition of *de minimis* conditions.

Phase I Environmental Site Assessment Recommendations- Pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), this assessment was conducted to identify sites within the American Society for Testing and Materials (ASTM) required search distance that may pose a risk of environmental contamination by hazardous wastes and substances. The Subject Property was not listed with any past environmental violations in any of the regulatory agency databases. Due to the fact that the Subject Property has been historically cultivated and is actively cultivated by a nursery operation tenant, all of the cultivated agricultural and nursery lands have been identified as an REC. Akana recommends a Phase II ESA to conduct sampling of surface soils in the cultivated areas of the Subject Property to determine the horizontal and vertical extent of COPC associated with the likely use of pesticides for agricultural purposes. Soil sampling should be conducted in accordance with the Oregon Department of Environmental Quality (DEQ) Guidance for Evaluating Residual Pesticides on Lands Formerly Used for Agricultural Production under the Hazardous Substance Remedial Action Rules (Oregon Administrative Rules (OAR) 340-122-0010 through 0115).

At the time of site reconnaissance, the Subject Property contained a substantial amount of miscellaneous debris identified at AOPC #1, 2, 3, 4. The debris included; discarded furniture, abandoned vehicles, empty drums, mechanical equipment, scrap metal, scrap brick and building supplies and various other refuse that could be associated with the current nursery operation active on the site. These four separate locations of discarded debris are identified in this report as four separate AOPC that are considered *de minimis* conditions. Prior to redevelopment, the materials located at these four separately identified AOPC should be recycled and/or properly disposed of and documentation of proper disposal should be kept on file.

3.3.B - Endangered Species Act Review

Akana staff conducted both desktop review and site reconnaissance for a review of the Endangered Species Act compliance as it pertains to the Subject Property and the proposed action of geotechnical site investigations. The purpose of this assessment is to review the existing conditions of the proposed PWB Subject Property in sufficient detail to determine whether a proposed action may affect any of the threatened, endangered, proposed or sensitive species identified to possibly inhabit the Subject Property in Southeast Multnomah County.

The species and associated critical habitats identified in the Information, Planning, and Consultation System (IPAC System) and Oregon Biodiversity Information Center (ORBIC) data sets for the Subject Property are as follows:

A wetland delineation conducted onsite as part of this assessment determined that there are no wetlands or rivers and streams on the Subject Property and therefore all the listed aquatic and fish species identified in the ORBIC report were not included and the following list was limited only to upland species.

Threatened(T), Endangered(E), Proposed Threatened(PT) or Proposed Endangered(PE)

Northern Spotted Owl (Strix occidentalis caurina) T

Streaked Horned Lark (Eremophila alpestris strigata) T

Bradshaw's Desert-parsley (Lomatium bradshawii) E

Kincaid's Lupine (Lupinus oreganus) T

Nelson's Checker-mallow (Sidalcea nelsoniana) T

Water Howellia (Howellia aquatilis T

Willamette Daisy (Erigeron decumbens) E

Candidate Species-

No Candidate Species listed for proposed site.

Sensitive Species (SS) and Species of Concern (SOC)-

Oregon Slender Salamander (Batrachoseps wrighti) SOC

Critical Habitat-

Based on Akana's evaluations of the remnant onsite habitat no critical habitat for any of the above listed species was identified to be located on or in the general vicinity of the Subject Property in both the IPaC and the ORBIC search reports. The action addressed in this assessment does not fall within Critical Habitat for any of the threatened and or endangered species.

Northern Spotted Owl (Stix occidentalis caurina) T
There is critical habitat for this species. Subject Property is outside the critical habitat.

Streaked Horned Lark (Eremophila alpestris strigata) T
There is critical habitat for this species. Subject Property is outside the critical habitat.

Bradshaw's Desert-parsley (Lomatium bradshawii) E
No critical habitat has been designated for this species, season of species identification due to vegetative growth not viable at the time of site visit recognizance.

Kincaid's Lupine (Lupinus oreganus) T
There is critical habitat for this species. Subject Property is outside the critical habitat.

Nelson's Checker-mallow (Sidalcea nelsoniana) T
No critical habitat has been designated for this species, remnant habitat vegetation searched on the site and no specimens were identified during site visit.

Water Howellia (Howellia aquatilis) T
No critical habitat has been designated for this species, season of species identification not viable at the time of site visit recognizance due to growth phase.

Willamette Daisy (Erigeron decumbens) E
No critical habitat has been designated for this species, season of species identification not viable at the time of site visit recognizance due to growth phase.

Oregon Slender Salamander (Batrachoseps wrighti) SOC
Species predominantly found in old decaying down logs, showing preference for old-growth timber areas. No old growth timber habitat identified on the Subject Property.

Subject Property Proposed Action

Proposed action for the redevelopment of the Subject Property at this time is limited to a geotechnical investigation planned for the months of February and March 2018. The majority of the Subject Project has been previously disturbed due to lands being actively cultivated during agricultural activities, and it is assumed that the geotechnical investigation sites will be limited to previously disturbed sites on the Subject Property

Endangered Species Act Review - Conclusion and Determination

Due to the Subject Property being historically and actively disturbed by agricultural cultivation, and the only forested habitat located on the northern border being clear cut multiple times in the last century, it is determined that the proposed activities would have no effect on threatened and endangered species. Akana recommends that the project proposed action be contained to the previously disturbed lands and to a reasonable extent and not to further disturb any remnant habitats. Akana recommends that once the full proposed action is defined for the Subject Property a updated Endangered Species Act review be conducted for the site based on the full scope of the proposed action for the Subject Property.

3.3.C - Wetland Delineation

PBS Engineering and Environmental completed a wetland determination field study for the Subject Property on January 12, 2018. The field study was conducted by Greg Swenson, Professional Wetland Scientist. The method used for determining the presence / absence of wetlands and waters followed the routine approach of the U.S. Army Corps of Engineers (USACE) *Wetlands Delineation Manual* (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (Version 2.0) (U.S. Army Corps of Engineers 2010). The method meets the technical requirements for both the Oregon Department of State Lands and USACE. Soils, vegetation, and indicators of hydrology were recorded at two sample plot locations on standard wetland determination data forms. Wetland plant ratings were assigned based on the *2016 National Wetland Plant List* (Lichvar et. al. 2016). Plot locations were chosen to represent contrasts in landscape positions. No modification of the standard wetland boundary determination methodology (i.e., presence of hydric soil indicators, hydrophytic plant dominance, and wetland hydrology indicators) was necessary during the determination. Note: due to ongoing cultivation, most of the vegetation within the study area would not be reliable for wetland determination purposes; however, the plot locations had remnant vegetation that was less disturbed. The remnant vegetation was considered reliable as noted in the Wetland Delineation report attached as Appendix E.

Upland conditions were documented through the study area, therefore no wetlands or waters were documented on the Subject Property.

4.0 SUMMARY OF FINDINGS AND RECOMENDATIONS

General Site Investigations- Akana identified the visible onsite and adjacent utilities. Akana made requests with the utility providers for as-constructed plans and no asconstruct drawings were provided. Akana recommends that prior to the geotechnical investigation that one-call utility locates be requested by the contractor for the Subject Property to identify exact locations of all the utilities on the site.

Cultural Resources Assessment- One feature of interest and no significant sites were identified on the Subject Property. Additional cultural resources testing and research, as outlined in the cultural resources results and recommendations section.

Phase I Environmental Site Assessment- One REC was identified as all cultivated crop lands on the Subject Property. Four locations of discarded debris were identified as *de minimis* conditions on the Subject Property. The four identified debris sites (AOPC #1, 2, 3, 4) be cleaned up and properly disposed of by the owners of the debris or Subject Property owners. The identified cultivated crop lands are considered a REC and a Phase II environmental assessment should be conducted prior to redevelopment of the Subject Property.

Endangered Species Act Assessment- No critical habitat or threatened and endangered species were identified by Akana on the Subject Property through a thorough desktop review and site visit. Akana recommends that action of geotechnical investigation proceed without disturbing existing remnant habitat and that Endangered Species Act review be reevaluated based on updated actions once preliminary plans, site impacts and construction schedule are finalized.

Wetland Delineation- No wetlands were identified on the Subject Property and Akana recommends no further wetland investigations or wetland permitting needs will be required.

5.0 ANTICIPATED PERMITS AND TIMELINE

Phase II Investigation- Akana recommends PWB approve a Phase II Environmental Site Assessment Investigation on all cultivated agricultural lands of the Subject Property. Timeline for completion of Phase II Environmental Site Assessment Investigation would be approximately 60 days to complete from the notice to proceed.

Cultural Resource Assessment- Akana and its subcontractor recommend PWB approve to conduct a formal archaeological survey across the project area. As part of the survey, further background research into the history of the historic trolley line corridor would be conducted, along with a systematic grid of shovel test probes across the project area to test for subsurface deposits. Also recommended is the preparation of a protocol for inadvertent discovery of subsurface cultural resources during further site investigation and/or construction. Timeline for completion of this survey and protocol development would be approximately 60 days from the notice to proceed.

Endangered Species Act- Akana recommends PWB approve to conduct additional Endangered Species Act review once the proposed actions for the Subject property have been finalized and the full scope of Subject Property redevelopment has been defined and by PWB. Timeline for completion of Endangered Species Act compliance would be approximately 60 days to complete from the notice to proceed.

6.0 APPENDICES

APPENDIX A—GENERAL SITE INVESTIGATION FIGURES

APPENDIX B—CULTURAL RESOURCES ASSESSMENT REPORT

APPENDIX C — PHASE I ENVIRONMENTAL SITE ASSESMENT REPORT

APPENDIX D – ENDANGERED SPECIES ACT SITE SPECIFIC DATA SETS

APPENDIX E— WETLAND DELINEATION REPORT

APPENDIX A—
GENERAL SITE INVESTIGATION FIGURES

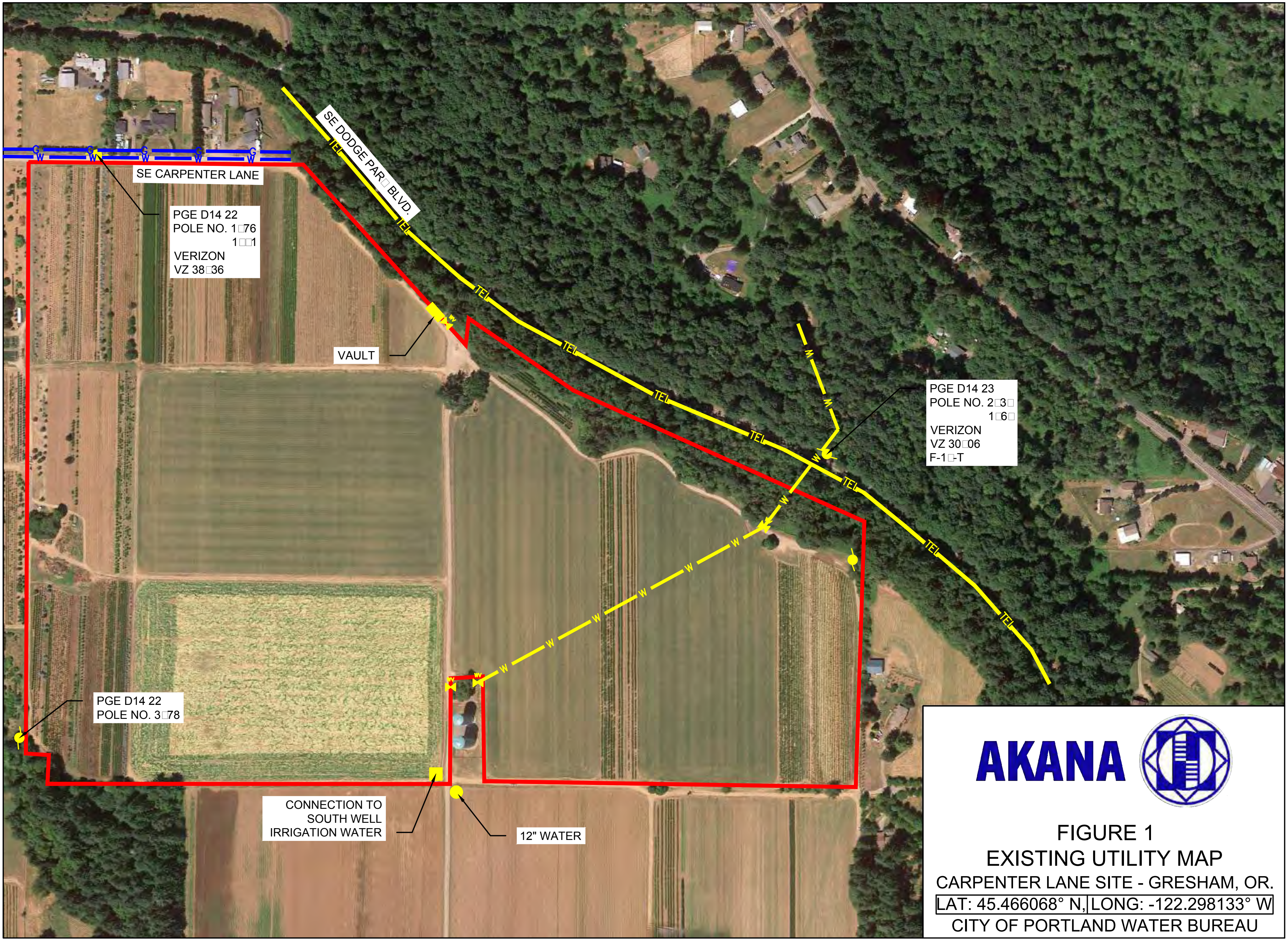

FIGURE 1
EXISTING UTILITY MAP
CARPENTER LANE SITE - GRESHAM, OR.
LAT: 45.466068° N, LONG: -122.298133° W
CITY OF PORTLAND WATER BUREAU

APPENDIX B—
CULTURAL RESOURCES ASSESSMENT REPORT

FINAL

Carpenter Lane Site Assessment Report

Prepared for
Akana

Submitted by
Dana L. Holschuh M.A., RPA, Project Director

3137 NE Rosa Parks Way
Portland, OR 97211

July 2018

Contract No. 18-005

Executive Summary

Harris Environmental Group, Inc. (HEG) was contracted by Akana to perform a cultural resources assessment of the proposed Carpenter Lane site selected by Portland Water Bureau (PWB) as a possible site for their new water filtration plant. The assessment consisted of background research with the Oregon State Historic Preservation Office (SHPO) and consultation with historic maps and aerial photographs, as well as a site visit to assess the potential for extant archaeological or historical resources within the proposed project site.

The proposed Carpenter Lane site, hereafter referred to as the subject property, is located in northwestern Oregon, in the eastern portion of Multnomah County in an area characterized by extensive agricultural and moderate residential development. It is located at the eastern terminus of Carpenter Lane, on a terrace above the Sandy River to the north/northeast. The subject property consists of approximately 108 acres of cultivated farmland that is currently being leased by Surface Nursery as a tree farm. It is characterized by plowed agricultural fields, which have been planted in rows of saplings, left unplanted or lightly covered with grassy ground cover.

Background research revealed that the subject property has not been previously surveyed for cultural materials, and no sites are previously recorded within a one-mile (1.6 km) radius. General Land Office (GLO) maps show no historic properties within the boundaries of the subject property. Aerial photomaps revealed the presence of two structures within the subject property in the mid-20th century: one along the central portion of the western boundary and one in the northern portion where Carpenter Lane turns south. Later photographs reveal the presence of a third structure in the southern portion, to the immediate north of the water tower that borders the subject property to the south. None of these structures are extant.

One feature of interest was identified during the background research- a trolley line corridor located directly adjacent to the northeastern and eastern side of the subject property. The corridor of the trolley line that extended from Montavilla, through Gresham and to the Bull Run River was located in or near the road prism of Dodge Park Boulevard. The 1914 historical topographic map shows a railroad symbol at this location. This trolley line may have local significance to the area.

HEG performed a site visit at the subject property on January 12th, 2018. HEG archaeologist Dana L. Holschuh performed a limited pedestrian survey, consisting of 5 parallel transects across the subject property. All exposed soils were inspected for integrity and cultural materials. No subsurface testing was undertaken during this site assessment. No cultural materials were observed, and soil on-site matched the descriptions given by the NRCS soil survey (2018). Soils are interpreted to be largely intact but have been heavily impacted by agricultural plowing.

Based on the results of both background research and the site visit, it is the opinion of HEG that the subject property has a low to moderate likelihood of containing intact archaeological and/or historical resources. No sensitive areas were identified.

The site visit described in this report represents a limited pedestrian survey intended to assess the likelihood of the subject property to contain intact deposits. It is the recommendation of HEG that a formal survey, including subsurface testing, is required in order to determine whether cultural deposits are located within the boundaries of the subject property.

Introduction

Harris Environmental Group, Inc. (HEG) was contracted by Akana to perform a cultural resources assessment of the proposed Carpenter Lane site selected by Portland Water Bureau (PWB) as a possible site for their new water filtration plant. The assessment was intended to evaluate the archaeological potential of the subject property. This assessment consisted of background research with the Oregon State Historic Preservation Office (SHPO) and consultation with historic maps and aerial photographs, as well as a site visit to assess the potential for intact archaeological or historical resources within the proposed project site. No archaeological testing was performed as part of this assessment.

The proposed Carpenter Lane site, hereafter referred to as the subject property, is located in northwestern Oregon, in the eastern portion of Multnomah County in an area characterized by extensive agricultural and moderate residential development. The subject property is located at the eastern terminus of Carpenter Lane, approximately 1.51 miles (2.43 km) northeast of Schmidt Airpark, approximately 3.38 Miles (5.44 km) north/northwest of the McKinnon Airpark, approximately 2.1 miles (3.38 km) south of Sandy River Oxbow State Park (Figure 1).

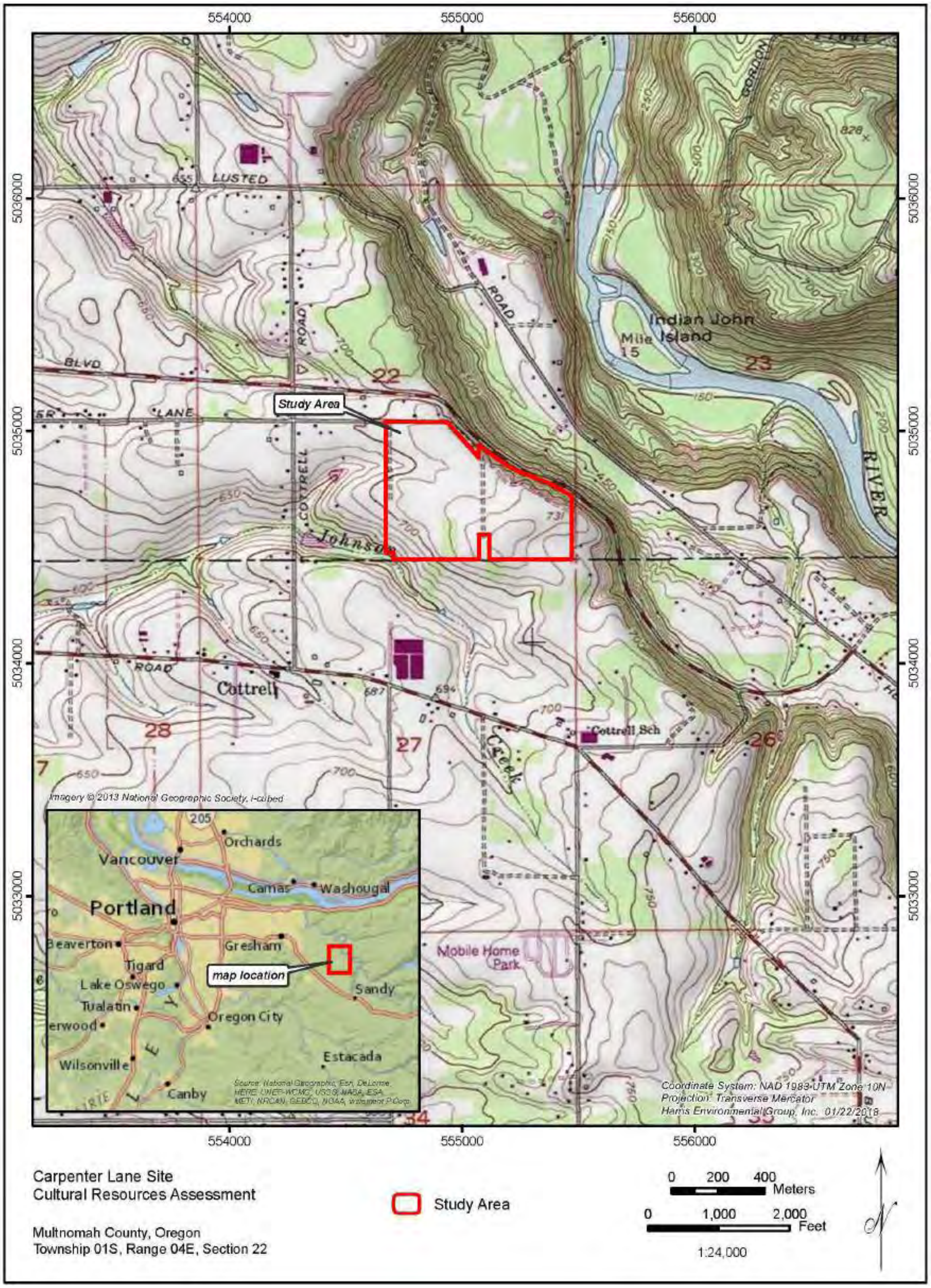

Figure 1- USGS map showing the location of the Carpenter Lane subject property.

The subject property consists of approximately 108 acres of cultivated farmland that is currently being leased by Surface Nursery as a tree farm. It is irregularly-shaped and is bounded by Carpenter Lane along its northern and northeastern boundaries, by residential properties along the eastern boundary, by a neighboring nursery along its western boundary, and by the continuation of Surface Nursery's tree farm along the southern boundary (Figure 2). Site access is provided by Carpenter Lane, which is paved along the northern border, becoming a gravel access road that runs along the northeastern border, turns south along the eastern border, and becomes a dirt track along the southern border.

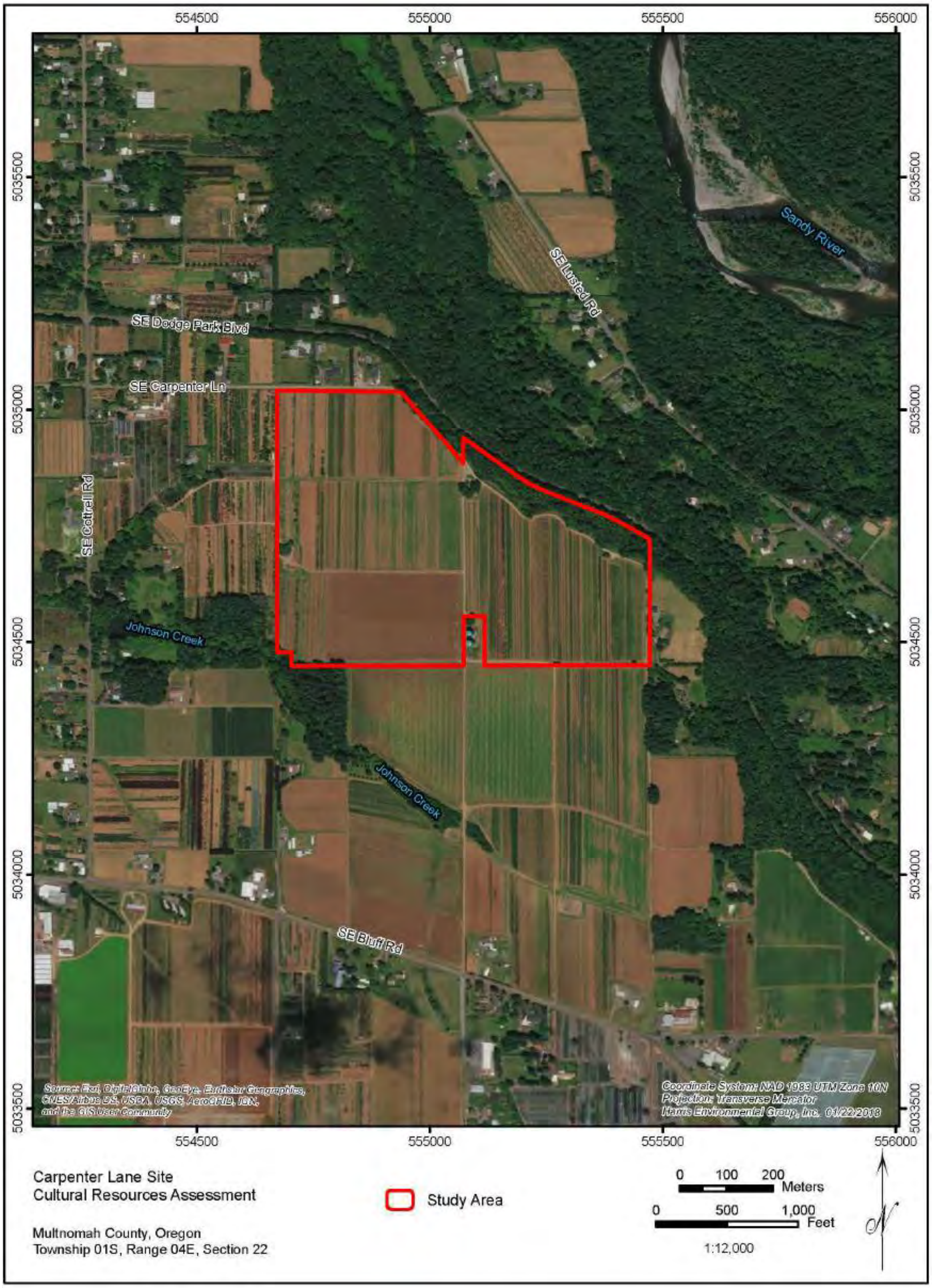

Figure 2. Aerial photomap overlaid with the boundaries of the Carpenter Lane subject property

The subject property is currently divided into a series of agricultural fields. Many of these are cultivated in rows of various size and species of trees (Figures 3 and 4). There are several fields that have been plowed and left uncultivated (Figure 5).

Figure 3. Photograph of field of planted tree saplings, looking west.

Figure 4. Photograph of planted field of slightly more mature saplings, looking south

Figure 5. Photograph of a plowed but uncultivated field within the subject property, looking south.

In addition to the plowed and cultivated fields, a few portions of the subject property are characterized by sparse grasses with limited vegetation along the margins (Figure 6).

Figure 6. Photograph showing a grass-covered field in the northeastern portion of the subject property, looking southwest.

There are three areas of mature trees within the boundaries of the subject property (Figure 2). One of these is located in the northern-central portion of the subject property, along the central gravel roadway where it turns to the south. This area is currently used to store trailer equipment (Figure 8). The southern-most stand of trees is located along the southern border, immediately north of the water towers on the adjacent property (Figure 8). The final stand is located along the western border of the subject property.

Figure 7. Photograph of the northern-most stand of mature trees, looking east.

Figure 8. The southern-most stand of mature trees, looking southeast.

Carpenter Lane turns south to become a gravel access road that runs through the central portion of the subject property (Figure 9). The western, southern, and eastern boundaries are composed of gravel roadways used to access the fields (Figure 10). Two dirt roadways extend west from the central gravel access to the western boundary, accessing the western fields.

Figure 9. Photograph of the gravel road that runs south through the center of the subject property.

Figure 10. Photograph of the dirt and gravel roadway that comprises the eastern boundary of the subject property, looking north/northwest

Background Research

The first portion of the Carpenter Lane site assessment project included performing background research to aid in ascertaining the likelihood that intact archaeological or historical resources are located within the boundaries of the subject property.

Soils and Environment

The subject property is located at the eastern edge of an upland area above the Sandy River, on a terrace at approximately 725 feet above mean sea level (amsl). Topographically, the subject property is mildly to moderately undulating with a high point in the southern-central portion and an overall north/northwestern aspect.

According the USDA Natural Resources Conservation Service's Web Soil Survey, soils across the majority of the subject property are mapped as Cazadero silty clay loam on 0 to 8 percent slopes. This soil is commonly found on convex side slopes of broad, rolling ridgetops and formed in old alluvium mixed with loess and volcanic ash. Typically, the surface layer consists of very dark brown silty clay loam to a depth of approximately 16 inches (40.64 cm). Below this, the subsoil is dark reddish brown silty clay loam over reddish brown silty clay to a depth of at least 60 inches (152.4 cm) (Green 1983; NRCS 2018).

Map Research

Historic map research was conducted using General Land Office (GLO) maps created in the 1800s. These maps depict natural and cultural features that existed during that period, as well as donation land claims (DLCs), which show land ownership.

Consultation with the GLO maps did not reveal any previous features that indicate the presence of historical or archaeological resources within the subject property. The subject property, within the southeastern portion of Section 22, Township 1 South, Range 4 East, is located within unclaimed land on the 1855 map of the area. The region is labeled as "Land Rolling. Soil 2nd Rate. Timber Fir, Cedar and Maple. Undergrowth vine maple & hazel" (GLO 1855). The 1862 GLO map shows the subject property also within unclaimed land. Two DLCs are located in the vicinity- that attributed to P.D. Terwilliger (Claim No. 38, measuring 160 acres) within Section 21, to the west of the subject property, and that attributed to L. Williams (Claim No. 37, measuring 320 acres) within Section 28, to the southwest (GLO 1862).

Historic aerial photographs reveal that the subject property has been under cultivation since at least the mid-20th century (Figures 11 and 12). While there are no extant structures within the subject property currently, map research revealed that there are three areas where structures have been previously located, all of which correlate with areas of mature trees that are still extant.

As seen in Figure 11, there are two structures that appear on the 1948 aerial photograph- one in the northern/central portion of the subject property, and one along the central portion of the western border. The western structure is a farmhouse that was occupied by the Porter family, according to a neighbor who was interviewed by Akana. It was accessed by the existing gravel driveway that forms the western boundary of the current subject property. This structure is visible on aerial photomaps until the 1970s, when it was demolished.

The second structure that appears on this early aerial is located in the northern portion of the subject property, amid a stand of trees where Carpenter Lane turns to the south and currently forms a parking area for trailer equipment (Figure 11). The function of this former structure is unknown, but it is a possibly farm building that was in use throughout the 20th century, appearing on aerial photomaps until approximately the 1980s. A third structure is visible on later maps of the subject property, beginning around 2005. It is located immediately north of the large water tower(s), along the southern boundary of the subject property within a small stand of mature trees. This structure is visible until the late 2000s. Its function is undetermined, but it appears to be a small shed or other small structure (Figure 12).

Figure 11. 1948 aerial photomap overlaid with the subject property and the locations of two historic structures, no longer extant.

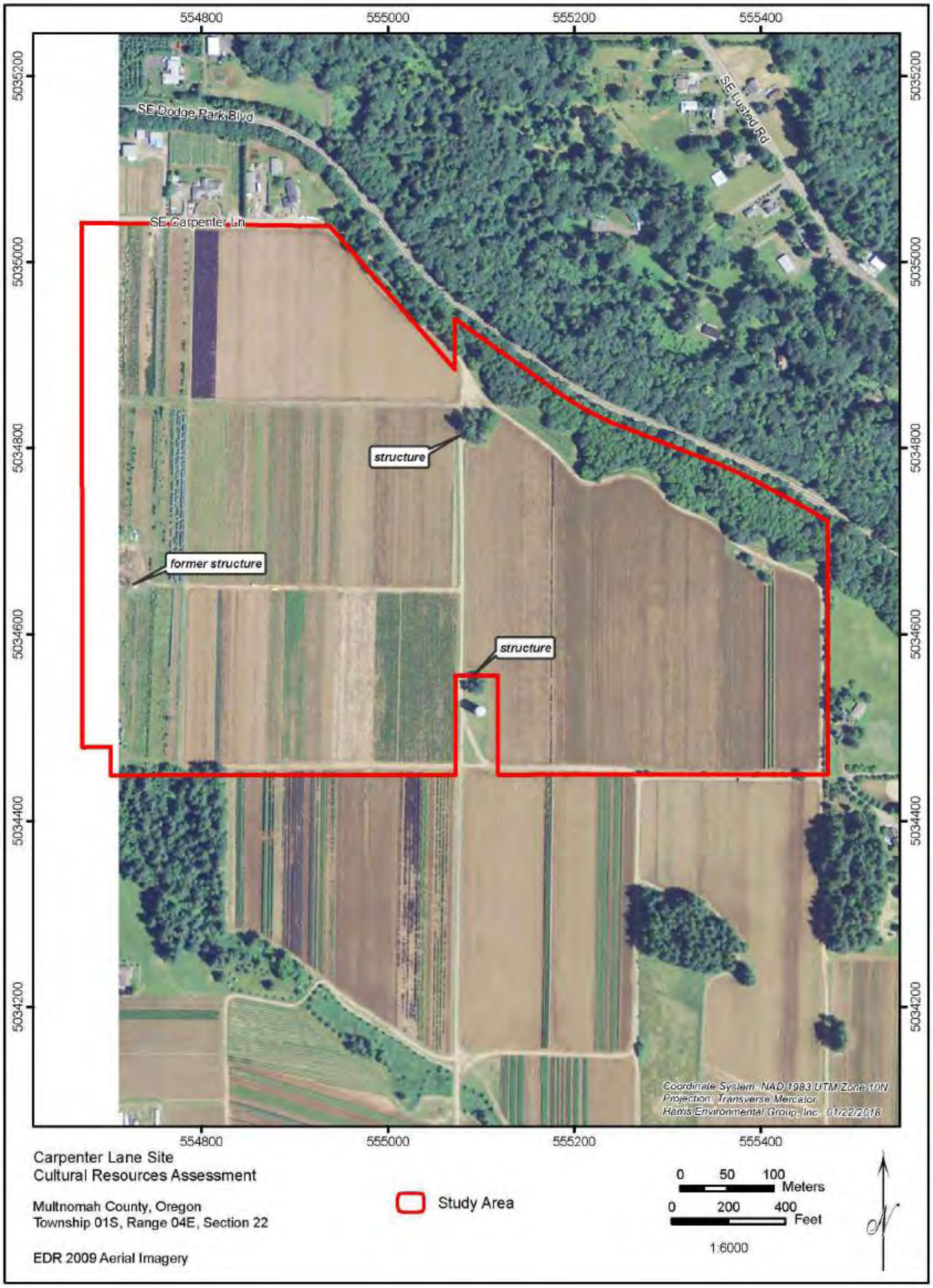

Figure 12. 2009 Aerial photomap overlaid with the subject property and the locations of two structures, no longer extant.

Previous Archaeology

Background research conducted via the Oregon Archaeological Records Remote Access (OARRA) web portal, maintained by the SHPO revealed that the subject property has not been previously surveyed for cultural resources. The property is located at the eastern margin of the Portland Basin, and is therefore included in the Archaeological Context Statement for that region (Ames 1992).

The nearest previously conducted survey to the subject property was performed approximately 0.62 miles (0.99 km) to the north, as a part of the Bull Run water system seismic upgrade project. The survey included two areas, one of which is Diack's Pond located to the north of the subject property. No cultural materials were identified during this survey (McDaniel 2005).

The nearest previously recorded site is located approximately 1.75 miles (2.83 km) to the north along the Sandy River. This site, 35MU275, consists of two discrete remnants (Loci A and B) of a sandbag riprap retaining wall built by the Corps in 1965 after a particularly damaging 1964 flood event. The sandbag riprap wall is composed of stacked nylon or burlap bags filled with sand and a cementing agent, which has solidified turning the bags into irregularly shaped blocks (Windler 2017). Locus A is the larger remnant of the two and consists of at least 16 courses of bags above the water-level, while Locus B consists of six courses of bags, with the topmost course covered in 1 to 2 inches of poured concrete. The site dates from 1965–1976 and is listed in poor condition and not eligible for inclusion on the National Register of Historic Places (NRHP) (Windler 2017).

One historic resource is located directly adjacent to the northeastern and eastern side of the subject property. The corridor of the trolley line that extended from Montavilla, through Gresham and to the Bull Run River was located in or near the road prism of Dodge Park Boulevard. The 1914 historical topographic map shows a railroad symbol at this location. This trolley line may have local significance to the area.

Site Visit

For the second part of the site assessment, HEG performed a site visit at the Carpenter Lane subject property on January 12th, 2018. Upon arrival at the subject property, HEG archaeologist Dana Holschuh, M.A., RPA met with personnel from Surface Nursery, Akana, and PBS Engineering + Environmental (PBS) to establish site boundaries, access, and site visit protocol, including the site health and safety plan.

The purpose of the site visit was to assess the likelihood of encountering intact archaeological or historical deposits within the subject property. In order to accomplish this, during the site visit, HEG performed a limited pedestrian survey across the landform, inspecting the soils, infrastructure, and general conditions on-site. During the limited pedestrian survey, transects were walked generally oriented north-south across the various fields, and along the boundaries of the subject property (Figure 13). These transects sampled each portion of the subject property. All exposed soils were inspected for cultural materials and assessed for integrity. Photographs were taken at various locations across the subject property to document the conditions across the site.

HEG inspected each area where a structure had previously been documented in order to ascertain whether structural remains or other archaeological deposits might still be in evidence.

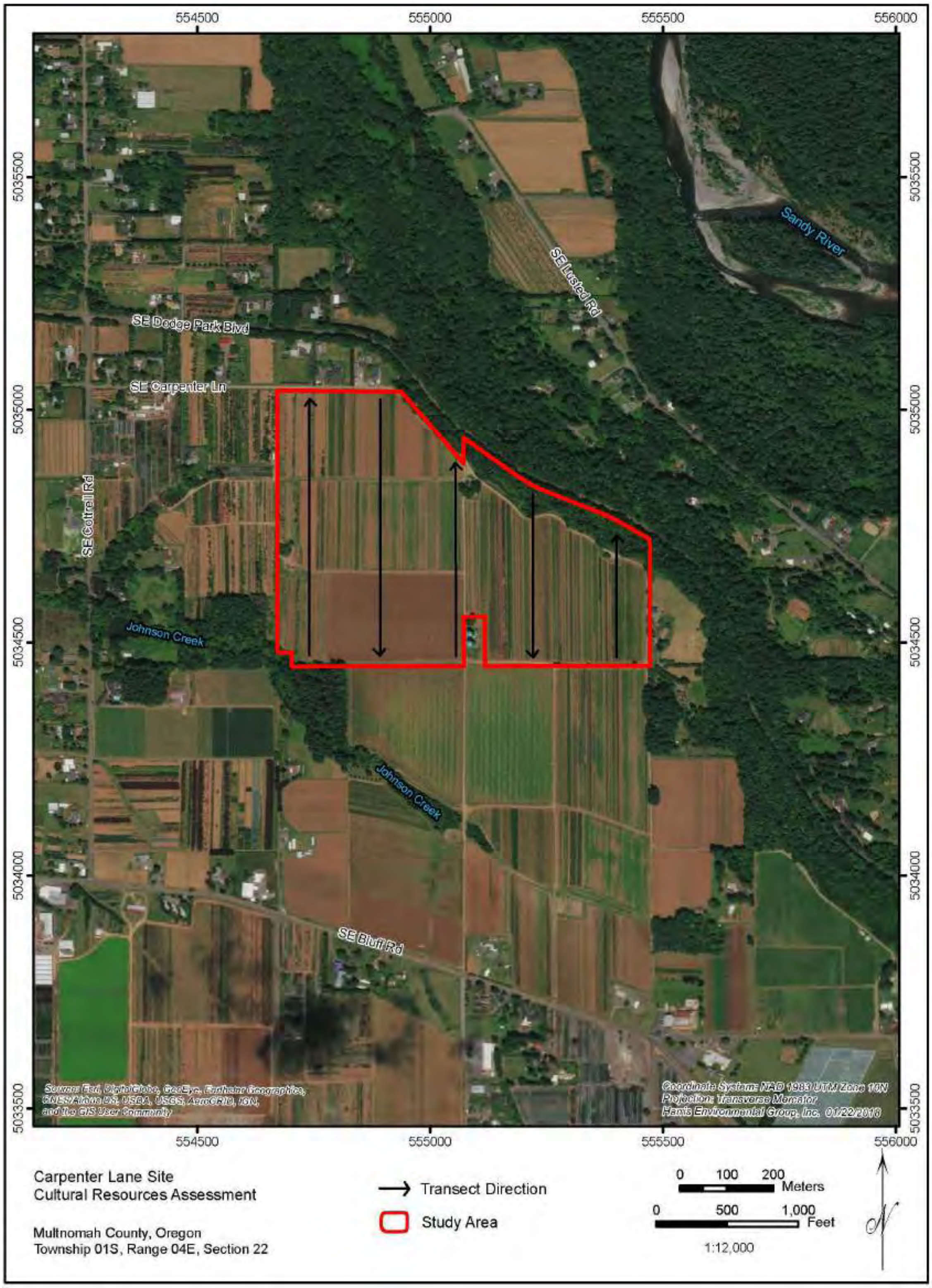

Figure 13. Aerial photomap of the subject property, showing the approximate extent and orientation of the transects walked by HEG during the limited pedestrian survey.

Results and Recommendations

HEG has completed background research and a site assessment within the Carpenter Lane subject property. Background research revealed that although the subject property has a moderate probability to contain cultural resources, based on its location above the Sandy River, there are no previously recorded historic properties, including archaeological resources, within its boundaries. The subject property is characterized by planted tree farm nursery, and has been under cultivation for at least the last 70 years, as evidenced by aerial photographs. Aerials photographs revealed three areas where structures had previously been located.

During the site visit, HEG observed excellent soil visibility, with nearly 100% of the soils across the portions of the subject property under active cultivation (Figures 3-5). Soils observed during the limited walkover survey were dark brown clay loam, with some areas of reddish soil visible where plowing had penetrated to the subsoil (Figure 14). The soils observed are consistent with the descriptions given by the NRCS (2018), and are interpreted to be primarily intact, although disturbed in the upper portions due to decades of agricultural plowing.

Figure 14. Photograph of the soils observed within the subject property, with reddish brown subsoil visible within plowed areas.

No extant structures are currently located within the subject property. HEG inspected all three areas where structures appeared on historic aerial photographs and did not observe evidence of these structures. Modern milled lumber and concrete were observed within the approximate footprint of the southernmost structure however these items are not definitively associated with the structure. No other evidence for structural remains were observed.

The location of the subject property, on a previously un-surveyed terrace above the Sandy River, at the eastern margin of the Portland Basin, increases the probability of encountering pre-contact archaeological resources. However, the long history of agricultural plowing within the upper sediments decrease the likelihood that any archaeological deposits will retain integrity. **Based on the results of both background research and the site visit, it is the opinion of Harris Environmental that the subject property has a low to moderate likelihood of containing intact archaeological and/or historical resources. Harris Environmental recommends additional testing and research as outlined below:**

1. The site visit described in this report represents a limited pedestrian survey intended to assess the likelihood of the subject property to contain intact deposits, only. No subsurface testing was performed as part of this assessment. As the planned project includes the possibility of deep excavation at the site to deal with hydraulic needs, **it is the recommendation of Harris Environmental that subsurface testing be performed in a systematic grid across the subject property in order to determine whether cultural deposits are located within the boundaries of the subject property that would be affected by the proposed project**.

2. Background research and consultation with HDR revealed that a historic trolley line corridor is located adjacent to the subject property. **Harris Environmental recommends further archival research on this resource** in order to identify the location of this rail corridor its connections to the community surrounding the project site and to the history of the water system in the region. Preliminary research can be accomplished at locations including, but not limited to: the Oregon Historical Society, Portland city archive, the Gresham Library, and the Sandy library. We also recommend contact with Portland General Electric about historical materials about the trolley and its uses, especially for freight, that PGE might have in order to characterize resources that might be disturbed by excavation for ancillary facilities for the treatment plant (access roads or pipe corridors) and to identify potential opportunities for educational interpretation at the site as a cultural amenity for the surrounding community and as a resource for water system education.

Although the potential is low, there remains a possibility that unidentified archeological materials/resources exist in the subject property, especially subsurface materials or features. In the unlikely event of an inadvertent discovery of potentially significant archaeological materials (bones, shell, stone tools, hearths, etc.) and/or human remains found on the subject property, all work in the immediate vicinity must stop, the area must be secured, and the discovery must be reported to the State Historic Preservation Office (SHPO) and the Commission on Indian Services (CIS). Native American ancestral remains, funerary objects, sacred objects, and objects of cultural patrimony associated with Oregon Tribes are protected under state law, which includes criminal penalties (ORS 97.740-.994 and ORS 358.905-.961). State law [ORS 97.745 (4)] requires that any discovered human remains suspected to be Native American shall be reported to the State Police, SHPO, CIS, and all appropriate Native American Tribes as provided by CIS. Compliance with all applicable laws pertaining to archaeological resources and human remains is required.

The following Inadvertent Discovery Plan (IDP) should be followed if cultural materials including human remains are encountered during construction.

<u>Protocol for coordination in the event of inadvertent discovery:</u>

- In the event of an inadvertent discovery of possible cultural materials, including human remains, all work will stop immediately in the vicinity of the find. A 30-meter buffer should be placed around the discovery with work being able to proceed outside of this buffered area unless additional cultural materials are encountered.
- The area will be secured and protected.
- The project manager/land manager will be notified. The project/land manager will notify the State Historic Preservation Office (SHPO). If possible human remains are encountered, the Oregon State Police, Commission on Indian Services (CIS), SHPO, and appropriate Tribes will also be notified.

  - Oregon State Police: Chris Allori 503-731-4717
  - CIS: Karen Quigley 503- 986-1067
  - Appropriate Tribes: As designated by CIS
  - SHPO: Dennis Griffin 503-986-0674, John Pouley 503-986-0675, or Matt Diederich 503-986-0577.

- No work may resume until consultation with the SHPO has occurred and a professional archaeologist is able to assess the discovery.
- If human remains are encountered, do not disturb them in any way. *Do not call 911*. Do not speak with the media. Secure the location. Do not take Photos. The location should be secured and work will not resume in the area of discovery until all parties involved agree upon a course of action.
- A professional archaeologist may be needed to assess the discovery and they will consult with SHPO and appropriate Tribal Governments to determine an appropriate course of action.
- Archaeological excavations may be required. This is handled on a case by case basis by the professional archaeologist and project manager, in consultation with SHPO and appropriate Tribes.

References

Ames, Kenneth

1992 *Archaeological Context Statement: Portland Basin*. On file at OR SHPO, accessed via OARRA web portal.

General Land Office

1855 Cadastral Plat Map of Township 1 South, Range 4 East, Willamette Meridian.https://www.blm.gov/or/landrecords/survey/yPlatView1_2.php?path=POR&name=t010s040e_001.jpg. Accessed online January 22nd, 2018.

1862 Cadastral Plat Map of Township 1 South, Range 4 East, Willamette Meridian. https://www.blm.gov/or/landrecords/survey/yPlatView1_2.php?path=POR&name=t010s040e_002.jpg. Accessed online January 22nd, 2018.

Green, George L.

1983 *Survey of Multnomah County, Oregon.* United States Department of Agriculture, Soil Conservation Service and Forest Service. Accessed online at https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/oregon/OR051/0/or051_text.pdf.

McDaniel, Sarah

2005 *Archaeological Resources Survey Report: Bull Run Water System Seismic Upgrade Project: Diack's and Sester's Ponds Conduit Replacement Project, Multnomah County, Oregon*. FEMA Project No. PDMC-PJ-10-0R-2005-009. On file at OR SHPO, accessed via OARRA web portal.

National Resources Conservation Service (NRCS)

2018 United States Department of Agricultural, Web Soil Survey. http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx Accessed online January 21st, 2018.

Windler, Zach

2017 *Archaeological Inventory Form: 35MU275.* On file at OR SHPO, accessed via OARRA web portal.

APPENDIX C —

PHASE I ENVIRONMENTAL SITE ASSESMENT REPORT

Phase I Environmental Site Assessment

Carpenter Lane Site
Gresham, Oregon
January 2018

Prepared For:

City of Portland Water Bureau
1120 SW 5th Avenue #600
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Prepared by:

AKANA

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EXECUTIVE SUMMARY

This Phase I Environmental Site Assessment (ESA) was conducted by Akana for City of Portland Water Bureau's (PWB) proposed water treatment facility location on Carpenter Lane, located in southeastern Multnomah County, Gresham, Oregon.

The objective of the Phase I was to determine if Recognized Environmental Conditions (RECs) were present on-site. RECs are defined by the American Society for Testing and Materials (ASTM) Standard E 1527-13 as "*the presence or likely presence of any hazardous substances or petroleum products in, on, or at a property: (1) due to any release to the environment; (2) under conditions that indicative of a release to the environment; or (3) under conditions that pose a material threat of a future release to the environment*."

De minimis conditions, also described in this report, are those conditions that generally do not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies. Conditions determined to be *de minimis* are not RECs.

We have performed a Phase I ESA in conformance with the scope and limitations of ASTM Practice E 1527-13 and 40 CFR Part 312, "Standards and Practices for All Appropriate Inquiries," for PWB Carpenter Lane site in Gresham, Oregon (herein after the Subject Property). Any exceptions to, or deletions from, these Practices are described in Section 9.0 of this report.

FINDINGS AND CONCLUSIONS

Subject Property

The Subject Property is currently owned by PWB and is located approximately four miles east of US 26. The Subject Property is south of Carpenter Lane, with the physical address of 35050 SE Carpenter Ln, Gresham, OR 97080. Land/Lease ownership, titles, and rights of way were not reviewed during the Phase I. Maps of the Subject Property are provided on Figures 2-1 and 2-2.

The Subject Property consists of 108 acres of predominantly agricultural land. The Subject Property has a northern border of Carpenter Lane on the western half of the property. On the eastern half of the property Dodge Park Boulevard creates the northern border. To the south of Dodge Park Boulevard there is a narrow strip of densely forested land on the Subject Property. Immediately south of the densely forested section of land is a metal fence with shade cloth that runs east to west on separating the forest and the cultivated lands on the Subject Property. To the south of the fence there is a dirt access road and cultivated farm lands extending to the south from the dirt access road.

No residential or agricultural related structures are located currently on the Subject Property but desktop review and site recognizance show locations of historical structures that have been removed on the Subject Property.

In the middle of the southern border of the Subject Property there is a separate land parcel approximated at 1.21 acres that is surrounded on the north, east and west sides by the Subject Property. The parcel has two vertical water tower tanks that are constructed on concrete pads and are surrounded by metal security fence with razor wire.

On the west-central border of the Subject Property Akana personnel also observed a large burn pile consisting of dead and discarded shrubs and trees, shrub and tree trimming, discarded furniture. The burn pile on the Subject Property was observed to cover a large area of over 1,500 square feet. To the north of the burn pile on the north side of a tree row Akana personnel observed two parked and disabled utility trucks, and various oil and hydraulic fluid containing mechanical equipment that have been abandoned, scrap metal, and various other trash items. An empty forty three gallon metal drum of unknown materials labeled with flammable warning label and second label with distributor information but no identification of the barrel contents. Akana personnel observed soils around the barrel to not have any strong odors or visible staining, and it was observed that the metal of the barrel was rusted and weathered. The integrity of the barrel was not determined during the site visit.

During field reconnaissance, the presence of the burn pile on the Subject Property was observed on the west-central portion of the Subject Property. The burned material was observed as a large burned up mound of charred materials with measurements of approximately 60 feet wide by 60 feet long and 8 feet high. The burn pile refers to unidentifiable woody debris, organic matter, soil, sand, or other debris brought to the burn pile location from unidentified locations with the majority visual identified. There are two primary environmental concerns associated with burn piles on the property. The first concern is the potential for the burned materials to have originated from an off-site contaminated source. The second environmental concern is the potential for contamination to be present on or in the soil beneath the burned fill materials. Historical aerial photographs of the area show this burn site to be the same approximate location of an agricultural outbuilding structure built sometime on or prior to 1948 and raised between 1975 and 1982.

Groundwater flow direction typically mimics surface topography that slopes gently to the southeast for the eastern half the Subject Property and generally flows to the southwest on the western half of the Subject Property.

Area Properties

The Subject Property is bound on the north by the eastern terminus of South East Carpenter Lane and a gravel road with undeveloped forest on the north side of the gravel road. To the east are multiple single family residences and the end of the gravel road extending from Carpenter Lane. Agricultural fields and a gravel road that forms the border between Multnomah and Clackamas County are located on the adjacent properties to the south. The upper reaches of Johnson Creek are located outside the border of the southwest corner of the Subject Property. An agricultural field with active shrub nursery operations separated by a dirt access road is located to the west of the Subject Property. Multiple single family residences are located outside the northwest corner of the Subject property at the end of paved section of South East Carpenter Lane.

De Minimis Conditions

Akana observed four separate areas on the Subject Property with scattered debris consisting of empty flammable material barrels, hydrologic and mechanical equipment, two disabled vehicles, discarded tires, treated timbers, scrap plastic, scrap metal, scrap building supplies such as bricks and mortar and various other incinerated organic materials and inorganic debris trash items on a burn pile. One empty 43 gallon metal barrel labeled with flammable materials warning labels was noted to be stored under a tree row. These four separate areas identified in this report as Areas of Potential Concern (AOPC) did not show evidence of soil staining, contamination, extreme noxious or heavy petroleum odors that would represent a REC; therefore, this area is considered to be a housekeeping issue that meets the definition of *de minimis* conditions.

Recommendations

Pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), this assessment was conducted to identify sites within the ASTM required search distance that may pose a risk of environmental contamination by hazardous wastes and substances. The Subject Property was not listed with any past environmental violations in any of the regulatory agency databases. Due to the fact that the Subject Property has been historically cultivated and is actively cultivated by a nursery operation tenant, all of the cultivated agricultural and nursery lands have been identified as a REC see figure 2-2. Akana recommends a Phase II ESA to conduct sampling of surface soils in the cultivated areas of the Subject Property to determine the horizontal and vertical extent of contaminants of potential concern (COPC) associated with agricultural activities. Soil sampling should be performed in conformance with the Oregon Department of Environmental Quality (DEQ) Guidance for Evaluating Residual Pesticides on Lands Formerly Used for Agricultural Production under the Hazardous Substance Remedial Action Rules (Oregon Administrative Rules (OAR) 340-122-0010 through 0115).

At the time of site reconnaissance the Subject Property contained a substantial amount of miscellaneous debris and trash items, discarded furniture, abandoned vehicles, empty barrel, mechanical equipment, scrap metal, scrap brick and building supplies and various other trash items that could be associated with the occupants nursery operation active on the site. These four locations of discarded debris on the Subject Property are identified in this report as four separate AOPC # 1, 2, 3, 4 that are considered *de minimis* conditions see figure 2-2. Prior to redevelopment, the discarded debris materials located at these four separately identified AOPC should be recycled and/or properly disposed of and documentation of proper disposal should be kept on file.