BROWN AND CALDWELL

Technical Memorandum

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Prepared for: Georgia-Pacific Consumer Operations LLC

Project Title: Wastewater Management Alternatives Evaluation

Project No: 138166.500

Technical Memorandum No. 3

Subject: Wastewater Treatment Alternatives Evaluation

Date: July 15, 2010

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EXECUTIVE SUMMARY

Brown and Caldwell (BC) was retained to conduct an engineering study that evaluated wastewater management alternatives for the Georgia-Pacific Consumer Operations LLC (GP) Mill in Palatka, Florida. The purpose of the evaluation was to examine whether it was feasible to implement additional technologies or control measures to reduce the levels of certain constituents in the final discharge so that specific water quality standards defined by the Florida Department of Environmental Protection (FDEP) can be maintained in Rice Creek at Mile Marker 2.4, particularly regarding particulates, iron, color, specific conductance, whole effluent toxicity (WET), and dioxin (i.e. 2,3,7,8, TCDD)[1]. This evaluation assumed that the portion of final effluent that is currently discharged at Mile Marker 3.4 would be re-directed to Mile Marker 2.4. Even with this discharge point relocation, the effluent standards imposed are exceedingly stringent and have not been consistently and collectively demonstrated elsewhere in the pulp and paper industry. For the purposes of this evaluation, "feasible" was defined as having been demonstrated in a comparable application. An extensive literature search was conducted to identify technologies that had been applied in full-scale installations to remove the constituents of concern. This search revealed that applicable technologies have been in practice for over a decade. However, not all of these applicable technologies have been applied on final effluents at bleached kraft mills. During the course of the study, reliability of achieving compliance with effluent standards became a prominent concern.

The study began in September 2009. BC met with FDEP and GP on October 20, 2009 to discuss and clarify the objectives, approach and deliverables. A technology screening memorandum was reviewed with FDEP and GP on December 9, 2009. This review presented the likely impacts on final effluent quality of thirteen different wastewater management alternatives, along with a discussion of how each would be implemented. During this review, BC expressed concern that the WET standard of No Observed Effect Concentration or NOEC of greater than or equal to 72 percent with *Ceriodaphnia dubia* would likely prove unattainable (regardless of wastewater management practices) on a consistent basis due to the sensitivity of the test species at the target effluent quality specific conductance (1,650 µS) and its sensitivity to the ionic composition of water. With this concern stated, nine alternatives were selected for development of a final report that present the conceptual level design, cost estimates, and impact on final effluent quality for each. This further development involved a review of prior work conducted by GP and others, site-specific treatability testing, and consideration of the current state of the art available in wastewater management.

The draft report was presented to FDEP on March 10, 2010. No treatment alternative was found capable of reliably complying with all effluent standards, particularly the WET standard. FDEP requested that additional considerations be given to blending multiple wastewater management practices together to enhance compliance with the effluent standards. Further treatability testing and evaluations were conducted and summarized in a memorandum that describes these combined alternatives that provide synergy.

The memorandum describing synergistic treatment alternatives and the revised draft report were presented to FDEP on May 26, 2010. In this meeting FDEP requested that the reports be revised to address two additional items: reconfiguration of the ponds to reduce the likelihood of legacy solids, in which detectable quantities of dioxin have been measured, being discharged in the final effluent and incremental improvement

[1] Since the implementation of the elemental chlorine-free bleaching process, dioxin has not been detected in GP's final mill effluent using EPA approved methodologies.

in final effluent quality for alternatives that do not provide compliance with final effluent water quality standards. Any incremental improvement in effluent quality could reduce the size of the mixing zone required for compliance with water quality standards in the St. John's River.

These reports have been revised and combined to form the work delineated herein. This cumulative work has reached the conclusions described below.

- No wastewater management alternative was determined to be feasible based on its capability of providing reliable compliance with effluent standards.
- The effluent WET standard cannot be reliably attained with demonstrated technology due to sensitivity of the test species at the water quality based specific conductance and the sensitivity of the test species to ionic composition.
- All ponds experienced infrequent abrupt increases in effluent suspended solids that commonly occurred at the same time during the period of 2004 through 2009. These abrupt increases may be due to solids re-suspension. This simultaneous increase indicates a common contributing factor of which wind effects is a demonstrated factor. High wind events that occur approximately 3 days every 2 years (hourly average wind speeds greater than 14 mph) appear to cause elevated suspended solids in all treatment ponds. The impact of these disturbances on elevated suspended solids varied from a few days to approximately one week. Reducing these opportunities for solids re-suspension will reduce the opportunities for legacy solids to be discharged in the final effluent. Operating the treatment ponds at a deeper depth will reduce the opportunity for solids re-suspension but at an increased risk of not having adequate flow storage during wet weather events. This risk can be mitigated by segregating and using the sedimentation zone of Pond 1 for wet weather storage with the gradual discharge of this wet weather volume back to Pond 2 after suspended solids in the stored wet weather volume have been allowed to settle to reasonable concentrations. This practice would also reduce the opportunity for re-suspended legacy solids in Pond 1 (where the highest quantity of legacy solids was identified) from being discharged to downstream ponds. Alternatively, the legacy solids in Pond 1 could be removed through dredging, dewatering and onsite disposal in the process residuals storage area. It is uncertain if either of these practices would reduce particulate dioxin in effluent, to the degree it may be present, since it is uncertain if the first few sedimentation zones of Pond 4 are resistant to wind disturbance and may currently provide consistent retention of legacy solids contributed by upstream ponds. Another other source of uncertainty in evaluating this alternative is that dioxin has not been measured in the final mill effluent using USEPA approved methodologies since implementing the elemental chlorine-free bleaching process[2].
- The only wastewater management alternative that was capable of complying with the effluent standards (excluding WET) was effluent coagulation and sedimentation followed by treatment of a portion of the effluent through microfiltration and reverse osmosis. The combined effluent would discharge through a newly constructed 1.8 mile pipeline into Rice Creek at Mile Marker 2.4 which discharges into the St. Johns River 2.4 miles downstream. The chemical sludge from pretreatment sludge dewatering (106 tons/day) and the salt cake (40 tons/day) from reverse osmosis would require disposal. The environmental soundness of this approach is questionable at best and at odds with the global desire to enhance the sustainability of the environment. Tremendous resources would be spent ($280 million present worth) and

[2] Since there is no indication that dioxin is present in the effluent using EPA approved methodology, any discussion of the potential effect the wastewater management alternatives addressed in this report may have on the presence of dioxin in the effluent is speculative and requires an assumption that dioxin is present. Therefore, this report focuses on how the wastewater management alternatives may reduce solids, including legacy solids, since the presence of solids in the effluent, and any corresponding reduction, can be measured.

great amounts of electricity would be consumed (with the attendant greenhouse gas and other emissions) to remove salt from the final effluent that could readily be assimilated in the nearby St. Johns River. Furthermore, this alternative has not been demonstrated on an application of this size and with this type of wastewater. Consequently, the cost presented above for typical installations may be understated.

1. INTRODUCTION

Georgia-Pacific Consumer Operations LLC (GP) owns and operates a pulp and paper products mill (the Mill) in Palatka, Florida. The Mill currently withdraws approximately 18 MGD of water from the headwaters of Etoniah Creek and treats this water for color in its water treatment plant. Water treatment consists of chemical conditioning with alum, sodium aluminate and organic flocculants at pH 5.5 s.u. followed by flocculation and then sedimentation. The effluent from sedimentation is conditioned with sodium hydroxide to adjust the pH to approximately 10 s.u. and is dosed with sodium hypochlorite to provide disinfection. The conditioned effluent is then subjected to filtration and distributed to the Mill as process water. The settled solids from sedimentation and the backwash water from filtration are discharged to the process wastewater sewer upstream of the wastewater primary clarifier.

During dry weather years like that experienced in 2007, GP withdraws its full annual groundwater allocation of 520 million gallons per year to supplement the flow in Etoniah Creek so that the required 18 MGD flow is available. During wet weather years like 2009, groundwater withdrawal is not required.

GP also withdraws approximately 5 MGD of water from Rice Creek at Mile Marker 3.0. This water is composed principally of effluent discharged from the onsite wastewater treatment plant at Mile Marker 3.4 and does not undergo water treatment prior to use as cooling water in the Mill. This cooling water is combined with other process wastewaters for treatment in the primary clarifier and downstream treatment ponds.

The sidestreams from water treatment (such as settled sludge and filter backwash water) combine with Mill wastewaters and cooling waters for treatment in the onsite wastewater treatment plant consisting of primary clarification, biological treatment and sedimentation in a series of four ponds as illustrated in Figure 1-1 below. The average and peak day flowrates that have been historically treated have been 23 MGD and 80 MGD. With improved management of treatment levels, GP believed the peak day flowrate could be limited to 45 MGD. All but 3 MGD of the final effluent from Pond 4 is discharged to Rice Creek at Mile Marker 3.4 (0.4 miles upstream of the water intake referenced above). A slipstream of the final effluent (3 MGD) is oxygenated and injected downstream at Mile Marker 2.4.

Brown and Caldwell (BC) was retained to evaluate wastewater management alternatives at the Mill for GP as approved by the Florida Department of Environmental Protection (FDEP). The purpose of this evaluation is to examine whether it is feasible to implement additional technologies or control measures to reduce the levels of certain constituents in the final discharge to meet water quality standards in Rice Creek. From previous examinations, only certain water quality parameters were considered to be potentially problematic and FDEP requested certain parameters to be evaluated; therefore, this wastewater treatment evaluation focused on iron, color, aluminum, specific conductance, whole effluent toxicity, and dioxin (i.e. 2,3,7,8 TCDD)[1] (parameters of interest). BC performed an initial screening analysis to identify wastewater treatment management alternatives that could potentially reduce the parameters of focus in the final effluent. Of particular interest was whether reconfiguration of the treatment ponds (particularly Pond 1) would reduce the likelihood of legacy solids being discharged in the final effluent. Interest was also expressed regarding the incremental improvement that could be gained in final effluent quality through a given wastewater management alternative that could not reliably achieve effluent water quality standards. Any incremental

[1] Since the implementation of the elemental chlorine-free bleaching process, dioxin has not been detected in GP's final mill effluent using EPA approved methodologies.

improvement in effluent quality could reduce the size of the mixing zone required for compliance with water quality standards in the St. John's River.

This analysis included an extensive literature search to identify technologies that had been applied in full-scale installations to remove the constituents of concern. This search revealed that all applicable technologies have been in practice for over a decade. This evaluation was summarized in Technical Memorandum (TM) No. 1, submitted to GP and FDEP on January 14, 2010, and is summarized below in Section 2. Of the thirteen alternatives considered in TM No. 1, nine were recommended for further development and are further discussed in this document.

A summary of the design wastewater considered in this evaluation and the effluent standards are presented in Table 1-1. With the exception of color and specific conductance, the effluent data used to develop Table 1-1 are from the discharge monitoring reports (DMRs). The color and specific conductance data are developed from the Mill operational data. DMR analysis for color is conducted by an outside, certified laboratory once per month using the National Council for Air and Stream Improvement (NCASI) Method 7101. In addition to the monthly DMR sample, the Mill collects and internally analyzes samples for color five days per week using the same NCASI Method. The Mill data provide a larger data set and the internal analysis allows for comparison of color development across the treatment system. The standards provided in Table 1-1 are those that would be imposed at Mile Marker 2.4. If the standards had been imposed at Mile Marker 3.4 (where the final effluent currently discharges), the standards for specific conductance, color and WET would have been even more restrictive (1,275 μS, approximately 150 PCU, and NOEC $\geq$ 95). Compliance with the specific conductance and color standards at either location could be achieved at a very high cost. Reliable compliance with a WET limit of NOEC $\geq$ 72 percent at Mile Marker 2.4 would be unlikely simply due to the ionic imbalances in the effluent and the sensitivity of the test species. Risk Sciences[2] has advised GP that the specific conductance and soluble aluminum concentrations in the final effluent would need to be reduced to 1,500 μS and 2 mg/L, respectively, to have an opportunity to comply with this WET limit. Compliance with a WET limit of NOEC $\geq$ 95 percent would be unachievable. Consequently, all treatment alternatives considered compliance with standards imposed at Mile Marker 2.4. This would require GP to reroute the final effluent from Pond 4 through a 1.8-mile gravity discharge line to Mile Marker 2.4 at an estimated construction cost of $7,200,000.

[2] Recommendations for Georgia-Pacific Palatka Mill by Risk Sciences in May 12, 2009.

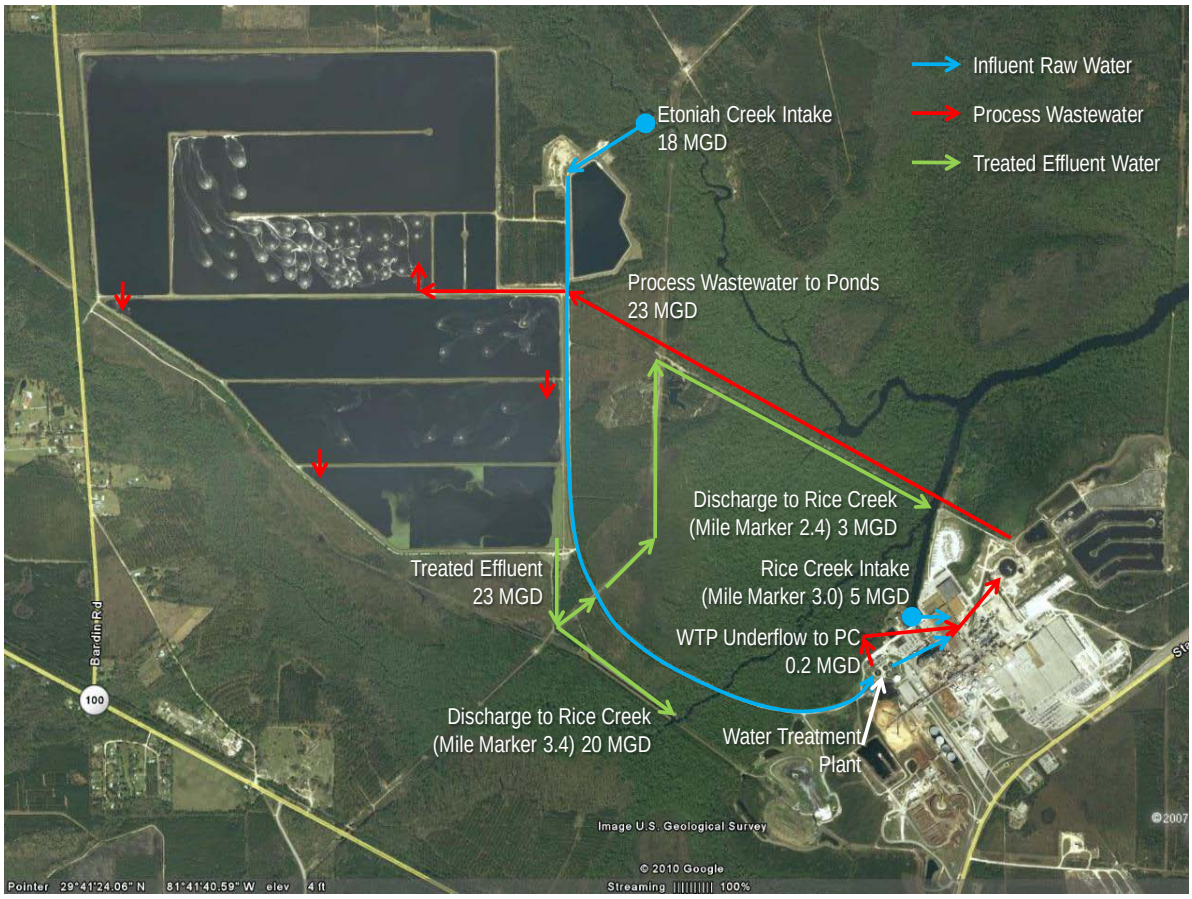

Figure 1-1. Broad Water Balance for Palatka Mill

Table 1-1. Current Effluent Characteristics and Proposed Effluent Quality Standards[1]

Parameter	Current Effluent Characteristics[2]				FDEP Proposed Effluent Limit For Rice Creek at Mile Point 2.4[1]
	Average	Daily Maximum	Standard Deviation	Count	Daily Maximum[3]
Color, PCU	1,000[6]	1,330[6]	117	55	275[4]
Specific Conductance, µmhos/cm	1,900	2,280	206	173	1,650
Iron[5], mg/L	0.75	0.9	0.1	4	1
Dioxin (2,3,7,8 TCDD), ppq	<10	<10	---	9	0.014
Chronic Toxicity, *C. dubia*, NOEC, %	< 8.3	< 6.25	3.2	6	≥ 72
Chronic Toxicity, *P. promelas*, NOEC, %	< 54	< 6.25	50	6	≥ 72

1 *Effluent limit to achieve compliance at boundary of mixing zone at Mile Point 2.4 or closer to the mouth of Rice Creek per pages 11 and 12 of Florida Department of Environmental Protection (FDEP) Administrative Order No. 039-NE.*

2 *January through September 2009 at the effluent of Pond 4 (Outfall D-001).*

3 *The standards have been interpreted for purposes of this report as daily maximum values.*

4 *As measured by spectrophotometry (e.g., USEPA Method 110.2) so that it can be compared to the water quality standard for transparency.*

5 *At pH 7.8 to pH 8.3*

6 *As measured by the Mill laboratory using the National Council for Air and Stream Improvement (NCASI) Method 7101.*

2. PARAMETERS OF INTEREST

2.1 Treatment Accomplished By Existing Wastewater Treatment System (WWTS)

The wastewater from the Mill and sidestreams from the water treatment plant (settled sludge and filter backwash water) discharge to a primary clarifier. The effluent from the primary clarifier discharges to either the emergency settling basins or to Pond 1. The settled sludge from the primary clarifier discharges to anaerobic sludge holding and digestion ponds. The supernatants or decants from these anaerobic ponds are discharged to the influent to the primary clarifier with the combined wastewater at approximately 2 percent flow contribution. The combined influent enters the first section of Pond 1, which is aerated. The last three sections of Pond 1 are not aerated and provide some solids settling. The effluent from Pond 1 enters Pond 2, which provides an aeration zone at the effluent end of the Pond. The effluent from Pond 2 enters Pond 3, which provides aeration throughout the pond. The effluent from Pond 3 enters Pond 4. The effluent passes through three baffled sections of Pond 4. None of these sections in the Pond are aerated. The dissolved oxygen concentration maintained throughout the surface of Ponds 2, 3 and 4 consistently exceeds 1 mg/L enabling them to provide the additional treatment that is evident. The effluent from Pond 4 discharges through an effluent monitoring station prior to Rice Creek. A summary of treatment process performance for January through September 2009 is summarized in Table 2-1. The 2009 data during this period are considered the baseline for this evaluation and have been utilized because they reflect conditions after the Mill had implemented a variety of waste management improvements ending in late 2008. It should be noted that during the baseline period the Kraft Machine No. 1 was not in operation for five of the first six months (January to June 2009). Also, the Tissue Machine No. 5 was operating at 60 percent capacity during this period. In response, the long term average flow of 23 MGD was used as the baseline flow instead of the average flow during this period (19 MGD) in order to be representative of full operation. Additionally, the average specific conductance was increased from 1,760 µS to 1,900 µS to better represent normal production. A summary of effluent quality data, similar to Table 1-1, was developed for the more recent period of October 2009 to May 2010 for comparison. This table is provided in Appendix A. The average values in Appendix A are within 20 percent of the average values used in this study for color, specific conductance, and iron. The more recent value for effluent chronic toxicity for C. dubia (NOEC) improved from <8.3 percent to <23 percent while the daily maximum value stayed unchanged at <6.25 percent. The more recent data would not appreciably change the conclusions reached herein. The facility information and performance summarized in Table 2-1 establish the following:

- Ponds 2, 3, and 4 typically operate at about half of their available safe operating depth determined by GP (3.3 feet of 6.4 feet, 3.3 feet of 6.1 feet, and 4.2 feet of 7.2 feet). Pond 1 operates at approximately 85 percent of its available depth (5.8 feet of 6.7 feet). The typical calculated hydraulic retention time or HRT values in Ponds 1, 2, 3, and 4 are 23, 9, 7, and 5 days, respectively (44 days cumulatively). Wind effects and hydraulic short-circuiting are anticipated to occur in these ponds, reducing the effective HRT. This coupled with the slow treatment kinetics necessitate the need for extensive treatment pond volumes to meet effluent standards. Ponds 1 and 4 would have the highest effective HRT to calculated HRT ratio due to their multi-leg and multi-cell configurations, respectively. The average effective HRT of Ponds 2, 3 and 4 could be increased by raising the operating depth. The effective HRT of Ponds 2 and 3 could also be increased by installing baffles across them as was practiced in Pond 4. Such an increase in effective HRT would make a negligible improvement in average effluent quality from Pond 4 but could reduce daily maximum values.
- The Mill effluent is restricted to a daily average of 3,500 lbs/day BOD and 5,000 lbs/day TSS during June through November (18 mg/L and 26 mg/L, respectively, at 23 MGD). The Mill effluent is also restricted

to 33,182 kg/year total phosphorus (TP) and 165,909 kg/year total nitrogen (TN) which are equivalent to 1.0 mg/L and 5.2 mg/L, respectively, at 23 MGD.

- The final effluent from the Mill is regulated on TP and TN but the Mill monitors orthophosphate-phosphorus (PO_4-P) and ammonia-nitrogen (NH_3-N) concentrations in the ponds since these are the forms of TP and TN that are readily bio-available.
- In order to estimate TP and TN concentrations within each pond, a value of 0.3 mg/L TP and 2.6 mg/L TN needs to be added to the measured concentrations of PO_4-P and NH_3-N, respectively. These values represent the average calculated contribution provided by Pond 4 effluent TSS concentration which is within 35 percent of the other pond average effluent TSS concentrations.
- The current practice of operating the ponds at reduced depths does allow the Mill to increase HRT for BOD, nutrient, and TSS removal when needed (especially after high wind events).
- Essentially all color formation that is going to occur within the WWTS has occurred by the end of Pond 1. Attenuation of daily maximum color is provided in the downstream treatment ponds.
- The effluent from Pond 1 is better in quality than that provided by typical secondary treatment. The effluent from Pond 1 would comply with effluent limits for BOD, TSS, TN and TP. Nutrient concentrations, on the average, slightly increase across Pond 1. Further improvement in effluent quality appears to be achieved for BOD, COD, nitrogen, and phosphorus as the wastewater passes through Ponds 2, 3, and 4, as would be expected. This improvement includes reductions in daily maximum concentrations as the wastewater undergoes further treatment in Ponds 2, 3 and 4. The treatment provided in all ponds is essential to producing the degree of effluent quality consistently provided today. With fewer ponds in service, final effluent daily maximum concentrations would deteriorate and the Mill may not have the needed capability to store wastewater during severe wet weather conditions to avoid non-compliance with effluent BOD and TSS limits.
- All ponds experience infrequent abrupt increases in effluent suspended solids that commonly occur at the same time. This abrupt increase may be due to solids re-suspension. This simultaneous increase indicates a common contributing factor of which wind effects is a demonstrated factor. High wind events that occur approximately 3 days every 2 years (hourly wind speeds greater than 14 mph) appear to cause elevated suspended solids in all treatment ponds.
- Pond 4 does provide significant reduction in effluent TSS.
- The effluent from Pond 4 is exemplary for a pulp and paper mill biological treatment system of any configuration (average BOD and TSS of less than 7 mg/L without tertiary filtration and nominal nutrients). Of eleven "bleached kraft other" mills surveyed by NCASI in 2006, the Palatka Mill discharged in its final effluent the second lowest quantity of BOD per unit production (1.33 lbs BOD/ton versus a minimum of 1.12 lbs BOD/ton and a mean of 3.06 lbs/ton).[3]

[3] Correspondence from National Council for Air and Stream Improvement, Inc to Georgia-Pacific on November 3, 2008.

Table 2-1. Wastewater Treatment System Performance (January through September 2009)								
	Clarifier Inlet	Clarifier Outlet	Pond 1 Outfall	Pond 2 Outfall	Pond 3 Outfall	Pond 4 Outfall	Limits at 23 MGD	Limits at 45 MGD
BOD, mg/L								
Average	315	210	9.8	7.1	6.0	3.9	18	9
Standard Deviation	83	54	6.3	3.3	2.8	2.8		
Daily Maximum	530	360	28	24	15	11		
No. of Samples	152	150	63	63	63	103		
COD, mg/L								
Average	1,390	790	360	330	310	310	NA	NA
Standard Deviation	415	250	105	62	64	61		
Daily Maximum	2,960	1,990	810	530	590	580		
No. of Samples	148	145	87	87	87	87		
Color, PCU								
Average	610	720	1,010	1,050	1,040	1,000		
Standard Deviation	280	235	200	150	140	140		
Daily Maximum	1,940	1,395	1,490	1,480	1,430	1,330	275	
No. of Samples	91	87	87	87	87	87		
TSS, mg/L								
Average	440	NA[1]	7.0	9.4	9.1	6.7	26	13
Standard Deviation	250	NA	4.8	7.5	6.2	5.1		
Daily Maximum	1,630	NA	22	63	41	23		
No. of Samples	231	NA	99	98	98	103		
NH_3-N, mg/L								
Average	2.1	0.62	0.81	0.58	0.39	0.34	2.6	1.3
Standard Deviation	0.95	0.50	0.71	0.44	0.30	0.25		
Daily Maximum	5.3	3.0	3.6	2.3	1.8	1.1		
No. of Samples	91	88	87	81	87	87		
PO_4-P, mg/L								
Average	0.40	0.24	0.40	0.35	0.35	0.32	0.7	0.3
Standard Deviation	0.23	0.15	0.17	0.13	0.11	0.11		
Daily Maximum	1.26	0.73	1.28	0.76	0.65	0.60		
No. of Samples	91	88	87	87	87	87		

1 Not available.

2.2 Color

Color at approximately 300 PCU is present in the raw water supply to the Mill. This color is due to the combination of 18 MGD from Etoniah Creek at 225 PCU and 5 MGD from Rice Creek at 525 PCU. Raw water in Etoniah Creek may also be supplemented by a maximum of 1.4 MGD (maximum groundwater allocation of 520 million gallons/year) groundwater at 50 PCU. The color reaches 610 PCU in the combined wastewater being discharged from the pulp and paper mill, water treatment plant, and primary sludge holding

and digestion pond decants to the primary clarifier. Testing indicates that this color is all true color (not removed through 0.45 um filtration). Consequently, color removal would not be expected to occur through primary clarification (see Table 2-1 for confirmation). The aerobic, anoxic and anaerobic treatment in Pond 1 causes the color to increase by 66 percent to 1,010 PCU. The color remains at this level through the final discharge from Pond 4.

Dr. Clifford Lange from Auburn University conducted multiple treatability studies for the GP Palatka Mill. These studies indicated that the color increase across the wastewater treatment system could be limited to a 48 percent increase (370 PCU to 550 PCU) if the primary clarifier sludge and effluent could be kept fully aerobic (3 mg/L Dissolved Oxygen (DO) minimum). Dr. Lange's work indicated that both nutrients and an active bacterial population are required to produce color. This likely explains the consistency in color across Ponds 2, 3, and 4 since nearly all BOD and nutrients are removed across Pond 1. Dr. Lange's work also indicated that the color increase associated with anoxic/anaerobic treatment was greater (138 percent, 420 PCU to 1,000 PCU) than that for aerobic treatment. This increase in color was worsened if anaerobic treatment was followed by aerobic treatment (221 percent, 420 PCU to 1350 PCU).

A month-long field trial conducted by GP added validity to Dr. Lange's premise that the color increase could be limited to 48 percent if the primary sludge were transferred and dewatered to prevent anaerobic activity. It is uncertain what the sustainable final effluent color would be under this alternative. It is certain that it would be significantly greater than the effluent color limit of 275 PCU. However, this reduction in color would offset downstream chemical addition requirements to comply with this color limit.

Based on the discussion above, the following observations were made:

- Switching raw water supply sources to strictly groundwater (if such a large quantity were available) could potentially reduce the Mill water supply color by 230 PCU. If the color removal in the water treatment plant were reversed when the coagulated color was discharged to the combined influent to the primary clarifier, then any reduction in color of the raw water supply would result in a direct color reduction in the combined wastestream and potentially the final effluent. Further testing would need to be conducted to determine if such a decrease would occur. If this decrease did occur, the daily maximum Pond 4 discharge color would be reduced from 1,330 to 1,100.
- The most reliable way the Mill can comply with the 275 PCU water quality standard is to treat to remove color following the significant biological treatment provided in Pond 1.

Significant color removal is required to meet FDEP's proposed effluent standards for Rice Creek (1,330 PCU to 275 PCU). The demonstrated technologies for this degree of color removal from pulp and paper industry wastewater are chemical oxidation and coagulation-sedimentation. Chemical oxidation has been successfully applied using chlorination, ozonation, and ozonation with hydrogen peroxide catalyst (perozonation). Due to concerns regarding the aquatic toxicity of chlorinated byproducts and the need to also lower the effluent specific conductance, only ozonation or perozonation will be considered. Coagulation and sedimentation have worked with aluminum salt addition at both the Georgia-Pacific Leaf River Mill and another Florida Mill. The Georgia-Pacific Leaf River Mill also achieved this degree of color removal with ferric chloride addition and polyamine addition. The other Florida Mill did not consistently achieve soluble aluminum concentrations of less than 2 mg/L (a requirement for the Palatka Mill) while using aluminum salt conditioning. Neither of these Mills was required to reduce effluent specific conductance (a requirement for the Palatka Mill).

Color removal through coagulation and sedimentation in the primary clarifier was considered. It is likely that a portion of the color removed would be reverted due to anaerobic treatment in the sludge digestion and storage ponds. Furthermore, the residual color in the clarifier sludge would be increased due to the anaerobic treatment provided in these ponds. The color that would be returned to the clarifier inlet would simply require re-removal across the primary clarifier.

Other treatment technologies considered for color removal were ion exchange, ultra filtration, nanofiltration, reverse osmosis, clay absorption, macro-reticular resin adsorption, and carbon adsorption. Ion exchange could provide color reduction but would require extensive resin regeneration and has only been demonstrated in bench-scale testing. Ultrafiltration (UF) could only provide color removal if the color causing compounds have a higher molecular weight than the cut off for UF. The effective molecular weight cut-off for UF is typically given as 10,000 daltons. Color causing organic acids such as fulvic acid can have a molecular weight as low as 2,000 daltons. Only membranes as small as nanofiltration or reverse osmosis (RO) could provide the required color reduction to meet the water quality standard. RO treatment has been demonstrated at a secondary fiber pulp and paper mill. The economics of this process would likely prove less cost-effective than other processes as illustrated in Section 6. Clay absorption and macro-reticular resin adsorption also would provide color reduction but have not been demonstrated for this purpose on a large-scale basis. Carbon adsorption is inefficient in providing color removal at pulp and paper mills as demonstrated at the Buckeye Mill. This inefficiency would result in large quantities of granular activated carbon (GAC) requiring daily regeneration.

2.3 Specific Conductance

Specific conductance is present in the raw water supply at 270 μmhos/cm (μS). This value is due to the combination of 18 MGD from Etoniah Creek at 90 μS and 5 MGD from Rice Creek at 1,070 μS. Raw water in Etoniah Creek may also be supplemented by a maximum of 1.4 MGD (maximum groundwater allocation of 520 million gallons/year) groundwater at 90 μS. This conductance is further increased as the water passes through chemical addition in the water treatment plant and in the pulp and paper mill. By-products release also contributes to the specific conductance increase in the pulp and paper mill. There would be no expected conductance increase across the treatment ponds with all ponds operating at an average specific conductance of 1,900 μS average (2,280 μS peak). In order to meet the required conductance of 1,650 μS, the Mill would need to reduce the peak day conductance by 730 μS or 32 percent.

Minor reductions in specific conductance can be achieved by changing raw water supplies. Changing raw water supply to groundwater only would reduce the peak day specific conductance of the wastewater directly by approximately 10 percent or 220 μS. Recent testing indicates that the current water treatment plant practices increase the total dissolved solids in the combined effluent by approximately 70 mg/L (approximately 120 μS or 6.3 percent of the average effluent 1,900 μS). The remainder of the specific conductance (94 percent) would be associated with Mill production activities.

Lower conductivity raw water or treated water could prompt greater conductivity feedback from mill processes. GP is not aware of any similar mill discharging effluent specific conductance values consistently below 1,650 μS.

Any additional reduction required to achieve the peak specific conductivity of 1,650 μS would require unconventional pulp and paper wastewater treatment. Treatment for specific conductance reduction requires dissolved salt removal. The only demonstrated treatment process for desalination is RO. This treatment would be provided on a slipstream of the Pond 4 effluent. The treatment would be preceded by color removal and microfiltration to mitigate fouling of the RO membranes. Backwash water from the microfiltration process would be returned to the inlet end of Pond 3. This would have negligible impact on Pond 3 or Pond 4 since it would represent less than a 5 percent increase in hydraulic throughput. The reject stream from the first RO process would be subjected to a second RO process in order to reduce the ultimate reject stream to 8 to 10 percent of the feed flow. Electrodialysis or softening may be required between the first and second RO process depending on scaling potential of the first RO process reject water. The reject from the second RO unit would be directed to an evaporation unit and crystallizer. The salt cake from the crystallizer would be disposed in the on-site solid waste disposal area.

This treatment would offer an overall effluent quality improvement (color, particulate iron, particulate aluminum, and particulate dioxin removal to the degree it may be present in effluent).

2.4 Iron and Aluminum

The concentration of iron in the Pond 4 effluent (0.75 mg/L average and 0.90 mg/L maximum) is anticipated to be largely in the particulate form at the operating pH (7.8 to 8.3 s.u.). Further reduction in iron should be achievable by reducing the pH in Ponds 3 and 4 to values closer to pH 7 s.u., the point at which the Buckeye Mill typically discharges soluble iron concentrations of less than 0.3 mg/L. This could be accomplished by adding sulfuric acid to the combined wastewater entering Pond 1 and allowing the precipitated ferric hydroxide to settle in Ponds 1, 2, 3 and 4. Nitric acid could be used to reduce impacts on effluent specific conductance since the oxygen demand in the non-aerated portions of the treatment ponds would consume the nitrate added through denitrification. Otherwise, such addition would increase effluent total nitrogen. Lastly, effluent microfiltration would also assist the Mill in continuing to operate within compliance with the 1 mg/L iron limit.

The concentrations of aluminum in the WWTS are summarized in Table 2-2. These data include total and filtered analyses conducted on the influent and effluent from the primary clarifier in May and October 2009. These data include total analyses from May and October 2009 and filtered analyses conducted in October 2009. It should be noted that work in October 2009 showed that filtered (1.5 µm nominal) and soluble (0.45 µm filtration) aluminum concentrations were comparable. These data, while collected at varying times, do provide an overview of how aluminum concentrations vary across the WWTS. The water treatment plant received approximately 57 to 66 percent of all aluminum used at the Mill during May and October 2009. Consequently, at least 5 to 15 mg/L of the aluminum present in the primary clarifier influent (10 to 26 mg/L) likely originates from water treatment plant discharge streams. If this aluminum contribution were eliminated, the final effluent aluminum concentration would likely decrease accordingly.

Table 2-2. Aluminum Concentrations in the WWTS

	Clarifier Inlet	Clarifier Outlet	Pond 1	Pond 2	Pond 3	Pond 4
Total Al, mg/L	10 to 26	8 to 21	8 to10	8 to13	8 to 14	7 to 14
Filtered [1] Al, mg/L	3.5 to 26	4.1 to 15	10	11	12	13

[1] *1.5 µm (nominal) filtration.*

Alternatively, aluminum could potentially be precipitated in the primary clarifier by adjusting the pH prior to clarification with sulfuric acid or carbon dioxide (as needed). Nitric acid could be used as a means of not increasing specific conductance since the nitrate would be converted to nitrogen gas through denitrification. This approach would offer the downside potential of floating solids in both the primary clarifier and sludge ponds due to denitrification if nitric acid were used (conversion of nitrate and nitrite to nitrogen gas). Either acid addition approach would minimize anaerobic digestion in the sludge ponds due to the lowering of alkalinity required for stable anaerobic treatment. Either acid addition would also allow greater sulfide generation and formation in these ponds due to the low operating pH.

Removal of aluminum in the pond system to a soluble concentration of 2 mg/L will likely require lowering the pH in Ponds to approximately 6.5 s.u. This can be accomplished without increasing effluent conductivity by adding nitric acid to the influent to Pond 1 and again to the effluent from Pond 2 as needed, since the oxygen demand in the non-aerated portions of the treatment ponds would consume the nitrate added. Otherwise, such addition would increase effluent total nitrogen.

The settled aluminum and iron would accumulate in the Ponds sediment layer at a rate of approximately 0.74 million lbs/year. At a sediment concentration of 50,000 mg/L, this sediment corresponds to a buildup of 1.8 million gallons/year or 0.073 inches per year across the 900 acres available in the settling areas provided in Ponds 1, 2, 3, and 4.

Ion exchange was considered for aluminum and iron removal. However, it would be more complex to implement than precipitation. Microfiltration was also considered to provide removal of non-settled, particulate iron and aluminum, if needed.

2.5 Particulates and Dioxin

Ponds 1, 2, 3 and 4 discharge exemplary effluent TSS concentrations under average conditions (less than 10 mg/L) with Pond 4 discharging the lowest concentrations (6.8 mg/L average and 23 mg/L daily maximum). Ponds 1 and 4 are least subject to wind effects and hydraulic short-circuiting and exhibit essentially the same daily maximum TSS concentration. Ponds 2 and 3 are most subject to wind effects and hydraulic short-circuiting and exhibit daily maximum TSS concentrations of 63 and 41 mg/L, respectively). The suspended solids in the effluent from each pond can be reduced under high wind conditions by operating the ponds at a deeper depth based on observed wind affects in these ponds. Operating the treatment ponds at a deeper depth will reduce the opportunity for solids re-suspension. Work by Brown and Caldwell[4] indicated that Ponds 1, 2, 3, and 4 should be operated at minimum liquid depths of 4 feet, 4.3 feet, 3.5 feet, and 3.25 feet, respectively, to prevent sediment disturbance under the 99th percentile wind event (hourly wind speed of 12.5 mph). The typical operating depth in Pond 1 (5.7 feet), Pond 3 (3.8 feet) and Pond 4 (4.2 feet) likely provide this level of protection. Pond 2 would provide this level of protection by increasing its normal operating depth from 3.8 feet to a liquid depth of 4.3 feet. However, operating the ponds at a greater depth increases the risk of not having adequate flow storage during severe wet weather events. This risk can be mitigated by segregating and using the sedimentation zone of Pond 1 for wet weather storage with the gradual discharge of this wet weather volume back to Pond 2 after suspended solids in the stored wet weather volume have been allowed to settle to reasonable concentrations. This practice would also reduce the opportunity for re-suspended legacy solids, in which detectable quantities of dioxin have been measured, in Pond 1(where the highest concentration of in legacy solids was found) from being discharged to downstream ponds[5]. It is uncertain if this practice would reduce particulates and associated compounds in the effluent, since it is uncertain if the first few sedimentation zones of Pond 4 are resistant to wind disturbance and currently provide consistent removal of legacy solids contributed by upstream ponds. The deeper depth provides greater resistance against sediment disturbance caused by wind effects and provides longer hydraulic retention times. Data indicate that elevated effluent TSS occurs in each pond under 14 mph hourly wind speeds that occur approximately 3 days every 2 years.

Baffles were installed in Pond 4 in the first quarter of 2006. Pond operations personnel have observed an improvement in Pond 4 effluent TSS control after installation. However, comparison of high wind events measured at the Palatka Mill and effluent TSS from Pond 4 provide inconclusive results regarding the performance of the baffles. Additional wind and pond TSS data collection is recommended for a more accurate evaluation of baffle performance. Since the current data set does not provide conclusive evidence of

[4] Evaluation of TSS Control Measures prepared for Georgia-Pacific by Brown and Caldwell on April 27, 2005

[5] Since the implementation of the elemental chlorine-free bleaching process, dioxin has not been detected in GP's final mill effluent using EPA approved methodologies.

the impact of the Pond 4 baffles, Brown and Caldwell has decided at this time to focus on depth increase, in preference to baffle installations, to reduce the opportunity for solids re-suspension due to wind effects.

Additional suspended solids (particulate) removal can be achieved by flocculent addition to the Pond 3 effluent. This addition has been practiced on an interim basis when solids are re-suspended due to very high wind conditions. The need for this practice can be reduced by operating Ponds 2 and 3 at a deeper depth.

A reduction in effluent TSS would prompt a reduction in effluent aluminum and iron. To the degree that dioxin may be present in the effluent, any reduction in effluent TSS could potentially provide dioxin reduction[6]. To reduce effluent TSS to less than the 1 mg/L average and 3 mg/L peak, microfiltration with an absolute pore size of 3 microns would be required. This was the 10 percentile size of the effluent suspended solids via particle size distribution determined by Beckman Coulter in October 2009.

Brown and Caldwell has identified treatment processes that have reduced dioxin to concentrations less than 10 ppq (the limit of quantitation) in other applications. Work in Australia demonstrated that microfiltration followed by RO was capable of reducing dioxin in the effluent from a municipal wastewater treatment facility from a mean concentration of 4.1 to a mean concentration of 2.7 ppq.[7] The test method used in this Australian work was USEPA Method 1613B and 1668A. Treatment for reduction of dioxin to the proposed standard (0.014 ppq) is unprecedented and unquantifiable. The proposed standard is 714 times more strict than the established limit of quantitation for a USEPA established method. Consequently, it is uncertain if *any* treatment technology can achieve the proposed standard if dioxin is present at concentrations greater than the water quality standard

2.6 Whole Effluent Toxicity

Risk Sciences believed that Georgia-Pacific would need to significantly reduce effluent specific conductance and aluminum to potentially comply with the water quality standard (NEOC $\geq$ 72 percent)[8]. Further discussions revealed that Risk Sciences[9] did not believe that GP could reliably or consistently comply with this standard even following these effluent quality improvements due to the ionic imbalances likely present in the effluent, and also due to test species sensitivity. Experience by BC also established that it is uncertain whether such a WET standard could be reliably and consistently achieved.

[6] Since there is no indication that dioxin is present in the effluent using EPA approved methodology, any discussion of the potential effect the wastewater management alternatives addressed in this report may have on the presence of dioxin in the effluent is speculative and requires an assumption that dioxin is present. Therefore, this report focuses on how the wastewater management alternatives may reduce solids, including legacy solids, since the presence of solids in the effluent, and any corresponding reduction, can be measured.

[7] Dioxins, Furans, and PCBs in Recycled Water for Indirect Potable Reuse, C. Rodriguez, A. Cook, B. Devine, P. Van Buynder, R. Lugg. K. Limge, and P. Weinstein, International Journal of Environmental Research and Public Health, Volume 5, No. 5, pages 356-367, 2008.

[8] Draft Focused Toxicity Identification Evaluation submitted to Georgia-Pacific on July 15, 2006 by RISK Sciences and Advent-Environ Corporation.

[9] Conversation with Tim Moore of Risk Services (author of Georgia-Pacific correspondence on effluent aquatic toxicity) on November 25, 2009.

3. INITIAL ALTERNATIVES SCREENING

The wastewater management alternatives considered and the ones recommended for further development are listed in Table 3-1. These alternatives were discussed with FDEP in a meeting on December 9, 2009. The outcome of these discussions led to dropping four alternatives from further consideration as described in the bullet points below. In addition, the concepts of pond reconfiguration as well as ultra-filtration were not developed further due to their lack of feasibility or inability to impact the parameters of focus.

Reconfiguration of the ponds was not further developed for several reasons. The ponds can be operated at depths that reduce elevated effluent TSS under high wind events that occur less than 1 percent of the time. Data presented herein indicates that further treatment is provided as wastewater passes through Ponds 1 through 4. Inclusion of all ponds in the WWTS is needed to consistently provide the current effluent quality and to provide the flexibility required in managing wet weather flows.

The use of UF for color removal was not further developed because many of the color causing compounds have been shown to have molecular weight values lower than the cut-off for UF. It was observed during preliminary lab testing that a 500 dalton molecular weight cut-off filter was required to reduce the color to less than 200 PCU and most UF units have an effective cut-off of 10,000 daltons. In addition, the concentrated reject from the UF system (approximately 15 percent of forward flow) would still have to be treated for color removal prior to discharge.

- Baffles added to Ponds 2 and 3: Baffles in Ponds 2 and 3 would provide little benefit under average conditions. Greater operating depths could accomplish the same purpose and is a more demonstrated method of controlling effluent TSS concentrations. Furthermore, the baffles installed in Pond 4 have not reduced Pond 4 effluent TSS concentrations below those observed prior to baffle installation despite comparable operating wind speeds and depths. Additional baffle installations should be postponed until this lack of improvement is better understood.
- Effluent carbon adsorption: Work at other pulp and paper mills (such as Buckeye in Perry, Florida) has demonstrated that carbon is inefficient in color removal. These inefficiencies would result in large quantities of carbon requiring daily regeneration. Other methods presented would be more cost effective.
- Stop anaerobic conditions in all ponds: Based on Dr. Lange's work and the full-scale trial conducted at GP, elimination of anaerobic conditions in the primary sludge pond would have a much greater impact than simply providing greater aeration in Ponds 1, 2, 3, and 4. Further aeration of Ponds 1, 2, 3, and 4 would not allow the Mill to comply with the final effluent color limit.
- Install ion exchange: Ion exchange was excluded from consideration since it would it would be a more costly option for reducing effluent aluminum and iron than other options considered. The process would result in a concentrated brine stream that would require off-site disposal. It would also not offer the benefit of color removal that other treatments for iron and aluminum provided.

Table 3-1. Likely Impact of Wastewater Management Alternatives on Final Effluent Quality							
Alternatives	Color (PCU)	Specific Conductivity (µmhos/cm or µS)	C. dubia Chronic NOEC (%)	Fe (mg/L)	Al (mg/L)	Dioxin (ppq)	Particulates
Status Quo	1,000	2,280	< 8.3	0.9	12	<10	
1. Change raw water supply	685	2,050	Improved	None	None	None	None
2. Provide coagulation and sedimentation at primary clarifier	Less	Less	Improved	Less	≤ 2	None	Uncertain
3. Provide aerobic handling and dewatering of primary solids	Less	None	None	None	None	None	None
4. Effluent chemical oxidation with ozone or perozone	< 250	None	None	None	None	See Footnote[1]	Uncertain
5. Effluent coagulation and sedimentation with polyamine	< 250	None	None	Less	≤ 2	See Footnote[1]	Less
6. Effluent microfiltration	None	None	None	Less	Less	See Footnote[1]	Less
7. Effluent microfiltration and reverse osmosis	< 250	< 1,500	Significantly Improved	Less	≤ 2	See Footnote[1]	Less
8. Pond pH adjustment and sedimentation	None	Less	Significantly Improved	Less	≤ 2	See Footnote[1]	Less

Table 3-1. Likely Impact of Wastewater Management Alternatives on Final Effluent Quality							
Alternatives	Color (PCU)	Specific Conductivity (µmhos/cm or µS)	C. dubia Chronic NOEC (%)	Fe (mg/L)	Al (mg/L)	Dioxin (ppq)	Particulates
9. Flocculent addition to Pond 3 effluent	None	None	None	Less	Less	See Footnote[1]	Less
10. Baffles in Ponds 2 and 3	None	None	None	Uncertain	Uncertain	See Footnote[1]	Less
11. Effluent carbon adsorption	Less	Less	None	Less	Less	See Footnote[1]	Less
12. Stop anaerobic conditions in all Ponds	900	None	None	None	None	None	None
13. Effluent ion exchange	Less	None	Significantly Improved	Less	≤ 2	None	None

Green highlights = Recommended for further development.

[1]These wastewater management alternatives have the potential to reduce dioxin if it is present in effluent.. Since the implementation of the elemental chlorine-free bleaching process, dioxin has not been detected in GP's final mill effluent using EPA approved methodologies

4. ALTERNATIVES SELECTED FOR FURTHER DEVELOPMENT

The alternatives listed below were selected for further development because they offered the greatest promise for achieving required effluent quality. They have been presented in the order of their capability to improve effluent quality in a feasible manner. Each of these are focused on improving the effluent quality.

1. Effluent coagulation and sedimentation
2. Coagulation and sedimentation in primary clarifier
3. Aerobic handling and dewatering of primary solids
4. Flocculent addition to Pond 3 effluent
5. Effluent coagulation, sedimentation, microfiltration and reverse osmosis
6. Effluent chemical oxidation with ozone or perozone
7. Pond pH adjustment and sedimentation
8. Effluent microfiltration
9. Change raw water supply
10. Maintenance of minimum operating depths in ponds
11. Wet weather storage in sedimentation zone of Pond 1
12. Final effluent pH adjustment
13. Dewatering water treatment plant sludge separately
14. Cessation of salt cake sewer discharges and changes in water treatment plant chemistry
15. Dredging legacy solids from Ponds 1, 2, 3 and 4

A series of bench-scale treatability tests were performed in the BC Treatability Laboratory in Nashville, Tennessee to evaluate the feasibility of alternatives. The results of the recommended alternatives evaluation are summarized in Section 5. Block flow diagrams, footprint requirements, utility requirements, and cost estimates are also provided in Section 5. Capital cost estimates provided in Sections 5 and 6 are Class 4 estimates in accordance with the Association for the Advancement of Cost Engineering International (AACE) criteria. The level of estimate is defined as a Planning Level or Design Technical Feasibility Estimate. The engineering is typically from 1 percent to 15 percent complete and the expected accuracy of the estimate is -30 percent to +50 percent. The detailed cost estimate for each alternative evaluated is provided in Appendix B. A summary of the evaluation is provided in Section 6.

5. EVALUATION RESULTS

This evaluation considered the baseline wastewater characteristics presented in Table 1-1 for development of conceptual level designs and cost estimates presented in Section 5. These characteristics were deemed representative of those expected at the Mill and therefore were suitable for the evaluation presented herein.

5.1 Final Effluent Coagulation and Sedimentation

Ten coagulants (four inorganic and six polyamine) were screened for color removal on the final Pond 4 effluent. This location was selected as it provided the greatest upstream storage during wet weather and the most reliable location for the intended color removal. The results of this screening are provided in Table 5-1.

Table 5-1. Jar Testing Results Evaluating Different Chemical Additives for Color Removal

Chemical Addition	Dose (mg/L or ppmv)[a]	pH (s.u.)	True Color (PCU)[b]	Conductivity (µS)
Raw	---	8.33	1,200	1,730
Ferric Sulfate	100	6.9	1,890	1,700
	200	6.5	2,575	1,675
	300	6.2	3,080	1,670
	400	5.9	2,380	1,710
	400 with acid	5.0	3,060	1,795
	500	5.5	610	1,705
	500 with acid	5.0	1,720	1,790
Alum	100	6.9	1,460	1,750
	100 with acid	5.0	1,340	1,885
	200	6.4	1,480	1,730
	200 with acid	5.0	155	1,835
	300	6.1	182	1,735
	300 with acid	5.0	39	1,760
	400	5.5	47	1,730
	500	4.75	33	1,730
Polyaluminum Chloride (Nalco 8136)	500	pH > 6	483	2,030
	1,000	pH > 6	103	2,130
	2,000	pH > 6	39	2,375
	3,000	pH > 6	30	2,620
Polyaluminum Chloride (Nalco 8140)	500	pH > 6	218	2,065
	1,000	pH > 6	62	2,150
	2,000	pH > 6	32	2,375
	3,000	pH > 6	31	2,656
Nalco 8100	50	8.4	735	Not Analyzed
	50 with acid	6.6	1,050	Not Analyzed
	100	8.21	111	1,728
	100	7.95	128	1,700

Table 5-1. Jar Testing Results Evaluating Different Chemical Additives for Color Removal (Cont.)

Chemical Addition	Dose (mg/L or ppmv)	pH (s.u.)	True Color (PCU)[b]	Conductivity (µS)
Nalco 8105	50	Approx. 8.4	2,150	Not Analyzed
	50 with acid	6.5	1,965	Not Analyzed
	100	8.26	157	1,684
	100 with acid	6.5	132	Not Analyzed
	200	8.3	79	Not Analyzed
	200 with acid	6.5	94	Not Analyzed
	300	8.27	106	Not Analyzed
	400	8.23	146	Not Analyzed
	500	8.22	146	Not Analyzed
Nalco 8108	100	8.32	2,195	1,655
Nalco 8190	100	8.3	1,725	1,668
Nalco 8799 LS	100	8.32	2,565	1,661
Nalco 8799+	100	8.31	2,095	1,703

[a]*Polyaluminum chloride and polyamine coagulant dose values are given as parts per million by volume of raw product (ppmv).*

[b]*Sample was filtered through 0.45 µm filter prior to color analysis.*

The target effluent color of less than 275 PCU was achieved with the following doses:

- 200 mg/L alum ($Al_2(SO4)_3 \cdot 18\ H_2O$) with acid addition to pH 5,
- 300 mg/L alum, 500 parts per million by volume (ppm_v) polyaluminum chloride (PAX) addition (as Nalco 8140), 1,000 ppmv PAX addition as Nalco 8136,
- 100 ppm_v polyamine polymer addition (as Nalco 8100 and 8105).

These additives have a chemical cost of $0.38/lb alum, $0.36/lb Nalco 8140, and $1.80/lb Nalco 8100. The specific weight of both the Nalco products is approximately 10 lbs/gallon. At an average flow of 23 MGD, the daily chemical cost would be $14,600/day of alum plus acid and caustic, $21,900/day of alum, $41,400/day of Nalco 8140, or $41,400/day of Nalco 8100. Treatability work demonstrated that the 300 mg/L alum dose caused an effluent TSS of 330 mg/L while the 100 mg/L Nalco 8100 caused an effluent TSS of 220 mg/L. When factoring in sludge disposal costs, the alum addition was the more cost competitive. A lower alum dose with both acid and caustic addition was not selected in order to minimize impacts on effluent specific conductance. Alum addition at 300 mg/L was selected for conceptual level design and cost development below.

Treatment of Pond 4 effluent at 300 mg/L alum did provide a 95 percent reduction in both color and soluble aluminum and an 80 percent reduction in soluble iron while not increasing effluent specific conductance as illustrated in Table 5-2. No other metals besides aluminum and iron were considered in these tests because they were not parameters of interest specified by FDEP. All three of these parameters where reduced below the target discharge values. This treatment may potentially reduce particulate dioxin to the degree it may be present in effluent. However, this treatment did not meet the effluent specific conductance limit (1,650 µS) nor the target specific conductance value for effluent WET improvement (1,500 µS). Consequently, it would be unlikely that this treatment would produce an effluent that consistently achieved the effluent WET limit (NOEC $\geq$ 72).

Table 5-2. Pond 4 (D-001) Effluent Treatment			
Parameter	Pond 4 Effluent	Alum Treated[a]	After Settling
pH, s.u.	8.33	6.04	6.04
True Color, PCU	1,200	62	62
Specific Conductance, µS	1,730	1,710	1,720
TSS, mg/L	7.5	331	<10
Total Aluminum, mg/L	6.32	---	1.25
Soluble Aluminum, mg/L	3.57	---	0.17
Soluble Iron, mg/L	0.52	---	<0.1
Chronic Toxicity, C. dubia, NOEC, %	100	---	100

[a]*Treatment with alum at 300 mg/L*

The proposed treatment system would consist of routing the Pond 4 effluent into a rapid mix tank where alum would be added, a maturation tank where fine sand would be blended, and clarifiers where the sand-weighted solids would be settled. The clarified effluent would discharge by gravity to Mile Marker 2.4 on Rice Creek. The settled solids would be discharged through a hydrocyclone to recover and reuse the sand. The scoured solids would be held in sludge holding tank and ultimately dewatered on a filter press. The dewatered cake would be disposed in the onsite solid waste management area.

The high rate clarification system has been applied in similar applications and was an alternative considered by another Florida Mill. This system was sized as one system train treating the average flow of 23 MGD with adequate treatment capacity to meet the TSS limits at 32 MGD and a hydraulic capacity to accommodate the storm-based peak flow of 45 MGD. The coagulation, clarification, and sludge handling systems would be housed in a 20,000 ft^2 building. Figure 5-1 is a block flow diagram depicting this alternative. Figure 5-2 shows the location and footprint requirements of the equipment required for this alternative.

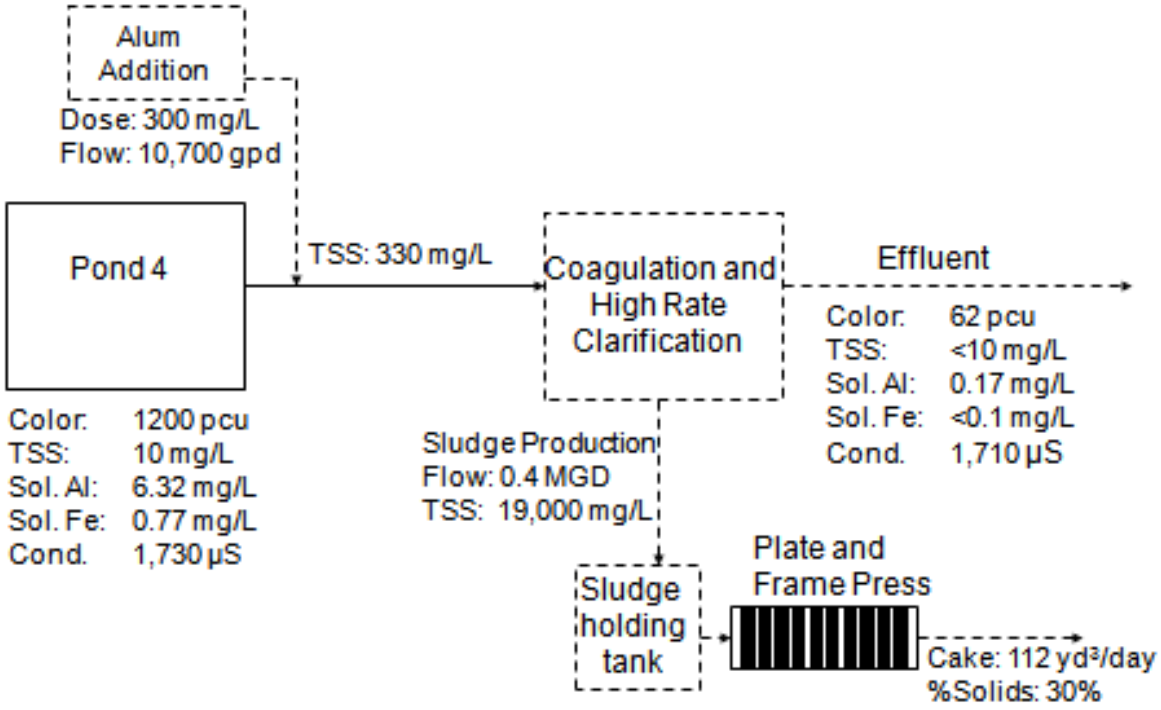

Figure 5-1. Block flow diagram of Pond 4 coagulation and clarification

Figure 5-2. Location and footprint requirements for Pond 4 coagulation and clarification

The power requirements for this system are provided in Table 5-3.

Table 5-3. Pond 4 Coagulation and Clarification Power Requirements

Item	Units	Value	Comments
Coagulant Mixer	HP	20	2 units
Maturation Tank Mixer	HP	15	
Scraper Drive	HP	1	
Recirculation Pumps	HP	40	2 units
Hydrocyclone	HP	30	2 units
Dewatering	HP	30	Estimate based on: belt press, feed pumps, wash water pumps, and polymer feed pump
Total	HP	136	
	KW	101	
Total	KWh/day	2,435	24 hr/day operation

The capital cost for this alternative is estimated at $32,170,000 ($39,370,000 including the pipeline to mile marker 2.4). Table 5-4 provides a list of the equipment required for this alternative. Table 5-5 provides the operational cost estimate. Capital and operating estimated costs are based upon treatment studies when the treated effluent color was measured using the EPA methodology to reflect the 275 PCU proposed limit in the Administrative Order.

Table 5-4. Major Equipment Requirements for Effluent Coagulation and Sedimentation

Item	Comments
Alum Storage Tank	75,000 gallons, 22 ft diameter
Alum Addition Pumps	Two 10 gpm units (one standby)
Alum Addition Piping	Approximately 100 ft
Actiflo Unit	Includes tank(s), recycle pumps, hydrocyclone, and mixers.
Sludge Holding Tank	250,000 gallons
Polymer Blending System	Make down raw polymer to 0.1% v/v
Polymer Addition Pumps (0.1% solution)	Two 24 gpm units (one standby)
Polymer Addition Piping	Approximately 50 ft
Plate and Frame Press	Approximately 750 ft^3

Table 5-5. Operational Cost Estimate for Coagulation and Sedimentation			
Item	Unit Price	Annual	Comments
Alum	$0.38 per lb	$16,457,000	
Polymer	$2.20 per lb	$255,126	Estimate from similar project
Power	$0.072 per KWh	$64,000	
Maintenance		$43,050	15% raw cost of equipment with moving parts
Operator	$73,000 per year per FTE	$306,600	4.2 FTEs
Sludge Disposal		$817,600	$20 per cubic yard for onsite disposal of mixed sludge. (Increases to $50 per cubic yard if it has to be disposed off site).
Estimate Total		$17,673,400	

5.2 Coagulation and Sedimentation in Primary Clarifier

Four inorganic metal salt coagulants and a polyamine coagulant were initially screened to provide color removal from the primary clarifier influent. This location was selected since it already provided a solids-liquid separation device and since such treatment would lower the waste load on the downstream treatment ponds. The results of this screening evaluation are provided in Table 5-6. A subsequent test was performed to evaluate bentonite addition for color removal. Even at the highest dose tested of 1,800 mg/L, the color was only reduced by approximately 3 percent.

Table 5-6. Jar Test Results Evaluating Coagulation and Sedimentation within Existing Primary Clarifier				
Chemical Addition	Dose (mg/L or ppmv)[a]	pH (s.u.)	True Color (PCU)	Conductivity (µS)
Raw	---	8.15	960	1,740
Ferric Sulfate	100	7.0	2,490	1,880
	200	6.6	3,020	1,875
	300	6.25	3,630	1,870
	400	6.0	4,350	1,890
	500	5.65	5,300	1,910
Ferric Chloride	375	6.2	3,950	Not Analyzed
	560	5.8	5,225	Not Analyzed
	750	5.1	5,525	Not Analyzed
Alum	100	6.85	2,090	1,880
	200	6.42	2,360	1,920
	300	6.03	2,640	1,950
	375	5.6	1,430	Not Analyzed
	400	5.55	2,360	1,970
	500	5.04	500	2,000
	560 with caustic	5.5	146	Not Analyzed
	600 with caustic	6.2	139	2,330
	750 with caustic	5.5	230	Not Analyzed

Table 5-6. Jar Test Results Evaluating Coagulation and Sedimentation within Existing Primary Clarifier

Chemical Addition	Dose (mg/L or ppmv)[a]	pH (s.u.)	True Color (PCU)	Conductivity (µS)
Polyaluminum Chloride (Nalco 8136)	500	pH > 6	226	1,714
	1,000	pH > 6	105	1,835
	2,000	pH > 6	54	2,090
	3,000	pH > 6	41	2,405
Polyaluminum Chloride (Nalco 8140)	500	pH > 6	140	1,724
	1,000	pH > 6	83	1,812
	2,000	pH > 6	40	2,030
	3,000	pH > 6	32	2,365
Nalco 8100[a]	100	8.0	1,300	1,870
	200	7.95	332	1,880
	300	8.0	232	1,880
	400	7.92	204	1,855
	500	7.85	212	1,860

[a]*Polyaluminum chloride and polyamine coagulant dose values are given in parts per million by volume (ppmv)*

A target primary clarifier effluent color of less than 180 PCU was selected to allow for a historical increase of color of 66 percent across the treatment ponds while still complying with the daily maximum color limit of 275 PCU. The target primary clarifier effluent color was achieved with the following doses: 580 mg/L alum ($Al_2(SO4)_3{\cdot}14\ H_2O$) alum, 500 ppm_v polyaluminum chloride (PAX) addition (as Nalco 8140), and 1,000 ppm_v PAX addition as Nalco 8136. These additives have a chemical cost of $0.38/lb alum and $0.36/lb Nalco 8140 (and 8136) with the Nalco product having a specific weight of 10 lbs/gallon. At an average flow of 23 MGD, the daily chemical cost would be $42,300/day of alum plus caustic addition or $41,400/day of Nalco 8140. The PAX (Nalco 8140) addition at 500 ppm_v was selected for conceptual level design and cost development below due to its lesser impact on effluent specific conductance.

Treatment of primary clarifier influent at 600 mg/L alum did provide an 85 percent reduction in both color and soluble aluminum and a 92 percent reduction in soluble iron but increased effluent specific conductance by 34 percent as illustrated in Table 5-7. Color, iron, and aluminum where reduced below the target discharge values. Comparable treatment would be expected at the 500 ppm_v dose of Nalco 8140 as evidenced by the matching color listed in Table 5-6. Further evaluation would be needed to confirm the degree of further color development that would be experienced in the treatment ponds following this treatment. This treatment may potentially reduce particulate dioxin to the degree it may be present in effluent. This treatment did not meet the effluent specific conductance limit (1,650 µS) or the target specific conductance value for effluent WET improvement (1,500 µS), and it would likely not appreciably reduce effluent particulate concentrations. Consequently, it would be unlikely that this treatment would produce an effluent that consistently achieved the effluent WET limit (NOEC $\geq$ 72).

Table 5.7. Primary Clarifier Treatment			
Parameter	Primary Clarifier Influent	After Alum Addition[a]	After Settling[b]
True Color (PCU)	960	139	139
Specific Conductance (µS)	1,740	2,330	2,330
TSS (mg/L)	340	644	8.0
pH (s.u.)	8.15	6.0	6.0
Total Aluminum (mg/L)	----	----	2.38
Soluble Aluminum (mg/L)	5.49	----	0.87
Soluble Iron (mg/L)	0.47	----	0.04

[a]*Treatment with 600 mg/L alum and pH adjustment to 5.5 – 6.2 s.u.*

[b]*Alum treated sample settled for 30 minutes.*

This treatment would cause a significant increase in sludge production. The primary clarifier underflow TSS discharge would increase from 51,220 to 122,000 lbs/day. The primary clarifier underflow currently has a TSS concentration of about 4,400 mg/L as currently operated. If underflow pumps are modified to reduce flow and increase retention time, then the underflow TSS concentration will likely increase to an estimated 15,000 mg/L.

Figure 5-3 presents a block flow diagram of this option, with the hashed lines indicating new treatment processes. At a 500 ppm_v dose of PAX (Nalco 8140) and an average flow of 23 MGD, an addition rate of 11,500 gpd is required. The equipment required for this option would be a coagulant storage tank, dosing pumps and piping. The PAX storage tank would be designed to hold one week's worth of coagulant, requiring an 80,500 gallon tank.

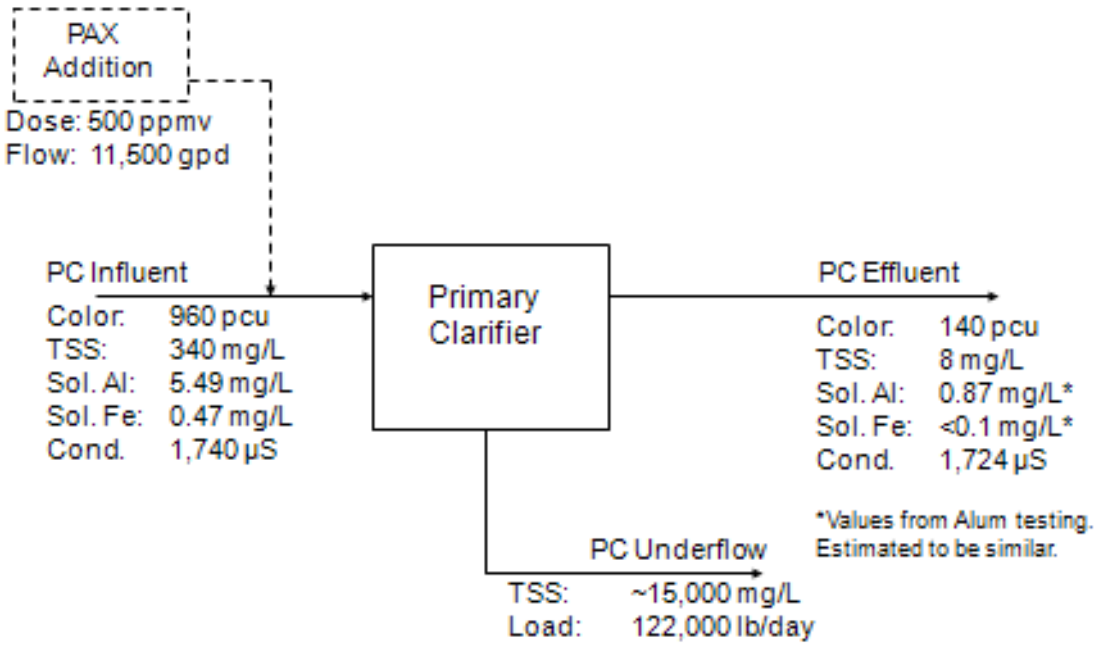

Figure 5-3. Block flow diagram of alum addition to primary clarifier influent

The primary clarifier has a diameter of 275 ft. Under baseline operating conditions, the clarifier has a hydraulic loading rate (HLR) of 390 gpd/ft², weir loading rate (WLR) of 26,650 gpd/ft, and a solids loading rate (SLR) at 1.1 lbs/ft²-day. Installing coagulant addition will increase the HLR to 400 gpd/ft², the WLR to 28,000 gpd/ft, and the SLR to 2 lbs/ft²-day. These values are well within the target operating ranges for primary clarification (400 to 800 gpd/ft²; 10,000 to 40,000 gpd/ft; and SLR target of 20 to 30 lbs/ft²-day). No capacity upgrades to the current primary clarifier would be required to accommodate this alternative.

The capital cost estimate for this alternative is $932,200 ($8,132,200 including the pipeline to Mile Marker 2.4). The major capital equipment for this alternative includes a PAX storage tank and addition system. The operational costs are primarily chemical costs with minor costs for modified underflow pumping requirements. It is assumed that the operator time required for this alternative is minimal and would be covered under the current operations schedule. Table 5-8 provides the operational cost estimate for this alternative. Capital and operating estimated costs are based upon treatment studies when the treated effluent color was measured using the EPA methodology to reflect the 275 PCU proposed limit in the Administrative Order.

Table 5-8. Annual Operational Cost Estimate for Alum Addition to Primary Clarifier Influent

Item	Unit Price	Annual Cost	Comments
PAX (Nalco 8140)	$0.36 per lb	$15,111,000	Price quote from Nalco
Chemical pumping	$0.072 per KWh	$2,353	5 hp PAX pump
Maintenance	----	$11,973	15% raw cost of equipment with moving parts
Operational Estimate Total		$15,125,400	Assumes PAX used instead of Alum

5.3 Aerobic Handling and Dewatering of Primary Solids

This alternative involves eliminating exposure of primary sludge to anaerobic treatment. Dr. Clifford Lange from Auburn University conducted multiple treatability studies for the GP Palatka Mill. These studies indicated that the color increase across the wastewater treatment system could be limited to a 48 percent increase (370 PCU to 550 PCU) if the primary clarifier sludge and effluent could be kept fully aerobic (3 mg/L Dissolved Oxygen (DO) minimum). A month-long field trial conducted by GP added validity to Dr. Lange's premise that the color increase could be limited to 48 percent if the primary sludge were transferred and dewatered to prevent anaerobic conditions. It is uncertain what the sustainable final effluent color would be under this alternative. It is certain that it would be significantly greater than the effluent color limit of 275 PCU. However, this reduction in color would offset downstream chemical addition requirements to comply with this color limit.

Aerobic sludge handling and dewatering of primary solids would reduce final effluent color. It would not be expected to reduce effluent specific conductance, iron, aluminum, or WET. Nor would it be expected to reduce dioxin on an effluent that contained dioxin. It would offer the benefits of reduced odor emissions and additional storage to manage wet weather flows. It would not reduce final effluent particulate concentrations.

Either primary clarifier underflow as currently produced, or after coagulant addition as described in Section 5.2, would be discharged directly to dewatering equipment. The current primary clarifier underflow would be dewatered using a screw press while the coagulant-treated underflow would be dewatered using a belt filter press since aluminum-based solids are not compatible with screw press technology.

The current primary clarifier underflow equates to a sludge load of approximately 51,200 lbs/day TSS at a flow of 0.41 MGD and a concentration of 15,000 mg/L (with reduced underflow rate). This would require a two parallel screw press units operating 24 hours/day and producing 0.39 MGD of filtrate that would be

returned to the clarifier influent. Having dual units will allow one unit to come down for maintenance while the other maintains operation. The screw press cake would be approximately 40 percent solids resulting in approximately 69 cubic yards/day of sludge being stored onsite as process residuals.

The coagulant-treated clarifier influent would have an underflow sludge load of approximately 122,000 lbs/day at a flow of 0.98 MGD and a concentration of 15,000 mg/L TSS (with reduced underflow rate). This would require three 3-m belt filter press units operated in parallel and would produce 0.90 MGD of filtrate to be returned to the clarifier influent. The belt press cake would be approximately 20 percent solids resulting in approximately 328 cubic yards/day of sludge being stored onsite as process residuals. Dewatering polymer would be added in both cases at a dose of 15 lbs/ton of dry solids. The non-coagulant option would require a daily polymer dose of approximately one 300-gallon tote every 10 days. The coagulant-treated option would require a daily polymer dose of approximately one 300-gallon tote every 3 days (115 gpd). A block flow diagram of this option is provided in Figure 5-4.

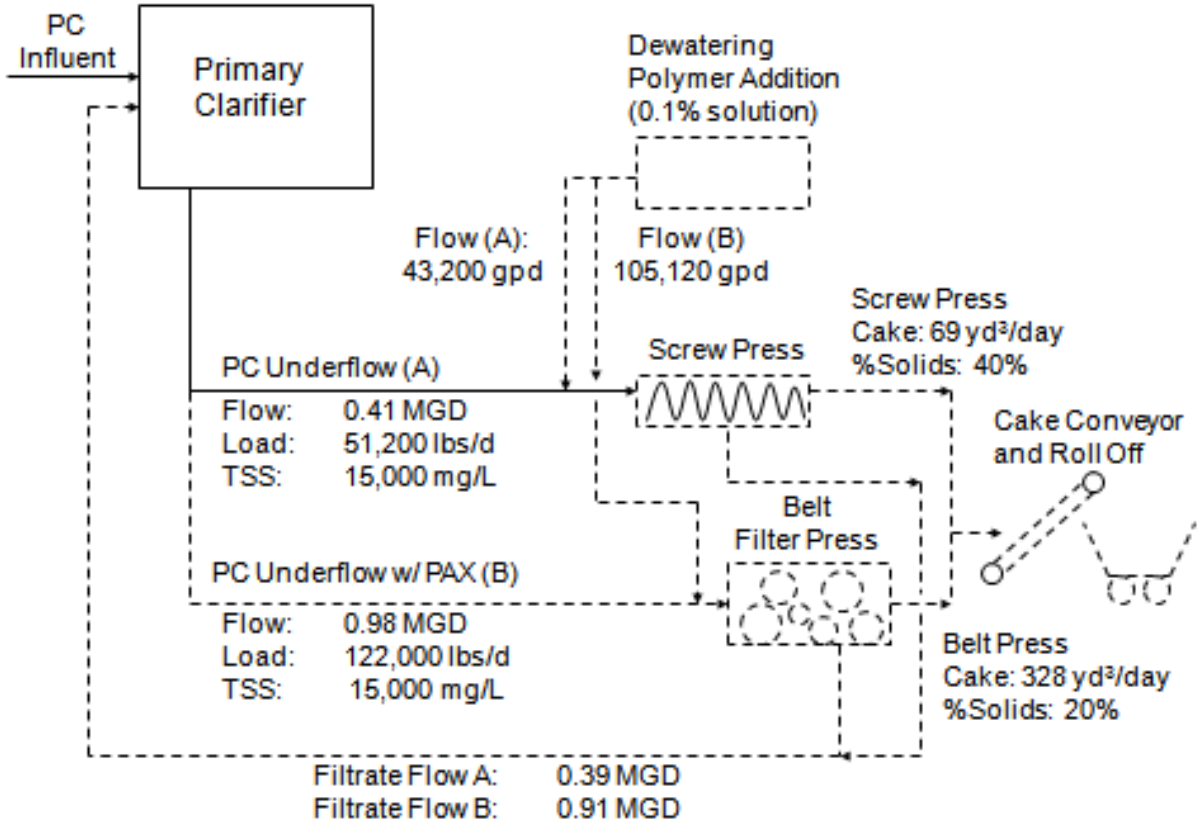

Figure 5-4. Block flow diagram of aerobic handling of primary clarifier solids.

Primary sludge dewatering equipment would be located in the open area east of the primary clarifier and west of the primary sludge storage pond. This location will take advantage of current underflow pipe routing to the primary sludge storage pond. When the dewatering equipment required service, sludge would be held in the primary clarifier or discharged to the primary sludge storage pond. Figures 5-5 and 5-6 present the footprint requirements for the dewatering equipment under both conditions.

Figure 5-5. Footprint requirements for dewatering primary clarifier underflow

Figure 5-6. Footprint requirements for dewatering alum treated primary clarifier underflow

Table 5-9 provides the equipment required for the options with and without coagulant treatment. The capital cost estimate for the non-coagulant addition dewatering options was developed by GP in 2002. Adjusted to 2010 dollars using Engineering New Record cost indices, the cost estimate for this option is

$5,838,000 ($13,038,000 including the pipeline to Mile Marker 2.4). The Mill is evaluating options for value engineering and expects the actual capital cost to be in the range of $2,000,000 to $5,800,000. The capital cost estimate for the PAX addition dewatering option is $4,814,300 ($12,014,300 including the pipeline to Mile Marker 2.4) including the PAX addition system, $932,200, plus dewatering system at $3,882,100.

Table 5-9. Major Equipment Requirements for Primary Sludge Dewatering

Non-Coagulant Option		Coagulant Option	
Equipment	Comments	Equipment	Comments
Underflow pump	275 gpm	PAX Storage Tank	25 ft diameter by 25 ft ht
Polymer blending unit		Chemical Addition Pumps	5 gpm
Polymer addition pump	30 gpm	Underflow pump	650 gpm
Screw Press		Polymer blending unit	
Building	50 ft by 75 ft	Polymer addition pump	75 gpm
		Belt Filter Press Units	Three 3-m belt press units in parallel
		Building	75 ft by 100 ft

The operational cost estimate for the non-coagulant dewatering options developed by GP was $497,500 (adjusted to 2010 dollars). This value also uses the GP reported cost of $10 per cubic yard for disposal of primary solids (no chemical sludge included) onsite. The disposal cost for PAX conditioned solids was assumed to be $20 per cubic yard due to the greater difficulty in handling the much wetter dewatered cake. Table 5-10 presents the operational costs for this alternative.

Table 5-10. Annual Operational Cost Estimate for PAX Treated Primary Sludge Dewatering

Item	Unit Price	Annual	Comments
Total from Table 5-8		$15,125,400	Total from coagulation and sedimentation in primary clarifier alternative (Section 5.2)
Polymer	$2.20 per lb	$765,375	
Power	$0.072 per KWh	$10,590	
Maintenance		$99,000	15% raw cost of equipment with moving parts
Operator	$73,000 per yr per FTE	$306,600	4.2 full time equivalents (FTEs) at $73,000/yr each (burdened)
Sludge Disposal		$1,408,900	$20 per cubic yard for onsite disposal of mixed sludge. (Increases to $50 per cubic yard if it has to be disposed off site).
Estimate Total		$17,715,900	

5.4 Flocculent Addition to Pond 3 Effluent

Flocculent addition to Pond 3 effluent is currently practiced on an intermittent basis when ponds are disturbed by high winds at lower operating depths. Long–term implementation was considered. This treatment could potentially provide comparable effluent quality, on average, to that achieved in treatment of Pond 4 effluent (achieving on average treatment objectives for color, aluminum, and iron) as described in Section 5.1. However, the in-pond configuration and associated dredging with this alternative would cause less reliable compliance with effluent standards. This alternative may potentially reduce effluent particulate dioxin, to the degree that it may be present in effluent. The alternative suffers from the same limitations as

those for treatment of Pond 4 effluent. The alternative will not meet the effluent specific conductance limit (1,650 µS) nor the target specific conductance value for effluent WET improvement (1,500 µS). Consequently, it would be unlikely that this treatment would produce an effluent that consistently achieved the effluent WET limit (NOEC $\geq$ 72).

Results for the Pond 4 testing were used for evaluating this alternative (Table 5-2). A polyamine coagulant (Nalco 8100) at 100 ppm_v, alum at 300 mg/L, and PAX at 500 ppm_v achieved the desired reductions in color, aluminum, and iron. However, the polyamine, alum, and PAX treatment increased the Pond 4 effluent TSS to 222, 331, and 165 mg/L respectively. The additional TSS would increase the sludge accumulation rate in Pond 4 to 1.2, 1.8, and 0.9 feet per year for the respective additions. Approximately every two years Pond 4 would require dredging. During this period, the effluent from the inlet end of Pond 3 would be discharged via a newly-installed bypass line to the final effluent. Due to its cost competitiveness in this option, alum was used to develop the cost estimate and design basis.

Two coagulant addition points would be required: one at the Pond 4 inlet for normal conditions and one at the Pond 2 inlet during Pond 4 dredging. Both alum addition areas would include a 75,000-gallon (22 ft diameter) storage tank and alum dosing pumps to add 10,700 gpd. The chemical addition locations in the pond would also include sheet pilings and mixers to provide chemical incorporation and flocculation. The Pond 4 bypass pipeline would receive discharge from the southeast corner of Pond 3 and travel 1,200 ft to the current Pond 4 discharge point. Baffles would be installed in both Ponds 2 and 3 in order to allow good solids settling even under windy day conditions while Pond 4 was being dredged. Periodically, Pond 2 would require dredging to remove solids accumulated during the Pond 4 dredging. As discussed by Brown and Caldwell in a Technical Memorandum issued April 27, 2005, baffles would be installed in designated ponds to meet a design guideline of less than 1,300 ft per fetch. This would require four baffles in Pond 2 and three baffles in Pond 3. Furthermore, implementation of this alternative would not be practicable without significant upgrades to roadways and without provision of power and permanent staging areas. The major equipment required for this alternative is summarized in Table 5-11.

Table 5-11. Pond 4 pH Adjustment

Item	Comments
Alum Storage Tanks	Two 75,000 gallon tanks (22 ft diameter)
Alum Addition Pumps	Four 5-hp chemical addition pumps
Sheet Piles (to create mixing zones)	
Floating Mixers	Four 5-hp mixers per mixing zone (eight mixers total)
Baffles for Ponds 2 and 3	Four in Pond 2 and three in Pond 3 (seven total)
Pond 4 Bypass Pipeline	5 ft diameter, 1,200 ft length

Figures 5-7 and 5-8 provide a block flow diagram and a layout for this alternative.

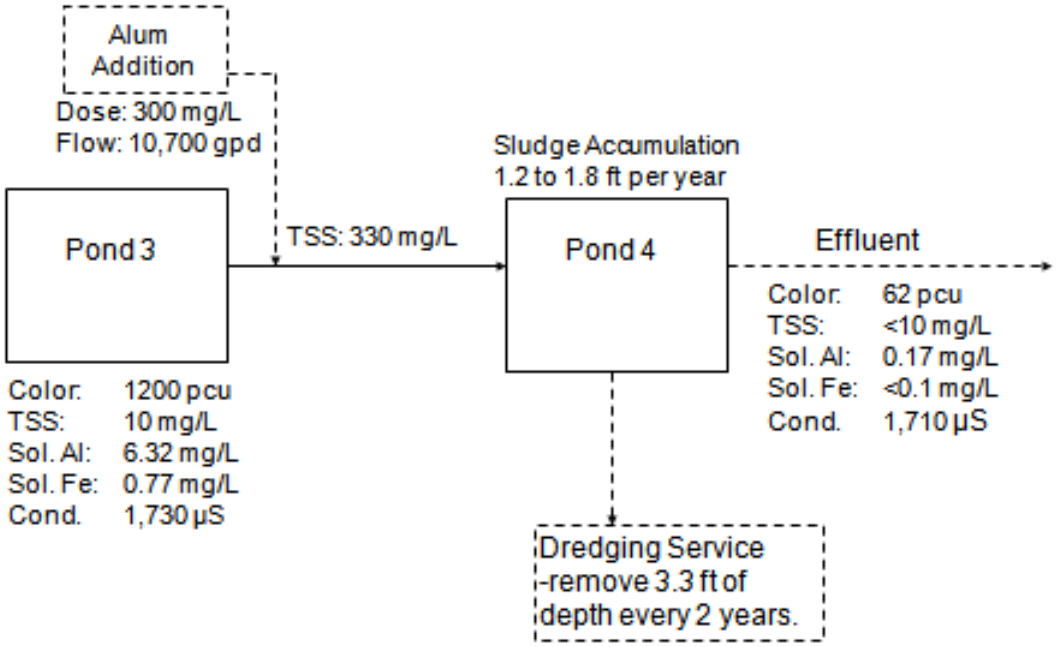

Figure 5-7. Block flow diagram of coagulant to Pond 3 effluent

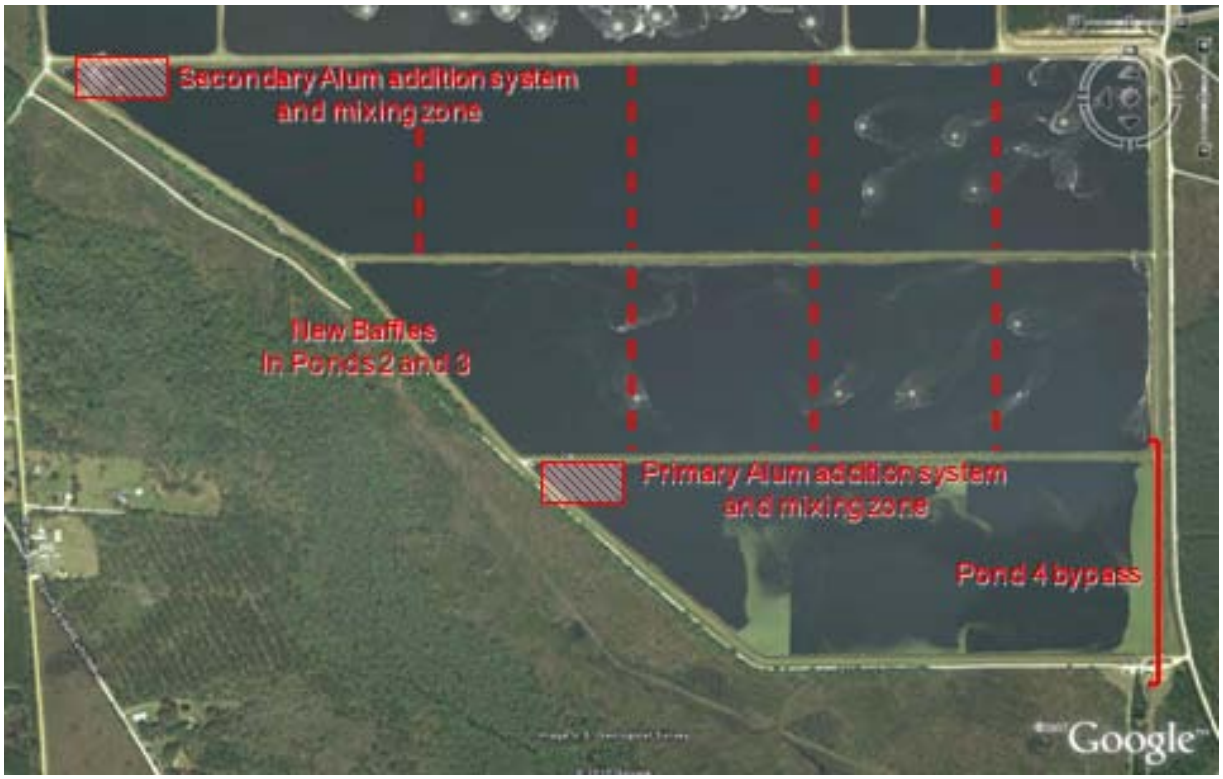

Figure 5-8. Layout of coagulant to Pond 3 effluent

The capital cost estimate for this alternative is $4,232,300 ($11,432,300 including the pipeline to Mile Marker 2.4). This cost does not include additional facility upgrades (roadways, staging areas, and power) required to make long-term implementation practical. The operating costs of this alternative would primarily be due to coagulant addition and dredging. Table 5-12 presents the operational cost estimate for this alternative. Capital and operating estimated costs are based upon treatment studies when the treated effluent color was measured using the EPA methodology to reflect the 275 PCU proposed limit in the Administrative Order.

Table 5-12. Annual Operational Cost Estimate for Effluent Coagulation

Item	Unit Price	Annual	Comments
Alum	$0.38 per lb	$16,457,000	
Power (mixing and pumping)	$0.072 per KWh	$24,073	Four 5-hp mixers per chemical addition zone (40 hp total) plus two 5-hp pumps
Dredging		$4,693,720	Dredging 3.3 ft from 95 acre Pond 4 every 2 years
Estimate Total		$21,110,800	

One variant of this alternative would be to install equipment needed to chemically condition Pond 3 effluent TSS and particulate concentrations when elevated due to solids re-suspension caused by high wind events. This alternative would include flocculent addition to the Outlet box of Pond 3 and construction of an in-pond rapid mix zone in Pond 4. These two rapid mix chambers would facilitate adequate conditioning of the Pond 4 effluent. The effluent from the final rapid mix zone would experience indirect flocculation as the effluent moved further into Pond 4. An on-line turbidimeter (particulate analyzer) would initiate chemical conditioning whenever the Pond 4 first cell effluent turbidity exceeded a selected value. The flocculent addition, once initiated, would be adjusted to maintain setpoint turbidity in the Pond 4 first cell effluent. Such treatment would likely reduce the daily maximum Pond 4 effluent TSS, particulate, aluminum, and iron. This alternative may potentially reduce particulate dioxin to the degree that it may be present in effluent. It is unlikely that it would appreciably change average Pond 4 effluent quality due to the infrequency of elevated effluent TSS discharged from Pond 3, but would likely decrease the daily maximum concentration. The alternative suffers from the same limitations as those for more rigorous treatment of Pond 3 effluent described above. The advantage that it offers is a much lower capital and operating cost as described below and the avoidance of near-term dredging due to the much lower quantity of solids generated.

Figure 5-9 provides a block flow diagram of this variant of the in-pond flocculation alternative. Using a lower flocculent dose of 50 ppm_v and only dosing during windy conditions (estimated to be 1 percent of the time assuming proper depth and fetch control), the sludge accumulation in Pond 4 is reduced to approximately 0.1 inches per year. This accumulation rate would result in the need for Pond 4 dredging approximately once every 200 years. Figure 5-10 provides the layout for this option.

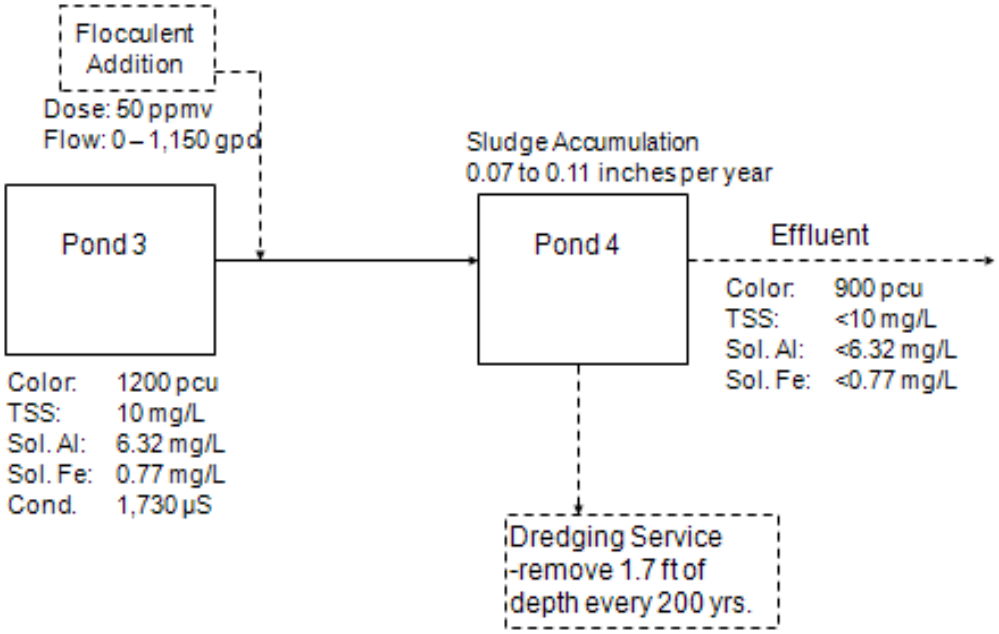

Figure 5-9. Block flow diagram of flocculent to Pond 3 effluent during peak TSS events

Figure 5-10. Layout of flocculent to Pond 3 effluent during peak TSS events

The capital cost for this option is $586,000. The cost estimate for this options was originally provided to GP in a report by BC, Evaluation of TSS Control Measures, submitted April 25, 2005. The cost estimate has

been adjusted to current dollars (2010) using the Engineering News-Record cost indices. An operation cost estimate for this option is provided in Table 5-13.

Table 5-13. Annual Operational Cost Estimate for Limited Pond 4 Flocculation

Item	Unit Price	Annual	Comments
Flocculent (Nalco 8100)	$1.80 per lb	$69,320	Based on a flow of 1,150 gpd operating 1 percent of the time.
Power (mixing and pumping)	$0.072 per KWh	$700	One 5-hp mixer plus one 5-hp pump operating 1 percent of the time.
Estimate Total		$70,020	

5.5 Effluent Microfiltration and Reverse Osmosis

Installing the Pond 4 effluent treatment described in Section 5.1 followed by microfiltration (MF) and RO on a slip stream would allow the effluent to meet the discharge requirements for color, aluminum, iron, and specific conductance. This technology would also remove all particulates in the treated slip stream. The RO unit would treat a significant daily volume slip stream of approximately 7.8 MGD in order to reduce the effluent specific conductance (daily max of 2,280 µS) to below 1,500 µS. It is uncertain whether this treatment would produce an effluent that consistently achieved the effluent WET limit (NOEC $\geq$ 72) due to sensitivity of the test species and potential ionic imbalances in the final effluent.

An RO reject stream of approximately 0.8 MGD would be sent to an evaporator for further concentration and finally to a crystallizer to allow for zero liquid disposal (ZLD). Figure 5-11 is a block flow diagram of this option.

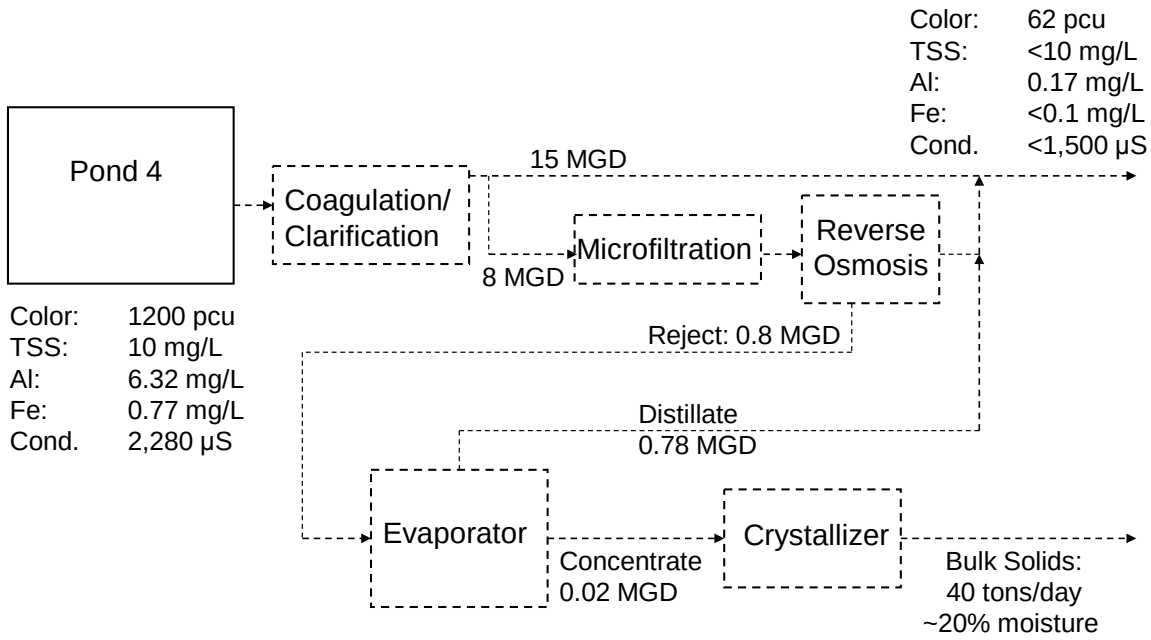

Figure 5-11. Block flow diagram of the MF, RO, and ZLD system

The footprint requirements would be the same as those shown in Section 5.1 plus an 80 ft by 200 ft building to house the MF, RO, and ancillary equipment. An outdoor area of 80 ft by 80 ft area would be allocated for the evaporator and crystallizer. Figure 5-12 presents the location and footprint of the required equipment. The total power requirements for this alternative are provided in Table 5-14.

Figure 5-12. Location and footprint of MF, RO, and ZLD system

Table 5-14. Power Requirements for MF, RO, and ZLD system

Item	Unit	Value	Comments
Coagulation/Clarification	KW	101	From Table 5-3
MF/RO	KW	480	
Evaporator	KW	2,075	
Crystallizer	KW	900	
Total	KW	3,556	
	KWh/day	85,344	24 hr/day operation

The capital cost for the ultrafiltration, reverse osmosis, and zero liquid discharge units is estimated at $49,990,400. This system would be added downstream of the alum addition and clarification system discussed in Section 5.1. The total capital cost estimate for this alternative would be $82,157,500 ($89,357,500 including the pipeline to mile marker 2.4). The operational cost estimate for this alternative is provided in Table 5-15.

Table 5-15. Annual Operational Cost Estimate for RO and ZLD			
Item	Unit Price	Annual	Comments
Total from Table 5-5		$17,673,400	From effluent coagulation and sedimentation option (Section 5.1)
Additional Power	$0.072 per KWh	$2,242,840	
Additional Maintenance		$2,970,000	15% raw cost of equipment with moving parts
Additional Operators	$73,000 per year per FTE	$306,600	
Additional Solids Disposal		$1,158,730	$100 per cubic yard
Estimate Total		$24,351,600	

The selected pretreatment upstream of the UF/RO system described above (coagulation, sedimentation, and dewatering) was less expensive than simply relying on filtration alone (microfiltration and ultrafiltration) upstream of reverse osmosis. Filtration alone as pretreatment would have required additional filtration equipment and would have produced an additional 2.5 MGD of reject water requiring evaporation and crystallization. This in turn would increase the capital to approximately $111,000,000 but would reduce the operating cost by approximately $2,900,000 per year due to the avoidance of alum addition (i.e. total operating cost from Table 5-5). In terms of present worth, the filtration option would result in approximately 0.7 percent savings ($2 million out of $280 million).

5.6 Pond 3 Effluent Chemical Oxidation with Ozone

Laboratory testing was performed to evaluate the impact of oxidants such as ozone and peroxide on color removal from the Pond 3 effluent. Ozone alone and a combination of ozone plus 30 mg/L peroxide (perozone) were both evaluated. The ozone was sparged into a 500 mL beaker at 0.83 liters per minute (Lpm) and a gas concentration of 23 mg O_3/L. Samples were pulled over a 20 minute period and analyzed for color. The results of this testing are provided in Table 5-16.

Table 5-16. Pond 3 Oxidation Testing			
Reaction Time (min)	Applied Dose (mg O_3/L)	True Color (PCU)	
		Ozone	Perozone
0	0	1,305	1,305
1	47	1,165	975
2	93	990	728
3	140	780	546
4	186	615	434
6	279	400	320
8	372	320	269
10	466	280	235
12	559	237	214
15	698	203	176
20	931	185	160

No significant additional benefit was observed when peroxide was added as catalyst. Ozone was observed to reduce the color to below 275 PCU at a dose of approximately 560 mg/L. This is a very high dose and equates to a full-scale dose of 50 to 70 tons O_3/day depending upon transfer efficiency. This full scale ozone application rate will require up to 20 ozone generators, each providing up to 6,700 lbs O_3/day. While ozone

addition achieved a color reduction below 275 PCU, it did not impact the specific conductance, and caused the BOD to increase from 14 mg/L to 40 mg/L. This increase in BOD would be due to the oxidation of poorly degradable compounds into more readily degradable compounds. Ozonation would not decrease particulates and may in fact increase suspended solids since bacteria will be generated from the degradation of the additional BOD. Due to the availability of lower cost alternatives for achieving the same effluent quality, the capital cost of this alternative was not developed. Figure 5-13 is a block flow diagram of the ozone addition alternative.

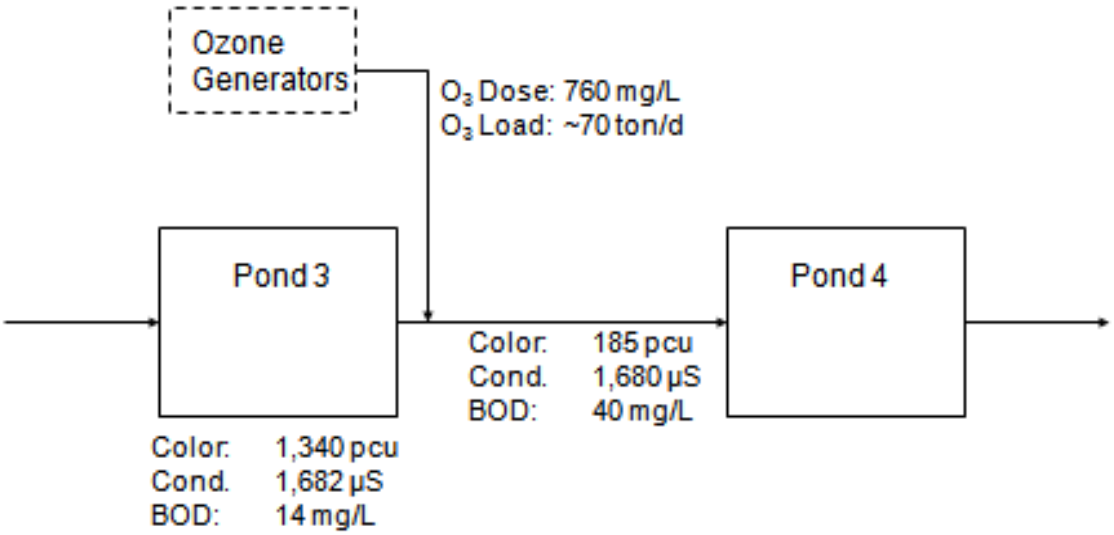

Figure 5-13. Block flow diagram of ozone addition to Pond 3

The ozone generators would be located on the east side of Pond 3 as illustrated in Figure 5-14. The power consumption for this alternative would be 630,000 KWh/day. At the current power cost of $72 per MWh, the daily cost would be $45,400 ($16.6 million/year). The units would require 1.37 MGD of cooling water for each generator and power supply unit. Assuming 20 units, the cooling water requirement would be 27.4 MGD. To produce 70 tons O_3/day, approximately 700 tons O_2/day would be required. Assuming an oxygen cost of $0.11 per lb O_2, the daily cost would be approximately $154,000 ($56.2 million/year). The high dose and related requirements render this option infeasible. Capital costs were not developed for this alternative.

Figure 5-14. Location of the ozone addition system

5.7 Pond 4 Effluent pH Adjustment followed by Filtration

The pH of Pond 4 effluent was adjusted and the sample was settled overnight (16 hours) and analyzed for its impact on total suspended solids (TSS), specific conductance, soluble color, soluble aluminum, and soluble iron. It should be noted that the apparent color and true color (color present after 0.45 µm filtration) were on average within 8 percent of each other in the untreated Pond 4 effluent sample. Table 5-17 presents these test results performed at pH 5.0, 5.5, 6.0, 6.5, and 7.0 s.u. The results indicate a 50 percent color reduction with no TSS generation and no removal of soluble aluminum and iron. This lack of iron and aluminum reduction is likely due to complexation with color causing substances (e.g., humic acid) since color removal observed in Pond 4 effluent treatment also provided soluble iron and soluble aluminum at these same pH conditions. Specific conductance was increased as a result of this treatment due to acid addition.

It is likely that the true color reduction observed in this alternative would be partly negated once the effluent pH was adjusted prior to discharge and adjusted further following discharge into Rice Creek. Subsequent testing showed that when the sample pH was increased back from 6.0 s.u. to 7.2 s.u. the net true color reduction was only 13 percent as opposed to the 38 percent observed at pH 6.0 s.u. in Table 5-17.

These data indicate that pH adjustment used in conjunction with microfiltration or sedimentation would not provide a means for complying any of the effluent standards or targets for color, specific conductance, WET, aluminum, and iron. It would likely provide a means of providing some color reduction with the undesired outcome of increasing specific conductance. This alternative may potentially reduce particulate dioxin to the degree it may be present in effluent.

Due to its inability to offer a significant means of achieving compliance with any effluent target, the alternative was considered non-viable as a stand-alone process. Consequently, capital and operating costs were not developed for this alternative.

Table 5-17. Pond 4 pH Adjustment					
pH (s.u.)	Color (PCU)	Soluble Al (mg/L)	Soluble Fe (mg/L)	Specific Conductance (µS)	TSS (mg/L)
8.22 (Raw)	1290	3.57	0.52	1,670	7.5
7.0	890	3.14	0.50	1,710	5.5
6.5	840	3.39	0.52	1,765	3.5
6.0	795	3.49	0.53	1,770	5.5
5.5	720	3.35	0.48	1,775	5.6
5.0	640	3.30	0.46	1,771	5.6

5.8 Effluent Microfiltration

Microfiltration (MF) would be employed on the Pond 4 effluent in order to remove all aluminum and iron associated with the particulate material in suspension. The MF system used would be the equivalent of a system used upstream of membrane bioreactors. The microfiltration would produce effluent concentrations equivalent to the soluble (0.45 µm filtered) effluent concentrations observed for aluminum, iron and color. The expected effluent values for aluminum, iron, and color would be 3.57 mg/L, 0.52 mg/L and 1,200 PCU respectively. This treatment alone would not provide any significant reduction in these constituents since essentially all effluent concentrations of these constituents are soluble. Consequently, this treatment process was considered non-viable as a stand-alone process. Capital and operating cost were not developed for this alternative. This treatment would provide removal of particulates and any compounds associated with those particulates.

The use of membrane filtration with a smaller nominal pore size was also evaluated in the treatability laboratory. Table 5-18 shows the results of passing the Pond 4 effluent through a 0.1 µm, 30,000 molecular weight cut off (MWCO), and 500 MWCO. The 0.1 µm filter is in the microfiltration range, the 30,000 MWCO filter is in the ultrafiltration range, and the 500 MWCO filter is in the nanofiltration range.

Table 5-18. Color removal at different filter pore size		
Filter Pore Size	Approximate Filtration Range	Effluent Color (PCU)
0.45 µm	Microfiltration	1,200
0.1 µm	Microfiltration	745
30,000 MWCO	Ultrafiltration	462
500 MWCO	Nanofiltration	12

The color limit could not be met until nanofiltration was employed. Nanofiltration is very similar in application to RO. The equipment requirements and operational costs would be similar to treating the effluent with RO as discussed in Section 5.5. It is uncertain whether nanofiltration would allow the effluent to meet the specific conductance limit of 1,650 µS.

5.9 Change Raw Water Supply

Georgia-Pacific has an annual groundwater withdrawal allocation of less than 2 MGD (520 million gallons/year) and an annual average wastewater discharge flowrate of 23 MGD (8,395 million gallons/year). The groundwater has a color of 50 PCU and a specific conductance of 90 µS. GP discharges groundwater into Etoniah Creek as needed to maintain withdrawals from Etoniah Creek at 18 MGD. The water withdrawn from Etoniah Creek (225 PCU color and 90 µS specific conductance) exhibits better water quality than the

5 MGD of water withdrawn from Rice Creek (525 PCU color and 1,070 µS specific conductance) that contains Mill effluent and is more subject to tidal influence. Additional groundwater cannot be withdrawn and placed in Etoniah Creek without GP receiving a higher annual groundwater withdrawal allocation since this allocation is already fully tapped in dry weather years such as 2007. The withdrawal of water from Rice Creek cannot be relocated upstream of the Mill effluent discharge influence because the Rice Creek headwaters flow is reportedly less than 1 MGD during dry weather periods.

Consequently, there is no feasible alternative for reducing treated wastewater effluent constituents (such as specific conductance) far enough to avoid treatment without significantly increasing the GP annual groundwater allocation. Replacing the Rice Creek flow of 5 MGD with groundwater would decrease the combined specific conductance by 213 µS (303 µS to 90 µS). If this reduction were to be realized in the effluent, then the peak specific conductance would theoretically be reduced from 2,280 µS to 2,067 µS which is still well above the limit of 1,650 µS. However, it is doubtful that this influent reduction will be reflected in the effluent as lower conductivity raw water would likely prompt greater conductivity feedback from mill processes. GP is not aware of any similar mill discharging effluent specific conductance values consistently below 1,650 µS. Additional groundwater supply to the Mill would require an additional parallel supply pipeline since the current supply system is constrained to 18 MGD. Figure 5-15 illustrates the path of this parallel pipeline.

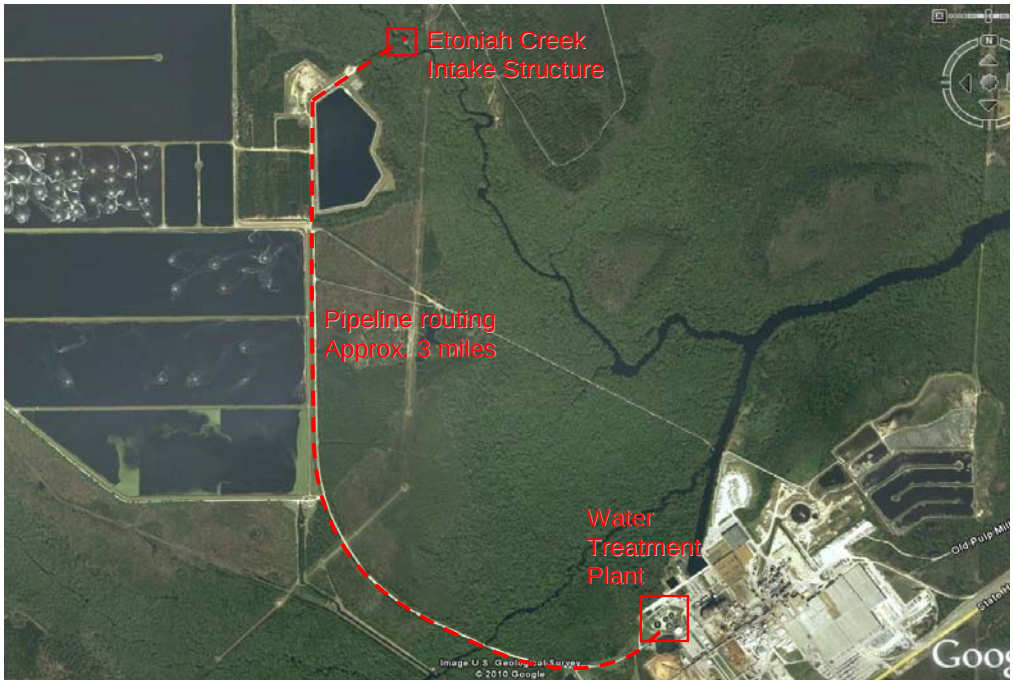

Figure 5-15. Water supply pipeline route

Due to the uncertainty that this alternative would result in any improvement in effluent quality, capital and operating costs were not developed.

5.10 Maintenance of Minimum Operating Depths in Ponds

GP operates Ponds 1 and 4 at operating depths that reduce the opportunity for solids re-suspension except under high wind events that appear to occur less than 1 percent of the time. Ponds 2 and 3 are often operating at depths that would allow solids re-suspension. The minimum operating liquid depths that should be maintained to reduce opportunity for solids re-suspension are 4 feet, 4.3 feet, 3.5 feet, and 3.25 feet in

Ponds 1, 2, 3 and 4 respectively. The risk associated with this is operation is not having the needed capability to store wastewater during severe wet weather conditions to avoid effluent non-compliance with BOD and TSS limits. This risk can be mitigated by segregating and using the sedimentation zone of Pond 1 for wet weather storage with the gradual discharge of this wet weather volume back to Pond 2 after suspended solids in the stored wet weather volume have been allowed to settle to reasonable concentrations. This practice would also reduce the opportunity for re-suspended legacy solids in Pond 1 from being discharged to downstream ponds.

This alternative may reduce the daily maximum Pond 4 effluent TSS, particulate, aluminum and iron. This alternative may potentially reduce particulate dioxin to the degree that it may be present in effluent. It is unlikely that it would appreciably change average Pond 4 effluent quality due to the infrequency of high effluent TSS discharged from Pond 3. There are no capital or operating costs associated with this alternative.

5.11 Wet Weather Storage in Sedimentation Zone of Pond 1

The baseline average flow used for the wastewater management alternatives evaluation was 23 MGD. The peak day flow used in that evaluation was 45 MGD; this peak day flow was used to size all equipment considered for final effluent treatment. Reducing this peak day flow would subsequently reduce the equipment sizes and costs for effluent treatment. The reduction in cost for the more cost effective effluent treatment option, effluent coagulation and sedimentation, was evaluated.

BC has maintained that GP needs to keep all ponds in service to provide adequate treatment and storage under wet weather flows. An option for reducing peak flows and providing comparable treatment under wet weather conditions would be to partition the largest treatment pond (Pond 1) into active treatment and wet weather storage. This Pond is already divided into four near sequential passes of which only the first and a small section of the second pass are completely-mixed and aerated. Under this alternative, the few aerators in the second pass would be moved to the first pass. The second, third, and fourth pass would be segregated by construction of a spillway across the opening between the first and second pass. Normally, the pond would be empty or only partially full in those three areas. Under normal flow conditions (less than 28 MGD), all flow would be routed to Pond 2 through a newly constructed weir. All flows in excess of 28 MGD would overflow the first pass into the second pass. This flow would travel through the second, third and fourth pass before being discharged gradually via a new, manually operated, 5 MGD lift station to Pond 2. This arrangement should allow GP to reduce peak day flow rates from 45 MGD to 28 MGD while consistently providing a hydraulic residence time in the ponds capable of meeting the effluent limits for BOD, TSS, nitrogen and phosphorus (greater than 20 days). This option would also reduce the opportunity for re-suspension of legacy solids in Pond 1. The active volume lost in Pond 1 segregation would be made up in operating Ponds 2, 3 and 4 at deeper depths and thus transferring the equivalent wet weather storage to Pond 1. The wastewater diverted to this portion of the Pond 1 would be given the opportunity to settle before being discharged to Pond 2.

Allowing Ponds 2, 3, and 4 to operate at a deeper depth may reduce average and daily maximum concentrations of effluent particulates discharged from Pond 4 and the associated color, iron, and aluminum. This alternative may potentially reduce particulate dioxin to the degree it may be present in effluent. This alternative would pose risks associated with odor emissions and creation of a mosquito breeding ground. These risks could be addressed in plans that are not developed at this time.

A layout of this concept is provided in Figure 5-16.

Figure 5-16. Peak flow reduction layout

The capital cost of this alternative would be approximately $1,200,000. A detailed breakdown of the conceptual level cost estimate is provided in Appendix B. The operational cost of this alternative would be $5,000 to $25,000 per year depending upon the frequency with which the lift station is required to operate. Reducing the peak flow from 45 MGD to 28 MGD would reduce the equipment cost for effluent coagulation and sedimentation (see Section 5.1) by approximately $1,000,000 and the overall project cost by approximately $2,000,000 (about a 5 percent reduction of the $39,370,000 for this option). The prior system was sized to provide full treatment at 32 MGD and partial treatment at the peak day flow of 45 MGD. This was selected with the understanding that the effluent under peak day flow would be more dilute. Consequently, downsizing this equipment from full treatment at 32 MGD to full treatment at 28 MGD resulted in a small cost difference. The net capital savings would therefore be approximately $800,000. The operational cost of $17,673,400 would not change as the chemical dose was calculated based on the average flow.

5.12 Final Effluent pH Adjustment

Prior work[10] indicated that the final effluent color could be reduced by more than 50 percent by lowering the pH from 8.6 to 5.0 s.u. Bench-scale tests were conducted to quantify the color reduction that could be achieved by adjusting the final effluent pH 8.6 to that of the receiving water body (St. Johns River at pH 7.2 s.u.). Carbon dioxide was evaluated for pH adjustment since this would have a minimal impact specific conductance.

This pH adjustment from carbon dioxide provided only a 15 percent true color reduction (1,515 PCU reduced to 1,295 PCU). Due to this modest reduction, the design and cost estimate of this option were not further developed.

5.13 Dewatering Water Treatment Plant Sludge Separately

The primary constituent identified in WET toxicity has been soluble aluminum. Further investigations have indicated that approximately 62 percent on average (up to 89 percent) of the effluent aluminum can be attributed to the use of aluminum in the Water Treatment Plant (WTP). This contribution could be reduced by more than 90 percent by dewatering the water treatment sludge separately. Such practice would reduce WET. It is unlikely that this practice would consistently allow compliance with the effluent WET standard ($\geq$72 percent No Observed Effect Concentration (NOEC) with *Ceriodaphnia dubia*). However, it is likely that an NOEC of 50 percent could be achieved through this measure. Segregation and dewatering of the WTP solids will not cause significant reductions in effluent color since the majority of the color comes from the process wastestreams.

Both a belt filter press and a plate-and-frame press were considered for this alternative, with the belt press option being the more cost competitive (lower present worth value). A schematic for this concept is provided in Figure 5-17.

[10] Recommendations for Georgia-Pacific Palatka Mill by Risk Sciences in May 12, 2009.

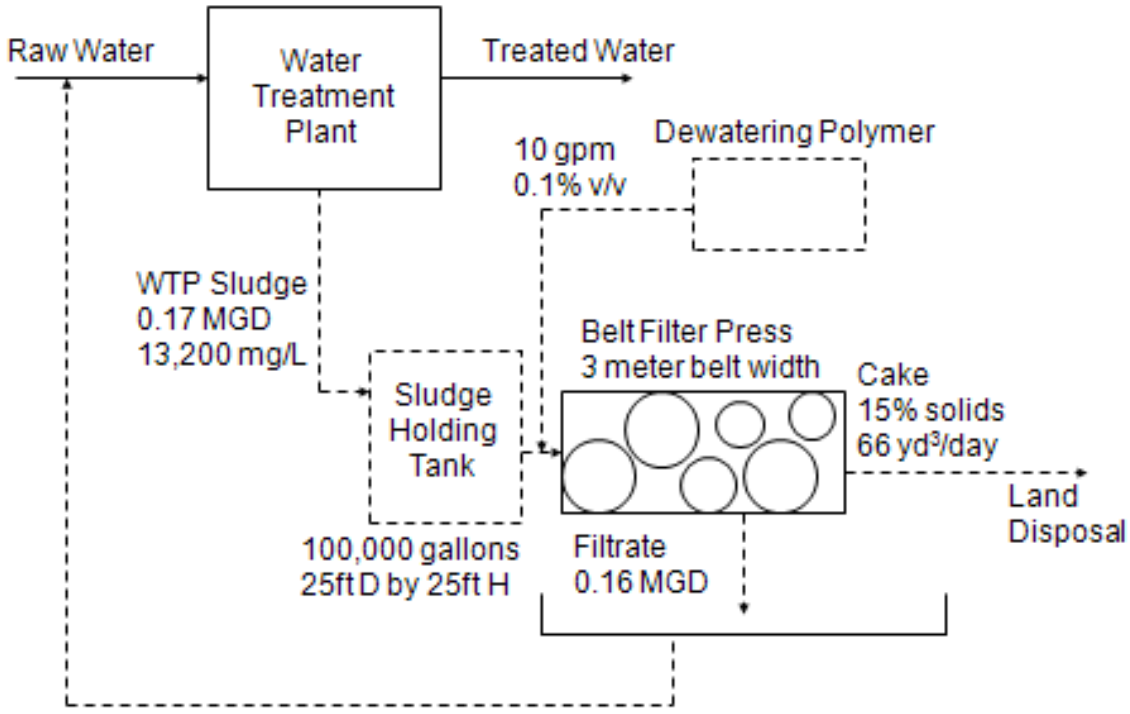

Figure 5-17. Block flow diagram of dewatering process with belt filter press

The capital cost of this alternative is $1.7 million with an annual operating cost of approximately $660,000. This yields a present worth value of $10,378,100 over a 10 year period, at 8 percent interest, and 4 percent inflation. This option will not reduce capital or operational cost of downstream treatment options because the sizes of these options are driven primarily by hydraulic load and color removal. However, this option will show significant reductions in effluent aluminum and WET.

It should be noted that GP is investigating changing the chemistry used at the WTP. A preliminary report by Nalco indicated that a significant aluminum reduction at the WTP may be realized due to the chemistry change. This would need to be further investigated as it may provide a more cost effective alternative for aluminum and subsequent WET reduction.

5.14 Cessation of Salt Cake Discharges to Sewer and Changes in Water Treatment Plant Chemistry

The Mill has implemented salt cake reuse at the facility to the extent presently possible. There continues to be approximately 11 dry tons/day of salt cake that is discharged to the sewer. If this salt cake were handled as a solid material and disposed off-site, the effluent total dissolved solids concentration would decrease by approximately 115 mg/L. The peak day effluent specific conductance would be decreased from approximately 2,280 µS to 2,130 µS (significantly greater than the 1,650 µS effluent standard).

The expense of installing a dry material handling and loading facility would be approximately $1,000,000. The annual cost of disposing of this material off-site would be approximately $100/ton or $400,000 annually.

Work by Nalco indicates that changing chemistry at the WTP from alum and sodium aluminate to a blended coagulant (soluble aluminum salt and polyquaternary amine chloride) would reduce the TDS in the WTP

effluent (Mill process influent) by approximately 50 mg/L. This would equate to a reduction in specific conductance of approximately 65 µS, however it is uncertain whether this conductivity reduction would be realized in the wastewater treatment system (WWTS) effluent. Changing the chemistry would cost GP approximately $144,540 in additional chemical costs per year. Switching WTP chemistry is also expected to reduce the sludge produced and thus the disposal costs. A full-scale trial would be needed to better assess these savings.

Combined, these two measures could potentially reduce the peak day effluent specific conductance to approximately 2,065 µS, still requiring additional treatment to reach the effluent standard of 1,650 µS. A full-scale trial would be required to demonstrate the actual benefits of these two measures.

If an effluent specific conductance reduction of 215 µS could be achieved, the microfiltration, reverse osmosis, and evaporator systems discussed in Section 5.5 of the Technical Memorandum No. 3, Wastewater Treatment Alternatives Evaluation, submitted May 2010, would be reduced by approximately 15 percent. The crystallizer associated with this system would not decrease in size. This reduction would result in an approximate savings on raw equipment cost of $2,600,000 and an overall project cost savings for this option of approximately $4,800,000. This equates to about 5 percent of the estimated capital cost of $89,357,500.

5.15 Sediment Removal from Ponds

Sediment could be removed from Ponds 1, 2, 3 and 4 via dredging accompanied with sludge dewatering and disposal on-site in the process residuals storage area. This measure would not be expected to improve average effluent quality. The intent of this measure would be to reduce the probability of discharging legacy solids, found in higher quantities in Pond 1, in the final effluent. It is uncertain if this alternative would reduce particulate dioxin in effluent, to the degree it may be present, since it is uncertain if the first few sedimentation zones of Pond 4 may be resistant to wind disturbance and may currently provide consistent retention of legacy solids contributed by upstream ponds.

The cost of this dredging would be approximately $4.6 million if only Pond 1 were dredged and $7.1 million if Ponds 1, 2, 3 and 4 were dredged. These capital cost estimates include $1.22 million for the installation of power at a dewatering staging area adjacent to the ponds.

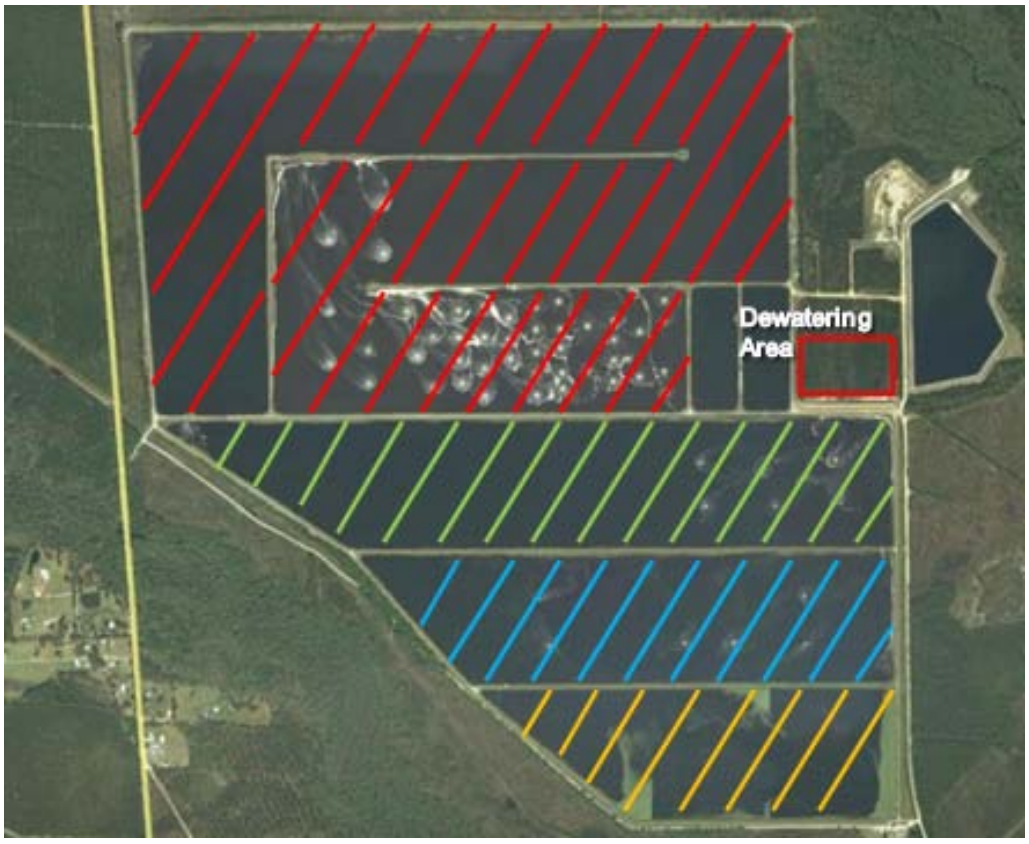

Figure 5-18. Dredging and Dewatering of Pond Sediment

6. SUMMARY

The alternatives discussed in Section 5 are summarized in Table 6-1 regarding their impact on effluent quality, capital cost, operational cost, and present worth cost. This report reaches the following conclusions:

- No wastewater management alternative was determined to be feasible based on its capability of providing reliable compliance with effluent standards.
- The effluent WET standard cannot be reliably attained at Mile Marker 2.4 in Rice Creek with demonstrated technology due to sensitivity of the test species at the water quality based specific conductance and the sensitivity of the test species to ionic composition.
- All ponds experience infrequent abrupt increases in effluent suspended solids that commonly occur at the same time. These abrupt increases may be due to solids re-suspension. This simultaneous increase indicates a common contributing factor of which wind effects is a demonstrated factor. High wind events that occur approximately 3 days every 2 years (hourly average wind speeds greater than 14 mph) appear to cause elevated suspended solids in all treatment ponds. The impact of these disturbances on elevated suspended solids varies from a few days to approximately one week. Reducing these opportunities for solids re-suspension will reduce the opportunities for legacy solids, in which detectable quantities of dioxin have been measured, to be discharged in the final effluent. Operating the treatment ponds at a deeper depth will reduce the opportunity for solids re-suspension but at an increased risk of not having adequate flow storage during wet weather events. This risk can be mitigated by segregating and using the sedimentation zone of Pond 1 for wet weather storage with the gradual discharge of this wet weather volume back to Pond 2 after suspended solids in the stored wet weather volume have been allowed to settle to reasonable concentrations. This practice would also reduce the opportunity for re-suspended legacy solids in Pond 1(where the highest quantity of legacy solids was identified) from being discharged to downstream ponds. Alternatively, the legacy solids in Pond 1 could be removed through dredging, dewatering and on-site disposal in the process residuals staging area. It is uncertain if either of these practices would reduce particulate dioxin in effluent, to the degree it may be present, since it is uncertain if the first few sedimentation zones of Pond 4 are resistant to wind disturbance and may currently provide consistent retention of legacy solids contributed by upstream ponds. Another source of uncertainty in evaluating this alternative is that dioxin has not been measured in the final mill effluent using USEPA approved methodologies since the implementation of the elemental chlorine-free bleaching process[11].
- The only wastewater management alternative that was capable of complying with the effluent standards in Rice Creek (excluding WET) was effluent coagulation and sedimentation followed by treatment of a portion of the effluent through microfiltration and reverse osmosis. The combined effluent would discharge through a newly constructed 1.8 mile pipeline into Rice Creek at Mile Marker 2.4 which discharges into the St. Johns River 2.4 miles downstream. The chemical sludge from pretreatment sludge dewatering (106 tons/day) and the salt cake (40 tons/day) from reverse osmosis would require disposal. The environmental soundness of this approach is questionable at best and at odds with the global desire to enhance the sustainability of the environment. Tremendous resources would be spent ($280 million present worth) and great amounts of electricity would be consumed (with the attendant greenhouse gas and other emissions) to remove salt from the final effluent that could readily be assimilated in the nearby

[11] Since there is no indication that dioxin is present in the effluent using EPA approved methodology, any discussion of the potential effect the wastewater management alternatives addressed in this report may have on the presence of dioxin in the effluent is speculative and requires an assumption that dioxin is present. Therefore, this report focuses on how the wastewater management alternatives may reduce solids, including legacy solids, since the presence of solids in the effluent, and any corresponding reduction, can be measured.

St. Johns River. Furthermore, this alternative has not been demonstrated on an application of this size and with this type of wastewater. Consequently, the cost presented above for typical installations may be understated.

- The next alternative that is capable of providing reliable and significant improvement in effluent quality is effluent coagulation and sedimentation. This alternative would allow compliance with effluent standards or targets for color, aluminum and iron. It would also improve effluent WET. This alternative may potentially reduce particulate dioxin to the degree it may be present in effluent. It would not reduce effluent specific conductance. The present worth cost of this alternative is $175,500,000.
- All other wastewater management alternatives address reduction of one effluent parameter of interest to compliance with water quality standards.

Table 6-1. Summary of Results

Alternative	Meet discharge standard?	Estimated Effluent Quality (daily maximum values)	Capital Cost[f]	Operational Cost (USD/year)	Present Worth[e]
No Additional Treatment	Color (No) Aluminum (No) Iron (Yes) Spec. Cond. (No) WET (No)	Color (1,330 PCU) Aluminum (>6mg/L) Iron (<1 mg/L[h]) Spec. Cond. (2,280 µS) WET (<28 % NOEC) Dioxin (<10 ppq) Particulates (Pending)	$0	$0	$0
Effluent Coagulation and Sedimentation	Color (Yes) Aluminum (Yes) Iron (Yes) Spec. Cond. (No) WET (Uncertain)	Color (<275 PCU) Aluminum (<2 mg/L[h]) Iron (<1 mg/L[h]) Spec. Cond. (No Impact) WET (50% NOEC) Dioxin (<10 ppq) Particulates (Reduced)	$32,170,000	$17,673,400	$175,500,000
Coagulation and Sedimentation in Primary Clarifier	Color (Uncertain) Aluminum (Yes) Iron (Yes) Spec. Cond. (No) WET (Uncertain)	Color (210 PCU[a]) Aluminum (<2 mg/L[h]) Iron (<1 mg/L[h]) Spec. Cond. (2,330 µS) WET (50% NOEC) Dioxin (<10 ppq) Particulates (Reduced)	$932,200	$15,125,400	$123,600,000
Dewatering Primary Solids	Reduce Color Only	Color (~600 PCU[a]) Particulates (No Impact)	$5,838,000	$497,500	$9,870,000
Coagulant Addition to Primary Clarifier plus Dewatering of Primary Solids	Color (Uncertain) Aluminum (Yes) Iron (Yes) Spec. Cond. (No) WET (Uncertain)	Color (~210 PCU[a]) Aluminum (<2 mg/L[h]) Iron (<1 mg/L[h]) Spec. Cond. (2,330 µS) WET (50% NOEC) Dioxin (<10 ppq) Particulates (Reduced)	$4,814,300[b]	$17,715,100	$148,500,000
Flocculent Addition to Pond 3	Color (Yes) Aluminum (Yes) Iron (Yes) Spec. Cond. (No) WET (Uncertain)	Color (<275 PCU) Aluminum (<2 mg/L[h]) Iron (<1 mg/L[h]) Spec. Cond. (No Impact) WET (50% NOEC) Dioxin (<10 ppq) Particulates (Reduced)	$4,232,300	$21,110,800	$175,500,000
Flocculent Addition to Pond 3 (during peak wind events)	Color (No) Aluminum (No) Iron (Yes) Spec. Cond. (No) WET (No)	Color (Reduced) Aluminum (Reduced) Iron (<1 mg/L[h]) Spec. Cond.(No Impact) WET (Reduced) Dioxin (<10 ppq) Particulates (Reduced)	$586,000	$70,020	$1,154,000

Table 6-1. Summary of Results (Cont.)

Alternative	Meet discharge standard?	Estimated Effluent Quality (daily maximum values)	Capital Cost[f]	Operational Cost (USD/year)	Present Worth[e]
Effluent Coagulation and Sedimentation plus Slip Stream Reverse Osmosis and Reject Crystallization	Color (Yes) Aluminum (Yes) Iron (Yes) Spec. Cond. (Yes) WET (Uncertain)	Color (<275 PCU) Aluminum (<2 mg/L[h]) Iron (<1 mg/L[h]) Spec. Cond. (<1,650 µS) WET (50% NOEC) Dioxin (<10 ppq) Particulates (Reduced)	$82,157,500[c]	$24,351,600[d]	$279,700,000
Ozone Addition to Pond 3 Effluent	Color (Yes) Aluminum (No) Iron(Yes) Spec. Cond. (No) WET(Uncertain)	Color (<275 PCU) Aluminum (>7 mg/L[g]) Iron (0.75 mg/L[g]) Spec. Cond. (1,900µS) WET (Uncertain) Dioxin (<10 ppq) Particulates (Uncertain)	Not Calculated	>$70,000,000	Not Calculated
Pond 4 pH Adjustment and Filtration	Color(No) Aluminum (No) Iron (Yes) Spec. Cond. (No) WET(Uncertain)	Color (850 PCU) Aluminum (~4 mg/L) Iron (0.5 mg/L) Spec. Cond. (No Impact) WET (Reduced) Dioxin (<10 ppq) Particulates (Reduced)	Not Calculated	Not Calculated	Not Calculated
Effluent Microfiltration	Color(No) Aluminum (No) Iron (Yes) Spec. Cond. (No) WET(Uncertain)	Color (1,200 PCU) Aluminum (~4 mg/L[g]) Iron (0.5 mg/L[g]) Spec. Cond. (1,900 µS) WET (Reduced) Dioxin (<10 ppq) Particulate (Reduced)	Not Calculated	Not Calculated	Not Calculated
New Raw Water Supply	Color(No) Aluminum (No) Iron (Yes) Spec. Cond. (No) WET(Uncertain)	Color(Reduced) Aluminum (Reduced) Iron (<1 mg/L) Spec. Cond. (Reduced) WET(Uncertain) Dioxin (<10 ppq) Particulates (No Impact)	Not Calculated	Not Calculated	Not Calculated-
Maintain Minimum Operating Depth	Color (No) Aluminum (No) Iron (Yes) Spec. Cond. (No) WET (Uncertain)	Color(No Impact) Aluminum (Reduced) Iron (<1 mg/L) Spec. Cond. (No Impact) WET(Reduced) Dioxin (<10 ppq) Particulates (Reduced)	$0	$0	$0

Table 6-1. Summary of Results (Cont.)

Alternative	Meet discharge standard?	Estimated Effluent Quality (daily maximum values)	Capital Cost[f]	Operational Cost (USD/year)	Present Worth[e]
Wet Weather Storage in Pond 1	Color (No) Aluminum (No) Iron (Yes) Spec. Cond. (No) WET (Uncertain)	Color(No Impact) Aluminum (Reduced) Iron (<1 mg/L) Spec. Cond. (No Impact) WET(Reduced) Dioxin (<10 ppq) Particulates (Reduced)	$1,200,000	$25,000	$1,403,000
Dewatering WTP Sludge	Color(No) Aluminum (Yes) Iron (Yes) Spec. Cond. (No) WET(Uncertain)	Color(No Impact) Aluminum (<2 mg/L) Iron (<1 mg/L) Spec. Cond. (No Impact) WET (50% NOEC) Dioxin (<10 ppq) Particulates (No Impact)	$1,700,000	$66,000	$2,235,000
Cessation of Salt Cake Discharge to Sewer and WTP Chemistry Change	Color(No) Aluminum (No) Iron (Yes) Spec. Cond. (No) WET(No)	Color (No Impact) Aluminum (Reduced) Iron (<1 mg/L) Spec. Cond. (2,065 µS) WET (Reduced) Dioxin (<10 ppq) Particulates (No Impact)	$1,000,000	$40,000	$1,324,000
Dredging Ponds	Color(No) Aluminum (No) Iron (Yes) Spec. Cond. (No) WET(No)	Color (No Impact) Aluminum (No impact) Iron (<1 mg/L) Spec. Cond. (No impact) WET (No Impact) Dioxin (<10 ppq) Particulates (Reduced)	$7,100,000	$0	$7,100,000

[a] *Assuming same color development of 66 percent observed across ponds*

[b] *This estimate includes the value for the coagulation/sedimentation in the primary clarifier plus $3,882,100 for the dewatering system.*

[c] *Since this option is provided in addition to the effluent coagulation/sedimentation, this value includes the value for effluent coagulation/sedimentation plus $49,990,400 for the MF, RO, and ZLD systems.*

[d] *This value includes the operational cost for the effluent coagulation and sedimentation option since this alternative would be added in combination.*

[e] *Based on 10 year amortization period, 8% interest, and 4% inflation.*

[f] *All capital cost estimates do not include the $7,200,000 construction cost for the new pipeline to Mile Marker 2.4.*

[g] *Soluble value*

APPENDIX A

Effluent Summary for October 2009 to May 2010

Brown AND Caldwell

501 Great Circle Road, Suite 150
Nashville, TN 37228
Tel: 615-255-2288
Fax: 615-256-8332

Memorandum

Date: July 15, 2010

To: Brad Purcell, Environmental Engineer, Georgia Pacific

From: Houston Flippin

Subject: Revised Table 1-1 for Period October 2009 through May 2010

The values summarized in the table below came from discharge monitoring report (DMR) data only.

Current Effluent Characteristics for the Period October 2009 through May 2010 and Proposed Effluent Quality Standards[1]

Parameter	Current Effluent Characteristics[2]				FDEP Proposed Effluent Limit For Rice Creek at Mile Point 2.4[1]
	Average	Daily Maximum	Standard Deviation	Count	Daily Maximum[3]
Color, PCU	833[6]	1,000[6]	121	8	275[4]
Specific Conductance, µmhos/cm	1,822	2,078	130	8	1,650
Iron[4], mg/L	0.79	0.96	0.18	3	1
Dioxin (2,3,7,8 TCDD), ppq	<10	<10	---	8	0.014
Chronic Toxicity, *C. dubia*, NOEC, %	<23.4%	<6.25%	19	4	≥ 72
Chronic Toxicity, *P. promelas*, NOEC, %	78.1%	12.5%	44	4	≥ 72

1 *Effluent limit to achieve compliance at boundary of mixing zone at Mile Point 2.4 or closer to the mouth of Rice Creek per pages 11 and 12 of Florida Department of Environmental Protection (FDEP) Administrative Order No. 039-NE.*

2 *October 2009 through May 2010 at the effluent of Pond 4 (Outfall D-001).*

3 *The standards have been interpreted for purposes of this report as daily maximum values.*

4 *As measured by spectrophotometry (e.g., USEPA Method 110.2) so that it can be compared to the water quality standard for transparency.*

5 *At pH 7.8 to pH 8.3*

6 *As measured by outside laboratory for DMR using the National Council for Air and Stream Improvement (NCASI) Method 7101.*

APPENDIX B

Cost Estimate Detail

MEMORANDUM

5039-137563-430

February 25, 2010

TO: THOMAS R. STEINWINDER, TENNESSEE

FROM: DES ORSINELLI, WALNUT CREEK

SUBJECT: GEORGIA PACIFIC WASTEWATER TREATMENT OPTION
5-PERCENT DESIGN COMPLETION
BASIS OF ESTIMATE OF PROBABLE CONSTRUCTION COST

The Basis of Estimate Report for the subject project is attached. Please call me if you have questions or need additional information.

DO:ua

Attachments
Summary Estimate
Detailed Estimate

cc: J. L. Matthews, Jacksonville

GEORGIA PACIFIC WASTEWATER TREATMENT OPTIONS

Introduction

Brown and Caldwell (BC) is pleased to present this estimate of probable construction cost (estimate) prepared for the HP Hood Process Liquid Neutralization System, Sacramento, California.

Summary

This Basis of Estimate contains the following information:

- Scope of work
- Background of this estimate
- Class of estimate
- Estimating methodology
- Direct cost development
- Indirect cost development
- Bidding assumptions
- Estimating assumptions
- Estimating exclusions
- Allowances for known but undefined work
- Contractor and other estimate markups

Scope of Work

The Project consists of five alternative scenarios.

1. Provide coagulation and sedimentation in primary clarifier
2. Aerobic handling and dewatering of primary solids - Non-alum option
3. Aerobic handling and dewatering of primary solids - Alum option
4. Effluent coagulation and sedimentation
5. Effluent microfiltration and reverse osmosis

Background of this Estimate

This is the first estimate by the Estimating and Scheduling Group for this scope. The attached estimate of probable construction cost is based on the technical memorandum dated February 24, 2010 and titled "Wastewater Treatment alternatives Evaluation and various vendor quotes and messages provided by project management.

Class of Estimate

In accordance with the Association for the Advancement of Cost Engineering International (AACE) criteria, this is a Class 4 estimate. A Class 4 estimate is defined as a Planning Level or Design Technical Feasibility Estimate. Typically, engineering is from 1 percent to 15 percent complete. Class 4 estimates are used to prepare planning level cost scopes or to evaluate alternatives in design conditions and form the base work for the Class 3 Project Budget or Funding Estimate.

Expected accuracy for Class 4 estimates typically range from -30 percent to +50 percent, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. In unusual circumstances, ranges could exceed those shown.

Estimating Methodology

This estimate was prepared using quantity take-offs, vendor quotes, and equipment pricing furnished either by the project team or by the estimator. The estimate includes direct labor costs, including a shift differential if applicable, and anticipated productivity adjustments to labor, and equipment. Where possible, estimates for work anticipated to be performed by specialty subcontractors have been identified.

Construction labor crew and equipment hours were calculated from production rates contained in documents and electronic databases published by R.S. Means, Mechanical Contractors Association (MCA), National Electrical Contractors Association (NECA), and Rental Rate Blue Book for Construction Equipment (Blue Book).

This estimate was prepared using BC's estimating system, which consists of a Windows-based commercial estimating software engine using BC's material and labor database, historical project data, the latest vendor and material cost information, and other costs specific to the project locale.

Direct Cost Development

Costs associated with the General Provisions and the Special Provisions of the construction documents, which are collectively referred to as Contractor General Conditions (CGC), were based on the estimator's interpretation of the contract documents. The estimates for CGCs are divided into two groups: a time-related group (e.g., field personnel), and non-time-related group (e.g., bonds and insurance). Labor burdens such as health and welfare, vacation, union benefits, payroll taxes, and workers compensation insurance are included in the labor rates. No trade discounts were considered. A 10 percent labor burden has been applied on top of the normal contractor general conditions to account for the conditions that Georgia-Pacific requires of the contractor for work on site.

Indirect Cost Development

Local sales tax has been applied to material and equipment rentals. A percentage allowance for contractor's home office expense has been included in the overall rate markups. The rate is standard for this type of heavy construction and is based on typical percentages outlined in Means Heavy Construction Cost Data, 2010.

The contractor's cost for builders risk, general liability, and vehicle insurance has been included in this estimate. Based on historical data, this is typically two to four percent of the overall construction contract amount. These indirect costs have been included in this estimate as a percentage of the gross cost, and are added to the net totals after the net markups have been applied to the appropriate items.

Bidding Assumptions

The following bidding assumptions were considered in the development of this estimate.

1. Bidders must hold a valid, current Contractor's credentials, applicable to the type of project.
2. Bidders will develop estimates with a competitive approach to material pricing and labor productivity, and will not include allowances for changes, extra work, unforeseen conditions, or any other unplanned costs.
3. Estimated costs are based on a minimum of four bidders. Actual bid prices may increase for fewer bidders or decrease for a greater number of bidders.
4. Bidders will account for General Provisions and Special Provisions of the contract documents and will perform all work except that which will be performed by traditional specialty subcontractors as identified here:
   - Electrical
   - Painting
   - Plumbing
   - HVAC

Estimating Assumptions

As the design progresses through different completion stages, it is customary for the estimator to make assumptions to account for details that may not be evident from the documents. The following assumptions were used in the development of this estimate.

1. Contractor performs the work during normal daylight hours, nominally 7 a.m. to 5 p.m., Monday through Friday, in an 8-hour shift. No allowance has been made for additional shift work or weekend work.
2. Contractor has complete access for lay-down areas and mobile equipment.
3. Equipment rental rates are based on verifiable pricing from the local project area rental yards, Blue Book rates, and/or rates contained in the estimating database.
4. Contractor markup is based on conventionally accepted values that have been adjusted for project-area economic factors.
5. Major equipment costs are based on both vendor supplied price quotes obtained by the project design team and/or estimators, and on historical pricing of like equipment.
6. Process equipment vendor training using vendors' standard Operations and Maintenance (O&M) material, is included in the purchase price of major equipment items where so stated in that quotation.
7. Bulk material quantities are based on manual quantity take-offs.
8. There is sufficient electrical power to feed the specified equipment. The local power company will supply power and transformers suitable for this facility.
9. The soil is suitable to support structures. There is no need for piling.
10. Groundwater is at 3-ft below surface level. Only some yard piping and the Actiflo tank require dewatering
11. Alternative 2.3b has two 40-ft diameter sludge holding tanks.
12. Alternative 2.7 requires no GAC
13. Documents call for an evaporator in some places and brine concentrator in others. They are one and the same units. Also, the Crystallizer is known as the zero liquid discharge system.
14. The evaporator is approximately 70-ft tall. The vendor supplied equipment does not include the steel access platform.

15. There is no bypass pumping required.

Estimating Exclusions

The following estimating exclusions were assumed in the development of this estimate.

1. Hazardous materials remediation and/or disposal.
2. O&M costs for the project with the exception of the vendor supplied O&M manuals.
3. Utility agency costs for incoming power modifications.
4. Permits beyond those normally needed for the type of project and project conditions.

Allowances for Known but Undefined Work

The following allowances were made in the development of this estimate.

1. Electrical and Instrumentation Allowance – 25% of net.
2. HVAC allowance in buildings only – $13/sf.
3. Small bore piping – ranging from $4,000 to $30,000 depending on alternative
4. Site civil (landscape, fencing, pavement, signs, cut-fill, grading, etc.) at 4% of net.
5. UF is a skid unit that sits on a pad. It does not sit in a concrete tank.
6. The Actiflo unit is designed to be fit into a concrete tank.

Contractor and Other Estimate Markups

Contractor markup is based on conventionally accepted values which have been adjusted for project-area economic factors. Estimate markups are shown in Table 1.

Table 1. Estimate Markups, February 2010

Item	Rate, percent
Georgia Pacific Contractor Labor Burden	10
Prime Contractor	
Labor (employer payroll burden)	10
Materials and process equipment	5
Equipment (construction-related)	5
Subcontractor	5
Sales Tax (State and local for materials, process equipment and construction equipment rentals, etc.)	7
Startup, Training, O&M – applied to division 11 items only	2
Builder's Risk, Liability, and Vehicle Insurance	2
Material Shipping and Handling	2

Table 1. Estimate Markups, February 2010	
Item	**Rate, percent**
Subcontractor Markups	Same as Prime
Escalation to Midpoint of Construction	
2.2	2.4
2.3a	2.8
2.3b	3.5
2.5	3.5
2.7	5.7
Contingency	30
Performance and Payment Bonds	1.5

Labor Markup. The labor rates used in the estimate were derived chiefly from the latest published State Prevailing Wage Rates. These rates include costs beyond raw labor for such items as Payroll Tax and Insurance (PT&I), FICA, and Workers Compensation Insurance. In addition to these markups, the General Contractor (GC) typically adds a percentage to each raw labor dollar to cover overhead and profit, payroll and accounting costs, additional insurance, retirement, 401k contributions, and sick leave/vacation cost.

Materials and Process Equipment Markup. This markup consists of the additional cost to the contractor beyond the raw dollar amount for material and process equipment. This includes shop drawing preparation, submittal and/or re-submittal cost, purchasing and scheduling materials and equipment, accounting charges including invoicing and payment, inspection of received goods, receiving, storage, overhead and profit.

Equipment (Construction) Markup. This markup consists of the costs associated with operating the construction equipment used in the project. Most GCs will rent rather than own the equipment and then charge each project for its equipment cost. The equipment rental cost does not include fuel, delivery and pick-up charges, additional insurance requirements on rental equipment, accounting costs related to home office receiving invoices and payment. However, the crew rates used in the estimate do account for the equipment rental cost. Occasionally, larger contractors will have some or all of the equipment needed for the job, but in order to recoup their initial purchasing cost they will charge the project an internal rate for equipment use which is similar to the rental cost of equipment. The GC will apply an overhead and profit percentage to each individual piece of equipment whether rented or owned.

Subcontractor Markup. This markup consists of the GC's costs for subcontractors who perform work on the site. This includes costs associated with shop drawings, review of subcontractor's submittals, scheduling of subcontractor work, inspections, processing of payment requests, home office accounting, and overhead and profit on subcontracts.

Sales Tax (Materials, Process Equipment and Construction Equipment). This is the tax that the contractor must pay according to state and local tax laws. The percentage is applied to both the

material and equipment the GC purchases as well as the cost for rental equipment. The percentage is based on the local rates in place at the time the estimate was prepared.

Contractor Startup, Training, and O&M Manuals. This cost markup is often confused with either vendor startup or owner startup. It is the cost the GC incurs on the project beyond the vendor startup and owner startup costs. The GC generally will have project personnel assigned to facilitate the installation, testing, startup, and O&M Manual preparation for equipment that is put into operation by either the vendor or owner. These project personnel often include an electrician, pipe fitter or millwright, and/or I&E technician. These personnel are not included in the basic crew makeup to install the equipment but are there to assist and trouble shoot the startup and proper running of the equipment. The GC also incurs a cost for startup for such things as consumables (oil, fuel, filters, etc.), startup drawings and schedules, startup meetings, and coordination with the plant personnel in other areas of the plant operation.

Builders Risk, Liability, and Vehicle Insurance. This percentage comprises all three items. There are many factors which make up this percentage, including the contractor's track record for claims in each of the categories. Another factor affecting insurance rates has been a dramatic price increase across the country over the past several years due to domestic and foreign influences. Consequently, in the construction industry we have observed a range of 0.5 to 1 percent for Builders Risk Insurance, 1 to 1.25 percent for General Liability Insurance, and 0.85 to 1 percent for Vehicle Insurance. Many factors affect each area of insurance, including project complexity, and contractor's requirements and history. Instead of using numbers from a select few contractors, we believe it is more prudent to use a combined 2 percent to better reflect the general costs across the country. Consequently, the actual cost could be higher or lower based on the bidder, region, insurance climate, and on the contractor's insurability at the time the project is bid.

Material Shipping and Handling. This can range from 2 percent to 6 percent, and is based on the type of project, material makeup of the project, and the region and location of the project. Material shipping and handling covers delivery costs from vendors, unloading costs (and in some instances loading and shipment back to vendors for rebuilt equipment), site paper work, and inspection of materials prior to unloading at the project site. BC typically adjusts this percentage by the amount of materials and whether vendors have included shipping costs in the quotes that were used to prepare the estimate. This cost also includes the GC's cost to obtain local supplies, e.g., oil, gaskets, and bolts that may be missing from the equipment or materials shipped.

Escalation to Midpoint for Labor, Materials and Subcontractors. n addition to contingency, it is customary for projects that will be built over several years to include an escalation to midpoint of anticipated construction to account for the future escalation of labor, material, and equipment costs beyond values at the time the estimate is prepared. For this project the anticipated rate of escalation is 2.5 percent per annum and is based on the latest information from industry leading economist projections.

The estimated construction time for this project is between 2 and 24 months depending on the alternative exclusive of unusual weather or site conditions delays. Construction is anticipated to start January 1, 2011..

Construction Contingency. The contingency factor covers unforeseen conditions, area economic factors, and general project complexity. This contingency is used to account for those factors that can not be addressed in each of the labor and/or material installation costs. Based on industry standards, completeness of the project documents, project complexity, the current design stage, and area factors, construction contingency can range from 10 percent to 50 percent.

Range of Accuracy. The amount of contingency in the estimate should not be confused with the accuracy of the estimate. The Expected Accuracy Range defines the window within which the bids are expected to fall based on the project complexity, information available during the estimate process, outside

influences (wage rates, material, bidding climate), and includes a level of contingency appropriate to the project definition at the time the estimate was prepared. It is important to understand that AACEI notes on its ranges of accuracy that,

> "The state of process technology and availability of applicable reference cost data affect the range markedly. The +/- value [of the ranges] represents typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50 percent level of confidence) for given scope."

While a 50-percent level of confidence in the contingency may seem broad, typically this results in a 90-percent confidence that the actual cost will fall within the bounds of the low and high ranges.

The caution here is that these estimates are not what are often referred to as "bid quality," i.e., estimates prepared by contractors who are receiving competitive bids from subcontractors, equipment vendors, and materials suppliers. In general, we receive reasonable budget values from those willing to provide quotations.

Performance and Payment Bonds. Based on historical and industry data, this can range from 0.75 percent to 3 percent of the project total. There are several contributing factors including such items as size of the project, regional costs, contractor's historical record on similar projects, complexity, and current bonding limits. BC uses 1.5 percent for bonds, which we have determined to be reasonable for most heavy construction projects.

BROWN AND CALDWELL
Environmental Engineers & Consultants

SUMMARY ESTIMATE REPORT
WITH MARK-UPS ALLOCATED
Wastewater Treatment Alternatives
Georgia Pacific

Conceptual Level Estimate

Project Number:	138882-005
BC Project Manager:	Thomas Steinwinder
BC Office:	Tennessee
Estimate Issue Number:	01
Estimate Original Issue Date:	2010-10-25
Lead Estimator:	Des Orsinelli
Estimate QA/QC Reviewer:	Butch Matthews
Estimate QA/QC Date:	2010-10-25

PROCESS LOCATION/AREA INDEX
2.2 - Coagulation / Sedimentation in Primary Clarifier
2.3A - Dewatering Primary Solids - Current operation
2.3B - Dewatering primary solids - with Alum dosing
2.5 - Effluent Coag/Sedimentation
2.7 - Effluent MF, RO, and ZLD

Description	WBS7	Labor Total	Equip Total	Mat Total	Subs Total	Other Total	Total w/ Markups Allocated
2.2 Coagulation and Sedimentation in Primary Clarifier		161,059	14,111	406,312	350,665		932,147
Coagulation and Sedimentation in Primary Clarifier							
01590 - Miscellaneous Equipment Rental without operators			10,340				10,340
02300 - Earthwork		809	627	1,873			3,309
02700 - Bases, Ballasts, Pavements & Appurtenances		1,094	2,152	15,364			18,611
03100 - Concrete Forms & Accessories		3,491		1,073			4,564
03200 - Concrete Reinforcement		2,317	60	3,318			5,695
03300 - Cast-In-Place Concrete		1,144	240	4,847			6,232
05050 - Basic Metal Materials & Methods		3,455	206	2,704			6,365
05100 - Structural Metal Framing		2,482	298	584			3,364
05500 - Metal Fabrications		2,660		5,930			8,590
09900 - Paints & Coatings		66,772		47,507			114,280
11000 - Equipment		4,469		298,107			302,577
13200 - Storage Tanks					191,502		191,502
15050 - Basic Materials & Methods		2,351		653			3,004
15100 - Building Services Piping		2,733	188	6,048			8,968
15200 - Process Piping		8,075		15,959			24,033
15950 - Testing/Adjusting/Balancing		58,847					58,847
16000 - Electrical and Instrumentation					159,162		159,162
17100 - Analytical Instruments		360		2,344			2,704
Coagulation and Sedimentation in Primary Clarifier Total		161,059	14,111	406,312	350,665		932,147
2.3A Dewatering Primary Solids - Current Operation		353,194	50,734	2,978,684	554,754	366	3,937,732
Dewatering Primary Solids - Current							
01590 - Miscellaneous Equipment Rental without operators			20,752				20,752
02300 - Earthwork		6,832	5,239	19,524			31,594
02700 - Bases, Ballasts, Pavements & Appurtenances		3,856	7,559	54,036			65,451
03100 - Concrete Forms & Accessories		1,054		304			1,357
03200 - Concrete Reinforcement		11,633	261	14,688			26,582
03300 - Cast-In-Place Concrete		5,918	1,033	25,966			32,917
05010 - Misc Metals		1,602		6,249			7,850
05050 - Basic Metal Materials & Methods		21,229	2,280	3,161			26,671
05100 - Structural Metal Framing		21,329	4,082	53,700			79,111
05400 - Cold-Formed Metal Framing		7,917		14,073			21,991
05500 - Metal Fabrications		7,167	532	72,967			80,665
07200 - Thermal Protection		1,781		6,746			8,527
07400 - Roofing And Siding Panels		12,918		37,385			50,303
07700 - Roof Specialties And Accessories		1,338		813			2,152
09000 - B & C Div 9 Coating Systems		10,781		38,561			49,341
09900 - Paints & Coatings		774		879			1,652
11000 - Equipment		42,646	1,543	2,164,949		366	2,209,505
15001 - Pipe, Water Supply		19,591	5,671	26,518			51,779
15010 - Misc. Mechanical		3,713		8,966			12,679
15050 - Basic Materials & Methods		9,687		2,087			11,774
15100 - Building Services Piping		75,731	932	362,857			439,520
15195 - Pipe, steel, fittings		4,479		1,000			5,479
15200 - Process Piping		33,995	850	15,294			50,138
15240 - Pipe, pvc, fittings		11,536		8,326			19,862
15285 - Valves, steel		8,860		32,136			40,996
15330 - Flexible connectors		1,109		3,983			5,093
15350 - Sleeves and escutcheons		1,008		1,309			2,316
15400 - Plumbing Fixtures & Equipment		809		2,206			3,015
15950 - Testing/Adjusting/Balancing		23,904					23,904
16000 - Electrical and Instrumentation					554,754		554,754
Dewatering Primary Solids - Current Total		353,194	50,734	2,978,684	554,754	366	3,937,732

Description	WBS7	Labor Total	Equip Total	Mat Total	Subs Total	Other Total	Total w/ Markups Allocated
2.3B Dewatering Primary Solids - With Alum Dosing		497,897	61,423	2,471,294	817,215	34,279	3,882,109
Dewatering Primary Solids - Alum							
01500 - Temporary Facilities & Controls		14,360	5,739	19,892			39,991
01590 - Miscellaneous Equipment Rental without operators			20,879				20,879
02300 - Earthwork		14,354	11,379	39,285			65,018
02700 - Bases, Ballasts, Pavements & Appurtenances		4,653	9,126	65,230			79,009
03100 - Concrete Forms & Accessories		1,484		428			1,912
03200 - Concrete Reinforcement		23,279	518	29,411			53,207
03300 - Cast-In-Place Concrete		12,830	2,426	60,957			76,212
04050 - Basic Masonry Materials And Methods		35,150	1,010	26,178			62,338
04700 - Manufactured Masonry		607		37,145			37,752
04800 - Masonry Assemblies		80,317		72,514			152,831
05010 - Misc Metals		3,223		12,574			15,797
05050 - Basic Metal Materials & Methods		15,774	3,026	1,825			20,625
05100 - Structural Metal Framing		10,024	1,205	2,357			13,587
05400 - Cold-Formed Metal Framing		15,933		28,318			44,251
06100 - Rough Carpentry		4,654		9,318			13,971
07200 - Thermal Protection		4,590		15,524			20,114
07300 - Shingles, Roof Tiles And Roof Coverings		596		1,488			2,084
07400 - Roofing And Siding Panels		25,581		81,102			106,683
07700 - Roof Specialties And Accessories		1,801		1,175			2,975
08100 - Metal Doors And Frames		1,403	104	7,926			9,433
08400 - Entrances And Storefronts		796		3,871			4,667
08700 - Hardware		1,379		4,831			6,210
09000 - B & C Div 9 Coating Systems		11,873		43,345			55,217
11000 - Equipment		85,999	1,043	1,588,138		569	1,675,750
15001 - Pipe, Water Supply		13,142	3,803	17,786			34,731
15010 - Misc. Mechanical		2,749		6,377			9,125
15050 - Basic Materials & Methods		6,498		1,400		33,711	41,609
15100 - Building Services Piping		51,792	644	252,181			304,618
15195 - Pipe, steel, fittings		2,884		644			3,528
15200 - Process Piping		18,541	522	8,923			27,987
15240 - Pipe, pvc, fittings		6,016		3,916			9,932
15285 - Valves, steel		5,943		21,555			27,498
15330 - Flexible connectors		744		2,672			3,416
15350 - Sleeves and escutcheons		608		790			1,398
15400 - Plumbing Fixtures & Equipment		814		2,220			3,033
15700 - Heating/Ventilating/Air Conditioning Equipment					145,774		145,774
15950 - Testing/Adjusting/Balancing		17,508					17,508
16000 - Electrical and Instrumentation					671,442		671,442
Dewatering Primary Solids - Alum Total		497,897	61,423	2,471,294	817,215	34,279	3,882,109
2.5 Effluent Coagulation and Sedimentation		1,575,111	219,869	25,702,736	4,618,812	50,566	32,167,094
Effluent Coagulation and Sedimentation							
01500 - Temporary Facilities & Controls		26,109	10,434	36,168			72,710
01590 - Miscellaneous Equipment Rental without operators			31,412				31,412
02300 - Earthwork		48,247	39,989	116,980			205,217
02700 - Bases, Ballasts, Pavements & Appurtenances		32,611	64,098	457,688			554,397
03100 - Concrete Forms & Accessories		58,462		12,294			70,756
03200 - Concrete Reinforcement		86,897	2,061	118,135			207,093
03300 - Cast-In-Place Concrete		40,908	8,361	200,160			249,428
04050 - Basic Masonry Materials And Methods		63,818	1,832	46,817			112,467
04700 - Manufactured Masonry		1,165		71,318			72,483
04800 - Masonry Assemblies		144,199		130,076			274,275
05010 - Misc Metals		2,417		9,430			11,848

Description	WBS7	Labor Total	Equip Total	Mat Total	Subs Total	Other Total	Total w/ Markups Allocated
05050 - Basic Metal Materials & Methods		31,018	4,560	5,494			41,073
05100 - Structural Metal Framing		22,482	3,640	13,218			39,340
05400 - Cold-Formed Metal Framing		42,487		75,516			118,003
05500 - Metal Fabrications		6,320	452	65,116			71,888
06100 - Rough Carpentry		12,410		24,847			37,257
07200 - Thermal Protection		12,240		41,397			53,636
07300 - Shingles, Roof Tiles And Roof Coverings		1,588		3,968			5,556
07400 - Roofing And Siding Panels		66,554		213,052			279,606
07700 - Roof Specialties And Accessories		2,441		1,589			4,030
08100 - Metal Doors And Frames		4,208	313	23,779			28,300
08400 - Entrances And Storefronts		2,387		11,613			14,000
08700 - Hardware		4,137		14,494			18,631
09000 - B & C Div 9 Coating Systems		31,055		112,624			143,679
09900 - Paints & Coatings		698		792			1,490
11000 - Equipment		400,351	45,791	23,031,134			23,477,277
13200 - Storage Tanks		2,029		48,765	325,119		375,914
15010 - Misc. Mechanical		6,405		14,150			20,555
15050 - Basic Materials & Methods		16,245		3,500		50,566	70,311
15100 - Building Services Piping		128,766	1,562	620,958			751,286
15195 - Pipe, steel, fittings		7,211		1,610			8,821
15200 - Process Piping		110,444	5,363	92,474			208,281
15240 - Pipe, pvc, fittings		19,371		14,212			33,583
15285 - Valves, steel		15,849		57,479			73,328
15330 - Flexible connectors		1,488		5,343			6,832
15350 - Sleeves and escutcheons		1,623		2,107			3,729
15400 - Plumbing Fixtures & Equipment		1,627		4,439			6,066
15700 - Heating/Ventilating/Air Conditioning Equipment					388,729		388,729
15950 - Testing/Adjusting/Balancing		118,845					118,845
16000 - Electrical and Instrumentation					3,904,963		3,904,963
Effluent Coagulation and Sedimentation Total		1,575,111	219,869	25,702,736	4,618,812	50,566	32,167,094
2.7 Effluent MF, RO, and ZLD		**1,830,123**	**211,481**	**41,585,175**	**6,320,544**	**43,034**	**49,990,357**
Effluent Mircrofiltration, Reverse Osmosis and Zero Liquid Discharge							
01500 - Temporary Facilities & Controls		22,356	8,931	30,861			62,149
01590 - Miscellaneous Equipment Rental without operators			32,010				32,010
02300 - Earthwork		28,971	22,907	84,995			136,872
02700 - Bases, Ballasts, Pavements & Appurtenances		50,016	98,311	701,858			850,184
03100 - Concrete Forms & Accessories		9,468		2,426			11,894
03200 - Concrete Reinforcement		48,776	1,076	61,585			111,437
03300 - Cast-In-Place Concrete		28,672	5,239	125,128			159,040
04050 - Basic Masonry Materials And Methods		54,616	1,567	41,519			97,702
04700 - Manufactured Masonry		990		60,563			61,553
04800 - Masonry Assemblies		122,756		116,666			239,422
05010 - Misc Metals		3,286		12,813			16,099
05050 - Basic Metal Materials & Methods		58,762	1,396	20,071			80,229
05100 - Structural Metal Framing		100,346	19,114	129,284			248,743
05500 - Metal Fabrications		31,802	1,541	167,328			200,670
08100 - Metal Doors And Frames		2,090	147	8,491			10,728
08700 - Hardware		2,853		9,017			11,869
09000 - B & C Div 9 Coating Systems		40,872		147,714			188,586
09900 - Paints & Coatings		3,111		3,531			6,642
11000 - Equipment		438,770	168	38,660,045			39,098,983
15001 - Pipe, Water Supply		50,237	14,535	67,969			132,740
15010 - Misc. Mechanical		9,793		21,630			31,423
15050 - Basic Materials & Methods		24,840		5,350		43,034	73,224
15100 - Building Services Piping		196,894	2,388	949,178			1,148,460

Description	WBS7	Labor Total	Equip Total	Mat Total	Subs Total	Other Total	Total w/ Markups Allocated
15195 - Pipe, steel, fittings		11,026		2,461			13,487
15200 - Process Piping		70,384	2,152	33,116			105,652
15240 - Pipe, pvc, fittings		23,513		15,542			39,055
15285 - Valves, steel		24,235		87,861			112,096
15330 - Flexible connectors		2,275		8,168			10,443
15350 - Sleeves and escutcheons		2,481		3,220			5,701
15400 - Plumbing Fixtures & Equipment		2,488		6,785			9,273
15700 - Heating/Ventilating/Air Conditioning Equipment					317,289		317,289
15950 - Testing/Adjusting/Balancing		363,446					363,446
16000 - Electrical and Instrumentation					6,003,255		6,003,255
Effluent Mircrofiltration, Reverse Osmosis and Zero Liquid Discharge Total		1,830,123	211,481	41,585,175	6,320,544	43,034	49,990,357

BROWN AND CALDWELL

Environmental Engineers & Consultants

DETAILED ESTIMATE REPORT
Georgia Pacific
Wastewater Treatment Alternatives

Conceptual Level Estimate

Project Number:	138882-005
BC Project Manager:	Thomas Steinwinder
BC Office:	Tennessee
Estimate Issue Number:	01
Estimate Original Issue Date:	2010-10-25
Lead Estimator:	Des Orsinelli
Estimate QA/QC Reviewer:	Butch Matthews
Estimate QA/QC Date:	2010-10-25

PROCESS LOCATION/AREA INDEX

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	2.2 Coagulation and Sedimentation in Primary Clarifier									
	Coagulation and Sedimentation in Primary Clarifier									**511,394**
	01590 - Miscellaneous Equipment Rental without operators									
	01590600 - Lifting and hoisting equipment rental without operators									
0300B	Rent crane climbing 101 foot jib, 10,250 lb 270 fpm - Rent per day	3.0	days				1,850.00		1,850.0	5,550
	Miscellaneous Equipment Rental without operators Total									**5,550**
	02300 - Earthwork									
	02315120 - Backfill, Structural									
4420	Backfill, structural, common earth, 200 H.P. dozer, 300' haul	17.6	L.C.Y.	0.67			1.37		2.0	36
	02315310 - Compaction, General									
7500	Compaction, 2 passes, 24" wide, 6" lifts, walk behind, vibrating roller	15.8	E.C.Y.	1.18			0.33		1.5	24
7520	Compaction, 3 passes, 24" wide, 6" lifts, walk behind, vibrating roller	6.7	E.C.Y.	1.77			0.48		2.3	15
7540	Compaction, 4 passes, 24" wide, 6" lifts, walk behind, vibrating roller	20.1	E.C.Y.	2.36			0.64		3.0	60
	02315492 - Hauling									
0009	Loading Trucks, F.E. Loader, 3 C.Y.	41.0	cuyd	0.51			0.95		1.5	60
4498	Cycle hauling(wait, load,travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 25 min load/wait/unload, 20 CY truck, cycle 20 miles, 45 MPH, no loading equipment	41.0	L.C.Y.	1.10			3.15		4.2	174
	02315610 - Excavating, Trench									
0060	Excavating, trench or continuous footing, common earth, 1/2 C.Y. excavator, 1' to 4' deep, excludes sheeting or dewatering	50.4	B.C.Y.	3.07			1.60		4.7	235
	02315640 - Utility Bedding									
0100	Fill by borrow and utility bedding, for pipe and conduit, crushed stone, 3/4" to 1/2", excludes compaction	23.3	L.C.Y.	5.64	43.11		1.83		50.6	1,179
	Earthwork Total									**1,784**
	02700 - Bases, Ballasts, Pavements & Appurtenances									
	02000000 - General Civil Work									
0990	Allowance - Site Work - 2%	1.0	LSUM	597.85	8,246.98		1,155.17		10,000.0	10,000
	Bases, Ballasts, Pavements & Appurtenances Total									**10,000**

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	03100 - Concrete Forms & Accessories									
	03110425 - Forms In Place, Equipment Foundations									
0050	**[2x] C.I.P. concrete forms, equipment foundations, 2 use, includes erecting, bracing, stripping and cleaning**	**40.0**	**sfca**	**8.02**	**1.74**				**9.8**	**390**
	03110455 - Forms In Place, Walls									
2550	C.I.P. concrete forms, wall, job built, plywood, 8 to 16' high, 4 use, includes erecting, bracing, stripping and cleaning	377.0	sfca	3.87	0.68				4.6	1,717
	03150860 - Waterstop									
0600	Waterstop, PVC, ribbed, with center bulb, 3/8" thick x 9" wide	62.8	LF	2.03	3.95				6.0	376
	Concrete Forms & Accessories Total									2,483
	03200 - Concrete Reinforcement									
	03210600 - Reinforcing In Place									
0602	**[3x] Reinforcing steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories**	**1,852.0**	**lb**	**0.33**	**0.45**				**0.8**	**1,446**
0702	Reinforcing steel, in place, walls, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	2,050.7	lb	0.24	0.45				0.7	1,400
2000	**[4x] Reinforcing steel, unload and sort, add to base**	**2.1**	**ton**	**24.65**			**7.36**		**32.0**	**67**
2210	**[4x] Reinforcing steel, crane cost for handling, average, add**	**2.1**	**ton**	**26.66**			**8.01**		**34.7**	**72**
2420	**[2x] Reinforcing steel, in place, dowels, deformed, 2' long, #5, A615, grade 60**	**36.0**	**EA**	**1.61**	**1.02**				**2.6**	**95**
	Concrete Reinforcement Total									3,079
	03300 - Cast-In-Place Concrete									
	03310220 - Concrete, Ready Mix Normal Weight									
0300	**[4x] Structural concrete, ready mix, normal weight, 4000 PSI, includes local aggregate, sand, Portland cement and water, delivered, excludes all additives and treatments**	**25.7**	**CY**		**100.00**				**100.0**	**2,570**
	03310700 - Placing Concrete									
4650	**[3x] Structural concrete, placing, slab on grade, pumped, over 6" thick, includes vibrating, excludes material**	**18.7**	**CY**	**11.38**			**3.98**		**15.4**	**287**
5350	Structural concrete, placing, walls, pumped, 15" thick, includes vibrating, excludes material	7.0	CY	17.53			6.15		23.7	165
	03350300 - Finishing Floors									

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
0150	Concrete finishing, floors, manual screed, bull float, manual float, broom finish	380.0	SF	0.43					0.4	164
	03350350 - Finishing Walls									
0150	**[2x] Concrete finishing, walls, carborundum rub, wet, includes breaking ties and patching voids**	**40.0**	**SF**	**1.59**					**1.6**	**63**
0750	**[2x] Concrete finishing, walls, sandblast, heavy penetration**	**24.0**	**SF**	**2.62**	**1.33**		**0.48**		**4.4**	**107**
	Cast-In-Place Concrete Total									**3,356**
	05050 - Basic Metal Materials & Methods									
	05090150 - Bolts & Hex Nuts									
1900	Bolt, hex head, plain steel, 5/8" dia x 6" L, A307, incl nut & washer	40.0	EA	3.18	1.63				4.8	192
	05090340 - Drilling									
0100	**[2x] Concrete impact drilling, for anchors, up to 4" D, 1/4" dia, in concrete or brick walls and floors, incl bit & layout, excl anchor**	**30.0**	**EA**	**3.37**	**0.05**				**3.4**	**103**
0400	**[3x] Concrete impact drilling, for anchors, up to 4" D, 5/8" dia, in concrete or brick walls and floors, incl bit & layout, excl anchor**	**156.0**	**EA**	**5.27**	**0.07**				**5.3**	**833**
	05090380 - Expansion Anchors									
8050	**[2x] Wedge anchor, carbon steel, 1/4" dia x 1-3/4" L, in concrete, brick or stone, excl layout & drilling**	**30.0**	**EA**	**1.69**	**0.20**				**1.9**	**56**
8400	Wedge anchor, carbon steel, 5/8" dia x 8-1/2" L, in concrete, brick or stone, excl layout & drilling	80.0	EA	2.20	1.67				3.9	310
	05090540 - Machinery Anchors									
0800	**[2x] Machinery anchor, heavy duty, 1" dia stud & bolt, incl sleeve, floating base nut, lower stud & coupling nut, fiber plug, connecting stud, washer & nut**	**16.0**	**EA**	**35.29**	**77.13**		**6.24**		**118.7**	**1,898**
	05090920 - Steel Cutting									
0100	Cutting, steel, to 1/2" thick, by hand, incl prep, torch cutting & grinding, excl staging	40.0	LF	1.16			0.27		1.4	57
	Basic Metal Materials & Methods Total									**3,450**
	05100 - Structural Metal Framing									
	05120440 - Lightweight Framing									
0470	Angle framing, structural steel, 2"x2"x1/4", field fabricated, incl cutting & welding	20.0	LF	11.74	2.26		1.39		15.4	308
0664	Channel framing, structural steel, field fabricated, C4x5.4, incl cutting & welding	70.0	LF	16.01	3.83		1.89		21.7	1,521
	Structural Metal Framing Total									**1,829**

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	05500 - Metal Fabrications									
	05580950 - Miscellaneous Fabrication									
0010bc	**[2x] Pump mounting base plate, complete w/ anchor bolts, 4 sf**	**4.0**	**each**	**363.30**	**795.79**				**1,159.1**	**4,636**
	Metal Fabrications Total									**4,636**
	09900 - Paints & Coatings									
	09910640 - B & C coating specification									
0020	Coatings & paints, B & C coating system E-2	30,000.0	sqft	0.23	0.85				1.1	32,520
	09990900 - Surface Preparation, Exterior									
9950ds	Surface preparation, stl, near white blast (sspc SP10), tight scale	10,000.0	SF	2.95					2.9	29,458
	Paints & Coatings Total									**61,978**
	11000 - Equipment									
	11000600 - Chemical Tanks									
0050	Caustic soda,35,000 gal.,fiberglass,UV resistant,14'x22'	1.0	each	968.19	70,726.23				71,694.4	71,694
0050	Accessories, hatch, ladder and overflow	1.0	each	91.92	6,714.95				6,806.9	6,807
	11000800 - Chemical Metering Pumps									
0040	Caustic soda, 50% NaOH, 260 gph,dc drive, 1.5 hp	2.0	each	263.39	10,610.60				10,874.0	21,748
0161D5	Chemical metering pump, 25 gpm Alum	2.0	each	427.34	29,300.00				29,727.3	59,455
	Equipment Total									**159,704**
	13200 - Storage Tanks									
	13201300 - Prestressed Concrete Water Storage Tanks									
0910	Aboveground Water Utility Storage Tanks, steel, ground level, ht/dia less than 1, 100,000 gallons, excl. foundation	1.0	EA			91,690.00			91,690.0	91,690
1000	Accessories, hatch, ladder and overflow	1.0	EA			17,800.00			17,800.0	17,800
	Storage Tanks Total									**109,490**
	15050 - Basic Materials & Methods									
	15060300 - Pipe Hangers And Supports									
0630	Pipe hanger / support, one hole clamp, 1" pipe size, for vertical mounting	20.0	EA	2.72	1.26				4.0	80

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
0770	Pipe hanger / support, riser or extension pipe clamp, carbon steel, 1" pipe size, type number 8 per MSS-SP58	20.0	EA	7.87	2.98				10.9	217
1180	**[2x] Pipe hanger / support, insert for concrete, wedge type, carbon steel body, 3/8" threaded rod size, includes malleable iron nut**	**30.0**	**EA**	**3.85**	**1.11**				**5.0**	**149**
1820	**[2x] Pipe hanger / support, adjustable clevis type band, carbon steel, for non-insulated pipe, 3/4" pipe size, type number 1 per MSS-SP58**	**30.0**	**EA**	**5.20**	**1.02**				**6.2**	**187**
	15080600 - Piping Insulation									
6870	Insulation, pipe covering (price copper tube one size less than I.P.S.), fiberglass with all service jacket, 1" wall, 1" iron pipe size	200.0	LF	4.01	1.01				5.0	1,003
	Basic Materials & Methods Total									**1,635**
	15100 - Building Services Piping									
	15107920 - Pipe, Stainless Steel									
1310	Pipe, stainless steel, butt weld, 1" diameter, schedule 5, type 316, includes weld joint and clevis type hangers 10' OC	200.0	LF	6.80	16.23		0.50		23.5	4,707
9120	Pipe, stainless steel, schedules 40 and 80, pipe, labor only, 1" through 2" pipe size, threading one end	20.0	EA	6.63					6.6	133
	Building Services Piping Total									**4,840**
	15200 - Process Piping									
	15200230 - Pipe, Plastic, Double Wall									
0030	Pipe, PVC hi imp/press, dbl wal, sched 80, 1" dia	20.0	lnft	11.55	10.98				22.5	451
0070	PVC, hi impact/pressure, sched 80, dbl wall.,90< elbow, 1"	200.0	each	20.90	41.73				62.6	12,527
	Process Piping Total									**12,977**
	15950 - Testing/Adjusting/Balancing									
	15955700 - Piping, Testing									
0320	Pipe testing, nondestructive hydraulic pressure test, isolate, 1 hour hold, 6" to 10" pipe, 0 - 250 L.F.	42.0	EA	765.44					765.4	32,148
	Testing/Adjusting/Balancing Total									**32,148**
	16000 - Electrical and Instrumentation									
	16000000 - Electrical and Instrumentation									
0001	Allowance - Electrical and Instrumentation Subcontract - 25%	1.0	Lsum			91,000.00			91,000.0	91,000

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	Electrical and Instrumentation Total									**91,000**
	17100 - Analytical Instruments									
	17100000 - Analytical Instruments									
0050	PH Analyzer	1.0	each	196.48	1,258.20				1,454.7	1,455
	Analytical Instruments Total									**1,455**

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	2.3A Dewatering Primary Solids - Current Operation									
	Dewatering Primary Solids - Current									**2,109,065**
	01590 - Miscellaneous Equipment Rental without operators									
	01590600 - Lifting and hoisting equipment rental without operators									
0300B	Rent crane climbing 101 foot jib, 10,250 lb 270 fpm - Rent per day	6.0	days				1,850.00		1,850.0	11,100
	Miscellaneous Equipment Rental without operators Total									**11,100**
	02300 - Earthwork									
	02315120 - Backfill, Structural									
4420	Backfill, structural, common earth, 200 H.P. dozer, 300' haul	35.0	L.C.Y.	0.67			1.37		2.0	71
	02315310 - Compaction, General									
7500	Compaction, 2 passes, 24" wide, 6" lifts, walk behind, vibrating roller	31.5	E.C.Y.	1.18			0.33		1.5	47
7520	Compaction, 3 passes, 24" wide, 6" lifts, walk behind, vibrating roller	69.4	E.C.Y.	1.77			0.48		2.3	156
7540	Compaction, 4 passes, 24" wide, 6" lifts, walk behind, vibrating roller	208.3	E.C.Y.	2.36			0.64		3.0	626
	02315492 - Hauling									
0009	Loading Trucks, F.E. Loader, 3 C.Y.	386.3	cuyd	0.51			0.95		1.5	562
4498	Cycle hauling(wait, load,travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 25 min load/wait/unload, 20 CY truck, cycle 20 miles, 45 MPH, no loading equipment	386.3	L.C.Y.	1.10			3.15		4.2	1,641
	02315610 - Excavating, Trench									
0060	Excavating, trench or continuous footing, common earth, 1/2 C.Y. excavator, 1' to 4' deep, excludes sheeting or dewatering	344.0	B.C.Y.	3.07			1.60		4.7	1,609
	02315640 - Utility Bedding									
0100	Fill by borrow and utility bedding, for pipe and conduit, crushed stone, 3/4" to 1/2", excludes compaction	242.2	L.C.Y.	5.64	43.11		1.83		50.6	12,251
	Earthwork Total									**16,964**
	02700 - Bases, Ballasts, Pavements & Appurtenances									
	02000000 - General Civil Work									
0990	Allowance - Site Work - 2%	1.0	LSUM	2,092.49	28,864.42		4,043.09		35,000.0	35,000
	02775275 - Sidewalks, Driveways, & Patios									

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
0850	Sidewalks, driveways, and patios, splash block, precast concrete, standard size	4.0	EA	1.59	9.76				11.3	45
	Bases, Ballasts, Pavements & Appurtenances Total									**35,045**
	03100 - Concrete Forms & Accessories									
	03110445 - Forms In Place, Slab On Grade									
3050	C.I.P. concrete forms, slab on grade, edge, wood, 7" to 12" high, 4 use, includes erecting, bracing, stripping and cleaning	250.0	sfca	2.29	0.65				2.9	736
	Concrete Forms & Accessories Total									**736**
	03200 - Concrete Reinforcement									
	03210600 - Reinforcing In Place									
0602	Reinforcing steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	17,578.7	lb	0.33	0.45				0.8	13,723
2000	Reinforcing steel, unload and sort, add to base	9.1	ton	24.65			7.36		32.0	291
2210	Reinforcing steel, crane cost for handling, average, add	9.1	ton	26.66			8.01		34.7	315
	Concrete Reinforcement Total									**14,329**
	03300 - Cast-In-Place Concrete									
	03310220 - Concrete, Ready Mix Normal Weight									
0300	Structural concrete, ready mix, normal weight, 4000 PSI, includes local aggregate, sand, Portland cement and water, delivered, excludes all additives and treatments	138.9	CY		100.00				100.0	13,889
	03310700 - Placing Concrete									
4650	Structural concrete, placing, slab on grade, pumped, over 6" thick, includes vibrating, excludes material	138.9	CY	11.38			3.98		15.4	2,133
	03350300 - Finishing Floors									
0150	Concrete finishing, floors, manual screed, bull float, manual float, broom finish	3,812.5	SF	0.43					0.4	1,641
	Cast-In-Place Concrete Total									**17,663**
	05010 - Misc Metals									
	05120440 - Lightweight Framing									
0020	Pump mounting base plate, complete w/ anchor bolts, 8 sf	2.0	each	435.96	1,671.17				2,107.1	4,214
	Misc Metals Total									**4,214**
	05050 - Basic Metal Materials & Methods									

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	05090150 - Bolts & Hex Nuts									
1900	Bolt, hex head, plain steel, 5/8" dia x 6" L, A307, incl nut & washer	266.0	EA	3.18	1.63				4.8	1,280
	05090340 - Drilling									
0300	Concrete impact drilling, for anchors, up to 4" D, 1/2" dia, in concrete or brick walls and floors, incl bit & layout, excl anchor	240.0	EA	5.07	0.05				5.1	1,228
0400	Concrete impact drilling, for anchors, up to 4" D, 5/8" dia, in concrete or brick walls and floors, incl bit & layout, excl anchor	798.0	EA	5.27	0.07				5.3	4,260
	05090380 - Expansion Anchors									
8250	Wedge anchor, carbon steel, 1/2" dia x 2-3/4" L, in concrete, brick or stone, excl layout & drilling	240.0	EA	1.81	0.76				2.6	616
8400	Wedge anchor, carbon steel, 5/8" dia x 8-1/2" L, in concrete, brick or stone, excl layout & drilling	532.0	EA	2.20	1.67				3.9	2,060
	05090900 - Welding Structural									
1800	Welding structural steel in field, 3 passes, 0.5 Lb/LF, 3/8" thick, continuous fillet, type 6011	25.0	LF	12.34	0.92		4.16		17.4	436
4010	Welding structural steel in field, cleaning & welding plates/bars/rods to existing beams/columns/trusses	100.0	LF	30.72	0.92		10.44		42.1	4,208
	05090920 - Steel Cutting									
0100	Cutting, steel, to 1/2" thick, by hand, incl prep, torch cutting & grinding, excl staging	266.0	LF	1.16			0.27		1.4	380
	Basic Metal Materials & Methods Total									**14,467**
	05100 - Structural Metal Framing									
	05120260 - Columns, Structural									
0940	Column, structural, concrete filled, 8" dia, extra strong pipe, incl shop primer, cap & base plate, excludes bolts	340.0	LF	2.21	68.12		1.47		71.8	24,415
	05120440 - Lightweight Framing									
0470	Angle framing, structural steel, 2"x2"x1/4", field fabricated, incl cutting & welding	133.0	LF	11.74	2.26		1.39		15.4	2,047
0476	Angle framing, structural steel, 3"x3"x3/8", field fabricated, incl cutting & welding	60.0	LF	18.54	5.09		2.19		25.8	1,549
0664	Channel framing, structural steel, field fabricated, C4x5.4, incl cutting & welding	465.5	LF	16.01	3.83		1.89		21.7	10,118
	05120560 - Plates									
0300	Steel plate, structural, for connections & stiffeners, 3/8" T, shop fabricated, incl shop primer	60.0	SF		18.01				18.0	1,081
	05120640 - Structural Steel Members									
0102	Structural steel member, 100-ton project, 1 to 2 story building, W6x9, A992 steel, shop fabricated, incl shop primer, bolted connections	180.0	LF	4.05	11.63		2.70		18.4	3,309

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	Structural Metal Framing Total									**42,518**
	05400 - Cold-Formed Metal Framing									
	05425600 - Framing, Roof Trusses									
9010	LB framing, site fab roof trusses, to 4:12 pitch, 18 ga	1,875.0	lf	2.30	4.01				6.3	11,838
	Cold-Formed Metal Framing Total									**11,838**
	05500 - Metal Fabrications									
	05514500 - Ladder									
0400	Ladder, shop fabricated, aluminum, 20" W, bolted to concrete, excl cage	8.0	vlft	16.69	50.50		1.47		68.7	549
	05520700 - Railing, Pipe									
0210	Railing, pipe, aluminum, clear finish, 3 rails, 3'-6" high, posts @ 5' O.C., 1-1/2" dia, shop fabricated	105.0	LF	10.36	55.59		0.91		66.9	7,020
	05530300 - Floor Grating, Aluminum									
0132	Floor grating, aluminum, 1-1/2" x 3/16" bearing bars @ 1-3/16" O.C., cross bars @ 4" O.C., up to 300 S.F., field fabricated from panels	1,000.0	SF	2.03	32.49		0.18		34.7	34,703
	05530360 - Grating Frame									
0020	Grating frame, aluminum, 1" to 1-1/2" D, field fabricated	130.0	LF	4.99	2.26				7.2	942
	Metal Fabrications Total									**43,215**
	07200 - Thermal Protection									
	07210950 - Wall Or Ceiling Insulation, Non-Rigid									
0260	Blanket insulation, for walls or ceilings, kraft faced fiberglass, 12" thick, R38, 23" wide	3,750.0	SF	0.19	0.91				1.1	4,122
	07260100 - Building Paper									
0900	Vapor Retarders, building paper, polyethylene vapor barrier, standard, .006" thick, 9' x 400' roll	37.5	sq	6.85	5.31				12.2	456
	Thermal Protection Total									**4,578**
	07400 - Roofing And Siding Panels									
	07410700 - Steel Roofing Panels									
0925	Steel roofing panels, on steel frame, flat profile, standard finish, 2" x 2" batten, 16-1/2" wide, 22 gauge	3,975.0	SF	1.66	4.83				6.5	25,793
1210	Steel roofing panels, on steel frame, ridge, galvanized, 20" wide	50.0	LF	1.99	4.72				6.7	335

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	07460300 - Fascia									
0100	Fascia, aluminum, reverse board & batten, colored, .032" thick, excl. furring	100.0	SF	3.50	5.50				9.0	900
	Roofing And Siding Panels Total									**27,029**
	07700 - Roof Specialties And Accessories									
	07710400 - Downspouts									
0400	Aluminum downspouts, enameled, 3" x 4", .024" thick	56.0	LF	3.64	2.44				6.1	340
	07710450 - Drip Edge									
0020	Aluminum drip edge, mill finish, .016" thick, 5" wide	159.0	LF	0.63	0.40				1.0	165
	07710650 - Gutters									
0100	Aluminum gutters, stock units, enameled, 5" box, .027" thick	100.0	LF	4.24	2.34				6.6	659
	Roof Specialties And Accessories Total									**1,164**
	09000 - B & C Div 9 Coating Systems									
	09910640 - B & C coating specification									
0020	Coatings & paints, B & C coating system E-2	24,000.0	sqft	0.23	0.85				1.1	26,016
0090	Coatings & paints, B & C coating system EP-1(Pipe)	480.0	sqft	0.53	0.47				1.0	478
	B & C Div 9 Coating Systems Total									**26,494**
	09900 - Paints & Coatings									
	09910640 - B & C coating specification									
0090bc	Coatings & paints, B & C coating system EP-1	1,000.0	sqft	0.42	0.47				0.9	891
	Paints & Coatings Total									**891**
	11000 - Equipment									
	11000100 - Process Equipment									
0170	Polymer Pump	1.0	each	1,848.00	22,300.00				24,148.0	24,148
1150	**[2x] Polyblend Unit**	**2.0**	**each**	**1,761.69**	**12,000.00**				**13,761.7**	**27,523**
1250	Chemical tote spill containment tray	1.0	each	127.05	2,436.50		29.15		2,592.7	2,593
1320	Screw Press	1.0	each	15,000.00	1,054,458.24		796.17		1,070,254.4	1,070,254
1430	Pumps,sludge - 275 gpm	2.0	each	599.44	13,324.79			112.50	14,036.7	28,073

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	11179150 - Waste Handling									
0010	Weight scale, polymer tote. including 4-20mA output (WS7411)	1.0	each	1,518.24	8,333.00				9,851.2	9,851
	Equipment Total									**1,162,443**
	15001 - Pipe, Water Supply									
	15001002 - Water Supply, Ductile Iron Pipe									
2060	Water supply distribution piping, ductile iron pipe, cement lined, mechanical joint, no fittings, 18' lengths, 8" diameter, class 50, excludes excavation or backfill	720.0	LF	14.81	19.70		4.21		38.7	27,882
	Pipe, Water Supply Total									**27,882**
	15010 - Misc. Mechanical									
	15050010 - Miscellaneous Mechanical									
0090	Pipe drain connection	2.0	each	86.63	103.45				190.1	380
0150	Utility stations, complete w/ valve, hose, rack,signage	4.0	each	245.44	371.37				616.8	2,467
0170	Emergency eyewash station, complete	3.0	each	288.75	1,034.53				1,323.3	3,970
	Misc. Mechanical Total									**6,817**
	15050 - Basic Materials & Methods									
	15080600 - Piping Insulation									
6890	Insulation, pipe covering (price copper tube one size less than I.P.S.), fiberglass with all service jacket, 1" wall, 1-1/2" iron pipe size	480.0	LF	5.23	1.21				6.4	3,092
	15080920 - Pipe Insulation Protective Jacketing, Aluminum									
0300	Pipe insulation, protective jacketing, aluminum, metal roll, aluminum with polykraft moisture barrier, smooth, .010" thick, 3-1/2" ID, cut from roll goods, size based on OD of insulation	432.0	LF	6.39	1.24				7.6	3,297
	Basic Materials & Methods Total									**6,390**
	15100 - Building Services Piping									
	15107420 - Pipe, Copper									
2240	Pipe, copper, tubing, solder, 1-1/2" diameter, type L, includes coupling & clevis hanger assembly 10' O.C.	400.0	LF	8.88	16.10				25.0	9,994
	15107460 - Pipe Fittings, Copper									
0130	Copper Fitting 1"	20.0	EA	29.02	6.80				35.8	716
	15107660 - Pipe Fittings, Steel									

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
0700	Gasket and bolt set, for flanges, 150 lb., 8" pipe size	24.0	EA	92.40	16.95				109.4	2,624
6170	Flange, steel, stainless steel, slip-on, 150 lb., 8" pipe size, welded front and back, includes weld machine	20.0	EA	267.47	63.50		10.39		341.4	6,827
6190	Flange, steel, stainless steel, slip-on, 150 lb., 12" pipe size, welded front and back, includes weld machine	7.0	EA	1,074.78	367.20		41.50		1,483.5	10,384
	15108560 - Pipe Fittings, Plastic									
2330	Fitting,plastic, PVC, socket joint, 4", schedule 80	15.0	EA	53.14	80.50				133.6	2,005
	15110160 - Valves, Bronze									
1500	Valves, bronze, ball, threaded, 150 lb., 2"	5.0	EA	42.05	61.50				103.6	518
	15110500 - Valves, Plastic									
1770	Valves, plastic, CPVC, ball, single union, socket or threaded, 2"	7.0	EA	27.25	128.00				155.2	1,087
6480	Valves, plastic, PVC, Y sediment strainer, socket or threaded, 2"	3.0	EA	27.25	102.00				129.2	388
	15110800 - Valves, Stainless Steel									
1670	Valves, stainless steel, ball, threaded, 1-1/2"	41.0	EA	38.91	163.00				201.9	8,278
2200	Valves, stainless steel, butterfly, flanged, 150 lb., 4"	12.0	EA	152.15	1,040.00				1,192.2	14,306
2210	Valves, stainless steel, butterfly, flanged, 150 lb., 6"	33.0	EA	232.87	1,794.00				2,026.9	66,887
2220	Valves, stainless steel, gate, OS&Y, flanged, 150 lb., 8"	7.0	EA	693.82	7,215.00				7,908.8	55,362
2240	Valves, stainless steel, butterfly, flanged, 150 lb., 12"	7.0	EA	366.85	6,084.00				6,450.9	45,156
	15150200 - Cleanouts									
0200	Cleanout, floor type, round or square, scoriated nickel bronze top, 8" pipe size	2.0	EA	220.08	445.00				665.1	1,330
	15150300 - Floor And Area Drains									
2180	Drain, floor, heavy duty, cast iron, 12" diameter anti-tilt grate, 2", 3", 4", 5" and 6" pipe size	20.0	EA	87.53	410.00				497.5	9,951
	Building Services Piping Total									**235,812**
	15195 - Pipe, steel, fittings									
	15200195 - Fittings, Steel									
0045	Pipe, steel ftngs, CI, standard weight, black, 90< elb, straight, 2"	50.0	each	48.77	10.70				59.5	2,973
	Pipe, steel, fittings Total									**2,973**
	15200 - Process Piping									

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	15200211 - Pipe, 304 Stainless Steel									
0150	Pipe, SS, A778, wld, Sched. 10S, type 304L, 3" dia.	180.0	lnft	11.85	8.52		0.88		21.2	3,824
0170	Pipe, SS, A778, wld, Sched. 10S, type 304L, 6" dia.	50.0	lnft	18.43	18.72		1.36		38.5	1,926
	15200216 - Fittings, 304 Stainless Steel									
2410	Fittings, SS, A774, butt weld jt, type 304L, sched. 10S, Tee, 6"	5.0	each	618.41	64.03		45.72		728.2	3,641
	15200230 - Pipe, Plastic, Double Wall									
0030	Pipe, PVC hi imp/press, dbl wal, sched 80, 1" dia	60.0	lnft	11.55	10.98				22.5	1,352
0060	**[2x] Pipe, PVC hi imp/press, dbl wall, sched 80, 4" dia**	**150.0**	**lnft**	**74.61**	**27.97**				**102.6**	**15,388**
0110	Pipe, plastic ftngs, PVC, dbl wall, sched 80, dbl90< elb, 2"	12.0	each	39.50	44.65				84.2	1,010
	Process Piping Total									**27,141**
	15240 - Pipe, pvc, fittings									
	15108560 - Pipe Fittings, Plastic									
1040	**[2x] PVC, hi impact/pressure, sched 80, tee, 8"**	**15.0**	**each**	**216.10**	**215.00**				**431.1**	**6,466**
3020	PVC flange, slip-on, Sch 80 std., 2"	90.0	each	33.76	13.65				47.4	4,267
	Pipe, pvc, fittings Total									**10,733**
	15285 - Valves, steel									
	15200255 - Valves, Iron Body									
1320	Ball valve, steel, 150 lb, flanged, 8" size	9.0	each	535.92	1,909.91				2,445.8	22,012
	Valves, steel Total									**22,012**
	15330 - Flexible connectors									
	15200330 - Flexible Connectors									
0160	Connectors, flex, corr, 2" I.D., wtr,	3.0	each	13.59	26.53				40.1	120
302	Connectors, flex, dismantling Joint, 6"	3.0	each	187.69	683.68				871.4	2,614
	Flexible connectors Total									**2,734**
	15350 - Sleeves and escutcheons									
	15200330 - Flexible Connectors									
0100	Pipe sleeve, stl, wtr stop, 12" L w/link seal, 10" dia for 6" carrier	5.0	each	109.72	140.00				249.7	1,249

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	Sleeves and escutcheons Total									**1,249**
	15400 - Plumbing Fixtures & Equipment									
	15414200 - Industrial Safety Fixtures									
6000	Industrial safety fixture, shower, single head, drench, ball valve, pull, freestanding, multi-nozzle eye/face wash combination, excludes rough-in	2.0	EA	220.08	590.00				810.1	1,620
	Plumbing Fixtures & Equipment Total									**1,620**
	15950 - Testing/Adjusting/Balancing									
	15955700 - Piping, Testing									
0320	Pipe testing, nondestructive hydraulic pressure test, isolate, 1 hour hold, 6" to 10" pipe, 0 - 250 L.F.	17.0	EA	765.44					765.4	13,012
	Testing/Adjusting/Balancing Total									**13,012**
	16000 - Electrical and Instrumentation									
	16000001 - Electrical and Instrumentation									
0001	Allowance - Electrical and Instrumentation Subcontract - 25%	1.0	Lsum			316,000.00			316,000.0	316,000
	Electrical and Instrumentation Total									**316,000**

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	2.3B Dewatering Primary Solids - With Alum Dosing									
	Dewatering Primary Solids - Alum									**2,084,347**
	01500 - Temporary Facilities & Controls									
	01540750 - Scaffolding									
2850	Scaffolding, steel tubular, regular, accessory, plank, rent/mo, 2" x 10" x 16' long	251.4	EA		6.00				6.0	1,509
3250	Scaffolding, steel tubular, heavy duty shoring, frame, rent/mo, 5' high x 2' & 4' wide	1,508.6	EA		5.00				5.0	7,543
3700	Scaffolding, steel tubular, heavy duty shoring, accessory, base plate, rent/mo, 8" x 8"	314.3	EA		1.00				1.0	314
3750	Scaffolding, steel tubular, heavy duty shoring, accessory, leveling jack, rent/mo	605.0	EA		2.00				2.0	1,210
9005bc	Scaffolding assembly and disassembly, ENCLOSED	8,800.0	sqft	0.88			0.35		1.2	10,820
	Temporary Facilities & Controls Total									**21,395**
	01590 - Miscellaneous Equipment Rental without operators									
	01590600 - Lifting and hoisting equipment rental without operators									
0300B	Rent crane climbing 101 foot jib, 10,250 lb 270 fpm - Rent per day	6.0	days				1,850.00		1,850.0	11,100
	Miscellaneous Equipment Rental without operators Total									**11,100**
	02300 - Earthwork									
	02315120 - Backfill, Structural									
4420	Backfill, structural, common earth, 200 H.P. dozer, 300' haul	66.5	L.C.Y.	0.67			1.37		2.0	136
	02315310 - Compaction, General									
7500	Compaction, 2 passes, 24" wide, 6" lifts, walk behind, vibrating roller	59.9	E.C.Y.	1.18			0.33		1.5	90
7520	Compaction, 3 passes, 24" wide, 6" lifts, walk behind, vibrating roller	138.9	E.C.Y.	1.77			0.48		2.3	313
7540	Compaction, 4 passes, 24" wide, 6" lifts, walk behind, vibrating roller	416.7	E.C.Y.	2.36			0.64		3.0	1,253
	02315492 - Hauling									
0009	Loading Trucks, F.E. Loader, 3 C.Y.	857.3	cuyd	0.51			0.95		1.5	1,248
4498	Cycle hauling(wait, load,travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 25 min load/wait/unload, 20 CY truck, cycle 20 miles, 45 MPH, no loading equipment	857.3	L.C.Y.	1.10			3.15		4.2	3,642
	02315610 - Excavating, Trench									
0060	Excavating, trench or continuous footing, common earth, 1/2 C.Y. excavator, 1' to 4' deep, excludes sheeting or dewatering	752.2	B.C.Y.	3.07			1.60		4.7	3,517

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	02315640 - Utility Bedding									
0100	Fill by borrow and utility bedding, for pipe and conduit, crushed stone, 3/4" to 1/2", excludes compaction	484.5	L.C.Y.	5.64	43.11		1.83		50.6	24,502
	Earthwork Total									**34,701**
	02700 - Bases, Ballasts, Pavements & Appurtenances									
	02000000 - General Civil Work									
0990	Allowance - Site Work - 2%	1.0	LSUM	2,510.98	34,637.30		4,851.71		42,000.0	42,000
	02775275 - Sidewalks, Driveways, & Patios									
0850	Sidewalks, driveways, and patios, splash block, precast concrete, standard size	4.0	EA	1.59	10.56				12.1	49
	Bases, Ballasts, Pavements & Appurtenances Total									**42,049**
	03100 - Concrete Forms & Accessories									
	03110445 - Forms In Place, Slab On Grade									
3050	C.I.P. concrete forms, slab on grade, edge, wood, 7" to 12" high, 4 use, includes erecting, bracing, stripping and cleaning	350.0	sfca	2.29	0.65				2.9	1,030
	Concrete Forms & Accessories Total									**1,030**
	03200 - Concrete Reinforcement									
	03210600 - Reinforcing In Place									
0602	Reinforcing steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	34,984.6	lb	0.33	0.45				0.8	27,312
2000	Reinforcing steel, unload and sort, add to base	17.9	ton	24.65			7.36		32.0	573
2210	Reinforcing steel, crane cost for handling, average, add	17.9	ton	26.66			8.01		34.7	621
	Concrete Reinforcement Total									**28,505**
	03300 - Cast-In-Place Concrete									
	03310220 - Concrete, Ready Mix Normal Weight									
0300	Structural concrete, ready mix, normal weight, 4000 PSI, includes local aggregate, sand, Portland cement and water, delivered, excludes all additives and treatments	324.1	CY		100.00				100.0	32,407
	03310700 - Placing Concrete									
4650	Structural concrete, placing, slab on grade, pumped, over 6" thick, includes vibrating, excludes material	324.1	CY	11.38			3.98		15.4	4,978

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	03350300 - Finishing Floors									
0150	Concrete finishing, floors, manual screed, bull float, manual float, broom finish	7,558.3	SF	0.43					0.4	3,253
	Cast-In-Place Concrete Total									**40,638**
	04050 - Basic Masonry Materials And Methods									
	04070420 - Grouting									
0250	Grout, concrete masonry unit (CMU) cores, 8" thick, 0.258 C.F./S.F., pumped, excludes blockwork	3,200.0	SF	1.78	0.91		0.06		2.8	8,800
0350	Grout, concrete masonry unit (CMU) cores, 12" thick, 0.422 C.F./S.F., pumped, excludes blockwork	5,600.0	SF	1.90	1.48		0.06		3.4	19,266
	04080200 - Reinforcing									
0015	Masonry reinforcing bars, #3 and #4 reinforcing steel bars, placed horizontally, ASTM A615	1,068.8	lb	0.61	0.45				1.1	1,130
0020	Masonry reinforcing bars, #5 and #6 reinforcing steel bars, placed horizontally, ASTM A615	2,920.4	lb	0.35	0.45				0.8	2,324
0050	Masonry reinforcing bars, #3 and #4 reinforcing steel bars, placed vertically, ASTM A615	534.4	lb	0.78	0.45				1.2	660
0060	Masonry reinforcing bars, #5 and #6 reinforcing steel bars, placed vertically, ASTM A615	1,460.2	lb	0.42	0.45				0.9	1,273
	04080650 - Wall Ties									
0680	**[2x] Masonry anchors, cavity wall ties, Z type, galvanized, 6" long x 1/4" diameter**	**0.3**	**C**	**26.14**	**32.71**				**58.8**	**19**
	Basic Masonry Materials And Methods Total									**33,471**
	04700 - Manufactured Masonry									
	04720200 - Cultured Stone Veneer									
0360	Cultured stone veneer, weather resistant barrier, #15 felt, excludes scaffolding	5,000.0	sq	0.07	3.95				4.0	20,076
	Manufactured Masonry Total									**20,076**
	04800 - Masonry Assemblies									
	04810187 - Concrete Block, High Strength									
0600	Concrete block, high strength, hollow, 5000 psi, 8" x 8" x 16", includes mortar and horizontal joint reinforcing every other course, excludes scaffolding, grout and vertical reinforcing	3,200.0	SF	3.85	3.35				7.2	23,063
0650	Concrete block, high strength, hollow, 5000 psi, 12" x 8" x 16", includes mortar and horizontal joint reinforcing every other course, excludes scaffolding, grout and vertical reinforcing	5,600.0	SF	5.56	4.97				10.5	58,942
	Masonry Assemblies Total									**82,004**
	05010 - Misc Metals									

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	05120440 - Lightweight Framing									
0020	**[2x] Pump mounting base plate, complete w/ anchor bolts, 8 sf**	**4.0**	**each**	**435.96**	**1,671.17**				**2,107.1**	**8,429**
	Misc Metals Total									**8,429**
	05050 - Basic Metal Materials & Methods									
	05090150 - Bolts & Hex Nuts									
1900	Bolt, hex head, plain steel, 5/8" dia x 6" L, A307, incl nut & washer	160.0	EA	3.18	1.63				4.8	770
	05090340 - Drilling									
0400	Concrete impact drilling, for anchors, up to 4" D, 5/8" dia, in concrete or brick walls and floors, incl bit & layout, excl anchor	480.0	EA	5.27	0.07				5.3	2,562
	05090380 - Expansion Anchors									
8400	Wedge anchor, carbon steel, 5/8" dia x 8-1/2" L, in concrete, brick or stone, excl layout & drilling	320.0	EA	2.20	1.67				3.9	1,239
	05090900 - Welding Structural									
4010	Welding structural steel in field, cleaning & welding plates/bars/rods to existing beams/columns/trusses	150.0	LF	30.72	0.93		10.44		42.1	6,313
	05090920 - Steel Cutting									
0100	Cutting, steel, to 1/2" thick, by hand, incl prep, torch cutting & grinding, excl staging	160.0	LF	1.16			0.27		1.4	229
	Basic Metal Materials & Methods Total									**11,113**
	05100 - Structural Metal Framing									
	05120440 - Lightweight Framing									
0470	Angle framing, structural steel, 2"x2"x1/4", field fabricated, incl cutting & welding	80.0	LF	11.74	2.26		1.39		15.4	1,231
0664	Channel framing, structural steel, field fabricated, C4x5.4, incl cutting & welding	280.0	LF	16.01	3.83		1.89		21.7	6,086
	Structural Metal Framing Total									**7,317**
	05400 - Cold-Formed Metal Framing									
	05425600 - Framing, Roof Trusses									
9010	LB framing, site fab roof trusses, to 4:12 pitch, 18 ga	3,750.0	lf	2.30	4.01				6.3	23,675
	Cold-Formed Metal Framing Total									**23,675**
	06100 - Rough Carpentry									
	06160800 - Sheathing									

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
0207	Sheathing, plywood on roof, CDX, 5/8" thick, pneumatic nailed	7,950.0	SF	0.32	0.62				0.9	7,471
	Rough Carpentry Total									**7,471**
	07200 - Thermal Protection									
	07210950 - Wall Or Ceiling Insulation, Non-Rigid									
0260	Blanket insulation, for walls or ceilings, kraft faced fiberglass, 12" thick, R38, 23" wide	7,500.0	SF	0.19	0.99				1.2	8,849
	07260100 - Building Paper									
0400	Vapor Retarders, building paper, asphalt felt sheathing paper, 15#	79.5	sq	6.85	4.97				11.8	940
0900	Vapor Retarders, building paper, polyethylene vapor barrier, standard, .006" thick, 9' x 400' roll	75.0	sq	6.85	5.78				12.6	947
	Thermal Protection Total									**10,736**
	07300 - Shingles, Roof Tiles And Roof Coverings									
	07310100 - Asphalt Shingles									
0825	Asphalt Shingles, #30 felt underlayment	79.5	sq	4.05	9.95				14.0	1,113
	Shingles, Roof Tiles And Roof Coverings Total									**1,113**
	07400 - Roofing And Siding Panels									
	07410700 - Steel Roofing Panels									
0925	Steel roofing panels, on steel frame, flat profile, standard finish, 2" x 2" batten, 16-1/2" wide, 22 gauge	7,950.0	SF	1.66	5.26				6.9	54,999
1210	Steel roofing panels, on steel frame, ridge, galvanized, 20" wide	75.0	LF	1.99	5.14				7.1	534
	07460300 - Fascia									
0100	Fascia, aluminum, reverse board & batten, colored, .032" thick, excl. furring	150.0	SF	3.50	5.99				9.5	1,424
	Roofing And Siding Panels Total									**56,957**
	07700 - Roof Specialties And Accessories									
	07710400 - Downspouts									
0400	Aluminum downspouts, enameled, 3" x 4", .024" thick	56.0	LF	3.64	2.66				6.3	352
	07710450 - Drip Edge									
0020	Aluminum drip edge, mill finish, .016" thick, 5" wide	212.0	LF	0.63	0.44				1.1	227
	07710650 - Gutters									

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
0100	Aluminum gutters, stock units, enameled, 5" box, .027" thick	150.0	LF	4.24	2.55				6.8	1,019
	Roof Specialties And Accessories Total									**1,599**
	08100 - Metal Doors And Frames									
	08110200 - Commercial Steel Doors									
1860	Doors, commercial, steel, insulated, half glass, 18 ga., 3'-0" x 7'-0" x 1-3/4" thick	4.0	EA	31.67	568.40				600.1	2,400
	08110250 - Door Frames									
0200	Door frames, steel channels with anchors and bar stops, 8" channel@ 11.5 lb/LF, 6' x 8' door, weighs 275 lb	4.0	EA	158.03	485.10		13.88		657.0	2,628
	Metal Doors And Frames Total									**5,028**
	08400 - Entrances And Storefronts									
	08410110 - Aluminum-Framed Storefronts									
1100	Frames, aluminum, door, entrance, black finish, storefront, 3' x 10' opening, with 3' high transoms	4.0	Opng	107.61	514.50				622.1	2,488
	Entrances And Storefronts Total									**2,488**
	08700 - Hardware									
	08710300 - Door Closers									
0015	Door hardware, door closer, rack and pinion	4.0	EA	38.80	145.04				183.8	735
	08710340 - Doorstops									
0020	Door hardware, doorstops, holder and bumper, floor or wall	4.0	EA	7.92	32.83				40.7	163
	08710520 - Hinges									
1100	Door hardware, hinges, full mortise, high frequency, steel base, USP, 5" x 5"	6.0	pair		53.41				53.4	320
	08710550 - Kick Plate									
0020	Door hardware, kick plate, stainless steel, 6" high for 3' door	4.0	EA	17.02	30.38				47.4	190
	08710650 - Lockset									
1400	Door hardware, lockset, heavy duty, cylindrical, with sectional trim, keyed, single cylinder function	4.0	EA	25.34	205.80				231.1	925
	08720300 - Weatherstripping, Window									
2300	Weatherstripping, doors, metal frame, spring type, bronze, for 3' x 7' door	4.0	Opng	84.72	34.79				119.5	478

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	08720800 - Thresholds									
0500	Thresholds, bronze	12.0	LF	4.24	37.73				42.0	504
	Hardware Total									**3,315**
	09000 - B & C Div 9 Coating Systems									
	09910640 - B & C coating specification									
0020	**[2x] Coatings & paints, B & C coating system E-2**	**27,000.0**	**sqft**	**0.23**	**0.85**				**1.1**	**29,268**
0090	Coatings & paints, B & C coating system EP-1(Pipe)	200.0	sqft	0.53	0.47				1.0	199
	B & C Div 9 Coating Systems Total									**29,467**
	11000 - Equipment									
	11000100 - Process Equipment									
0170	Polymer Pump	1.0	each	2,457.84	29,659.00				32,116.8	32,117
0170	Feeder, polymer incl multi-zone mixer, progressive cavity type variable speed metering pump (CFR1455)	2.0	each	1,848.00	22,300.00				24,148.0	48,296
1150	Mixer, polymer tank with mounting bracket, 3/4-hp, 42" 316ss shaft and 9" dia 316ss propeller (MX7411)	1.0	each	885.45	1,900.00				2,785.4	2,785
1250	Chemical tote spill containment tray	1.0	each	127.05	2,436.50		29.15		2,592.7	2,593
1320	Belt filter press,3 m, 12-pressure roll incl. hydraulic system, wash pump, belt drives	3.0	each	10,000.00	224,000.00		175.16		234,175.2	702,525
1430	Pumps,sludge 650 gpm	2.0	each	899.17	19,987.19			168.75	21,055.1	42,110
	11000600 - Chemical Tanks									
0065do	XLHDPE tank, 1000 gallon - dual wall. HDXLPE with OR1000 inner & 1.9 crosslink luter. 6'5"dia. x 4' high. Includes $800 WA PE stamp. sismic clips, shipping	1.0	each	534.05	7,680.40				8,214.5	8,214
	11000800 - Chemical Metering Pumps									
0340	Pump, polymer addition	1.0	each	3,991.68	15,040.53				19,032.2	19,032
	11179150 - Waste Handling									
0010	Weight scale, polymer tote. including 4-20mA output (WS7411)	2.0	each	1,518.24	8,333.00				9,851.2	19,702
	Equipment Total									**877,376**
	15001 - Pipe, Water Supply									
	15001002 - Water Supply, Ductile Iron Pipe									

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
2060	Water supply distribution piping, ductile iron pipe, cement lined, mechanical joint, no fittings, 18' lengths, 8" diameter, class 50, excludes excavation or backfill	480.0	LF	14.81	19.70		4.21		38.7	18,588
	Pipe, Water Supply Total									**18,588**
	15010 - Misc. Mechanical									
	15050010 - Miscellaneous Mechanical									
0090	Pipe drain connection	2.0	each	86.63	103.45				190.1	380
0150	Utility stations, complete w/ valve, hose, rack,signage	3.0	each	245.44	371.37				616.8	1,850
0170	Emergency eyewash station, complete	2.0	each	288.75	1,034.53				1,323.3	2,647
	Misc. Mechanical Total									**4,877**
	15050 - Basic Materials & Methods									
	15050010 - Miscellaneous Mechanical									
0008	Piping, bldg srvc/domestic, allowance	1.0	lsum					20,000.00	20,000.0	20,000
	15080600 - Piping Insulation									
6890	Insulation, pipe covering (price copper tube one size less than I.P.S.), fiberglass with all service jacket, 1" wall, 1-1/2" iron pipe size	320.0	LF	5.23	1.21				6.4	2,062
	15080920 - Pipe Insulation Protective Jacketing, Aluminum									
0300	Pipe insulation, protective jacketing, aluminum, metal roll, aluminum with polykraft moisture barrier, smooth, .010" thick, 3-1/2" ID, cut from roll goods, size based on OD of insulation	288.0	LF	6.39	1.24				7.6	2,198
	Basic Materials & Methods Total									**24,260**
	15100 - Building Services Piping									
	15107420 - Pipe, Copper									
2240	Pipe, copper, tubing, solder, 1-1/2" diameter, type L, includes coupling & clevis hanger assembly 10' O.C.	288.0	LF	8.88	16.10				25.0	7,196
	15107460 - Pipe Fittings, Copper									
0130	Copper Fitting 1"	13.0	EA	29.02	6.80				35.8	466
	15107660 - Pipe Fittings, Steel									
0700	Gasket and bolt set, for flanges, 150 lb., 8" pipe size	16.0	EA	92.40	16.95				109.4	1,750
6170	Flange, steel, stainless steel, slip-on, 150 lb., 8" pipe size, welded front and back, includes weld machine	13.0	EA	267.47	63.50		10.39		341.4	4,438

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
6190	Flange, steel, stainless steel, slip-on, 150 lb., 12" pipe size, welded front and back, includes weld machine	5.0	EA	1,074.78	367.20		41.50		1,483.5	7,417
	15110160 - Valves, Bronze									
1500	Valves, bronze, ball, threaded, 150 lb., 2"	5.0	EA	42.05	61.50				103.6	518
	15110500 - Valves, Plastic									
1770	Valves, plastic, CPVC, ball, single union, socket or threaded, 2"	7.0	EA	27.25	128.00				155.2	1,087
6480	Valves, plastic, PVC, Y sediment strainer, socket or threaded, 2"	3.0	EA	27.25	102.00				129.2	388
	15110800 - Valves, Stainless Steel									
1670	Valves, stainless steel, ball, threaded, 1-1/2"	27.0	EA	38.91	163.00				201.9	5,451
2200	Valves, stainless steel, butterfly, flanged, 150 lb., 4"	8.0	EA	152.15	1,040.00				1,192.2	9,537
2210	Valves, stainless steel, butterfly, flanged, 150 lb., 6"	22.0	EA	232.87	1,794.00				2,026.9	44,591
2220	Valves, stainless steel, gate, OS&Y, flanged, 150 lb., 8"	5.0	EA	693.82	7,215.00				7,908.8	39,544
2240	Valves, stainless steel, butterfly, flanged, 150 lb., 12"	5.0	EA	366.85	6,084.00				6,450.9	32,254
	15150200 - Cleanouts									
0200	Cleanout, floor type, round or square, scoriated nickel bronze top, 8" pipe size	2.0	EA	220.08	445.00				665.1	1,330
	15150300 - Floor And Area Drains									
2180	Drain, floor, heavy duty, cast iron, 12" diameter anti-tilt grate, 2", 3", 4", 5" and 6" pipe size	13.0	EA	87.53	410.00				497.5	6,468
	Building Services Piping Total									**162,434**
	15195 - Pipe, steel, fittings									
	15200195 - Fittings, Steel									
0045	Pipe, steel ftngs, CI, standard weight, black, 90< elb, straight, 2"	32.0	each	48.77	10.70				59.5	1,903
	Pipe, steel, fittings Total									**1,903**
	15200 - Process Piping									
	15200211 - Pipe, 304 Stainless Steel									
0150	Pipe, SS, A778, wld, Sched. 10S, type 304L, 3" dia.	120.0	lnft	11.85	8.52		0.88		21.2	2,550
0170	Pipe, SS, A778, wld, Sched. 10S, type 304L, 6" dia.	26.0	lnft	18.43	18.72		1.36		38.5	1,001
	15200216 - Fittings, 304 Stainless Steel									
2410	Fittings, SS, A774, butt weld jt, type 304L, sched. 10S, Tee, 6"	3.0	each	618.41	64.03		45.72		728.2	2,184

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	15200230 - Pipe, Plastic, Double Wall									
0030	Pipe, PVC hi imp/press, dbl wal, sched 80, 1" dia	50.0	lnft	11.55	10.98				22.5	1,126
0060	Pipe, PVC hi imp/press, dbl wall, sched 80, 4" dia	70.0	lnft	74.61	27.97				102.6	7,181
0110	Pipe, plastic ftngs, PVC, dbl wall, sched 80, dbl90< elb, 2"	12.0	each	39.50	44.65				84.2	1,010
	Process Piping Total									**15,053**
	15240 - Pipe, pvc, fittings									
	15108560 - Pipe Fittings, Plastic									
1040	PVC, hi impact/pressure, sched 80, tee, 8"	6.0	each	216.10	215.00				431.1	2,587
3020	PVC flange, slip-on, Sch 80 std., 2"	58.0	each	33.76	13.65				47.4	2,750
	Pipe, pvc, fittings Total									**5,336**
	15285 - Valves, steel									
	15200255 - Valves, Iron Body									
1320	Ball valve, steel, 150 lb, flanged, 8" size	6.0	each	535.92	1,909.91				2,445.8	14,675
	Valves, steel Total									**14,675**
	15330 - Flexible connectors									
	15200330 - Flexible Connectors									
0160	Connectors, flex, corr, 2" I.D., wtr,	2.0	each	13.59	26.53				40.1	80
302	Connectors, flex, dismantling Joint, 6"	2.0	each	187.69	683.68				871.4	1,743
	Flexible connectors Total									**1,823**
	15350 - Sleeves and escutcheons									
	15200330 - Flexible Connectors									
0100	Pipe sleeve, stl, wtr stop, 12" L w/link seal, 10" dia for 6" carrier	3.0	each	109.73	140.00				249.7	749
	Sleeves and escutcheons Total									**749**
	15400 - Plumbing Fixtures & Equipment									
	15414200 - Industrial Safety Fixtures									
6000	Industrial safety fixture, shower, single head, drench, ball valve, pull, freestanding, multi-nozzle eye/face wash combination, excludes rough-in	2.0	EA	220.08	590.00				810.1	1,620

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	Plumbing Fixtures & Equipment Total									**1,620**
	15700 - Heating/Ventilating/Air Conditioning Equipment									
	15700100 - HVAC Allowance									
0010	HVAC heating, cooling allowance, $12.00/sf	7,500.0	sqft			11.00			11.0	82,500
	Heating/Ventilating/Air Conditioning Equipment Total									**82,500**
	15950 - Testing/Adjusting/Balancing									
	15955700 - Piping, Testing									
0320	Pipe testing, nondestructive hydraulic pressure test, isolate, 1 hour hold, 6" to 10" pipe, 0 - 250 L.F.	11.0	EA	861.12					861.1	9,472
	Testing/Adjusting/Balancing Total									**9,472**
	16000 - Electrical and Instrumentation									
	16000001 - Electrical and Instrumentation									
0001	Allowance - Electrical and Instrumentation Subcontract - 25%	1.0	Lsum			380,000.00			380,000.0	380,000
	Electrical and Instrumentation Total									**380,000**

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	2.5 Effluent Coagulation and Sedimentation									
	Effluent Coagulation and Sedimentation									**17,068,968**
	01500 - Temporary Facilities & Controls									
	01540750 - Scaffolding									
2850	Scaffolding, steel tubular, regular, accessory, plank, rent/mo, 2" x 10" x 16' long	457.1	EA		6.00				6.0	2,743
3250	Scaffolding, steel tubular, heavy duty shoring, frame, rent/mo, 5' high x 2' & 4' wide	2,742.9	EA		5.00				5.0	13,714
3700	Scaffolding, steel tubular, heavy duty shoring, accessory, base plate, rent/mo, 8" x 8"	571.4	EA		1.00				1.0	571
3750	Scaffolding, steel tubular, heavy duty shoring, accessory, leveling jack, rent/mo	1,100.0	EA		2.00				2.0	2,200
9005bc	Scaffolding assembly and disassembly, ENCLOSED	16,000.0	sqft	0.88			0.35		1.2	19,672
	Temporary Facilities & Controls Total									**38,901**
	01590 - Miscellaneous Equipment Rental without operators									
	01590600 - Lifting and hoisting equipment rental without operators									
0300D	Rent crane climbing 101 foot jib, 10,250 lb 270 fpm - Rent per month	1.0	mnth				16,700.00		16,700.0	16,700
	Miscellaneous Equipment Rental without operators Total									**16,700**
	02300 - Earthwork									
	02315120 - Backfill, Structural									
4420	**[3x] Backfill, structural, common earth, 200 H.P. dozer, 300' haul**	**422.4**	**L.C.Y.**	**0.67**			**1.37**		**2.0**	**862**
	02315310 - Compaction, General									
7500	**[3x] Compaction, 2 passes, 24" wide, 6" lifts, walk behind, vibrating roller**	**380.1**	**E.C.Y.**	**1.18**			**0.33**		**1.5**	**573**
7520	**[3x] Compaction, 3 passes, 24" wide, 6" lifts, walk behind, vibrating roller**	**413.6**	**E.C.Y.**	**1.77**			**0.48**		**2.3**	**931**
7540	**[3x] Compaction, 4 passes, 24" wide, 6" lifts, walk behind, vibrating roller**	**1,240.7**	**E.C.Y.**	**2.36**			**0.64**		**3.0**	**3,730**
	02315492 - Hauling									
0009	**[3x] Loading Trucks, F.E. Loader, 3 C.Y.**	**3,020.2**	**cuyd**	**0.51**			**0.95**		**1.5**	**4,397**
4498	**[3x] Cycle hauling(wait, load,travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 25 min load/wait/unload, 20 CY truck, cycle 20 miles, 45 MPH, no loading equipment**	**3,020.2**	**L.C.Y.**	**1.10**			**3.15**		**4.2**	**12,830**
	02315610 - Excavating, Trench									

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
0060	**[3x] Excavating, trench or continuous footing, common earth, 1/2 C.Y. excavator, 1' to 4' deep, excludes sheeting or dewatering**	**2,838.1**	**B.C.Y.**	**3.07**			**1.60**		**4.7**	**13,272**
	02315640 - Utility Bedding									
0100	**[3x] Fill by borrow and utility bedding, for pipe and conduit, crushed stone, 3/4" to 1/2", excludes compaction**	**1,442.7**	**L.C.Y.**	**5.64**	**43.11**		**1.83**		**50.6**	**72,960**
	Earthwork Total									**109,555**
	02700 - Bases, Ballasts, Pavements & Appurtenances									
	02000000 - General Civil Work									
0990	Allowance - Site Work - 2%	1.0	LSUM	17,636.67	243,285.83		34,077.50		295,000.0	295,000
	02775275 - Sidewalks, Driveways, & Patios									
0850	Sidewalks, driveways, and patios, splash block, precast concrete, standard size	4.0	EA	1.59	10.56				12.1	49
	Bases, Ballasts, Pavements & Appurtenances Total									**295,049**
	03100 - Concrete Forms & Accessories									
	03110425 - Forms In Place, Equipment Foundations									
0050	C.I.P. concrete forms, equipment foundations, 2 use, includes erecting, bracing, stripping and cleaning	36.0	sfca	8.02	1.74				9.8	351
	03110445 - Forms In Place, Slab On Grade									
3050	**[3x] C.I.P. concrete forms, slab on grade, edge, wood, 7" to 12" high, 4 use, includes erecting, bracing, stripping and cleaning**	**921.1**	**sfca**	**2.29**	**0.65**				**2.9**	**2,712**
	03110455 - Forms In Place, Walls									
2550	C.I.P. concrete forms, wall, job built, plywood, 8 to 16' high, 4 use, includes erecting, bracing, stripping and cleaning	7,448.0	sfca	3.87	0.68				4.6	33,930
	03150860 - Waterstop									
0600	Waterstop, PVC, ribbed, with center bulb, 3/8" thick x 9" wide	196.0	LF	2.03	3.95				6.0	1,172
	Concrete Forms & Accessories Total									**38,165**
	03200 - Concrete Reinforcement									
	03210600 - Reinforcing In Place									
0602	**[4x] Reinforcing steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories**	**104,070.7**	**lb**	**0.33**	**0.45**				**0.8**	**81,246**

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
0702	Reinforcing steel, in place, walls, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	36,378.2	lb	0.24	0.45				0.7	24,829
2000	**[5x] Reinforcing steel, unload and sort, add to base**	**71.3**	**ton**	**24.65**			**7.36**		**32.0**	**2,281**
2210	**[5x] Reinforcing steel, crane cost for handling, average, add**	**71.3**	**ton**	**26.66**			**8.01**		**34.7**	**2,471**
2420	Reinforcing steel, in place, dowels, deformed, 2' long, #5, A615, grade 60	33.0	EA	1.61	1.02				2.6	87
	Concrete Reinforcement Total									**110,914**
	03300 - Cast-In-Place Concrete									
	03310220 - Concrete, Ready Mix Normal Weight									
0300	**[5x] Structural concrete, ready mix, normal weight, 4000 PSI, includes local aggregate, sand, Portland cement and water, delivered, excludes all additives and treatments**	**1,063.8**	**CY**		**100.00**				**100.0**	**106,382**
	03310700 - Placing Concrete									
4650	**[4x] Structural concrete, placing, slab on grade, pumped, over 6" thick, includes vibrating, excludes material**	**971.9**	**CY**	**11.38**			**3.98**		**15.4**	**14,927**
5350	Structural concrete, placing, walls, pumped, 15" thick, includes vibrating, excludes material	92.0	CY	17.53			6.15		23.7	2,177
	03350300 - Finishing Floors									
0150	**[2x] Concrete finishing, floors, manual screed, bull float, manual float, broom finish**	**21,219.1**	**SF**	**0.43**					**0.4**	**9,133**
	03350350 - Finishing Walls									
0150	**[2x] Concrete finishing, walls, carborundum rub, wet, includes breaking ties and patching voids**	**166.7**	**SF**	**1.59**					**1.6**	**264**
0750	Concrete finishing, walls, sandblast, heavy penetration	24.0	SF	2.62	1.33		0.48		4.4	107
	Cast-In-Place Concrete Total									**132,991**
	04050 - Basic Masonry Materials And Methods									
	04070420 - Grouting									
0250	Grout, concrete masonry unit (CMU) cores, 8" thick, 0.258 C.F./S.F., pumped, excludes blockwork	6,400.0	SF	1.78	0.91		0.06		2.8	17,600
0350	Grout, concrete masonry unit (CMU) cores, 12" thick, 0.422 C.F./S.F., pumped, excludes blockwork	9,600.0	SF	1.90	1.48		0.06		3.4	33,027
	04080200 - Reinforcing									
0015	Masonry reinforcing bars, #3 and #4 reinforcing steel bars, placed horizontally, ASTM A615	2,137.6	lb	0.61	0.45				1.1	2,260

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
0020	Masonry reinforcing bars, #5 and #6 reinforcing steel bars, placed horizontally, ASTM A615	5,006.4	lb	0.35	0.45				0.8	3,984
0050	Masonry reinforcing bars, #3 and #4 reinforcing steel bars, placed vertically, ASTM A615	1,068.8	lb	0.78	0.45				1.2	1,319
0060	Masonry reinforcing bars, #5 and #6 reinforcing steel bars, placed vertically, ASTM A615	2,503.2	lb	0.42	0.45				0.9	2,182
	04080650 - Wall Ties									
0680	**[2x] Masonry anchors, cavity wall ties, Z type, galvanized, 6" long x 1/4" diameter**	**0.3**	**C**	**26.14**	**32.71**				**58.8**	**19**
	Basic Masonry Materials And Methods Total									**60,391**
	04700 - Manufactured Masonry									
	04720200 - Cultured Stone Veneer									
0360	Cultured stone veneer, weather resistant barrier, #15 felt, excludes scaffolding	9,600.0	sq	0.07	3.95				4.0	38,546
	Manufactured Masonry Total									**38,546**
	04800 - Masonry Assemblies									
	04810187 - Concrete Block, High Strength									
0600	Concrete block, high strength, hollow, 5000 psi, 8" x 8" x 16", includes mortar and horizontal joint reinforcing every other course, excludes scaffolding, grout and vertical reinforcing	6,400.0	SF	3.85	3.35				7.2	46,125
0650	Concrete block, high strength, hollow, 5000 psi, 12" x 8" x 16", includes mortar and horizontal joint reinforcing every other course, excludes scaffolding, grout and vertical reinforcing	9,600.0	SF	5.56	4.97				10.5	101,043
	Masonry Assemblies Total									**147,168**
	05010 - Misc Metals									
	05120440 - Lightweight Framing									
0020	Pump mounting base plate, complete w/ anchor bolts, 8 sf	3.0	each	435.96	1,671.17				2,107.1	6,321
	Misc Metals Total									**6,321**
	05050 - Basic Metal Materials & Methods									
	05090150 - Bolts & Hex Nuts									
1900	Bolt, hex head, plain steel, 5/8" dia x 6" L, A307, incl nut & washer	280.0	EA	3.18	1.63				4.8	1,347
	05090340 - Drilling									
0300	Concrete impact drilling, for anchors, up to 4" D, 1/2" dia, in concrete or brick walls and floors, incl bit & layout, excl anchor	340.0	EA	5.68	0.06				5.7	1,950
0400	**[2x] Concrete impact drilling, for anchors, up to 4" D, 5/8" dia, in concrete or brick walls and floors, incl bit & layout, excl anchor**	**873.0**	**EA**	**5.27**	**0.07**				**5.3**	**4,660**

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	05090380 - Expansion Anchors									
8250	Wedge anchor, carbon steel, 1/2" dia x 2-3/4" L, in concrete, brick or stone, excl layout & drilling	340.0	EA	2.02	0.86				2.9	978
8400	Wedge anchor, carbon steel, 5/8" dia x 8-1/2" L, in concrete, brick or stone, excl layout & drilling	560.0	EA	2.20	1.67				3.9	2,168
	05090540 - Machinery Anchors									
0800	Machinery anchor, heavy duty, 1" dia stud & bolt, incl sleeve, floating base nut, lower stud & coupling nut, fiber plug, connecting stud, washer & nut	12.0	EA	35.29	77.13		6.24		118.7	1,424
	05090900 - Welding Structural									
1800	Welding structural steel in field, 3 passes, 0.5 Lb/LF, 3/8" thick, continuous fillet, type 6011	40.0	LF	13.82	1.04		4.66		19.5	781
4010	Welding structural steel in field, cleaning & welding plates/bars/rods to existing beams/columns/trusses	200.0	LF	30.72	0.93		10.44		42.1	8,417
	05090920 - Steel Cutting									
0100	Cutting, steel, to 1/2" thick, by hand, incl prep, torch cutting & grinding, excl staging	280.0	LF	1.16			0.27		1.4	400
	Basic Metal Materials & Methods Total									**22,127**
	05100 - Structural Metal Framing									
	05120440 - Lightweight Framing									
0470	Angle framing, structural steel, 2"x2"x1/4", field fabricated, incl cutting & welding	140.0	LF	11.74	2.26		1.39		15.4	2,155
0476	Angle framing, structural steel, 3"x3"x3/8", field fabricated, incl cutting & welding	85.0	LF	20.76	5.74		2.45		29.0	2,461
0664	Channel framing, structural steel, field fabricated, C4x5.4, incl cutting & welding	490.0	LF	16.01	3.83		1.89		21.7	10,650
	05120560 - Plates									
0300	Steel plate, structural, for connections & stiffeners, 3/8" T, shop fabricated, incl shop primer	85.0	SF		20.30				20.3	1,725
	05120640 - Structural Steel Members									
0102	Structural steel member, 100-ton project, 1 to 2 story building, W6x9, A992 steel, shop fabricated, incl shop primer, bolted connections	200.0	LF	4.54	13.11		3.03		20.7	4,134
	Structural Metal Framing Total									**21,125**
	05400 - Cold-Formed Metal Framing									
	05425600 - Framing, Roof Trusses									
9010	LB framing, site fab roof trusses, to 4:12 pitch, 18 ga	10,000.0	lf	2.30	4.01				6.3	63,134
	Cold-Formed Metal Framing Total									**63,134**
	05500 - Metal Fabrications									

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	05520700 - Railing, Pipe									
0210	Railing, pipe, aluminum, clear finish, 3 rails, 3'-6" high, posts @ 5' O.C., 1-1/2" dia, shop fabricated	80.0	LF	11.60	62.66		1.02		75.3	6,023
	05530300 - Floor Grating, Aluminum									
0132	Floor grating, aluminum, 1-1/2" x 3/16" bearing bars @ 1-3/16" O.C., cross bars @ 4" O.C., up to 300 S.F., field fabricated from panels	800.0	SF	2.28	36.63		0.20		39.1	31,280
	05530360 - Grating Frame									
0020	Grating frame, aluminum, 1" to 1-1/2" D, field fabricated	120.0	LF	5.59	2.54				8.1	976
	Metal Fabrications Total									**38,278**
	06100 - Rough Carpentry									
	06160800 - Sheathing									
0207	Sheathing, plywood on roof, CDX, 5/8" thick, pneumatic nailed	21,200.0	SF	0.32	0.62				0.9	19,924
	Rough Carpentry Total									**19,924**
	07200 - Thermal Protection									
	07210950 - Wall Or Ceiling Insulation, Non-Rigid									
0260	Blanket insulation, for walls or ceilings, kraft faced fiberglass, 12" thick, R38, 23" wide	20,000.0	SF	0.19	0.99				1.2	23,598
	07260100 - Building Paper									
0400	Vapor Retarders, building paper, asphalt felt sheathing paper, 15#	212.0	sq	6.85	4.97				11.8	2,506
0900	Vapor Retarders, building paper, polyethylene vapor barrier, standard, .006" thick, 9' x 400' roll	200.0	sq	6.85	5.78				12.6	2,526
	Thermal Protection Total									**28,630**
	07300 - Shingles, Roof Tiles And Roof Coverings									
	07310100 - Asphalt Shingles									
0825	Asphalt Shingles, #30 felt underlayment	212.0	sq	4.05	9.95				14.0	2,969
	Shingles, Roof Tiles And Roof Coverings Total									**2,969**
	07400 - Roofing And Siding Panels									
	07410700 - Steel Roofing Panels									
0925	Steel roofing panels, on steel frame, flat profile, standard finish, 2" x 2" batten, 16-1/2" wide, 22 gauge	21,200.0	SF	1.66	5.26				6.9	146,664

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
1210	Steel roofing panels, on steel frame, ridge, galvanized, 20" wide	100.0	LF	1.99	5.14				7.1	712
	07460300 - Fascia									
0100	Fascia, aluminum, reverse board & batten, colored, .032" thick, excl. furring	200.0	SF	3.50	5.99				9.5	1,899
	Roofing And Siding Panels Total									**149,275**
	07700 - Roof Specialties And Accessories									
	07710400 - Downspouts									
0400	Aluminum downspouts, enameled, 3" x 4", .024" thick	56.0	LF	3.64	2.66				6.3	352
	07710450 - Drip Edge									
0020	Aluminum drip edge, mill finish, .016" thick, 5" wide	424.0	LF	0.63	0.44				1.1	454
	07710650 - Gutters									
0100	Aluminum gutters, stock units, enameled, 5" box, .027" thick	200.0	LF	4.24	2.55				6.8	1,359
	Roof Specialties And Accessories Total									**2,165**
	08100 - Metal Doors And Frames									
	08110200 - Commercial Steel Doors									
1860	Doors, commercial, steel, insulated, half glass, 18 ga., 3'-0" x 7'-0" x 1-3/4" thick	12.0	EA	31.67	568.40				600.1	7,201
	08110250 - Door Frames									
0200	Door frames, steel channels with anchors and bar stops, 8" channel@ 11.5 lb/LF, 6' x 8' door, weighs 275 lb	12.0	EA	158.03	485.10		13.88		657.0	7,884
	Metal Doors And Frames Total									**15,085**
	08400 - Entrances And Storefronts									
	08410110 - Aluminum-Framed Storefronts									
1100	Frames, aluminum, door, entrance, black finish, storefront, 3' x 10' opening, with 3' high transoms	12.0	Opng	107.61	514.50				622.1	7,465
	Entrances And Storefronts Total									**7,465**
	08700 - Hardware									
	08710300 - Door Closers									
0015	Door hardware, door closer, rack and pinion	12.0	EA	38.80	145.04				183.8	2,206
	08710340 - Doorstops									

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
0020	Door hardware, doorstops, holder and bumper, floor or wall	12.0	EA	7.92	32.83				40.7	489
	08710520 - Hinges									
1100	Door hardware, hinges, full mortise, high frequency, steel base, USP, 5" x 5"	18.0	pair		53.41				53.4	961
	08710550 - Kick Plate									
0020	Door hardware, kick plate, stainless steel, 6" high for 3' door	12.0	EA	17.02	30.38				47.4	569
	08710650 - Lockset									
1400	Door hardware, lockset, heavy duty, cylindrical, with sectional trim, keyed, single cylinder function	12.0	EA	25.34	205.80				231.1	2,774
	08720300 - Weatherstripping, Window									
2300	Weatherstripping, doors, metal frame, spring type, bronze, for 3' x 7' door	12.0	Opng	84.72	34.79				119.5	1,434
	08720800 - Thresholds									
0500	Thresholds, bronze	36.0	LF	4.24	37.73				42.0	1,511
	Hardware Total									**9,944**
	09000 - B & C Div 9 Coating Systems									
	09910640 - B & C coating specification									
0020	**[2x] Coatings & paints, B & C coating system E-2**	**70,000.0**	**sqft**	**0.23**	**0.85**				**1.1**	**75,880**
0090	Coatings & paints, B & C coating system EP-1(Pipe)	800.0	sqft	0.53	0.47				1.0	797
	B & C Div 9 Coating Systems Total									**76,677**
	09900 - Paints & Coatings									
	09910640 - B & C coating specification									
0090bc	Coatings & paints, B & C coating system EP-1	800.0	sqft	0.47	0.53				1.0	799
	Paints & Coatings Total									**799**
	11000 - Equipment									
	11000100 - Process Equipment									
0710	actiflo process unit, , complete	1.0	each	135,000.00	10,000,000.00		22,940.00		10,157,940.0	10,157,940
1250	Chemical tote	2.0	each	49.89	1,195.97				1,245.9	2,492
1250	Chemical tote spill containment tray	2.0	each	127.05	2,436.50		29.15		2,592.7	5,185
1320	Plate Press/Sludge Tank	1.0	each	75,000.00	2,000,000.00		1,346.50		2,076,346.5	2,076,347

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	11000800 - Chemical Metering Pumps									
0340	Pump, polymer addition	1.0	each	3,205.60	12,078.59				15,284.2	15,284
	11179150 - Waste Handling									
0010	Weight scale, polymer tote. including 4-20mA output (WS7411)	2.0	each	1,518.24	8,333.00				9,851.2	19,702
	Equipment Total									**12,276,950**
	13200 - Storage Tanks									
	13201300 - Prestressed Concrete Water Storage Tanks									
1000	Aboveground Water Utility Storage Tanks, steel, ground level, ht/dia less than 1, 250,000 gallons, excl. foundation	1.0	EA			184,000.00			184,000.0	184,000
3170	Storage Tanks, horizontal, steel, above ground, single wall, 20,000 gallon, incl. cradles, coating & fittings, excl. foundation, pumps or piping	1.0	EA	1,097.93	25,484.70				26,582.6	26,583
	Storage Tanks Total									**210,583**
	15010 - Misc. Mechanical									
	15050010 - Miscellaneous Mechanical									
0090	Pipe drain connection	4.0	each	86.63	103.45				190.1	760
0150	Utility stations, complete w/ valve, hose, rack,signage	8.0	each	245.44	371.37				616.8	4,934
0170	Emergency eyewash station, complete	4.0	each	288.75	1,034.53				1,323.3	5,293
	Misc. Mechanical Total									**10,988**
	15050 - Basic Materials & Methods									
	15050010 - Miscellaneous Mechanical									
0008	Piping, bldg srvc/domestic, allowance	1.0	lsum					30,000.00	30,000.0	30,000
	15080600 - Piping Insulation									
6890	Insulation, pipe covering (price copper tube one size less than I.P.S.), fiberglass with all service jacket, 1" wall, 1-1/2" iron pipe size	800.0	LF	5.23	1.21				6.4	5,154
	15080920 - Pipe Insulation Protective Jacketing, Aluminum									
0300	Pipe insulation, protective jacketing, aluminum, metal roll, aluminum with polykraft moisture barrier, smooth, .010" thick, 3-1/2" ID, cut from roll goods, size based on OD of insulation	720.0	LF	6.39	1.24				7.6	5,496
	Basic Materials & Methods Total									**40,650**
	15100 - Building Services Piping									

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	15107420 - Pipe, Copper									
2240	Pipe, copper, tubing, solder, 1-1/2" diameter, type L, includes coupling & clevis hanger assembly 10' O.C.	720.0	LF	8.88	16.10				25.0	17,989
	15107460 - Pipe Fittings, Copper									
0130	Copper Fitting 1"	32.0	EA	29.02	6.80				35.8	1,146
	15107660 - Pipe Fittings, Steel									
0700	Gasket and bolt set, for flanges, 150 lb., 8" pipe size	40.0	EA	92.40	16.95				109.4	4,374
6170	Flange, steel, stainless steel, slip-on, 150 lb., 8" pipe size, welded front and back, includes weld machine	32.0	EA	267.47	63.50		10.39		341.4	10,924
6190	Flange, steel, stainless steel, slip-on, 150 lb., 12" pipe size, welded front and back, includes weld machine	12.0	EA	1,074.78	367.20		41.50		1,483.5	17,802
	15108560 - Pipe Fittings, Plastic									
2330	Fitting,plastic, PVC, socket joint, 4", schedule 80	24.0	EA	53.14	80.50				133.6	3,207
	15110160 - Valves, Bronze									
1500	Valves, bronze, ball, threaded, 150 lb., 2"	8.0	EA	42.05	61.50				103.6	828
	15110500 - Valves, Plastic									
1770	Valves, plastic, CPVC, ball, single union, socket or threaded, 2"	12.0	EA	27.25	128.00				155.2	1,863
6480	Valves, plastic, PVC, Y sediment strainer, socket or threaded, 2"	4.0	EA	27.25	102.00				129.2	517
	15110800 - Valves, Stainless Steel									
1670	Valves, stainless steel, ball, threaded, 1-1/2"	68.0	EA	38.91	163.00				201.9	13,730
2200	Valves, stainless steel, butterfly, flanged, 150 lb., 4"	20.0	EA	152.15	1,040.00				1,192.2	23,843
2210	Valves, stainless steel, butterfly, flanged, 150 lb., 6"	56.0	EA	232.87	1,794.00				2,026.9	113,505
2220	Valves, stainless steel, gate, OS&Y, flanged, 150 lb., 8"	12.0	EA	693.82	7,215.00				7,908.8	94,906
2240	Valves, stainless steel, butterfly, flanged, 150 lb., 12"	12.0	EA	366.85	6,084.00				6,450.9	77,410
	15150200 - Cleanouts									
0200	Cleanout, floor type, round or square, scoriated nickel bronze top, 8" pipe size	4.0	EA	220.08	445.00				665.1	2,660
	15150300 - Floor And Area Drains									
2180	Drain, floor, heavy duty, cast iron, 12" diameter anti-tilt grate, 2", 3", 4", 5" and 6" pipe size	32.0	EA	87.53	410.00				497.5	15,921
	Building Services Piping Total									**400,625**

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	15195 - Pipe, steel, fittings									
	15200195 - Fittings, Steel									
0045	Pipe, steel ftngs, CI, standard weight, black, 90< elb, straight, 2"	80.0	each	48.77	10.70				59.5	4,757
	Pipe, steel, fittings Total									**4,757**
	15200 - Process Piping									
	15200211 - Pipe, 304 Stainless Steel									
0150	Pipe, SS, A778, wld, Sched. 10S, type 304L, 3" dia.	300.0	lnft	11.85	8.52		0.88		21.2	6,374
0170	Pipe, SS, A778, wld, Sched. 10S, type 304L, 6" dia.	88.0	lnft	18.43	18.72		1.36		38.5	3,389
0180	Pipe, SS, A778, wld, Sched. 10S, type 304L, 8" dia.	1,200.0	lnft	22.82	29.04		1.75		53.6	64,338
	15200216 - Fittings, 304 Stainless Steel									
2410	Fittings, SS, A774, butt weld jt, type 304L, sched. 10S, Tee, 6"	8.0	each	618.41	64.03		45.72		728.2	5,825
	15200230 - Pipe, Plastic, Double Wall									
0030	Pipe, PVC hi imp/press, dbl wal, sched 80, 1" dia	100.0	lnft	11.55	10.98				22.5	2,253
0060	**[2x] Pipe, PVC hi imp/press, dbl wall, sched 80, 4" dia**	**272.0**	**lnft**	**74.61**	**27.97**				**102.6**	**27,904**
0110	Pipe, plastic ftngs, PVC, dbl wall, sched 80, dbl90< elb, 2"	20.0	each	39.50	44.65				84.2	1,683
	Process Piping Total									**111,766**
	15240 - Pipe, pvc, fittings									
	15108560 - Pipe Fittings, Plastic									
1040	**[2x] PVC, hi impact/pressure, sched 80, tee, 8"**	**26.0**	**each**	**216.10**	**215.00**				**431.1**	**11,209**
3020	PVC flange, slip-on, Sch 80 std., 2"	144.0	each	33.76	13.65				47.4	6,827
	Pipe, pvc, fittings Total									**18,036**
	15285 - Valves, steel									
	15200255 - Valves, Iron Body									
1320	Ball valve, steel, 150 lb, flanged, 8" size	16.0	each	535.92	1,909.91				2,445.8	39,133
	Valves, steel Total									**39,133**
	15330 - Flexible connectors									
	15200330 - Flexible Connectors									

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
0160	Connectors, flex, corr, 2" I.D., wtr,	4.0	each	13.59	26.53				40.1	160
302	Connectors, flex, dismantling Joint, 6"	4.0	each	187.69	683.68				871.4	3,485
	Flexible connectors Total									**3,646**
	15350 - Sleeves and escutcheons									
	15200330 - Flexible Connectors									
0100	Pipe sleeve, stl, wtr stop, 12" L w/link seal, 10" dia for 6" carrier	8.0	each	109.72	140.00				249.7	1,998
	Sleeves and escutcheons Total									**1,998**
	15400 - Plumbing Fixtures & Equipment									
	15414200 - Industrial Safety Fixtures									
6000	Industrial safety fixture, shower, single head, drench, ball valve, pull, freestanding, multi-nozzle eye/face wash combination, excludes rough-in	4.0	EA	220.08	590.00				810.1	3,240
	Plumbing Fixtures & Equipment Total									**3,240**
	15700 - Heating/Ventilating/Air Conditioning Equipment									
	15700100 - HVAC Allowance									
0010	HVAC heating, cooling allowance, $12.00/sf	20,000.0	sqft			11.00			11.0	220,000
	Heating/Ventilating/Air Conditioning Equipment Total									**220,000**
	15950 - Testing/Adjusting/Balancing									
	15955700 - Piping, Testing									
0320	Pipe testing, nondestructive hydraulic pressure test, isolate, 1 hour hold, 6" to 10" pipe, 0 - 250 L.F.	28.0	EA	2,296.32					2,296.3	64,297
	Testing/Adjusting/Balancing Total									**64,297**
	16000 - Electrical and Instrumentation									
	16000001 - Electrical and Instrumentation									
0001	Allowance - Electrical and Instrumentation Subcontract - 25%	1.0	Lsum			2,210,000.00			2,210,000.0	2,210,000
	Electrical and Instrumentation Total									**2,210,000**

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	2.7 Effluent MF, RO, and ZLD									
	Effluent Mircrofiltration, Reverse Osmosis and Zero Liquid Discharge									**25,971,004**
	01500 - Temporary Facilities & Controls									
	01540750 - Scaffolding									
2850	Scaffolding, steel tubular, regular, accessory, plank, rent/mo, 2" x 10" x 16' long	384.0	EA		6.00				6.0	2,304
3250	Scaffolding, steel tubular, heavy duty shoring, frame, rent/mo, 5' high x 2' & 4' wide	2,304.0	EA		5.00				5.0	11,520
3700	Scaffolding, steel tubular, heavy duty shoring, accessory, base plate, rent/mo, 8" x 8"	548.6	EA		1.00				1.0	549
3750	Scaffolding, steel tubular, heavy duty shoring, accessory, leveling jack, rent/mo	864.0	EA		2.00				2.0	1,728
9005bc	Scaffolding assembly and disassembly, ENCLOSED	13,440.0	sqft	0.88			0.35		1.2	16,525
	Temporary Facilities & Controls Total									**32,625**
	01590 - Miscellaneous Equipment Rental without operators									
	01590600 - Lifting and hoisting equipment rental without operators									
0300D	Rent crane climbing 101 foot jib, 10,250 lb 270 fpm - Rent per month	1.0	mnth				16,700.00		16,700.0	16,700
	Miscellaneous Equipment Rental without operators Total									**16,700**
	02300 - Earthwork									
	02315120 - Backfill, Structural									
4420	**[3x] Backfill, structural, common earth, 200 H.P. dozer, 300' haul**	**162.9**	**L.C.Y.**	**0.67**			**1.37**		**2.0**	**333**
	02315310 - Compaction, General									
7500	**[3x] Compaction, 2 passes, 24" wide, 6" lifts, walk behind, vibrating roller**	**146.6**	**E.C.Y.**	**1.18**			**0.33**		**1.5**	**221**
7520	**[3x] Compaction, 3 passes, 24" wide, 6" lifts, walk behind, vibrating roller**	**272.6**	**E.C.Y.**	**1.77**			**0.48**		**2.3**	**614**
7540	**[3x] Compaction, 4 passes, 24" wide, 6" lifts, walk behind, vibrating roller**	**817.8**	**E.C.Y.**	**2.36**			**0.64**		**3.0**	**2,458**
	02315492 - Hauling									
0009	**[3x] Loading Trucks, F.E. Loader, 3 C.Y.**	**1,677.5**	**cuyd**	**0.51**			**0.95**		**1.5**	**2,442**
4498	**[3x] Cycle hauling(wait, load,travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 25 min load/wait/unload, 20 CY truck, cycle 20 miles, 45 MPH, no loading equipment**	**1,677.5**	**L.C.Y.**	**1.10**			**3.15**		**4.2**	**7,126**
	02315610 - Excavating, Trench									

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
0060	**[3x] Excavating, trench or continuous footing, common earth, 1/2 C.Y. excavator, 1' to 4' deep, excludes sheeting or dewatering**	**1,504.4**	**B.C.Y.**	**3.07**			**1.60**		**4.7**	**7,035**
	02315640 - Utility Bedding									
0100	**[3x] Fill by borrow and utility bedding, for pipe and conduit, crushed stone, 3/4" to 1/2", excludes compaction**	**950.9**	**L.C.Y.**	**5.64**	**46.63**		**1.83**		**54.1**	**51,440**
	Earthwork Total									**71,669**
	02700 - Bases, Ballasts, Pavements & Appurtenances									
	02000000 - General Civil Work									
0990	Allowance - Site Work - 2%	1.0	LSUM	26,544.68	366,165.79		51,289.53		444,000.0	444,000
	Bases, Ballasts, Pavements & Appurtenances Total									**444,000**
	03100 - Concrete Forms & Accessories									
	03110425 - Forms In Place, Equipment Foundations									
0050	C.I.P. concrete forms, equipment foundations, 2 use, includes erecting, bracing, stripping and cleaning	384.0	sfca	8.02	1.81				9.8	3,773
	03110445 - Forms In Place, Slab On Grade									
3050	**[3x] C.I.P. concrete forms, slab on grade, edge, wood, 7" to 12" high, 4 use, includes erecting, bracing, stripping and cleaning**	**848.0**	**sfca**	**2.29**	**0.67**				**3.0**	**2,518**
	Concrete Forms & Accessories Total									**6,291**
	03200 - Concrete Reinforcement									
	03210600 - Reinforcing In Place									
0602	**[4x] Reinforcing steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories**	**70,180.0**	**lb**	**0.33**	**0.45**				**0.8**	**55,171**
2000	**[4x] Reinforcing steel, unload and sort, add to base**	**36.5**	**ton**	**24.65**			**7.36**		**32.0**	**1,168**
2210	**[4x] Reinforcing steel, crane cost for handling, average, add**	**36.5**	**ton**	**26.66**			**8.01**		**34.7**	**1,265**
2420	Reinforcing steel, in place, dowels, deformed, 2' long, #5, A615, grade 60	368.0	EA	1.61	1.03				2.6	972
	Concrete Reinforcement Total									**58,577**
	03300 - Cast-In-Place Concrete									
	03310220 - Concrete, Ready Mix Normal Weight									

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
0300	**[4x] Structural concrete, ready mix, normal weight, 4000 PSI, includes local aggregate, sand, Portland cement and water, delivered, excludes all additives and treatments**	**647.9**	**CY**		**100.00**				**100.0**	**64,790**
	03310700 - Placing Concrete									
4650	**[4x] Structural concrete, placing, slab on grade, pumped, over 6" thick, includes vibrating, excludes material**	**647.9**	**CY**	**11.38**			**3.98**		**15.4**	**9,951**
	03350300 - Finishing Floors									
0150	**[3x] Concrete finishing, floors, manual screed, bull float, manual float, broom finish**	**14,861.3**	**SF**	**0.43**					**0.4**	**6,397**
	03350350 - Finishing Walls									
0150	Concrete finishing, walls, carborundum rub, wet, includes breaking ties and patching voids	384.0	SF	1.59					1.6	609
0750	Concrete finishing, walls, sandblast, heavy penetration	320.0	SF	2.62	1.53		0.48		4.6	1,484
	Cast-In-Place Concrete Total									**83,231**
	04050 - Basic Masonry Materials And Methods									
	04070420 - Grouting									
0250	Grout, concrete masonry unit (CMU) cores, 8" thick, 0.258 C.F./S.F., pumped, excludes blockwork	5,600.0	SF	1.78	0.96		0.06		2.8	15,677
0350	Grout, concrete masonry unit (CMU) cores, 12" thick, 0.422 C.F./S.F., pumped, excludes blockwork	7,840.0	SF	1.90	1.56		0.06		3.5	27,604
	04080200 - Reinforcing									
0015	Masonry reinforcing bars, #3 and #4 reinforcing steel bars, placed horizontally, ASTM A615	1,870.4	lb	0.61	0.45				1.1	1,977
0020	Masonry reinforcing bars, #5 and #6 reinforcing steel bars, placed horizontally, ASTM A615	4,088.6	lb	0.35	0.45				0.8	3,253
0050	Masonry reinforcing bars, #3 and #4 reinforcing steel bars, placed vertically, ASTM A615	935.2	lb	0.78	0.45				1.2	1,154
0060	Masonry reinforcing bars, #5 and #6 reinforcing steel bars, placed vertically, ASTM A615	2,044.3	lb	0.42	0.45				0.9	1,782
	04080650 - Wall Ties									
0680	**[2x] Masonry anchors, cavity wall ties, Z type, galvanized, 6" long x 1/4" diameter**	**0.3**	**C**	**26.14**	**34.48**				**60.6**	**17**
	Basic Masonry Materials And Methods Total									**51,465**
	04700 - Manufactured Masonry									
	04720200 - Cultured Stone Veneer									
0360	Cultured stone veneer, weather resistant barrier, #15 felt, excludes scaffolding	8,000.0	sq	0.07	3.95				4.0	32,122

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	Manufactured Masonry Total									**32,122**
	04800 - Masonry Assemblies									
	04810187 - Concrete Block, High Strength									
0600	Concrete block, high strength, hollow, 5000 psi, 8" x 8" x 16", includes mortar and horizontal joint reinforcing every other course, excludes scaffolding, grout and vertical reinforcing	5,600.0	SF	3.85	3.54				7.4	41,380
0650	Concrete block, high strength, hollow, 5000 psi, 12" x 8" x 16", includes mortar and horizontal joint reinforcing every other course, excludes scaffolding, grout and vertical reinforcing	7,840.0	SF	5.56	5.24				10.8	84,635
	Masonry Assemblies Total									**126,016**
	05010 - Misc Metals									
	05120440 - Lightweight Framing									
0020	Pump mounting base plate, complete w/ anchor bolts, 8 sf	4.0	each	435.96	1,671.17				2,107.1	8,429
	Misc Metals Total									**8,429**
	05050 - Basic Metal Materials & Methods									
	05090150 - Bolts & Hex Nuts									
1900	Bolt, hex head, plain steel, 5/8" dia x 6" L, A307, incl nut & washer	1,000.0	EA	3.18	1.63				4.8	4,811
	05090340 - Drilling									
0300	Concrete impact drilling, for anchors, up to 4" D, 1/2" dia, in concrete or brick walls and floors, incl bit & layout, excl anchor	332.0	EA	5.07	0.05				5.1	1,701
0400	**[2x] Concrete impact drilling, for anchors, up to 4" D, 5/8" dia, in concrete or brick walls and floors, incl bit & layout, excl anchor**	**3,368.0**	**EA**	**5.27**	**0.07**				**5.3**	**17,979**
	05090380 - Expansion Anchors									
8250	Wedge anchor, carbon steel, 1/2" dia x 2-3/4" L, in concrete, brick or stone, excl layout & drilling	332.0	EA	1.81	0.76				2.6	853
8400	Wedge anchor, carbon steel, 5/8" dia x 8-1/2" L, in concrete, brick or stone, excl layout & drilling	2,000.0	EA	2.20	1.67				3.9	7,743
	05090540 - Machinery Anchors									
0800	Machinery anchor, heavy duty, 1" dia stud & bolt, incl sleeve, floating base nut, lower stud & coupling nut, fiber plug, connecting stud, washer & nut	64.0	EA	35.29	77.62		6.24		119.1	7,625
	05090900 - Welding Structural									
1800	Welding structural steel in field, 3 passes, 0.5 Lb/LF, 3/8" thick, continuous fillet, type 6011	14.0	LF	12.34	0.93		4.16		17.4	244
	05090920 - Steel Cutting									

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
0100	Cutting, steel, to 1/2" thick, by hand, incl prep, torch cutting & grinding, excl staging	1,000.0	LF	1.16			0.27		1.4	1,430
	Basic Metal Materials & Methods Total									**42,386**
	05100 - Structural Metal Framing									
	05120440 - Lightweight Framing									
0470	Angle framing, structural steel, 2"x2"x1/4", field fabricated, incl cutting & welding	500.0	LF	11.74	2.26		1.39		15.4	7,697
0476	**[2x] Angle framing, structural steel, 3"x3"x3/8", field fabricated, incl cutting & welding**	**683.0**	**LF**	**18.54**	**5.12**		**2.19**		**25.8**	**17,655**
0664	Channel framing, structural steel, field fabricated, C4x5.4, incl cutting & welding	1,750.0	LF	16.01	3.83		1.89		21.7	38,036
	05120560 - Plates									
0300	Steel plate, structural, for connections & stiffeners, 3/8" T, shop fabricated, incl shop primer	83.0	SF		18.12				18.1	1,504
	05120640 - Structural Steel Members									
0102	Structural steel member, 100-ton project, 1 to 2 story building, W6x9, A992 steel, shop fabricated, incl shop primer, bolted connections	496.0	LF	4.05	11.70		2.70		18.5	9,154
1302	**[2x] Structural steel member, 100-ton project, 1 to 2 story building, W12x22, A992 steel, shop fabricated, incl shop primer, bolted connections**	**1,697.0**	**LF**	**2.76**	**28.76**		**1.85**		**33.4**	**56,631**
	Structural Metal Framing Total									**130,677**
	05500 - Metal Fabrications									
	05520700 - Railing, Pipe									
0210	**[2x] Railing, pipe, aluminum, clear finish, 3 rails, 3'-6" high, posts @ 5' O.C., 1-1/2" dia, shop fabricated**	**574.0**	**LF**	**10.36**	**55.95**		**0.91**		**67.2**	**38,582**
	05530300 - Floor Grating, Aluminum									
0132	**[2x] Floor grating, aluminum, 1-1/2" x 3/16" bearing bars @ 1-3/16" O.C., cross bars @ 4" O.C., up to 300 S.F., field fabricated from panels**	**1,580.0**	**SF**	**2.03**	**32.70**		**0.18**		**34.9**	**55,159**
	05530360 - Grating Frame									
0020	**[2x] Grating frame, aluminum, 1" to 1-1/2" D, field fabricated**	**1,548.0**	**LF**	**4.99**	**2.27**				**7.3**	**11,237**
	Metal Fabrications Total									**104,978**
	08100 - Metal Doors And Frames									
	08110200 - Commercial Steel Doors									
0100	Doors, hollow metal, commercial, steel, flush, full panel, hollow core, 1-3/8" thick, 20 ga., 3'-0" x 7'-0"	8.0	EA	29.69	289.10				318.8	2,550

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	08110250 - Door Frames									
0100	Door frames, steel channels with anchors and bar stops, 6" channel@ 8.2 lb/LF, 3' x 7' door, weighs 150 lb	8.0	EA	108.96	264.60		9.60		383.2	3,065
	Metal Doors And Frames Total									**5,616**
	08700 - Hardware									
	08710300 - Door Closers									
0015	Door hardware, door closer, rack and pinion	8.0	EA	38.80	145.04				183.8	1,471
	08710340 - Doorstops									
0020	Door hardware, doorstops, holder and bumper, floor or wall	8.0	EA	7.92	32.83				40.7	326
	08710520 - Hinges									
0100	Door hardware, hinges, full mortise, average frequency, steel base, USP, 5" x 5"	12.0	pair		40.18				40.2	482
	08710550 - Kick Plate									
0020	Door hardware, kick plate, stainless steel, 6" high for 3' door	8.0	EA	17.02	30.38				47.4	379
	08710700 - Mortise Lockset									
0020	Door hardware, mortise lockset, commercial, wrought knobs and full escutcheon trim, non-keyed, passage, minimum	8.0	EA	28.11	171.50				199.6	1,597
	08720300 - Weatherstripping, Window									
2300	Weatherstripping, doors, metal frame, spring type, bronze, for 3' x 7' door	8.0	Opng	84.72	34.79				119.5	956
	08720800 - Thresholds									
0500	Thresholds, bronze	24.0	LF	4.24	37.73				42.0	1,007
	Hardware Total									**6,218**
	09000 - B & C Div 9 Coating Systems									
	09910640 - B & C coating specification									
0020	**[2x] Coatings & paints, B & C coating system E-2**	**90,000.0**	**sqft**	**0.23**	**0.85**				**1.1**	**97,560**
0090	Coatings & paints, B & C coating system EP-1(Pipe)	1,200.0	sqft	0.53	0.47				1.0	1,196
	B & C Div 9 Coating Systems Total									**98,756**
	09900 - Paints & Coatings									
	09910640 - B & C coating specification									

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
0090bc	**[2x] Coatings & paints, B & C coating system EP-1**	**3,920.0**	**sqft**	**0.42**	**0.47**				**0.9**	**3,494**
	Paints & Coatings Total									**3,494**
	11000 - Equipment									
	11000100 - Process Equipment									
0719	Microfiltration unit - ZW 500d (3 trains of 7 cassettes) 7mgd	1.0	each	47,985.60	5,800,000.00				5,847,985.6	5,847,986
0719	Reverse Osmosis - GE Pro 45AP60 -	1.0	each	63,980.80	5,200,000.00				5,263,980.8	5,263,981
0719	Evaporator system - 500 gpm	1.0	each	83,974.80	6,300,000.00				6,383,974.8	6,383,975
0719	Crystallizer - 30 gpm	1.0	each	31,990.40	2,500,000.00				2,531,990.4	2,531,990
1250	Chemical tote spill containment tray	3.0	each	127.05	2,436.50		29.15		2,592.7	7,778
	11179150 - Waste Handling									
0010	Weight scale, polymer tote. including 4-20mA output (WS7411)	3.0	each	1,518.24	8,333.00				9,851.2	29,554
	Equipment Total									**20,065,263**
	15001 - Pipe, Water Supply									
	15001002 - Water Supply, Ductile Iron Pipe									
2060	Water supply distribution piping, ductile iron pipe, cement lined, mechanical joint, no fittings, 18' lengths, 8" diameter, class 50, excludes excavation or backfill	1,800.0	LF	14.81	19.70		4.21		38.7	69,705
	Pipe, Water Supply Total									**69,705**
	15010 - Misc. Mechanical									
	15050010 - Miscellaneous Mechanical									
0090	Pipe drain connection	6.0	each	86.63	103.45				190.1	1,140
0150	Utility stations, complete w/ valve, hose, rack,signage	12.0	each	245.44	371.37				616.8	7,402
0170	Emergency eyewash station, complete	6.0	each	288.75	1,034.53				1,323.3	7,940
	Misc. Mechanical Total									**16,482**
	15050 - Basic Materials & Methods									
	15050010 - Miscellaneous Mechanical									
0008	Piping, bldg srvc/domestic, allowance	1.0	lsum					25,000.00	25,000.0	25,000
	15080600 - Piping Insulation									

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
6890	Insulation, pipe covering (price copper tube one size less than I.P.S.), fiberglass with all service jacket, 1" wall, 1-1/2" iron pipe size	1,200.0	LF	5.23	1.21				6.4	7,731
	15080920 - Pipe Insulation Protective Jacketing, Aluminum									
0300	Pipe insulation, protective jacketing, aluminum, metal roll, aluminum with polykraft moisture barrier, smooth, .010" thick, 3-1/2" ID, cut from roll goods, size based on OD of insulation	1,080.0	LF	6.39	1.24				7.6	8,244
	Basic Materials & Methods Total									**40,974**
	15100 - Building Services Piping									
	15107420 - Pipe, Copper									
2240	Pipe, copper, tubing, solder, 1-1/2" diameter, type L, includes coupling & clevis hanger assembly 10' O.C.	1,080.0	LF	8.88	16.10				25.0	26,983
	15107460 - Pipe Fittings, Copper									
0130	Copper Fitting 1"	48.0	EA	29.02	6.80				35.8	1,720
	15107660 - Pipe Fittings, Steel									
0700	Gasket and bolt set, for flanges, 150 lb., 8" pipe size	60.0	EA	92.40	16.95				109.4	6,561
6170	Flange, steel, stainless steel, slip-on, 150 lb., 8" pipe size, welded front and back, includes weld machine	48.0	EA	267.47	63.50		10.39		341.4	16,385
6190	Flange, steel, stainless steel, slip-on, 150 lb., 12" pipe size, welded front and back, includes weld machine	18.0	EA	1,074.78	367.20		41.50		1,483.5	26,703
	15108560 - Pipe Fittings, Plastic									
2330	Fitting,plastic, PVC, socket joint, 4", schedule 80	36.0	EA	53.14	80.50				133.6	4,811
	15110160 - Valves, Bronze									
1500	Valves, bronze, ball, threaded, 150 lb., 2"	12.0	EA	42.05	61.50				103.6	1,243
	15110500 - Valves, Plastic									
1770	Valves, plastic, CPVC, ball, single union, socket or threaded, 2"	18.0	EA	27.25	128.00				155.2	2,794
6480	Valves, plastic, PVC, Y sediment strainer, socket or threaded, 2"	6.0	EA	27.25	102.00				129.2	775
	15110800 - Valves, Stainless Steel									
1670	Valves, stainless steel, ball, threaded, 1-1/2"	102.0	EA	38.91	163.00				201.9	20,594
2200	Valves, stainless steel, butterfly, flanged, 150 lb., 4"	30.0	EA	152.15	1,040.00				1,192.2	35,765
2210	Valves, stainless steel, butterfly, flanged, 150 lb., 6"	84.0	EA	232.87	1,794.00				2,026.9	170,257
2220	Valves, stainless steel, gate, OS&Y, flanged, 150 lb., 8"	18.0	EA	693.82	7,215.00				7,908.8	142,359

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
2240	Valves, stainless steel, butterfly, flanged, 150 lb., 12"	18.0	EA	366.85	6,084.00				6,450.9	116,115
	15150200 - Cleanouts									
0200	Cleanout, floor type, round or square, scoriated nickel bronze top, 8" pipe size	6.0	EA	220.08	445.00				665.1	3,990
	15150300 - Floor And Area Drains									
2180	Drain, floor, heavy duty, cast iron, 12" diameter anti-tilt grate, 2", 3", 4", 5" and 6" pipe size	48.0	EA	87.53	410.00				497.5	23,881
	Building Services Piping Total									**600,938**
	15195 - Pipe, steel, fittings									
	15200195 - Fittings, Steel									
0045	Pipe, steel ftngs, CI, standard weight, black, 90< elb, straight, 2"	120.0	each	48.77	10.70				59.5	7,136
	Pipe, steel, fittings Total									**7,136**
	15200 - Process Piping									
	15200211 - Pipe, 304 Stainless Steel									
0150	Pipe, SS, A778, wld, Sched. 10S, type 304L, 3" dia.	450.0	lnft	11.85	8.52		0.88		21.2	9,561
0170	Pipe, SS, A778, wld, Sched. 10S, type 304L, 6" dia.	132.0	lnft	18.43	18.72		1.36		38.5	5,084
	15200216 - Fittings, 304 Stainless Steel									
2410	Fittings, SS, A774, butt weld jt, type 304L, sched. 10S, Tee, 6"	12.0	each	618.41	64.03		45.72		728.2	8,738
	15200230 - Pipe, Plastic, Double Wall									
0030	Pipe, PVC hi imp/press, dbl wal, sched 80, 1" dia	150.0	lnft	11.55	10.98				22.5	3,379
0060	Pipe, PVC hi imp/press, dbl wall, sched 80, 4" dia	258.0	lnft	74.61	27.97				102.6	26,468
0110	Pipe, plastic ftngs, PVC, dbl wall, sched 80, dbl90< elb, 2"	30.0	each	39.50	44.65				84.2	2,525
	Process Piping Total									**55,754**
	15240 - Pipe, pvc, fittings									
	15108560 - Pipe Fittings, Plastic									
1040	PVC, hi impact/pressure, sched 80, tee, 8"	24.0	each	216.10	215.00				431.1	10,346
3020	PVC flange, slip-on, Sch 80 std., 2"	216.0	each	33.76	13.65				47.4	10,241
	Pipe, pvc, fittings Total									**20,587**
	15285 - Valves, steel									

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	15200255 - Valves, Iron Body									
1320	Ball valve, steel, 150 lb, flanged, 8" size	24.0	each	535.92	1,909.91				2,445.8	58,700
	Valves, steel Total									**58,700**
	15330 - Flexible connectors									
	15200330 - Flexible Connectors									
0160	Connectors, flex, corr, 2" I.D., wtr,	6.0	each	13.59	26.53				40.1	241
302	Connectors, flex, dismantling Joint, 6"	6.0	each	187.69	683.68				871.4	5,228
	Flexible connectors Total									**5,469**
	15350 - Sleeves and escutcheons									
	15200330 - Flexible Connectors									
0100	Pipe sleeve, stl, wtr stop, 12" L w/link seal, 10" dia for 6" carrier	12.0	each	109.72	140.00				249.7	2,997
	Sleeves and escutcheons Total									**2,997**
	15400 - Plumbing Fixtures & Equipment									
	15414200 - Industrial Safety Fixtures									
6000	Industrial safety fixture, shower, single head, drench, ball valve, pull, freestanding, multi-nozzle eye/face wash combination, excludes rough-in	6.0	EA	220.08	590.00				810.1	4,860
	Plumbing Fixtures & Equipment Total									**4,860**
	15700 - Heating/Ventilating/Air Conditioning Equipment									
	15700100 - HVAC Allowance									
0010	HVAC heating, cooling allowance, $12.00/sf	16,000.0	sqft			11.00			11.0	176,000
	Heating/Ventilating/Air Conditioning Equipment Total									**176,000**
	15950 - Testing/Adjusting/Balancing									
	15955700 - Piping, Testing									
0320	Pipe testing, nondestructive hydraulic pressure test, isolate, 1 hour hold, 6" to 10" pipe, 0 - 250 L.F.	42.0	EA	4,592.64					4,592.6	192,891
	Testing/Adjusting/Balancing Total									**192,891**
	16000 - Electrical and Instrumentation									
	16000001 - Electrical and Instrumentation									

Item	Item Description	Qty	Unit	Labor $/Unit	Materials $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
0001	Allowance - Electrical and Instrumentation Subcontract - 25%	1.0	Lsum			3,330,000.00			3,330,000.0	3,330,000
	Electrical and Instrumentation Total									**3,330,000**

Category	Percent	Amount	Hours
2.2 Coagulation and Sedimentation in Primary Clarifier Totals			
Labor	**0.18 %**	**87,988**	**2,415.5**
Material	**0.45 %**	**215,342**	
Subcontractor	**0.42 %**	**200,490**	
Equipment	**0.02 %**	**7,574**	**66.6**
Other			
User			
Net Costs		**511,394**	
Labor Mark-up	10.00 %	8,799	
Material Mark-up	5.00 %	10,767	
Subcontractor Mark-up	5.00 %	10,025	
Equipment Mark-up	5.00 %	379	
Sales tax	7.00 %	15,604	
Material Shipping & Handling	2.00 %	3,145	
Escalation to Midpoint	2.40 %	12,273	
Subtotal		**572,386**	
Contractor General Conditions	10.00 %	57,239	
Subtotal		**629,625**	
Start-up, training, O & M	2.00 %		
Subtotal		**629,625**	
Construction Contingency	30.00 %	188,888	
Subtotal		**818,513**	
Bldg Risk, Liability Auto Ins.	2.00 %	16,370	

Category	Percent	Amount	Hours
Subtotal		**834,883**	
Bonds	1.50 %	12,523	
Subtotal		**847,406**	
Georgia Pacific contractor Division	10.00 %	84,741	
Subtotal		**932,147**	
Total 2.2 Coagulation and Sedimentation in Primary Clarifier		**932,147**	
2.3A Dewatering Primary Solids - Current Operation Totals			
Labor	**0.40 %**	**192,269**	**4,617.7**
Material	**3.30 %**	**1,573,434**	
Subcontractor	**0.66 %**	**316,000**	
Equipment	**0.06 %**	**27,137**	**559.4**
Other	**0.00 %**	**225**	
User			
Net Costs		**2,109,065**	
Labor Mark-up	10.00 %	19,227	
Material Mark-up	5.00 %	78,672	
Subcontractor Mark-up	5.00 %	15,800	
Equipment Mark-up	5.00 %	1,357	
Sales tax	7.00 %	112,040	
Material Shipping & Handling	2.00 %	22,764	
Escalation to Midpoint	2.80 %	59,048	

Category	Percent	Amount	Hours
Subtotal		**2,417,972**	
Contractor General Conditions	10.00 %	241,797	
Subtotal		**2,659,769**	
Start-up, training, O & M	2.00 %		
Subtotal		**2,659,769**	
Construction Contingency	30.00 %	797,931	
Subtotal		**3,457,700**	
Bldg Risk, Liability Auto Ins.	2.00 %	69,154	
Subtotal		**3,526,854**	
Bonds	1.50 %	52,903	
Subtotal		**3,579,757**	
Georgia Pacific contractor Division	10.00 %	357,976	
Subtotal		**3,937,732**	
Total 2.3A Dewatering Primary Solids - Current Operation		**3,937,732**	
2.3B Dewatering Primary Solids - With Alum Dosing Totals			
Labor	**0.56 %**	**269,370**	**6,895.5**
Material	**2.72 %**	**1,299,484**	
Subcontractor	**0.97 %**	**462,500**	
Equipment	**0.07 %**	**32,655**	**714.0**
Other	**0.04 %**	**20,338**	
User			

Category	Percent	Amount	Hours
Net Costs		**2,084,347**	
Labor Mark-up	10.00 %	26,937	
Material Mark-up	5.00 %	64,974	
Subcontractor Mark-up	5.00 %	23,125	
Equipment Mark-up	5.00 %	1,633	
Sales tax	7.00 %	93,250	
Material Shipping & Handling	2.00 %	16,599	
Escalation to Midpoint	3.50 %	72,952	
Subtotal		**2,383,817**	
Contractor General Conditions	10.00 %	238,382	
Subtotal		**2,622,198**	
Start-up, training, O & M	2.00 %		
Subtotal		**2,622,198**	
Construction Contingency	30.00 %	786,659	
Subtotal		**3,408,858**	
Bldg Risk, Liability Auto Ins.	2.00 %	68,177	
Subtotal		**3,477,035**	
Bonds	1.50 %	52,156	
Subtotal		**3,529,190**	
Georgia Pacific contractor Division	10.00 %	352,919	
Subtotal		**3,882,109**	
Total 2.3B Dewatering Primary Solids - With Alum Dosing		**3,882,109**	

Category	Percent	Amount	Hours
Labor	**1.78 %**	**852,159**	**21,575.6**
Material	**28.18 %**	**13,455,916**	
Subcontractor	**5.47 %**	**2,614,000**	
Equipment	**0.24 %**	**116,893**	**3,312.2**
Other	**0.06 %**	**30,000**	
User			
Net Costs		**17,068,968**	
Labor Mark-up	10.00 %	85,216	
Material Mark-up	5.00 %	672,796	
Subcontractor Mark-up	5.00 %	130,700	
Equipment Mark-up	5.00 %	5,845	
Sales tax	7.00 %	950,097	
Material Shipping & Handling	2.00 %	241,230	
Escalation to Midpoint	3.50 %	597,414	
Subtotal		**19,752,264**	
Contractor General Conditions	10.00 %	1,975,226	
Subtotal		**21,727,491**	
Start-up, training, O & M	2.00 %		
Subtotal		**21,727,491**	
Construction Contingency	30.00 %	6,518,247	
Subtotal		**28,245,738**	
Bldg Risk, Liability Auto Ins.	2.00 %	564,915	
Subtotal		**28,810,653**	

Category	Percent	Amount	Hours
Bonds	1.50 %	432,160	
Subtotal		**29,242,813**	
Georgia Pacific contractor Division	10.00 %	2,924,281	
Subtotal		**32,167,094**	
Total 2.5 Effluent Coagulation and Sedimentation		**32,167,094**	
2.7 Effluent MF, RO, and ZLD Totals			
Labor	**2.03 %**	**971,297**	**23,851.4**
Material	**44.73 %**	**21,358,376**	
Subcontractor	**7.34 %**	**3,506,000**	
Equipment	**0.23 %**	**110,332**	**2,298.2**
Other	**0.05 %**	**25,000**	
User			
Net Costs		**25,971,004**	
Labor Mark-up	10.00 %	97,130	
Material Mark-up	5.00 %	1,067,919	
Subcontractor Mark-up	5.00 %	175,300	
Equipment Mark-up	5.00 %	5,517	
Sales tax	7.00 %	1,502,810	
Material Shipping & Handling	2.00 %	396,646	
Escalation to Midpoint	5.70 %	1,480,347	
Subtotal		**30,696,672**	
Contractor General Conditions	10.00 %	3,069,667	

Category	Percent	Amount	Hours
Subtotal		**33,766,340**	
Start-up, training, O & M	2.00 %		
Subtotal		**33,766,340**	
Construction Contingency	30.00 %	10,129,902	
Subtotal		**43,896,241**	
Bldg Risk, Liability Auto Ins.	2.00 %	877,925	
Subtotal		**44,774,166**	
Bonds	1.50 %	671,612	
Subtotal		**45,445,779**	
Georgia Pacific contractor Division	10.00 %	4,544,578	
Subtotal		**49,990,357**	
Total 2.7 Effluent MF, RO, and ZLD		**49,990,357**	

BROWN AND CALDWELL

Environmental Engineers & Consultants

SUMMARY ESTIMATE REPORT WITH MARK-UPS ALLOCATED

Pond 4 Bypass Pipeline
Conceptual Level Estimate

Project Number:	138882-005
BC Project Manager:	Thomas Steinwinder
BC Office:	Tennessee
Estimate Issue Number:	01
Estimate Original Issue Date:	2010-03-05
Lead Estimator:	Des Orsinelli
Estimate QA/QC Reviewer:	Butch Matthews
Estimate QA/QC Date:	2010-03-04

Georgia Pacific

Pond 4 Bypass Pipeline
Conceptual Level Estimate

Description		Total w/ Markups Allocated
--- Base Estimate ---		1,021,485
Pond 4 Bypass		
01590 - Miscellaneous Equipment Rental without operators		875
02200 - Site Preparation		19,690
02300 - Earthwork		37,869
02600 - Drainage & Containment		698,326
02700 - Bases, Ballasts, Pavements & Appurtenances		4,983
03100 - Concrete Forms & Accessories		28,950
03200 - Concrete Reinforcement		43,805
03300 - Cast-In-Place Concrete		29,203
11000 - Equipment		55,009
15001 - Pipe, Water Supply		72,734
15050 - Basic Materials & Methods		22,968
15950 - Testing/Adjusting/Balancing		7,074
	Pond 4 Bypass Total	1,021,485
	Grand Total	1,021,485

BROWN AND CALDWELL

Environmental Engineers & Consultants

SUMMARY ESTIMATE REPORT WITH MARK-UPS ALLOCATED

Pond 4 Bypass Pipeline
Conceptual Level Estimate

Project Number:	138882-005
BC Project Manager:	Thomas Steinwinder
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Pond 4 Bypass Pipeline
Conceptual Level Estimate

Item	Item Description	Qty	Unit	Materials $/Unit	Labor $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	--- Base Estimate ---									
	Pond 4 Bypass									545,094
	01590 - Miscellaneous Equipment Rental without operators									
	01590400 - General equipment rental without operators									
7030B	Rent trench box, 3000 lbs 6' x 8' - Rent per day	5.0	days				93.00		93.0	465
	Miscellaneous Equipment Rental without operators Total									465
	02200 - Site Preparation									
	02220250 - Demolish, Remove Pavement And Curb									
5050	Demolish, remove pavement & curb, remove bituminous pavement, 4" to 6" thick, excludes hauling and disposal fees	70.0	SY		3.54		2.32		5.9	410
	02220330 - Selective Demolition, Dump Charges									
9999	Dump Charge, typical urban city, fees only, bldg constr mat'ls	200.0	ton					33.00	33.0	6,600
	02230100 - Clear And Grub									
7080	Clearing & grubbing, tree removal congested area, 12" diameter, tree removal, aerial lift truck	12.0	EA		214.25		135.13		349.4	4,193
	Site Preparation Total									11,203
	02300 - Earthwork									
	02315120 - Backfill, Structural									
4420	**[2x] Backfill, structural, common earth, 200 H.P. dozer, 300' haul**	**1,372.9**	**L.C.Y.**		**0.67**		**1.37**		**2.0**	**2,804**
	02315310 - Compaction, General									
7000	**[3x] Compaction, around structures and trenches, 2 passes, 18" wide, 6" lifts, walk behind, vibrating plate**	**230.0**	**E.C.Y.**		**1.18**		**0.15**		**1.3**	**306**
7220	Compaction, 3 passes, 18" wide, 12" lifts, walk behind, vibrating plate	41.5	E.C.Y.		0.63		0.09		0.7	30
7500	Compaction, 2 passes, 24" wide, 6" lifts, walk behind, vibrating roller	1,109.6	E.C.Y.		1.18		0.33		1.5	1,673
	02315492 - Hauling									
0009	**[2x] Loading Trucks, F.E. Loader, 3 C.Y.**	**522.6**	**cuyd**		**0.51**		**0.95**		**1.5**	**761**
4498	**[2x] Cycle hauling(wait, load,travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 25 min load/wait/unload, 20 CY truck, cycle 20 miles, 45 MPH, no loading equipment**	**522.6**	**L.C.Y.**		**1.10**		**3.15**		**4.2**	**2,220**
	02315610 - Excavating, Trench									
0060	Excavating, trench or continuous footing, common earth, 1/2 C.Y. excavator, 1' to 4' deep, excludes sheeting or dewatering	1,244.4	B.C.Y.		3.07		1.60		4.7	5,819
1000	Excavating, trench or continuous footing, common earth, 1 1/2 C.Y. excavator, 10' to 14' deep, excludes sheeting or dewatering	270.0	B.C.Y.		1.14		1.49		2.6	710
	02315640 - Utility Bedding									
0100	Fill by borrow and utility bedding, for pipe and conduit, crushed stone, 3/4" to 1/2", excludes compaction	110.0	L.C.Y.	46.63	5.64		1.83		54.1	5,951
	Earthwork Total									20,274
	02600 - Drainage & Containment									
	02630530 - Sewage/Drainage Collection, Concrete Pipe									
2090	Reinforced concrete pipe (RCP), 60" diameter, 8' lengths, class 3, excludes excavation or backfill, gaskets	1,200.0	LF	249.03	39.13		21.90		310.1	372,076
	Drainage & Containment Total									372,076
	02700 - Bases, Ballasts, Pavements & Appurtenances									
	02740310 - Asphaltic Concrete Pavement, Highways									
1050	Plant-mix asphalt paving, for highways and large paved areas, pavement replacement over trench, 4" thick, for paving projects 300 tons or less add for trucking	70.0	SY	13.56	22.84		1.84		38.2	2,677
	Bases, Ballasts, Pavements & Appurtenances Total									2,677
	03100 - Concrete Forms & Accessories									
	03110430 - Forms In Place, Footings									
5150	C.I.P. concrete forms, footing, spread, plywood, 4 use, includes erecting, bracing, stripping and cleaning	5,120.0	sfca	0.64	2.41				3.0	15,605
	Concrete Forms & Accessories Total									15,605
	03200 - Concrete Reinforcement									
	03210600 - Reinforcing In Place									
0602	Reinforcing steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	27,690.8	lb	0.48	0.33				0.8	22,533

Pond 4 Bypass Pipeline
Conceptual Level Estimate

Item	Item Description	Qty	Unit	Materials $/Unit	Labor $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
2000	Reinforcing steel, unload and sort, add to base	13.9	ton		24.65		7.36		32.0	445
2210	Reinforcing steel, crane cost for handling, average, add	13.9	ton		26.66		8.01		34.7	482
	Concrete Reinforcement Total									**23,461**
	03300 - Cast-In-Place Concrete									
	03310220 - Concrete, Ready Mix Normal Weight									
0300	Structural concrete, ready mix, normal weight, 4000 PSI, includes local aggregate, sand, Portland cement and water, delivered, excludes all additives and treatments	134.8	CY	100.00					100.0	13,481
	03310700 - Placing Concrete									
4650	Structural concrete, placing, slab on grade, pumped, over 6" thick, includes vibrating, excludes material	134.8	CY		11.38		3.98		15.4	2,071
	Cast-In-Place Concrete Total									**15,552**
	11000 - Equipment									
	11000500 - Sluice gates									
0160	Valve, Isolation. 60" manual	1.0	each	21,900.00	4,822.93		2,226.93		28,949.9	28,950
	Equipment Total									**28,950**
	15001 - Pipe, Water Supply									
	15001001 - Water Supply, Concrete Pipe									
3280	Water supply distribution piping, elbow 45 degree, RCP, 150 PSI, 60" diameter	6.0	EA	5,000.00	934.33		526.61		6,460.9	38,766
	Pipe, Water Supply Total									**38,766**
	15050 - Basic Materials & Methods									
	15060300 - Pipe Hangers And Supports									
4180	Pipe support, 60" strap	80.0	EA	132.12	20.88				153.0	12,240
	Basic Materials & Methods Total									**12,240**
	15950 - Testing/Adjusting/Balancing									
	15955700 - Piping, Testing									
0380	Pipe testing, nondestructive hydraulic pressure test, isolate, 1 hour holdF.	1.0	EA		3,827.20				3,827.2	3,827
	Testing/Adjusting/Balancing Total									**3,827**

Pond 4 Bypass Pipeline
Conceptual Level Estimate

Category	Percent	Amount
--- Base Estimate --- Totals		
Labor	**18.21 %**	**99,254**
Material	**72.91 %**	**397,421**
Subcontractor		
Equipment	**7.67 %**	**41,820**
Other	**1.21 %**	**6,600**
User		
Net Costs		**545,094**
Labor Mark-up	10.00 %	9,925
Material Mark-up	5.00 %	19,871
Subcontractor Mark-up	5.00 %	
Equipment Mark-up	5.00 %	2,091
Sales tax	7.00 %	30,747
Material Shipping & Handling	2.00 %	438
Escalation to Midpoint	3.50 %	19,078
Contractor General Conditions	10.00 %	62,725
Subtotal		**689,970**
Start-up, training, O & M	2.00 %	
Subtotal		**689,970**
Construction Contingency	30.00 %	206,991
Subtotal		**896,960**
Bldg Risk, Liability Auto Ins.	2.00 %	17,939
Subtotal		**914,900**
Bonds	1.50 %	13,723
Subtotal		**928,623**
Georgia Pacific contractor Division	10.00 %	92,862
Subtotal		**1,021,485**
Total Estimate		**1,021,485**

BROWN AND CALDWELL

Environmental Engineers & Consultants

SUMMARY ESTIMATE REPORT
WITH MARK-UPS ALLOCATED

Discharge Pipeline
Conceptual Level Estimate

Project Number:	138882-005
BC Project Manager:	Thomas Steinwinder
BC Office:	Tennessee
Estimate Issue Number:	01
Estimate Original Issue Date:	2010-03-05
Lead Estimator:	Des Orsinelli
Estimate QA/QC Reviewer:	Butch Matthews
Estimate QA/QC Date:	2010-03-04

Georgia Pacific

Discharge Pipeline
Conceptual Level Estimate

Description		Total w/ Markups Allocated
--- Base Estimate ---		6,960,484
Discharge Pipeline		
01590 - Miscellaneous Equipment Rental without operators		875
02200 - Site Preparation		107,029
02300 - Earthwork		191,147
02450 - Foundation & Load Bearing Elements		28,737
02600 - Drainage & Containment		5,530,741
02700 - Bases, Ballasts, Pavements & Appurtenances		4,983
03100 - Concrete Forms & Accessories		229,427
03200 - Concrete Reinforcement		347,153
03300 - Cast-In-Place Concrete		231,432
05100 - Structural Metal Framing		22,259
15001 - Pipe, Water Supply		72,734
15050 - Basic Materials & Methods		176,282
15950 - Testing/Adjusting/Balancing		17,685
	Discharge Pipeline Total	6,960,484
	Grand Total	6,960,484

BROWN AND CALDWELL

Environmental Engineers & Consultants

DETAILED ESTIMATE REPORT

Discharge Pipeline
Conceptual Level Estimate

Project Number:	138882-005
BC Project Manager:	Thomas Steinwinder
BC Office:	Tennessee
Estimate Issue Number:	01
Estimate Original Issue Date:	2010-03-05
Lead Estimator:	Des Orsinelli
Estimate QA/QC Reviewer:	Butch Matthews
Estimate QA/QC Date:	2010-03-04

Discharge Pipeline
Conceptual Level Estimate

Item	Item Description	Qty	Unit	Materials $/Unit	Labor $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	--- Base Estimate ---									
	Discharge Pipeline									**3,714,901**
	01590 - Miscellaneous Equipment Rental without operators									
	01590400 - General equipment rental without operators									
7030B	Rent trench box, 3000 lbs 6' x 8' - Rent per day	5.0	days				93.00		93.0	465
	Miscellaneous Equipment Rental without operators Total									**465**
	02200 - Site Preparation									
	02220250 - Demolish, Remove Pavement And Curb									
5050	Demolish, remove pavement & curb, remove bituminous pavement, 4" to 6" thick, excludes hauling and disposal fees	70.0	SY		3.54		2.32		5.9	410
	02220330 - Selective Demolition, Dump Charges									
9999	Dump Charge, typical urban city, fees only, bldg constr mat'ls	800.0	ton					33.00	33.0	26,400
	02230100 - Clear And Grub									
7080	Clearing & grubbing, tree removal congested area, 12" diameter, tree removal, aerial lift truck	95.0	EA		214.25		135.13		349.4	33,191
	Site Preparation Total									**60,001**
	02300 - Earthwork									
	02315120 - Backfill, Structural									
4420	**[2x] Backfill, structural, common earth, 200 H.P. dozer, 300' haul**	**9,910.9**	**L.C.Y.**		**0.67**		**1.37**		**2.0**	**20,238**
	02315310 - Compaction, General									
7000	**[3x] Compaction, around structures and trenches, 2 passes, 18" wide, 6" lifts, walk behind, vibrating plate**	**230.0**	**E.C.Y.**		**1.18**		**0.15**		**1.3**	**306**
7220	Compaction, 3 passes, 18" wide, 12" lifts, walk behind, vibrating plate	328.7	E.C.Y.		0.63		0.09		0.7	237
7500	Compaction, 2 passes, 24" wide, 6" lifts, walk behind, vibrating roller	8,793.8	E.C.Y.		1.18		0.33		1.5	13,259
	02315492 - Hauling									
0009	**[2x] Loading Trucks, F.E. Loader, 3 C.Y.**	**2,756.9**	**cuyd**		**0.51**		**0.95**		**1.5**	**4,013**
4498	**[2x] Cycle hauling(wait, load,travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 25 min load/wait/unload, 20 CY truck, cycle 20 miles, 45 MPH, no loading equipment**	**2,756.9**	**L.C.Y.**		**1.10**		**3.15**		**4.2**	**11,711**
	02315610 - Excavating, Trench									

Item	Item Description	Qty	Unit	Materials $/Unit	Labor $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
0060	Excavating, trench or continuous footing, common earth, 1/2 C.Y. excavator, 1' to 4' deep, excludes sheeting or dewatering	9,862.2	B.C.Y.		3.07		1.60		4.7	46,118
1000	Excavating, trench or continuous footing, common earth, 1 1/2 C.Y. excavator, 10' to 14' deep, excludes sheeting or dewatering	270.0	B.C.Y.		1.14		1.49		2.6	710
	02315640 - Utility Bedding									
0100	Fill by borrow and utility bedding, for pipe and conduit, crushed stone, 3/4" to 1/2", excludes compaction	110.0	L.C.Y.	46.63	5.64		1.83		54.1	5,951
	Earthwork Total									**102,544**
	02450 - Foundation & Load Bearing Elements									
	02455450 - Prestressed Concrete Piles									
2300	Prestressed concrete piles, 14" diameter, 2-1/2" wall, priced using 200 piles, 50' long, unless specified otherwise, excludes pile caps or mobilization	200.0	vlft	28.41	4.32		1.21		33.9	6,786
	02455800 - Piling Special Costs									
0500	Piling special costs, cutoffs, concrete piles, plain	4.0	EA		67.58				67.6	270
	02455900 - Mobilization									
1100	Mobilization, set up and remove, rule of thumb: complete pile driving set up, small	1.0	EA		6,525.11		1,829.11		8,354.2	8,354
	Foundation & Load Bearing Elements Total									**15,411**
	02600 - Drainage & Containment									
	02630530 - Sewage/Drainage Collection, Concrete Pipe									
2090	Reinforced concrete pipe (RCP), 60" diameter, 8' lengths, class 3, excludes excavation or backfill, gaskets	9,504.0	LF	249.03	39.13		21.90		310.1	2,946,840
	Drainage & Containment Total									**2,946,840**
	02700 - Bases, Ballasts, Pavements & Appurtenances									
	02740310 - Asphaltic Concrete Pavement, Highways									
1050	Plant-mix asphalt paving, for highways and large paved areas, pavement replacement over trench, 4" thick, for paving projects 300 tons or less add for trucking	70.0	SY	13.56	22.84		1.84		38.2	2,677
	Bases, Ballasts, Pavements & Appurtenances Total									**2,677**
	03100 - Concrete Forms & Accessories									
	03110430 - Forms In Place, Footings									
5150	C.I.P. concrete forms, footing, spread, plywood, 4 use, includes erecting, bracing, stripping and cleaning	40,576.0	sfca	0.64	2.41				3.0	123,667

Item	Item Description	Qty	Unit	Materials $/Unit	Labor $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	Concrete Forms & Accessories Total									**123,667**
	03200 - Concrete Reinforcement									
	03210600 - Reinforcing In Place									
0602	Reinforcing steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	219,449.7	lb	0.48	0.33				0.8	178,575
2000	Reinforcing steel, unload and sort, add to base	110.3	ton		24.65		7.36		32.0	3,530
2210	Reinforcing steel, crane cost for handling, average, add	110.3	ton		26.66		8.01		34.7	3,824
	Concrete Reinforcement Total									**185,929**
	03300 - Cast-In-Place Concrete									
	03310220 - Concrete, Ready Mix Normal Weight									
0300	Structural concrete, ready mix, normal weight, 4000 PSI, includes local aggregate, sand, Portland cement and water, delivered, excludes all additives and treatments	1,068.4	CY	100.00					100.0	106,841
	03310700 - Placing Concrete									
4650	Structural concrete, placing, slab on grade, pumped, over 6" thick, includes vibrating, excludes material	1,068.4	CY		11.38		3.98		15.4	16,410
	Cast-In-Place Concrete Total									**123,251**
	05100 - Structural Metal Framing									
	05120260 - Columns, Structural									
7150	Column, structural, 2-tier, W12x50, A992 steel, incl shop primer, splice plates, bolts	150.0	LF	65.01	2.35		1.58		68.9	10,341
7150	Steel, structural, cross beams	1.0	lsum	1,414.50	51.23		34.27		1,500.0	1,500
	Structural Metal Framing Total									**11,841**
	15001 - Pipe, Water Supply									
	15001001 - Water Supply, Concrete Pipe									
3280	Water supply distribution piping, elbow 45 degree, RCP, 150 PSI, 60" diameter	6.0	EA	5,000.00	934.33		526.61		6,460.9	38,766
	Pipe, Water Supply Total									**38,766**
	15050 - Basic Materials & Methods									
	15060300 - Pipe Hangers And Supports									
4180	Pipe support, 60" strap	614.0	EA	132.12	20.88				153.0	93,942
	Basic Materials & Methods Total									**93,942**

Item	Item Description	Qty	Unit	Materials $/Unit	Labor $/Unit	Subs $/Unit	Equip $/Unit	Other $/Unit	Total $/Unit	Total Net Cost $
	15950 - Testing/Adjusting/Balancing									
	15955700 - Piping, Testing									
0380	Pipe testing, nondestructive hydraulic pressure test, isolate, 1 hour holdF.	1.0	EA		9,568.00				9,568.0	9,568
	Testing/Adjusting/Balancing Total									**9,568**

Category	Percent	Amount
--- Base Estimate --- Totals		
Labor	**18.09 %**	**672,201**
Material	**73.73 %**	**2,738,867**
Subcontractor		
Equipment	**7.47 %**	**277,433**
Other	**0.71 %**	**26,400**
User		
Net Costs		**3,714,901**
Labor Mark-up	10.00 %	67,220
Material Mark-up	5.00 %	136,943
Subcontractor Mark-up	5.00 %	
Equipment Mark-up	5.00 %	13,872
Sales tax	7.00 %	211,141
Material Shipping & Handling	2.00 %	
Escalation to Midpoint	3.50 %	130,022
Contractor General Conditions	10.00 %	427,410
Subtotal		**4,701,508**

Category	Percent	Amount
Construction Contingency	30.00 %	1,410,453
Subtotal		**6,111,961**
Bldg Risk, Liability Auto Ins.	2.00 %	122,239
Subtotal		**6,234,200**
Bonds	1.50 %	93,513
Subtotal		**6,327,713**
Georgia Pacific contractor Division	10.00 %	632,771
Subtotal		**6,960,484**
Total Estimate		**6,960,484**

Dredging and Dewatering Cost Estimate

Item	Capital Cost Estimate	Notes
Dredging/Dewatering (Four Ponds)	$5,836,563	Dredging and Dewatering
Power Installation	$1,220,000	GP Estimate
Total Estimate (Four Pond)	**$7,056,563**	All four ponds
Dredging/Dewatering (Pond 1 Only)	$3,371,834	Estimate. Pond 1 solids make up 58% of the total volume provided in the vendor estimate.
Power Installation	$1,220,000	GP Estimate
Total Estimate	**$4,591,834**	Pond 1 Only

Notes:

Vendor estimate includes the following:

- Mobilization
- All Equipment
- All Labor
- All polymers
- Demobilization

Vendor estimate does not include:

- Electric costs
- Fresh water costs