LEACHATE PRE-TREATMENT SYSTEM PLAN

SUBMITTED IN COMPLIANCE WITH AGREED ORDER SECTION 17.D.

Prepared for:

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1.0 GENERAL INFORMATION

Bridgeton Landfill, LLC owns and manages the Bridgeton Sanitary Landfill site located at 13570 St. Charles Rock Road in Bridgeton, Missouri (see Figure 1). The Bridgeton Sanitary Landfill (Landfill) previously discharged leachate from the Landfill to the Metropolitan St. Louis Sewer District (MSD) Missouri River Treatment Facility (MRTF) through an on-site discharge point connecting to what is referred to as MSD's West Lake pump station. Due to the change in concentrations of various constituents in the leachate, direct discharge had been curtailed.

In order to resume direct discharge of leachate to the MRTF, Bridgeton Landfill has been working with MSD on development of a pretreatment system. The major components and treatment technologies are determined; however, Bridgeton Landfill is still testing and refining technologies before final implementation.

Consistent with the Section 17.D of the Agreed Order, entered May 13, 2013, Bridgeton Landfill is submitting this Leachate Pretreatment Plan to the Missouri Department of Natural Resources (MDNR). Bridgeton Landfill intends to continue its ongoing work with MSD on development of this plan and construction of the pretreatment system. In addition to meeting the condition of Agreed Order Section 17.D, this Plan is intended to provide a working document to allow Bridgeton Landfill to obtain the input of MSD for development of a final pretreatment plan.

Bridgeton Landfill continues to work diligently in a cooperative effort with MSD on development of the ultimate pretreatment system in order to confirm that the system is developed to meet MSD's needs and allow for long term discharge.

1.1 REGULARTORY BACKGROUND

The Landfill leachate discharge to MSD must comply with all applicable ordinances regulating the discharge to the facilities of The Metropolitan St. Louis Sewer District. Ordinance 12559 requires pretreatment limits of 312 mg/l BOD; 953 mg/l COD; and 65 mg/l TSS as well as the previously certified levels, as follows:

"At the point of discharge from the user's property to the District's wastewater system, all users shall comply with the following limitations. Separate limitations apply for discharges to the District's plants with outfalls to the Mississippi and Missouri Rivers (Large Rivers) and for plants with outfalls to all other streams (Small Rivers)."

Parameter*	**Daily Average Limit****		**Instantaneous Limit****	
	Large Riv.	***Small Riv.***	***Large Riv.***	***Small Riv.***
Antimonv	0.5	0.5	1.5	1.5
Arsenic	0.4	0.3	1.2	0.9
Barium	10.0	30.0	30.0	30.0
Beryllium	0.4	0.1	1.2	0.3
Cadmium	0.7	0.07	1.2	0.21
Chromium	5.0	5.0	15.0	15.0
Copper	2.7	0.7	4.5	2.1
Cvanide. Amenable	0.4	0.1	1.2	0.3
Iron	150.0	25.0	450.0	75.0
Lead	0.4	0.2	0.6	0.6
Mercurv	0.01	0.01	0.03	0.03
Nickel	2.3	1.0	4.1	3.0
Total Oil &Grease	200	200	200	200
Phenolic Compounds	7.0	7.0	21.0	21.0
Selenium	0.2	0.2	0.6	0.6
Silver	0.5	0.5	1.5	1.5
Zinc	3.0	3.0	9.0	9.0

Total Toxic Organics: Shall not exceed 5.844 mg/l at any time
Temperature: Shall not exceed 140°F (60°C) at any time***
pH: Shall be in the range of 5.5 to 11.5 s.u. at all times***

1.2 BASIS OF DESIGN

The design parameters and units of treatment for the permanent pretreatment system are proposed in this document. The basis of design relies on bench scale treatability tests currently being conducted at Civil & Environmental Consultants, Inc. (CEC) treatability laboratory in Charlotte, NC, as well as performance of a pilot scale treatability program currently underway at the Landfill. These activities are described in following sections.

1.3 SOURCE, VOLUME AND NATURE OF LEACHATE

The leachate is generated from leachate collection wells and condensate from gas well pumping wells at various places around the facility (collectively termed "leachate" in this document). This leachate is collected at various points and discharged to a perimeter collection line that flows to a central collection point. Currently the leachate is pumped into the buffer tank farm consisting of 40 interconnected frac tanks. Following equalization in the buffer tank farm, the leachate is currently pumped in batches into the 316,000 gallon treatment tank, as discussed below. Treated leachate is loaded into trucks for off-site discharge, or pumped to the 97,000 gallon tank for discharge to the MSD MRTF.

Upon completion of the first of four planned 1,000,000 gallon storage/treatment tanks, an intermediate approach for leachate treatment and discharge will allow the leachate to be pumped to one of these tanks for equalization and aeration, and the buffer tank farm disassembled and removed from the site. The leachate will then flow to the existing 316,000 gallon tank for further aeration and discharge

The leachate generation volume ranges from 150,000 to 300,000 gallons per day (gpd) of combined leachate flows. The design flow is based on 300,000 gpd.

The permanent Pretreatment Plan is developed to achieve MSD's need to receive a consistent and compliant effluent stream. The current technological, engineering, and management evaluation supports the concept that a consistent, optimal operation of the entire liquids removal and treatment system is the best way of avoiding toxics and treating the high strength pollutants to an acceptable pretreatment discharge. This concept is based on the incorporation of the new 316,000 gallon tank as an equalization tank followed by a treatment scenario described in subsequent sections.

Although significant variation is seen in the analytical results, the design basis used for a treatment evaluation includes the following parameters:

Flow:	150,000 gpd average; 300,000 gpd max (design flow)
BOD:	31,000 mg/l
COD:	71,000 mg/l
TSS:	2,600 mg/l
Ammonia N:	1,000 mg/l
Zinc:	50 mg/l
Iron:	800 mg/l

1.4 TREATABILITY TEST PROGRAM – BENCH SCALE

In order to develop a pretreatment system that is appropriately designed and constructed to achieve the treatment goals of MSD, it is imperative to utilize treatability tests during the design phase. Both bench scale tests and field pilot scale leachate treatability tests have been in progress for several months. CEC has performed, and is currently performing, a number of simulated bench scale treatability tests, employing pH adjustment chemicals of sodium hydroxide (caustic), lime, and fly ash from a coal burning power plant as an absorbent for volatile fatty acids, or other constituents. Other chemical additions are being pilot tested including ozone, hydrogen peroxide, ferric chloride, Fenton's Reagent, and others. Subsequent to the precipitation and settling, biological test units are under evaluation for treating the leachate in various configurations. Anaerobic treatability tests were initially considered with an outside vendor, but will not be implemented, as reasonable treatment with aerobic systems is progressing, and the timing available for study and implementation do not achieve the schedule that Bridgeton Landfill and MSD are working to maintain for implementation of treatment.

Additionally, a bench scale test of the electrocoagulation treatment process was performed in June 2013 by Ecolotron of Kemah, Texas. Electrocoagulation (EC), the passing of electrical current through water, has proven effective in the removal of contaminants from water. Electrocoagulation systems have been in existence for many years (Dietrich, patented 1906), using a variety of anode and cathode geometries, including plates, balls, fluidized bed spheres, wire mesh, rods, and tubes. Limited evaluation has been performed on landfill leachate, and this test was conducted to identify short and long term characteristics of the process and applicability to the Bridgeton Landfill leachate. Implementation of an EC unit prior to clarification will be considered based on the success of clarification removing a portion of the solids and heavy metals.

The pH adjustment tests continued through July and August 2013. Liquid/solids separation occurred with the addition of coagulants and polymers, but significant volumes of sludge were generated. Metals were also precipitated in this step and reduced to levels that can be aerobically treated without biological inhibition in the subsequent aeration tank trials. The bench scale aerobic biological treatment unit tests confirmed leachate treatability for design considerations.

1.5 TREATABILITY TEST PROGRAM – PILOT SCALE

At the same time as the bench scale tests occurred, a pilot scale treatability evaluation was initiated and is continuing at the site. A sand enhanced clarification mobile unit from Siemens ("Actiflo") is on-site with testing having started in mid-June 2013. Other process components being evaluated in addition to the clarification unit include pH adjusting to raise the pH for metals removal, and a pH adjustment to neutral following clarification for further biological treatment.

The following details the process, anticipated chemical usage, and equipment that are components of the pilot scale chemical modification tests at the Siemens clarification unit.
The components include the following:

- Caustic pH adjustment tank
- Caustic feed pumps
- Caustic storage tank
- Acid pH adjustment tank
- Acid storage tank (concentrated)
- Acid feed pumps (concentrated)
- Chemical feed – Polymer, Ferric Chloride, or other chemicals

A pilot Membrane Bioreactor (MBR) system is on-site and is undergoing evaluation. Dynatec Corporation supplied a pilot system consisting of two aeration tanks of 3,000 gallons and 1,000 gallons and an ultrafilter module to simulate a full scale aerobic and ultrafilter processes. The pilot system includes an internal solids liquids separation device consisting of a membrane separation system unit to function as a MBR. This approach provides for a mixed liquor equivalent suspended solids concentration approaching 10,000 mg/l. Several analytical sampling events and analyses of this system showed each metal constituent and TSS can be removed to below pretreatment standards. Foam control has been identified as a system requirement, and defoaming agents have been evaluated. As the biological mixed liquor is in the process of

becoming acclimated, some of the BOD results have been below treatment standards, and the COD reduction has been significant, but currently above pretreatment standards. Removals of all constituents range from 96% to above 99%.

The leachate liquid treatment system will require sludge storage, thickening, and a dewatering system, which is also a component of the pilot test program. Bio-Nomics Corporation currently is testing a dewatering system consisting of a plate and frame dewatering press with integral chemical addition to condition the pilot test produced sludge as well as to dewater existing on-site sludge. Although sludge dewatering will include a sludge thickener and screw dewatering press, the pilot plate and frame press will provide baseline dewater capability characteristics. The pH adjustment in the clarifier will elevate the pH of the sludge for dewatering, and subsequent pH adjustment by acid or ferric chloride addition of the sludge may be required. Polymer addition to enhance sludge dewatering is also being evaluated. Sludge dewatering performance has been successful, providing dewatered solids that pass the paint filter test. Odor control has been required during the test.

Odor control at the 316,000 gallon tank, currently used as batch aeration treatment prior to leachate hauling or discharge to MSD, was initially controlled by activated carbon. As experience has shown that the carbon life was significantly shorter than estimated, other technologies for odor control were evaluated. The odor control technology selected for the carbon replacement was a thermal oxidizer. The thermal oxidizer was permitted and installed. The thermal oxidizer operation commenced in late August 2013. Odors are being evaluated and appear to be controlled with a thermal oxidizer.

1.6 GENERAL FACILITY LAYOUT DIAGRAM

Evaluation of the bench scale and pilot scale process tests have conceptually provided information for development of a facility layout and process flow diagrams to comply with the September 1st MDNR submission date. Design parameters for several of the process units that are being developed concurrently with the September 1st submission date include process assumptions and engineering experience on reaction and degradation rates. The site plan, process flow diagram, and treatment building plan is provided in the figures attached to this report.

2.0 FULL SCALE PRETREATMENT FACILITY DESIGN

The leachate pretreatment plan incorporates an equalization tank, physical/chemical precipitation to remove zinc, iron, and other metals that may inhibit biological pretreatment, aerobic biological treatment, leachate cooling, membrane separation for solids removal, return and waste sludge pumping, solids storage and dewatering, solids disposal, and effluent monitoring and discharge. Chemical addition at various stages will be required, and odor control at the various units is included.

Process flow calculations were performed to identify candidate sizing for process treatment tank(s) for the Bridgeton Landfill leachate. The leachate exhibited significant variability in flow and strength. Therefore, the design basis incorporated many assumptions of strength, variability, process degradation rates of waste and many other assumptions associated with the leachate generated at the site. In addition, other unit processes may be recommended to reduce the leachate concentrations to a level acceptable by MSD, if the proposed processes in the full scale pretreatment plant do not adequately treat the leachate to the level desired, based on the bench and pilot tests described herein.

The anticipated flow and characteristics used in a preliminary design approach for aeration tank and other process unit sizing are presented below based on limited analyses or verbal discussions, and are listed as follows:

Flow:	300,000 gpd max (design)
BOD:	31,000 mg/l
COD:	71,000 mg/l
TSS:	2, 600 mg/l
Ammonia N:	1,000 mg/l
Zinc:	50 mg/l
Iron	800 mg/l

Due to the concentrations identified above, a design basis of anaerobic treatment followed by aerobic treatment was originally considered, but eliminated due to the long treatability test period and the time to bring a completed system to full operation compared to a shorter timeframe for an aerobic biological treatment process. This decision on approach reduced the design and startup process by almost one year. Numerous ancillary units are proposed for the permanent pretreatment plant, including:

- Pumping units
- Equalization Storage (incorporating the possible use of the new 316,000 gallon tank and the first of four 1,000,000 gallon tanks currently under construction)
- Chemical feed for pH modification for metals removal
- Chemical feed for neutralization
- Clarification
- Nutrient and chemical addition
- Aeration, including MBR processes with suspended and/or fixed media
- Odor control
- Process cooling
- Membrane separation
- Solids wasting
- Sludge holding
- Solids dewatering
- Effluent loadout
- Electrical feed and motor control center
- Process controls units
- Water supply
- Process Control Laboratory
- Operations Maintenance area
- Discharge to MSD or Loadout area using the 316,000 gallon tank.

EQUALIZATION

The existing 316,000 gallon tank will receive leachate from the landfill and provide aeration from two dedicated blowers and a pumped aeration mixing system delivered through a jet aeration mixer. The unit will operate at hold volume, providing 12 hours detention. The upper volume of the tank will provide for an equal 12 hours storage at the maximum design flow. Discharge from this tank will flow to the treatment building for further treatment, or can be selectively hauled off for disposal at the dedicated sludge loadout area that is provided with secondary containment.

CLARIFICATION

Because there have been analyses of leachate suspended solids concentrations averaging 2,600 mg/l, a primary settling step is recommended. Additionally, leachate metals concentrations can impede biological treatment. Based on initial characterization, concentration levels of zinc may be a concern. Therefore, a preliminary sedimentation step for metals and some suspended solids

removal is planned. Iron concentration will also be addressed, either by pre-aeration before the physical/chemical clarification step (to oxidize dissolved iron to change the form to particulates that are more easily removed in a clarification settling step) or by other technologies. CEC anticipates a significant concentration of volatile fatty acids (VFA) will be present in the leachate, contributing to the high COD concentrations. Fly ash or other substances were unsuccessfully evaluated in a bench scale test for use in the preliminary clarification step to reduce the leachate VFA concentration. Because the clarification step was initially attempted and successful in the bench scale test at a pH in the 10 to 11 range, severe scaling of this scale-forming leachate was anticipated. Further testing and pilot scale test during the pilot test at the landfill to reduce the pH and still achieve separation at a slightly lower and less scale forming pH were successful, as measured by achieving liquid/solids separation at a pH of 9. This lower operating pH reduces the scaling potential and the amount of caustic needed. Selection of materials of construction, proper anti-scaling agents, and polymer addition to sequester metals and aid in solids liquid separation at the lower pH may reduce the scaling/corrosion issue.

The clarification process will require chemical feeds are currently being confirmed in a pilot test, and includes a coagulant and a polymer. Based on bench scale and pilot scale testing and engineering judgment, equipment supplier recommendation and availability, an inclined plate clarifier with a net loading rate of 0.11 gpm/sf is included in the design. This translates to an equivalent traditional circular clarifier with an equivalent loading of 148 gpd/sf. A rapid sludge withdrawal mechanism is included in the design to pump the clarifier sludge to a clarifier sludge holding tank.

BIOLOGICAL TREATMENT

Based on the anticipated strength of the leachate, CEC initially evaluated the concept of a two stage anaerobic/aerobic treatment process following the initial clarification step. Based on time to develop a bench and pilot scale anaerobic system, complexity of operation, and other O&M requirements, the decision was made to eliminate this concept and provide treatment by aerobic treatment only. The time frame for design, installation, and startup of an anaerobic system would not allow meeting the plant startup date of December 31, 2013, established by MSD.

A second option of using either a single or two stage aerobic Sequencing Batch Reactor with an internal settling device process was considered. As settling was not achievable in bench scale aerobic testing, the Sequencing Batch Reactor concept was eliminated. Using an external membrane ultrafilter following aeration was then considered as the most appropriate option.

Therefore, this design is based on four (4) tanks at 1,000,000 gallons each tank processing in parallel. The implementation of jet aeration was evaluated as the best alternative for this installation. The four tanks will be implemented with dual mixing flow and air supply headers in each tank, as shown in the attached plan. Process flow will be arranged such that the flow can be equally distributed to each tank, or two tanks will operate as a first stage with the second two tanks operating as a second stage. Additionally, piping will be planned to provide a variety of options for flow split among the four tanks. Based on a flow rate of 300,000 gallons per day and a combined volume of 4 million gallons, a hydraulic detention time of 12 days is planned. The following design is based on engineering judgment, and by the results of the bench and pilot tests.

After equalization and primary pH adjustment and sedimentation treatment, the aerobic biological step will treat the leachate. This biological treatment step includes jet aeration blowers and pumps and an external membrane solids separation unit to achieve a BOD reduction and a similar COD reduction according to the following calculation:

Assuming no BOD reduction in primary clarification:

31,000 mg/l BOD influent = 31,000 mg/l effluent from the clarifier.

The BOD mass loading following primary sedimentation is at 31,000 mg/l at a flow rate of 300,000 gpd:

*BOD mass loading = 0.3 mgd * 31,000 mg/l *8.34 = 77,562 # BOD/day*

If the aeration units function as complete mixed conventional treatment, a food to microorganism ration (F/M) could range from 0.2 to 0.4 #/day.

THEREFORE;

Assume a F/M ratio of 0.3 lb BOD/lb MLSS:

The 4 million gallon tanks (939,000 gallons each after reduction for freeboard) = 14,197,680 liters. At 0.3 F/M ratio:

MLSS = 77,562 lb BOD/(0.3 F/M) = 258,540 lb MLLS under aeration

The loading of 77,562 lb BOD = (258,540 lb)(454 gm/lb)(1,000 mg/gm) = 11.74X10^{10} mg MLSS

Concentration of MLSS = 11.74 X10^{10} mg MLSS /14,197,680 liters = 8,267 mg/l

This Mixed Liquor Suspended Solids (MLSS) concentration is at double the concentration usually seen at complete mixed aeration systems, and is consistent with the process used at other landfills for an aeration system and membrane separation technology.

Air required in aeration system:

Oxygen requirements equal carbonaceous demand plus endogenous respiration plus nitrification demand.

The following parameters were supplied by MTS Corporation, the chosen supplier of the Jet Aeration system components.

Assume:

Alpha = 0.85 (Submerged aeration)
Beta = 0.9 (conservative)
C = 4.6 (for nitrification)

At 1.25lb Oxygen/lb BOD gives; (77,652lbs BOD)(1.25lb oxygen/lb BOD) = 97,065lb O_2 /day carbonaceous demand.

Endogenous = (0.08)(8,267 mg/l)*(4 MG)*(8.34) = 22,063lb/day*

Nitrification: (4.6)(0.3mg)*(1,000 mg/l ammonia)*(8.34) = 11,509 lb O_2/day*

AOR = (130,524 lbs/day)/ 24 = 5,439 lb/hr oxygen

SOTR correction for temperature, altitude, alpha, Beta corrections = 2.2 (AOTR)
At 0.0175 lb O_2/ CFM air

7 % efficiency per meter at depth (assume 30 feet or 9 meter)

Air flow = [(5,439 lb/hr)(2.2)] / [(0.0175)(0.07)(9 meter)] = 1,080,943 CF/hr for Total BOD demand.

Air flow = 1,080,943 CF/Hr/60 min/hr = 18,016 scfm,

Therefore, size two blowers for each tank at approximately 2,100 scfm per blower, with two spare blowers of the same size for maximum flow rate and concentration contingency, with a total of 10 blowers, yielding 21,000 scfm to account for the maximum conditions.

Equipment for the aeration system includes four 1,000,000 gallon tanks, with each tank having two aeration headers, two blowers, and two jet aeration mixing pumps. Equipment from MTS for the Jet Aeration header system has been ordered, and the maximum air flow based on their evaluation is 17,120 scfm, which is similar to the design calculations above.

Proposal received from Kaeser blowers for 2,140 scfm model HB 950 C 200 HP 2375 RPM, Quotation 8988693 have been ordered, using two blowers per tank to provide 4,280 scfm to each tank to provide approximately 16% contingency with all units in operation. The steel for the glass lined tanks has been delivered to the site on August 23, 2013, and the blowers are anticipated to start arriving September 25 with the jet aeration system anticipated to arrive shortly thereafter.

SLUDGE PRODUCTION TREATMENT AND DISPOSAL

Sludge generation and dewatering evaluation based on pilot scale production will provide design and capacity requirements for a full scale installation. The components of the sludge production have been evaluated on the basis of both the bench scale settleability results with various coagulants and verified by the pilot scale clarifier unit.

The clarifier sludge holding tank will be combined with the waste activated sludge holding tank in a mechanical sludge thickener before a dewatering step. Drainage from the sludge thickener and sludge press will flow to a sump in the sludge dewatering area, which will then be pumped back to the 316,000 gallon equalization tank. A sludge thickener from Parkson Corporation and a Kusters Water sludge screw press dewatering at 110 gpm have been ordered.

The biological waste activated sludge production will be documented through the aerobic bench scale tests using raw leachate and with clarified leachate sources. Preliminary Clarifier sludge production may be estimated at 75% removal of the influent 2,600 mg/l TSS. As the majority of the BOD is soluble and will flow through to the aeration tanks, the TSS removal in the clarifier is

an adjunct of the metals precipitation unit operation. It was not possible to estimate the removal percentages during the pilot test; therefore, a conservative approach to solids removal volume calculation was used. In this case, the primary solids generation anticipates 100 % of the TSS will be removed in the clarification unit. This will also account for the volume of chemical addition and the amount of metals precipitation to be achieved.

This clarifier sludge generation is calculated as:

0.3 mgd * 2,600 mg/l * 8.34 = 6,505 lbs per day

If this sludge will be collected at a 2 % concentration, the volume would equal:

6,505 lbs per day /(20,000 *8.34) = 0.039 mgd, which is 39,000 gallons per day.

The aerobic sludge wasting is calculated as follows:

Estimate 0.4 to 0.8 lbs sludge produced per lb BOD destroyed.

At the more conservative sludge wasting of 0.8 lb rate, aerobic sludge = 19,700 lbs/day destroyed and 15,760 lbs sludge produced.

At 2% (or 20,000 mg/l TSS) = 15,760lbs / ((20,000mg/l)(8.34)) = 94,484 gals aerobic sludge daily for dewatering. Therefore, the total sludge production is anticipated as the total of primary and secondary sludge as:

6,505 lbs + 15,760 lbs = 22,265 lbs/day for dewatering.

A sludge thickener will be installed to thicken the estimated 2 % combined clarifier and waste activated sludge to 6% dry solids before sludge dewatering through a screw press.

The flow rate to a screw press is estimated to be:

*22,265 lbs per day /(8.34*60,000 mg/l) = 44,500 gallons per day*
If dewatering occurs 24 hours per day = 30.9 gpm
If dewatering occurs 8 hours per day = 92.7 gpm

A sludge dewatering press will require a polymer feed, based on performance of a similar screw press at the Middlepoint, TN Republic landfill. A minimum 100 gpm dewatering screw press will be installed with space allocated for a second unit if flows or volumes increase.

PROCESS COOLING

The aeration process will generate a significant amount of heat, based on concentration of organics, ambient temperature and other factors. A model was developed to predict temperature rise, and based on boundary conditions, temperatures ranged from 110 degrees F to 150 degrees F.

A design temperature of 130 degrees F was selected for a cooling temperature and a temperature difference of 35 degrees F was selected for cooling to allow for a 95 degree operating temperature. A process cooling of 35 degrees F (delta T) will be provided by a closed loop cooling tower combined with a plate and frame cooling unit located in the membrane unit area. This temperature is well below the MSD required discharge temperature, and is provided solely for biological process control.

ODOR CONTROL

Odor Control units will be supplied for the Equalization Tank and for the Treatment Building. Initial odor control units are planned for four 1 MG aeration tanks, and these odor control units at the aeration tanks are anticipated to be removed from the site as the biological solids become acclimated to the leachate constituents and odors abate.

The Equalization tank odor control options were evaluated using either carbon contactors, a thermal oxidizer, or a chemical scrubber. Evaluation of scrubber technology was also evaluated as a two stage scrubber using sodium hydroxide and sodium hypochlorite scrubbing in a second stage. A similar evaluation for the Treatment Building and temporary odor control at the four 1 MG tanks was reviewed for odor control to limit offensive odors.

The currently installed thermal oxidizer unit at the 316,000 gallon equalization tank is being evaluated, and if odors are reduced to an acceptable level, regenerative thermal oxidizers will be planned for the 316,000 gallon equalization tank and for the Treatment Building. The anticipated flow rate for the Equalization Tank is 1,000 scfm, and the Treatment Building capacity is anticipated at 30,000 scfm.

3.0 OPERATION AND MAINTENANCE CONSIDERATIONS

The major components of the annual operation and maintenance include labor, chemicals, power (electricity), water, equipment replacement, and analytical testing and reporting. The chemicals anticipated to be used at the site include caustic soda (25% sodium hydroxide), sulfuric acid, coagulants, magnesium hydroxide, defoamer, polymers to enhance settling and sludge dewatering, anti-scaling agent to prevent scaling in the clarifier, and minor amounts of membrane cleaning chemicals consisting of caustic and bleach as well as phosphoric acid, urea, and micro-nutrients for the bio-reactors. The following sections describe and detail each of the operational and maintenance components.

3.1 LABOR

The labor to operate and maintain the pretreatment system is anticipated to require three (3) full time equivalents (FTE). Significant components of the operation will be monitored and controlled by PLC controllers and remote reporting. Major outside repair services will be a component of the repair and replacement cost item.

3.2 CHEMICAL – MAGNESIUM HYDROXIDE

Magnesium Hydroxide (magox) is anticipated to be used to assist in the liquid/solids separation at the clarifier to reduce the caustic feed rate and provide a better settling sludge. Bench tests at the site provided recommendations to feed the magox at a feed rate of 40 gph at a 0.3 mgd flow rate. This material in the storage tank requires mixing to keep the magox in suspension.

3.3 CHEMICAL – SODIUM HYDROXIDE

Sodium hydroxide (caustic) will be stored in a six thousand gallon tank inside the treatment building. The caustic will be used to raise the pH from approximately 5.5 S.U. to 9 S.U. in the pH adjustment tank before the clarifier to assist in precipitating zinc and other metals. The volume of caustic feed is based on preliminary bench scale testing that showed an addition of 0.016 gallon of 25% sodium hydroxide per 1.32 gallons of leachate will raise the pH to 11 S.U. This calculates to 0.012 gallons caustic per gallon of leachate. As the pH is anticipated to affect metals precipitation and solids separation at a pH of 9 S.U., a smaller volume of caustic is required. We anticipate a flow a 300,000 gallons per day (gpd) will require 33% of the caustic to achieve a pH of 11 S.U. Sodium hydroxide has a specific gravity (S.G.) of 1.52. The caustic requirement is estimated is presented as follows:

Caustic = (300,000 gpd)(365 days/year)(0.012 gal/gal)(33% of pH 11)(1.52)(8.34 lb/gal)

= 5,496,914 lb/yr.

A minor amount of caustic will be used in the ultrafilter cleaning, and is within the range of the volume estimate provided above.

3.4 CHEMICAL – CAGULANT

Clarification will require a coagulant for effective liquids/solids separation. Testing at the pilot clarifier identified an aluminum chlorhydrate as an effective coagulant at a feed rate to achieve 300 mg/l concentration. This translates to a feed rate of up to 3 gallons per hour.

3.5 CHEMICAL – SULFURIC ACID

Sulfuric acid will be used to lower the pH after the clarifier before the leachate is pumped to the aeration tanks. A maximum of pH of 8 S.U. will be provided to the aeration tanks to prevent biological inhibition. The amount of sulfuric acid is based on the CEC preliminary bench scale test to lower the pH from 11 S.U. to 8 S.U. with sulfuric acid (93%) resulted in 309.7 gpd sulfuric acid at a flow rate of 100 gallons per minute (gpm). At 300,000 gpd (208 gpm), this would translate to 644.2 gpd. With a reduction in the change of pH 9 S.U. to 8 S.U. the usage is estimated at 3% of the higher pH reduction. The sulfuric acid has a specific gravity of 1.84. The estimated sulfuric acid annual usage is anticipated as follows:

Sulfuric Acid = (644.2 gpd)(3%)(8.34lbs/gal)(1.84 S.G.)(365 days)=

= 108,247 lbs/yr

3.6 CHEMICAL – DEFOAMER

Aeration of the leachate can cause extensive foaming that could interfere with efficient operation. In order to eliminate foam, a defoaming chemical must be added, and is currently in use. The application point will be in the 316,000 gallon tank from defoamer storage and feed location in the treatment building. Selection of defoamer will be based on field tests, but will focus on defoamers that do not include silicone to prevent membrane fouling. Typical application ranges from 10 mg/l to 50 mg/l. For estimating purposes, a midpoint of 30 mg/l is used. The anticipated annual quantity of the defoamer is calculated as follows:

Defoamer = (30 mg/l)(8.34)(0.3 mgd)(365 days/yr)

= 27,370 lbs/yr.

3.7 CHEMICAL – POLYMER

Polymer addition will be used in both the clarifier Rapid Mix tank to assist in liquid/solid separation, and as a sludge separation agent. Various polymers have been evaluated, and applications have been less that 50 mg/leach in the clarifier and in the sludge process area. It is anticipated that an anionic polymer will be used in the clarifier and a cationic polymer will be fed to the sludge thickening/dewatering process. The volume of various polymer chemicals used per year, at a feed rate of 50 mg/l is estimated below:

Polymer = (50 mg/l)(0.3mgd)(8.34)(365 days/yr

= 45,662 lb/yr each polymer

3.8 CHEMICAL – OTHER CHEMICALS

The treatment system will require a number of additional chemicals, ranging from anti-scaling agent, to phosphoric acid and other nutrient feed, to minor amounts of cleaning chemicals for process units, such as caustic and bleach for membrane cleaning to maintenance chemicals.

3.9 POWER

The pretreatment process will use electricity in various unit operations. The largest power draws are in the aeration blowers and pumps, with other uses including process pumping, chemical feed pumping, air pollution odor control from regenerative thermal oxidizers, and building electrical uses. Electric charges are calculated based on $0.07 per kilowatt hour (KW).

The power draw for the various uses is estimated as follows:

Description	Volts	HP connected per unit	Number units	Total Connected HP	Actual Max Motor HP Draw, Each	Efficiency, %	KW	Actual KW Consumed
Influent pumps	480	15	4	60	8.5	70		36.2
316 pumps	480	20	2	40	15.0	70		32.0
316 Blowers	480	40	2	80	60.0	70		127.9
Clarifier Feed Pump	480	5	1	5	5.0	70		5.3
8 @ Chemical Feed Pumps	480	2	8	16	1.0	70		8.5
2- mixers	480	2	2	4	1.0	70		2.1
4 - Aeration Tank Feed Pumps	480	5	4	20	0.9	70		3.8
4 - Jet Mixers pumps	480	40	4	160	30.0	70		127.9
4- Jet Aeration Blowers	480	200	4	800	185.0	70		788.6
4 - Membrane Feed Pumps	480	15	4	60	8.5	70		36.2
4 - Membrane Aeration Pumps	480	5	4	20	3.0	70		12.8
2 - membrane Circulation Pumps	480	200	2	400	85.0	70		181.2
2 - Membrane Effluent Pumps	480	5	2	10	3.0	70		6.4
Misc chemical pumps, feeders	120	10	1	10	8.0	70		8.5
Sludge Press	480	40	2	80	56.0	70		119.4
Regen Thermal Oxidizer	480						100	100.0
Building Electrical	110						10	10.0
Total				1585	386.4	840		1606.9

3.10 SLUDGE DISPOSAL

Dewatered sludge is to be disposed at the Roxana Landfill in Illinois. This estimate assumes that the sludge will be non-hazardous, based on metals concentrations and recent TCLP analyses. Preliminary sludge wasting is calculated at 100% removal of 2,600 mg/l to account for chemical feed and contingency amounts, or

Sludge = (2,600 mg/L))(8.34)(0.30 mgd)(365 days/yr)/(2,000 lbs/ton)

= 1,188 tons/yr

For biological sludge, an estimate is typically in the range of 0.4 to 0.8 pounds sludge produced per pound BOD destroyed. At the more conservative sludge wasting of 0.8 pound rate and an estimated 19,700 pounds per day of BOD destroyed:*Aerobic sludge produced = (19,700 lb/day destroyed)(0.8)(365 days/yr)/(2,000lbs/ton).*

= 2,876 tons/yr

Total sludge = 1,188 tons/yr + 2,876 tons/yr

= 4,064 tons/yr

If the sludge is 25% dry solids (based on engineering estimates and discussions with the equipment manufacturer), the weight is 4,062 tons/yr / 25% = 16,080 tons/yr.

4.0 SUMMARY OF DESIGN BASIS

The basis of design considers results of analytical tests, bench scale tests in progress at Civil & Environmental Consultants, Inc. (CEC) laboratory in Charlotte, NC; pilot tests currently being performed at the landfill; and engineering experience and judgment. The process anticipates using the existing 316,000 gallon aerated tank as an equalization tank and pumping the 316,000 gallon tank leachate to a treatment building. PLC Controls will be used for operation of hydraulic flow control at the various units and for chemical feed. Operation tasks include equipment performance monitoring, daily and other reports, chemical feed supply loading and ordering, equipment periodic and breakdown maintenance, responding to and evaluating alarms, and process optimization.

Processes in the treatment building will include a pH adjustment tank where caustic will be added to raise the pH to 9 S.U. to help precipitate zinc and other metals, and then the leachate will flow to a clarifier rapid mix tank where coagulants, polymers and other chemicals will be added to encourage a preliminary liquids/solids separation. The leachate will flow by gravity to an inclined plate clarifier for solids separation. The liquid will then enter a pH adjustment tank where sulfuric acid may be added to lower the pH to 8 S.U. before being pumped to four aeration tanks sized at one million gallons each.

The solids from the inclined plate clarifier will enter a sludge thickener that will raise the solids content from approximately 2% to approximately 5% solids and then pumped to a primary sludge storage tank in advance of being pumped to a screw dewatering press for mixing with the waste activated sludge and subsequent dewatering. The liquid flow from the aeration tanks will be pumped to an ultrafilter system to separate the mixed liquor solids from a relatively clear effluent. The jet aeration and membrane ultrafilter comprise a Membrane Bioreactor system (MBR). That effluent will be pumped to the existing 97,000 gallon storage tank before discharge to the MSD's MRTF. A portion of the solids separated in the ultrafilter will then be returned to the aeration tanks as return activated sludge. The excess sludge to be wasted will be pumped from the ultrafilter return sludge line to a waste activated sludge tank in the treatment building. The waste activated sludge solids in the treatment building will be thickened and mixed with the primary sludge and then mixed with polymers and other chemicals prior to dewatering in ascrew dewatering press. The dewatered solids from the volute press will be placed in 20 cubic yard roll-off containers for transport to the Roxana Landfill.

Exhaust air from the 316,000 gallon tank will be treated by a regenerative thermal oxidizer odor control unit, or through other odor reducing technologies. Initially, air exhaust from the four,

one million-gallon jet aeration tanks will be treated by a rented thermal oxidizer for a period of time until the sludge mass becomes acclimated to the leachate. When acclimatization occurs, the odors from the exhaust air are anticipated to be minimal with an earthy odor; however, if odors continue to be generated, the odor control equipment will remain. The exhaust air from the treatment building will be captured and treated in a regenerative thermal oxidizer before being emitted, or by other suitable alternative means.

FIGURES

NORTH

REFERENCE

1. TOPOGRAPHIC INFORMATION BASED UPON Bridgeton Landfill-DTM.dwg PROVIDED BY COOPER AERIAL SURVEYS CO., DATED FEB 2013. SURVEY FIELD SUPPLEMENTED BY WEAVER BOOS CONSULTANTS

***NOTE: DISTURBED AREAS SHALL BE RESTORED WITH GRAVEL AT THE DISCRETION OF OWNER. DRIVE AISLES SHOULD BE RESTORED PER DETAIL FOR GRAVEL ROAD ON SHEET C800.**

EXISTING 1M GAL LEACHATE STORAGE TANK

EXISTING 1M GAL LEACHATE STORAGE TANK

EXISTING 1M GAL LEACHATE STORAGE TANK

EXISTING 316K LEACHATE STORAGE TANK

EXISTING BUFFER TANK FARM

EXISTING SODA PRESS TRAILER

EXISTING SIEMENS TRAILER

EXISTING FRAC TANK

EXISTING FRAC TANK

EXISTING SKID PLATE FOR PUREAIR FILTRATION TANK

EXISTING MBR UNIT

FUTURE LIFT STATION BY OTHERS

ASSUMED LOCATION OF U/G GAS LINE TO EW BLDG.

100' X 150' TREATMENT & STORAGE BLDG.

PROPOSED ELECTRIC SERVICE FROM POWER BUILDING

ROLL-UP DOOR

ROLL-UP DOORS

ROLL-UP DOOR

DUMPSTER PAD (SEE STRUCTURAL FOR DETAILS)

LIMITS OF DISTURBANCE

GRAVEL ROAD EXTENSION TYPICAL (SEE DETAIL SECTION SHEET C800)

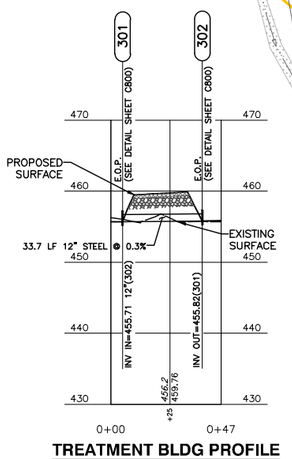
CHEMICAL DELIVERY AREA

REPLACE EXISTING BERM TO TOP OF GRAVEL PAD

E.O.P. INV OUT=455.82(301) 302

33.7 LF 12" STEEL @ 0.33%

E.O.P. INV IN=455.71(302) 301



TREATMENT BLDG PROFILE
SCALE H:1"=30'; V:1"=10'

NOT FOR CONSTRUCTION

SCALE IN FEET
0 30 60

KEVIN KAMP, ENGINEER
PE - 2006019670
***HAND SIGNATURE ON INDIVIDUAL SHEETS**

STATE OF MISSOURI
KEVIN T. KAMP
NUMBER PE-2006019670
PROFESSIONAL ENGINEER
6/5/13

REVISION RECORD

NO	DATE	DESCRIPTION
1		
2		
3		
4		
5		
6		
7		
8		

Civil & Environmental Consultants, Inc.
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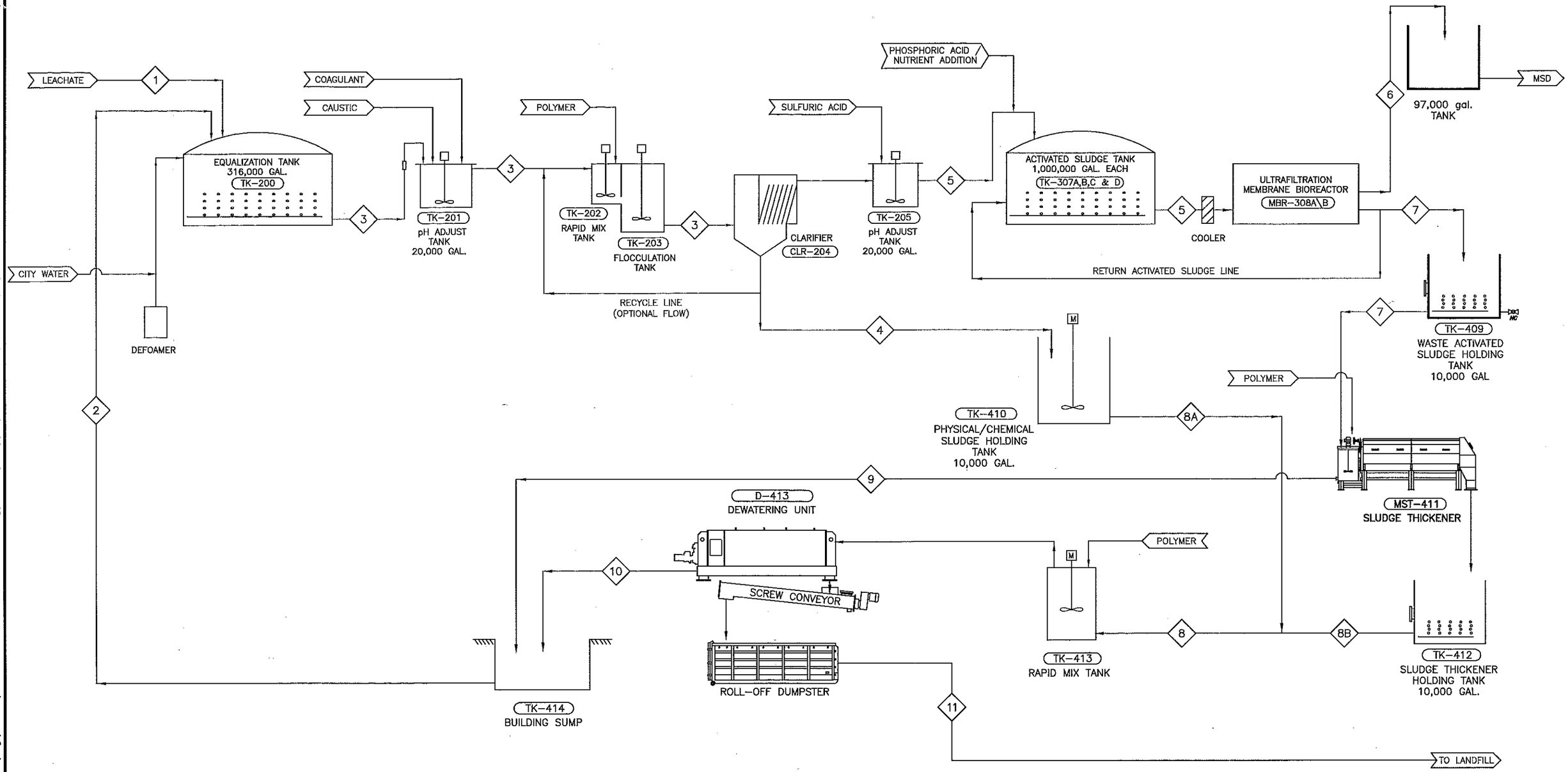
BRIDGETON, MO 63044
PHONE: (314) 744-8195
FAX: (314) 656-2107

BRIDGETON LANDFILL
13570 ST. CHARLES ROCK ROAD
TREATMENT BLDG CONSTRUCTION PLANS
SITE LAYOUT

DATE:	AUGUST 2013
DRAWN BY:	CAC
DWG SCALE:	1" = 30'
CHECKED BY:	KTK
PROJECT NO:	130-484
APPROVED BY:	KTK (SIGNED & SEALED)*

DRAWING NO.:
C200

P:\2013\130-484\1-CADD\DWG\PHASE01\130484-C101-CROSS.DWG LAST SAVED BY:(CDS,THOMP) - 8/30/2013 8:33:26 AM, LAST PLOTTED BY:(CDS,THOMP, CYNTHIA) - 8/30/2013 10:52:17 AM



Stream No.	Stream Description	Max Flow (gpm)	Max Flow (gpd)	Max Flow (MGD)	Max Flow (gpm)	Average Flow (gpd)	Average Flow (MGD)	Tank	Detention Time (days)	Detention Time (hours)
1	From Leachate field to Equalization Tank	208.3	300,000	0.300	104.2	150,000	0.150			
2	From Floor Sump to Equalization Tank	67.2	96,736	0.097	33.6	48,368	0.048	Equalization Tank	0.80	19.1
3	From Equalization Tank to pH Adjust Tank to Clarifier	275.5	396,736	0.397	137.8	198,368	0.198	Clarifier*	0.02	0.53
4	From Clarifier to Phys/Chem Sludge Tank (P/C Sludge)	10.8	15,600	0.016	5.4	7,800	0.008	P/C Sludge Tank	0.64	15.39
5	From Clarifier to pH Adjust Tank to Transfer Tank to Aerobic Tanks	264.7	381,136	0.381	132.3	190,568	0.191	Aeration Tanks	9.85	236.51
6	From MBR to 97,000 gallon Tank to MSD	199.1	286,652	0.287	99.5	143,326	0.143	97K Tank	0.34	8.12
7	From MBR to WAS tank to Sludge Thickener (A Sludge)	65.6	94,484	0.094	32.8	47,242	0.047			
8A	Phys/Chem Sludge Tank to Sludge Dewatering (P/C Sludge)	10.8	15,600	0.016	5.4	7,800	0.008			
8B	Sludge Thickener to Sludge Dewatering (A Sludge)	26.2	37,794	0.038	13.1	18,897	0.019			
8	Combined Phys/Chem Sludge Tank and Sludge Thickener to Sludge Dewatering (P/C + A Sludge)	37.1	53,393	0.053	18.5	26,697	0.027			
9	From Sludge Thickener to Floor Sump	39.4	56,691	0.057	19.7	28,345	0.028	Floor Sump	0.03	0.74
10	From Sludge Dewatering to Floor Sump	27.8	40,045	0.040	13.9	20,022	0.020			
11	From Sludge Dewatering to Landfill (P/C + A Sludge)	9.3	13,348	0.013	4.6	6,674	0.007			

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BRIDGETON, MO 63044
PHONE: (314) 744-8195

PROCESS FLOW
MASS BALANCE DIAGRAM

DRAWN BY:	JKS	CHECKED BY:	DRAFT	APPROVED BY:	DRAFT	DRAWING NO.:	P-308
DATE:	AUGUST 2013	DWG SCALE:	NOT TO SCALE	PROJECT NO:	130-484		

\\SVR-STLOUIS\Projects\2013\130-484\-CADD\Dwg\Phase III\130484-CV01-P-308 Mass Balance.dwg[LAYOUT2] LS:(8/16/2013 - kstills) - LP: 8/16/2013 5:08 PM

NORTH

150'

66'

30'

100'

2'x24' LONG STEEL PLATE FOR ROLL-OFF (4 TYP.)

DUMPSTER PAD (SEE STRUCTURAL DRAWINGS FOR PAD DETAILS)

TO ACTIVATED SLUDGE TANKS TK-307

INSULATED ROLL-UP DOOR 12'x12'

AIR PURIFICATION

INSULATED ROLL-UP DOORS 12'x16' TYP. FOR 4)

3" ANGLE GUIDES

ELECTRICAL 20'x8'-8"

MCC

PLC

CONTROL ROOM 19'-8"x8'-8"

RESTROOM 4'-4"x8'-8"

WATER ROOM 4'-0"x8'-8"

GRIT REMOVAL AREA No. 2

FEED PUMP P-409

FEED PUMP P-410

FEED PUMP P-412

BLOWER BLO-412

TK-409 WASTE ACTIVATED SLUDGE HOLDING TANK

TK-410 PHYSICAL/CHEMICAL SLUDGE HOLDING TANK

SLUDGE THICKENING MST-411A

SLUDGE THICKENING MST-411

SCREW PRESS D-413

FUTURE SCREW PRESS

ULTRAFILTRATION MEMBRANE BIOREACTOR MBR-308A

ULTRAFILTRATION MEMBRANE BIOREACTOR MBR-308B

PROCESS COOLING

BLOWER BLO-409

POLYMER TOTE

POLYMER PUMP

FILTRATE TRANSFER TANK TK-415

SLUDGE THICKENER HOLDING TANK TK-412

TRENCH DRAINS (TYP.)

BLDG. SUMP TK-414

SUMP PUMPS P-414A P-414B

FUTURE EFFLUENT pH ADJUSTMENT TANK

FUTURE CLARIFIER #2

FUTURE RAPID MIX/FLOCCULATION TANK #2

FUTURE POLYMER PUMP & DRUM

FUTURE CLARIFIER SLUDGE PUMP

FUTURE pH ADJUST TANK #2

POLYMER PUMP & DRUM

TRENCH DRAINS (TYP.)

CLARIFIER SLUDGE PUMP P-204A

TK-205 EFFLUENT pH ADJUSTMENT TANK #1

TRANSFER TANK TK-206

pH ADJUST TANK #1 TK-201

MAINTENANCE AREA

VEHICLE STORAGE AREA 54'-5"x53'-4"

AIR COMPRESSOR AND AIR RECEIVING TANK (LOCATED UNDER STAIRS)

INSULATED ROLL-UP DOOR 10'x12'

INSULATED ROLL-UP DOOR 10'x12'

INSULATED ROLL-UP DOOR 10'x12'

INSULATED ROLL-UP DOOR 12'x12'

STANDBY POWER GENERATION

AERATION TANKS FEED PUMPS P-206A, B & C

CLARIFIER SLUDGE PUMP P-204B

CLARIFIER #1 CLR-204

RAPID MIX/FLOCCULATION TANK #1 CLR-202 CLR-203

INSTALL CONTAINMENT AREA

SUMP (18"x18"x2'-0")

COAG FEED PUMPS

COAGULANT STORAGE TANK TK-502

ACID FEED PUMPS

ACID TANK TK-501

CAUSTIC FEED PUMPS

CAUSTIC STORAGE TANK TK-500

FEED PUMPS

NEUTRALIZATION SUSPENSION TANK TK-503

INSTALL CONTAINMENT AREA

GRIT REMOVAL AREA No. 1

EYE WASH/ SHOWER

EYE WASH/ SHOWER

EYE WASH/ SHOWER

DRAIN

CURBED TRUCK UNLOADING

12" CONTAINMENT CURB

80'-6"

20'

4'-0" sq. CONCRETE PAD (TYP. FOR ALL EXTERIOR DOORWAYS)

LEGEND

ELEVATED TANKS

NOT FOR CONSTRUCTION

SCALE: 1/8" = 1'-0"

STATE OF MISSOURI IVAN J. COOPER NUMBER PE-2003009211 PROFESSIONAL ENGINEER

REVISION RECORD

NO.	DESCRIPTION	DATE
0		####
0		####
0		####
0		####
0		####
0		####
0		####
0		####
0		####
0		####

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BRIDGETON, MO 63044
PHONE: (314) 744-8195
FAX: (314) 656-2107

BRIDGETON LANDFILL
13570 ST. CHARLES ROCK ROAD
TREATMENT BUILDING
BUILDING PIPING LAYOUT

DATE:	JULY 2013
DRAWN BY:	JKS
DWG SCALE:	1/8" = 1'-0"
CHECKED BY:	DRAFT
PROJECT NO:	130-484
APPROVED BY:	DRAFT

DRAWING NO.:
P-501

\\SVR-STUDIO\PROJECTS\2013\130-484\-CAD\DWG\PHASE01\130484-P501.DWG LAST SAVED BY:KSTILLEY - 6/29/2013 3:19:32 PM, LAST PRINTED BY:CELTHORPE, CYNTHIA - 8/30/2013 11:26:42 AM

APPENDIX A

EQUIPMENT AND MOTOR LISTS

TANKS				
Number	**Description**	**Motor Hp**	**Genset Backup ATS1**	**Rental Genset Backup ATS2**
BLO-307A1	Activated sludge tank 307A blower #1	200		Yes
BLO-307A2	Activated sludge tank 307A blower #2	200		
P-307A1	Activated sludge tank 307A recirculation pump #1	50		Yes
P-307A2	Activated sludge tank 307A recirculation pump #2	50		
P-307A3	Activated sludge tank 307A tranfer pump #1	15		Yes
P-307A4	Activated sludge tank 307A tranfer pump #2	15		
P-307A5	Activated sludge tank 307A sump pump	10		Yes
OCD-307	Odor Control Device 307	50		Yes
	TK 307A Level controls		Yes	
BLO-307B1	Activated sludge tank 307B blower #1	200		
BLO-307B2	Activated sludge tank 307B blower #2	200		
P-307B1	Activated sludge tank 307B recirculation pump #1	50		
P-307B2	Activated sludge tank 307B recirculation pump #2	50		
P-307B3	Activated sludge tank 307B tranfer pump #3	15		
P-307B3	Activated sludge tank 307B sump pump	10	Yes	
BLO-307C1	Activated sludge tank 307C blower #1	200		
BLO-307C2	Activated sludge tank 307C blower #2	200		
P-307C1	Activated sludge tank 307C recirculation pump #1	50		
P-307C2	Activated sludge tank 307C recirculation pump #2	50		
P-307C3	Activated sludge tank 307C tranfer pump #1	15		
P-307C4	Activated sludge tank 307C tranfer pump #2	15		
P-307C5	Activated sludge tank 307A sump pump	10	Yes	
BLO-307D1	Activated sludge tank 307D blower #1	200		
BLO-307D2	Activated sludge tank 307D blower #2	200		
P-307D1	Activated sludge tank 307D recirculation pump #1	50		
P-307D2	Activated sludge tank 307D recirculation pump #2	50		
P-307D3	Activated sludge tank 307D recirculation pump #3	15		
P-307D4	Activated sludge tank 307D sump pump	10	Yes	
Preliminary Motor List for Single 316K Tank Containment Area for E-Power (8/27)				
Number	**Description**	**Motor Hp**		
BLO-200	Equaliztion tank 200 blower	30		
P-200	Equalization tank 200 recirculation pump	25	Yes	
P-200A	Equalization tank 200 transfer pump #1	15		
P-200B	Equalization tank 200 transfer pump #2	15		
P-200C	Equalization tank 200 loadout pump #1	10		
P-200D	Equalization tank 200 loadout pump #2	10		Yes
P-200E	Equalization tank sump pump	10		Yes

RTO-200	VOC & Odor Control	20	Yes	
Preliminary Motor List for Single 90K Pit for E-Power (8/27)				
Number	**Description**	**Motor Hp**		
P-100A	90K pit transfer pump #1	15	Yes	
P-100B	90K pit transfer pump #2	15		
OCD-100	Odor Control Device	20		Yes
	Pit level controls		Yes	

TREATMENT BUILDING				
Number	**Description**	**Motor Hp**	**Genset Backup ATS1**	**Rental Genset Backup ATS2**
MX-201	pH Adjustment Tank #1 Mixer	7.5		
MX-202	Flash Mixer	1		
MX-203	Flocculator Mixer	1		
P-204A	Clarifier Sludge Recycle Pump	10		
MX-205	pH Adjustment Tank #2 Mixer	7.5		
P-404B	Clarifier Sludge Transfer Pump	10		
FDR-202	Polymer Feeder Physical Chemical Precipitation	3		
P-206A	Activated Sludge Feed Pump #1	15		
P-206B	Activated Sludge Feed Pump #2	15		
P-206C	Activated Sludge Feed Pump #3	15		
	PLC and HMI		Yes	
Preliminary Motor List for Sludge Thickening and Dewatering Equipment for E-Power				
Number	**Description**	**Motor Hp**		
MX-410	Physical Chemical Sludge Holding Mixer	7.5		
P-410	Sludge Dewatering Feed Pump #1	10		
BLO-409	Waste Activated Sludge Holding Blower	11.53		
P-409	Rotary Drum Thickener Feed Pump	10		
MX-411	Rotary Drum Thickener Floc Gearmotor	0.5		
DR- 411	Rotary Drum Thickener Drum Gearmotor	1		
P-411	Rotary Drum Thickener Booster Pump	3		
BLO-412	Thickened Sludge Holding Blower	11.53		
P-412	Sludge Dewatering Feed Pump #2	10		
MX-413	Sludge Dewatering Mixer	1		
DR- 413	Sludge Dewatering Drive	5		
FDR-411	Polymer Feeder Rotary Drum Thickener	3		
FDR-413	Polymer Feeder Sludge Dewatering Unit	3		
CVR-413A	Sludge Dewatering Conveyor #1	5		
CVR-413B	Sludge Dewatering Conveyor #2	5		
CVR-413C	Sludge Dewatering Conveyor #3	5		
P-414A	Floor Sump Pump #1	10		
P-414B	Floor Sump Pump #2	10		
Preliminary Motor List for Grit Removal System for E-Power (8/27)				
Number	**Description**	**Motor Hp**		
MX-600	Holding Tank Mixer (Hold)	15		
P-600A	Cyclone Feed Pump #1 (Hold)	7.5		
P-600B	Cyclone Feed Pump #2 (Hold)	7.5		
CYC-610A	Grit Classifier Conveyor #1 (Hold)	5		
CYC-610B	Grit Classifier Conveyor #1 (Hold)	5		
P-404B	Clarifier Sludge Transfer Pump (Hold)	10		

MBR AND FEEDS				
Number	**Description**	**Motor Hp**	**Genset Backup ATS1**	**Rental Genset Backup ATS2**
VR-800	VOC Removal	25		Yes
OC-800	Odor Control Scubber Blower	75		Yes
P-800A	Odor Control Scubber Reciculation Pump #1	5	Yes	
P-800B	Odor Control Scubber Reciculation Pump #2	5		
P-800C1	Odor Control Caustic Feed Pump #1	1	Yes	
P-800C2	Odor Control Caustic Feed Pump #2	1		
P-800D1	Odor Control Hypochlorite Feed Pump #1	1	Yes	
P-800D2	Odor Control Hypochlorite Feed Pump #2	1		
P-800E1	Odor Control Acid Feed Pump #1	1	Yes	
P-800E2	Odor Control Acid Feed Pump #2	1		
AC-810	Air Compressor Package	15	Yes	
Preliminary Motor List for Chemical Feed for E-Power (8/27)				
Number	**Description**	**Motor Hp**		
P-510	Caustic Metering Pump to TK-200	3		
P-511	Caustic Metering Pump to TK-201	3		
P-512	Caustic Metering Pump to TK-200 or TK-201	3		
P-521	Acid Metering Pump to TK-205	1		
P-522	Acid Metering Pump to TK-205	1		
Preliminary Motor List for MBR Equipment for E-Power (8/27)				
Number	**Description**	**Motor Hp**		
CT-700A	Cooling System for MBR #1	50		
CT-700B	Cooling System for MBR #2	50		
P-710	UF Module 1 Circulation Pump	100		
P-720	UF Module 2 Circulation Pump	100		
P-730	UF Module 3 Circulation Pump	100		
P-740	UF Module 4 Circulation Pump (Future)	100		
P-711	UF Module 1 RAS Pump	10		
P-721	UF Module 2 RAS Pump	10		
P-731	UF Module 3 RAS Pump	10		
P-741	UF Module 4 RAS Pump (Future)	10		
STR-751	Pre-strainer #1	5		
STR-752	Pre-strainer #2	5		
STR-753	Pre-strainer #3	5		
STR-754	Pre-strainer #4 (Future)	5		
CF-760	Nutrient Feed	1		
CF-761	Cleaning Chemical Pump	1		
CF-762	Cleaning Chemical Pump	1		
DI- 770	DI Water Treatment System and Pumps	10		

H-771	Cleaning System Heater	10		
P-772	Cleaning Circulation Pump	20		
P- 781	Strainer Booster Pump #1	40		
P- 782	Strainer Booster Pump #2	40		
P- 783	Strainer Booster Pump #3	40		
P- 784	Strainer Booster Pump #4 (Future)	40		

APPENDIX B

CONTROL NARRATIVE

Bridgeton Landfill Leachate Pretreatment Control System

As part of the Pretreatment System being installed at the Bridgeton Landfill, CEC is specifying a PLC and operator interface. A description of the necessary control functions follows below.

Control Loop 1: FIC-200 Equalization Tank (TK-200) Flow Control

GENERAL

This loop maintains the Equalization Tank discharge flow rate by modulating the pump speed via its VFD. The controller's input signal is provided by the influent Flow meter (FE/FT-200) located downstream of the pump discharge. The flow controller's set point can be provided either by the operator (FLOW MODE) or by the equalization tank level controller (LEVEL MODE) as set by operator by switch on the HMI. The LEVEL MODE of control is described in Control Loop 2. In the FLOW MODE there is a response to decreasing flow as described below.

FLOW CONTROL

The flow transmitter (FIT-200) outputs a 4-20 mA signal proportional to the flow rate. This signal is inputted into the PLC. The PLC contains a PID control strategy. The PID controller outputs a 4-20 mA control signal to the VFDs (P-200A & B). The VFD action is that the pump speed slows to decrease flow and vice versa. The set point to alarm at high flow conditions shall be field adjustable at the operator interface. This control loop automatically increases or decreases the VFD (P-200A & B), as well as turning on/off the influent feed pumps from the 90,000 gallon pit (at the remote Control Panel) at operator entered set points. The Equalization Tank (TK-200) will typically operate at 50% capacity. This allows for 50% capacity to be available for emergency storage in the event of a power outage or an emergency event.

COMPONENTS

FE-200	Magnetic Flow Tube
FT-200	Flow Meter Transmitter
FIC-200	PLC Display (Indicate, Record)

Initial Settings:

Normal operating target level: 50% of tank working volume
Shutdown remote transfer pumps from 90,000 gallon pit: 55% of tank working volume
High level alarm: 55% of tank working volume
High High level alarm: 95% of tank working volume
High High level alarm: Level Switch LSH-200
Lead/Lag pump selection: P-200A or P-200B
Low level alarm: 40% of tank working volume
Low Low level alarm: 5% of tank working volume

Control Loop 2: LIC-200 Equalization Tank 200 Level Control

GENERAL

This loop maintains the Equalization Tank Level by modulating the Discharge Transfer Pumps (P-200A &B). The controller's input signal is provided by the Equalization Tank Level Sensor and Transmitter (LE-200 and LT-200). The Equalization Tank Level set point is entered by the operator. In response to an increasing Equalization Tank Level, this control loop automatically increases the Discharge Transfer Pump speed and flow rate. If the pump speed is full open and the tank level continues to rise, then the feed pumps from the 90,000 gallon pit will be stopped. The minimum and maximum hertz settings (pump speeds) will be hard coded into the VFD. If the tank level continues to rise to an operator configurable set point, an alarm will energize. The Equalization Tank also has interlock I-200 to activate at a discrete high level alarm (LSH-200). The level to turn on/off each pump shall be field adjustable with operation of the pumps in an alternating pump control strategy. Operation of the pumps is in a manual/automatic mode, with either manual operator control of each pump or automatic control based on operator-selected LEVEL MODE described here or FLOW MODE previously described.

COMPONENTS:

LE- 200	Equalization Tank Level Sensor
LIT- 200	Equalization Tank Level Transmitter
LIC- 200	Equalization Tank PLC PID Controller
LSH-200	High Level Switch

INITIAL SETTINGS:

Normal operating level target: 50% of tank working volume
Shutdown remote transfer pumps from 90,000 gallon pit: 55% of tank working volume
High level alarm: 55% of tank working volume
High High level alarm: 95% of tank working volume
High High level alarm: Level Switch LSH-200
Lead/Lag pump selection: P-200A or P-200B
Low level alarm: 40% of tank working volume
Low Low level alarm: 5% of tank working volume

Control Loops: pH Control

GENERAL – CHEMICAL FEED PUMP CONTROLS

All chemical feed pumps can be operated either manually or automatically using the PLC controller. Manual operation of the feed pumps can be controlled by setting each pump to manual. In manual mode, pump flow can be controlled using the speed adjustment for normal operation, thus flow is controlled by the operator, not by the tank pH. It is recommended to normally operate the pumps in automatic mode by setting the pump control on each pump to analog, which allows the pumps to be controlled by the PLC based on numerical pH values. Chemical pump output is controlled by a 4-20 mA analog signal.

Control Loop 3: AIC- 200 Equalization Tank pH Control

GENERAL

This loop controls the pH in the 316,000 Gallon Tank (TK-200) via Caustic (Sodium Hydroxide) addition. The PLC contains a control strategy that maintains PID (proportional) control of the Sodium Hydroxide Storage Tank (TK-500) caustic feed pumps in response to pH changes in the Equalization Tank. The caustic will be supplied from the 6,000 gallon Sodium Hydroxide Storage Tank. The control strategy is based upon initial pH set points listed below.

pH CONTROL

The Equalization Tank's feed pH transmitter (AIT-200) outputs a 4-20 mA signal proportional to the process pH. This signal is entered into the feed pump controller and inputted into the PLC. The PLC contains a proportional pulse control strategy that starts, stops, speeds up or slows down the selected pump to add Sodium Hydroxide into the Equalization Tank (TK-200). Set points shall be operator adjustable. When in manual operation, control set points and interlocks are ignored.

COMPONENTS

AE- 200	pH Sensor
AIT- 200	pH Transmitter
AIC-200	PLC PID Controller
AIR-200	PLC Display (Indicate, Record)
P-510	Sodium Hydroxide Pump
P-512	Sodium Hydroxide Backup Pump

The dead band is a delay centered around the set point, and has been installed on the pumps. For example, a pump with 1 pH unit dead band and set point of 8 turns on at < 7.5 and off at > 8.5. Settings are operator selectable. Initial settings are listed below:

Settings	Pump Start	Setpoint	Pump Stop
Sodium Hydroxide	< 7.5	8.0	> 8.5

INTERLOCKS

Sodium Hydroxide Pump P-510 (and backup P-512) is locked out until the Recirculation Pump P-200 is on.

Control Loop 4: AIC-201 Pre-Clarifier or 1st pH Tank pH Control

GENERAL

This loop controls the pH in the 1st pH Tank via Sodium Hydroxide addition into tank (TK-201). The PLC contains a control strategy that maintains PID (proportional) control of the tank's caustic feed pump in response to changes in the pH of the tank.

pH CONTROL

The tank's feed pH transmitter (AIT-201) outputs a 4-20 mA signal proportional to the process pH. This signal is entered into the PLC. The PLC contains a proportional pulse control strategy that starts, stops, speeds up or slows down the selected pump to add Sodium Hydroxide into the 1st pH Tank (TK-201). Set points shall be operator adjustable. When in manual operation control set points and interlocks are ignored.

Settings	Pump Start	Setpoint	Pump Stop
Caustic	< 8.5	9.0	>9.5

COMPONENTS

AE- 201	pH Sensor
AIT- 201	pH Transmitter
AIC-201	PLC PID Controller
AIR-201	PLC Display (Indicate, Record)
P-500B	Sodium Hydroxide Pump

INTERLOCKS

The Sodium Hydroxide Pump P-511(and backup 512) is locked out until MX-201 is on.

Control Loop 5, 6 and 7: Coagulant and Polymer Metering Pump Control and Sludge Recirculation Pump (TK-201 and TK 202)

Coagulant and Polymer Blender Feeder units will pace off the supplied 4-20 mA flow meter (FIT-200) system. When pumps P-200A and/or P200B are on the Coagulant and Polymer Metering Pumps are on.
These pumps can speed up or slow down by directly proportional 4 -20 mA control. These pumps are controlled by PLC PID Controllers interlocked with the Flow Transmitter FT-200 as the flow rate increased the PLC PID Controllers with increase the 4-20 mA signal to the Coagulant and Polymer Metering pumps and vice versa. The sludge recirculation pump P-204A cuts on whenever P-200A and/or P-200B are on.

INTERLOCKS

1. MX-202 and MX-203 cut on whenever P-200A and/or P-200B are on.
2. P-204A cuts on whenever P-200A and/or P-200B are on.

Control Loop 8: AIC-205 Post-Clarifier 2nd pH Tank pH Control

GENERAL

This loop controls the pH in the Post-Clarifier pH Tank via acid addition into pH Tank (TK-205). The PLC contains a control strategy that maintains PID (proportional) control of the tank's acid feed pumps in response to changes in the pH in the tank.

pH CONTROL

The tank's feed pH transmitter (AIT-205) outputs a 4-20 mA signal proportional to the process pH. This signal is entered into the PLC. The PLC contains a proportional pulse control strategy that starts, stops, speeds up or slows down the selected pump to add Sulfuric Acid into the 2nd pH Tank (TK-205). Set points shall be operator adjustable. When in manual operation control set points and interlocks are ignored.

Settings	Pump Start	Setpoint	Pump Stop
Acid	>8.0	7.5	<7.0

COMPONENTS

AE- 205	pH Sensor
AIT- 205	pH Transmitter
AIC-205	PLC PID Controller
AIR-205	PLC Display (Indicate, Record)
P-521	Sulfuric Acid Pump
P-522	Sulfuric Acid Backup Pump

INTERLOCKS

Acid Pump P-521 (and backup P-522) is locked out until MX-205 is on.

Control Loop 9: LIC-206 Transfer Tank 206 Level Control

GENERAL

This loop maintains the Transfer Tank Level by modulating the Discharge Transfer Pumps (P-206A, B& C). The controller's input signal is provided by the Transfer Tank Level Sensor and Transmitter LE-206 and LT-206. The Transfer Tank Level set point is entered by the operator. In response to an increasing Transfer Tank Level, this control loop automatically increases the Discharge Transfer Pump speed and flow rate and vice versa. If the pump speed is full open and the tank level continues to rise, then the feed pumps from the 316,000 gallon Equalization Tank will be stopped. The minimum and maximum hertz settings (pump speeds) will be hard coded into the VFD. If the tank level continues to rise to an operator configurable set point, an alarm will energize. The Equalization Tank also has interlock I-206 to activate at a discrete high level

alarm. The level to turn on/off each pump shall be field adjustable with operation of the feed pumps from the tank in an alternating pump control strategy. Operation of the feed pumps is in a manual/automatic mode, with either manual operator control of each pump or automatic control based on operator-selected LEVEL MODE described here, PARALLEL FLOW MODE or SERIES FLOW MODE to be described in later.

COMPONENTS:

LE- 206	Transfer Tank Level Sensor
LIT- 206	Transfer Tank Level Transmitter
LIC- 206	PLC Transfer Tank PID Controller
LSH-206	High Level Switch

INITIAL SETTINGS:

Normal operating level target: 50% of tank working volume
Shutdown pumps from the 316,000 gallon Equalization Tank: 55% of tank working volume
High level alarm: 55% of tank working volume
High High level alarm: 95% of tank working volume
High High level alarm: Level Switch LSH-206
Lead/Lag pump selection: P-206A, P-206B, or P- 206C
Low level alarm: 40% of tank working volume
Low Low level alarm: 5% of tank working volume

INTERLOCKS

P-200A and/or P-200B cuts off whenever TK 206 is in High level alarm.

Control Loop 10: Flowmeter Controllers (FIC-307A, FIC-307B, FIC-307C, FIC-307D), Transfer Pumps (P-206A, P-206B, P-206C), Proportional Control Valves (AV-307A, AV-307B, AV-307C and AV-307D) and Automatic Valves (AV-307A&B, AV-307C&D) for "Parallel" Flow Control

GENERAL

This loop maintains the Transfer Tank discharge flow rate by modulating the P-206A, P-206B and/or P-206C pump speed via their VFDs, AV-307A, AV-307B, AV-307C and AV-307D Control Valves for equal flow to each activated sludge tank and AV-307A&B, AV-307C&D Automatic Valves to set "parallel" operating mode. The PLC controller's input signal is provided by the Flow meters- FE/FT-307A, FE/FT-307B, FE/FT-307C and FE/FT-307D located downstream of the pump discharges and at the inlets into TK-307A, TK-307B, TK-307C and TK-307D. The flow controller's set point can be selected either by the operator ("PARALLEL" FLOW MODE or "SERIES" FLOW MODE) or by the transfer tank level controller (LEVEL MODE) as set by the operator on the HMI. The LEVEL MODE of control is described in Control Loop 9. In the "PARALLEL" FLOW MODE there is a response to decreasing flow or vice versa for Control Loop 11 as described below. The "SERIES" FLOW MODE is an alternative operating mode and described below for Control Loop 12.

PARALLEL FLOW CONTROL

The flow transmitters (FT-307A, FT-307B, FT-307C and FT-307D) outputs a 4-20 mA signal proportional to the flow rate. This signal is inputted into the PLC. The PLC contains a PID control strategy. The PID controllers output 4-20 mA control signals to the VFDs (P-206A, P-206B and P-206C), the proportional control valves (AV-307A, AV-307B, AV-307C and AV-307D) as well as automatic valves (AV-307A&B, AV-307C&D). The VFD action is that the pump speed slows to decrease flow (and vice versa) and the proportional control valves throttle to provide equal flow rates to all four (4) activated sludge tanks (TK-307A, TK-307B, TK-307C and TK-307D). The automatic valves AV-307A&B and AV-307C&D are directional valves and their position sets "parallel" or "series" operating modes. The set point to alarm at high flow conditions shall be field adjustable at the operator interface. This control loop automatically decreases or increases the VFD (P-206A, P-206B & P-206C), throttling the control valves and turning on/off the influent feed pumps from the 316,000 gallon Equalization Tank at operator entered set points. The Transfer Tank TK-206 will typically operate at 50% capacity. This allows for 50% capacity to be available for emergency storage in the event of a power outage or an emergency event. The Equalization Tank also has I-206 interlock to activate at a discrete high level alarm LSH-206.

COMPONENTS

P-206A, B and C	Transfer Pumps and their VFDs
FE-307A, B, C &D	Magnetic Flow Tubes
FT-307A, B, C &D	Flow Meter Transmitters
FIC-307A, B, C &D	PLC Display (Indicate, Record)
CV-307A, B, C &D	Proportional Control Valves
AV-307A&B, 307C&D	Automatic Valves
LE-307A, B, C &D	Pressure (Level) element
LT-307A, B, C &D	Pressure Transmitters

LIC-307A, B, C &D	PLC Display (Indicate, Record)
LSH-307A, B, &C	High Level Switches
LSH-206	High Level Switches

Initial Settings:

Normal operating target level: 50% of transfer tank working volume
Shutdown transfer pumps from 316,000 gallon Equalization Tank: 55% of tank working volume
High level alarm: 75% of Transfer Tank (TK-206) working volume
High High level alarm (Analog): 95% of Transfer Tank (TK-206) working volume
High High level alarm (Discrete): Level Switch LSH-206, LSH-307A, LSH-307B, LSH-307C and/or LSH-307D (all set at 97% of Tank height)
Lead/Lag pump selection: P-206A, P-206B and/or P-206C
Low level alarm: 40% of tank working volume
Low Low level alarm: 5% of tank working volume

INTERLOCKS

1. P-200A and/or P-200B cuts off whenever TK 206 is in High level alarm.
2. P-206A, P-206B and/or P-206C cut off whenever TK 307A, TK-307B, TK-307C and/or TK307D are in High High level alarm and "parallel" operating mode.

Control Loop 11: Flow Meter Controllers (FIC-307A, FIC-307B, FIC-307C, FIC-307D), Transfer Pumps (P-206A, P-206B, P-206C, P-307A3, P-307A4, P-307B3, P-307C3, P-307C4, P-307D3), Proportional Control Valves (AV-307A, AV-307B, AV-307C), Automatic Valves (AV-307A&B, AV-307C&D) for "Series" Flow Control

GENERAL

The difference between the "Series" Flow Control and Control Loop 10: "Parallel" Flow Control (previously described) is the "parallel" flow operation utilizing all four (4) activated sludge tanks (TK-307A, TK-307B, TK-307C and TK-307D) in "parallel" while the "series" flow operation utilizes two tanks (either TK-307A & B or TK-307C & D) as dual primary tanks followed in series by dual secondary tanks (either TK-307C & D or TK-307A & B).

This loop maintains the Transfer Tank discharge flow rate by modulating the P-206A, P-206B and/or P-206C pump speed along with either P-307A3, P-307A4 & P-307B3 or P-307C3, P-307C4 & P-307D3 via their VFDs and AV-307A, AV-307B, AV-307C and AV-307D Control Valves for equal flow to each activated sludge tank and AV-307A&B, AV-307C&D Automatic Valves to set "series" operating mode. The PLC controller's input signal is provided by the Flow meters- FE/FT-307A, FE/FT-307B, FE/FT-307C and FE/FT-307D located downstream of the pump discharges and at the inlets into TK-307A, TK-307B, TK-307C and TK-307D. The flow controller's set point can be provided either by the operator ("PARALLEL" FLOW MODE or "SERIES" FLOW MODE) or by the transfer tank level controller (LEVEL MODE) as set by

operator by switch on the HMI. The LEVEL MODE of control is described previously in Control Loop 9. The "PARALLEL" FLOW MODE of control is described previously in Control Loop 10.

SERIES FLOW CONTROL

The flow transmitters (FT-307A, FT-307B, FT-307C and FT-307D) outputs a 4-20 mA signal proportional to the flow rate. This signal is inputted into the PLC. The PLC contains a PID control strategy. The PID controllers output 4-20 mA control signals to the VFDs (P-206A, P-206B and P-206C) and (P-307A3, P-307A4 &P-307B3) or (P-307C3, 307C4 & 307D3) the proportional control valves (CV-307A, CV-307B, CV-307C and CV-307D) as well as automatic valves (AV-307A&B, AV-307C&D). The VFD action is that the pump speed slows to decrease flow (and vice versa) and the proportional control valves throttle to provide equal flow rates to all four (4) activated sludge tanks (TK-307A, TK-307B, TK-307C and TK-307D). The automatic valves AV-307A&B and AV-307C&D are directional valves and their position sets "parallel" or "series" operating modes. The set point to alarm at high flow conditions shall be field adjustable at the operator interface. This control loop automatically decreases or increases the VFD (P-206A, P-206B & P-206C) and (P-307A3, P-307A4 &P-307B3) or (P-307C3, 307C4 & 307D3), throttling the control valves and turning on/off the influent feed pumps from the 316,000 gallon Equalization Tank at operator entered set points. The Transfer Tank TK-206 will typically operate at 50% capacity. This allows for 50% capacity to be available for emergency storage in the event of a power outage or an emergency event. The Equalization Tank also has I-206 interlock to activate at a discrete high level alarm LSH-206.

COMPONENTS

P-206A, B and C	Transfer Pumps and their VFDs
FE-307A, B, C &D	Magnetic Flow Tubes
FT-307A, B, C & D	Flow meter Transmitters
FIC-307A, B, C & D	PLC Display (Indicate, Record)
CV-307A, B, C & D	Proportional Control Valves
AV-307A&B, 307C&D	Automatic Valves
P-307A3, A4 and B3	Transfer Pumps and their VFDs
P-307C3, C4 and D3	Transfer Pumps and their VFDs
LE-307A, B, C &D	Pressure (Level) element
LT-307A, B, C & D	Pressure Transmitters
LIC-307A, B, C & D	PLC Display (Indicate, Record)
LSH-307A, B, C &D	High Level Switches

Initial Settings:

Normal operating target level: 50% of tank working volume
Shutdown remote transfer pumps from 316,000 gallon pit: 55% of tank working volume
High level alarm: 75% of tank working volume
High High level alarm: 95% of tank working volume

High High level alarm: Level Switch LSH-206, LSH-307A, LSH-307B, LSH-307C and/or LSH-307D
Lead/Lag pump selection: P-206A, P-206B and/or P-206C
Low level alarm: 40% of tank working volume
Low Low level alarm: 5% of tank working volume
Lead/Lag pump selection: P-307A3, P-307A4 and/or P-307B3
Lead/Lag pump selection: P-307C3, P-307C4 and/or P-307D3

INTERLOCKS

1. P-200A and/or P-200B cuts off whenever TK 206 is in High level alarm.
2. P-206A, P-206B and/or P-206C cut off whenever the primary tanks (TK 307A and/or TK-307B or TK-307C and/or TK307D) are in High level alarm and "series" operating mode.
3. P-307A3, P-307A4 and/or P-307B3 or P-307C3, P-307C4 and/or P-307D3 cut off whenever the secondary tanks (TK 307C and/or TK-307D or TK-307A and/or TK307B) respectively are in High High level alarm and "series" operating mode.

Control Loop 12, 13, 14 and 15: Level Controls (LIC-307A, LIC-307B, LIC-307C and LIC-307D Activated Sludge Tank Level Controls

GENERAL

These loops maintain the Activated Sludge Tank Levels by modulating the Discharge Transfer Pumps (P-307A3, P-307A4, P-307B3, P-307C3, P-307C4, and P-307D3). The controller's input signals are provided by the Activated Sludge Tank Level Sensor and Transmitter (LE-307A, 307B, 307C, 307D and LT-307A, LT-307B, LT-307C and LT-307D). The Activated Sludge Tank Levels set points are entered by the operator. In response to an increasing Activated Sludge Tank Level, this control loop automatically increases the Discharge Transfer Pump speed and flow rate. If the pump speed is full open and the tank level continues to rise, then the feed pumps (P-206A, P-206B and/or P-206C) from the Transfer Tank will be stopped. The minimum and maximum hertz settings (pump speeds) will be hard coded into the VFD. If the tank level continues to rise to an operator configurable set point, an alarm will energize. The Activated Sludge Tanks also have interlocks (I-307A, I-307B, I-307C and I-307D) to activate at a discrete high level alarm. The level to turn on/off each pump shall be field adjustable with operation of the feed pumps from the tank in an alternating pump control strategy. Operation of the feed pumps is in a manual/automatic mode, with either manual operator control of each pump or automatic control based on operator-selected LEVEL MODE, PARALLEL FLOW MODE or SERIES FLOW MODE described previously.

COMPONENTS:

LE- 307A, 307B, 307C & 307D	Transfer Tank Level Sensor
LIT- 307A, 307B, 307C & 307D	Transfer Tank Level Transmitter
LIC- 307A, 307B, 307C & 307D	PLC Transfer Tank PID Controller
LSH- 307A, 307B, 307C & 307D	High Level Switch in Each Tank

INITIAL SETTINGS:

Normal operating level target: 90% of Activated Sludge Tank working volume
Shutdown pumps (P-307A3, A4, B3, C3, C4, D3) from the Activated Sludge Tank: 95% of tank working volume
High level alarm: 95% of the Activated Sludge Tank working volume
High High level alarm: 97% of Activated Sludge Tank working volume
High level alarm: Level Switch LSH-307A, 307B, 307C, and 307D
Lead pumps selection: P-206A, P-206B, or P- 206C and 307A3, P-307B3, P-307C3 and P-307D3
On-Line backup pumps: P-307A4 and P-307C4
Low level alarm: 50% of tank working volume
Low Low level alarm: 25% of tank working volume

INTERLOCKS

1. P-206A, P-206B and/or P-206C cut off whenever the primary tanks (TK 307A and/or TK-307B or TK-307C and/or TK307D) are in High level alarm and "series" operating mode.
2. P-206A, P-206B and/or P-206C cut off whenever the primary tanks (TK 307A, TK-307B, TK-307C or TK307D) are in High level alarm and "parallel" operating mode.
3. P-307A3, P-307A4 and/or P-307B3 or P-307C3, P-307C4 and/or P-307D3 cut off whenever the secondary tanks (TK 307C and/or TK-307D or TK-307A and/or TK307B) or respectively are in High level alarm and "series" operating mode and there is no OK to feed signal from the Membrane Bio-Reactor 1 and/or 2 respectively and the operation is in parallel operating mode.
4. P-307A3, P-307A4 and/or P-307B3 or P-307C3, P-307C4 and/or P-307D3 cut off whenever there is no OK to feed signal from the Membrane Bio-Reactor 1 and/or 2 respectively and the operation is in parallel operating mode.

Control Loops: DO Control

GENERAL – DISSOLVED OXYGEN CONTROLS

The aeration blowers in activated sludge tanks can be operated either manually or automatically using the PLC controller. Manual operation of the blowers can be controlled by setting each blower to manual. In manual mode, blower flow can be controlled using the speed adjustment

for normal operation, thus flow is controlled by the operator, not by the tank DO. It is recommended to normally operate the blowers in automatic mode by setting the blower control on each blower to analog, which allows the blowers to be controlled by the PLC based on numerical DO values. Blower output is controlled by 4-20 mA analog signal.

Control Loop 16, 17, 18 and 19: (AIC- 307A, AIC-307B, AIC-307C and AIC-307D) Activated Sludge Tanks DO Control

GENERAL

This loop controls the DO in the 1-MG, Activated Sludge Tanks (TK-307A, TK-307B, TK-307C and TK-307D) via blower air addition. The PLC contains a control strategy that maintains PID (proportional) control of the activated sludge tanks by varying the rate that the blowers feed in response to DO changes in activated sludge tanks by way of VFDs on each blower. The blower will be supplied to pressurize ambient air into the activated sludge basins. The control strategy is based upon initial DO set points listed below.

DO CONTROL

The DO transmitters (AIT-307A, AIT-307B, AIT-307C and AIT-307D) outputs a 4-20 mA signal proportional to the process DO. This signal is enter in AIT-307A, B, C and D to the feed pump controller and inputted into the PLC. The PLC contains a proportional pulse control strategy that starts, stops, speeds up or slows down the selected blower to add dissolved oxygen into the activated sludge bio-mass by pressurizing atmospheric air. Set points shall be operator adjustable. When in manual operation, control set points and interlocks are ignored.

COMPONENTS

AE- 307A, 307B, 307C &307D	DO Sensor
AIT- 307A, 307B, 307C &307D	DO Transmitter
AIC-307A, 307B, 307C &307D	PLC PID Controller
AIR-307A, 307B, 307C &307D	PLC Display (Indicate, Record)
BLO-307A1, 307A2, 307B1, 307B2 plus a spare	Blower Controls
BLO-307C1, 307C2, 307D1, 307D2 plus a spare	Blower Controls

The dead band is a delay centered around the set point, and has been installed on the blowers. For example, a blower control with 0.5 mg/L DO unit dead band and set point of 3.0 turns on at < 2.5 mg/L and off at > 4.0 initial settings are listed below:

Settings	Pump Start	Setpoint	Pump Stop
Dissolved Oxygen	<2.5	3.0	> 4.0

INTERLOCKS

None.

GENERAL - MEMBRANE BIO-REACTOR SUB-SYSTEM CONTROL

The flow from the activated sludge reactor tanks either by parallel or series operation flows to dual membrane bio-reactor subsystems. The subsystem is controlled independently by controls supplied by the system supplier but is intended to be EtherNet/ IP protocol or equivalent. The EtherNet/IP network uses standard EtherNet and TCP/IP technologies and an open protocol called Common Industrial Protocol (CIP). The CIP makes interoperability and interchangeability of industrial automation and controls devices on the EtherNet/IP network for ease of communication between the main control PLC and HMI and automation, real time control and interlocks required for optimum automation and function of the MBR controls.

More detail will be provided upon finalization of the process MBR design.

Critical Control Loops to be addressed will include:

1. Booster or feed pumps to the 1 mm screens prior to on-board aeration
2. Return Activated Sludge to the Activated Sludge Treatment Reactors
3. Waste Activated Sludge to the Waste Activated Sludge Holding Tank for thickening and dewatering
4. Permeate discharge from the MBR to the existing 97,000 gallon on-site holding tank

Control Loop 20: Clarifier Underflow Sludge Pump (P-404B)

The clarifier underflow sludge pump will be controlled by manual or automatic control. In manual mode the pump's speed or flow rate can be set on the HMI panel by the operator. The manually selected pump rate can be set to underflow sludge at a rate that is predicted by conducting a sludge settling jar test on a routine basis and by monitoring the sample ports on the bottom cone of the lamella clarifier. In the automatic mode the pumps VFD can be paced off the 4-20 mA flow meter system on the inlet to the 1st pH adjust tank prior to the clarifier. The pump should also cut on and off with the main feed pumps (P-200A & B) from the 316,000 gallon tank (TK-200). These pumps can speed up or slow down by proportional 4 -20 mA control. These pumps are controlled by PLC PID Controllers interlocked with the Flow FT-200 as the flow rate increased the PLC PID Controllers will increase the 4-20 mA signal to the pump. Pump (P-404B) can also be used to feed directly to the sludge dewatering unit in the event that the Physical/Chemical Sludge Holding Tank (TK-410) is down for service.

INTERLOCKS

1. Tank Full and High level in the Physical/Chemical Sludge Holding Tank (TK-410) cuts off pump (P-404B).
2. P-404B cuts on whenever P-206A and/or P-206B are on.

Control Loop 21 and 22: (LIC-410 and LIC-409) Physical/Chemical Sludge Holding and Waste Activated Sludge Holding Level Controls

GENERAL

These level controls monitor, alarm, and provide interlocks to cut-off transfer pumps. The PLC controller's input signal is provided by the Physical/Chemical Sludge Holding and Waste Activated Sludge Holding Tank's Level Sensors and Transmitters (LE-410, LE-409, LT-410 and LT-409). The tank level set points are entered by the operator for control points such as start mixing, stop mixing, OK to pump and stop pump, high level alarms, and high high level alarms. These controls can also be used in the future to provide a semi-automatic mode of operation so that sludge can be allowed to settle and thicken, clear water can be decanted and thickened sludge can be sent to additional dewatering processes. The minimum and maximum hertz settings (pump speeds) for pumps (P-404B, P-409, P-410) feeding and discharging from these tanks will be hard coded into the VFD. The tank's also have interlocks I-410 and I-409 to activate at a discrete high level alarm. The level to turn on/off each pump shall be field adjustable with operation of the feed pumps from the MBRs and the Physical/Chemical Clarifier an alternating pump control strategy. Operation of the feed and discharge pumps is in a manual/automatic mode, with either manual operator control of each pump or future automatic control based on operator-selection paced off of the dewatering press influent flow meter or to match predetermined allowable feed rates to the rotary drum thickener.

COMPONENTS:

LE- 409, LE-410	Tank Level Sensor
LIT- 409, LIT-410	Tank Level Transmitter
LIC- 409, LIT-410	Tank PLC PID Controller
LSH-409, LSH-410	Tank backup high levels

INITIAL SETTINGS:

Normal operating level target: 25% to 75% of tank working volume
Shutdown remote transfer pumps from MBR and Clarifier Underflow: 75% of tank working volume
Start mixers: 35% of tank working volume
Stop mixer: 30% of tank working volume
High level alarm: 80% of tank working volume
High High level alarm: 85% of tank working volume
High High level alarm: Level Switch LSH-409 or LSH-410
Low level alarm: 20% of tank working volume
Low Low level alarm: 15% of tank working volume

GENERAL – ACTIVATED SLUDGE THICKENING SUB-SYSTEM CONTROL

The waste activated sludge (WAS) flow from the MBR system in either by parallel or series operation flows from the dual containerized membrane bio-reactor subsystems to the Waste Activated Sludge Holding Tank (TK-409). The waste activated sludge is then transferred via P-409 to the rotary drum thickener subsystem that includes a flocculation tank as well as a rotary drum thickener. This subsystem is controlled independently by controls supplied by the system supplier but is intended to be EtherNet/IP protocol or equivalent. The EtherNet/IP network uses standard EtherNet and TCP/IP technologies and an open protocol called Common Industrial Protocol (CIP). The CIP makes inter-operability and inter-changeability of industrial automation and controls devices on the EtherNet/IP network for ease of communication between the main control PLC and HMI, real time control and interlocks required for optimum automation and function of the MBR controls.

More detail will be provided upon finalization of the rotary drum thickener process design details from the supplier.

Critical Control Loops to be addressed will include:

1. Feed pump
2. Polymer blender feeder to flocculation tank
3. Manual and automatic screen washing
4. Discharge

Control Loop 23: (MST-411) Polymer Metering Pump Control

Polymer Blender Feeder units will pace off supplied 4-20 mA flow meter system.
The metering pump can speed up or slow down by directly proportional 4 -20 mA control. This pump is controlled by PLC PID Controllers interlocked with the MST-411Controls the flow rate to the rotary drum thickener (MST-411) increased the PLC PID Controllers increases the 4-20 mA signal to the Polymer Blender Feeder metering pump.

INTERLOCKS

1. Polymer blender feeder metering pump cuts on and off with the MST-411 feed pump P-409.
2. High level in the Sludge Thickener Holding Tank (TK-412) cuts off both the MST-411 feed pump (P-409) as well as the interlocked polymer blender feeder pump.

GENERAL – SLUDGE DEWATERING SUB-SYSTEM CONTROL

The thickened waste activated sludge from the Sludge Thickener Holding Tank (TK-412) and the thickened physical/chemical sludge from the Physical/Chemical Sludge Holding Tank (TK-410) are dewatered in the Sludge Dewatering Unit (D-413). The sludge feed rate for each type of sludge is set by the operator on the HMI screen. The flow meter consisting of a flow element(FE-413) and a flow transmitter (FT-413) that outputs a 4-20 mA signal that is inputted to the PLC. The PLC contains a PID control strategy. The PID outputs a 4-20mA control signal to the Polymer Blender Feeder to send a polymer feed directly proportional to the flow to the flocculation chamber of the Screw Press Dewatering Unit (D-413). The Screw Press is a subsystem controlled independently by controls supplied by the system supplier but is intended to be EtherNet/IP protocol or equivalent. The EtherNet/IP network uses standard EtherNet and TCP/IP technologies and an open protocol called Common Industrial Protocol (CIP). The CIP makes inter-operability and inter-changeability of industrial automation and controls devices on the EtherNet/IP network for ease of communication between the main control PLC and HMI, real time control and interlocks required for optimum automation and function of the screw press controls.

More detail will be provided upon finalization of the screw press process design details from the supplier.

Critical Control Loops to be addressed will include:

1. Feed pumps
2. Polymer blender feeder to flocculation tank
3. Manual and automatic screen washing
4. Discharge

Control Loop 24: (D-413) Polymer Metering Pump Control

Polymer Blender Feeder units will pace off supplied 4-20 mA flow meter system.
The metering pump can speed up or slow down by directly proportional 4 -20 mA control. This pump is controlled by PLC PID Controllers interlocked with the D-413 Controls the flow rate to the screw press (D-413) increased the PLC PID Controllers increases the 4-20 mA signal to the Polymer Blender Feeder metering pump.

INTERLOCKS

1. Polymer blender feeder metering pump cuts on and off with the D-413 feed pump P-410 and P-412 and the influent flow meter.
2. High level signals from the sludge conveyor subsystem.

GENERAL – SLUDGE CONVEYOR SUB-SYSTEM CONTROL

The dewatered sludge from the Sludge Dewatering Unit (D-413) discharges to a sludge conveyor subsystem. The sludge conveyor subsystem consist of three conveyors to control the sludge discharge to a total of six (6) strategically located discharge points in two roll-off dumpsters providing for a more uniform fill of the roll-off dumpsters without moving them with a dedicated winch. All three conveyors are equipped with reversing motor starters. The primary conveyor (CVR-415A) receives all of the sludge from the dewatering screw press unit and conveys the sludge to distribution conveyor #1 or #2 (CVR-415B or CVR-415C). The distribution conveyors discharge to one of three (3) sludge discharge points by automatic opening and closing of knife gate valves (based on an operator selected preset and as monitored by six (6) ultrasonic level sensors (LE-415B1, LT-415B1, LE-415B2, LT-415B2, LT-415B3, LT-415B3, LE-415C1, LT-415C1, LE-415C2, LT-415C2, and LT-415C3, LT-415C3) [three (3) strategically located sensors over each of the two roll-off dumpsters].

The rotary drum thickener sludge and the thickened physical/chemical sludge from the Physical/Chemical Sludge Holding Tank (TK-410) are dewatered in the Sludge Dewatering Unit (D-413). The sludge feed rate for each type of sludge is set by the operator on the HMI screen. The flow meter consisting of a flow element(FE-413) and a flow transmitter (FT-413) that outputs a 4-20 mA signal that is inputted to the PLC. The PLC contains a PID control strategy. The PID outputs a 4-20mA control signal to the Polymer Blender Feeder to send a polymer feed directly proportional to the flow to the flocculation chamber of the Screw Press Dewatering Unit (D-413). The Screw Press is a subsystem controlled independently by controls supplied by the system supplier but is intended to be EtherNet/IP protocol or equivalent. The EtherNet/IP network uses standard EtherNet and TCP/IP technologies and an open protocol called Common Industrial Protocol (CIP). The CIP makes inter-operability and inter-changeability of industrial automation and controls devices on the EtherNet/IP network for ease of communication between the main control PLC and HMI, real time control and interlocks required for optimum automation and function of the screw press controls.

More detail will be provided upon finalization of the screw press process design details from the supplier.

Critical Control Loops to be addressed will include:

1. Feed pumps
2. Polymer blender feeder to flocculation tank
3. Manual and automatic screen washing
4. Discharge

Control Loop 24: (D-413) Polymer Metering Pump Control

Polymer Blender Feeder units will pace off supplied 4-20 mA flow meter system.
The metering pump can speed up or slow down by directly proportional 4 -20 mA control. This pump is controlled by PLC PID Controllers interlocked with the D-413 Controls the flow rate to

the screw press (D-413) increased the PLC PID Controllers increases the 4-20 mA signal to the Polymer Blender Feeder metering pump.

INTERLOCKS

1. Polymer blender feeder metering pump cuts on and off with the D-413 feed pump P-410 and P-412 and the influent flow meter.
2. High level signals from the sludge conveyor subsystem.

Control Loop 25: LIC-414 Building Sump (TK-414) Level Control

GENERAL

The decants, filtrate and/or wash waters from the Dewatering Press (D-413), the Rotary Drum Thickener (MST-411), the Physical/Chemical Sludge Holding Tank (TK-410), the Waste Activated Sludge Holding Tank (TK-409), and the Sludge Thickener Holding Tank (TK-412) all flow to the building sump (TK-414). These flows need to be recycled back through the system for re-processing.

This loop maintains the Building Sump Level by starting and stopping the sump pumps (P-414A and P-414B) to recycle collected flows back to the 316,000 gallon tank (TK-200). The controller's input signal is provided by the Building Sump Level Sensor and Transmitter LE-414 and LT-414. The PLC controller LIC-414 provides an on/off control strategy that starts and stops as well as ratchets the dual pumps. The pump's on and off set points as well as High Level and High High Level alarms are operator configurable.

COMPONENTS:

LE- 414	Building Sump Level Sensor
LIT- 414	Building Sump Level Transmitter
LIC- 414	Building Sump Level PLC Control
LSH-414	Building Sump High Level Switch

INITIAL SETTINGS:

Normal operating level target: 25% to 35% of tank working volume
Shutdown sludge transfer pumps: 55% of tank working volume
High level alarm: 55% of tank working volume
High High level alarm: 60% of tank working volume
High High level alarm: Level Switch LSH-414
Lead/Lag pump selection: P-414A or P-414B
Low level alarm: 20% of tank working volume

Control Loop 26, 27 & 28: LIC-500, LIC- 501 and LIC-502 Chemical Feed Tanks (TK-500, TK-501 and TK-502) Level Controls

GENERAL

These control loops monitor, shut-off, indicate and alarm the critical levels in the Chemical Feed Tanks (TK-500, TK-501 and TK502). The controller's input signals are provided by the Chemical Feed Tank Level Sensors and Transmitters LE-500, LE-501, LE-502 and LT-500, LT-501, LT-502. The PLC controllers LIC-500, LIC-501, LIC-502 provides a Level indication of the chemicals in each of the tanks, alarms at High Level via I-500, I-501, I-502, a Reorder Level indication and an automatic shut-off of the chemical feed pumps at Low Level. Primary pump or back-up pump are operator selectable. All set points are operator configurable.

COMPONENTS:

LE- 500, LE-501 & LE-502	Chemical Tank Level Sensors
LIT- 500, LIT-501 & LIT-502	Chemical Tank Level Transmitters
LIC- 500, LIC-501 & LIC-502	Chemical Tank PLC Controls
LSH-500, LSH-501 & LSH-502	Chemical Tank Area Sump High Level Switches

INITIAL SETTINGS:

Normal operating level target: 20% to 70% of tank working volume
Shutdown sludge transfer pumps: 10% of tank working volume
High level warning: 75% of tank working volume
High level alarm: 80% of tank working volume
High level alarm: Chemical Tank Area Sump Level Switch LSH-500, LSH-501, LSH-502
Lead/Lag pump selection: P-510, P-511, P-512 (Backup), P-521, P-522 (Backup), P-531, P-532 (Backup)
Low level alarm: 15% of tank working volume
Reorder level warning: 30% of tank working volume

INTERLOCKS

Low level alarms in each Chemical Tank shuts-off the associated Chemical Feed Pumps.

APPENDIX C

PROCESS EQUIPMENT SPECIFICATIONS

EQUIPMENT DATA SHEETS

Table of Contents
Equipment Data Sheets
Bridgeton Landfill, LLC
Bridgeton Landfill Leachate Treatment System

Table of Contents - Continued

Notes:

- Equipment numbers are referenced on Process & Instrumentation Drawings

EQUIPMENT DATA SHEET
Bridgeton Landfill, LLC
Bridgeton Landfill Leachate Treatment System

Equalization Tank

EQ. No.:	TK-200
Number:	One
Manufacturer:	Aquastore
Material of Construction:	Glass Fused to Steel Shell and aluminum dome
Volume:	316,000 gallons
Dimensions:	47.56 foot diameter by 24.52 foot height
Type:	Flat bottom, cylindrical, covered top
Service:	Hold leachate with a pH 7-10 s.u.
Working Temperature:	Below 150 degrees F+/-
Working Pressure:	Atmospheric
Contents:	Leachate with pH range from 5-8
Seismic Zone:	St. Louis, MO area
Accessories:	Ladder with cage kit, manway platform assembly
Ref. Drawing:	TK-200

EQUIPMENT DATA SHEET
Bridgeton Landfill, LLC
Bridgeton Landfill Leachate Treatment System

Aeration Blowers

EQ.No.:	BLO-200
Number:	One
Purpose:	Provide air for equalization tank
Manufacturer:	Kaeser Omega
Model:	DB-236C
Speed:	2905 RPM
Discharge Temp.:	225ºF
Design Inlet Temp.:	95ºF
Pump Motor	
Size:	30 HP
Electrical:	460 V/60 Hz
Capacity, each:	433 SCFM
Discharge Pressure:	24.7 psi
Accessories:	Temperature gauge, pressure gauge, sound enclosure with blowoff valve and filter with maintenance indicator
Sound Level:	71db
Approx. Dimensions, (LxWxD):	44” x 46” x 51”
Connections:	4” Inlet and Outlet

EQUIPMENT DATA SHEET
Bridgeton Landfill, LLC
Bridgeton Landfill Leachate Treatment System

Rapid Mix/Flocculation Tank

EQ. No.:	TK-202 and TK-203
Number:	One
Manufacturer:	Parkson, WESCO, Monroe Environmental or Equal
Material of Construction:	Coated Carbon Steel
Volume:	230 gallons and 1,350 gallons plus 1 ft freeboard
Dimensions:	2'-6" x 2'-6" x 6'-0" and 6'-0" x 6'-0" x 6'-0"
Type:	Flat bottom, rectangular, 2 chambered, covered top
Service:	High pH leachate for mixing and settling
Working Temperature:	Ambient to 140ºF
Working Pressure:	Atmospheric
Contents:	Leachate with pH range from 7-11
Interior Piping:	None
Submittals:	Shop Drawings
Seismic Zone:	St. Louis, MO
Accessories:	Nozzles include inlet, 1 outlet, overflow weir, hold down lugs, mixer channels for two mixers (one rapid mix, one flocculation tank), platform (by others)
Ref. Drawing:	CLR-204

EQUIPMENT DATA SHEET
Bridgeton Landfill, LLC
Bridgeton Landfill Leachate Treatment System

Sludge Holding Tanks:
Physical/Chemical Sludge Holding Tank, Waste Activated Sludge Holding and Mechanical Sludge Thickener Holding Tank

EQ. No.:	TK-410, TK-409 and TK-412
Number:	Three
Manufacturer:	Plas Tanks, Augusta Fiberglass or equal
Material of Construction:	FRP
Volume:	12,000 gallons
Dimensions:	12’ Diameter, x 12’ high
Type:	Flat bottom, cylindrical, covered top
Service:	Leachate treatment sludge. Tank to be resistant to hydroxides (synthetic veil)
Working Temperature:	Ambient to 140ºF
Working Pressure:	Atmospheric
Contents:	Leachate sludge with pH range from 7-11, max specific gravity 1.1
Interior Piping:	None
Submittals:	Shop Drawings
Seismic Zone:	St. Louis, MO area
Accessories:	24” Side manway Nozzles include 1-1/2” sample decants , 4” outlets, drain, hold down lugs, mixer or sparge ring supports
Ref. Drawing:	TK-409, TK-410 & TK-412

EQUIPMENT DATA SHEET
Bridgeton Landfill, LLC
Bridgeton Landfill Leachate Treatment System

pH Adjustment Tanks: Number 1 and 2

EQ. No.:	TK-201/ TK-205
Number:	Two
Manufacturer:	Plas Tanks, Augusta Fiberglass or equal
Material of Construction:	FRP
Volume:	20,000/15,000 gallons
Dimensions:	12’ Diameter, x 25’/19’ high
Type:	Flat bottom, cylindrical, covered top
Service:	pH adjust acidic leachate, with 25% sodium hydroxide. Tank to be resistant to hydroxides (synthetic veil)
Working Temperature:	Ambient to 140ºF
Working Pressure:	Atmospheric
Contents:	Leachate with pH range from 7-11
Interior Piping:	Gravity overflow
Submittals:	Shop Drawings
Seismic Zone:	St. Louis, MO area
Accessories:	Nozzles include 10” outlet, drain, hold down lugs, mixer mounting channels
Ref. Drawing:	TK-201, TK-205

EQUIPMENT DATA SHEET
Bridgeton Landfill, LLC
Bridgeton Landfill Leachate Treatment System

Transfer Tank

EQ. No.:	TK-206
Number:	One
Manufacturer:	Plas Tanks, Augusta Fiberglass or equal
Material of Construction:	FRP
Volume:	15,000 gallons
Dimensions:	12’ Diameter, x 19’ high
Type:	Flat bottom, cylindrical, covered top
Service:	Transfer treated leachate with neutral or high pH, tank to be resistant to hydroxides (synthetic veil)
Working Temperature:	Ambient to 140ºF
Working Pressure:	Atmospheric
Contents:	Leachate with pH range from 8-11
Interior Piping:	Downspout from TK-205
Submittals:	Shop Drawings
Seismic Zone:	St. Louis, MO area
Accessories:	Nozzles include drain, 4” outlet, hold down lugs
Ref. Drawing:	TK-206

EQUIPMENT DATA SHEET
Bridgeton Landfill, LLC
Bridgeton Landfill Leachate Treatment System

Sulfuric Acid Storage Tank

EQ. No.:	TK-501
Number:	One
Manufacturer:	Poly Processing Co. or equal
Material of Construction:	High density crosslinked polyethylene (HDXLPE) with OR1000 liner
Volume:	6,000 gallons
Type:	Flat bottom, cylindrical, dome top, double wall in containment area
Service:	Sulfuric acid 93-98% storage
Working Temperature:	Ambient to 140ºF
Working Pressure:	Atmospheric
Contents:	93-98% sulfuric acid
Interior Piping:	None
Submittals:	Shop Drawings
Seismic Zone:	1
Accessories:	Dome top, 19” manway Nozzles: Fill: 3” bulkhead fitting with flange adapter Level gauge: 4” bulkhead fitting with flange adapter Outlet: 2” sidewall fitting Drain: 2” Vent: 6” bulkhead fitting with flange adapter
Ref. Drawing:	TK-501

EQUIPMENT DATA SHEET
Bridgeton Landfill, LLC
Bridgeton Landfill Leachate Treatment System

Caustic Storage Tank and
Coagulant Storage Tank

EQ. No.:	TK-500, TK-502
Number:	Two
Manufacturer:	Poly Processing Co. or equal
Material of Construction:	High density crosslinked polyethylene (HDXLPE)
Volume:	6,000 gallons
Type:	Flat bottom, cylindrical, dome top, single wall in containment area
Service:	25 or 50% sodium hydroxide
Working Temperature:	Ambient to 140°F
Working Pressure:	Atmospheric
Contents:	25 or 50% sodium hydroxide
Interior Piping:	None
Submittals:	Shop Drawings
Seismic Zone:	1
Accessories:	Dome top, 24” manway Nozzles: Fill: 3” bulkhead fitting with flange adapter Level gauge: 4” bulkhead fitting with flange adapter Outlet: 2” sidewall fitting Drain: 2” 6” U vent
Ref. Drawing:	TK-500

EQUIPMENT DATA SHEET
Bridgeton Landfill, LLC
Bridgeton Landfill Leachate Treatment System

Sludge Pumps

EQ. No.:	P-240A, P-204B, P-409, P-410 and P-412
Purpose:	To transfer clarifier sludge to Physical/Chemical sludge holding tank, to transfer sludge from Waste Activated Sludge holding tank to rotary drum thickener, to transfer sludge from Physical/Chemical sludge holding tank to sludge dewatering unit, and to transfer sludge from sludge thickener holding tank to sludge dewatering unit
Manufacturer:	Seepex or Equal
Pumped Fluid:	Physical/Chemical Sludge and Biological Sludge
Model:	BN-52-6LS
Number:	Five (one spare)
Type:	Progressive Cavity
Capacity:	75 GPM at 142 rpm
Speed:	Variable (285 RPM max)
Max Pump:	30 psi pump
Material of Construction:	316 SS wetted casing parts, EPDM stator
Suction Condition:	Flooded suction
Driver Information:	
Motor Type:	NEMA motor
HorsePower:	10 HP
Electrical:	460/60
Speed:	1272 nominal, 1921 max

EQUIPMENT DATA SHEET
Bridgeton Landfill, LLC
Bridgeton Landfill Leachate Treatment System

Transfer Pumps

EQ. No.:	P-200A& B
Number Pumps:	Two
Manufacturer:	Corcoran, Fybroc or Equal
Duty Points, each:	275 GPM, TDH = 70 ft 140 GPM TDH = 70 ft
Pumped Fluid:	Leachate, pH 4-7
Liquid Temperature:	50º to 120ºF
Materials of Construction:	Super Duplex Stainless Steel or 316 SS Super Duplex Stainless Steel or 316 SS Semi open impeller
Type:	Centrifugal, non-clog, direct drive
Speed:	Variable (1750 RPM Max)
Suction Condition:	Flooded suction
Seal:	316 S/S double mechanical seals
Seal Options:	Alloy 20 or Monel
Seal Flush Water:	Manufacturer to confirm not required for application
Accessories:	Base mount
Inlet & Outlet Size:	3” Inlet x 2” Outlet
Driver Information	
Motor Type:	TEFC
Horsepower:	10 HP
Electrical:	3 phase/60 Hz/460
Speed:	1750 RPM
Service Factor:	1.15
Type:	Inverter Duty
Accessories:	VFD
Efficiency at Design Flow:	54% @ 140 GPM, 66% @ 275 GPM
Approx. Pump Dimensions, (LxWxD):	53” x 15”x 20”

EQUIPMENT DATA SHEET
Bridgeton Landfill, LLC
Bridgeton Landfill Leachate Treatment System

Transfer Pumps

EQ. No.:	P-206A, B& C, P-307A3& 4, P-307B3, P-307C3& 4, P-307D3, P308A3 and P-308B3
Number Pumps:	Eleven (11)
Manufacturer:	Corcoran, Fybroc or Equal
Duty Points each:	600 GPM, TDH = 75 ft 135 GPM TDH = 75 ft
Pumped Fluid:	Leachate, pH 4-7
Liquid Temperature:	55º to 120ºF
Model:	5000FH Model A60-2
Materials of Construction:	Super Duplex Stainless Steel or 316 SS Super Duplex Stainless Steel or 316 SS Semi open impeller
Type:	Centrifugal, non-clog, direct drive
Speed:	Variable (1750 RPM Max)
Suction Condition:	Flooded suction
Seal:	316 Stainless Steel Double Mechanical
Seal Options:	Alloy 20 or Monel
Seal Flush Water:	External water source required
Accessories:	Base mount
Inlet & Outlet Size:	3” Inlet x 2” Outlet
Driver Information	
Motor Type:	TEFC
Horsepower:	25 HP Non-Overloading
Electrical:	3 phase/60 Hz/460
Speed:	1750 RPM
Service Factor:	1.15
Type:	Inverter Duty
Accessories:	VFD
Efficiency at Design Flow:	53% @ 135 GPM, 66% @ 600 GPM
Approx. Pump Dimensions, (LxWxD):	53” x 15”x 20”

Equipment Data Sheet
Bridgeton Landfill, LLC
Bridgeton Landfill Leachate Treatment System

Activated Sludge Tanks

EQ. No.:	TK-307A, TK-307B, TK-307C, TK-307D
Number:	Four
Manufacturer:	Aquastore Inc.
Material of Construction:	Glass Fused to Steel Shell
Volume:	1,000,400 Gallons with 18” freeboard
Dimensions:	72.73 foot diameter by 33.69 foot sidewall height
Type:	Cylindrical with 73 foot aluminum Geodesic dome
Service:	Activated Sludge Tank, organics resistance, acid resistant (except for HF acid), Salt resistant
Working Temperature:	Below 150 degrees F+/-
Working Pressure:	Atmospheric
Contents:	Leachate with a pH range of 7-10
Interior Piping:	None
Seismic Zone:	St. Louis, MO area
Accessories:	Ladder and cage system, top manway platform, Geodesic dome comes with vent, roof and dome hatch.
Ref. Drawing:	TK-307A, TK-307B, TK-307C, TK-307D

EQUIPMENT DATA SHEET
Bridgeton Landfill, LLC
Bridgeton Landfill Leachate Treatment System

Aeration Blowers

EQ.No.:	BLO-307A1,A2,B1,B2,C1, C2, D1, D2 (plus two spares)
Number:	Ten (10)
Purpose:	Provide air for activated sludge tanks
Manufacturer:	Kaeser
Model/Type:	Positive Displacement Blower
Blower Motor Size:	200 HP TEFC Motor
Capacity, each:	2140 SCFM
Discharge Pressure:	14.3 psig
Accessories:	Discharge check valve, discharge pressure gauge, inlet filter and silence, discharge silencer, discharge temperature gauge, blow-off pressure release valve, outdoor sound enclosure and isolated bearing kit

EQUIPMENT DATA SHEET
Bridgeton Landfill, LLC
Bridgeton Landfill Leachate Treatment System

Recirculation Pumps & Jet Mix

EQ. No.:	P-307A1, A2, B1, B2, C1, C2, D1, D2
Purpose:	Recirculate Activated Sludge Tanks with aeration manifold
Manufacturer:	MTS Jet Aeration Systems or Equal
Pumped Fluid:	Activated Sludge
Model/Type:	50 HP end suction liquid recirculation pump with MT4JM-18 jet aeration manifold system
Number:	Eight
Type:	Centrifugal
Design Conditions:	6588 GPM at 18 ft max
Materials of Construction:	Cast Iron Casing, duplex stainless steel impeller
Accessories:	Pump inlet suction bell fabricated of FRP (24” bell x 16” flange), 18” diameter liquid pipe, 16” tank penetration to connect with manifold

EQUIPMENT DATA SHEET
Bridgeton Landfill, LLC
Bridgeton Landfill Leachate Treatment System

MBR

EQ. No.:	MBR 308-A, MBR 308-B and MBR 308-C
Number of Units:	Three Modules (Two operational, one standby)
Manufacturer:	Dynatec Systems Inc.
Model/Type:	Hi-Rate UF System
Flow Design:	150,000 gpd each module
Membrane Type:	Tubular membrane
Number of Modules	Five membrane modules in series

EQUIPMENT DATA SHEET
Bridgeton Landfill, LLC
Bridgeton Landfill Leachate Treatment System

Combined Sump Pumps

EQ. No.:	P-414A& B
Number Pumps:	Two
Manufacturer:	Stancor or Equal
Required Capacity, each:	125 GPM, TDH = 70 ft
Running Capacity:	150 GPM, TDH = 70
Pumped Fluid:	Raw wastewater
Allowed pH Range:	2-10
Liquid Temperature:	70º to 100ºF
Model:	SS-750
Materials of Construction:	SS Outer Casing
	SS Impeller, Viton oil seal
Type:	Submersible, centrifugal, direct drive
Speed:	3600 RPM
Suction Condition:	Submersible (flooded)
Maximum Solids Passage:	2 1/8”
Accessories:	Level controls (by others)
	Discharge elbow
	Guide rail

Driver Information	
Horsepower:	7.5 HP
Electrical:	3 phase/60 Hz/460
Speed:	3600 RPM
Service Factor:	1.15
Type:	Constant speed
Accessories:	Overload/thermal protection, 33’ cable
Discharge Connection:	3” NPT
Efficiency at Design Flow:	73%
Approx. Pump Dimensions,	27.38” x 8.51” x 32.11”
(LxWxD)	(includes discharge elbow)
Pump Weight:	141 lbs

EQUIPMENT DATA SHEET
Bridgeton Landfill, LLC
Bridgeton Landfill Leachate Treatment System

Sodium Hydroxide Metering Pumps and Manifold Assembly

EQ. No.:	P-502
Purpose:	To meter sodium hydroxide to pH adjustment tanks for pH control
Type:	Diaphragm Metering Pump
Manufacturer:	LMI or Equal
Liquid Service:	25% Sodium Hydroxide`
Number of Feed Pumps:	Three (two installed and one spare)
Design Capacity, each:	120 GPH
Design Pressure:	60 psi
Maximum Pressure:	60 psi
Material of Construction:	PVC head and fittings, PTFE diaphragm, EPDM gasket
End Connections:	½" NPT
Electrical:	120/1/60
Control:	Manual or 4-20 mA control
Maximum Pulse Rate:	180 pulses/min
Accessories:	Pressure relief valve, back pressure valve (1/2" PVC), pulsation dampener, calibration cylinder, priming/deaeration valve, manifolded skid mounting, external input and output control cables; shop drawings
Reference Drawing:	
Manifold Assembly:	1" PVC Sch 80 Piping and Fittings

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Sulfuric Acid Metering Pumps and Manifold Assembly

EQ. No.:	P-503
Purpose:	Meter sulfuric acid feed for pH control
Type:	Diaphragm Metering Pump
Manufacturer:	LMI or Equal
Liquid Service:	93% Sulfuric Acid
Number of Feed Pumps:	Two (one installed and one spare)
Design Capacity, each:	60 GPH
Maximum Pressure:	60 psi
Material of Construction:	PVDF head and fittings, PTFE diaphragm, PTFE gasket
End Connections:	1/2” NPT
Electrical:	120/1/60
Control:	Manual or 4-20 mA control
Maximum Pulse Rate:	180
Accessories:	Injection check valve; back pressure valve (1/2” PVDF), pulsation dampener, priming/deaeration valve, manifold skid mounting, external control input and output connect cable; shop drawings
Manifold Assembly:	½” PVDF Sch 80 Piping and Fittings

EQUIPMENT DATA SHEET
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pH Adjust #1 Mixer, pH Adjust #2 Mixer and Physical/Chemical Mixer

EQ. No.:	MX-201/ MX-205 and MX-410
Number:	One (1)
Manufacturer:	Brawn in or Equal
Type:	Top Mounted Gear Drive
Model:	6BTO7.5-45/ 4BTO5-45 and 4BTO5-45
Motor Size:	7.5 Hp/ 5Hp and 5 Hp
Motor Enclosure:	TEFC
Mixer RPM:	45 all three
Material of Construction:	316 Stainless steel shaft and impeller
Power:	460/3/60
No. of Impellers:	Dual/ Dual and Single
Impeller Type:	56” A35 with stabilizer fins 50” A35 with stabilizer fins 57” A35 with stabilizer fins
Chemical Mixed:	Leachate, pH 8 to 11
Specific Gravity:	1.0
Shaft Dia. X Length:	3.5” X 258”/2.5” X 192” and 156”
Accessories:	Mounting channels (by others) 2 piece mixer shaft

Tank Information:

Max Flow:	300 GPM
Tank Geometry:	See Tank Equipment Data Sheets TK-201, TK-205 and MX-410

EQUIPMENT DATA SHEET
Bridgeton Landfill, LLC
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Rapid Mix Tank/Flocculation Tank Mixers

EQ. No.:	MX-202 and MX-203
Number:	Two (2)
Manufacturer:	Lightnin or Equal
Type:	Top Mounted Gear Drive
Model:	EV5Q25M
Motor Size:	0.25 HP
Motor Enclosure:	TEFC
Mixer RPM:	Variable Speed
Material of Construction:	Stainless steel shaft and impeller
Power:	120/1/60
No. of Impellers:	One
Impeller:	11.2 A310 Impeller
Chemical Mixed:	Leachate, pH 8 to 11
Specific Gravity:	1.0
Shaft Length:	48” (all four mixers)
Accessories:	Mounting channels (by others)
Control Setting:	Manual to optimize precipitated particle size
Tank Information:	
Tank Geometry:	See Tank Equipment Data Sheets TK-202/203 TK-413A/413B

EQUIPMENT DATA SHEET
Bridgeton Landfill, LLC
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Aeration Blowers

EQ.No.:	BLO-409 and BLO-412
Number Pumps:	Two (2)
Purpose:	Provide air for sludge holding tanks
Manufacturer:	ELMO Rietschle
Model:	2BH16107HH56
Speed:	3450 RPM
Discharge Temp.:	168ºF
Design Inlet Temp.:	90ºF
Pump Motor	
Size:	11.5 HP
Electrical:	460 V/3pH/60 Hz
Type:	IP 55
Capacity, each:	75 SCFM
Discharge Pressure:	8.3 psig
Materials of Construction:	Carbon Steel
Type:	Oil free, regenerative
Accessories:	Silencer, inlet filter and pressure relief valve, 3 blowers manifolded together (aeration tank #1, 2 and spare), 1 blower separate (receiving tank)
Sound Level:	75db
Approx. Pump Dimensions, (LxWxD):	22” x 25” x 17”
Connections:	2” Inlet and Outlet

EQUIPMENT DATA SHEET
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Tank Sparge Ring

EQ. No.:	R-412 and R-409
Number:	Two (2)
Purpose:	To mix aeration tank; receiving tank and oxygen
Manufacturer:	Aertec Aergrid
Capacity:	75 scfm
Pressure Prop (at Dropleg):	6 psig
Materials of Construction:	SS Drop Pipe HDPE Header
Diffuser:	(2) – 3" HDPE Aergrid Laterals
Accessories:	Yoke lateral supports, drop pipe supports
Tank Info:	Aeration Tanks: TK-412, TK-409
Dia:	10'
Height:	11'
Liquid SWD:	10
Tank Reference Drawing:	TK-412, TK-409, Receiving Tank
Dia:	10'
Height:	11'
Liquid SWD:	Variable
Tank Reference Drawing:	R-412 and R-409

EQUIPMENT DATA SHEET
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Clarifiers

EQ. No.:	CLR-204
Number:	One (1)
Type:	Inclined Plate Lamella
Manufacturer:	Parkson, Monroe Environmental, Wesco, or equal
Model:	LGS-2500/55
Materials of Construction:	Vessel: Coated carbon steel Plates vinyl ester FRP or 316 Stainless Steel
Design Flow:	140 to 270 gpm
Total Settling Area:	2500 Equivalent ft^2
Design Loading Rate:	0.056 to 0.11 gpm/Equivalent ft^2
Electrical Characteristics:	None
Inlet:	10” NPT Flange (see Accessories)
Outlet:	12” NPT Flange
Sludge:	8” NPT Flange
Accessories:	Common fabrication with flash mix and flocculation tank (by manufacturer) 4-Sample Taps on side of cone bottom Free discharge sample taps for quick representative sampling Carbon steel coating to suit high chlorides and high TDS
Service:	Wastewater pH: 8-11 High chlorides and high TDS

EQUIPMENT DATA SHEET
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Sludge Dewatering Press Unit

EQ. No.:	D-413A & B
Number:	One and one future
Manufacturer:	Kuster-Water or Equal
Type:	Screw Dewatering Press
Model:	ACAT/Kusters Water Model AS 0905
Materials:	316 Stainless Steel
Sludge Type:	Metals Precipitation Sludge, metal hydroxide, and Biological Sludges
Dry Sludge Feed:	60-110 gpm or 660-1120 lb DS/HR
Type:	Screw Press
Accessories:	Flash mixing tank including gear motor, a flocculation tank including gear motor, (2-3) dewatering drum (with drive motor, filtrate collection pan, and support frame), Shop Drawings
Materials of Construction:	316 STN. STL., pH range of sludge 7 to 11 s.u.

EQUIPMENT DATA SHEET
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Air Compressor and Receiver Tank

EQ. No.:	AC-504
Number:	One (1)
Type:	Duplex Reciprocating Compressor
Manufacturer:	Atlas Copco
Model No.:	LP-15 Duplex
Capacity, each:	Minimum 109 scfm @ 100 psi
Receiver Capacity:	200 gal
Materials of Construction:	Carbon Steel
Accessories:	Oil/Water filter (DD 60) 10RS-E-309B, particle filters (PD 60) (10RS-E-309A), NEMA 4 Control panel including NEMA motor starter prewired at factory, alternator operation air dryer

Driver Information

Motor Type:	TEFC
Electrical:	3 phase/60 Hz/460 volt
No.:	Two
Size:	15 Hp
Service Factor:	1.15
Type:	Constant speed

Air Dryer

EQ. No.:	10RS-E-309
Type:	Refrigerated Air Dryer
Manufacturer:	Atlas Copco
Model:	Fx8 (A7) A UL 115 V 1 P H60
Capacity:	127 CFM Inlet
Type:	Refrigerated Air Dryer
Electrical:	120 V/1 ph/60 Hz

EQUIPMENT DATA SHEET
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Polymer Feeders

EQ. No.:	FDR-204, FDR-411 and FDR-413
Manufacturer:	UGSI Chemfeed or Equal
Model:	M240-D1AA, M601-D2.5AA, M1200-D10AA
Dimensions:	36”x41”x20”
Materials:	304 SS Frame, PVC and Teflon
Polymer Range:	0.05-1.0, 0.13-2.5 and 1.0-10.0 gph
Materials Pumped:	Polymer solution
Connections:	½” (F) NPT
Pump Type	Diaphragm
Power:	120 V/1phase/60 Hz
Electrical Usage:	1/6 HP
Signal Input:	4-20 mA pulse from flowmeter
Accessories:	Suction tube straightener, foot valve, PVC back pressure valve, REM-1E interface, Unit Stand (by others)
Dilution Water Range:	12-240, 30-600, and 60-1200 GPH
% Solution:	1.0

EQUIPMENT DATA SHEET
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Power Winch

EQ. No.:	10RS-WIN-510
Purpose:	Drag roll off boxes into position
Manufacturer:	Thern
Model:	4WS9M18
Number:	One (1)
Capacity:	10,000 lb
Line Speed:	10 FPM
Type:	Heavy Duty Power Winch
Motor Size:	5 Hp
Motor Type:	TEFC severe duty
Power:	460 V/4 pH/60 HZ
Enclosure:	NEMA 4x
Accessories:	Electric motor controls 10S7E4
	Wire rope assembly (7/16”)
	Base

Equipment Data Sheet
Bridgeton Landfill, LLC
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Rotary Drum Thickener

EQ. No.:	MST-411A & B
Number:	One with one future
Manufacturer:	Parkson or equal
Material of Construction:	316 SS
Type:	Polymer Assisted Rotary Drum Sludge Thickener
Model:	RDT-150
Design Spec:	150 gpm nominal feed rates
Service:	Activated Sludge thickening, Influent solids concentration of 1% to 3%
Accessories:	Return water collection tank, floc development tank drive, internal spray system, vortex mixer and polymer injection ring, and standard control panel
Ref. Drawing:	MST-411