BOROUGH OF CHAMBERSBURG

WWTP UPGRADE PROJECT

BASIS OF DESIGN REPORT

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<u>Introduction</u>
The Borough of Chambersburg ("Borough") owns and operates a wastewater treatment plant (WWTP) that serves the Borough, along with portions of Greene, Hamilton, and Guilford Townships, in Franklin County, Pennsylvania. A small portion of Letterkenny Township is also serviced through Hamilton Township.

The Chambersburg WWTP is located in the Potomac River Basin within the Chesapeake Bay Watershed, and will therefore be subject to Total Phosphorous (TP) and Total Nitrogen (TN) limits of the Commonwealth's recently adopted Chesapeake Bay Tributary Strategy.

The Borough and its partners have determined that an upgrade and expansion of the WWTP is required at this time in order to meet the anticipated growth within the service area and to meet the new total nitrogen (TN) and phosphorus (TP) discharge limits that have been established by the PA DEP.

As such, the Borough has contracted with AECOM, in partnership with ARRO Consulting, to provide engineering services for a WWTP Upgrade Project that will meet these objectives. This Basis of Design Report (BDR) will provide a general summary of the project as it has developed during conceptual design through interaction between the Borough's staff and its consultants. This BDR will serve as a tool for interaction and to take place that will enable the AECOM team proceeds with preliminary design in accordance with the desires of the Borough.

<u>General Project Overview</u>
The existing treatment facilities at the Chambersburg WWTP are not able to meet the pending nutrient discharge limits. Therefore, an upgrade to the WWTP will be required to meet the TN and TP caps. In addition to meeting the TN and TP caps, an expansion from 6.8 MGD to 11.28 MGD is needed to accommodate the anticipated growth within the service area. A peak design flow of 28.2 MGD, based upon a 2.5 peaking factor, has also been established for the plant design.

As will be discussed in more detail in the following sections, the upgrade will consist of the following primary components:

Liquid Processing System Upgrades

- Replacement of the existing comminutor with a new screening system.
- Upgrade of the existing influent pump station to accommodate the projected future average daily flow (ADF) of 11.28 mgd with a peaking factor of 2.5.
- Upgrade of the existing grit removal system to accommodate the future flow of 11.28 ADF.

- Upgrade and supplement the existing Vertical Loop Reactor (VLR) treatment process to provide biological nutrient removal. The upstream portion of the VLR will be operated as an anoxic reactor and the back portion will be operated as an aerobic reactor. Additional aerobic reactor volume will be constructed, in the form of a fine-bubble diffused air reactor tank, downstream of the exisiting VLR to provide additional aerobic treatment volume for full nitrification. This will be followed by a deoxygenation tank that will remove the available dissolved oxygen. A portion of the flow from the deoxygenation tank will be recycled to the anoxic portion of the existing VLR, while the balance of the flow will be conveyed to a new secondary anoxic reactor for further denitrification treatment. Effluent from the new secondary anoxic zone will be re-aerated prior to flowing to the final clarifier splitter box. Phosphorus removal will be enhanced by metal salt addition in the clarifiers.
- A new final clarifier will be constructed along and an accompanying RAS pump installed.
- The UV System will be expanded to accommodate the projected 11.28 MGD ADF.

Solids Handling System Upgrades

The solids handling process will be upgraded so that there is no longer two separate solids products produced, but rather one Class B solids product. This will be attained by the following modifications

- The waste activated sludge (WAS) will be withdrawn from the secondary clarifiers and pumped to the existing aerated waste sludge holding tank.
- This WAS will be thickened by the existing rotary drum thickeners.
- The thickened WAS will be combined with the gravity-thickened primary sludge in a newly constructed acid phase anaerobic digester.
- Flow from the acid phase digester will be directed into a gas phase digester, which will be provided by converting the existing primary digester to be used for this purpose. The digested sludge will be conveyed into the existing secondary digester (which has a gas-storing Dystor cover) and then into the existing digested sludge storage tank, as is the current practice.
- The digested solids will be pumped from the digested sludge storage tank to the existing belt filter presses to be dewatered and then taken off-site as a Class B biosolids product.

The electrical and SCADA systems will be upgraded as required to accommodate the plant upgrades. All of the upgrades will be designed for the projected ADF of 11.28 mgd with appropriate peaking factors.

The one exception to this will be the biological treatment process. Based upon conventional biological modeling, the configuration and tank sizes selected will provide treatment for approximately 9.0 to 9.5 MGD. However, a side stream treatment process (a sequencing batch reactor, "SBR") is proposed for treating filtrate from the belt filter presses to reduce the recycle nutrient loads to the head of the plant. It is intended to use the microorganisms incubated in this side-stream reactor to bioaugment the VLR-based biological treatment process. As a result of this bioaugmentation with microorganisms grown in an environment to promote efficient nutrient removal, it is anticipated that the actual performance of the biological treatment process will exceed the results projected by conventional modeling.

If this hypothesis proves to be accurate, an application will be made for a re-rating of the facilities. The original Water Quality Management Permit application will be made for 9.0 to 9.5 MGD (depending upon the results of the original biological modeling that assumed conventional biological kinetics), and the re-rate application will be based upon the results of a model that is calibrated for actual performance with bioaugmentation, for up to the projected build-out of 11.28 MGD. If actual operational data does not support a re-rating to the full 11.28 MGD projected build-out, supplemental treatment facilities will be constructed to provide the required additional treatment capacity at the time flows dictate that they are needed. By taking this approach of evaluating actual system performance prior to providing additional treatment tank capacity, the Borough can ensure that it does not incur greater construction costs than necessary.

A general site layout, showing the proposed locations for new structures, is included in the appendix of this report.

Following is a more focused discussion of the various aspects of the WWTP Upgrade project.

Mechanical and Process

Headworks

Flow enters the treatment plant by gravity flow through a 48" sewage interceptor main prior to discharging into the headworks. The existing headworks provides three parallel channels. The first channel has a manually cleaned bar screen, the second channel has a hydraulically operated JWC grinder (Model 30003-0040-DI), and the third channel serves as a bypass. The channels are separated by removable sliding plates and flow into a single Parshall flume. Presently, the second channel is the primary channel and the only channel used under normal operations.

The scope of design for the headworks is presently under evaluation. There are several potential scenarios that have been identified, they are described as follows:

1. Option 1 was discussed with Borough staff at the design kick-off meeting. Under this option, the existing bar screen would remain in the first channel. If possible, the existing grinder would be moved to the bypass channel. For this to take place, minor concrete, and hydraulic tubing changes would be required. Borough staff stated that, if it is possible, an automatically cleaned coarse screen and a mechanical fine screen should be installed in the main channel, where the grinder is presently located. A wash compactor and vertical conveyer will be required to move screenings outside the headworks structure into a bin. The screenings equipment would need to be heat traced and insulated to protect against freezing if the selected equipment is conducive to such, or some type of radiant heat would be required in the headworks area to prevent freezing.

   After a preliminary review, it appears that there is not adequate space to install a coarse screen and fine screen in parallel within the existing headworks channels. Although there are facilities where a fine screen is installed without an upstream bar screen, it is generally standard practice to have some type of protection upstream of a fine screen that is receiving raw wastewater in order to protect the fine screen. As such, provision of the screening equipment that was requested by the Borough is not feasible in the existing headworks structure.

   AECOM has been investigating a ¼-inch screen provided by Huber called the RakeMax, which is a single screening unit that could potentially serve the purpose of both coarse and fine screening and is designed to be utilized without an upstream bar screen or other protective device. Huber representatives indicate that the RakeMax with ¼" spacing is designed such that the frame itself is used as a course screen with up to 2" bar spacing, and that the bars are designed to be replaceable in the event that one does become damaged, which does not happen often.

   In its preliminary review, the Huber representative indicated that installing a RakeMax screen in the current location of the grinder would require that a platform be placed across the open well/pit since the RakeMax, installed at a 75 degree angle, will not reach the back wall of the well/pit.

   It is not finally established whether this equipment could be reasonably fit in the existing headworks, but in either case, this technology may present an attractive alternative for a "all-in-one-unit" screening solution either in the existing headworks or a new headworks structure.

   An further consideration related to continuing use of the existing headworks is that it is uncertain whether one of the existing channels will be of adequate size to accommodate the peak design flow of 28.2 mgd. A complete hydraulic analysis of the facility will be performed once the survey is completed and exact elevations of weirs and hydraulic structures are obtained, but snow cover has prevented the survey to be completed at this time. If it is determined that one channel will not be adequate to convey the peak design flow, a decision would need to be made whether two parallel channels are operated under normal operation or if a second channel is made active only during high flow conditions. In addition, it would need to be determined whether both channels would be equipped with new screening equipment or whether one would utilize either the existing manually cleaned bar screen or the existing grinder.

Another concern regarding this alternative is that, although the screenings equipment could be heat traced and insulated or radiant heat provided to protect the screenings against freezing, the headworks would still be uncovered, which makes servicing the equipment in cold and rainy/snowy conditions difficult for plant staff.

Finally, WWTP staff has noted that the existing isolation gates do not seal completely and should be replaced with manually operated fabricated slide gates if the existing headworks is to be re-used.

Regardless of which headworks option is selected, it is recognized that a reliable influent meter, capable of measuring flows at the peak design flow, will be required. The existing Parshall flume utilizes a bubbler which cannot read flows above 15 mgd. As such, modifications to the influent flow metering system are required.

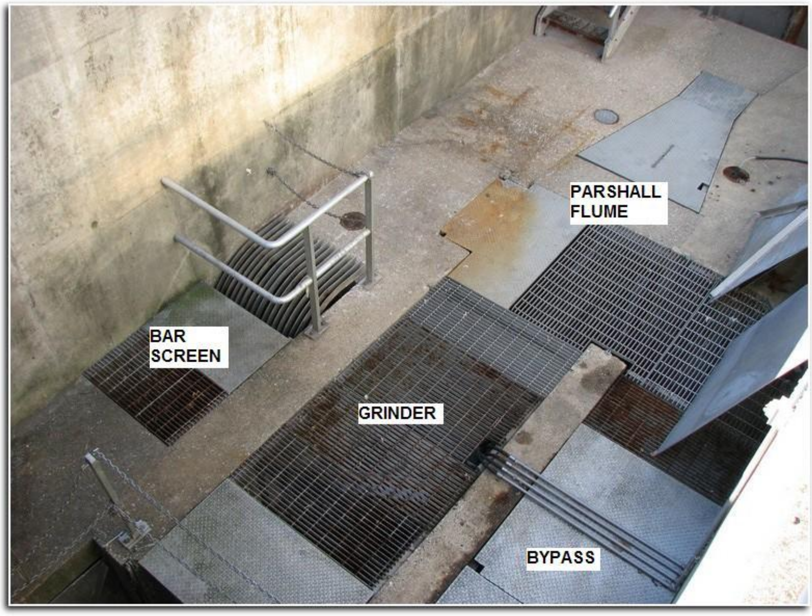
2. In light of the challenges associated with modifying the existing headwork structure to accommodate the requested equipment at peak design flow, a second alternative, that of constructing a new headworks facility, has been discussed. The proposed new headworks structure could be constructed either south of the existing headworks and 48" influent pipe, with flows then redirected to the new headworks, or it could be located to the east of the existing headworks structure, in line with the existing influent pipe.

   If a new headworks were constructed, it is anticipated that two channels would be provided. One channel would be the primary channel containing an automatically cleaned bar screen, followed by a fine screen, or by a screen (such as the RakeMax) that could serve both purposes. The primary channel would be sized for the peak design flow, as would be the bypass channel. The bypass channel would be used only under emergency or maintenance conditions and could be equipped with screening equipment identical to that installed in the primary channel, or could be equipped simply with a manually cleaned bar screen if the Borough felt this was acceptable.

3. An additional option could be considered by the Borough if a new headworks is constructed. It is recognized that the current operation of pumping influent to the grit removal process from the influent pump station is somewhat unconventional and potentially problematic. As such, if a new headworks were constructed, consideration could be given to installing a new grit removal system as part of the headworks, thereby

eliminating the need for grit removal at its current location, behind the solids handling building. However, since the WWTP is already equipped with one functioning grit removal system located downstream of the pump station, and given that the WWTP has been operating acceptably under the present sequence of treatment (i.e., pumping to the grit removal), the benefits of constructing a completely new grit removal system at the headworks do not likely justify the additional cost that would be incurred.

As mentioned previously, further evaluation is required to determine if the existing channels are large enough to accommodate the new peak flow rate. If the existing channels do not have the hydraulic capacity for the expected peak flow of 28.2 MGD, a new headworks structure would likely need to be constructed. The possibility of performing significant structural modifications to the existing headworks to convert the three existing channels into two channels, each of which would be sized to accommodate the peak design flow, could be investigated. However, it does not seem likely that such a scenario would be feasible. Additionally, maintaining plant operations during such structural modifications would be difficult and costly.



The Existing Headworks

Influent Wastewater Pump Station

The existing influent wastewater pump station consists of two (2) 16-in Fairbanks Morse vertical turbine solids handling pumps, “VTSH pumps”, (Model VTSH-UWF, 5250 gpm, 69 feet total dynamic head, “TDH”, 1185 rpm, 125 HP) and (5) existing Allis Chalmers centrifugal dry pit pumps (Model 400, 6 x 6 x 17, 1513 gpm, 82 feet TDH, 1175 rpm, 50 HP). The existing vertical turbine pumps are located outdoors and have a dedicated wet well, which is exposed to atmosphere and hydraulically connected to the dry pit pump wet well by a 36-in diameter pipe. The vertical turbine pumps discharge to a single 18-in force main. The existing dry pit pumps are located inside the pump station and discharge to two existing 16-in force mains. Flows from all three force mains combine when they discharge into a single 30-in pipe on the north end of the site, upstream of the grit chamber.

Several scenarios for modifying the existing raw wastewater pump station have been discussed. Since the wet well that is utilized for the vertical turbine pumps is somewhat problematic due to its propensity for collecting grit, one attractive option is to provide a new pumping scheme that would utilize only the wet well that is presently used in conjunction with five new larger centrifugal pumps, located in the location of the existing pumps, with a sixth centrifugal pump installed for redundancy.

One potential way to achieve this would be to remove the existing 36-in pipe connecting the two existing wet wells and to seal the holes. The existing slide gate that is located at the sixth pump bay would then be removed and a new pipe casting would be installed for this new sixth pump. The vertical turbine pumps would be demolished and the associated wet well would no longer be used. The existing dry pit centrifugal pumps would be replaced, along with the associated piping and knife gate valves.

To accommodate the future peak flows, six (6) new vertical dry pit solids handling pumps would be installed inside the pump station. Each pump would be rated for 3,920 gpm and approximately 90 feet total dynamic head. Five (5) pumps operating would produce the required peak flow of 28.2 MGD. Two (2) pumps running would provide the average flow of 11.3 MGD. One (1) pump would serve as a standby. A variable frequency drive (VFD) would be provided for each pump. New piping and valves would be provided. Five (5) of the existing wall castings would be reused and (1) new casting would be required for the 6th pump. Under this scenario, the existing HVAC in the pump station would require modifications to dissipate the additional heat created by the new pumps and VFDs and the existing monorail would need to be replaced. All three of the existing force mains would be used to convey raw wastewater to grit removal.

A first step in evaluating this alternative was to determine whether the larger pumps that would be necessary could physically fit inside the existing structure. Preliminary layouts indicate that there is adequate space to fit the larger pumps in the existing the space and through the existing hatch. Further investigation would be required to determine if there is enough space for the larger variable frequency drives. However, it has been discovered that the geometry and hydraulics of the existing wet well cannot provide the submergence or net positive suction head required for the pump selected in the initial investigation. Due to the narrow wet well and location of the two existing 36-in inlets, excessive turbulence is a concern. The existing wet well is not recommended for use with larger pumps that would be sized to accommodate the entire design flow.

The (2) Existing Vertical Turbine Pumps (2 of the 5) Existing Dry Pit Pumps

This being the case, another option that could be considered would be to continue use of a two wet well/two pump system pump station. Under this option, the existing vertical turbine solids handling pumps would be replaced by a different type of pump that is more conducive to pumping grit-containing wastewater since WWTP staff has indicated that the existing VTSH pumps require an exorbitant amount of maintenance to keep operational. One option would be to select another variety of solids handling vertical turbine pump that may be more conducive for this application, although it is recognized that no vertical turbine-type pump is ideal for pumping wastewater that contains grit.

A second VTSH pump replacement option would be to install solids handling submersible pumps on slide rails in the existing vertical turbine pump wet well. If this general approach, that of maintaining the existing two-wet well system and replacing the existing VTSH pumps, is adopted by the Borough, WWTP staff will be consulted to select their preferred pump type and more detailed investigation would be made to determine the feasibility and suitability of using the staff's preferred pump type with the existing VTSH wet well. Additionally, if the Borough elects this general approach, it could either keep the existing 5 centrifugal pumps as they are and pursue up-sizing the pumps that will replace the existing VTSH pumps so that the new pumps provide the additional flow required by this upgrade, or upgrading the 5 existing centrifugal pumps could also be considered to provide the additional flow. It is noted that some of the existing centrifugal pumps have been re-built in recent years, but some have not.

A third option for maintaining the existing two wet well/two pump station system would be installing dry pit pumps in a new dry pit constructed adjacent to the existing vertical turbine pump wet well. These pumps would draw suction out of the existing wet well. Although this would provide a more maintenance-friendly scenario and allow for selection pumps that are more conducive to pumping grit-containing wastewater, it is noted that this option would require the additional cost of the new dry pit structure. As such, given the Borough's intent to control costs on this project, the investment of constructing a new dry pit structure may not be considered worthwhile.

If the existing two wet well/two pump station system is maintained, WWTP staff has expressed interest in replacing the existing knife gates at the pump station due to continual leaking problems that have been encountered. It is also preferred by WWTP staff, for operational flexibility and energy cost savings, that variable frequency drives be provided with any new pumps. As neither of these are critical to basic operation of the pump station, direction as to whether they should be included in the project will be required from the Borough.

A fourth option, that of constructing a completely new pump station has also been discussed. A new pump station could be designed to increase efficiency, be self-cleaning, and facilitate easier maintenance. The size of the new pump station could be minimized by locating the electrical equipment in the existing pump station. Constructing a new pump station would also significantly reduce the level of effort and time required for staging and construction during the plant upgrades. However, it is also recognized that this would also be the highest cost alternative. As such, all feasible options for retrofitting or augmenting the existing pump station are being evaluated for suitability, and construction of a new pump station would only be considered if no suitable retrofit alternative can be identified.

Grit Removal

The existing grit chamber is a John Meunier 16-ft diameter vortex type with a 2 HP paddle drive. There are (2) existing centrifugal self-priming grit pumps (Gorman-Rupp Model T4A3-B /F, 7.5 HP) located in the basement of the solids handling building, that feed the existing classifier.

Assuming that constructing a new headworks facility that would include new grit removal treatment prior to pumping is not the selected alternative, a new grit chamber will be installed as part of this project. The new grit chamber would be identical to but installed as a mirror image of the existing one. This will promote even flow distribution across both units. Further investigation is required to determine if the two units will be capable of performing over the entire flow range, or if there will need to be a way to switch to operation of a single unit under low flow conditions. The existing truck unloading station will be demolished to provide the space required for the new grit chamber. Since the existing truck unloading station is currently not being used, it will not need to be replaced. A new sample pump and flow meter will be provided. The new grit chamber will have a dedicated 4-in glass lined ductile iron pipe, routed to grit pumps in the basement of the solids handling building. A 3rd grit pump will be provided so each grit chamber has a dedicated pump and the grit piping will be modified so (1) pump will serve as a common standby. Manual slide gates will be installed on the new grit unit similar to the existing one, to allow for isolation and maintenance. Some modifications to the existing 30-

in inlet and 42-inch discharge piping will be required. It has been assumed that the existing odor control system will be tied into the new grit chamber inlet channel. However, it must be confirmed that the existing odor control system has sufficient capacity available to accommodate this additional load.

The Existing Grit Chamber

The (2) Existing Grit Pumps

Biological Treatment Process Description

Modifications will be made to supplement the existing vertical loop reactor (VLR) treatment process to accommodate the increased flows and to provide for biological nutrient removal (BNR) treatment. The upstream portion of the VLR will be operated as an anoxic reactor and the back portion will be operated as an aerobic reactor. Additional aerobic reactor volume ("post aeration") will be constructed, in the form of a fine-bubble diffused air reactor tank, downstream of the exisiting VLR. This will provide additional aerobic treatment volume for full nitrification.

Post aeration will be followed by a deoxygenation tank that will remove the available dissolved oxygen. A portion of the flow from the deoxygenation tank will be recycled to the anoxic portion of the existing VLR, while the balance of the flow will be conveyed to a new secondary anoxic reactor for further denitrification treatment. Effluent from the new secondary anoxic zone will be re-aerated prior to flowing to the final clarifier splitter box. Phosphorus removal will be enhanced by metal salt addition to both the primary and secondary clarifier feeds. Experience indicates that overall chemical consumption is lower when addition is made at both clarifier feed points. Following is further discussion of the proposed new tanks associated with the biological treatment process.

VLR Modifications

Mechanical mixers will be provided in the first loop of the VLR system, so that recirculation and mixing can be accomplished without the introduction of performance-compromising oxygen into what will be operated as a pure anoxic zone. Surface wasting of foam and filamentous growth will be provided in the fourth VLR loop. Control of filamentous (bulking) microorganisms will improve clarifier performance and ensure that the long Solids Retention Times (SRTs) required for nitrification will be maintained. Chlorine (bleach) sprays will be provided at the foam collection area/surface as part of the surface wasting system to retard filamentous growth. Plant staff has also identified the need for upgrade of the existing VLR drives.

Post Aeration Tank

A new post aeration tank will be constructed on the northeast corner of the site, between the solids handling building and the sludge storage tanks. This reactor will serve to augment the aeration treatment that is provided in the back portion of the VLR so that complete nitrification is achieved. The size of this post aeration tank will be finalized based upon consultation with the Borough. Since the proposed location for this tank allows for a greater tank volume than the location initially envisioned, installing a larger aeration tank, on the order of 1 million gallons (MG), could be considered to improve the robustness of the system and to increase the likelihood that additional tank volume will never be required to obtain the 11.28 mgd ADF ultimate design flow. However, if deferring initial project costs is prioritized, a tank similar in size to what was initially envisioned could be constructed.

The tank will be divided into (2) trains that will typically be operated in parallel to allow for isolation of one train to accommodate maintenance. Fine bubble aeration diffusers will be installed in both trains and new blowers will be required. Further design calculations are required to determine the size and number of required operating blowers. At least (1) standby blower will be provided. It has been preliminarily discussed that the blowers would be positive displacement equipped with variable frequency drives and air flow meters. The use of high speed turbo blowers could be considered given their superior efficiency, however it would need to be determined if the head required for the anticipated depth of the aeration tanks could be provided with turbo blowers. The blowers will be located outdoors on a concrete pad with an integral sound-attenuating enclosure. New insulated stainless steel piping will be provided. The tank drains will be tied into the existing plant drain system. Manual slide gates will be provided for isolation. The existing 36-in VLR effluent piping will be modified to feed the new post aeration tank. The post aeration tank effluent will flow directly to a new deoxygenation tank.

Deoxygenation Tank

A new 0.1 million gallon deoxygenation channel will be constructed adjacent to the post aeration tank. The purpose of this tank is to reduce the dissolved oxygen concentration in the mixed liquor so that it does not introduce oxygen into the downstream anoxic treatment zones, which would inhibit denitrification activity.

The deoxygenation tank will have an internal recycle pump station that will discharge a high percentage of the flow into the anoxic zone of VLR Tank No. 1, while the balance of the pump discharge will continue in the biological treatment process to the downstream secondary anoxic reactor. The recycle pump station will consist of submersible solids handling pumps, with one standby pump provided for redundancy. The pumps will be driven by variable frequency drives and controlled by a new magnetic flow meter. The tank drains will be tied into the existing plant drain system. Manual slide gates will be provided for isolation. The deoxygenation tank effluent will flow directly to a new secondary anoxic tank.

The location of the existing electrical duct bank (labeled “FF” on the 1997 upgrade project’s record drawings) conflicts with the proposed location of the post aeration and deoxygenation tanks. Relocation of the duct bank will therefore be required. The 2001 record drawings indicate that the existing ductbank labeled “FF” contains (5) spare conduits and (1) telephone line. A 4-in PVC drain must also be relocated, to accommodate the new tank.

Secondary Anoxic Tank

A new 0.6 million gallon secondary anoxic tank will be constructed on the south end of the site, between the RAS/WAS pump station and the gravity thickener. This tank will be used to provide additional denitrification treatment. A supplemental carbon source will be added in this tank to facilitate this microbial process since it is expected that essentially all of the carbon that was included in the influent wastewater will have been removed by this point in the treatment process. Mechanical mixers will be installed in the anoxic tank to keeps solids in suspension. The tank drains will be tied into the existing drain system. Manual slide gates will be provided for isolation. The secondary anoxic tank effluent will flow directly to a new re-aeration tank.

Re-aeration Tank

A new 0.1 million gallon re-aeration tank will be constructed adjacent to the secondary anoxic tank. The purpose of the re-aeration tank is to strip out the nitrogen gas that was produced during the denitrification process performed in the secondary anoxic tank and to raise the dissolved oxygen level in the wastewater so that proper settling can take place in the downstream clarifiers. Fine bubble aeration diffusers will be installed and new blowers will be required. Further design is required to determine the size and number of required operating blowers (1 standby blower will be provided). The blowers will be positive displacement with variable frequency drives and flow meters. The blowers will be located outdoors on a concrete pad with an integral sound-attenuating enclosure. New insulated stainless steel piping will be provided. The tank drains will be tied into the existing plant drain system. Manual slide gates will be provided for isolation. The re-aeration tank effluent will flow directly to the final clarifier splitter box through the existing 36-in pipe, provided that the hydraulic analysis indicates that this is hydraulically feasible.

Final Clarifier No. 4

There are (3) existing final clarifiers (Envirodyne Model HB37-TDS-1, 88-ft diameter by 16-ft total side wall).

A 4th clarifier will be required to accommodate the additional flows associated with this project. As seen on the general site plan included in the appendix, space has been allocated for a future 5th final clarifier should it be determined in the future that it is required.

As part of this upgrade project, a new weir and manual stainless steel slide gate will be installed in the existing final clarifier splitter box. A new 30-in cement-lined ductile iron pipe will connect the existing splitter box to the new clarifier inlet. A new 24-in cement-lined ductile iron pipe will be tied into the existing 36-in pipe between the clarifiers and UV disinfection. A new 6-in glass-lined ductile iron pipe will be provided to bring scum to the existing final clarifier scum pump station. Plant staff has requested that the existing scum pumps be replaced with new, chopper type scum pumps as part of this project.

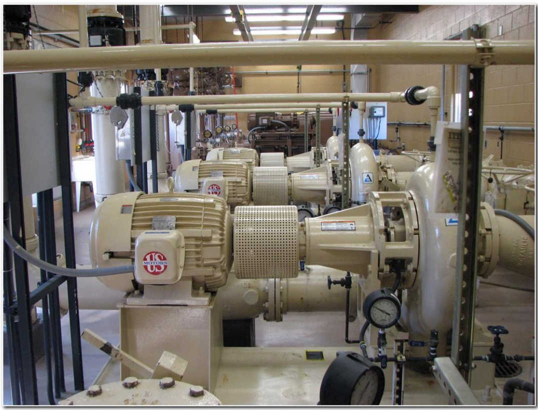
A new 12-in cement-lined ductile iron pipe will be routed from the new clarifier to a new return activated sludge (RAS) pump. Further investigation is required to determine the new clarifier and baffle type. Plant staff has indicated that there have been no significant problems with the existing clarifiers, but would be interested in investigating other technologies that are available.

(1 of 3) Existing Final Clarifiers

RAS/WAS Pump Station

There are (4) existing RAS pumps (Allis-Chalmers Model 150, Type NSX, 6 x 6 x 14, 1575 gpm, 22 feet TDH, 705 rpm, 20 HP).

To serve final clarifier No. 4 and maintain a common standby for all the clarifiers, a new RAS pump with characteristics similar to the existing pumps will be provided. A new variable frequency drive and magnetic flow meter will be provided for the new pump. The east end of the pump station will be extended to fit the additional pump. The existing sodium hypochlorite totes must be moved to provide space for this pump station expansion. The existing suction and discharge piping will be modified so that each clarifier will have a dedicated RAS pump and access to a standby pump. The existing RAS pumps will continue to supply one of the waste activated sludge (WAS) storage tanks for storage prior to pumping to the rotary drum thickener (RDT).



Existing RAS/WAS Pump Station

Ultraviolet Disinfection (UV)

There is an existing channel-type UV disinfection unit (Trojan Model UV4000) that disinfects the treated wastewater prior to discharge.

A second channel-type UV unit will be added to operate in parallel with the existing one to provide the additional disinfection capacity required for the peak design flow. It is anticipated that a similar Trojan Model UV 4000 would be the basis of design so that there is interchangeability of parts between the existing and proposed units. The existing chlorine contact chamber will be modified to accept the new unit. A new 10-ft effluent weir will be required to maintain the water elevation through the UV unit.

Existing Ultraviolet Disinfection Unit

Sequencing Batch Reactor (SBR)

A new packaged system SBR will be located on the northeast end of the site, to the east of the waste activated sludge (WAS) holding tanks. This SBR will provide sidestream treatment of the belt filter press (BFP) filtrate to reduce the nitrogen load that the filtrate will impose on the main treatment process. One of two existing WAS holding tanks will be converted to a filtrate equalization tank. This equalization will allow for accumulation of filtrate over the course of a week while the BFPs are being operated. The accumulated filtrate will then be used to feed the SBR and allow for continuous SBR operation over the weekend while the BFPs are not being operated. One of the existing WAS holding tanks will provide approximately 3 days of storage at the design condition.

A new cover will be installed on the equalization tank to control odors. As the design progresses, AECOM will discuss with the Borough whether they would like to include an odor control system on the vent from the equalization tank or if this is unnecessary.

The belt filter presses (BFP) will be modified so that filtrate is isolated from other flows and can be piped directly to the equalization tank. Filtrate will be pumped from the equalization tank to the SBR inlet. The separated filtrate can flow by gravity to the pump room below the BFPs. There appears to be room to install the filtrate transfer pumps on the south side of the pump room. SBR decant will be piped back to the headworks. SBR mixed liquor will be "wasted" by pumping it to the post-aeration tank in order to introduce the SBR sidestream solids ot the VLR system. This mixed liquor will contain nitrifying microorganisms in high concentrations due to being incubated in a high-nitrogen environment, so they will serve to "seed" the nitrifying microorganism population in the main VLR treatment process.

Two leading manufacturers of SBR packaged systems, Aqua Aerobics and Jet Tech, have been contacted as possible suppliers of this treatment system. In addition, a relatively new SBR manufacturer, Invent, has been contacted to provide a preliminary design proposal for an appropriate system. It is anticipated that the selected system will include two SBR reactor tanks for redundancy and to facilitate sequencing treatment operations.

Existing WAS Holding Tanks

Acid Phase Digester

A new steel (either welded steel with epoxy coating or glass-lined bolted steel) acid phase digester will be constructed to the east of the existing primary digester. The digester will be cylindrically shaped with a conical bottom, approximately 20-ft diameter by 50 feet high. The new acid phase reactor will receive both the thickened waste activated sludge (TWAS), which will have been thickened by the existing rotary drum thickeners, and primary thickened sludge that has been gravity thickened (GT). The TWAS piping will be modified so that it includes an in-line grinder upstream of the transfer pumps, as is currently provided for the GT flow. The piping modifications will also allow TWAS to blend in-line with the GT discharge and flow directly to the acid phase digester from the TWAS holding tank. The acid phase digester effluent will flow by gravity to the existing gas phase (primary) digester. The acid phase digester will be constructed with a skirt such that the area underneath the bottom cone will form a new support building with the skirt as its walls. This enclosed area will house the feed and recirculation pumps. The acid phase digester gas will be tied into the existing digester gas system with a new flow meter. Heat tracing and weather protection will be provided.

Digester heating will be accomplished with a combination of the existing Envirex sludge heater and steam injection. Replacement of the existing Bryan boiler with a new steam boiler with dual-fuel capability (natural and digester gas) is being investigated as a preferred way to provide steam. Steam injection avoids the need to add additional heat exchange equipment and eliminates concerns over heat exchanger tube fouling. Preliminary investigations indicate that a new steam boiler could be located in place of the existing Bryan boiler, but this needs to be confirmed.

The acid phase digester will be constructed with a skirt such that the area underneath the bottom cone will form a new support building with the skirt as its walls. This enclosed area will house the feed and recirculation pumps. The acid phase digester gas will be tied into the existing digester gas system with a new flow meter. Heat tracing and weather protection will be provided.

Gas Phase Digester

The Borough has an existing 60-ft diameter by 23-ft high primary digester with a USFilter/Envirex steel floating cover that is mounted with (2) 10 HP Vaughan mixing pumps.

This existing primary digester will be modified to operation as the gas phase digester. The (2) existing mixers on the floating cover have been ineffective in mixing and will be demolished and replaced by a new mixer. A new linear motion mixer is being investigated as the most likely basis of design for this function. Modifications to the center dome, sludge piping, and gas piping would likely be required to accommodate the new linear motion mixer. Discussion with the cover and mixer manufacturers are presently underway to determine the full extent of the modifications required. The digested solids in the gas phase digester will be pumped to the existing secondary digester, then to the sludge holding tank, before flowing by gravity to the sludge pumping station to be pumped to the belt filter presses for dewatering.

Floating Cover on the Existing Primary Digester

(1 of the 2) Existing Mixing Pumps

Solids Handling Piping Changes

Currently the Gravity Thickener (GT) operates without elutriation water. This can lead to odor issues and rising solids which reduce the concentration fed to the digester. To address these concerns, WWTP staff has asked that this upgrade project makes provision for plant water addition to provide elutriation (dilution) water for the primary solids feed to the GT. It has been proposed that this be accomplished by adding plant water to the discharge of the primary sludge transfer pumps at the Primary Sludge pump station. Further investigation is required to determine if the existing utility water pumps would need to be upgraded to provide the required pressure for this purpose.

Currently there are no means for transferring primary sludge to the rotary drum thickening system. Adding a small amount of primary sludge to the RDT system will reduce polymer demand and improve percent solids performance. This capability will be provided by the addition of remotely actuated valves to "jumper" primary solids to the BFP "suction" piping in the digester pump room, and a second tie-in in the RAS pump station from the BFP suction to the WAS transfer pumps. This will be used to introduce approximately a 10% mix of primary solids to the RDT WAS storage tank, which is the percent composition that experience indicates optimizes thickening performance.

Chemical Addition

Heated fiberglass sheds will be provided for new chemical feed equipment. Metal salt addition (alum is typically the preferred choice for wastewater facilities that utilize UV disinfection) will be utilized at the primary and secondary clarifiers for phosphorous removal. Sodium hydroxide is required at post aeration for pH adjustment. A supplemental carbon source will also be required at the SBR and secondary anoxic tank to accommodate the denitrification treatment process. Glycerol has been discussed as a possible supplemental carbon source alternative.

Electrical

Emergency Generator and Electrical Service Upgrade

At this preliminary phase, the Basis of Design for this project assumes the same electrical upgrade will be required as was requested in the "Request for Proposals" dated March 2010, i.e., that the plant's existing 800-amp service be increased to 1200 amps and a new generator be installed. It is noted that the existing switchgear has a 3000-amp rating. The appropriate size of the service will be verified as the design progresses and the post-upgrade load is determined.

The plant is served from two separate underground primary service laterals and two separate pad-mounted transformers. The two transformers are rated at 1,500 and 2,500 kVA. Both transformer secondary feeders route from the transformers into the existing switchgear located in the Main Electric Building.

The Borough has indicated that the two existing 1980 vintage 500 kW generators cannot handle the existing plant loads. It is reported that the Belt Filter Presses cannot be operated when the plant is on generator power. The existing plant loads that are to remain and the new upgraded plant loads will be reviewed with the Client and the Design Team to determine which of the connected loads must be functional during operation of the generator(s).

The existing generators are presently used for power curtailment, which is consistent with what has been requested to be provided by the new generators. Review of the EPA regulations for exhaust emission will be critical in determining the cost of the generator and scrubbers for power production/curtailment versus a generator that is only used for required backup generation for the plant only. There are very strict emission regulations that might impact this design.

At this time the Borough is undecided as to whether several smaller generators or one larger unit should be the basis of the generator design. After the generator operated plant loads have been determined, a comparison can be addressed with accuracy. After a determination has been made, the required building size for housing the generator(s) can then be determined.

Previously, it was envisioned that a new building would be constructed proximal to the existing emergency generator building. However, recent discussions with the Borough indicate that it is likely that an “oversized” generator will be installed; that is to say, a generator would be selected that has greater capacity than would be required simply for emergency power back-up for the WWTP so that power could produced and provided for use by the Borough beyond the WWTP.

One factor that makes this an attractive option is that the Borough intends to install a natural gas service line to the WWTP, providing a more economical fuel source than the diesel fuel that is presently utilized. Preliminary estimates provided indicate a natural gas service line could be provided to the facility (at a length of approximately ½ mile) for approximately $40,000 if it were installed by Borough staff. The Borough is still evaluating the timing and procedure for installing the new service line.

With this revised approach to power generation for the facility, it is now proposed that the new generator be located in the new maintenance service building (proposed to be located at the far eastern side of the site near the entrance). This would be more conducive to the unit being operated by the Electric Department. This may also result in the new generator not being considered as part of the air emissions associated with the WWTP, and therefore may not need to be added in when determining the aggregate emissions from the WWTP. This is something that will require further investigation and discussion with PA DEP as the project scope develops.

It has not been finally decided whether the new generator(s) will be operated on natural gas or diesel fuel. While diesel fuel is presently on-site and utilized for the existing emergency generators, as mentioned previously, it seems that natural gas will become available in the near future. One consideration regarding utilizing natural gas generators is that they could be disrupted under extreme catastrophe. To deal with this possibility, one option would be to compose a plan to shed plant load under such an extreme event and to operate only the minimum essential equipment on the existing diesel units.

Additionally, if the Borough elects to install oversized gas-fueled generator(s), the recommended operation would be to power the WWTP by the gas-fueled generator(s), to use the grid as the back-up for power supply to the WWTP, and to provide excess power produced by the generator(s) to feed the grid. The reason for this is that there is a start-up time associated with gas-fueled generators that makes them less than optimal for providing quick emergency power.

Finally, if the oversized gas-fueled generator(s) option is selected, the Borough should consider installing two generators, each with a minimal generation capacity equal to the WWTP's demand, so that one generator could be off-line for maintenance without adversely affecting supply of power to the WWTP.

The decision on which fuel will be used should be a collaborative decision between the Borough and the design team, with pertinent input from local code officials as appropriate.

It has been discussed at previous meetings that it would be beneficial for the generator transfer switch(es) to operate in a closed-transition configuration. During exercising of the generator, this allows the loads to be transferred to the generator(s) virtually unnoticed. Plant staff has mentioned that they currently need to bring in a portable heat bar unit to test the generators under load. This is inconvenient and requires additional cost. Furthermore, when switching to generator power, it is reported that lamps in the UV system are oftentimes damaged. These issues will be addressed as part of this project.

After the Borough has had the opportunity to review this BDR and design direction is more fully established, a meeting with plant personnel and power company personnel will provide additional information on the existing facility which will be critical in advancing the design.

Electrical Components

a. Introduction

At this early stage of the project, it is premature to designate those electrical components that will remain or those that will be added based on the design. If there are manufacturers the Client prefers, they will be incorporated into the design specifications with equals or no equals depending on the Client's requirements.

There are areas where unclassified or hazardous conditions exist. These areas will be addressed both by ventilation means and equipment meant specifically for the areas. By ventilating in specific ways, there are some hazardous areas that can be degraded to lesser conditions and there are areas that can be downgraded to unclassified conditions.

b. Applicable Codes and Standards

All of the codes applicable to the project cannot be identified at this early stage of the project; however, there are some codes that are known to apply and, as such, will be followed. These include the following:

National Electrical Manufacturers Association (NEMA).

Occupational Safety and Health Administration (OSHA).

American National Standards Institute (ANSI).

National Fire Protection Association (NFPA).

NFPA 70; 2011 National Electrical Code, and current amendments.

NFPA 820 – Standard for Fire Protection in Wastewater Treatment and Collection Facilities.

Underwriters' Laboratories, Inc. (UL) Listings, Labels, and Approvals shall govern the quality and performance of certain specified Products.

Institute of Electrical and Electronic Engineer (IEEE).

Insulated Cable Engineers Association (ICEA).

International Building Code as pertinent.

As the design progresses into the next stage, the AECOM Team will discuss with the Borough whether there are local electrical codes that should have bearing on the design.

c. Existing Electrical Distribution

It is apparent that the electrical distribution equipment will have to be evaluated based on the upgrade plant loading. There will be locations where the distribution system will remain undisturbed while areas with upgrades will command changes. Those areas where change is warranted, additional capacity will be built in to accommodate reasonable future loads.

d. Site Lighting

There will be areas of disturbance where existing site lighting might be interfered with due to the upgrades. In these instances, new site lighting will adhere to the existing lighting appearance, type of lamp, and distribution pattern as much as possible. Tank catwalks and building walls will receive lighting treatment to complement the site lighting. The control of site lighting will be a continuation of the existing methods of control. All lighting will be designed with energy efficiency in mind.

Instrumentation and Control

a. Introduction

The existing plant is operating through a redundant set of in-plant Supervisory Control and Data Acquisition (SCADA) systems using CitectSCADA by Schneider Electric. The design intent is to expand the system to incorporate the added facilities, but maintain the human-machine interface so as not to make the plant Operators learn an entirely different system.

b. Applicable Codes and Standards

Instrument Society of America (ISA)

National Electrical Manufacturers Association (NEMA)

Occupational Safety and Health Administration (OSHA)

American National Standards Institute (ANSI)

National Fire Protection Association (NFPA)

Scientific Apparatus Makers Association (SAMA)

Institute of Electrical and Electronic Engineer (IEEE)

Electronic Industries Association (EIA)

Insulated Cable Engineers Association (ICEA)

Local Power and Telephone Companies

c. Existing SCADA Systems

The existing plant wide system will remain in place. Buildings presently have remote terminal units for input/output functions as well as message display units. These I/O units are connected to the master via fiber optic cables.

d. Proposed SCADA Interface

The main program will be expanded to accommodate the plant upgrade. Remote I/O will be added to each new facility and existing remote I/O systems will be modified to follow changes to process within existing facilities. New I/O will be connected to the master via fiber optic cables.

e. Instrumentation

The equipment used for monitoring process conditions will be specified with consensus from the Borough in those areas for which there is a choice of equipment.

f. Installation and Testing

All hardware and system programs shall be completely factory tested under simulated operating conditions. In addition, the configured system shall be subjected to a Factory Acceptance Test (FAT) witnessed by the Engineer/Owner.

The Procedures shall follow, insofar as they apply, to Section 8, Recommended Tests for Interacting Systems established by the Instrument Society of America under Standard RP 55.1 and the Factory Acceptance Plan detailed within these Specifications. The submittal shall contain a schedule identifying each testing activity. Upon satisfactory completion of each testing activity, the System Manufacturer shall provide the certification and documentation.

The availability of the entire distributed control system shall not be less than 99.97 percent with a mean time to repair (MTTR) of two (2.0) hours for any consecutive period of six months during the one (1) year guarantee period.

Availability, MTTR and other supporting terminology shall be as defined in SAMA Standard PMC32.1-1976.

Structural

There will be several new concrete tank structures included in the project. The Borough has requested that the project bidding documents be structured such that prices are obtained for both cast-in-place and precast concrete structures.

Following are the criteria that will be used for design:

- Design shall conform to the current edition of the International Building Code.
- Loading criteria and loading combinations for buildings and structures shall conform to the American Society of Civil Engineers ***Minimum Design Loads for Buildings and Other Structures*** *(*ASCE/SEI-7) unless more severe loadings are required by the applicable building code.
- Design and placement of structural concrete shall conform to the American Concrete Institute ***Building Code Requirements for Reinforced Concrete*** (ACI 318).
- Design and placement of concrete for liquid containment structures shall follow the American Concrete Institute ***Code Requirements for Environmental Engineering Concrete Structures*** (ACI 350) in addition to the requirements of ACI 318.
- Design, fabrication, and erection of structural steel shall follow the American Institute of Steel Construction ***Specification for Structural Steel Buildings*** (June 1, 1989) and the 9th Edition (1989) of the AISC Manual of Steel Construction.
- Welding procedures and qualifications for welders shall follow the recommended practices of the American Welding Society D1.1 Structural Welding Code.
- Design and erection of masonry materials of brick, concrete block, or structural tile shall conform to the ***Building Code Requirements for Masonry Structures*** (ACI 530 / ASCE 5 / TMS 402) and the ***Specifications for Masonry Structures*** (ACI 530.1 / ASCE 6-99 / TMS 602) reported by the Masonry Standards Joint Committee.

Architectural

Codes and Regulations

The following codes and regulations shall be used to perform the architectural work for the project:

- Building Code – 2009 International Building Code (IBC) with local amendments
- Fire/Life Safety Code – 2009 International Fire Code
- Accessibility Code – 2009 IBC Chapter 11 & 2003 ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities
- The American Disabilities Act (ADA)
- Energy Code – 2009 International Energy Conservation Code (IECC)
- Occupational Safety and Health Act (OSHA) Regulations

Energy Code Requirements

The Borough of Chambersburg is located in Franklin County and is classified as Climate Zone 5A by the IECC. Minimum building envelope requirements for opaque assemblies in Zone 5A are as follows:

- Roofs with insulation entirely above deck – R-20ci
- Above grade mass walls – R-11.4ci
- Below grade walls – R-7.5ci
- Mass Floors – R-10ci
- Unheated slab-on-grade floors – No Requirement
- Swinging opaque doors – U-0.70
- Roll-up doors – U-0.50

Exterior Materials Overview

It is anticipated that a new electrical building will be required as part of the upgrade. The new building will be a single story masonry bearing wall structure with a flat roof and be similar in appearance to the existing Solids Handling and RAS buildings. The walls will be constructed of a CMU back-up wall with an air space/insulation cavity and concrete masonry veneer. The architectural aesthetic will complement the existing structures but will not be identical.

The roofing material will be a light colored multi-ply modified bitumen with a 25 year minimum service life. The light color will reflect the sun's energy, keeping the building cooler in the summer months while helping to reduce the heat island effect caused by dark colored surfaces. Doors and louvers will be constructed of anodized or Kynar finished aluminum for durability, corrosion resistance and minimal maintenance.

The addition to the RAS Building will receive a similar material palette and aesthetic as the original structure. Existing materials will be investigated and upgraded as required. The new addition will comply with the latest applicable codes.

Interior Materials and Finishes
Interior finishes will be selected for durability, ease of maintenance and appearance. The selection of finishes, furnishings, colors, and lighting will be analyzed in much greater depth during detailed design. Proposed preliminary finish choices are as follows.

Wall finishes and materials will be selected for maintainability, sound absorption and light reflectance. Paint colors will be chosen for visual balance and light reflectance of interior spaces. Interior doors will be painted hollow metal doors for durability. Process area finishes will be selected for minimal maintenance. Concrete floors will receive liquid hardener or dust proof sealer as appropriate. CMU walls will be painted for light reflectance and to provide an easily cleanable surface. Ceilings will be exposed steel framing or concrete with a paint finish. Metals such as guard railings shall be provided with a clear anodic finish and hatches will be corrosion resistant mill finished aluminum. Overhead structures such as monorails and specific floor areas will receive safety paint markings.

Safety
The facility will be designed to meet applicable code requirements for safety. Specific signs, equipment colors and other measures as required by code will be incorporated into this design to provide a safety conscious working environment. First aid kits and fire extinguishers will be provided.

Energy Conservation
The entire building envelope will contain sufficient insulation so as to satisfy, in conjunction with heating and ventilation equipment, the area temperature requirements that are determined in the HVAC design.

Sound Control
The acoustical design for the new structure that houses the new generator(s) will include the use of acoustical masonry walls and insulated metal doors.

<u>HVAC</u>

At this conceptual design phase of the project, the HVAC design has not yet been initiated since evaluation of HVAC requirements must follow the preliminary design of the other disciplines.

The following codes and regulations shall be used to guide the HVAC for the project:

- Mechanical Code – 2009 International Mechanical Code (IMC)
- Energy Code – 2009 International Energy Conservation Code (IECC)
- American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc. (ASHRAE)
- National Fire Protection Association (NFPA)
- Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)

Permitting

Based upon the project components that have been established at this point, it is anticipated that the following permits will be required.

- Water Quality Management Part II Permit, which will include:
    i. General Information Form (GIF)
    ii. PA Natural Diversity Inventory (PNDI). Scope of Work is based on no PNDI "hits" requiring additional permits, meetings, reports, site visits or other work.
    iii. PA Historic & Museum Commission (PHMC). Scope of Work is based on no PHMC "hits" requiring additional permits, meetings, reports, site visits or other work.
    iv. Engineer's Report
- Erosion & Sedimentation Control Permit
- Demonstration of Compliance with International Energy Code
- Air Quality Request for Determination (RFD). Currently assumed scope of work is based upon submission being made for a RFD to PA DEP and that the RFD results in no additional permits being required. If additional emergency generation is the only relevant revision to current practices that is included in the project, then it may be that no additional air permitting is required. It is noted that, based upon preliminary investigations and discussions with the Borough, it does not seem that there is an existing air permit for the WWTP.

  AECOM is presently completing a Combined Heat and Power (CHP) Study that evaluates the feasibility of utilizing the digester gas to be produced by the two-phased anaerobic process for beneficial heat and power purposes. Additionally, because the Borough is planning to install a new natural gas supply line to the WWTP, the possibility of installing power generation equipment at the WWTP site has also been discussed. If additional sources of emissions are added to the site, it will likely have bearing on the air permitting requirements.
- NPDES Permit for Stormwater Discharge
- Wetlands walkover, assessment and delineate with flagging.
- Storage Tank Registration & Permitting for new tanks (>250 gals of regulated substance)
- Land Development Plan: Based on the site work involved with this project, it is anticipated that the sketch plan and preliminary plan submissions will be waived such that only a final land development plan will be submitted to the Borough's Zoning Hearing Board, Planning Commission and Council. Generally the approval process takes about four months.

Additionally, given that the plant is located beside a creek, typical stormwater practice is to have the peak stormwater discharge from this site enter the creek as soon as possible so that the site's stormwater does not contribute flow to the creek at the same time that the creek flow peaks due to upstream discharges. As a result, consistent with AECOM's design proposal, this BDR anticipates that the stormwater calculations, report and detention requirements will be waived following the Borough's "no harm" option. Stormwater best management practices will be incorporated into the civil design when feasible.

Survey

Survey of the site, by Dennis E. Black Engineering, is underway but has been impeded in part by winter weather conditions. A site survey and elevation survey of points critical to the hydraulic profile evaluation will both be completed in the near future.

Geotechnical Investigations

After the Borough and the AECOM Team have had opportunity to review the BDR and confirm final locations for proposed structures, the geotechnical subconsultant, ECS, will arrange for drilling operations to be performed as the basis for the geotechnical report.

Additional Items

The initial concept for this upgrade project included a 6-bay municipal garage. However, the Borough has recently expressed the desire to construct a structure that would include additional features and would also potentially house the new power generation equipment. Concurrent with a review meeting to discuss this BDR, the Borough and the AECOM design team will discuss the new expectations for this new structure.

A Combined Heat and Power (CHP) Study is presently being completed, which will evaluate the options for utilizing the digester gas produced by the anaerobic digestion process. Depending upon the findings of the CHP Study, the Borough may elect to include CHP components as part of this design or to plan for their implementation as a separate project.

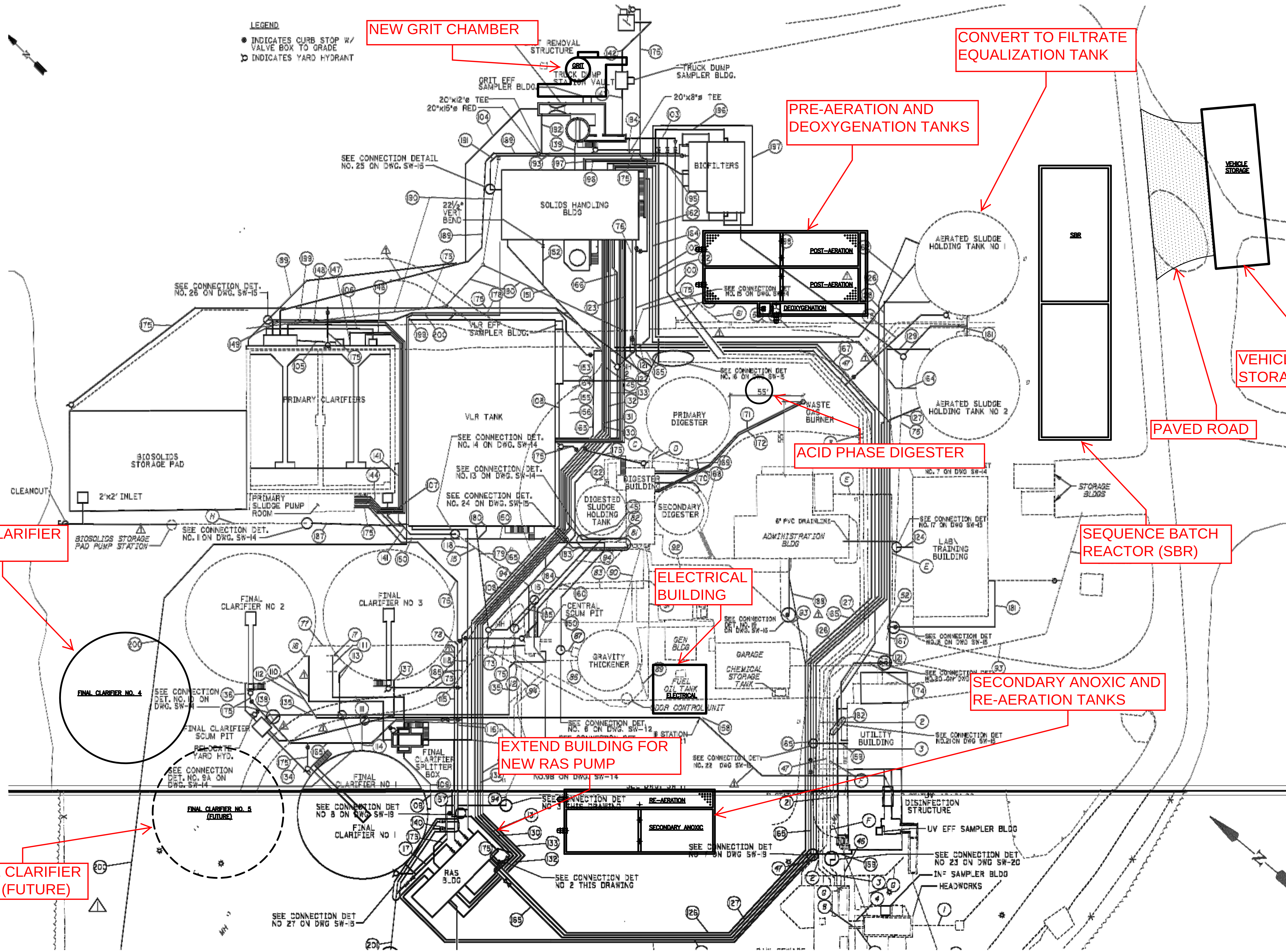
It is noted that the design basis for the two phase anaerobic digestion process is to provide for a Class B biosolids product. However, the Borough has requested that the design include provision for future adaptation of the process to produce a Class A biosolids product.

Included in the Appendix of this BDR is a "working copy" of the process flow diagram for the WWTP. It is intended to serve as and aid in discussions. It includes both existing and proposed WWTP infrastructure and processes. Some of the equipment shown will be reused, some replaced, and some simply removed. Determination on these matters will be made through discussions with the Borough and during the preliminary design process.

APPENDIX:

GENERAL SITE LAYOUT

WORKING COPY OF PROCESS FLOW DIAGRAM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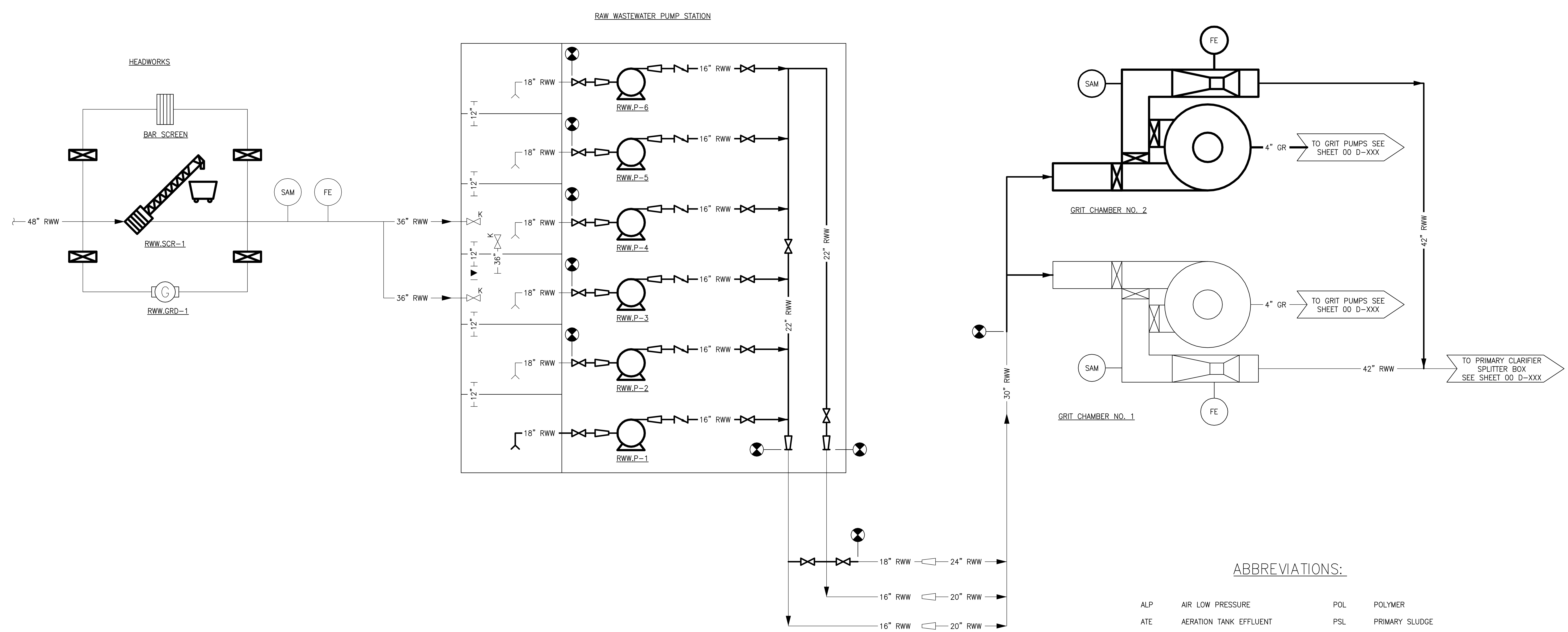
INDICATES YARD HYDRANT
NEW GRIT CHAMBER
CONVERT TO FILTRATE EQUALIZATION TANK
PRE-AERATION AND DEOXYGENATION TANKS
VEHICLE STORAGE
PAVED ROAD
ACID PHASE DIGESTER
SEQUENCE BATCH REACTOR (SBR)
FINAL CLARIFIER NO. 4
ELECTRICAL BUILDING
SECONDARY ANOXIC AND RE-AERATION TANKS
EXTEND BUILDING FOR NEW RAS PUMP
FINAL CLARIFIER NO. 5 (FUTURE)
TRUCK DUMP SAMPLER BLDG.
GRIT EFF SAMPLER BLDG.
BIOFILTERS
SOLIDS HANDLING BLDG
POST-AERATION
DEOXYGENATION
AERATED SLUDGE HOLDING TANK NO 1
AERATED SLUDGE HOLDING TANK NO 2
SBR
PRIMARY CLARIFIERS
VLR TANK
VLR EFF SAMPLER BLDG.
PRIMARY DIGESTER
WASTE GAS BURNER
BIOSOLIDS STORAGE PAD
2'x2' INLET
CLEANOUT
PRIMARY SLUDGE PUMP ROOM
BIOSOLIDS STORAGE PAD PUMP STATION
DIGESTER BUILDING
DIGESTED SLUDGE HOLDING TANK
SECONDARY DIGESTER
ADMINISTRATION BLDG
LAB\ TRAINING BUILDING
STORAGE BLDGS
FINAL CLARIFIER NO 2
FINAL CLARIFIER NO 3
CENTRAL SCUM PIT
GRAVITY THICKENER
GEN BLDG
GARAGE
CHEMICAL STORAGE TANK
FUEL OIL TANK
ELECTRICAL
FINAL CLARIFIER NO. 4
FINAL CLARIFIER SCUM PIT
RELOCATE YARD HYD.
FINAL CLARIFIER NO. 5 (FUTURE)
FINAL CLARIFIER NO 1
FINAL CLARIFIER SPLITTER BOX
RAS BLDG
RE-AERATION
SECONDARY ANOXIC
UTILITY BUILDING
DISINFECTION STRUCTURE
UV EFF SAMPLER BLDG
INF SAMPLER BLDG
HEADWORKS



ABBREVIATIONS:

ALP	AIR LOW PRESSURE	POL	POLYMER
ATE	AERATION TANK EFFLUENT	PSL	PRIMARY SLUDGE
BFP	BELT FILTER PRESS	RAS	RETURN ACTIVATED SLUDGE
D	DRAIN	RDT	ROTARY DRUM THICKENER
DSL	DIGESTED SLUDGE	RWW	RAW WASTEWATER
FCE	FINAL CLARIFIER EFFLUENT	SAM	SAMPLE
FE	FLOW ELEMENT	SC	SCUM
FIL	FILTRATE	SCR	SCREEN
GR	GRIT	SH	SODIUM HYPOCHLORITE
GRD	GRINDER	SN	SUPERNATENT
GTO	GRAVITY THICKENER OVERFLOW	TSL	THICKENED SLUDGE
MIX	MIXER	TWAS	THICKENED WASTE ACTIVATED SLUDGE
OV	OVERFLOW	WAS	WASTE ACTIVATED SLUDGE
P	PUMP	UVE	ULTRAVIOLET EFFLUENT
PE	PRIMARY EFFLUENT	V	VENT

NOT FOR CONSTRUCTION

MARK	DATE	MADE BY	CHECKED	DESCRIPTION

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CITY OF CHAMBERSBURG, PA
CHAMBERSBURG WWTP UPGRADE

PROCESS FLOW DIAGRAM 1 OF 7

MECHANICAL PROCESS

PROJECT NO:	60186852
CAD DWG FILE:	00 D-603
DESIGNED BY:	D. YURK
DRAWN BY:	D. YURK
DEPT CHECK:	C. GALLIGAN
PROJ CHECK:	J. RAINWATER
DATE:	----
SCALE:	NOT TO SCALE

00 D-603

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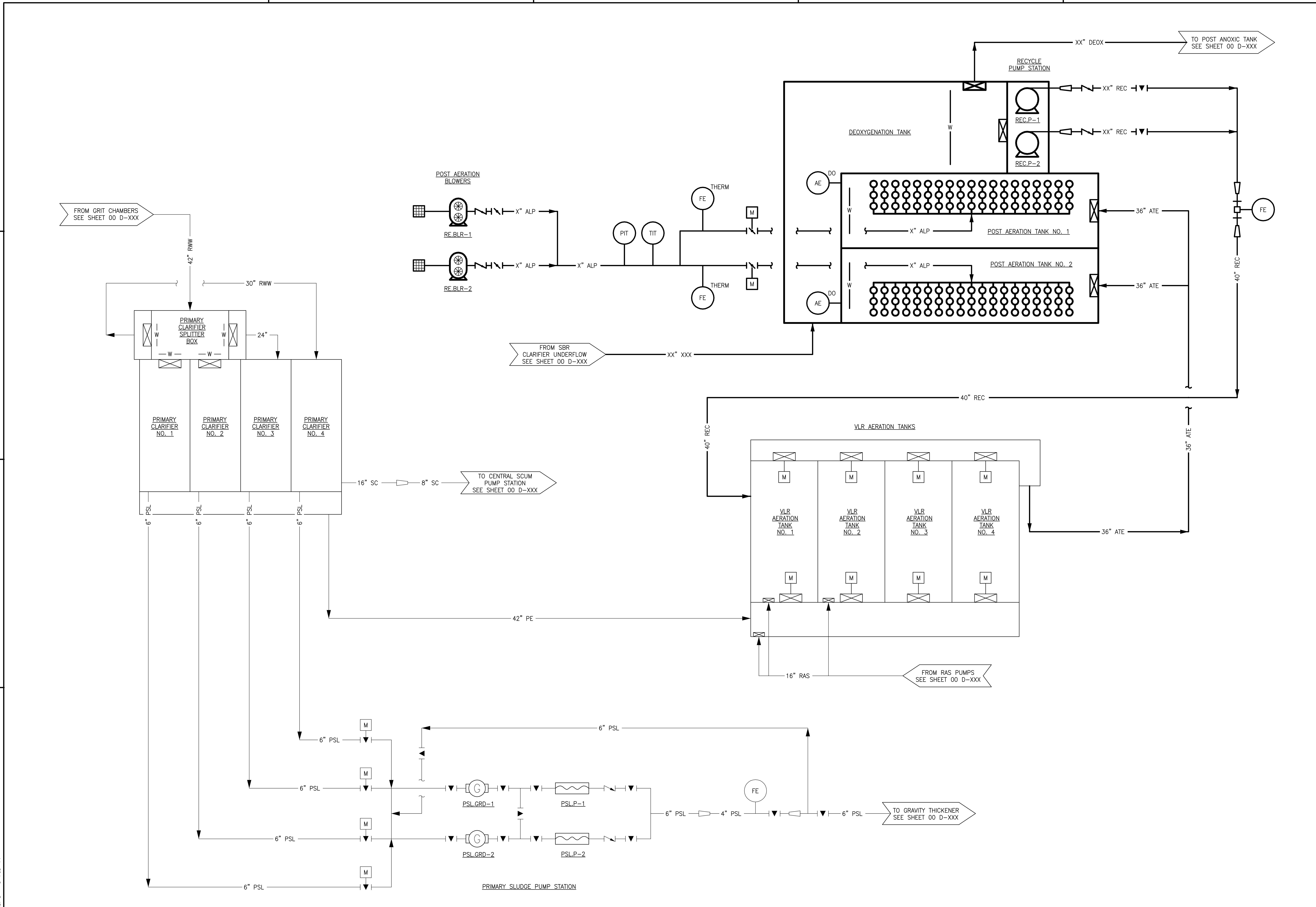
ANSI D - 3-Feb-11



NOT FOR CONSTRUCTION

MARK	DATE	MADE BY	CHECKED	DESCRIPTION

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CITY OF CHAMBERSBURG, PA
CHAMBERSBURG WWTP UPGRADE

PROCESS FLOW DIAGRAM 2 OF 7
MECHANICAL PROCESS

PROJECT NO:	60186852
CAD DWG FILE:	00 D-604
DESIGNED BY:	D. YURK
DRAWN BY:	D. YURK
DEPT CHECK:	C. GALLIGAN
PROJ CHECK:	J. RAINWATER
DATE:	----
SCALE:	NOT TO SCALE

00 D-604

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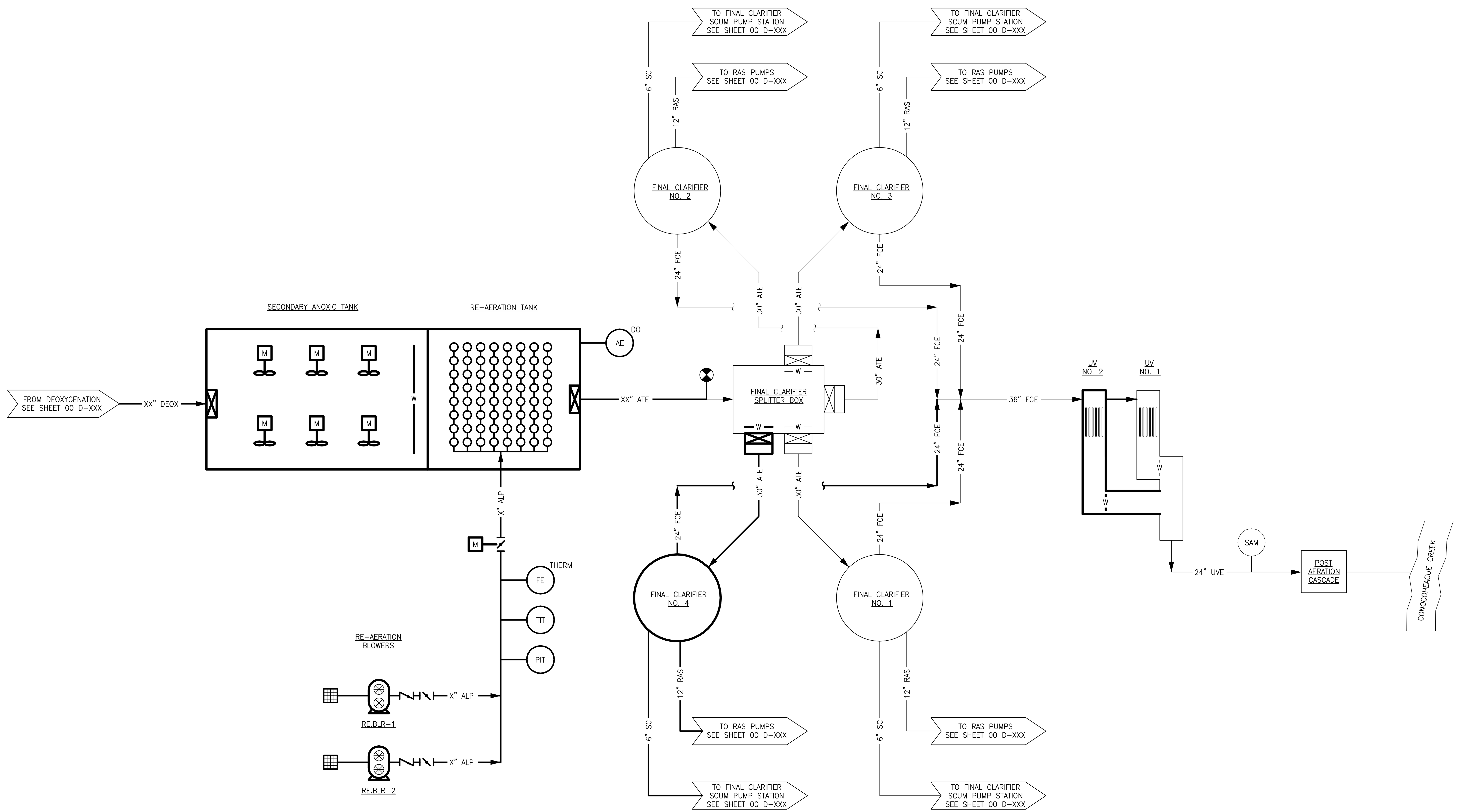

NOT FOR CONSTRUCTION

MARK	DATE	MADE BY	CHECKED	DESCRIPTION

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CITY OF CHAMBERSBURG, PA
CHAMBERSBURG WWTP UPGRADE

PROCESS FLOW DIAGRAM 3 OF 7

MECHANICAL PROCESS

PROJECT NO:	60186852
CAD DWG FILE:	00 D-605
DESIGNED BY:	D. YURK
DRAWN BY:	D. YURK
DEPT CHECK:	C. GALLIGAN
PROJ CHECK:	J. RAINWATER
DATE:	----
SCALE:	NOT TO SCALE

00 D-605

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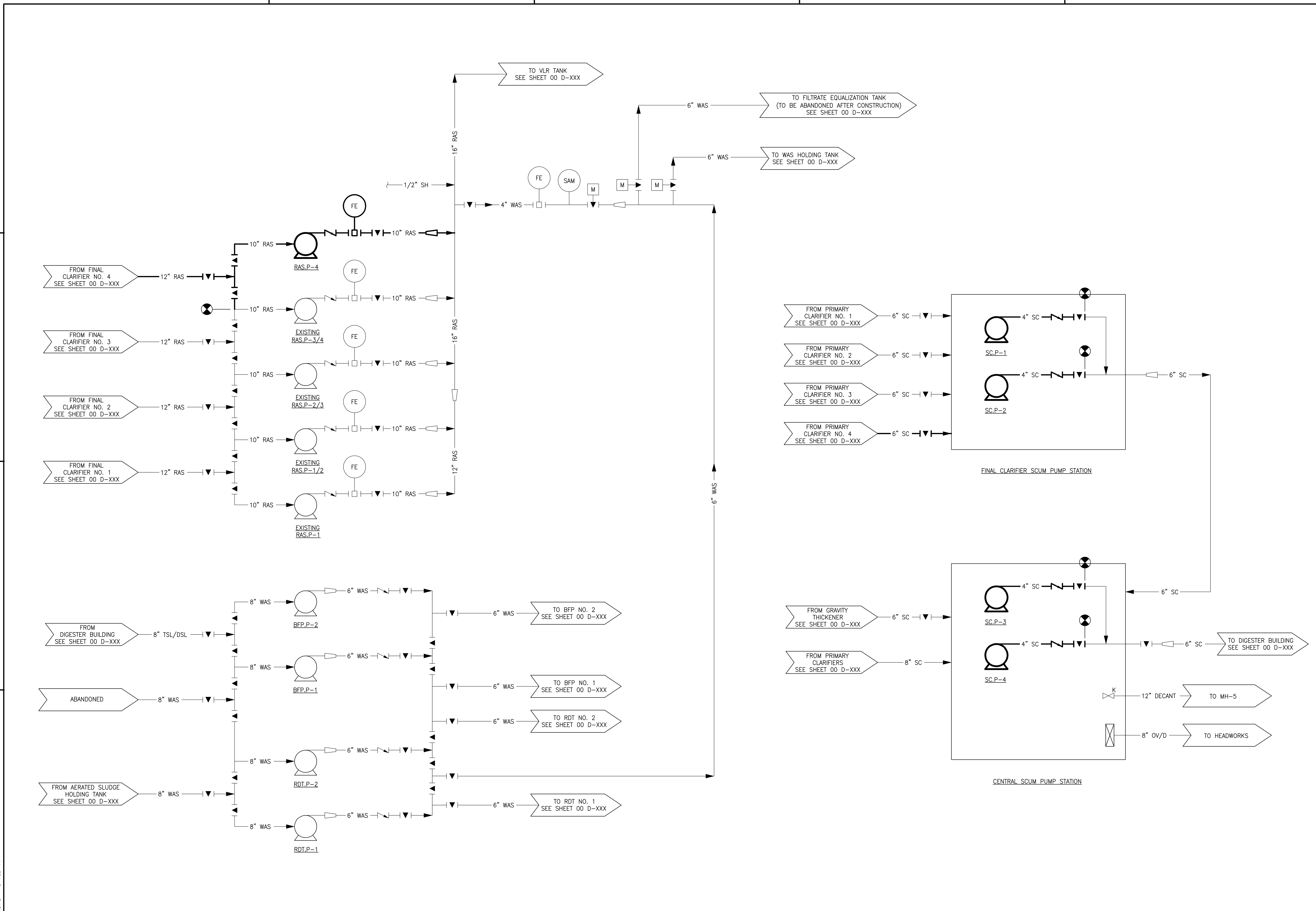
LAST UPDATE: Thursday, January 20, 2011 4:01:54 PM PLOT DATE: Thursday, February 03, 2011 2:04:38 PM
ANSI D - 20-Jan-11



NOT FOR CONSTRUCTION

MARK	DATE	MADE BY	CHECKED	DESCRIPTION

REVISIONS

AECOM
1700 MARKET ST. SUITE 1700
PHILADELPHIA, PA 19103
PHONE (215) 399-4370

ARRO ENGINEERING & ENVIRONMENTAL CONSULTANTS
IN ASSOCIATION WITH ARRO
108 WEST AIRPORT ROAD
LITITZ, PA 17543
PHONE (717) 569-7021

CITY OF CHAMBERSBURG, PA
CHAMBERSBURG WWTP UPGRADE

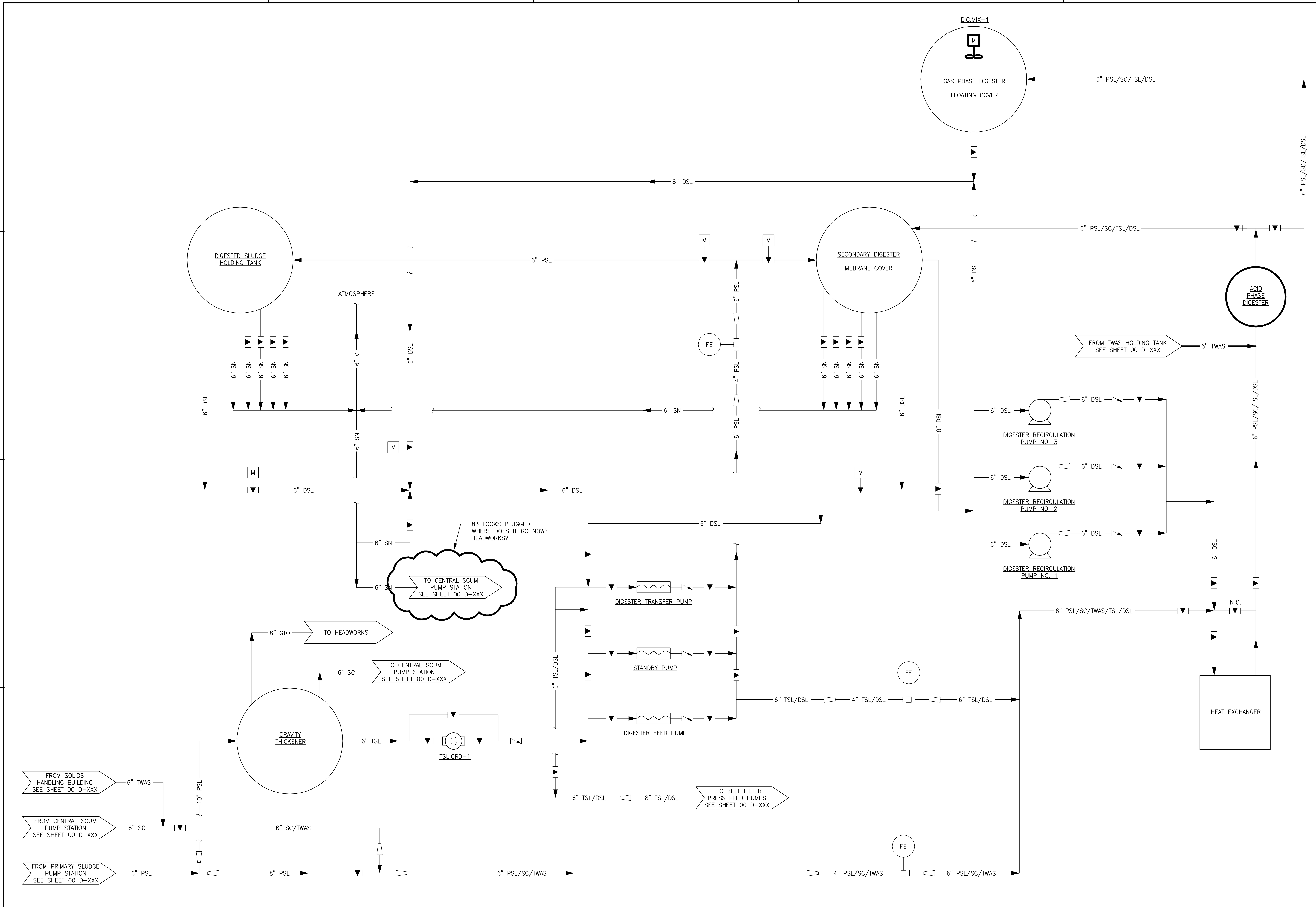
PROCESS FLOW DIAGRAM 4 OF 7

MECHANICAL PROCESS

PROJECT NO:	60186852
CAD DWG FILE:	00 D-606
DESIGNED BY:	D. YURK
DRAWN BY:	D. YURK
DEPT CHECK:	C. GALLIGAN
PROJ CHECK:	J. RAINWATER
DATE:	----
SCALE:	NOT TO SCALE

00 D-606

PATH/FILENAME: \\USMAK1FP001\PROJ\60186852 - CHAMBERSBURG WWTP UPGRADE\SHEETS\D\00 D-606.DWG
PLOT DATE: Thursday, February 03, 2011 2:04:41 PM
LAST UPDATE: Thursday, February 03, 2011 2:03:35 PM
ANSI D - 3-Feb-11



NOT FOR CONSTRUCTION

MARK	DATE	MADE BY	CHECKED	DESCRIPTION

REVISIONS

AECOM
1700 MARKET ST. SUITE 1700
PHILADELPHIA, PA 19103
PHONE (215) 399-4370

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PHONE (717) 569-7021

CITY OF CHAMBERSBURG, PA
CHAMBERSBURG WWTP UPGRADE

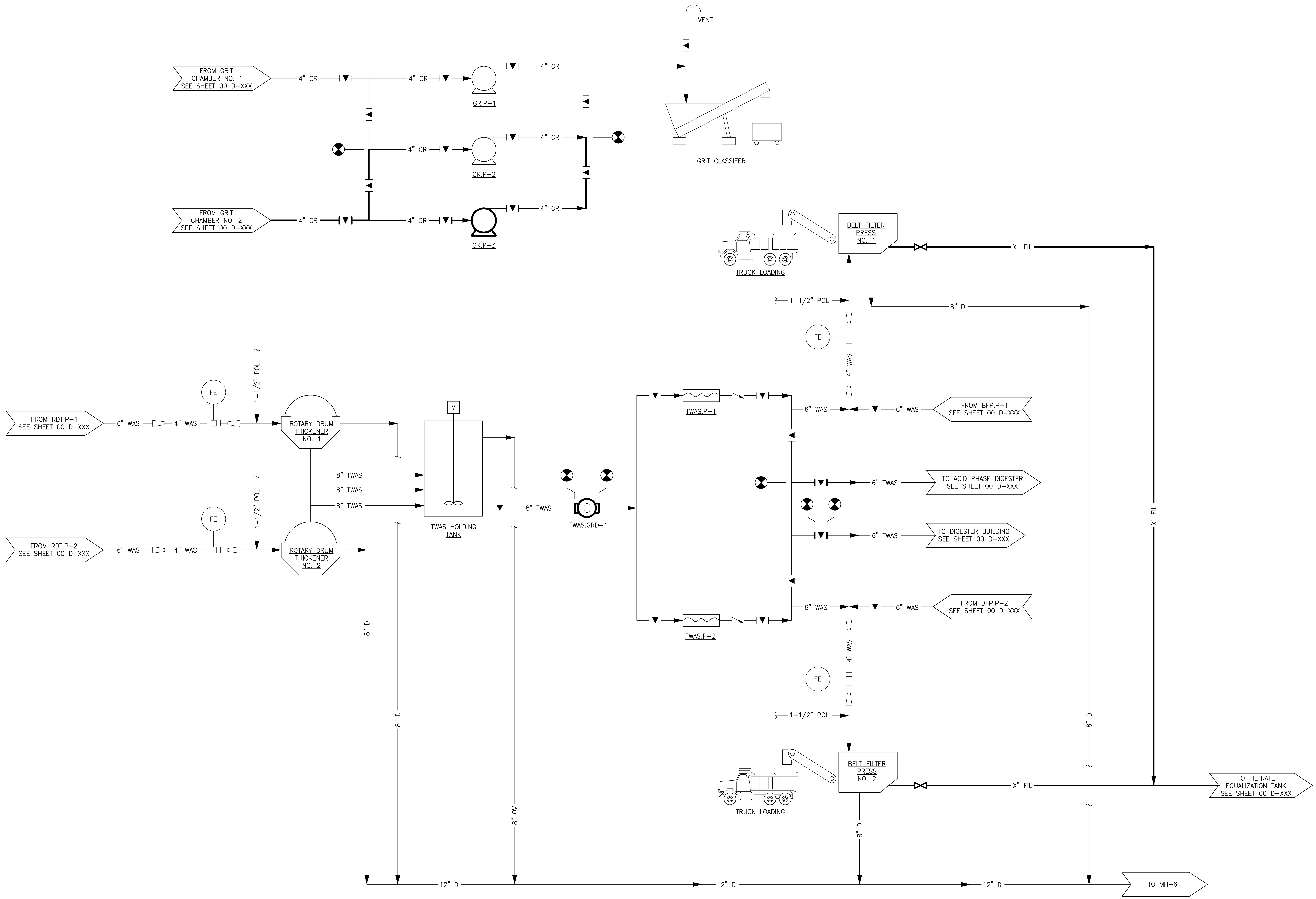
PROCESS FLOW DIAGRAM 5 OF 7

MECHANICAL PROCESS

PROJECT NO:	60186852
CAD DWG FILE:	00 D-607
DESIGNED BY:	D. YURK
DRAWN BY:	D. YURK
DEPT CHECK:	C. GALLIGAN
PROJ CHECK:	J. RAINWATER
DATE:	----
SCALE:	NOT TO SCALE

00 D-607

PATH/FILENAME: \\USMAK1FP001\PROJ\60186852 - CHAMBERSBURG WWTP UPGRADE\SHEETS\D\00 D-607.DWG
LAST UPDATE: Thursday, February 03, 2011 1:39:22 PM PLOT DATE: Thursday, February 03, 2011 2:04:44 PM
ANSI D - 3-Feb-11



NOT FOR CONSTRUCTION

MARK	DATE	MADE BY	CHECKED	DESCRIPTION

REVISIONS

AECOM
1700 MARKET ST. SUITE 1700
PHILADELPHIA, PA 19103
PHONE (215) 399-4370

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CITY OF CHAMBERSBURG, PA
CHAMBERSBURG WWTP UPGRADE

PROCESS FLOW DIAGRAM 6 OF 7

MECHANICAL PROCESS

PROJECT NO:	60186852
CAD DWG FILE:	00 D-608
DESIGNED BY:	D. YURK
DRAWN BY:	D. YURK
DEPT CHECK:	C. GALLIGAN
PROJ CHECK:	J. RAINWATER
DATE:	----
SCALE:	NOT TO SCALE

00 D-608

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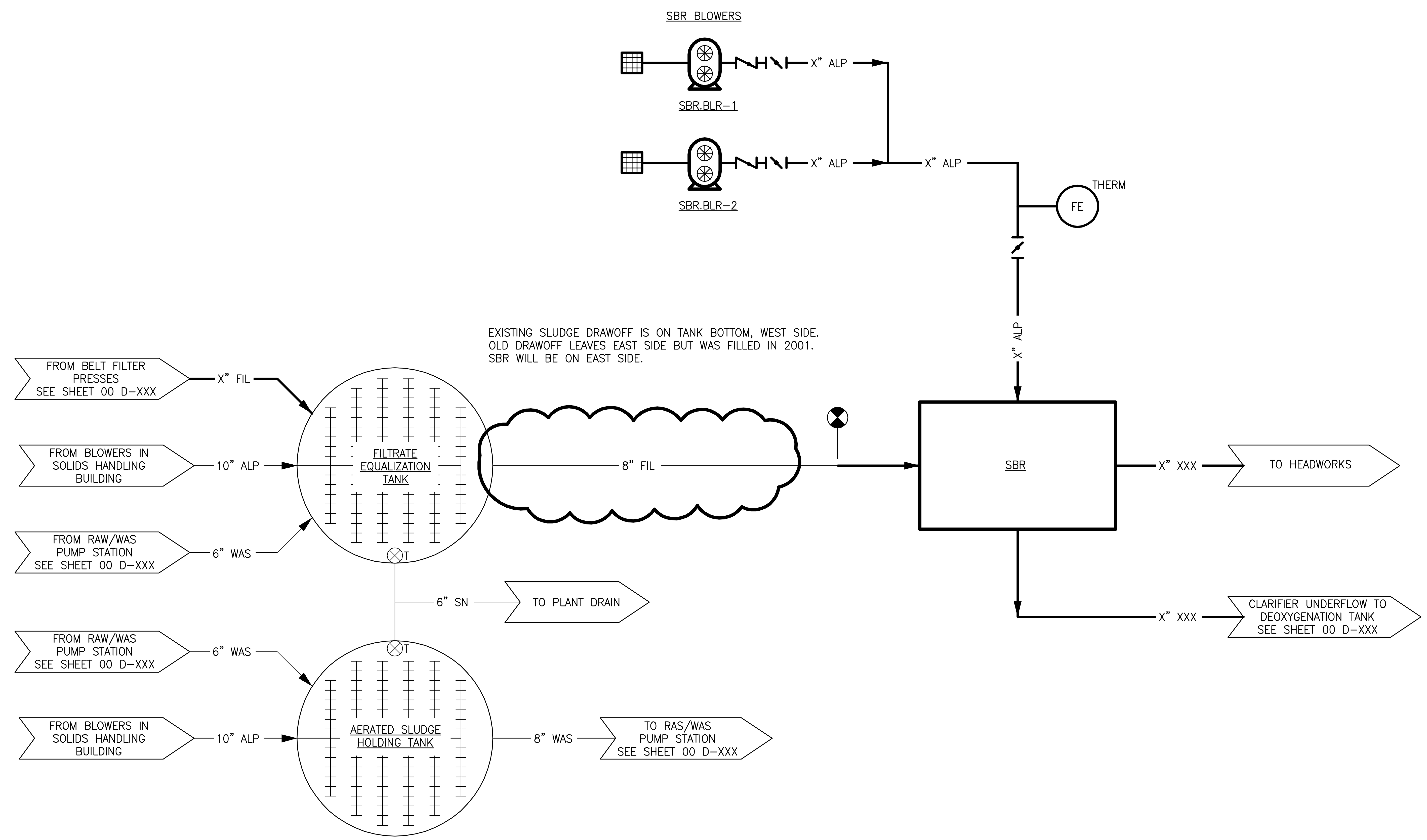
LAST UPDATE: Thursday, February 03, 2011 1:51:54 PM PLOT DATE: Thursday, February 03, 2011 2:04:48 PM
ANSI D - 3-Feb-11



NOT FOR CONSTRUCTION

MARK	DATE	MADE BY	CHECKED	DESCRIPTION

REVISIONS

AECOM
1700 MARKET ST. SUITE 1700
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CHAMBERSBURG WWTP UPGRADE

PROCESS FLOW DIAGRAM 7 OF 7

MECHANICAL PROCESS

PROJECT NO:	60186852
CAD DWG FILE:	00 D-609
DESIGNED BY:	D. YURK
DRAWN BY:	D. YURK
DEPT CHECK:	C. GALLIGAN
PROJ CHECK:	J. RAINWATER
DATE:	----
SCALE:	NOT TO SCALE

00 D-609