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OCT 27 2010

J-60147310

October 22, 2010

Mr. Peter Rice, P.E.
City Engineer
Department of Public Works
680 Peverly Hill Road
Portsmouth, NH 03801

Subject: Filter Building Retrofit Evaluation for Secondary Treatment
Peirce Island WWTF
Wastewater Master Plan, Value Engineering (VE) Review

Dear Mr. Rice:

AECOM has completed a conceptual level evaluation of the potential secondary treatment capacity that could be achieved by retrofitting the existing Filter Building at the Peirce Island WWTF. This letter report presents the findings of the evaluation including costs of the options being considered.

The evaluation is based on maintaining the existing chemically enhanced primary treatment process in operation. Effluent from the proposed treatment systems is intended to meet conventional secondary effluent quality with typical water quality limits of 30 milligrams per liter (mg/L) of 5-day Biochemical Oxygen Demand (BOD) and total suspended solids (TSS) on an average monthly basis. The influent to the proposed treatment system was based on chemically enhanced primary treatment (CEPT) effluent with typical BOD and TSS values of 75 to 85 mg/L and 55 to 65 mg/L, respectively. For this evaluation, it is anticipated that only dry weather flows would receive secondary treatment (up to 7.5 million gallons per day (MGD) peak hour flows) with wet weather flows in excess of the secondary treatment capacity receiving CEPT and disinfection as currently provided.

To maximize the secondary treatment capacity that could be provided in the existing Filter Building, AECOM evaluated three secondary treatment technologies including Biological Aerated Filter (BAF), Moving Bed Biofilm Reactors (MBBR), and Membrane Bioreactors (MBR). Each technology has certain benefits and challenges, particularly when retrofitting an existing building for installation. Many of the challenges will impact costs and are reflected accordingly. The need for fine screens to remove debris from the CEPT effluent prior to secondary treatment was common to all technologies considered. It was assumed that an upgrade of the existing headworks with coarse screens and grit removal as proposed in the Wastewater Master Plan would be performed in advance of primary clarification. Fine screens would be used to screen only secondary influent flow upstream of the Filter Building. The details associated with each option are detailed later in this letter and the results of our evaluation are presented below. Table 1 presents a summary of the anticipated treatment capacity and associated costs for the processes considered.

Table 1 – Summary of Results

Secondary Treatment Technology Option	Manufacturer	Flow Capacity		Number of Existing Bays Occupied (8 exist)	Opinion of Cost	Attachment No.
		Average Day (MGD)	Maximum Day (MGD)			
Biological Aerated Filter (BAF)	Infilco-Degremont BIFOR C	5.0	7.5	2*	$30M	1A
	Kruger BIOSTYR	5.0	7.5	8		1B
Membrane Bioreactors (MBR)	Ovivio Enviroquip	Pending	Pending	Pending	$44.7M**	Pending
	Zenon	4.3	7.5	8 (4 biological, 4 membrane)		2B
Moving Bed Biofilm Reactors (MBBR)	Infilco-Degremont	5.3	8.85	4	$33M	3A
	Kruger AnoxKaldness	5.0	9.5	4*		3B

*These systems require construction of new tanks within limits of existing cells to provide additional side water depth – see structural analysis discussion for additional details.
**Opinion of cost from modified version of Wastewater Master Plan cost spreadsheet. See explanation in Opinion of Cost section of this letter report.

STRUCTURAL REVIEW

Based on record drawings provided by the city, the existing filter building consists of eight rapid sand filter bays (30 feet by 16 feet in plan) separated by 1-foot thick walls. On both sides of the filter bays is a pipe gallery. Below the filter bays is a wet well that slopes to an effluent pump station located at the East end of the facility. Below the North pipe gallery is a clearwell that captures and stores treated effluent for backwash purposes. Below the South gallery is a mud well where filter backwash was stored for subsequent return to the primary clarifiers for treatment. The top of the existing rapid sand filter bays is at elevation 26.0 and the floor of the filter bays is at elevation 13.0. The wet well extends below the filter bay floor to a sloping floor with a high point of elevation 6.5, and the mud well is at a similar elevation.

Understanding that the proposed technologies under evaluation would require deep tanks, AECOMs structural group evaluated the potential for removal of the existing filter bay floor that separates the filters and the wet well below. It is our opinion that with certain modifications the existing floor separating the filters and the wet well could be removed and the interior filter bay walls extended to the wet well floor to increase the available side water depth (SWD) of the tanks (up to 18.5 feet with 1 foot of freeboard under maximum hydraulic grade line condition). Certain technologies required even deeper SWDs. This required further evaluation and it is our opinion that in order to construct higher tank walls, the interior tank walls separating existing filter bays would have to be removed and new tanks would be constructed within the limits of the exterior walls of the existing filter bay area (e.g. a "box within a box") to avoid excess forces on the existing structure. This would allow for construction of new tanks that could accommodate a 20 to 22 foot side water depth with 1 to 2 feet of freeboard.

There is also a concern with the existing masonry Filter Building structure and the changes in building codes that have occurred since the existing building was designed. The existing building is of masonry bearing wall construction with some reinforcing in the masonry units. If significant changes are made to the existing structure (as determined by the local building officials), the City may be required to upgrade the structure to meet current seismic code requirements. One benefit of the existing building is that the existing subsurface information indicates that the building is founded on rock, which improves the Site Class which is used in the seismic analysis per the International Building Code design. The need to upgrade the building for seismic requirements is tied to a number of thresholds in terms of the percentage of the building area and structural members that are modified. This could impact the cost for using this building and since the extent of the required seismic upgrade that could be required has not been established at this conceptual level, no additional allowance was carried in the cost opinions for seismic code improvements.

FINE SCREENING and PUMPING

Common to all technologies evaluated was the need for influent fine screening and pumping into the secondary treatment process. AECOM developed a concept for a combined fine screening and lift station building. Although the clear opening size of the required screen varied, it was important to each system to avoid fouling of the nozzle decks for BAFs, membranes for MBRs and for process performance in the MBBRs. Fine screening requirements generally ranged from 2mm (sometimes 1mm preferred) for MBRs and BAFs to 6 mm for MBBRs. Requirements differed between manufacturers.

The proposed building to house both fine screens and the pump station would be located between the primary clarifier (PC) distribution box and the Filter Building. Overall dimensions are expected to be on the order of 45 feet by 35 feet and will include the following major components:

- Screen Room
  - Fine screens (2)
  - Washer compactor (1)
- Pump Room
  - Wet well (1)
  - Submersible pumps (3 to handle range of flows)
- Odor control unit (1)
  - External pad mounted fan and carbon canister
- Electrical Room

BAF OPTION

AECOM consulted two manufacturers of BAF systems; Infilco-Degremont who manufactures the BIOFOR® and Kruger who manufacturers the BIOSTYR® system.

Treatment Description

Upflow biological filters are attached growth processes, which act in a similar manner to packed filter beds. In these systems the media provides a surface for the organisms to attach themselves. The wastewater flows upward through the media by gravity. The media is retained in the filter while the treated effluent is discharged. The upward flow passing through the packed media provides a level of solids removal, eliminating the need for separate clarifiers.

The new upflow biological filters would be aerobic and provide removal of BOD and TSS. Multiple filters would be constructed in order to provide some redundancy and to accommodate backwash cycles. There are currently two major manufacturers of this type of filter system: the BIOSTYR manufactured by Kruger, and the BIOFOR manufactured by Infilco-Degremont. The primary differences between the two systems are in the media used. The BIOSTYR uses a styrene bead which floats and the BIOFOR uses an expanded shale media which is heavier than water. The specific surface area of the two media are different, requiring differing bed depths to achieve the same degree of treatment. The BIOSTYR process uses a concrete nozzle deck at the top of the filter cells to retain the floating media in the filter. The BIOFOR media is heavier than water and is retained by gravity, and a concrete nozzle deck is provided at the bottom of the filter cells to support the media. The media depth would range from 8 to 12 feet depending on the manufacturer.
Both systems have flow nozzles to distribute the flow evenly across the filter area, and both systems have an aeration grid at the bottom of each cell.

Retrofit Details

The BIOFOR system would require the use of 4 existing filter cells to construct two new BAF cells with a total surface area of 1,290 square feet, a media depth of 12 feet and overall sidewater depth of 20.5 feet. In order to meet the required sidewater depth, new tanks will be constructed within the existing tanks extending approximately 4 feet higher than the original tanks (to elevation 30.0 – existing top of filter is at elevation 26.0), providing a 2 foot freeboard. The existing clearwell would be used for storing filtered water for backwash cycles and the BIOFOR system requires backwash pumps. The existing mud well and remaining unused filter cells would be used for storing backwash water to be pumped back to the primary clarifiers.

The BIOSTYR system would require the use of 8 filter cells with a total surface area of 2,432 square feet with a media depth of 8.2 feet. The physical layout of the BIOSTYR option is similar to the above description. The BIOSTYR system diverts a portion of the treated effluent downwards through the filter for backwashing, and this eliminates the need for separate backwash pumps. A full evaluation of volumes required for clean washwater and dirty washwater for the BIOSTYR was not completed since the Biostyr utilized 8 existing filter cells, and required a larger washwater storage volume than the Biofor.

The major components of the process include:

- Upflow biological filters (2 to 8 cells) within the limits of the existing tanks inclusive of nozzle deck, media and media retention screens
- Process piping to the existing clearwell for backwash operations
- Process piping to the existing dirty wash water storage tank (mud well)
- Backwash pumps (2 pumps – BIOFOR only)
- Blowers (one per cell and one standby)
- Instrument air compressor
- Dirty washwater recycle pumps (2)
- Controls and instrumentation

A process flow schematic is attached as PFS-1.

Further considerations should be given to the following items:

- Difference in design criteria between BIOFOR and BIOSTYR

- Media depths and sidewater depths
- Uplift forces for the BIOSTYR nozzle deck
- Adequacy of existing clearwell and mud well volumes

MBR OPTION

AECOM consulted two manufacturers of MBR systems; Zenon who manufactures the Zeeweed membrane and Ovivio/Enviroquip who manufacturers the former Kubota membrane.

Treatment Description

Membrane bioreactor systems combine ultrafiltration technology with biological treatment for wastewater treatment and water reuse applications. Membrane bioreactor (MBR) systems replace conventional activated sludge treatment and combine clarification, aeration, and filtration into a single process. MBR systems incorporate reinforced hollow fiber or reinforced plate membranes into removable cassette arrangements. Membrane cassettes are submerged in the aeration tank and suction is applied to the membrane to filter water out of the mixed liquor suspended solids (MLSS). An MBR process is able to operate at MLSS concentrations as high as 8,000 – 10,000 mg/L, which significantly reduces the necessary footprint by concentrating treatment. The pores in the membranes typically range from 0.04 μm to 0.4 μm in size. The resulting effluent usually contains lower turbidity than tertiary effluent from sand bed filters.

Large recirculation rates are necessary to maintain the higher MLSS concentrations and prevent the membrane cassettes from being encased in sludge. Due to the high MLSS concentration, sludge can be wasted directly from the aeration basin without the use of clarifiers.

Retrofit Details

Zenon's membrane system is a hollow fiber type membrane and would require the use of all 8 existing filter cells with four of those cells including membrane cassettes. All tanks would act as activated sludge biological treatment however, the first four tanks would be conventional tanks with aeration systems only while the last four tanks would be aerated and have membrane cassettes in the activated sludge. No additional tank height would be needed for the membrane's SWD requirement of 18 ft. During the manufacturer's evaluation, it was determined that the available biological activated sludge volume is the limiting factor for the treatment capacity within the retrofit tank size. To increase treatment capacity, the first four biological tanks would have a jet aeration system to provide an oxygen transfer rate on the order of 150 mg/L/hr while the cassette tanks would have a standard membrane coarse bubble aeration system that prevents membrane fouling and provides an oxygen transfer rate on the order of 100 mg/L/hr. Membranes are scoured (by air) and backwashed with both clean water and chemical to prevent fouling. Membrane cassettes are approximately 11 feet high and require a minimum of approximately 13-15 feet of headroom to remove. This requires further evaluation since the existing headroom in the building is only 10 feet. The existing clearwell would be used for storing filtered water for backwash cycles. Membrane systems do not require a backwash discharge or mud well as all "backwash" remains in the tanks. It should be noted that the proposed membrane system was designed to partially nitrify (to ammonia levels of 5-8 mg/L) to reduce membrane fouling.

Enviroquip's system is a reinforced flat plate membrane that uses a shorter cassette height (6 feet) than Zenon's. Enviroquip indicated in preliminary discussions that 10 feet may be adequate to remove their cassettes, which get stacked in the tank vertically to make a membrane stack. After

reviewing the project further, they indicated that they would need all of the existing tank capacity to meet hydraulic requirements of the 6 foot high cassette membrane. Discussions with Enviroquip were not complete at the time this letter report was finalized, but their membrane cartridge height may provide an option to avoid significant structural modifications to the existing Filter Building.

The major components of the process include:

- Membrane cassettes in 4 of the 8 existing tanks - 6 cassettes per tank for 24 total cassettes
- Coarse bubble aeration system for membrane tanks
- Supplemental fine bubble aeration system if membrane cassettes are placed at top of tank
- Jet aeration equipment for first four aeration basins
    - Jet aeration manifold and nozzles (1/tank)
    - Air downcomer (1/tank)
    - Liquid distribution pipe (1/tank)
- Process piping for mixed liquor recycle and recycle pumps (2 pumps)
- Process piping to the existing clearwell for backwash operations
- Instrument air compressor
- Permeate pumps (1 per membrane tank – 4 total)
- Controls and instrumentation

A process flow schematic is attached as PFS-2.

Further considerations should be given to the following items:

- Headroom requirements for removal of membrane tanks

MBBR OPTION

AECOM consulted two manufacturers of MBBR systems; Infilco-Degremont who manufactures the METEOR system and Kruger who manufacturers the AnoxKaldness system.

AECOM consulted one manufacturer of dissolved air flotation (DAF) clarification systems for solids separation following the MBBR; Infilco-Degremont who manufactures the AquaDAF.

AECOM consulted one manufacturers of microsand ballasted flocculation clarification systems for solids separation following the MBBR; Kruger who manufactures the ACTIFLO system.

Treatment Description

Moving bed biological reactors incorporate floating media with a high specific surface area in the aeration basin to increase treatment surface area, thereby reducing the footprint of tanks or increasing the capacity of existing tanks. An MBBR is very similar to Integrated Fixed Film Activated Sludge (IFAS) systems, only different because MBBRs do not include a mixed liquor recycle. The biomass that treats the wastewater is attached to the media and is retained in the reactor with no return sludge. The media is continuously agitated by the aeration systems used to support biomass growth and treatment. Clarification is still needed following the MBBR to remove solids that pass through the system and for removal of biomass that comes off the media. The level of treatment provided in an MBBR can be modified by the percentage of media in the reactor, which typically does not exceed 60 to 70 percent. The media does not require cleaning or backwashing.

Clarification following the MBBR can be provided by a number of different settling technologies. For the purpose of this evaluation, AECOM focused on small footprint technologies including DAFs and ballast assisted settling.

DAF systems use microbubbles to float floc formation to the water surface for wasting. A typical system includes two stages of floc formation and in-line mixing upstream of the dissolved air section. Microbubbles are produced by a pressurized stream of clarified water and air. Clarified water passes under the surface float which is wasted on a periodic basis

Ballast assisted settling incorporates the use of a ballast, often sand, to provide surface area for floc formation and to assist settling by adding weight to the floc. The resulting floc settles much quicker than floc without ballast, allowing settling tanks to perform at much higher overflow rates and shorter detention times. The sand is introduced to the wastewater during the flocculation step of the process and provides a foundation for a stable floc. Once the floc is formed, settling is significantly enhanced. The settled ballasted floc is pumped through a hydrocyclone to separate the sand and sludge. Sludge is wasted and the sand is reused for floc formation.

Retrofit Details

Kruger's AnoxKaldness MBBR system would require the use of 4 existing filter cells. The basis of this arrangement includes a total aerobic reactor volume of 38,400 cubic feet (287,230 gallons) with a media fill of 47 percent for a total media volume of 18,010 cubic feet. Kruger's tanks would require a SWD requirement of 20 ft, so additional tank height may be required. This arrangement allows for the other 4 existing filter cells to be used for clarification.

Infilco-Degremont's retrofit for MBBR using the METEOR system would require the use of all 8 existing filter cells, leaving no room in the existing building for clarification. The basis of this arrangement includes a total aerobic reactor volume of 59,400 cubic feet (444,312 gallons) with a media fill of 21 percent for a total media volume of 12,500 cubic feet. The exact sidewater depth of the METEOR system is to be determined, but the intent was to use the available tank depth.

Infilco-Degremont's AquaDAF system includes two 3.75 MGD DAF units each with a primary and secondary flocculation tanks and flotation zone. Overall footprint of the system is 39 feet by 54.5 feet. This initial footprint does not fit within the footprint of the available 4 cells (~67 feet x 30 feet) remaining to couple with the Kruger AnoxKaldness MBBR. For the purposes of this evaluation, the DAF was not considered further. It is recommended that additional discussions with Infilco-Degremont take place to determine if the tank width can be reduced for additional tank length if this evaluation is continued further.

Kruger's ActiFLO system includes two 5 MGD ActiFLO ballasted flocculation units each with a coagulation, maturation and settling tank. Overall footprint of the system is 39 feet by 29 feet. This footprint will fit within the area of the available 4 cells (~67 feet x 30 feet) remaining to couple with the Kruger AnoxKaldness MBBR.

The major components of the process include:

- Medium bubble aeration system for 4 existing cells
- MBBR media and media retention screens
- Blowers for process air (5 – 1 per tank and 1 standby)
- Process piping

- Effluent lift pumps (if needed – to be confirmed)
- Clarifier (based on ActiFLO
    - Structural modification to retrofit sand filter bays for ActiFLO clarifiers (not yet evaluated)
    - Mixers (coagulation and maturation)
    - Settling component (lamella settlers, sludge scraper)
    - Sand recirculation system (pumps, piping hydrocyclone)
    - Waste sludge pumps)
- Controls and instrumentation

A process flow schematic is attached as PFS-3.

Further considerations should be given to the following items:

- Confirm potential retrofit of existing 4 cells with DAF equipment

CONCEPT LEVEL OPINION OF COST

Following our discussion of the potential upgrade options on September 23, 2010, AECOM developed preliminary opinions of cost for the implementation of the proposed BAF and MBBR retrofit options. A new opinion of cost for the MBR retrofit was not developed because of the outstanding headroom clearance issue and a previous cost estimate for an MBR was completed as part of the City's "DRAFT Wastewater Master Plan and Long Term Control Plan Update" (Master Plan) by Brown and Caldwell and Weston and Sampson, dated July 1, 2010. Instead, the Master Plan MBR option was modified for the purposes of comparison.

The opinion of cost for each option attached at the end of this letter report and summarized below combine components of the Wastewater Master Plan opinions of cost and new opinions of cost developed for the conceptual treatment alternatives presented in this letter report. The Wastewater Master Plan recommended a number of upgrades at the Peirce Island plant that would need to be implemented if the Filter Building were retrofitted to provide secondary treatment using one of the options previously discussed. Accordingly, AECOM carried the Wastewater Master Plan opinion of cost for Headworks, Sanitary Disinfection, Biosolids Processing, and Additional Structures and Modifications from "Cost Estimate Scenario 1B – Peirce Island Alternative TN 8 – MBR Secondary Treatment at PI Site (6.2 MGD), PIT Site (1.7 MGD)" contained in Appendix I of the draft report for both the BAF and MBBR options. For the non Filter Building upgrade elements, the Wastewater Master Plan allowance percentages were used for yard piping, electrical, instrumentation and controls, and site work and landscaping. The Wastewater Master Plan allowances for engineering and contingency, which total 50 percent, were also used for the non Filter Building upgrade elements. For the secondary lift station and the secondary treatment process, an allowance of 40 percent for engineering and contingency was used.

The Wastewater Master Plan cost estimates for work on Peirce Island also included an Island Construction Premium of 15 percent. In developing the updated opinions of cost for the secondary treatment options, AECOM discussed the applicability of this factor with two construction contractors that specialize in water and wastewater facilities, and who were familiar with the Peirce Island constraints. Based on their feedback, the 15 percent Island Construction Premium in the Wastewater Master Plan estimates was reduced to 3 percent for the BAF and MBBR options.

In addition, the allowance for the cost of a pilot study for the secondary treatment process was also carried at $1,000,000, however, AECOM added this allowance onto the total project cost (unloaded)

verses including it within the capital costs of the project as was done for the MBR options in the Wastewater Master Plan estimates. Items used from the Master Plan estimates are shown on the attached opinions of cost.

Lastly, during AECOM's review of the referenced opinion of cost from the Wastewater Master Plan, several other items were noted that required adjustment of the estimate., In reviewing the cost spreadsheets contained in Appendix I, and in particular "Cost Estimate Scenario 1B – Peirce Island Alternative TN 8 – MBR Secondary Treatment at PI Site (6.2 MGD), PIT Site (1.7 MGD)" it appears that a calculation error was made on this sheet and the markup for MBR equipment used in similar cost estimates (TN 3 and TN 5 scenarios) was not applied to equipment for the TN 8 alternative. In addition, there was no indication of secondary fine screens or pumping shown in the alternative. To utilize the full depth of the existing filter cells as noted in the Master Plan, based on AECOM's review of the hydraulic profile, pumping would be needed. With MBRs fine screens would also be needed to 2mm or less so an additional $2.327M was added to the estimate for these elements. The modified opinion of cost is attached. The following table summarizes the opinion of costs for the different options:

Table 2 – Opinion of Cost Summary

Option	Estimated Cost (Million $)
BAF	$30.0
MBBR	$33.0
MBR from Wastewater Master Plan TN 8	$36.7 original $44.7 modified

Based on these estimated costs, the options of retrofitting the Filter Building to provide secondary treatment using BAFs or MBBRs would be less costly than the MBR option.

Recommendations

The evaluations presented in this letter report indicate that under the assumed conditions there are several high rate treatment processes that can be used to implement secondary treatment within the existing Filter Building at the Peirce Island WWTF. Several of these processes are proprietary, such as the BAF process, and others are relatively newly developed with limited full scale installations such as the MBBR process. In addition, one area of concern identified in the WMP is the impact of fats, oils, and grease (FOG) loadings on the candidate treatment processes for the Peirce Island WWTF. It is reported that FOG loadings to the Peirce Island WWTF can be significant at times. To address this concern, the WMP recommended that both a wastewater characterization program and a pilot testing program be conducted as the next step in the WMP process. The wastewater characterization program would identify the frequency and magnitude of the FOG issue, and also to characterize the seasonal high and low flow conditions that occur due to the combined sewer system.

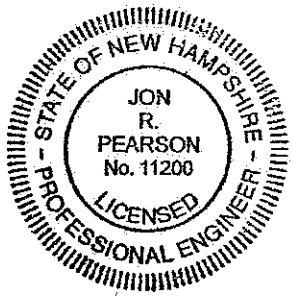
Pilot testing of candidate treatment processes for upgrading the Peirce Island WWTF was recommended in the WMP since many of the candidate treatment technologies are susceptible to high FOG and/or are relatively new or are still considered to be emerging, with limited amounts of empirical design data. Piloting these technologies would allow Portsmouth specific loading rates and other criteria to be established, and provide objective data on the ability of the processes to meet the city's needs. This is particularly desirable in light of the city's prior experience with the Zimpro Hydro-

Clear process that was the basis for the existing filter building design. In addition, the long term plan to expand the Pease WWTF is based on the use of an emerging treatment technology, BioMag, which could also be utilized to upgrade the Peirce Island WWTF to provide secondary treatment. BioMag operates at similar mixed liquor concentrations as an MBR process, but does not have an issue with membrane fouling as MBR's do. With this in mind, BioMag appears to be another viable approach to retrofit secondary treatment into the existing Filter Building. The WMP recommended pilot testing of the BioMag process, since it has not been used to upgrade a SBR process like that used at the Pease WWTF. We recommend that the City proceed with pilot testing the most promising treatment processes to upgrade the Peirce Island WWTF to secondary, including BioMag in the pilot testing, and conduct the wastewater characterization program recommended in the WMP.

We would be pleased to discuss any comments or questions that you may have on this information.

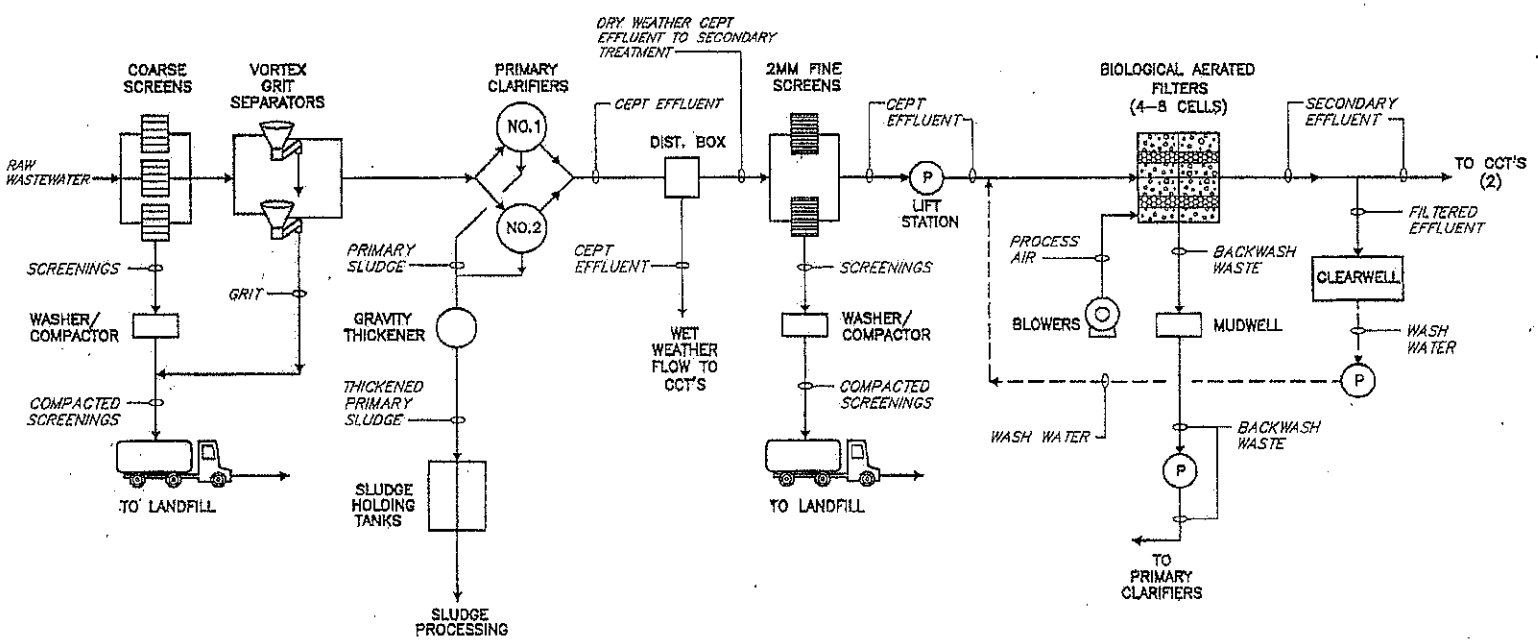
Very truly yours,

Jon R. Pearson
Vice President
AECOM



JRP/tld

Att.



BAF OPTION

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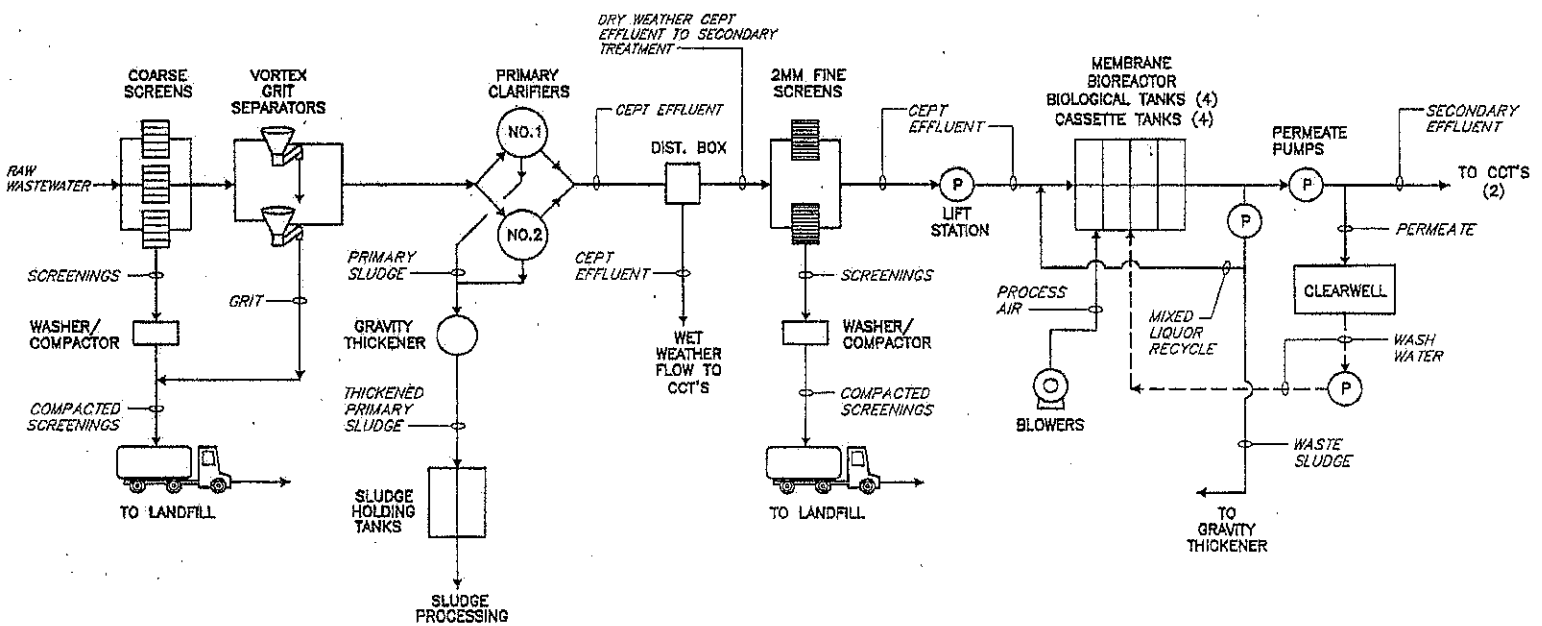
FILTER BUILDING RETROFIT EVALUATION
PIERCE ISLAND WWTF
PORTSMOUTH, NH

PROCESS FLOW SCHEMATIC BAF OPTION

PROJECT NO:	60147310
CAD DWG FILE:	PFS1.dwg
DESIGN BY:	TLD
DRAWN BY:	MJC
SCALE:	NTS

PFS-1



MBR OPTION

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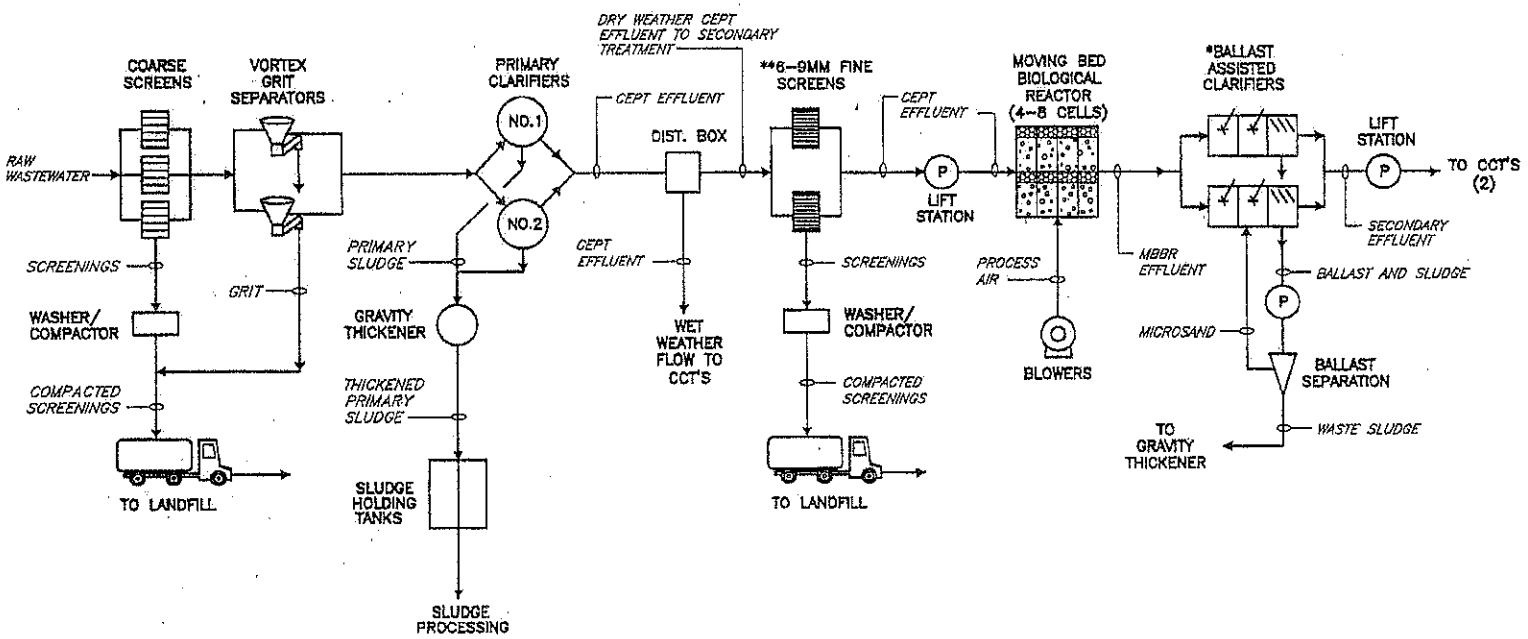
FILTER BUILDING RETROFIT EVALUATION
PIERCE ISLAND WWTF
PORTSMOUTH, NH

PROCESS FLOW SCHEMATIC MBR OPTION

PROJECT NO:	60147310
CAD DWG FILE:	PFS1.dwg
DESIGN BY:	TLD
DRAWN BY:	MJC
SCALE:	NTS

PFS-2



MBBR OPTION

* ALTERNATIVE TO BALLAST ASSISTED CLARIFICATION OPTION IS DISSOLVED AIR FLOTATION (DAF) CLARIFICATION.

** SOME MANUFACTURERS MAY NOT REQUIRE SCREENS BEFORE MBBR IF PRIMARY CLARIFICATION IS PROVIDED

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FILTER BUILDING RETROFIT EVALUATION
PIERCE ISLAND WWTF
PORTSMOUTH, NH

PROCESS FLOW SCHEMATIC MBBR OPTION

PROJECT NO:	60147310
CAD DWG FILE:	PFS1.dwg
DESIGN BY:	TLD
DRAWN BY:	MJC
SCALE:	NTS

PFS-3

Date: 9/29/10

Opinion of Cost - BAF Option

Secondary Treatment at Peirce Island Site (5.0 MGD)

PEIRCE ISLAND CAPITAL COST ESTIMATE

SOURCE	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	Subtotal
Portions of Wastewater Master Plan, June 2010, Cost Estimate Scenario 1B - Peirce Island Alternative TN 8, MBR Secondary Treatment at PI Site (6.2 MGD), PIT Site (1.7 MGD)	**Headworks**					
	Structure	2500	SF	$ 300	$ 750,000	
	Equipment:					
	Odor Control	1	EA	$ 60,000	$ 87,000	
	Bar Screens	2	EA	$ 250,000	$ 725,000	
	Screenings Washer & Compactor	2	EA	$ 50,000	$ 145,000	
	Grit Pumps	3	EA	$ 35,000	$ 152,250	
	Vortex Grit Removal	2	EA	$ 75,000	$ 217,500	
	Grit Classifier & Washer	2	EA	$ 40,000	$ 116,000	
						$ 2,192,750
	Sanitary Disinfection					
	Equipment:					
	Pump System	1	EA	$ 100,000	$ 100,000	
	UV Disinfection	1	EA	$ 200,000	$ 200,000	
						$ 300,000
	Biosolids Processing					
	Structure					
	Rehab Existing Process Building	1	EA	$ 350,000	$ 350,000	
	Equipment:					
	Carbon Odor Control	1	EA	$ 60,000	$ 87,000	
	Rotary Drum Thickener	2	EA	$ 150,000	$ 435,000	
	Dewatering Screw Press	2	EA	$ 400,000	$ 1,160,000	
	Conveyors	2	EA	$ 50,000	$ 145,000	
						$ 2,177,000
	Additional Structures and Modifications					
	Structure					
	PE Splitter - Upstream - Rehab Existing	1	EA	$ 500,000	$ 500,000	
	PE Splitter - Downstream	2200	SF	$ 300	$ 660,000	
	Sludge Storage Tank	4360	SF	$ 175	$ 763,000	
						$ 1,923,000
	SUBTOTAL					$ 6,592,750
	Yard Piping (12%)					$ 791,130
	Electrical (22%)					$ 1,450,405
	Instrumentation and Controls (6%)					$ 395,565
	Site Work and Landscaping (7%)					$ 461,493
	SUBTOTAL					$ 9,691,343
	Island Construction Premium (3%)					$ 290,740
	Engineering (20%)					$ 1,938,269
	Contingency (30%)					$ 2,907,403
	SUBTOTAL FROM WASTEWATER MASTER PLAN ESTIMATES					$ 14,827,754
AECOM Value Engineering Services, Secondary Treatment Retrofit Evaluation, September 2010	**Secondary Pump Station (Fine Screens and Lift Station)**					
	Secondary Pump Station	1	EA	$ 2,327,000	$ 2,327,000	
						$ 2,327,000
	BAF Secondary Treatment Retrofit of Filter Building					
	Retrofit Filter Building for BAF	1	EA	$ 7,490,000	$ 7,490,000	
						$ 7,490,000
	SUBTOTAL					$ 9,817,000
	Island Construction Premium (3%)					$ 294,510
	Engineering and Contingency (40%)					$ 3,926,800
	SUBTOTAL FROM AECOM VE SERVICES					$ 14,038,310

OPINION OF CONSTRUCTION COST	
Total Construction, Engineering and Contingency	$ 28,866,064
Secondary Treatment Process Pilot	$ 1,000,000
OPINION OF PROJECT COST (Rounded)	**$ 30,000,000**

Date: 9/29/10

Opinion of Cost - MBBR Option

Secondary Treatment at Peirce Island Site (5.0 MGD)

PEIRCE ISLAND CAPITAL COST ESTIMATE

SOURCE	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	Subtotal
Portions of Wastewater Master Plan, June 2010, Cost Estimate Scenario 1B - Peirce Island Alternative TN 9, MBR Secondary Treatment at PI Site (6.2 MGD), PIT Site (1.7 MGD)	**Headworks**					
	Structure	2500	SF	$ 300	$ 750,000	
	Equipment:					
	Odor Control	1	EA	$ 60,000	$ 87,000	
	Bar Screens	2	EA	$ 250,000	$ 725,000	
	Screenings Washer & Compactor	2	EA	$ 50,000	$ 145,000	
	Grit Pumps	3	EA	$ 35,000	$ 152,250	
	Vortex Grit Removal	2	EA	$ 75,000	$ 217,500	
	Grit Classifier & Washer	2	EA	$ 40,000	$ 116,000	
						$ 2,192,750
	Sanitary Disinfection					
	Equipment:					
	Pump System	1	EA	$ 100,000	$ 100,000	
	UV Disinfection	1	EA	$ 200,000	$ 200,000	
						$ 300,000
	Biosolids Processing					
	Structure					
	Rehab Existing Process Building	1	EA	$ 350,000	$ 350,000	
	Equipment:					
	Carbon Odor Control	1	EA	$ 60,000	$ 87,000	
	Rotary Drum Thickener	2	EA	$ 150,000	$ 435,000	
	Dewatering Screw Press	2	EA	$ 400,000	$ 1,160,000	
	Conveyors	2	EA	$ 50,000	$ 145,000	
						$ 2,177,000
	Additional Structures and Modifications					
	Structure					
	PE Splitter - Upstream - Rehab Existing	1	EA	$ 500,000	$ 500,000	
	PE Splitter - Downstream	2200	SF	$ 300	$ 660,000	
	Sludge Storage Tank	4360	SF	$ 175	$ 763,000	
						$ 1,923,000
	SUBTOTAL					$ 6,592,750
	Yard Piping (12%)					$ 791,130
	Electrical (22%)					$ 1,450,405
	Instrumentation and Controls (6%)					$ 395,565
	Site Work and Landscaping (7%)					$ 461,493
	SUBTOTAL					$ 9,691,343
	Island Construction Premium (3%)					$ 290,740
	Engineering (20%)					$ 1,938,269
	Contingency (30%)					$ 2,907,403
	SUBTOTAL FROM WASTEWATER MASTER PLAN ESTIMATES					$ 14,827,754
AECOM Value Engineering Services, Secondary Treament Retrfoit Evaluation, September 2010	**Secondary Pump Station (Fine Screens and Lift Station)**					
	Secondary Pump Station	1	EA	$ 2,327,000.00	$ 2,327,000.00	
						$ 2,327,000
	MBBR Secondary Treatment Retrofit of Filter Building					
	Retrofit Filter Building for MBBR	1	EA	$ 9,219,000.00	$ 9,219,000.00	
						$ 9,219,000
	SUBTOTAL					$ 11,546,000
	Island Construction Premium (3%)					$ 346,380
	Engineering and Contingency (40%)					$ 4,618,400
	SUBTOTAL FROM AECOM VE SERVICES					$ 16,510,780

OPINION OF CONSTRUCTION COST	
Total Construction, Engineering and Contingency	$ 31,338,534
Secondary Treatment Process Pilot	$ 1,000,000
OPINION OF PROJECT COST (Rounded)	**$ 33,000,000**

Date: 10/7/10

MBR Opinion of Cost - Modified from Wastewater Master Plan

Cost Estimate Scenario 1B - Peirce Island Alternative TN 8

MBR Secondary Treatment at PI Site (6.2 MGD), PIT Site (1.7 MGD)

PEIRCE ISLAND WWTF UPGRADE CAPITAL COST ESTIMATE - for Consent Decree						Modified Version
ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	Subtotal	October 2010
PI Headworks						Headworks
Structure	2500	SF	$ 300	$ 750,000		
Equipment:						
Odor Control	1	EA	$ 60,000	$ 87,000		
Bar Screens	2	EA	$ 250,000	$ 725,000		
Screenings Washer & Compactor	2	EA	$ 50,000	$ 145,000		
Grit Pumps	3	EA	$ 35,000	$ 152,250		
Vortex Grit Removal	2	EA	$ 75,000	$ 217,500		
Grit Classifier & Washer	2	EA	$ 40,000	$ 116,000		
					$ 2,192,750	$ 2,192,750
New Process Reactors (2 Aerobic and 2 Anoxic						New Process Reactors (2 Aerobic and 2 Anoxic
Structure	1	EA	$ 750,000	$ 750,000		
Equipment:	1	EA	$ 602,000	$ 872,900		
Blowers						
EDI Fine Bubble Aeration						
Mechanical Mixers						
Internal Recycle						
RAS Pumps (Centrifugal)						
WAS Pumps (Centrifugal)	2	EA	$ 20,000	$ 58,000		
					$ 1,680,900	$ 1,680,900
MBR:						Biosolids Processing
Pilot Testing	1	EA	$ 1,000,000	$ 1,000,000		
Structure						
Existing Filter Building Internal Demolition	1	EA	$ 200,000	$ 200,000		
Filter Building Modifications	1	EA	$ 250,000	$ 250,000		
Equipment:	1	SET	$ 5,387,000	$ 5,387,000		
Membranes						
Pumps						
Blowers						
Cleaning System						
Valves and Headers						
PLC						$ 9,261,150
					$ 6,837,000	See Note 1
PI Sanitary Disinfection						Sanitary Disinfection
Equipment:						
Pump System	1	EA	$ 100,000	$ 100,000		
UV Disinfection	1	EA	$ 200,000	$ 200,000		
					$ 300,000	$ 300,000
Biosolids Processing						Biosolids Processing
Structure						
Rehab Existing Process Building	1	EA	$ 350,000	$ 350,000		
Equipment:						
Carbon Odor Control	1	EA	$ 60,000	$ 87,000		
Rotary Drum Thickener	2	EA	$ 150,000	$ 435,000		
Dewatering Screw Press	2	EA	$ 400,000	$ 1,160,000		
Conveyors	2	EA	$ 50,000	$ 145,000		
					$ 2,177,000	$ 2,177,000
PI Additional Structures and Modifications						Additional Structures and Modifications
Structure						
PE Splitter - Upstream - Rehab Existing	1	EA	$ 500,000	$ 500,000		
PE Splitter - Downstream	2200	SF	$ 300	$ 660,000		
Sludge Storage Tank	4360	SF	$ 175	$ 763,000		
					$ 1,923,000	$ 1,923,000
						Secondary Pump Station (Fine Screens and Lift Station)
						$ 2,327,000
PI ITEM TOTAL					$ 15,110,650	$ 19,861,800
Yard Piping (12%)					$ 1,813,278	$ 2,383,416
Electrical (22%)					$ 3,324,343	$ 4,369,596
Instrumentation and Controls (6%)					$ 906,639	$ 1,191,708
Site Work and Landscaping (7%)					$ 1,057,746	$ 1,390,326
PI TOTAL CAPITAL					$ 22,212,656	$ 29,196,846
Island Construction Premium See Note 2					$ 3,331,898	$ 875,905
Engineering (20%)					$ 4,442,531	$ 5,839,369
Contingency (30%)					$ 6,663,797	$ 8,759,054
TOTAL WWTF CAPITAL TO MEET CONSENT DECREE (ROUNDED)					$ 36,700,000	$ 44,700,000

Notes:

1. Modified version includes markup on MBR equipment from $5,387,000 to $7,811,150 similar to other Master Plan estimates for TN 3 and TN 5 options.
2. Island Construction Premium is 15% for WWMP Estimate and 3% for Modified Estimate

Attachment 1A – Infilco Degremont BIOFOR C BAF

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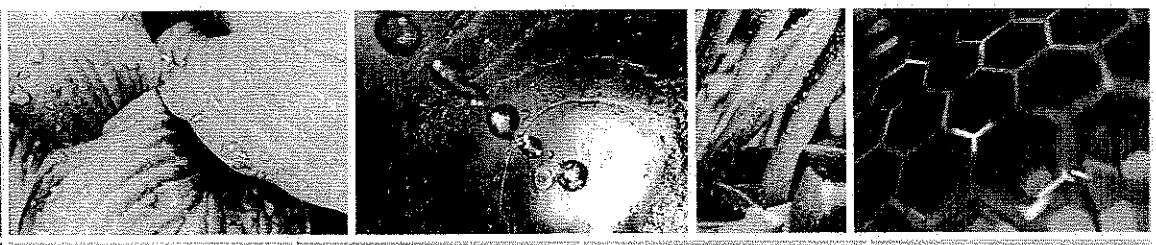
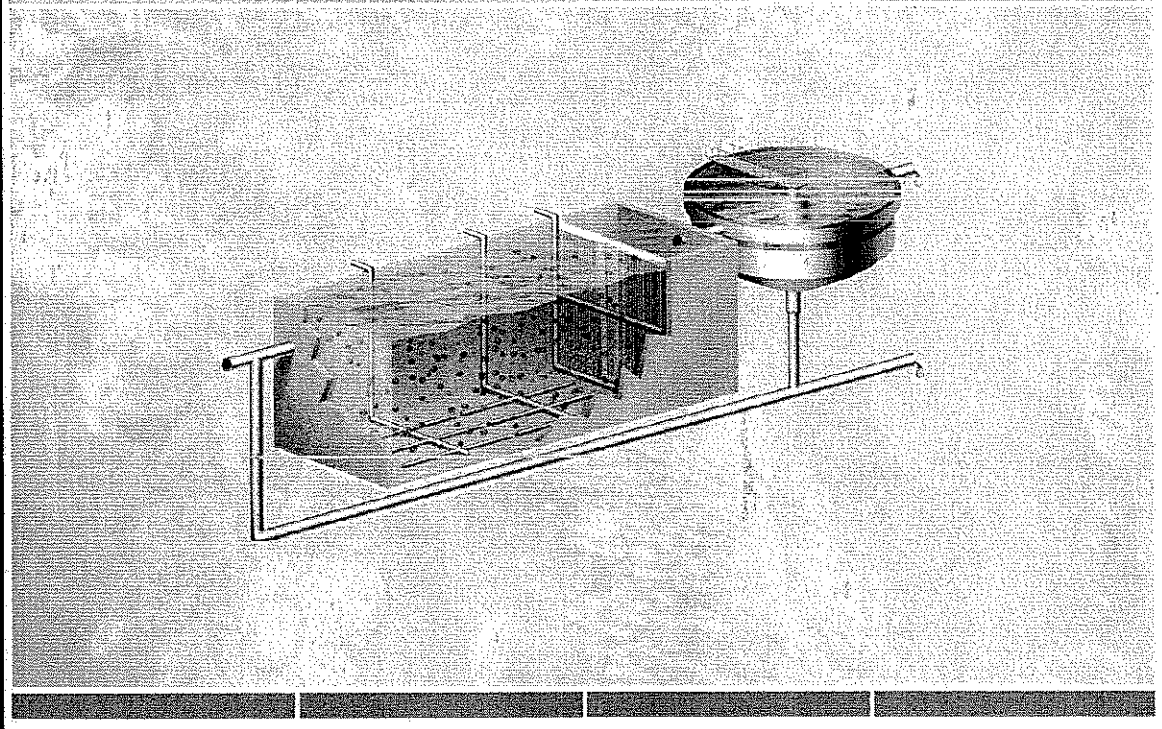
Degremont Technologies

SUEZ

HEADWORKS
BIOLOGY
SEPARATION
MEMBRANE
DISINFECTION
BIOSOLIDS
SYSTEMS





BIOFOR® System
Design Brief Rev 1

Project: Pierce Island WWTP, NH

Date: 09.22.10

September 22, 2010

Terry Desmarais Jr.
AECOM Water

Re: Pierce Island WWTP, NH
BIOFOR® Biological Filtration System
Inquiry No. 50084585.01 Rev 1

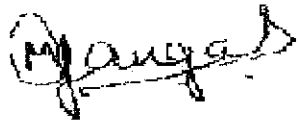
Dear Mr. Desmarais:

Pursuant to our conversation last week on the Pierce Island WWTP, NH wherein it was suggested that the existing filter cell dimensions could be changed and the finalized design flow of 5 MGD and peak hour flow of 7.5 MGD, IDI is pleased to present a revised design summary and layout for a BIOFOR® system to retrofit the existing filters.

The revised design is based on using two (2) BIOFOR C cells of dimensions 30' x 21.5 ft (645 ft^2 filter area each). The design is based on treating the design flow and loads with one filter on-line, and one filter under backwash/ out-of-service.

In case of any questions please don't hesitate to contact Mike, our regional sales representative or me directly.

Sincerely,



Mudit Gangal
Application Engineer - Biological Systems Group

Regional Business Manager
Mervyn Bowen
Degremont Technologies – Infilco

P. O. Box 71390
Richmond, VA 23255-1390
Tel: 804/756-7786
Fax: 804/756-7643

Email: mervyn.bowen@infilcodegremont.com

Sales Representative
Michael Loncoski
Aqua Solutions Inc.
18 Linsausig Way
Falmouth, ME 04105
Tel: (207) 828-5559
Fax: (207) 871-5972

Email: mloncoski@aquasolutionsinc.net

DESIGNS SUMMARY

BIOFOR® BAF SYSTEM

The BIOFOR® C BAF system retrofit to achieve the desired treatment objective is as follows:

Design Basis
Design Flow: 5 MGD
Peak Flow: 7.5 MGD
Influent BOD: 85 mg/l
Influent TSS: 65 mg/l
Influent NH_3-N: 5 mg/l (assumed)
Influent TKN: 7 mg/l (assumed)
Design Temperature: 10 ^{0}C

BIOFOR® C

No. of Filter Cells = 2 (1 + 1)
Size of each Filter Cell = 30' x 21.5'
Area of each Filter Cell = 645 ft^2
Footprint including wash water tanks = 5,485 ft^2
Clean Wash Water Tank Volume = 192,240 gallons
Dirty Wash Water Tank Volume = 237,865 gallons

Effluent BOD: < 25 mg/l
Effluent TSS: < 25 mg/l

The proposed BAF treatment system would comprise 2 BIOFOR® C cells to achieve the requisite BOD and TSS removal. Of the 2 BIOFOR® C cells there will be 1 BIOFOR® C cell in operation and 1 under backwash/out of service.

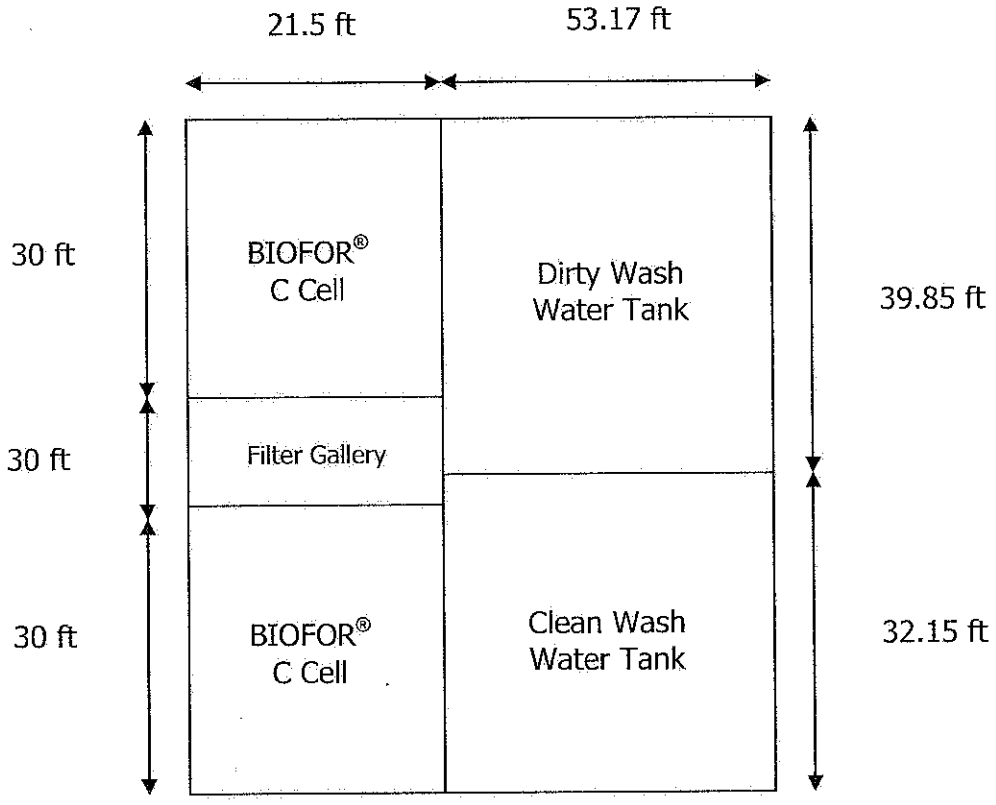


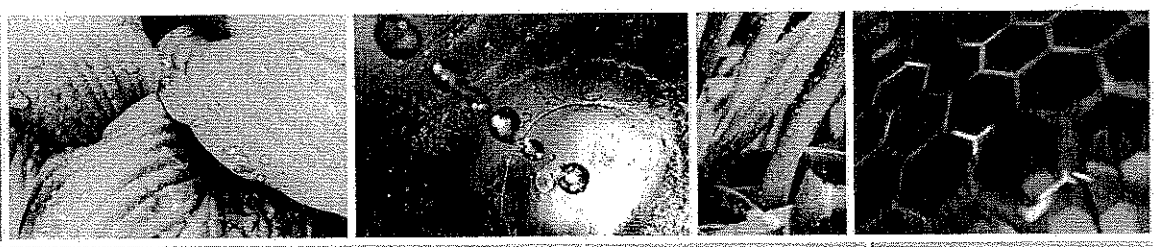
Fig: Pierce Island WWTF BIOFOR® C System Schematic

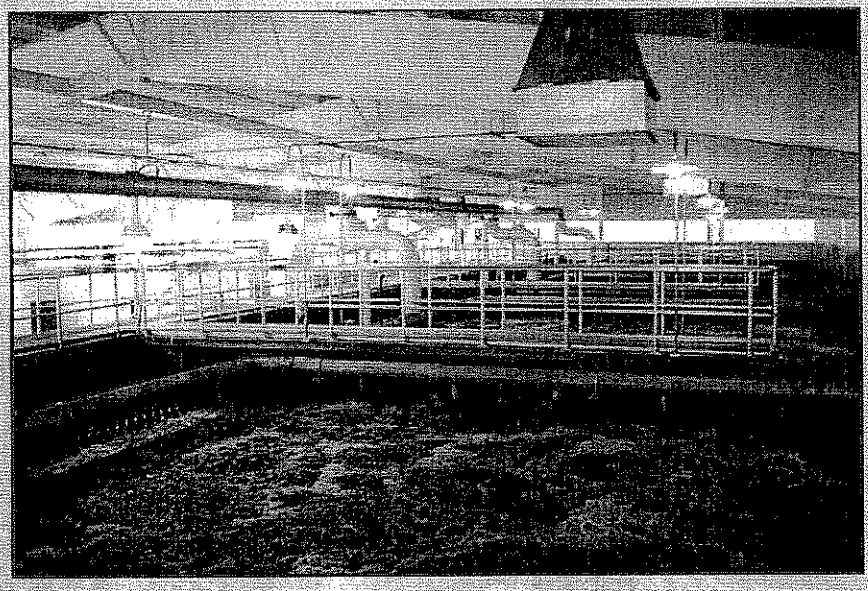
Infilco

Degremont Technologies

SUEZ

HEADWORKS
BIOLOGY
SEPARATION
MEMBRANE
DISINFECTION
BIOSOLIDS
SYSTEMS





BIOFOR® Biological Filtration System Preliminary Design Proposal

Proposal No. 50084585.01 Rev 1

Project: Pierce Island WWTP, NH

Engineer: AECOM Water

Date: 09.27.10

Infilco

Degremont Technologies
SUEZ

Infilco September 27, 2010

Terry Desmarais
AECOM Water

Re: Pierce Island WWTP, NH
BIOFOR® Biological Filtration System
Inquiry No. 50084585.01 Rev 1

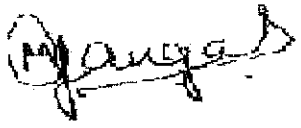
Dear Mr. Desmarais:

With regard to our conversation this morning on the Pierce Island WWTP, NH, IDI is pleased to present its proposal for a BIOFOR® C system to retrofit the existing plant filters, to treat a design flow of 5 MGD and peak hour flow of 7.5 MGD.

As described in the design brief previously submitted the BIOFOR® C design is based on using two (2) BIOFOR® C cells of dimensions 30' x 21.5 ft (645 ft^2 filter area each). The design is based on treating the design flow and loads with one filter on-line, and one filter under backwash/ out-of-service.

We have endeavored to provide complete information in this proposal. However, if you have any questions or need additional information, please don't hesitate to contact Mike, our regional sales representative or me directly.

Sincerely,



Mudit Gangal
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Email: mloncoski@aquasolutionsinc.net

TABLE OF CONTENTS

1. BIOFOR®- General Description

The BIOFOR® is a biological, submerged filter containing a fixed, dense granular bed with influent wastewater flowing in the upward direction. The BIOFOR® Process is applied individually or in separate stages for carbonaceous BOD_5 reduction (BIOFOR®-C), nitrification (BIOFOR®-N), and denitrification (BIOFOR®-Pre-DN, BIOFOR®-Post-DN). In aerated systems (C and N), process air is introduced at the bottom of the media bed and flows co-currently with the influent wastewater.

The BIOFOR® is based on the following basic principles:

- A single layer of granular BIOLITE™ media for biomass attachment and retention of suspended solids.
- A discrete process air distribution system (for aerated systems only)
- Upflow, co-current distribution of air and water
- Backwash sequence automated and optimized per application requirements

BIOLITE™ Media

BIOLITE™ media is an expanded clay material with a high specific surface area, low density, and good resistance to attrition. The porosity of the material ensures biomass attachment. Different particle sizes ranging from 1mm to 5mm are available depending on the application.

OXAZUR® Air Diffusers

OXAZUR® air diffusers, present in all aerated BIOFOR® units, are aerating devices with elastic rubber membranes enclosed in a polypropylene casing. The diffusers are installed on a series of process air distribution pipes located at the bottom of the media bed, directly above the plenum. The combination of diffused air and media retention produces a highly efficient aeration system with fine bubble diffusion characteristics. In order to assure homogeneous distribution over long-term operation, a pressurized cleaning water system is provided and operated approximately once per month to flush the diffusers.

Upflow Distribution of Air and Water

Distribution of process air and influent wastewater is upward through the BIOLITE™ media. This co-current, upward flow ensures an even distribution of water and air. It enables the media to retain solids and biomass throughout the entire bed depth and prevents short-circuiting and gas entrapment. In anoxic, denitrifying systems, nitrogen gas bubbles are continuously and effectively released from the media to atmosphere. The media operates in slight expansion,

thereby ensuring full use of the available media volume and allowing high hydraulic loading rates.

MONOFLOR® Underdrain

Concrete BIOFOR® installations have the distribution nozzles located in the poured-in-place filter floor. To ensure an accurate, grout-free installation, the MONOFLOR underdrain is used. This underdrain is simple to install, leak-proof, and has been widely used on filter systems for many years.

Backwash Sequence

Backwash sequences for biological filters must comply with several requirements:

- The entire filter bed must be cleaned of retained solids and excess biomass
- Sufficient biomass must remain in the reactor following a backwash
- Air and water flows must not cause filter media to be lost
- Water and energy consumption must be minimized
- The backwash sequence must be initiated and carried out automatically.

The standard BIOFOR® backwash sequence has been developed specifically to meet the requirements listed above. The backwash sequence may be optimized during start-up and can be modified based on operating experience.

The sequence may be initiated manually, on operating time, or upon reaching a pre-set terminal headloss. The main steps of the sequence are:

- Quick drain to backflush the influent distribution nozzles
- Air scour
- A series of simultaneous air/water washes
- Water rinse

The water used for backwashing is typically BIOFOR® effluent that is stored in a separate clean water tank. Backwash wastewater is normally stored in a separate holding tank and pumped over time back to the head of the treatment plant.

2. Design Conditions

The BIOFOR® biological aerated filter system described herein is a one-stage wastewater treatment system designed for the removal of Biological Oxygen Demand (BOD), and suspended solids (TSS). The system will have a design flow capacity of 5 MGD (peak flow = 7.5 MGD).

The design is based on treating municipal wastewater with the following influent characteristics:

Influent Parameter (Maximum Month)	Value
Biological Oxygen Demand ($CBOD_5$) – mg/L	85
Total Suspended Solids (TSS) – mg/L	65
Total Kjeldahl Nitrogen (TKN) – mg/L	7 (assumed)
Design Water Temperature: Minimum	10 °C

The BIOFOR-C® system described herein is designed to achieve the following monthly effluent quality for the specified flows:

Effluent Requirements	Value
Biological Oxygen Demand ($CBOD_5$) – mg/L	≤ 30
Total Suspended Solids (TSS) – mg/L	≤ 30

The BIOFOR C® system consists of Two (2) filter cells sized at 645 ft^2 (30 ft x 21.5 ft). The system will be capable of treating the design flow, with one cell offline, to the effluent requirements listed above.

2.1. *Description of Operation*

The influent is pumped to a flow channel for the BIOFOR®-C units and is evenly distributed to the cells through a series of weirs in the central gallery. Wastewater to be treated is introduced into the plenum and flows upward through the BIOLITE™ media. As the wastewater and process airflows co-currently through the media bed, attached heterotrophic biomass oxidizes carbonaceous compounds, autotrophic biomass oxidizes ammonia and suspended solids and biomass are retained. Process air, required for biomass growth and activity, is injected through an air distribution system located within the gravel bed immediately above the plenum. As proposed, each Biofor cell has its own dedicated positive displacement process air blower.

Due to solids retention and biomass growth within the filter media, backwashing of the Biofor units is necessary to remove retained solids and maintain a thin, active biofilm. Backwashing is initiated either manually or automatically, based upon elapsed time or on reaching a pre-set terminal headloss. The backwash sequence includes a number of distinct steps, the duration and extent of each step being optimized during plant start-up and modified based on operating experience. The basic backwash sequence includes the following steps:

- Quick drain to backflush the underdrain nozzles
- Air scour
- Combination air and water backwash
- Water rinse
- Repeat of the above steps three times
- Water rinse with influent wastewater (filter to waste)

A centrifugal pump from the clearwell supplies clean water used for backwashing the cells. The backwash water flow rate can be controlled with an automatic flow control valve while a positive displacement blower supplies air used for air scour. Spare, installed units are provided for both the air scour blower and backwash water supply pump.

Wastewater from the quick drain step is collected in a drain sump and typically flows into the backwash waste tank. Wastewater from the remaining steps collects in a common backwash flume and flows to the backwash waste storage tank. Stored backwash wastewater is normally returned to the head of the plant; if necessary, it may need to be treated in a separate side stream due to backwashing considerations.

3. BIOLOGICAL REACTORS

Infilco Degremont, Inc. will provide upflow biological aerated fixed-film reactors as described with BIOLITE™ media for biomass support.

3.1. *BIOFOR®-C*

	Design
Unit Filtration Area	645 ft^2
Total Number of Cells	2
Biolite Media Depth	12 ft – 2 inches

Each reactor will consist of a concrete tank with monolithic underdrain (MONOFLOR®), bottom influent and air/water backwash distribution system, process air distribution system, granular expanded clay media, gravel support bed, influent channel, effluent and backwash waste channels with stilling baffle. Common instrumentation furnished by IDI includes: process air blowers, air distribution system cleaning pump, air scour blowers, backwash pumps, controls and instrumentation and all associated automatic valves and skid piping.

3.2. *Backwashing*

The media will be periodically washed by a sequence of air scour, combination air scour/backwash water, and water only rinse steps. Water used to backwash the biofilter will be pumped from a separate storage tank supplied by others. The air scour blower capacity is based on a maximum air scour rate of 5.3 scfm/ft^2 of filter media. The backwash pump will be sized for a maximum backwash water rate of 8.2 gpm/ft^2 of filter media.

SCOPE OF SUPPLY

Complete IDI Scope of Supply:

3.3. Biofilter Modules

BIOFOR® C Reactors, with all internals and required wall pieces.

Each reactor will include the following:

- Equipment for MONOFLOR® underdrain including forms, polyethylene nozzles and accessories.
- 1 - Tranquilizer (stilling) baffle consisting of staggered vertical aluminum slats extending across the width of the reactor. Installation of the tranquilizer baffle is by others.
- Process air distribution system in 316 stainless steel with OXAZUR® air diffusers

3.4. Media and Support Gravel

Support gravel, 20" depth in the BIOFOR® C (includes 5% extra)

BIOLITE™-"L" media, 2.7mm, to 12'-2" depth in the Biofor-C reactors (includes 10% extra)

	BIOFOR C 2 Filters
Total Gravel Volume - ft^3	2,260
Biolite L 2.7 Media Volume - ft^3	17,170

3.5. Centrifugal Pumps

2 - Backwash supply pumps, horizontal centrifugal type rated for 60' TDH (1 x 100% duty)

1 - Air distribution system cleaning pump, horizontal centrifugal type 120' TDH

	Design Flow
Backwash Pump Capacity	5,275 gpm
Cleaning Pump Capacity	1,980 gpm

Pumps will be skidded on a structural steel base with required piping, valves, flange fittings and accessories - fully assembled.

3.6. *Blowers and Appurtenances*

One process air blower dedicated to each Biofor-C reactor. Rotary lobe type rated for 11.5 psig (1 x 100% duty per cell)

2 - Air scour blowers, rotary lobe type, rated for 10.5 psig (1 x 100% duty)

	Design Flow
Process Air Blower Capacity	385 scfm
Air Scour Blower Capacity	3,405 scfm

Each blower provided with:

- Motor
- V-belt drive
- Inlet filter/silencer and outlet silencer
- Check valve
- Manual valve for outlet isolation
- Relief valve
- Flexible connections
- Discharge pressure gauge
- Acoustic enclosure, to meet 85 dBA free field noise requirements.

Blowers shipped to site skidded on separate structural steel bases, assembled with piping, silencers, valves and fittings.

An automatic by-pass flow control valve is included with each air scour blower.

3.7. *Compressed Air for Automatic Valves*

1 - Compressed Air System, comprising:

- 1 - dual-head reciprocating type compressor rated for 7.5 scfm at 100 psig
- 1 - standby head
- 1 - 100 gallon carbon steel receiver
- Air dryer
- Required relief, exit, and blowdown valves
- Pressure gauges

System shipped to site pre-piped and skidded on a structural steel base.
Pneumatic tubing, valves, and appurtenances for air feed to automatic valves are by others.

3.8. *Automatic and Manual Valves*

3.8.1. BIOFOR® C Automatic Valves

	BIOFOR® C	
Valve Type - Open/Close	**Quantity**	**Diameter**
Influent	2	12"
Backwash Water Inlet	2	24"
Air Scour Inlet	2	12"
Air Cushion Vent	2	2.5"
Process Air, Cleaning Water	2	6"
Backwash Waste	2	24"
Quick Drain	2	10"

3.8.2. Common Valves

	Design	
Valve Type – Modulating	**Quantity**	**Diameter**
Air Scour Vent Flow Control	1	12"
Backwash Water Flow Control	1	24"

- All automatic valves are butterfly type equipped with double-acting pneumatic cylinder actuators. Solenoids are mounted directly on actuators. Positioners are pneumatic. Valves include open and close limit switches.
- There are no manual valves included in IDI's Scope of Supply.

3.9. *Strainers*

	Design	
Strainer Type	**Quantity**	**Diameter**
Oxazur Cleaning Strainer	1	6"
Backwash Inlet Strainer	1	24"

Backwash inlet strainers – In-line Y-Type, (one per system with one spare), 2.4-mm stainless steel mesh, carbon steel body with flanged ends.

Air distributor cleaning header strainers – in-line Y-Type, 2.4-mm stainless steel mesh, carbon steel body with flanged ends.

All required process flow strainers, 2-4 mm stainless steel mesh (inline or static).

3.10. Controls and Instrumentation

3.10.1.Control System

1 - PLC/PC control system, mounted in a free-standing NEMA 12 enclosure.

3.10.2.Field Instruments, BIOFOR® C

	BIOFOR® C
	Quantity
Field Instruments – Lot	
Pressure Transmitters (Cell)	2
Pressure Transmitters (Plenum)	2
Process Air Flowmeters /Transmitters	2

Lot - pressure gauges, local indication only
Lot - pressure gauges, local indication only

3.10.3.General Instruments

	Design	
General Instruments – Lot	**Quantity**	**Diameter**
Backwash Flowmeter/Transmitter	1	24"
Air Scour Flowmeter/Transmitter	1	12"
Level Transmitters*	4	N/A
Strainer Differential Pressure Gages	2	24"

** Ultrasonic Level Transmitters located at Clearwell, Mudwell and individual cells*

3.11. Field Service

30 - days total service time by a qualified, factory-trained service engineer to inspect the Biofor equipment installation, provide start-up assistance and training of operations personnel.

Also included: Four (4) O & M Manuals.

4. Budget Estimate

PURCHASE PRICE: **As Advised by Rep**

(Exclusive of taxes per Condition 6 of IDI Conditions of Sale)
Our price is based on IDI's standard terms and conditions, which can be provided upon request.
The above price in this proposal is tied to the London Metal Exchange index for stainless steel finished products and stainless steel rolled coil.

FOB shipping point, freight allowed.

TERMS OF PAYMENT (as follows, subject to Condition 2 of IDI Conditions of Sale):

10% Net Cash, Payable in thirty (30) days from date of submittal of initial drawings for approval;
85% Net Cash, Payable in progress payments thirty (30) days from dates of respective shipments of the Products;
5% Net Cash, Payable in thirty (30) days from Product installation and acceptance or ninety (90) days after date of final Product delivery, whichever occurs first.

Attachment 1B – Kruger BIOSTYR BAF

KRÜGER

September 22, 2010

Terry Desmarais, Jr., P.E.
AECOM Water
500 Southborough Drive
South Portland, ME 04106

Re: Carbon Removal BIOSTYR®
Portsmouth, NH
Kruger Project No: 42290804

Dear Mr. Desmarais:

Please find enclosed our revised proposal for the BIOSTYR process for the Peirce Island WWTF in Portsmouth, NH.

The treatment facility will be required to meet BOD and TSS effluent limits. Source water for the proposed BIOSTYR system is effluent from an existing CEPT system. For this application, we are proposing an eight (8) cell BIOSTYR system for secondary carbon removal.

Kruger appreciates the opportunity to provide this proposal to you. If you have any questions or need further information, please contact our local representative, Henry Albro of F.R. Mahony, or our Regional Sales Manager, Ken Krupa (540-389-5092; ken.krupa@veoliawater.com).

Respectfully,
I. Kruger Inc.

Sent via email

Michele Kline
Sr. Product Manager
Biological Treatment Systems

ATT

cc: KMK, DOF, project file (Kruger)
Henry Albro (F.R. Mahony)

Kruger Inc.
401 Harrison Oaks Blvd. Suite 100
Cary, NC 27513 USA
Tel: 919-677-8310 • Fax: 919-677-0062
Web site: www.krugerusa.com

VEOLIA WATER
Solutions & Technologies

BIOSTYR Proposal for

Portsmouth, NH

Kruger Project No.: 42290804

KRÜGER

Terry Desmarais, Jr., P.E.
AECOM Water
500 Southborough Drive
South Portland, ME 04106

September 22, 2010

I. Kruger Inc.
401 Harrison Oaks Blvd.
Suite 100
Cary, NC 27513

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Table of Contents

Proposal History

Revision	Date	Process Eng.	Comments
0	9/7/10	DOF	Initial, budgetary proposal.
1	9/22/10	DOF	Revised peak flow, system layout

KRÜGER

1. Company Introduction

I. Kruger Inc. (Kruger) is a water and wastewater solutions provider specializing in advanced and differentiating technologies. Kruger provides complete processes and systems ranging from biological nutrient removal to mobile surface water treatment. The ACTIFLO® Microsand Ballasted Clarifier, BIOCON® Dryer, BIOSTYR® Biological Aerated Filter (BAF), NEOSEP™ MBR and HYDROTECH Discfilters are just a few of the innovative technologies offered by Kruger. Kruger is a subsidiary of Veolia Water Solutions and Technologies (VWS), a world leader in engineering and technological solutions in water treatment for industrial companies and municipal authorities.

VWS, present throughout the world, develops a global approach responding to specific needs of customers at each of their production facilities. This has allowed VWS to become the world leader in design, project management, and execution of projects for water and wastewater treatment plants. The company also creates dedicated technology solutions to meet its customer's needs. Its unique portfolio of differentiating technologies, developed by the group's R&D centers, ensures unsurpassed innovation and control of each treatment line for public organizations and industries. Furthermore, a whole range of associated services is offered on each site to guarantee the technical efficiency and life expectancy of the installed solutions. VWS continually extends and enriches its offer, to guarantee expertise and competence at every step of the projects it undertakes.

Kruger prides itself for being a customer focused organization that provides solutions to challenges faced by municipalities and not just another equipment supplier. To achieve this, Kruger has gathered a force of process experts, trained sales staff, and project managers that share our vision and priorities.

2. Energy Focus

Kruger, along with Veolia Water Solutions & Technologies (VWS) is actively pursuing a strategy to deliver sustainable and innovative technologies and solutions.

We offer our customers integrated solutions which include resource-efficient technology to improve operations, reduce costs, achieve sustainability goals, decrease dependency on limited resource, and comply with current and anticipated regulations.

Veolia's investments in R&D outpace that of our competition. Our focus is on delivering

- neutral or positive energy solutions
- migration toward green chemicals or zero chemical consumption
- water-footprint-efficient technologies with high recovery rates

Our carbon footprint reduction program drives innovation, accelerates adoption and development of clean technologies, and offers our customers sustainable solutions.

Kruger is benchmarking its technologies and solutions by working with our customers and performing total carbon cost analysis over the lifetime of the installation. By committing to the innovative development of clean and sustainable technologies and solutions worldwide, Kruger and VWS will continue to maximize the financial benefits for every customer.

3. Process Description

The BIOSTYR system is an up-flow submerged fixed-film filter that biologically treats carbonaceous and nitrogenous wastes (CBOD, NH_4-N, NO_3-N) and removes insoluble pollutants (TSS) through the filtering mechanism of the process. One distinguishing characteristic of the BIOSTYR process is that a complete treatment facility is composed of individual filter units. Adding BIOSTYR filters to an existing facility allows for incremental expansion.

The BIOSTYR process can be designed to accomplish BOD removal, nitrification, and/or denitrification. As shown in Figure 1, the influent wastewater is first pumped to a common inlet feed channel above the BIOSTYR cells where it flows down to the individual cells by gravity. Upon entering the BIOSTYR cells, the wastewater is forced upwards through the filter media. The media contained in the cells is composed of specially manufactured high-density polystyrene beads covered by active biomass. This active biomass provides biological treatment to the wastewater as it flows through the cells.

Ceiling plates with regularly spaced nozzles are used to retain the filter media. The nozzles allow the treated water to enter a common water reservoir above the filters, which in turn is used to provide water during backwash sequences. In a system designed for carbon removal only, a process air grid is placed below the filter media so that the entire filter bed is aerobic. BOD is oxidized by the biomass in the lower section of the filter. As the wastewater continues up the filter, additional BOD is consumed. Nitrification can also occur in limited amounts when the BOD:TKN ratio falls below a certain limiting level, thereby converting some ammonia to nitrate.

Growth of biomass and the retention of suspended solids in the filter media make periodic backwashing necessary. The BIOSTYR process is designed for a backwash interval of 24 hours or more. The backwash sequence is performed automatically and is triggered either when a preset time limit has expired or when the head loss across the filter exceeds a pre-determined setpoint. Water from the common treated water reservoir flows down through the filter by gravity, thereby expanding the media bed. The air grid located below the media is used to supply scouring air during the backwash sequence. This grid is composed of perforated stainless steel piping that allows air to be injected into the filters.

Like other filtration processes, high TSS and BOD concentrations in the influent waste stream can increase the rate of clogging. If the influent waste stream contains high levels of TSS or BOD, it is desirable to install clarification to partially treat the wastewater.

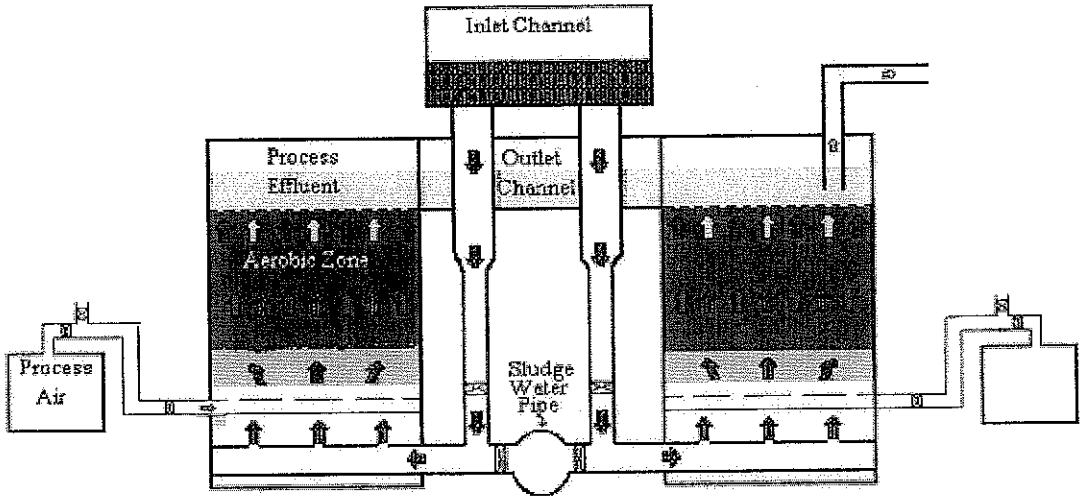

Figure 1 - BIOSTYR System for BOD Removal, Nitrification and Denitrification

The BIOSTYR process provides several significant improvements over other fixed film systems. First, using a floating media bed in conjunction with an up-flow system ensures that the nozzles used to retain the media are only in contact with treated water. This prevents the nozzles from clogging and provides easy access for nozzle maintenance or replacement.

Second, the counter-current backwashing sequence ensures efficient removal of accumulated solids. During backwashing sequences, the downward flow expands the filter media and utilizes gravity to aid in flushing solids from the bottom of the filter. Additionally, the backwash water is supplied from a common reservoir above the filter cells, eliminating the costs associated with backwash pumping. Finally, used backwash water is collected in drainpipes at the bottom of the filters. It is not exposed to the atmosphere, so the potential for odor problems is dramatically reduced.

4. Design Summary

The design assumes that the raw influent wastewater is biodegradable, no toxic compounds are present, sufficient alkalinity is available to avoid pH depressions, that the COD/BOD ratio is between 1.7 and 2.3, and that none of the equipment provided would be used in a classified area (e.g. Class 1, Division 1 or Class 1, Division 2) except for methanol feed equipment.

Secondary BIOSTYR cells do not require dedicated influent screens. Kruger recommends the site have 10 mm fine screening, bar or mesh screens, which could occur upstream of the filters, for instance at the plant headworks. Kruger understands that influent will be fed to the BIOSTYR system by pumping.

The BAF influent design basis is summarized in Table 1. The target effluent criteria for the BIOSTYR system are listed in Table 2. The process design is summarized in Table 3.

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Table 1: BIOSTYR Influent Design Basis

Parameter	Units	Value
Flow, Peak	mgd	7.5
Flow, Design	mgd	5.0
BOD, Max. Month	mg/L	85
TSS, Max. Month	mg/L	65
Min. Temperature	°C	10

Table 2: BIOSTYR Effluent Achieved (30-Day Average)

Parameter	Units	Value
$CBOD_5$	mg/L	≤ 30
TSS	mg/L	≤ 30

Table 3: BIOSTYR Process Design Summary

Parameter	Units	Value
Size of Cells	ft^2	304
Number of Cells	-	8
Size of Media	mm	4.5
Height of Media	ft	8.20
Hydraulic, Peak (N-1 Cells in Filtration)	$m^3/m^2/hr$ gpm/ft^2	6.9* 2.82*
Hydraulic, Design (All Cells in Filtration)	$m^3/m^2/hr$ gpm/ft^2	3.9* 1.60*
BOD, Max. Month	$kg/m^3/d$ $lb/1000\ ft^3/d$	2.84 177
TSS, Max. Month	$kg/m^3/d$ $lb/1000ft^3/d$	2.17 135
Sludge Production, Max. Month	lb/d	3,650
Backwash Wastewater Production, Max. Month	gal/d	596,700
Process Air / Cell, Max. Month	scfm	108
Backwash Air / Cell	scfm	200

* Includes recirculation of BIOSTYR backwash wastewater.

Pollutant loading rates for the design are based on design conditions provided. The peak hydraulic loading dictates the size of the design.

A plant layout is included at the end of the proposal. The footprint for the system proposed is roughly 134 ft x 30 ft.

The main costs for the BIOSTYR system will be for feed pumping and aeration.

BIOSTYR feed pumping energy will depend on the discharge head on the pump station. Although we do not have information about the site to detail pumping head, we can state that the elevation difference from the bottom of a cell to the feed channel is roughly 30-35 ft.

Aeration demands are summarized in Table 3. Process air will be supplied to each cell with a dedicated blower of the rotary-lobe type. The discharge pressure will typically range from 12.0 to 14.0 psig, but will depend on the final design.

Backwash water volumes are summarized in Table 3.

During backwash, the used backwash water is detained in a waste backwash mud well and then pumped to a facility where it will be treated. The water from each backwash would need to be pumped from the waste backwash mud well over a period of 90 to 120 minutes. The used backwash water can be handled by recycling it to the primary treatment works. A sludge production estimate is provided in Table 3.

There is no annual media replacement cost. The media will compress slightly (5-10%), mostly during the first year of operation. During media installation, additional media is installed to compensate for this initial compression.

5. Scope of Supply

Kruger is pleased to present our scope of supply which includes process engineering design, equipment procurement, and field services required for the proposed treatment system, as related to the equipment specified. The work will be performed to Kruger's high standards under the direction of a Project Manager. All matters related to the design, installation, or performance of the system shall be communicated through the Kruger representative giving the Engineer and Owner ready access to Kruger's extensive capabilities.

Process and Design Engineering
Kruger can provide process engineering and design support for the system as follows:

- Design submittal for the Engineer's review and approval. Submittal included process sizing criteria, hydraulic profile, preliminary BIOSTYR building layout, detailed cell layout, and details of cell internals.
- Shop drawing submittal for Engineer's review and approval. Includes detailed equipment information for all equipment supplied by Kruger.
- Equipment installation instructions for all equipment supplied by Kruger.

Field Services
Kruger will furnish a Service Engineer as specified at the time of start-up to inspect the installation of the completed system, place the system in initial operation, and to instruct operating personnel on the proper use of the equipment. Specifically, Kruger will provide:

- A minimum of 30 man-days field support during the construction and start-up of the facility. Included in this period is time for training Owner's staff in the proper operation and maintenance of the BIOSTYR facility.

Equipment Supply
Kruger will supply the following equipment associated with the system:

- Mechanical Equipment
  - Pre-cast reinforced concrete nozzle slabs for all BIOSTYR cells.
  - One (1) nozzle slab manway per cell.
  - Nozzles and gaskets for all cells . Installed by Contractor.
  - One (1) stainless steel pipe gallery manway per cell.
  - One (1) stainless steel sight glass per cell. Sight glasses are cast in the concrete pipe gallery wall of the BIOSTYR cells.
  - Pressure port inserts, two (2) per cell.
  - Sample ports for profile sampling, two (2) cells equipped with 3 ports each.
  - 4.5 mm media to fill all cells to the indicated depth of 8.20 ft (2.5 m). Media installation is included.
  - One (1) process/backwash aeration grid per cell, including inlet header, purge header, lateral distribution lines, couplings, wall brackets, floor stand support structure, and wall inserts. Piping is stainless steel. Anchor bolts provided by Contractor.
  - Aeration blower packages, one (1) per cell. Positive displacement rotary lobe style blowers or centralized aeration blower station consisting of multiple blowers and a PLC-based control system.
  - One (1) set of feed/backwash pipes per cell. Anchor bolts provided by Contractor.
  - Sludge pumps to transfer backwash water from the backwash mud well to primary treatment facility, including necessary check and isolation valves.
  - All automatic process valves for the BIOSTYR system. Process valves are primarily wafer-style butterfly valves. Actuators are primarily dual acting pneumatic.
- Instrumentation and Control System

  The instrumentation and control system is proposed as detailed herein to meet the functional requirements of the proposed systems. The complete system will include detailed engineering submittals comprised of product data sheets, panel layouts, wiring diagrams, and field installation instructions. The complete system will be comprised of the following:

- One (1) instrument air system to provide compressed air for pneumatic actuators. System includes backup/duplex compressor, receiving tank, refrigerated air dryer, controller, regulator, and necessary filters.
- Process instrumentation. Includes DO meter, pressure instruments, pH instrument, temperature instrument, and level instruments.
- PLC-based control system. Includes control cabinet, programming, and customized SCADA system.

Contractor's Scope of Supply
The contractor's scope of supply for the BIOSTYR system should include, but is not limited to, the following items:

- Concrete construction of the BIOSTYR cells, including assembly of the nozzle decks using the prefabricated, modular slabs.
- Aluminum slide gates in the BIOSTYR cell effluent channel.
- All piping, up to the walls of the BIOSTYR cells.
- Anchor bolts for all equipment installation.
- Installation of nozzles in the nozzle slabs.
- Feed pump station (*can be included in Kruger's scope upon request*).
- Mechanical structures such as handrails, stairways, and platforms.
- All electrical and mechanical hardware with the exception of the equipment that is identified above.
- HVAC for the building pipe gallery, equipment rooms, and control room.

6. Design Options

In addition to the proposed system as detailed herein, Kruger is able to further incorporate our process and controls expertise into wastewater treatment plants, allowing municipalities to meet stringent effluent requirements and future plant upgrades. Kruger is able to offer our instrumentation and controls expertise to build upon the proposed system by incorporating a customized **plant-wide SCADA system** or designing a **Motor Control Center (MCC)**, providing municipalities a single source responsibility for plant controls. Please contact Kruger if the above options are of interest to be included in the current proposed system or future upgrades.

7. Pricing, Payment Terms, and Schedule

Pricing
The price for the BIOSTYR system, as defined herein, including process and design engineering, field services, and equipment supply is **$2,254,000**.

Please note that the above pricing is expressly contingent upon the items in this proposal and are subject to I. Kruger Inc. Standard Terms of Sale detailed herein.

This pricing is FOB shipping point, with freight allowed to the job site. This pricing does not include any sales or use taxes. In addition, pricing is valid for ninety (90) days from the date of issue and is subject to negotiation of a mutually acceptable contract.

Terms of Payment

The terms of payment are as follows:

- 10% on receipt of fully executed contract
- 15% on submittal of shop drawings
- 75% on the delivery of equipment to the site

Payment shall not be contingent upon receipt of funds by the Contractor from the Owner. There shall be no retention in payments due to I. Kruger Inc. All other terms per our Standard Terms of Sale are attached.

All payment terms are net 30 days from the date of invoice. Final payment not to exceed 120 days from delivery of equipment.

Schedule

- Shop drawings will be submitted within 6-8 weeks of receipt of an executed contract by all parties.
- All equipment will be delivered within 18-20 weeks after receipt of written approval of the shop drawings.
- Installation manuals will be furnished upon delivery of equipment.
- Operation and Maintenance Manuals will be submitted within 90 days after receipt of approved shop drawings.

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8. I. Kruger Inc. Standard Terms of Sale

1. Applicable Terms. These terms govern the purchase and sale of the equipment and related services, if any (collectively, "Equipment"), referred to in Seller's purchase order, quotation, proposal or acknowledgment, as the case may be ("Seller's Documentation"). Whether these terms are included in an offer or an acceptance by Seller, such offer or acceptance is conditioned on Buyer's assent to these terms. Seller rejects all additional or different terms in any of Buyer's forms or documents.

2. Payment. Buyer shall pay Seller the full purchase price as set forth in Seller's Documentation. Unless Seller's Documentation provides otherwise, freight, storage, insurance and all taxes, duties or other governmental charges relating to the Equipment shall be paid by Buyer. If Seller is required to pay any such charges, Buyer shall immediately reimburse Seller. All payments are due within 30 days after receipt of invoice. Buyer shall be charged the lower of 1 ½% interest per month or the maximum legal rate on all amounts not received by the due date and shall pay all of Seller's reasonable costs (including attorneys' fees) of collecting amounts due but unpaid. All orders are subject to credit approval.

3. Delivery. Delivery of the Equipment shall be in material compliance with the schedule in Seller's Documentation. Unless Seller's Documentation provides otherwise, Delivery terms are F.O.B. Seller's facility.

4. Ownership of Materials. All devices, designs (including drawings, plans and specifications), estimates, prices, notes, electronic data and other documents or information prepared or disclosed by Seller, and all related intellectual property rights, shall remain Seller's property. Seller grants Buyer a non-exclusive, non-transferable license to use any such material solely for Buyer's use of the Equipment. Buyer shall not disclose any such material to third parties without Seller's prior written consent.

5. Changes. Seller shall not implement any changes in the scope of work described in Seller's Documentation unless Buyer and Seller agree in writing to the details of the change and any resulting price, schedule or other contractual modifications. This includes any changes necessitated by a change in applicable law occurring after the effective date of any contract including these terms.

6. Warranty. Subject to the following sentence, Seller warrants to Buyer that the Equipment shall materially conform to the description in Seller's Documentation and shall be free from defects in material and workmanship. The foregoing warranty shall not apply to any Equipment that is specified or otherwise demanded by Buyer and is not manufactured or selected by Seller, as to which (i) Seller hereby assigns to Buyer, to the extent assignable, any warranties made to Seller and (ii) Seller shall have no other liability to Buyer under warranty, tort or any other legal theory. If Buyer gives Seller prompt written notice of breach of this warranty within 18 months from delivery or 1 year from beneficial use, whichever occurs first (the "Warranty Period"), Seller shall, at its sole option and as Buyer's sole remedy, repair or replace the subject parts or refund the purchase price therefore. If Seller determines that any claimed breach is not, in fact, covered by this warranty, Buyer shall pay Seller its then customary charges for any repair or replacement made by Seller. Seller's warranty is conditioned on Buyer's (a) operating and maintaining the Equipment in accordance with Seller's instructions, (b) not making any unauthorized repairs or alterations, and (c) not being in default of any payment obligation to Seller. Seller's warranty does not cover damage caused by chemical action or abrasive material, misuse or improper installation (unless installed by Seller). THE WARRANTIES SET FORTH IN THIS SECTION ARE SELLER'S SOLE AND EXCLUSIVE WARRANTIES AND ARE SUBJECT TO SECTION 10 BELOW. SELLER MAKES NO OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE.

7. Indemnity. Seller shall indemnify, defend and hold Buyer harmless from any claim, cause of action or liability incurred by Buyer as a result of third party claims for personal injury, death or damage to tangible property, to the extent caused by Seller's negligence. Seller shall have the sole authority to direct the defense of and settle any indemnified claim. Seller's indemnification is conditioned on Buyer (a) promptly, within the Warranty Period, notifying Seller of any claim, and (b) providing reasonable cooperation in the defense of any claim.

8. Force Majeure. Neither Seller nor Buyer shall have any liability for any breach (except for breach of payment obligations) caused by extreme weather or other act of God, strike or other labor shortage or disturbance, fire, accident, war or civil disturbance, delay of carriers, failure of normal sources of supply, act of government or any other cause beyond such party's reasonable control.

9. Cancellation. If Buyer cancels or suspends its order for any reason other than Seller's breach, Buyer shall promptly pay Seller for work performed prior to cancellation or suspension and any other direct costs incurred by Seller as a result of such cancellation or suspension.

10. LIMITATION OF LIABILITY. NOTWITHSTANDING ANYTHING ELSE TO THE CONTRARY, SELLER SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL, INCIDENTAL, SPECIAL, PUNITIVE OR OTHER INDIRECT DAMAGES, AND SELLER'S TOTAL LIABILITY ARISING AT ANY TIME FROM THE SALE OR USE OF THE EQUIPMENT SHALL NOT EXCEED THE PURCHASE PRICE PAID FOR THE EQUIPMENT. THESE LIMITATIONS APPLY WHETHER THE LIABILITY IS BASED ON CONTRACT, TORT, STRICT LIABILITY OR ANY OTHER THEORY.

11. Miscellaneous. If these terms are issued in connection with a government contract, they shall be deemed to include those federal acquisition regulations that are required by law to be included. These terms, together with any quotation, purchase order or acknowledgement issued or signed by the Seller, comprise the complete and exclusive statement of the agreement between the parties (the "Agreement") and supersede any terms contained in Buyer's documents, unless separately signed by Seller. No part of the Agreement may be changed or cancelled except by a written document signed by Seller and Buyer. No course of dealing or performance, usage of trade or failure to enforce any term shall be used to modify the Agreement. If any of these terms is unenforceable, such term shall be limited only to the extent necessary to make it enforceable, and all other terms shall remain in full force and effect. Buyer may not assign or permit any other transfer of the Agreement without Seller's prior written consent. The Agreement shall be governed by the laws of the State of North Carolina without regard to its conflict of laws provisions.

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Attachment I

Brochure

VEOLIA WATER
Solutions & Technologies

KRÜGER

Attachment II

Preliminary Drawing(s)

VEOLIA WATER
Solutions & Technologies

Attachment 2A – Ovivio Enviroquip MBR

From: Seng Matthew
To: Desmarais, Terry
Cc: Pearson, Jon (Wakefield)
Subject: RE: Portsmouth, NH - Filter Bldg Kubota Membrane Eval
Date: Thursday, September 23, 2010 2:23:57 PM

Hi Terry,

Thanks very much for the opportunity to look at this interesting project. We're out, though. We'd need most, if not all, of the eight 16' wide by 30' long bays to meet the hydraulic requirements depending on the type of Membrane Unit we could propose (based on the 10' ceiling clearance above the tanks).

Again, I do appreciate your time yesterday and I compliment you on the good project description and information below. I wish we could have a feasible solution for you.

Thanks again, and good luck with the project.

Matt

Matthew M. Seng, PE
Regional Manager, MBR Systems

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2404 Rutland Dr.
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Tel: 512-963-3421
Fax: 512-834-6039
Email: Matthew.Seng@ovivowater.com
Web: www.ovivowater.com

From: Desmarais, Terry [mailto:Terry.Desmarais@aecom.com]
Sent: Wednesday, September 22, 2010 4:08 PM
To: Seng Matthew
Cc: Pearson, Jon (Wakefield)
Subject: Portsmouth, NH - Filter Bldg Kubota Membrane Eval

Matthew

As we discussed recently on the phone, we are working with Portsmouth NH to review options to upgrade the Peirce Island WWTF. A key concept for the upgrade would be to use the currently unused filter building. To support the evaluation of the concept we are asking that Enviroquip

complete a conceptual level analysis/layout to determine if the existing Filter Building (rapid sand filter type) can be retrofitted with Kubota Ultrafiltration Membrane technology to provide secondary level treatment.

Please provide the arrangement needed to retrofit the existing facility with a membrane system to treat 5.0 MGD Avg Day and 7.5 MGD peak hour flows with the characteristics provided below.

Below is a summary of some of the details of the existing facility. I will forward scanned drawings by AECOM sendfiles. Attached is an 11x17 of the hydraulic profile through the filters.

Purpose:

- Determine if the existing Filter Building can be retrofitted to provide treatment by Ultrafiltration Membrane technology to provide a secondary level of treatment at the Peirce Island WWTF

Existing Treatment Train

- Pumping at Mechanic Street Pump Station with coarse bar rack
- Aerated Grit Tank
- Chemically Enhanced Primary Treatment (CEPT)
- Filtration (not currently used for treatment – focus of potential retrofit)
- Chlorination
- Dechlorination

Wastewater Characteristics:

- CEPT effluent/filter influent:
  - BOD: 75 to 85 mg/L
  - TSS: 55 to 65 mg/L
- Treated Effluent:
  - Conventional secondary effluent limits with monthly average BOD and TSS of 30 mg/L

Existing Filter Building:

- See drawings to be sent via AECOM sendfiles.
- General:
  - CEPT effluent flow in from primary clarifiers/primary distribution box by gravity to 60" influent header at centerline el 20.91
  - Influent distribution to 8 Sand Filter troughs by 12" pipe to filter influent box /weir el 20.91
  - Filtration through 10" sand media (top el 16.08) and discharge to filter under drain el 15.25
  - Filter effluent discharge through 16" pipe to Clearwell underneath pipe gallery
    - Clearwell storage used for backflush water
  - Clearwell overflow (weir el 9.67) to Wetwell beneath filters and pumped to Parshall Flume Structure (el 24.0) to chlorination
  - Backwash through backwash trough (weir el 18.58) to Mudwell adjacent to Wetwell below pipe gallery
- 8 rapid sand filter bays, 16' wide x 30'long, top of concrete wall at el 26.0, bottom of filter at el 13.0. The filter bays and the wetwell are separated by a 1'-3" thick "floor". The

Wetwell ceiling is at el 11.75 and the bottom of the wetwell is a sloping floor which varies between el 6.5 and el 5.0, except nearest the pumps where it slopes to el -3.25.

- normal water surface elevation operating range in the filter bays= 16.08 to 20.91

Proposed Modifications:

- Membrane
  1. Option 1 – 6 biological and 2 membrane tanks within existing bay depth with max water surface elevation of 25.0 – 2 membrane bays likely will be the 4th and 5th filter bays
  2. Option 2 - 6 biological and 2 membrane with increased bay depth for the filter bays at a minimum – this option will likely require removal of portions of the floor to accommodate the membrane cartridges and adding lower cell walls to maintain 8 independent cells

Other Considerations/Questions:

- Our proposed concept may include screenings if needed between the Filter Influent D-box and the Filter Building
- Is there adequate headroom to remove filter cartridges (~10')?
- Will fine screening be required for membrane influent? If so, what size?
- We are not considering any TN removal limits for this immediate evaluation but may in the near future.

We have agreed to provide the City an answer on this issue tomorrow and costing information by the end of next week.

Please give me a call with any questions.

Thank you,

Terry

Terry Desmarais, Jr., P.E.
Project Manager
AECOM Water
D 207.541.2007
C 207.807.8376
terry.desmarais@aecom.com

AECOM
500 Southborough Drive
South Portland, ME 04106
T 207.775.2800 F 207.775.4820
www.aecom.com

Attachment 2B – Zenon MBR

From: Phagoo, Deo (GE Power & Water)
To: Desmarais, Terry
Cc: Rob Trzepacz; Pearson, Jon (Wakefield)
Subject: RE: Portsmouth, NH - Filter Bldg Zenon Membrane Eval
Date: Monday, September 20, 2010 3:49:04 PM
Attachments: Plant 01.jpg
DSCF4383.JPG

Terry,

We ran the revised design and here are the results:

- With 4 membrane trains and 4 filter basin converted to bioreactor (aeration only) the system can only treat 4.3 MGD
- This assumes bioreactor (4 filters) plus membrane tanks (4 filters) volume of 530,000 gal (i.e., 66,400 gal x 8 filters)
- OUR is 144 mg/L/h in the bioreactor and 102 mg/L/h in the membrane tank (Assuming effluent NH4-N at 5 mg/L).
- With 6 cassette spaces per filter and 4 filters used as membrane tanks, we could handle 4.5 mgd ADF and 7.5 mgd PHF with all trains in service.
- Therefore we are limited below 5 mgd ADF both biologically and also membrane (4.3 and 4.5 mgd respectively)

In order to achieve the 5 mgd ADF, we believe it would be more economical to install steel membrane tanks and use all the filters as bioreactors. See attached is a 3D rendering and actual photos of a 10 mgd peak flow system we installed in Marco Island, FL several years ago. This option provide the added volume and membrane capacity to treat 5 mgd ADF and also offers ease of construction since only aeration systems will need to be installed in the filters. The equipment for the membrane filtration system can also be skid mounted for ease of installation on-site.

Please let me know how you would like to proceed. Call me if you have any questions.

Thanks
Deo

Deo Phagoo, P.Eng.
GE
Water & Process Technologies
Regional Director - North East US
ZENON Membrane Solutions

T 905 465 3030 x3082
F 905 465 3050
C 905 330 0363
E deo.phagoo@ge.com
www.gewater.com

3239 Dundas Street West
Oakville, ON L6M 4B2 Canada

From: Desmarais, Terry [mailto:Terry.Desmarais@aecom.com]
Sent: Monday, September 20, 2010 2:28 PM
To: Phagoo, Deo (GE Power & Water)
Cc: Rob Trzepacz; Pearson, Jon (Wakefield)
Subject: RE: Portsmouth, NH - Filter Bldg Zenon Membrane Eval

Deo,

Just to clarify our work of the jet aeration system – AECOM will design and be responsible in terms of developing this proposal for a jet aeration system and ancillary equipment including blower for four existing tanks.

We expect Zenon's proposal to include aeration and blower sizing and other equipment needed for the four membrane cassette tanks.

Thanks

Terry

Terry Desmarais, Jr., P.E.
Project Manager
AECOM Water
D 207.541.2007
C 207.807.8376
terry.desmarais@aecom.com

AECOM
500 Southborough Drive
South Portland, ME 04106
T 207.775.2800 F 207.775.4820
www.aecom.com

From: Desmarais, Terry
Sent: Monday, September 20, 2010 8:26 AM
To: Phagoo, Deo (GE Power & Water)
Cc: Rob Trzepacz; Pearson, Jon (Wakefield)
Subject: RE: Portsmouth, NH - Filter Bldg Zenon Membrane Eval

Deo,

As we discussed on Friday afternoon, we would like Zenon to provide a proposal for the Portsmouth project assuming that AECOM will design a jet aeration system to provide an oxygen transfer rate of 150 mg/L/hr. Capacity requirements will be 5 MGD average day and 7.5 mgd peak hour.

Please provide the following:

- By close of business Wednesday, 9/22
  - Equipment arrangement
  - Backflushing water volume requirements
    - Existing clearwell is ~121,000 gals
    - Existing mudwell is ~60,000 gals
- Price quote for equipment by close of business Friday, 9/24

Please give me a call with questions.

Thank you,

Terry

Terry Desmarais, Jr., P.E.
Project Manager
AECOM Water
D 207.541.2007
C 207.807.8376
terry.desmarais@aecom.com

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500 Southborough Drive
South Portland, ME 04106
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www.aecom.com

From: Phagoo, Deo (GE Power & Water) [mailto:Deo.Phagoo@ge.com]
Sent: Friday, September 10, 2010 10:21 AM
To: Desmarais, Terry
Cc: Rob Trzepacz
Subject: RE: Portsmouth, NH - Filter Bldg Zenon Membrane Eval

Hi Terry,

I would just like to summarize our discussion this morning related to Portsmouth upgrade. Based on the effluent concentration from the CEPT and the available filter tanks at 18ft water depth, an MBR will handle up to 3.5 mgd ADF. This is based on complete BOD/TSS removal (<5 mg/L) and partial nitrification down to around 5-8 mg/L ammonia. The design is limited by the biological reactor design and specifically the oxygen transfer rate – for conventional fine bubble aeration this is typically limited to 100 mg/L/h. This corresponds to a minimum HRT of around 3 hr. The design is not limited by membrane filtration capacity.

To handle 5 mgd ADF with an HRT of around 3 hr, the total aerobic volume required is around 650,000 gal. If you use the filter tanks at 12 ft water depth (300,000 gal total volume) as membrane tanks, you will need to build about 350,000 gal new aeration tank capacity (50ft x 50ft x 18ft).

To handle 6.2 mgd ADF with an HRT of around 3 hr, the total aerobic volume required is around 800,000 gal. If you use the filter tanks at 12 ft water depth (300,000 gal total volume) as membrane tanks, you will need to build about 500,000 gal new aeration tank capacity (75ft x 50ft x 18ft).

Hope this summary helps and let Rob or I know if you need any additional information.

Thanks
Deo

Deo Phagoo, P.Eng.
GE
Water & Process Technologies
Regional Director - North East US
ZENON Membrane Solutions

T 905 465 3030 x3082
F 905 465 3050
C 905 330 0363
E deo.phagoo@ge.com
www.gewater.com

3239 Dundas Street West
Oakville, ON L6M 4B2 Canada

Begin forwarded message:

From: "Desmarais, Terry" <Terry.Desmarais@aecom.com>
Date: September 3, 2010 2:24:25 PM EDT
To: <RobT@TechSalesNE.com>
Cc: "Pearson, Jon (Wakefield)" <Jon.Pearson@aecom.com>
Subject: Portsmouth, NH - Filter Bldg Zenon Membrane Eval

Rob,

As we discussed recently on the phone, we are working with Portsmouth NH to review options to upgrade the Peirce Island WWTF. A key concept for the upgrade would be to use the currently unused filter building. To support the evaluation of the concept we are asking that Zenon complete a conceptual level analysis/layout to determine if the existing Filter Building (rapid sand filter type) can be retrofitted with Ultrafiltration Membrane technology to provide secondary level treatment. The goal of the analysis is to answer the following general questions:

1. What capacity of secondary level treatment (Q, MGD) can be accommodated using the existing filter bays with a maximum sidewater depth (including backwash head conditions) of 12 feet (el 25 to el 13.0). This allows 1' of freeboard to the top of concrete at el 26.0.
2. What capacity of secondary level treatment (Q, MGD) can be accommodated by modifying the existing filter bays to utilize the area of the existing Wetwells below by removing or otherwise modifying the exiting floor at elevation 13 to el 11.75. This would increase maximum sidewater depth to approximately 18.5 feet (el 25 to el 6.5).

Below is a summary of some of the details of the existing facility. I will forward scanned drawings by AECOM sendfiles. Attached is an 11x17 of the hydraulic profile through the filters.

Purpose:

- Determine if the existing Filter Building can be retrofitted to provide treatment by Ultrafiltration Membrane technology to provide a secondary level of treatment at the Peirce Island WWTF

Existing Treatment Train

- Pumping at Mechanic Street Pump Station with coarse bar rack
- Aerated Grit Tank

- Chemically Enhanced Primary Treatment (CEPT)
- Filtration (not currently used for treatment – focus of potential retrofit)
- Chlorination
- Dechlorination

Wastewater Characteristics:

- CEPT effluent/filter influent:
  - BOD: 75 to 85 mg/L
  - TSS: 55 to 65 mg/L
- Treated Effluent:
  - Conventional secondary effluent limits with monthly average BOD and TSS of 30 mg/L

Existing Filter Building:

- See drawings to be sent via AECOM sendfiles.
- General:
  - CEPT effluent flow in from primary clarifiers/primary distribution box by gravity to 60" influent header at centerline el 20.91
  - Influent distribution to 8 Sand Filter troughs by 12" pipe to filter influent box /weir el 20.91
  - Filtration through 10" sand media (top el 16.08) and discharge to filter under drain el 15.25
  - Filter effluent discharge through 16" pipe to Clearwell underneath pipe gallery
    - Clearwell storage used for backflush water
  - Clearwell overflow (weir el 9.67) to Wetwell beneath filters and pumped to Parshall Flume Structure (el 24.0) to chlorination
  - Backwash through backwash trough (weir el 18.58) to Mudwell adjacent to Wetwell below pipe gallery
- 8 rapid sand filter bays, 15' wide x 30'long, top of concrete wall at el 26.0, bottom of filter at el 13.0. The filter bays and the wetwell are separated by a 1'-3" thick "floor". The Wetwell ceiling is at el 11.75 and the bottom of the wetwell is a sloping floor which varies between el 6.5 and el 5.0, except nearest the pumps where it slopes to el -3.25.
  - normal water surface elevation operating range in the filter bays= 16.08 to 20.91

Proposed Modifications:

- Membrane
  1. Option 1 – 6 biological and 2 membrane tanks within existing bay depth with max water surface elevation of 25.0 – 2 membrane bays likely will be the 4th and 5thfilter bays
  2. Option 2 - 6 biological and 2 membrane with increased bay depth for the filter bays at a minimum – this option will likely require removal of portions of the floor to accommodate the membrane cartridges and adding lower cell walls to maintain 8 independent cells

Other Considerations/Questions:

- Our proposed concept may include screenings if needed between the Filter Influent D-box and the Filter Building
- We plan to pump into the Filter Building and flow by gravity to the CCT. This is opposite the existing arrangement, which pumps treated effluent from the Filter Building to the CCT via

a parshall flume.

- Is there adequate headroom to remove filter cartridges (~10')?
- Will fine screening be required for membrane influent? If so, what size?
- We are not considering any TN removal limits for this immediate evaluation but may in the near future.

We have agreed to provide the City an answer on this issue by the middle of September, so **we need to have a conceptual layout completed early next week**.

Please give me a call with any questions.

Thank you,

Terry

Terry Desmarais, Jr., P.E.
Project Manager
AECOM Water
D 207.541.2007
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terry.desmarais@aecom.com

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South Portland, ME 04106
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www.aecom.com

jet aeration systems

BUDGET PROPOSAL

JET AERATION SYSTEM

for

AECOM
ZENON PROJECT

20 September 2010

MTS # M210195 Revision 0

Quote is valid for 60 days from date of proposal

MASS TRANSFER SYSTEMS, 23 Walpole Park South, Walpole, Massachusetts, 02081-2558 USA
T: (508) 660-9150 • F: (508) 660-9151 • E-mail: sales@mtsjets.com

MTS - MASS TRANSFER SYSTEMS
JET AERATION SYSTEM DESIGN
AECOM
NH ZENON APPLICATION
MTS #M210195

DESIGN PARAMETERS

Process	AERATION	
Number of Tanks/Basins	1	
	ENGLISH	METRIC
Total AOR	83 lb O_2/hr	38 kg O_2/h
Rectangular Tank		
Width	16 ft	4.9 m
Length	30 ft	9.1 m
Liquid Depth	18.5 ft	5.6 m
Volume Per Tank/Basin	66,427 gal	251 m^3
Alpha	0.85	0.85
Beta	0.95	0.95
Theta	1.024	1.024
Residual DO	2.0 mg/L	2.0 mg/L
Wastewater Temperature	77 °F	25 °C
Maximum Air Temperature	95 °F	35 °C
Site Elevation	100 ft	30 m

Note: Some of the above parameters were supplied to or assumed by MTS and should be reviewed.

DESIGN SUMMARY

Total SOTR	128 lb O_2/hr	58 kg O_2/h
MTS Jet Aerators Required	1 @ MT4JM-6	1 @ MT4JM-6
Air Flow Rate per Aerator	492 SCFM	836 std m^3/hr[1]
Total Air Flow Rate	492 SCFM	836 std m^3/hr
Air Pressure Required at Manifold[2]	7.4 psig	0.51 bar gauge
Standard Oxygen Absorption Efficiency	25.2 %	25.2 %
Liquid Flow Rate per Aerator	2,196 gpm	139 L/s
Total Liquid Flow Rate	2,196 gpm	139 L/s
Liquid Pressure Required at Manifold[3]	16 ft TDH	4.9 m TDH
Total Blower Power[4]	23 bhp	17 bkW
Total Pump Power[5]	12 bhp	9 bkW
Total Power	35 bhp	26 bkW
Standard Aeration Efficiency	3.63 lb O_2/bhp-hr	2.21 kg O_2/bkW-h
Power Density	533 bhp/MG	105 bkW/1000 m^3

[1] A standard m3 of air defined at 20°C, 1 atm, and 36% RH.

[2] At maximum water depth. Does not includes losses in the out-of-basin piping (typically 1 psi/0.07 bar).

[3] Does not include losses in out-of-basin piping (typically 2 ft /0.6 m).

[4] Assumes blower adiabatic efficiency of 70%.

[5] Assumes pump hydraulic efficiency of 80%.

20 September 2010

MTS# M210195 Revision 0

AECOM
ZENON PROJECT

SCOPE OF SUPPLY

- Four (4) MT4JM-6 directional jet aeration manifolds (1 per tank) fabricated of FRP, each consisting of six (6) MT4 jet aeration nozzles mounted on one side of the liquid distribution pipe and connection to the air distribution pipe. Each MT4 jet aeration nozzle if fabricated with silicone carbide impregnated fiberglass resin for superior abrasion resistance and is capable of passing a 2.2-inch spherical solid particle. The liquid pipe shall be 12-inch and the air pipe shall be 6-inch. The manifold will be fabricated in sections up to 30 feet in length with plain ends prepared for field wrap connections during installation. The manifolds shall be complete with ANSI style flanged ends for connection to the customer interface flanges.

- Four (4) 12-inch x 17-inch suction inlet bells fabricated of FRP.

- All necessary in-basin supports shall be fabricated of type 304 stainless steel and hardware fabricated of type 18-8stainless steel. Support saddle liners shall be EPDM rubber.

- Three (3) rotary lobe positive displacement blowers (2 duty / 1 standby), complete with base, V-belt drive and guard, check valve, discharge pressure gauge, inlet filter and silence, discharge silencer, discharge temperature gauge, acoustic sound enclosure, and 30 HP TEFC motor.

- Four (4) end suction centrifugal liquid recirculation pumps, complete with base, stainless steel impeller, cast iron casing, dynamic seal, direct drive and guard, and 15 HP TEFC motor.
  Note: Pumps are rough aligned at the factory, final alignment after installation is recommended (to be provided by others)

- Field service can be provided for the rate of $850/day plus travel and expenses.

- Freight to Jobsite

BUDGET PRICE (FOB: Factory): **$ 195,000 USD**

All taxes are specifically excluded.

Continued.

TERMS OF PAYMENT

Terms of payment require net cash payment at the time of invoice for the first and second payment and within 30 days from the date of invoice for shipment. Accounts not paid on net cash due date shall bear interest at the rate of 2% per month on the outstanding balance. Partial payment against partial shipment shall be permitted and shall be net 30 days.

Invoicing shall be applied upon the following schedule:

Drawing Approval ..... 25% of Purchase Order Value
After Shipment of Equipment..... 75% of Purchase Order Value (Net 30 Days)

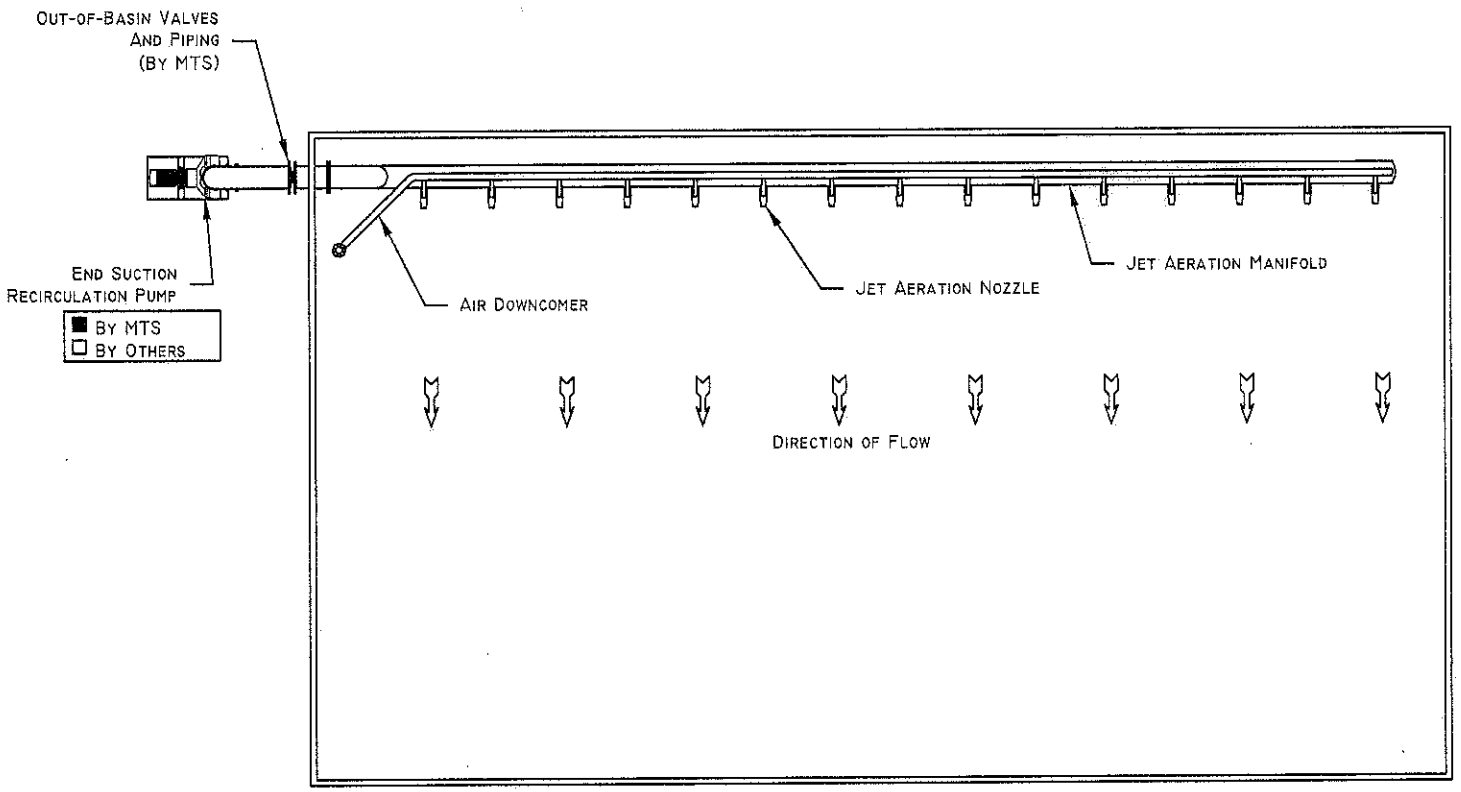
DELIVERY

The following delivery schedule is based on current availability of materials. This delivery schedule can be confirmed at the time of an order.

Drawings for Approval .....Approx. 2-4 weeks after order acceptance
Shipment of Manifolds .....Approx. 10-14 weeks after release to manufacture
Shipment of Pumps .....Approx. 10-16 weeks after release to manufacture
Shipment of Blowers.....Approx. 10-16 weeks after release to manufacture

NOTE: Price is subject to re-quote 60 days from date of proposal.

MASS TRANSFER SYSTEMS, 23 Walpole Park South, Walpole, Massachusetts, 02081-2558 USA
T: (508) 660-9150 • F: (508) 660-9151 • E-mail: sales@mtsjets.com

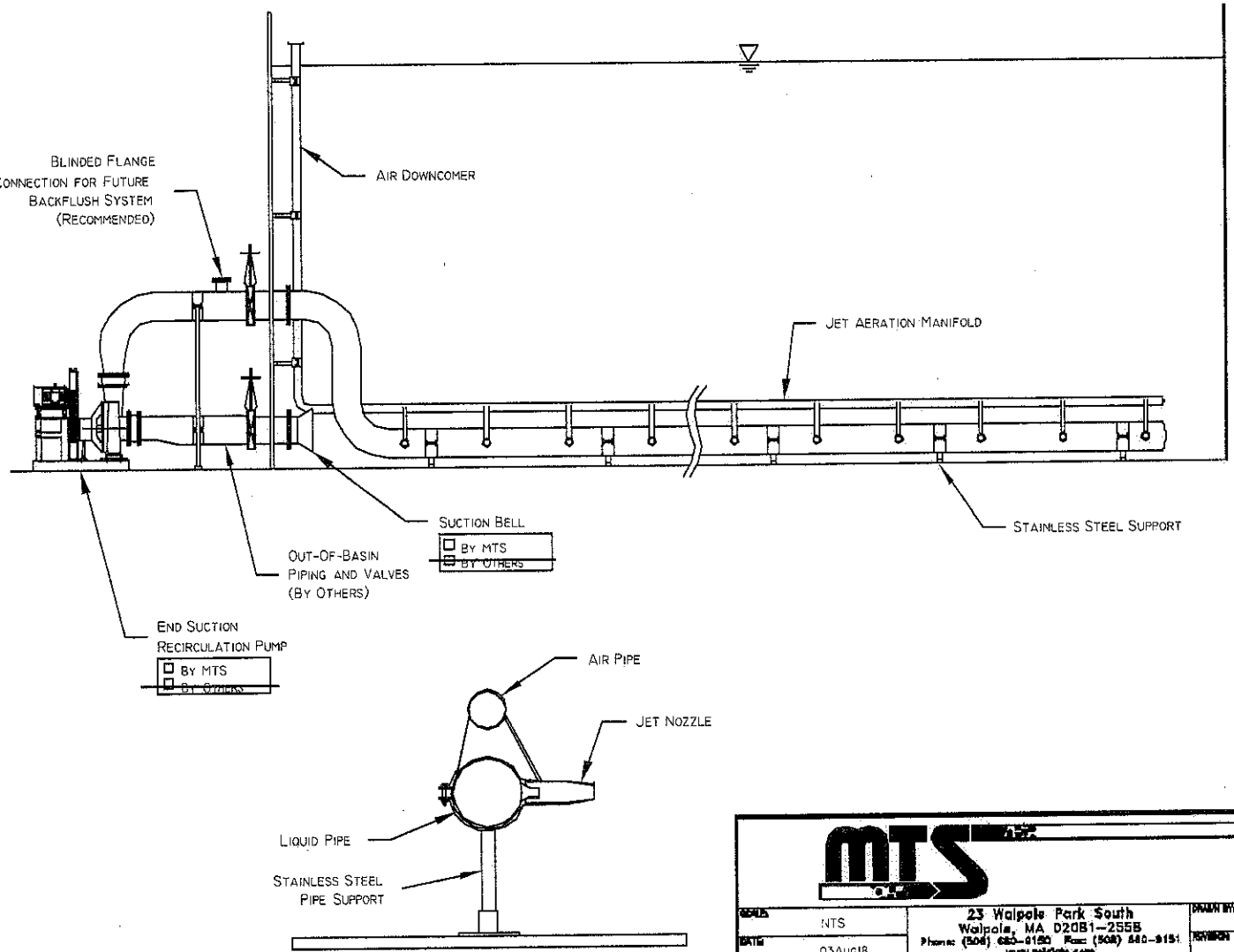


630 Currant Road, Fall River, MA 02720
Phone: (508) 679-6770
Fax: (508) 672-5779

SCALE: NTS	DRAWN BY: JSA
DATE: 26JAN01	REVISION:

TYPICAL JET AERATION MANIFOLD
- PLAN VIEW -

DRAWING #: PA_JM_009



TYPICAL MANIFOLD SECTION

23 Walpole Park South
Walpole, MA 02081-2555
Phone: (508) 660-0150 Fax: (508) 660-9151
www.mtsjets.com

SCALE	NTS
DATE	03AUG18
DRAWN BY	JSA
REVISION	B

TYPICAL JET AERATION MANIFOLD
- ELEVATION VIEW -

DRAWING # EA_JM_001

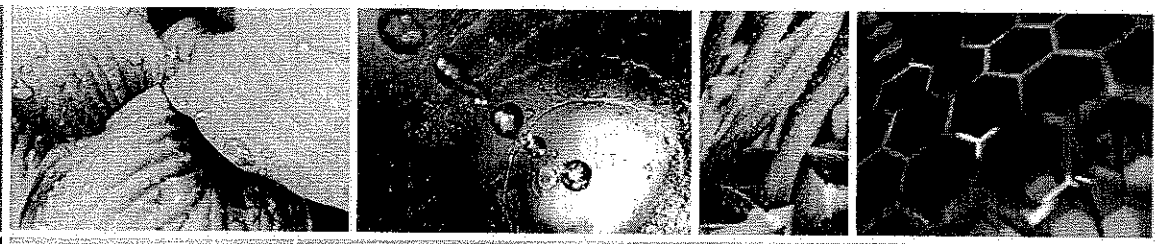
Attachment 3A – Infilco Degremont MBBR

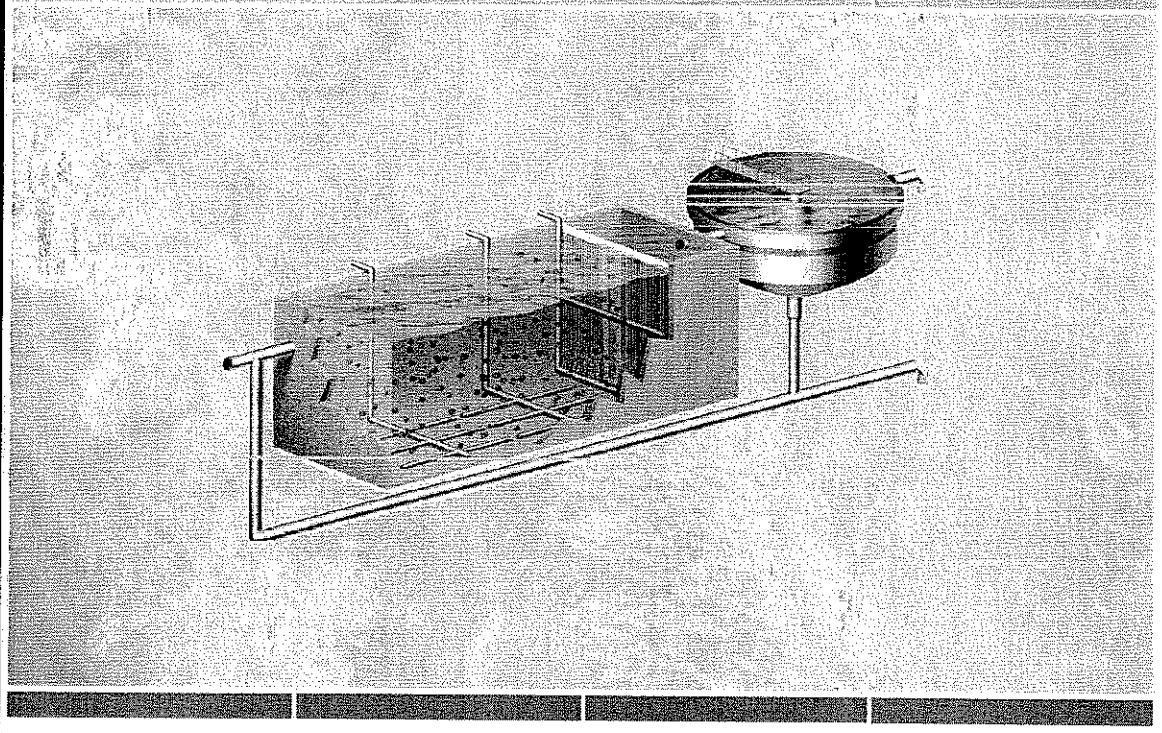
Infilco

Degremont Technologies

SUEZ

HEADWORKS
BIOLOGY
SEPARATION
MEMBRANE
DISINFECTION
BIOSOLIDS
SYSTEMS





METEOR® and BIOFOR® System Design Brief

Project: Pierce Island WWTP, NH

Date: 09.16.10

September 16, 2010

Terry Desmarais Jr.
AECOM Water

Re: Pierce Island WWTP, NH
BIOFOR® Biological Filtration System
Inquiry No. 50084585.01

Dear Mr. Desmarais:

Based on the design information provided for the Pierce Island WWTP, NH two technology considerations were reviewed and IDI is pleased to provide the following design summary. The two designs discussed are:

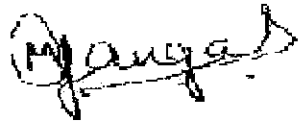
Design 1: Retrofit All 8 Filters with the IDI METEOR® MBBR System to be capable to treating 5.3 MGD (Peak flow 8.85 MGD) flow to achieve effluent BOD < 30 mg/l. This would entail utilizing all the tank depth available i.e. 18.5 ft (for a SWD of 16.5 ft) for all 8 filters as mentioned in Option 2 provided by AECOM Water. The MBBRs would have to be followed with a solids separation system like the IDI AquaDAF system.

~~**Design 2:** Retrofit 4 of the 8 Filters into the BIOFOR® Systems to be able to treat 9.5 MGD (Peak flow 15.9 MGD) to achieve effluent BOD < 30 mg/l. This upgrade choice would require utilizing all the tank depth available i.e. 18.5 ft and require an additional 4 ft of increase in height for the 4 filters being retrofit. This option would not only treat a much higher flow but also eliminate BOD and TSS to < 30 mg/l each in 1 step.~~

Note: A Peaking Factor of 1.67 has been used to determine the hydraulic capacity of both systems based on current flow data.
Prices for both systems will be advised by the Rep.

In case of any questions please don't hesitate to contact Mike, our regional sales representative or me directly.

Sincerely,



Mudit Gangal

Application Engineer - Biological Systems Group

Regional Business Manager
Mervyn Bowen
Degremont Technologies – Infilco

P. O. Box 71390
Richmond, VA 23255-1390
Tel: 804/756-7786
Fax: 804/756-7643

Email: mervyn.bowen@infilcodegremont.com

Sales Representative
Michael Loncoski
Aqua Solutions Inc.
18 Linsausig Way
Falmouth, ME 04105
Tel: (207) 828-5559
Fax: (207) 871-5972

Email: mloncoski@aquasolutionsinc.net

DESIGNS SUMMARY

Design 1:

METEOR® MBBR SYSTEM

Below is the design summary for the proposed MBBR system (using all 8 filters):

BOD Removal MBBR

Design Basis
Design Flow: 5.3 MGD (Maximum Flow Capable of being treated in the volume)
Peak Flow: 8.85 MGD
Influent BOD: 85 mg/l
Influent TSS: 65 mg/l
Influent NH_3-N: 5 mg/l (assumed)
Influent TKN: 7 mg/l (assumed)
Design Temperature: 10 ^{0}C
MLSS: 0 mg/l

Design Details
BOD Removal Volume: 444,312 gal (21% biofilm carrier fill)
Biofilm carrier: NutriCELL™ 450
Total volume of biofilm carriers: 353 m^3
Fine bubble Air requirement: 2,200 scfm (At 22 °C – Temperature Assumed)
Number of 12" dia x 72" long screens: 16
Effluent BOD: < 20 mg/l

Design 2:

BIOFOR® BAF SYSTEM

The BIOFOR® C BAF system retrofit to achieve the desired treatment objective is as follows:

Design Basis
Design Flow: 9.5 MGD
Peak Flow: 15.9 MGD
Influent BOD: 85 mg/l
Influent TSS: 65 mg/l
Influent NH_3-N: 5 mg/l (assumed)
Influent TKN: 7 mg/l (assumed)
Design Temperature: 10 ^{0}C

BIOFOR® C

No. of Filter Cells = 4 (3 + 1)
Size of each Filter Cell = 30' x 15'
Area of each Filter Cell = 450 ft^2
Footprint including wash water tanks = 5,190 ft^2

Effluent BOD: < 25 mg/l
Effluent TSS: < 25 mg/l

The proposed BAF treatment system would comprise 4 BIOFOR® C cells to achieve the requisite BOD and TSS removal. Of the 4 BIOFOR® C cells there will be 3 BIOFOR® C cells in operation and 1 under backwash/out of service.

Attachment 3B – Kruger MBBR

KRÜGER

September 23, 2010

Terry Desmarais, Jr., P.E.
AECOM Water
500 Southborough Drive
South Portland, ME 04106

Re: *Revised* AnoxKaldnes™ Moving Bed Bio-film Reactor (MBBR) Proposal
Portsmouth, New Hampshire –Pierce Island WWTP Upgrade
Kruger Project No: 42290805

Dear Mr. Desmarais:

Enclosed is our *revised* proposal for the equipment required to convert four (4) of the existing eight (8) deep bed filters in the existing filter building at the Peirce Island WWTF to a MBBR for BOD removal. This proposal utilizes 18.5 ft as the SWD rather than the 20 ft SWD in our original proposal dated September 15th and reduces the number of blowers from five (5) to three (3) to save space as was requested by Jon Pearson. Please note that reducing the SWD by 2.5 ft increases our percent fill from 47% to 51%, which is still less than our recommended max fill percentage of 55%.

Kruger's proposed scope of supply includes the AnoxKaldnes media, retention screens, medium bubble aeration grids, three (3) blowers and I&C as detailed in this proposal.

Thank you for considering retrofitting the existing filter bays to a MBBR process. If you have any questions or need further information, please contact our local representative, Henry Albro of F.R. Mahony (978 597 0703), or our Northeast Regional Sales Manager, Ken Krupa (540-389-5092; ken.krupa@veoliawater.com).

Respectfully,
I. Kruger Inc.

Sent via email

Susan Roszko
Senior Application Engineer
AnoxKaldnes

ATT

cc: Glenn Thesing, Ken Krupa, David Foster, project file (Kruger)
Henry Albro (F.R. Mahony)

Kruger Inc.
401 Harrison Oaks Blvd. Suite 100
Cary, NC 27513 USA
Tel: 919-677-8310 • Fax: 919-677-0082
Web site: www.krugerusa.com

VEOLIA WATER
Solutions & Technologies

Revised AnoxKaldnes MBBR BOD Removal Proposal

for the

Portsmouth, New Hampshire Pierce Island WWTF Upgrade

Kruger Project No.: 42290805

KRÜGER

Terry Desmarais, Jr., P.E.
AECOM Water
500 Southborough Drive
South Portland, ME 04106

September 23, 2010

I. Kruger Inc.
401 Harrison Oaks Blvd.
Suite 100
Cary, NC 27513

VEOLIA
WATER
Solutions & Technologies

KRÜGER

Table of Contents

Proposal History

Revision	Date	Process Eng.	Comments
0	9/15/10	DOF	Initial, budgetary proposal.
1	9/21/10	DOF	Peak flow and reactor SWD decreased.

KRÜGER

1. Company Introduction

I. Kruger Inc. (Kruger) is a water and wastewater solutions provider specializing in advanced and differentiating technologies. Kruger provides complete processes and systems ranging from biological nutrient removal to mobile surface water treatment. The ACTIFLO® Microsand Ballasted Clarifier, BIOCON® Dryer, BIOSTYR® Biological Aerated Filter (BAF), AnoxKaldnes HYBAS™, AnoxKaldnes™ MBBR, NEOSEP™ MBR and HYDROTECH Discfilters are just a few of the innovative technologies offered by Kruger. Kruger is a subsidiary of Veolia Water Solutions and Technologies (VWS), a world leader in engineering and technological solutions in water treatment for industrial companies and municipal authorities.

VWS, present throughout the world, develops a global approach responding to specific needs of customers at each of their production facilities. This has allowed VWS to become the world leader in design, project management, and execution of projects for water and wastewater treatment plants. The company also creates dedicated technology solutions to meet its customer's needs. Its unique portfolio of differentiating technologies, developed by the group's R&D centers, ensures unsurpassed innovation and control of each treatment line for public organizations and industries. Furthermore, a whole range of associated services is offered on each site to guarantee the technical efficiency and life expectancy of the installed solutions. VWS continually extends and enriches its offer, to guarantee expertise and competence at every step of the projects it undertakes.

Kruger prides itself for being a customer focused organization that provides solutions to challenges faced by municipalities and not just another equipment supplier. To achieve this, Kruger has gathered a force of process experts, trained sales staff, and project managers that share our vision and priorities.

2. Energy Focus

Kruger, along with Veolia Water Solutions & Technologies (VWS) is dedicated to delivering sustainable and innovative technologies and solutions.

We offer our customers integrated solutions which include resource-efficient technology to improve operations, reduce costs, achieve sustainability goals, decrease dependency on limited resources, and comply with current and anticipated regulations.

Veolia's investments in R&D outpace that of our competition. Our focus is on delivering

- neutral or positive energy solutions
- migration towards green chemicals or zero chemical consumption
- water-footprint-efficient technologies with high recovery rates

Our carbon footprint reduction program drives innovation, accelerates adoption and development of clean technologies, and offers our customers sustainable solutions.

Kruger is benchmarking its technologies and solutions by working with our customers and performing total carbon cost analysis over the lifetime of the installation.

By committing to the innovative development of clean and sustainable technologies and solutions worldwide, Kruger and VWS will continue to maximize the financial benefits for every customer.

KRÜGER

3. Process Description

Kruger's AnoxKaldnes process design is based on more than 20 years of experience with Moving Bed Biological Reactors (MBBR) and Integrated Fixed Film Activated Sludge (IFAS) systems. Our knowledge is supported by lab and pilot scale studies and data from more than 475 AnoxKaldnes operating systems for BOD, nitrification, and TN removal.

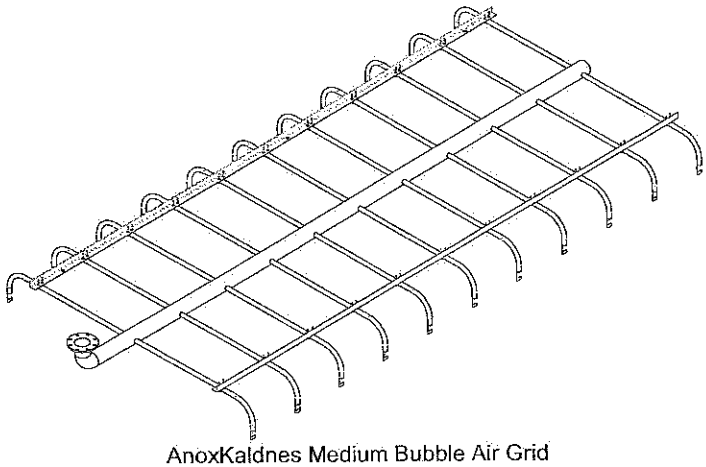
The MBBR and IFAS (or Hybas - Hybrid Activated Sludge) processes are continuous flow through, non-clogging bio-film reactors containing "carrier elements" or media with a high specific surface. The media does not require backwashing or cleaning.

The biomass that treats the wastewater is attached to the surfaces of the media. The media is designed to provide a large protected surface area for the biofilm and optimal conditions for biological activity when suspended in water. Media of different shapes and sizes provide flexibility to use the most suitable type depending on wastewater characteristics, discharge standards and available volumes. AnoxKaldnes media is made from polyethylene and has a density slightly less then water.

In the MBBR process, all of the biomass is attached to the media and retained in the reactor, with no returned sludge. In the Hybas process, the reactor contains both free-floating biomass (activated sludge) and biomass attached to the media. The free-floating biomass passes through the reactor, is settled and recycled back to the reactor. The media and attached biofilm remain in the reactor as in a MBBR.

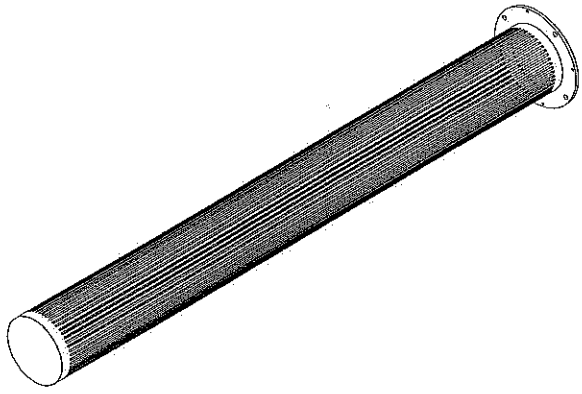
The Hybas process is often considered for upgrading existing conventional activated sludge systems within the existing tankage for either maintaining nitrification at new higher flow rates or loads or upgrading a plant to meet new nitrification requirements. It is accomplished by adding the media directly into the activated sludge reactors to enhance the growth of the autotrophic bacteria. The Hybas system is capable of meeting these new effluent requirements at low solids retention times (SRTs) and short hydraulic retention times (HRTs).

The mixing of the media within MBBR and IFAS reactors is provided by AnoxKaldnes' medium bubble aeration system in aerobic application, whereas specially designed submersible mixers are used in anoxic environments for denitrification.

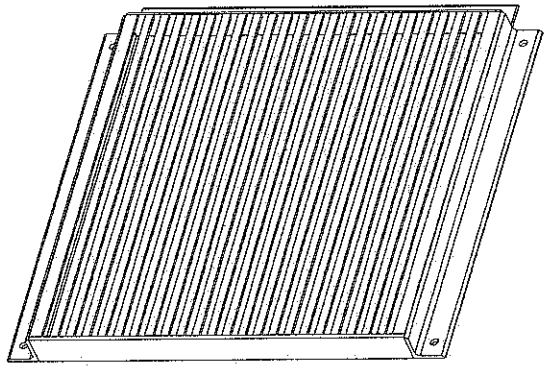


AnoxKaldnes Medium Bubble Air Grid

The media is retained within the reactor using stainless steel retention screens (sieves).



AnoxKaldnes Stainless Steel Cylindrical Sieve



AnoxKaldnes Stainless Steel Flat Screen

Kruger's minimum scope of supply for MBBR and Hybas systems includes the AnoxKaldnes media, screen assemblies (to keep media in each reactor), medium bubble aeration grid assemblies and submersible mixers for the anoxic zones. In cases where they are needed,

Kruger also provides the blowers, instrumentation and controls, SCADA, and field instruments (dissolved oxygen, nitrate, ammonia, etc.) for single source responsibility.

4. Design Summary

The proposed design is based on the following influent wastewater characteristics and incorporating peak flow conditions for sieve design purposes only. The design assumes that the raw influent wastewater is biodegradable, no toxic compounds are present, sufficient alkalinity is available to avoid pH depressions, that the COD/BOD ratio is between 1.7 and 2.3, and that none of the equipment provided would be used in a classified area (e.g. Class 1, Division 1 or Class 1, Division 2).

Facilities that lack primary clarification will require screening with a maximum of 6 mm (1/4 inch) openings for removal of this particulate matter (rags, debris, etc.) prior to entering the AnoxKaldnes MBBR treatment reactor(s).

The MBBR influent design basis is summarized in Table 1. The target effluent criteria for the MBBR system are listed in Table 2. The process design is summarized in Table 3.

Table 1: AnoxKaldnes MBBR Influent Design Basis

Parameter	Units	Value
Flow, Peak	MGD	7.5
Flow, Design	MGD	5.0
BOD, Max. Month	mg/L	85
TSS, Max. Month	mg/L	65
Max. Temperature	°C	20
Min. Temperature	°C	10

Table 2: AnoxKaldnes MBBR Effluent Achieved (30-Day Average)

Parameter	Units	Value
Soluble $CBOD_5$	mg/L	≤ 20

Kruger proposes four (4) process trains of one (1) reactor for biological treatment of BOD using the AnoxKaldnes Moving Bed biofilm technology. The AnoxKaldnes MBBR basin will be a standalone process without a need for backwashing or returning sludge from secondary clarifiers. If additional capacity is desired from the MBBR, this design allows for the addition of more media to accommodate an increase in load seen by the facility. The effluent from the MBBR will require clarification prior to discharge from the facility.

Table 3: MBBR Basin Design Summary

Parameter	Units	Value
Number of Process Trains	-	4
Number of Aerobic Reactors per Train	-	1
Total Reactor Volume (all stages, all trains)	ft^3	35,520
Reactor Dimensions (Each)	ft	30 L x 16 W x 18.5 SWD
Reactor Volume (Each)	ft^3	8,880
Recommended Freeboard	ft	2-3
Total Bulk Volume of Media	ft^3	18,010
Total Effective Surface Area	ft^2	4,391,675
Fill of Biofilm Carriers, All Reactors	%	51
Aeration System	-	Medium Bubble (4.0 mm Orifice)
Residual D.O., Max. Month	mg/L	2
Total Air Requirement, Max. Month	SCFM	826 @ 8.3 psig discharge pressure
New Sludge Production, Max. Month	lb/d	2,987
Effluent TSS, Max. Month	mg/L	90-137

5. Scope of Supply

Kruger is pleased to present our scope of supply which includes process engineering design, equipment procurement, and field services required for the proposed treatment system, as related to the equipment specified. The work will be performed to Kruger's high standards under the direction of a Project Manager. All matters related to the design, installation, or performance of the system shall be communicated through the Kruger representative giving the Engineer and Owner ready access to Kruger's extensive capabilities.

Process and Design Engineering
Kruger will provide process engineering and design support for the system as follows:

- Process Engineering consisting of aeration system sizing and configuration, sieve and outlet design.
- Review and approval of P&I Diagram for the AnoxKaldnes MBBR portion of the process. Preliminary General Arrangement Drawings and review and approval of final General

Arrangement Drawings for the MBBR process. Review of MBBR reactor drawings with respect to nozzles, penetrations and dimensions, excluding structural design.

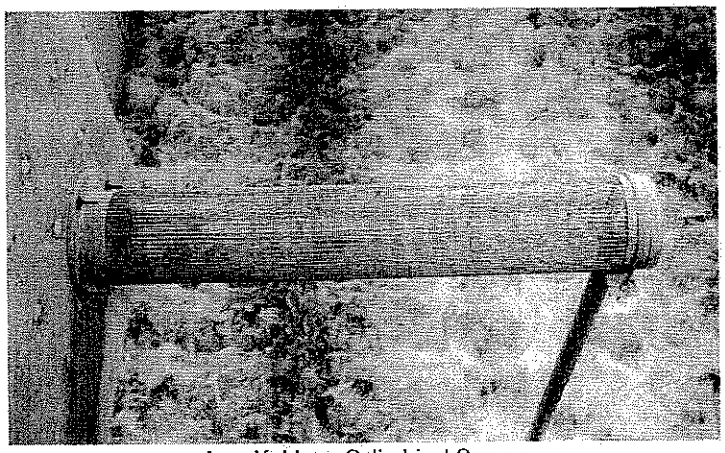
- Equipment installation instructions for all equipment supplied by Kruger.

Field Services
Kruger will furnish a Service Engineer to perform the following tasks:

- Inspect installation of key pieces of equipment during construction.
- Inspect the completed system prior to startup.
- Assist the Contractor with initial startup of the system.
- Train the Owner's staff in the proper operation and maintenance of the AnoxKaldnes MBBR system.
- Test and start any Kruger-supplied control equipment, including PLC programming and SCADA systems.

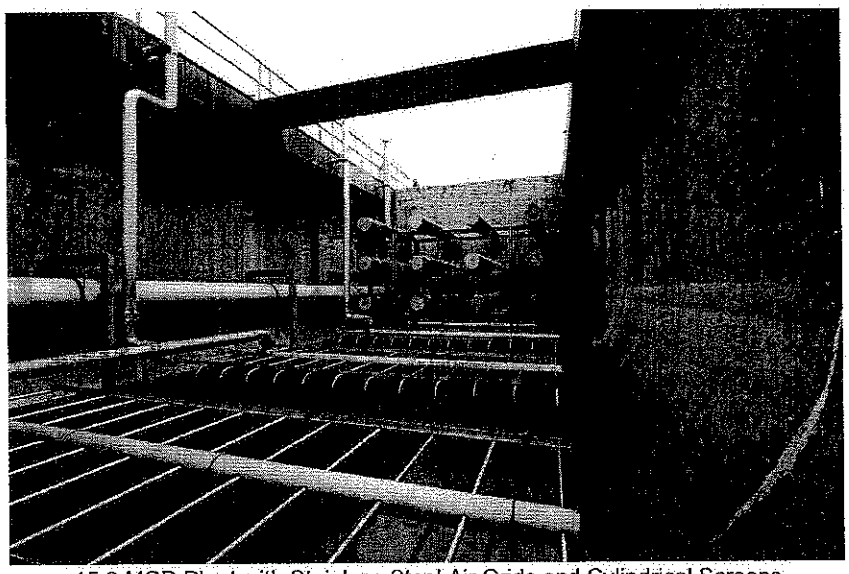
Equipment Supply – LIMITED TO IN-BASIN EQUIPMENT ONLY
Kruger will supply the following equipment associated with the system:

- Process and Mechanical Equipment
  - AnoxKaldnes Matrix-Sol high density polyethylene carrier elements as quantified in Table 3.
  - Two (2) sieve assemblies in 304L stainless steel including support systems will be provided for each reactor for a total of eight (8) sieves. Sieves are 16" diameter wedge-wire pipes terminated in ANSI flanges for connection to wall spool pieces (by others).

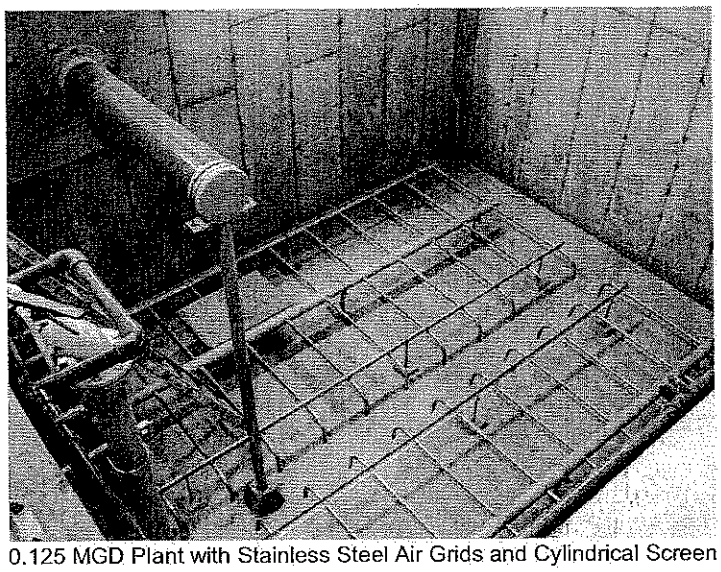


AnoxKaldnes Cylindrical Screen

  - A site-specific AnoxKaldnes Medium Bubble aeration system in 304L stainless steel including header and lateral piping within each reactor. All internal piping and hardware (excluding concrete anchor bolts) are provided up to the header pipe termination flanges at the top of the reactor walls.

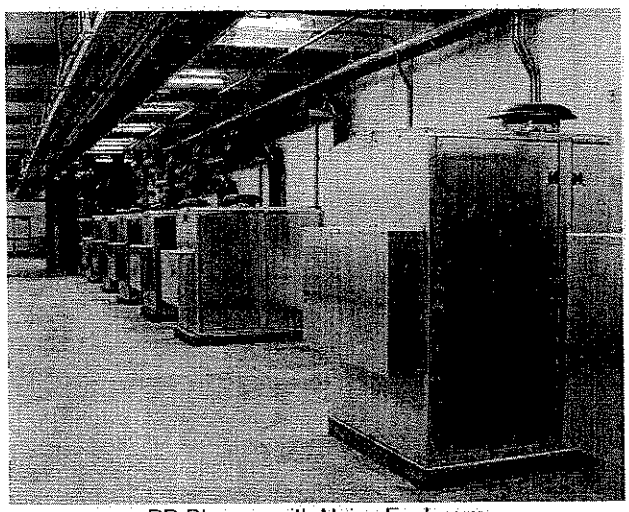


15.9 MGD Plant with Stainless Steel Air Grids and Cylindrical Screens



0.125 MGD Plant with Stainless Steel Air Grids and Cylindrical Screen

- Three (3) positive displacement blowers, two duty and one standby. Each blower will be rated for 413 SCFM and 20 HP. Blowers and motors will be delivered on preassembled skids with inlet and discharge silencers and a soundproof enclosure.

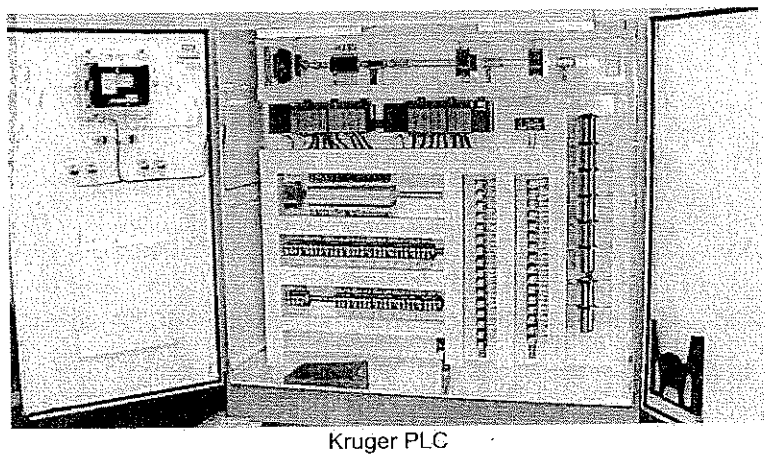


PD Blowers with Noise Enclosure

- Instrumentation and Control

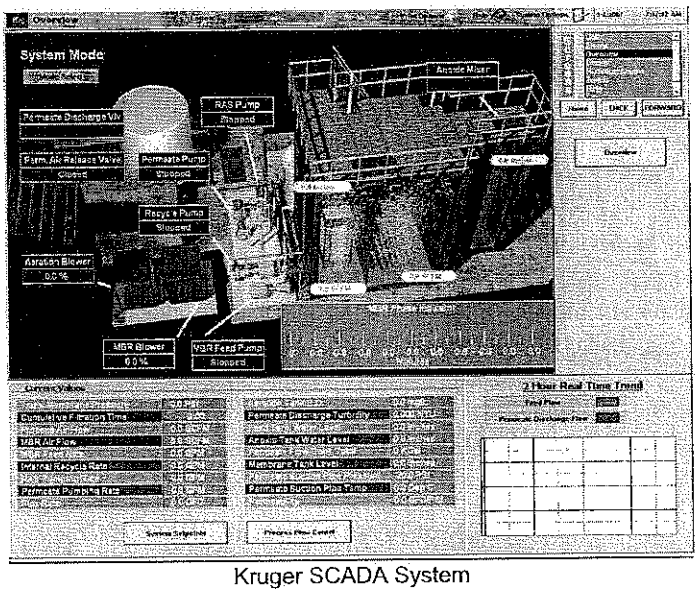
The instrumentation and control system is proposed as detailed herein to meet the functional requirements of the proposed systems. The complete system will include detailed engineering submittals comprised of product data sheets, panel layouts, wiring diagrams, and field installation instructions. The complete system will be comprised of the following:

Item	Description	Manufacturer
1.	NEMA 12 Wall Mounted Panel	Hoffman or Equivalent
2.	Backpanel for Control Panel	Hoffman or Equivalent
3.	Processor	Allen Bradley
4.	Panelview Operator Interface	Allen Bradley
5.	Associated Input and Output Modules	Allen Bradley
6.	120 VAC Surge Protector	EDCO or Equivalent
7.	Circuit Breakers	Square D or Equivalent
8.	Alarm Horn	Federal or Equivalent
9.	Cabinet Light & Convenience Outlet	
10.	Misc. Wire and Panduit	



Kruger PLC

- Field instruments:
  - Four (4) high level float switches
  - Four (4) DO probes



Kruger SCADA System

Contractor's Scope of Supply

The contractor's scope of supply for the AnoxKaldnes MBBR system should include, but is not limited to, the following items:

- All civil/site and electrical work.
- A concrete foundation for the tanks.
- Reactors for the MBBR.
- All provisions for interconnecting piping.
- Unloading, storage and installation of equipment.

6. Design Options

In addition to the proposed system as detailed herein, Kruger is able to further incorporate our process and controls expertise into wastewater treatment plants, allowing municipalities to meet stringent effluent requirements and future plant upgrades. Kruger is also able to offer our instrumentation and controls expertise to build upon the proposed system by providing a **customized plant-wide SCADA system** or designing a **Motor Control Center (MCC)**, providing municipalities a single source responsibility for plant controls. Please contact Kruger if the options above are of interest or to be included in the current proposed system or future upgrades. ***Please note that the design options listed above are not included in the pricing noted herein.*

7. Pricing, Payment Terms, and Schedule

Pricing
The price for the AnoxKaldnes MBBR BOD system, as defined herein, including process and design engineering, field services, and equipment supply is **$1,050,000**.

Please note that the above pricing is expressly contingent upon the items in this proposal and are subject to I. Kruger Inc. Standard Terms of Sale detailed herein.

This pricing is FOB shipping point, with freight allowed to the job site. This pricing does not include any sales or use taxes. In addition, pricing is valid for ninety (90) days from the date of issue and is subject to negotiation of a mutually acceptable contract.

Terms of Payment
The terms of payment are as follows:

- 10% on receipt of fully executed contract
- 15% on submittal of shop drawings
- 75% on the delivery of equipment to the site

Payment shall not be contingent upon receipt of funds by the Contractor from the Owner. There shall be no retention in payments due to I. Kruger Inc. All other terms per our Standard Terms of Sale are attached.

All payment terms are net 30 days from the date of invoice. Final payment not to exceed 120 days from delivery of equipment.

Schedule

- Shop drawings will be submitted within 6-8 weeks of receipt of an executed contract by all parties.
- All equipment will be delivered within 18-20 weeks after receipt of written approval of the shop drawings.
- Installation manuals will be furnished upon delivery of equipment.
- Operation and Maintenance Manuals will be submitted within 90 days after receipt of approved shop drawings.

KRÜGER

8. I. Kruger Inc. Standard Terms of Sale

1. Applicable Terms. These terms govern the purchase and sale of the equipment and related services, if any (collectively, "Equipment"), referred to in Seller's purchase order, quotation, proposal or acknowledgment, as the case may be ("Seller's Documentation"). Whether these terms are included in an offer or an acceptance by Seller, such offer or acceptance is conditioned on Buyer's assent to these terms. Seller rejects all additional or different terms in any of Buyer's forms or documents.

2. Payment. Buyer shall pay Seller the full purchase price as set forth in Seller's Documentation. Unless Seller's Documentation provides otherwise, freight, storage, insurance and all taxes, duties or other governmental charges relating to the Equipment shall be paid by Buyer. If Seller is required to pay any such charges, Buyer shall immediately reimburse Seller. All payments are due within 30 days after receipt of invoice. Buyer shall be charged the lower of 1 ½% interest per month or the maximum legal rate on all amounts not received by the due date and shall pay all of Seller's reasonable costs (including attorneys' fees) of collecting amounts due but unpaid. All orders are subject to credit approval.

3. Delivery. Delivery of the Equipment shall be in material compliance with the schedule in Seller's Documentation. Unless Seller's Documentation provides otherwise, Delivery terms are F.O.B. Seller's facility.

4. Ownership of Materials. All devices, designs (including drawings, plans and specifications), estimates, prices, notes, electronic data and other documents or information prepared or disclosed by Seller, and all related intellectual property rights, shall remain Seller's property. Seller grants Buyer a non-exclusive, non-transferable license to use any such material solely for Buyer's use of the Equipment. Buyer shall not disclose any such material to third parties without Seller's prior written consent.

5. Changes. Seller shall not implement any changes in the scope of work described in Seller's Documentation unless Buyer and Seller agree in writing to the details of the change and any resulting price, schedule or other contractual modifications. This includes any changes necessitated by a change in applicable law occurring after the effective date of any contract including these terms.

6. Warranty. Subject to the following sentence, Seller warrants to Buyer that the Equipment shall materially conform to the description in Seller's Documentation and shall be free from defects in material and workmanship. The foregoing warranty shall not apply to any Equipment that is specified or otherwise demanded by Buyer and is not manufactured or selected by Seller, as to which (i) Seller hereby assigns to Buyer, to the extent assignable, any warranties made to Seller and (ii) Seller shall have no other liability to Buyer under warranty, tort or any other legal theory. If Buyer gives Seller prompt written notice of breach of this warranty within 18 months from delivery or 1 year from beneficial use, whichever occurs first (the "Warranty Period"), Seller shall, at its sole option and as Buyer's sole remedy, repair or replace the subject parts or refund the purchase price therefore. If Seller determines that any claimed breach is not, in fact, covered by this warranty, Buyer shall pay Seller its then customary charges for any repair or replacement made by Seller. Seller's warranty is conditioned on Buyer's (a) operating and maintaining the Equipment in accordance with Seller's instructions, (b) not making any unauthorized repairs or alterations, and (c) not being in default of any payment obligation to Seller. Seller's warranty does not cover damage caused by chemical action or abrasive material, misuse or improper installation (unless installed by Seller). THE WARRANTIES SET FORTH IN THIS SECTION ARE SELLER'S SOLE AND EXCLUSIVE WARRANTIES AND ARE SUBJECT TO SECTION 10 BELOW. SELLER MAKES NO OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE.

7. Indemnity. Seller shall indemnify, defend and hold Buyer harmless from any claim, cause of action or liability incurred by Buyer as a result of third party claims for personal injury, death or damage to tangible property, to the extent caused by Seller's negligence. Seller shall have the sole authority to direct the defense of and settle any indemnified claim. Seller's indemnification is conditioned on Buyer (a) promptly, within the Warranty Period, notifying Seller of any claim, and (b) providing reasonable cooperation in the defense of any claim.

8. Force Majeure. Neither Seller nor Buyer shall have any liability for any breach (except for breach of payment obligations) caused by extreme weather or other act of God, strike or other labor shortage or disturbance, fire, accident, war or civil disturbance, delay of carriers, failure of normal sources of supply, act of government or any other cause beyond such party's reasonable control.

9. Cancellation. If Buyer cancels or suspends its order for any reason other than Seller's breach, Buyer shall promptly pay Seller for work performed prior to cancellation or suspension and any other direct costs incurred by Seller as a result of such cancellation or suspension.

10. LIMITATION OF LIABILITY. NOTWITHSTANDING ANYTHING ELSE TO THE CONTRARY, SELLER SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL, INCIDENTAL, SPECIAL, PUNITIVE OR OTHER INDIRECT DAMAGES, AND SELLER'S TOTAL LIABILITY ARISING AT ANY TIME FROM THE SALE OR USE OF THE EQUIPMENT SHALL NOT EXCEED THE PURCHASE PRICE PAID FOR THE EQUIPMENT. THESE LIMITATIONS APPLY WHETHER THE LIABILITY IS BASED ON CONTRACT, TORT, STRICT LIABILITY OR ANY OTHER THEORY.

11. Miscellaneous. If these terms are issued in connection with a government contract, they shall be deemed to include those federal acquisition regulations that are required by law to be included. These terms, together with any quotation, purchase order or acknowledgement issued or signed by the Seller, comprise the complete and exclusive statement of the agreement between the parties (the "Agreement") and supersede any terms contained in Buyer's documents, unless separately signed by Seller. No part of the Agreement may be changed or cancelled except by a written document signed by Seller and Buyer. No course of dealing or performance, usage of trade or failure to enforce any term shall be used to modify the Agreement. If any of these terms is unenforceable, such term shall be limited only to the extent necessary to make it enforceable, and all other terms shall remain in full force and effect. Buyer may not assign or permit any other transfer of the Agreement without Seller's prior written consent. The Agreement shall be governed by the laws of the State of North Carolina without regard to its conflict of laws provisions.

KRÜGER

Attachment I

Brochure

VEOLIA WATER
Solutions & Technologies

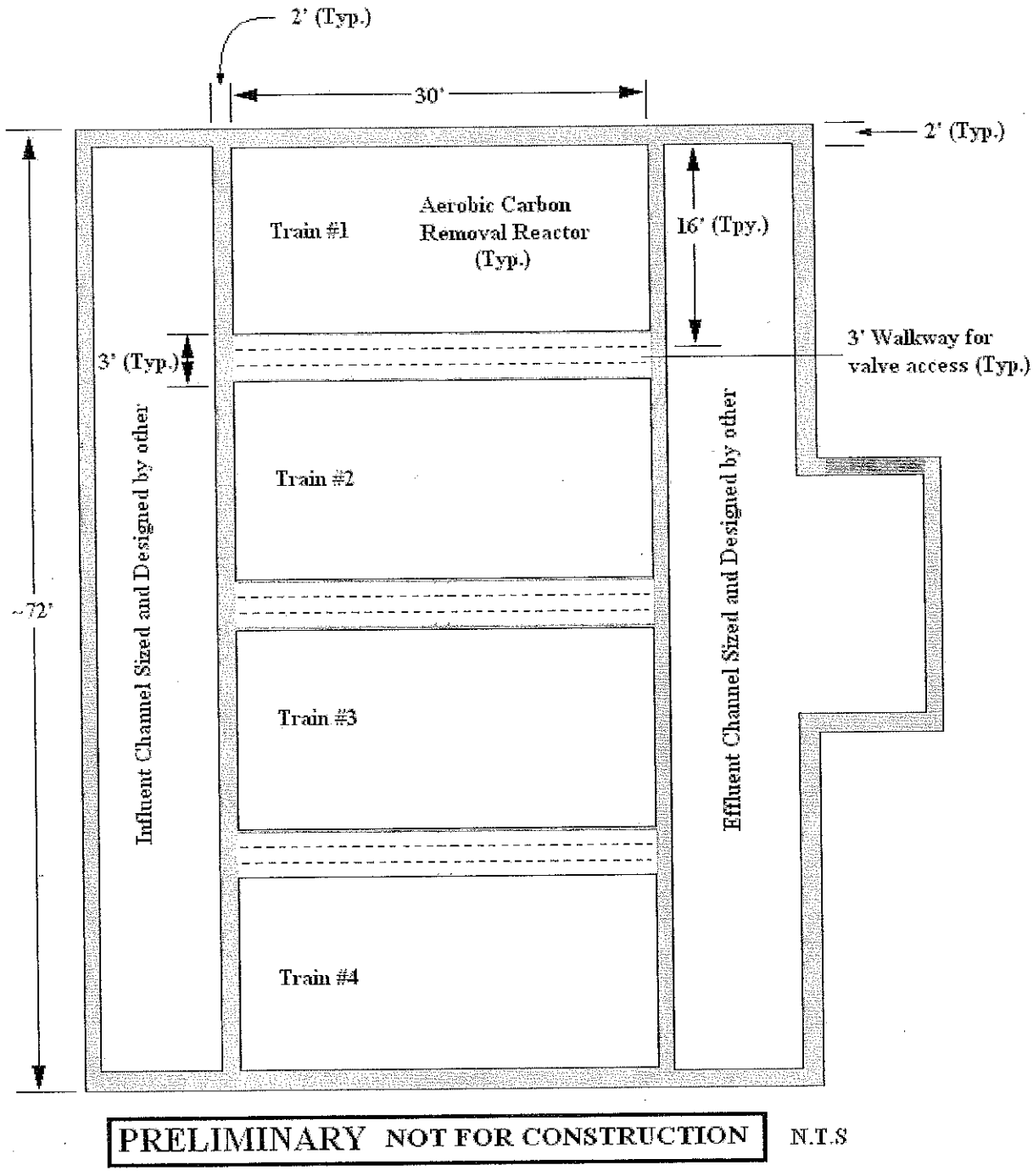
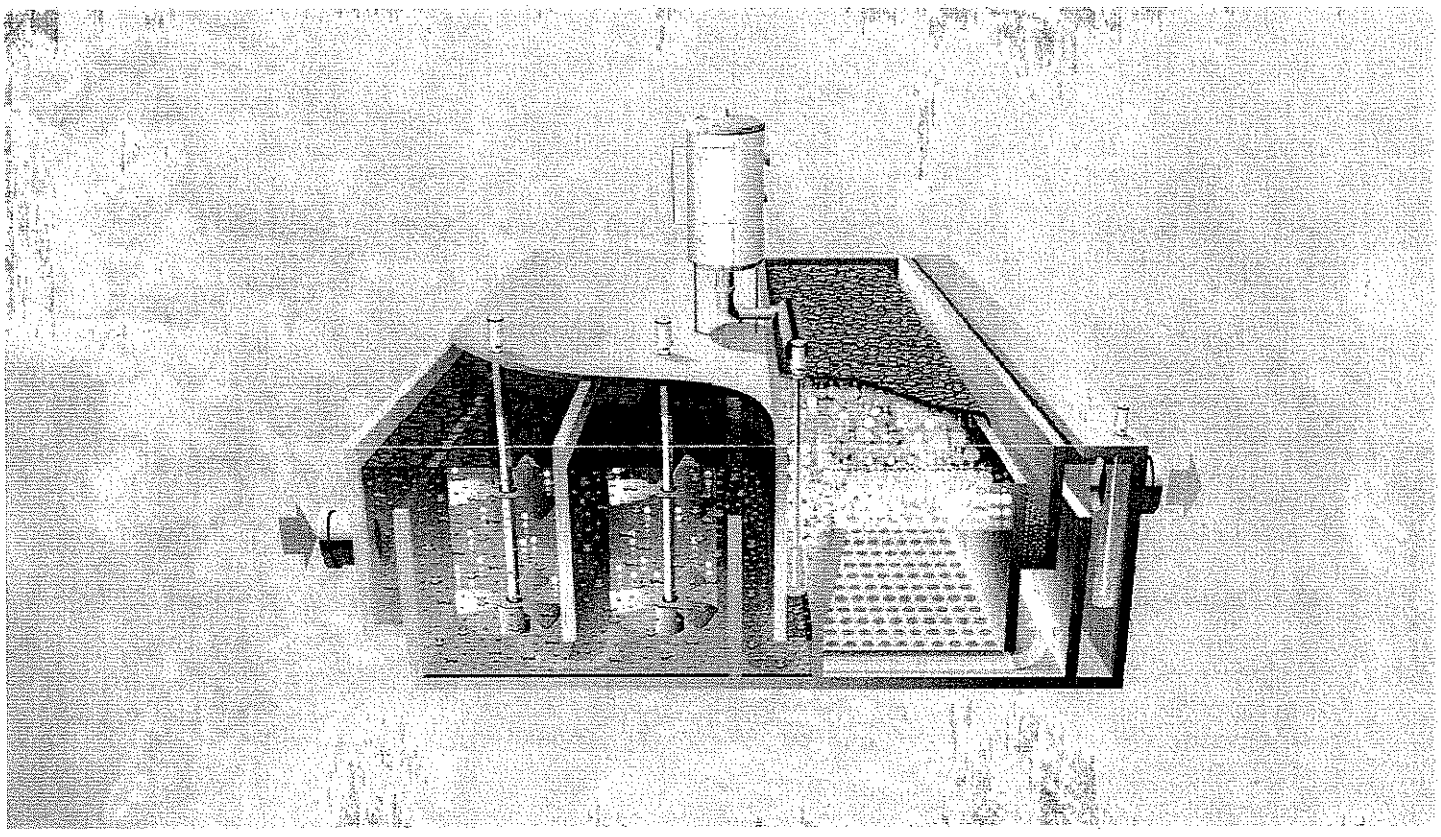


Figure1: Portsmonth BOD Removal MBBR Layout Sketch

Attachment 4A – Infilco Degremont AquaDAF

AquaDAF® High-Rate Dissolved Air Flotation
Preliminary Budget Proposal



Project: Pierce Island WWTF
Engineer: AECOM
IDI Proposal: 50084585.02
Date: September 23, 2010

INFILCO DEGREMONT INC.
8007 DISCOVERY DRIVE, RICHMOND, VA 23229 USA
P.O. BOX 71390, RICHMOND, VA 23255-1390 USA
TEL 804 756-7600 | FAX 804 756-7643

September 23, 2010

Attn: Mr. Terry Desmarais, Jr.
AECOM
500 Southborough Drive
South Portland, ME 04106

Subject: AquaDAF® Preliminary Budget Proposal – Portsmouth, NH
IDI Proposal No. – 50084585.02

Dear Terry:

In accordance with your recent request, we are pleased to submit our preliminary AquaDAF® proposal for the following:

- Two (2) 3.75-MGD AquaDAF® clarifier units with auxiliaries

The enclosed design for the AquaDAF® is in conjunction with IDI's MBBR proposal. The AquaDAF® clarifier will treat effluent from the MBBR and shall reduce the TSS prior to discharging into the Pierce Island WWTF effluent. This design is based upon very preliminary information sent to IDI about the water source to be treated and may require sizing modifications following a detailed review and understanding of the process requirements.

Additional information such as preliminary P&IDs, hydraulic profiles are available upon request.

We have endeavored to provide complete information here, but if you have any questions or require additional information please do not hesitate to contact me at 800.446.1150 at your convenience. We look forward to further discussions with you concerning this project.

Sincerely,

Kevin A. Flis

Kevin Flis
Application Engineer – Separations Group
Infilco Degremont, Inc.

TABLE OF CONTENTS

1. ABOUT INFILCO DEGREMONT, INC.

Infilco Degremont, Inc. (IDI) offers a full array of integrated water solutions in the U.S. and throughout the world. Infilco is a part of SUEZ Environment and Degremont Group, which is located in 65 countries, serving over 1 billion people with water and wastewater solutions.

IDI offers an array of water, wastewater and industrial treatment solutions for any size client. Headworks, clarification, filtration, biological and disinfection systems are several of the product disciplines in our portfolio, which include product offerings such as bar screens, clarifiers, thickeners, filters, nutrient removal systems, biological filter systems, UV disinfection, MBBR, incineration, RO, membranes and complete industrial systems.

With a variety of filtration and clarification products in our SEPARATIONS department, Infilco engineers carefully evaluate each application to provide the most cost-effective and efficient treatment solution.

If interested in this product, check out some of the complimentary SEPARATIONS products:

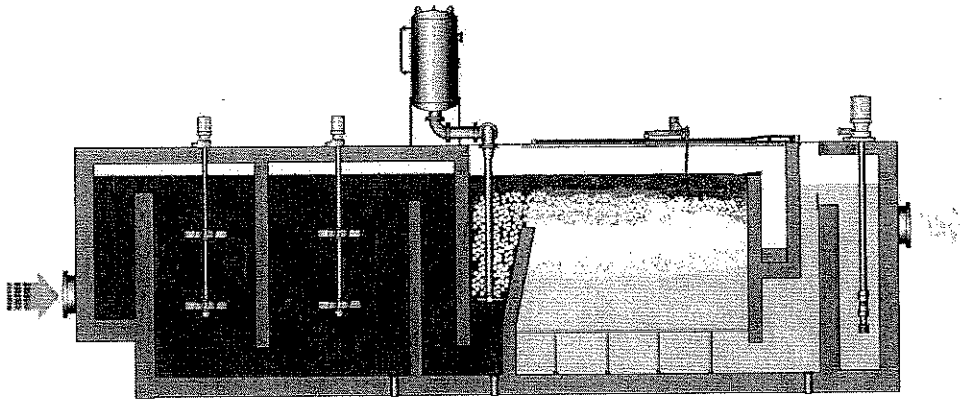
- SuperPulsator® Clarifier
- DensaDeg® Clarifier, Softener, Thickener
- Accelator® Clarifier, Softener
- Greenleaf® Filter System
- ABW® Automatic Backwash Filter
- Monoflor®-HD Nozzle Underdrains (including air scour, surface sweep & wash troughs)

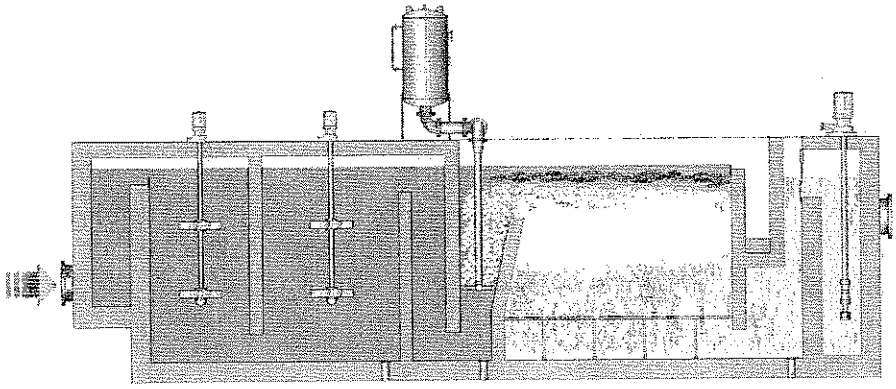
Our technologies are longstanding market references, like the Climber Screen® Mechanical Bar Screen, ABW® Automatic Backwash Filter, and Cannon® Digester Mixing System. IDI continues to be the technology leader in the industry with technological advances such as the AquaDAF® High-rate Dissolved Air Flotation System, Thermylis® High Temperature Fluid Bed Incinerator, Biofor™ Biological Aerated Filter, and Meteor® ActiveCell for nutrient removal, among many other solutions.

Feel free to visit our website at www.degremont-technologies.com

2. AQUADAF® PROCESS DESCRIPTION

After in-line rapid mixing and two stages of flocculation the water enters the AquaDAF® dissolved air flotation section of the unit. In this zone, the previously formed floc particles attach to microbubbles and are entrained by the bubbles to the surface. The microbubbles are produced by the depressurization of a partially air saturated pressurized recycle stream. This recycle stream is a portion of the clarified water stream that is pressurized by a recycle pump and saturated in a specially designed saturator tank. Depressurization of the stream takes place through proprietary dispersion nozzles fixed on a header that is located at the entrance of the DAF section. The clarified water passes through a patented perforated floor and leaves the unit over a weir plate into an effluent channel.





As floated floc particles accumulate on the surface of the DAF unit, a thick sludge layer is formed. Periodic removal of the sludge layer is required and may be carried out by one of two methods. Either by hydraulic means, where by raising the water level in the unit causes the overflow of the sludge blanket into the sludge collection trough. This is accomplished by raising an automatic effluent weir plate on a prescribed frequency and duration. If highly concentrated sludge is desired, a mechanical scraper system may be implemented to scrape the accumulated sludge onto a sludge beach and into the sludge trough.

3. AQUADAF® DESIGN BRIEF

SIZING CRITERIA

Application ..... Drinking Water Clarification

Total No. of DAF Basins ..... 2 N
Total Peak Flow 7.5-MGD
Unit Peak Flow 3.75-MGD
DAF Loading Rate at Peak Flow ..... 9.0 gpm/ft^2

Unit Width (inside)..... 18.0 ft
Unit Length (includes flocculation) ..... 54.5 ft
Unit DAF Water Level..... 10.42 ft
Unit Height (includes freeboard)..... 12.42 ft

Method of Flocculation ..... 2-stage Mechanical
Total Flocculation Time at Peak Flow ..... 10.6 minutes

Sludge Removal Method(1)..... Mechanical
Estimated Solids Concentration..... 2.0 to 4.0%

(1) Hydraulic sludge removal is offered as an option. Est. sludge concentration is 0.3-0.5%.

INSTALLATION

Estimated Total Concrete* ..... ~330 yds^3
(Includes: Inlet/Outlet Channel, Flocculation & DAF basin walls, sludge channels, platforms)
(Assumes: 12" interior walls)

OPERATION & MAINTENANCE

Estimated Power Consumption*..... 775 kW*hr/day
(Power estimated as consumed HP with **ALL** units running)

Estimated Chemical Consumption ..... Lab Analysis Required

Mechanical Maintenance: As with all mechanical equipment, lubricate all motors, gear reducers, and accessory equipment as directed by the manufacturer's instructions. Inspect the automatic valves, compressors, pumps, timers and proportioning devices periodically to determine proper operation.

Basin Cleaning: As with any clarifier system, the unit should be drained and inspected for solids buildup every 6-12 months. Any deposits/solids buildup should be removed.

*Estimates are based on previously executed projects or preliminary data and are provided as a courtesy and are for estimating purposes only. Actual quantities may vary.

4. STANDARD SCOPE OF SUPPLY

Infilco proposes to furnish the following equipment for **each** AquaDAF® unit (unless noted):

1. **Flocculation Equipment** - Two (2) primary vertical mount mechanical flocculator mixer(s) and two (2) secondary vertical mount mechanical flocculator mixer(s).

   Each mechanical mixer shall be sized per IDI's recommendation. Motors: Each mixer shall have a 460-volt, 3-phase, 60 Hz, TEFC, 1.5 HP, inverter duty motor (VFDs are by Others). All motors shall have Class F insulation with a 1.15 service factor. All wetted material of construction shall be 316SS. The CONTRACTOR shall provide the flocculator support bridges/pads.

2. **Air Saturator** - One (1) 304 stainless steel, glass-beaded finish, ASME tank designed to a working pressure of 150 psi. Miscellaneous components include pressure relief, needle and solenoid valves, air check valves, pressure gauges, level controller/indicator, diffuser, flanges and gaskets.

3. **Air Dispersion Headers** - One (1) set of Sch. 10 304 stainless pipe headers from the saturator vessel outlet connection to the air dispersion header. Includes header supports and removable threaded PVC dispersion nozzles. Multiple header design options are available at a cost adder.

4. **Recycle Pumps** - One (1) vertical turbine pump per unit plus one (1) **total** spare. Pump includes cast iron casing, casing cover and frame. Impellers and shafts will be of bronze construction. Line and bowl shaft shall be 316SS. Motors: Each pump shall have a 460-volt, 3-phase, 60 Hz, TEFC, 50 HP, inverter duty motor (VFDs are by Others). All motors shall have Class F insulation with a 1.15 service factor. The pumps shall be supplied on a steel base sole plate for mounting on a concrete pad by Others.

5. **Air Compressor System** – Two (2) air compressors (1 duty + 1 spare) will be provided for the entire system, consisting of rotary screw type compressors with 460-volt, 3 phase, 60 Hz, 25.0 HP motor. The compressor will be sized by IDI and will be supplied with on one air receiver tank. All interconnecting compressed air piping/wiring shall be by the Contractor. Other components (integral to compressor) are auto drain, inlet throttling valve, motor, belt drive with guard, air/oil water separator, food-grade oil compatible, motor starters, general purpose particulate, 1 micron filter, oil coalescing, 0.01 micron filters, pressure gauge, integrated refrigerated dryer, one (1) control module for each compressor, NEMA3R enclosure, and associated valves.

6. **Collection System** - Pre-drilled perforated false floor fabricated from 4' x 8' x 1/8" thick aluminum sheets with aluminum support columns. All components shipped loosed for installation by Contractor.

7. **Valves** – The following process valves will be provided:

Item Description	Qty	Type/Actuator
Recycle Pump Isolation (discharge)	3	Butterfly - Lever
Recycle Pump Check (discharge)	3	Check
Pressure Reducing Valve (Scraper or Eff. weir)	3	
Scraper or Eff. Weir Air (auto)	2	Solenoid – Electric
Scraper or Eff Weir Air (manual)	2	Ball - Manual
Saturator Pressure Relief	2	
Saturator Air Inlet (auto)	2	Solenoid - Electric
Saturator Air Inlet	2	Check
Saturator Air Bleed	2	Globe – Manual
Saturator Tank Drain	2	Ball – Manual
Sludge Wash/Spray Supply Inlet	4	Ball – Electric
Spray Wash/Spray Supply Isolation	4	True Union Ball - Manual

8. **Sludge Removal System** – One (1) carbon steel scraper mechanism with 0.5 HP motor and carbon steel 3- rail track will be provided

9. **Sludge Wash System** - One (1) spray header system designed to break the sludge surface tension around the periphery of the float area. The spray header system will be fabricated of ¾" (minimum) diameter Sch 80 PVC and includes automatic solenoid valves, isolation valves, pressure reducing valve, piping and hardware for bracing.

   A sludge dilution system with 316SS spray nozzles will be provided along the sludge trough, in addition to the spray header system listed above.

10. **Weirs** - One (1) sludge beach, one (1) hinged effluent weir with pneumatic actuated tension rope, and one (1) influent distribution weir, each fabricated of 1/4" thick 304 SS.

11. **Control Panel** - A **total** of one (1) main DAF control panel in NEMA 4X (FRP or 304SS) enclosure for the entire DAF system. The control panel will include a GE Fanuc or equal PLC and QuickPanel or equal HMI and required control devices to provide automatic and manual control of recycle pumps, saturators, and associated instruments. The DAF control panel will contain necessary input/output devices for control capabilities through the plant main SCADA system (by others).

12. **Process Instrumentation** – The following process instruments will be provided:

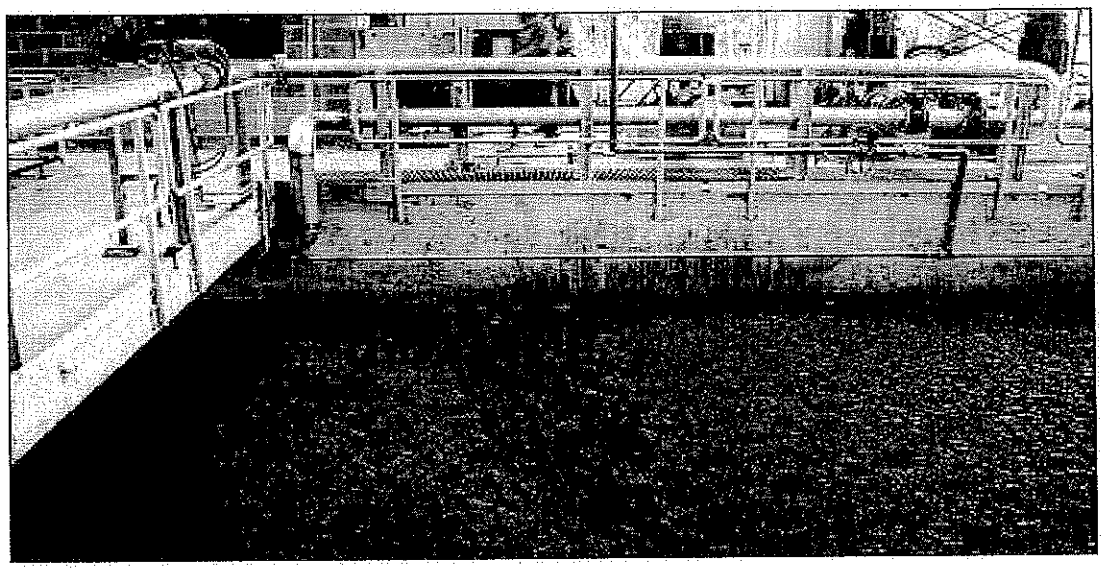
Item Description	Qty	Type/Actuator
Recycle Flowmeter	2	Magmeter
Recycle Pressure Transmitter	2	
Pressure Switch/Gauge Assembly (recycle pump)	3	Ashcroft
Start-up Strainer (recycle line)	2	Conical Type
Liquid Level Control (recycle pumps)	2	Float Switch
Saturator Level Controller	2	Magnetic Type

13. **Field Service** - Fifteen (15) days of service shall be supplied for construction inspections, start-up and performance testing in no more than five (5) trips to the jobsite.

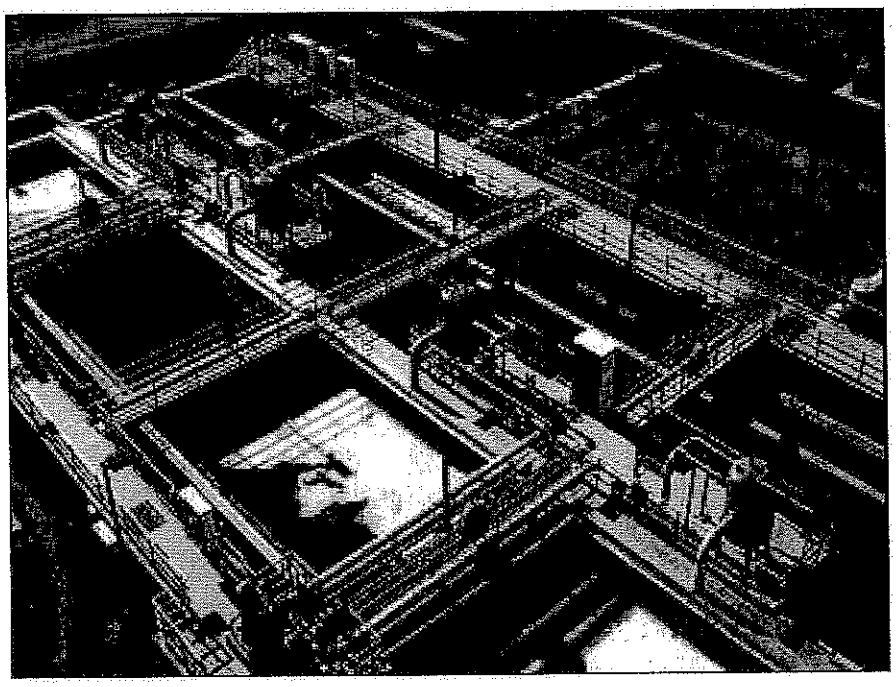
SCOPE OF SUPPLY BY OTHERS

1. Installation of any kind and unloading of equipment from delivering carrier
2. All concrete, grout and fill
3. Building or cover structure for DAF basins
4. In-line static or rapid mixer system
5. Sludge sumps and sludge waste pumps
6. All influent, effluent, recycle, sludge waste, drain and air piping & piping supports.
7. All VFD's
8. All required walkways, access stairs & ladders
9. All chemical feed systems, chemicals and chemical feed lines
10. All basin drains and drain valves
11. Supply and installation of all power and control wiring and conduit to the equipment served plus interconnections between Infilco equipment as required - wire, cable, junction boxes, fittings, conduit, safety disconnect switches, circuit breakers, etc.
12. Install and provide all motor control centers, motor starters, field wiring, wireways, supports and transformers
13. All embedded pipe sleeves and anchor bolts
14. All other necessary equipment and services not otherwise listed as supplied by Infilco

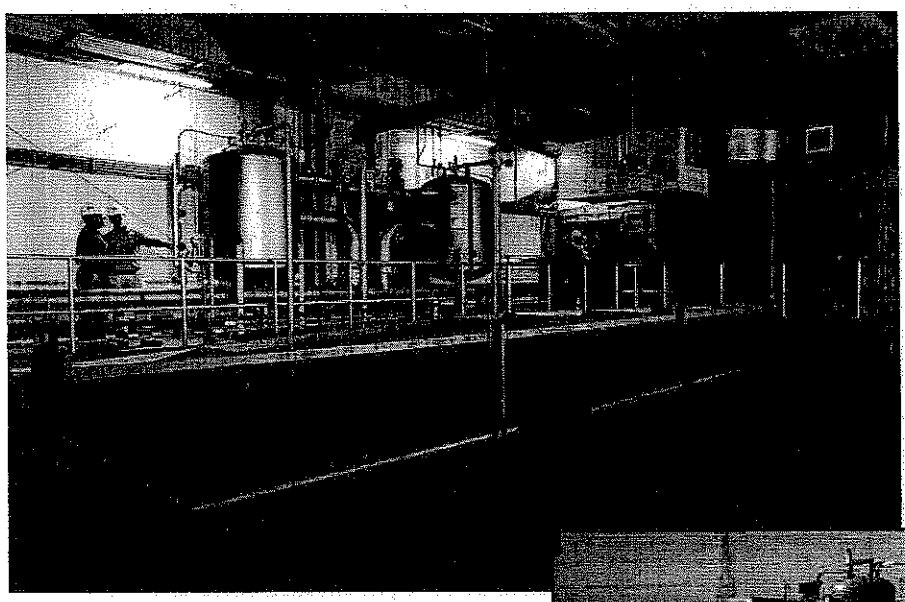
5. PHOTO GALLERY



(Above) DAF basins at the Lake Deforest WTP, NY installation operating at 12.5 gpm/sq.ft

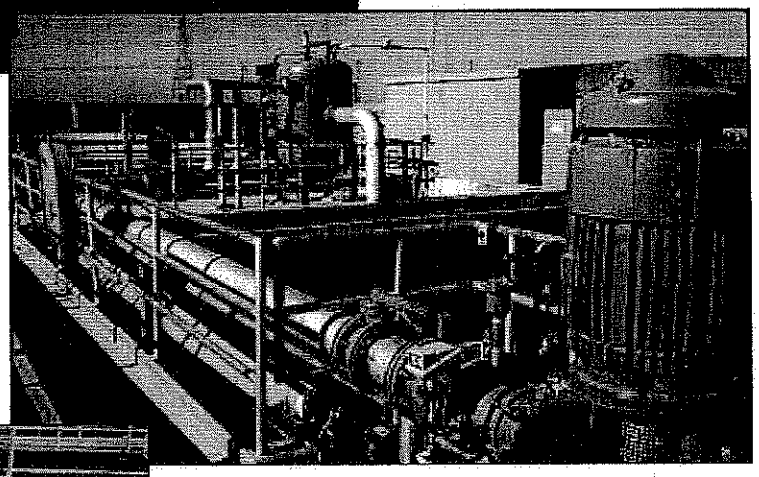


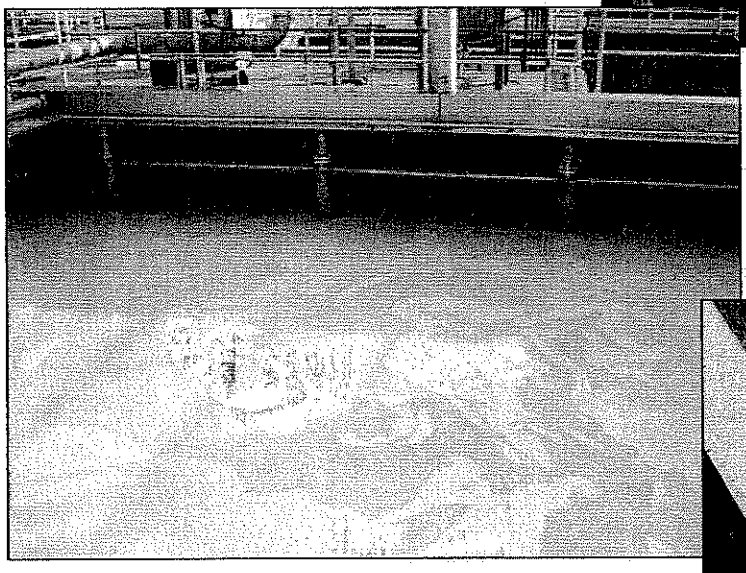
(Left) Aerial of AquaDAF basins at the SSJID, CA – 40-MGD system



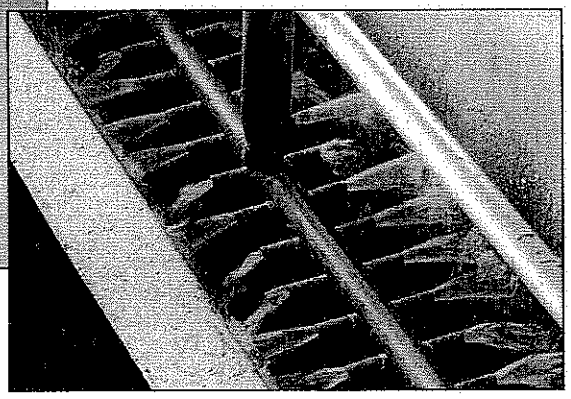
(Left) Dual saturator system at a 200-MGD AquaDAF installation.

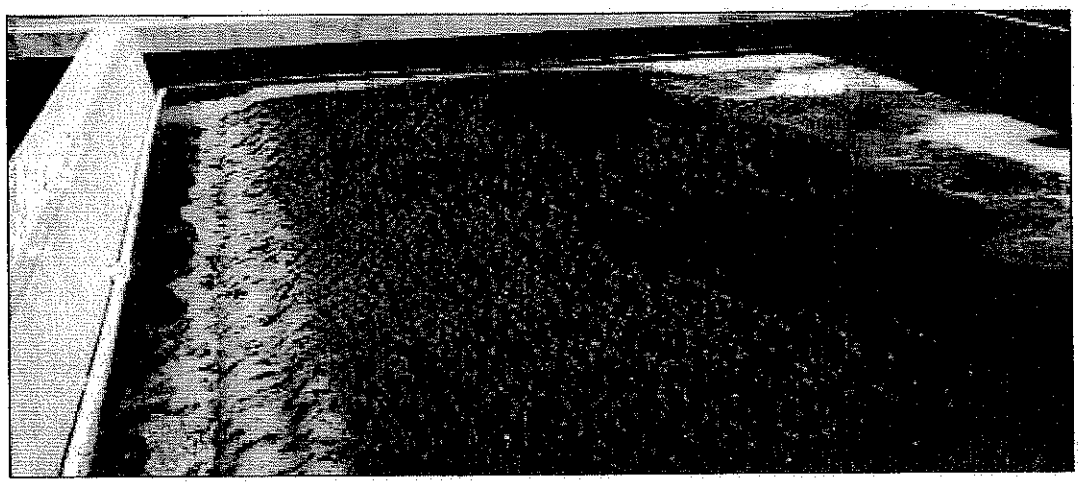
(Below) Typical recycle system



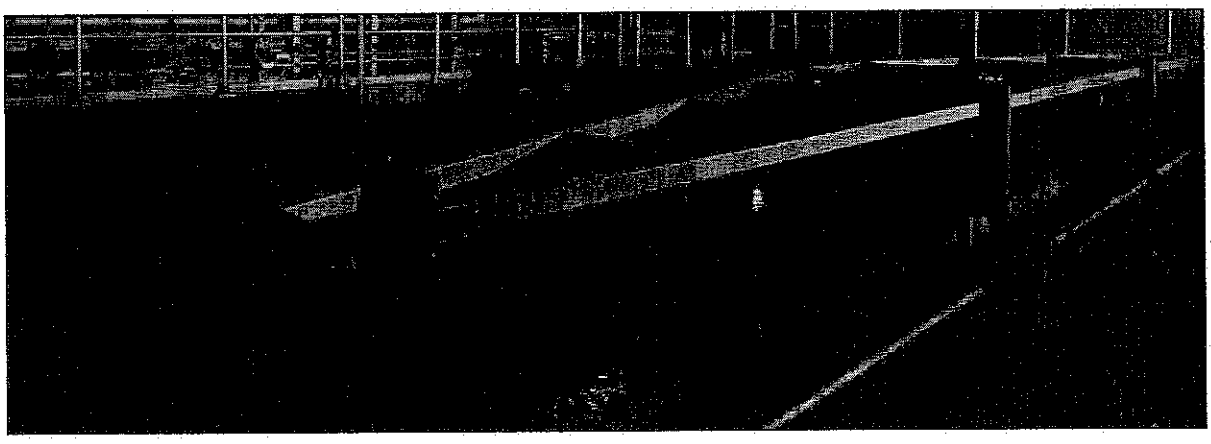


(Left & Below): Air dispersion nozzles and air bed



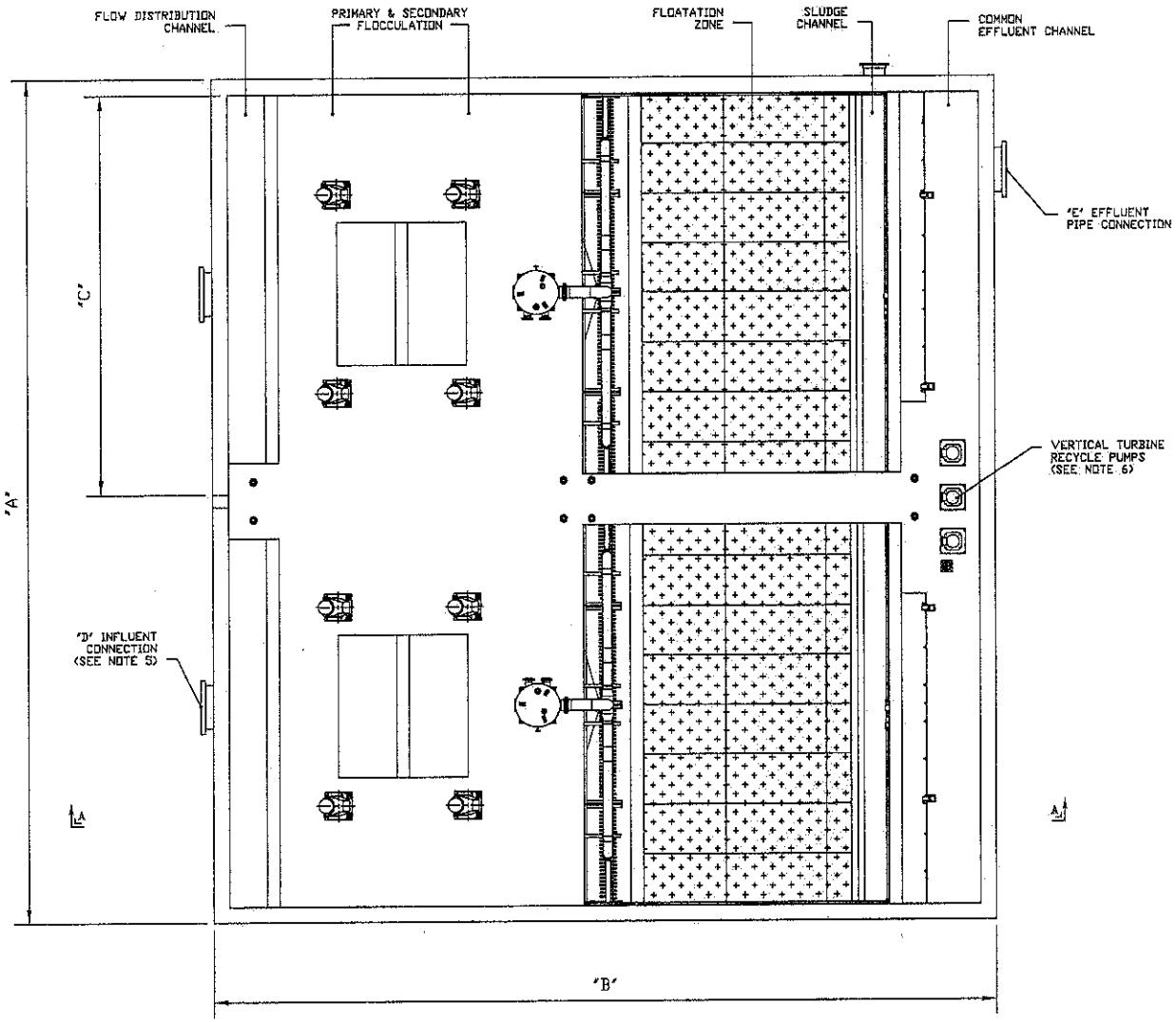


(Above) Hydraulic Sludge Removal: Automated pneumatic effluent weir actuator controls prescribed sludge removal cycle. Sludge blanket flows into sludge trough during removal.



(Above) Mechanical Sludge Removal: Traveling bridge type mechanism

6. PRELIMINARY DRAWINGS



GENERAL LEGEND	SYMBOL	VALUE	UNITS
OVERALL WIDTH	A	39.0	FT
OVERALL LENGTH	B	54.50	FT
UNIT WIDTH (INSIDE)	C	18.0	FT
INLET PIPE DIAMETER	D	16	IN
EFFLUENT PIPE DIAMETER	E	24	IN

NOTES:

1. DRAWING IS CONSIDERED PRELIMINARY & NOT FOR CONSTRUCTION
2. DESIGN OF CONCRETE STRUCTURES IS BY OTHERS
3. DIMENSIONS ASSUME 12" THK. INTERNAL/EXTERNAL WALLS.
4. AIR COMPRESSOR SYSTEM TO BE LOCATED BY ENGINEER
5. INFLUENT/FLOW SPLITTING ARRANGEMENT TBD BY ENGINEER
6. RECYCLE PUMP LOCATION TBD BY ENGINEER

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APP	DATE

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APP	DATE
	ORIGINAL ISSUE				

PROJECT INFORMATION

Infilco Degremont, Inc.
Post Office Box 71390
Richmond, Virginia 23255-1390
(800) 446-1150

	BY	DATE
DRAWN		
CHECKED		
APP		
REV.		

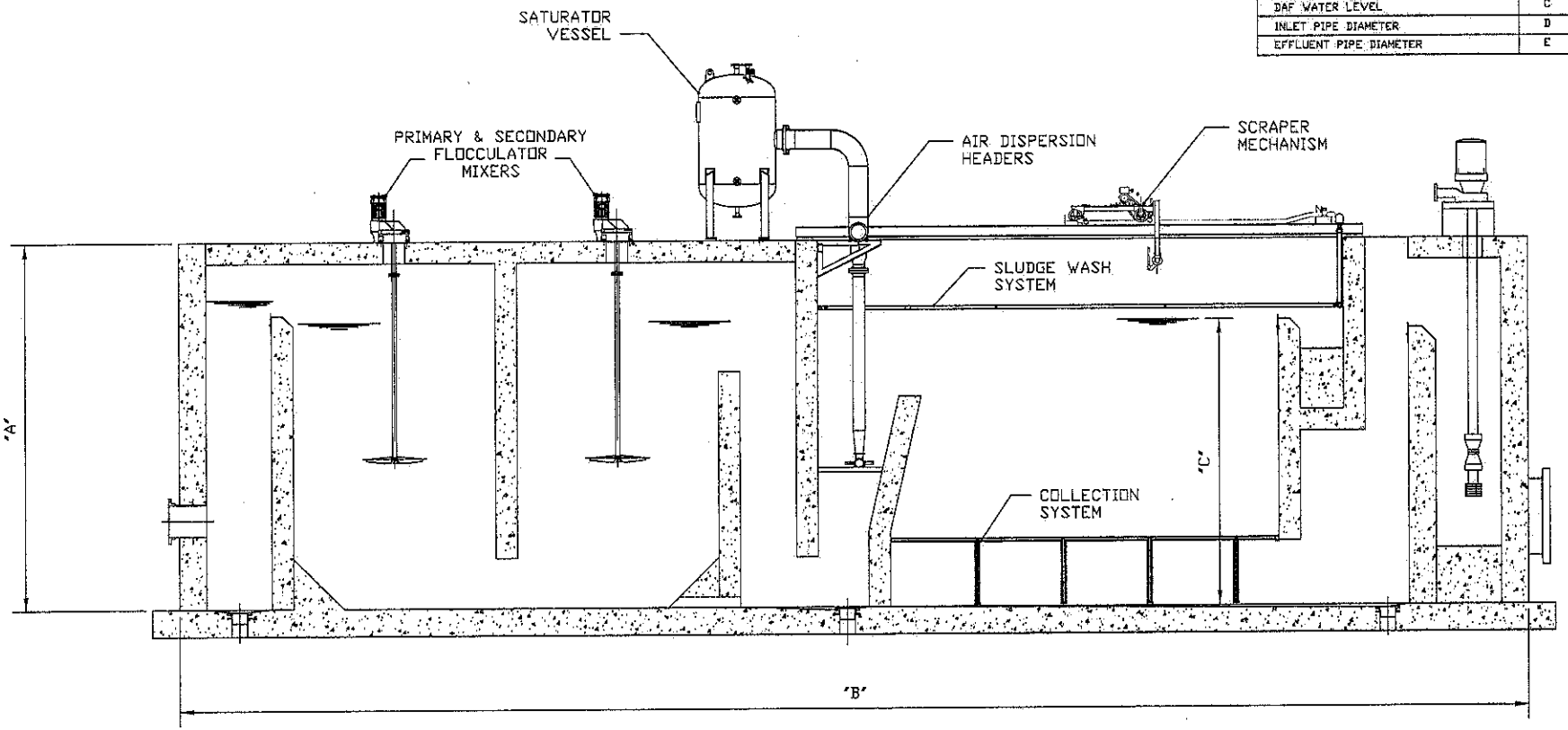
DO NOT SCALE

SCALE NTS

LAYOUT - PLAN VIEW
AQUADAF SYSTEM

SIZE D | DWG. NO. -001 | REV.

GENERAL LEGEND	SYMBOL	VALUE	UNITS
OVERALL HEIGHT	A	12.42	FT
OVERALL LENGTH	B	54.50	FT
DAF WATER LEVEL	C	10.42	FT
INLET PIPE DIAMETER	D	16	IN
EFFLUENT PIPE DIAMETER	E	24	IN



SECTION 'A–A'

NOTES:

1. DRAWING IS CONSIDERED PRELIMINARY & NOT FOR CONSTRUCTION
2. DESIGN OF CONCRETE STRUCTURES IS BY OTHERS
3. DIMENSIONS ASSUME 12" THK. INTERNAL/EXTERNAL WALLS.
4. AIR COMPRESSOR SYSTEM TO BE LOCATED BY ENGINEER
5. INFLUENT/FLOW SPLITTING ARRANGEMENT TBD BY ENGINEER
6. RECYCLE PUMP LOCATION TBD BY ENGINEER

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APP.	DATE
–	ORIGINAL ISSUE				

PROJECT INFORMATION

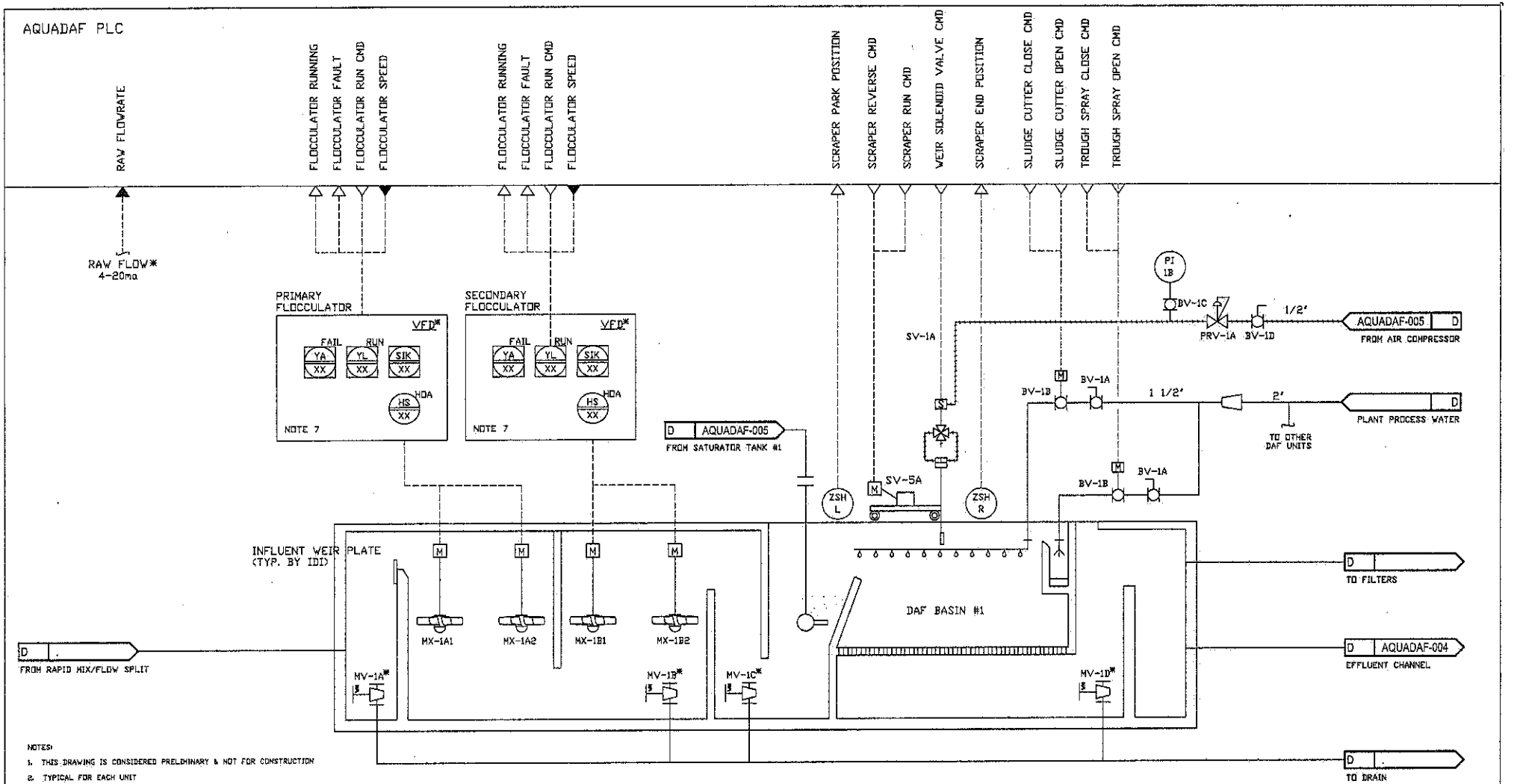
Infilco Degremont, Inc.
Post Office Box 71390
Richmond, Virginia 23255-1390
(800) 446-1150

	BY	DATE
DRAWN		
CHECKED		
APP		
REF		

DO NOT SCALE
SCALE NTS

LAYOUT - SECTION
AQUADAF SYSTEM

SIZE D | DWG -002 | REV



NOTES:

1. THIS DRAWING IS CONSIDERED PRELIMINARY & NOT FOR CONSTRUCTION
2. TYPICAL FOR EACH UNIT
3. AQUADAF PLC SHALL BE LOCATED IN THE AQUADAF LOCAL CONTROL PANEL
4. RAW FLOW CONTROL & FLOW SPLITTING DESIGN BY ENGINEER
5. (*) INDICATES ITEMS NOT BY IDI
6. ALL INTERCONNECTING PIPING (DRAINS, INLET, OULET, AIR, ETC) ARE NOT BY IDI
7. VFD'S SHOWN ARE TYPICAL ONLY

REV	REVISION DESCRIPTION	DRAWN	CHECKED	APP	DATE
–	ORIGINAL ISSUE				

PROJECT INFORMATION

Infilco Degremont, Inc.
Post Office Box 71390
Richmond, Virginia 23255-1390
(800) 446-1190

	BY	DATE
DRAWN		
CHECKED		
APP.		

DO NOT SCALE
SCALE NTS

P&ID (TYPICAL)
AQUADAF SYSTEM
HYDRAULIC SLUDGE

SIZE D | DWG. NO. -003 | REV.

7. BUDGET PRICING

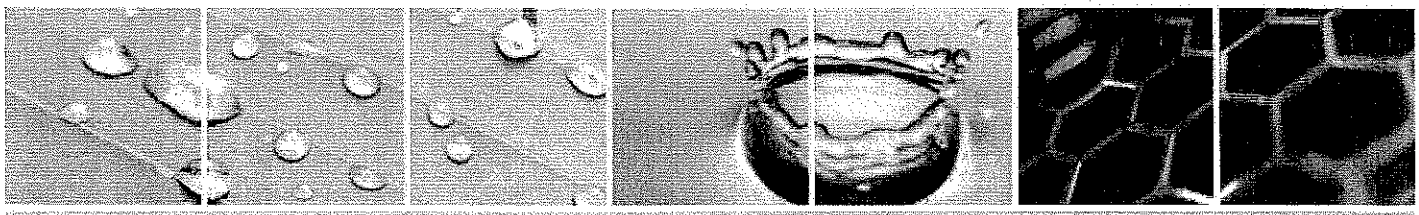
IDI's current budget price for the complete AquaDAF® system described above, including freight to jobsite (within North America), is **$LATER**. This price will be valid for 90 days. Our price is based on IDI's standard terms and conditions, which can be provided upon request.

8. PRODUCT BROCHURE

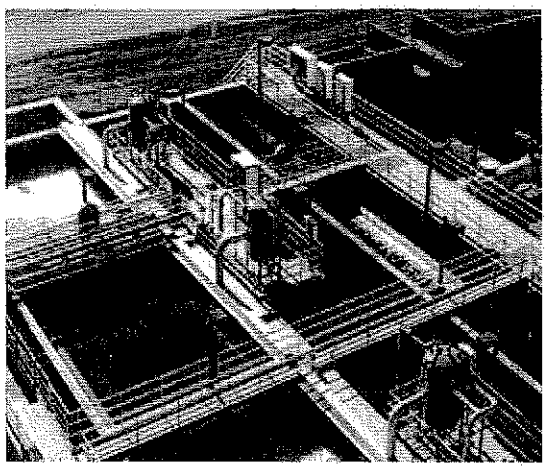
INFILCO

AQUADAF®

Clarifier



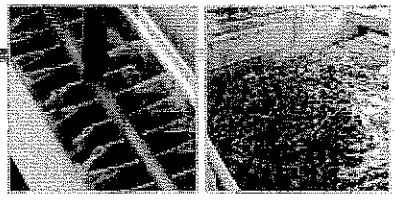
- Drinking Water Clarification
- Membrane (UF, MF, RO) Pretreatment
- Tertiary TSS and Phosphorous Removal
  TOC and Color Removal
- Cold Water Treatment
- Conventional Basin Retrofit
  Desalination Pretreatment
- Filter Backwash Recovery/Thickening



AquaDAF® is a high-rate clarifier for low-turbidity and algae-laden surface waters. The AquaDAF® clarifier's uniquely engineered effluent collection system provides operating rates unequaled by conventional flotation technologies. The result is increased capacity for existing or new treatment facilities with no minimal space required.

MAIN FEATURES

- → Compact footprint - 10 to 20 gpm/ft² DAF loading rate
- → All stainless steel recycle system
- → No, or limited, polymer use
- → Start-up & shutdown within minutes
- → Ideal membrane pretreatment technology - increased flux rates
- → Hydraulic or mechanical sludge removal options



ENHANCED DISSOLVED AIR FLOTATION TECHNOLOGY

Dissolved Air Flotation (DAF) is an excellent solution for clarifying water with high levels of algae and other low-density solids that cannot be removed efficiently by sedimentation. The AquaDAF® clarifier combines conventional DAF principles with several enhanced components, including a unique effluent collection system. This and other process improvements allow efficient hydraulics within the DAF flotation zone at superior surface loading rates.

AQUADAF®

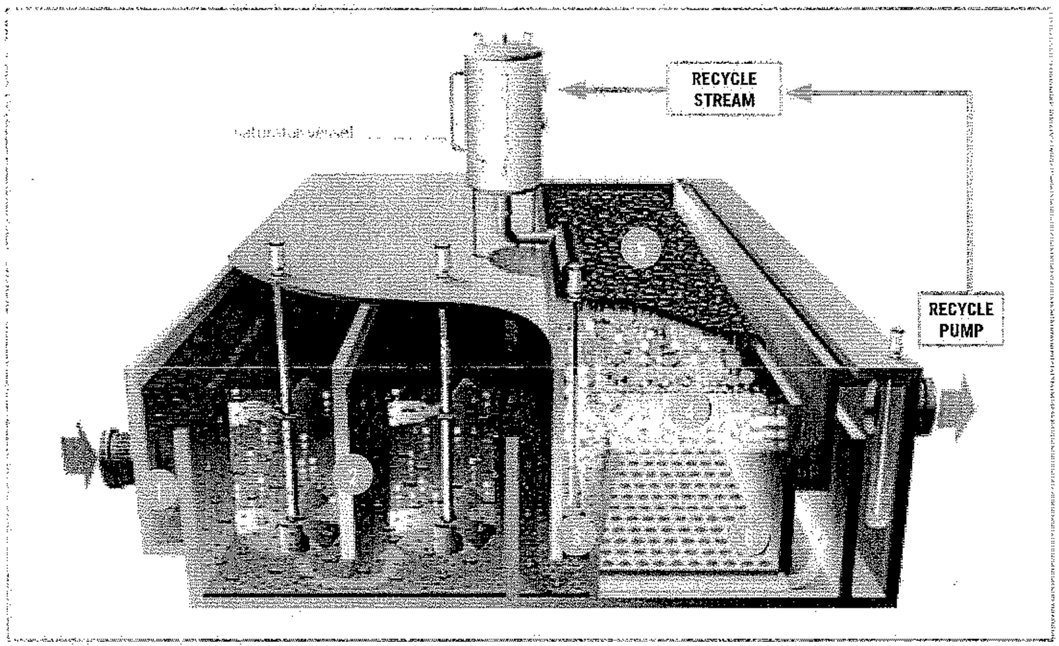
HOW IT WORKS

1 **RAW WATER INLET:** Coagulated water from an in-line rapid mixer enters a flow distribution channel prior to the flocculation zone. Coagulation is the destabilization of colloidal particles, which facilitates their aggregation and is achieved by the injection of a coagulant, such as alum or ferric chloride.

2 **FLOCCULATION ZONE:** Coagulated water is equally split to each unit, with traditional 2-stage tapered energy flocculation with variable frequency mixers. In this step, the destabilized particles agglomerate and form larger floc particles. The AquaDAF® flotation process requires only the formation of light, pinpoint particles, eliminating or significantly reducing the need for flocculant polymers. Additionally, the retention time employed in this stage is generally between 8 to 10 minutes.

3 **AIR-WATER DISPERSION ZONE:** Flocculated water is then transitioned to the base of the flotation zone, where it passes through the injection of a saturated air-water recycle stream. This recycle stream is produced by recycling 8-12% of clarified or filtered water to a pressurized saturator vessel (70 to 90 psi). The recycle stream is then depressurized through a series of release nozzles, which are submerged and span the entire width of this transition zone. This depressurization creates thousands of micro bubbles, which disperse into the flotation zone.

4 **FLOTATION ZONE:** The principle behind the flotation process is the micro-bubbles which will form a dense air blanket within the flotation zone. The flocculated particulate will agglomerate with the micro-bubbles, as they rise to the surface, subsequently clarifying the water.



AquaDAF®

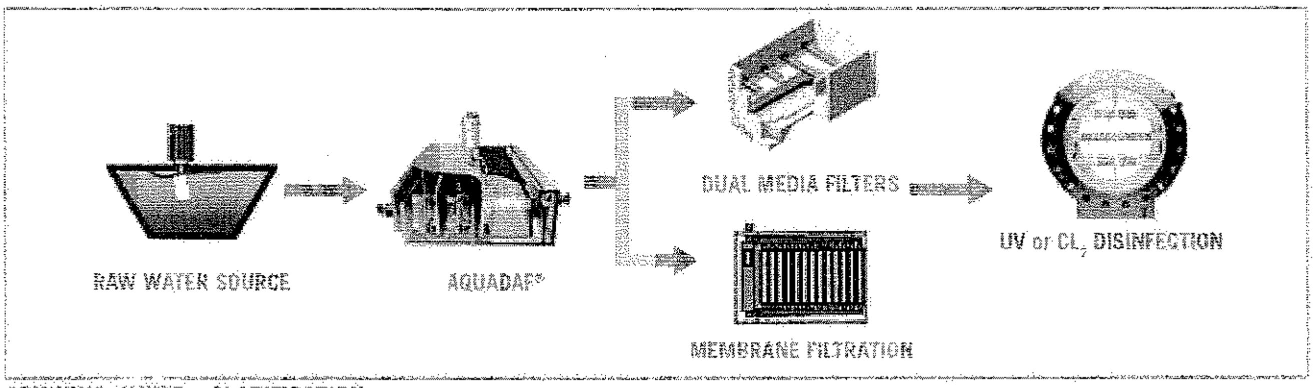
5 **SLUDGE ACCUMULATION:** The floated solids accumulate on the surface of the AquaDAF® resulting in a thick sludge layer. Sludge may be removed with one of two methods:

- Hydraulically, whereby an automatic effluent weir rises in a prescribed time. Subsequently, the flotation zone water level rises and the sludge is removed to an integral sludge trough.
- Mechanically, whereby a traveling bridge scraper mechanism will penetrate and scrape the solids layer into the integral sludge trough.

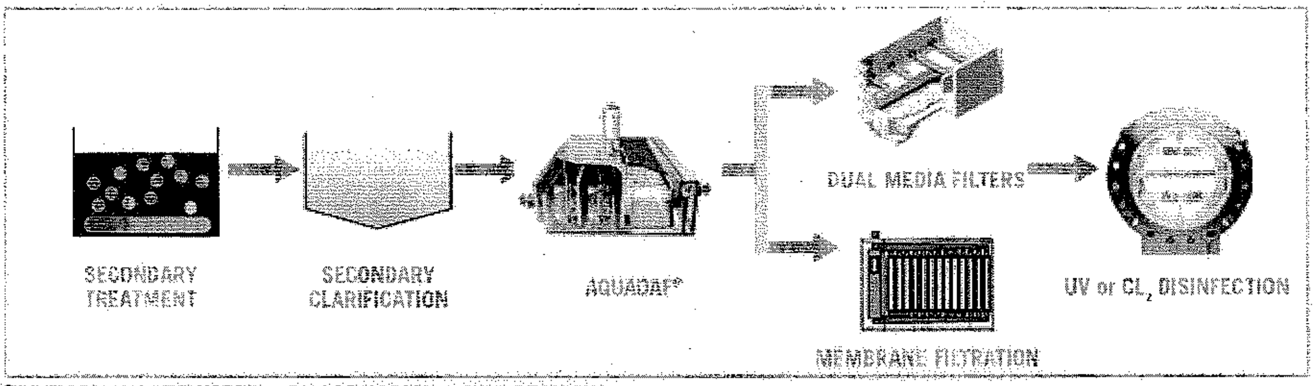
6 **COLLECTION:** Clarified water is collected uniformly across a perforated collection floor. This uniquely engineered system, in combination with other process enhancements, creates resistance over the flotation zone, resulting in uniform collection and efficient hydraulics throughout the basin. The result is the ability to handle high downward velocities and DAF loading rates significantly higher than conventional DAF processes.

Product Highlights

> Efficient removal of low-density particles
> Polymer-free membrane pretreatment
> Clarification of water with low turbidity
> Cold water treatment
> Filter backwash applications



DRINKING WATER - CLARIFICATION



TERTIARY WASTEWATER – PHOSPHORUS & TSS REMOVAL

PERFORMANCE ADVANTAGES

- Clarified turbidity less than 1 NTU
- Algae removal greater than 90%
- Flocculation time of less than 10 minutes
- Phosphorus removal less than 0.1 mg/l TP
- Thickened sludge of 2-4 %

DESIGN SPECIFICATIONS

	Single Unit Capacity
AquaDAF® 10 - 20 gpm/ft²	MGD
	0.5 to 25

DESIGN OPTIONS

- Hydraulic or mechanical sludge removal
- Package Systems - Nine standard package units from 100 gpm to 1,750 gpm (with or without filters)

Technical Features

→ Flexible layout options
→ Customize to any size plan
→ Loading Rates: 10 to 20 gpm/ft²
→ No or limited polymer use
→ Polymer free membrane pretreatment
→ Efficient for cold water clarification
→ Unit heights 10 to 14 feet
→ Start-up and shutdown within minutes
→ Retrofit existing sedimentation basins
→ Common wall layout with our Greenleaf® Filter

AQUADAF®

COMPLETE TREATMENT SOLUTIONS

Infilco Degremont offers an array of water, wastewater and industrial treatment solutions for any size client. Headworks, clarification, filtration, biological and disinfection systems are several of the product disciplines in our portfolio.

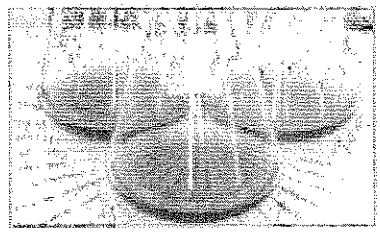
With a variety of filtration and clarification products in our SEPARATIONS department, Infilco engineers carefully evaluate each application to provide the most cost-effective and efficient treatment solution.

If interested in this product, check out some of the complementary SEPARATIONS products:

- Superpulsator® Clarifier
- Accelator® Clarifier-Softener
- Greenleaf® Filter System
- Tetra™ Block Underdrains
- DensaDeg® Clarifier/Thickener
- Monoflor® Nozzle Underdrains
- ABW® Automatic Backwash Filter
- PulsaPAK® Package Clarifier/Filter System
- AquaPAK Package Clarifier/Filter System
- AccelaPAK® Package Clarifier-Softener/Filter

PILOTING SERVICES

Infilco offers pilot systems and services for the equipment in this brochure as well as many of our other product offerings. Pilot studies are a practical means of optimizing physical-chemical and biological process designs and offer the client several benefits, such as:



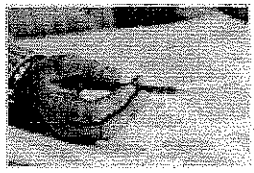
- Proof of system reliability
- Optimal design conditions for the full-scale system
- Free raw water lab analysis
- Regulatory approval

If interested in a pilot study for your system, please contact us for a proposal.

SERVICES INFILCare®

Part Sales

Infilco Degremont sells parts and components for most INFILCO brand equipment as well as parts for demineralizers, thickeners, nozzles, pressure filters, and valves. We offer reliable spare parts at competitive prices. We maintain records of previous installations to quickly identify your requirements. Many items are shipped directly from stock for quick delivery.



Rebuilds, Retrofits and Upgrades

Infilco Degremont offers cost-effective rebuilds and upgrades for INFILCO provided systems, no matter what year they were built. If you are interested in an economical alternative to installing a whole new system, contact us for a proposal.

PARTNER WWW.DEGREMONT-TECHNOLOGIES.COM

Infilco Degremont Inc.
8007 Discovery Drive
Richmond, VA 23229-8605, USA
Tel: +1 804 756 7600
Fax: +1 804 756 7643
info-infilco@degtec.com

Degrémont Limitée
1375, route Transcanadienne,
Bureau 400
Dorval (Qc) H9P 2W8, Canada
Tel: +1 514 683 1200
Fax: +1 514 683 1203
info-canada@degtec.com

Manufacturers' Representative:

Attachment 4B – Siemens/Envirex FLOAT-TREAT

From: Mike Sullivan
To: Desmarais, Terry
Subject: FW: Portsmouth NH WWTF
Date: Thursday, September 23, 2010 9:16:33 AM
Attachments: DAFT Brochure.pdf
315 Binder Drawings - Rectangular DAFT.pdf

Dear Terry,

I looked this over briefly. If you have any questions, please feel free to call my cell (508-878-1016).

Thanks,

Mike Sullivan
DAVID F. SULLIVAN & ASSOC., INC.
19 Batchelder Road, Suite 2B
Seabrook, NH 03874
Phone: 603-474-2484
Fax: 603-474-3682
www.davidfsullivan.com

From: Selle, William H (WT) [mailto:William.Selle@siemens.com]
Sent: Wednesday, September 22, 2010 5:05 PM
To: mikesullivan@davidfsullivan.com
Cc: Davis, Bryan N (WT); Kaiser, Dennis K (WT); Thiel, Donald J (WT)
Subject: RE: Portsmouth NH WWTF

Mike:

Dennis Kaiser forwarded me your e-mail below. The desired retrofit to DAF thickeners sounds like it can work.

If I assume a MBBR effluent of 350 mg/l and no polymer, then the (4) existing tanks can handle the peak flow condition. However, we probably should consider flash mixing/flocculation just in case the MBBR pushes more solids through the system. The budgetary price for the DAFT equipment for all (4) units is $974,200. This includes the top skimmer, bottom collector, pressurization system, flash mixer, flocculation, electrical controls and field service. It does **not** include interconnecting piping or installation.

Add another $20,000 for freight.

I have attached a sketch of a concrete DAFT and a brochure. Let me know if you need additional information or if the scope changes.

Best regards,

Bill Selle, PE
Senior Technical Manager – Chain & Scrapers

Siemens Water Technologies
P.O. Box 1604
Waukesha, WI 53187-1604
Ph. 262.521.8317
Fax 262.521.8553
Cell 262.442.0018
william.selle@siemens.com
www.water.siemens.com

From: Kaiser, Dennis K (WT)
Sent: Tuesday, September 21, 2010 6:20 PM
To: Thiel, Donald J (WT); Selle, William H (WT)
Cc: Davis, Bryan N (WT)
Subject: FW: Portsmouth NH WWTF

Guys,

Here's a more pressing request for a DAF design and budget number. Is this something one of you might be able to get to by close of business tomorrow Wednesday?

Dennis Kaiser
Technical Sales Manager - Chain Products
Siemens Water Technologies Corp.
1901 S. Prairie Ave.
Waukesha, WI. 53189
E-mail Dennis.Kaiser@Siemens.com
Phone (262) 521-8461
Fax (262) 521-8553
Cell (414) 322-1904
www.water.Siemens.com

From: Davis, Bryan N (WT)
Sent: Tuesday, September 21, 2010 2:09 PM
To: Kaiser, Dennis K (WT); Thiel, Donald J (WT)
Cc: Schmidt, Steven R (WT)
Subject: Fw: Portsmouth NH WWTF

Bryan Davis
Siemens Water Technologies
Cell: 262-617-3870

Sent from my Blackberry device

From: Mike Sullivan <mikesullivan@davidfsullivan.com>
To: Schmidt, Steven R (WT); Davis, Bryan N (WT); Thiel, Donald J (WT)
Cc: Engelsman, Stuart (WT)
Sent: Tue Sep 21 14:46:24 2010
Subject: Portsmouth NH WWTF
Gentlemen,

Brown & Caldwell Engineers have been working on a preliminary design effort evaluating alternatives to convert this existing facility to secondary treatment. AECOM has been hired to do a value engineering effort and their concept is to utilize an MBBR followed by a dissolved air floatation clarifier. They would like Siemens/Envirex's input on the clarifier/DAF technology. If we have a process that could be applicable for the described system, they would like sizing and budget pricing no later than tomorrow. I would appreciate your review of the information contained herein and a phone call regarding our ability to follow through on this request. If necessary, feel free to call Terry Desmarais at AECOM directly for additional input.

Thanks for your help on this.

Regards,

Mike Sullivan
DAVID F. SULLIVAN & ASSOC., INC.
19 Batchelder Road, Suite 2B
Seabrook, NH 03874
Phone: 603-474-2484
Fax: 603-474-3682
www.davidfsullivan.com

From: Desmarais, Terry [mailto:Terry.Desmarais@aecom.com]
Sent: Tuesday, September 21, 2010 1:33 PM
To: mikesullivan@davidfsullivan.com
Subject: Portsmouth NH WWTF - DAF sizing

Mike,

We are looking to get a proposal for a DAF clarifier following an MBBR for the referenced project. The concept is to retrofit eight existing rapid sand filter bays with a treatment technology for conventional secondary level treatment. We have quotes from different MBBR suppliers and want to clarify/separate solids with dissolved air units. Our hope is to use 4 existing bays for the MBBR and 4 existing bays for the DAFs. The DAFs can be set on a new floor within the limits of the existing bays. Each bay is approximately 30'x16' as shown on the attached drawings. More drawings are available if needed.

We owe the City a summary of the proposed units by Thursday AM, so therefore need a sizing and

generic information on the DAF by the close of business tomorrow. We would like a full proposal including costs by the end of the week.

Design criteria are as follows:
Q average day = 5.0 MGD
Q peak hour = 7.5 MGD
MBBR effluent/DAF Influent solids = unknown (I'm working on getting this info from the supplier but if you have generic solids values for MBBR effluent please use that for now)

The proposed system is enhanced primary treatment (CEPT effluent BOD 75 to 85 mg/L and TSS 55 to 65 mg/L) which will be followed by fine screening to 6 mm upstream of the MBBR.

Please call with any questions.

Thank you,

Terry

Terry Desmarais, Jr., P.E.
Project Manager
AECOM Water
D 207.541.2007
C 207.807.8376
terry.desmarais@aecom.com

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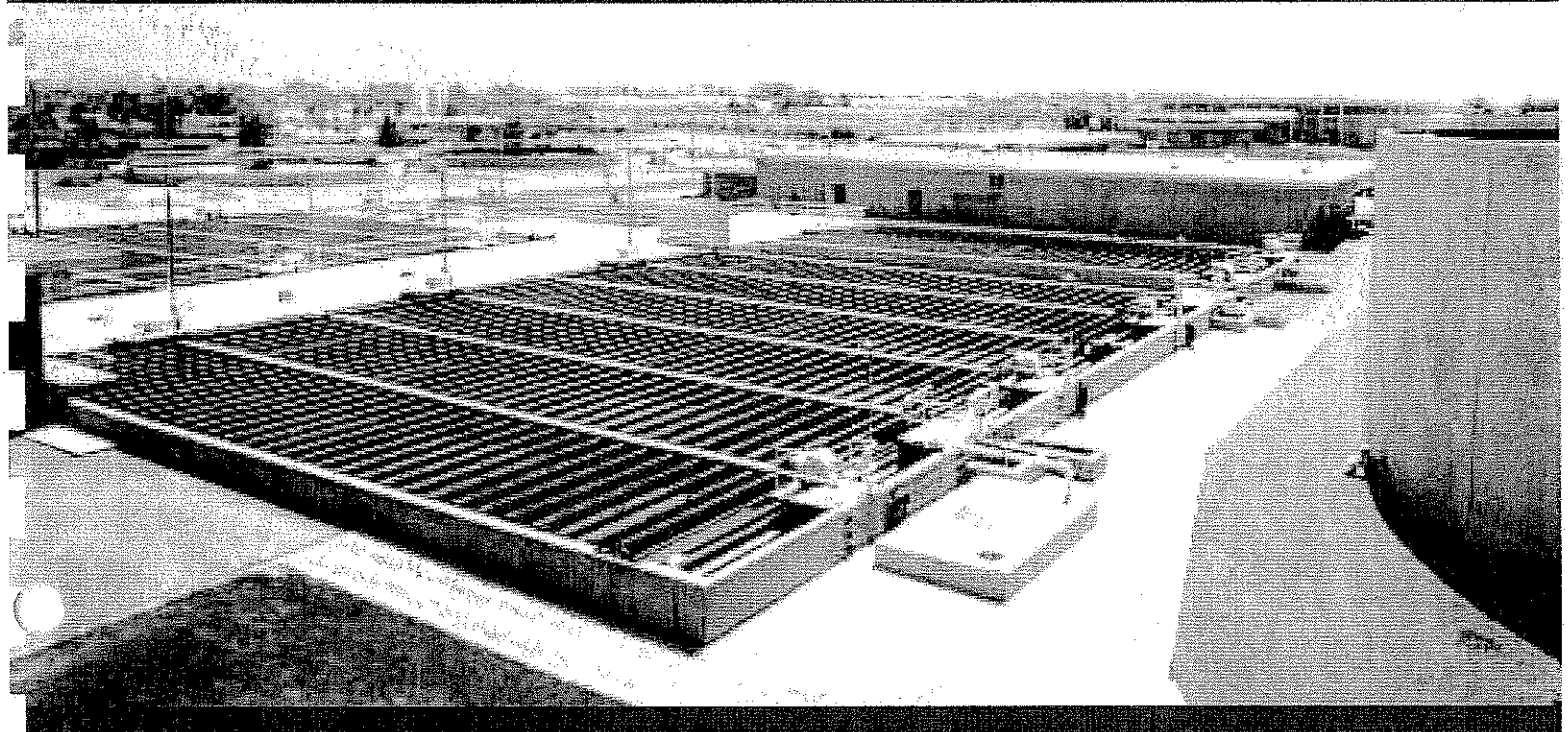


100% water

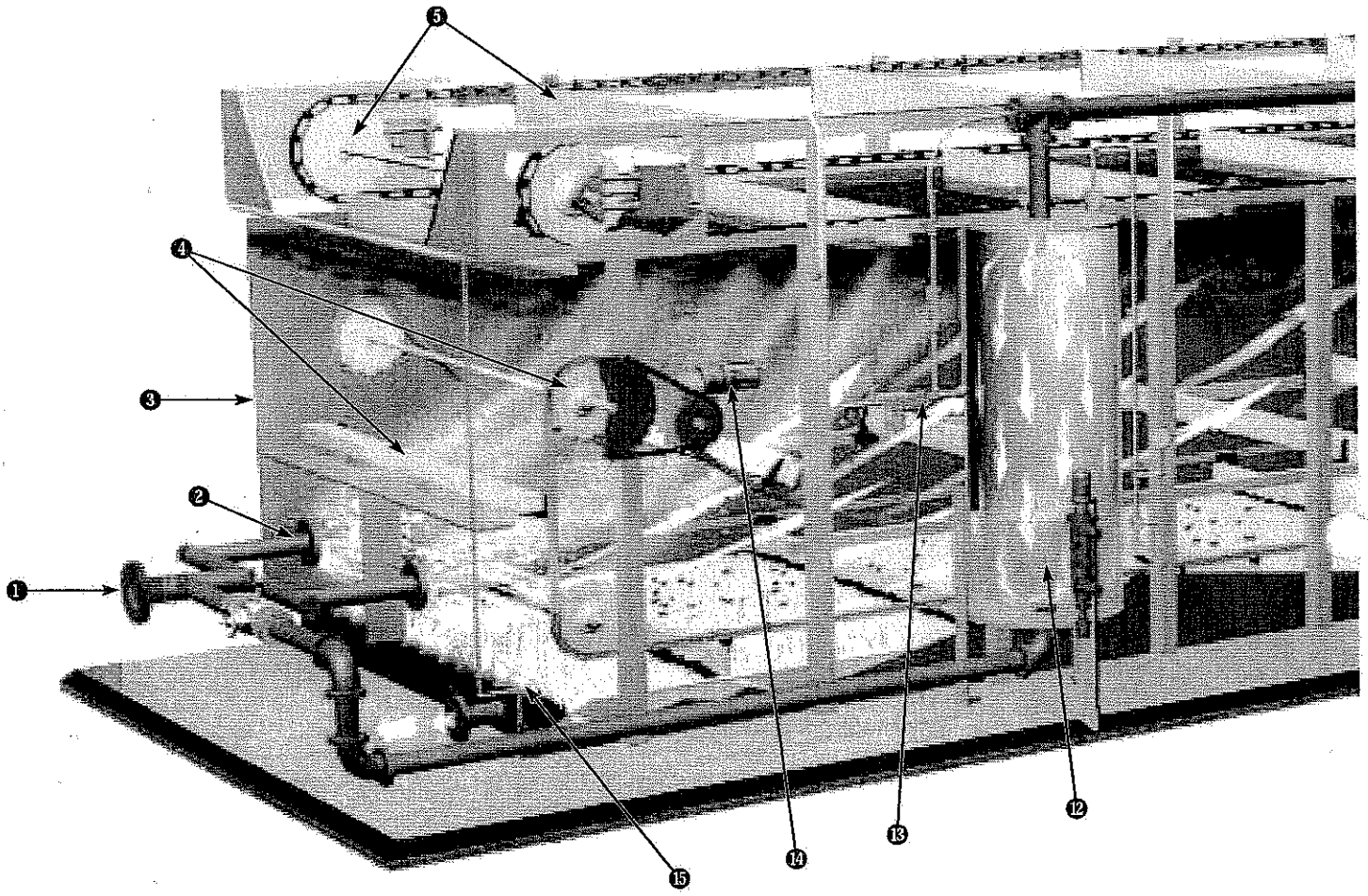
U.S. FILTER

ENVIREX

Taking care of the world's water.

FLOAT-TREAT®

THICKENERS

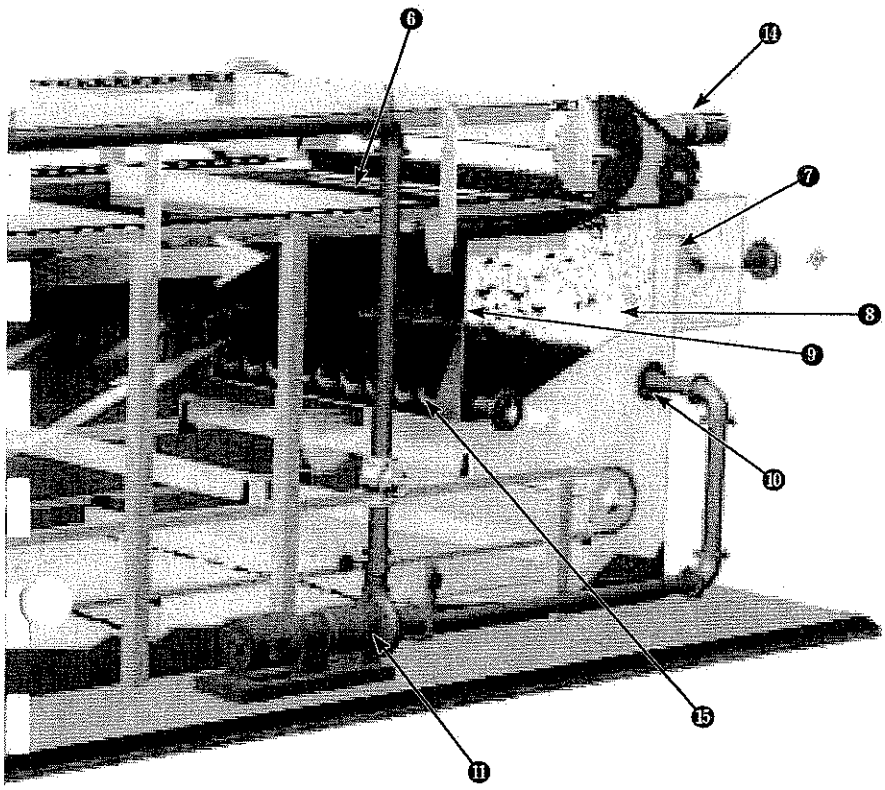


Float-Treat® thickeners have compiled outstanding performance records for solids concentrating on water and wastewater sludges. Plants have obtained 5% total solids and more on biological sludges alone, far surpassing the performance of conventional gravity type systems.

With the Float-Treat thickener, millions of tiny air bubbles float solids to the tank surface, forming a highly concentrated sludge blanket. The compacting effect of the continuous supply of air bubbles results in a sludge density much greater than normally obtained by gravity sedimentation. Skimmers remove the thickened sludge at the end of the tank for disposal.

An important principle of the Float-Treat thickener is the introduction of air into an external liquid source such as recirculated effluent, blending this flow with the raw flow. The recycle liquid is pumped at elevated pressure to a saturation tank where air is introduced. While flowing through the tank, the maximum possible quantity of air is dissolved in the recycle stream.

This air-saturated stream is then blended with the sludge to be thickened and introduced to the Float-Treat tank. As the stream enters the tank, it impinges on circular, concave baffles (reaction jets) which assure thorough, rapid blending and dispersion throughout the cross-section of the flow-thru zone.



1. SLUDGE INLET PIPING

2. BLENDING AND DISTRIBUTION SYSTEM Sludge and pressurized flow enter the Float-Treat thickener through the inlet manifold. As the blended stream enters the tank, it impinges on concave reaction baffles for thorough diffusion across entire cross section of flow-thru zone. Inlet piping and reaction jets are carefully sized and located for correct velocities, proper bubble formation and thorough blending.

3. FLOAT TREAT THICKENER TANK
May be of concrete or steel as illustrated. Basin sizes selected to provide the optimum in sludge concentration for each application. A wide range of tank sizes available to suit local site conditions.

4. POSITIVE GRIT REMOVAL
Conveyor sludge collector scrapes non-floatable material to a hopper for removal.

5. SKIMMERS
Remove thickened sludge from tank surface. Pivoting skimming flights assure removal of scum at highest possible solids concentration.

6. SKIMMER BEACH
Two skimmer blades may be positioned at one time on extra long beach to assure maximum sludge removal capacity. Sludge carried upon beach is positively confined between blades, assuring high quality effluent.

7. EFFLUENT WEIR
Adjustable for control of water skimming depths.

8. THICKENED SLUDGE TROUGH
Screw conveyor may be employed in trough to aid sludge removal for further disposal.

9. SLUDGE RETENTION BAFFLE
Allows optimum sludge blanket formation and retains floated solids in thickening zone.

10. SOURCE OF PRESSURIZED FLOW
Is generally plant or screened primary effluent. An alternative pressurized flow line is provided since thickener effluent, in some cases, may be used as an alternative source for pressurized flow.

11. RECYCLE PUMP
Selected to provide optimum volume of pressurized flow to insure adequate supply of bubbles for flotation and thickening.

12. RECYCLE SATURATION TANK
Recycle water and air are blended under pressure. Tank is built and tested to conform to rigid code requirements. Positive liquid level control assures maximum saturation of pressurized flow. Correct pressure and flow is maintained throughout recycle system by simple controls for all flow conditions.

13. AIRLINE
Proper amount of air is fed directly into the inlet tee associated with the pressure tank for optimum saturation.

14. DRIVE MECHANISMS
For Skimmer and Scraper Conveyors.

15. SCREW CONVEYOR
Employed to concentrate and convey solids to one side of tank for removal.

CHEMICAL TREATMENT

Float-Treat thickeners have proven exceptionally effective in concentrating chemically treated sludges as well as sludges floated without the use of chemicals. When chemicals are employed, loadings have been increased up to 300% with some increase in float solids concentrations. The versatility of the Float-Treat thickener allows the user the choice of operating with or without chemicals depending on the best economics for each situation.

■ DESIGN FLEXIBILITY – The widest choice of tank sizes to suit any requirement . . . concrete or steel tanks, new or existing installations . . . available for use with or without chemical addition.

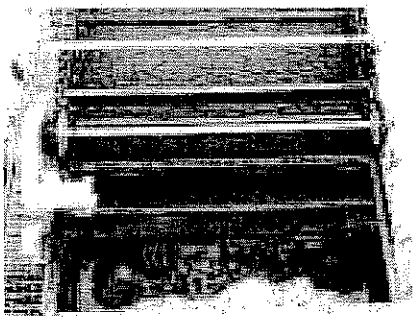
■ ADVANTAGES – Unlike a gravity belt thickener or centrifuge, a Float Treat thickener provides grit removal, doesn't require polymer use. Its rectangular design also permits easy weir adjustment, true plug flow operation without short circuiting, and the use of long lasting, low maintenance non-metallic components.

■ CONTROLLED RESULTS – Correct pressurized flow is selected for each application . . . controlled air with mechanical adjustment assures minimum optimum usage with maximum quantity of bubbles . . . controlled flow distribution and blending with recycle flow introduced in raw flow inlet pipe . . . reaction jet baffles assure proper distribution across full width and depth of flow-thru zone . . . controlled skimmer speed to assure the maximum sludge withdrawal rate consistent with optimum sludge concentration.

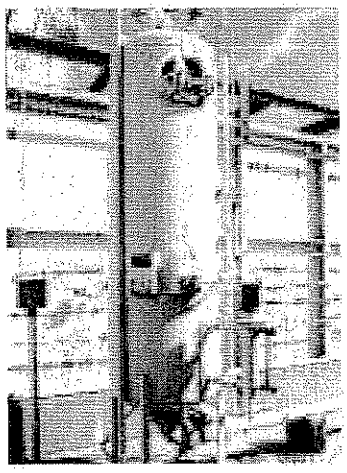
■ EFFICIENT, LOW-COST PERFORMANCE – Assured by use of simplified, standard components. Sound, proven hydraulic design assures economical basin construction.

■ LOW PUMPING REQUIREMENTS – By assuring optimum air saturation with exclusive pressure tank design, the minimum amount of pressurized flow is needed thus reducing cost of pumping equipment, pressure vessels, controls and pumping costs.

■ BENCH SCALE TESTING – Practically all biological sludges are amenable to thickening, to some degree, with Float-Treat. The design loadings, air and recycle requirements and anticipated results can be established confidently by bench scale studies.



This steel tank Float-Treat thickener, complete with walkways, produces a solids concentration of better than 4%.



The pressurization vessel is responsible for greater than 90% dissolution efficiencies of air into the recycle flow.

To find out more about how to put U.S. Filter to work for you, contact us at:

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Waukesha, WI 53187
414.547.0141 *phone*
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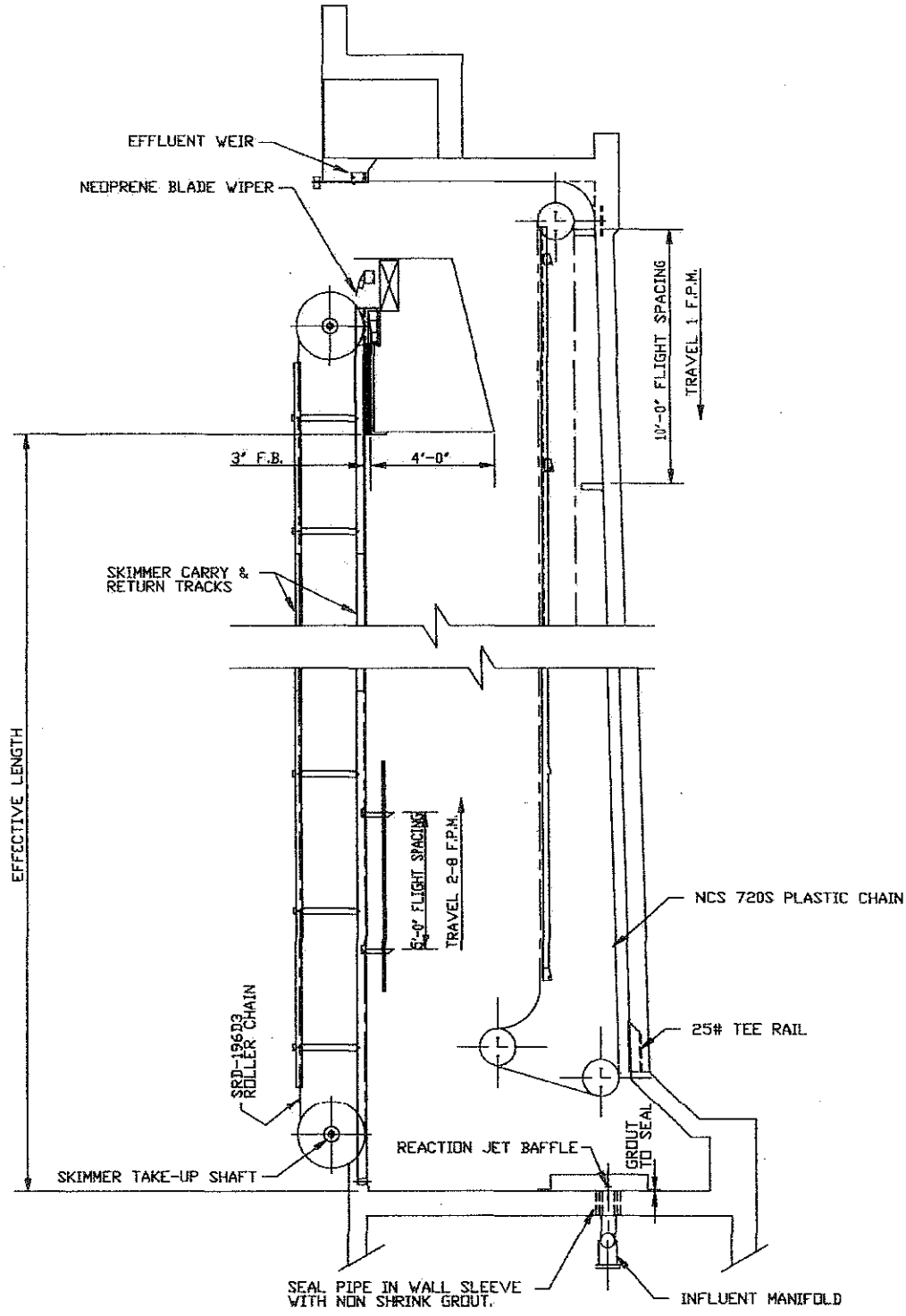
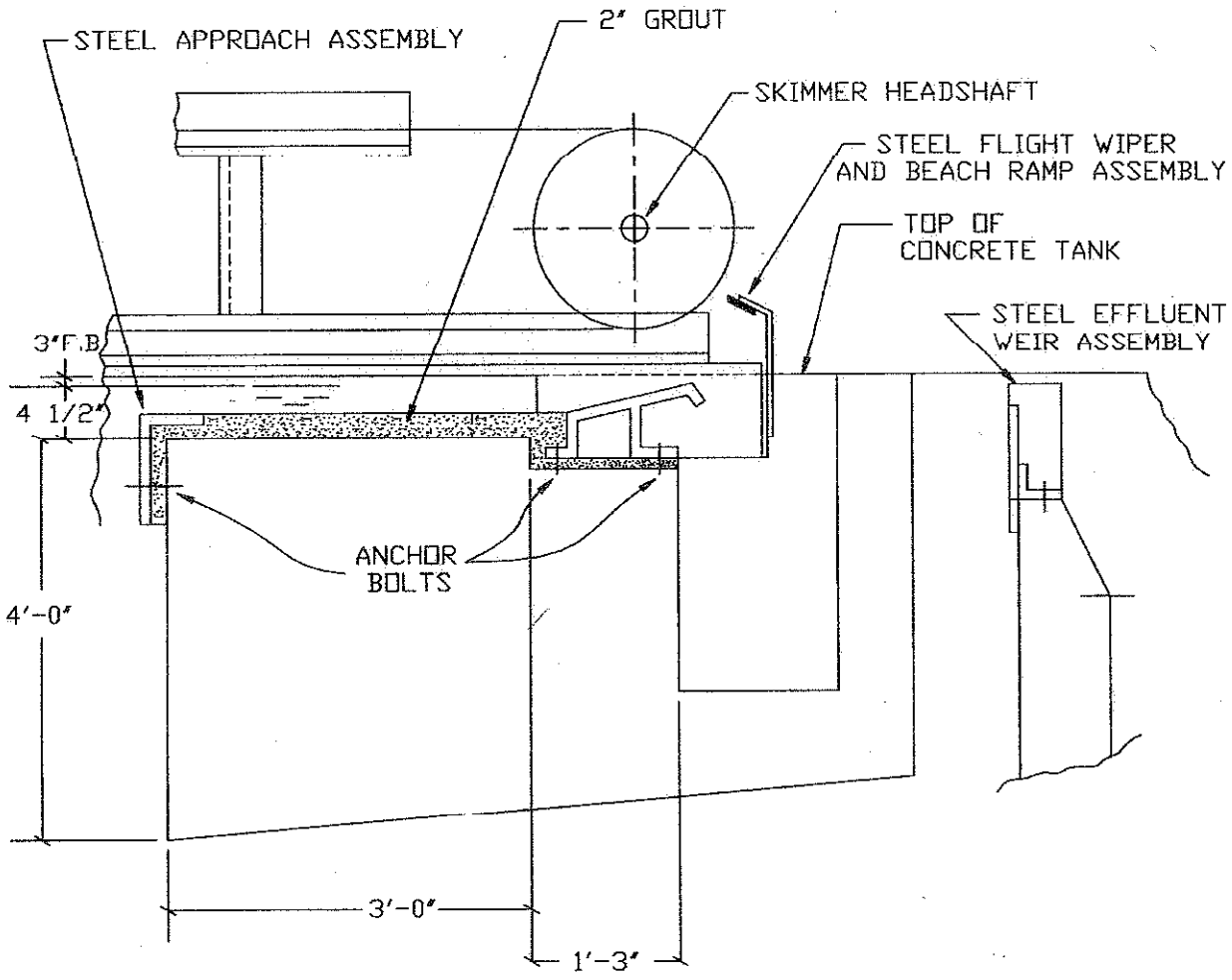
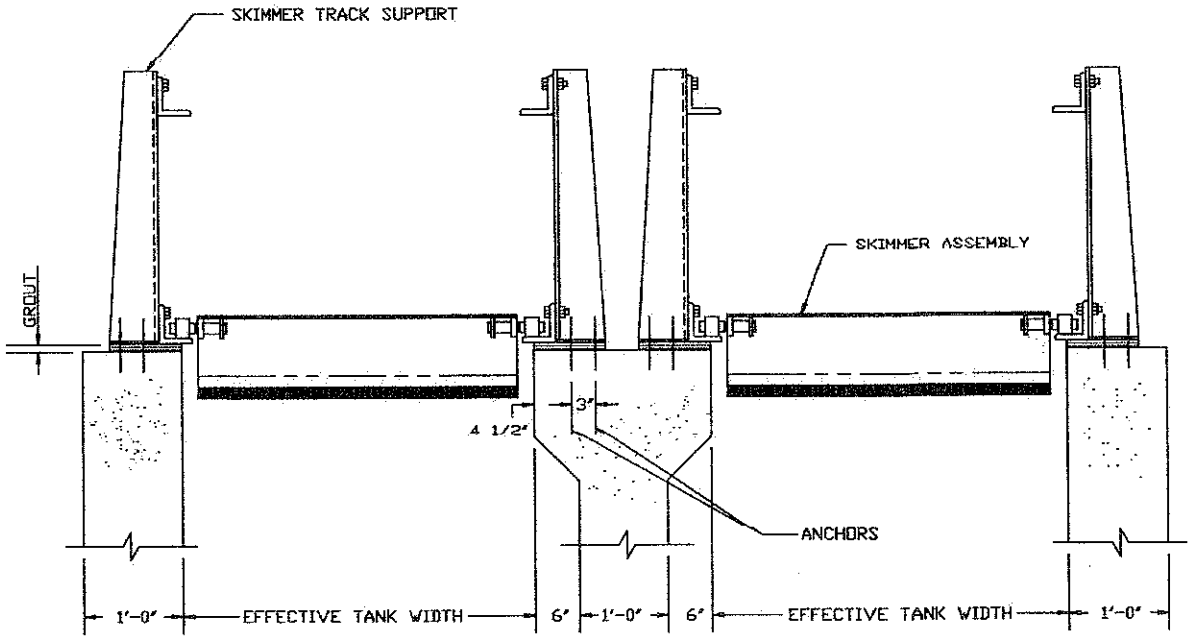


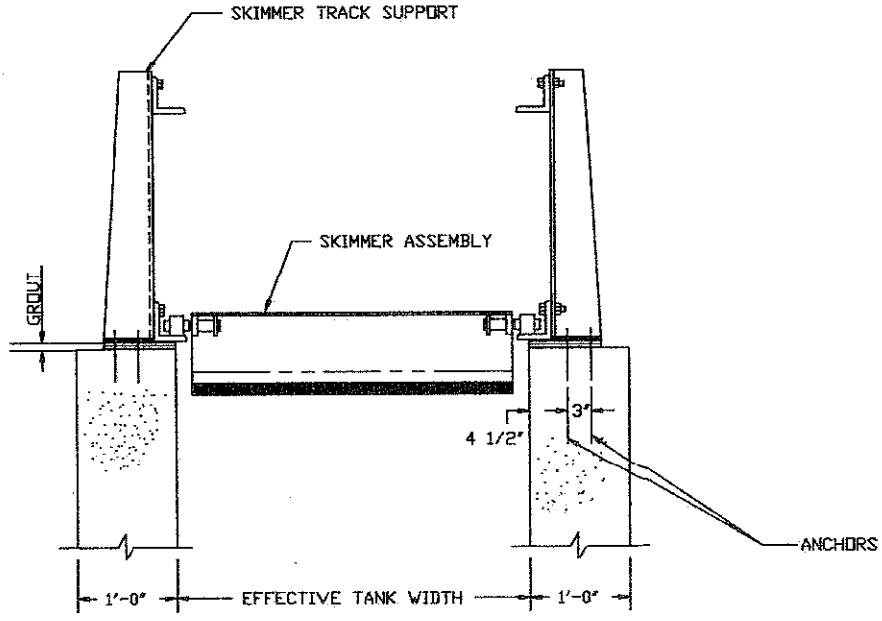
Envirex	General Arrangement - Rectangular Concrete Tank	21.301


STEEL APPROACH ASSEMBLY
2" GROUT
SKIMMER HEADSHAFT
STEEL FLIGHT WIPER
AND BEACH RAMP ASSEMBLY
TOP OF
CONCRETE TANK
STEEL EFFLUENT
WEIR ASSEMBLY
3"F.B.
4 1/2"
ANCHOR
BOLTS
4'-0"
3'-0"
1'-3"

SKIMMER CARRY & RETURN TRACK INSTALLATION FOR
DOUBLE CONCRETE TANKS WITH COMMON WALL

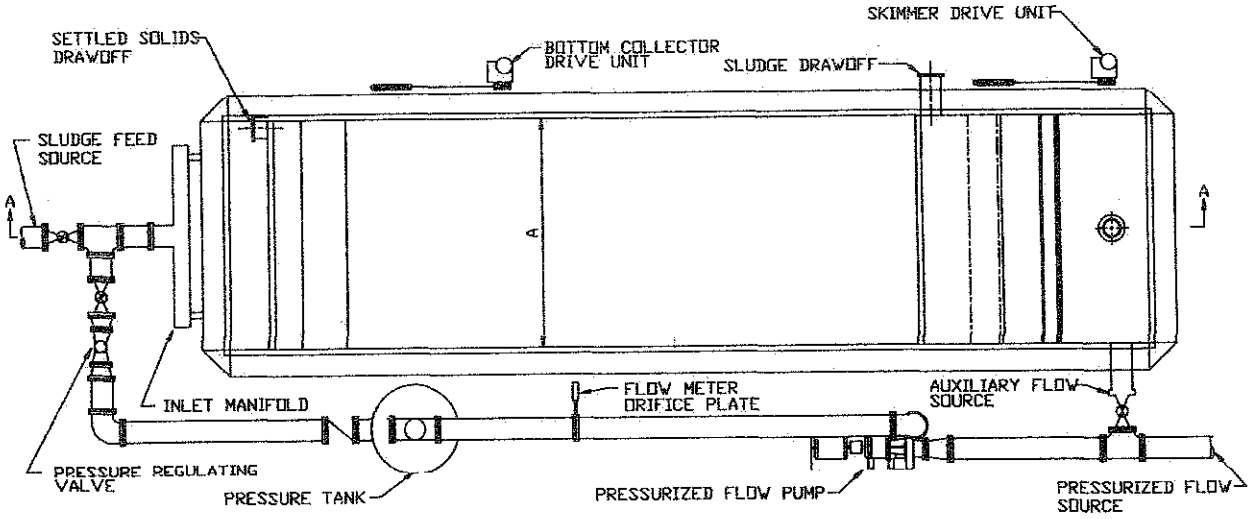


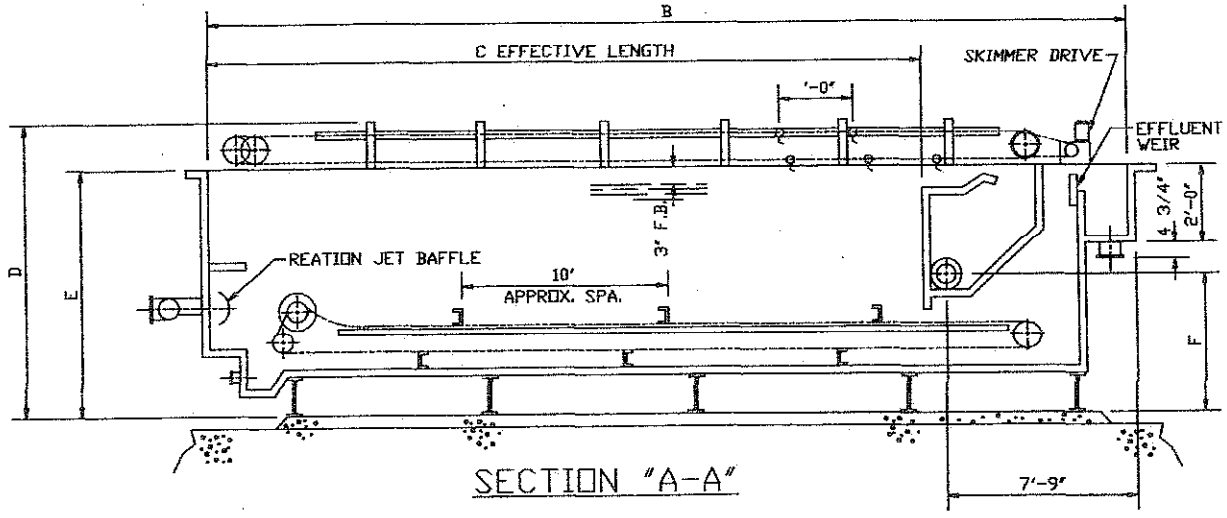
SKIMMER CARRY & RETURN TRACK INSTALLATION FOR
SINGLE CONCRETE TANK



Envirex	Details and Dimensions - Skimmer Flight Track for Single and Double Tanks	21.303

MODEL NUMBER	SURFACE AREA FT²	A TANK WIDTH	B INSIDE LENGTH	C EFFECTIVE LENGTH	D TOTAL HEIGHT	E TANK HEIGHT	F	TANK WEIGHT EMPTY 3/16"	TANK WEIGHT WITH WATER
45	450	9'-6"	55'-6"	47'-6"	11'-0"	9'-0"	4'-6"	32,150	277,150
40	400	9'-6"	50'-0"	42'-0"	11'-0"	9'-0"	4'-6"	29,500	250,500
35	350	9'-6"	45'-0"	37'-0"	11'-0"	9'-0"	4'-6"	27,100	226,100
30	300	9'-6"	40'-0"	32'-0"	11'-0"	9'-0"	4'-6"	24,650	193,650
25	250	7'-6"	41'-6"	33'-6"	10'-0"	8'-0"	4'-0"	22,400	161,900
20	200	7'-6"	35'-0"	27'-0"	10'-0"	8'-0"	4'-0"	19,800	128,300
15	150	6'-0"	33'-0"	25'-0"	9'-3"	7'-3"	3'-3"	16,300	96,800
10	100	5'-0"	28'-0"	20'-0"	8'-9"	6'-9"	3'-0"	11,500	57,800





Attachment 4C – Kurger ACTIFLO

KRÜGER

September 20, 2010

Terry Desmarais, Jr., P.E.
Project Manager
AECOM Water
500 Southborough Drive
South Portland, ME 04106
(207) 775-2800

Re: 2 x 5 MGD ACTIFLO® System
Portsmouth, NH

Dear Mr. Desmarais:

Please find enclosed our *preliminary* design proposal for the above referenced project. Based on the effluent requirements, Kruger has proposed the ACTIFLO® process for MBBR/BAF effluent clarification. Enclosed is our price estimate, design summary, layout, and equipment scope of supply for a 2 x 5 MGD ACTIFLO® system. The proposed system will treat the average daily flow of 5 MGD with one train out of service and the peak hour flow of 7.5 MGD with both trains in service.

The ACTIFLO® process has a long standing reputation for its ability to handle fluctuations in influent flow rates and solids loading while maintaining a consistent effluent quality. Over the past 10 years, the ACTIFLO® process has competed head to head against numerous dissolved air flotation (DAF) processes on a pilot scale and consistently outperformed them in this regard. In addition to this, if future discharge permits require lower phosphorus limits to be met, the ACTIFLO® process proposed for the Portsmouth, NH project can be used to accomplish this without the need for additional process equipment.

Please note the following requirements prior to the raw water entering the ACTIFLO® system:

- Removal of particles greater than 10 mm in size which will occur prior to the Kruger MBBR/BAF.
- A reliable and accurate flow signal must be established for each train,
- Proper dispersion of the coagulant (upstream of the ACTIFLO® system) must be achieved

The corresponding scope of supply is detailed in the following pages and summarized below:

- Mechanical equipment related to the ACTIFLO® system
- ACTIFLO® system based PLC control panel
- Process instrumentation and Spare parts

The schedule of delivery shall be as follows:

- Shop drawings will be submitted within 6-8 weeks of receipt of an executed contract by all parties.
- All equipment will be delivered within 18 – 20 weeks after receipt of approved shop drawings. Approval must be in the written form.
- O&M Manuals will be submitted within 90 days after receipt of approved shop drawings

Kruger appreciates the opportunity to provide this proposal to you. If you have any questions or need further information, please contact our local representative, Henry Albro, or contact me at 919-653-5084.

Respectfully,

Thomas Perry
Product Manager
ACTIFLO® Systems
I. Kruger, Inc.

ATT
cc: Robert Clay, Matt Cotton, Daniel Austria, project file (Kruger) Henry Albro (FR Mahony)

Kruger Inc.
401 Harrison Oaks Blvd. Suite 100
Cary, NC 27513 USA
Tel: 919-677-8310 • Fax: 919-677-0082
Web site: www.krugerusa.com

VEOLIA WATER
Solutions & Technologies

ACTIFLO® Proposal for

Portsmouth, NH

KRÜGER

Terry Desmarais, Jr., P.E.
Project Manager
AECOM Water
500 Southborough Drive
South Portland, ME 04106
(207) 775-2800

September 20, 2010

I. Kruger Inc.
401 Harrison Oaks Blvd.
Suite 100
Cary, NC 27513

VEOLIA WATER
Solutions & Technologies

KRÜGER

Table of Contents

VEOLIA WATER
Solutions & Technologies

KRÜGER

1. Company Introduction

I. Kruger Inc. (Kruger) is a water and wastewater solutions provider specializing in advanced and differentiating technologies. Kruger provides complete processes and systems ranging from biological nutrient removal to mobile surface water treatment. The ACTIFLO® Microsand Ballasted Clarifier, BIOCON® Dryer, BIOSTYR® Biological Aerated Filter (BAF), NEOSEP™ MBR and HYDROTECH Discfilters are just a few of the innovative technologies offered by Kruger. Kruger is a subsidiary of Veolia Water Solutions and Technologies (VWS), a world leader in engineering and technological solutions in water treatment for industrial companies and municipal authorities.

VWS, present throughout the world, develops a global approach responding to specific needs of customers at each of their production facilities. This has allowed VWS to become the world leader in design, project management, and execution of projects for water and wastewater treatment plants. The company also creates dedicated technology solutions to meet its customer's needs. Its unique portfolio of differentiating technologies, developed by the group's R&D centers, ensures unsurpassed innovation and control of each treatment line for public organizations and industries. Furthermore, a whole range of associated services is offered on each site to guarantee the technical efficiency and life expectancy of the installed solutions. VWS continually extends and enriches its offer, to guarantee expertise and competence at every step of the projects it undertakes.

Kruger prides itself for being a customer focused organization that provides solutions to challenges faced by municipalities and not just another equipment supplier. To achieve this, Kruger has gathered a force of process experts, trained sales staff, and project managers that share our vision and priorities.

2. Process Description

The ACTIFLO® process is a compact clarification system that utilizes microsand as a seed for floc formation. The microsand provides surface area that enhances flocculation and acts as a ballast or weight. The resulting sand ballasted floc display unique settling characteristics, which allow for clarifier designs with high overflow rates and short retention times. These designs result in system footprints that are between 5 and 20 times smaller for water and 5 to 50 times smaller for wastewater applications than conventional clarification systems of similar capacity.

ACTIFLO® differs from conventional clarification in that it provides microsand as a ballasting agent in the flocculation process step. The microsand serves several important roles in the ACTIFLO® process such as forming a seed which promotes the formation of large stable, high-density floc, dampens the effects of changes in the raw water quality due to its high concentration within in the process, and is effectively removed from the chemical sludge and reused in the process due to its chemically inert qualities. This floc has considerably higher settling velocities than conventional floc and allows significantly higher clarifier overflow rates. The higher overflow rates possible with ACTIFLO® translate directly into reduced process volume, reduced system footprint, and significant reductions in total civil cost. Overall, these factors provide a process that is extremely efficient in the treatment of "difficult" waters, stable with changes in raw water quality, and relatively easy to operate and optimize.

The ACTIFLO® process is currently in operation worldwide in small communities as well as large metropolitan areas. In drinking water treatment, the ACTIFLO process can be applied to both ground or surface waters where either better performance or cost reduction is desired. It is ideally suited for difficult to treat waters such as rapidly fluctuating sources or extreme conditions. The process consistently displays efficient removals from raw waters containing turbidity (high and low), color, TOC, algae, particle counts, Cryptosporidium, iron, manganese, arsenic and other typical undesirable water contaminants.

In wastewater treatment, the ACTIFLO® process is appropriate for use in any application that would benefit from physical-chemical treatment including coagulation, flocculation and settling. It can be applied to primary and tertiary wastewater treatment where either better performance or cost reduction is desired. It is ideally suited for storm water treatment including CSO, SSO or other overflows due to its high performance, small footprint, and extremely short start-up time. The process consistently displays efficient removals of TSS, BOD, Total P, COD, metals, fecal coliform, and other typical wastewater contaminants, which can be removed by physical-chemical processes.

Listed below are several advantages that ACTIFLO® process offers compared to conventional treatment alternatives:

- Reduced footprint 5 to 50 times smaller than conventional clarification processes resulting in low installation costs
- Large sand particle surface area serve as a "seed" for floc formation which when combined with polymer produces a large, stable floc with fast settling characteristics
- Enhanced coagulation allows for variable process chemistry with efficient chemical usage
- Flexible and stable process for handling fluctuating water quality while continuously delivering high quality effluent
- Rapid start-up and shut-down with a short hydraulic retention time

3. Design Summary

Tables 1, 2 and 3 summarize the design criteria and preliminary process parameters for the proposed design.

Table 1: Design Criteria

Parameter	Units	Value
Total Design Capacity	MGD	10
Design Capacity per Train	MGD	5
Influent TSS	mg/l	70 – 150
Required Effluent TSS at design Flow	mg/l	< 30 mg/l
Expected Effluent TSS at design Flow	mg/l	≤ 10 mg/l

Table 2: Bio ACTIFLO® Process Parameters

Process Parameters	
Coagulation Tank HRT, min	2.0
Maturation Tank HRT, min	4.2
Rise Rate at Design Capacity, gpm/ft^2	40
Sand Recirculation Pumps per Train	2 duty + 1 standby
Sand Recirculation Pump Capacity, gpm	210
Number of Hydrocyclones per Pump	1
Estimated Sludge Concentration, % solids	0.3 to 0.5
Estimated Sludge Concentration with HCS system, % solids	> 1
Sludge Discharge per Train at Design Flow, gpm	168
Sludge Discharge per Train at Design Flow with HCS system, gpm	85
ACTIFLO® Process Dimensions	
Number of trains	2
Coagulation Tank	
Length, ft	8.75
Width, ft	8.75
Side Water Depth, ft	13.0
Maturation Tank	
Length, ft	13.25
Width, ft	12.25
Side Water Depth, ft	13.0
Settling Tank	
Length, ft	12.25
Width, ft	12.25
Side Water Depth, ft	13.0

4. Scope of Supply

Kruger is pleased to present our scope of supply which includes process engineering design, equipment procurement, and field services required for the proposed treatment system, as related to the equipment specified. The work will be performed to Kruger's high standards under the direction of a Project Manager. All matters related to the design, installation, or performance of the system shall be communicated through the Kruger representative giving the Engineer and Owner ready access to Kruger's extensive capabilities.

Process and Design Engineering

Kruger can provide process engineering and design support for the system as follows:

- Equipment specifications for equipment supplied by Kruger
- Technical instructions for operation and start-up of the system
- Equipment location drawings and installation plans
- Project specific O&M manuals

KRÜGER

Field Services

Kruger will furnish a Service Engineer as specified at the time of start-up to inspect the installation of the completed system, place the system in initial operation, and to instruct operating personnel on the proper use of the equipment. Specifically, Kruger will provide:

- On-site equipment checkup and start-up assistance, including advice during construction and operator training, for a period not exceeding fifteen (15) man days and three (3) site visits

Equipment Supply

Kruger will supply the following equipment associated with the system:

- Mechanical Equipment

Description	Units per Train	Total No. of Units
Coagulation Tanks		
• Coagulation tank top entering mixer(s), 3 HP, TEFC, 460/3/60 motor, 304 stainless steel shaft and impellers.	1	2
Maturation Tanks		
• Maturation tank top entering mixer(s), 5 HP, TEFC, 460/3/60 inverter duty motor, 304 stainless steel shaft and impellers.	1	2
• Draft Tube with supports, grating, side baffles, 304 SS	1	2
• Stilling baffle with supports, 304 SS	1	2
• VFD to be supplied by others	--	By Others
Settling Tanks		
• Sludge scraper assemblies, 304 stainless steel, center drive, 1.5 HP, TEFC, 460/3/60 inverter duty motor, speed reducer, complete with drive shaft, shaft protector, rake arms and blades.	1	2
• VFD to be supplied by others	--	By Others
• Lamella tube module sets, polystyrene.	1 set	2 sets
• Lamella tube supports, 304 stainless steel.	1 set	2 sets
• Lamella tube tie-down assembly, wire rope, clips, etc. 304 stainless steel.	1 set	2 sets
• Effluent collection troughs, 7.2' length, 1' width, 304 stainless steel.	4	8
• Supports for collection troughs, 304 stainless steel.	1 set	2 sets

KRÜGER

Description	Units per Train	Total No. of Units
Microsand Recycle Circuits • Microsand recirculation pumps, centrifugal, cast iron body, with rubber-lined volute and impeller, hydrostatic gland seal, drip pan, 210 gpm capacity, 30 HP, TEFC, 460/3/60 motor with V-belt and pulley drive.	1duty + 1 standby	2 duty + 2 standby
• Discharge side pump isolation valves, 4" diameter, eccentric plug type, manual	2	4
• Suction side pump isolation valves, 4" diameter, eccentric plug type, manual	2	4
• Flush connection valve, 1.5" diameter, ball valve	2	4
• Microsand Recirculation Pump Pressure Transmitter, Endress + Hauser Cerbar M PMC45 Transmitter w/Integral Display and isolation ball valve	2	4
• Hydrocyclones, 210 gpm capacity, urethane.	2	4
• Hydrocyclone support stand, 304 stainless steel.	2	4
• Imhoff Cone for Sand Concentration Sampling.	2	2
• Microsand for Start-up (Tons)	--	10
• Polymer for initial operations (Tons)	--	1

- Instrumentation and Control System

PLC Based Control Panel

One (1) PLC Based Control panel(s) will be supplied, as specified below, to control the ACTIFLO® Process based on operator setpoints. All I/O will be wired to field terminations as required. The Control Panel will be completely assembled, tested, and programmed for the required functionality. One U. L. labeled Panel will be comprised of the following:

NEMA 12 Freestanding Enclosure (Indoor Install Only)	Hoffman
Backpanel & Panel Shelf	Hoffman
Surge Protection	Innovative Tech
20A Main Circuit Breaker, 1-POLE, 120VAC (MCB)	SquareD
24VDC Power Supply 5A	Sola
DC/DC Transmitter Isolator, 4-20 mA	Phoenix
M-UFB 2/2-24 VDC Minitrab Surge Arrestor	Phoenix
M-UFB R-4 Minitrab Base Element, 4 Plugs	Phoenix
SLKK 5 Double Level Terminal Block w/GND	Phoenix
DIGI-KEY Part No. 1.5KE30CATR Diode	Diodes Inc.
D-UKK 3/5 End Cover	Phoenix
FB 10-6 Fixed Bridge Bar	Phoenix
E/UK 1 End Clamp	Phoenix
UKK 5 Double Level Terminal Block	Phoenix
2.0A, 3.0 A, 7.0A, 15.0A Circuit Breakers	Allen Bradley or equal
Terminal Block	Allen Bradley
Terminal Block (GND)	Allen Bradley
Center Jumper - 10 Pole	Allen Bradley
End Barrier and End Anchor	Allen Bradley
Output Relay, 2PDT, Form C Contact, 24VDC	Allen Bradley or equal
Relay Bases	Allen Bradley or equal
SLC 5/05 Processor	Allen Bradley
13 SLOT Chassis	Allen Bradley
Power Supply	Allen Bradley
Rack Interconnect Cable	Allen Bradley
DC Powered Discrete Input Card	Allen Bradley
DC Powered Discrete Output Card	Allen Bradley
DC Powered Analog Input Card	Allen Bradley
DC Powered Analog Output Card	Allen Bradley
Panelview 1000 w/ Ethernet	Allen Bradley
10/100 Base T Ethernet Switch	N-Tron
Push Button, Flush, Non-ill, MOM.NO. Contact	SquareD
Misc. Wire, Wire Duct, and Cabinet Light	Generic
Receptacle w/ Box/Cover, UL Listed	Generic
Alarm Horn (Supplied loose for mounting by contractor)	Generic

Panel design is based on control of only the equipment included in Kruger's scope of supply only. If control of additional equipment beyond Kruger's scope of supply is required, please contact Kruger for a price adder. The PLC Control Panel will include the necessary input/output to support the I/O needed by the panel (i.e. door mounted pushbuttons, power fail alarm(s), etc.).

- Instrumentation

Description	Units per Train	Total No. of Units
• Raw water turbidimeter, Hach	--	1
• pH meter for raw water, Hach	--	1
• pH meter after coagulant addition, Hach	1	2
• Settled water turbidimeter, Hach	1	2

- Spare Parts

Description	Units per Train	Total No. of Units
Mechanical Spare Parts • Coagulation tank mixer bearings and seals	--	1 set
• Maturation tank mixer bearings and seals	--	1 set
• Apex tips	2	4
• V-belts for microsand pumps	2	4

5. Design Options

In addition to the proposed system as detailed herein, Kruger is able to further incorporate our process and controls expertise into wastewater treatment plants, allowing municipalities to meet stringent effluent requirements and future plant upgrades. Kruger is able to offer our instrumentation and controls expertise to build upon the proposed system by providing a customized plant-wide SCADA system or designing a Motor Control Center (MCC), providing municipalities a single source responsibility for plant controls. Please contact Kruger if the options below are of interest to be included in the current proposed system or future upgrades.

- Motor Control Center (MCC) – Kruger can also supply MCCs, typically Square D, for all Kruger supplied equipment. The MCCs can be supplied in either a hard-wired configuration or "smart" configuration. The hard-wired configuration is the typical MCC and these can be supplied to match the specifications and the electrical contract drawings. The "smart" MCC configuration consists of either communications resident to the MCC or a PLC in one of the MCC sections. The "smart" MCC is easily expandable and reduces the amount of wiring to the PLC panel, allowing for lower installed costs and more flexibility in the future.
- Plant-wide and Process Specific SCADA - Kruger can supply SCADA systems for either plant-wide or process specific applications. Wonderware is Kruger's standard SCADA environment but other SCADA platforms are available upon request (iFix, Citect, RSView, etc.). Kruger's SCADA system provides the plant operation staff with a highly customized, flexible, powerful plant monitoring operations package. The staff can utilize the system to record, analyze, and distribute plant process and runtime data, as well as reduce risk via remote plant alarm notifications. Kruger's SCADA system supplies reports and information that can be used for advanced troubleshooting. In addition, it provides remote access for the plant personnel to monitor plant operations and for Kruger (with limited access) in order to aid in troubleshooting or problem resolution.

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6. Pricing, Payment Terms, and Schedule

Pricing
The price for the Bio ACTIFLO® system, as defined herein, including process and design engineering, field services, and equipment supply is **$996,600**.

Please note that the above pricing is expressly contingent upon the items in this proposal and are subject to I. Kruger Inc. Standard Terms of Sale detailed herein.

This pricing is FOB shipping point, with freight allowed to the job site. This pricing does not include any sales or use taxes. In addition, pricing is valid for ninety (90) days from the date of issue and is subject to negotiation of a mutually acceptable contract.

Terms of Payment
The terms of payment are as follows:

- 10% on receipt of fully executed contract
- 15% on submittal of shop drawings
- 75% on the delivery of equipment to the site

Payment shall not be contingent upon receipt of funds by the Contractor from the Owner. There shall be no retention in payments due to I. Kruger Inc. All other terms per our Standard Terms of Sale are attached.

All payment terms are net 30 days from the date of invoice. Final payment not to exceed 120 days from delivery of equipment.

Schedule

- Shop drawings will be submitted within 6-8 weeks of receipt of an executed contract by all parties.
- All equipment will be delivered within 18-20 weeks after receipt of written approval of the shop drawings.
- Installation manuals will be furnished upon delivery of equipment.
- Operation and Maintenance Manuals will be submitted within 90 days after receipt of approved shop drawings.

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7. I. Kruger Inc. Standard Terms of Sale

1. Applicable Terms. These terms govern the purchase and sale of the equipment and related services, if any (collectively, "Equipment"), referred to in Seller's purchase order, quotation, proposal or acknowledgment, as the case may be ("Seller's Documentation"). Whether these terms are included in an offer or an acceptance by Seller, such offer or acceptance is conditioned on Buyer's assent to these terms. Seller rejects all additional or different terms in any of Buyer's forms or documents.

2. Payment. Buyer shall pay Seller the full purchase price as set forth in Seller's Documentation. Unless Seller's Documentation provides otherwise, freight, storage, insurance and all taxes, duties or other governmental charges relating to the Equipment shall be paid by Buyer. If Seller is required to pay any such charges, Buyer shall immediately reimburse Seller. All payments are due within 30 days after receipt of invoice. Buyer shall be charged the lower of 1 ½% interest per month or the maximum legal rate on all amounts not received by the due date and shall pay all of Seller's reasonable costs (including attorneys' fees) of collecting amounts due but unpaid. All orders are subject to credit approval.

3. Delivery. Delivery of the Equipment shall be in material compliance with the schedule in Seller's Documentation. Unless Seller's Documentation provides otherwise, Delivery terms are F.O.B. Seller's facility.

4. Ownership of Materials. All devices, designs (including drawings, plans and specifications), estimates, prices, notes, electronic data and other documents or information prepared or disclosed by Seller, and all related intellectual property rights, shall remain Seller's property. Seller grants Buyer a non-exclusive, non-transferable license to use any such material solely for Buyer's use of the Equipment. Buyer shall not disclose any such material to third parties without Seller's prior written consent.

5. Changes. Seller shall not implement any changes in the scope of work described in Seller's Documentation unless Buyer and Seller agree in writing to the details of the change and any resulting price, schedule or other contractual modifications. This includes any changes necessitated by a change in applicable law occurring after the effective date of any contract including these terms.

6. Warranty. Subject to the following sentence, Seller warrants to Buyer that the Equipment shall materially conform to the description in Seller's Documentation and shall be free from defects in material and workmanship. The foregoing warranty shall not apply to any Equipment that is specified or otherwise demanded by Buyer and is not manufactured or selected by Seller, as to which (i) Seller hereby assigns to Buyer, to the extent assignable, any warranties made to Seller and (ii) Seller shall have no other liability to Buyer under warranty, tort or any other legal theory. If Buyer gives Seller prompt written notice of breach of this warranty within 18 months from delivery or 1 year from beneficial use, whichever occurs first (the "Warranty Period"), Seller shall, at its sole option and as Buyer's sole remedy, repair or replace the subject parts or refund the purchase price therefore. If Seller determines that any claimed breach is not, in fact, covered by this warranty, Buyer shall pay Seller its then customary charges for any repair or replacement made by Seller. Seller's warranty is conditioned on Buyer's (a) operating and maintaining the Equipment in accordance with Seller's instructions, (b) not making any unauthorized repairs or alterations, and (c) not being in default of any payment obligation to Seller. Seller's warranty does not cover damage caused by chemical action or abrasive material, misuse or improper installation (unless installed by Seller). THE WARRANTIES SET FORTH IN THIS SECTION ARE SELLER'S SOLE AND EXCLUSIVE WARRANTIES AND ARE SUBJECT TO SECTION 10 BELOW. SELLER MAKES NO OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE.

7. Indemnity. Seller shall indemnify, defend and hold Buyer harmless from any claim, cause of action or liability incurred by Buyer as a result of third party claims for personal injury, death or damage to tangible property, to the extent caused by Seller's negligence. Seller shall have the sole authority to direct the defense of and settle any indemnified claim. Seller's indemnification is conditioned on Buyer (a) promptly, within the Warranty Period, notifying Seller of any claim, and (b) providing reasonable cooperation in the defense of any claim.

8. Force Majeure. Neither Seller nor Buyer shall have any liability for any breach (except for breach of payment obligations) caused by extreme weather or other act of God, strike or other labor shortage or disturbance, fire, accident, war or civil disturbance, delay of carriers, failure of normal sources of supply, act of government or any other cause beyond such party's reasonable control.

9. Cancellation. If Buyer cancels or suspends its order for any reason other than Seller's breach, Buyer shall promptly pay Seller for work performed prior to cancellation or suspension and any other direct costs incurred by Seller as a result of such cancellation or suspension.

10. LIMITATION OF LIABILITY. NOTWITHSTANDING ANYTHING ELSE TO THE CONTRARY, SELLER SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL, INCIDENTAL, SPECIAL, PUNITIVE OR OTHER INDIRECT DAMAGES, AND SELLER'S TOTAL LIABILITY ARISING AT ANY TIME FROM THE SALE OR USE OF THE EQUIPMENT SHALL NOT EXCEED THE PURCHASE PRICE PAID FOR THE EQUIPMENT. THESE LIMITATIONS APPLY WHETHER THE LIABILITY IS BASED ON CONTRACT, TORT, STRICT LIABILITY OR ANY OTHER THEORY.

11. Miscellaneous. If these terms are issued in connection with a government contract, they shall be deemed to include those federal acquisition regulations that are required by law to be included. These terms, together with any quotation, purchase order or acknowledgement issued or signed by the Seller, comprise the complete and exclusive statement of the agreement between the parties (the "Agreement") and supersede any terms contained in Buyer's documents, unless separately signed by Seller. No part of the Agreement may be changed or cancelled except by a written document signed by Seller and Buyer. No course of dealing or performance, usage of trade or failure to enforce any term shall be used to modify the Agreement. If any of these terms is unenforceable, such term shall be limited only to the extent necessary to make it enforceable, and all other terms shall remain in full force and effect. Buyer may not assign or permit any other transfer of the Agreement without Seller's prior written consent. The Agreement shall be governed by the laws of the State of North Carolina without regard to its conflict of laws provisions.

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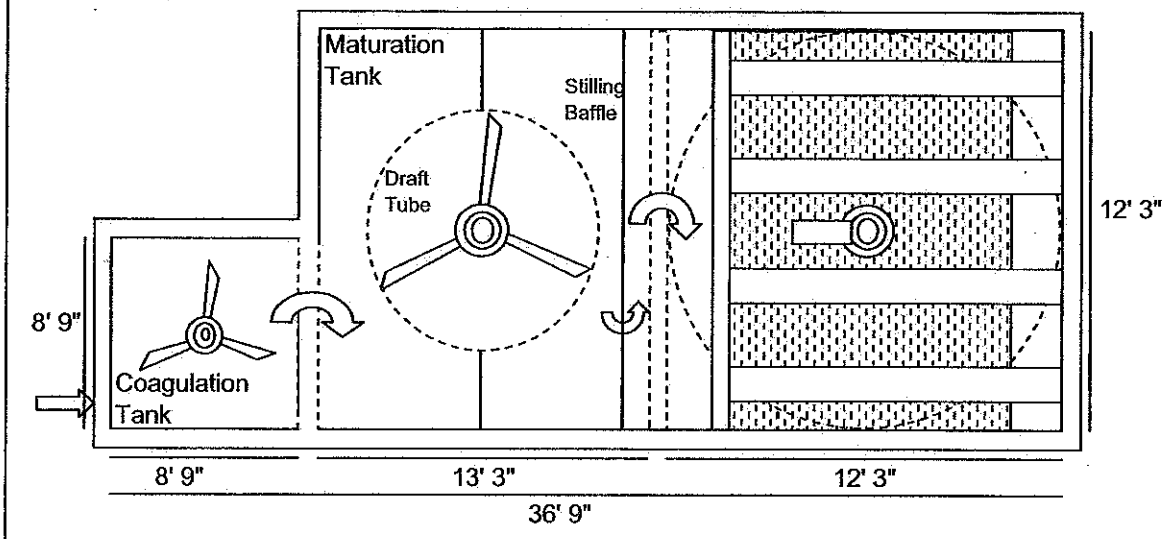
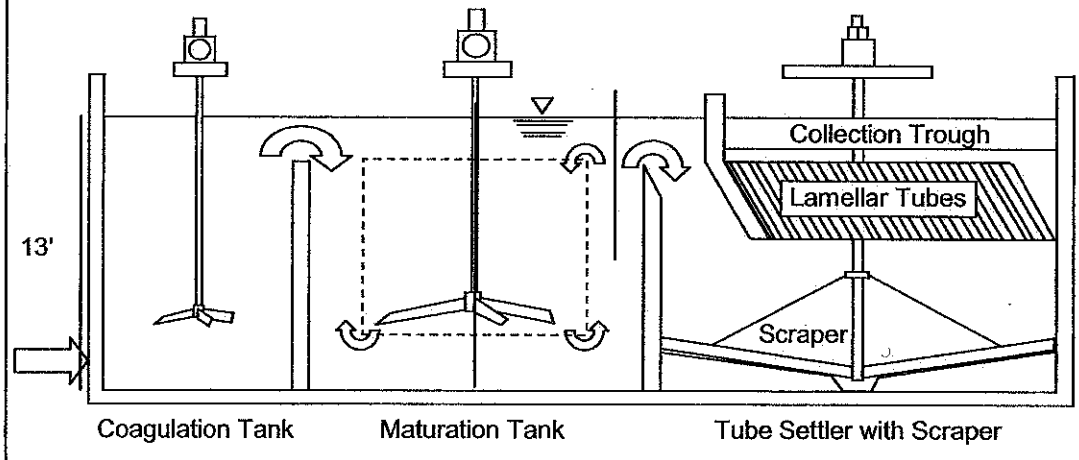
Attachment I

Preliminary Drawing(s)

VEOLIA WATER
Solutions & Technologies

Preliminary ACTIFLO Single Train Layout
2 x 5 MGD ACTIFLO
Total Capacity = 10 MGD
Capacity per Train: 5 MGD





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Attachment II

Brochure

VEOLIA WATER
Solutions & Technologies

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ACTIFLO® Process For Wet Weather and Wastewater Treatment

VEOLIA
WATER
Solutions & Technologies

ACTIFLO® Microsand Ballasted Clarification Process

ACTIFLO® is a high rate, compact process developed by Veolia Water Solutions & Technologies. The process operates with microsand which enhances floc formation and acts as a ballast to aid in rapid settlement of coagulated material.

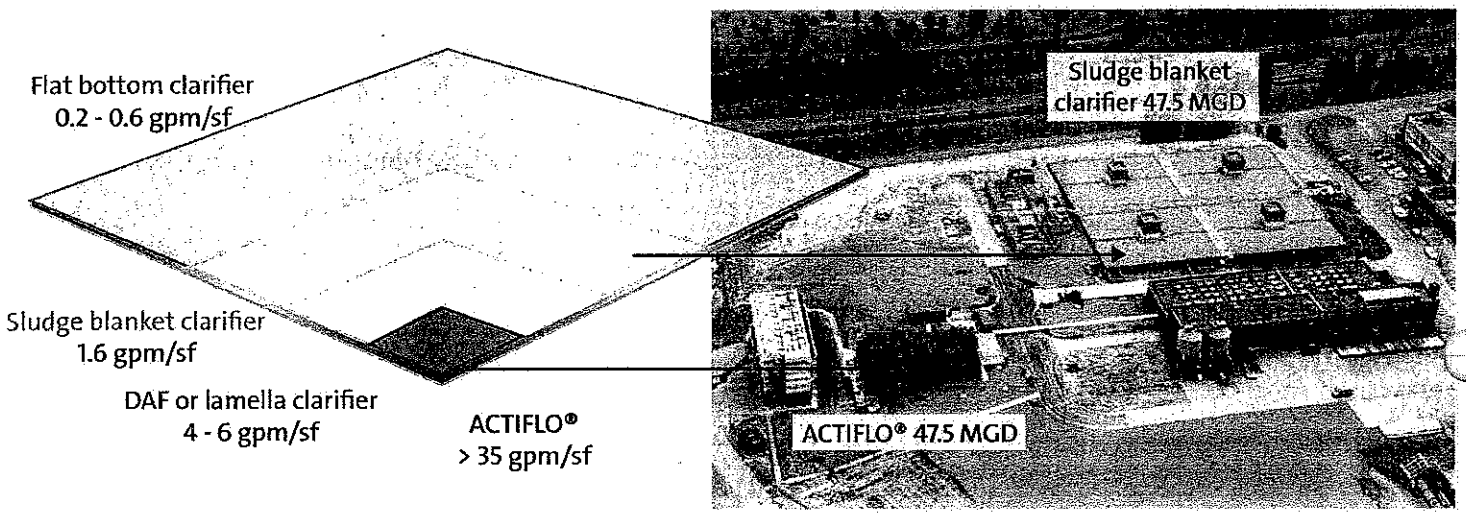
The ACTIFLO® process can be used at various stages of wastewater treatment including: enhanced primary treatment, wet weather clarification, high rate secondary clarification and final polishing for the removal of solids, phosphorus and metals.

Typical ACTIFLO® Performance

Application	Loading Rates gpm/sf	Phosphorus (mg/l)	sBOD (mg/l)	BOD_5 (mg/l)	TSS (mg/l)	UV Transmittiance (%)
Wet Weather	60	0.5 - 1.5	10 - 20	< 30	< 20	50 - 70
Bio ACTIFLO	45	0.1 - 1.0	1 - 10	< 20	< 15	60 - 70
Secondary	20	0.5 - 1.5	1 - 10	< 10	< 10	65 - 75
Tertiary	45	as low as 0.05	< 10	< 10	≤ 5	75 - 90

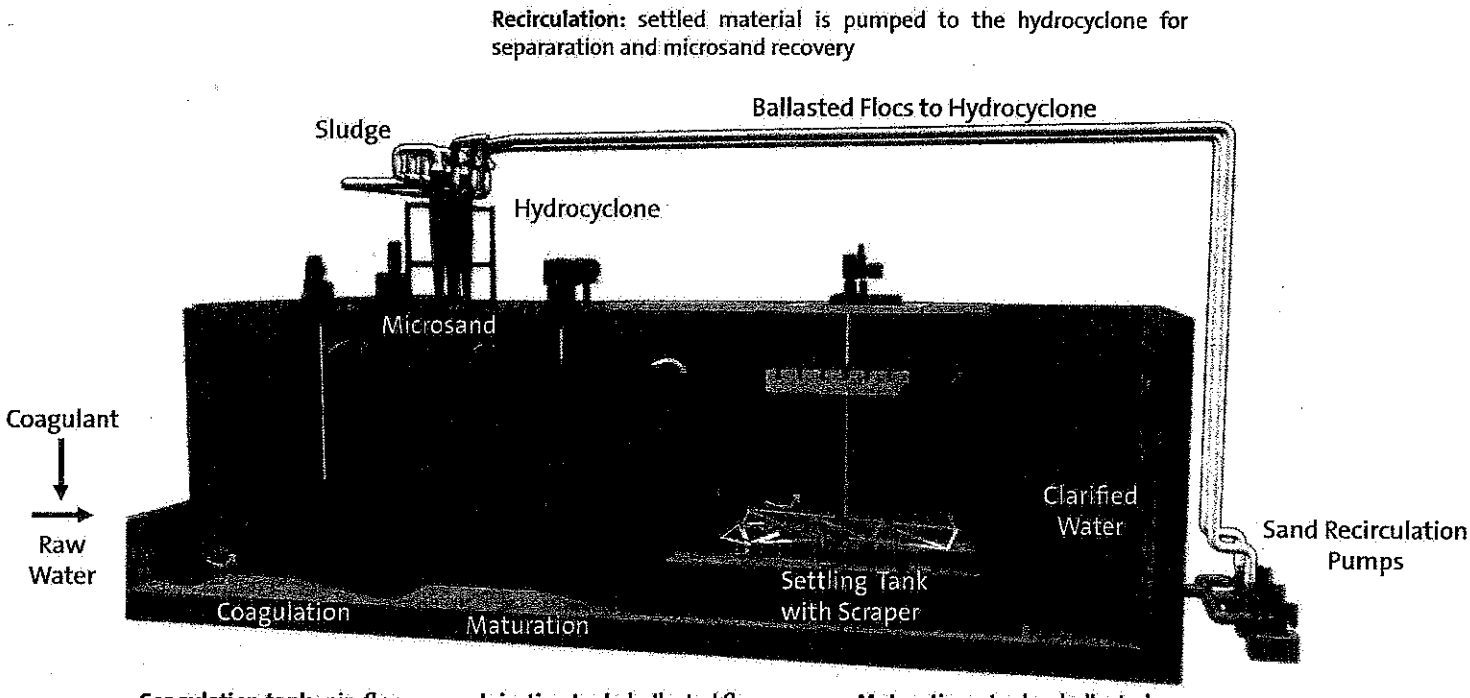
ACTIFLO®: Compactness Displaying Its True Potential

The microsand ballasted flocs display unique settling characteristics, which allow for clarifier designs with very high overflow rates and short retention times. These designs result in footprints that are 5 times smaller lamella clarifiers or dissolved air flotation (DAF) and up to 20 times smaller than conventional clarification systems.



* Surface water treatment reference

CSO/SSO Parallel Treatment with ACTIFLO®

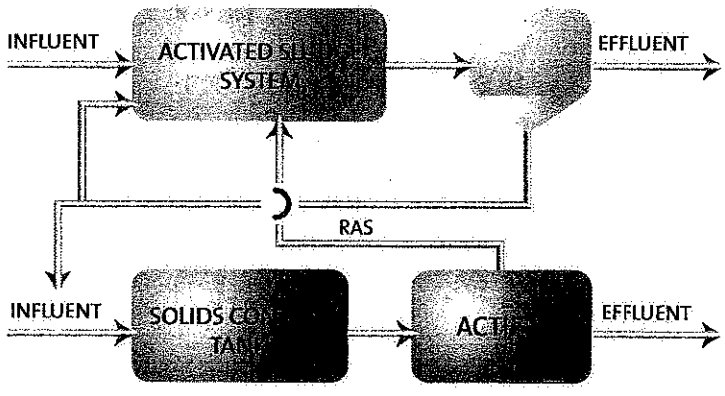


During peak wet weather flow conditions, many plants need to divert a portion of the total plant flow around their biological treatment process. To achieve high levels of TSS and particulate BOD removal of these diverted excess flows, the ACTIFLO® process can be installed at the treatment plant or at a satellite facility within the collection system.

The ACTIFLO® process can be fully automated and the process train(s) can sit idle for extended periods of time and still be fully operational within 15 minutes of start-up.

CSO/SSO Treatment Bio ACTIFLO®

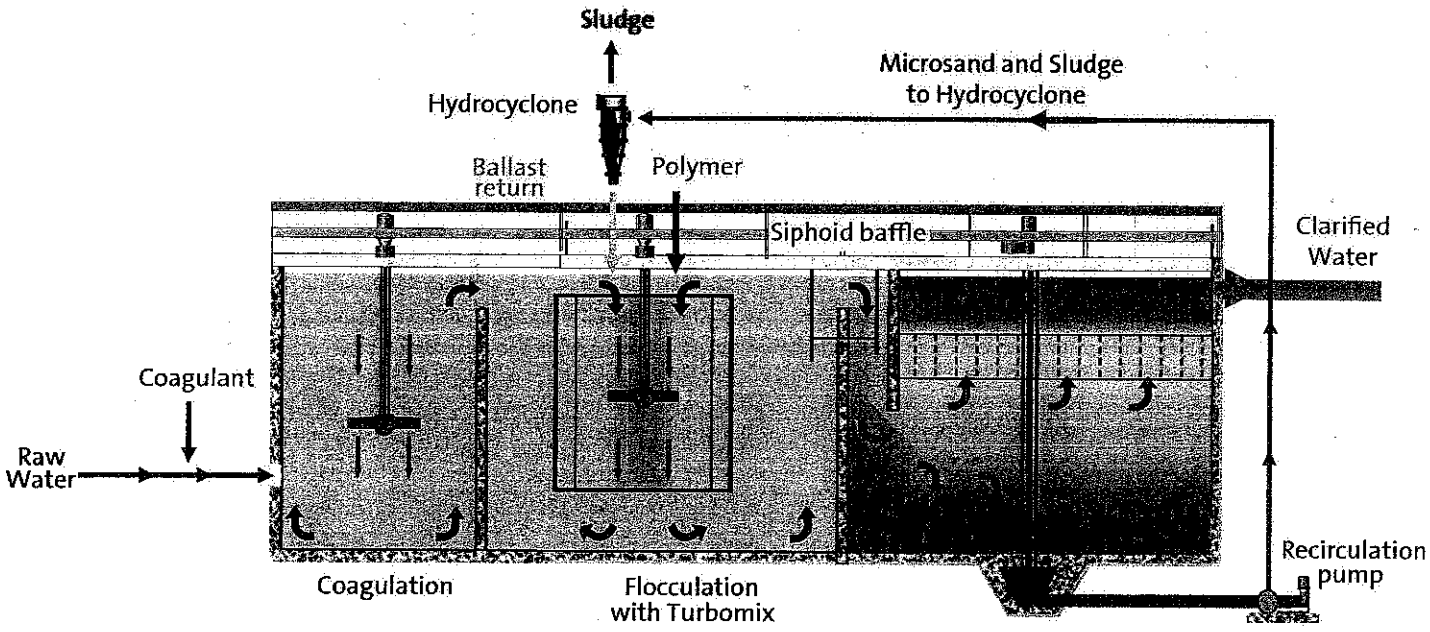
If flow diversion is not an option at a particular site, or the TSS and particulate BOD removal with ACTIFLO® alone are not enough, a biological solids contact tank can be incorporated into the treatment flow path to improve soluble BOD removal through the system.



Return activated sludge (RAS) from the existing clarifiers is combined with the excess flows into a solids contact tank. A targeted mixed liquor suspended solids (MLSS) concentration is maintained in the contact tank to facilitate rapid uptake of soluble biological oxygen demand (BOD) via contact stabilization. Clarification with ACTIFLO follows, producing exceptional TSS and total BOD removal rates.

Tertiary Treatment with ACTIFLO®

With tighter discharge limits being imposed on wastewater treatment plants the need for a cost effective, flexible process has evolved. Over the years, the ACTIFLO® process has proven its effectiveness in meeting extremely low phosphorus, metals and TSS limits.



Process Benefits

- Small process footprint
- Restricted space
- retrofits
- Low system
- into most ex
- Reduced
- High degree
- Short start
- Minimum
- easily acces

For tertiary treatment applications, the ACTIFLO® process offers:

- Ability to treat a wide range of influent phosphorus levels to extremely low limits
- Flexibility to meet future limits (phosphorus, metals) without modifying the process train
- The same tertiary treatment trains can also be used to treat wet weather flows
- Treatment of flows with high solids concentration without impacting effluent quality or treatment train capacities (solids washout from secondary clarifiers during peak flow)

Worldwide References

The ACTIFLO® process is currently in operation worldwide in small communities and large metropolitan areas, as well as in various installations for the treatment of industrial process water and effluents.

Syracuse, NY
Onondaga wastewater treatment plant

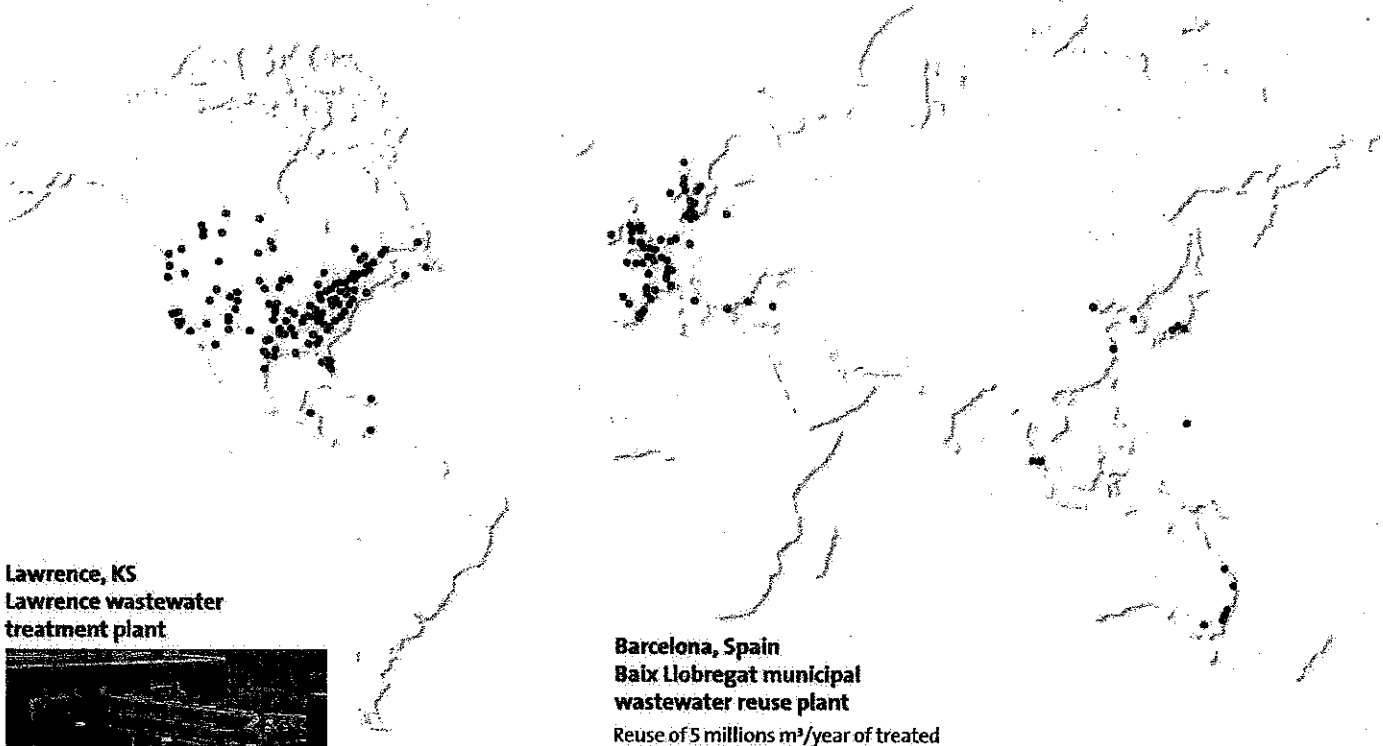
ACTIFLO® for tertiary polishing and phosphorus removal downstream of biofiltration (BIOSTYR®) 126 MGD achieving < 0.10 mg/L Total P

Kaukauna, WI
Heart of Valley wastewater treatment facility

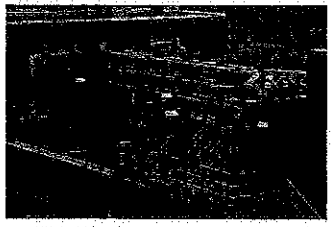
SSO/Primary, ACTIFLO® followed by BIOSTYR®
60 MGD Nominal, 2 x 30 MGD
70 MGD Peak Capacity, 2 x 35 MGD

Geneva, Switzerland
Aire wastewater treatment plant

ACTIFLO® for primary, wet weather and biofilter backwash water treatment (BIOSTYR®) 137 MGD



Lawrence, KS
Lawrence wastewater treatment plant



ACTIFLO® for wet weather flow treatment 40 MGD

Barcelona, Spain
Baix Llobregat municipal wastewater reuse plant

Reuse of 5 millions m³/year of treated water for irrigation
ACTIFLO® for tertiary treatment upstream of disc filtration 79.8 MGD

Paris, France
Seine-Aval wastewater treatment plant

ACTIFLO® for wet weather treatment or tertiary treatment (dry weather) 686.8 MGD

Sydney, Australia
Illawarra wastewater reclamation plant

ACTIFLO® for wet weather treatment upstream of UV disinfection 84.5 MGD

KRÜGER

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VEOLIA WATER
Solutions & Technologies

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HPD

WHITTIER FILTRATION

N.A. WATER SYSTEMS

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