Appendix A

Coventry High School OWTS Alternatives Memorandum

FUSS & O'NEILL

TECHNICAL MEMORANDUM

TO: Daniel Parrillo, Town Manager
Town of Coventry, Rhode Island

FROM: Laura Marcolini, P.E., Fuss & O'Neill, Inc.
Douglas Brisee, P.E., Fuss & O'Neill Inc.

DATE: July 21, 2023

RE: Town of Coventry, RI High School OWTS Alternative Evaluation

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Introduction

Coventry High School (Owner) is located nearby Johnson's Pond as an unsewered parcel. Wastewater treatment is facilitated by an onsite wastewater treatment system (OWTS) south of the School's Walter Clarke Athletic Complex. The OWTS is no longer functioning appropriately to serve the High School and another viable solution needs to be determined to serve the High School moving forward. The following alternatives have been developed and are summarized herein for the Town's consideration:

1.) **Alternative No. 1** – Extend Gravity Sewer from Tiogue Avenue to the High School Site
2.) **Alternative No. 2** – Construct Equalization Tank and Pump Station at the High School, Tie into Existing Force Main on Reservoir Road / Discharge to Tiogue Avenue Force Main
3.) **Alternative No. 3** – Construct On-Site Passive Treatment System with Groundwater Discharge (e.g. septic tanks and conventional leachfield)
4.) **Alternative No. 4** – Construct On-Site Active Treatment System with Groundwater Discharge (i.e. replace the existing on site system)

This memorandum provides an overview of the existing OWTS system and its current deficiencies. The alternative analysis includes budgetary opinion of costs for each option (-30%/+50%) and a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis. Lastly, the memorandum includes a recommendation for the Town's consideration.

Existing Onsite Wastewater System

The existing system (circa 1973) consists of an extended aeration, clarifier, and sludge holding basin constructed as a shared-wall, CIP concrete basin. The system is a single train with duplicate electromechanical equipment such as blowers and pumps. Effluent is conveyed to an onsite sand bed filtration basin by means of two submersible pumps stationed in the adjacent pump house. The system receives wastewater influent from the high school, which consists of a functional cafeteria and gym, as well as an additional full scale test kitchen with a subsequent downstream grease trap. A copy of the record drawings for the existing onsite wastewater treatment system is provided in **Appendix A.** Note that the entire set of plans are not available, and are limited to the sheets included in Appendix A. Fuss & O'Neill conducted a RIDEM file review. Based upon our limited research, it appears that the OWTS was approved by the local health agent, prior to RIDEM's oversight of onsite systems.

Based on a site visit by our staff performed on April 5, 2023, numerous deficiencies were identified. This includes, but is not limited to, the following:

1.) Extended Air Wastewater Treatment System Observations
    a. Only 2 of the diffusers operate
    b. Grating is rusted and unsafe
    c. Clarifier chain and flight system is broken
    d. Aged wastewater transfer pump to disposal field
    e. Corroded discharge piping
    f. Severe corrosion on support leg for control panel
2.) Groundwater Discharge / Disposal Field Observations
    a. Broken distribution piping
    b. Distribution box missing from cell no. 1
    c. Field shows signs of organic fouling of sand (dark biomat).

Based on the deficiencies list above, it has been determined that the existing OWTS is no longer in satisfactory condition to serve the High School. The Town has contracted Ray Plante & Sons, Inc. to pump wastewater from the aeration basin and haul it to Cranston WWTP for appropriate treatment and disposal. This is not a viable, long-term solution, and it is costly.

Alternatives Evaluation

The following alternatives have been evaluated.

Alternative 1: Extend Gravity Sewer in Tiogue Avenue

A sanitary sewer manhole and 18-inch PVC stub and end cap gravity sewer line exists approximately 2,100 feet East of the intersection of Tiogue Avenue and Reservoir Road. The invert elevation for the existing 18-inch stub is approximately 234.63± and was installed as part of Coventry's Sewer Extension Contract 4, circa 2005.

Alternative 1 involves extending the existing gravity sewer line approximately 2,100 feet West along Tiogue Avenue and North another 1,700 feet on Reservoir Road to the entrance of the high school. The High School's gravity collection system (8" diameter gravity line) will require extension to convey wastewater flow to the East, ultimately discharging to the new 18" gravity sewer extension from Tiogue Avenue. The High School's collection system currently flows towards the South-West where the existing OWTS is sited.

As part of this alternative, it is estimated that approximately 3,800 linear feet of 18-inch gravity sewer and 1,200 linear feet of 8-inch gravity sewer would need to be installed. See **Figure 1** for a conceptual layout of this alternative.

The budgetary opinion of cost for this alternative is $4,220,000 (Range -30%/+50%: $2,360,000 to $5,060,000).

Alternative 2: Construct High School Pump Station and Tie Into Existing Force Main
Westwood Estates, toward the northern end of Reservoir Road, owns/operates an existing private pump station (identified as the Reservoir Road Pump Station in the Facility Plan). The private pump station is equipped with a 6-inch discharge and force main that travels South on Reservoir Road before ultimately tying into Woodland Manor Pump Station's 10-inch force main, which travels West-East in Tiogue Avenue.

Alternative 2 involves construction of a new "smart" pump station at the entrance of the high school. The High School's pump station would tie into the existing 6-inch force main on Reservoir Road, ultimately discharging to the 10" Woodland Manor force main. The High School's pump station would need to be equipped with an equalization tank, so the wastewater could be pumped during "off-hours", protecting the other pump stations and force mains. The High School's pump station will require 24/7 odor control.

In addition to the pump station, equalization tank, and odor control system, it is estimated that this alternative will require 1,200 linear feet of 8" gravity sewer and 100 linear feet of force main. The 8" gravity sewer will convey wastewater from the high school to the new EQ tank, and the force main will convey pump station effluent to the private 6" force main in Reservoir Road.

Furthermore, the existing stations (Reservoir Road Pump Station and Woodland Manor Pump Station) would also need to be upgraded to ensure proper communications between all three. We also recommend evaluation of the condition of each force main. We believe the risk of implementing Alternative No. 2 is not limited to damage or replacement of the 6-inch force main, but also potential damage to the other pump stations. The potential risk is on the order of $500,000 or more and is not captured in the budgetary opinion of cost below. Additionally, the potential cost of tie-in to or acquisition of the private force main is not included in the budgetary opinion of cost. See **Figure 2** for a conceptual layout of this alternative.

The budgetary opinion of cost for this alternative is $2,540,000 (Range -30%/+50%: $1,430,000 to $3,050,000).

Alternative 3: Construct On-Site Passive System
Alternative 3 involves construction of an on-site system comprised of passive treatment (grease traps, septic tanks, an equalization tank, and a dosing pump station) followed by groundwater discharge via a conventional leachfield.

Pursuant to RIDEM design standards for conventional onsite wastewater treatment systems, the design wastewater generation rate is 40,000 gallons per day (gpd)for the high school, and the passive treatment tanks would need to be sized as follows:

- Grease Traps: 50% Design Volume – 20,000 gallons

- Septic Tanks: 200% Design Volume – 80,000 gallons
- Equalization Tank: 100% Design Volume – 40,000 gallons

The design of the conventional leachfield for this alternative is largely dependent on the site's soil type and depth to the restrictive layer (ledge or groundwater). Based on soil types, leach field trench widths and separation distances, the groundwater disposal field will likely be 2-3 acres in size. Soil evaluation and mounding analysis will be required to finalize groundwater disposal type and size. See **Figure 3** for the soil type surrounding Coventry High School.

The budgetary opinion of cost for this alternative is $5,950,000 (Range -30%/+50%: $3,340,000 to $7,140,000).

Alternative 4: Construct On-Site Advanced Treatment System
Alternative 4 involves construction of a new wastewater treatment plant and groundwater discharge system.

Five (5) treatment system vendors provided proposals for retrofit and replacement options. For the retrofit option, many of the proposals were contingent upon the re-use of the existing aeration/clarifier tank. Preliminary efforts were made to pump down the tank to evaluate its condition. The existing extended aeration basin has a steel liner that is severely corroded. Repair/retrofit of the basin is not viable, and a formal structural inspection could not be conducted due to the presence of non-pumpable sludge in the bottom 18" of the basin.

Therefore, a new treatment system (replacement) will be required for Alternative 4. The quality of treated wastewater will be high enough to warrant higher applications rates than required of the leach field included in Alternative 3. Based on soil types and presuming utilization of a recirculating sand filter, the groundwater disposal field will likely be less than 0.5 acres in size. Soil evaluation and mounding analysis will be required to finalize groundwater disposal type and size. See **Figure 3** for the soil type surrounding Coventry High School.

The budgetary opinion of cost for this alternative is $4,950,000 (Range -30%/+50%: $2,780,000 to $5,940,000).

SWOT Analysis

A Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis has been performed for the above-mentioned alternatives. Those are presented in **Appendix B**.

Summary of Costs and Recommendations

Below is a summary of the budgetary opinion of costs associated with each alternative presented above. A detailed breakdown of the opinion of cost for each alternative is provided in **Appendix C.**

Alternative	Budgetary Opinion of Project Cost
Alt. No. 1 – Extend Gravity Sewer	**$4,220,000** (Range -30%/+50%: $2,360,000 to $5,060,000).
Alt. No. 2 – EQ Tank and Pump Station	**$2,540,000** (Range -30%/+50%: $1,430,000 to $3,050,000).
Alt. No. 3 – On-site Passive System	**$5,950,000** (Range -30%/+50%: $3,340,000 to $7,140,000)
Alt. No. 4 – On-site Active System	**$4,950,000** (Range -30%/+50%: $2,780,000 to $5,940,000)

Notes

1.) Budgetary Opinion of Project Costs include 25% Contingency and 22% for Engineering, Legal and Administrative.
2.) Interim hauling and abandonment/closure of existing wastewater treatment system is not included in the Budgetary Opinion of Project Costs presented above.

Despite Alternative No. 1's estimated project cost being higher than that of Alternative No. 2, we recommend implementation of Alternative No. 1 – Extend Gravity Sewer in Togue Avenue. Alternative 1 aligns with the Town's Wastewater Facility Plan and is an investment in the Town's long term sewer infrastructure. In our opinion this is the best return on the Town's investment.

Alternatives 2-4 are limited to serving only the High School parcel, and pursuit of these alternatives will result in sunk costs when considering the long-term sewer extension to Planning Areas 1 and 2 recommended in the Facility Plan. Alternative No. 1 will provide benefits to the Town in the long term by enabling future sewer service to Planning Areas 1 and 2.

Figures

1 - Alternative No. 1 – Extend Gravity Sewer
2 - Alternative No. 2 – Pump Station
3 - Coventry High School Soil Type

Appendices

A - Record Drawings
B - SWOT Analysis
C - Detailed Opinion of Cost

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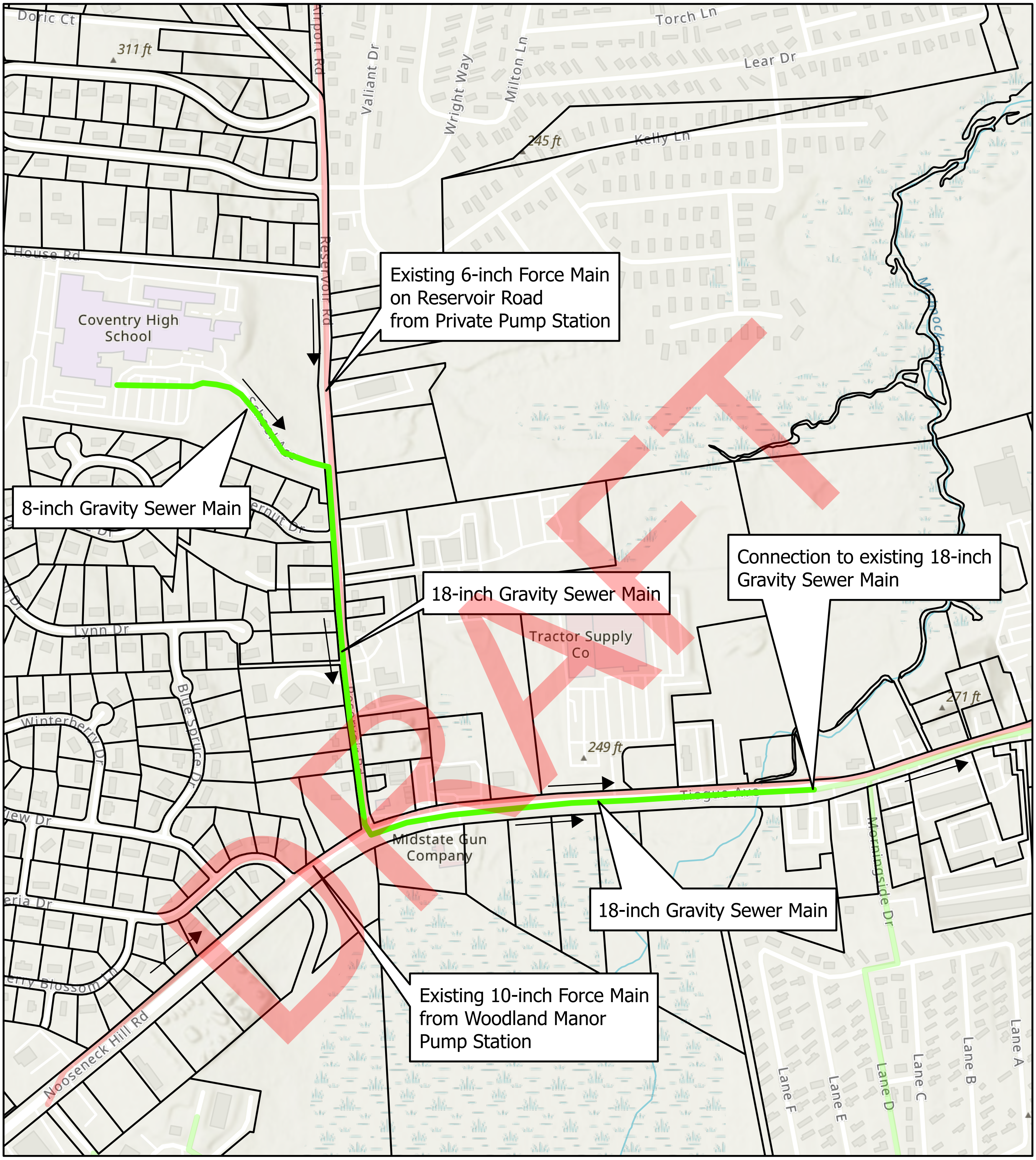
Figures



Legend

- Proposed Gravity Sewer Main
- Parcel Line
- Existing Froce Main
- Existing Gravity Sewer Main

0 200 400 800 Feet

N

Disclaimer: This map is not the product of a Professional Land Survey. It was created by Fuss & O'Neill, Inc. for general reference, informational, planning and guidance use, and is not a legally authoritative source as to location of natural or manmade features. Proper interpretation of this map may require the assistance of appropriate professional services. Fuss & O'Neill, Inc. makes no warrantee, express or implied, related to the spatial accuracy, reliability, completeness, or currentness of this map.

Alternative No. 1

Extend Gravity Sewer in Tiogue Avenue

Coventry | Rhode Island

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Figure #1

Folder: K:\P2022\0052\A30\MXD\Coventry, RI Sewer System - High School Alternates\ Project: Coventry, RI Sewer System - High School Alternates Layout: Alternate No. 1 Map: Main Data Frame Map Frame
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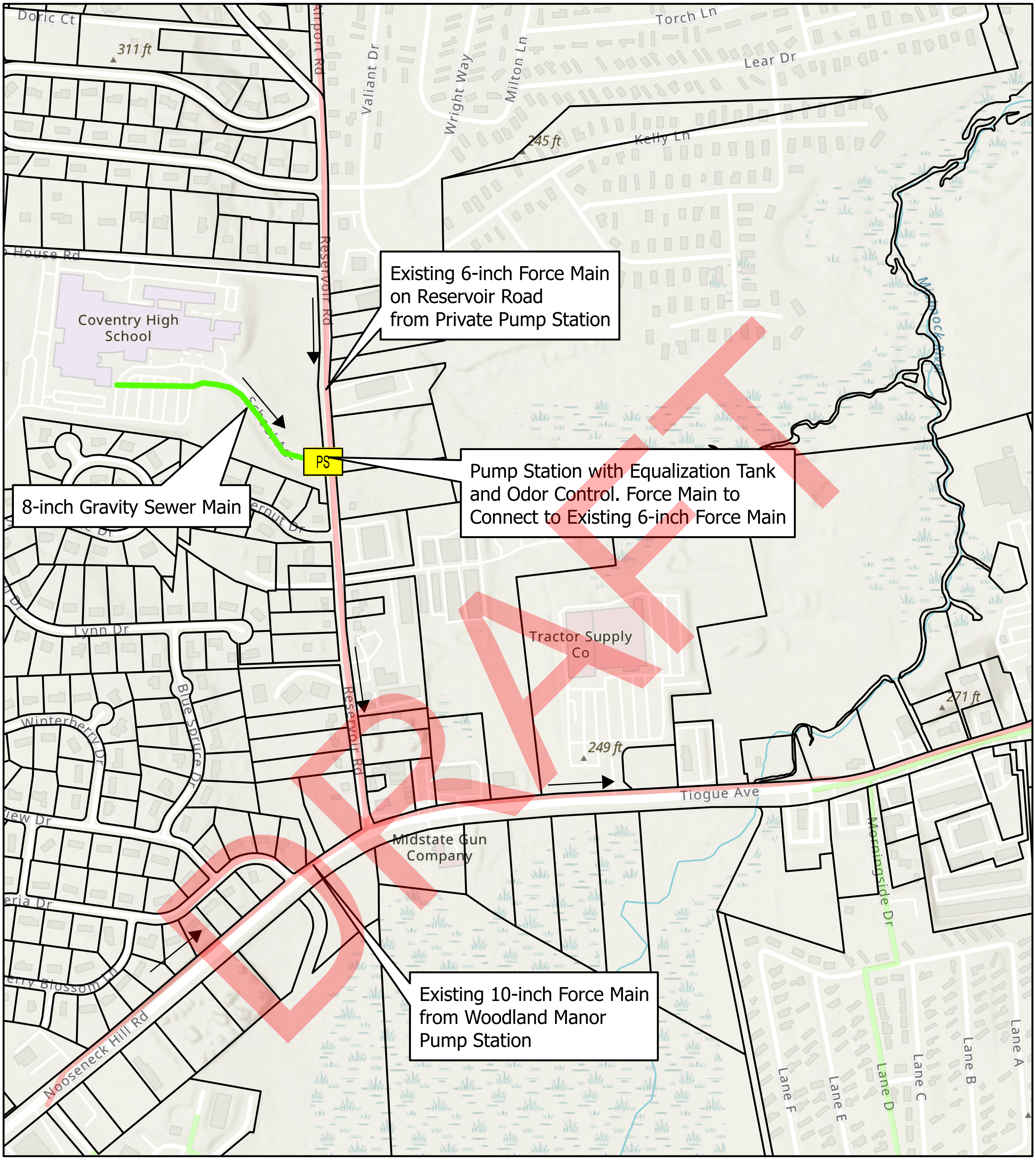

Legend

PS Proposed Pump Station

Parcel Line

Existing Froce Main

Existing Gravity Sewer Main

Proposed Gravity Sewer Main

0 200 400 800 Feet

N

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Alternative No. 2
Construct Equalization Tank and Pump Station and Tie-in to Existing Force Main on Reservoir Road

Coventry Rhode Island

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Figure #2

Folder: K:\P2022\0052\A30\MXD\Coventry, RI Sewer System - High School Alternates\ Project: Coventry, RI Sewer System - High School Alternates Layout: Alternate No. 2 Map: Main Data Frame Map Frame
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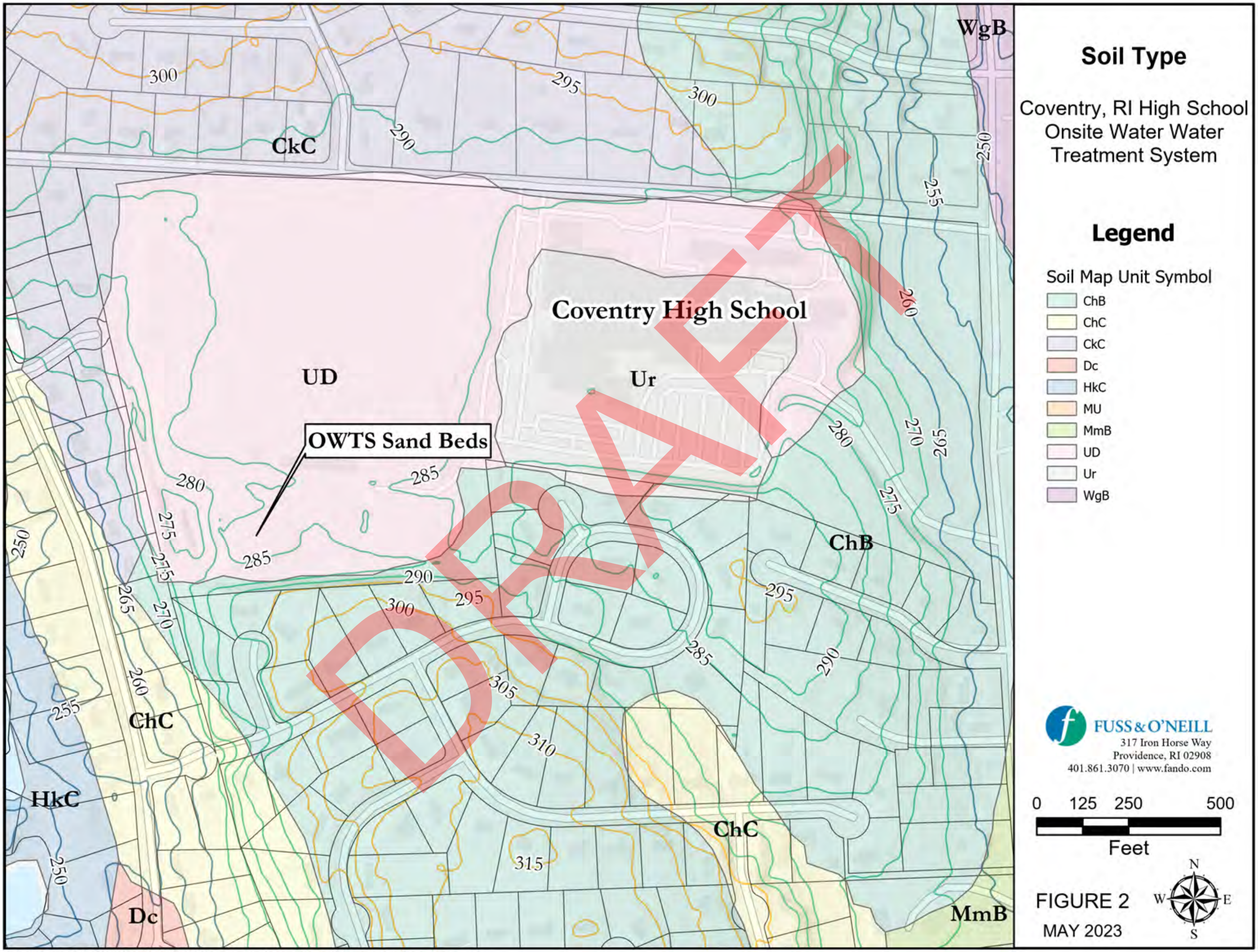

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Appendix A

Record Drawings


NOTES
1 FOR SITE UTILITY LEGEND AND SEE DWG NO. SE-8
HYDRANT - MUELLER A-24012 W/ GATE VALVE & BOX & THRUST BLOCK
1/4 C.I. BEND W/ THRUST BLOCK
8"x6" REDUCER C.I.
6" GATE VALVE & BOX
NEW 8" WATER
90° C.I. BEND W/ THRUST BLOCK STA. C1+50
8" GATE VALVE AND BOX STA C2+00
8"x6" C.I. TEE W/ THRUST BLOCK
8"x6" C.I. TEE W/ THRUST BLOCK
TEMPORARY 6" TEST END 5' FROM BUILDING
CLUBHOUSE
6" AC WATER SERVICE
HYDRANT - MUELLER A-24012 OPEN LEFT W/ GATE VALVE & BOX & THRUST BLOCK
8"x6" TEE W/ THRUST BLOCK STA. C4+00
MATCH LINE DWG. NO. SE-6
4' DIA PRECAST METER PIT SEE DETAIL SHEET
8"x4" TEE W/ THRUST BLOCK STA C5+60
4" AC WATER TO ATHLETIC FIELD
4" GATE VALVE & BOX
1/4 C.I. BEND W/ THRUST BLOCK STA. C6+48
NEW 8" AC WATER MAIN
MANHOLE INV. 278.52
INV. 278.00
INV. 280.50
INV. 278.21
INV. 277.60
INV. 279.14
1/8 BEND C.I. W/ THRUST BLOCK STA. A10+74
MANHOLE INV. 277.30
8"x6" TEE C.I. W/ THRUST BLOCK STA. A10+16
MANHOLE INV. 276.83
1/8 BEND C.I. W/ THRUST BLOCK STA. A 13+62
6" GATE VALVE & BOX
TEMPORARY 6" TEST END 5' FROM BUILDING
MANHOLE INV. 277.90
HYDRANT - MUELLER A-24012 OPEN LEFT W/ GATE VALVE & BOX & THRUST
8"x6" TEE W/ THRUST BLOCK STA. A5+00
6" AC FIRE SERVICE
2 1/2 WYE CONNECTION SEE PLUMBING FOR BUILDING
VALVE INDICATOR POST MUELLER A-20800 W/ MUELLER A-2072-20 VALVE
6' MIN. DEPTH OF COVER IN VICINITY OF DITCH OVER WATER LINE
10' OFF CURB
6' OFF CURB
370' - 8" VC S = 0.004
MANHOLE INV. 276.17
MANHOLE INV. EL. 274.69
NEW 8" AC WATER MAIN
See attached plan for added drainage from adjacent subdivision
ROAD
RESERVOIR
8" AC WATER SERVICE TO CURB LINE BY K.C.W.A.
PLUG W/ THRUST BLOCK BY K.C.W.A.
8"x8" TEE W/ THRUST BLOCK BY K.C.W.A.
8" GATE VALVE & BOX BY K.C.W.A.
TEMPORARY 8" TEST END AT CURB LINE
8" A.C. WATER MAIN EXTENSION BY K.C.W.A.
DRAFT
SCALE: 1" = 50'


DRAFT
PLAN
SCALE 3/8"=1'-0"
CONTROL ROOM
CLARIFIER CHAMBER
AERATION CHAMBER
SCUM POCKET
ADJUSTABLE EFFLUENT WEIR TROUGH
CONCRETE SLAB
PIPE STRUTS
STEEL GRATING
SLUDGE HOPPER
3" SCUM RETURN LINE
INLET BAFFLES FOR SETTLING TANK
3"Ø SLUDGE RETURN LINE
SLUDGE HOPPER CONNECTING PIPE
BLOWER UNIT FOR AIR DIFFUSER W/ WEATHERPROOF HOUSING
DIFFUSER AIR ADJUSTING VALVE
MAIN AIR HEADER
DIFFUSER ASSEMBLIES
COMMINUTOR
SPRAY LINE W/ NOZZLES
SPRAY PUMP
OPERATING LEVER
COLLECTING DRIVE UNIT
CONTROL PANEL
FINISH FLOOR ELEV. 273.50
STEEL STAIRWAY
EXHAUST VENT
2" P.V.C. WATER LINE
WATTS 900 BACKFLOW PREVENTER 3/4" SIZE
G.E. SILICONE ROOFING OR APPROVED EQUAL
STEEL STAIRS
MOTOR
FEED DRAIN
START 2ND. PUMP AT ELEV. 269.05
START 1ST PUMP AT ELEV. 268.55
STOP PUMPS 1 & 2 AT ELEV. 263.83
WET WELL
PUMP
PUMP HOUSE
PREFABRICATED PUMP HOUSE SEE SPECS.
8" FIRST CLASS BEDDING
TOP OF STEEL TANK ELEV. 276.25
FINISH GRADE ELEV. 276.00
EFFLUENT WEIR TROUGH
8" SCUM SKIMMER PIPE W/ OPERATING LEVEL
H.W.L. ELEV. 270.87
GROUT RING
INV. EL. 270.37
8" C.I. EFFLUENT PIPE
BAFFLE
8" MECHANICAL COUPLING
DRIVE CHAIN
FLIGHT
AIR LIFT PUMP
COLLECTOR SPEED 2 F.P.M.
BOTTOM OF TANK ELEV. 261.37
DIFFUSER DROPS
SUBMERGED BAR SCREEN
8" C.I. INFLUENT SEWER
SECTION A-A
SCALE 3/8"=1'-0"
#5 @ 12" T&B
#6 @ 12" T&B
PREFABRICATED AIRATION & CLARIFIER CHAMBER
ADDENDUM NO.
LABELLED SCUM RETURN
REVISIONS
CHANGED SIZE OF SLUDGE
BLOWER UNITS W/ WEATHERPROOF HOUSING
INLET BAFFLE
CLARIFIER CHAMBER
AIR LIFT PUMPS
SLUDGE HOPPER CONNECTING PIPE
ELEV. 261.37
SLUDGE HOPPER ELEV. 257.54 ELEV. 256.54
SLUDGE HOPPER
SECTION B-B
SCALE 3/8"=1'-0"
3" SCUM RETURN
3"Ø SLUDGE RETURN
SUBMERGED BAR SCREEN
AERATION CHAMBER
MAGNESIUM ANODE PACKAGE
ANCHOR TURNBUCKLE
BOTTOM OF TANK ELEV. 261.37
SECTION C-C
SCALE 3/8"=1'-0"


DRAFT
CONTROL ROOM
CLARIFIER CHAMBER
AERATION CHAMBER
PLAN
SCALE 3/8"=1'-0"
CONTROL ROOM
WET WELL
PUMP HOUSE
CLARIFIER CHAMBER
AERATION CHAMBER
SECTION A-A
SCALE 3/8"=1'-0"
CLARIFIER CHAMBER
AIR LIFT PUMPS
SECTION B-B
SCALE 3/8"=1'-0"
AERATION CHAMBER
SECTION C-C
SCALE 3/8"=1'-0"
TOP OF STEEL TANK ELEV. 276.25
FINISH GRADE ELEV. 276.00
BOTTOM OF TANK ELEV. 261.37
SLUDGE HOPPER ELEV. 257.54 ELEV. 256.54
MAIN AIR HEADER
DIFFUSER AIR ADJUSTING VALVE
3" SLUDGE RETURN
SUBMERGED BAR SCREEN
INLET BAFFLE
SLUDGE HOPPER CONNECTING PIPE
STEEL GRATING
CONCRETE SLAB
DIFFUSER ASSEMBLIES
COMMINUTOR
NOTE
PREFABRICATED AIRATION & CLARIFIER CHAMBERS
ADDENDUM NO. 2
REVISIONS
CHANGED SIZE OF SLUDGE HOPPE
FENTON
CONSULTI
DESIGNED BY P.H.
DRAWN BY W.H.W.
SEWAGE
PLA
SAN


FOOTBALL GOAL POSTS
FOOTBALL
FIELD
FOOTBALL GOAL POSTS
DENSE TREES
225'
100'
40'
110'
165'
165'
114'
114'
150'
80'
30'
23'-4"
R=106'
350'-0" TO ℄ ROAD "C"
MATCH LINE
PT. 236 STA. D12+02.209
N8,816.144
E15,950.511
2-7'H.x4'W. C.L. GATES
PERMANENT STANDS
3040 SEAT CAP.
(ALT. #2)
8'H.x24'W. C.L. DOUBLE GATE
PT. 247
N8,773.399
E15,889.979
244
B.H.#27
PT. 243
N8,793.778
E16,011.542
PT. 244
N8,748.709
E15,995.025
8'H.x12'W. C.L. GATE
STORAGE BLDG.
(ALT. NO. 8)
154°30'
128'
SAND FILTER BEDS
PT. 245
N8,725.539
E15,893.639
T.P. #1
T.P. #2
8'H. CHAIN LINK FENCE
W/7'H.x4'W. C.L. GATE
7'H.x4'W. C.L. GATE (2)
PT. 246
N8,613.865
E15,902.179
8'H. CHAIN LINK FENCE
PT. 5
N8,481.554
E15,791.645
888.694'
N80°52'-24.4"W
TREES
300
D.H.
E15,750
E16,000
E16,250
N8,250
100'
100'
DRAFT

Appendix B

SWOT Analysis

SWOT ANALYSIS

ALT 1: Gravity Sewer Extension from Tiogue Avenue

STRENGTHS (S)

- In-keeping with Facility Plan recommendations. Invests in sewer infrastructure to serve PA 1 and 2 in the future.
- Life Cycle – lowest energy
- Shortest Implementation Time

WEAKNESSES (W)

- Odor control: If Westwood Estates ties in, it will help, but plan for routine flushing of 18" line recommended until PA1/2 are sewered.

OPPORTUNITIES (O)

- Westwood PS tie-in to ALT 1 will alleviate Woodland Manor PS backpressure and provide scouring of 18" gravity sewer.
- If ALT 2 is implemented before ALT 1, opportunity to tie gravity line feeding the HS PS to the future 18" gravity interceptor

THREATS (T)

- Potential issues with site clearing, ledge
- RIDEM approval – verbal agreement to provide expedited review of design. Goal to obtain written follow-up once RIDEM director returns from vacation 7/26/23.

SWOT ANALYSIS

ALT 2: Pump to Reservoir Road Force Main

STRENGTHS

S

- Lowest capital cost estimate
- Life Cycle – moderate energy consumption

WEAKNESSES

W

- No FP sewer infrastructure investment. Serves HS property, only.
- 40,000 gallons+ in EQ volume, new pump station. Routine maintenance & 24/7 Odor Control
- Leadtime of Genset 9-12 months.

OPPORTUNITIES

O

- If/When gravity sewer extends N along Reservoir Rd, tie gravity line feeding the HS PS to the gravity sewer, eliminating the PS

THREATS

T

- Agreement with owner of Westwood Estates PS and Reservoir Rd Force Main owner
- Potential issues with site clearing, ledge, and/or utility limitations
- Risk of force main damage, repair/replacement costs, $500,000+ potential liab.

SWOT ANALYSIS

ALT 3: Passive Treatment and Groundwater Discharge Via Conventional Leachfield

STRENGTHS

S

- Low maintenance
- Less invasive to access roadways
- No licensed WWT operation.
- Life Cycle – low energy

WEAKNESSES

W

- No FP sewer infrastructure investment. Serves HS property, only.
- Requires 120,000 gallons+ in basin volume and ~ 3 acres of drainage field
- RIDEM will stipulate external grease trap for any/all kitchens

OPPORTUNITIES

O

- No opportunity afforded to the future sewer extension.

THREATS

T

- Soil Evaluation and Mounding analysis may not bode well for the option
- Requires routine pump/haul settled solids, oil/grease, and trash from trash trap

SWOT ANALYSIS

ALT 4: Biological Treatment and Groundwater Discharge via Pressure Dosing Field

STRENGTHS (S)

- Less invasive to access roadways
- Minimizes GW drainage field size
- No licensed WWT operation
- Life Cycle – low energy

WEAKNESSES (W)

- No FP sewer infrastructure investment. Serves HS property, only.
- Requires 40,000 gallons+ in EQ volume and new WWTS and new pump station (dosing to GW)
- Life Cycle – highest energy, requires operator (labor)

OPPORTUNITIES (O)

- No opportunity afforded to the future sewer extension.

THREATS (T)

- Soil Evaluation and Mounding analysis required
- Routine pump/haul settled solids, oil/grease, and trash from trash trap
- RIDEM may req. external grease trap if all kitchens are not tied to the existing external trap.

Appendix C

Detailed Opinion of Cost

FUSS & O'NEILL

Coventry Highschool Wastewater Alternatives Analysis

Alternative Number 1 - Extend Gravity Sewer in Tiogue Avenue

Coventry, Rhode Island

Item No.	Description	Unit of Measure	Quantity	Unit Cost	Extended Cost
	Gravity Sewer Installation				
	8-inch Gravity Sewer	L.F.	1,200	$125	$150,000
	18-Inch Gravity Sewer	L.F.	3,800	$200	$760,000
	Sanitary Sewer Manholes	EA.	10	$7,500	$75,000
	Rock Excavation[1]	C.Y.	800	$200	$160,000
	Construction Mobilization[3]	L.S.	1	$80,000	$80,000
	Record Drawings	L.S.	1	$10,000	$10,000
	Traffic Control - State Police Officer[4]	HR.	336	$100	$33,600
	Maintenance & Control of Traffic	L.S.	1	$50,000	$50,000
	Gravity Sewer Installation Total				*$1,320,000*
	Temporary Bituminous Repair (Town Road)	L.F.	2,500	$35	$87,500
	Permanent Bituminous Repair (Town Road)	L.F.	2,500	$65	$162,500
	Temporary Bituminous Repair (State Road)	L.F.	2,100	$40	$84,000
	Permanent Bituminous Repair (State Road)	L.F.	2,100	$85	$178,500
	Mill and Overlay (State Road)[2]	S.Y.	15,200	$40	$608,000
	Mill and Overlay (Town Road)[2]	S.Y.	7,800	$40	$312,000
	Engineering/Legal/Administrative		22%		$610,000
	Subtotal				**$3,370,000**
	Contingency		25%		$850,000
	Total Opinion of Project Cost				**$4,220,000**
	TOTAL COST (-30% TO +50% ROUNDED)				$2,360,000 TO $5,060,000

This is an order of magnitude cost estimate that is expected to be within -30 to +50 percent of the actual project cost. Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions. Fuss & O'Neill's opinion of probable Total Project Costs and Construction Cost are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.

Date: March 2023 | Prepared By: RM | Checked By: DB/LM

Notes:

1.) Assume 1 foot of rock excavation for entire length of gravity sewer along Tiouge Avenue
2.) State Road based on measured road width for Tiogue Ave and Town Road based on measured road width of Reservoir Road & High School Driveway
3.) Construction Mobilization is assumed to be 3% of the total construction costs
4.) Calculated using assumption of 8 hours per day for two officers for of installation of 2000 LF of pipe along Tiogue Ave at a rate of 100 LF per day.
5.) Typical planning level costs carry contingencies of -30% to +50%. Opinion of costs will continue to be refined during subsequent phases.
6.) Total cost (-30% To 50%) does not include contingency of 25%
7.) Interim hauling not included.
8.) Abandonment/closure of existing wastewater treatment system not included.
9.) Total cost (-30% To 50%) does not include contingency of 25%

FUSS & O'NEILL

Coventry Highschool Wastewater Alternatives Analysis

Alternative Number 2 - Construct Equalization Tank and Pump Station and Tie Into Existing Force Main on Reservoir Road & Discharge to Tiogue Avenue Force Main

Coventry, Rhode island

Item No.	Description	Unit of Measure	Quantity	Unit Cost	Extended Cost
	Gravity Sewer Installation				
	8-Inch Gravity Sewer	L.F.	1,200	$125	$150,000
	Sanitary Sewer Manholes	EA.	8	$7,500	$60,000
	Manhole Reconstruction	L.S.	1	$10,000	$10,000
	Rock Excavation[1]	C.Y.	300	$200	$60,000
	Construction Mobilization[3]	L.S.	1	$50,000	$50,000
	Record Drawings	L.S.	1	$10,000	$10,000
	Maintenance & Control of Traffic	L.S.	1	$50,000	$50,000
	Equalization Tank	L.S.	1	$181,000	$181,000
	Valve Vault and Associated Piping and Valves	L.S.	1	$50,000	$50,000
	HS PS Equipment, Controls and Communication for 2 Existing PS's	L.S.	1	$460,000	$460,000
	Force Main	L.F.	100	$90	$9,000
	Force Main Investment	L.S.	1	$0	$0
	Odor Control	L.S.	1	$100,000	$100,000
	Slatted Perimeter Fence and Double Swing Gates	L.F.	240	$150	$36,000
	Backup Generator	L.S.	1	$100,000	$100,000
	Electrical Service	A.L.	1	$15,000	$15,000
	Field Svc, Programming/comm. Allowance, 3 PS's across 2 FM's	L.S.	1	$30,000	$30,000
	Site Clearing and Grubbing	L.S.	1	$100,000	$100,000
	Temporary Bituminous Repair (Town Road)	L.F.	800	$35	$28,000
	Permanent Bituminous Repair (Town Road)	L.F.	800	$65	$52,000
	Mill and Overlay (Town Road)[2]	S.Y.	2,200	$40	$88,000
	Force Main Condition Assessment	L.S.	1	$20,000	$20,000
	Engineering/Legal/Administrative		22%		$370,000
	Subtotal				**$2,030,000**
	Contingency		25%		$510,000
	Total Opinion of Project Cost				**$2,540,000**
		TOTAL COST (-30% TO +50% ROUNDED)			$1,430,000 TO $3,050,000

This is an order of magnitude cost estimate that is expected to be within -30 to +50 percent of the actual project cost. Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions. Fuss & O'Neill's opinion of probable Total Project Costs and Construction Cost are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.

Date: July 2023	Prepared By: RM	Checked By: DB/LM

Notes:
1.) Assume 1 foot of rock excavation for entire length of gravity sewer along High School Driveway
2.) Based on estimated road width for Town Road and High Way Driveway.
3.) Construction Mobilization is assumed to be 3% of the total construction costs
4.) Typical planning level costs carry contingencies of -30% to +50%. Opinion of costs will continue to be refined during subsequent phases.
5.) Total cost (-30% To 50%) does not include contingency of 25%
6.) Interim hauling not included.
7.) Abandonment/closure of existing wastewater treatment system not included.

FUSS & O'NEILL

Coventry Highschool Wastewater Alternatives Analysis

Alternative Number 3 - Construction On-Site Passive System

Coventry, Rhode island

Item No.	Description	Unit of Measure	Quantity	Unit Cost	Extended Cost
	Tanks				
	Grease Trap Tanks (20,000 Gallons)[1]	EA.	2	$37,500	$75,000
	Septic Tanks (80,000 Gal)[2]	EA.	7	$37,500	$262,500
	Equalization Tank (40,000 Gal)[3]	EA.	2	$75,000	$150,000
	Leach Field				
	Leaching Field[4]	LF	13,610	$225	$3,062,250
	Disposal of Impacted Sand Filter Material	LS	1	$55,000	$55,000
	Effluent Pump Station	LS	1	$100,000	$100,000
	Site Restoration/Improvements	LS	1	$200,000	$200,000
	Engineering/Legal/Administrative		22%		$860,000
	Subtotal				**$4,760,000**
	Contingency		25%		$1,190,000
	Total Opinion of Project Cost				**$5,950,000**
		TOTAL COST (-30% TO +50% ROUNDED)			$3,340,000 TO $7,140,000

This is an order of magnitude cost estimate that is expected to be within -30 to +50 percent of the actual project cost. Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions. Fuss & O'Neill's opinion of probable Total Project Costs and Construction Cost are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.

Date: July 2023	Prepared By: RM	Checked By: DB/LM

Notes:

1.) Grease Trap sized to be 50% of design flow
2.) Septic Tanks sized to be 200% of design flow
3.) Equalization Tank sized to be 50% of design flow
4.) Length of leachfield calculated assuming application rate 0.7 gpd/ft^2 and 4.2 ft^2 leach area per linear foot. This application rate requires formal soil evaluation and mounding analysis.
5.) Typical planning level costs carry contingencies of -30% to +50%. Opinion of costs will continue to be refined during subsequent phases.
6.) Interim hauling not included.
7.) Abandonment/closure of existing wastewater treatment system not included.

FUSS & O'NEILL

Coventry Highschool Wastewater Alternatives Analysis

Alternative Number 4 - Construct On-Site Active System

Coventry, Rhode island

Item No.	Description	Unit of Measure	Quantity	Unit Cost	Extended Cost
	Tanks				
	Septic Tanks	EA.	1	$37,500	$37,500
	Wastewater Treatment System				
	Demolition & Disposal of Mtl inside Existing Basin	LS.	1	$200,000	$200,000
	Skid System Treatment System	LS.	1	$1,300,000	$3,250,000
	New Effluent Pump Station with Controls	LS.	1	$100,000	$100,000
	Leach Field				
	Disposal of Impacted Sand Filter Material	LS.	1	$55,000	$55,000
	Recirculating Sand Filter	LS.	1	$312,000	$312,000
	Gravity Piping to Distribution Field	LS.	1	$5,000	$5,000
	Engineering/Legal/Administrative		22%		$870,000
	Subtotal				$3,959,500
	Contingency		25%		$989,900
	Total Opinion of Project Cost				**$4,950,000**
	TOTAL COST (-30% TO +50% ROUNDED)				$2,780,000 TO $5,940,000

This is an order of magnitude cost estimate that is expected to be within -30 to +50 percent of the actual project cost. Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions. Fuss & O'Neill's opinion of probable Total Project Costs and Construction Cost are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.

Date: July 2023	Prepared By: RM	Checked By: DB/LM

Notes:

1). Assumes existing aeration/clarifier tank is in unsatisfactory condition for reuse.
2.) Skid System Treatment System cost based vendor proposal for Membrane Bioreactor skid mounted system.
3). Assumes 90 Days, 10 Hours a day, 200$ an hour.
4.) Typical planning level costs carry contingencies of -30% to +50%. Opinion of costs will continue to be refined during subsequent phases.
5.) Interim hauling not included.
6.) Abandonment/closure of existing wastewater treatment system not included.

Appendix B

RIDEM Email Correspondence

From: Laura Marcolini <LMarcolini@fando.com>
Sent: Wednesday, April 19, 2023 11:13 AM
To: Freij, Mohamed (DEM) <mohamed.freij@dem.ri.gov>
Cc: Douglas Brisee <dbrisee@fando.com>; Ryan Morais <RMorais@fando.com>; Lafaille, Brian (DEM) <brian.lafaille@dem.ri.gov>; Ferreira, Kyle (DEM) <kyle.ferreira@dem.ri.gov>; Duranleau, David (DEM) <David.Duranleau@dem.ri.gov>
Subject: RE: Coventry High School OWTS

Thank you again, Mohamed. This feedback is appreciated.

Best regards, Laura

Laura Marcolini, PE
Vice President | Business Line Manager
Fuss & O'Neill, Inc. | LMarcolini@fando.com
(845) 452-6801 | cell: (401) 533-4235
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www.fando.com [fando.com] | Instagram [instagram.com] | vimeo [vimeo.com] | facebook [facebook.com] | linkedin [linkedin.com]

From: Freij, Mohamed (DEM) <mohamed.freij@dem.ri.gov>
Sent: Wednesday, April 19, 2023 10:53 AM
To: Laura Marcolini <LMarcolini@fando.com>
Cc: Douglas Brisee <dbrisee@fando.com>; Ryan Morais <RMorais@fando.com>; Lafaille, Brian (DEM) <brian.lafaille@dem.ri.gov>; Ferreira, Kyle (DEM) <kyle.ferreira@dem.ri.gov>; Duranleau, David (DEM) <David.Duranleau@dem.ri.gov>
Subject: RE: Coventry High School OWTS

I think you should start by having a soil evaluation done within 25' of the existing sand filter bed to establish a depth to Seasonal High Groundwater Table(SHGWT), this will allow you to assess if this existing sand bed provides proper vertical separation to SHGWT. If you could salvage this sand bed as you described below maybe we could move forward without advanced Groundwater studies but if you conclude that a new leaching field would be needed a Groundwater study would be needed as an important part of sizing the leaching field.

MJF

From: Laura Marcolini <LMarcolini@fando.com>
Sent: Tuesday, April 18, 2023 3:52 PM
To: Freij, Mohamed (DEM) <mohamed.freij@dem.ri.gov>
Cc: Douglas Brisee <dbrisee@fando.com>; Ryan Morais <RMorais@fando.com>; Lafaille, Brian (DEM) <brian.lafaille@dem.ri.gov>; Ferreira, Kyle (DEM) <kyle.ferreira@dem.ri.gov>; Duranleau, David (DEM)

<David.Duranleau@dem.ri.gov>
Subject: RE: Coventry High School OWTS

Mohamed,

I have one question related to Rule 6.39: Would this rule apply if we source a new treatment system to replace the extended aeration basin but **repair the existing sand filter beds** [clear brush, remove top layers of sand, install new sand, and new distribution boxes, new laterals]? This may be the path we have to take, but I just wanted to clarify that we don't intend to build a new groundwater discharge bed.

Basically, I am asking whether the groundwater study and mounding analysis would be required under this scenario.

Laura Marcolini, PE
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From: Freij, Mohamed (DEM) <mohamed.freij@dem.ri.gov>
Sent: Tuesday, April 18, 2023 12:54 PM
To: Laura Marcolini <LMarcolini@fando.com>
Cc: Douglas Brisee <dbrisee@fando.com>; Ryan Morais <RMorais@fando.com>; Lafaille, Brian (DEM) <brian.lafaille@dem.ri.gov>; Ferreira, Kyle (DEM) <kyle.ferreira@dem.ri.gov>; Duranleau, David (DEM) <David.Duranleau@dem.ri.gov>
Subject: RE: Coventry High School OWTS

Thank you very much for your detailed summary.
I would design a system based on current and future needs for this school and I would not attempt to reduce the design flow based on average use. Please use the minimum design flow requirements per the current OWTS Regulations. Based on your analysis below I would stick with at least 40,000 GPD if not more depending on what the Town's projected near term and long term needs.
For a large system you would need to comply with Rule 6.39 of the OWTS Rules for Large System requirements which includes a groundwater study and mounding analysis.
The OWTS application form is the same for a small system or a large system.

Should you have any questions please contact me any time.

MJF

From: Laura Marcolini <LMarcolini@fando.com>
Sent: Thursday, April 13, 2023 1:24 PM
To: Freij, Mohamed (DEM) <mohamed.freij@dem.ri.gov>
Cc: Douglas Brisee <dbrisee@fando.com>; Ryan Morais <RMorais@fando.com>
Subject: Coventry High School OWTS

Mohamed,

We have exhausted the option to repair the existing extended aeration treatment system. Since the system was procured circa 1973, parts are no longer available. I have spoken with David Fernandes of Fernco Services, Inc. and with the original system supplier Boydco.

- Fernco would be able to and has provided service associated with electro-mechanical equipment that is operational at the HS's WWTP. The equipment that is operational is limited to blowers and effluent pumps. David indicates the comminutor has not been operational for some time. While he may be able to replace the comminutor, he has little confidence that he will be able to obtain replacement parts to fix the clarifier due to age.
- Boydco does not offer the parts/services required and does not sell WWTP's anymore.

Ray Plante is pumping and hauling wastewater from the extended aeration EA basin at the HS. I called Ray Plante's company earlier today to verify that their pump/haul service is keeping up with the wastewater generation rate. It is and a summary follows:

- Last week, they were hauling (2) trucks per day, each having a capacity of ~7,000 gallons, so that's 14,000 gallons per day. The liquid level in the basin was dropping by a couple inches each day.
- This week, school is not in, and they are hauling (1) truckload (~7,000 gallons per day). The basin water surface is down several feet, so they have some EQ buffer for when the kids are back to school next week.
- The current average daily flow looks to be ~10,000 gpd. Based on 2022 KCWA data, the water consumption by students/faculty was ~5,000 gpd. There could be some groundwater intrusion, but we have not investigated this fully.

The original EA system design flow was 40,000 gpd. The RIDEM OWTS criteria is 25 gpd/person for schools with cafeteria and gymnasiums. At 1,500 population, the design flow would be 37,500 gpd (so the 40,000 gpd makes sense).

Fuss & O'Neill will be obtaining (on behalf of the Town) proposals/quotes from suppliers for rental or purchase of a packaged WWT system until such time that we are able to design/extend sewer to the HS property.

- Can you please weigh in on the capacity required for the package plant?
- Should we stick with 40,000 gpd or could we justify a lower design flow?

I know GW discharge criteria looks for 10 mg/L nitrate at the property line. I am inclined to specify 10 mg/L TN in the system effluent.

After a system is identified and selected, Fuss & O'Neill will draft a repair/replacement application. If there is a specific document you require, would you please send me that? I could only identify a form suited for individual homes on RIDEM's website.

I appreciate your feedback on this and look forward to hearing from you. My colleagues Doug Brisee and Ryan Morais are copied here. I did not copy the larger group who attended our virtual meeting a week or so ago.

Best regards, Laura

Laura Marcolini, PE
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Appendix C

RFP/Q for Prepackaged Wastewater Treatment Systems

Packaged Wastewater Treatment Plant Request for Proposals/Quotations

Prepared On Behalf of Town of Coventry School Department Location: Coventry High School

Coventry, Rhode Island

April 2023

FUSS & O'NEILL
146 Hartford Road
Manchester, CT 06040

Table of Contents

Request For Proposals
Long-Term Packaged Wastewater Treatment Plant Options
Coventry High School

1 Introduction

1.1 Overview of Scope of Services

Fuss & O'Neill, Inc. requests a proposal for long-term packaged wastewater treatment plant options for Coventry, RI High School. Fuss & O'Neill is soliciting proposals on behalf of the Town of Coventry School Department and will not be the entity issuing any purchase order or engaging in the final contract. The system will be in use until sanitary infrastructure construction is extended to the project area.

1.2 Summary of Existing System

The existing system (circa 1973) consists of an extended aeration, clarifier, and sludge holding basin constructed as a shared-wall, CIP concrete basin. The system is a single train with duplicate electro-mechanical equipment such as blowers and pumps. Duplicity is only required for electro-mechanical equipment. The original system was not designed for TN removal. The existing system may be retrofitted to perform as an influent equalization (EQ) and transfer (pump) station to convey wastewater to the packaged treatment plant, or a new influent pump station will be installed by others, i.e. the supplier will not be responsible for supply of the influent pump station. Any/all required appurtenances such as comminutor, instrumentation, controls, blowers, mixers should be included or identified in proposal documents.

The influent wastewater stream includes the high school (assumed full capacity) including a functional cafeteria and gym, as well as an additional full scale test kitchen with a subsequent downstream grease trap.

2 Design Basis

The packaged wastewater treatment plant must have adequate capacity and treatment performance to comply with the provided design criteria provided in Tables 1 & 2. Table 1 design parameters. Criteria are per RIDEM OWTS Criteria (250-RICR-150-10-6). Table 2 water consumption is derived from monthly water usage readings from onsite water meters.

Table 1: Design Criteria for the Packaged Wastewater Treatment System

Location	Parameter	Criteria
Influent	Design Capacity Wastewater Flow	40,000 gpd Rounded up from 25 gpd/pe and 1,500 gpd/pe
	Actual Water Consumption	**See Table 2**
	BOD, TSS, TN, TP (mg/L)	250, 250, 40, 8
	Wastewater Temp	55-70º F
Effluent	BOD, TSS (mg/L)	30, 30
	Nitrate (mg/L), regulated at property line.	10

Table 2: Actual Water Consumption Data (Metered Data)

Coventry Public Schools Daily Water Consumption		pe=1,500
Days in Meter Period	**Gallons Per Day (gpd)**	**gpd/Persons (pe)**
35	4,613	3.08
25	7,830	5.22
35	4,432	2.95
30	5,101	3.40
30	4,679	3.12
30	3,435	2.29
32	3,271	2.18
37	4,055	2.70
43	5,201	3.47
29	4,469	2.98
35	2,245	1.50
RIDEM OWTS Criteria, School/Cafeteria/Gym		25.00
Total Design Flow (gpd) with 1,500 Students + Faculty		**37,500**

Provided gpd/pe are derived from monthly averages from a system that should be assumed to have higher flow volumes during weekdays of typical school calendar (August – June).

A final treatment system effluent of 30/30/10 (BOD/TSS/TN) is desirable; however, the groundwater discharge standards in RI allow for a maximum of 10 mg/L nitrate at the property line. Suppliers are encouraged to indicate system ability to meet 10 mg/L TN, impacts on cost and footprint.

Final effluent will be conveyed to the existing sand bed on site (groundwater disposal field). Coordination of final effluent transfer will be by others, i.e., package system suppliers are not expected to coordinate or provide final effluent transfer.

Town's Contractor shall install the system pursuant to vendor's instructions. The system will likely be installed on a concrete foundation, such that the system is above grade. The system should meet the operating noise requirements of less than 72 dBA at a distance of 30 feet. The system's compartments must be capable of withstanding hydrostatic pressure with any compartment empty or operating. The system shall be designed to withstand full exposure to winter and summer conditions in Rhode Island without piping/fitting or basin failure due to freeze/thaw conditions deteriorating structural soundness, and watertightness.

3 System Supplier Scope of Supply

The following table summarizes the system suppliers proposed division of scope of supply for the packaged wastewater treatment system including equipment, design, and implementation services.

- (3) Installation, Operation and Maintenance (IOM) Manuals
- Dimensional Data
- Electrical One-line Diagram and Requirements
- System Weight
  - Empty Weight
  - Operating Weight
- Product Data
- Anticipated Final Effluent Characteristics
- Instrumentation and Control integral to the system, a list of required or allowable interlocks between the influent pump station, the WWT system, and the effluent pump station. The influent and effluent pump stations are by others, so integration will be required between the system suppliers and Contractor.
- Cost
  - To be priced on a per month basis (lease basis), and
  - Optional purchase price.
- Startup & Training
  - 2 days of installation supervision
  - 3 days for commissioning and start-up, and performance testing
  - 2 8-hr days of normal working time of training over two separate trips within a three-month period.

4 Submittals & Services

The following information shall be submitted by the system supplier with their proposal:

- Proposals shall be clearly organized, with a table of contents.
- The proposal shall include a detailed mechanical and performance specification covering rental of all process equipment items to be supplied.
- The proposal shall include a listing of all equipment components required for the process.
- The proposal shall include drawings of the system configuration.
- The proposal shall include on-site equipment and process operation/control instruction as presented in the system supplier's Scope of Supply. Furnish the services of a competent field representative of the manufacturer to inspect the final installation, to test all components, and to perform the initial start-up and the acceptance test.

4.1 Operating & Maintenance Manuals

Operation & Maintenance (O&M) manuals shall include, but not necessarily be limited to the following. Costs for O&M Manuals shall be included in the Proposal as part of the Price. 3 paper copies, and a PDF of the O&M manual shall be submitted by the system supplier for review and approval.

- Table of contents and indexes
- Brief description of each system and components
- Starting and stopping procedures
- Special operating instructions
- Routine maintenance procedures
- Clean and concise manufacturers printed operating and maintenance instructions, adjustments, lubricants, and other maintenance of equipment including: parts list, illustrations, and diagrams
- Name and address and telephone numbers of local service representatives

5 Submittal of Proposals

A. Proposals shall be **addressed** to: Town of Coventry School Department
B. Proposals shall be submitted via email in PDF format to Ryan Morais & Douglas Brisee at Fuss & O'Neill, Inc.: RMorais@fando.com & DBrisee@fando.com
C. Questions shall be submitted to Ryan Morais & Douglas Brisee via email: RMorais@fando.com & DBrisee@fando.com
D. Proposals shall be submitted prior to 3:00 PM E.S.T. on April 28, 2023

Appendix D

April 5th, 2023, Site Visit Photos

Figure 1: Aeration Tank

Figure 2: Deteriorated Aeration Piping

Figure 3: Cracked Sand Bed Effluent Distribution Piping

Figure 4: OWTS Compressor

Figure 5: Pumping Station Interior

Figure 6: Pump Valve Configuration

Appendix E

RFP/Q Summary Table

System Description	Manufacturer & Plant Type	Retrofit/ Replace	Inclusions	Exclusions	Vendor Proposal Cost[1]	Notes
Extended Aeration Plant	**Smith & Loveless Inc. ADDIGEST**	Replace	• Factory-built, epoxy coated tankage. • 304 stainless steel, 3/4" opening, manual bar screen • One (1) WAS/RAS 3-inch Airlift pump • One (1) Sludge Holding zone 2-inch Decant pump • Air headers • Coarse bubble diffusers (SH, Aeration) with drop pipes • Valves for diffuser drop pipes • HC-142 Hopper type clarifier • Tablet Chlorination-Dechlorination Zone • One (1) 316SS Anoxic Zone Mixers & Guiderails • Two (2) Main Plant Blowers (duty + standby) • NEMA 4X Control Panel with relay logic controls • Freight • Start-up	• Unloading and setting of tank • Any buildings • Interconnecting piping and wiring outside of tank • Tank Covers • Any civil or concrete works	$895,000	One year manufacturing lead time.
Sequencing Batch Reactor	**Aqua-Aerobic Systems, INC. AQUACAM-D**	Retrofit	• 2.4 HP submersible pump • 3 inch diameter plug valve • 3 inch diameter swing check valve • 1 AQUACAM-D assembly - 25 HP aerator - 25 HP mixer - 25 HP decanter - 6 inch butterfly valve with actuator • Pressure transducer assembly • Controls with starters -NEMA 12 panel enclosure -Circuit breaker -Operator interface	• Freeze protection • Equipment vault • Unloading and storage • Concrete, handrail and all civil works • Interconnecting piping, wiring and installation • All flanges and/or unions in the piping to service the equipment • VFDs, Motor starters and MCC • Electrical conduit, hardware, supports, attachment of cables, wiring and j-boxes between motors, electrical valves, instruments and the control panel • Concrete, volumes as required, to fill mooring posts • Biological tanks, influent pump stations, pre-equalization system, downstream system	$253,355	Investigation required to determine if existing concrete structurally viable for usage.
Membrane Bioreactor	**AWC Solutions AWC MBR-40**	Replace	• Inlet piping • Inlet fine screen & compactor • Insulated equalization pre-aeration tank • Air cooled blower • Two (2) transfer pumps for aeration • Insulated aeration tank • PVDF membrane system with automated cleaning • Sludge holding tank with sludge decant pump • System pH Control • UV disinfection • Instrumentation sensors, flow meters, level transmitters, switches, gauges • PLC control systems for automatic operation • Access ladder and walkway	• Receiving, unloading and suitable storage of material • Installation of all equipment supplied • Site preparation, foundations and building work • Piping connections, yard piping, drain piping, or other piping outside the tank, skid, or plant structures • Design, supply, and installation of pipe connections between tanks and air blower(s) or backwash pumps • Design, supply and installation of field electrical wiring • Minor re-termination of electrical wiring from equipment to junction boxes due to shipping constraints • Backwash pumps and water supply • Sludge Pumping • Chemical Injection • Effluent pumps	$1,300,000	Not recommended, high operational requirements.
High-Rate Activated Sludge	**Newterra AI-40-FESH**	Replace	• Aeration, Anoxic & Sludge holding tanks • Dual-Hopper Clarifier • Bar screen • One (1) Submersible Mixer • Two (2) Aeration 7.5 HP Aeration Blowers • One (1) Air Manifold • One (1) 0.5 HP Internal Recycle Pump • Two (2) Airlift Sludge Return Pumps • Two (2) Airlift Scum Return Pumps • UV Disinfection System • System Control Panel	• Installation • Civil Engineering • Digested Sludge Handling/Disposal • Chemicals and Chemical Feed Systems • Interconnecting Piping, Valves, and Fittings Outside of Basin • Concrete Anchor or Epoxy Bolts • Unloading, Storage, and Accounting of Equipment	$797,000	Optional $474,000 Adder - Flow Equalizer
Membrane Aerated Bioreactor	**flucece Aspiral L4**	Replace	• One (1) 40-foot tank, four (4) MABR T2 Spiral Towers, internal pipelines, valves, and connections • Mixing blower • Fine and course bubble diffusers • MABR chamber mixing/aeration blower on separate skid • Containerized secondary clarifier • WAS/RAS pump • Chlorine dosing pump and contact tank • Anoxic Selector Tank Zone • Instrumentation for secondary treatment • One (1) MemTalk PLC Based Electrical Control Panel	• Use of existing concrete plant for EQ and Sludge Storage • Pre-treatment equipment to include FOG Trap at the minimum • Civil detailed design and works for overall site • Installation of equipment and tanks • Interconnecting piping, Aspiral L4 container inlet and outlet piping, aeration piping, fittings and valves • Detailed site electrical design and onsite electrical supply, electrical works and communication • Discharge of treated effluent • Sludge disposal (according to local requirements) • Containers for screenings or compactor • Electrical and communication supply to control cabinet	Purchase: $638,000 Lease (Monthly): $9,765.00	$35,000 Removal Fee.

Notes:
1.) Vendor proposal cost does not include engineering, permitting, or soil evaluation fees.

Appendix F

Prepackaged Pumping Stations Proposals

AQUA-AEROBIC SYSTEMS, INC.
A Metawater Company

REQUEST FOR PROPOSALS/QUOTATIONS
Packaged Wastewater Treatment Plant

For
Town of Coventry School Department
Coventry High School
Coventry, Rhode Island

Proposal Due Date:
April 28, 2023

Takuya Sakomoto, Application Engineer
Phone: 815-639-4487 | Fax: 815-654-8258
Email: tsakomoto@aqua-aerobic.com

April 27, 2023

Correspondence ID#: AAL-46253
Town of Coventry School Department
Attn: To Whom It May Concern
Coventry, Rhode Island
USA

Project: COVENTRY HIGH SCHOOL RI

RE: Request for Proposals/Quotations for Packaged WWTP Town Coventry School Department dated April 2023
AASI Project #117720
AASI Preliminary Proposal Package #171283 dated April 27, 2023

We are pleased to enclose our proposal preliminary package for the AquaSBR® Sequencing Batch Reactor System utilizing our Aqua-CAMD® Equipment for the New High School Wastewater at the Town of Coventry. Included within this package are recommendations for a True Batch SBR system process that meets or exceeds the effluent requirement listed within the documents received. Aqua-Aerobic Systems, Inc. is offering the proposed equipment to meet the referenced effluent targets,subject to approval by the Owner or the Consulting Engineer. Please take a moment to review our proposal notes for Aqua-Aerobic Systems' equipment terminations and items not included in Aqua-Aerobic Systems' scope of supply which are to be provided by the Installing Contractor.

The proposal package includes all the deliverables in the order requested.

While many SBR systems look similar there are distinct differences. We understand that effluent quality management is important for this project, therefore based on the operation of the AquaSBR system as a True Batch system with a time-based approach, the owner will benefit from this unique control strategy to allow for maximum treatment capacity.

The AquaSBR System proposed includes all equipment accessible from the side of the tank and all the maintenance can be done without need for dewatering the basin. Aqua-Aerobic has been providing SBR systems since 1986, and since then, many of the SBR systems provided have taken advantage of the modular capability of the AquaSBR. The system can be easily expanded by simply adding SBR tanks to handle future flows. In addition, the system features separation aeration and mixing, which gives the ability to change the treatment environment to meet more stringent requirements.

As requested by RFP, we are including in this cover letter the price for the AquaSBR® Sequencing Batch Reactor System equipment, freight and supervision services as detailed in our proposal package is $253,355.

We would like to call attention that if the school process system requires a permit limit of only BOD/TSS removal to limits of 30/30 mg/l on a monthly basis an alternate solution that we can offer is our AquaBioMax® System. The advantages of BioMax system is that the installation is fairly straightforward, please refer to Section 4 of this proposal package for details in this process.

We appreciate the opportunity to be considered as a solution for the Town of Coventry School Department' wastewater treatment needs, and welcome any questions that may arise regarding our system during the evaluation period. Please contact me at 815-639-4487 or by e-mail at tsakomoto@aqua-aerobic.com, or our local sales representative, listed below

Sincerely,

Takuya Sakomoto
Application Engineer

CC: Technology Sales Associates / ph#: 774/248-5479 / fx#: N/A
Matt Vareika / MattV@techsalesne.com

Aqua-Aerobic Systems, Inc.
Tom Miles / TMiles@aqua-aerobic.com

Thea Davis / TDavis@aqua-aerobic.com

Town of Coventry School Department
Coventry High School
Coventry, Rhode Island

Table of Contents

April 27, 2023

AASI Cover Letter # AAL-46253

AQUA-AEROBIC SYSTEMS, INC.
A Metawater Company

Process Design Report

COVENTRY HIGH SCHOOL RI

Design# 171283

Option: Preliminary AquaSBR Design

AquaSBR®

Sequencing Batch Reactor

April 27, 2023

Designed By: Takuya Sakomoto

6306 N. Alpine Rd Loves Park, IL 61111
(815) 654-2501 www.aqua-aerobic.com

Upstream Recommendations

- Neutralization is required ahead of the biological system if the pH is expected to fall outside of 6.5-8.5 for significant durations.

- Coarse screening and grit removal is recommended (by others) ahead of the biological system.

- Elevated concentration of hydrogen sulfide can be detrimental to both civil and mechanical structures. If anaerobic conditions exist in the collection system, steps should be taken to eliminate hydrogen sulfide prior to the treatment system.

- Flow equalization is required ahead of the biological reactor(s) to provide interruption of flow during the non-fill phases. Flow equalization and equipment shall be provided by others by RFP.

- SBR design assumes the equalization basin is equipped with a dedictaed feeding pump system with one standby pump to control flow, so no influent valves will be required with this set up.

Flow Considerations

- The maximum flow has been assumed to be equal to the average flow.

Biological Process

- The decanter performance is based upon a free-air discharge following the valve and immediately adjacent to the basin. Actual decanter performance depends upon the complete installation including specific liquid and piping elevations and any associated field piping losses to the final point of discharge. Modification of the high water level, low water level, centerline of discharge, and / or cycle structure may be required to achieve discharge of full batch volume based on actual site installation specifics.

Process/Site

- The anticipated effluent nitrogen requirement is predicated upon an influent waste temperature of 10 °C or greater. While lower temperatures may be acceptable for a short-term duration, nitrification and (if required) denitrification below 10 °C can be unpredictable, requiring special operator attention.

- Sufficient alkalinity is required for nitrification, as approximately 7.1 mg alkalinity (as $CaCO3$) is required for every mg of $NH3$-N nitrified. If the raw water alkalinity cannot support this consumption, while maintaining a residual concentration of 50 mg/l, supplemental alkalinity shall be provided (by others).

- The average and maximum flow and loading conditions, shown within the report, are based on maximum month conditions, respectively.

Equipment

- Changes in basin geometry may require alterations in the equipment recommendation.

- The basins are not included and shall be provided by others.

- Influent is assumed to enter the reactor above the water level, away from the decanter, and to avoid splashing or direct discharge in the immediate vicinity of other equipment. If the influent enters the basin below the water level, adequate hydraulic capacity shall be made in the headworks to prevent backflow from one reactor to the other during transition of influent.

- A minumum freeboard of 2.0 ft is recommended for use of the AquaCAM-D.

- Scope of supply includes freight, installation supervision and start-up services.

- Equipment selection is based upon the use of Aqua-Aerobic Systems' standard materials of construction and electrical components, suitable for non-classified electrical environments.

- The basin dimensions reported on the design have been assumed based upon the required volumes and assumed basin geometry. Actual basin geometry may be circular, square or rectangular with construction materials including concrete or steel.

- The control panel does not include motor starters for equipment not described in this design, which should be provided in a separate MCC (by others).

- Provisions should be made, by others, for overflows in each of the recommended basins.

- Aqua-Aerobic Systems, Inc. is familiar with various “Buy American” Acts (i.e. AIS, ARRA, Federal FAR 52.225, EXIM Bank, USAid, PA Steel Products Act, etc.). As the project develops Aqua-Aerobic Systems can work with you to ensure full compliance of our goods with various Buy American provisions if they are applicable/required for the project. When applicable, please provide us with the specifics of the project’s “Buy American” provisions.

PRE-EQUALIZATION DESIGN PARAMETERS

Avg. Daily Flow:	= 0.04 MGD	= 151 m3/day
Max. Daily Flow:	= 0.04 MGD	= 151 m3/day

No. of SBR Reactors:	= 1
No. of Cycles/Day/Basin (Ncpd):	= 5
Duration of Non-Fill/cycle (Tnf):	= 2.4 Hours/Cycle
Influent Production Period (Tp):	= 24 Hours/Day
Storage Retention (Tr):	= 2.4 Hours

PRE-EQUALIZATION VOLUME DETERMINATION

The storage retention time (Tr) required for equalization has either been given to Aqua Aerobic Systems, Inc. or has been assumed with the data provided. The volume required for equalization/storage (Vs) shall be provided between the high and low water levels of the basins(s) listed above and has been specifically selected such that it will allow interruption of flow to a single basin SBR during its scheduled non-filling phases (React, Settle, and Decant). The storage volume (Vs) has been determined by the following:

Vs = (MDF x Tnf x 60)/1440 = 4,000 gal = (534.8 ft^3) = (15.1 m^3)

The volumes determined in this summary reflect the minimum volumes necessary to achieve the desired results based upon the input provided to Aqua. If other hydraulic conditions exist that are not mentioned in this design summary or associated design notes, additional volume may be warranted.

PRE-EQUALIZATION BASIN DESIGN VALUES

No./Basin Geometry:	= 1 Basin(s) By Others	
Required Basin Vol. Basin:	= 5,121.9 gal	= (19.4 m^3)
Max Flow Rate Required Basin :	= 56 gpm	= (0.210 m^3/min)

AquaSBR® - Sequencing Batch Reactor - Design Summary

Design#: 171283

Project: COVENTRY HIGH SCHOOL RI

Option: Preliminary CamD Design

Designed by Takuya Sakomoto on Thursday, April 27, 2023

AQUA-AEROBIC SYSTEMS, INC.
A Metawater Company

DESIGN INFLUENT CONDITIONS

Avg. Design Flow (ADF)	= 0.04 MGD	= 151 m³/day
Max Design Flow (MDF)	= 0.04 MGD	= 151 m³/day

DESIGN PARAMETERS

	Influent	mg/l	Effluent Required	<= mg/l	Effluent Anticipated	<= mg/l
Bio/Chem Oxygen Demand:	BOD5	250	BOD5	30	BOD5	10
Total Suspended Solids:	TSS	250	TSS	30	TSS	10
Total Kjeldahl Nitrogen:	TKN	40	--	--	--	--
Ammonia Nitrogen:	--	--	NH3-N	1	NH3-N	1
Total Nitrogen:	--	--	TN	10	TN	10
Total Phosphorus:	TP	8	--	--	--	--

SITE CONDITIONS

	Maximum		Minimum		Elevation (MSL)
Ambient Air Temperatures:	85 F	29.4 C	20 F	-6.7 C	174 ft
Influent Waste Temperatures:	70 F	21.1 C	55 F	10.0 C	53.0 m

SBR BASIN DESIGN VALUES

			Water Depth			Basin Vol./Basin		
No./Basin Geometry:	= 1 Rectangular Basin(s)		**Min (LWL)**	= 11.9 ft	= (3.6 m)	**Min (Vlwl)**	= 0.03 MG	= (115.0 m³)
Freeboard:	= 2.0 ft	= (0.6 m)	**Avg (AWL)**	= 15.0 ft	= (4.6 m)	**Avg (Vawl)**	= 0.038 MG	= (145.3 m³)
Length of Basin:	= 19.0 ft	= (5.8 m)	**Max (HWL)**	= 15.0 ft	= (4.6 m)	**Max (Vhwl)**	= 0.038 MG	= (145.3 m³)
Width of Basin:	= 18.0 ft	= (5.5 m)						

Number of Cycles:	= 5 per day/basin (advances cycles beyond MDF)	
Cycle Duration:	= 4.8 hr/cycle	
Food/Mass (F/M) ratio:	= 0.073 lbs. BOD5/lb. MLSS-Day	
MLSS Concentration:	= 4,500 mg/l @ LWL	
Hydraulic Retention Time:	= 0.959 days @ AWL	
Solids Retention Time:	= 15.8 days	
Est. Net Sludge Yield:	= 0.824 lbs. WAS/lb. BOD5	
Est. Dry Solids Produced:	= 68.7 lbs. WAS/day	= (31.2 kg/day)
Est. Solids Flow Rate:	= 20 gpm (824 gal/day)	= (3.1 m³/day)
Decant Flow Rate @ MDF:	= 200 gpm (as avg. from HWL to LWL)	= (12.6 l/sec)
LWL to CenterLine Discharge:	= 1.0 ft	= (0.3 m)
Lbs. O2/lb. BOD5	= 1.25	
Lbs. O2/lb. TKN	= 4.6	
Actual Oxygen Required:	= 166 lbs./day	= (75.1 kg/day)
Daily Max. Month Avg. Estimated Power*:	= 300.3 kWh/day	

* Power consumption calculations in this document are based on maximum month conditions. Detailed power vs. loading calculations can be provided if requested.

DRAFT

AquaSBR

WAS Transfer Pumps/Valves

1 Submersible pump assembly(ies) consisting of the following items:

- 2.4 HP Submersible Pump(s) with painted cast iron pump housing, discharge elbow, and multi-conductor electrical cable.
- 3 inch diameter plug valve(s).
- 3 inch diameter swing check valve.
- Guide bar(s).
- Upper guide bar bracket(s).

AquaCam-D

1 AQUACAM-D Assembly(ies) consisting of:

- 25 HP Aerator/Mixer/Decanter(s) with fiberglass floats, painted steel power section, and 304 stainless steel restrained mooring frame and weir.
- Aluminum band clamp heater integral to the decanter power section(s).
- 6 inch diameter decant hose assembly.
- 4" schedule 40 galvanized restrained mooring post(s) with base plate.
- #8 AWG four-conductor electrical service cable(s).
- #14 AWG ten-conductor electrical service cable(s).
- 6 inch electrically operated butterfly valve(s) with actuator.

Level Sensor Assemblies

1 Pressure Transducer Assembly(ies) each consisting of:

- Pressure transducer(s).
- Mounting bracket weldment(s).
- Transducer mounting pipe weldment(s).

1 Level Sensor Assembly(ies) will be provided as follows:

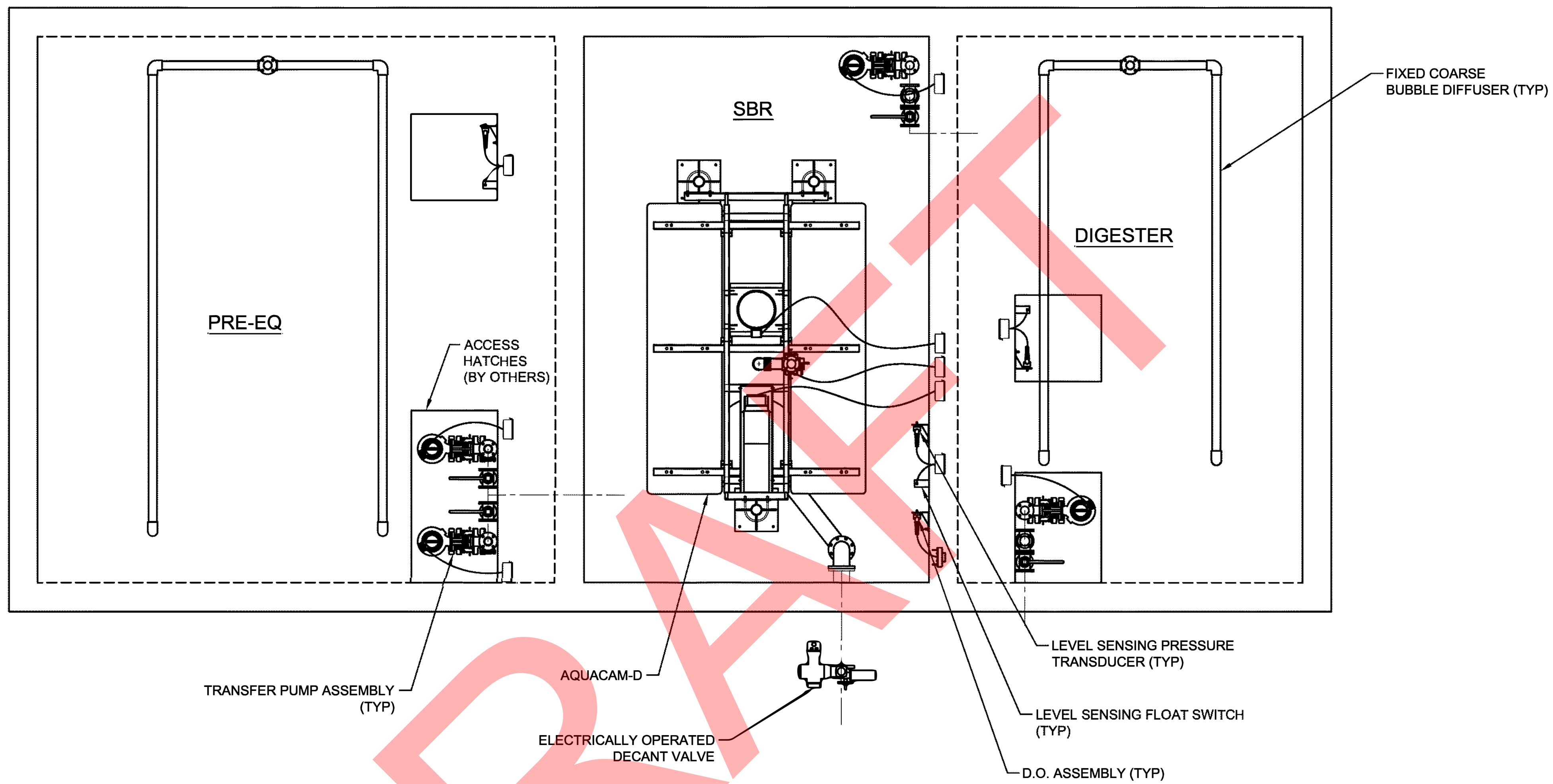
- Float switch(es).
- Float switch mounting bracket(s).
- Stainless steel anchors.

Controls

Controls w/Starters

1 Controls Package(s) will be provided as follows:

- NEMA 12 panel enclosure suitable for indoor installation and constructed of painted steel.
- Circuit breaker with handle.
- Fuse(s) and fuse block(s).
- Compactlogix Processor.
- Operator interface(s).
- Size 0 motor starter(s).
- Size 2 motor starter(s).
- Remote access Ethernet modem(s).



PRE-EQUALIZATION BASIN

19.0' X 18.0'
15.5' BASIN DEPTH
13.8' MAXIMUM WATER DEPTH
1.5' MINIMUM WATER DEPTH

SBR BASIN

19.0' X 12.0'
15.5' BASIN DEPTH
14.5' MAXIMUM WATER DEPTH
10.8' MINIMUM WATER DEPTH

DIGESTER BASIN

19.0' X 12.0'
15.5' BASIN DEPTH
11.0' MAXIMUM WATER DEPTH
7.7' MINIMUM WATER DEPTH

GROUTING:
NOTE: IF BASINS WITH SLOPED FLOORS ARE UTILIZED, SUPPLY OF GROUT PADS BENEATH THE PROPOSED EQUIPMENT TO PROVIDE FOR A LEVEL INSTALLATION ELEVATION FOR THE EQUIPMENT IS TO BE PROVIDED BY THE INSTALLING CONTRACTOR/PURCHASER.

NOTE: ALL VALVE VAULTS, DISCONNECT BOXES, INFLUENT PIPING, EFFLUENT PIPING, SLUDGE / TRANSFER PIPING, AND WALKWAYS ARE SHOWN FOR REFERENCE ONLY AND ARE TO BE SUPPLIED AND INSTALLED BY OTHERS.
NOTE: BASIN OVERFLOWS MUST BE PROVIDED.
NOTE: INFLUENT VALVE ISOLATION OR BY-PASS MUST BE PROVIDED BY THE INSTALLING CONTRACTOR.
NOTE: VENTING OF DECANT LINE MAY BE REQUIRED DEPENDING ON DOWN STREAM CONDITIONS.

DIFFUSED AIR SYSTEM:
NOTE: DEPENDING ON THE ACTUAL YARD PIPING FROM THE BLOWERS TO THE DIFFUSER SYSTEM AND THE HEAT LOSSES ASSOCIATED WITH THE YARD PIPING, ADDITIONAL PROVISIONS FOR COOLING OF THE AIR (I.E. INCORPORATING HEAT EXCHANGERS) AND/OR MODIFICATION OF IN-BASIN PIPING AND/OR DIFFUSER SLEEVE MATERIAL MAY BE REQUIRED. AQUA-AEROBIC SYSTEMS, INC. RESERVES THE RIGHT TO MODIFY THE FOLLOWING EQUIPMENT OFFERING TO ENSURE COMPATIBILITY OF ALL IN-BASIN COMPONENTS WITH ACTUAL AIR TEMPERATURES.

FIXED COARSE BUBBLE DIFFUSER:
NOTE: BLOWER DISCHARGE MANIFOLD AND PIPING LOSSES ARE ASSUMED AT 0.30 psi. FROM TERMINATION FLANGE OF THE BLOWER TO THE DIFFUSER RISER PIPE TERMINATION FLANGE. ENGINEER TO VERIFY ACTUAL LINE LOSSES DO NOT EXCEED THE ABOVE. INLET LOSSES ARE ASSUMED AT 0.25 PSI FOR INLET SILENCER AND A CLEAN FILTER. NO INLET LOSSES HAVE BEEN ASSUMED FOR INLET FILTER PIPING, AND IT IS ASSUMED THAT THE FILTER IS LOCATED ON EACH BLOWER.

NOT FOR CONSTRUCTION

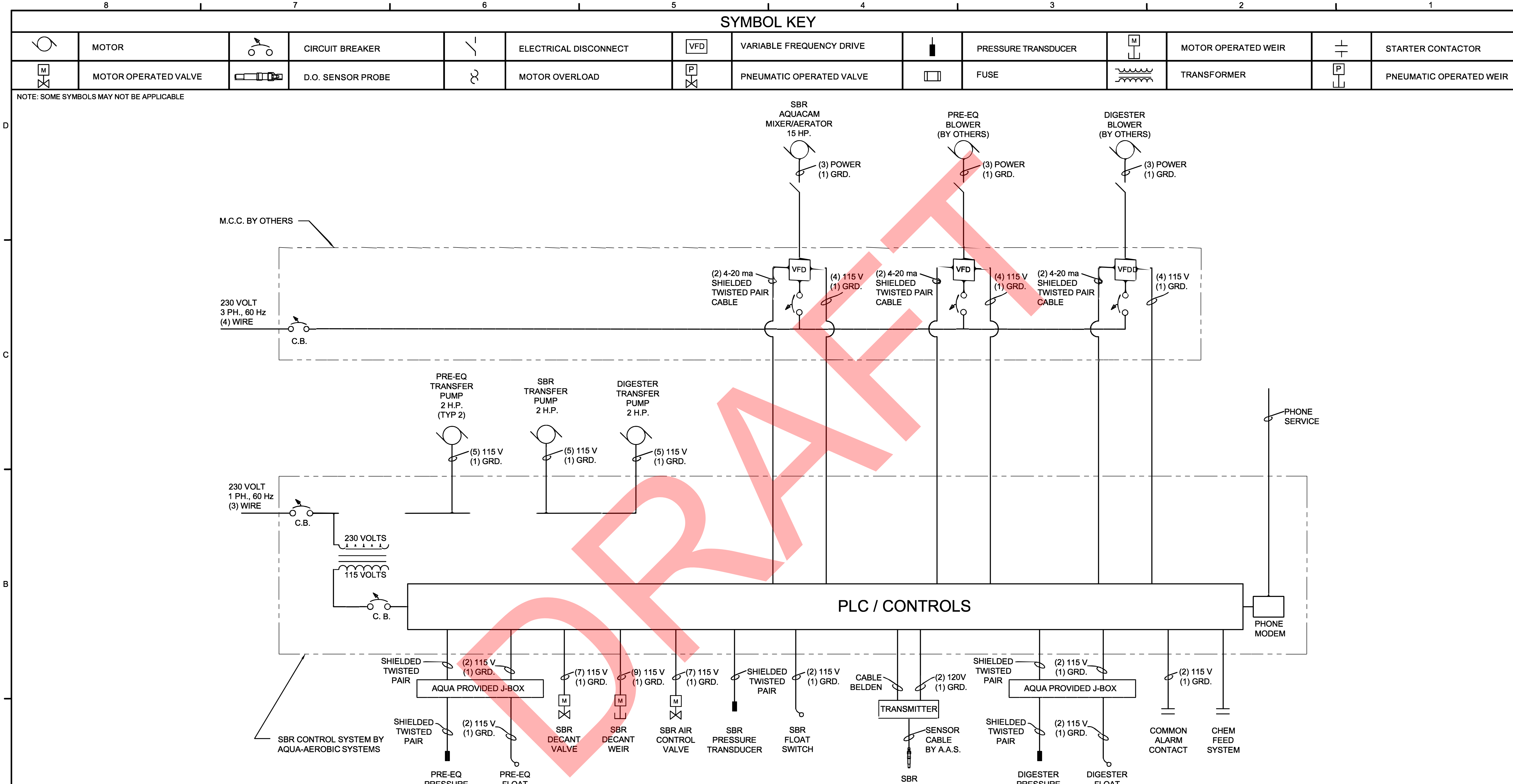
JOB NAME: TYPICAL LAYOUT SINGLE BASIN				
JOB LOCATION: MI				
A	-	2019-02-05	AMG	REQUESTED UPDATES
REV	ERN / ECO	DATE	BY	REVISION DESCRIPTION
DRAWING NAME: LAYOUT				

AQUA-AEROBIC SYSTEMS, INC.
A Metawater Company

DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
FRACTIONAL DIMENSIONS +/- 1/16
ALL TWO PLACE DECIMALS +/- 0.010
ALL THREE PLACE DECIMALS +/- 0.005
ALLANGLES +/- 1/2°
ANSI

MATERIAL:
SIMILAR TO:
TYPE:
DRAWN BY: AMG | DATE: 2018-08-27
WEIGHT: | SHEET: 1 OF 1
DRAWING NUMBER: 8115304-1 | SCALE: | SIZE: D



NOTE: IF PUMPS, MIXERS, AND AERATORS ARE PROVIDED A MULTI-CONDUCTOR S.O. CABLE SHALL BE INCLUDED. THE CABLE SHALL TERMINATE AT A JUNCTION BOX/DISCONNECT PROVIDED BY OTHERS.

NOTE: SUBMERSIBLE PUMPS ARE PROVIDED WITH CONTROL WIRES FOR THE THERMAL SWITCH EMBEDDED IN THE WINDINGS OF THE PUMP. (TWO CONTROL AND ONE GROUND)

NOTE: ANCILLARY EQUIPMENT MONITORING AND/OR CONTROL REQUIREMENTS ARE YET TO BE DETERMINED. ELECTRICAL REQUIREMENTS FOR AQUA-AEROBIC SYSTEMS CONTROL PANEL ARE SUBJECT TO CHANGE, PENDING VERIFICATION OF ANCILLARY EQUIPMENT CONTROL FOR MONITORING REQUIREMENTS.

NOTE: IF REQUIRED, SKIMMER LOCAL CONTROL POWER MAY BE PROVIDED VIA ANY SOURCE IN LIEU OF THE SBR CONTROL PANEL.

NOT FOR CONSTRUCTION

JOB NAME: TYPICAL ONE LINE DIAGRAM
JOB LOCATION: MI

AQUA-AEROBIC SYSTEMS, INC.

DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED

REV	ERN / ECO	DATE	BY	REVISION DESCRIPTION
A	-	2019-02-05	AMG	REQUESTED UPDATES

MATERIAL:
SIMILAR TO:
TYPE:
DRAWN BY: AMG DATE: 2018-08-27
CHECKED BY: DATE:
WEIGHT: SHEET: 1 OF 1
DRAWING NAME: SBR ONELINE
DRAWING NUMBER: 8115304-2
SCALE:
SIZE: D

20-YEAR O&M ESTIMATE

COVENTRY HIGH SCHOOL RI

Design#: 171283

Option: Preliminary CamD Design

Designed By Takuya Sakomoto on Thursday, April 27, 2023

Prepared By Tatiana Mazzei on Thursday, April 27, 2023

Biological Estimated Operation & Maintenance Costs — Design#: 171283

Project: COVENTRY HIGH SCHOOL RI

Option: Preliminary CamD Design

Designed by Takuya Sakomoto on Thursday, April 27, 2023

AQUA-AEROBIC SYSTEMS, INC.
A Metawater Company

I. EQUIPMENT MAINTENANCE AND REPLACEMENT ESTIMATE

Qty	Unit	Service Required	Replacement Interval (Years)	Material Cost	20-Year Total
	AquaSBR				
1	AquaCam-D	Motor Grease	1	$4	$80
1	AquaCam-D	Replace Actuator, Capacitor, Limit Switch	5	$1,200	$4,800
1	Sludge Pump	Repair Kit	5	$589	$2,356
	Controls				
1	Controller	Replace Relays, Switches, Fuses	1	$50	$1,000
1	Controller	Replace Microprocessor Battery	3	$26	$156

INTERVAL TOTALS:

1-Year	2-Year	3-Year	5-Year	7-Year
$54	-	$26	$1,789	-

20-Year Estimated Total: $8,392

II. LABOR REQUIREMENTS ESTIMATE

Estimated General Operation & Maintenance **

6.0 = Man Hours/week for Process Testing

2.0 = Man Hours/week for General Plant Cleanup and Routine Maintenance

III. POWER CONSUMPTION ESTIMATE

Power Costs of All Equipment as Proposed *

AquaSBR	300	(kWh/day)
Total:	300	(kWh/day)
Estimated $/kWh:	$0.08	
Total Annual Power Cost:	$8,767	

20-Year Estimated Power Cost: $175,340

IV. O&M NOTES

* This is based upon operation at 100% of design conditions.

** The values listed are for estimating purposes only. The actual amount of operator attention provided will be dependent upon local requirements and the size of the staff available for testing.

All estimates are based upon equipment maintenance and operation in accordance with the O & M instructions provided by Aqua-Aerobic Systems. They are based on typical SBR installations with a normal preventative maintenance schedule for the equipment. The actual maintenance man hours required for each project will vary depending upon site and climate conditions, which may alter the frequency of the maintenance schedule.

Work by Others

-Materials and Services not specifically described/itemized in this proposal are not included in the quoted total price, and are to be supplied by the installing contractor/purchaser.

- Freeze protection may be required for outdoor installation in cold weather climates. All such protection, including but not limited to, heat tracing and insulation of pumps and piping, as well as protection against internal tank freezing, shall be provided and installed by the installing contractor.

-If steel tanks are utilized, field welding/attachment of equipment and/or components to the steel tank is the responsibility of the installing contractor/purchaser. Tank bosses, if applicable, are to be provided by the installing contractor/purchaser.

-If basins with sloped floors are utilized, supply of minimum 4000 psi type grout pads beneath the proposed equipment (such as base plates, brackets, mooring posts, diffuser supports/racks, etc.) are required to provide for a level installation elevation for the equipment. Grout pads are not included in Aqua-Aerobics' scope of supply or price, and are to be provided by the installing contractor/purchaser.

-Equipment vault(s) (if applicable) must be supplied with drain and/or sump.

- Unloading and storage.

- Provisions for equipment access.

- Concrete, handrail and all civil works.

-All air and process piping, spool pieces, supports, gaskets and hardware beyond Aqua-Aerobic's equipment terminations.

- Interconnecting piping, wiring and installation.

- All flanges and/or unions in the piping to service the equipment.

- VFDs, Motor starters and MCC (Motor Control Center).

- Electrical conduit, hardware, supports, attachment of cables, wiring and j-boxes (if any) between motors, electrical valves, instruments and the control panel.

- Installation/field wiring of the control panel(s) that ship loose.

- Electrical wiring and supply power.

- Concrete, volumes as required, to fill mooring posts.

- Biological tanks, influent pump stations, pre-equalization system, downstream system.

AquaCAM-D®
Combination Aerator/Mixer/Decanter
Operational Description

Mix Fill Phase

Prior to the start of the Mix Fill phase, the reactor contents exist in a stratified condition. The bottom portion of the reactor consists of settled sludge, and the top portion consists of a clear supernatant. At this point in time, the reactor has recently completed a Decant cycle, and the overall water depth is equal to the minimum side water depth (SWD).

The reactor environment has been "conditioned" by events that occurred during the prior cycle. First, the reactor environment has been conditioned by the termination of flow (and associated organic loading) to the reactor as the React Fill phase was completed. Second, the completion of the React phase provided the opportunity for the wastewater contaminants in the reactor to be "polished off". Third, the absence of mixing and aeration during the Settle, Decant, Idle and Waste Sludge phases further conditioned the reactor environment.

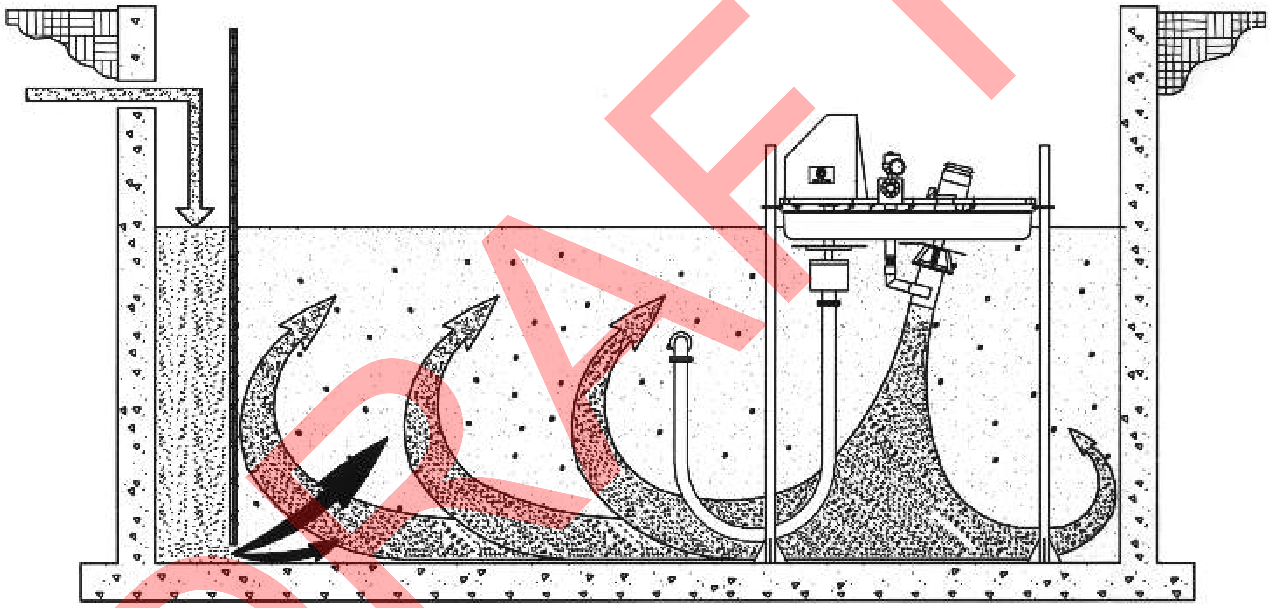
Typically, the settled sludge zone will contain the majority of the microbial life. This microbial life continues a certain level of respiration and effectively depletes this settled sludge zone of any dissolved oxygen (D.O.).

The supernatant layer above the settled sludge zone represents a significant fraction (typically 50 % to 70 %) of the reactor volume. Since the majority of the microbial life has settled to the bottom of the reactor, the relative effect of microbial respiration in the supernatant layer (compared to the sludge mass layer) is generally reduced. Therefore, the D.O. concentration in the supernatant layer typically ranges from 0.50 to 1.5 mg/l prior to the start of the Mix Fill phase.

The water in the supernatant layer is generally of reasonably good quality with respect to the concentration of specific wastewater parameters. Residual soluble levels of organic material (as determined by a BOD_5measurement) are present in concentrations at or below the anticipated effluent value. Total suspended solids (TSS), total nitrogen (Tot-N) and total phosphorus (Total P) are also present in concentrations at or below the anticipated effluent concentrations.

As the Mix Fill phase of operation begins, wastewater flow is initiated to the reactor. At this point, the mixer on the AquaCAM-D (combination aerator/mixer/decanter) begins mixing the reactor while the air valve remains closed. The AquaCAM-D is not providing oxygen to the reactor at this time. The stratified condition of the reactor that existed in the preceding phases is now converted to a completely mixed condition. The settled biomass is now resuspended and combined with the previously isolated supernatant layer and the raw wastewater entering the reactor. A schematic of this phase of operation, along with its associated process and mechanical considerations, is shown in Figure 1.

Mix Fill Phase (Figure 1)



Process Considerations	Mechanical Considerations
Zero or Near Zero D.O.	Mixing System Operating
Complete Mix Conditions	Influent Valve Open/Transfer Pump Operating
Denitrification	Air Valve Closed
Phosphorus Release	Sludge Pump Off
Sludge Conditioning	Decant Weir Closed
Filamentous Control	

As raw wastewater continues to flow into the reactor, the completely mixed condition results in the dispersal of the microbial life and incoming wastewater throughout the reactor. The residual level of D.O. that existed in the supernatant layer is rapidly depleted as a result of microbial respiration being effective throughout the entire reactor volume.

As raw wastewater enters the reactor, the amount of organic material (as measured by the soluble BOD_5 concentration) present in the reactor increases. Since an aerobic phase has not yet been initiated in this cycle, biological degradation of the organic material in the influent wastewater is limited.

The concentration of Total Kjeldahl nitrogen (TKN) in the reactor also increases. The TKN consists of organic nitrogen (Org-N) and ammonia nitrogen (NH_3-N). By the process of hydrolysis (with or without oxygen present), the majority of the organic nitrogen is converted to ammonia nitrogen. The ammonia nitrogen must then be oxidized by the nitrification process. In the presence of oxygen, the nitrification process converts the ammonia nitrogen to nitrate nitrogen (NO_3-N). However, since an aerobic phase has not yet been initiated, active nitrification is not occurring.

Due to the absence of D.O. in the reactor, denitrification is capable of occurring during the Mix Fill phase. As a result, the residual level of nitrate nitrogen that previously existed in the supernatant layer is depleted to a near-zero concentration level. The denitrification process converts the nitrate nitrogen to nitrogen gas (N_2), and the nitrogen gas is subsequently released to the atmosphere.

The Mix Fill phase, in combination with the "non-aerated" periods during the React Fill and React phases, can be effective in producing an extremely low NO_3-N concentration in the system effluent. However, since the nitrogen that enters the reactor is generally not in the form of NO_3-N, the amount of denitrification that occurs during the Mix Fill phase is limited to the residual NO_3-N from the previous cycle. Before the nitrogen in the influent can be denitrified, it must first be nitrified during the aerated periods of the React Fill and React phases. Therefore, a relatively small fraction of the total nitrogen removal requirement is accomplished during the Mix Fill phase.

At the start of the Mix Fill phase, the effective mixing of the biomass with the influent wastewater in an anoxic environment results in a substantial release of phosphorus from the cell mass to the liquid medium. This phosphorus is now distributed throughout the entire reactor volume. A typical monitoring program would indicate a steady increase in the concentration of phosphorus during the Mix Fill phase. The rate of this increase is significantly greater than what could be attributed to the contribution of phosphorus present in the raw wastewater.

The use of anoxic conditioning of the sludge mass can be highly effective with respect to improved settling characteristics and controlling the predominance of filamentous organisms in the treatment system. The Mix Fill phase of operation readily creates an anoxic condition throughout the entire reactor. A treatment cycle structure which incorporates this repetitive phase of operation can be effective in avoiding or controlling the predominance of filamentous populations in the reactor.

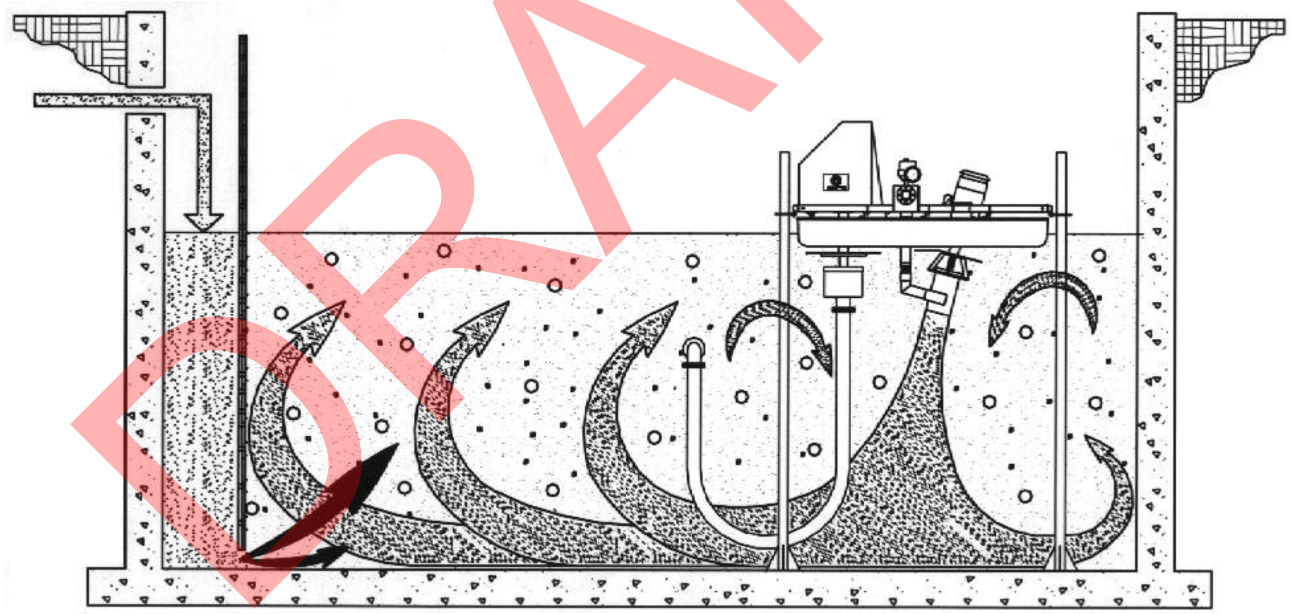
In summary, the Mix Fill phase of operation is characterized by a completely mixed anoxic environment in the reactor. The reactor contains a uniform blend of raw influent wastewater, previously settled biomass, and supernatant from the previous cycle. The environment is classified as anoxic with D.O. concentrations at or near zero. Effluent quality parameters will provide the system operator with a basis for determining the necessity of adjusting the specific duration of this phase of operation. In essence, this phase is utilized for denitrification, biological phosphorus release, and anoxic conditioning of the sludge mass.

React Fill Phase

During the React Fill phase of operation, wastewater continues to enter the reactor, and the air valve on the AquaCAM-D opens and begins delivering oxygen to the reactor. The mixer on the AQUACAM-D continues to operate, and the completely mixed environment is maintained. The introduction of oxygen converts the reactor from an anoxic environment to an aerobic environment. Since the AquaSBR was designed to achieve nitrification and denitrification, the aeration system is cycled on and off during the React Fill phase. This alternately creates aerobic and anoxic conditions. Refer to "AquaSBR Description of Operation" for the specific aeration cycle times.

Nitrification occurs during the aerated periods of operation, and denitrification occurs during the non-aerated periods of operation. Although BOD_5 reduction normally occurs under aerobic and anoxic conditions, the rate of BOD_5 reduction is much greater during the aerated periods of operation. A schematic of the React Fill phase of operation is shown in Figure 2.

React Fill Phase (Figure 2)



Process Considerations	Mechanical Considerations
Alternating Aerobic/Anoxic Conditions	Mixing System Operating
Complete Mix Conditions	Influent Valve Open/Transfer Pump Operating
BOD_5 Reduction	Air Valve Open/Closed
Nitrification/Denitrification	Sludge Pump Off
Phosphorus Uptake	Decant Weir Closed

The wastewater that has entered (and continues to enter) the reactor represents a certain potential oxygen demand. The oxygen demand is due to the aerobic metabolism of the organic constituents (i.e. BOD_5 reduction) and the nitrification of NH_3-N. The aeration system has been sized to meet this oxygen demand.

The dissolved oxygen (D.O.) concentration profile in the reactor will normally reveal a pattern of increasing D.O. concentration during the aerated periods, followed by decreasing D.O. concentration (to near-zero) during the non-aerated periods. In other words, the D.O. concentration will reach a peak value at the end of each aeration period.

The repetitive on/off cycling of the air supply will also produce a pattern of increasing peak D.O. concentrations with each successive aerated period. This is the result of the system achieving an ever-increasing degree of treatment as this phase progresses. As the degree of treatment increases, a steady decline in the oxygen uptake rate (OUR) of the biomass will result. The exact magnitude of this decline will be affected by the loading to the system and the duration of each of the individual phases of a complete treatment cycle.

The concentration of total nitrogen present in the reactor will steadily decline as the React Fill phase is completed. The nitrification and denitrification processes typically reduce total nitrogen concentrations in the reactor as the raw waste flow continues to enter the reactor with additional nitrogen. In other words, the rates of nitrification and denitrification are typically more than sufficient to offset the rate of nitrogen entering the reactor.

Nitrification is a two-step process involving two individual groups of microorganisms, namely *Nitrosomonas* and *Nitrobacter*. This process does not remove nitrogen from the wastewater. It merely converts it from one form of nitrogen to another form of nitrogen. In the presence of oxygen, ammonia nitrogen (NH_3-N) is first converted to nitrite nitrogen (NO_2-N) by the *Nitrosomonas*. The nitrite nitrogen is then converted to nitrate nitrogen (NO_3-N) by the *Nitrobacter*. Since the *Nitrobacter* are generally much faster "workers" than the *Nitrosomonas*, the NO_2-N concentration in the reactor is usually negligible.

Nitrogen is actually removed from the wastewater by the denitrification process. Denitrification is performed by a broad range of microorganisms, collectively known as "heterotrophs", that are present in most wastewater treatment systems. In the absence of oxygen, these heterotrophs convert nitrate nitrogen to nitrogen gas (N_2). The nitrogen gas is subsequently released from the reactor into the atmosphere.

The amount of organic material (as evidenced by the BOD_5 concentration) in the reactor will typically decrease during the React Fill phase. During this phase, biological oxidation occurs simultaneously with the addition of organic material to the reactor. The decline in BOD_5 concentration will closely parallel the pattern observed for the total nitrogen concentration.

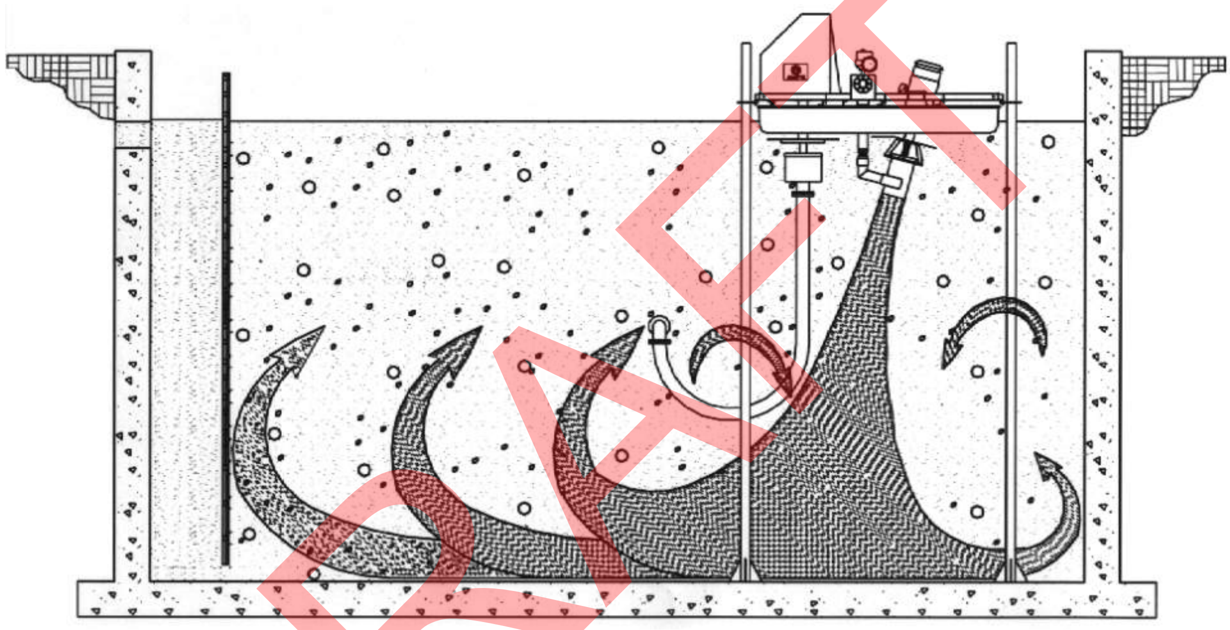
During the initial period of the React Fill phase, the onset of aerobic conditions in the reactor allows the microorganisms to "take in" phosphorus. Therefore, the phosphorus that was previously released into solution (during the Mix Fill phase) is now taken back into the cell mass. The phosphorus present in the influent is also taken in by the biomass. Since the microorganisms were previously "depleted" of phosphorus, they have a tendency to take in more phosphorus than the amount that is necessary to meet their nutritional requirements. The term used to describe this phenomenon is “enhanced biological phosphorus removal". The anoxic periods during the React Fill and React phases are not long enough to allow a re-release of phosphorus from the biomass into the liquid medium. Therefore, the effluent from the reactor will contain a low concentration of total phosphorus.

Effluent quality parameters will provide the operator with a basis for determining the necessity of adjusting the duration of the React Fill phase and/or the aeration on/off cycle structure. In summary, the React Fill phase features a reactor that is always in a completely mixed condition that alternates between an aerobic and anoxic environment.

React Phase

During the React phase of operation, wastewater flow is not entering the reactor. The mixer on the AQUACAM-D continues to operate and completely mix the reactor, and the air valve on the AQUACAM-D continues to be cycled open and closed. This alternately creates aerobic and anoxic conditions. A schematic of this phase is shown in Figure 3.

React Phase (Figure 3)



Process Considerations	Mechanical Considerations
Alternating Aerobic/Anoxic Conditions	Mixing System Operating
Complete Mix Conditions	Influent Valve Closed/Transfer Pump Off
"Polishing Off" BOD_5 and Total N	Air Valve Open/Closed
	Sludge Pump Off
	Decant Weir Closed

The importance of this phase should be recognized by the operator with respect to the "opportunity" that this phase provides to "reduce the concentration levels of all wastewater parameters without the influence of additional wastewater entering the reactor." In effect, the React phase provides a period of time in which wastewater contaminants are "polished off" to the desired or required concentration levels.

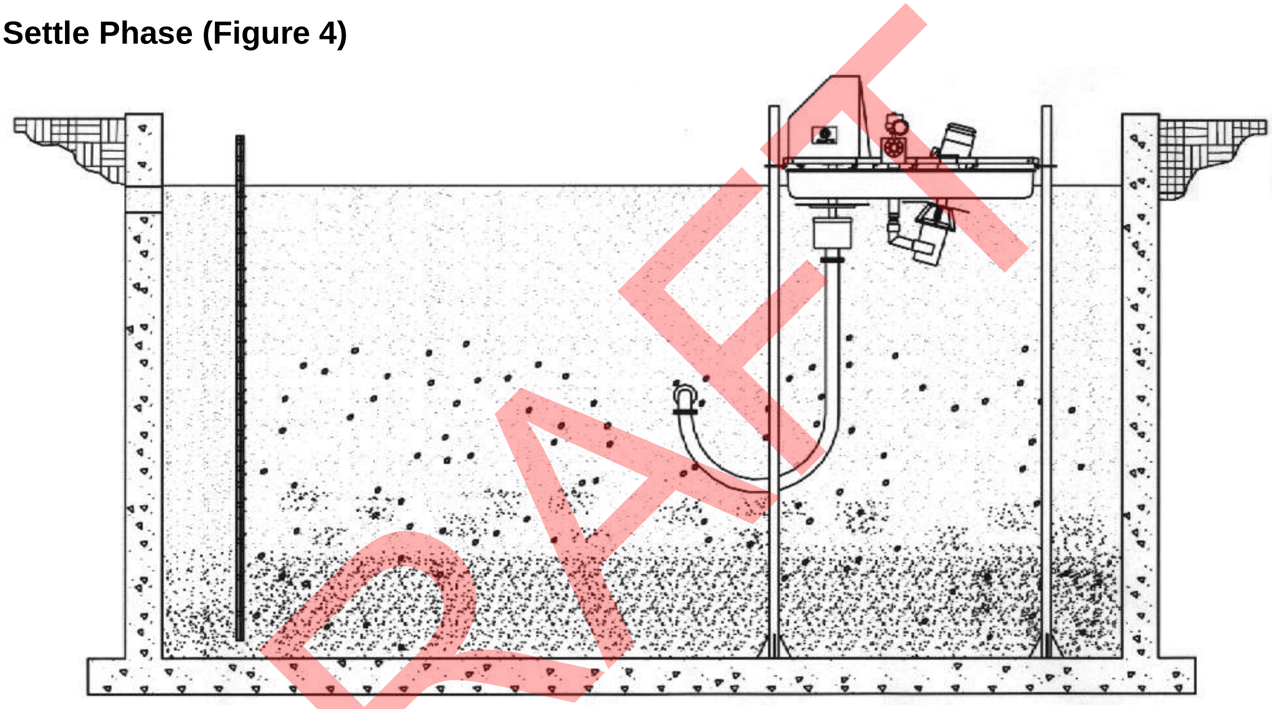
A profile of the soluble BOD_5 concentration in a reactor, as aeration phases occur, indicates a general decline in the amount of organic material present. The initiation of aeration at the start of the React Fill phase results in a gradual decline in BOD_5 concentration. By comparison, the rate of decline in the React phase (with the absence of any additional influent wastewater entering the reactor) is dramatically increased.

In summary, the React phase features a reactor that is always in a completely mixed condition, which alternates between an aerobic and an anoxic environment. The absence of flow and organic loading provides a unique opportunity to "polish off" wastewater contaminants. This results in a reduction of organic material (BOD_5) and total nitrogen present in the reactor to very low effluent concentrations. Since the majority of the biological phosphorus removal normally will have already taken place during the React Fill phase, the React phase does not have a major effect on the effluent total phosphorus concentration.

Settle Phase

During the Settle phase, wastewater is not entering the reactor. Also, the mixing system and the aeration system are both turned "off". The absence of flow, mixing, and aeration activity produces an ideal quiescent environment in the reactor for solids-liquid separation. Figure 4 shows the related process and mechanical considerations for this phase of operation.

Settle Phase (Figure 4)



Process Considerations	Mechanical Considerations
Quiescent Conditions	Mixing System Off
Static Clarifier	Influent Valve Closed/Transfer Pump Off
Settling Biomass	Air Valve Closed
	Sludge Pump Off
	Decant Weir Closed

At this point in time, the preceding phases have accomplished all of the process objectives related to the reduction of organic compounds (BOD_5), total nitrogen and total phosphorus. The reactor acts as a "static clarifier" as opposed to a "flow-through clarifier". Since there is no flow entering or exiting the reactor, the settling of solids is simply not affected by system hydraulics.

Furthermore, sludge is removed from the reactor by a stationary sludge pump after the completion of the Settle phase. Therefore, settling is not affected by any type of stirring action caused by a mechanical sludge collector. Such an ideal quiescent settling environment is unique to SBR systems.

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Decant Phase

Following the treatment of a batch of wastewater and the subsequent solids-liquid separation achieved during the Settle phase, it is then necessary to remove approximately the same volume of liquid that entered the reactor during the Mix Fill and React Fill phases of operation.

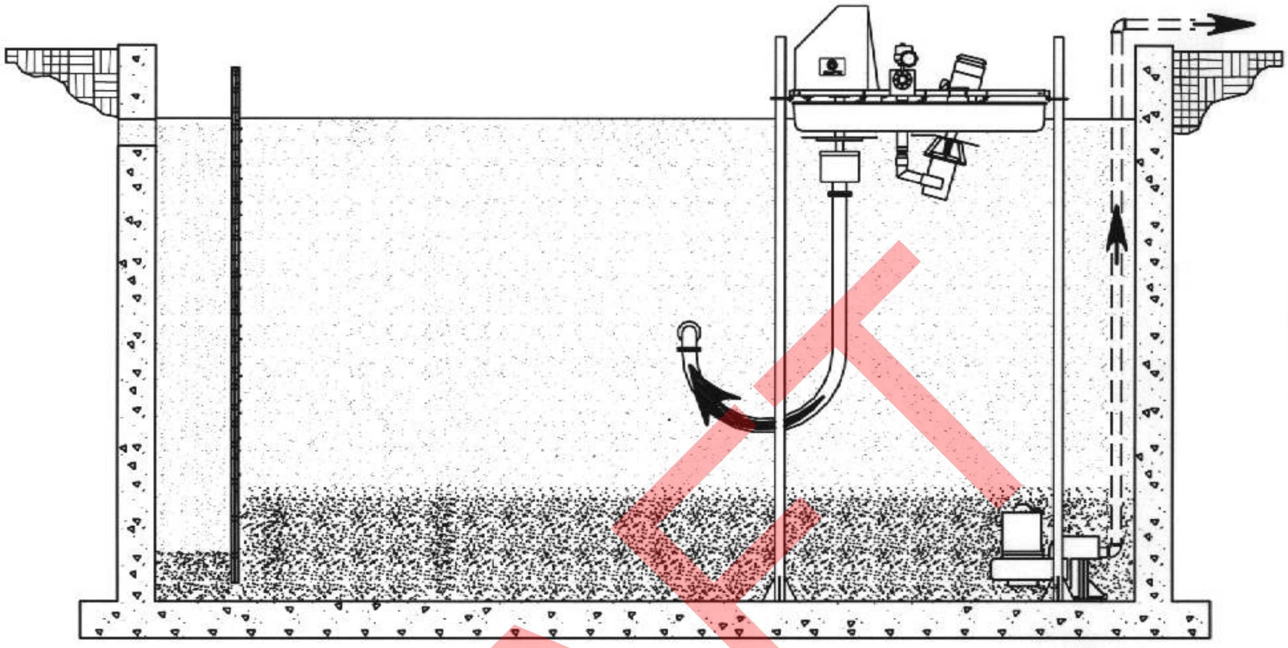
The AquaSBR accomplishes the removal of treated effluent through the AquaCAM-D, which remains in the reactor at all times. The AquaCAM-D is installed in a manner that permits it to rise and descend with the reactor water level during the Fill and Draw modes of operation.

AquaCAM-D unit features an outlet weir and discharge system that incorporates a positive seal prohibiting the entry of mixed liquor suspended solids during the mixed and aerated phases of operation. At the completion of the Settle phase, an electrical signal from the system control panel initiates the opening of the decant weir and the effluent discharge valve.

The configuration of a weir suspended below a floating structure provides an effluent withdrawal point that is located just below the surface of the reactor. The positioning of this withdrawal point provides effluent from the uppermost region of the stratified reactor without allowing any surface scum or foam to be drawn into the effluent. The vertical distance from the top of the settled sludge layer to the effluent withdrawal point is also maximized.

As the Decant phase progresses, the decanter units maintain this optimum position of effluent withdrawal by simply floating on the surface and descending with the reactor water level. The Decant phase of operation is terminated at the predetermined minimum reactor water level that is controlled by a level sensor system. An electrical signal, prompted by the attainment of the minimum reactor water level, reverses the position of the decanter components by closing the effluent valve and sealing the decant weir against the bottom of the float structure. The mechanical aspects of the AquaCAM-D unit are described in further detail in the Aqua-Aerobic Systems, Inc. Operation and Maintenance Manual. A schematic of the AquaSBR during this phase is shown in Figure 5.

Decant/Sludge Waste Phase (Figure 5)



Process Considerations	Mechanical Considerations
Quiescent Conditions	Mixing System Off
Removing "Clear" Supernatant	Influent Valve Closed/Transfer Pump Off
Continue Settling	Air Valve Closed
Removing Excess Biomass	Sludge Pump On
	Decant Weir Open

Once the reactor has been decanted to the design minimum side water depth (SWD), the Decant phase is automatically terminated. At this point, the decant valve and weir are automatically closed. If the minimum SWD is attained before the end of the programmed duration of this phase, the remaining time is utilized as the Idle phase.

The system operator should recognize that the time dedicated to the Decant phase represents an extension of the total time during which solids-liquid separation occurs in each reactor. After the completion of the Settle phase, the mixer and aeration systems are still inoperative and the quiescent conditions are maintained in the reactor as the Decant phase is initiated. The settled sludge mass is typically well below the reactor surface water level as the Decant phase starts, and sedimentation continues throughout the Decant phase.

Idle Phase

The Idle phase in an AquaSBR is a variable time period. The exact duration of the Idle phase is dependent upon specific hydraulic aspects of the treatment system. The AquaSBR system is designed on the basis of two distinct volume increments in each reactor. These two volume increments are defined as the "react volume" and the "maximum decant volume".

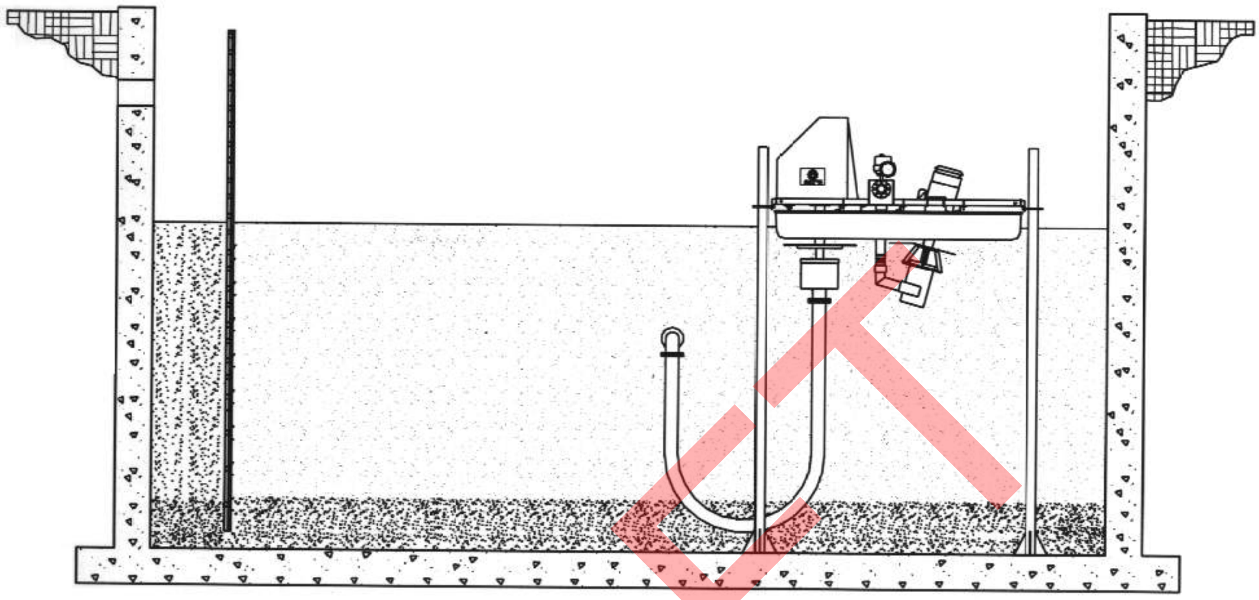
The react volume is the volume present in a reactor at the predetermined minimum reactor side water depth (SWD). The maximum decant volume is the volume represented by the difference between the minimum and maximum side water depths. The maximum decant volume is established in the design as the reactor volume required to receive the maximum design flow sustained throughout a single treatment cycle.

The AquaCAM-D is appropriately sized (in terms of the decant weir diameter and the outlet piping and valving) to discharge the maximum decant volume over the entire duration of the Decant phase. At system flow rates significantly less than the design maximum value, each reactor will receive less than the maximum decant volume. However, the effluent will still be decanted at approximately the design discharge flow rate.

The volume received in one cycle (at less than the maximum design flow rate) will therefore be discharged over a time period that is less than the programmed duration of the Decant phase. The minimum water level sensor will terminate the decant cycle at the pre-set minimum SWD, regardless of the volume received per treatment cycle during the Fill phases of operation. At this point, the timer within the AquaSBR control system will continue to operate for the entire programmed duration of the Decant phase. The Idle phase is then the resultant time increment between the time of decant termination by the level sensor and the termination of the programmed duration of the Decant phase. As the description implies, the reactor simply remains in an idle mode with all mechanical systems being inoperative.

With respect to process considerations, the reactor is in a stratified condition and wastewater is not entering the reactor. Process and mechanical considerations of the AquaSBR during this phase of operation are shown in Figure 6.

Idle Phase (Figure 6)



Process Consideration	Mechanical Considerations
Quiescent Conditions	Mixing System Off
	Influent Valve Closed/Transfer Pump Off
	Air Valve Closed
	Sludge Pump Off
	Decant Weir Closed

In summary, a description of the Idle phase is dependent upon related factors that affect this phase of operation. It is a necessary phase of operation when a treatment system is required to treat variable hydraulic loading rates on a pre-set time cycle basis of operation.

Waste Sludge Phase

AquaSBR systems, like other activated sludge process variations, are dependent upon the development of a mixed culture of bacteria and other microbial life forms to accomplish treatment objectives. As a result of the biological degradation of organic matter and the accumulation of inert material present in most wastewaters, it is necessary to discharge certain quantities of solids from the reactors in order to maintain an appropriate concentration of mixed liquor suspended solids (MLSS) in the reactor, and to control the sludge age. This phase of operation within the treatment cycle is designed as a time increment that occurs simultaneously with the Decant/Idle phase.

The programmable logic controller (PLC) has been programmed to initiate the Waste Sludge phase during the final minutes of the Decant/Idle phase. At this time, the reactor is in a stratified condition and one or more solids handling pumps are removing settled sludge from the bottom of the reactor. Since waste sludge solids concentration levels are typically in the range of 0.75% to 1.25%, the sludge remains in a fluid condition throughout a typical waste sludge pumping cycle. See Figure 5, integral w/ Decant, for process and mechanical considerations during this phase of operation.

AQUA-AEROBIC SYSTEMS, INC.

AquaCAM-D®

COMBINATION AERATOR/MIXER/DECANTER

AquaCAM-D®

COMBINATION AERATOR/MIXER/DECANTER

The AquaCAM-D® is a combination aerator/mixer/decanter designed for use in sequencing batch reactor systems (SBRs), treating flows as low as a few thousand gallons per day up to 100,000 gallons per day. The unit independently aerates and mixes the reactor to achieve anaerobic, anoxic and aerobic environments, while offering subsurface decanting of the final effluent. These capabilities make the AquaCAM-D ideal for low level phosphorus and total nitrogen applications. The unit has proven performance in a variety of municipal and industrial applications for both pretreatment and secondary wastewater treatment.

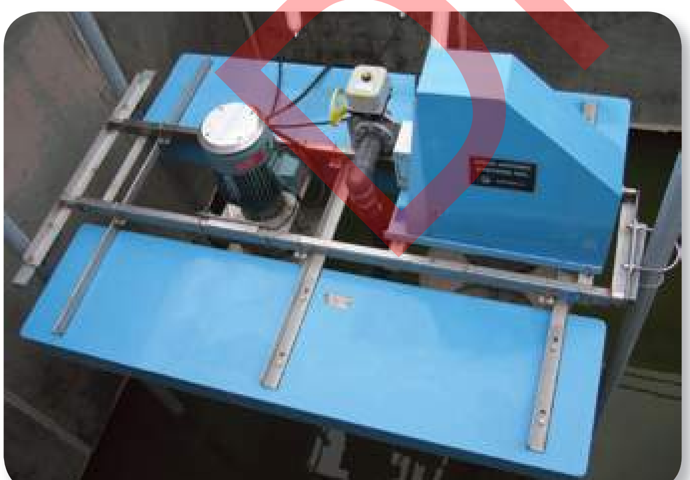
Features and Advantages

- Economical Enhanced Biological Nutrient Removal for Lower Flows
- Simple, Low Cost Installation
- Surface Accessible Components
- Proven Aqua-Aerobic Decanter
- Modular Design Promotes Easy Expansion
- Flexible Tank Options
- No Aeration Yard Piping or Blower Buildings
- Ideal for Cold Climates

Overview of the AquaCAM-D® unit in a SBR reactor.

Typical Applications

- Schools
- Residential Subdivisions
- Shopping Malls
- Parks, Camps, and Resorts
- Mobile Home Parks
- Nursing Homes
- Landfill Leachate
- Industrial Wastewater



Close-up view of the AquaCAM-D® system.

Operation Description

High velocity movement of water through the air induction volute creates a pressure differential. Atmospheric air is drawn into the volute through the air intake port and forcefully discharged into the basin, enhancing oxygen transfer. By opening the unit's electrically operated air valve, the Aqua CAM-D is operated as an aerator. Closing the air valve enables the unit to operate as a mixer, allowing for anoxic mixing during selected phases of the SBR cycle. Following the Settle phase of the SBR cycle, the submerged weir of the decanter opens and draws clear effluent from below the water surface. The AquaCAM-D is then ready to begin its next cycle of treatment.

Operation of the unit is controlled by a microprocessor with automatic level overrides to control the system during conditions of greater than peak flow.

Visit our website to learn more about the AquaCAM-D® system and our complete line of products and services.

Aqua-Aerobic Systems, Inc. 6306 N. Alpine Rd. Loves Park, IL 61111 **P** 815.654.2501 **F** 815.654.2508 www.aqua-aerobic.com solutions@aqua-aerobic.com

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Valued customers have come to know that when you purchase from Aqua-Aerobic Systems, you are gaining a partner for the life of your plant.

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- Factory or on-site training available
- Earn PDH credits
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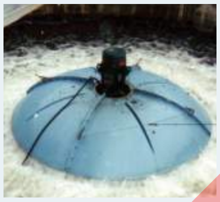
- Short or long term options
- New & reconditioned units
- Programs tailored to meet your needs



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AQUA-AEROBIC SYSTEMS, INC.

Aqua-Aerobic Controls & SCADA

PANELS AND SYSTEMS

Aqua-Aerobic

Controls & SCADA PANELS AND SYSTEMS

Aqua-Aerobic Systems, Inc. offers design and development of Electrical Control Panels and Supervisory Control And Data Acquisition (SCADA) systems, targeted for wastewater treatment equipment and processes. The available IntelliPro® Monitoring and Control System enhances your SCADA system by automating the operation of biological processes, including nutrient removal. Panels and systems are verified through rigorous testing prior to shipment to minimize field installation time and provide a customized, quality product to the end-user.

Features and Advantages

System Control Panels

- Reliable Programmable Logic Controller (PLC) with Color Touchscreen Human Machine Interface (HMI)
- Backup Hardwired Equipment Overrides
- Pressure Transducer Level Control
- Variety of Interfaces to Third Party Systems
- Allen-Bradley Controller Platform is Standard
- Available with or Without Motor Starters
- Flexible Networking/Communication Options
- Upgrade Capabilities for Existing Controls

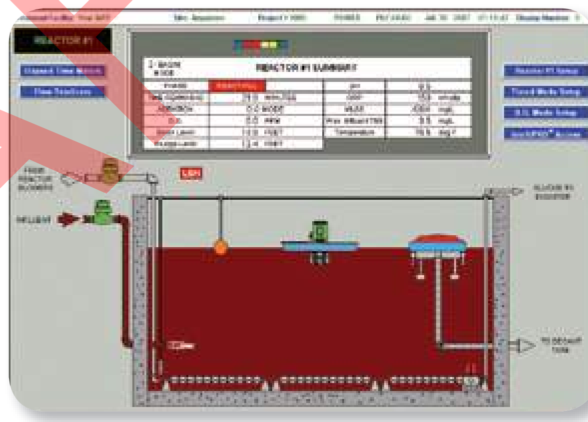
Configurations for custom applications.

Applications include Aqua-Aerobic batch reactor systems, phased activated sludge systems, cloth media filters, membrane systems, aeration control, and plant wide auxiliary systems.

Aqua-Jet® aerator and typical Definite Purpose Control Panel.

SCADA Systems

- Single Point of Control for Plant-Wide Monitoring
- Detailed, Dynamic Graphics Depicting Equipment Status and PLC Command Status
- Simple, Intuitive Navigation Between Screens
- Historical Trending and Logging of Data
- Consolidated Alarming for All Monitored Areas
- Remote Access and Support; Optional Electronic O&M Manual
- Reporting and Printing Capabilities
- Upgrade Capabilities for Older Systems



Dynamic Graphic - AquaSBR® basin detail screen.

Applications include Aqua-Aerobic batch reactor systems, phased activated sludge systems, cloth media filters, membrane systems, aeration control, and plant optimization.

Definite Purpose Control Panels

- Enclosures Constructed of Nema 3R (mild steel) or Nema 4X (stainless steel or FRP)
- Operator Devices Include Selector Switches, Optional Timers and Elapsed Time Meters
- Single or Multiple Starter Configurations

Applications include Aqua-Aerobic mechanical surface aerators, direct-drive mixers, stand-alone mixer or aerator, and equipment local control.

Visit our website to learn more about our control systems and our complete line of products and services.

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Aqua BioMax®

Dual Treatment System

AQUA-AEROBIC SYSTEMS, INC.
A Metawater Company

System Features and Advantages

The Aqua BioMax® dual treatment system is a unique combination of rotating biological contactor (RBC) technology and cloth media filtration. The package unit utilizes multiple RBC disks that are vertically mounted and closely spaced on a steel shaft, providing a large surface area for biofilm growth. The disks rotate out of the wastewater to provide aeration for efficient BOD removal and nitrification. A cloth media drum filter follows the RBC to collect and remove the biological solids prior to the effluent discharge. This cloth media filter eliminates the need for a secondary clarifier. The Aqua BioMax system is an ideal solution for low flow applications (up to 100,000 gpd) where economical treatment and simple operation are critical.

Advantages

- Minimum energy consumption
- Reduced maintenance
- Easy access to internal components
- Utilizes exclusive OptiFiber® cloth filtration media in a drum configuration
- Reduced footprint requirements
- Minimal operator attention needed
- No need for mechanical aeration or diffuser systems with blowers
- Low installation costs
- Pre-assembled plant, complete with an integrated electric control panel allowing rapid installation and start-up

Internal view of the RBC and cloth media drum filters

Typical Applications

- Small Communities
- Tourist Complexes/Camping Sites
- Construction Sites
- Industrial Wastewater
- Hotels
- Schools
- Highway Rest Areas

Aqua BioMax® system overview (filter cover removed)

Operation Description

Effluent from an upstream primary sedimentation basin enters the Aqua BioMax unit through the biological treatment section of the unit. Biofilm grows on the RBC disks, removing BOD and oxidizing ammonia. The RBC disks are 40% submerged and rotate continuously to allow for aeration of the biomass when exposed outside of the water. This method of providing oxygen to the biomass eliminates the need for mechanical aerators or diffusers systems with blowers, resulting in significant power savings.

Flow then enters the filter portion of the unit. Biological solids are collected on the outside of the cloth media and removed when the filter is backwashed. Effluent is then discharged. The back-wash water is returned to the upstream primary sedimentation basin and the biosolids are typically anaerobically digested in the bottom of the pre-treatment tank. The digested solids are removed from the tank every three to six months.

Rotation of both the RBC disks and the cloth media filter drum is accomplished by a small gear motor, 1.0 to 2.0 horsepower (hp) (0.75 to 1.5 kilowatts kW). In addition, there are one or two 0.8 hp (0.6 kW) backwash pumps for the drum filter, depending on the unit size.

Aqua BioMax®
Dual Treatment System

AQUA-AEROBIC SYSTEMS, INC.
A Metawater Company

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FUSS & O'NEILL

Town of Coventry School Department Membrane Bio Reactor (MBR) Packaged Wastewater Treatment Plant

AWC Reference No.: 46780

DRAFT

SUBMITTED BY:

AWC Solutions
9087A 198 Street
Langley, BC V1M 3B1

Main Contact
Name: Alex Passini
Telephone: 604-365-1876
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Tech Sales NE
Name: Matt Vareika
Telephone: 774-248-5479
Email: MattV@TechSalesNE.com

April 28, 2023

Attn: Ryan Morais
Fuss & O'Neill
146 Hartford Road
Manchester, CT 06040

RE: 46780 Coventry High School Wastewater Treatment Plant

Thank you for the opportunity to submit our proposal for the Coventry High School Wastewater Treatment Plant.

We have proposed a completely pre-assembled modular **Membrane BioReactor (MBR)** wastewater treatment plant rated for 40,000 gallons per day (GPD). The MBR treatment plant includes a pre-screen, one equalization tank for diurnal surge capacity, a reactor tank for aeration, with an MBR tank.

The process building (by others) will include control panel, blowers, pumps and UV disinfection. Our modular design allows rapid installation at site and easy transportation. Typically our systems are treating wastewater within two weeks from arrival at site, providing the site utilities and hook-ups are ready. The system is designed to run as a fully automated system for day-to-day operations. Our certified operators will be on site for startup and will provide training for the Owner's operator.

AWC Water Solutions Ltd. (AWC) has one of the most experienced groups of water and wastewater treatment experts in the industry. The team has decades of history in designing and successfully delivering one of the most widely recognized water treatment systems in the industry. Our in-house engineering and technical teamwork with clients to select the best process and design a custom package to reliably meet environmental, financial, and quality standards for your project.

AWC is your one-stop-shop for modular turnkey industrial process solutions. We work extremely hard to provide our clients with unmatched service and provide the best total value and experience possible.

Our water treatment plants have been chosen as the ideal method of treatment for many communities in the US. They are well known and liked by water treatment operators (very easy to operate and maintain).

Thank you for considering our proposal. If you have any questions, please do not hesitate to contact me at the coordinates below.

Sincerely,

Alex Passini,
Business Development Manager
604-365-1876
alexp@awcsolutions.com

TABLE OF CONTENTS

1 AWC COMPANY OVERVIEW

AWC Water Solutions Ltd. (AWC) designs and builds complete, packaged, and modular water and wastewater treatment systems. AWC has one of the most experienced groups of water and wastewater treatment experts in the industry. The team has decades of experience designing and successfully commissioning hundreds of unique and exceptional water treatment solutions. Our in-house engineering and technical team will work with clients to select the best process, and design a custom package to reliably meet environmental, financial, and quality standards for your project.

In addition to packaged and modular water treatment systems, AWC offers a wide variety of in-house services including engineering & design, fabrication & machining, automation & controls including an in-house panel shop, project management, and a full field service support team for all manufactured and distributed products.

AWC has a track record of supplying treatment plants to remote locations including permits, turnkey package plants, and site installation, startup, commissioning, operations, and training.

1.1 Water and Wastewater Treatment Capabilities

AWC and its predecessor companies have been in operation for over 40 years and have built over 500 packaged water and wastewater treatment plants. We have experience in both the municipal and industrial markets. We maintain close relationships with many world-leading Original Equipment Manufacturer (OEM) process suppliers enabling us to offer the high performance, state-of-the-art systems for our clients' applications at an affordable price due to our competitive OEM pricing. The inclusion of advanced process controls and remote monitoring to our systems enables us to monitor system performance long after the commissioning of the plant. Core to AWC's success is the ability to quickly assist clients, optimize their system performance or importantly troubleshoot operating challenges. As we control the designs of our systems, we are also able to upgrade original installations to meet increased capacity, increased water quality requirements or changing raw water quality.

1.2 Certified Operators

To add value for our clients, AWC has enhanced our field service offering by bringing on board a team highly trained and experienced operators. Working with our technicians in the field, our operators are able to significantly reduce the time required to commission and train. Our operators bring an enhanced level of support offerings for our clients by being able to provide a range of services such as full plant Operations contracts for the life of the plant, routine maintenance and membrane CIP support, ongoing training, monthly reviews, remote diagnostics and troubleshooting support.

AWC strives to bring added value to our clients. We believe that with our experience, proprietary designs, manufacturing capabilities, our field service and full lifecycle support, we bring intangible value to our clients.

1.3 Safety First – HSE at AWC

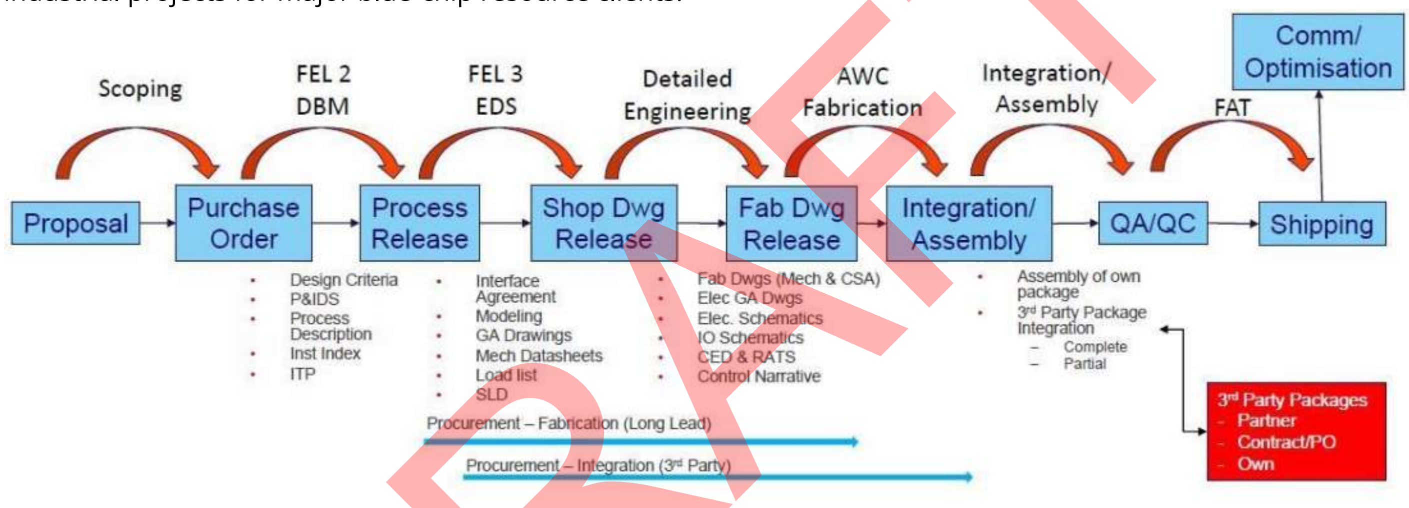
A company's most valuable resource is the employees. AWC is committed to ensuring all workers (those who work at AWC, and those who with AWC such as contractors and Owners' representatives) to have a safe working environment.

A safety-first mentality is of the highest priority to all staff. AWC takes pride in our excellent safety record, which is reflected in the ***1+ million hours worked with ZERO Lost Time Injury incidents***. Our goal is to maintain an open, cooperative workplace environment where everyone is invested in each other's health and safety.

AWC strives to provide a sound and minimal risk work environment for each employee through the prevention of accidents, occupational illness, and injuries. We prepare and implement a site-specific Health and Safety Plan for every site that we work on and conduct a safety kickoff at the beginning of every project. On-site, our staff completes daily safety toolbox meetings to review safe work practices for the day and identify any risks that may be encountered.

1.4 Project Execution Approach

AWC project execution follows a rigorous approach, based on processes and procedures used at the major EPCM companies (see Figure 1). This means our documentation and quality standards for project design, procurement, fabrication, assembly, testing, and Startup are robust and thorough to minimize any risks to the Client when our package arrives at site. Our team includes senior engineering project managers that have executed large industrial projects for major blue-chip resource clients.



AWC strives to bring added value to our clients. We believe that with our experience, proprietary designs, manufacturing capabilities, our field service and full lifecycle support, we bring intangible value to our clients.

1.5 Quality Assurance/Quality Control Program

AWC is committed to providing quality, efficient systems that meet applicable regulatory and customer specifications. Our Project Quality program confirms deliverables and milestones that are consistent with the scope of work defined in the project. The overall project performance is measured against these criteria using quality assurance and quality control techniques.

The purpose of this program ensures that AWC has a documented procedure for project management as well as a Quality Assurance/Quality Control (QA/QC) plan for every project. The objective is to execute and deliver a superior product to the Owner and implement actions to achieve planned results for continual improvement.

The output of the project deliverables should be consistent with the planning activities (i.e. quality reviews, test performance, customer acceptance, etc.). Any corrective and preventive actions identified will follow established procedures to ensure similar situations do not arise in the future. The following factors are taken into consideration for each project executed by AWC:

- Project Overview – Provides the background and justification for the project.

- Quality Standards – Defined by AWC, the customer, regulatory bodies, and other relevant stakeholders.
- Quality Tools – Tools and techniques used by the Project Management Team to manage the objectives of the project.
- Responsibilities – Team member roles (including the Management Representative) are outlined to ensure ownership, accountability, and success of the project.
- Quality Assurance – Key processes that support the project and determination of evaluation methods and frequency (reviews, inspection & testing, customer acceptance and commissioning, etc.)
- Monitoring – Project related information is monitored to ensure quality objectives are suitably managed. Project team members are solicited for their progress, actions are assigned, and resources are allocated as appropriate.
- Quality Control Procedures – Listing of QC controls and activities that are required in the project.
- Inspection and Testing – Verification and validation activities to confirm objectives of the project have been accomplished. Our in-house testing capabilities include:
    - A 10,000 USG Freshwater Storage Tank
    - Water Recirculation Test Pumps Range from 400gpm @ 20psi to 200gpm @85psi
    - Complete Water, Electrical and Automation Testing Station
    - Up to 600V Capabilities
- Changes – Suitable mechanisms for review, communication, and implementation of necessary changes to the Project Quality Plan are critical for subsequent stages of production and operations.
- Records shall be maintained to support the Project activities and the resulting management.

1.6 Facility

AWC has a 60,000 ft^2 integrated office, warehouse, and manufacturing facility in Langley, BC.

Fabrication

- 27,000 ft2 Fabrication Area
- Specialized in Aluminum, Stainless, and Carbon Steel
- Four – Full Length Crane Bays
- 20+ Welding Machines
- 20-ton Lift Capacity
- Sheer & Plasma Cutting
- Hydrostatic Testing
- Large Round Tank Welding Rollers
- CWB 47.1 and 47.2, ASME B31.3 Certified / Compliant

Machine Shop

- Lathe (22"x90" capacity)
- Milling Machine (40" dia. c/w 30" vert. travel)
- Press Brake & Sheer
- 50-ton Press
- Industrial Parts Washer
- Multiple Band Saws (capacity up to 31.5")

Electrical Panel Shop

- CSA 22.2 & UL 508A certified
- 26' Overhead Clearance

Shipping / Receiving

- 18,000 ft2 Indoor Warehouse
- Four Loading Bays, 3 at Grade
- 20-ton Lift Capacity (when crane loading)
- Four Forklifts (3,000-17,000 lbs)

Secured Yard

- Large Paved Yard Area (Fully Enclosed Portions)
- 24hr Monitored Security
- Large Crane and Truck Loading Area
- Local Off-Site Storage Capabilities

QA/QC Testing Capabilities

- Full Quality Assurance Program
- 10,000 USG Freshwater Storage Tank
- Water Recirculation Pumps (400-200gpm @ 20-85psi)
- Complete Water, Electrical and Automation Testing Station
- Up to 600V Capabilities

2 PRELIMINARY TECHNICAL PROPOSAL

The WWTP plant scope of supply is based on a turnkey package for installation on site by the Owner. The package will be delivered in multiple modules including the EQ, aeration tank, MBR tank and process building. Tanks will be constructed of marine grade aluminum. Piping will be Schedule 80 PVC, CPVC for air lines, and chemical tubing for chemical dosing.

The system is designed to operate on its own, **without daily intervention from operators**. The wastewater treatment system is factory tested for proper operation, as are the pump and blower skids which are complete with piping, valves, pump and motors. These systems require only hook ups for power, communication, raw water, treated effluent, waste, drains and a pressurized service water supply. The plant is designed to operate automatically. Manual duties to support the automatic operation consists of maintaining adequate treatment chemical levels, including sodium hypochlorite (bleach) and citric acid as necessary for membrane cleaning.

Prior to shipping, the system is assembled and fully wet and dry tested. The intent is to ship pre-assembled and pre-wired, however, some items may be removed for shipping (clean in place tank, permeate pumps, etc.) which are re-assembled and re-terminated at site using “plug and play” type connectors wherever possible.

The treatment system is designed to treat the flowrates included in Table 1:

Table 1: Design Flow Characteristics

Coventry Public Schools Daily Water Consumption		pe=1,500
Days in Meter Period	**Gallons Per Day (gpd)**	**gpd/Persons (pe)**
35	4,613	3.08
25	7,830	5.22
35	4,432	2.95
30	5,101	3.40
30	4,679	3.12
30	3,435	2.29
32	3,271	2.18
37	4,055	2.70
43	5,201	3.47
29	4,469	2.98
35	2,245	1.50
RIDEM OWTS Criteria, School/Cafeteria/Gym		25.00
Total Design Flow (gpd) with 1,500 Students + Faculty		**37,500**

2.1 Design Criteria for the Packaged Wastewater Treatment System

Location	Parameter	Criteria
Influent	Design Capacity Wastewater Flow	40,000 gpd Rounded up from 25 gpd/pe and 1,500 gpd/pe
	Actual Water Consumption	**See Table 2**
	BOD, TSS, TN, TP (mg/L)	250, 250, 40, 8
	Wastewater Temp	55-70° F
Effluent	BOD, TSS (mg/L)	30, 30
	Nitrate (mg/L), regulated at property line.	10

2.2 Process Summary

2.2.1 Influent Wastewater and Screening Process

Influent screening shall be completed using a maximum of 2.0 mm openings. Screenings openings of 1.0 mm has proven to provide more successful MBR facilities and should also be considered.

2.2.2 Membrane Bioreactor Treatment System

Wastewater from the screening system will enter the equalization tank. This tank is sized to allow for a more continuous wastewater flow to the biological treatment process where bacteria consume the organic material in the wastewater (BOD). The processes are described in summary in the following sections.

2.2.2.1 Aerobic Tank

Screened wastewater will first enter the aerobic tank where it will mix with return activated sludge (RAS) from the membrane bioreactor. The incoming wastewater and the RAS are mixed by fine bubbles from the aeration system within the tank. The tank is operated to accomplish both BOD oxidation using dissolved oxygen as the electron acceptor. Dissolved oxygen (DO) is critical to the biological process; therefore, in-basin DO meter will installed in the aeration tank to continuously monitor the DO levels and will control the VFD of the aeration blowers. If the DO drops too low, the blower VFDs will ramp up to produce more oxygen. If the DO gets too high, the VFDs can be turned down to minimize power consumption.

Oxygen will be added to the aeration tanks from air provided by the aeration blowers. Each tank will have a dedicated blower with a swing spare blower. Air is piped to the aeration tank and diffused into the aeration using fine bubble diffusers set in the bottom of each aeration tank. The diffusers create micro-fine bubbles that allow oxygen to easily diffuse into the aeration basin water. There will be two headers of diffusers in each aeration basin, and each header is removable to facilitate periodic maintenance of the diffusers (approximately once every 7 – 10 years).

2.2.2.2 RAS/WAS Pump Skid

The RAS/WAS pumps will be mounted on a pump skid with two pumps (1 duty, 1 standby) to recycle the mixed liquor from the aeration tank to the membrane tank at a ratio of approximately 4 parts RAS to every one part influent wastewater. Sludge is periodically wasted from the RAS/WAS pump line to the Aerated Sludge Holding Tank according to an operator-set timed interval throughout the day. Proper sludge wasting will assure the treatment plant operates at the correct solids retention time (SRT) depending on the time of year and the influent nitrogen load to the treatment plant. The pump configuration is summarized in Table 4.

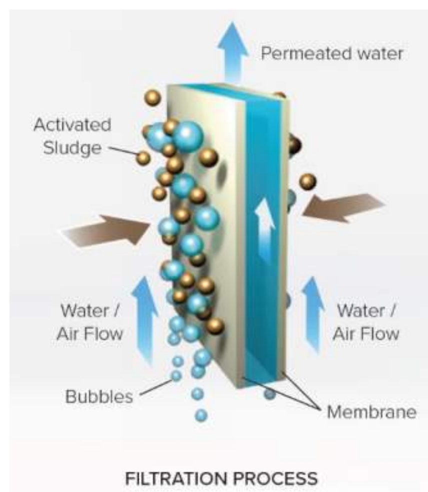
Table 2: RAS/WAS Pump and Aerated Sludge Holding Tank Design

Design Criteria	Value	Unit
RAS/WAS Pumps		
Number	2 + 1	duty + spare
Type	Goulds Centrifugal	
Design flowrate, each	80	gpm
Design pressure	10	ft head

2.2.2.3 Membrane Bioreactor Tank

Mixed liquor from the end of the aeration tank will be pumped to the membrane bioreactor tank. There will be five membrane racks included in each the membrane bioreactor tank. Each rack will be connected to an air header to provide periodic air scouring of the membranes to help keep the membrane surface clean. This aeration also helps to keep a dissolved oxygen level throughout the membrane tank. Permeate pumps pull clean water through the membranes and leave the bacteria in the membrane bioreactor tank. The permeate pumps are centrifugal pumps that are capable of suction lift. The pumps are designed for two pumps in service with one standby.

Following the membrane tank, the concentrated mixed liquor will overflow a weir and flow by gravity back to the head of the aeration tank in the form of Return Activated Sludge (RAS).



[1]Values calculated at design ADF unless stated otherwise

The membranes will periodically require chemical cleaning to maintain the flux rate through the membrane. The clean-in-place (CIP) membrane cleans occur approximately once every three months depending on water quality. The CIP will use sodium hypochlorite (bleach) to remove organic contaminants and a follow-up clean with citric acid to assure proper flux maintenance through the membranes. The exact chemical recipes will depend on the wastewater characteristics, but initially will start with a 3 g/L bleach solution, followed by a 1% citric acid solution through each membrane module to prevent membrane scaling. The chemical cleaning system will consist of a chemical makeup tank easily accessible from ground level and a pump to head tank on the top of the membrane tank.

2.3 Treatment Tanks

The process tanks consist of 1 stainless steel 304 tank. The tank provides sufficient hydraulic retention to meet all the treatment requirements. All tanks are prewired and pre-piped and undergo extensive FAT programs at AWC before shipping to site. SS304 was selected due to the long term corrosion free performance of the material in wastewater treatment duty. Coated mild steel tanks often experience coating failures due to improper surface preparation and even the best coatings typically need maintenance and repairs after 10-20 years in service.

The outer perimeter of the tanks a lined with aluminized 2" foam core panels providing R15 insulation.

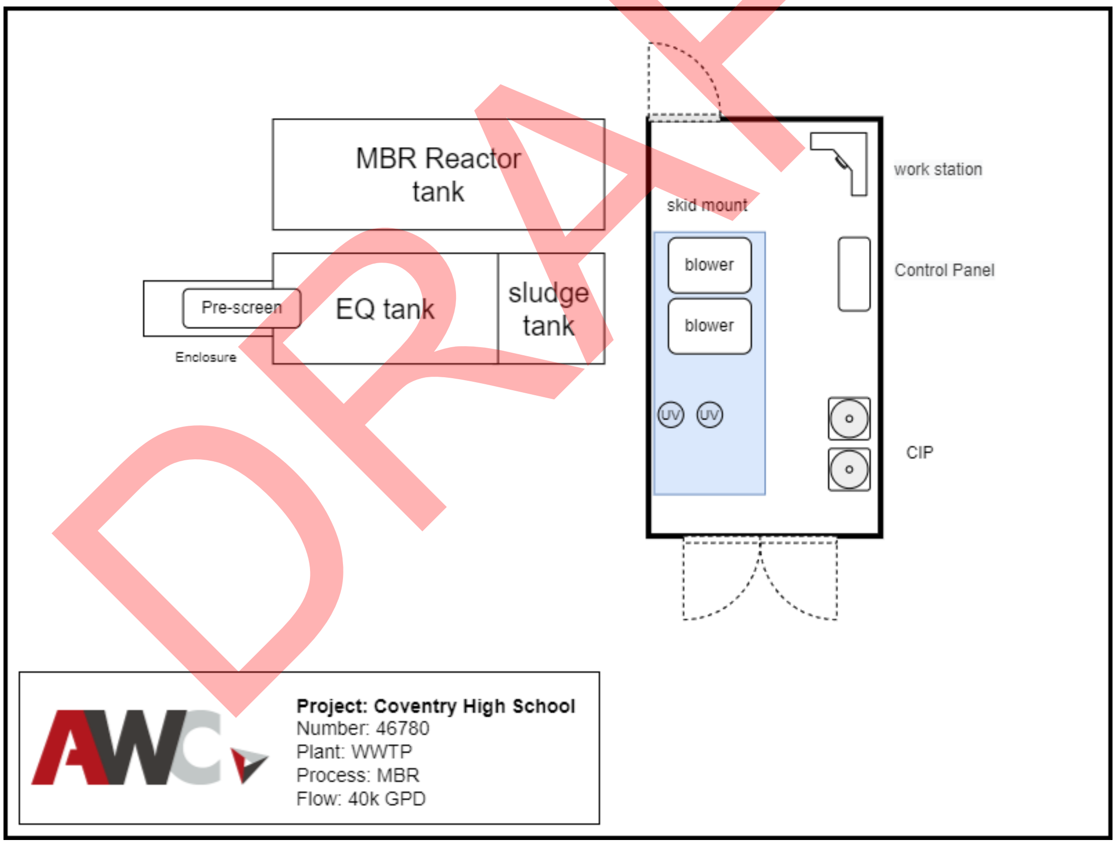
Having the tanks installed parallel to the equipment module keeps the piping and electrical connections short and importantly within the thermal envelop preventing the risk of pipe freeze-ups and failure with out the cost and expense of operating heat tracing. Heat tracing is also prone to failure over the years.

Note that a minor amount of heat tracing may be required for the incoming raw sewage pipe, the treated effluent discharge pipe and Cam lock sludge connection depending on the final design of the client specified systems. AWC will work with the contractor to determine the requirement and provide a heat trace proposal if it is required.

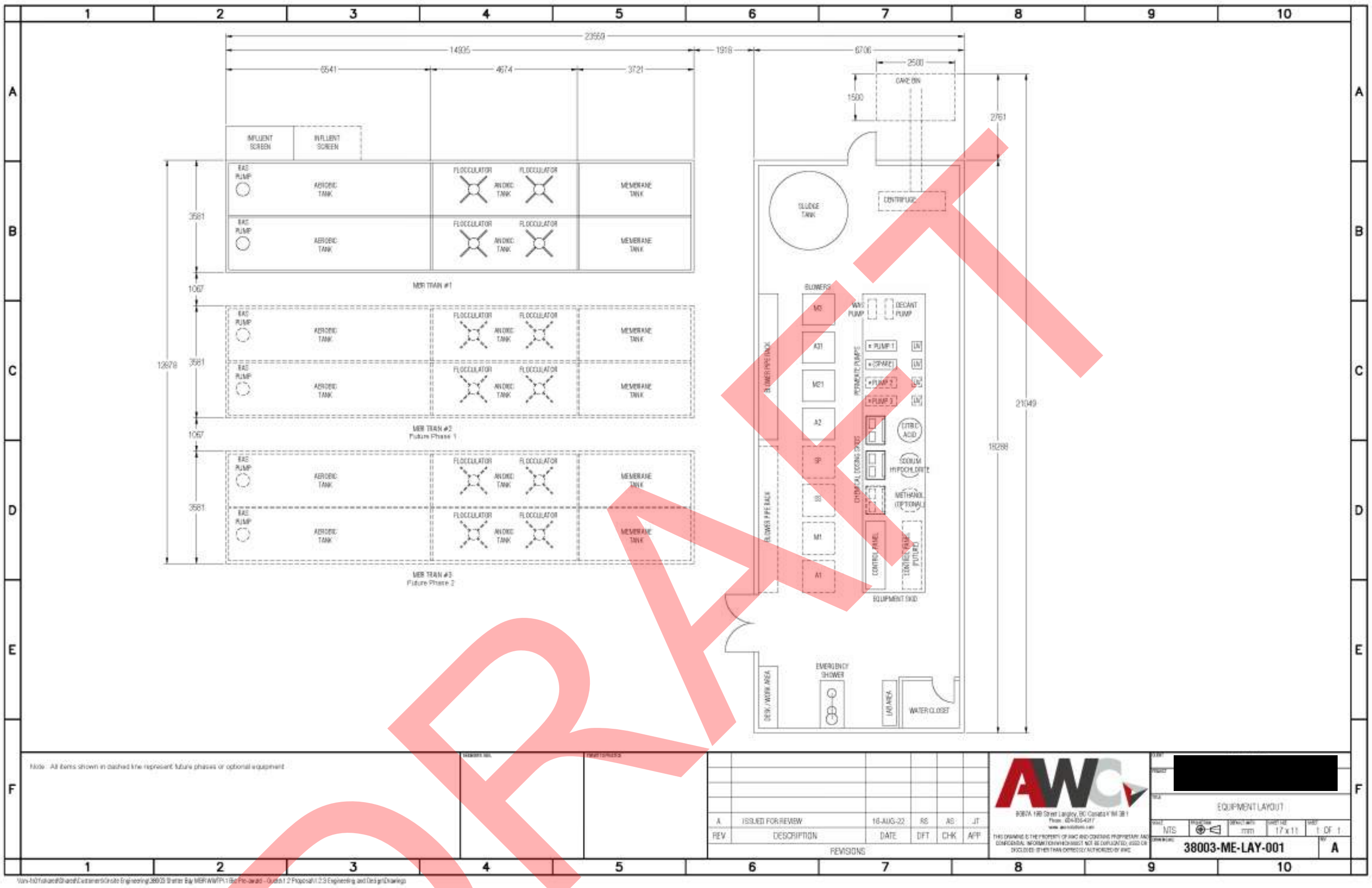
Foundation fastening responsibility

AWC will perform seismic anchor sizing as per the specification and applicable governing codes and standards. AWC will include and stamp anchor details showing the required anchor reaction force, anchor size, material and grade on general arrangement drawings, included in the shop drawing package. AWC's design will be authenticated by our Structural Engineer. Please note: Anchor supply and all calculations related to concrete strength, embedment depth and/or epoxy selection and any other associated calculations/design shall be by others.

2.4 Proposed Layout



Sample Layout (reference only)



Plant Type AWC-MBR-40

WWTP sized for peak flow of 40,000 gallons per day.

The WWTP comprises affine screen and compactor with fine screen, EQ tank, aeration tank, MBR system, UV, blower system and chemical dosing

Inlet System (designed for 40,000 GPD)

- Inlet piping with one of each of the following:
    - Inlet flange (tie-in point) and manual isolation valve (ball valve);
    - flow meter;
    - Inlet pressure gauge with diaphragm isolation; and
    - Manual control valve (diaphragm valve).
- Inlet fine screen and compactor (automated) (Quantity: 1) including:
    - Covered rotary drum screen with 1 mm punch hole screen and compactor;
    - Screen sized for instantaneous peak flow of 140 gpm;
    - Intermittent spray wash (using effluent);
    - High-level sensor;
    - Screen to be installed on site (by Others) with gravity flow to EQ tank;

Equalization System

- Equalization provided in one train sized for 6 hours retention time including:
    - Equalization Pre-Aeration tank (quantity: one):
        - Coarse bubble aeration diffusers;
        - Level transmitter;
        - High and low level float switch;
        - Fully enclosed tank with vent (gooseneck and bird screen);
        - Insulated and designed for outdoor installation.
    - Blower regenerative, oil-free, air cooled, filter and pressure relief valve, installed in a sound enclosure to be installed in the Building (by Others) (Quantity: one);
    - EQ Transfer Pumps (2 x 100%) to pump to the Aeration tank
- Aeration tank
        - Total available hydraulic retention time: 4 hours per train;
        - Mixed liquor suspended solids typical 7,500 mg/L;
        - Fine bubble aeration diffusers;
        - Level transmitter;
        - High and low level float switch;
        - Fully enclosed tank with vent (gooseneck and bird screen);
        - Insulated and designed for outdoor installation.

- Membrane system provided in two, sized for 40,000 gpd including:
    - Feed pump with VFD;
    - membrane modules in series
        - Membrane Type: Ultrafiltration
        - Brand: PermaFlux V-10
        - Material: PVDF
        - Membrane Area (per module): 214.8 sf
        - Pore Size: 40 nm
        - Temperature Range: 41°F to 158°F (5-70 °C) (for operation)
        - pH Range: 5-10 for operation (1.9-12 for cleans)
        - Max TMP: 20 psi (expected running TMP between 6 and 15 psi)
        - Flow Configuration: Outside-In

    - Automated membrane cleaning, each train configured separately:
        - Automated, **chemical free backwash** (every 10 to 30 minutes);
        - Maintenance clean once a week (chemicals depend on water quality):
            - Citric acid for inorganic scaling; and
            - Sodium hypochlorite for organic scaling;
- Sludge Holding Tank provided in one train sized for 10 days retention time including:
    - Sludge holding tank (quantity: one):
        - 2100 ft^3 Operating volume;
        - Coarse bubble aeration diffusers;
        - Level transmitter;
        - High and low level float switch;
        - Fully enclosed tank with vent (gooseneck and bird screen);
        - Insulated and designed for outdoor installation.
    - Blower regenerative, oil-free, air cooled, filter and pressure relief valve, installed in a sound enclosure to be installed in the Building (by Others) (Quantity: one);
    - Sludge decant pump (1 x 100%) to pump decant to the Aeration tank.
    - Camlock for vacuum truck connection.

2.4.1 Chemical Systems

- System pH control one common system with one of each of the following components:
    - pH sensor;
    - soda-ash day tank with mixer and containment pallet;
    - Level sensor (ultrasonic);
    - soda ash chemical pump:
        - Peristaltic pump with automated speed control;
        - pressure relief valve; and
        - injection port.
- Membrane maintenance clean – citric acid - one common system with one of each of the following components:
    - Chemical peristaltic pump with manual rheostat speed control;
    - foot valve;
    - pressure relief valve;
    - injection port; and
    - containment tray.
- Membrane maintenance clean – sodium hypochlorite - one common system with one of each of the following components:
    - Chemical peristaltic pump with manual rheostat speed control;
    - foot valve;
    - pressure relief valve;
    - injection port; and
    - containment tray.
- UV Disinfection
    - 30 mJ/cm2, 70% (minimum)

2.4.2 Instrumentation Summary

- one pH/ORP sensor Hach, Endress Hauser, or equivalent (Qty 1);
- one TSS sensor Hach, Endress Hauser, or equivalent (Qty 1);
- magnetic flow meters:

    - inlet (Qty 1);
    - discharge (Qty 1); and
    - permeate (Qty 1).
- Level transmitters (Qty 4);
- High-level switches (Qty 3)
- Pressure transmitters two per membrane train (Qty 2);
- Pressure gauges with diaphragm (Qty 8);

PLC control system for fully automatic operation

Access ladder and walkway

A commissioning report

Operation and Maintenance Manual 1 digital and 3 hard copies

Startup, Commissioning and Training: Startup, Commission and Training is included in price to a maximum of:

- 7 days on site
- Total one trip to site

2.5 AWC Standard Scope of Work

AWC's scope includes the following project requirements:

- Process, mechanical, electrical and pipe design for the packaged or modular plant
- Drawing preparation including P&I, Layouts, Electrical and Mechanical
- Equipment fabrication
- System assembly
- Factory Acceptance Testing
- Shipping to site
- Commissioning and Training including O&M manuals

3 BUDGETARY PRICING

AWC's Budgetary pricing is provided below. Note: This pricing is based on preliminary design based on limited project information and is subject to change. Pricing is to be used for budgeting purposes only.

Item#	Quantity	Equipment Description	Unit Price
1	1	**Membrane Bio Reactor AWC-MBR-40**	$1,300,000
		Total:	**$1,300,000**
***Includes shipping and commissioning**			

3.1 Currency

All pricing excludes taxes and is in USD currency.

3.2 Payment Terms

Payment milestones for any project proceeding to the contract phase shall be:

- 10% net 30 upon receipt PO
- 25% net 30 upon submission of drawings
- 55% net 30 upon purchase of major equipment
- 10% net 30 upon readiness to ship

3.3 Terms and Conditions

AWC Standard Terms and Conditions are attached in Appendix A for reference.

3.4 Customer Scope of Supply

The following is not included in AWC's scope and will be the responsibility of the customer on delivery:

- Receiving, unloading and suitable storage of material
- Cleaning of tanks and equipment following shipment, if required. Shrink wrapping or tarping of systems is available if shipping or security conditions require.
- Installation of all equipment supplied
- Site preparation, foundations and building work
- Piping connections, yard piping, drain piping, or other piping outside the tank, skid, or plant structures

- Design, supply, and installation of pipe connections between tanks and air blower(s) or backwash pumps
- Design, supply and installation of field electrical wiring and conduit between control panel(s) and junction boxes
- Minor re-termination of electrical wiring from equipment to junction boxes due to shipping constraints
- Backwash pumps and water supply
- Sludge Pumping
- Chemical Injection
- Effluent pumps
- Permitting and approvals
- Sampling and lab testing for performance testing

3.5 Shipping Terms

DAP: The budgetary price includes shipping to site. Freight costs included are preliminary and subject to change. Off-loading to be completed by others.

3.6 Schedule and Shipment

Shop drawings will be submitted for approval within (10-12) weeks after acceptance of Purchase Order. Fabrication will not commence until the Purchaser has indicated, in writing, approval of the shop drawings.

AWC assumes a (2) week drawing review by Purchaser.

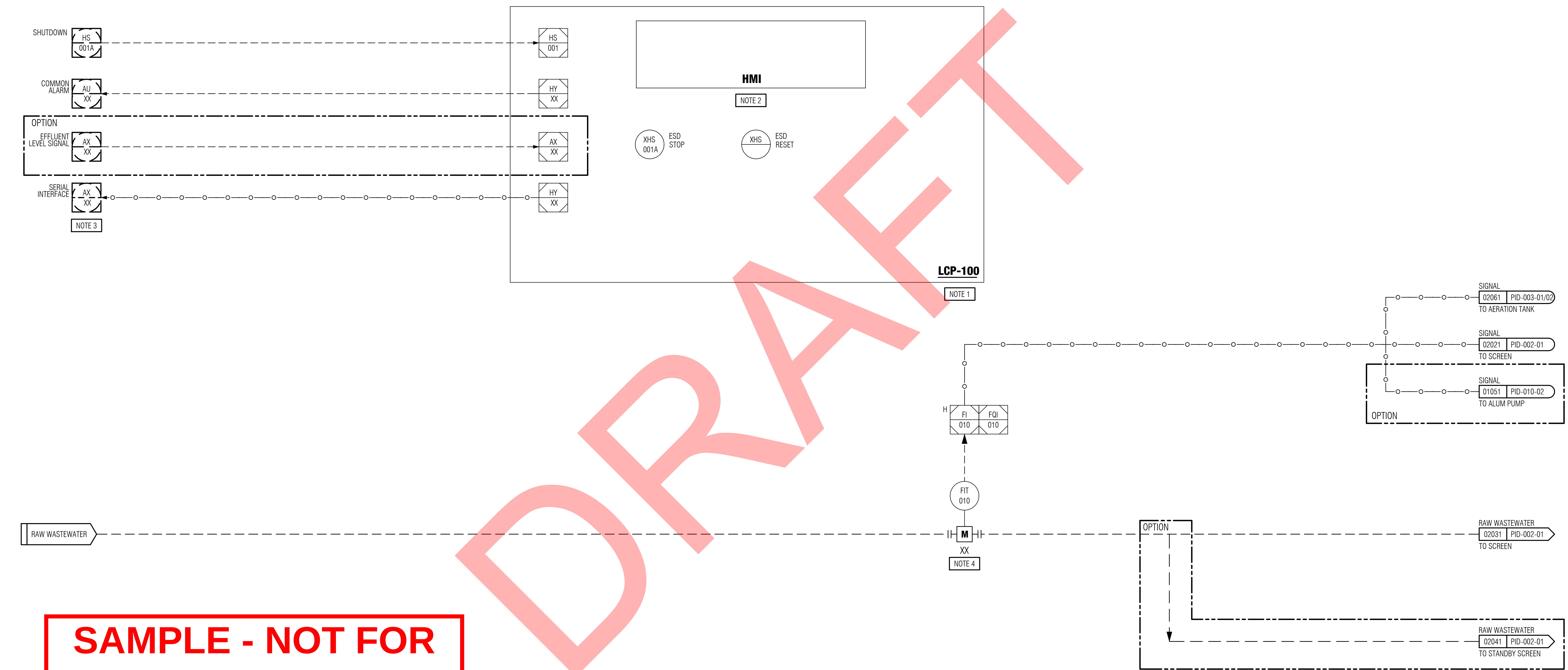
Shipment is typically made within (28) weeks of approval of drawings. Delivery schedule is contingent on AWC receiving, in a timely manner, all required technical info, including drawing approval and all required commercial documents, delivery instructions, responses to RFIs, and other information requested.

NOTE: All schedules are preliminary and subject to change based on time of order and AWC fabrication facility capacity.

3.7 Warranty

AWC warranty has been included for reference as Appendix B Standard Equipment Warranty. Additional coverage is available, please contact your representative for details.

EXHIBIT 1 SAMPLE P&IDs



DRAFT

SAMPLE - NOT FOR CONSTRUCTION

NOTES:
1. NOT ALL CONTROLS AND SWITCHES ARE SHOWN ON THIE PAGE, REFER TO ASSOCIATED P&IDS.
2. HMI SCREEN TO BE 15".
3. REFER TO SERIAL INTERFACE LIST.
4. ALL EQUIPMENT IN SOLID LINE TYPE IS SUPPLIED BY AWC, SHIPPED LOOSE FOR INSTALLATION BY OTHERS.

ENGINEER'S SEAL

PRELIMINARY
NOT FOR CONSTRUCTION

THE INFORMATION ON THIS DRAWING IS INTENDED FOR CONCEPTUAL DEVELOPMENT, PRELIMINARY DESIGN, OR FOR GUIDANCE ONLY. THIS DOCUMENT SHOULD NOT BE CONSIDERED A FINALIZED PROFESSIONAL WORK PRODUCT.

PERMIT TO PRACTICE

REV	DESCRIPTION	DATE	DFT	CHK	APP
B	RE-ISSUED FOR INTERNAL REVIEW	12-AUG-22	BM	JT	JT
A	ISSUED FOR INTERNAL REVIEW	21-JUL-22	RB	ZH	JT

REVISIONS

9087A 198 Street Langley, BC Canada V1M 3B1
Phone : 604-936-4217
www.awcsolutions.com

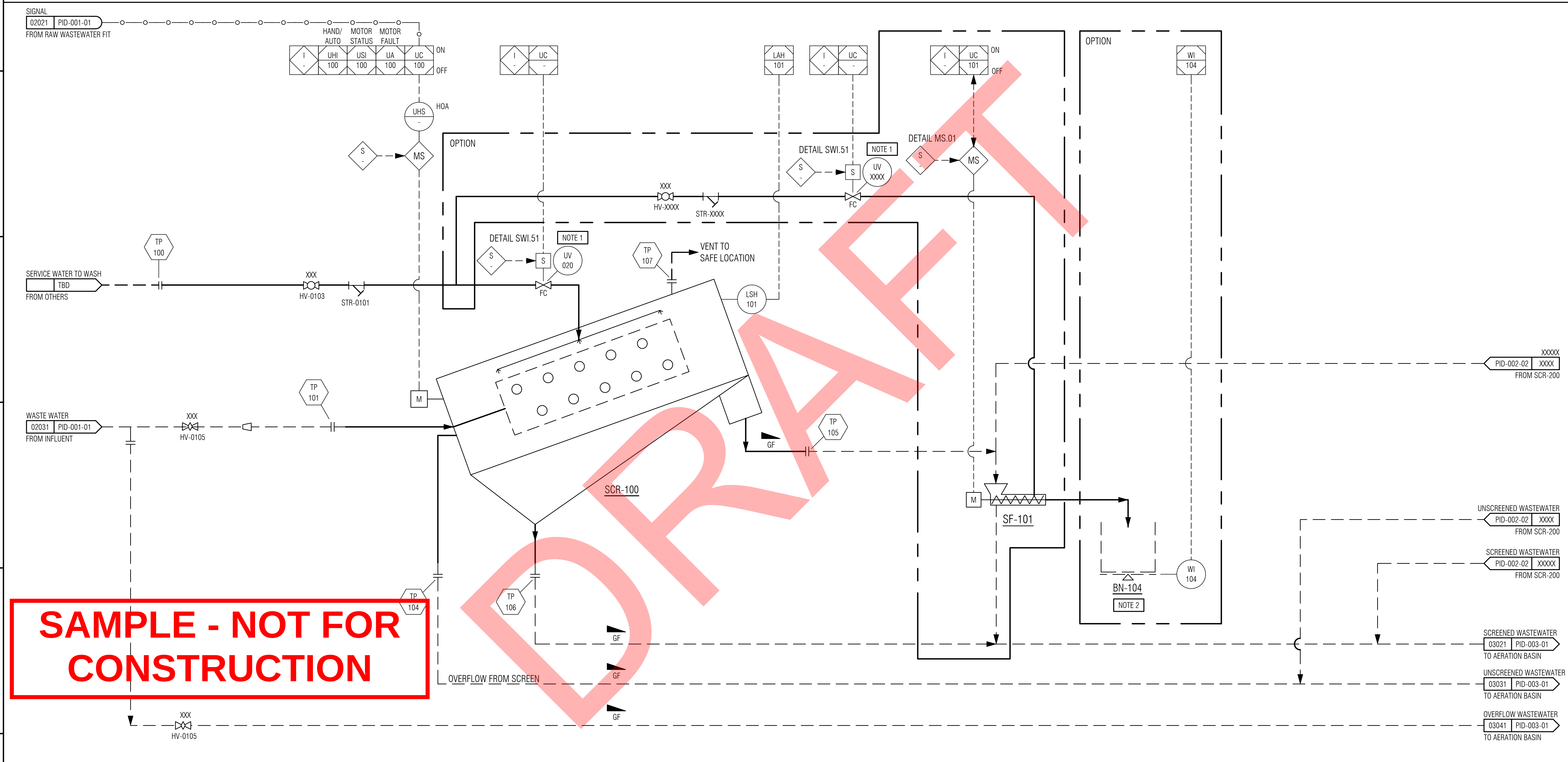
CLIENT: AWC
PROJECT: AWC STANDARD - MBR (HOLLOW FIBER)
TITLE: PIPING & INSTRUMENTATION DIAGRAM

SCALE	PROJECTION	DEFAULT UNITS	SHEET SIZE	SHEET
NTS		<UNITS>	17 x 11	1 OF 1

DRAWING NO.: 40MBR-PR-PID-001
REV: B

FILE:

SCR-100	SF-101	BN-104
INFLUENT SCREEN MANUFACTURER: LACKEBY MODEL: SCREEN SIZE: 2MM POWER: MATERIAL: 304 STAINLESS STEEL	SCREENING COMPACTOR MANUFACTURER: MODEL: POWER: MATERIAL:	BIN MANUFACTURER: MODEL: MATERIAL:



SAMPLE - NOT FOR CONSTRUCTION

NOTES:

1. HOA SWITCH LOCATED ON LCP-001.
2. BIN BY OTHERS.

ENGINEER'S SEAL

PRELIMINARY NOT FOR CONSTRUCTION

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REV	DESCRIPTION	DATE	DFT	CHK	APP
B	RE-ISSUED FOR INTERNAL REVIEW	12-AUG-22	BM	JT	JT
A	ISSUED FOR INTERNAL REVIEW	21-JUL-22	RB	ZH	JT

REVISIONS

AWC
9087A 198 Street Langley, BC Canada V1M 3B1
Phone : 604-936-4217
www.awcsolutions.com

CLIENT: AWC

PROJECT: AWC STANDARD - MBR (HOLLOW FIBER)

TITLE: PIPING & INSTRUMENTATION DIAGRAM

SCALE	PROJECTION	DEFAULT UNITS	SHEET SIZE	SHEET
NTS		<UNITS>	17 x 11	1 OF 2

DRAWING NO.: 40MBR-PR-PID-002 REV: B

FILE:

P-301A / P-301B

RAS PUMPS
MANUFACTURER:
MODEL:
CAPACITY: X.XX L/s @ XXX kPa
RATING: X.XX kW XXX FLA
POWER: XXXV/XPh/XXHz

TK-310

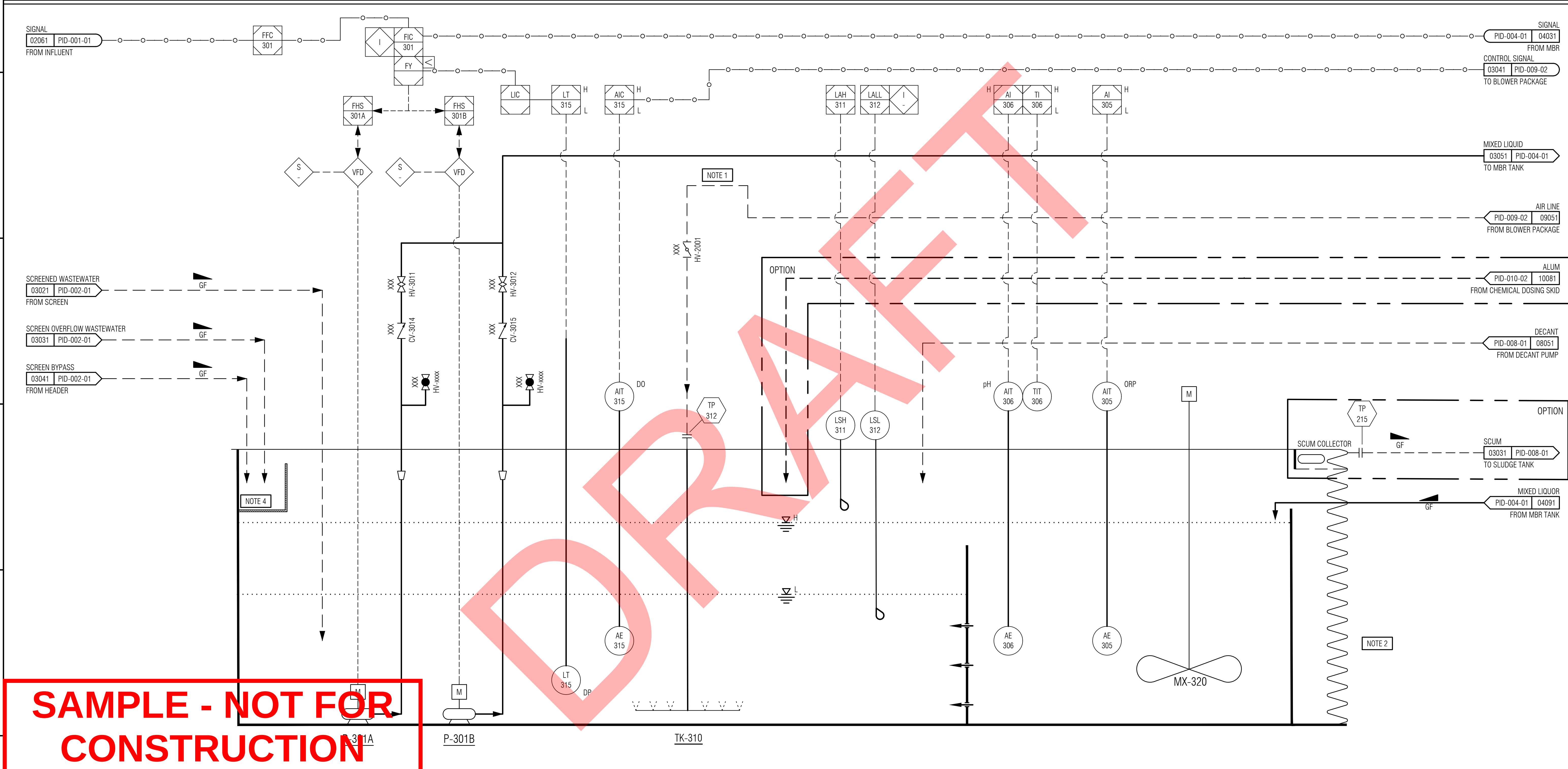
AERATION TANK
VOLUME:
AERATION: FINE BUBBLE TYPE
MATERIAL: 304 SS

MX-320

TANK MIXER
MANUFACTURER:
MODEL:
POWER:

TK-300

ANOXIC TANK
VOLUME:
MATERIAL:



NOTES:
1. AIR LINE MUST GO 1-2 FT. ABOVE THE WATER LEVEL BEFORE ENTERING TANK.
2. SCUM TO SLUDGE TANK. TBD. GRAVITY FLOW.
3. MBR TANK CONNECTED TO AERATION TANK
4. OVERFLOW SCREEN CHAMBER WITH FOG MANAGEMENT TO COMPLY WITH NFPA 820-XXXX

ENGINEER'S SEAL

PRELIMINARY NOT FOR CONSTRUCTION

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PERMIT TO PRACTICE

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CLIENT: AWC
PROJECT: AWC STANDARD - MBR (HOLLOW FIBER)
TITLE: PIPING & INSTRUMENTATION DIAGRAM
SCALE: NTS | PROJECTION | DEFAULT UNITS: <UNITS> | SHEET SIZE: 17 x 11 | SHEET: 2 OF 2
DRAWING NO.: 40MBR-PR-PID-003 | REV: B

FILE:

1	2	3	4	5	6	7	8	9	10

MBR-321 / MBR-322 / MBR-323 / MBR-324

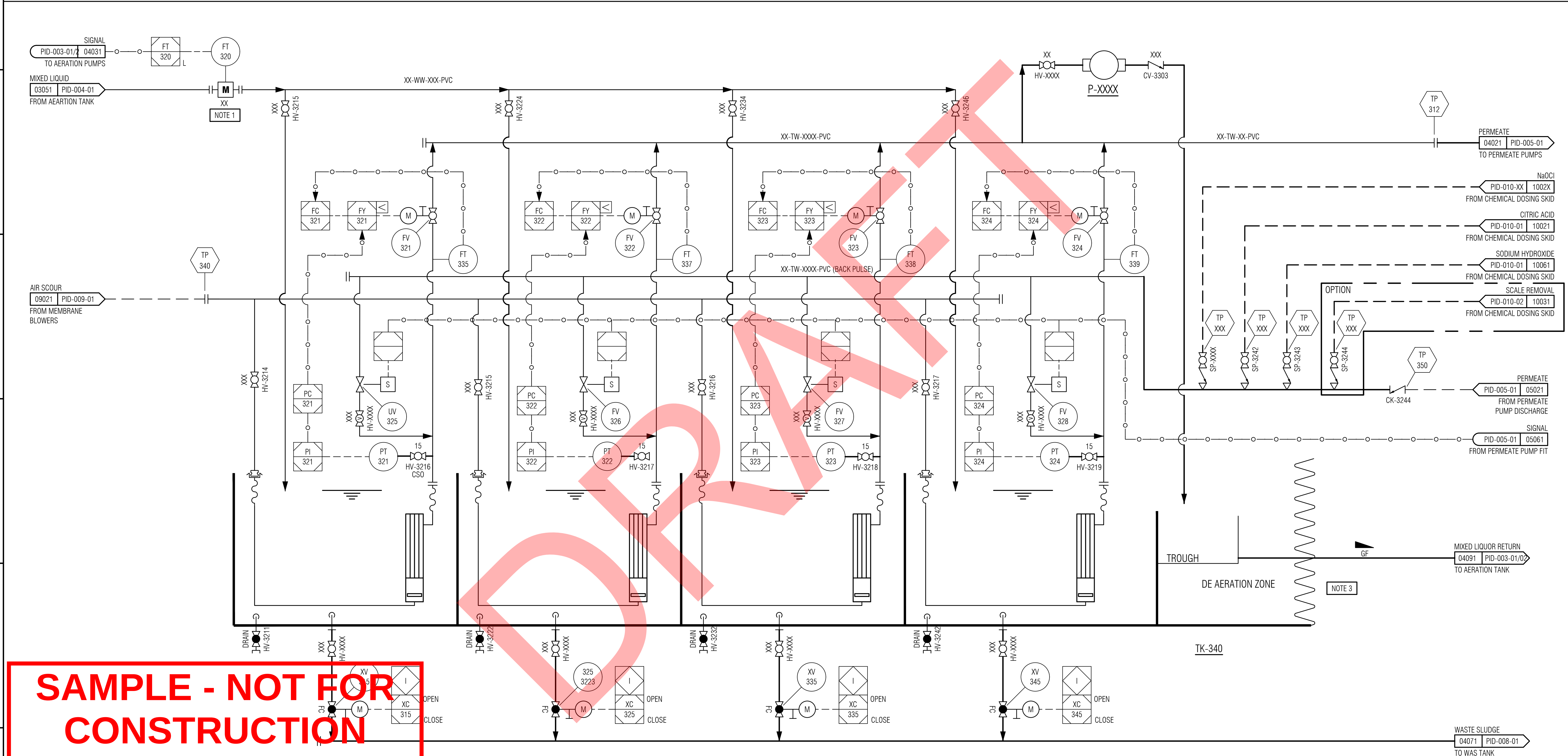
MEMBRANE HOLLOW FIBER
MANUFACTURER: DUPONT
MODEL: B40N
RACKS PER COMPARTMENT:
CASSETTES PER RACK:
TOTAL MBR AREA:

TK-340

MEMBRANE TANK
SIZE:
MATERIAL: ALUMINUM/TBD

P-XXXX

VACUUM PUMP
MANUFACTURER:
MODEL:
CAPACITY: X.XX L/s @ XXX kPa
RATING: X.XX kW XXX FLA
POWER: XXXV/XPh/XXHz



NOTES:
1. FLOW TO BE 5X INFLUENT Q
2. OPEN WAS VALVES ON MBR TANK HIGH LEVEL (TBD)
3. MBR TANK CONNECTED TO AERATION TANK

ENGINEER'S SEAL

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REVISIONS

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www.awcsolutions.com

CLIENT: AWC
PROJECT: AWC STANDARD - MBR (HOLLOW FIBER)
TITLE: PIPING & INSTRUMENTATION DIAGRAM

SCALE	PROJECTION	DEFAULT UNITS	SHEET SIZE	SHEET
NTS		<UNITS>	17 x 11	1 OF 1

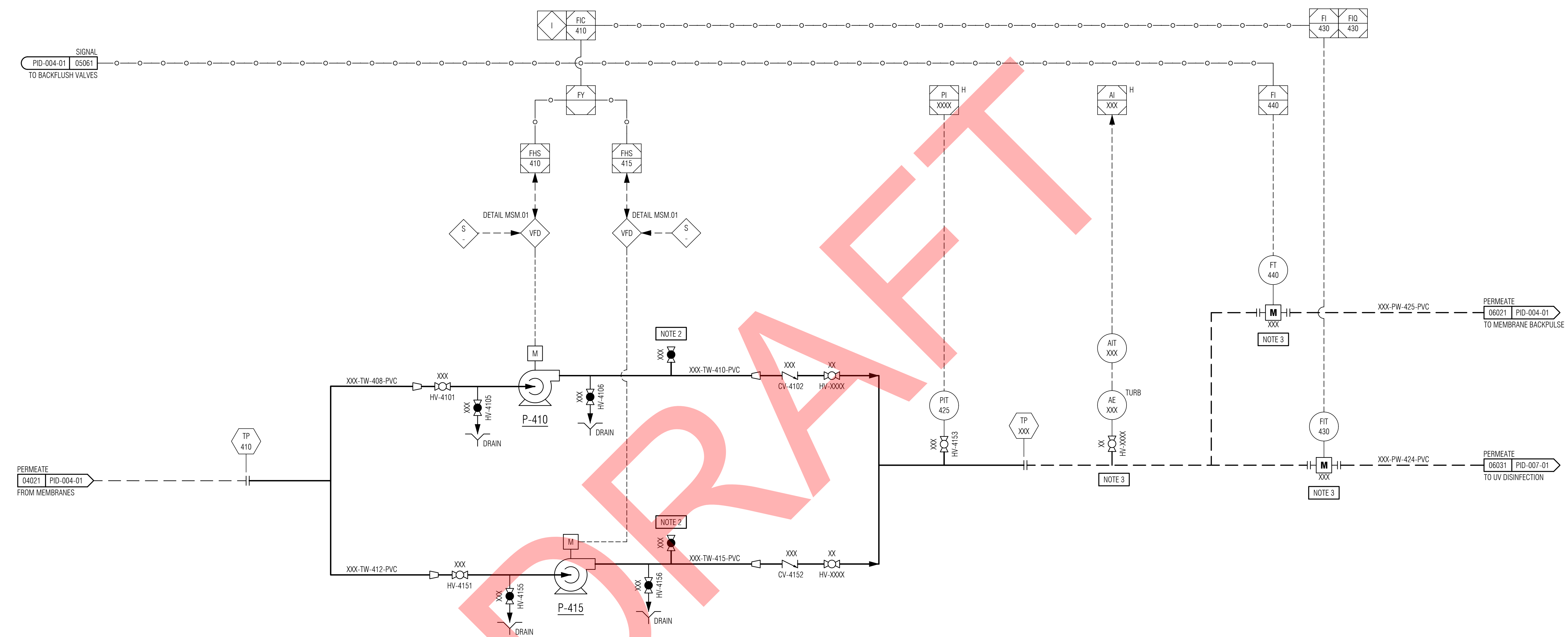
DRAWING NO. **40MBR-PR-PID-004** REV **B**

1	2	3	4	5	6	7	8	9	10

FILE:

P-410 / P-415

PERMEATE PUMP
MANUFACTURER:
MODEL:
CAPACITY: X.XX L/s @ XXX kPa
RATING: X.XX kW XXX FLA
POWER: XXXV/XPh/XXHz



SAMPLE - NOT FOR CONSTRUCTION

NOTES:
1. HOA SWITCH LOCATED ON LCP-001.
2. OPERATOR TO USE PRE-CALIBRATED GAUGES FOR STARTUP AND TESTING.
3. ALL EQUIPMENT IN SOLID LINE TYPE IS SUPPLIED BY AWC, SHIPPED LOOSE FOR INSTALLATION BY OTHERS.

ENGINEER'S SEAL

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CLIENT: AWC
PROJECT: AWC STANDARD - MBR (HOLLOW FIBER)
TITLE: PIPING & INSTRUMENTATION DIAGRAM

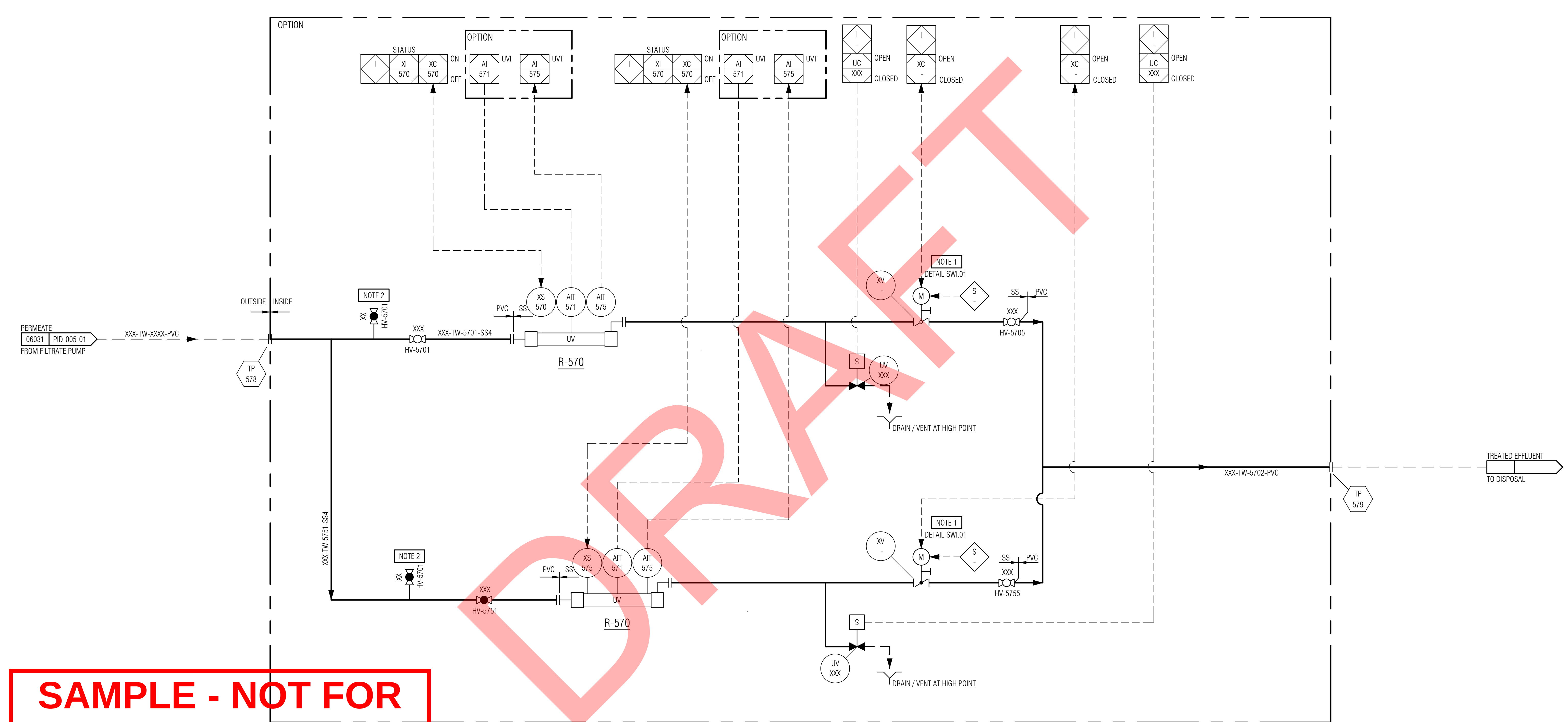
SCALE	PROJECTION	DEFAULT UNITS	SHEET SIZE	SHEET
NTS		<UNITS>	17 x 11	1 OF 1

DRAWING NO. 40MBR-PR-PID-005 REV B

FILE:

UV-570 / UV-575

ULTRAVIOLET DISINFECTION
TYPE: LOW PRESSURE HIGH INTENSITY
MODEL: TROJAN PTP 3200K
CAPACITY: XX M ^ 3/d
POWER:



SAMPLE - NOT FOR CONSTRUCTION

NOTES:
1. HOA SWITCH LOCATED ON LCP-001.
2. OPERATOR TO USE PRE-CALIBRATED GAUGES FOR STARTUP AND TESTING.

ENGINEER'S SEAL

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PROJECT: AWC STANDARD - MBR (HOLLOW FIBER)
TITLE: PIPING & INSTRUMENTATION DIAGRAM

SCALE	PROJECTION	DEFAULT UNITS	SHEET SIZE	SHEET
NTS		<UNITS>	17 x 11	1 OF 1

DRAWING NO. 40MBR-PR-PID-007 REV B

FILE:

P-331

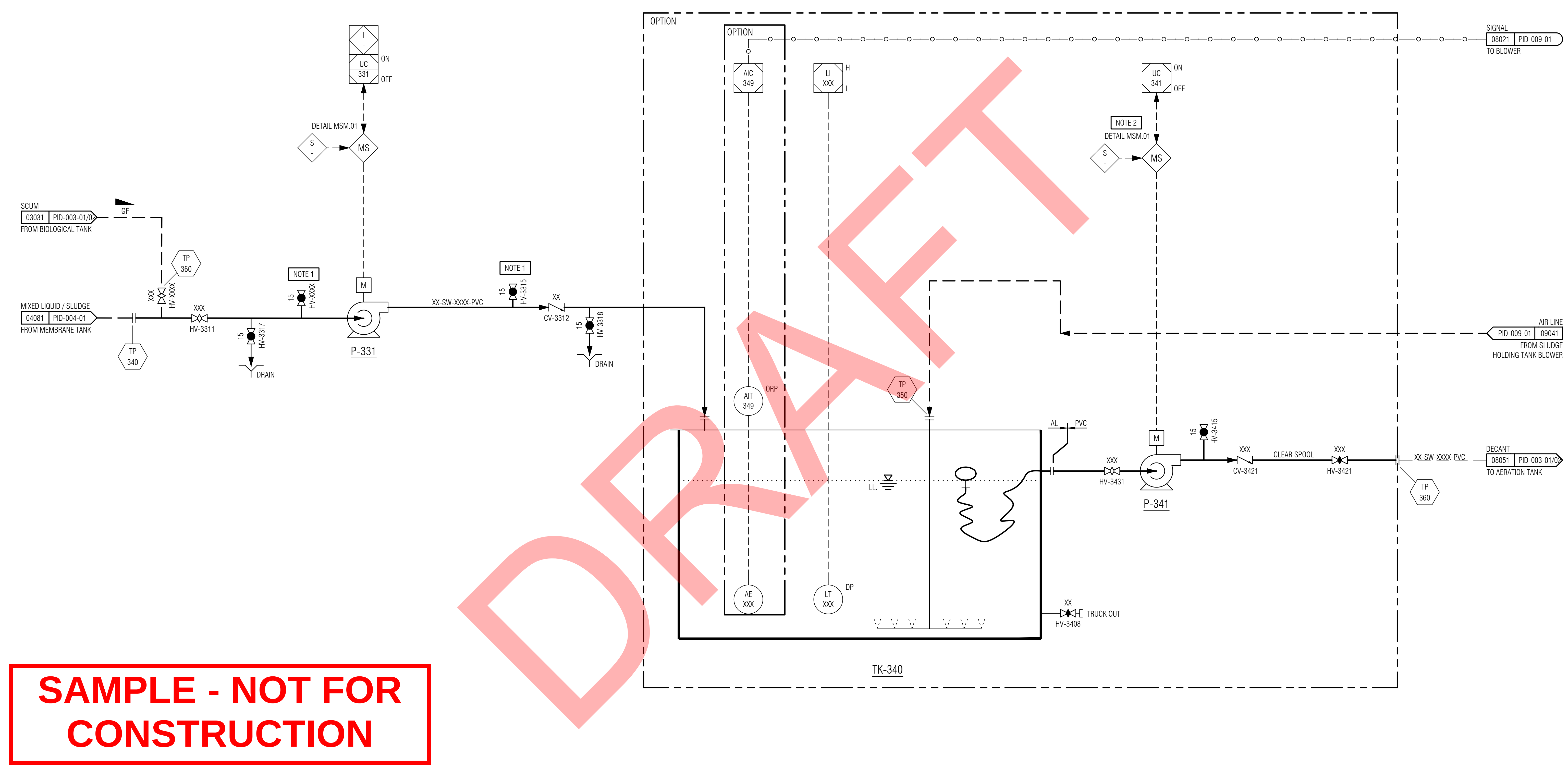
WAS PUMP
MANUFACTURER: GOULDS e-SH
MODEL: 03SH08J05T4EW
CAPACITY: XX m3/hr @ XX psi
POWER: 5HP, 230V/3PH/60Hz

TK-340

AERATED SLUDGE HOLDING TANK
VOLUME: XXXm ^ 3
DIM.: XX' L x XX' W x XX' H
RETENTION TIME: XXDAYS @ MDF
MATERIAL: 304 SS
DIFFUSERS: COURSE BUBBLE

P-341 / P-342 (STAND BY)

DECANT PUMP
MANUFACTURER: AMT
MODEL: XX
CAPACITY: XX m3/hr @ XX psi
POWER: XXHP, 115V/1PH/60Hz



SAMPLE - NOT FOR CONSTRUCTION

NOTES:
1. OPERATOR TO USE PRE-CALIBRATED GAUGES FOR STARTUP AND TESTING.
2. HOA SWITCH LOCATED ON LCP-001.

ENGINEER'S SEAL

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www.awcsolutions.com

CLIENT	AWC
PROJECT	AWC STANDARD - MBR (HOLLOW FIBER)
TITLE	PIPING & INSTRUMENTATION DIAGRAM
SCALE	NTS
DEFAULT UNITS	<UNITS>
SHEET SIZE	17 x 11
SHEET	1 OF 1
DRAWING NO.	40MBR-PR-PID-008
REV	B

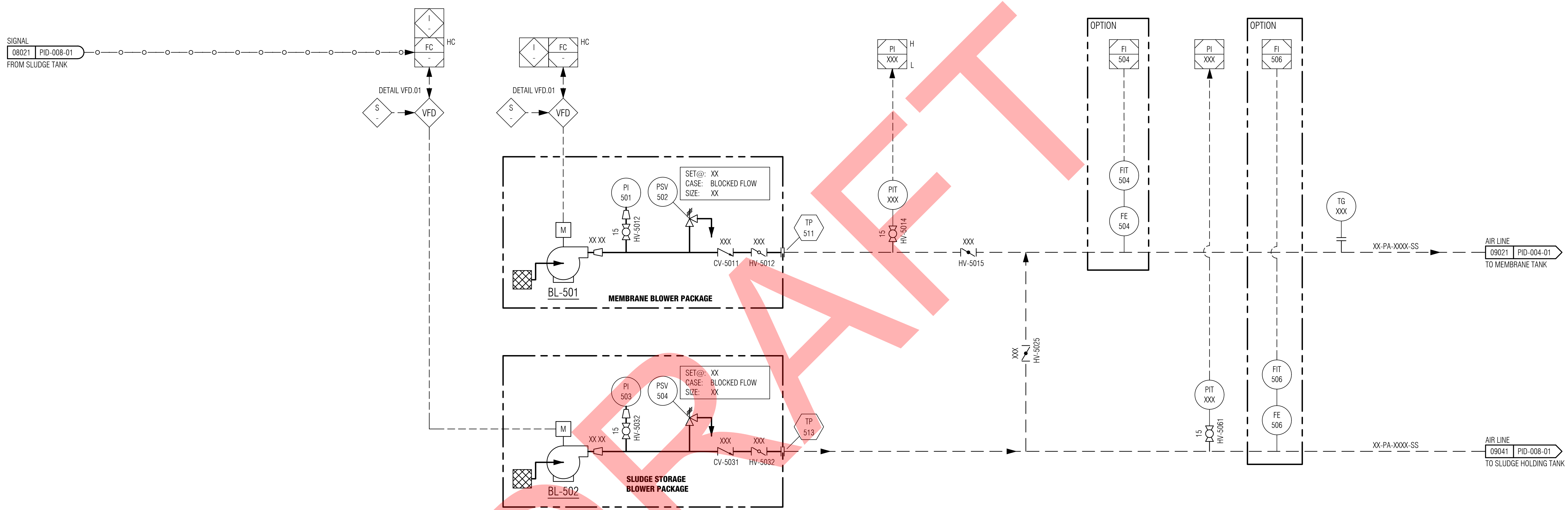
FILE:

BL-501

MEMBRANE BLOWER
MANUFACTURER: AERZEN
MODEL: TBD
CAPACITY: XX m^3 /hr. @ XX psi
POWER: XX HP

BL-502

SLUDGE BLOWER
MANUFACTURER:
MODEL:
CAPACITY: XX m^3 /hr. @ XX psi
POWER: XX HP



SAMPLE - NOT FOR CONSTRUCTION

NOTES:
1. HOA SWITCH LOCATED LOCAL TO BLOWER

ENGINEER'S SEAL

PRELIMINARY NOT FOR CONSTRUCTION

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CLIENT: AWC
PROJECT: AWC STANDARD - MBR (HOLLOW FIBER)
TITLE: PIPING & INSTRUMENTATION DIAGRAM

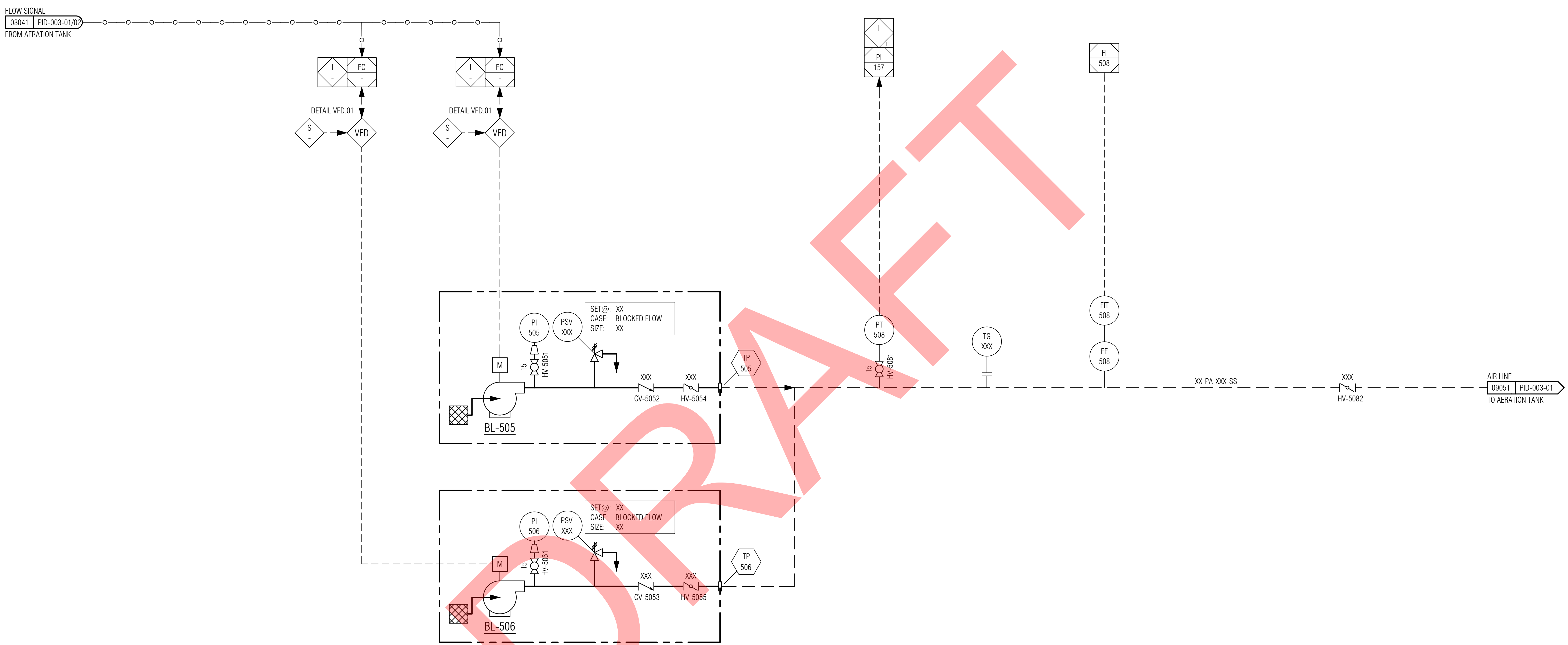
SCALE	PROJECTION	DEFAULT UNITS	SHEET SIZE	SHEET
NTS		<UNITS>	17 x 11	1 OF 2

DRAWING NO. 40MBR-PR-PID-009 REV B

FILE:

BL-505 / BL-506

AERATION BLOWER
MANUFACTURER: AERZEN
MODEL: XXXX
CAPACITY: XX m^3 /hr @ XX psi
POWER: XX HP



SAMPLE - NOT FOR CONSTRUCTION

NOTES:
1.

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REVISIONS

AWC

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Phone : 604-936-4217
www.awcsolutions.com

CLIENT: AWC

PROJECT: AWC STANDARD - MBR (HOLLOW FIBER)

TITLE: PIPING & INSTRUMENTATION DIAGRAM

SCALE	PROJECTION	DEFAULT UNITS	SHEET SIZE	SHEET
NTS		<UNITS>	17 x 11	2 OF 2

DRAWING NO.: 40MBR-PR-PID-009 REV: B

FILE:

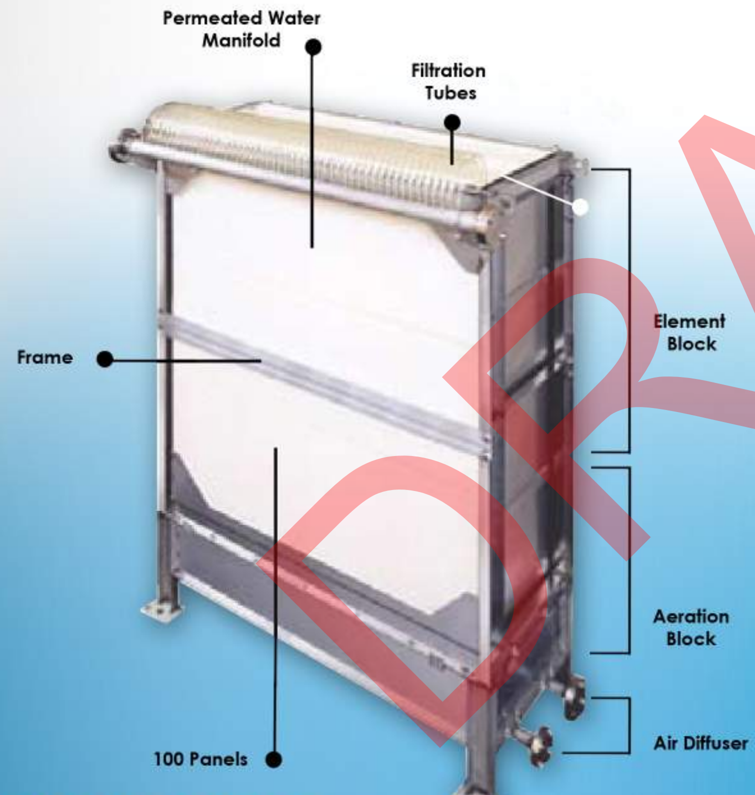
EXHIBIT 2 MBR BROCHURE

AWC WATER SOLUTIONS LTD.

MEMBRANE BIOREACTOR
WASTEWATER TREATMENT PLANTS

AWC Water Systems offers packaged membrane bioreactor (MBR) wastewater treatment plants based on submerged membrane modules. Designed to treat domestic, commercial and industrial sewage for the removal of biochemical oxygen demand, total suspended solids, total nitrogen, ammonia and phosphorous, the AWC MBR plant achieves very high re-use quality water and can handle a wide variation in loading and flow rates. Automation and flexible operating parameters deliver a cost-effective, trouble-free treatment process.

HOW THE MBR TECHNOLOGY WORKS



FLAT PANEL MEMBRANE

1. Raw screened sewage is pumped at a controlled rate from an equalization tank into the treatment train(s), which typically include aerobic and membrane compartments.
Due to the long sludge age of the biomass, ammonia is almost completely nitrified minimizing potential aquatic toxicity concerns. Redundant equipment is provided to meet applicable regulations.

2. For advanced nutrient removal, an anoxic zone is added to the treatment train if total nitrogen reduction is required. To control phosphorous, a chemical precipitant system is also added.
AWC's MBR system will achieve <0.1 mg/L phosphorous levels due to the efficient removal of solids compared to conventional systems. Biological phosphorous removal to reduce chemical consumption is offered for larger systems (>1,000 m3/d). This involves the installation of an anaerobic tank to facilitate biological phosphorous uptake.

3. In the aeration tanks, aerobic micro-organisms feed on the soluble organics to reduce the biological oxygen demand of wastewater.
Typically, dissolved oxygen control and other advanced instrumentation such as oxidation-reduction potential and pH sensors are utilized to reduce power consumption and improve treatment performance.

4. Finally, treated water is either drawn under low pressure through the membranes using permeate pumps or forced through by hydraulic head. Where required, ultraviolet (UV) disinfection is provided.

The MBR greatly reduces coliform bacteria and produces clear effluent, resulting in smaller UV reactors and less UV power consumption.

PLANT FEATURES

ADVANCED MEMBRANE TECHNOLOGY

The membranes feature submerged flat sheet modules made of polyvinylidene fluoride for the functional layer, with a polyester non-woven fabric as the support layer. These materials provide superior physical strength and chemical stability for extended membrane life. Additional features include:

Uniform 0.08 micron pore size

- Reliably achieves clean effluent quality and disinfection by forming a physical barrier that blocks suspended solids and bacteria
- Provides disinfection by high rejection of coliform bacteria
- Protects sensitive aquatic environments by blocking suspended solids and reducing phosphorous precipitates to very low levels
- Improves membrane life and minimizes membrane fouling

Flat sheet configuration

- Improves reliability, as solids cannot get tangled in panels (as with hollow fiber membrane systems)
- Enables effective cleaning of membranes through coarse bubbles and periodic relaxations of the permeate flow. No complicated backpulse system is required. This maintains high permeability, decreases fouling and reduces chemical cleaning requirements. The simplified cleaning process (as compared to hollow fiber systems) also reduces equipment maintenance costs

Large panel design with larger surface area and tight panel spacing

- Reduces equipment footprint to build more compact plants or to retrofit existing tanks
- Reliable high MLSS operation (up to 16,000 ml/L) permits very small tank volumes for smallest possible plant

QUALITY TANK CONSTRUCTION

AWC constructs its tanks out of highly corrosion-resistant marine grade 5086 aluminum alloy. This construction eliminates the need for corrosion-protection coatings and prevents premature failures, which can occur with poor coating application or coating failures. Sacrificial anodes are used to further increase protection against corrosion. All fasteners in contact with the aluminum are 316 stainless steel to minimize galvanic corrosion. Stainless steel tanks are also available for critical applications.

Our skid-mounted equipment systems can also be supplied for installation into site-constructed concrete tanks or retrofitted into existing tankage. In these circumstances, AWC can provide tank dimensions and other civil criteria.

ELECTRICAL SYSTEM & CONTROL PANELS

AWC designs, builds, programs and commissions fully integrated automated control and electrical systems. Our systems feature:

- Integrated UL and CSA approved MCC's and control panels
- Fully automatic operation with advanced instruments and controls
- Remote monitoring, control and SCADA options
- Industrial quality PLC's with simple plug-in, pre-programmed modules

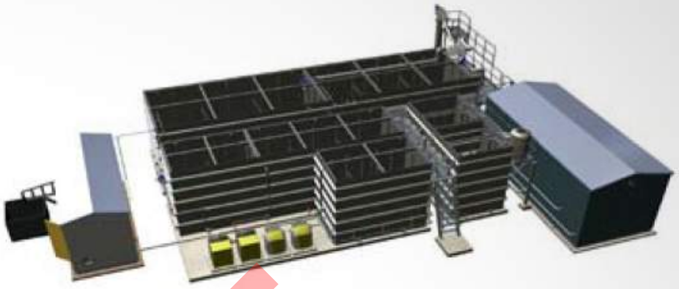
CHEMICAL SYSTEM

We offer a full range of chemical mixing and dosing systems, including solution tanks, mixers, dosing pumps and safety equipment.

PLANT ADVANTAGES

CORROSION-RESISTANT

Our plants are fabricated with marine-grade aluminum alloy with sacrificial anodes or 304 stainless steel. This provides superior resistance to chemicals and corrosion, resulting in longer life. Unlike mild steel tanks, recoating is not required.



UNCOMPLICATED MEMBRANE MAINTENANCE

Due to the efficient scouring action of the membrane, chemical cleaning is required less frequently and fewer chemicals are used, minimizing handling and operating costs. Complicated backwash cycles are not required, improving system reliability, reducing complexity and minimizing operator labor.

UNIQUE MEMBRANE TECHNOLOGY

Due to advanced manufacturing processes and flat panel configuration, the membranes have superior physical strength, operate with reduced membrane flux pressure, are less vulnerable to fouling and are highly resistant to clogging.

They also deliver stable, clear treated effluent with minimal operator input.

COMPLETE PROCESS

As a single source of responsibility, AWC delivers the complete system from the influent pump station to the sludge dewatering.

COST EFFECTIVE

Our modular MBR plants feature an uncomplicated and easily maintained design for economical, trouble-free and long-term operation.

COMPACT FOOTPRINT

The membrane's larger panel size, tight panel spacing, high MLSS operation and elimination of clarifiers provide a compact footprint for ease of installation and flexibility in retrofitting existing tanks.

ENVIRONTMENTALLY FRIENDLY

Our plants produce clear effluent with reduced nutrient loads, protecting our environment and aquatic habitat.

ABOUT AWC WATER SYSTEMS

AWC Water specializes in providing innovative packaged and modular water and wastewater treatment solutions for municipal and industrial applications. With more than 500 plants delivered around the world, we offer unmatched expertise and a reputation for delivering reliable, high quality water and wastewater solutions.

Contact AWC today to discuss your project needs.

AWC WATER SOLUTIONS LTD.
Tel. 604-638-0760 Fax. 604-638-0795
Website. http://www.awcwater.com
Email. info@awcwater.com

APPENDIX A AWC TERMS AND CONDITIONS

DEFINITIONS:

i. **“Agreement”** means the Buyer’s agreement to purchase the Product(s) and/or Services from the Seller.

ii. **“Buyer”** means the company, partnership, person, or entity purchasing the Product(s) and/or Services from the Seller identified in the Purchase Documents.

iii. **“Product(s)”** means the equipment parts and materials being purchased by the Buyer identified in the Purchase Documents.

iv. **“Purchase Documents”** means the documents accompanying these Terms and Conditions which more fully describe the Products and/or Services being purchased from the Seller, including, as applicable, the Buyer’s request for quotation, purchase orders, and the Seller’s quotation.

v. **“AWC Solutions”**, **“AWC”** and **“Seller”** means AWC Process Solutions Ltd or AWC Water Solutions Ltd.

vi. **“Force Majeure”** means an event beyond reasonable control, including, without limitation, acts of God, earthquake, tsunami, storm, washout, landslide, avalanche or other extreme weather conditions, fire, flood, vandalism, explosions, strikes, lockouts or other industrial disturbances, unavailability of any goods, materials or equipment, acts of the Queen’s or public enemies, wars, blockades, insurrections, riots, arrests, restraints or other civil disturbances, epidemics, restraints or prohibitions by any court or governmental board, department, commission or agency, and new or amended laws, and all other events of a similar nature.

2. APPLICATION: These terms and Conditions apply to every sale of Product(s) and every supply of Services by the Seller to the Buyer. The Buyer specifically agrees and acknowledges that unless the Seller agrees in writing to a modification of these Terms and Conditions, these Terms and Conditions apply and take precedence over any of the Buyer’s Terms and Conditions whether set out in the Purchase Documents or otherwise.

3. PRICES: Unless otherwise specified by the Seller, the Seller’s price for the sale of the Product(s) will remain in effect for forty-five (45) days from the date provided. The Seller’s prices do not include applicable taxes which will be added to the price quoted and appear as a separate line item on the Seller’s invoice. In case of any discrepancies between Buyer’s Purchase Order and Seller’s Order Confirmation it is the responsibility of Buyer to notify Seller within 24 hours of receiving the Seller’s Order Confirmation after which point Buyer is bound to prices in Seller’s Order Confirmation.

4. TERMS OF PAYMENT: Payment terms and schedule are of the essence**.** Subject to approval of the Seller’s accounting department, the Buyer shall pay the Seller the price of the Product(s) and/or Services provided within thirty (30) days from the date of the Seller’s invoice. If the Seller and the Buyer have agreed to a milestone payment schedule, the payment specified in the milestone payment schedule shall be paid on the dates that each milestone is achieved. All overdue payments bear interest commencing on the day on which the amount became payable, calculated at the rate of 1.2% per month compounded monthly (15.3895% per annum).

5. DELIVERY AND TRANSFER OF TITLE AND RISK: All delivery dates of the Product(s) and/or Services to be provided by the Seller are approximate only and are based on the Seller having received from the Buyer all information required by the Seller to provide the Product(s) and/or Services. Seller shall in good faith attempt to effect delivery by the date specified but shall not be responsible or liable for delays due to unexpected circumstances. In no event will Seller be liable for incidental or consequential damages resulting from failure to meet the specified or amended delivery dates. All Product(s) shall be delivered to the Buyer at the location indicated in the Purchase Documents, EX WORKS at the point of the manufacture of the Product(s). All risk of loss or damage to the Products while in transit shall be borne by the Buyer. Title to the Product(s) shall pass to the Buyer on the Buyer making payment in full for the Product(s) or on the Product(s) being delivered to the Buyer, whichever occurs later.

6. DOCUMENTATION: The Seller shall supply the Buyer with the documentation specified in the Seller’s quotation. Any additional copies of the documentation or the supply of documentation on alternative media will be provided by the Seller to the Buyer at the Seller’s price in effect at the time of the request.

7. INSTALLATION: The Buyer shall be responsible for transporting, receiving, storing, installing, starting up, and maintaining all Product(s). If requested, the Seller may, at its option, provide Services to assist the Buyer in the installation of the Product(s) at a price agreed upon between the Buyer and the Seller or at the rates set out in the Seller’s published rate schedule at the time the Services are rendered.

8. EXCUSE OF PERFORMANCE: The Seller shall be excused from the performance of any term or condition of this sale or the provision of Services when and to the extent that the performance is delayed beyond its reasonable control including, without limitation to, acts of God, wars, riots, labour unrest, inability to obtain materials or components, explosions, accidents, governmental requests, laws, regulations, orders or actions. If such an event occurs, the delivery date and the price of the Product(s) and/or Services to be provided by the Seller may be revised by agreement made between the Buyer and the Seller or the Seller may at its option cancel the sale of the Product(s) or agreement to provide Services in which case the Buyer will pay the Seller any and all losses, damages, dismantling, restocking fees, and any other costs or expense incurred by the Seller arising from such a termination.

9. TERMINATION AND SUSPENSION: The Buyer may terminate or suspend its purchase of all the Product(s) and/or Services provided that it pays the Seller for any and all losses, dismantling, restocking fees and any other costs or expenses arising from such termination or suspension. The Seller shall have the right, in addition to any other remedy deemed necessary, to either terminate its agreement to sell the Product(s) or provide the Services or suspend further deliveries of the Product(s) or provision of the Services to the Buyer in the event the Buyer fails to make any payment required to be made to the Seller when due.

10. WARRANTY: Subject to the limitations of liability and remedies set out in Section 12, the Seller warrants its Product(s) and/or Services as follow:

Seller’s Products: The Seller will, at its option, repair or replace any defects in material or workmanship in any Product(s) manufactured by the Seller which appear within the earlier of twelve (12) months from the date of initial installation of the Seller’s Product(s) by the Buyer, or eighteen months from the date the Seller’s Products(s) were delivered to the Buyer.

Re-Sale Products: The Product(s) manufactured by any third party (including the Seller’s principals and their affiliated companies) provided by the Seller to the Buyer as the manufacturer’s distributor shall be subject to the manufacturer’s standard warranty. The Buyer agrees that the Seller shall have no liability for correcting any defect in the materials and workmanship in any re-sale Product(s) and that the Seller’s only obligation is to make a reasonable commercial effort to assist the Buyer in making a warranty claim as against the manufacturer’s standard warranty.

Services: Any Services supplied by the Seller, including component integration, device configuration, and the repair of Product(s) are warranted against defects in workmanship for a period of the earlier of ninety (90) days from the date of the installation of the Product(s) or one hundred and twenty (120) days from the date of the delivery of the Product(s) to the Buyer. Any interpretative services provided by the Seller are not warranted wither as to the accuracy or correctness of any such interpretations or any recommendations made by the Seller based upon these interpretations.

On-Site Warranty Support: If the Buyer requires the Seller to provide any Services relating to any defect in the Product(s) and/or Services rendered or any warranty claim made by the Buyer in respect of the Product(s) and/or Services, including diagnosis, dismantling, and reinstallation of Product(s), at the Buyer's site, all costs of travel to and from the Buyer's site and of these Services shall be paid by the Buyer at the rates set out in the Seller's published rate schedule in effect at the time the Services are actually provided.

11. WARRANTY EXCLUSIONS:

a) The Seller does not warrant the performance of any Product(s) and/or services provided by it to the extent that the actual operating or other conditions differ from the specifications or other data supplied by the Buyer for the purpose of selection of design of the Product(s) and/or Services to be provided by the Seller.

b) This limited warranty shall not apply to any repair or replacement of Product(s) caused by abuse, accidental damage, misuse, improper installation, and improper application, corrosion or inadequate or improper preventative maintenance of the Product(s).

c) Except as expressly provided herein, there are no other representations or warranties of any kind, express or implied, as to the merchantability, fitness for particular purpose, or any other matter with respect to the product (s) or services.

12. LIMITATION OF REMEDY AND LIABILITY: The Seller shall not be liable for any kind of consequential damages including loss of anticipated profits, loss of use of equipment or any associated equipment, the loss of product from the Buyer's facility(s) or the loss of capital however caused. The Buyer agrees that the Seller's sole and exclusive liability for all losses and damages arising out of or connected in any way with the Product(s) and/or Services provided by the Seller shall be limited to the repair, correction, or replacement of the Product(s) and/or Services in accordance with the terms of limited warranty set out in Section 10 herein. The Buyer further agrees that the Seller's total liability arising out or connected in any way with the provision of the Product(s) and/or Services is limited to the value of the Product(s) and/or Services provided by the Seller under this Agreement.

13. INDEMINITY: The Seller agrees to protect, defend, and indemnify the Buyer, its respective officers, directors, employees, and consultants from and against any and all claims, demands, losses, causes of action, liability and costs (including all legal costs and attorney fees) of every kind and nature arising out of or connected in any way with damage to property, person injury, or death of the Buyer's employees, or third parties alleged to have been caused by any act or omission of the Seller connected with the Product(s) and/or Services provided by the Seller. The Buyer agrees to protect, defend, and indemnify the Seller, its respective officers, directors, employees, and consultants from and against all claims, demands, losses, causes of action, liability and costs (including all legal costs and attorney fees) of every kind and nature arising out of or connected in any with damage to property, personal injury, or death of the Seller's employees, or third parties alleged to have been caused by any act or omission of the Buyer.

14. INSURANCE: The Buyer shall provide at its expense property damage insurance or "all risk" builder's risk insurance covering all its property on the basis of full replacement cost value without depreciation which will name the Seller and any manufacturer of the Product(s) as additional insureds with a waiver of subrogation against all insured parties thereunder.

15. GENERAL PROVISIONS:

a) Buyer shall not assign its rights or obligations under this Agreement without Seller's prior written consent.

b) There are no understandings, agreements, or representations, express or implied, not specified in this Agreement.

c) No action, regardless of form, arising out of transactions under this Agreement, may be brought by either party more than two (2) years after the cause of action arose.

d) This Agreement is formed and shall be construed, performed and enforced under the laws of the Province of British Columbia. Any suit, action, or proceeding arising out of or connected in any way with this agreement shall be brought in a Court of the Province of British Columbia which the parties shall have exclusive jurisdiction to hear and resolve such disputes, subject only to the parties agreeing to resolve such disputes through arbitration.

16. CANCELLATION, CHANGES, AND / OR DELAYS: In the event an order is cancelled; a cancellation charge shall be applied. Cancellation fees shall be at the sole discretion of AWC, and based upon on allocated or buy-in material's status and/or labor applied, as well as a reasonable amount to cover overhead and profit.

Changes to the scope of supply as described in the prevailing Purchase Order, after approval of drawings or release to manufacture shall be subject to a change-order charge and subsequent delivery delay. Where possible AWC shall endeavor to accommodate such changes, however AWC cannot be held responsible for Deliverables that may become affected as a result of such change/s, whether a charge is applicable or not.

In the event of a delay outside the control of AWC, and where substantial work or costs have been incurred by AWC, payment terms shall be adjusted to preserve AWC's initially projected cash position.

AWC shall not accept an order which contains a penalty clause for late delivery unless otherwise described in the quoted Bill of Materials. AWC shall not participate with or become partners in a project where a penalty for late/non-compliant delivery would constitute a financial back-charge or discount to the agreed upon order value. AWC will not accept back-charges or claims for late delivery whether directly or indirectly caused by AWC or its suppliers.

17. FORCE MAJEURE: Neither Party shall be liable for delay or failure in the performance of any of its obligations hereunder if such delay or failure is due to causes beyond its reasonable control, including, without limitation, acts of God, fires, earthquakes, strikes and labor disputes, acts of war, terrorism, civil unrest or intervention of any governmental authority ("Force Majeure"); provided, however, that the affected Party promptly notifies the other Party and further provided that the affected Party shall use its commercially reasonable efforts to avoid or remove such causes of non-performance and to mitigate the effect of such occurrence, and shall continue performance with the utmost dispatch whenever such causes are removed. When such circumstances arise, the Parties shall negotiate in good faith any modifications of the terms of this Agreement that may be necessary or appropriate in order to arrive at an equitable solution. Each Party shall bear its own costs and expenses incurred in connection with Force Majeure (including for any efforts to mitigate the effect or impact of the Force Majeure), and neither shall seek recovery of such costs or expenses from the other Party. Throughout any period of Force Majeure, the Party affected shall provide the other Party with regular status updates, including reasonable and non-binding predictions as to when the Force Majeure condition is likely to cease.

APPENDIX B STANDARD EQUIPMENT WARRANTY

1. For the Warranty Period, AWC WATER SOLUTIONS LTD. ("**AWC**") warrants that the identified equipment ("**Equipment**") will be free from material defects in fabrication, subject to the terms of this Warranty.

2. For all valid Warranty Claims made by the Client, AWC will repair or replace any defective parts in the Equipment, free of charge, provided that the defective Equipment is returned to AWC. All returns shall be made at the sole cost of the Client to the address designated by AWC, shipping costs prepaid. Should AWC determine that the Equipment requires replacement, AWC will immediately commence sourcing of the replacement and will keep Client appraised of the delivery schedule. Replaced Equipment shall be subject to the balance of the original Warranty period. Should AWC determine that a Warranty Claim is not covered by this Warranty, AWC will offer to repair or replace the Equipment subject to the Client's written acceptance of AWC's quotation for same.

3. The Client shall issue AWC immediate written notice of any Equipment defect upon discovery in compliance with the terms of this Warranty. Any Warranty Claim that is not made immediately upon discovery, or that is not made in compliance with this Warranty or that is made after the expiry of the Warranty Period will not be honoured.

4. This Warranty excludes Warranty Claims for:

    a. any Equipment failure caused by incorrect storage or deviation from manufacturer's preservation instructions,

    b. any Equipment failure caused by deviation of AWC's transportation or lifting procedures / instructions or generally recognized Industry practices,

    c. any Equipment failure caused directly or indirectly by the improper operation or maintenance of the Equipment,

    d. any Equipment failure caused directly or indirectly by any failure to comply with the Operations Manual, the Maintenance Manual, system design specifications, any directions issued by AWC from time to time or recognized industry operating practices,

    e. any Equipment that has been modified or repaired by the Client or the Client's Contractor unless it has been modified or repaired strictly in compliance with AWC's written instructions as confirmed by photos and videos taken at the time of the modification or repair and sent to AWC promptly,

    f. any damage to Equipment caused by any person intentionally or unintentionally other than by AWC, its employees or contractors,

    g. any damage to the Equipment caused by a facility fire, accident, or Force Majeure event,

    h. paint or coatings are not warrantied beyond manufacturer's standard periods,

    i. any Equipment parts that are designated by AWC or recognized within common industry practices as ordinary wear and tear items or

    j. any Equipment that has been modified by AWC at the request of the Client or its Contractor against the advice of AWC.

5. Any Warranty Claim shall include a clear written description of the Equipment defect, and all relevant data to assist in remedying the defect. Upon request by AWC, the Client shall promptly supply copies of the operators log data,

maintenance records, names of the operators operating the equipment, specific photos and videos related to the Equipment, and other data requested by AWC from time to time. If Client has not maintained the operator's log and maintenance records in the manner required by the Operations and Maintenance manual or in a manner inconsistent with normal/standard operating procedures, this warranty may, at AWC's discretion, be invalidated by written notice.

6. The Client shall hire competent operators to run and maintain the Equipment and provide AWC with all information related to any Warranty Claim. Upon receipt of a Warranty Claim, AWC will assist the Client's operator remotely (by telephone or other electronic means) with the diagnosis, repair and replacement of defective Equipment or parts or any other resolution of any Warranty Claim. Immediately after completing any Warranty Claim repair or Equipment replacement, the Client shall send photos and videos showing that the work has been completed in compliance with AWC's instructions.

7. Any Warranty Claims will not be honoured if any amounts payable to AWC by the Client, its Contractor or relating to the project are past-due unless payment is promptly made after receipt of written notice from AWC.

8. AWC's sole and exclusive liability to the Client, for the supplied Equipment or services, shall be limited to AWC's obligations in this Warranty whether the claim is based in contract, tort or on any other legal basis. In no event shall AWC be responsible for any claims related to damages, whether direct, indirect, consequential, incidental, liquidated damages or any other damages or penalties related to the Equipment or services supplied by AWC or its contractors. In no event shall AWC's liability to the Client for all Warranty Claims arising from the supply of the Equipment and services exceed the purchase price of the Equipment under Warranty Claim. If AWC completes any Equipment repair on a goodwill basis, it shall not constitute any admission of liability relating to the Equipment.

9. This Warranty provides the sole remedy for all claims based on a failure of or defect in the Equipment or related to any services supplied by AWC. Any implied or express conditions or warranties regarding the Equipment imposed by any applicable Sale of Goods legislation or other legislation are hereby excluded. Any liability of AWC with respect to the Equipment or services supplied will end on the expiry date of the Warranty. Only the identified Client may make a claim under this Warranty. The Warranty shall not be transferrable, without the prior written consent of AWC, which shall not be unreasonably withheld. This Warranty shall be interpreted in accordance with the laws of British Columbia, Canada and any claims under this Warranty or otherwise against AWC shall be resolved exclusively by the courts in Vancouver, British Columbia.

Warranty Period

12 months from start-up or 18 months from ready to ship notification, whichever is earlier.

BUDGETARY PROPOSAL

Fluence's Packaged MABR Solution

Prepared for Coventry, RI High School WWTF

Fuss & O'Neill

Proposal No: 2023 - 121

Proposal Date: May 5, 2023

Attn: Mssrs. Ryan Morais & Douglas Brisee

Fluence is pleased to provide you with this budgetary proposal for an onsite wastewater treatment packaged plant with a flow rate of 40,000 gpd, using Fluence's innovative MABR technology. This si not a membrane separation device for clarifying effluent but our proprietary aeration system for nitrification .

Overview

Fluence combines advanced water treatment technologies and proven delivery platforms to optimize the water cycle for the 21st century. We provide the middle market with local, sustainable, and fast-to-deploy water and wastewater treatment and reuse solutions, empowering businesses and communities worldwide to make the most of their water resources.

The Solution

Aspiral™ L4 Smart Packaged Wastewater Treatment Solution

- Consistently delivers high-quality effluent with a low energy consumption
- Packaged design for fast installation and startup
- Simultaneous nitrification/denitrification (SND) provides increased efficiency
- Smart operation requires minimal maintenance, resulting in lower operating costs
- A modular solution allows for future expansion

Our local Representative is AQUA Solutions, Inc.
Contact isJim Deluca @ (617) 480-9643

Fluence's Scope of Supply and Responsibilities

- Influent Flow Equalization **(Tankage by others)**
  - Manual course screen
  - 1.5 mm rotary fine screen with manual backup screen
  - Mixing blower on separate skid
- One (1) Aspiral L4 Packaged Biological Treatment System, each unit includes:
  - One (1) 40-foot tank, four (4) MABR T2 Spiral Towers, internal pipelines, valves, and connections.
  - Fine and course bubble diffusers
  - MABR chamber mixing/aeration blower on separate skid
- Containerized secondary clarifier
  - WAS/RAS pump
  - Chlorine dosing pump **(Contact us if you prefer to use UV for Disinfection)**
  - Chlorine contact tank **(or UV Feed tank)**
  - Anoxic Selector Tank Zone for MLSS and Influent mixing
  - Instrumentation for secondary treatment (incl DO, NH3 to manage our aeration system)
  - One (1) MemTalk PLC Based Electrical Control Panel w/ 10 inch HMI and Motor Starters
- Biological treatment design, process flow diagram, P&ID, and preliminary general layout drawings (including hydraulic profile and elevations, excluding constructor drawings)
- DDP to Coventry, RI
- 1 Trip and 5 Days for Installation Supervision
- 1 trip and 5 Days of Start-up and Commissioning

Scope of Supply and Responsibilities – by others

- Raw wastewater feed into Fluence battery limits
- Use of existing concrete plant for EQ and Sludge Storage
- Pre-treatment equipment to include at the minimum:
  - FOG trap (to reduce FOG in raw wastewater to less than 60 mg/l)
- Civil detailed design and works for overall site
- Installation of equipment and tanks
- Interconnecting piping, Aspiral L4 container inlet and outlet piping, aeration piping, fittings and valves
- Detailed site electrical design and onsite electrical supply, electrical works and communication
- Discharge of treated effluent
- Sludge disposal (according to local requirements)
- Containers for screenings or compactor
- Electrical and communication (wired/mobile) supply to main control cabinet
- All permits and related fees
- See Appendix 3 for details + **(Decommissioning by others to Fluence Specs and Directions)**

CAPITAL COSTS AND LEASING COSTS:

The following table details the pricing for delivery of the services outlined in this proposal. This pricing is valid for 60 days from the date of this proposal:

Description	Price [USD]
Option #1 – Purchase price (see Appendix 3)	**$638,000.00**
Option #2 - Fluence LEquipment ease Terms	**$9,765.00/Month**
Removal Fee (Fluence will take system off site after Decommissioning by others at Fluence Direction)	**$35,000.00**

Disclaimer: Prices are subject to change if project specifications are changed.

Client may elect to keep renting the system afte the Lease Term expires at an adjusted cost based upon current CPI vs original date of Lease Consumer Price Index levels .

Services

- 1 Trip and 5 Days Installation Supervision
- 1 trip and 5 Days of Start-up and Commissioning
- Any additional working day for Fluence technician will be priced at USD$ 1,200 per day, not including travel and accommodation.

Terms

- Payment Terms for capitol purchase:
  - 40% down payment
  - 50% notification of Ready-To-Ship
  - 10% Upon delivery
- Shipment: DDP Freight estimate included in budget price
- Schedule:
  - Submittals 4-6 weeks from receipt of down payment and executed contract
  - Ready to ship: 20 – 22 weeks from approved submittals
- See Appendix 7 for additional standard terms.

Conclusion

At Fluence, we pride ourselves on partnering with our customers to provide innovative solutions for their water challenges while also providing the highest level of service from the proposal stage, through successful execution, and beyond.

Thank you for your consideration,   Bruce P. Stevens - Business Development Manager

Our local Representative is AQUA Solutions, Inc.
Contact isJim Deluca @ (617) 480-9643

Appendices to Budgetary Proposal No: 2023-121

Table of Contents

Appendix 1

Basis of Design

Fluence's Aspiral L4 solution as presented was designed according to the parameters of plant capacity and influent and effluent quality specified below, are based on the information provided in the RFQ document and further Addenda. These assumptions will need to be validated by the customer, prior to any commitments by Fluence regarding the scope and/or price.

Fluctuations from the assumed design conditions may influence performance of the WWTP, therefore a thorough survey of the raw wastewater characteristic is required.

Influent and Treated Effluent Wastewater Characteristics

Parameter	Units	Typical Influent Wastewater	Effluent Quality (mg/l)
Design flow rate	gpd	40,000	
Minimum wastewater design temperature	ºC	12.8	
pH range	-	6.5 – 8.5	
Carbonaceous biochemical oxygen demand	mg/l	250	≤25
Total Suspended Solids		250	≤25
TN (influent) / TN (effluent)		40	≤10
ecal coliform		n/a	200 per 100 ml
D.O.		n/a	6.0 (min)

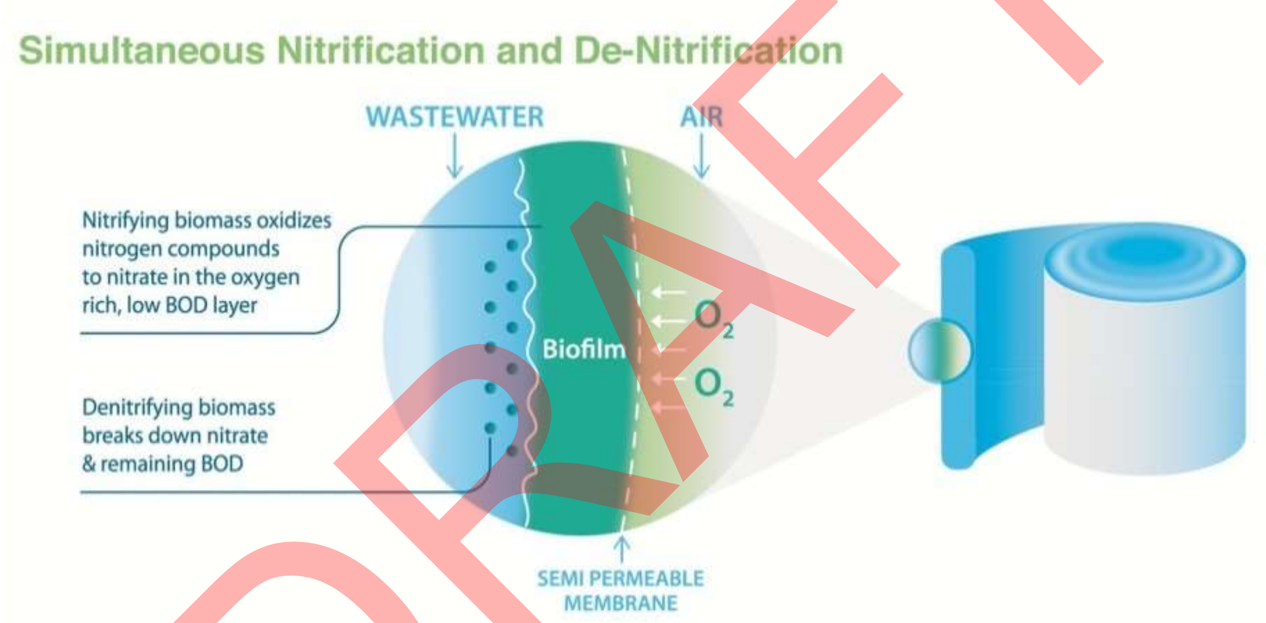
Our local Representative is AQUA Solutions, Inc.
Contact isJim Deluca @ (617) 480-9643

Appendix 2

Description of Proposed WWTP - Aspiral™ L4

Fluence's MABR Technology is a low energy advanced aerobic biological treatment, based on the Membrane Aeration Biofilm Reactor process, using an enclosed patented spiral membrane aerated biofilm reactor.

MABR treatment significantly reduces energy consumption by eliminating the need for compressed air for fine bubble aeration of the wastewater. A biofilm forms on the semi permeable membrane assembled in a continuous spiral using low pressure oxygen to fuel the nitrifying biomass we form.



A constant stream of low-pressure air distributes oxygen to the wastewater through the MABR spirals, which consist of membrane sheets and spacers. This structure produces optimal oxygen transfer efficiency using air diffusion from one side of the membrane to the wastewater on the other side.

The oxygen is consumed by nitrifying bacteria on the membrane, creating an anoxic area on the further side of the membrane, where de-nitrification and BOD removal occur.

The MABR Technology

- Wastewater is contacted with the surface of an aerated sleeve of oxygen permeable material
- Aerobic bacteria that develop on the surface of the sleeve treat the wastewater

One spirally wound long sleeve

Aspiral L4 Treatment Process Description

The proposed Aspiral L4 system has been designed assuming an equalization tank (EQ) will be installed. This design allows the unit to safely treat up to 110% of its average hourly capacity.

The raw wastewater is pumped into a pretreatment unit where it is screened by a perforated 1 mm fine screen (FOG trap is required in case oil & grease concentration is higher than 60 mg/L and is NOT included in this proposal).

The pretreated wastewater flows into a selector tank where the influent and RAS streams are mixed and flow by gravity to the Fluence Aspiral unit where submerged MABR module will allow simultaneous nitrification and denitrification process removing organic matter and nutrient pollutants from the wastewater.

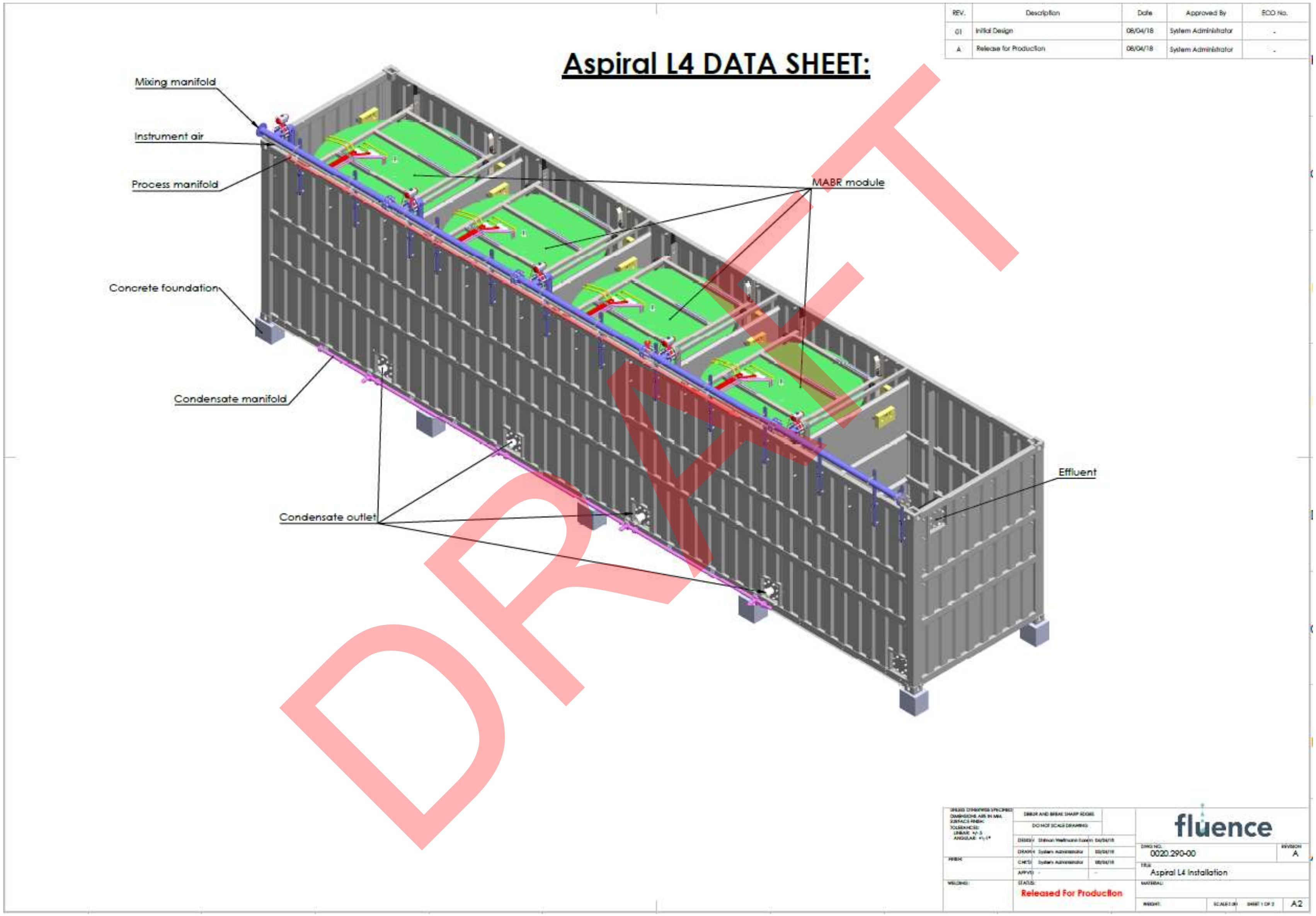
The effluent from the MABR stage flows into an activated sludge compartment ('CAS') for BOD polishing and then to the a secondary clarifier unit where the it is separated to two phases: clean high-quality effluent, and sludge.

Most of the produced sludge is re-circulated back to the MABR process (RAS) while the rest (WAS) is periodically discharged to the sludge holding tank.

The entire MABR process is monitored and automated using a programmable logic controller with remote access with GSM connectivity.

Our local Representative is AQUA Solutions, Inc.
Contact isJim Deluca @ (617) 480-9643

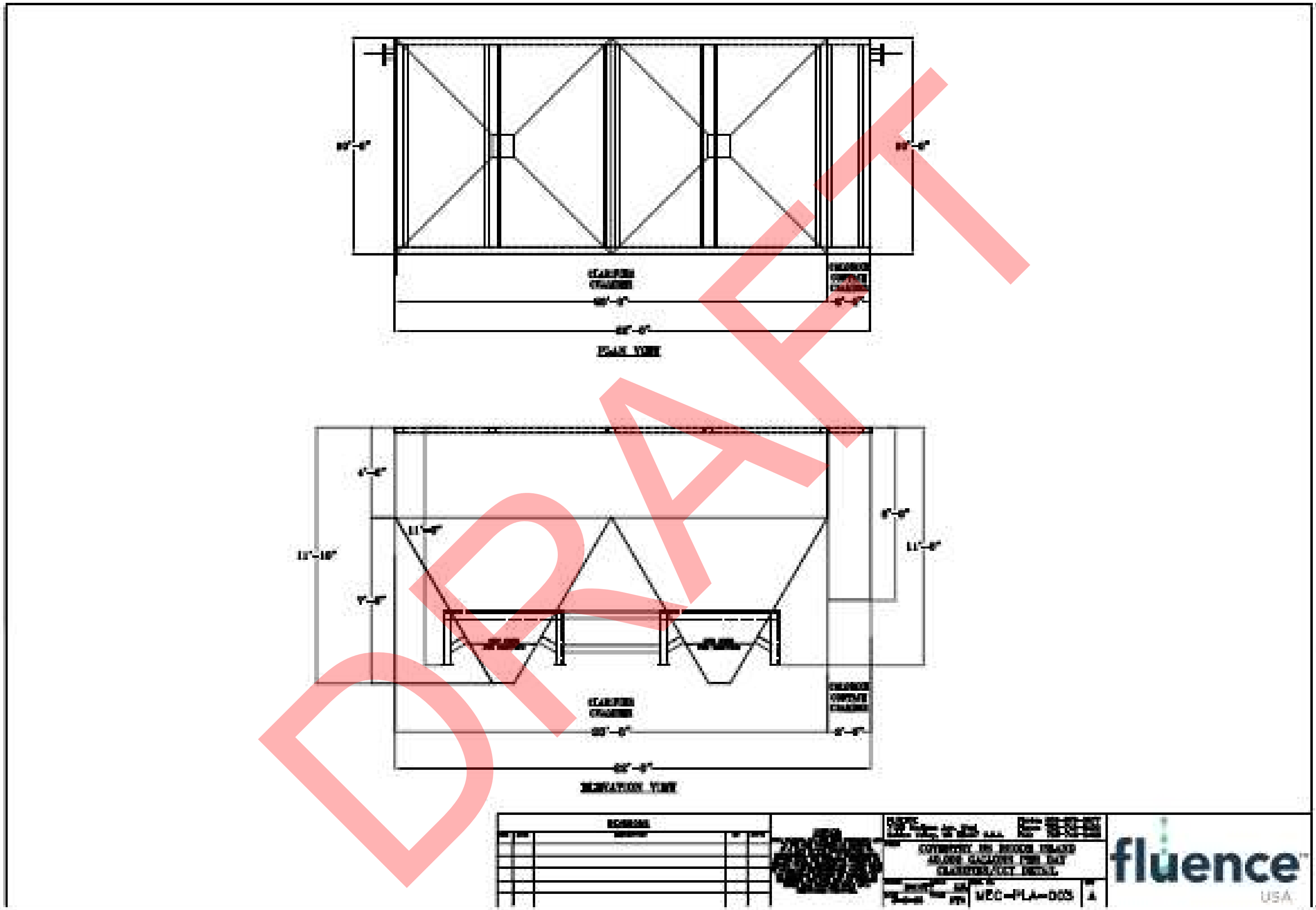
Aspiral L4 Datasheet



#	TAG No.	SERVICE	SIZE	CONECTION
1	N1	Effluent water	DN150	DN150 DIN FLANGE PN10
2	N2	Process air in	50mm	PE100 Union male
3	N3	Mixing air in	DN80	DN80 DIN FLANGE PN10
4	N4	Drain out	DN100	DN100 DIN FLANGE PN10
5	N5	Condasate drain	50mm	PE100 Union male
6	N6	Instrument air	6mm	6mm quick connector Pressure - 6[bar] Volume - each valve 800 [cm3]

Empty Weight of Aspiral Container – 24,250 lbs **Operating Weight of full container – 190,00lbs**

Note: Clarifier System Dimensions may change from this drawing after final design review and submittals



Empty Weight: 19,750 pounds **Loaded Weight: 175,100 pounds**

Appendix 3

Preliminary Equipment Specification for a 40,000 GPD Plant

The following specifications refer to the suggested plant design as presented in Appendix 1.

Component	Specification	Quantity	Responsibility/ Supply by	Comments
Equalization Tank	Manual coarse bar screen	N/A	By Others in Existing Concrete	To Be Determined by Engr
Feed Pump	(Supplied By Others)	N/A		Dual pump system installed in concrete EQ tank
Sludge holding tank	(Cleaned Tank Supplied By Others)	N/A		To Be Determined by Engr
Fine Screen	1.5 mm perforated self cleaning Rotary Strainer with manual back up bar screen	1	Fluence	Toro or equal Does not include screening compactor
Aspiral L4	40 ft. special design tank Coarse bubble diffusers Aeration volume equipped with fine bubble diffusers Internal piping, fittings and valves	1		4 MABR towers
Effluent contact tank	V = 1,600 gallons	1		30 min contact time
Containerized Clarifier	Including a selector zone, clarifier container, electrical and control cabinet w pumps + CL2 Contact Tank	1		Complete System
Chlorination dosing pump	Tipton Standard Tablet Chlorinator	1		Included w CCT
Instrumentation	Flow meter, Pressure Indicator, Temp. indicator Float switches, DO probe, NH3 Probes, etc	1 Lot		Note preferences b4 order
FOG trap	To reduce FOG to below 60 mg/l	1	By Others	Only if FOG > 60 mg/l
Concrete Pads	According to detailed design made by certified constructor	1		Civil Design Work Others
Interconnecting Piping and electrical wiring	Scope to be Determined after final design	1		By Others

1. Some of the equipment's specifications might change in accordance with the design detailed.

Appendix 4

Equipment Installation, Start-up and Commissioning

(Under Fluence Supervision)

1. Installation requirements are estimated to include:
   a. 5 days for qualified installation contractor assembly & debugging assistance by Fluence Corp
   b. 5 days for a certified electrician familiar with local codes and practices
   c. 1-3 day for a lifting crane with operator to set equipment
2. Commissioning and startup requirements are estimated to include:
   a. Local operator
   b. Seeding: Delivery of 10,000 gallons of screened domestic sludge (preferably from a nitrifying WWTP) to the site and added to each Aspiral L4 bioreactor. (optional)

Appendix 5

Estimated Operating Parameters

Estimated operating parameters for Aspiral L4 unit include:

- Sludge production:
  - 1-2% of the daily capacity will be wasted, 1-2% solids.

Appendix 6

Fluence's Selected MABR Technology Reference Sites

1	Midland, TX	USA	5,000	SES	Aspiral S1
2	Albuquerque, NM	USA	10,000	Flying J	Aspiral M1+
3	CENTA	Spain	10,500	CENTA	Aspiral S1
4	One Thousand Trails	USA	18,500	Orenco/Equity lifesyle	MABR Modules
5	Boca Chica, TX	USA	50,000	WaterFleet/Space X	Aspiral L4 + UF
6	Westgrove	Philippines	105,700	Manila Water	Aspiral L2
7	Friendship	Jamaica	206,000	National Housing Trust	SUBRE Plant
8	Liaoning Panjin	China	0.8 MGD	Liaoning Huahong	SUBRE Plant
9	SV Project – PS3	Cambodia	1.6 MGD	Xwater	SUBRE Plant
10	Ma'ayan Zvi	Israel	2.8 MGD	Ma'ayanot Hamakim	SUBRE Upgrade

Fluence has over 350 worldwide MABR installations, and over 300 Aspiral packaged plants.

Appendix 7

Standard Terms of Sale

1. Applicable Terms. Fluence Corporation Ltd. ("**Fluence**") provides the following Standard Terms and Conditions of Sale ("**T&Cs**"), which apply to all quotations and sales of Fluence's products and services (collectively, the "**Systems**"), whether these terms are explicitly included in Fluence's quotation, proposal, acknowledgment, invoice or any other document (collectively "**Fluence's Documentation**") or not. For the avoidance of doubt, all purchases are expressly limited and conditioned upon acceptance of these T&Cs, and no provision contained in any order, acceptance, confirmation or acknowledgement which is inconsistent with, different from, or in addition to these T&Cs is accepted by Fluence unless specifically agreed to in writing. All quotations are valid for a period of sixty (60) days, unless otherwise specified.

2. Delivery. Delivery terms are Ex-Works Fluence warehouse unless Fluence's Documentation provides otherwise, and the purchaser (whether end-user, integrator or whatsoever) (the "**Purchaser**") agrees that risk of loss with respect to the Systems passes to the Purchaser at the time that the Systems are delivered to the applicable common or private carrier. The property rights in the Systems, however, shall pass to the Purchaser only after Fluence has received payment in full. Until such time as the property rights in the Systems passes to the Purchaser, the Purchaser shall hold the Systems as Fluence's fiduciary agent and bailee. The carrier shall be selected by Fluence unless the Purchaser designates a carrier preference. Delivery date(s) quoted by Fluence are based on Fluence's best estimate and Fluence shall not be responsible for early or late delivery or partial shipments. If the Purchaser fails to take delivery of the Systems or fails to give Fluence adequate delivery instructions then without prejudice to any other right or remedy available to Fluence, Fluence may (i) store the Systems until and charge the Purchaser for the reasonable costs (including insurance) of storage; (ii) sell the Systems at the best price readily obtainable and (after deducting all reasonable storage and selling expenses) account to the Purchaser for the excess over sum paid in advance or charge the Purchaser for any shortfall below the sum received upon the sale thereof.

3. Payment. The Purchaser shall pay Fluence the full amount set forth in Fluence's Documentation. Payment terms shall be as follows: 40% of the amount will be due upon order confirmation by Fluence; 50% of the amount will be due upon Fluence's confirmation that the Systems are ready for shipment, prior to actual shipment; and the remaining 10% will be paid upon arrival of the Systems at the job site. Freight, storage, insurance and all taxes, duties or other governmental charges relating to the Systems shall be paid by the Purchaser. Federal, state or local indirect taxes, including but not limited to sales and/or use taxes, VAT, GST, transfer taxes or any similar tax are not included in prices quoted. If Fluence is required to pay any such charges, the Purchaser shall reimburse Fluence upon first demand. The Purchaser shall be charged the lower of 1 ½% interest per month or the maximum rate permissible by law, on all amounts not received by the due date and shall pay all of Fluence's reasonable costs (including attorneys' fees) associated with collecting amounts due but unpaid. Failure to make payment when due is a material breach of an order and without incurring any liability, Fluence may suspend performance until such time as the overdue payment is made. All orders are subject to credit approval and the applicable export licenses (to the extent required) being in force at such time.

4. Intellectual Property. Fluence retains all right, title and interest in any patent right, copyright, mask work right, sui generis database right, know-how, trade secret or other intellectual or industrial property right of any sort throughout the world (including any application therefor associated with its business including but not limited to the intellectual property rights associated with the Systems (the "Intellectual Property"), whether used in the past, currently being used or that will be used in the future, including without limitation (i) the proprietary original design of the Systems whether pursuant patent, copyright, industrial design or whatsoever, (ii) the technology, know-how, show-how, specifications and trade secrets with regard to amongst others the manMBRacture, marketing, sale and distribution of the Systems or other proprietary products and services, and (iii) trademarks, trade names (including but not limited to the name "Fluence" and the brand name, under which the Systems are currently marketed (collectively the "Brand"), slogans and marketing intangibles, and the Purchaser shall make no claim of any interest therein. The Purchaser shall not alter or remove any of Fluence's trademarks from the Systems. At no time during or after the term of this agreement shall Purchaser challenge or assist others to challenge Fluence's Intellectual Property or attempt to register any trademarks, marks or trade names similar to those of the Fluence. Any and all goodwill associated with the Fluence's Intellectual Property will inure exclusively to the benefit of Fluence. Fluence shall own all rights, title and interest in any ideas, designs, concepts, techniques, inventions, discoveries, improvements, results, data, know-how, reports and/or outcome relating to the Intellectual Property and the manMBRacture and functioning of the Systems, whether developed or conceived of by Fluence and/or the Purchaser or both. All devices, designs (including drawings, plans and specifications), estimates, prices, notes, electronic data and other documents or information prepared or disclosed by Fluence, and all related intellectual property rights, shall remain Fluence's property. Subject to payment in full, Fluence grants Purchaser a non-exclusive, non-transferable license solely for the Purchaser's use of the Systems purchased. For the removal of doubt, it is hereby noted that other than aforementioned rights, no rights are granted to the Purchaser with regard to the Systems or the Intellectual Property.

5. Confidential Information. All information, drawings, plans, designs and specifications furnished to the Purchaser by Fluence have been developed at Fluence's expense and shall not be disclosed by the Purchaser or used for any purposes other than to install, operate and maintain the Systems.

6. Warranty. Fluence warrants that under normal usage and subject to appropriate installation and suitable infrastructure, the Systems, except for membranes, will, for a period of twelve (12) months from receipt at the Purchaser's warehouse or fifteen (15) months from delivery EX-Works (the earlier of the foregoing), be free from defects in material and workmanship, subject to the exclusions set forth below (the "**Warranty Period**"). The foregoing warranty shall not apply to any equipment furnished or specified by the Purchaser. This warranty excludes any damage or deficiencies caused by or resulting from accident, fire, other hazards or acts of God; or alteration, modification, misuse, tampering, negligence, improper installation, improper storage, maintenance conducted by unauthorized personnel, misapplication, mishandling or abuse of the Systems. Fluence's warranty is conditioned upon the Purchaser (a) operating and maintaining the Systems in accordance with Fluence's instructions, (b) not making any unauthorized repairs or alterations, and (c) not being in default of any payment obligation to Fluence.

7. Fluence's warranty does not cover damage caused by chemical action or abrasive material, misuse, improper installation or unsuitable infrastructure. Fluence shall, at its sole and exclusive discretion and as the Purchaser's sole remedy, repair or replace the subject parts FOB port of manMBRacture, or refund the purchase price therefor, at its sole and exclusive discretion. If Fluence determines that any claimed breach is not, in fact, covered by this warranty, Purchaser shall pay Fluence its then customary charges for any repair or replacement made by Fluence. Membranes and designs are sold "AS IS". EXCEPT AS EXPRESSLY STATED IN THIS WARRANTY SECTION, SELLER PROVIDES PRODUCTS "AS IS" AND MAKES NO OTHER EXPRESS WARRANTIES, WRITTEN OR ORAL, AND ALL OTHER WARRANTIES ARE SPECIFICALLY EXCLUDED, INCLUDING, BUT NOT LIMITED TO THE IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT, AND ANY WARRANTY ARISING BY STATUTE, OPERATION OF LAW, COURSE OF DEALING OR PERFORMANCE, OR USAGE OF TRADE.

8. Force Majeure. Fluence shall not be liable for any loss, damages or breach caused by circumstances beyond its reasonable control including but not limited to 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 including inability to obtain appropriate regulatory approval such as export license or other government or institutional approval required, or any other cause beyond its reasonable control, whether similar or dissimilar to those listed.

9. Cancellation or Alteration of Order. No order which has been accepted by Fluence may be cancelled by Purchaser except with Fluence's agreement in writing and subject to the Purchaser indemnifying Fluence in full against all loss, costs, damages, charges and expenses incurred by Fluence as a result of such cancellation. No order which has been accepted by Fluence may be changed or altered by the Purchaser except with Fluence's agreement in writing and an adjustment of appropriate price, if required. If the Purchaser cancels or suspends its order for any reason other than Fluence's breach, Purchaser shall promptly pay Fluence for work performed prior to cancellation or suspension, and for any other direct costs incurred by Fluence as a result of such cancellation or suspension.

10. LIMITATION OF LIABILITY. NOTWITHSTANDING ANYTHING ELSE TO THE CONTRARY, FLUENCE SHALL NOT BE LIABLE FOR ANY LOST PROFITS, CONSEQUENTIAL, INCIDENTAL, SPECIAL, PUNITIVE OR OTHER INDIRECT DAMAGES, WHETHER ARISING UNDER WARRANTY, CONTRACT, NEGLIGENCE, STRICT LIABILITY, INDEMNIFICATION, OR ANY OTHER CAUSE OR COMBINATION OF CAUSES WHATSOEVER. FLUENCE'S TOTAL LIABILITY ARISING AT ANY TIME FROM THE SALE OR USE OF THE SYSTEMS SHALL NOT EXCEED THE PURCHASE PRICE PAID FOR THE SYSTEMS.

11. Installation, Field Service. Installation of goods furnished hereunder shall be the responsibility of Purchaser, unless otherwise agreed to in writing. The Purchaser shall be responsible for all infrastructure modifications that may be required. Field service may be provided, upon prior written authorization by Fluence and will be charged at the rates in effect at the time such services are provided, unless otherwise agreed. In addition, purchaser will be required to cover costs of travel, lodging and *per diem* for field staff.

12. Export Sales. No provision of this agreement will be construed to require Fluence to export or deliver any technical information, data and/or equipment if such export or delivery is prohibited or restricted by any applicable law or regulation. Purchaser will not, directly or indirectly, sell, export, re-export or otherwise dispose of the Systems or any other technology or services received in connection with this order to any person, entity, or destination without obtaining prior written authorization from Fluence.

13. Governing Law and Venue. This agreement shall be subject to and interpreted under the laws of the State of New York, USA. The Purchaser hereby consents to the exclusive jurisdiction of the courts of New York City, New York, USA for the adjudication of any dispute arising under this agreement. Both sides may jointly elect to resolve any dispute by arbitration. In such case, the arbitration laws existing in Israel will bind the parties. All disputes arising out of or in connection with this agreement shall be finally settled under the Rules of Arbitration of the International Chamber of Commerce by one arbitrator appointed in accordance with the said Rules. The place of the arbitration shall be New York City, New York USA or any other agreed location, and the language of the arbitration shall be English..

14. Miscellaneous. These terms, together with any quotation, purchase order or acknowledgement issued or signed by Fluence, comprise the complete and exclusive statement of the agreement between the parties (collectively, the "**Agreement**") and supersede any terms contained in the Purchaser's documents, unless separately signed by Fluence. No part of the Agreement may be changed or cancelled except by a written document signed by Fluence and Purchaser. 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. Purchaser may not assign or permit any other transfer of the Agreement without Fluence's prior written consent.

Smith & Loveless, Inc.

14040 Santa Fe Trail Dr.
Lenexa, KS 66215-1284
Phone: (913) 888-5201
Fax: (913) 888-2173

ADDIGEST® Proposal:

Extended Aeration Plant
April 27, 2023

Consultant:

FUSS & O'NEIL, INC.
Coventry High School WWTP

Represented by:

Russell Resources

Proposal Table of Contents

Understanding Your Treatment System Needs

One (1) new above grade extended aeration factory-built ADDIGEST® package plant wastewater treatment system to handle an average daily flow of 40,000 gallons/day.

The raw and treated wastewater characteristics you provided are summarized below:

Flow Conditions	
Design Flow:	40.0 kGPD
Maximum Month Daily Flow	na kGPD
Peak Day Flow:	na kGPD
Peak Hour Flow (1hr):	na kGPD

Site	
Elevation:	na ft
Summer Air Temperature:	˚C Max
Winter Air Temperature:	˚C Min
Available Footprint / Area:	N/A

Influent Waste Characteristics	
BOD_5:	250 mg/L
TSS:	250 mg/L
TKN:	40 mg/L
TP:	NA mg/L
pH:	7-8 pH units
Alkalinity (assumed):	300 mg $CaCO_3$/L
Min. Water Temperature	55° F
Max. Water Temperature	70° F

Effluent Requirements	
BOD_5:	30 mg/L
TSS:	30 mg/L
TN:	10 mg/L
NH_3-N:	na mg/L
pH:	6.5 to 9 pH units
Alkalinity (No Less Than):	75 mg $CaCO_3$/L

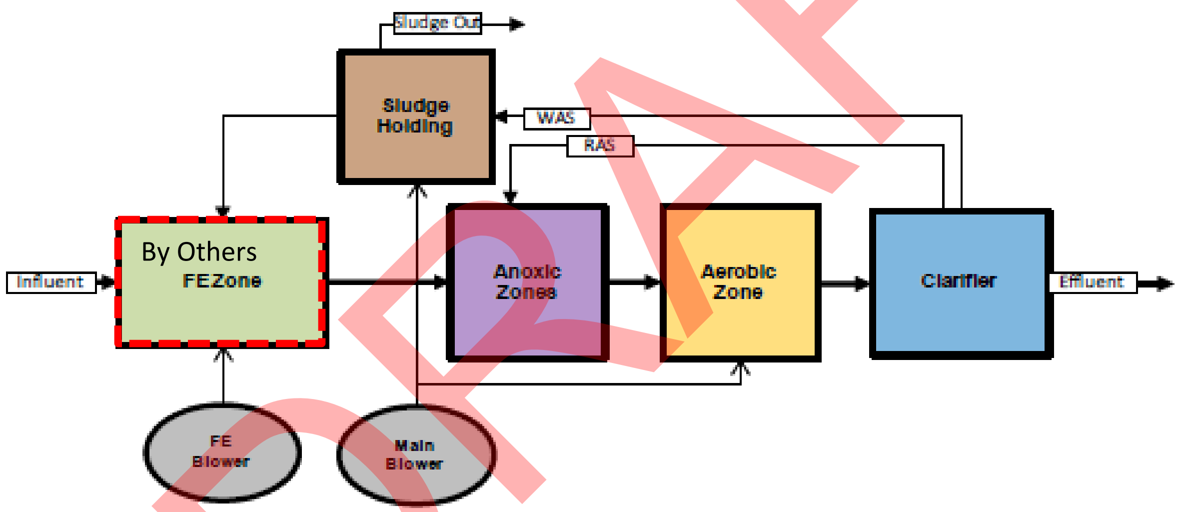
Achieving Results

To address the treatment system needs we recommend our **ADDIGEST®** extended aeration system. This system will arrive in complete section(s) ready for installation above grade.

Features

- Simple extended aeration system
- V-Crimp design allows for better corrosion protection and longer tank life
- System is factory-built, eliminating concrete pour on-site
- Factory-built reduces contractor time and errors spent on installation
- Factory prepared steel surfaces with epoxy coating increases life of tankage
- No field welding required
- American made with American steel and fabrication in Lenexa, KS

Process Flow Scheme & Executive Summary



The treatment plant structure shall be completely factory-built, with bottom, side walls, end plates, partitions and other shell tankage of not less than 1/4" (6 mm) thick structural grade steel plate reinforced to withstand all hydrostatic pressures. The structural reinforcing shall be accomplished by forming the sides, partitions, and end plates with V-shapes.

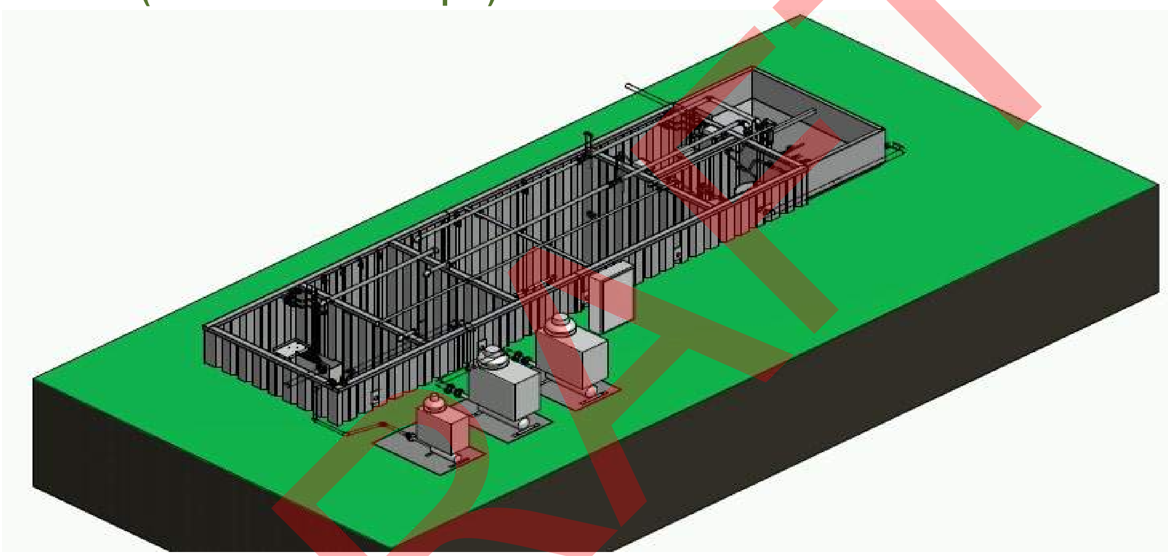
A 316 SS manual bar screen with 3/4" spacing and mounted at 45 degrees is included in this proposal. Pricing is also provided for an optional automatic **S&L** Spiral Fine Screen mounted on the flow equalization zone. The automatic screen shall consist of perforated metal trough with a maximum ¼" opening. The fine screen components shall be of 316 stainless steel with the conveying screw of high tensile steel.

The flow equalization zone (by others) shall handle surge flows and provide additional operation flexibility. It shall be equipped with coarse bubble diffusers and MiniJect® pumps capable of delivering wastewater into the process train(s).

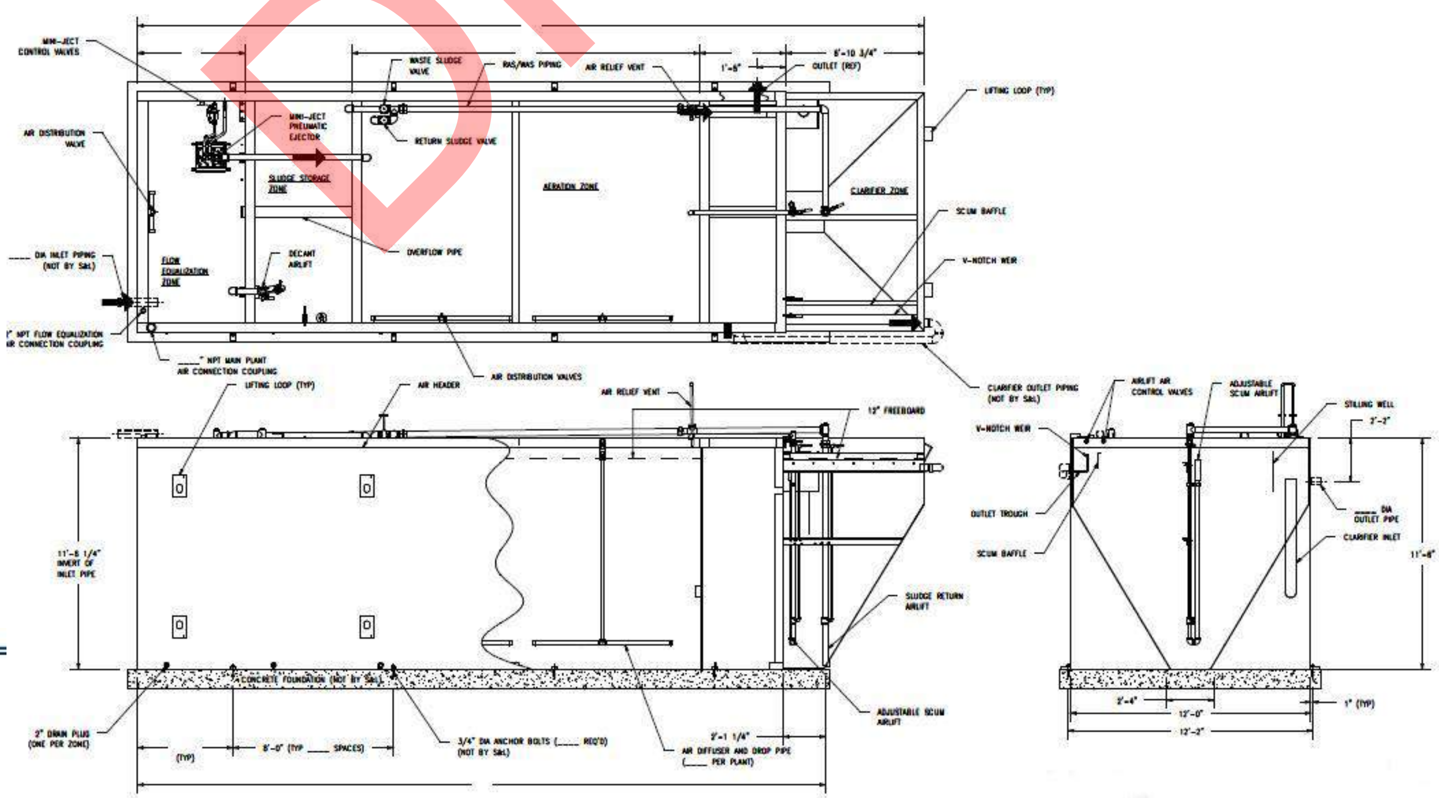
The plant shall include anoxic, aerobic, and clarifier process zones. A sludge holding zone shall be used for further digestion of wasted sludge and increased operator flexibility. The factory-built system shall have an integrated air supply/header system built in.

Typical Drawings

Isometric View (Below Grade Example)



Plan and Sectional View (Example)



Estimated Plant Size *(Process Design Report & Layout Drawing with dimensions available upon request)*

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Width:	12'-0"
Height:	11'-6"
SWD:	10'-6"

Nominal Zone Sizes (length / volume or surface area):

Tank 1		Tank 2	
Anoxic	**Aeration**	**Sludge Holding**	**Clarifier**
14'-8" Length	40' Length	5'-4"	12' x 12'
1,848 ft^3	5,040 ft^3	672 ft^3	142 ft2

Scope of Supply

Items Included:

- Factory-built, epoxy coated tankage.
- 304 stainless steel, 3/4" opening, manual bar screen
- One (1) WAS/RAS 3-inch AirLift pump
- One (1) Sludge Holding zone 2-inch Decant pump
- Air headers
- Coarse bubble diffusers (SH, Aeration) with drop pipes
- Valves for diffuser drop pipes
- HC-142 Hopper type clarifier
- Tablet Chlorination-Dechlorination Zone
- One (1) 316SS Anoxic Zone Mixers & Guiderails
- Two (2) Main Plant Blowers (duty + standby)
- NEMA 4X Control Panel with relay logic controls
- Freight
- Start-up

OPTIONAL ITEMS:

- 0.25" Perforated Plate Automatic Fine Screen
- Automatic solenoids and timers for airlifts
- UV Disinfection

Items Not Included:

- Unloading and setting of tank(s)
- Any buildings
- Interconnecting piping and wiring (outside of tank)
- Tank Covers
- Any civil or concrete work

Online: smithandloveless.com • Phone: 913.888.5201 • FAX: 913.888.2173

Investment and Timeline:

ADDIGEST Treatment Tank: **Options:**	**$ 895,000** **$ 118,500 OBEX Fine Screen**
Startup Cost:	Two Trips, 6 days total Included
Freight:	Included
Submittal Timeline:	8-10 Weeks (after receipt of complete order details)
Mfg. Timeline:	30-34 Weeks (after receipt in Seller's office of approved Submittal Data) *Lead times may change depending on current shop load
Delivery Timeline:	1 Week (after Manufacturing)

Additional Price Details:

Pricing is based on standard S&L offering and basic controls. Scope changes will affect pricing estimates.

The estimated cost of this proposal constitutes a non-binding estimate for certain goods and/or services and is exclusive of applicable taxes.

Progress payments (to be determined by credit department) will be required. Non-bonded projects require up front payment.

F.O.B. factory plus any taxes, which may apply. Truck/Rail freight allowed to the job site, rail siding or nearest unloading area-unloading to be by Buyer.

Smith & Loveless, Inc. will provide one electronic copy of the O&M on CD in PDF format and four hard copies of the O&M.

Online: smithandloveless.com • Phone: 913.888.5201 • FAX: 913.888.2173

ENGINEERING DATA

Smith & Loveless, Inc.®

14040 Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Factory-Built **ADDIGEST**®
Treatment Plant
Design Data Tables

FACTORY-BUILT ADDIGEST® TREATMENT PLANTS WITH HOPPER CLARIFIER (DRAWING 53D1014)

TYPICAL DESIGN DATA ENGLISH UNITS

MODEL	AVG. FLOW	FLOW EQUALIZATION		AERATION			CLARIFIER		ANOXIC			SLUDGE HOLDING	
		VOLUME	LENGTH	VOLUME	LENGTH	BOD	SURF. AREA	AVG SOR	VOL	LENGTH	TKN	VOLUME	LENGTH
	GPD	CF	FT	CF	FT	LBS/DAY	SF	GPD/SF	CF	FT	LBS/DAY	CF	FT
12AD30-HC142	30,000	1,008	8'-0"	3,696	29'-3"	51.3	144	208	1,344	10'-8"	11.3	504	4'-0"
~~12AD35-HC142~~	~~35,000~~	~~1,176~~	~~9'-4"~~	~~4,368~~	~~34'-8"~~	~~59.8~~	~~144~~	~~243~~	~~1,512~~	~~12'-0"~~	~~13.1~~	~~672~~	~~5'-4"~~
12AD40-HC142	40,000	1,344	10'-8"	5,040	40'-0"	68.4	144	278	1,848	14'-8"	15.0	672	5'-4"
~~12AD45-HC142~~	~~45,000~~	~~1,512~~	~~12'-0"~~	~~5,544~~	~~44'-0"~~	~~76.9~~	~~144~~	~~313~~	~~2,015~~	~~16'-0"~~	~~16.9~~	~~842~~	~~6'-8"~~

DRAFT

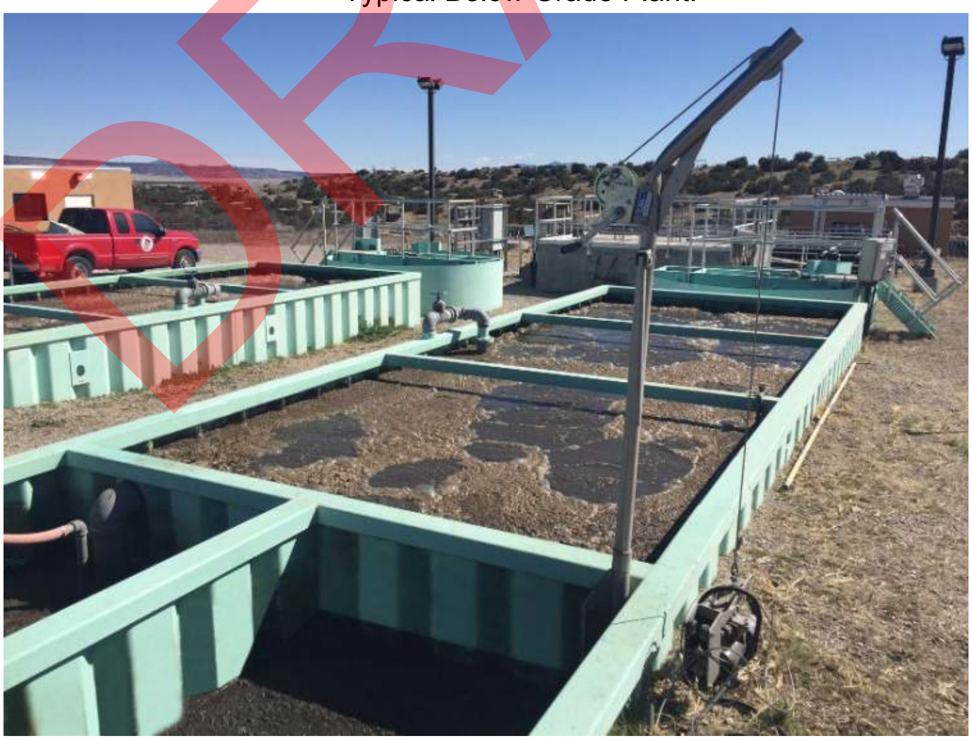
NOTES:

1. Aeration tank loading is based on influent wastewater with 205 mg/L BOD and TSS, and 45mg/L TKN.
2. For systems requiring nitrification, wastewater temperature is assumed to be $\geq$ 15°C.
3. Minimum zone length is 4'-0" due to factory-built V-Crimp tank design.
4. Sludge Holding zones are sized for a minimum of 8 days of sludge storage capacity. Lower flow systems will have more than 8 days, due to the minimum zone length for V-Crimped tanks.
5. Flow Equalization zones are sized for approximately 6 hours of detention time at the average flow. Lower flow systems will have longer detention time, due to the minimum zone length for V-Crimped tanks.
6. Clarifier Model HC-142 is a hopper type, 12' wide x 12' long.
7. Tank height is 11'-6", with 10'-6" side water depth. Tank width is 12'-0".
8. Maximum single-truck shipment is 60'.

Installation Overviews:

Typical Above Grade Plant:

Typical Below Grade Plant:



Typical Multi-Tank Plant:

Typical Plant Installation Inside a Building:

ADDIGEST®
Packaged Treatment System

Smith & Loveless Inc.

Factory-Built ADDIGEST® Delivers Economical Wastewater Treatment

The factory-built **ADDIGEST®** is an aerobic wastewater treatment system designed for both municipal and industrial applications. The trade name **ADDIGEST®** is derived from "add-on-digestion" and attests to the versatility of this system. It offers treatment from basic BOD and TSS removal to nutrient removal and advanced treatment arranged in a single factory-built tank.

Design Flexibility

- Customize the system for any level of treatment, ranging from basic BOD removal to advanced treatment suitable for water reuse.
- Handles treatment for extended aeration loadings up to 56,000 gpd (212 cmd) in a single manufactured tank. For larger capacities, see Factsheet 1246-2, which features the field-erected **ADDIGEST®** wastewater treatment system.
- Add either hopper bottom type clarifiers or all steel circular clarifiers with rotating sludge collectors.
- Choose either above or below grade installation.
- Meet space requirements with end-to-end or side-by-side installation, ensuring an efficient footprint for multiple tank installations.
- Simplify restrictive shipping limitations with the availability of component and weld together units.

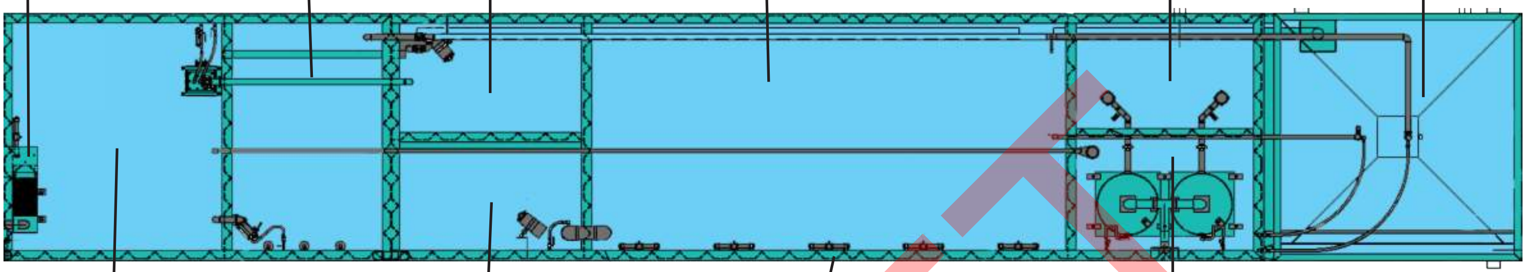
The Benefits

- Design offers virtually unlimited capacity and wastewater treatment capabilities.
- Design makes the factory built **ADDIGEST®** easy to install and operate with little routine maintenance.
- Inspection occurs on every factory built **ADDIGEST®** prior to shipment, ensuring quality.
- V-crimped structural walls create greater volume per unit-dimension than a circular cross section, reducing corrosion compared to plants with I-beams for structural reinforcement.
- V-crimp also provides greater rigidity and economy in manufacturing, while minimizing weight.
- **VERSAPOX®** coating on all surfaces ensures the best resistance against corrosion and abrasion.

The ADDIGEST® is proven in hundreds of installations.

Factory-Built ADDIGEST® Provides Versatile Treatment Options

Various treatment configurations can be achieved with the versatile factory-built **ADDIGEST®** to meet particular effluent requirements — ranging from pretreatment to effluent water reuse. The factory-built **ADDIGEST®** also comes in full hopper clarifier and circular clarifier configurations. For membrane additions, request S&L bulletin 4000 for **TITAN MBR™**.



Add-On-Digestion

Flexibility is the key to the factory-built **ADDIGEST®**. The basic system comes equipped with an aeration zone and a clarifier. To this, several components can be added to meet effluent requirements including:

- Flow Equalization
- Sludge Storage
- Filtration
- Disinfection (Chlorination or UV)
- Post Aeration
- Dechlorination
- Nutrient Removal (Nitrogen and Phosphorus)
- Nitrification

Additional System Benefits

- Electrical controls and instrumentation, air blowers, walkways, grating, access ladders and other accessories are readily available to provide a complete installation.
- Installation ready, the factory-built **ADDIGEST®** can be installed upon arrival, reducing standard delivery time, erection time and installation costs.
- Smith & Loveless provides single-source responsibility, from design and process engineering to manufacturing and installation.

Multi-train factory-built ADDIGEST® installations are available, as seen in this picture.

Smith & Loveless Inc.
www.SmithandLoveless.com
Phone: (913) 898-5201
Fax: (913) 888-2173

Understanding Your Effluent Goals: ADDIGEST®

Project Name: Virginia City NV
Project Manager: Jeff Hunninghake

Units: US Customary

Date: 4/26/2019

Flow Conditions		
Avg. Flow	10.0	kGPD
Peak Flow	N/A	kGPD
Primary Source / Type	N/A	
Data Parameter 4	N/A	

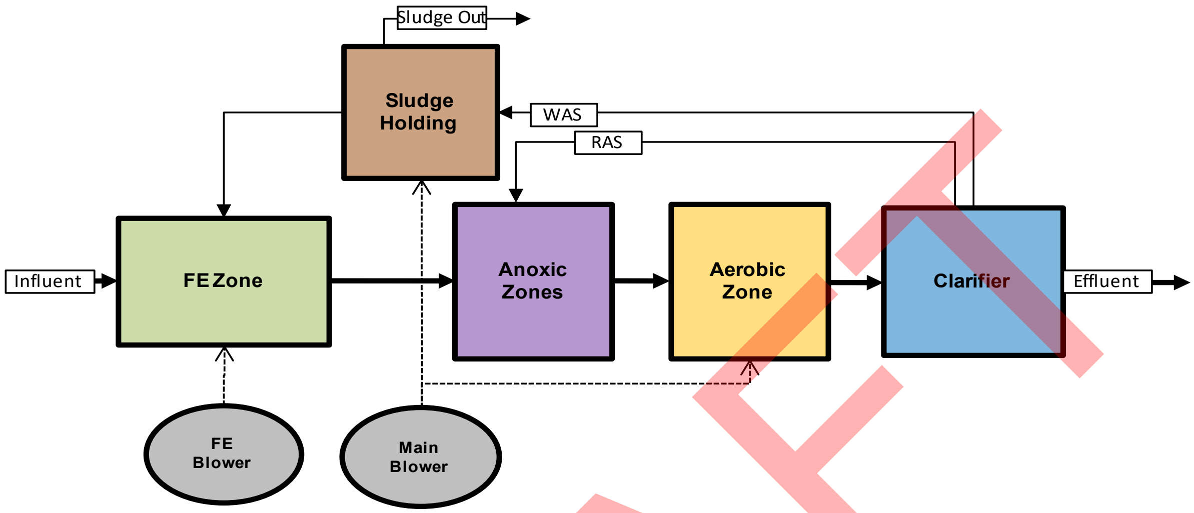
Site		
Elevation	6,000	ft
Summer Air Temperature	30	°C Max
Winter Air Temperature	11	°C Min
Available Footprint / Area	N/A	$ft.^2$

Influent Waste Characteristics		
Design Flow Rate	10.0	kGPD
BOD5	250	mg/L
TSS	250	mg/L
TKN	40	mg/L
TP	#N/A	mg/L
pH	6.5-8	pH units
Alkalinity	300	mg $CaCO_3$/L
Min. Water Temperature	13	°C
Max. Water Temperature	30	°C

Effluent Requirements		
BOD5	30	mg/L
TSS	30	mg/L
NH_3-N	#N/A	mg/L
TN	10	mg/L
TP	#N/A	mg/L
pH	6.5-8	pH units
Alkalinity (No Less Than)	75	mg $CaCO_3$/L

Achieving Results: ADDIGEST® Process Design Summary

Units: US Customary



Anoxic Zones

Flow enters the Anoxic Zone it is combined with a recycle flow from the Aerobic reactor. The aerobic reactor contains oxydized nitrogen in the form a nitrate. Under anoxic conditions, the biomass converts nitrate to nitrogen gas while reducing BOD.

	Design Goals	
Number Of Zones	1	Zones
Volume Each Zone	845	ft^3
Design Anoxic Recycle Ratio	3.1	QIR/Q
Design Denitrification Rate	2.79	lb NO_3-N/d
Design Effluent Nitrate	8	mg/L

Aerobic Reactor

The flow will be transferred to the aerobic zone from the anoxic zone. In Aerobic conditions the biomass reduces BOD and oxidizes ammonia to nitrate. This zone is designed based on the characteristics listed at right.

	Design Goals	
Number of Zones	1.0	Zones
Volume Each Zone	1,207.5	ft^3
Design Solids Retention Time	16.4	days
Hydraulic Retention Time	21.7	hours
Mixed Liquor Concentration	3,000	mg TSS/L
Volatile Mixed Liquor Concentration	1,825	mg VSS/L
F/M Ratio MLVSS Basis	0.089	
BOD Loading Rate	10.16	lb/kft^3-d

Smith & Loveless Inc.

Achieving Results: ADDIGEST® Process Design Summary

Clarifier

After aeration zone, the flow will enter clarifier, where biomass and treated wastewater will be separated through sedimentation process. Treated wastewater will be discharged from clarifier, while biomass will be recycled to anoxic zone or sludge holding zone.

	Design Goals
Number of Clarifiers	1.0
Clarifier Model	HC 58
Total Surface Aera	58.0 ft^2
Overflow Rate	172.4 gpd/ft^2
Solids Loading Rate	8.6 lb/ft^2-d

Flow Equalization

Flow enters the FE or Flow Equalization zone and is mixed with coarse bubble diffusers to keep solids in suspension. At average flow condition, the FE zone can hold the water for the retention time, that can help the maintenance and improve the consistency of flow to the system.

	Design Goals
Number of FE Zones	1.0
Peak Flow*	N/A kGPD
Equalized Design Flow	10.0 kGPD
Usable Volume Each Zone	543 ft^3
Retention Time at Design Flow	7.9 hrs

*Duration of PK Flow: N/A

Sludge Holding

As the waste is treated, and solids removed from the water, the amount of MLSS in the aeration zone will increase. Solids must be removed from the aeration zone as to keep the concentration near the design mixed liquor concentration. The **ADDIGEST®** is equipped with a sludge holding zone to transfer and hold the excess solids until they can be properly dealt with. This zone has the capabilities to further concentrate the solids and decant the supernatant back to the FE zone. The sludge holding zone was designed based the values listed at right.

	Design Goals
Number of Zones	1.0
Volume Each Zone	543.4 ft^3
Estimated Solids Production	13.8 lb TSS/d
Waste Sludge Concentration	5,835 mg TSS/L
Volume of WAS per Day	283.1 gpd
% Solids After Thickening (Est.)	2.0 %
Solids Holding Time with Thickening	49 days

Achieving Results: ADDIGEST® Process Design Summary

Supplemental Chemical Addition

MacroNutrients		
N Req'd. for BOD Removal	7.5	mg N/L
P Req'd. for BOD Removal	1.6	mg P/L

Phosphorus (P) Removal Design		
P to be Removed Chemically	None	mg TP/L
Chemical to Use	N/A	
Dosing Rate	N/A	lbs/day

Alkalinity Addition		
INF Alkalinity (Client Verify)	300	mg $CaCO_3$/L
Supplimental Alk Required?	No	
Alkalinity to be Added	0	lb $CaCO_3$/d

Aeration Requirements

To supply the system with the required dissolved oxygen for BOD removal, air diffusers are installed in the aeration zone. A main blower is used to provide air to aerated zones except FE zone. A FE blower is used to provide air to mix the FE zone. The aeration requirements were designed as follows.

Diffuser Design		
Fine Bubble Diffusers		
Actual O_2 Requirement (AOR)	36.9	lbs O_2/d
Alpha	0.65	
Beta	0.95	
Fine Bubble Air	37.8	scfm
Total Aerobic Zone Air	37.8	scfm

Additional Operational Air Requirements		
Mixing in Sludge Holding	16.3	scfm
Air For Airlifts	40.0	scfm
Mixing in the Flow EQ	8	scfm

Total Air Requirements		
Main Blower	94	scfm
Flow EQ Blower	8	scfm

Power Requirements

Main Blower Design		
Main - Gauge Pressure	7.4	psi
Calculated Power Req'd	5.2	BHP

Flow Equalization Blower Design		
FE Blower Gauge Pressure	7.2	psi
Calculated Power Req'd	0.4	BHP

Smith & Loveless Inc.

Achieving Results: ADDIGEST® Process Design Summary

DGF Filter		*Design Goals*
DGF Filtration is a polishing process following clarifier to futher reduce TSS level in order to comply with stringent effluent requirements.	**Number of DGFs**	1.0
	DGF Model	DGF- #VALUE!
	Surface Aera of Each	###### ft^2
	Overflow Rate	###### gpm/ft^2
	DGF Length	###### ft2

Chlorination/ DeChlorination		*Design Goals*
Chlorination is a disinfection process that kills pathogens such as bacteria and viruses. Chlorination is often followed by dechlorination to removel excess chlorine in effluent.	**Chlorine Contact Time**	48 minutes
	Chlorine Contact Volume	178.3 ft^3
	DeChlorination Contact Time	48.0 minutes
	DeChlorination Contact Volume	178.3 ft^3

SPECIFICATION
FACTORY-BUILT ADDIGEST® TREATMENT PLANT

GENERAL
The contractor shall furnish and install ________ Smith & Loveless Model ________ AD ________ - _________ Factory-Built **ADDIGEST**® Treatment Plant(s) as shown on the drawings and specified herein. Similar units may be provided for parallel operation where the total capacity justifies such construction. Each plant shall be of the extended aeration type employing separate compartments for aeration (chlorination) (sludge holding) (flow equalization) (anoxic) (filtration), and clarification. The **ADDIGEST**® Treatment System shall be capable of treating an average total flow of ________ GPD (____ CMD) with a total organic loading of ________ pounds (___kg) of 5-day BOD per day.

CONSTRUCTION
Each **ADDIGEST**® shall form a complete wastewater treatment plant shippable in ________ major section(s). All steel plate forming the bottom, side walls, end plates, trough, partitions and other shell tankage shall be minimum 1/4" (6 mm) thick structural grade steel reinforced as required to withstand all hydrostatic pressures. All major treatment and holding zones shall be completely dewaterable, independently, when (installed on grade) (buried to a depth of ________ feet or meters) with the surrounding water table at an elevation of _________ feet or meters (above) (below) grade level.

All welded steel structural members shall be joined by electric arc welding with fillets of adequate section for the joint involved. Where required for additional strength or watertight integrity, such welds shall be continuous inside and out. Inlet and outlet connections shall be as shown on the drawings.

AERATION
The total aeration volume shall be ______ $ft.^3$ (______ m^3). Dimensions shall be as shown on the drawings. Each air supply header shall be provided with air connection couplings, drop pipes and diffusers as shown. A 1" (25 mm) air hose shall be provided between the aeration tank and the clarifier for air supply to the airlift pump. Each two inch galvanized pipe diffuser shall extend from the air supply header through a 2" (50 mm) ball valve. The ball valves shall provide for individual throttling of the air flow.

SLUDGE RETURN
Sludge return piping shall extend the full length of each aeration tank. RAS and WAS valves shall be provided as shown. A 4" (100 mm) diameter sludge return pipe shall be installed between the aeration tank and clarifier as shown on the drawings.

CLARIFIER
(OPTION A - HOPPER BOTTOM) CHECK IF REQUIRED
The clarifier shall be a welded steel structure, rectangular in plan section and shall have one or more sludge hoppers. The walls shall be structural grade steel plate not less than 1/4" (6 mm) thick. All structural shapes used for reinforcing and bracing shall have 1/4" (6 mm) minimum thickness in the thinnest section. All welded steel structural members shall be joined by electric arc welding with fillets of adequate section for the joint involved. Where required for additional strength or watertight integrity, such welds shall be continuous inside and out. Coating shall be as specified herein. Inlet and outlet connections shall be as shown on the drawings.

The sludge return from each clarifier hopper shall incorporate a _______" (______ mm) diameter airlift pump. The airlift pump shall have a maximum discharge rate of _______ GPM (____LPS) using not more than ________ CFM (_____LPS) of air. Each airlift pump shall have an air inlet flow regulating ball valve. Sludge return piping, surface skimmer, waste sludge piping, control baffles and valves shall be as shown on the drawings.

The clarified liquid shall pass over the edges of the effluent weir, into the effluent trough, which shall be connected to the clarifier outlet pipe. The adjustable weir plate shall be 1/8" (3 mm) aluminum plate and shall have 1" (25 mm) deep 90° V-notches spaced approximately 4" (100 mm) apart. The scum baffle shall be 1/4" (6 mm) steel plate x 6" (150 mm) deep welded to the tank wall.

The clarifier surface area shall be ________ ft.^{2} (______ m^2).

CLARIFIER
(OPTION B - CIRCULAR) CHECK IF REQUIRED

The clarifier shall be a welded steel structure, circular in plan, and shall have a rotating sludge collector. Dimensions shall be as shown on the drawings. The tank walls and bottom shall be structural grade steel plate not less than 1/4" (6 mm) thick. All structural shapes used for reinforcing and bracing shall have 1/4" (6 mm) minimum thickness in the thinnest section. All welded steel structural members shall be joined by electric arc welding with fillets of adequate section for the joint involved. Where required for additional sectional strength or watertight integrity, such welds shall be continuous inside and out. Coating shall be as specified herein. Inlet and outlet connections shall be as shown on the drawings. A _______" (______ mm) diameter steel inlet stilling well shall be provided.

Sludge removal shall consist of a rotating vacuum-type sludge collector and sludge riser pipe. Neoprene squeegees shall be attached to the sludge collector. The riser and collector pipe shall be attached to a support bearing and drive which shall support the weight of the riser and collector pipe by means of a ball bearing assembly. The drive unit shall be a worm gear speed reducer with a direct-coupled 1/2 HP (0.37 kW), three-phase, _____ volt, ____cycle TEFC drive motor. The worm gear unit shall drive the collector by means of sprockets and chain and shall have a torque limiter mounted on the drive unit sprocket to limit the torque applied to the collector mechanism. The drive shall be mounted on the bridge for easy access. The air supply pipe for the return sludge airlift pump shall pass through the top of the support. The maximum pumping capacity shall be _________ GPM (_____ LPS) using ________ CFM (_____ LPS) of air.

Scum removal shall consist of a steel skimming arm, which rotates the scum to the skimming box. (Scum shall be prevented from rotating past the skimming box by a flexible anti-rotation bar.) The scum shall enter the skimming box over an aluminum weir in the clarifier so that only the scum and the top layer of water are removed. The scum shall be discharged from the skimming box to the aeration tank. Both the sludge return airlift and the scum removal airlift shall be controlled by means of plug valves.

A ________" (_______ mm) wide walkway bridge, designed for minimum deflection, shall span the clarifier and support the sludge scraping mechanism while maintaining the proper clearance without binding. (An aluminum access ladder shall be provided by the clarifier Manufacturer.)

An effluent weir shall be provided around the entire periphery of the clarifier. To exclude scum, the effluent shall be collected by means of submerged orifices.

The clarifier surface area shall be ________ ft.^{2} (_____ m^2) The effective volume shall be _______ gallons (_____liters).

FLOW EQUALIZATION TANK
(OPTIONAL ITEM; CHECK IF REQUIRED)

The flow equalization tank shall have a capacity of ________ gallons (_____ liters). Dimensions shall be as shown on the drawings. A Smith & Loveless **MINI-JECT**® pneumatic ejector shall be provided capable of delivering 1 GPM to _______ GPM (0.1 LPS to _____ LPS) of wastewater at design head. The pumping rate shall be infinitely adjustable between these limits and shall be adjusted by a throttling valve in the air supply line. All openings and passages shall be large enough to permit the passage of a sphere 3" (75 mm) in diameter. S&L **MULTIFUSER**® diffuser(s) shall be provided and all necessary air control valves.

SLUDGE HOLDING TANK
(OPTIONAL ITEM; CHECK IF REQUIRED)

The sludge holding tank shall have a capacity of _________ gallons (_____ liters). Air shall be distributed to the sludge holding tank through S&L **MULTIFUSER**® diffuser(s), and all necessary air control valves shall be provided. Dimensions shall be as shown on the drawings.

ANOXIC
(OPTIONAL ITEM; CHECK IF REQUIRED)

The anoxic tank shall have a capacity of ________ gallons (_______ liters), and be divided into two (2) equally sized compartments. Dimensions shall be as shown on the drawings. Each anoxic compartment shall include a submersible mixer with a 2.2 HP (1.6 kW), 3-phase, _____ volt, _____ cycle motor. A _____" (____ mm) recycle airlift shall be installed in the second anoxic compartment, capable of pumping ____________ GPM (_____ LPS).

INTEGRAL FILTER
(OPTIONAL ITEM; CHECK IF REQUIRED)

The duplex gravity filter shall include two (2) filter cells, each to have a surface area of _____ ft^2 (_____ m^2), for a total effective filtration area of _________ ft^2 (_____ m^2). The filter shall include backwash storage of _____ gallons (____ liters) and two (2) backwash pumps, each capable of ____GPM (____ LPS) and driven by _ HP (___kW), 3-phase, _____cycle, ____ volt motors. The filter shall include a mudwell of _____ gallons (____ liters). A mudwell pump shall be provided, capable of _ GPM (_____ LPS) against _________ ft.(____ m) TDH, driven by a ___ HP (___kW), 3-phase, ______ cycle, _____ volt motor. Anthracite and sand media shall be provided. Automatic filtration and backwash controls shall be provided.

CHLORINE CONTACT TANK
(OPTIONAL ITEM; CHECK IF REQUIRED)

The chlorine contact tank shall have a capacity of ________ gallons (______ liters) with underflow inlet baffle and provisions for mounting chlorination equipment. Dimensions shall be as shown on the drawings.

BLOWERS AND MOTORS
(OPTIONAL ITEM; CHECK IF REQUIRED)

Two blowers shall be furnished by the Manufacturer of the treatment plant, each to deliver ________ CFM (_____LPS) of free air measured at the blower inlet of _______ PSI (____ bar) when operating at a speed of _______ RPM. Blowers shall be S&L Part No. _______ rotary positive displacement type with guarded V-belt connection to the motors. Blowers shall be equipped with filter silencers with weather-hood and specially built check valve.

Each blower shall be driven by a ____ HP (____ kW), 1750 RPM, _______ volt, _______ phase, _______ Hertz, horizontal (open drip-proof) (totally enclosed and fan cooled), ball bearing electric motor.

Motors shall be mounted on a steel base plate with slots provided for adjustment. The motors shall have a 15% service factor but shall not be overloaded beyond the nameplate rating at the design conditions specified above.

Blower/motor units shall be off-plant mounted in close proximity to the plant. They are to be installed by the purchasing contractor.

BLOWER HOUSING
(OPTIONAL ITEM; CHECK IF REQUIRED)

A fiberglass reinforced, one-piece rectangular housing, hinged at the base and provided with provisions for locking will be furnished to protect the motors and blowers.

ELECTRICAL CONTROLS
(OPTIONAL ITEM; CHECK IF REQUIRED)

The electrical components shall be furnished in a NEMA 3R rain-tight cabinet with stand. The cabinet and stand shall be mounted by the purchasing contractor on the concrete blower pad. A separate thermal magnetic circuit breaker and magnetic contactor shall be furnished for each blower motor. Blower starters shall be controlled by a selector switch. Starters for 3-phase circuits shall have overload and under voltage release protection on each conductor.

A separate 115-volt, single-phase supply circuit breaker shall be provided for control circuits and auxiliary equipment. A manual starter with thermal overload protection shall be provided for all auxiliary motor-driven devices furnished with the **ADDIGEST®** Treatment Plant.

Wiring in the control cabinet shall be color-coded and shall be in accordance with the National Electrical Code.

All conduit and wiring between the electrical control panel enclosure and the various motors furnished with the **ADDIGEST®** Treatment Plant and between the panel and the power utility pole shall be furnished and installed by the purchasing contractor.

WELDING

All steel structural members shall be joined by electric arc welding with fillets of adequate section for the joint involved. Where required for additional sectional strength, such welds shall be continuous inside and out.

PROTECTION AGAINST CORROSION AND ABRASION

After welding, all steel surfaces shall be blasted to remove rust, mill scale, weld slag, etc. All weld spatter and surface roughness shall be removed by grinding. Following cleaning, a single heavy inert coating shall be applied to all surfaces. This coating shall be of **VERSAPOX®** epoxy resin especially formulated by Smith & Loveless for abrasion and corrosion resistance. The dry coating shall contain a minimum of 85% epoxy resin with the balance being pigments and thixotropic agents. The dry coating shall be a minimum of 6 mils (0.15 mm) thickness.

All stainless steel, aluminum and other corrosion resistant surfaces shall not be coated.

A touch-up kit shall be provided by the Manufacturer for repair of all scratches or mars occurring during installation. This kit shall contain detailed instructions for use and shall be a material, which is compatible with the original coatings.

CATHODIC PROTECTION
(OPTIONAL ITEM; CHECK IF REQUIRED)

For cathodic protection of tanks installed below ground, a minimum of ________ packaged magnesium anodes similar and equal to International Metal Company, 17-pound (7.7 kg) anodes shall be buried around each structure and securely connected thereto by heavy insulated copper wires in good electrical contact with the steel treatment plant.

FACTORY TEST
(OPTIONAL ITEM; CHECK IF REQUIRED)

The blowers and blower-motors (and the electrical control equipment) shall be tested at the factory by the plant Manufacturer prior to shipment.

INSTALLATION

The purchasing contractor shall install the treatment plant in accordance with the Installation Instructions manual provided by the Manufacturer. The Manufacturer shall provide these instructions prior to shipment of the plant equipment. Installation shall specifically include, but not be limited to the following:

1. All excavation, backfilling and grading.

2. Construction of all necessary concrete foundations, pads, etc.
3. Furnishing and installing all influent and effluent pipes, and interconnecting piping as applicable.
4. (Furnishing and installing all electrical controls.)
5. Furnishing and installing all electrical wire and conduit between the electrical control panel(s) and the motors, etc. of all power operated equipment.
6. Furnishing and installing the electric power service pole, main disconnect and service wiring and conduit.
7. Installation of all equipment, including placement of the tank(s) and installation of all unmounted equipment such as (blower assemblies,) (control panel,) drop pipes, (anode packs,) etc.
8. Field touch-up painting as required. Touch-up paint to be furnished by the plant Manufacturer.

OPERATION AND MAINTENANCE INSTRUCTIONS

The Manufacturer shall provide a complete and detailed operation and maintenance manual. This manual shall include detailed operation and maintenance procedures regarding proper process control of the treatment plant and troubleshooting guide for specific process problems. The manual shall also provide operation maintenance and servicing procedures of the major individual components provided with the treatment plant.

MANUFACTURER'S INSURANCE

ALL EQUIPMENT MANUFACTURERS, either direct or subcontractors to the general or mechanical contractors, SHALL HAVE in effect at TIME OF BID, CONTRACT AWARD, CONTRACT PERFORMANCE, and WARRANTY TERM, PRODUCT AND COMPREHENSIVE LIABILITY INSURANCE, INCLUDING SUDDEN AND ACCIDENTAL POLLUTION COVERAGE, in the amount of FIVE MILLION DOLLARS ($5,000,000) through an insurance company with a minimum rating of A+ (SUPERIOR) XV according to the BEST'S INSURANCE REPORTS. All policies must be written on an OCCURRENCE BASIS. Policies written on a CLAIMS MADE BASIS are not acceptable. The CERTIFICATE OF INSURANCE attesting to the specified coverage issued by the responsible carrier naming the ENGINEER OF RECORD and the OWNER as ADDITIONAL INSURED, must be presented to the named additional insured prior to contract award. A FAILURE TO COMPLY with this requirement BY THE BIDDER will require DISQUALIFICATION of the BID and CONTRACT AWARD.

STARTUP

The Manufacturer shall provide the services of a factory-trained representative for a maximum period of _____ days on-site to assist with the initial startup, and to instruct the Owner's operating personnel in the operation and maintenance of the equipment.

WARRANTY

The Manufacturer of the equipment shall warrant for one (1) year from date of startup, not to exceed eighteen (18) months from date of shipment, that all equipment he provides will be free from defects in material and workmanship.

In the event a component fails to perform as specified, or is proven defective in service during the warranty period, the Manufacturer shall repair or replace, at his discretion, such defective part. He shall further provide, without cost, such labor as may be required to replace, repair or modify major components. After startup service has been performed, the labor to replace accessory items shall be the responsibility of others.

The repair or replacement of those items normally consumed in service such as seals, grease, light bulbs, etc., shall be considered as part of routine maintenance and upkeep.

It is not intended that the Manufacturer assume responsibility for contingent liabilities or consequential damages of any nature resulting from defects in design, material, workmanship or delays in delivery, replacement or otherwise.

MANUFACTURED EQUIPMENT
OPTION 1 (STANDARDIZATION) [DELETE THIS LINE FROM FINAL SPEC TEXT]

The specifications and drawings detail Smith & Loveless equipment and represent the minimum standard of quality for both equipment and materials of construction. The contractor shall prepare his bid on the basis of the particular equipment and materials specified for the purpose of determining the low bid.

The owner has standardized on the named equipment in order to optimize their operation, maintenance, and safety programs, provide for interchangeability of costly equipment items, reduce stocking levels required for necessary spare parts and provide increased flexibility in the utilization of their facility. Equipment substitutions, since incompatible with the Owner's standardization program, will not be considered.

OPTION 2 (BASE BID WITH BID SUBMITTAL) [DELETE THIS LINE FROM FINAL SPEC]

The specifications and drawings detail Smith & Loveless equipment and represent the minimum standard of quality for both equipment and materials of construction. The contractor shall prepare his bid on the basis of this equipment for the purpose of determining the low bid without consideration of a possible substitute.

Substitution of other makes may be considered if the equipment proposed for substitution is superior or equal in quality and efficiency to the standards of quality named in the specifications and this is demonstrated to the satisfaction of the engineer. Contractors wishing to offer a deduct for substitute equipment shall include the following submittal information with their proposal.

BID SUBMITTAL

This submittal shall include all necessary information for the proper determination of the acceptability of the proposed substitution, and shall not necessarily be limited to the following:

A. Complete description of the equipment, system, process, or function, including a list of system components and features, drawings, catalog information and cuts, Manufacturer's specifications, including materials description.
B. Performance data and curves, and power requirements.
C. Outside utility requirements, such as water, power, air, etc.
D. Functional description of any internal instrumentation and control supplied including list of parameters monitored, controlled, or alarmed.
E. Addresses and phone numbers of nearest service centers and a listing of the Manufacturers or Manufacturer's representatives services available at these locations, including addresses and phone numbers of the nearest parts warehouses capable of providing full parts replacement and/or repair services.
F. A list of five installations in the state where similar equipment by the Manufacturer is currently in similar service; include contact name, telephone number, mailing address of the municipality or installation, engineer, Owner, and installation contractor; if five installations do not exist, the list shall include all that do exist, if any.
G. Detailed information on site, architectural, structural, mechanical, plumbing, electrical, and control, and all other changes or modifications to the design and construction work necessary to adapt the equipment or systems to the arrangement shown and/or functions described on the drawings and in the technical specifications. This shall include plan view and section sketches illustrating any additional space requirements necessary to provide the minimum adequate clear space within and around the equipment for operation and maintenance, as shown on the drawings and specified.
H. All differences between the specifications and the proposed substitute equipment shall be clearly stated in writing under a heading of "differences".
I. Other specific submittal requirements listed in the detailed equipment and material specifications.

EVALUATION

Approval of the substitution to bid as an alternate shall in no way relieve the contractor from submitting the specified shop drawings for approval or complying fully with all provisions of the specifications and drawings.

If substituted equipment is accepted. The contractor shall, at his own expense, make any changes in the structures, piping, electrical, etc., necessary to accommodate the equipment. If engineering is required due to substitution of alternate equipment, the contractor shall pay for all engineering charges.

To receive final consideration, copies of the Manufacturers' quotations for the equipment may be required to document the savings to the satisfaction of the engineer. It is the intent that the owner shall receive the full benefit of the savings in cost of equipment and the contractor's bid price shall be reduced by an amount equal to the savings. In all technical and other evaluations, the decision of the engineer is final.

TYPICAL BID FORM
[ADD TO BID FORM AS APPLICABLE TO ABOVE SELECTED OPTION]

OPTION 1

For reasons of standardization, bids shall be based on the named equipment. Alternate bids will not be allowed.

OPTION 2

Bids shall be based on the named equipment. Alternate/substitute equipment may be offered as a deduct, provided all conditions of the "manufactured equipment" section are met.
Alternate/Substitute Manufacturer ____.

Deduct $______________.

PROCESS DESIGN REPORT AND PROPOSAL

UNISYSTEM PACKAGE WASTEWATER TREATMENT PLANT

Project Name: High School WWTP – Coventry, RI

Proposal #2302235.R0

5/5/2023

Designed by: Alex Danuser, EIT, Newterra Corporation, Inc.

The enclosed information is based on preliminary data provided by the owner/engineer. This data has been reviewed and has been utilized as the basis of the following design recommendations. There may be unknown factors which would alter the design recommendation. Newterra Corporation, Inc. assumes no responsibility for the validity or any risks associated with the use of modeling software or industry standard assumptions. Newterra Corporation, Inc. assumes no responsibility for or liability resulting from the use of the recommendations provided as part of the subject design.

4100 Peavey Road • Chaska, Minnesota 55318 • USA
Telephone: (952) 448-6789 • Email: info@newterra.com • Fax: (952) 448-7293

1. Design Specifications

1.1. Average Flow Rates

The wastewater treatment system has been designed for 24-hour / 7-day flow. The system will have a design average flow of 40,000 gallons per day.

1.2. Influent Water Quality

Influent water quality parameters have been provided by the engineer.

PARAMETER	INFLUENT	UNITS
BOD_5	250	mg/L
TSS	250	mg/L
TN	40	mg/L
P	8	mg/L
Water Temp, Min	55	°F
Water Temp, Max	70	°F

1.3. Effluent Requirements

Effluent Requirements listed below have been provided by the engineer.

PARAMETER	EFFLUENT	UNITS
BOD_5	20	mg/L
TSS	20	mg/L
NO_3-N	10	mg/L

2. Design Considerations

2.2. Pre-Biological Unit Process

Neutralization is recommended/required if the pH is expected to fall outside of 6.5-8.5 for extended durations.

2.3. Process Aeration

The aeration system has been designed to provide 1.3 lbs O2/lb BOD5 applied and 4.6 lbs O2/lb TKN applied at the design average flow.

No denitrification credits have been assumed. No assimilation credits have been assumed.

The aeration system has been designed with a mixing intensity greater than 30 SCFM/1000 ft^3, which is sufficient to maintain suspension of all solids.

2.4. Process Conditions

Sufficient alkalinity is required for nitrification as approximately 7.1 mg alkalinity (as CaCO3) is required for each milligram of NH3-N nitrified. If the raw water cannot support this consumption while maintaining residual alkalinity concentration of 50 mg/L, supplemental alkalinity shall be provided (by others).

The effluent quality is predicated upon the ability of the sludge to settle to reasonable levels to prevent the discharge of TSS. An SVI of 150 is assumed.

Maximum fats, oils, and grease to the biological process unit is 100 mg/L. Depending on the nature of the FOG, reduction in activated sludge treatment is unpredictable. If FOG effluent requirements exist, FOG should be reduced to the effluent limit prior to the biological unit process. High FOG levels may also cause poor settling and excessive foaming, resulting in effluent quality degradation.

3. Equipment Summary

3.2. Tanks

One (1) Prefabricated Steel Treatment Plant Section, consisting of:
- 6,300 gallon Anoxic tank
- 22,573 gallon Aeration Tank
- 6,000 gallon Sludge Holding Tank

One (1) Prefabricated Steel Treatment Plant Section, consisting of:
- 19,427 gallon Aeration Tank
- 7,891 gallon Dual-Hopper Clarifier

Corrosion Protection for Steel Tanks, consisting of:
- Interior vessel surface protection (Tnemec N69 Epoxy), 12-16 mils TDFT
- Exterior vessel surface protection (Tnemec N69 Epoxy), 12-16 mils TDFT
- Cathodic protection with six magnesium anodes

3.3. Screening

One (1) Bar Screen

3.4. Anoxic Tank

One (1) Submersible Mixer, consisting of:
- 0.5 hp, 460V, 3-phase, 60 Hz

3.5. Aeration Tank

Two (2) Aeration Blowers (One Duty, One Standby), consisting of:
- 7.5 HP, 460V, 3-phase, 60 Hz
- 230 CFM at 5 psi

One (1) Air Manifold, consisting of:
- Steel air diffuser drop assemblies
- Seventy-two (7) diffuser heads
- Air regulating valves
- Pressure relief valves with pressure gauge
- Diffuser drop connection valving

One (1) Internal Recycle Pumps, consisting of:
- 0.5 HP, 460V, 3-phase, 60 Hz
- 70 gpm at 10 feet TDH
- Complete with piping to flow control box

3.6. Clarifier

Two (2) Airlift Sludge Return Pumps
- Sludge return to anoxictank or waste to sludge holding tank

Two (2) Airlift Scum Return Pump
- Scum return to aeration tank

3.7. Disinfection

One (1) UV Disinfection Units

3.8. Sludge Holding Tank

One (1) Air Manifold, consisting of:
- Steel air diffuser drop assemblies
- Eight (8) diffuser heads
- Air regulating valves
- Pressure relief valves with pressure gauge
- Diffuser drop connection valving
- Air supply shared with aeration tank

One (1) Sludge Supernatant Baffle
- Supernatant return to influent inlet

3.9. Controls

Prewiring of Electrical Components Installed in Tanks

One (1) System Control Panel, consisting of:
- NEMA outdoor-rated panel enclosure
- Programmable logic controller
- Touchscreen HMI

4. Freight and Installation/Startup Supervision

Freight, DAP Jobsite (Incoterms 2020)

Startup and Installation Supervision, consisting of:
- One trip, two days, including travel expenses

5. Items Not Included
- Installation
- Civil Engineering
- Digested Sludge Handling/Disposal (i.e. Sludge Pumps, Dewatering Equipment, etc.)
- Chemicals and Chemical Feed Systems
- Interconnecting Piping, Valves, and Fittings Outside of Basin
- Concrete Anchor or Epoxy Bolts
- Unloading, Storage, and Accounting of Equipment
- Taxes or Duties of Any Kind
- Anything not Specifically Mentioned Above

TOTAL PRICE: $797,000 USD

6. Adder – Flow Equalization

Two (2) FRP Pre-Equalization Tanks, consisting of:
- 36,930 gallons equalization volume per tank
- 2 day storage at average flow

Four (4) Flow Equalization Pumps (One Duty, One Standby per EQ Tank), consisting of:
- 0.5 HP, 460V, 3-phase, 60 Hz
- 28 gpm at 10 feet TDH
- Complete with piping to flow control box

Eight (8) Float Switches

Two (2) Flow Equalization Blowers (One Duty, One Standby), consisting of:
- 7.5 HP, 460V, 3-phase, 60 Hz
- 185 CFM at 5 psi

Coarse Bubble Diffusers Preinstalled

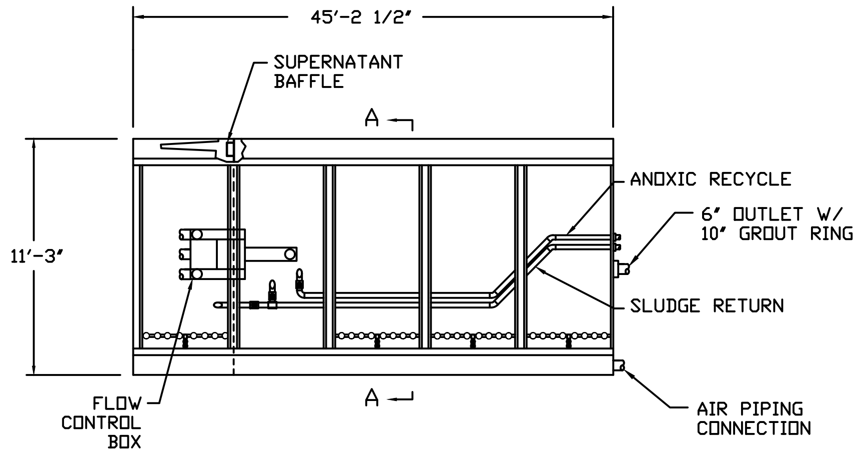
ADDER PRICE: $474,000 USD

NOTE: Submittal and delivery schedule estimates are available upon request.

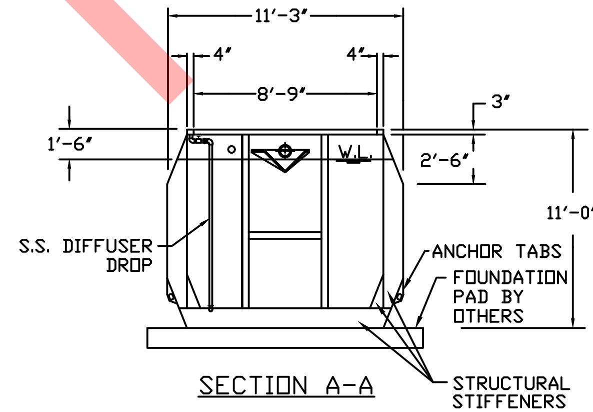
Quotation valid for 30 days.

PAYMENT: 25% Upon Acceptance of Purchase Order (Due Net 30 Days)
25% Upon Submittal of Drawings for Approval (Due Net 30 Days)
25% Upon Approval to Order Materials (Due Net 30 Days)
25% Prior to Shipment (Invoice to be Supplied 30 Days in Advance)

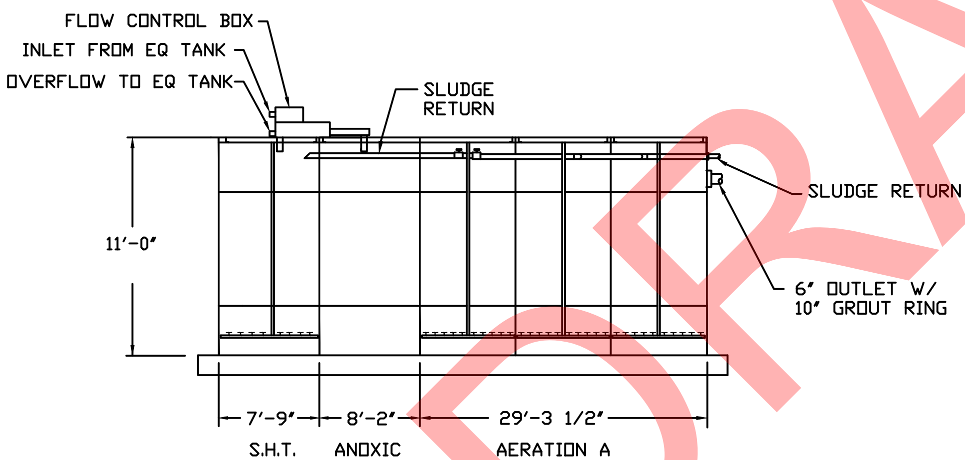
TERMS: General Terms and Conditions attached (5 pages)



PLAN



SECTION A-A



ELEVATION

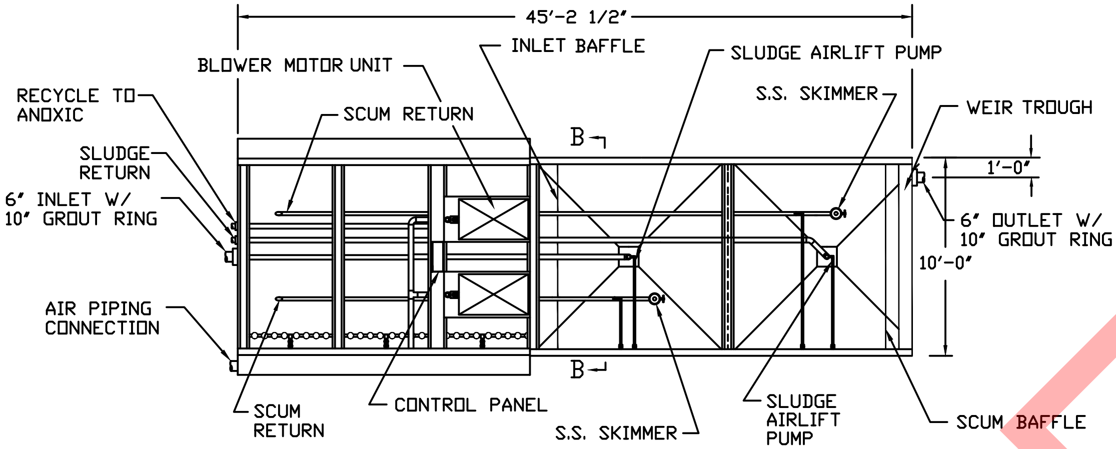
VOLUMES

S.H.T.	ANOXIC TANK	AERATION TANK A
6,000 GAL.	6,300 GAL.	22,573 GAL.

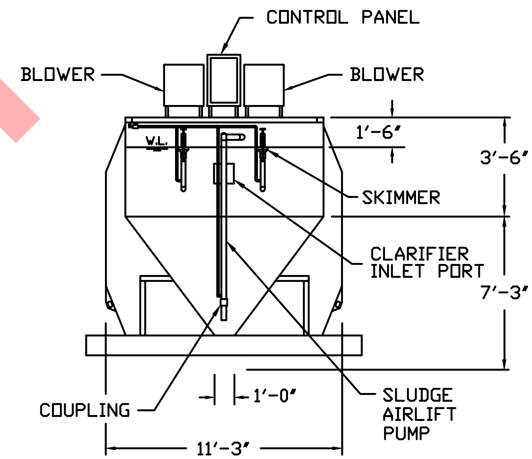
Aeration Industries International, Inc.
P.O. Box 59144 Minneapolis, MN 55459 USA
Telephone: 1(612)448-6789 Telex: 9105780838 Facsimile: 1(612)448-7293

MODEL:
AI-40-FESH

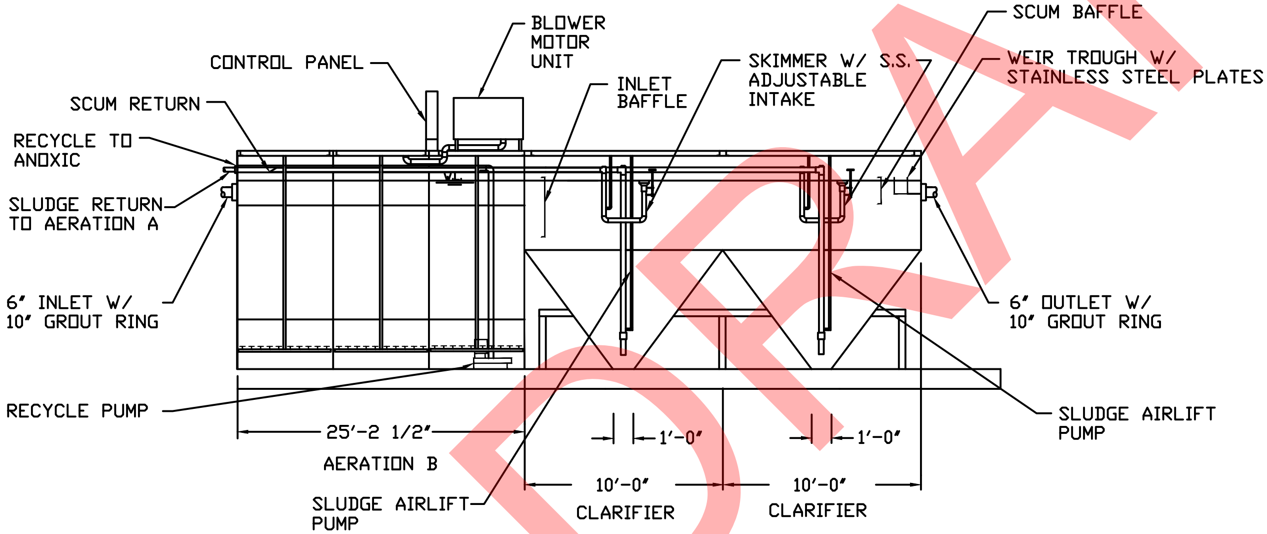
TITLE	PACKAGE W.W.T.S. HIGH SCHOOL WWTP
REF.	35
DRAWN	AMD
DATE	5/3/2023
APPROVED	
DATE	
DRAWING NO.	SK93-044
PROJECT NO.	2302235
REV.	A1
SCALE	---
PLOT	1 = 120 A
SHEET	1
OF	2



PLAN



SECTION B-B



ELEVATION

VOLUMES

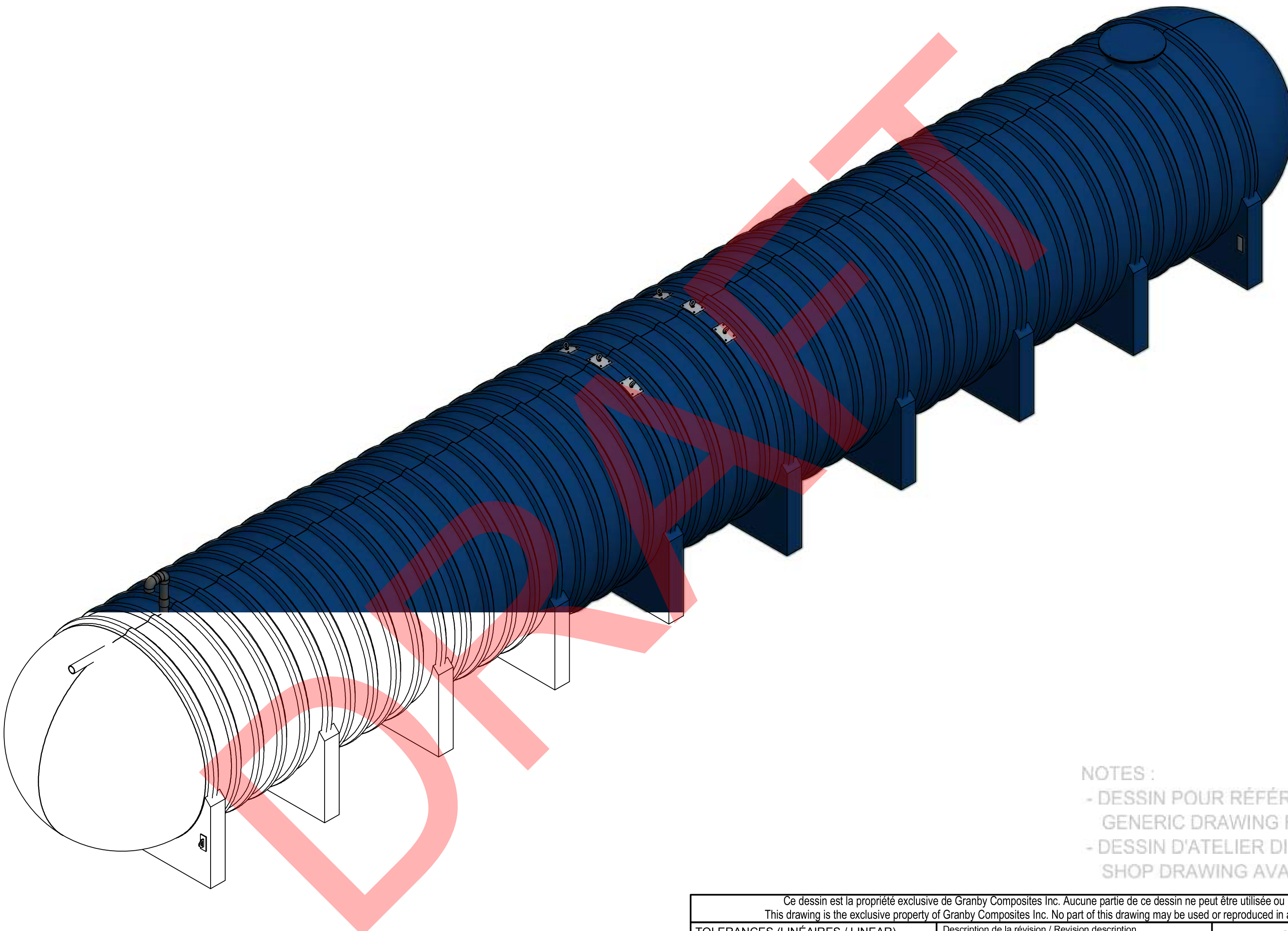
AERATION TANK B	CLARIFIERS
19,427 GAL.	7,891 GAL.

Aeration Industries International, Inc.
P.O. Box 59144 Minneapolis, MN 55459 USA
Telephone: 1(612)448-6789 Telex: 9105780838 Facsimile: 1(612)448-7293

MODEL: AI-40-FESH	TITLE: PACKAGE W.W.T.S. HIGH SCHOOL WWTP		REF. 35
DRAWN: AMD	DATE: 5/2/2023	DRAWING NO. SK93-044	PROJECT NO. 2302235	REV. A1
APPROVED	DATE	SCALE ---	PLOT 1 = 120 A	SHEET 2 OF 2

NN10461577HS

RÉSERVOIR DE FIBRE DE VERRE / FIBERGLASS TANK



NOTES :
- DESSIN POUR RÉFÉRENCE SEULEMENT / GENERIC DRAWING FOR REFERENCE ONLY
- DESSIN D'ATELIER DISPONIBLE SUR DEMANDE / SHOP DRAWING AVAILABLE ON REQUEST

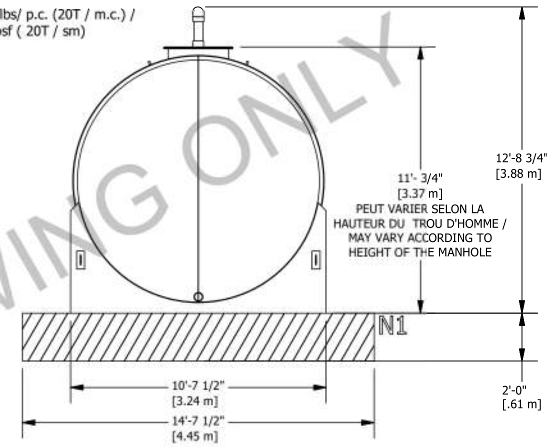
TOLERANCES (LINÉAIRES / LINEAR) 0 OR FRAC. (X/X) -> ±1% 0.00 -> ±0.25" 0.0 -> ±0.5" 0.000 -> ±0.125"	Description de la révision / Revision description	Granby Composites Inc. © 2018 Granby Composites Inc.
TOLERANCES (ANGULAIRES / ANGULAR) 0 -> ± 2 DEG. 0.0 -> ± 0.5 DEG. 0.00 -> ± 0.1 DEG.	Dessiné par / Drawn by: S. Potvin — 07/04/2018	Format / Size: B — No de la pièce / Part no.: NN10461577HS — REV: 01
Poids / Weight : 12325 Lb / 5590 Kg	Approuvé par / Approved by :	Description / Title: RÉSERVOIR 10' Dia. / 155944 L / 41196 gal US - TANK
Client	Unités / Units: INCHES — Feuille Sheet: 1 / 3	# Projet: Project #

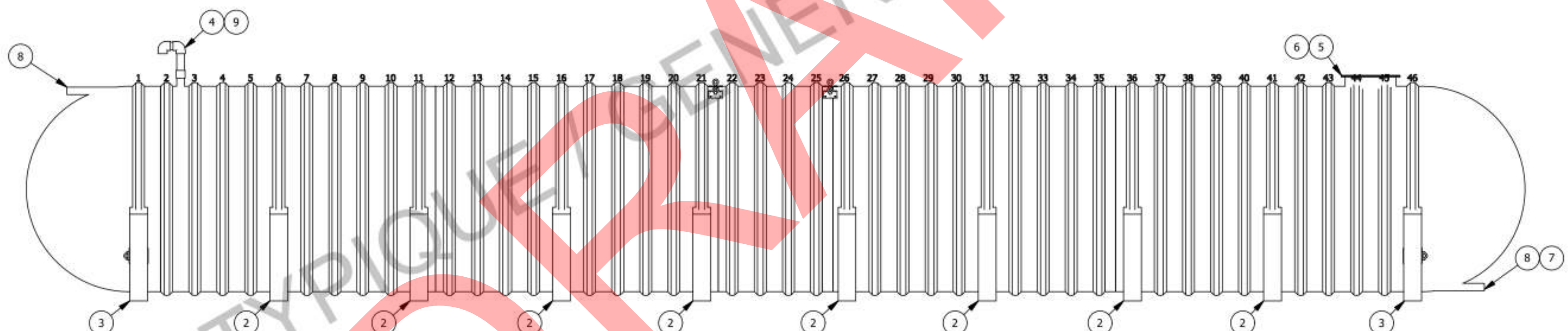
D-PRTS_TMPLT_G

Item	Numéro de pièce / Part Number	Qté / Qty	Description	Check List
1	ADP0000001	6	PLAQUES DE LEVAGE (Granby #AS1108) - LIFTING LUG	
2	BERCEAU10	8	BERCEAU - 10' - SADDLE	
3	BERCEAU10LUGS	2	BERCEAU AVEC ANCRAGES - 10' - SADDLE WITH LUGS	
4	EV480	1	ENSEMBLE ÉVENT - 4" SCH. 80 - VENT KIT	
5	GMHE30-COVER00	1	COUVERCLE DE TROU HOMME BOULONNÉ - 30" DIA. FRP. - BOLTED MAN HOLE COVER	
6	MH-30 (6"L.)	1	TROU D'HOMME - 30" DIA. x 6" L. - MANHOLE	
7	PFV01414	1	PLAQUE ANTI-VORTEX 0.5" x 13.5" x 13.5" - ANTI-VORTEX PLATE	
8	TP80400G01 (48.5"L.)	2	TUYAU PVC GRIS - 4" SCH.80 - PVC PIPE GREY	
9	TP80400G01 (9"L.)	1	TUYAU PVC GRIS - 4" SCH.80 - PVC PIPE GREY	

PROPRIÉTÉS DE LA FONDATION / FOUNDATION'S PROPERTIES

N1 - Structure de chaussée bien drainée (avec ou sans dalle de béton) d'une capacité portante de 4,000 lbs/ p.c. (20T / m.c.) / Well drained roadway structure (with or without concrete pad) with load bearing capacity of 4,000 psf (20T / sm)





NOTES :
- DESSIN POUR RÉFÉRENCE SEULEMENT / GENERIC DRAWING FOR REFERENCE ONLY
- DESSIN D'ATELIER DISPONIBLE SUR DEMANDE / SHOP DRAWING AVAILABLE ON REQUEST

Informations techniques / Technical informations

- Diamètre intérieur / Inside Diameter : 120" / 3.048 m
- Longueur minimale requise de la chaîne pour le levage à 60° / Minimum required length of the chain for the 60° lifting : 135" / 3.429 m"
- Fabriqué selon les exigences ANSI-AWWA D120 / Manufactured according to ANSI-AWWA D120 requirements
- Couche isolante d'uréthane en option / Urethane insulation layer in option
- Protection gelcoat contre les UV en option / Gelcoat UV protection in option
- Exigences NSF-61 pour eau potable en option / NSF-61 requirements for drinkable water in option

Le réservoir doit être installé selon les instructions du manufacturier. / The tank must be installed in accordance with the manufacturer's instructions.

TOLERANCES (LINÉAIRES / LINEAR)
0 OR FRAC. (X/X) -> ± 1% 0.00 -> ± 0.25"
0.0 -> ± 0.5" 0.000 -> ± 0.125"

TOLERANCES (ANGULAIRES / ANGULAR)
0 -> ± 2 DEG.
0.0 -> ± 0.5 DEG. 0.00 -> ± 0.1 DEG.

Poids / Weight : 12325 Lb / 5590 Kg

Client

Description de la révision / Revision description

Dessiné par / Drawn by S. Potvin 07/04/2018

Approuvé par / Approved by :

Unités / Units INCHES Feuille Sheet 2 / 3

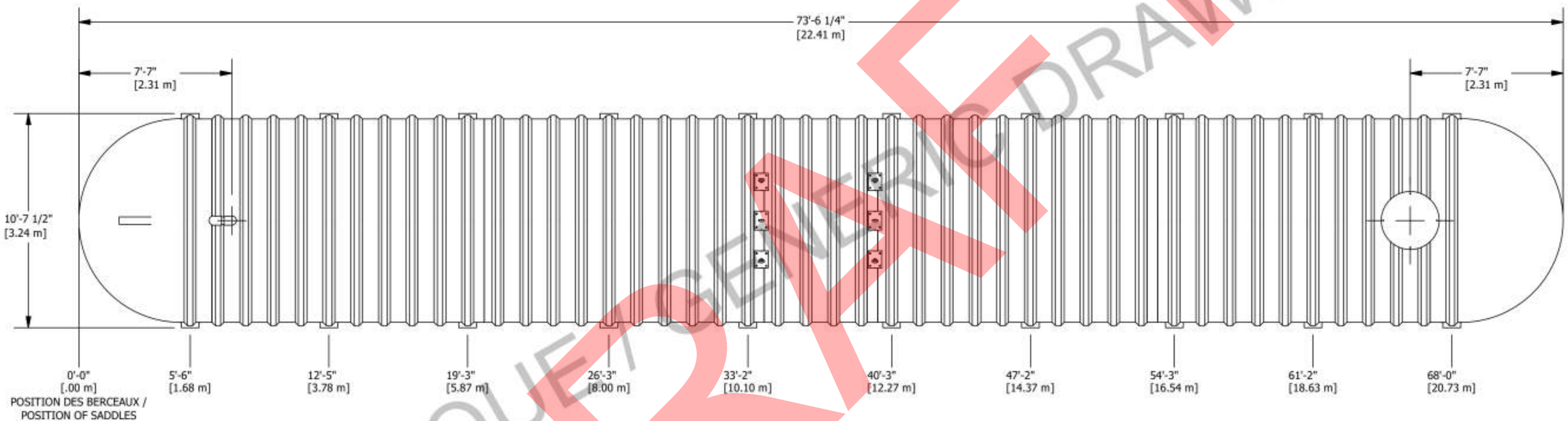
Granby Composites Inc.

Format / Size B No de la pièce / Part no. NN10461577HS REV 01 .

Description / Title RÉSERVOIR 10' Dia. / 155944 L / 41196 gal US - TANK

Projet Project

D-PRTS_TMPLT_G



VUE DE PLAN
PLAN VIEW

NOTES :
- DESSIN POUR RÉFÉRENCE SEULEMENT / GENERIC DRAWING FOR REFERENCE ONLY
- DESSIN D'ATELIER DISPONIBLE SUR DEMANDE / SHOP DRAWING AVAILABLE ON REQUEST

TOLERANCES (LINÉAIRES / LINEAR)
0 OR FRAC. (X/X) -> ±1% 0.00 -> ±0.25"
0.0 -> ±0.5" 0.000 -> ±0.125"
TOLERANCES (ANGULAIRES / ANGULAR)
0 -> ± 2 DEG.
0.0 -> ± 0.5 DEG. 0.00 -> ± 0.1 DEG.
Poids / Weight : 12325 Lb / 5590 Kg
Client

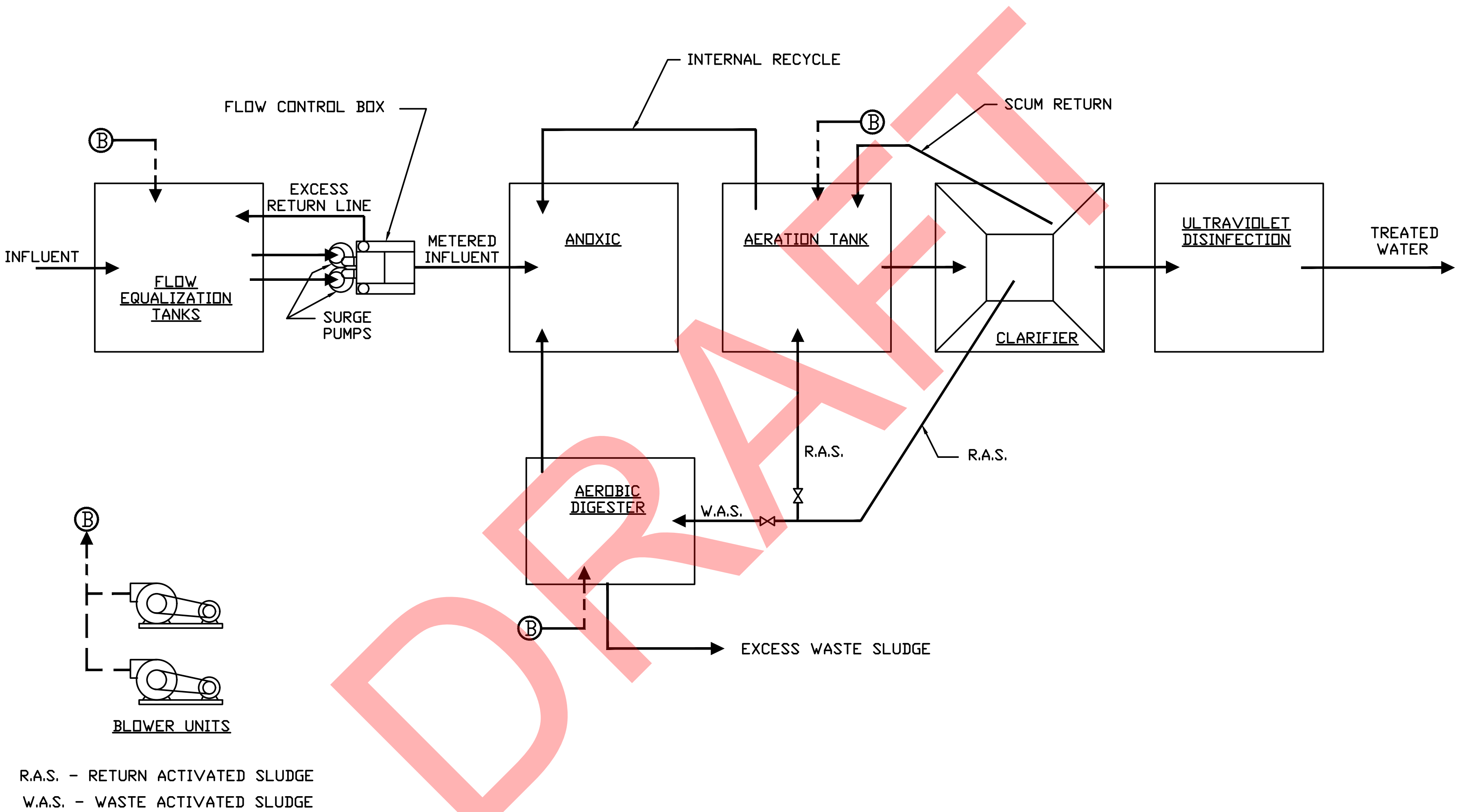
Description de la révision / Revision description
Dessiné par / Drawn by: S. Potvin 07/04/2018
Approuvé par / Approved by :
Unités / Units: INCHES Feuille Sheet 3 / 3

Granby Composites Inc.

Format / Size: B No de la pièce / Part no.: NN10461577HS REV: 01.
Description / Title: RÉSERVOIR 10' Dia. / 155944 L / 41196 gal US - TANK
Projet: Project

D-PRTS_TMPLT_G

PRELIMINARY



NOTES

newterra

PHONE:
(800) 420-4056
www.newterra.com

LEVEL	REVISION	DATE (mm/dd/yy)	BY
A	PRELIMINARY PID		AMD

PROJECT NUMBER: 2302235.R0

CUSTOMER: NEXGEN ENERGY

TITLE AND LOCATION: UNISYSTEM PACKAGE PLANT PRELIMINARY PIPING AND INSTRUMENTATION DIAGRAM

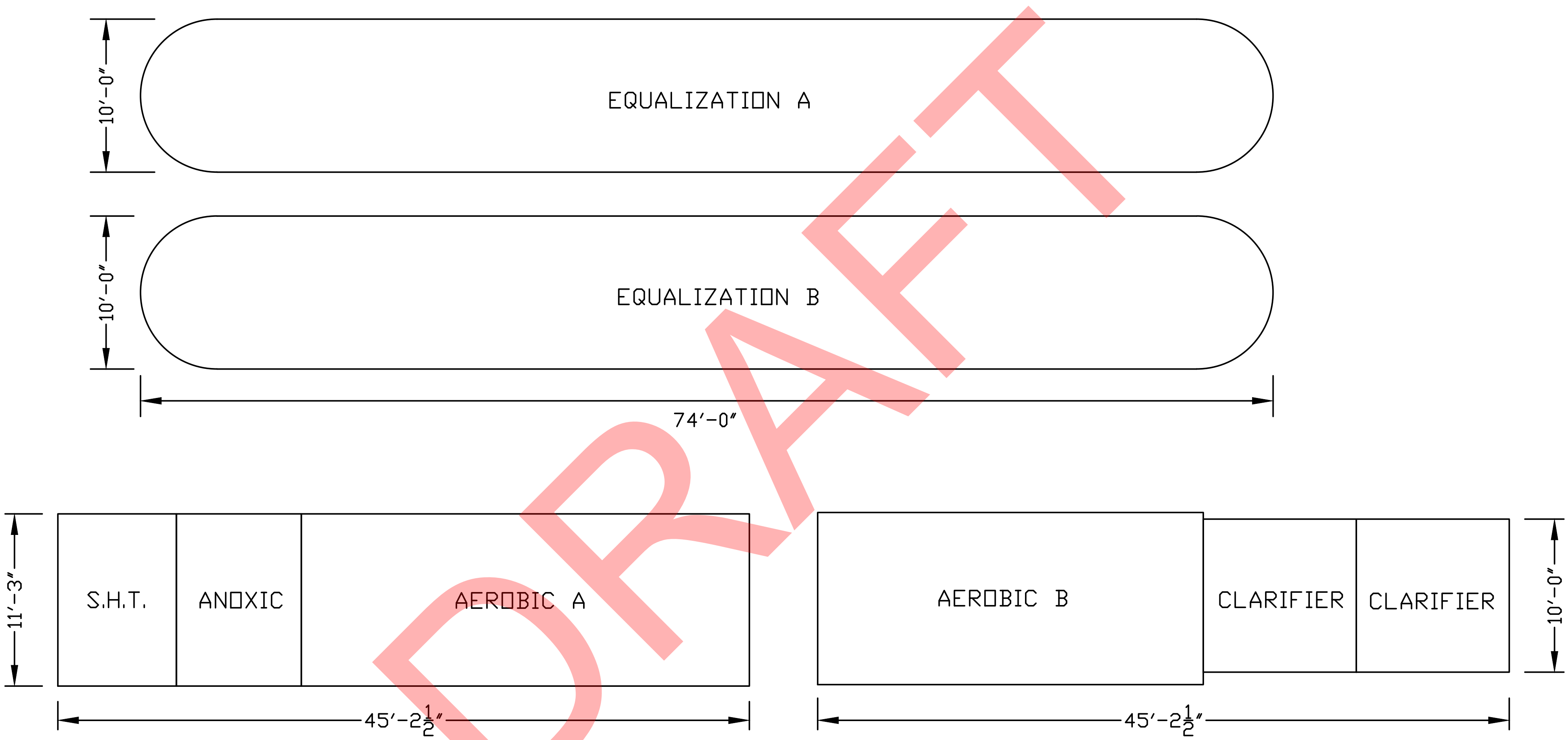
DRAWN BY: AMD

DATE: 5/4/2023

SHEET

SHEETS

PRELIMINARY



NOTES

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LEVEL	REVISION	DATE (mm/dd/yy)	BY
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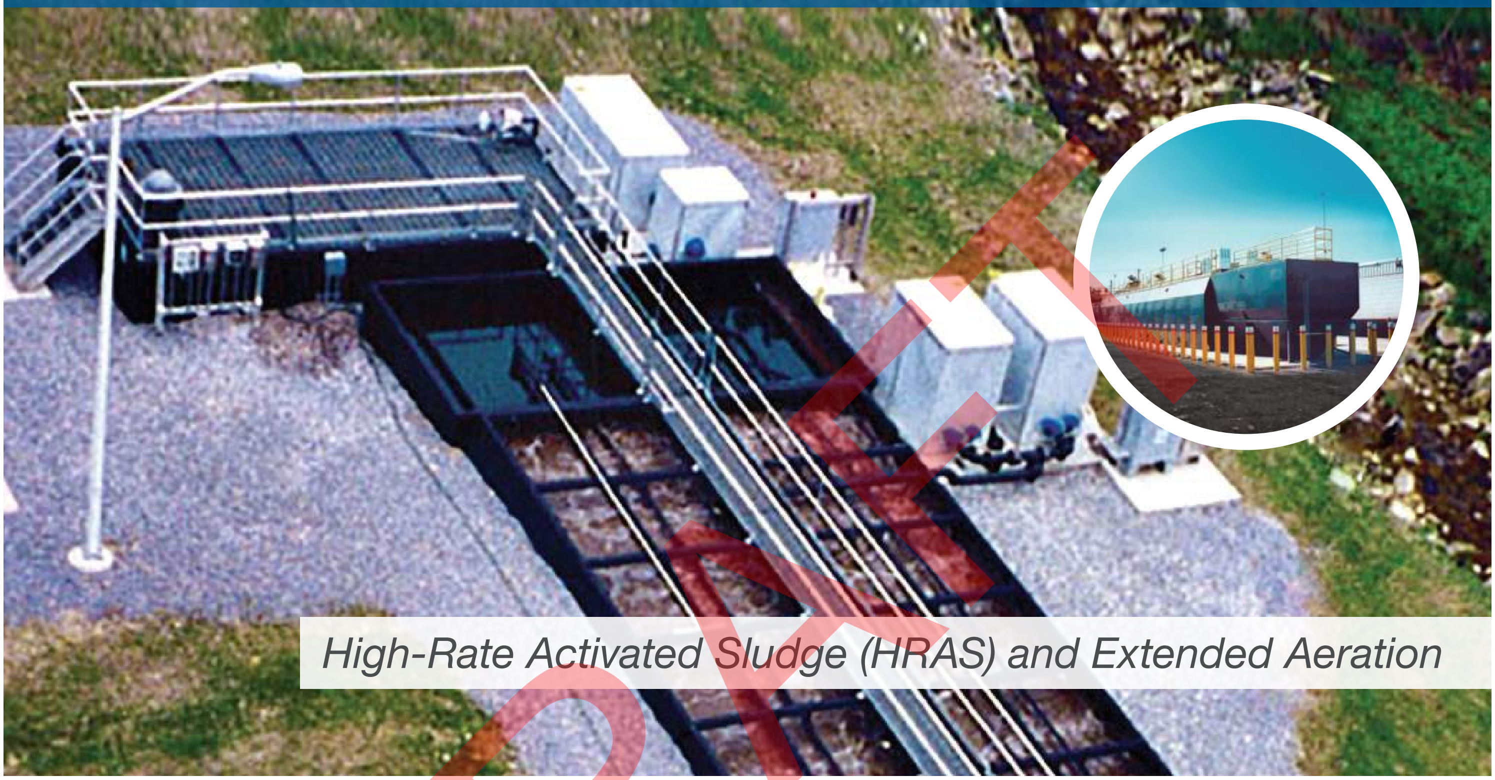
CUSTOMER: NEXGEN ENERGY

DRAWN BY	DATE	SHEET	SHEETS
AMD	5/4/2023		

newterra
AIRE-O2®

UniSystem® Package Wastewater Treatment Plant



High-Rate Activated Sludge (HRAS) and Extended Aeration

Industrial and Municipal Wastewater Treatment

Utilizing a modification of the activated sludge process, the "UniSystem®" can be designed as an extended aeration or a high-rate treatment plant. The system is designed to maintain sufficient oxygen, mixing, and detention time to allow micro-organisms to oxidize treatable wastes for removal of BOD, TSS, ammonia, and other wastewater constituents.

The standard UniSystem® package plant is a rectangular tank consisting of an aeration chamber, hopper bottom clarifier, sludge holding tank, and chlorine disinfection chamber. Aeration Industries can supply painted carbon steel tankage or all of the internals and ancillary equipment for installation in concrete tanks. Treatment modules can be easily added to the design of the UniSystem® depending on influent characteristics and effluent requirements. Treatment module options include a comminutor, flow equalization, denitrification equipment, filters, a membrane bioreactor, UV disinfection, post aeration, and phosphorus removal equipment.

The prefabricated UniSystem® is designed for ease of installation for customers located remote from municipal treatment facilities or for customers requiring pretreatment prior to discharge to a municipal sewer system. The standard UniSystem® is designed to treat single unit flow rates between 5,000 gallons per day (gpd) and 100,000 gpd. Multiple units can be installed to operate in parallel to accommodate higher flow rates and customized circular UniSystem® designs can be engineered for flow rates up to 500,000 gpd.

UniSystem® Design Advantages

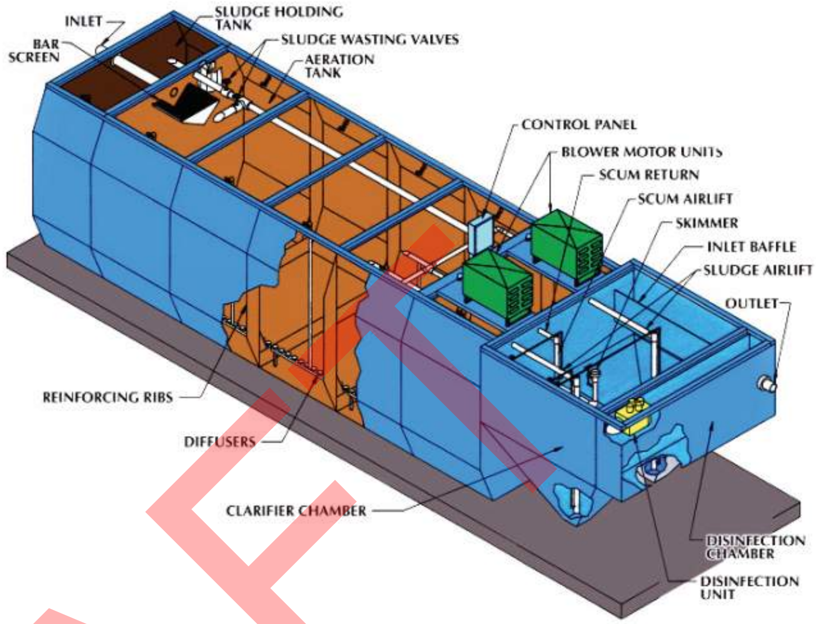
- Small footprint reduces land use and allows plant to be easily covered
- Suitable for both municipal and industrial wastewater applications
- Flow capacities from
- Minimum operator attendance required
- Minimum maintenance requirements

High-Rate Activated Sludge (HRAS) & Extended Aeration

UniSystem® Applications

For locations requiring domestic wastewater treatment but unable to connect to an existing municipal sewer system, the UniSystem® offers a sustainable high-end wastewater treatment solution, requiring far less space, easy installation, and simple operation for the following applications:

- Small communities and remotely located housing developments
- Industrial office parks
- Recreational camps and mobile communities
- Truck stops and highway rest areas
- Industrial pretreatment, prior to discharge to municipal sewers
- Food and beverage processors
- Pulp and paper manufacturers
- Shopping centers and restaurants
- Resorts, golf courses, and country clubs
- Rural area schools
- Hospitals and retirement centers



1 **Above-ground** HRAS UniSystem® for industrial wastewater treatment at a food processing facility, 2 **In-Ground** Air UniSystem® for municipal wastewater treatment with tertiary filters and UV disinfection, 3 **Custom-engineered** circular tank UniSystem® with internal clarifier for treating 190,000 gpd of wastewater

UniSystem® Standard System Sizing*

Average Design Flow (gpd)	Average Design Flow (m³/day)	Length	Width	Height
5,000	18.93	18’-9” (15.72 m)	8’-0” (2.44 m)	9’-6” (2.89 m)
10,000	37.85	24’-9” (17.55 m)	10’-0” (3.05 m)	11’-0” (3.35 m)
20,000	75.71	36’-0” (10.98 m)	11’-11” (13.63 m)	11’-0” (13.35 m)
30,000	113.56	53’-0”(16.18m)	11’-11’ (13.63 m)	11’-0’ (13.35 m)
40,000	151.42	69’-0” (21.05 m)	11’-11” (13.63 m)	11’-0” (13.35 m)
50,000	189.27	83’-0” (25.33 m)	11’-11’ (13.63 m)	11’-0’ (3.35 m)
60,000	227.12	58’-0” (17.68 m)	23’-10” (7.26 m)	11’-0” (3.35 m)
70,000	264.98	65’-0” (19.82 m)	23’-10” (7.26 m)	11’-0” (3.35 m)
80,000	302.83	72’-0” (21.94 m)	23’-10” (7.26 m)	11’-0” (3.35 m)
90,000	340.69	79’-0” (24.11 m)	23’-10’ (7.26 m)	11’-0’ (3.35 m)
100,000	378.54	86’-0” (26.22 m)	23’-10” (7.26 m)	11’-0” (13.35 m)

** Includes Sludge Holding Tank, Aeration Tank, Clarifier, Chlorine Contact Tank*

TERMS AND CONDITIONS:

1. PURCHASE ORDER:
Newterra ("Newterra" or "Seller") will not initiate work prior to purchasing party ("Buyer") providing a signed purchase order or letter which includes the overall price of system and options chosen, purchase order number, payment terms, billing address, Tax Identification Number, and Newterra Proposal Number including revision and date.

2. APPLICABILITY / SCOPE:
All goods and services provided shall be governed by the terms and conditions set forth herein. Any modifications to these terms or to the scope of any purchase order or project hereunder, shall be mutually agreed upon and set forth in writing executed by both parties. Such writing shall clearly set forth the nature and extent of the change, and, if applicable, any adjustment in price associated with such change.

3. SCHEDULE
Newterra's estimated delivery schedule is included in the proposal and may be affected by manufacturing loading at time of order. Authorizing Newterra to order long lead components at time of order may help to expedite the project schedule. In order to notify Newterra of the intent to allow the long lead components to be ordered immediately please check the box on the signature page of this document.

4. CREDIT APPROVAL:
All new purchase orders are subject to mandatory credit approval for first time Newterra Buyers and discretionary credit approval for repeat Newterra Buyers (credit approval form available from Newterra upon request). Should Seller learn of any information that causes Seller concern about Buyer's ability to perform any of its obligations owing to Seller under a purchase order, Seller has the right to request Buyer to provide Seller adequate assurance of due performance on such terms as are deemed reasonable by Seller when acting in good faith, including the right to demand full or partial payment from Buyer as demanded by Seller. A complete credit check is required prior to shipping on a Net-30 or "C.O.D. – customer check acceptable" basis.

5. TELEMETRY SERVICES AGREEMENT:
A Telemetry Services Agreement must be completed for all system orders that include a Newterra SiteLink Remote Telemetry and Communication Package. The Telemetry Services Agreement is required to activate the services listed in the proposal (Telemetry Service Agreement available from Newterra upon request).

6. CURRENCY: As per pricing page of the proposal.

7. PAYMENT TERMS:
The price to be paid by Buyer shall be mutually agreed upon by the parties and set forth in writing. Unless otherwise agreed to, prices quoted do not include any state or local sales or use tax, special fees, duties or custom fees, freight and handling charges, or export crating costs that may be added to the price at invoicing. The Buyer agrees to make payments as described herein.

Additionally, the Buyer agrees to grant to Newterra security as described below to secure the payment in full for the equipment supplied relating to this purchase order. The Buyer hereby assigns and pledges to Newterra a security interest in all of the Buyer's rights, title, and interest in the following (the "Collateral"):

i. Equipment, supplies, fittings, machinery, and other tangible personal property, wherever located, sold to Buyer by Newterra under the purchase order;
ii. The trade account receivable generated by the design, construction and installation of the equipment referenced above up to the cost of such equipment.

The Buyer represents and warrants that this agreement and the UCC Financing Statement(s) executed herewith create a valid and perfected priority security interest in the Collateral, securing the payment of amounts owing by the Buyer to Newterra. The Security interest assigned to Newterra by the Buyer is released upon payment in full for the equipment.

8. METHOD OF PAYMENT:
All orders shall be shipped C.O.D. or require payment in advance until credit has been established. Payment shall be made in the currency quoted without discount. Minimum billing amount is $100. Shipments outside of the U.S.A. and Canada shall be prepaid (by credit card, wire transfer, or cashier's check), or by an irrevocable Letter of Credit.

Processing fees may be assessed for additional costs incurred for credit card charges, returned checks, Letters of Credit, or other bank charges. Wire transfers should be initiated with all bank charges paid from the account of the Buyer. Newterra reserves the right to specify the method and/or timing of payment (including prior to shipment).

Newterra shall be entitled to a liquidated late charge calculated at a rate of 1.5% per month (18% per annum) or if lower, at the maximum rate permitted by law, for any payment not made within 10 days following the date due.

If the Buyer disputes any portion of an invoice, they shall notify Newterra in writing with specific details and pay the undisputed portion as per the executed purchase order. Buyer shall reimburse all costs incurred in collection of past due amounts including but not limited to attorney's fees, court costs and collection fees incurred by Newterra.

At Newterra's option, Letters of Credit will be accepted by Newterra when compliant with the following: The Letter of Credit must (a) Be IRREVOCABLE and CONFIRMED by a U.S.A. or Canadian bank; (b) Be in favor of Newterra; (c) State payment is by site draft payable; (d) State that ALL bank charges, including those outside the country of origin, are to be applied to BUYER'S account; (e) Must state Ex-Works, point as factory unless terms of Pro Forma Invoice specify otherwise, (f) Be advised through a class A bank and show Buyer as applicant for the Letter of Credit.

9. SHIPPING & DELIVERY TERMS:
Unless otherwise specified in the proposal, shipping incoterms are:

FCA delivery location* as per incoterms® 2020, cost of transportation and in-transit insurance will be prepaid and added to the final invoice.
*delivery location as specified in the proposal.

If a customer wishes to arrange for their own transportation, then incoterms will be FCA Newterra final manufacturing facility as per incoterms® 2020.

Equipment provided by Newterra cannot be held after completion without additional charges being paid to Newterra.

10. ACCEPTANCE:
(a) Buyer shall inspect all shipments of equipment or other goods within 10 days of receipt and shall promptly notify Newterra of any specific defects or non-conforming goods. The parties acknowledge that acceptance of any goods supplied hereunder shall be deemed to have occurred if Buyer fails to notify Newterra of any such defects or non-conforming goods within 10 days of the date of receipt. The parties acknowledge that acceptance of any services provided hereunder shall be deemed to have occurred if Buyer fails to notify Newterra of any defects or non-conformance in such services within 10 days of the date the services were completed;

(b) For any order hereunder which requires Newterra's involvement in the installation, start-up, check-out and/or commissioning of any Newterra equipment or system, the parties acknowledge that system acceptance shall be deemed to have occurred upon completion of the startup and checkout of the system, or upon beneficial use of the system by Buyer, whichever occurs first.

11. OPERATIONAL AND MAINTENANCE PROCEDURES:
Buyer acknowledges that any improper use, maintenance, or modification of the equipment provided hereunder, or use of unqualified maintenance or service technicians will severely impair the operational effectiveness of the entire system. Buyer hereby agrees to indemnify, defend and hold harmless Newterra from and against any and all third-party claims arising, in any manner, out of: (a) Buyer's neglect of the equipment; (b) Buyer's use of technicians not authorized by Newterra to service the equipment; or (c) Buyer's improper use or modification of the equipment or failure to follow the operational and maintenance procedures provided with the equipment.

12. CUSTOM EQUIPMENT OR SYSTEMS:
Buyer acknowledges that any approvals and/or listings specified in Newterra's proposal are limited to the specific scope and application set forth in the proposal and may not cover or apply to any custom or special equipment or services which are outside the scope of Newterra's proposal.

Newterra shall retain all proprietary rights to any and all technical data, designs, or other information developed by Newterra (and not provided by Buyer) in the course of designing, developing and/or manufacturing custom equipment or systems.

Programming for Newterra's custom equipment and systems is proprietary and will remain the property of Newterra and is not available for distribution to Buyer or others at any time.

13. TAXES:
All applicable Federal, State/Provincial/Local sales or use taxes and/or custom/duty taxes are not included in the prices quoted by the Seller unless otherwise specified in writing. If Seller is subjected to any such tax in connection with this sale or the delivery; the same shall be added to the purchase price and Buyer shall be responsible for paying that tax or reimbursing Seller therefore within 30 days.

14. PROPOSAL EXPIRATION:
Proposal and pricing valid for 90 days unless extended, in its sole discretion, by Newterra unless stated otherwise in the proposal.

15. DELAYS:
If the approval to proceed with ordering material is not given within 21 days of execution of this order, Newterra reserves the right to adjust the sell price of this Purchase Order based on actual increases incurred from its Suppliers due to the delay in the project schedule.

16. SYSTEM STORAGE AFTER COMPLETION:
At the Buyer's request, storage of completed systems may be provided. Upon receipt of a system storage request, Newterra will provide a quote to store the system at a nearby storage facility. The costs will include a monthly storage fee as well as the costs associated to load and unload the system at the storage yard (e.g. crane or fork truck), and financing charges for any unpaid balance that goes beyond due date of the requested storage time. The warranty period will start upon the date of notice of readiness to ship. Any invoices due for payment that are subject to the shipment of the system will be initiated and subject to payment based on the date of notice of readiness to ship.

17. OVERDUE ACCOUNTS:
Overdue accounts of the above terms are subject to a finance charge of 1.5% per month. If legal proceedings are instituted for collection of overdue accounts unpaid after 30 days, the Buyer will be liable for all costs adjudged by the court, including court costs and reasonable attorney fees.

18. CHANGE ORDERS:
Any Buyer driven change orders accepted by Newterra will be billed as follows: (1) Engineering hours billed at a rate of $150 per hour, (2) $500 administration fee plus materials and labor, and (3) all other costs associated with execution of change order, including but not limited to restocking fees, return fees, etc.

19. TECHNICAL ASSUMPTIONS:
This proposal and pricing is based on Newterra's interpretation of the sections of the RFP or specification that have been made available to Newterra. Exceptions have been noted wherever possible. In the event of a conflict between the language in the specification or the proposal, Buyer agrees that the language in the proposal takes precedence and is the basis of the proposed pricing and scope.

20. HEALTH & SAFETY:
Any health and safety requirements for entering a project site must be communicated at the time of Order. It is the Buyer/Owner's responsibility to ensure that field technicians operating on live panels are informed and equipped with the appropriate PPE.

21. INSTALLATION:
Electrical service and installation are not included unless specifically indicated in the proposal and approved in writing.

22. APPROVALS:
Local approvals and certificates are not included unless otherwise specified in the proposal.

23. SITE PERMITS & INSPECTIONS:
Obtaining any required site permits (i.e. building) is the responsibility of the Buyer/Owner; Newterra is not responsible for any such items unless otherwise specified in the proposal.

All required site inspections including, but not limited to electrical, building and fire are the responsibility of the Buyer/Owner; Newterra is not responsible for any such items.

24. WARRANTY:
Refer to separate warranty document(s) attached hereto and incorporated herein as if set forth in full

25. ENGINEERING SUBMITTAL PACKAGE:
Upon receipt of purchase order, Newterra and Buyer shall agree to a timeline for provision of engineering documentation, unless otherwise agreed to in writing.

26. BREACH:
In addition to any failure to comply with any other terms as set forth herein, the occurrence of any of the following events shall constitute a breach on the part of Buyer: (a) If Buyer shall become insolvent or make a general assignment for the benefit of creditors; (b) If a petition for Bankruptcy is filed by or against Buyer; (c) If, at any time Buyer fails to fulfill its obligations under the terms and conditions hereof, or acts in such a manner as to endanger performance of such obligations; (d) If Newterra shall reasonably believe that Buyer will not timely fulfill its obligations or otherwise perform hereunder, and Buyer is unable to provide reasonable assurances that such timely performance will occur.

Upon breach by Buyer, Newterra may terminate the contract or agreement by giving notice to the Buyer. Such termination may be effective immediately at the sole choice and discretion of Newterra. In the event of a breach and contract termination, Buyer is still responsible for all costs incurred by Newterra.

27. INDEMNIFICATION:
Each party shall defend, indemnify and hold each other's officers, directors and employees, harmless from and against any third party claims, damages or losses, including reasonable attorney's fees and costs (whether based on negligence, contract or any other legal theory), to the extent such claims, damages or losses are attributable to the negligence of each party or each party's failure to perform in accordance with the terms and conditions set forth herein and the recovering party is the prevailing party in any claim or litigation.

28. CONFIDENTIAL & PROPRIETARY INFORMATION:
Buyer acknowledges that the information and processes utilized by Newterra in the design, manufacture, and supply of its products and systems are confidential and proprietary to Newterra. Buyer agrees to treat as confidential and proprietary any such information or processes, including, but not limited to, design information or data, proposals, software, schematics, drawings, operational and maintenance manuals, testing procedures or other similar technical information ("Confidential Information") provided by Newterra in connection with the supply or installation of products or systems hereunder, and will, at a minimum, protect any such confidential Information in a manner commensurate with the measures taken to protect Buyer's own confidential or proprietary information. Newterra retains all rights, titles and interests in all such Confidential Information and Buyer shall not use or otherwise disclose to any third party any such Confidential Information except to the extent authorized by Newterra in writing.

29. INTELLECTUAL PROPERTY RIGHTS:
Excepting for the benefit of air and/or water treatment as contemplated by the design of the equipment, all rights, benefits from any value received as a result of the use of intellectual property, equipment, information or advice provided by Newterra remain the sole property of Newterra, specifically, including, but not limited to, as it may relate to carbon or water credits, etc.

Newterra retains any and all intellectual property rights in and to the equipment, services, and/or information supplied hereunder (including, but not limited to, patents, copyrights, trademarks and trade secrets) ("Intellectual Property").

Buyer is not granted any interest, right, or license with respect to any such Intellectual Property, except to use the equipment, services and/or information for the purposes for which it is specifically provided to Buyer in accordance with the terms and conditions hereof.
Newterra shall indemnify and hold Buyer harmless from and against all third-party claims of infringement or alleged infringement arising out of Buyer's use of any equipment, services, or information supplied by Newterra hereunder. Provided, however, that Newterra's indemnity obligation hereunder shall not apply to, and Newterra shall not be responsible for, any claims to the extent arising out of Buyer's modification of Newterra's equipment, services or information,

or use of such equipment, services or information: (a) in combination with equipment, services or information not supplied by Newterra, or (b) in the operation of any process or in any other manner inconsistent with the purpose for which Newterra's equipment, services or information were intended.

30. INSURANCE:
Each party shall provide and maintain at its own expense, such policies of insurance in such amounts as are appropriate and commercially reasonable for parties engaging in the type of activities contemplated by the projects entered into hereunder. Upon request, each party shall furnish the other with certificates evidencing the required insurance coverage.

31. LIENS:
Newterra shall promptly pay for all materials, supplies and labor employed by it in providing the goods and/or services hereunder, such that any equipment or system supplied to Buyer remains free of materialmen's, warehousemen's, mechanics', and any other similar liens. Newterra shall promptly discharge any such liens arising out of its performance hereunder.

32. PRESERVATION OF LIEN RIGHTS:
Newterra reserves all rights hereunder to file notice and execute liens in the event Buyer breaches it obligations in the proposal, purchase order, or as set forth herein. Any executed lien waiver, release claim, or payment application executed and submitted by Newterra shall not serve to waive Newterra's right to pursue a lien claim for previously noticed, reserved, or filed claims.

33. ASSIGNMENT:
The rights and responsibilities of Buyer as set forth herein are personal to Buyer and may not be assigned or delegated without the prior written consent of Newterra.

34. NON-WAIVER:
The parties' failure to demand strict performance or to otherwise enforce any rights hereunder shall not constitute a waiver of any rights hereunder. No claim arising out of a breach hereof may be discharged in whole or in part by a waiver of the claim unless supported by consideration and set forth in a writing signed by the waiving party. Any such waiver shall apply to the specifically identified claim only and shall in no way constitute a waiver or discharge of any other prior or subsequent claim.

35. SUSPENSION BY BUYER:
If any project or order, for which Newterra is to supply goods and/or services hereunder, is suspended by Buyer for any reason other than a breach by Newterra, Newterra shall take all reasonable measures to cooperate with Buyer in rescheduling any planned or ongoing work, and in otherwise complying with the suspension instructions. Provided, however, that in the event of any such suspension which continues for a period of 90 days, Newterra shall be entitled to terminate that order, without any further liability or obligation thereunder. Provided, further, that Newterra shall be entitled to prompt reimbursement from Buyer per Cancellation/Termination clause below.

36. CANCELLATION/TERMINATION:
Purchaser reserves the right at any time without cause to terminate or cancel all or part of any undelivered or unperformed portion of this Purchase Order by notice to Seller. Upon receipt of such notice, Seller shall immediately stop delivery or work on the portion of the order terminated or canceled. In the event of such termination or cancellation, Purchaser shall be liable for the value of the work performed, materials received, and any materials not received that cannot be cancelled, prior to the time that notice of termination is given. If any project or order, for which Newterra is to supply goods and/or services hereunder, is terminated in agreement with the provisions of these terms and conditions, Newterra shall be entitled to charge 25% of selling price if canceled prior to incurring related engineering, drafting, and production time. Additional costs incurred as a direct result of termination may include, but are not limited to, freight and storage charges, costs of labor, and transportation.

37. APPLICABLE LAW / DISPUTES:
Buyer acknowledges that the "Terms" from the Contract are deemed to be made in Pennsylvania for transactions in the U.S.A. and in Ontario for transactions in Canada, and that Buyer, in relation to this project, is deemed to be transacting business in Pennsylvania (U.S.A. transactions) and Ontario (Canadian transactions). It is the expectation of the parties that any disputes arising hereunder, whether in contract, tort or otherwise, will be amicably resolved by mutual agreement of the parties.

Any dispute, involving the supply of goods or services within the U.S.A. or Canada, which cannot be amicably resolved by the parties, shall be submitted to binding arbitration in accordance with the applicable rules and regulations of the American Arbitration Association for U.S.A contracts or the Canadian Arbitration Association for Canadian contracts. The substantive law of Pennsylvania for U.S.A. contracts or Ontario for Canadian contracts shall apply to any such arbitration, which shall be conducted in Philadelphia, Pennsylvania (U.S.A. contracts) or Ottawa, Ontario (Canadian contracts).

Nothing herein shall be construed as preventing Seller from enforcing any claim or right to a mechanic's lien or any claim or right against a bond regardless of where such a claim must be filed or enforced.

38. FORCE MAJEURE:
Neither party shall be liable for any cost increase, failure or delay in its performance resulting from any cause beyond its reasonable control including, but not limited to, acts of God; acts or omissions of civil or military authority; fires; floods; unusually severe weather; strikes or other labor disputes; embargoes; wars; political strife; riots; epidemic; pandemic; changes in laws, delays in transportation; sabotage; or fuel, power, material or labor shortages.

39. INTEGRATION / MODIFICATION:
Except as otherwise specifically set forth herein, these terms and conditions are intended by both Buyer and Newterra as the final and exclusive integrated expression of their agreement with

respect to any projects or orders subject hereto. No additions to or modifications of any of the terms or conditions herein shall be effective unless set forth in a writing duly executed by both parties.

40. CONSTRUCTION:
If these terms and conditions have been provided in response to an invitation to bid or other solicitation from Buyer, and the provisions set forth herein differ in any way from the provisions (if any) of Buyer's invitation or solicitation, these terms and conditions shall constitute Newterra's binding counteroffer upon the Buyer's decision to order from Newterra. If these terms and conditions constitute a counteroffer, acceptance hereof must be on the exact terms contained herein. Any additional, conflicting or different terms proposed by Buyer shall constitute a counteroffer by Buyer and shall not be effective unless set forth in a mutually agreed upon writing executed by both parties.

41. RETURNED GOODS:
No equipment shall be returned to Seller without its prior written authorization. All returns due to unwanted products or Buyer error will be assessed a minimum 25% restocking charge, based on the original invoice amount (shipping charges will be borne by the Buyer).

The Buyer will be credited the full invoice amount, including return shipping charges, if the original shipment was Newterra's error. To obtain specific performance under this warranty, the defective product must be returned to Newterra together with proof of purchase, installation date, failure date, supporting technical data, and documentation supporting the warranty claim.

Any defective product to be returned to a Newterra factory or service center must be sent Freight Prepaid. Buyers desiring to return product should contact our Customer Service Department at 1-800-420-4056 to obtain a Return Authorization (RA) number and a Return Material Tag (RMT). Each carton must be visibly marked with the RA number and have the RMT tag (RMT) in the packing list pouch and shipped via ground transport to: The Newterra facility indicated on the Return Authorization form.

The following applies to returns: (a) Cartons that are not marked with the RA number or do not have the RMT tag in the packing list pouch will be returned to the sender, unopened; (b) The appropriate credit will be issued upon verification of the age and condition of the product returned; (c) Customized products cannot be returned for credit unless it is identified that Newterra shipped the order in error; (d) Return of products not manufactured by Newterra will be subject to the original manufacturer's return to stock policy; (e) Newterra will not accept C.O.D. return shipments; (f) A return authorization will become null and void if equipment is not received by Newterra within 30 days of the date of issue. Claims for error in quantity or condition must be made within 10 days of receipt of the material. Newterra will not be responsible for any claimed shortages not reported within 10 days.

42. LIMIT TO LIABILITY:
Under no circumstances whatsoever will Newterra be responsible for liquidated, indirect, special, incidental or consequential damages including, but not limited to, lost business, overhead, loss of use of property, delay, damages, lost profits or third party claims, whether foreseeable or not, even if Newterra has been advised of the possibility of such damages in connection with the delivery, installation, use or performance of the equipment or the provision of maintenance services by Newterra regardless of whether such claims are alleged to have arisen out of breach of warranty, breach of contract, stricter absolute liability in tort, or other act, error or omission or any other cause whatsoever, or any combination of the foregoing.

Under no circumstances whatsoever will Newterra be responsible for direct damages in excess of 15% of the contract value.

43. HOLDBACK:
Newterra reserves the exclusive right to provide an irrevocable letter of credit in lieu of any holdback amount.

IN WITNESS WHEREOF, the Buyer hereby agrees and accepts these Terms and Conditions.

The customer authorizes Newterra to proceed with ordering the long lead parts per section 3 of these terms and conditions.

☐ Yes ☐ No

Company: ______________________________

Signature: ______________________________

Name (print): ______________________________

Title: ______________________________

Date: ______________________________

Appendix G

RIDEM Request to Inspect And/or Copy Public Records

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF CUSTOMER & TECHNICAL ASSISTANCE
235 Promenade Street, 2nd Floor
Providence, Rhode Island 02908
Tel: (401) 222-4700 Fax: (401) 222-3810
DEM.Filereview@dem.ri.gov

REQUEST TO INSPECT AND/OR COPY PUBLIC RECORDS

Under the *Access to Public Records Act*, R.I.Gen. Laws §§ 38-2-1 et seq.

Request to Inspect Records: ☐ Request to Obtain Copies: ■ Walk-in ☐

REQUESTOR'S INFORMATION: (OPTIONAL)

NAME: Laura Marcolini
ADDRESS: 317 Iron Horse Way Ste 204, Providence, RI 02908
TELEPHONE NO: (845) 452-6801
EMAIL: LMarcolini@fando.com

RECORDS REQUESTED:

SITE/OWNER NAME	SITE ADDRESS	CITY	SITE TYPE/TYPE OF FILE	ASSESSOR'S PLAT/LOT (IF APPLICABLE)	SITE ID NO. (IF APPLICABLE)
Coventry High School	40 Reservoir Road	Coventry	Design Criteria	0035-014.000	3287

ADDITIONAL NOTES:

Request for all information related to record drawings, equipment, and design criteria for the onsite waste water treatment system for Coventry High School.

IS THE SUBJECT MATTER OF THIS REQUEST CURRENTLY IN LITIGATION? YES ☐ NO ☐

FORMAT REQUESTED: PAPER ☐ ELECTRONIC ■ FACSIMILE ☐

FEES: For applicable fees, please see DEM's Public Records Request Guidelines.

By making records available for review and/or copying, the Department does not waive any rights that it may have, or may assert, regarding their admissibility or the use of their contents in any pending or future proceeding pursuant to rules of discovery or evidence as may be applicable in such proceeding.

SIGNATURE: ______________________ (Optional)
DATE: 4/6/2023

OFFICE USE ONLY

No. of Copies: ________ *No. of Large Copies:* ________ *Fee Received by:* ________ *Received: $*________ *Cash* ☐ *Check* ☐

Department of Environmental Management
Office of Customer & technical assistance
235 Promenade Street, 2nd Floor
Providence, Rhode Island 02908
Tel: (401) 222-4700 Fax: (401) 222-3810
DEM.Filereview@dem.ri.gov

Requestor: ______________________________ Page______of_______

Site/owner Name	Site Address	City	Site type/type of file	Assessor's plat/lot (if applicable)	Site Id No. (if applicable)

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF CUSTOMER & TECHNICAL ASSISTANCE
235 Promenade Street, 2nd Floor
Providence, Rhode Island 02908
Tel: (401) 222-4700 Fax: (401) 222-3810
DEM.Filereview@dem.ri.gov

PUBLIC RECORDS REQUEST GUIDELINES

The Department of Environmental Management has instituted the following procedures to help you obtain public records.

1. All public record requests or inquiries should be forwarded to the Keeper of Records, Department of Environmental Management, Office of Customer & Technical Assistance, 235 Promenade Street, Providence, Rhode Island 02908 or by telephone at (401) 222-4700 ext. 7307 or by email at DEM.Filereview@dem.ri.gov.

2. The regular business hours of the Department are Monday through Friday 8:30 a.m. to 4:00 p.m.

3. In order to ensure that you are provided with the public records you seek in an expeditious manner, we ask you to complete the Public Records Request Form located at the front desk, or on our website.

4. Please be advised that the Access to Public Records Act allows a public body ten (10) business days to respond, which can be extended an additional twenty (20) business days for "good cause." We appreciate your understanding and patience.

5. STATEMENT OF FEE FOR RETRIEVAL AND/OR COPYING:
The cost per copied page of written public documents will be $.15 for documents that may be copied on common business or legal size paper. You may elect to obtain public records in any and all media in which we are capable of providing them. The Access to Public Records Act permits a charge for search and retrieval of documents not to exceed fifteen ($15.00) per hour, with no charge for the first hour. For purposes of calculating search and retrieval time, multiple requests received from the same person or entity within a thirty (30) day period shall be considered as one request. In addition, the entity accessing public records shall be assessed additional fees if the Department is assessed a retrieval fee in order to retrieve records from storage, is required to redact records, and/or the actual cost of delivery if delivery is requested. If your request requires a charge to be assessed, the Department upon request will provide you with an estimate. Upon a request, the Department will provide a detailed itemization of the costs charged for search and retrieval. Copies on paper larger than 8.5" x 14" or made available on media different than that on which the information is stored, will be charged at the actual production and/or reproduction cost.

6. You may also obtain a copy of the Attorney General's Guide to Open Government, which can be found at http://www.riag.ri.gov/civil/opengovernment.

7. If you feel that you have been denied access to public records, you have the right to file a review petition with the Director of the Department of Environmental Management. If you are still not satisfied, you may seek further review from the Department of the Attorney General or file a lawsuit in Superior Court.

8. The Department of Environmental Management is committed to providing you with public records in an expeditious and courteous manner.

Revised October 2015

Appendix B

RIPDES Permit No. RIO100153

AUTHORIZATION TO DISCHARGE UNDER THE
RHODE ISLAND POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of Chapter 46-12 of the Rhode Island General Laws, as amended,

The Town of West Warwick

is authorized to discharge from a facility located at

West Warwick Wastewater Treatment Facility
1 Pontiac Avenue
West Warwick, Rhode Island

to receiving waters named

Pawtuxet River

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective January 1, 2020.

This permit and the authorization to discharge expire at midnight, five (5) years from the effective date.

This permit supersedes the permit issued on September 30, 2008.

This permit consists of 25 pages in Part I including effluent limitations, monitoring requirements, etc. and 10 pages in Part II including General Conditions.

Signed this 30th day of September, 2019.

Angelo S. Liberti

Angelo S. Liberti, P.E., Administrator of Surface Water Protection
Office of Water Resources
Rhode Island Department of Environmental Management
Providence, Rhode Island

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. During the period beginning on the effective date and lasting through permit expiration, the permittee is authorized to discharge from outfall serial number(s) 001A. Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations					Monitoring Requirement	
	Quantity - lbs./day		Concentration - specify units				
	Average Monthly	Maximum Daily	Average Monthly *(Minimum)	Average Weekly *(Average)	Maximum Daily *(Maximum)	Measurement Frequency	Sample Type
Flow	11.0 MGD	--- MGD				Continuous	Recorder
$CBOD_5$							
(Nov 1-May 31)	2,294 lb/day	4,128 lb/day	25 mg/l	40 mg/l	45 mg/l	1/Day	24-Hr. Comp.
(June 1-June 30 & Oct. 1-Oct. 31)	1,314 lb/day	1,751 lb/day	15 mg/l	15 mg/l	20 mg/l	1/Day	24-Hr. Comp.
(July 1 – Sept. 30)	876 lb/day	1,314 lb/day	10 mg/l	10 mg/l	15 mg/l	1/Day	24-Hr. Comp.
$CBOD_5$ - % Removal			85%			1/Month	Calculated
TSS							
(Nov 1-May 31)	2,627 lb/day	4,379 lb/day	30 mg/l	45 mg/l	50 mg/l	1/Day	24-Hr. Comp.
(June 1-June 30 & Oct. 1-Oct. 31)	2,189 lb/day	2,627 lb/day	25 mg/l	25 mg/l	30 mg/l	1/Day	24-Hr. Comp.
(July 1 – Sept. 30)	1,751 lb/day	2,627 lb/day	20 mg/l	20 mg/l	30 mg/l	1/Day	24-Hr. Comp.
TSS - % Removal			85%			1/Month	Calculated
Settleable Solids				--- ml/l	--- ml/l	1/Day	Grab

--- Signifies a parameter which must be monitored and data must be reported; no limit has been established at this time.

Influent sampling for TSS and $CBOD_5$ shall be conducted three (3) times/week and coordinated with effluent sampling to provide appropriate allowances for hydraulic detention (flow-through) time.

Sampling for TSS and $CBOD_5$ shall be performed five (5) times/week, Sunday – Saturday. One (1) of the TSS samples shall be collected on either Saturday or Sunday. Sampling for Flow and Settleable Solids shall be performed Sunday-Saturday.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location: Outfall 001A.

A. **EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS**

2. During the period beginning on the effective date and lasting through permit expiration, the permittee is authorized to discharge from outfall serial number(s) 001A. Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations					Monitoring Requirement	
	Quantity - lbs./day		Concentration - specify units				
	Average Monthly	Maximum Daily	Average Monthly *(Minimum)	Average Weekly *(Average)	Maximum Daily *(Maximum)	Measurement Frequency	Sample Type
Enterococci			54 cfu[1] / 100 ml		175 cfu[1] / 100 ml	3/Week	Grab
Fecal Coliform			--- MPN[1] / 100 ml	--- MPN[1] / 100 ml	--- MPN[1] / 100 ml	3/Week	Grab
UV Intensity[2]			(--- mw/cm^2)	(--- mw/cm^2)	(--- mw/cm^2)	Continuous	Recorder
UV Transmittance[2]			(--- %)	(--- %)	(--- %)	Continuous	Recorder
UV Dosage[2]			(---$mw\text{-}s/cm^2$)[3]	(---$mw\text{-}s/cm^2$)[3]	(---$mw\text{-}s/cm^2$)[3]	Continuous	Recorder
pH			(6.0 SU)		(9.0 SU)	2/Day	Grab
Dissolved Oxygen (June 1 –Oct. 31)			(6.0 mg/l)			Continuous	Recorder

[1]Two (2) of the three (3) Enterococci and Fecal coliform samples are to be taken Tuesday and Thursday. The Fecal Coliform samples shall be taken at the same time as the Enterococci samples. The Geometric Mean shall be used to obtain the “weekly average” and "monthly average." The facility shall report any fecal coliform sample result that exceeds 400 MPN/100 mL to the RI DEM in accordance with the 24-hour reporting requirements under Part II(l)(5) of the permit.

[2]UV Intensity, Transmittance, and Dosage readings shall be recorded continuously to provide a record that proper disinfection was achieved at all times.

[3]UV Dosage is defined as the UV Intensity (mW/cm^2) multiplied by the Exposure Time (s).

*Values in parentheses () are to be reported as Minimum/Average/Maximum for the reporting period rather than Average Monthly/Average Weekly/Maximum Daily.

Sampling for DO, pH, UV Intensity, UV Transmittance, and UV Dosage shall be performed Sunday – Saturday.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location: Outfall 001A.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

3. During the period beginning on the effective date and lasting through permit expiration, the permittee is authorized to discharge from outfall serial number(s) 001A. Such discharges shall be monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations: Quantity - lbs. per day: Average Monthly	Quantity - lbs. per day: Maximum Daily	Concentration - specify units: Average Monthly	Concentration - specify units: Average Weekly	Concentration - specify units: Maximum Daily	Monitoring Requirement: Measurement Frequency	Monitoring Requirement: Sample Type
Phosphorus, Total							
(Nov.1 – March 31)			1.0 mg/l		--- mg/l	1/Week	24-Hr. Comp.
(April 1 – Oct. 31)			0.1 mg/l		--- mg/l	1/Week	24-Hr. Comp.
Orthophosphorus							
(Nov. 1 – March 31)			--- mg/l		--- mg/l	1/Week	24-Hr. Comp.
Ammonia, Total (as N)							
(Nov. 1 – April 30)			13.5 mg/l	--- mg/l	60.4 mg/l	1/Week	24-Hr. Comp.
(May 1 – May 31)			5.2 mg/l	--- mg/l	61.0 mg/l	1/Week	24-Hr. Comp.
(June 1 - Oct. 31)			2.0 mg/l	2.0 mg/l	3.0 mg/l	1/Week	24-Hr. Comp.
Nitrogen, Total (TKN + Nitrate + Nitrite, as N)							
(Nov. 1 – April 30)[1]	--- lb/d		--- mg/l		--- mg/l	2/Month	Calculated
(May 1 - Oct. 31)	701 lb/d		7.6 mg/l		--- mg/l	1/Week	Calculated

--- Signifies a parameter which must be monitored and data must be reported; no limit has been established at this time.

[1]The permittee shall operate the treatment facility to reduce the discharge of total nitrogen, during the months of November through April, to the maximum extent possible using all available treatment equipment in place at the facility, except methanol addition.

Samples taken in compliance with the monitoring requirements specified above shall be taken Monday through Friday at the following locations: Outfall 001A.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

4. During the period beginning on the effective date and lasting through permit expiration, the permittee is authorized to discharge from outfall serial number(s) 001A. Such discharges shall be monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations					Monitoring Requirement	
	Quantity - lbs. per day		Concentration - specify units				
	Average Monthly	Maximum Daily	Average Monthly	Average Weekly	Maximum Daily	Measurement Frequency	Sample Type
TKN							
(Nov. 1 – April 30)			--- mg/l		--- mg/l	2/Month	24-Hr. Comp.
(May 1 - Oct. 31)			--- mg/l		--- mg/l	1/Week	24-Hr. Comp.
Nitrate, Total (as N)							
(Nov. 1 – April 30)			--- mg/l		--- mg/l	2/Month	24-Hr. Comp.
(May 1 - Oct. 31)			--- mg/l		--- mg/l	1/Week	24-Hr. Comp.
Nitrite, Total (as N)							
(Nov. 1 – April 30)			--- mg/l		--- mg/l	2/Month	24-Hr. Comp.
(May 1 - Oct. 31)			--- mg/l		--- mg/l	1/Week	24-Hr. Comp.

--- Signifies a parameter which must be monitored and data must be reported; no limit has been established at this time.

Samples taken in compliance with the monitoring requirements specified above shall be taken Monday through Friday at the following locations: Outfall 001A.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

5. During the period beginning on the effective date and lasting through permit expiration, the permittee is authorized to discharge from outfall serial number(s) 001A. Such discharges shall be monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations: Quantity - lbs. per day: Average Monthly	Quantity - lbs. per day: Maximum Daily	Concentration - specify units: Average Monthly	Concentration: Average Weekly	Concentration: Maximum Daily	Monitoring Requirement: Measurement Frequency	Monitoring Requirement: Sample Type
Lead, Total			0.34 µg/l[1]		8.7 µg/l	1/ Week	24-Hr. Comp.
Aluminum, Total			119 ug/l		1026 µg/l	See Footnote 3	24-Hr. Comp.
Iron, Total			1444 ug/l		--- ug/l	See Footnote 3	24-Hr. Comp.
Cyanide			--- µg/l		--- µg/l	1/ Quarter	Composite[2]
Cadmium, Total			--- µg/l		--- µg/l	1/ Quarter	24-Hr. Comp.
Copper, Total			--- µg/l		--- µg/l	1/ Quarter	24-Hr. Comp.
Hexavalent Chromium			--- µg/l		--- µg/l	1/ Quarter	24-Hr. Comp.
Nickel, Total			--- ug/l		--- µg/l	1/ Quarter	24-Hr. Comp.
Zinc, Total			--- µg/l		--- µg/l	1/ Quarter	24-Hr. Comp.

--- Signifies a parameter which must be monitored and data must be reported; no limit has been established at this time.

[1] The limit at which compliance/noncompliance determinations will be based is the quantitation limit which is defined as 3.0 µg/l for Lead. These values may be reduced by permit modification as EPA and the State approve more sensitive methods.

[2] Compliance with these limitations shall be determined by taking three grab samples per day, equally spaced over one (1) day with a minimum of three hours between grabs, and preserved immediately upon collection. All three (3) samples shall be composited, then analyzed for available cyanide.

[3] Weekly sampling for Total Iron and/or Total Aluminum is only in effect during months in which Iron based and/or Aluminum based coagulation chemicals are used in the treatment process. For all other periods sampling is only required for Total Aluminum on a quarterly basis in accordance with Part I.B of this permit.

Samples taken in compliance with the monitoring requirements specified above shall be taken Monday through Friday at the following locations: Outfall 001A.

A. **EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS**

6. During the period beginning on the effective date and lasting through permit expiration, the permittee is authorized to discharge from outfall serial number(s) 001A. Such discharges shall be monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations					Monitoring Requirement	
	Quantity - lbs. per day		Concentration - specify units				
	Average Monthly	Maximum Daily	Average Monthly	Average Weekly	Maximum Daily	Measurement Frequency	Sample Type
Ceriodaphnia sp.							
LC50[1]					100% or Greater[2]	1/Quarter	24-Hr. Comp.
C-NOEC[3]					50% or Greater[4]	1/Quarter	24-Hr. Comp.
Pimephales promelas							
LC50[1]					100% or Greater[2]	1/Quarter	24-Hr. Comp.

[1]LC_{50} is defined as the concentration of wastewater that causes mortality to 50% of the test organisms.

[2]The limit of 100% or greater is defined as a sample which is composed of 100% effluent.

[3]Chronic – No Observed Effects Concentration (C-NOEC) is the concentration of toxicant or effluent to which organisms are exposed in a life-cycle or partial life-cycle which causes no adverse effect on growth, survival or reproduction (see Section I.B.).

[4]The limit of 50% or greater is defined as a sample which is composed of 50% effluent.

--- Signifies a parameter which must be monitored and data must be reported; no limit has been established at this time.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following locations: at Outfall 001A in accordance with Part I.B. of the permit.

7. a. The pH of the effluent shall not be less than 6.0 nor greater than 9.0 standard units at any time, unless these values are exceeded due to natural causes or as a result of the approved treatment processes.

b. The discharge shall not cause visible discoloration of the receiving waters.

c. The effluent shall contain neither a visible oil sheen, foam, nor floating solids at any time.

d. The permittee's treatment facility shall maintain a minimum of 85 percent removal of both total suspended solids and 5-day biochemical oxygen demand. The percent removal shall be based on monthly average values.

e. When the effluent discharged for a period of 90 consecutive days exceeds 80 percent of the designed flow, the permittee shall submit to the permitting authorities a projection of loadings up to the time when the design capacity of the treatment facility will be reached, and a program for maintaining satisfactory treatment levels consistent with approved water quality management plans.

f. The permittee shall analyze its effluent annually for the EPA Priority Pollutants as listed in 40 CFR 122, Appendix D, Tables II and III. Such analysis shall be conducted during the third calendar quarter bioassay sampling event. The effluent sample shall be collected during the same twenty-four (24) hour period as the bioassay sample. The results of these analyses shall be submitted to the Department of Environmental Management by October 15th of each year. All sampling and analysis shall be done in accordance with EPA Regulations, including 40 CFR, Part 136; grab and composite samples shall be taken as appropriate.

g. This permit serves as the State's Water Quality Certificate for the discharges described herein.

h. This permit authorizes the use of chorine disinfection only for emergency purposes in accordance with the Bypass and Upset provisions from Part II of the permit. Any emergency uses of chlorination shall be in accordance with the facility's Operation and Maintenance Manual and shall be reported on the cover letter to the DMRs. The chlorination usage reporting must include the reason why chorine was used, the duration of its use, and sampling/analytical data.

B. BIOMONITORING REQUIREMENTS AND INTERPRETATION OF RESULTS

1. General

Beginning on the effective date of the permit, the permittee shall perform eight (8) toxicity tests per year on samples collected from discharge Outfall 001A. The permittee shall conduct the tests during dry weather periods (no rain within forty-eight (48) hours prior to or during sampling unless approved by DEM) according to the following test frequency and protocols. Chronic and acute toxicity data shall be reported as outlined in Section B.9. The acute fish and chronic daphnid tests shall be used to calculate the acute LC_{50} at the forty-eight (48) hour exposure interval. Test results will be interpreted by the State. The State may require additional screening, range finding, definitive acute or chronic bioassays as deemed necessary based on the results of the initial bioassays required herein. Indications of toxicity could result in requiring a Toxicity Reduction Evaluation (TRE) to investigate the causes and to identify corrective actions necessary to eliminate or reduce toxicity to an acceptable level.

2. Test Frequency

For four (4) sampling events, (one each calendar quarter) the permittee will conduct a forty-eight (48) hour acute definitive toxicity test on one (1) species and a seven day chronic toxicity tests on one (1) species listed below, for a total of four (4) acute and four (4) chronic toxicity tests per year. This requirement entails performing two-species testing as follows:

Species	Test Type Two Species Test (Four Times Annually)	Frequency
Daphnid (Ceriodaphnia sp.)	Reproduction/Survival Acute Static (LC_{50})	Quarterly
Fathead Minnow (Pimephales promelas)	Survival Acute Static (LC_{50})	Quarterly

A sampling event is defined as three (3) 24-hour composites collected over the seven-day test period (see Section B.4).

3. Testing Methods

Toxicity testing shall be conducted in accordance with protocols listed in 40 CFR Part 136.

4. Sample Collection

For each sampling event a twenty-four (24) hour flow proportioned composite effluent sample shall be collected at a location just prior to the outfall during a dry weather period (no rain 48 hours prior to or during sampling unless approved by DEM). For each sampling event, the effluent samples shall be collected on days 0, 3, and 5 of the 7-day exposure period. The first sample is used for test initiation, Day 1, and for test solution renewal on Day 2. The second sample would be used for test solution renewal on Days 3 and 4. The third sample would be used for test solution renewal on Days 5, 6, and 7.

To eliminate the problem of potential rainfall interference during the five-day sampling period for the chronic tests, DEM suggests collecting enough sample on Day 0 to properly store and use one-third on both Days 3 and 5 if rain has occurred since Day 0. In addition, if no rainfall has occurred since Day 3, enough sample should also be collected on Day 3 to use for Day 5 if necessary. In the laboratory, the initial sample (Day 0) will be split into two (2) subsamples, after thorough mixing, for the following:

A: Chemical Analysis
B: Chronic Toxicity Testing

Day 3 and 5 samples will be held until test completion. If either the Day 3 or 5 renewal sample is of sufficient potency to cause lethality to 50% or more test organisms in any of the dilutions for either species, then a chemical analysis shall be performed on the appropriate samples as well.

All samples held overnight shall be refrigerated at 4°C.

5. Dilution Water

Dilution water used for freshwater acute and chronic toxicity analyses should be of sufficient quality to meet minimum acceptability of test results (see Sections B.6 and B.7). The West Warwick WWTF is authorized to use laboratory water of known quality with a hardness and pH similar to that of the receiving water as an alternate dilution water source for the Fathead Minnow test. The DEM reserves the right to revoke this authorization at any time and may immediately require the permittee to use Pawtucket Reservoir water as a diluent as DEM deems necessary. If such a determination is made it will be provided in writing to the permittee. For the Daphnid, natural freshwater shall be used as the dilution water. This water shall be collected from Pawtucket Reservoir. If this natural freshwater diluent is found to be, or suspected to be toxic or unreliable, an alternate or laboratory source of water of known quality with a hardness and pH similar to that of the receiving water may be substituted AFTER RECEIVING WRITTEN APPROVAL FROM RIDEM.

6. Effluent Toxicity Test Conditions for the Daphnid (Ceriodaphnia dubia sp.) Survival and Reproduction Test

a.	Test Type	Static Renewal
b.	Temperature (C)	25° ± 1° C (temperature must not deviate by more than 3° C during test)
c.	Light Quality	Ambient laboratory illumination
d.	Photoperiod	16 hours light, 8 hours dark
e.	Test Chamber Size	30 ml
f.	Test Solution Volume	15 ml
g.	Renewal of Test Solutions	Daily, using most recently collected sample.
h.	Age of Test Organisms	Less than twenty-four (24) hours and all released within an eight (8) hour period of each other.
i.	Number of Neonates Per Test Chamber	1
j.	Number of Replicate Test Chambers Per Treatment	10
k.	Number of Neonates Per Test Concentration	10
l.	Feeding Regime	Feed 0.1 ml each of YTC and algal suspension per exposure chamber daily
m.	Aeration	None
n.	Dilution Water	Pawtucket Reservoir, see Section B.5

o.	Effluent Concentrations	Five (5) dilutions plus a control: 100%, 50%, 25%, 12.5%, 6.25% and 0% effluent
p.	Test Duration	Until 60% of control females have three (3) broods (may require seven (7) days; max 8 days)
q.	End Points	Survival and reproduction
r.	Test Acceptability	80% or greater survival of control organisms and an average of fifteen (15) or more neonates per female in the control solutions. At least 60% of surviving females in control should have produced three broods
s.	Sampling Requirements	For off-site tests, a minimum of three (3) samples are collected (i.e., Days 0, 3 & 5) and used for renewal (see Section B.4). Off-site test samples must be first used within thirty-six (36) hrs after the last sample of composite is collected
t.	Sample Volume Required	Minimum 2 liters/day

7. Effluent Toxicity Conditions for the Fathead Minnow (Pimephales promelas)[1] Mortality Test

a.	Test Type	48-hour Static Acute Definitive
b.	Temperature	$25^\circ \pm 1^\circ$C (temperature must not deviate by more than 3° C during test)
c.	Light Quality	Ambient laboratory illumination
d.	Photoperiod	16 hours light, 8 hours dark
e.	Test Chamber Size	250-1000 ml
f.	Test Solution Volume	Minimum 200 ml/replicate
g.	Renewal of Test Solution	After 48 hrs
h.	Age of Organisms	1 - 14 Days; less than 24h range in age
i.	No. Organisms Per Test Chamber	10
j.	No. of Replicate Test Chambers Per Concentration	2
k.	Total No. of Organisms Per Test Concentration	20

l.	Feeding Regime	Feed Artemia nauplii prior to the test; add 0.2 mL Artemia nauplii concentrate 2h prior to test solution renewal at 48h
m.	Aeration	None, unless DO concentration falls below 4.0 mg/L at which aeration rate should not exceed 100 bubbles/min
n.	Dilution Water	laboratory water of known quality with a hardness and pH similar to that of the receiving water. see Section B.5
o.	Number of Dilutions	Five dilutions plus a control: 100%, 50%, 25%, 12.5%, 6.25% and 0% effluent
p.	Effect Measured and Test Duration	Mortality - no movement, 48-hour LC_{50} and NOAEL
q.	Test Acceptability	90% or greater survival of test organisms in control solution
r.	Sampling Requirements	Samples are collected and used within 36 hours after the last sample of the composite is collected
s.	Sample Volume Required	Minimum 2 liters

[1]Adapted from EPA-821-R-02-012

8. Chemical Analysis

The following chemical analysis shall be performed for every two-specie sampling event.

Parameter	Effluent	Diluent	Detection Limit (mg/l)
Hardness	X	X	0.5
Alkalinity	X	X	2.0
pH	X	X	---
Specific Conductance	X	X	---
Total Solids and Suspended Solids	X	X	---
Total Ammonia	X	X	0.1
Total Organic Carbon	X		0.5
Cyanide	X		0.010

During each calendar quarter bioassay sampling events the following chemical analyses shall be performed:

Total Metals	Effluent	Diluent	Minimum Detection Limit (ug/l)
Total Aluminum	X	X	5.0
Total Cadmium	X	X	0.1
Total Copper	X	X	1.0
Hexavalent Chromium	X	X	20.0
Total Lead	X	X	1.0
Total Nickel	X	X	1.0
Total Zinc	X	X	5.0

The above metal analyses may be used to fulfill, in part or in whole, monthly monitoring requirements in the permit for these specific metals.

During the third calendar quarter bioassay sampling event, the final effluent sample collected during the same twenty-four (24) hour period as the bioassay sample, shall be analyzed for priority pollutants (as listed in Tables II and III of Appendix D of 40 CFR 122). The bioassay priority pollutant scan shall be a full scan and may be coordinated with other permit conditions to fulfill any priority pollutant scan requirements.

In addition, the following chemical analyses shall be performed as part of each daily renewal procedures on each dilution and the controls.

Parameter	Beginning of 24-Hour Exposure Period	End of 24-Hour Exposure Period
Dissolved Oxygen	X	X
Temperature	X	
pH	X	
Specific Conductance	X	
Alkalinity	X[1]	
Hardness	X[1]	

[1]These are performed on the 100% effluent and control samples only.

9. Toxicity Test Report Elements

A report of results will include the following:

- Description of sample collection procedures and site description.
- Names of individuals collecting and transporting samples, times, and dates of sample collection and analysis.

- General description of tests: age of test organisms, origin, dates and results of standard toxicant tests (quality assurance); light and temperature regime; dilution water description; other information on test conditions if different than procedures recommended.

- Raw data and laboratory sheets.

- Any other observations or test conditions affecting test outcome.

- Results of required chemical and physical analyses.

Toxicity test data shall include the following:

<u>Chronic</u>

- Daily survival of test organisms in the controls and all replicates in each dilution. Survival data should be analyzed by Fisher's Exact Test prior to analysis of reproduction data.

- Young per female for all replicates in each dilution for <u>Ceriodaphnia</u> and weight for minnow larvae.

- Dissolved oxygen, pH, specific conductance and temperature for each dilution.

- Results of Dunnett's Procedure and/or other EPA recommended or approved methods for analyzing the data.

- C-NOEC = Chronic No Observed Effect Concentration

- LOEC = Lowest Observed Effect Concentration

- MATC = Maximum Allowable Toxicant Concentration

<u>Acute</u> - (These data points are to be obtained 48 hours into the chronic test).

- Survival for each concentration and replication at time 24 and 48 hours.

- Dissolved oxygen, pH and specific conductance for each concentration.

- LC_{50} and 95% confidence limits using one of the following methods in order of preference: Probit, Trimmed Spearman Karber, Moving Average Angle, or the graphical method; printout or copy of these calculations. The Probit, Trimmed Spearman Karber and Moving Average Angle methods of analyses can only be used when mortality of some of the test organisms are observed in at least two (2) of the (% effluent) concentrations tested (i.e., partial mortality). If a test results in a 100% survival and 100% mortality in adjacent treatments ("all or nothing" effect), a LC_{50} may be estimated using the graphical method.

10. Reporting of Bioassay Testing

Bioassay Testing shall be conducted as follows:

Quarter Testing to be Performed	Results Submitted on DMR for
January 1 - March 31	March
April 1 - June 30	June
July 1 - September 30	September
October 1 - December 31	December

Reports shall be maintained by the permittee and shall be made available upon request by RIDEM.

C. INDUSTRIAL PRETREATMENT PROGRAM

1. Definitions

For the purpose of this permit, the following definitions apply.

a. 40 CFR 403 and sections thereof refer to the General Pretreatment regulations, 40 CFR Part 403 as revised.

b. Categorical Pretreatment Standards mean any regulation containing pollutant discharge limits promulgated by the USEPA in accordance with section 307(b) and (c) of the Clean Water Act(33 USC 1251), as amended, which apply to a specific category of industrial users and which appears in 40 CFR Chapter 1, subchapter N.

c. Pretreatment Standards include all specific prohibitions and prohibitive discharge limits established pursuant to 40 CFR 403.5, including but not limited to, local limits, and the Categorical Pretreatment Standards.

d. Regulated Pollutants shall include those pollutants contained in applicable categorical standards and any other pollutants listed in the Pretreatment Standards which have reasonable potential to be present in an industrial user's effluent.

2. Implementation

The authority and procedures of the Industrial Pretreatment Program shall at all times be fully and effectively exercised and implemented, in compliance with the requirements of this permit and in accordance with the legal authorities, policies, procedures and financial provisions described in the permittee's approved Pretreatment Program and Sewer Use Ordinance, the Rhode Island Pretreatment Regulations and the General Pretreatment Regulations 40 CFR 403. The permittee shall maintain adequate resource levels to accomplish the objectives of the Pretreatment Program.

3. Local Limits

Pollutants introduced into POTWs by a non-domestic source (user) shall not: pass through the POTW, interfere with the operation or performance of the works, contaminate sludge as to adversely effect disposal options, or adversely effect worker safety and health.

a. The permittee has an approved Local Limits Monitoring Plan (LLMP) that shall continue to be implemented at all times.

b. At the time of renewal of this permit and in accordance with 40 CFR 122.44(j)(2), the permittee shall submit to the DEM with its permit renewal application a written technical evaluation of the need to revise local limits. The evaluation shall be based, at a minimum, on information obtained during the implementation of the permittee's local limits monitoring plan and procedures required by Part I.C.3.a of this permit and current RIPDES permit discharge limits, sludge disposal criteria, secondary treatment inhibition, and worker health and safety criteria.

4. Enforcement Response Plan (ERP)

The permittee has an approved ERP dated January 22, 2008 that meets the requirements of 40 CFR 403.8(f)(5). The permittee shall continue to implement its approved ERP at all times.

5. General

a. The permittee shall carry out inspection, surveillance, and monitoring procedures which will determine, independent of information supplied by the industrial user, whether the industrial user is in compliance with Pretreatment Standards. At a minimum, all significant industrial users shall be inspected and monitored for all regulated pollutants at the frequency established in the approved Industrial Pretreatment Program but in no case less than once per year (one (1) year being determined as the reporting year established in Part I.C.7 of this permit). In addition, these inspections, monitoring and surveillance activities must be conducted in accordance with EPA's Industrial User Inspection and Sampling Manual for POTW's, April 1994. All inspections, monitoring, and surveillance activities shall be performed, and have records maintained, with sufficient care to produce evidence admissible in enforcement proceedings or judicial actions. The permittee shall evaluate, at least every two years unless specific superseding 40 CFR 403 streamlining provisions have been adopted, whether each SIU requires a Slug Control Plan. If a Slug Control Plan is required, it shall include the contents specified by 40 CFR 403.8(f)(2)(vi).

b. The permittee shall reissue all necessary Industrial User (IU) control mechanisms within thirty (30) days of their expiration date. The permittee shall issue, within sixty (60) days after the determination that an IU is a Significant Industrial User (SIU), all SIU control mechanisms. All SIU control mechanisms must contain, at a minimum, those conditions stated in 40 CFR 403.8(f)(1)(iii)(B). All control mechanisms must be mailed via Certified Mail, Return Receipt Requested. A complete bound copy of the control mechanism with the appropriate receipt must be kept as part of the Industrial User's permanent file. In addition, the permittee must develop a fact sheet describing the basis for the SIU's permit and retain this fact sheet as part of the SIU's permanent file.

c. The permittee must identify each instance of noncompliance with any pretreatment standard and/or requirement and take a formal documented action for each instance of noncompliance. Copies of all such documentation must be maintained in the Industrial User's permanent file.

d. The permittee shall prohibit Industrial Users from the dilution of a discharge as a substitute for adequate treatment in accordance with 40 CFR 403.6(d).

e. The permittee shall comply with the procedures of 40 CFR 403.18 for instituting any modifications of the permittee's approved Pretreatment Program. Significant changes in the operation of a POTW's approved Pretreatment Program must be submitted and approved following the procedures outlined in 40 CFR 403.18(b) and 403.9(b). However, the endorsement of local officials responsible for supervising and/or funding the pretreatment program required by 403.9(b)(2) will not be required until DEM completes a preliminary review of the submission. The DEM will evaluate and review the permittee's initial proposal for a modification and provide written notification either granting preliminary approval of the proposed modifications or stating the deficiencies contained therein. DEM's written notification will also include a determination whether the submission constitutes a substantial or non-substantial program modification as defined by 40 CFR 403.18. Should DEM determine that a deficiency exists in the proposed modification, the permittee shall submit to DEM, within thirty (30) days of the receipt of said notice, a revised submission consistent with DEM's notice of deficiency.

Pretreatment program modifications which the permittee considers Non-substantial, shall be deemed to be approved within forty-five (45) days after submission of the request for modification, unless DEM determines that the modification is in fact a substantial modification or notifies the permittee of deficiencies. Upon receipt of notification that DEM has determined the modification is substantial, the permittee shall initiate the procedures and comply with the deadlines for substantial modifications, which are outlined below.

For substantial modifications, the permittee shall, within sixty (60) days (unless a longer time frame is granted) of the receipt of DEM's preliminary approval of the proposed modification, submit documentation (as required by 403.9(b)(2)) that any local public notification/participation procedures required by law have been completed, including any responses to public comments, and a statement that the local officials will endorse and/or approve the modification upon approval by DEM.

Within thirty (30) days of DEM's final approval of the proposed modification(s), the permittee shall implement the modification and submit proof that the local officials have endorsed and/or approved the modification(s) to the DEM. Upon final approval by the DEM and adoption by the permittee, this modification(s) shall become part of the approved pretreatment program and shall be incorporated into this permit in accordance with 40CFR 122.63(g).

f. All sampling and analysis required of the permittee, or by the permittee of any Industrial User, must be performed in accordance with the techniques described in 40 CFR 136.

g. For those Industrial Users with discharges that are not subject to Categorical Pretreatment Standards, the permittee shall require appropriate reporting in accordance with 40 CFR 403.12(h).

h. The permittee shall, in accordance with 40 CFR 403.12(f), require all Industrial Users to immediately notify the permittee of all discharges by the Industrial User that could cause problems to the POTW, including slug loadings, as defined by 40 CFR 403.5.

i. The permittee shall require all Industrial Users to notify the permittee of substantial changes in discharge as specified in 40 CFR 403.12(j) and the permittee shall also notify DEM of each such substantial change in discharge prior to acceptance.

j. The permittee shall require New Sources to install and have in operation all pollution control equipment required to meet applicable Pretreatment Standards before beginning to discharge. In addition, the permittee shall require New Sources to meet all applicable Pretreatment Standards within the shortest feasible time which shall not exceed ninety (90) days in accordance with 40 CFR 403.6(b).

k. The permittee shall require all Industrial Users who are required to sample their effluent and report the results of analysis to the POTW to comply with signatory requirements contained in 40 CFR 403.12(l) when submitting such reports.

l. The permittee shall determine, based on the criteria set forth in 40 CFR 403.8(f)(2)(viii), using the EPA method of "rolling quarters", the compliance status of each Industrial User. Any Industrial User determined to meet Significant Non-Compliance (SNC) criteria shall be included in an annual public notification as specified in 40 CFR 403.8(f)(2)(viii).

m. The permittee shall require Industrial Users to comply with the notification and certification requirements of 40 CFR 403.12(p)(1), (3) and (4) pertaining to the discharge of substances to the POTW, which if disposed of otherwise, would be a hazardous waste under 40 CFR Part 261.

n. The permittee shall continue to designate, as SIUs, those Industrial Users (IUs) which meet the definition contained in 40 CFR 403.3 and the permittee's sewer use ordinance. The permittee shall notify each newly designated SIU of its classification as an SIU within thirty (30) days of identification and shall inform the SIU of the requirements of an SIU contained in 40 CFR 403.12.

6. Categorical Industrial Users (CIUs)

a. The permittee shall require Industrial Users to comply with applicable Categorical Pretreatment Standards in addition to all applicable Pretreatment Standards and Requirements. The permittee shall require of all Categorical Industrial Users (CIUs), all reports on compliance with applicable Categorical Pretreatment Standards and Categorical Pretreatment Standard deadlines as specified in and in accordance with Sections (b), (d), (e) and (g) of 40 CFR 403.12. In addition, the permittee shall require Categorical Industrial Users to comply with the report signatory requirements contained in 40 CFR 403.12(1) when submitting such reports.

b. If the permittee applies the Combined Wastestream Formula (CWF) to develop fixed alternative discharge limits of Categorical Pretreatment Standards, the application of the CWF and the enforcement of the resulting limits must comply with 40 CFR 403.6(e). The permittee must document all calculations within the control mechanism fact sheet and the resulting limits within the CIU's control mechanism. The permittee must ensure that the most stringent limit is applied to the CIU's effluent at end-of-pipe based upon a comparison of the resulting CWF limits and the permittee's local limits.

c. If the permittee has or obtains the authority to apply and enforce equivalent mass-per-day and/or concentration limitations of production-based Categorical Pretreatment Standards, then the permittee shall calculate and enforce the limits in accordance with 40 CFR 403.6(c). The permittee must document all calculations within the control mechanism fact sheet and the resulting limits within the CIU's control mechanism.

7. Annual Report

The annual report for the permittee's program shall contain information pertaining to the reporting year which shall extend from July 1st through June 30th and shall be submitted to the DEM by September 15th. Each item below must be addressed separately and any items which are not applicable must be so indicated. If any item is deemed not applicable a brief explanation must be provided. The annual report shall include the following information pertaining to the reporting year:

a. A listing of Industrial Users which complies with requirements stated in 40 CFR 403.12(i)(1). The list shall identify all Categorical Industrial Users, Significant Industrial Users and any other categories of users established by the permittee;

b. A summary, including dates, of any notifications received by the permittee of any substantial change in the volume or character of pollutants being introduced into the POTW by new or existing IUs. If applicable, an evaluation of the quality and quantity of influent introduced into the POTW and any anticipated impact due to the changed discharge on the quantity or quality of effluent to be discharged from the POTW shall be included;

c. A summary of the Compliance status of each Industrial User (IU), as of the end of last quarter covered by the annual report. The list shall identify all IUs in non-compliance, the pretreatment program requirement which the IU failed to meet, and the type, and date of the enforcement action initiated by the permittee in response to the violation. If applicable, the list shall also contain the date which IUs in non-compliance returned to compliance, a description of corrective actions ordered, and the penalties levied.

d. A list of industries which were determined, in accordance with Part I.C.5.(l) of this permit, to be in significant non-compliance required to be published in a local newspaper and a copy of an affidavit of publication, from the newspaper, averring that the names of these violators has been published;

e. A summary of inspection and monitoring activity performed by the permittee, including;

- significant industrial users inspected by the POTW (include inspection dates for each industrial user);
- significant industrial user sampled by the POTW (include sampling dates and dates of analysis

f. A summary of permit issuance/reissuance activities including the name of the industrial user, expiration date of previous permit, issuance date of new permit, and a brief description of any changes to the permit;

g. A list including the report/notification type, due date, and receipt date for each report/notification required by 40 CFR 403.12.

h. A summary of public participation efforts including meetings and workshops held with the public and/or industry and notices/newsletters/bulletins published and/or distributed;

i. A program evaluation in terms of program effectiveness, local limits application and resources which addresses but is not limited to:
- A description of actions being taken to reduce the incidence of SNC by Industrial Users;
- effectiveness of enforcement response program;
- sufficiency of funding and staffing;
- sufficiency of the SUO, Rules and Regulations, and/or statutory authority;

j. An evaluation of recent/proposed program modifications, both substantial and non-substantial, in terms of the modification type, implementation and actual/ expected effect (note proposed modifications must be submitted under separate cover along with the information required by 40 CFR 403.18);

k. A detailed description of all interference and pass-through that occurred during the past year and, if applicable;

- A thorough description of all investigations into interference and pass-through during the past year;

- A description of the monitoring, sewer inspections and evaluations which were done during the past year to detect interference and pass-through, specifying pollutants analyzed and frequencies;

l. A summary of the average, maximum concentration, minimum concentration, and number of data points used for pollutant analytical results for influent, effluent, sludge and any toxicity or bioassay data from the wastewater treatment facility. The summary shall include a comparison of influent sampling results versus the maximum allowable headworks loadings contained in the approved local limits evaluation and effluent sampling results versus water quality standards. Such a comparison shall be based on the analytical results required in Parts I.A and I.C. of this permit and any additional sampling data available to the permittee; and

m. A completed Annual Pretreatment Report Summary Sheet.

8. Interjurisdictional Agreement

Within sixty (60) days of the effective date of the permit, the permittee shall submit to the DEM, an attorney's statement which contains an evaluation, by the Town Solicitor or a public official acting in a comparable capacity, of the interjurisdictional agreements between the Town of West Warwick and the contributing jurisdictions of Coventry, Warwick and West Greenwich. The attorney statement shall evaluate the adequacy of the interjurisdictional agreements in terms of, but not limited to, legal authority provided for: the consistency of the West Warwick Sewer Use Ordinance and adopted local limits with respect to Coventry, Warwick and West Greenwich; enforcement actions by West Warwick for violations of the West Warwick Pretreatment Program in Coventry, Warwick and West Greenwich; permitting, inspecting, and sampling of Industrial Users located in each contributing jurisdiction; West Warwick's right to enter facilities located in Coventry, Warwick and West Greenwich; West Warwick's authority to access all records compiled by each contributing jurisdiction in relation to pretreatment program activities; and remedies for breach of contract. In addition, the attorney statement must evaluate the present status of the implementation of the agreement by Coventry, Warwick and West Greenwich.

If any interjurisdictional agreement is determined deficient, the attorney statement shall contain a proposed interjurisdictional agreement which provides adequate legal authority. A proposed compliance schedule shall also be submitted for implementing any requirements of the interjurisdictional agreement which have yet to be fulfilled. Upon approval of the DEM, the proposed interjurisdictional agreement and compliance schedule shall be adopted within 180 days.

9. Sewer Use Ordinance

The permittee has an approved Sewer Use Ordinance which shall continue to be implemented at all times.

D. OPERATION AND MAINTENANCE OF THE SEWER SYSTEM

Operation and maintenance of the sewer system shall be in compliance with the General Requirements of Part II and the following terms and conditions:

1. Maintenance Staff

The permittee shall provide an adequate staff to carry out the operation, maintenance, repair, and testing functions required to ensure compliance with the terms and conditions of this permit.

2. Infiltration/Inflow

The permittee shall minimize infiltration/inflow to the sewer system. A summary report of all actions taken to minimize infiltration/inflow during the previous two (2) years shall be submitted to RIDEM, Office of Water Resources, by the 15th day of January of every other year. The first report is due January 15, 2019.

3. Operation and Maintenance Plans

The permittee shall submit an addendum to their Operation and Maintenance plans to specifically address steps they have, and the steps they will take, to operate the treatment works as efficiently as possible and reduce effluent nitrogen concentrations as low as possible. The revised Operation and Maintenance plans are due ninety (90) days after the issuance of this permit.

4. Resiliency Planning

Within one year of the effective date of this permit, the permittee shall submit a Resiliency Plan and schedule of short and long term actions that will be taken to maintain operation and protect key collection and treatment system assets. The plan shall be consistent with the DEM's Guidance for the Consideration of Climate Change Impacts in the Planning and Design of Municipal Wastewater Collection and Treatment Infrastructure and include consideration of the findings of the 2017 DEM report Implications of Climate Change for Rhode Island Wastewater Collection and Treatment Infrastructure. The Resiliency Plan shall include, but not be limited to: (i) an assessment of current and projected impacts from natural hazards on critical components within the collection and treatment systems, as well as on the systems themselves; (ii) a plan to adapt and protect vulnerable components and systems; (iii) an analysis that provides justification for selected adaptation methods. The analysis must consider component and system design life and sea-level rise projections. For the purposes of this Resiliency Plan, critical components are considered those necessary to ensure the forward flow and treatment of wastewater in accordance with the limits set forth in this permit. The Resiliency Plan shall also consider impacts on the WWTF from neighboring facilities during high hazard events. This Plan shall be subject to DEM review and approval. If DEM determines that modifications need to be made to the Plan, DEM shall notify the permittee in writing which elements of the Plan need to be modified and the reason for the needed modification. This notification shall include a schedule for making the changes. After such notification from the DEM, the permittee shall make changes to the Plan and submit the revisions to the DEM for their approval.

E. SLUDGE

The permittee shall conform and adhere to all conditions, practices and regulations as contained in the State of Rhode Island Rules and Regulations for Sewage Sludge Management. The permittee shall comply with its RIDEM Order of Approval for the disposal of sludge.

F. DETECTION LIMITS

The permittee shall assure that all wastewater testing required by this permit, is performed in conformance with the method detection limits listed below. In accordance with 40 CFR Part 136, EPA approved analysis techniques, quality assurance procedures and quality control procedures shall be followed for all reports required to be submitted under the RIPDES program. These procedures are described in "Methods for the Determination of Metals in Environmental Samples" (EPA/600/4-91/010) and "Methods for Chemical Analysis of Water and Wastes" (EPA/600/4-79/020).

The report entitled "Methods for the Determination of Metals in Environmental Samples" includes a test which must be performed in order to determine if matrix interferences are present, and a series of tests to enable reporting of sample results when interferences are identified. Each step of the series of tests becomes increasingly complex, concluding with the complete Method of Standard Additions analysis. The analysis need not continue once a result which meets the applicable quality control requirements has been obtained. Documentation of all steps conducted to identify and account for matrix interferences shall be documented and maintained onsite.

If, after conducting the complete Method of Standard Additions analysis, the laboratory is unable to determine a valid result, the laboratory shall report "could not be analyzed". Documentation supporting this claim shall be maintained onsite. If valid analytical results are repeatedly unobtainable, DEM may require that the permittee determine a method detection limit (MDL) for their effluent or sludge as outlined in 40 CFR Part 136, Appendix B.

When calculating sample averages for reporting on discharge monitoring reports (DMRs):

1. "could not be analyzed" data shall be excluded, and shall not be considered as failure to comply with the permit sampling requirements;

2. results reported as less than the MDL shall be reported as zero in accordance with the DEM's DMR Instructions, provided that all appropriate EPA approved methods were followed.

Therefore, all sample results shall be reported as: an actual value, "could not be analyzed", or zero. The effluent or sludge specific MDL must be calculated using the methods outlined in 40 CFR Part 136, Appendix B. Samples which have been diluted to ensure that the sample concentration will be within the linear dynamic range shall not be diluted to the extent that the analyte is not detected. If this should occur the analysis shall be repeated using a lower degree of dilution.

LIST OF TOXIC POLLUTANTS

The following list of toxic pollutants has been designated pursuant to Section 307(a)(1) of the Clean Water Act. The Method Detection Limits (MDLs) represent the required Rhode Island MDLs.

Volatiles - EPA Method 624		**MDL ug/l (ppb)**
1V	acrolein	10.0
2V	acrylonitrile	5.0
3V	benzene	1.0
5V	bromoform	1.0
6V	carbon tetrachloride	1.0
7V	chlorobenzene	1.0
8V	chlorodibromomethane	1.0
9V	chloroethane	1.0
10V	2-chloroethylvinyl ether	5.0
11V	chloroform	1.0
12V	dichlorobromomethane	1.0
14V	1,1-dichloroethane	1.0
15V	1,2-dichloroethane	1.0
16V	1,1-dichloroethylene	1.0
17V	1,2-dichloropropane	1.0
18V	1,3-dichloropropylene	1.0
19V	ethylbenzene	1.0
20V	methyl bromide	1.0
21V	methyl chloride	1.0
22V	methylene chloride	1.0
23V	1,1,2,2-tetrachloroethane	1.0
24V	tetrachloroethylene	1.0
25V	toluene	1.0
26V	1,2-trans-dichloroethylene	1.0
27V	1,1,1-trichloroethane	1.0
28V	1,1,2-trichloroethane	1.0
29V	trichloroethylene	1.0
31V	vinyl chloride	1.0

Acid Compounds - EPA Method 625		**MDL ug/l (ppb)**
1A	2-chlorophenol	1.0
2A	2,4-dichlorophenol	1.0
3A	2,4-dimethylphenol	1.0
4A	4,6-dinitro-o-cresol	1.0
5A	2,4-dinitrophenol	2.0
6A	2-nitrophenol	1.0
7A	4-nitrophenol	1.0
8A	p-chloro-m-cresol	2.0
9A	pentachlorophenol	1.0
10A	phenol	1.0
11A	2,4,6-trichlorophenol	1.0

Pesticides - EPA Method 608		**MDL ug/l (ppb)**
1P	aldrin	0.059
2P	alpha-BHC	0.058
3P	beta-BHC	0.043
4P	gamma-BHC	0.048
5P	delta-BHC	0.034
6P	chlordane	0.211
7P	4,4'-DDT	0.251
8P	4,4'-DDE	0.049
9P	4,4'-DDD	0.139
10P	dieldrin	0.082
11P	alpha-endosulfan	0.031
12P	beta-endosulfan	0.036
13P	endosulfan sulfate	0.109
14P	endrin	0.050
15P	endrin aldehyde	0.062
16P	heptachlor	0.029
17P	heptachlor epoxide	0.040

Pesticides - EPA Method 608		**MDL ug/l (ppb)**
18P	PCB-1242	0.289
19P	PCB-1254	0.298
20P	PCB-1221	0.723
21P	PCB-1232	0.387
22P	PCB-1248	0.283
23P	PCB-1260	0.222
24P	PCB-1016	0.494
25P	toxaphene	1.670

Base/Neutral - EPA Method 625		**MDL ug/l (ppb)**
1B	acenaphthene *	1.0
2B	acenaphthylene *	1.0
3B	anthracene *	1.0
4B	benzidine	4.0
5B	benzo(a)anthracene *	2.0
6B	benzo(a)pyrene *	2.0
7B	3,4-benzofluoranthene *	1.0
8B	benzo(ghi)perylene *	2.0
9B	benzo(k)fluoranthene *	2.0
10B	bis(2-chloroethoxy)methane	2.0
11B	bis(2-chloroethyl)ether	1.0
12B	bis(2-chloroisopropyl)ether	1.0
13B	bis(2-ethylhexyl)phthalate	1.0
14B	4-bromophenyl phenyl ether	1.0
15B	butylbenzyl phthalate	1.0
16B	2-chloronaphthalene	1.0
17B	4-chlorophenyl phenyl ether	1.0
18B	chrysene *	1.0
19B	dibenzo (a,h)anthracene *	2.0
20B	1,2-dichlorobenzene	1.0
21B	1,3-dichlorobenzene	1.0
22B	1,4-dichlorobenzene	1.0
23B	3,3'-dichlorobenzidine	2.0
24B	diethyl phthalate	1.0
25B	dimethyl phthalate	1.0
26B	di-n-butyl phthalate	1.0
27B	2,4-dinitrotoluene	2.0
28B	2,6-dinitrotoluene	2.0
29B	di-n-octyl phthalate	1.0
30B	1,2-diphenylhydrazine (as azobenzene)	1.0
31B	fluoranthene *	1.0
32B	fluorene *	1.0
33B	hexachlorobenzene	1.0
34B	hexachlorobutadiene	1.0
35B	hexachlorocyclopentadiene	2.0
36B	hexachloroethane	1.0
37B	indeno(1,2,3-cd)pyrene *	2.0
38B	isophorone	1.0
39B	naphthalene *	1.0
40B	nitrobenzene	1.0
41B	N-nitrosodimethylamine	1.0
42B	N-nitrosodi-n-propylamine	1.0
43B	N-nitrosodiphenylamine	1.0
44B	phenanthrene *	1.0
45B	pyrene *	1.0
46B	1,2,4-trichlorobenzene	1.0

OTHER TOXIC POLLUTANTS

	MDL ug/l (ppb)
Antimony, Total	3.0
Arsenic, Total	1.0
Beryllium, Total	0.2
Cadmium, Total	0.1
Chromium, Total	1.0
Chromium, Hexavalent	20.0
Copper, Total	1.0
Lead, Total	1.0
Mercury, Total	0.001
Nickel, Total	20.0
Selenium, Total	2.0
Silver, Total	0.5
Thallium, Total	1.0
Zinc, Total	5.0
Asbestos	**
Cyanide, Available	10.0
Phenols, Total	50.0
TCDD	**
MTBE (Methyl Tert Butyl Ether)	1.0

** No Rhode Island Department of Environmental Management (RIDEM) MDL

NOTE:

The MDL for a given analyte may vary with the type of sample. MDLs which are determined in reagent water may be lower than those determined in wastewater due to fewer matrix interferences. Wastewater is variable in composition and may therefore contain substances (interferents) that could affect MDLs for some analytes of interest. Variability in instrument performance can also lead to inconsistencies in determinations of MDLs.

To help verify the absence of matrix or chemical interference the analyst is required to complete specific quality control procedures. For the metals analyses listed above the analyst must withdraw from the sample two equal aliquots; to one aliquot add a known amount of analyte, and then dilute both to the same volume and analyze. The unspiked aliquot multiplied by the dilution factor should be compared to the original. Agreement of the results within 10% indicates the absence of interference. Comparison of the actual signal from the spiked aliquot to the expected response from the analyte in an aqueous standard should help confirm the finding from the dilution analysis. (Methods for Chemical Analysis of Water and Wastes EPA-600/4-79/020).

For Methods 624 and 625 the laboratory must on an ongoing basis, spike at least 5% of the samples from each sample site being monitored. For laboratories analyzing 1 to 20 samples per month, at least one spiked sample per month is required. The spike should be at the discharge permit limit or 1 to 5 times higher than the background concentration determined in Section 8.3.2, whichever concentration would be larger. (40 CFR Part 136 Appendix B Method 624 and 625 subparts 8.3.1 and 8.3.11).

G. MONITORING AND REPORTING

1. Monitoring

   All monitoring required by this permit shall be done in accordance with sampling and analytical testing procedures specified in Federal Regulations (40 CFR Part 136).

2. Submittal of DMRs Using NetDMR

   a. The permittee shall continue to submit its monthly monitoring data in Discharge Monitoring Reports (DMRs) to DEM no later than the 15th day of the month electronically using NetDMR. When the permittee submits DMRs using NetDMR, it is not required to submit hard copies of DMRs to DEM.

b. Submittal of Reports as NetDMR Attachments

Unless otherwise specified in this permit, the permittee must submit electronic copies of documents in NetDMR that are directly related to the DMR. These include the following:

- DMR Cover Letters
- Below Detection Limit summary tables
- Monthly Operating Reports

c. Submittal of Reports in Hard Copy Form

The following notifications and reports shall be submitted as hard copy with a cover letter describing the submission. These reports shall be signed and dated originals when submitted to DEM.

- Written notifications required under Part II
- Notice of unauthorized discharges, including Sanitary Sewer Overflow (SSO) reporting
- Priority Pollutant Scan results for Outfall 001A
- Infiltration/Inflow Reports
- Pretreatment Reports

This information shall be submitted to DEM at the following address:

The Rhode Island Department of Environmental Management
RIPDES Program
235 Promenade Street
Providence, Rhode Island 02908

d. Verbal Reports and Verbal Notifications

Any verbal reports or verbal notifications, if required in Parts I and/or II of this permit, shall be made to the DEM. This includes verbal reports and notifications which require reporting within 24 hours. (See Part II(l)(5) General Requirements for 24-hour reporting). Verbal reports and verbal notifications shall be made to DEM at (401) 222-4700 or (401) 222-3070 at night.

RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF WATER RESOURCES
235 PROMENADE STREET
PROVIDENCE, RHODE ISLAND 02908-5767

FACT SHEET

RHODE ISLAND POLLUTANT DISCHARGE ELIMINATION SYSTEM (RIPDES) PERMIT TO DISCHARGE TO WATERS OF THE STATE

RIPDES PERMIT NO. RI0100153

NAME AND ADDRESS OF APPLICANT:

The Town of West Warwick
West Warwick, RI

NAME AND ADDRESS OF FACILITY WHERE DISCHARGE OCCURS:

West Warwick Wastewater Treatment Facility
1 Pontiac Avenue
West Warwick, RI

RECEIVING WATER: **Pawtuxet River (Water Body ID # RI0006017R-03)**

CLASSIFICATION: **B1**

I. Proposed Action, Type of Facility, and Discharge Location

The above-named applicant has applied to the Rhode Island Department of Environmental Management for reissuance of a RIPDES Permit to discharge into the designated receiving water. The discharge is from the treatment of industrial and municipal wastewater.

II. Description of Discharge

A quantitative description of the discharge in terms of significant effluent parameters based on DMR data from December 2008 through April 2016 is shown in Attachment 1.

III. Permit Limitations and Conditions

The final effluent limitations and monitoring requirements may be found in the draft permit. The permit includes new limits for Total Aluminum and Total Iron, which the facility may not be able to meet. Therefore, the DEM is willing to enter into a consent agreement with the Town that will establish a schedule for the Town to evaluate its ability to meet the final limits and attain compliance with these limits.

IV. Permit Basis and Explanation of Effluent Limitation Derivation

The Town of West Warwick owns and operates the Wastewater Treatment Facility located on 1 Pontiac Avenue in West Warwick, Rhode Island. The discharge to the Pawtuxet River consists of treated domestic and industrial wastewater contributed by the municipalities of West Warwick, Scituate, West Greenwich, Coventry, Cranston and Warwick. As of June 2016, the end of West Warwick's most recent Industrial Pretreatment Program reporting year, there were seven (7)

Significant Industrial Users (SIUs) and approximately four hundred (400) other (i.e., non-SIU) permitted industrial users contributing wastewater to the West Warwick WWTF. Treatment consists of the following: Mechanical Screening, Grit Removal, Primary Clarification, Activated Sludge, Biological Media Filters for advanced treatment, Secondary Clarification, and Ultraviolet Disinfection. The Town of West Warwick completed their advanced wastewater treatment upgrades in July 2005 to comply with the 2000 permit conditions/limits (i.e., ammonia, total nitrogen and total phosphorus). In 2016 the Town of West Warwick completed additional tertiary treatment plant upgrades associated with the removal of Phosphorus in order to comply with the 2008 final permit limits. A diagram of the facility is included in Attachment A-2.

Receiving Water Description

The water body segment that receives the discharge from the West Warwick WWTF is described as the Main Stem of the Pawtuxet River from the confluence of the North and South branches at Riverpoint to the Pawtuxet Cove Dam at Pawtuxet. The waterbody identification number for these waters is RI0006017R-03. This segment is located in West Warwick, Warwick, and Cranston and is classified as a class B1 water body according to the Rhode Island Water Quality Regulations. Class B1 waters are designated for primary and secondary contact recreational activities and fish and wildlife habitat. They shall be suitable for compatible industrial processes and cooling, hydropower, aquacultural uses, navigation, and irrigation and other agricultural uses. These waters shall have good aesthetic value. Primary contact recreational activities may be impacted due to pathogens from approved wastewater discharges. However all Class B criteria must be met. Currently this segment is not supporting the Fish and Wildlife Habitat use due to impairments associated with Benthic-Macroinvertebrate Bioassessments, Cadmium, Non-Native Aquatic Plants, and Total Phosphorus. This segment is also not supporting the Fish Consumption use due to impairments associated with Mercury in fish tissue. Lastly this segment is not supporting the primary and secondary contact recreation use due to impairments associated with Enterococcus.

The requirements set forth in this permit are from the State's Water Quality Regulations and the State's Regulations for the Rhode Island Pollutant Discharge Elimination System, both filed pursuant to RIGL Chapter 46-12, as amended. RIDEM's primary authority over the permit comes from EPA's delegation of the program in September 1984 under the Federal Clean Water Act (CWA).

Development of RIPDES permit limitations is a multi-step process consisting of the following steps: calculating allowable water quality-based discharge levels based on instream criteria, background data and available dilution; identifying any technology-based limits that apply to the facility; assigning appropriate Best Professional Judgment (BPJ) limits; setting the most stringent of these limits as the final allowable discharge levels; comparing existing discharge concentrations to the new allowable discharge levels; and evaluating the ability of the facility to meet the final permit effluent limits.

Water Quality Based Permit Limits

The DEM previously issued RIPDES permits for the wastewater treatment facilities (WWTFs) owned and operated by the Town of West Warwick and the Cities of Warwick and Cranston (the Communities). These permits included limitations necessary to allow the Pawtuxet River to meet the numeric water quality standards for certain metals and Dissolved Oxygen (DO), which were established using a wasteload allocation process after application of the computer models PAWTOXIC and Qual II. Details of the wasteload allocation process may be found in the communities' previous permit development documents.

Flow Limitations

In November of 2011 the Town of West Warwick submitted a Facilities Plan Amendment which called for an increase in the design flow of the WWTF from 10.5 MGD (16.24 cfs) to 11.0 MGD (17.02 cfs). In March of 2014 the DEM granted an Order of Approval for the construction of plant phosphorus removal upgrades which were based on a future flow of 11.0 MGD. As a result the DEM modified the wastewater flow for West Warwick that was used in the above-mentioned models. Below is a Table summarizing the WWTF flows used in the 2017 wasteload allocation (WLA). These flows were also used as the monthly average permitted flow limits.

Table 1. WWTF Design Flows		
	Cubic Feet Per Second (cfs)	Million Gallons Per Day (MGD)
West Warwick	17.02	11.0
Warwick	11.91	7.7
Cranston	31.26	20.2
Former Clariant Corp.	1.62	1.05

Permit Limitations Based upon the Dissolved Oxygen Wasteload Allocation Modeling

In 1989, the SEMCOG version of Qual II was used to model the DO dynamics of the Pawtuxet River and develop discharge limits for Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), Ammonia, and DO. However, the SEMCOG version can't be run on a personal computer and, therefore, all the recent DO model runs were performed using the Qual 2E model. To determine if the proposed modifications in wastewater design flows necessitated a reduction in the permit limits, the instream concentrations of DO, BOD, and Ammonia predicted by the 2006 wasteload allocation were compared against the values predicted by the Qual 2E model with the revised flow for the West Warwick WWTF. Table 2 presents the maximum instream pollutant levels predicted in the 2006 Qual2E WLA and the 2017 Qual2E WLA. As can be seen from this table, the increased West Warwick wastewater flow (10.5 MGD to 11 MGD) resulted in insignificant changes to the predicted instream water quality. As a result, it was determined that modifying the permitted wastewater flow rate for the West Warwick WWTF while keeping the BOD, Ammonia and DO discharge limits for Cranston, Warwick, and West Warwick equal to the previous permit limits would satisfy the antidegradation and antibacksliding requirements of the Rhode Island Water Quality Regulations and the RIPDES Regulations.

Table 2. Maximum Waste Load Allocation (WLA) Instream Concentrations		
	2006 WLA	**2017 WLA**
Dissolved Oxygen	5.0	5.0
Ammonia	0.93	0.93
BOD	4.4	4.4

Permit Limitations Based upon the Metals Wasteload Allocation Modeling

The fate and transport of toxic pollutants were simulated using the computer model PAWTOXIC. Information concerning the calibration and validation of the PAWTOXIC model is presented in A Study of the Water Quality of the Pawtuxet River: Chemical Monitoring and Computer Modeling of Pollutants, Volume 2: Computer Modeling of Toxic Pollutants in the Pawtuxet River (Wright and McCarthy, 1985) and in Fate and Transport of Heavy Metals in the Pawtuxet River (McCarthy, 1986). The PAWTOXIC model was used to determine the maximum discharge levels for Cadmium, Chromium, Copper, Lead, Nickel, and Silver that would result in compliance with the water quality criteria. Since metals criteria are dependent upon the hardness of the receiving water and it has been observed that there is a strong inverse correlation between river flow and hardness, a lognormal-lognormal relationship was developed between flow and hardness from data collected at the Cranston US Geological Survey gauging station to establish aquatic life criteria for metals. Based on this relationship, a hardness of 63.2 mg/l at the 7Q10 flow was used to determine the appropriate metals criteria. Details of this relationship can be found in the *1999 Permit Development Document*.

As part of their efforts to attain compliance with the 1989 permit limitations, the Communities completed site-specific criteria studies to determine if aquatic life criteria for the Pawtuxet River should be modified. These studies are summarized in the report entitled "*Report on Rhode Island Site Specific Criteria Development Program, April 1992*". As a result of these studies the Rhode Island Water Quality Regulations were revised to establish the site-specific criteria noted in Table 3.

Table 3. Pawtuxet River Site Specific Metals Criteria (Hardness = 63.2 mg/L)		
Parameter	**Acute Criteria**	**Chronic Criteria**
Cadmium	5.14	0.79
Copper	54.87	38.87
Lead	8.65	0.34
Silver	5.25	---
Zinc	129.30	117.12

The metals waste load allocation that was used in 1999 assigned all three communities (West Warwick, Warwick, and Cranston) an equivalent discharge concentration that was set such that the Pawtuxet River's in-stream concentrations would not exceed 90% of the site specific water quality criteria. However, after the final permits were issued in 1999, the City of Cranston decreased their approved design flow. Therefore, due to the decrease in design flow, the DEM subsequently adjusted the Nickel, Copper, Lead, Cadmium, Chromium, and Silver permit limits for the Cranston WWTF in the 2008 permit cycle. To determine the appropriate metals limits, the DEM used an iterative approach and ran the PAWTOXIC model using Cranston's new design flow and various modified metals concentrations for Cranston. This approach was used to determine the maximum metals concentrations that could be discharged from the Cranston facility and not result in an increase in the maximum in-stream concentration predicted for the Pawtuxet River. The results of these model runs conducted in 2006 which were triggered by Cranston's flow modification are reflected in the tables below.

As previously indicated, the Town of West Warwick submitted a Facilities Plan Amendment which called for an increase in its design flow from 10.5 MGD (16.24 cfs) to 11.0 MGD (17.02 cfs) and DEM granted an Order of Approval for the construction of plant phosphorus removal upgrades which were designed based on a future flow of 11.0 MGD. Therefore due to an increase in the approved design flow for the West Warwick WWTF, the DEM took steps to determine what adjustments to the Nickel, Copper, Lead, Cadmium, Chromium, and Silver permit limits were necessary for the West Warwick WWTF. The appropriate metals limits were calculated using an iterative approach by running the PAWTOXIC model using West Warwick's revised design flow from Table 1 and various metals discharge concentrations for West Warwick.

Table 4 lists the maximum discharge concentrations that were used in the final PAWTOXIC model runs in 2006. Table 5 presents the proposed discharge levels for each wastewater facility as determined by the 2017 PAWTOXIC Model runs. The DEM reduced the permit limits for West Warwick only and the reductions to permit limits were made until the model generated in stream concentrations that were equivalent (or nearly equivalent) to the modeling conducted in 1999 and 2006. Table 6 and Table 7 present the maximum instream pollutant levels, predicted each time the required changes to model inputs were required. As can be seen from these tables, the increased wastewater flow and decreased metals limits modeled for West Warwick resulted in minimal changes to the instream water quality.

The new limits proposed for the West Warwick WWTF will not result in any significant increase to the in-stream pollutant concentrations. As a result, it was determined that modifying the permitted wastewater flow rate while setting the metals discharge limits equal to those listed in Table 5 will satisfy the antidegradation and antibacksliding requirements of the Rhode Island Water Quality Regulations and the RIPDES Regulations.

Table 4. Maximum Allowable Discharge Levels from 2006 PAWTOXIC Model						
	Former Clariant Corp.		**W. Warwick & Warwick**		**Cranston**	
Parameter	**Monthly Ave. (ug/l)**	**Daily Max. (ug/l)**	**Monthly Ave. (ug/l)**	**Daily Max. (ug/l)**	**Monthly Ave. (ug/l)**	**Daily Max. (ug/l)**
Nickel	200	1750	185	1750	197	1840
Copper	100	100	40	95	42.2	98
Lead	0.34	8.65	0.34	8.65	0.34	8.65
Cadmium	3.32	9	1	9	1.1	9.6
Chromium	1000	3000	290	2500	312	2700
Silver[1]	---	11	---	11	---	11.9

[1]The RI Water Quality Regulations do not contain chronic water quality criteria for silver, therefore, a monthly average limit could not be calculated.

Table 5. Maximum Allowable Discharge Levels from 2017 PAWTOXIC Model								
	Former Clariant Corp.		Warwick		W. Warwick		Cranston	
Parameter	Monthly Ave. (ug/l)	Daily Max. (ug/l)	Monthly Ave. (ug/l)	Daily Max. (ug/l)	Monthly Ave. (ug/l)	Daily Max. (ug/l)	Monthly Ave. (ug/l)	Daily Max. (ug/l)
Nickel	200	1750	185	1750	180	1698	197	1840
Copper	100	100	40	95	38	92	42.2	98
Lead	0.34	8.65	0.34	8.65	0.34	8.65	0.34	8.65
Cadmium	3.32	9	1	9	0.97	8.8	1.1	9.6
Chromium	1000	3000	290	2500	280	2422	312	2700
Silver[1]	---	11	---	11	'---	10.6	---	11.9

[1]The RI Water Quality Regulations do not contain chronic water quality criteria for silver, therefore, a monthly average limit could not be calculated.

Table 6. Comparison of Chronic Criteria to Instream Concentrations					
Parameter	Chronic Criteria (ug/l)	90% of Criteria	1999 Maximum Instream Concentration (ug/l)	2006 Maximum Instream Concentration (ug/l)	2017 Maximum Instream Concentration (ug/l)
Nickel	106.94	96.25	96.25	96.18	96.08
Copper	38.87	34.98	24.02	24.01	23.91
Lead*	0.34	0.31	10.59	10.59	10.59
Cadmium	0.79	0.71	0.70	0.70	0.69
Chromium	152.28	137.05	133.66	133.64	133.62

*The Pawtuxet River would violate criteria even if the discharge concentrations for the point sources were set equal to 0.0 ug/l. Therefore, the allowable discharge level for Lead was set equal to the criteria.

Table 7. Comparison of Acute Criteria to Instream Concentrations					
Parameter	Acute Criteria (ug/l)	90% of Criteria (ug/l)	1999 Maximum Instream Concentration (ug/l)	2006 Maximum Instream Concentration (ug/l)	2017 Maximum Instream Concentration (ug/l)
Nickel	961.96	865.8	872.73	864.92	863.6
Copper	54.87	49.38	49.87	49.05	49.03
Lead*	8.65	7.78	10.59	10.59	10.59
Cadmium	5.14	4.63	4.60	4.59	4.59
Chromium	1207.8	1087.0	1063.34	1062.80	1062.74
Silver	5.25	4.73	4.62	4.6	4.6

*The Pawtuxet River would violate criteria even if the discharge concentrations for the point sources were set equal to 0.0 ug/L. Therefore, the allowable discharge level for Lead was set equal to criteria.

Additional Water Quality Based Permit Limitations

In addition to the pollutant limitations established above, additional water quality based effluent limitations were established on the basis of acute and chronic aquatic life criteria and human health criteria using the following: available instream dilution; an allocation factor; and background concentrations when available and/or appropriate. The aquatic life and human health criteria are specified in the Rhode Island Water Quality Regulations. Aquatic life criteria have been established to ensure the protection and propagation of aquatic life while human health criteria represent the pollutant levels that would not result in a significant risk to public health from ingestion of aquatic organisms. The more stringent of the two criteria was then used in establishing allowable effluent limitations. Details concerning the calculation of potential permit limitations, selection of factors that influence their calculation, and the selection of final permit limitations are included below or in the attached documents. The Town's first permit to contain water quality based limits was issued in 1989.

Appendix B of the Water Quality Regulations describes the flows used to determine compliance with human health and aquatic life criteria. The design flow to be utilized for freshwater human health for both carcinogenic and non-carcinogenic pollutants is the harmonic mean flow. The harmonic mean flow is a long-term mean flow value calculated by dividing the number of daily flows analyzed by the sum of the reciprocals of those daily flows. Aquatic life criteria shall not be exceeded at or above the lowest average 7 consecutive day low flow with an average recurrence frequency of once in 10 years (7Q10).

The Pawtuxet River Harmonic Mean flow profile, indicating the variation of flow with respect to distance along the river, was calculated using procedures similar to those followed in the *Pawtuxet River Wasteload Allocation Strategy for the Development of RIPDES Permit Limits (DEM, 1988)* for the development of the 7Q10 flow profile. The Flat River Reservoir flow was calculated using Harmonic Mean Flow data from the Washington USGS gauging station and groundwater incremental flows. Harmonic Mean Flow data from the Cranston USGS gauging station was used to calculate Harmonic Mean Flow/7Q10 ratios. These ratios were then used to recalculate groundwater incremental flows and Scituate Reservoir releases. The spreadsheets used to determine the 7Q10 and Mean Harmonic dilution factors were carried over from the *2008 Permit Development Document* and copies of these spreadsheets have been included in Attachment A-3 of this Fact Sheet.

When determining Ammonia limitations, an exception was made regarding the use of the year-round 7Q10 to determine allowable discharge concentrations. For Ammonia, a seasonal 7Q10 dilution factor was determined for the winter (November 1 – April 30). Use of a seasonal dilution factor for Ammonia was also supported by the fact that Ammonia removal is strongly dependent on temperature (nitrification rate decreases temperature decreases) and since Ammonia does not bioaccumulate or accumulate in sediment. A winter 7Q10 flow profile, determined in a manner similar to that used for the Harmonic Mean flow profile, was used to determine the appropriate winter dilution factor. In addition, since Ammonia criteria are dependent on pH and Temperature, the DEM calculated the upper 90% pH and Temperature values and the associated Ammonia criteria for each month. The DEM then used the minimum monthly criteria for the months of November – April and May - October, along with the appropriate dilution factor, when determining the Ammonia limitations. Calculation of the Ammonia limitations is available in Attachment B of the 2008 Permit Development Document entitled *"Calculation of Allowable Acute and Chronic Discharge Limitations Based on Freshwater Aquatic Life Criteria and Human Health Criteria"*. It should be noted that the Ammonia limitations for the months of June –October were based on the dissolved oxygen model since these limits were more stringent than the aquatic toxicity-based limits.

The allowable discharge limits were calculated as follows:

a) Background concentration unknown or available data is impacted by sources that have not yet achieved water quality based limits.

$$Limit_{1} = (DF) * (Criteria) * (80\%)$$

Where: DF = acute or chronic dilution factor, as appropriate

b) Using available background concentration data.

$$Limit_{1} = (DF) * (Criteria) * 90\% - (Background) * (DF - 1)$$

Where: DF = acute or chronic dilution factor, as appropriate

The permit limits noted above were developed by assigning an equivalent discharge concentration to each WWTF. This is consistent with the limits assigned in the 1999 permits. However, subsequent to the issuance of the 1999 permits, the City of Cranston decreased its WWTF's approved design flow. Therefore, as a result of the design flow reduction from 23 MGD to 20.2 MGD in 2007, the DEM modified the allowable discharge concentration limits proportionately to the reduction in flow for the Cranston WWTF so the mass load remains constant. In this 2017 draft permit the applicable permit limitations were again modified for West Warwick due to the fact that the effluent design flow for the West Warwick WWTF was increased from 10.5 MGD to 11 MGD. As a result the DEM modified the allowable discharge concentration limits proportionately to the increase in flow for the West Warwick WWTF so that the mass load remains constant. A spreadsheet which contains a summary of all applicable water quality based limits is included in Attachment A-4 of this document.

The formulas and data noted above were applied with the following exceptions

A) Pollutants that based on the acute and chronic dilution factors, have a higher allowable chronic limit than allowable acute limit. For this situation, both the "Monthly Average" and "Daily Maximum" limits were set at the allowable acute limit.

B) Total residual chlorine. The limits for total residual chlorine (TRC) were established in accordance with the DEM Effluent Disinfection Policy. The "Monthly Average" and "Daily Maximum" were based on a 100% allocation, a zero background concentration, and the appropriate dilution factor(s). The 100% allocation factor for TRC was used due to the non-conservative nature of chlorine and the improbability of the receiving water having a detectable background TRC concentration.

C) Pollutants with water quality based monthly average limits in the previous RIPDES permit. The relaxation of monthly average limits from the previous permit was restricted in accordance with the antibacksliding provisions of the Clean Water Act and the Policy on the Implementation of the Antidegradation Provisions of the Rhode Island Water Quality Regulations.

Since the analysis outlined above may allow a relaxation of monthly average limits, provided below is a brief introduction to Antibacksliding and Antidegradation; as well as a discussion on how the two policies were used to calculate water quality based limits.

Antibacksliding

Antibacksliding restricts the level of relaxation of water quality based limits from the previous permit. Section 303(d)(4) of the Clean Water Act addresses antibacksliding as the following:

Section 303(d)(4)

A) Standards not attained - For receiving waters that have not attained the applicable water quality standards, limits based on a TMDL or WLA can only be revised if the water quality standards will be met. This may be done by (i) determining that the cumulative effect of all such revised limits would assure the attainment of such water quality standards; or (ii) removing the designated use which is not being attained in accordance with regulations under Section 303.

B) Standards attained - For receiving waters achieving or exceeding applicable water quality standards, limits can be relaxed if the revision is consistent with the State's Antidegradation Policy.

Therefore, in order to determine whether backsliding is permissible, the first question that must be answered is whether or not the receiving water is attaining the water quality standard. The Office has determined the most appropriate evaluation of existing water quality is by calculating the pollutant levels, which would result after consideration of all currently valid RIPDES permit limits or historic discharge data (whichever is greater), background data (when available), and any new information (i.e.: dilution factors).

Antidegradation

The DEM's "Policy on the Implementation of the Antidegradation Provisions of the Rhode Island Water Quality Regulations July 2006" (the Policy) establishes four tiers of water quality protection:

Tier 1. In all surface waters, existing uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.

Tier 2. In waters where the existing water quality exceeds the levels necessary to support the propagation of fish and wildlife and recreation in and on the water, that quality shall be maintained and protected except for insignificant changes in water quality as determined by the Director and in accordance with the Antidegradation Implementation Policy, as amended. In addition, the Director may allow significant degradation, which is determined to be necessary to achieve important economic or social benefits to the State in accordance with the Antidegradation Implementation Policy.

Tier 2½. Where high quality waters constitute Special Resource Protection Waters SRPWs[1], there shall be no measurable degradation of the existing water quality necessary to protect the characteristics which cause the waterbody to be designated a SRPW. Notwithstanding that all public drinking water supplies are SRPWs, public drinking water suppliers may undertake temporary and short-term activities within the boundary perimeter of a public drinking water supply impoundment for essential maintenance or to address emergency conditions in order to prevent adverse effect on public health or safety. These activities must comply with the requirements set fourth in Tier 1 and Tier 2.

Tier 3. Where high quality waters constitute an Outstanding Natural Resource ONRWs[2], that water quality shall be maintained and protected. The State may allow some limited activities that result in temporary and short-term changes in the water quality of an ONRW. Such activities must not permanently degrade water quality or result in water quality lower than necessary to protect the existing uses in the ONRW.

The formulas previously presented ensure that permit limitations are based upon water quality criteria and methodologies established to ensure that all designated uses will be met.

In terms of the applicability of Tier 2 of the Policy, a water body is assessed as being high quality on a parameter-by-parameter basis. In accordance with Part II of the Policy, "Antidegradation applies to all new or increased projects or activities which may lower water quality or affect existing water uses, including but not limited to all 401 Water Quality Certification reviews and any new, reissued, or modified RIPDES permits." Part VI.A of the Policy indicates that it is not applicable to activities which result in insignificant (i.e.: short-term minor) changes in water quality and that significant changes in water quality will only be allowed if it is necessary to accommodate important economic and social development in the area in which the receiving waters are located (important benefits demonstration). Part VI.B.4 of the Policy states that: "Theoretically, any new or increased discharge or activity could lower existing water quality and thus require the important benefits demonstration. However, DEM will: 1) evaluate applications on a case-by-case basis, using BPJ and all pertinent and available facts, including scientific and technical data and calculations as provided by the applicant; and 2) determine whether the incremental loss is significant enough to require the important benefits demonstration described below. [If not then as a general rule DEM will allocate no more than 20%.] Some of the considerations which will be made to determine if an impact is significant in each site specific decision are: 1) percent change in water quality parameter value and their temporal distribution; 2) quality and value of the resource; 3) cumulative impact of discharges and activities on water quality to-date; 4) measurability of the change; 5) visibility of the change; 6) impact on fish and wildlife habitat; and 7) impact on potential and existing uses. As a general guide, any discharge or activity which consumes greater than 20% of the remaining assimilative capacity (See Section VI.B.2) will be considered a significant impact and will be required to demonstrate important economic or social benefits to justify the activity (See Section VI.C. below). However, on a case-by-case basis, <u>any</u> proposed percent consumption of the remaining assimilative capacity may be deemed significant and invoke full requirements to demonstrate important economic or social benefits."

In terms of a RIPDES permit, an increased discharge is defined as an increase in any limitation, which would result in an increased mass loading to a receiving water. The baseline for this comparison would be the monthly average mass loading established by the previous permit. It would be inappropriate to use the daily maximum mass loading since the Policy is not applicable to short-term changes in water quality.

For the purposes of ensuring that the revised limit is consistent with the requirements of antidegradation, existing water quality must be defined. As explained earlier, DEM evaluates existing water quality by determining the pollutant levels which would result under the design conditions appropriate for the particular criteria (i.e., background water quality, when available and/or appropriate; non-point source inputs; and existing RIPDES permit limitations or recent

[1] SRPWs are surface waters identified by the Director as having significant recreational or ecological uses.

[2] ONRWs are a special subset of high quality water bodies, identified by the State as having significant recreational or ecological water uses.

historical discharge data, whichever is higher). In general, available data would be used to make this determination.

Using the above-mentioned criteria, the present instream water quality C_p is defined as:

$$C_p = \frac{(DF - 1) * C_b + (1 * C_d)}{DF}$$

where: C_b = background concentration[3]
C_d = discharge data[4]
DF = dilution factor

If the waterbody is a high quality water for the pollutant in question ($C_p < C_{criteria}$), then the discharge requires an evaluation under Tier 2 protection. If the waterbody is not determined to be high quality for that parameter, then antibacksliding will allow an increased permit limit only if it can be assured that water quality standards would be attained. Therefore, the permit limit would be calculated to comply with Tier 1 protection, using the procedures noted previously (i.e., $Limit_1$).

Assuming the receiving water has been designated as a high quality waterbody for the parameter under investigation, the next step is to determine whether the new or increased discharge is permissible and if so whether an important benefits demonstration is required. As explained above, for existing discharges DEM shall follow the general rule of allocating no more than 20% of the remaining assimilative capacity without the need to complete this demonstration (assuming the receiving water is not an SRPW or ONRW). On a case-by-case basis, the DEM may limit the allocation or determine that any incremental loss or impact to the receiving water is significant enough to require a detailed important benefits demonstration.

Since none of the limits proposed in this permit are less stringent than the limits from the previous permit, the proposed limits comply with the State's antibacksliding and antidegradation policies and additional analysis is not required.

Reasonable Potential

In accordance with 40 CFR 122.4(d)(1)(iii), it is only necessary to establish permit limits for those pollutants in the discharge which have the reasonable potential to cause or contribute to the exceedance of instream criteria. In order to evaluate the need for permit limits, the most stringent calculated acute and chronic limits are compared to the Discharge Monitoring Report (DMR) data and annual priority pollutant scan data reported by the permittee. A complete summary of DMR data from December 2008 thru April 2016 is provided in Attachment A-1. Attachment A-5 contains a listing of all priority pollutant scan data detections reported by the permittee from 2011 thru 2015. Attachment A-6 is a summary comparison of the allowable discharge levels vs. the DMR data vs. annual priority pollutant scan detections. Based on the analysis presented above, permit limits are required for Lead. Total Ammonia limits have also been included to ensure that the facility continues to nitrify year round. Although the previous permit included limitations for Cyanide, Cadmium, Copper, and Zinc these limits have been removed from the proposed permit due to revised data which no longer demonstrates that the facility has reasonable potential to cause or contribute to the exceedance of instream criteria associated with these pollutants. As indicated below, monitoring will still be required for these pollutants.

The Town of West Warwick utilizes aluminum sulfate (alum) as the tertiary treatment ballasted flocculation coagulant for phosphorus removal. Based on the Town's use of alum in the tertiary treatment process a monthly average of 119 ug/l and a daily maximum limit of 1026 ug/l Total Aluminum have been included in the permit. As an alternative to alum the facility may decide to utilize ferric sulfate as the preferred flocculation coagulant. For this reason, a monthly average Total

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[3] Data collected at a location that is unimpacted by significant point source discharges.

[4] Discharge data refers to the maximum of the permit limit or the historic discharge level. The historic discharge level is determined by calculating the upper 95th percent confidence interval for the monthly average reported data for the past five (5) years. For specific cases, changes in treatment efficiency or pretreatment limitations may support the use of an alternative period of time.

Iron permit limit of 1444 ug/l has been included in the permit. Weekly sampling for Total Iron and/or Total Aluminum is only in effect during months in which Iron based or Aluminum based coagulation chemicals are used in the treatment process. For all other periods sampling is only required for Total Aluminum on a quarterly basis in accordance with Part I.B of this permit.

Although these pollutants did not have "reasonable potential", quarterly monitoring for Cyanide, Total Aluminum, Total Cadmium, Total Copper, Hexavalent Chromium, Total Nickel, and Total Zinc have been included in the permit as part of the standard list of pollutants monitored as part of the quarterly bioassay testing.

Quantitation Levels

In instances where the permit limit is below the applicable quantitation level, the permit includes a condition that compliance with the limits will be evaluated using the quantitation levels listed in Table 8. These values may be reduced by permit modification as EPA and the State approve more sensitive methods.

Table 8. Quantitation Levels

Parameter	Quantitation Level (ug/l)
Lead	3

Conventional Pollutant Permit Limitations

The pH limitations are based upon the secondary treatment requirements as defined in 40 CFR 133.102 (a)-(c). The "Average Monthly" and "Average Weekly" CBOD and TSS limitations, for November 1 – May 31, are based upon the secondary treatment requirements in Section 301(b)(1)(B) of the Clean Water Act and 40 CFR 133.102 (a) – (c). The November 1 – May 31 "Maximum Daily" CBOD and TSS limits are based on Rhode Island requirements for Publicly Owned Treatment Works (POTWs) under Rule 17.04(b) of the RIPDES Regulations and as provided in 40 CFR 123.25. The "Percent Removal" requirements for CBOD and TSS are in accordance with 40 CFR 133.102(a) and (b). CBOD and TSS limits for June 1 – October 31 are based on modeling performed by the DEM. CBOD limitations were used since it was determined that it is appropriate to apply the QUAL 2E modeled limits as CBOD when the point source dischargers are nitrifying. DEM and EPA agree that Total Suspended Solids is an appropriate measure of the solids content being discharged to the receiving waters and that Settleable Solids is a "process-control parameter" that can aid in assessing the operation of the plant but need not be an effluent limit.

The Rhode Island Water Quality Regulations include Enterococci criteria for primary contact/swimming of a geometric mean of 54 colonies/100ml and a single sample maximum of 61 colonies/100ml. The "single sample maximum" value is only used to evaluate swimming advisories at designated public beaches and does not apply to the receiving water in the area of the outfall. EPA's November 12, 2008 memorandum regarding "Initial Zones of Dilution for Bacteria in Rivers and Streams Designated for Primary Contact Recreation" clarifies that it is not appropriate to use dilution for bacteria criteria in receiving waters that are designated for primary contact recreation. Therefore, because the receiving water is designated for primary contact recreation, the DEM has assigned a monthly average Enterococci limit of 54 colonies/100ml. The daily maximum enterococci limit has been set at the 90% upper confidence level value for "lightly used full body contact recreation" of 175 colonies/100ml. The DEM has also assigned Fecal Coliform monitoring to ensure that the WWTF is providing treatment that is comparable to historic treatment levels.

Disinfection Limits

To ensure that the WWTF is providing proper disinfection, the permit contains continuous monitoring of the UV intensity, UV transmittance, and UV dosage. This data will be used to ensure that the UV disinfection system is operating as designed and approved. This permit also authorizes the use of chorine disinfection only for emergency purposes and in accordance with the facility's Operation and Maintenance Manual.

Nutrient Limits

Nitrogen:
The Providence and Seekonk Rivers are impacted by low DO levels and high phytoplankton concentrations that are related to excessive nitrogen loadings. Significant areas of the Providence and Seekonk Rivers suffer from hypoxic (low DO) and anoxic (lack of DO) conditions and violate water quality standards. Available data shows that nitrogen loads are dominated by wastewater treatment facility inputs.

DEM hired a consultant and has been working with a technical advisory committee (TAC), consisting primarily of scientists and engineers representing, academic, municipal, state and federal organizations, to calibrate a model and develop a water quality restoration plan, or TMDL. It was concluded that the hydrodynamic model could not adequately simulate conditions due to the relatively severe changes in the bathymetry in the Providence River. Therefore, the DEM has concluded that the best method available for evaluating impacts and setting nitrogen load reduction targets for the Providence River is to use the set of empirical relations developed from the Marine Ecosystems Research Laboratory (MERL) enrichment gradient studies at the University of Rhode Island.

In February 2004, DEM developed an analysis titled *Evaluation of Nitrogen Targets and WWTF Load Reductions for the Providence and Seekonk Rivers.* This analysis indicated that even if the wastewater treatment facility (WWTF) discharges are reduced to the limit of technology (total nitrogen of 3 mg/l), the Seekonk River and portions of the Providence River would not fully comply with existing water quality standards for DO. DEM has evaluated the implementation costs, the performance of available technology, and estimates of water quality improvement to develop a phased plan for implementation of WWTF improvements at Massachusetts and Rhode Island WWTFs which maximizes the DO levels relative to implementation cost. Estimates of capital costs to modify existing facilities to achieve the target levels on a seasonal basis were developed. These costs included allowances for planning, design, construction and administration and must be considered Order-of-Magnitude estimates, since specific facility characteristics were not evaluated.

Based on this evaluation of the sources of excessive nitrogen levels in the rivers and the capabilities of existing treatment processes, the DEM in 2008 determined that it would be appropriate to establish seasonal (May – October) limits for total nitrogen of 8.0 mg/l to the West Warwick WWTF. These limits, in combination with the reductions being assigned to the other WWTFs, will achieve a 50% reduction from the 1995-1996 Rhode Island WWTF loading, consistent with the recommendations from The Governor's Narragansett Bay and Watershed Planning Commission. In addition to adding a seasonal total nitrogen limit of 8.0 mg/l, the 2008 permit also required that the permittee operate the treatment facility to reduce the discharge of total nitrogen, during the months of November through March, to the maximum extent possible using all available treatment equipment in place at the facility. Assigning seasonal total nitrogen limits and requiring that the WWTF be operated year round in a manner to reduce the discharge of nitrogen to the maximum extent possible will result in substantial progress towards the mitigation of hypoxic/anoxic events and meeting water quality standards. The analysis contained in *Evaluation of Nitrogen Targets and WWTF Load Reductions for the Providence and Seekonk Rivers*, indicates that the contribution of the Massachusetts WWTFs is significant and, therefore, DEM is also working with the MADEP and the EPA to pursue appropriate nitrogen reductions at these WWTFs.

In order to maintain the same total nitrogen load contributed by the West Warwick WWTF while at the same time granting an increase in the monthly average discharge flow limit from 10.5 MGD to 11.0 MGD, a revised total nitrogen concentration limit of 7.6 mg/l has been included in the proposed permit.

An integral component of this phased plan is a water quality reassessment that will evaluate the water quality improvements achieved after the WWTF upgrades have been completed and will determine the need for further reductions. In addition several researchers are currently developing water quality models that DEM will evaluate to determine their utility towards evaluating the need for further reductions. This permit maintains the Total Nitrogen permit limits from the previous permit.

Phosphorus:

Rule 8.D(2), Table 1 of the Rhode Island Water Quality Regulations requires that nutrients shall not be discharged "in such concentration that would impair any usages specifically assigned to said class, or cause undesirable or nuisance aquatic species associated with cultural eutrophication" and also requires that "phosphates shall be removed from existing discharges to the extent that such removal is or may become technically and reasonably feasible." In freshwater systems, phosphorus is typically the limiting nutrient and controls the production of aquatic plants and algae in the water.

As stated previously the segment of the Pawtuxet River that receives the discharge from the West Warwick WWTF is currently not supporting the Fish and Wildlife Habitat use due to impairments associated with Total Phosphorus, as provided in the DEM's 303(d) list of impaired waters dated May 2015. Reaches along the Pawtuxet River still suffer from cultural eutrophication caused by excessive nutrients entering and accumulating in the river. Because the Pawtuxet River is a freshwater system, excessive levels of phosphorus will promote the growth of nuisance algae and rooted aquatic plants. This excessive algal and/or plant growth results in reduced water clarity and poor aesthetic quality. As a result, the discharge of phosphorus from the Pawtuxet River WWTFs is impairing usages assigned to the Main Stem of the Pawtuxet River by causing the growth of undesirable and nuisance aquatic species and causing cultural eutrophication. Therefore, the DEM determined that in accordance with Rule 8.D(2) of the Rhode Island Water Quality Regulations the discharge of phosphorus must be removed to the lowest levels that are technically and reasonably feasible.

The DEM previously determined that total phosphorus levels of 0.1 mg/l are both technically and reasonably achievable using existing treatment technologies. In addition to ensuring that the 0.1 mg/l total phosphorus limit is technically and reasonably feasible, the DEM also performed an analysis to determine if the 0.1 mg/l limit will be protective of water quality. EPA has produced several guidance documents, which contain recommended total phosphorus criteria for flowing water bodies. The 1986 Quality Criteria of Water ("the Gold Book") recommends in-stream phosphorus concentrations of 0.1 mg/l for any stream not discharging directly to lakes or impoundments. The DEM reviewed the flow characteristics of the Main Stem of the Pawtuxet River to determine if the river is impounded. Based upon this analysis, the DEM has determined that the river is not impounded. Therefore, the recommended total phosphorus criteria that would apply to the Main Stem of the Pawtuxet River from the Gold Book is 0.1 mg/l. In addition, in December 2000, EPA published updated nutrient guidelines, which vary based by eco-region. The recommended EPA criteria applicable to Rhode Island waters are described in the document titled *Ambient Water Quality Criteria Recommendations: Information Supporting the Development of State and Tribal Nutrient Criteria, Rivers and Streams in Nutrient Ecoregion XIV (EPA 822-B-00-022, December 2000)*. This document identifies the EPA recommended guidelines applicable to Rhode Island waters as 23.75 ug/l in rivers. However, these recommended guidelines do not substitute for the CWA or EPA's regulations, nor are the documents themselves regulations. Thus, they cannot impose legally binding requirements on EPA, States, Indian tribes or the regulated community. Using the WWTF's design flows and 7Q10 flow of the Pawtuxet River, the DEM determined that by assigning a total phosphorus limit of 0.1 mg/l the in-stream phosphorus concentration of the River would fall between the Gold Book and Ecoregion criteria. Therefore, the DEM made a determination that a total phosphorus limit of 0.1 mg/l is appropriate.

In order to maintain the same total phosphorus load contributed by the West Warwick WWTF while at the same time granting an increase in the monthly average discharge flow limit from 10.5 MGD to 11.0 MGD, a revised total phosphorus concentration limit was calculated by multiplying the 0.1 mg/l limit by a factor of 0.95 (i.e. 0.95 = 10.5MGD/11MGD). After adjusting the concentration limit to account for the increase in the monthly average flow limit the reduced concentration based limit would be 0.095 mg/l. Due to mathematical rounding the 2008 limit of 0.1 mg/l total phosphorus will be maintained in the proposed 2017 permit.

The total phosphorus limit (0.1 mg/l) is a monthly average limit in effect from April 1 through October 31. The maximum daily value must also be reported for each month. In addition, the permit also contains a total phosphorus monthly average limit of 1.0 mg/l during November 1 through March 31. The winter period limitation on phosphorus is necessary to ensure that the higher levels of phosphorus discharged in the winter period do not result in the accumulation of phosphorus in the sediments. The limitation assumes that the dissolved fraction of the total phosphorus will pass through the system given the short detention time of the Pawtuxet River and the lack of plant growth during the winter period. A monitoring requirement for orthophosphorus has been included for the winter period in order to determine the particulate fraction. The Total Phosphorus limits in this permit are consistent with the above requirements and the limits from the previous permit.

Bioassay Testing

DEM's toxicity permitting policy is based on past toxicity data and the level of available dilution. Based upon past toxicity results and available dilution, the draft permit requires an LC_{50} $\geq$100% effluent limit for quarterly acute tests. Chronic toxicity testing for daphnids is required based on the chronic dilution factor of 1.8 which is lower than the 10 dilution threshold; thereby requiring a chronic toxicity limit of $\geq$ 50% effluent. The biomonitoring requirements are set fourth in 40 CFR 131.11 and the State's Water Quality Regulations to assure control of toxicity in the effluent. If toxicity is demonstrated, then toxicity identification and reduction will be required.

Other Limits and Conditions

The effluent monitoring requirements have been specified in accordance with RIPDES regulations as well as 40 CFR 122.41 (j), 122.44 (i), and 122.48 to yield data representative of the discharge.

The permit contains requirements for the permittee to comply with the State's Rules and Regulations for Sewage Sludge Management and its DEM Order of Approval for sludge disposal in accordance with the requirements of Section 405(d) of the Clean Water Act (CWA). Permits must contain sludge conditions requiring compliance with limits, State laws, and applicable regulations as per Section 405(d) of the CWA and 40 CFR 503. The DEM Sludge Order of Approval sets forth the conditions to ensure this compliance.

The permit contains a reporting requirement for a local program to regulate industrial discharges to the sewer system (referred to as pretreatment program). This program is being required under authority of Section 402 (b)(8) of the CWA and 40 CFR 122.44 (j) and 403.8 because the Town receives significant discharges of industrial wastewater.

The Office has determined that all permit limitations are consistent with the Rhode Island Antidegradation policy.

The remaining general and specific conditions of the permit are based on the RIPDES regulations as well as 40 CFR Parts 122 through 125 and consist primarily of management requirements common to all permits.

V. Comment Period, Hearing Requests, and Procedures for Final Decisions

All persons, including applicants, who believe any condition of the draft permit is inappropriate must raise all issues and submit all available arguments and all supporting material for their arguments in full by the close of the public comment period, to the Rhode Island Department of Environmental Management, Office of Water Resources, 235 Promenade Street, Providence, Rhode Island, 02908-5767. In accordance with Chapter 46-17.4 of Rhode Island General Laws, a public hearing will be held prior to the close of the public comment period. In reaching a final decision on the draft permit the Director will respond to all significant comments and make these responses available to the public at DEM's Providence Office.

Following the close of the comment period, and after a public hearing, the Director will issue a final permit decision and forward a copy of the final decision to the applicant and each person who has submitted written comments, provided oral testimony, or requested notice. Within thirty (30) days following the notice of the final permit decision any interested person may submit a request for a formal hearing to reconsider or contest the final decision. Requests for formal hearings must satisfy the requirements of Rule 49 of the Regulations for the Rhode Island Pollutant Discharge Elimination System.

VI. **DEM Contact**

Additional information concerning the permit may be obtained between the hours of 8:30 a.m. and 4:00 p.m., Monday through Friday, excluding holidays from:

Abdulrahman Ragab, Sanitary Engineer
Department of Environmental Management/Office of Water Resources
235 Promenade Street
Providence, Rhode Island 02908
Telephone: (401) 222-4700 Ext. 7201
Email: Abed.Ragab@dem.ri.gov

12/5/18
Date

Joseph B. Haberek, PE
Supervising Sanitary Engineer
RIPDES Program
Office of Water Resources
Department of Environmental Management

ATTACHMENT A-1

DESCRIPTION OF DISCHARGE: Secondary treated domestic and industrial wastewater.
DISCHARGE: 001A - Secondary Treatment Discharge

AVERAGE EFFLUENT CHARACTERISTICS AT POINT OF DISCHARGE:

PARAMETER	AVERAGE[1]	MAXIMUM[2]
Flow (MGD)	5.74 MGD	7.67 MGD
BOD_5 Loading (Nov. 1 – May 31)	309.57 lb/day	711.68 lb/day
BOD_5 (Nov. 1 – May 31)	5.76 mg/l	13.32 mg/l
BOD_5 % Removal (Nov. 1 – May 31)	95.7% (Minimum)	
$CBOD_5$ Loading		
(June 1 – June 30)	326.43 lb/day	736.71 lb/day
(July 1 – Sept. 30)	187.05 lb/day	460.52 lb/day
(Oct. 1 – Oct. 31)	171.57 lb/day	363.43 lb/day
$CBOD_5$		
(June 1 – June 30)	7.31 mg/l	16.73 mg/l
(July 1 – Sept. 30)	4.94 mg/l	12.04 mg/l
(Oct. 1 – Oct. 31)	4.60 mg/l	9.19 mg/l
$CBOD_5$ % Removal (June 1 – Oct. 31)	96.5% (Minimum)	
TSS Loading		
(Nov. 1 – May 31)	202.25 lb/day	590.70 lb/day
(June 1 – June 30)	162.43 lb/day	501.29 lb/day
(July 1 – Sept. 30)	163.14 lb/day	427.90 lb/day
(Oct. 1 – Oct. 31)	125.33 lb/day	449.00 lb/day
TSS		
(Nov. 1 – May 31)	3.75 mg/l	10.79 mg/l
(June 1 – June 30)	3.51 mg/l	11.14 mg/l
(July 1 – Sept. 30)	4.63 mg/l	11.52 mg/l
(Oct. 1 – Oct. 31)	3.29 mg/l	10.89 mg/l
TSS % Removal	96.8 %	
Settleable Solids		0.06 ml/l
Fecal Coliform	9.39 MPN/100 ml (geometric mean)	247.69 MPN/100 ml
UV Intensity	75.71 mW/cm^2	99.95 mW/cm^2
UV Transmittance	71.76 %	76.69 %
UV Dosage	355.77 $mw\text{-}s/cm^2$	774.95 $mw\text{-}s/cm^2$
pH	6.91 S.U.(Minimum)	7.65 S.U.(Maximum)
Dissolved Oxygen (June 1 – Oct. 31)	6.84 mg/l (Minimum)	
Phosphorus, Total (Nov. 1 – March 31)	0.93 mg/l	1.24 mg/l

(April 1 – Oct. 31)	1.01 mg/l	1.31 mg/l
Orthophosphorus		
(Nov. 1 – March 31)	0.87 mg/l	1.11 mg/l
Ammonia, Total (as N)		
(Nov. 1 – April 30)	1.13 mg/l	2.63 mg/l
(May 1 – May 31)	2.97 mg/l	3.46 mg/l
(June 1 – Oct. 31)	1.30 mg/l	3.22 mg/l
Nitrogen, Total (TKN + Nitrate + Nitrite, as N)		
(Nov. 1 – April 30)	17.56 mg/l	19.87 mg/l
(May 1 – Oct. 31)	9.12 mg/l	11.61 mg/l
Nitrogen, Total (TKN + Nitrate + Nitrite, as N) Loading		
(Nov. 1 – April 30)	881.92 lb/day	
(May 1 – Oct. 31)	370.95 lb/day	
Nitrogen, Total Kjeldahl		
(Nov. 1 – April 30)	2.2 mg/l	3.0 mg/l
(May 1 – Oct. 31)	4.1 mg/l	6.7 mg/l
Nitrate, Total (as N)		
(Nov. 1 – April 30)	15.23 mg/l	17.01 mg/l
(May 1 – Oct. 31)	5.04 mg/l	6.79 mg/l
Nitrite, Total (as N)		
(Nov. 1 – April 30)	0.31 mg/l	0.41 mg/l
(May 1 – Oct. 31)	0.51 mg/l	0.83 mg/l
Lead, Total	0.51 ug/l	0.67 ug/l
Cyanide[3]	0.00 ug/l	0.00 ug/l
Cadmium, Total[4]	0.00 ug/l	0.04 ug/l
Copper, Total	3.69 ug/l	3.69 ug/l
Zinc, Total	20.58 ug/l	20.58 ug/l

[1]Data represents the mean of the monthly average data from December 2008 – April 2016.
[2]Data represents the mean of the daily maximum data from December 2008 – April 2016.
[3]Data represents the mean of the monthly average and the mean of the daily maximum data from January 2011 – April 2016
[4]Data represents the mean of the monthly average and the mean of the daily maximum data from January 2010 – April 2016

Whole Effluent Toxicity Testing Results (percent effluent)

Species: Ceriodaphnia Dubia

Monitoring Quarter	LC50 Result	C-NOEC Result
1st Quarter 2014	=100%	=100%
2nd Quarter 2014	=100%	=100%
3rd Quarter 2014	=100%	=6%
4th Quarter 2014	=100%	=100%
1st Quarter 2015	=100%	=100%
2nd Quarter 2015	=100%	=100%
3rd Quarter 2015	=100%	=100%
4th Quarter 2015	=100%	=100%

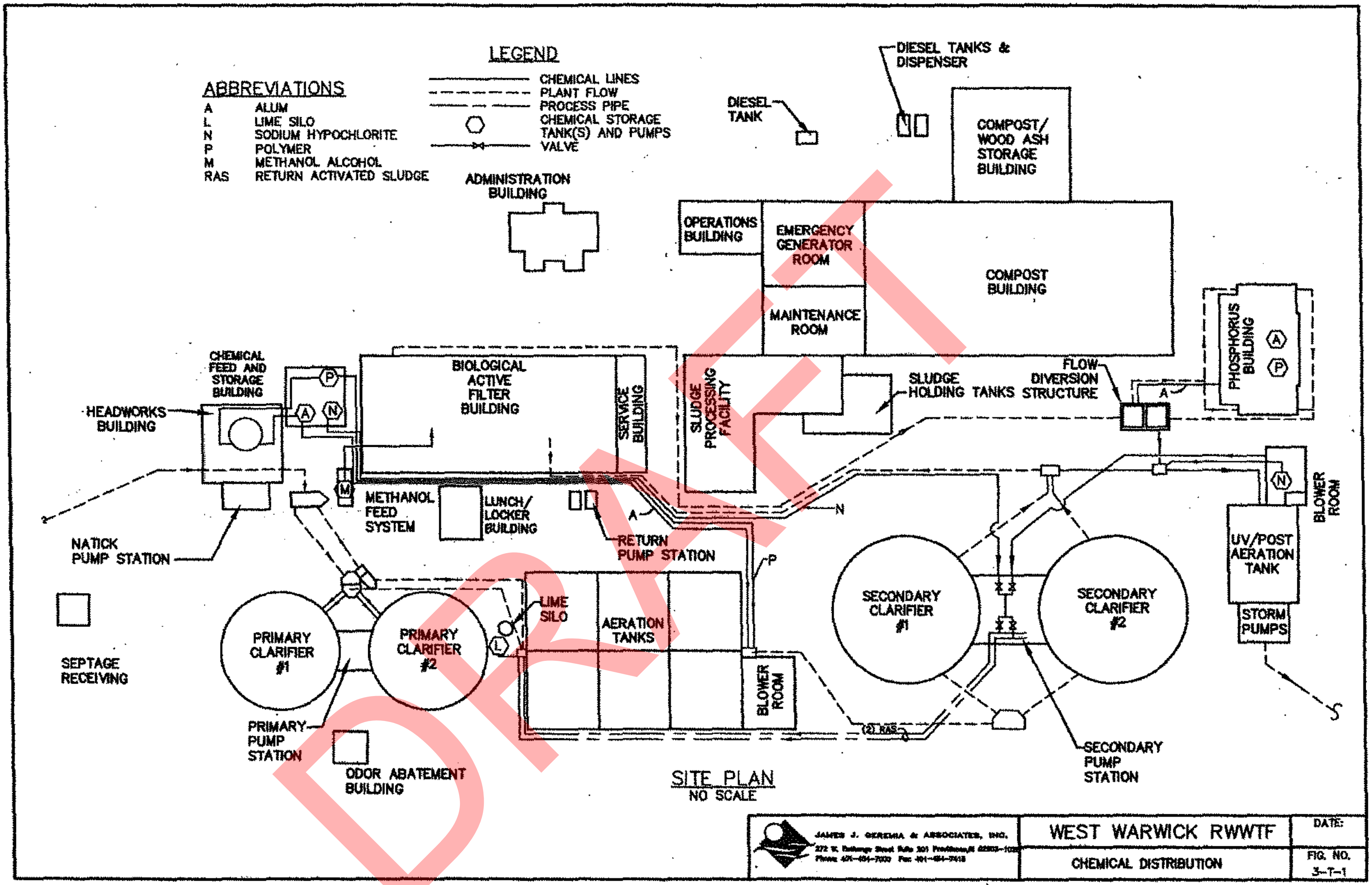
1st Quarter 2016	=100%	=100%

Species: Pimephales Promelas

Monitoring Quarter	LC50 Result
1st Quarter 2014	=100%
2nd Quarter 2014	=100%
3rd Quarter 2014	=100%
4th Quarter 2014	=100%
1st Quarter 2015	=100%
2nd Quarter 2015	=100%
3rd Quarter 2015	=100%
4th Quarter 2015	=100%
1st Quarter 2016	=100%

ATTACHMENT A-2

West Warwick WWTF Treatment Process Schematic



LEGEND
CHEMICAL LINES
PLANT FLOW
PROCESS PIPE
CHEMICAL STORAGE TANK(S) AND PUMPS
VALVE
ABBREVIATIONS
A ALUM
L LIME SILO
N SODIUM HYPOCHLORITE
P POLYMER
M METHANOL ALCOHOL
RAS RETURN ACTIVATED SLUDGE
ADMINISTRATION BUILDING
DIESEL TANK
DIESEL TANKS & DISPENSER
COMPOST/ WOOD ASH STORAGE BUILDING
OPERATIONS BUILDING
EMERGENCY GENERATOR ROOM
MAINTENANCE ROOM
COMPOST BUILDING
PHOSPHORUS BUILDING
CHEMICAL FEED AND STORAGE BUILDING
HEADWORKS BUILDING
BIOLOGICAL ACTIVE FILTER BUILDING
SERVICE BUILDING
SLUDGE PROCESSING FACILITY
SLUDGE HOLDING TANKS
FLOW DIVERSION STRUCTURE
BLOWER ROOM
METHANOL FEED SYSTEM
LUNCH/ LOCKER BUILDING
RETURN PUMP STATION
NATICK PUMP STATION
UV/POST AERATION TANK
STORM PUMPS
SEPTAGE RECEIVING
PRIMARY CLARIFIER #1
PRIMARY CLARIFIER #2
LIME SILO
AERATION TANKS
BLOWER ROOM
SECONDARY CLARIFIER #1
SECONDARY CLARIFIER #2
(2) RAS
PRIMARY PUMP STATION
ODOR ABATEMENT BUILDING
SECONDARY PUMP STATION
SITE PLAN
NO SCALE
JAMES J. GEREMIA & ASSOCIATES, INC.
WEST WARWICK RWWTF
CHEMICAL DISTRIBUTION
DATE:
FIG. NO.
3-T-1
DRAFT

ATTACHMENT A-3

Pawtuxet River Flow Profile

ITERATIONS FOR CYANIDE USING PRELIMINARY DESIGN FLOWS

Cyanide Criteria	22	Ratio of Hoechst to WWTF Limit	5
80% of Criteria	17.6		
7Q10 River Flow Upstream of Hoechst	20.05	Hoechst Celanese Flow	1.62
7Q10 River Flow Upstream of W. Warwick	52.26	West Warwick Flow	16.24
7Q10 River Flow Upstream of Warwick	77.05	Warwick Flow	11.91
7Q10 River Flow Upstream of Cranston	92.65	Cranston Flow	35.58
Ground Water Upstream of Hoechst	0.1	Total Flow Downstream of Hoechst	21.77
Ground Water Upstream of W. Warwick	0.82	Total Flow Downstream of W. Warwick	69.32
Ground Water Upstream of Warwick	0.27	Total Flow Downstream of Warwick	89.23
Ground Water Upstream of Cranston	2.04	Total Flow Downstream of Cranston	130.27

River concentration up of Hoe.	0
POTW Effluent Concentration	31.91914
POTW Dilution Factor	**1.813588**
Hoechst Effluent Concentration	159.5957
Hoechst Dilution Factor	9.067938

Hoechst-Cel.	Before W.W	West Warw.	Before War.	Warwick	Before Crans	Cranston
11.87621	11.44511	11.20762	11.16413	12.96726	12.67743	17.6

ITERATIONS FOR CYANIDE USING PRELIMINARY DESIGN FLOWS

Cyanide Criteria	22	Ratio of Hoechst to WWTF Limit	5
80% of Criteria	17.6		
7Q10 River Flow Upstream of Hoechst	35.56	Hoechst Celanese Flow	1.62
7Q10 River Flow Upstream of W. Warwick	76	West Warwick Flow	16.24
7Q10 River Flow Upstream of Warwick	103.1	Warwick Flow	11.91
7Q10 River Flow Upstream of Cranston	119.7	Cranston Flow	35.58
Ground Water Upstream of Hoechst	0.13	Total Flow Downstream of Hoechst	37.31
Ground Water Upstream of W. Warwick	1.04	Total Flow Downstream of W. Warwick	93.28
Ground Water Upstream of Warwick	0.35	Total Flow Downstream of Warwick	115.36
Ground Water Upstream of Cranston	2.59	Total Flow Downstream of Cranston	157.87

River concentration up of Hoe.	0
POTW Effluent Concentration	38.68178
POTW Dilution Factor	**2.197828**
Hoechst Effluent Concentration	193.4089
Hoechst Dilution Factor	10.98914

Hoechst-Cel.	Before W.W	West Warw.	Before War.	Warwick	Before Crans	Cranston
8.397813	8.170075	10.09342	10.05569	12.15512	11.88821	17.6

ITERATIONS FOR CYANIDE USING PRELIMINARY DESIGN FLOWS

Cyanide Criteria	22	Ratio of Hoechst to WWTF Limit	5
80% of Criteria	17.6		
Mean Harmonic River Flow Upstream of Hoechst	66.97	Hoechst Celanese Flow	1.62
Mean Harmonic River Flow Upstream of W. Warwick	155.58	West Warwick Flow	16.24
Mean Harmonic River Flow Upstream of Warwick	196.2	Warwick Flow	11.91
Mean Harmonic River Flow Upstream of Cranston	218.64	Cranston Flow	35.58
Ground Water Upstream of Hoechst	0.28	Total Flow Downstream of Hoechst	68.87
Ground Water Upstream of W. Warwick	2.34	Total Flow Downstream of W. Warwick	174.16
Ground Water Upstream of Warwick	0.79	Total Flow Downstream of Warwick	208.9
Ground Water Upstream of Cranston	5.82	Total Flow Downstream of Cranston	260.04

River concentration up of Hoe.	0
POTW Effluent Concentration	63.71577
POTW Dilution Factor	**3.620214**
Hoechst Effluent Concentration	318.5789
Hoechst Dilution Factor	18.10107

Hoechst-Cel.	Before W.W	West Warw.	Before War.	Warwick	Before Crans	Cranston
7.493796	7.247546	8.904696	8.864487	11.05647	10.75678	17.6

ATTACHMENT A-4

Summary of Applicable Water Quality Based Limits

CALCULATION OF WATER QUALITY BASED NON-CLASS AA FRESHWATER DISCHARGE LIMITS

FACILITY SPECIFIC DATA INPUT SHEET

NOTE: LIMITS BASED ON RI WATER QUALITY CRITERIA DATED JULY 2006

FACILITY NAME: **West Warwick**
RIPDES PERMIT #: **RI0100153**

	DISSOLVED BACKGROUND DATA (ug/L)	ACUTE METAL TRANSLATOR	CHRONIC METAL TRANSLATOR
ALUMINUM	**NA**	**NA**	**NA**
ARSENIC	**NA**	**1**	**1**
CADMIUM	**NA**	**modeled**	**modeled**
CHROMIUM III	**NA**	**modeled**	**modeled**
CHROMIUM VI	**NA**	**modeled**	**modeled**
COPPER	**NA**	**modeled**	**modeled**
LEAD	**NA**	**modeled**	**modeled**
MERCURY	**NA**	**0.85**	**0.85**
NICKEL	**NA**	**modeled**	**modeled**
SELENIUM	**NA**	**NA**	**NA**
SILVER	**NA**	**modeled**	**NA**
ZINC	**NA**	**0.978**	**0.986**
AMMONIA (as N)	**NA**		

USE NA WHEN NO DATA IS AVAILABLE

NOTE 1: METAL TRANSLATORS FROM RI WATER QUALITY REGS.

DILUTION FACTORS	
ACUTE =	**1.8**
CHRONIC =	**1.8**
(MAY-OCT) =	**1.8**
(NOV-APR) =	**2.2**
HARMONIC FLOW =	**3.6**
HARMONIC FLOW =	**3.6**

pH = See Ammonia Input Sheet
HARDNESS = 63.2 (mg/L as CaCo3)

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WATER QUALITY BASED EFFLUENT LIMITS - FRESHWATER

CALCULATION OF WATER QUALITY BASED NON-CLASS AA FRESHWATER DISCHARGE LIMITS

Facility Name: West Warwick RIPDES PERMIT #. RI0100153

Month	Upper 90th% pH	Upper 90th% Temp (C)	Acute Criteria * ug/L as N	Chronic Criteria* ug/L as N
May	6.7	15.4	44.6	6.09
Jun	6.6	21	46.8	4.32
Jul	6.6	23	46.8	3.80
Aug	6.7	22.8	44.6	3.78
Sep	6.7	19.9	44.6	4.55
Oct	6.7	14.8	44.6	6.33
Nov	6.6	9.6	46.8	9.02
Dec	6.9	5.1	39.1	9.93
Jan	7	2.1	36.1	9.60
Feb	6.8	3.1	42	10.22
Mar	6.7	5.7	44.6	10.46
Apr	6.8	10.7	42	8.05

**NOTE: Criteria from Appendix B of the RI Water Quality Regs., July 2006.*

CALCULATION OF WATER QUALITY BASED NON-CLASS AA FRESHWATER DISCHARGE LIMITS

FACILITY NAME: West Warwick RIPDES PERMIT #: RI0100153

NOTE: METALS CRITERIA ARE EXPRESSED AS DISSOLVED, METALS LIMITS ARE EXPRESSED AS TOTAL

CHEMICAL NAME	CAS #	BACKGROUND CONCENTRATION (ug/L)	FRESHWATER CRITERIA ACUTE (ug/L)	DAILY MAX LIMIT (ug/L)	FRESHWATER CRITERIA CHRONIC (ug/L)	HUMAN HEALTH NON-CLASS A CRITERIA (ug/L)	MONTHLY AVE LIMIT (ug/L)
PRIORITY POLLUTANTS:							
TOXIC METALS AND CYANIDE							
ANTIMONY	7440360		450	648	10	640	14.4
ARSENIC (limits are total recoverable)	7440382	NA	340	489.6	150	1.4	4.032
ASBESTOS	1332214			No Criteria			No Criteria
BERYLLIUM	7440417		7.5	10.8	0.17		0.2448
CADMIUM (limits are total recoverable)	7440439	NA	#NUM!	see dev doc	#NUM!		see dev doc
CHROMIUM III (limits are total recoverable)	16065831	NA	#NUM!	see dev doc	#NUM!		see dev doc
CHROMIUM VI (limits are total recoverable)	18540299	NA	16	see dev doc	11		see dev doc
COPPER (limits are total recoverable)	7440508	NA	#NUM!	see dev doc	#NUM!		see dev doc
CYANIDE	57125		22	31.68	5.2	140	7.488
LEAD (limits are total recoverable)	7439921	NA	#NUM!	see dev doc	#NUM!		see dev doc
MERCURY (limits are total recoverable)	7439976	NA	1.4	2.371764706	0.77	0.15	0.508235294
NICKEL (limits are total recoverable)	7440020	NA	#NUM!	see dev doc	#NUM!	4600	see dev doc
SELENIUM (limits are total recoverable)	7782492	NA	20	28.8	5	4200	7.2
SILVER (limits are total recoverable)	7440224	NA	#NUM!	see dev doc	NA		see dev doc
THALLIUM	7440280		46	66.24	1	0.47	1.3536
ZINC (limits are total recoverable)	7440666	NA	129.3010814	186	#NUM!	26000	see dev doc
VOLATILE ORGANIC COMPOUNDS							
ACROLEIN	107028		2.9	4.176	0.06	290	0.0864
ACRYLONITRILE	107131		378	544.32	8.4	2.5	7.2
BENZENE	71432		265	381.6	5.9	510	8.496
BROMOFORM	75252		1465	2109.6	33	1400	47.52
CARBON TETRACHLORIDE	56235		1365	1965.6	30	16	43.2
CHLOROBENZENE	108907		795	1144.8	18	1600	25.92
CHLORODIBROMOMETHANE	124481			No Criteria		130	374.4
CHLOROFORM	67663		1445	2080.8	32	4700	46.08
DICHLOROBROMOMETHANE	75274			No Criteria		170	489.6
1,2DICHLOROETHANE	107062		5900	8496	131	370	188.64
1,1DICHLOROETHYLENE	75354		580	835.2	13	7100	18.72
1,2DICHLOROPROPANE	78875		2625	3780	58	150	83.52
1,3DICHLOROPROPYLENE	542756			No Criteria		21	60.48
ETHYLBENZENE	100414		1600	2304	36	2100	51.84
BROMOMETHANE (methyl bromide)	74839			No Criteria		1500	4320
CHLOROMETHANE (methyl chloride)	74873			No Criteria			No Criteria
METHYLENE CHLORIDE	75092		9650	13896	214	5900	308.16

CALCULATION OF WATER QUALITY BASED NON-CLASS AA FRESHWATER DISCHARGE LIMITS

FACILITY NAME: West Warwick RIPDES PERMIT #: RI0100153

NOTE: METALS CRITERIA ARE EXPRESSED AS DISSOLVED, METALS LIMITS ARE EXPRESSED AS TOTAL

CHEMICAL NAME	CAS #	BACKGROUND CONCENTRATION (ug/L)	FRESHWATER CRITERIA ACUTE (ug/L)	DAILY MAX LIMIT (ug/L)	FRESHWATER CRITERIA CHRONIC (ug/L)	HUMAN HEALTH NON-CLASS A CRITERIA (ug/L)	MONTHLY AVE LIMIT (ug/L)
1,1,2,2TETRACHLOROETHANE	79345		466	671.04	10	40	14.4
TETRACHLOROETHYLENE	127184		240	345.6	5.3	33	7.632
TOLUENE	108883		635	914.4	14	15000	20.16
1,2TRANSDICHLOROETHYLENE	156605			No Criteria		10000	28800
1,1,1TRICHLOROETHANE	71556			No Criteria			No Criteria
1,1,2TRICHLOROETHANE	79005		900	1296	20	160	28.8
TRICHLOROETHYLENE	79016		1950	2808	43	300	61.92
VINYL CHLORIDE	75014			No Criteria		2.4	6.912
ACID ORGANIC COMPOUNDS							
2CHLOROPHENOL	95578		129	185.76	2.9	150	4.176
2,4DICHLOROPHENOL	120832		101	145.44	2.2	290	3.168
2,4DIMETHYLPHENOL	105679		106	152.64	2.4	850	3.456
4,6DINITRO2METHYL PHENOL	534521			No Criteria		280	806.4
2,4DINITROPHENOL	51285		31	44.64	0.69	5300	0.9936
4NITROPHENOL	88755			No Criteria			No Criteria
PENTACHLOROPHENOL	87865		#NUM!	No Criteria	#NUM!	30	86.4
PHENOL	108952		251	361.44	5.6	1700000	8.064
2,4,6TRICHLOROPHENOL	88062		16	23.04	0.36	24	0.5184
BASE NEUTRAL COMPUNDS							
ACENAPHTHENE	83329		85	122.4	1.9	990	2.736
ANTHRACENE	120127			No Criteria		40000	115200
BENZIDINE	92875			No Criteria		0.002	0.00576
POLYCYCLIC AROMATIC HYDROCARBONS				No Criteria		0.18	0.5184
BIS(2CHLOROETHYL)ETHER	111444			No Criteria		5.3	15.264
BIS(2CHLOROISOPROPYL)ETHER	108601			No Criteria		65000	187200
BIS(2ETHYLHEXYL)PHTHALATE	117817		555	799.2	12	22	17.28
BUTYL BENZYL PHTHALATE	85687		85	122.4	1.9	1900	2.736
2CHLORONAPHTHALENE	91587			No Criteria		1600	4608
1,2DICHLOROBENZENE	95501		79	113.76	1.8	1300	2.592
1,3DICHLOROBENZENE	541731		390	561.6	8.7	960	12.528
1,4DICHLOROBENZENE	106467		56	80.64	1.2	190	1.728
3,3DICHLOROBENZIDENE	91941			No Criteria		0.28	0.8064
DIETHYL PHTHALATE	84662		2605	3751.2	58	44000	83.52
DIMETHYL PHTHALATE	131113		1650	2376	37	1100000	53.28
DI-n-BUTYL PHTHALATE	84742			No Criteria		4500	12960
2,4DINITROTOLUENE	121142		1550	2232	34	34	48.96

CALCULATION OF WATER QUALITY BASED NON-CLASS AA FRESHWATER DISCHARGE LIMITS

FACILITY NAME: West Warwick RIPDES PERMIT #: RI0100153

NOTE: METALS CRITERIA ARE EXPRESSED AS DISSOLVED, METALS LIMITS ARE EXPRESSED AS TOTAL

CHEMICAL NAME	CAS #	BACKGROUND CONCENTRATION (ug/L)	FRESHWATER CRITERIA ACUTE (ug/L)	DAILY MAX LIMIT (ug/L)	FRESHWATER CRITERIA CHRONIC (ug/L)	HUMAN HEALTH NON-CLASS A CRITERIA (ug/L)	MONTHLY AVE LIMIT (ug/L)
1,2DIPHENYLHYDRAZINE	122667		14	20.16	0.31	2	0.4464
FLUORANTHENE	206440		199	286.56	4.4	140	6.336
FLUORENE	86737			No Criteria		5300	15264
HEXACHLOROBENZENE	118741			No Criteria		0.0029	0.008352
HEXACHLOROBUTADIENE	87683			No Criteria		180	518.4
HEXACHLOROCYCLOPENTADIENE	77474		0.35	0.504	0.008	1100	0.01152
HEXACHLOROETHANE	67721		49	70.56	1.1	33	1.584
ISOPHORONE	78591		5850	8424	130	9600	187.2
NAPHTHALENE	91203		115	165.6	2.6		3.744
NITROBENZENE	98953		1350	1944	30	690	43.2
N-NITROSODIMETHYLAMINE	62759			No Criteria		30	86.4
N-NITROSODI-N-PROPYLAMINE	621647			No Criteria		5.1	14.688
N-NITROSODIPHENYLAMINE	86306		293	421.92	6.5	60	9.36
PYRENE	129000			No Criteria		4000	11520
1,2,4trichlorobenzene	120821		75	108	1.7	70	2.448
PESTICIDES/PCBs							
ALDRIN	309002		3	4.32		0.0005	0.00144
Alpha BHC	319846			No Criteria		0.049	0.14112
Beta BHC	319857			No Criteria		0.17	0.4896
Gamma BHC (Lindane)	58899		0.95	1.368		1.8	5.184
CHLORDANE	57749		2.4	3.456	0.0043	0.0081	0.006192
4,4DDT	50293		1.1	1.584	0.001	0.0022	0.00144
4,4DDE	72559			No Criteria		0.0022	0.006336
4,4DDD	72548			No Criteria		0.0031	0.008928
DIELDRIN	60571		0.24	0.3456	0.056	0.00054	0.0015552
ENDOSULFAN (alpha)	959988		0.22	0.3168	0.056	89	0.08064
ENDOSULFAN (beta)	33213659		0.22	0.3168	0.056	89	0.08064
ENDOSULFAN (sulfate)	1031078			No Criteria		89	256.32
ENDRIN	72208		0.086	0.12384	0.036	0.06	0.05184
ENDRIN ALDEHYDE	7421934			No Criteria		0.3	0.864
HEPTACHLOR	76448		0.52	0.7488	0.0038	0.00079	0.0022752
HEPTACHLOR EPOXIDE	1024573		0.52	0.7488	0.0038	0.00039	0.0011232
POLYCHLORINATED BIPHENYLS3	1336363			No Criteria	0.014	0.00064	0.0018432
2,3,7,8TCDD (Dioxin)	1746016			No Criteria		0.000000051	1.4688E-07
TOXAPHENE	8001352		0.73	1.0512	0.0002	0.0028	0.000288
TRIBUTYLTIN			0.46	0.6624	0.072		0.10368

CALCULATION OF WATER QUALITY BASED NON-CLASS AA FRESHWATER DISCHARGE LIMITS

FACILITY NAME: West Warwick RIPDES PERMIT #: RI0100153

NOTE: METALS CRITERIA ARE EXPRESSED AS DISSOLVED, METALS LIMITS ARE EXPRESSED AS TOTAL

CHEMICAL NAME	CAS #	BACKGROUND CONCENTRATION (ug/L)	FRESHWATER CRITERIA ACUTE (ug/L)	DAILY MAX LIMIT (ug/L)	FRESHWATER CRITERIA CHRONIC (ug/L)	HUMAN HEALTH NON-CLASS A CRITERIA (ug/L)	MONTHLY AVE LIMIT (ug/L)
NON PRIORITY POLLUTANTS: OTHER SUBSTANCES							
ALUMINUM (limits are total recoverable)	7429905	NA	750	1080	87		125.28
AMMONIA as N(winter/summer)	7664417		36.1 | 44.6	63536 | 64224	8.05 | 3.78		14171.1 | 5439
4BROMOPHENYL PHENYL ETHER			18	25.92	0.4		0.576
CHLORIDE	16887006		860000	1238400	230000		349600
CHLORINE	7782505		19	34.2	11		19.8
4CHLORO2METHYLPHENOL			15	21.6	0.32		0.4608
1CHLORONAPHTHALENE			80	115.2	1.8		2.592
4CHLOROPHENOL	106489		192	276.48	4.3		6.192
2,4DICHLORO6METHYLPHENOL			22	31.68	0.48		0.6912
1,1DICHLOROPROPANE			1150	1656	26		37.44
1,3DICHLOROPROPANE	142289		303	436.32	6.7		9.648
2,3DINITROTOLUENE			17	24.48	0.37		0.5328
2,4DINITRO6METHYL PHENOL			12	17.28	0.26		0.3744
IRON	7439896			No Criteria	1000		1520
pentachlorobenzene	608935		13	18.72	0.28		0.4032
PENTACHLOROETHANE			362	521.28	8		11.52
1,2,3,5tetrachlorobenzene			321	462.24	7.1		10.224
1,1,1,2TETRACHLOROETHANE	630206		980	1411.2	22		31.68
2,3,4,6TETRACHLOROPHENOL	58902		7	10.08	0.16		0.2304
2,3,5,6TETRACHLOROPHENOL			8.5	12.24	0.19		0.2736
2,4,5TRICHLOROPHENOL	95954		23	33.12	0.51		0.7344
2,4,6TRINITROPHENOL	88062		4235	6098.4	94		135.36
XYLENE	1330207		133	191.52	3		4.56

CALCULATION OF WATER QUALITY BASED NON-CLASS AA FRESHWATER DISCHARGE LIMITS

FACILITY NAME: WEST WARWICK

RIPDES PERMIT #:RI0100153

CHEMICAL NAME	CAS#	DAILY MAX LIMIT (ug/L)	MONTHLY AVE LIMIT (ug/L)
PRIORITY POLLUTANTS:			
TOXIC METALS AND CYANIDE			
ANTIMONY	7440360	648.00	14.40
ARSENIC, TOTAL	7440382	489.60	4.03
ASBESTOS	1332214	No Criteria	0.00
BERYLLIUM	7440417	10.80	0.24
CADMIUM, TOTAL	7440439	see dev doc	see dev doc
CHROMIUM III, TOTAL	16065831	see dev doc	see dev doc
CHROMIUM VI, TOTAL	18540299	see dev doc	see dev doc
COPPER, TOTAL	7440508	see dev doc	see dev doc
CYANIDE	57125	31.68	7.49
LEAD, TOTAL	7439921	see dev doc	see dev doc
MERCURY, TOTAL	7439976	2.37	0.51
NICKEL, TOTAL	7440020	see dev doc	see dev doc
SELENIUM, TOTAL	7782492	28.80	7.20
SILVER, TOTAL	7440224	see dev doc	see dev doc
THALLIUM	7440280	66.24	1.35
ZINC, TOTAL	7440666	186.00	see dev doc
VOLATILE ORGANIC COMPOUNDS			
ACROLEIN	107028	4.18	0.09
ACRYLONITRILE	107131	544.32	7.20
BENZENE	71432	381.60	8.50
BROMOFORM	75252	2109.60	47.52
CARBON TETRACHLORIDE	56235	1965.60	43.20
CHLOROBENZENE	108907	1144.80	25.92
CHLORODIBROMOMETHANE	124481	No Criteria	374.40
CHLOROFORM	67663	2080.80	46.08
DICHLOROBROMOMETHANE	75274	No Criteria	489.60
1,2DICHLOROETHANE	107062	8496.00	188.64
1,1DICHLOROETHYLENE	75354	835.20	18.72
1,2DICHLOROPROPANE	78875	3780.00	83.52
1,3DICHLOROPROPYLENE	542756	No Criteria	60.48
ETHYLBENZENE	100414	2304.00	51.84
BROMOMETHANE (methyl bromide)	74839	No Criteria	4320.00
CHLOROMETHANE (methyl chloride)	74873	No Criteria	0.00
METHYLENE CHLORIDE	75092	13896.00	308.16
1,1,2,2TETRACHLOROETHANE	79345	671.04	14.40

CHEMICAL NAME	CAS#	DAILY MAX LIMIT (ug/L)	MONTHLY AVE LIMIT (ug/L)
TETRACHLOROETHYLENE	127184	345.60	7.63
TOLUENE	108883	914.40	20.16
1,2TRANSDICHLOROETHYLENE	156605	No Criteria	28800.00
1,1,1TRICHLOROETHANE	71556	No Criteria	0.00
1,1,2TRICHLOROETHANE	79005	1296.00	28.80
TRICHLOROETHYLENE	79016	2808.00	61.92
VINYL CHLORIDE	75014	No Criteria	6.91
ACID ORGANIC COMPOUNDS			
2CHLOROPHENOL	95578	185.76	4.18
2,4DICHLOROPHENOL	120832	145.44	3.17
2,4DIMETHYLPHENOL	105679	152.64	3.46
4,6DINITRO2METHYL PHENOL	534521	No Criteria	806.40
2,4DINITROPHENOL	51285	44.64	0.99
4NITROPHENOL	88755	No Criteria	0.00
PENTACHLOROPHENOL	87865	No Criteria	86.40
PHENOL	108952	361.44	8.06
2,4,6TRICHLOROPHENOL	88062	23.04	0.52
BASE NEUTRAL COMPUNDS			
ACENAPHTHENE	83329	122.40	2.74
ANTHRACENE	120127	No Criteria	115200.00
BENZIDINE	92875	No Criteria	0.01
PAHs		No Criteria	0.52
BIS(2CHLOROETHYL)ETHER	111444	No Criteria	15.26
BIS(2CHLOROISOPROPYL)ETHER	108601	No Criteria	187200.00
BIS(2ETHYLHEXYL)PHTHALATE	117817	799.20	17.28
BUTYL BENZYL PHTHALATE	85687	122.40	2.74
2CHLORONAPHTHALENE	91587	No Criteria	4608.00
1,2DICHLOROBENZENE	95501	113.76	2.59
1,3DICHLOROBENZENE	541731	561.60	12.53
1,4DICHLOROBENZENE	106467	80.64	1.73
3,3DICHLOROBENZIDENE	91941	No Criteria	0.81
DIETHYL PHTHALATE	84662	3751.20	83.52
DIMETHYL PHTHALATE	131113	2376.00	53.28
DI-n-BUTYL PHTHALATE	84742	No Criteria	12960.00
2,4DINITROTOLUENE	121142	2232.00	48.96
1,2DIPHENYLHYDRAZINE	122667	20.16	0.45
FLUORANTHENE	206440	286.56	6.34

CALCULATION OF WATER QUALITY BASED NON-CLASS AA FRESHWATER DISCHARGE LIMITS

FACILITY NAME: WEST WARWICK RIPDES PERMIT #:RI0100153

CHEMICAL NAME	CAS#	DAILY MAX LIMIT (ug/L)	MONTHLY AVE LIMIT (ug/L)
FLUORENE	86737	No Criteria	15264.00
HEXACHLOROBENZENE	118741	No Criteria	0.01
HEXACHLOROBUTADIENE	87683	No Criteria	518.40
HEXACHLOROCYCLOPENTADIENE	77474	0.50	0.01
HEXACHLOROETHANE	67721	70.56	1.58
ISOPHORONE	78591	8424.00	187.20
NAPHTHALENE	91203	165.60	3.74
NITROBENZENE	98953	1944.00	43.20
N-NITROSODIMETHYLAMINE	62759	No Criteria	86.40
N-NITROSODI-N-PROPYLAMINE	621647	No Criteria	14.69
N-NITROSODIPHENYLAMINE	86306	421.92	9.36
PYRENE	129000	No Criteria	11520.00
1,2,4trichlorobenzene	120821	108.00	2.45
PESTICIDES/PCBs			
ALDRIN	309002	4.32	0.00
Alpha BHC	319846	No Criteria	0.14
Beta BHC	319857	No Criteria	0.49
Gamma BHC (Lindane)	58899	1.37	1.37
CHLORDANE	57749	3.46	0.01
4,4DDT	50293	1.58	0.00
4,4DDE	72559	No Criteria	0.01
4,4DDD	72548	No Criteria	0.01
DIELDRIN	60571	0.35	0.00
ENDOSULFAN (alpha)	959988	0.32	0.08
ENDOSULFAN (beta)	33213659	0.32	0.08
ENDOSULFAN (sulfate)	1031078	No Criteria	256.32
ENDRIN	72208	0.12	0.05
ENDRIN ALDEHYDE	7421934	No Criteria	0.86
HEPTACHLOR	76448	0.75	0.00
HEPTACHLOR EPOXIDE	1024573	0.75	0.00
POLYCHLORINATED BIPHENYLS3	1336363	No Criteria	0.00
2,3,7,8TCDD (Dioxin)	1746016	No Criteria	0.00
TOXAPHENE	8001352	1.05	0.00
TRIBUTYLTIN		0.66	0.10

CHEMICAL NAME	CAS#	DAILY MAX LIMIT (ug/L)	MONTHLY AVE LIMIT (ug/L)
NON PRIORITY POLLUTANTS:			
OTHER SUBSTANCES			
ALUMINUM, TOTAL	7429905	1080.00	125.28
AMMONIA (as N), WINTER (NOV-API	7664417	63536.00	14171.09
AMMONIA (as N), SUMMER (MAY-OC	7664417	64224.00	5439.31
4BROMOPHENYL PHENYL ETHER		25.92	0.58
CHLORIDE	16887006	1238400.00	349600.00
CHLORINE	7782505	34.20	19.80
4CHLORO2METHYLPHENOL		21.60	0.46
1CHLORONAPHTHALENE		115.20	2.59
4CHLOROPHENOL	106489	276.48	6.19
2,4DICHLORO6METHYLPHENOL		31.68	0.69
1,1DICHLOROPROPANE		1656.00	37.44
1,3DICHLOROPROPANE	142289	436.32	9.65
2,3DINITROTOLUENE		24.48	0.53
2,4DINITRO6METHYL PHENOL		17.28	0.37
IRON	7439896	No Criteria	1520.00
pentachlorobenzene	608935	18.72	0.40
PENTACHLOROETHANE		521.28	11.52
1,2,3,5tetrachlorobenzene		462.24	10.22
1,1,1,2TETRACHLOROETHANE	630206	1411.20	31.68
2,3,4,6TETRACHLOROPHENOL	58902	10.08	0.23
2,3,5,6TETRACHLOROPHENOL		12.24	0.27
2,4,5TRICHLOROPHENOL	95954	33.12	0.73
2,4,6TRINITROPHENOL	88062	6098.40	135.36
XYLENE	1330207	191.52	4.56

ATTACHMENT A-5

Priority Pollutant Scan Summary Data

West Warwick WWTF - RIPDES Permit No. RI0100153
Summary of Effluent Priority Pollutant Scan Detections

Parameter (ug/l)	2011	2012	2013	2014	2015	Average	Maximum
Chromium III	1.9	0	0	0	0	0.38	1.9
Nickel	1.9	0	1.3	1.2	2.3	1.34	2.3
Copper	2.5	2	3.3	2.9	2.7	2.68	3.3
Zinc	18	24	26	30	52	30	52
Bis (2-ethylhexyl)phthalate	1.7	0	1.2	1	0	0.78	1.7
Iron	120	0	92	96	130	87.6	130

ATTACHMENT A-6

Comparison of Allowable Limits with Discharge Monitoring Report Data and Annual Priority Pollutant Scan Data

Facility Name: ***West Warwick WWTF***

RIPDES Permit #: ***RI0100153***

Outfall #: ***001A***

NOTE: METALS LIMITS ARE TOTAL METALS

Parameter	CAS #	Concentration Limits (ug/L) Based on WQ Criteria		Antideg. Limits (ug/L)	Priority Pollutant Data (ug/L) 2011 - 2015		Ave. DMR Data (ug/L) December '08 - April '16		Potential Permit Limits (ug/L)	
		Daily Max	Monthly Ave	Monthly Ave	Max	Ave	Daily Max	Monthly Ave	Daily Max	Monthly Ave
PRIORITY POLLUTANTS										
TOXIC METALS AND CYANIDE										
ANTIMONY	7440360	615.6	13.68	---	---	---	---	---	No RP	No RP
ARSENIC (limits are total recoverable)	7440382	465.12	3.8304	---	---	---	---	---	No RP	No RP
ASBESTOS	1332214	No Criteria	No Criteria	---	---	---	---	---	No RP	No RP
BERYLLIUM	7440417	10.26	0.23256	---	---	---	---	---	No RP	No RP
CADMIUM (limits are total recoverable)	7440439	8.8*	0.97*	---	---	---	0.04	0	No RP	No RP
CHROMIUM III (limits are total recoverable)	16065831	792.51	36.93	---	1.9	0.38	---	---	No RP	No RP
CHROMIUM VI (limits are total recoverable)	18540299	2422*	280*	---	---	---	---	---	No RP	No RP
COPPER (limits are total recoverable)	7440508	92*	38*	---	3.3	2.68	3.69	3.69	No RP	No RP
CYANIDE	57125	30.096	7.1136	---	---	---	---	---	No RP	No RP
LEAD (limits are total recoverable)	7439921	8.65*	0.34*	---	---	---	0.67	0.51	8.65*	0.34*
MERCURY (limits are total recoverable)	7439976	2.25	0.48	---	---	---	---	---	No RP	No RP
NICKEL (limits are total recoverable)	7440020	1698*	180*	---	2.3	1.34	---	---	No RP	No RP
SELENIUM (limits are total recoverable)	7782492	27.36	6.84	---	---	---	---	---	No RP	No RP
SILVER (limits are total recoverable)	7440224	10.6*	No Criteria	---	---	---	---	---	No RP	No RP
THALLIUM	7440280	62.928	1.2825	---	---	---	---	---	No RP	No RP
ZINC (limits are total recoverable)	7440666	177.65	120.65	---	52	30	20.58	20.58	No RP	No RP
VOLATILE ORGANIC COMPOUNDS										
ACROLEIN	107028	3.97	0.08	---	---	---	---	---	No RP	No RP
ACRYLONITRILE	107131	517.104	6.84	---	---	---	---	---	No RP	No RP
BENZENE	71432	362.52	8.0712	---	---	---	---	---	No RP	No RP
BROMOFORM	75252	2004.12	45.144	---	---	---	---	---	No RP	No RP
CARBON TETRACHLORIDE	56235	1867.32	41.04	---	---	---	---	---	No RP	No RP
CHLOROBENZENE	108907	1087.56	24.624	---	---	---	---	---	No RP	No RP
CHLORODIBROMOMETHANE	124481	No Criteria	355.68	---	---	---	---	---	No RP	No RP
CHLOROFORM	67663	1976.76	43.776	---	---	---	---	---	No RP	No RP
DICHLOROBROMOMETHANE	75274	No Criteria	465.12	---	---	---	---	---	No RP	No RP
1,2DICHLOROETHANE	107062	8071.2	179.208	---	---	---	---	---	No RP	No RP
1,1DICHLOROETHYLENE	75354	793.44	17.784	---	---	---	---	---	No RP	No RP
1,2DICHLOROPROPANE	78875	3591	79.344	---	---	---	---	---	No RP	No RP
1,3DICHLOROPROPYLENE	542756	No Criteria	57.456	---	---	---	---	---	No RP	No RP
ETHYLBENZENE	100414	2188.8	49.248	---	---	---	---	---	No RP	No RP
BROMOMETHANE (methyl bromide)	74839	No Criteria	4104	---	---	---	---	---	No RP	No RP

Facility Name: *West Warwick WWTF*
RIPDES Permit #: *RI0100153*
Outfall #: *001A*

NOTE: METALS LIMITS ARE TOTAL METALS

Parameter	CAS #	Concentration Limits (ug/L) Based on WQ Criteria		Antideg. Limits (ug/L)	Priority Pollutant Data (ug/L) 2011 - 2015		Ave. DMR Data (ug/L) December '08 - April '16		Potential Permit Limits (ug/L)	
		Daily Max	Monthly Ave	Monthly Ave	Max	Ave	Daily Max	Monthly Ave	Daily Max	Monthly Ave
CHLOROMETHANE (methyl chloride)	74873	No Criteria	No Criteria	---	---	---	---	---	No RP	No RP
METHYLENE CHLORIDE	75092	13201.2	292.752	---	---	---	---	---	No RP	No RP
1,1,2,2TETRACHLOROETHANE	79345	637.488	13.68	---	---	---	---	---	No RP	No RP
TETRACHLOROETHYLENE	127184	328.32	7.2504	---	---	---	---	---	No RP	No RP
TOLUENE	108883	868.68	19.152	---	---	---	---	---	No RP	No RP
1,2TRANSDICHLOROETHYLENE	156605	No Criteria	27360	---	---	---	---	---	No RP	No RP
1,1,1TRICHLOROETHANE	71556	No Criteria	No Criteria	---	---	---	---	---	No RP	No RP
1,1,2TRICHLOROETHANE	79005	1231.2	27.36	---	---	---	---	---	No RP	No RP
TRICHLOROETHYLENE	79016	2667.6	58.824	---	---	---	---	---	No RP	No RP
VINYL CHLORIDE	75014	No Criteria	6.5664	---	---	---	---	---	No RP	No RP
ACID ORGANIC COMPOUNDS										
2CHLOROPHENOL	95578	176.472	3.9672	---	---	---	---	---	No RP	No RP
2,4DICHLOROPHENOL	120832	138.168	3.0096	---	---	---	---	---	No RP	No RP
2,4DIMETHYLPHENOL	105679	145.008	3.2832	---	---	---	---	---	No RP	No RP
4,6DINITRO2METHYL PHENOL	534521	No Criteria	766.08	---	---	---	---	---	No RP	No RP
2,4DINITROPHENOL	51285	42.408	0.94392	---	---	---	---	---	No RP	No RP
4NITROPHENOL	88755	No Criteria	No Criteria	---	---	---	---	---	No RP	No RP
PENTACHLOROPHENOL	87865	No Criteria	82.08	---	---	---	---	---	No RP	No RP
PHENOL	108952	343.368	7.6608	---	74	35.4	---	---	343.368	7.6608
2,4,6TRICHLOROPHENOL	88062	21.888	0.49248	---	---	---	---	---	No RP	No RP
BASE NEUTRAL COMPOUNDS										
ACENAPHTHENE	83329	116.28	2.5992	---	---	---	---	---	No RP	No RP
ANTHRACENE	120127	No Criteria	109440	---	---	---	---	---	No RP	No RP
BENZIDINE	92875	No Criteria	0.005472	---	---	---	---	---	No RP	No RP
POLYCYCLIC AROMATIC HYDROCARBONS		No Criteria	0.49248	---	---	---	---	---	No RP	No RP
BIS(2CHLOROETHYL)ETHER	111444	No Criteria	14.5008	---	---	---	---	---	No RP	No RP
BIS(2CHLOROISOPROPYL)ETHER	108601	No Criteria	177840	---	---	---	---	---	No RP	No RP
BIS(2ETHYLHEXYL)PHTHALATE	117817	759.24	16.416	---	1.7	0.78	--	--	No RP	No RP
BUTYL BENZYL PHTHALATE	85687	116.28	2.5992	---	---	---	---	---	No RP	No RP
2CHLORONAPHTHALENE	91587	No Criteria	4377.6	---	---	---	---	---	No RP	No RP
1,2DICHLOROBENZENE	95501	108.072	2.4624	---	---	---	---	---	No RP	No RP
1,3DICHLOROBENZENE	541731	533.52	11.9016	---	---	---	---	---	No RP	No RP
1,4DICHLOROBENZENE	106467	76.608	1.6416	---	---	---	---	---	No RP	No RP
3,3DICHLOROBENZIDENE	91941	No Criteria	0.76608	---	---	---	---	---	No RP	No RP

Facility Name: *West Warwick WWTF*
RIPDES Permit #: *RI0100153*
Outfall #: *001A*

NOTE: METALS LIMITS ARE TOTAL METALS

Parameter	CAS #	Concentration Limits (ug/L) Based on WQ Criteria		Antideg. Limits (ug/L)	Priority Pollutant Data (ug/L) 2011 - 2015		Ave. DMR Data (ug/L) December '08 - April '16		Potential Permit Limits (ug/L)	
		Daily Max	Monthly Ave	Monthly Ave	Max	Ave	Daily Max	Monthly Ave	Daily Max	Monthly Ave
DIETHYL PHTHALATE	84662	3563.64	79.344	---	---	---	---	---	No RP	No RP
DIMETHYL PHTHALATE	131113	2257.2	50.616	---	---	---	---	---	No RP	No RP
DInBUTYL PHTHALATE	84742	No Criteria	12312	---	---	---	---	---	No RP	No RP
2,4DINITROTOLUENE	121142	2120.4	46.512	---	---	---	---	---	No RP	No RP
1,2DIPHENYLHYDRAZINE	122667	19.152	0.42408	---	---	---	---	---	No RP	No RP
FLUORANTHENE	206440	272.232	6.0192	---	---	---	---	---	No RP	No RP
FLUORENE	86737	No Criteria	14500.8	---	---	---	---	---	No RP	No RP
HEXACHLOROBENZENE	118741	No Criteria	0.0079344	---	---	---	---	---	No RP	No RP
HEXACHLOROBUTADIENE	87683	No Criteria	492.48	---	---	---	---	---	No RP	No RP
HEXACHLOROCYCLOPENTADIENE	77474	0.4788	0.010944	---	---	---	---	---	No RP	No RP
HEXACHLOROETHANE	67721	67.032	1.5048	---	---	---	---	---	No RP	No RP
ISOPHORONE	78591	8002.8	177.84	---	---	---	---	---	No RP	No RP
NAPHTHALENE	91203	157.32	3.5568	---	---	---	---	---	No RP	No RP
NITROBENZENE	98953	1846.8	41.04	---	---	---	---	---	No RP	No RP
NNITROSODIMETHYLAMINE	62759	No Criteria	82.08	---	---	---	---	---	No RP	No RP
NNITROSODINPROPYLAMINE	621647	No Criteria	13.9536	---	---	---	---	---	No RP	No RP
NNITROSODIPHENYLAMINE	86306	400.824	8.892	---	---	---	---	---	No RP	No RP
PYRENE	129000	No Criteria	10944	---	---	---	---	---	No RP	No RP
1,2,4trichlorobenzene	120821	102.6	2.3256	---	---	---	---	---	No RP	No RP
PESTICIDES/PCBs										
ALDRIN	309002	4.104	0.001368	---	---	---	---	---	No RP	No RP
Alpha BHC	319846	No Criteria	0.134064	---	---	---	---	---	No RP	No RP
Beta BHC	319857	No Criteria	0.46512	---	---	---	---	---	No RP	No RP
Gamma BHC (Lindane)	58899	1.2996	4.9248	---	---	---	---	---	No RP	No RP
CHLORDANE	57749	3.2832	0.0058824	---	---	---	---	---	No RP	No RP
4,4DDT	50293	1.5048	0.001368	---	---	---	---	---	No RP	No RP
4,4DDE	72559	No Criteria	0.0060192	---	---	---	---	---	No RP	No RP
4,4DDD	72548	No Criteria	0.0084816	---	---	---	---	---	No RP	No RP
DIELDRIN	60571	0.32832	0.00147744	---	---	---	---	---	No RP	No RP
ENDOSULFAN (alpha)	959988	0.30096	0.076608	---	---	---	---	---	No RP	No RP
ENDOSULFAN (beta)	33213659	0.30096	0.076608	---	---	---	---	---	No RP	No RP
ENDOSULFAN (sulfate)	1031078	No Criteria	243.504	---	---	---	---	---	No RP	No RP
ENDRIN	72208	0.117648	0.049248	---	---	---	---	---	No RP	No RP
ENDRIN ALDEHYDE	7421934	No Criteria	0.817	---	---	---	---	---	No RP	No RP

Facility Name: *West Warwick WWTF*
RIPDES Permit #: *RI0100153*
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NOTE: METALS LIMITS ARE TOTAL METALS

Parameter	CAS #	Concentration Limits (ug/L) Based on WQ Criteria		Antideg. Limits (ug/L)	Priority Pollutant Data (ug/L) 2011 - 2015		Ave. DMR Data (ug/L) December '08 - April '16		Potential Permit Limits (ug/L)	
		Daily Max	Monthly Ave	Monthly Ave	Max	Ave	Daily Max	Monthly Ave	Daily Max	Monthly Ave
HEPTACHLOR	76448	0.71136	0.00216144	---	---	---	---	---	No RP	No RP
HEPTACHLOR EPOXIDE	1024573	0.71136	0.00106704	---	---	---	---	---	No RP	No RP
POLYCHLORINATED BIPHENYLS3	1336363	No Criteria	0.00175104	---	---	---	---	---	No RP	No RP
2,3,7,8TCDD (Dioxin)	1746016	No Criteria	1.39536E-07	---	---	---	---	---	No RP	No RP
TOXAPHENE	8001352	0.99864	0.0002736	---	---	---	---	---	No RP	No RP
TRIBUTYLTIN		0.62928	0.098496	---	---	---	---	---	No RP	No RP
NON PRIORITY POLLUTANTS:										
OTHER SUBSTANCES										
ALUMINUM (limits are total recoverable)	7429905	1026	119.016	---	---	---	---	---	1026	119.016
AMMONIA (winter)	7664417	60359.2	13462.45	---	---	---	2630	1130	60359.2	13462.45
AMMONIA (summer)		61012.8	5167.05	---	---	---	3220	1300	61012.8	5167.05
4BROMOPHENYL PHENYL ETHER		24.624	0.5472	---	---	---	---	---	No RP	No RP
CHLORIDE	16887006	1176480	332120	---	---	---	---	---	No RP	No RP
CHLORINE	7782505	32.49	18.81	---	---	---	---	---	No RP	No RP
4CHLORO2METHYLPHENOL		20.52	0.43776	---	---	---	---	---	No RP	No RP
1CHLORONAPHTHALENE		109.44	2.4624	---	---	---	---	---	No RP	No RP
4CHLOROPHENOL	106489	262.656	5.8824	---	---	---	---	---	No RP	No RP
2,4DICHLORO6METHYLPHENOL		30.096	0.65664	---	---	---	---	---	No RP	No RP
1,1DICHLOROPROPANE		1573.2	35.568	---	---	---	---	---	No RP	No RP
1,3DICHLOROPROPANE	142289	414.504	9.1656	---	---	---	---	---	No RP	No RP
2,3DINITROTOLUENE		23.256	0.50616	---	---	---	---	---	No RP	No RP
2,4DINITRO6METHYL PHENOL		16.416	0.35568	---	---	---	---	---	No RP	No RP
IRON	7439896	No Criteria	1444	---	130	87.6	---	---	Monitor Only	1444
pentachlorobenzene	608935	17.784	0.38304	---	---	---	---	---	No RP	No RP
PENTACHLOROETHANE		495.216	10.944	---	---	---	---	---	No RP	No RP
1,2,3,5tetrachlorobenzene		439.128	9.7128	---	---	---	---	---	No RP	No RP
1,1,1,2TETRACHLOROETHANE	630206	1340.64	30.096	---	---	---	---	---	No RP	No RP
2,3,4,6TETRACHLOROPHENOL	58902	9.576	0.21888	---	---	---	---	---	No RP	No RP
2,3,5,6TETRACHLOROPHENOL		11.628	0.25992	---	---	---	---	---	No RP	No RP
2,4,5TRICHLOROPHENOL	95954	31.464	0.69768	---	---	---	---	---	No RP	No RP
2,4,6TRINITROPHENOL	88062	5793.48	128.592	---	---	---	---	---	No RP	No RP
XYLENE	1330207	181.944	4.332	---	---	---	---	---	No RP	No RP

* Indicates limits that were developed via PAWTOXIC WQ Model.

"No RP" = The facility has no reasonable potential to exceed applicable WQ based limits.

PART II
TABLE OF CONTENTS

GENERAL REQUIREMENTS

GENERAL REQUIREMENTS

(a) Duty to Comply

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of Chapter 46-12 of the Rhode Island General Laws and the Clean Water Act (CWA) and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.

(1) The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the CWA for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

(2) The CWA provides that any person who violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the CWA is subject to a civil penalty not to exceed $10,000 per day of such violation. Any person who willfully or negligently violates permit conditions implementing Sections 301, 302, 306, 307 or 308 of the Act is subject to a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment of not more than 1 year, or both.

(3) Chapter 46-12 of the Rhode Island General Laws provides that any person who violates a permit condition is subject to a civil penalty of not more than $5,000 per day of such violation. Any person who willfully or negligently violates a permit condition is subject to a criminal penalty of not more than $10,000 per day of such violation and imprisonment for not more than 30 days, or both. Any person who knowingly makes any false statement in connection with the permit is subject to a criminal penalty of not more than $5,000 for each instance of violation or by imprisonment for not more than 30 days, or both.

(b) Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. The permittee shall submit a new application at least 180 days before the expiration date of the existing permit, unless permission for a later date has been granted by the Director. (The Director shall not grant permission for applications to be submitted later than the expiration date of the existing permit.)

(c) Need to Halt or Reduce Not a Defense

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

(d) Duty to Mitigate

The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

(e) Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures, and, where applicable, compliance with DEM "Rules and Regulations Pertaining to the Operation and Maintenance of Wastewater Treatment Facilities" and "Rules and Regulations Pertaining to the Disposal and Utilization of Wastewater Treatment Facility Sludge." This provision requires the operation of back-up or auxiliary facilities or similar systems only when the operation is necessary to achieve compliance with the conditions of the permit.

(f) Permit Actions

This permit may be modified, revoked and reissued, or terminated for cause, including but not limited to: (1) Violation of any terms or conditions of this permit; (2) Obtaining this permit by misrepresentation or failure to disclose all relevant facts; or (3) A change in any conditions that requires either a temporary or permanent reduction or elimination of the authorized discharge. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

(g) Property Rights

This permit does not convey any property rights of any sort, or any exclusive privilege.

(h) Duty to Provide Information

The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

(i) Inspection and Entry

The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

(1) Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

(2) Have access to and copy, at reasonable times any records that must be kept under the conditions of this permit;

(3) Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices or operations regulated or required under this permit; and

(4) Sample or monitor any substances or parameters at any location, at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the CWA or Rhode Island law.

(j) Monitoring and Records

(1) Samples and measurements taken for the purpose of monitoring shall be representative of the volume and nature of the discharge over the sampling and reporting period.

(2) The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings from continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 5 years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time.

(3) Records of monitoring information shall include:

(i) The date, exact place, and time of sampling or measurements;

(ii) The individual(s) who performed the sampling or measurements;

(iii) The date(s) analyses were performed;

(iv) The individual(s) who performed the analyses;

(v) The analytical techniques or methods used; and

(vi) The results of such analyses.

(4) Monitoring must be conducted according to test procedures approved under 40 CFR Part 136 and applicable Rhode Island regulations, unless other test procedures have been specified in this permit.

(5) The CWA provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall upon conviction, be punished by a fine of not more than $10,000 per violation or by imprisonment for not more than 6 months per violation or by both. Chapter 46-12 of the Rhode Island General Laws also provides that such acts are subject to a fine of not more than $5,000 per violation, or by imprisonment for not more than 30 days per violation, or by both.

(6) Monitoring results must be reported on a Discharge Monitoring Report (DMR).

(7) If the permittee monitors any pollutant more frequently than required by the permit, using test procedures approved under 40 CFR Part 136, applicable State regulations, or as specified in the permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR.

(k) Signatory Requirement

All applications, reports, or information submitted to the Director shall be signed and certified in accordance with Rule 12 of the Rhode Island Pollutant Discharge Elimination System (RIPDES) Regulations. Rhode Island General Laws, Chapter 46-12 provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction, be punished by a fine of not more than $5,000 per violation, or by imprisonment for not more than 30 days per violation, or by both.

(l) Reporting Requirements

(1) Planned changes. The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility.

(2) Anticipated noncompliance. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with the permit requirements.

(3) Transfers. This permit is not transferable to any person except after written notice to the Director. The Director may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under State and Federal law.

(4) Monitoring reports. Monitoring results shall be reported at the intervals specified elsewhere in this permit.

(5) Twenty-four hour reporting. The permittee shall immediately report any noncompliance which may endanger health or the environment by calling DEM at (401) 222-4700 or (401) 222-3070 at night.

A written submission shall also be provided within five (5) days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

The following information must be reported immediately:

(i) Any unanticipated bypass which causes a violation of any effluent limitation in the permit; or

(ii) Any upset which causes a violation of any effluent limitation in the permit; or

(iii) Any violation of a maximum daily discharge limitation for any of the pollutants specifically listed by the Director in the permit.

The Director may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

(6) Other noncompliance. The permittee shall report all instances of noncompliance not reported under paragraphs (1), (2), and (5), of this section, at the time monitoring reports are submitted. The reports shall contain the information required in paragraph (l)(5) of the section.

(7) Other information. Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Director, they shall promptly submit such facts or information.

(m) Bypass

"Bypass" means the intentional diversion of waste streams from any portion of a treatment facility.

(1) Bypass not exceeding limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs (2) and (3) of this section.

(2) Notice.

(i) Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten (10) days before the date of the bypass.

(ii) Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in Rule 14.18 of the RIPDES Regulations.

(3) Prohibition of bypass.

(i) Bypass is prohibited, and the Director may take enforcement action against a permittee for bypass, unless:

(A) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage, where "severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production;

(B) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

(C) The permittee submitted notices as required under paragraph (2) of this section.

(ii) The Director may approve an anticipated bypass, after considering its adverse effects, if the Director determines that it will meet the three conditions listed above in paragraph (3)(i) of this section.

(n) Upset

"Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

(1) Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of paragraph (2) of this section are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

(2) Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

(a) An upset occurred and that the permittee can identify the cause(s) of the upset;

(b) The permitted facility was at the time being properly operated;

(c) The permittee submitted notice of the upset as required in Rule 14.18 of the RIPDES Regulations; and

(d) The permittee complied with any remedial measures required under Rule 14.05 of the RIPDES Regulations.

(3) Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

(o) Change in Discharge

All discharges authorized herein shall be consistent with the terms and conditions of this permit. Discharges which cause a violation of water quality standards are prohibited. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any anticipated facility expansions, production increases, or process modifications which will result in new, different or increased discharges of pollutants must be reported by submission of a new NPDES application at least 180 days prior to commencement of such discharges, or if such changes will not violate the effluent limitations specified in this permit, by notice, in writing, to the Director of such changes. Following such notice, the permit may be modified to specify and limit any pollutants not previously limited.

Until such modification is effective, any new or increased discharge in excess of permit limits or not specifically authorized by the permit constitutes a violation.

(p) Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner consistent with applicable Federal and State laws and regulations including, but not limited to the CWA and the Federal Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq., Rhode Island General Laws, Chapters 46-12, 23-19.1 and regulations promulgated thereunder.

(q) Power Failures

In order to maintain compliance with the effluent limitation and prohibitions of this permit, the permittee shall either:

> In accordance with the Schedule of Compliance contained in Part I, provide an alternative power source sufficient to operate the wastewater control facilities;

or if such alternative power source is not in existence, and no date for its implementation appears in Part I,

> Halt reduce or otherwise control production and/or all discharges upon the reduction, loss, or failure of the primary source of power to the wastewater control facilities.

(r) Availability of Reports

Except for data determined to be confidential under paragraph (w) below, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the DEM, 291 Promenade Street, Providence, Rhode Island. As required by the CWA, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the CWA and under Section 46-12-14 of the Rhode Island General Laws.

(s) State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law.

(t) Other Laws

The issuance of a permit does not authorize any injury to persons or property or invasion of other private rights, nor does it relieve the permittee of its obligation to comply with any other applicable Federal, State, and local laws and regulations.

(u) Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

(v) Reopener Clause

The Director reserves the right to make appropriate revisions to this permit in order to incorporate any appropriate effluent limitations, schedules of compliance, or other provisions which may be authorized under the CWA or State law. In accordance with Rules 15 and 23 of the RIPDES Regulations, if any effluent standard or prohibition, or water quality standard is promulgated under the CWA or under State law which is more stringent than any limitation on the pollutant in the permit, or controls a pollutant not limited in the permit, then the Director may promptly reopen the permit and modify or revoke and reissue the permit to conform to the applicable standard.

(w) Confidentiality of Information

(1) Any information submitted to DEM pursuant to these regulations may be claimed as confidential by the submitter. Any such claim must be asserted at the time of submission in the manner prescribed on the application form or instructions or, in the case of other submissions, by stamping the words "confidential business information" on each page containing such information. If no claim is made at the time of submission, DEM may make the information available to the pubic without further notice.

(2) Claims of confidentiality for the following information will be denied:

(i) The name and address of any permit applicant or permittee;

(ii) Permit applications, permits and any attachments thereto; and

(iii) NPDES effluent data.

(x) Best Management Practices

The permittee shall adopt Best Management Practices (BMP) to control or abate the discharge of toxic pollutants and hazardous substances associated with or ancillary to the industrial manufacturing or treatment process and the Director may request the submission of a BMP plan where the Director determines that a permittee's practices may contribute significant amounts of such pollutants to waters of the State.

(y) Right of Appeal

Within thirty (30) days of receipt of notice of a final permit decision, the permittee or any interested person may submit a request to the Director for an adjudicatory hearing to reconsider or contest that decision. The request for a hearing must conform to the requirements of Rule 49 of the RIPDES Regulations.

DEFINITIONS

1. For purposes of this permit, those definitions contained in the RIPDES Regulations and the Rhode Island Pretreatment Regulations shall apply.

2. The following abbreviations, when used, are defined below.

cu. M/day or M^3/day	cubic meters per day
mg/l	milligrams per liter
ug/l	micrograms per liter
lbs/day	pounds per day
kg/day	kilograms per day
Temp. °C	temperature in degrees Centigrade
Temp. °F	temperature in degrees Fahrenheit
Turb.	turbidity measured by the Nephelometric Method (NTU)
TNFR or TSS	total nonfilterable residue or total suspended solids
DO	dissolved oxygen
BOD	five-day biochemical oxygen demand unless otherwise specified
TKN	total Kjeldahl nitrogen as nitrogen
Total N	total nitrogen
NH_3-N	ammonia nitrogen as nitrogen
Total P	total phosphorus
COD	chemical oxygen demand
TOC	total organic carbon
Surfactant	surface-active agent
pH	a measure of the hydrogen ion concentration
PCB	polychlorinated biphenyl
CFS	cubic feet per second
MGD	million gallons per day
Oil & Grease	Freon extractable material
Total Coliform	total coliform bacteria
Fecal Coliform	total fecal coliform bacteria
ml/l	milliliter(s) per liter
NO_3-N	nitrate nitrogen as nitrogen
NO_2-N	nitrite nitrogen as nitrogen
NO_3-NO_2	combined nitrate and nitrite nitrogen as nitrogen
$C1_2$	total residual chlorine

RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF WATER RESOURCES
235 Promenade Street, Providence, Rhode Island 02908

October 1, 2019

CERTIFIED MAIL

Mr. Ernest Zmyslinski
Town Manager
Town of West Warwick
1170 Main Street
West Warwick, RI

RE: Final Permit for West Warwick Wastewater Treatment Facility
RIPDES Permit No. RI0100153

Dear Mr. Zmyslinski:

Enclosed is the final Rhode Island Pollutant Discharge Elimination System (RIPDES) Permit issued for the above-mentioned facility. State regulations, promulgated under Chapter 46-12 of the Rhode Island General Laws of 1956, as amended, require this permit to become effective on the date specified in the permit. Also enclosed is a copy of the Rhode Island Department of Environmental Management's (DEM's) response to the comments received on the draft permit and information relative to hearing requests and stays of RIPDES Permits.

Please note that a requirement has been added to Part I.D. of the permit, requiring your facility to submit an addendum to your Operation and Maintenance plans to specifically address steps you have, and the steps you will take to operate the treatment works as efficiently as possible and reduce effluent nitrogen concentration as low as possible within 90 days of issuance of the permit.

As noted in the Response to Public Comments, the DEM is aware that the facility may not be able to immediately comply with certain limitations/conditions in the new permit. Therefore, the DEM is willing to enter into a Consent Agreement with the Town of West Warwick that will establish a compliance schedule for the Town of West Warwick to come into compliance with these requirements. Specifically, the DEM is willing to enter into a Consent Agreement that will include a compliance schedule for the Town of West Warwick to comply with its Total Aluminum limits. In order for the DEM to be able to enter into a Consent Agreement with the Town of West Warwick, the Town of West Warwick must file an appeal of the above-mentioned permit requirements.

In order to appeal the permits, the Town of West Warwick must request an adjudicatory hearing pursuant to RIPDES Regulations 250-RICR-150-10-50 within thirty (30) days. Additionally, to obtain a stay of the contested limits for the duration of the appeal, the Town of West Warwick must also request a temporary stay for the duration of the adjudicatory hearing proceedings in accordance with RIPDES Regulations 250-RICR-150-10-51.

We appreciate your cooperation throughout the development of this permit. Should you have any questions concerning this permit, feel free to contact Abdulrahman Ragab of the State Permits Staff at 401-222-4700, extension 7201 or via email at Abed.Ragab@dem.ri.gov.

Sincerely,

Joseph B. Haberek, P.E.
Environmental Engineer IV

JBH:ar

Enclosures

Ecc: Bernie Bishop, West Warwick WWTF
Harrison Songolo, West Warwick WWTF
Steven Brittsan, Pawtuxet River Authority
Michael Jarbeau, Save the Bay
Crystal Charbonneau, DEM/OWR
Angelo Liberti, P.E., DEM/OWR
Bill Patenaude, DEM/OWR
David Turin, EPA
Sandy Mojica, EPA

RESPONSE TO COMMENTS

On December 19, 2018, the Rhode Island Department of Environmental Management (DEM) public noticed its proposed reissuance of Rhode Island Pollutant Discharge Elimination System (RIPDES) Permit numbers RI010013, RI0100234, and RI0100153, which were issued to the Cranston Water Pollution Control Facility, Warwick Wastewater Treatment Facility, and West Warwick Wastewater Treatment Facility (the WWTFs) respectively. The Public Comment Period was from December 19, 2018 through February 1, 2019 with a public hearing held at the DEM's Providence offices on January 31, 2019. In response to this public notice, DEM received comment letters on the proposed draft permits from the City of Cranston, the City of Warwick, the West Warwick WWTF, the Warwick Sewer Authority (WSA), the Pawtuxet River Authority, and Save the Bay. The following is a synopsis of the comments DEM received on the draft permits and DEM's responses to these comments.

Comment 1. WSA commented on the new aluminum (Al) limits stating that WSA will not be able to meet the proposed Al limit. WSA had also previously commented on the 14-draft permit indicating that these new Al limits will require costly changes and/or installation of new technology, and that these limits were not anticipated by WSA or raised by RI DEM following review of 20-year plan and approval of total phosphorous (TP) removal process.

The West Warwick WWTF also commented that complying with the new Al limits will require extensive modifications to treatment process. West Warwick indicated that they can't use ferric coagulating chemicals for TP removal because of their use of ultraviolet (UV) system for disinfection. West Warwick requested review of allocation method and reallocation of Al loads from Hoechst Celanese and Cranston WWTF as they use ferric salt as coagulant.

Response: West Warwick and Warwick WWTFs utilize aluminum sulfate (Alum) as the tertiary treatment ballasted flocculation coagulant for phosphorus removal. Based on the use of Alum in the tertiary treatment process, a limit for total aluminum was developed from the current RI DEM freshwater aquatic life chronic water quality criteria and included in the permits. The RIPDES limitations will ensure that the discharge does not cause an exceedance of the water quality criteria.

As indicated in the recent meetings between RI DEM and the WWTFs, United States Environmental Protection Agency (EPA) recently updated the aquatic life ambient water quality criteria for freshwaters for aluminum. RI DEM expects to make appropriate updates to its water quality regulations based on consideration of EPA's new recommended aluminum criteria. The new Al criteria takes into consideration the receiving water pH, hardness and Dissolved Organic Carbon (DOC) concentration. Using typical background pH, hardness, and DOC concentrations, EPA's updated Al criteria will result in significantly higher Al limits than the limits currently assigned in the permits.

The RI DEM did consider different Al allocation scenarios for the WWTFs discharging to the Pawtuxet River. DEM considered different discharge scenarios including:

- Allocating the Al waste load allocation to West Warwick, Warwick, and Cranston WWTFs using current RI DEM freshwater aquatic life chronic water quality criteria
- Allocating the Al waste load allocation to West Warwick, and Warwick WWTF only using current RI DEM freshwater aquatic life chronic water quality criteria
- Allocating the Al waste load allocation to West Warwick only using current RI DEM freshwater aquatic life chronic water quality criteria

Review of the different scenarios and WWTFs Al effluent data provided by Warwick and West Warwick show that average Al concentration in the WWTFs effluent is in the range of 500 ug/l which is greater than the Al limit in any of the discharge scenarios mentioned above. Therefore, the limits in the final permit were established using the same allocation as other pollutants (i.e., equal allocation among all three WWTFs) to be equitable among all WWTFs.

DEM also calculated what Al limits might be if EPA's new Al criteria was adopted into RI water quality regulations. Based on the following assumptions for the Pawtuxet River; instream hardness of 62.3 mg/L, pH value of 7, and DOC of 6 mg/L, the Al limits will be in the range of 700 – 1,500 ug/L.

DEM is issuing the permits with Al limits based on current RI water quality criteria and subsequent to issuance of the permits the DEM anticipates entering into a Consent Agreement with the permittees that will establish interim limits and a schedule for the permittees to evaluate their ability to meet the final limits and attain compliance with these limits. Under this Consent Agreement DEM expects that the permittees will collect instream data (such as pH, DOC, and hardness) that will be necessary to calculate the new Al criteria and, until new Al limits are assigned, the WWTFs will optimize Al removal under current operational processes. In order for the DEM to enter a consent agreement, the permittee must comment on any new permit conditions/limits that cannot be achieved during the public notice period.

Comment 2. WSA commented on chloroform limits stating that WSA will not be able to meet the new limit for chloroform.

Response: Review of previously submitted Priority Pollutant Scan (PPS) reports and effluent chloroform results from 2010 to 2018 provided by WSA shows that the facility may have difficulty meeting the chloroform limits. chloroform concentrations from previous PPS reports are summarized in the following table:

DATE	Concentration (ug/L)
8/7/2018	19.0
7/29/2018	46.0
6/20/2018	8.4
5/23/2018	4.0
8/2/2017	24.0
6/14/2017	4.3
12/7/2016	52.0
9/7/2016	42.0

DATE	Concentration (ug/L)
6/29/2016	25.0
4/28/2016	24.0
8/6/2015	70.0
6/22/2015	57.0
7/22/2014	30.0
7/30/2013	11.0
7/24/2012	50.0
7/21/2011	20.0
8/31/2010	17.0

The permit assigned a chloroform monthly average limit of 46 ug/l. Although the average chloroform concentration from 2010 to 2018 in Warwick's effluent is 29.6 ug/L, there have been several monthly samples that exceeded the proposed limit. Therefore, The DEM is willing to enter into a Consent Agreement with Warwick that will establish interim limits and a schedule for the permittee to evaluate its ability to meet the final limits and attain compliance.

Comment 3. The City of Cranston indicated that it may not be able to meet its selenium limits and, therefore, requested a stay of the selenium limit to locate the source of selenium.

Response: Currently Cranston is conducting a study to try and locate the source of high selenium inflow into the WWTF. Cranston has been collecting and analyzing water samples from the WWTF for selenium since June 2017. Based on discussions with Cranston and after review of data provided to DEM by Cranston in which recent data has complied with the limit but historic data had exceedances, it has been determined that Cranston may not be able to regularly and consistently meet selenium limit. Therefore, the DEM is willing to enter into a Consent Agreement with Cranston to develop a compliance schedule to meet selenium limits.

Comment 4. Save the Bay commented on the Total Nitrogen limit and requested RI DEM to reconsider the Total Nitrogen limit for Cranston, Warwick, and West Warwick facilities and impose a limit of 3mg/L from June 1 through October 31. Save the Bay also commented that the Cranston, Warwick, and West Warwick WWTFs are affecting the health of the Providence River and Upper Narragansett Bay and continue to note that further assessment is needed to study the impact of current nitrogen reductions. Save the Bay urged DEM to allocate the necessary resources and prioritize research on the impact of nitrogen reductions on the Bay.

Response: Since 2004 a number of agencies have worked together to establish a network of fixed-site monitoring stations throughout Narragansett Bay to monitor changes in dissolved oxygen and chlorophyll levels. The network is now an essential component of Rhode Island's monitoring strategy for the Bay. The stations were located strategically to transect the length of Narragansett Bay and serve as sentinels of changing conditions. There is a greater concentration of sites in upper Narragansett Bay purposefully located due to the presence of discharges from both wastewater treatment facilities and large tributary rivers. The DEM Office of Water Resources has taken a lead role in coordinating the multi-agency network effort. The cooperating agencies are as follows:

- Rhode Island Department of Environmental Management- Office of Water Resources (RIDEM-OWR)
- Narragansett Bay Commission (NBC)
- Narragansett Bay National Estuarine Research Reserve (NBNERR)
- Narragansett Bay Estuary Program (NBNEP),
- The Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS)
- University of Rhode Island, Graduate School of Oceanography (URI-GSO)
- University of Rhode Island, Coastal Institute
- Brown University

Over the past 10 or so years several researchers have been working to develop models to better understand the nutrient dynamics and ecosystem response to the reduction in nitrogen loads to Narragansett Bay. The NOAA Coastal Hypoxia Research Program (CHRP) funded a project entitled "Observations and Modeling of Narragansett Bay Hypoxia and its Response to Nutrient Management." This CHRP funded research included hydrodynamic modeling using the Regional Ocean Modeling System (ROMS) by Ulman et al. (2019) and two-dimensional ecosystem box models were developed by Dr. Jamie Vaudry (using exchanges rates from ROMS) and Dr. Mark Brush (using the Officer box modeling approach to derive exchange rates). While multiple journal articles were produced from the CHRP funded project, final ecosystem modeling reports are in the works. In addition, the EPA Narragansett Atlantic Ecology Division (Ed Dettmann and associates) has been developing a three dimensional linked hydrodynamic and water quality model for the Bay. EPA is currently working to finalize the draft report.

The Narragansett Bay Commission (NBC) has been contributing toward Dr. Chris Kincaid's work to collect hydrodynamic data and calibrate a ROMS model for Narragansett Bay. Most recently, NBC is also supporting the inclusion of a biological-oxygen model to the ROMS model and adding the Seekonk River to the model system.

Since 2012 nitrogen loadings to Narragansett Bay have been reduced approximately 50%. Oczkowski et al. (2018) evaluated annual, seasonal and regional changes in DIN and Secchi depth from the early 1970s through the 2016 and reported only a few subtle differences. In addition, Oczkowski et al. (2018) also concluded that: "it is too soon to fully assess the legacy effects of more than a century of heavy nutrient fertilization on the ecosystem".

Upon receipt of the final modeling reports, DEM expects the model(s) will provide insight into the final time required for the ecosystem to respond to the nitrogen and phosphorus reductions implemented to date and serve as the foundation for predicting the water quality changes that would be achieved by additional nitrogen reduction strategies and for implementing appropriate strategies. We anticipate final model reports from the EPA AED and Dr. Mark Brush by the end of the year or early next year.

In the interim, DEM is taking additional steps to address the nitrogen loadings from Cranston, West Warwick and Warwick (the facilities with the highest nitrogen limits of those required to reduce nitrogen to improve water quality and reduce ecosystem impacts in the Providence River, Seekonk River and Upper Bay). Section 1.14.F of the RIPDES Regulations (250-RICR-150-10-1) requires that: "The permittee shall at all times maintain in good working order and **operate as efficiently as possible all treatment works**, facilities and systems of treatment and control (and related appurtenances) for collection and treatment which are installed or used by the permittee for water pollution control and abatement to achieve compliance with the terms and conditions of the permit." Section 4.5 of 250-RICR-150-10-1 also requires that "At all times, Wastewater Treatment Facilities shall be maintained in good working order and operated **as efficiently as possible**." RIDEM has revised the permits to require that within 90 days, each WWTF submit an addendum to their Operation and Maintenance plans to specifically address steps they have, and the steps they will take to operate the treatment works as efficiently as possible and reduce effluent nitrogen concentrations as low as possible.

Comment 5. Pawtuxet River Authority commented on the volume of water the Providence Water Supply Board releases to Pawtuxet River. Pawtuxet River Authority requested DEM stays the permits until there is a discussion for fair allocation of loadings and dilution on the Pawtuxet River.

Response: The RI Water Quality Regulations (250-RICR-150-05) Part 1.26 describes the flows used to determine compliance with the aquatic life criteria and permit limits, specifying that the design flow to be utilized for aquatic life criteria shall not be exceeded at or above the lowest average seven (7) consecutive day low flow with an average recurrence frequency of once in ten (10) years (7Q10). Although the volume of water release to the Pawtuxet River might affect the 7Q10 flow, the RIPDES permitting program does not regulate the volume of water released to the

Pawtuxet River by the Providence Water Supply Board. Therefore, RIPDES permit are developed using the current 7Q10 flows.

Comment 6. The City of Warwick commented on new metals limit (aluminum limits) and costs.

Response: See response to Comment 1.

Comment 7. The City of Warwick also commented on the permit term stating that in order to help treatment facilities with long term planning, facility service life, and debt repayment, longer term permits of at least 10-20 years would be more appropriate.

Response: Regulations for the Rhode Island Pollutant Discharge Elimination System (RI Code of Regulations; 250-RICR-150-10-1.20 Duration of Permit) states that a permit shall be effective for a fixed term not to exceed the duration specified in 40 C.F.R. § 122.46. 40 CFR 122.46(a) states that: NPDES permits shall be effective for a fixed term not to exceed 5 years. Therefore, RIPDES permits issued by DEM have a maximum term of five years.

HEARING REQUESTS

If you wish to contest any of the provisions of this permit, you must request a formal hearing within thirty (30) days of receipt of this letter. The request should be submitted to the Administrative Adjudication Division at the following address:

Mary Dalton, Clerk
Department of Environmental Management
Office of Administrative Adjudication
235 Promenade Street
3rd Floor, Rm 350
Providence, RI 02908

Any request for a formal hearing must conform to the requirements of §1.50 of the Regulations for the Rhode Island Pollutant Discharge Elimination System (RI Code of Regulations; 250-RICR-150-10-1.50).

STAYS OF RIPDES PERMITS

Should the Department receive and grant a request for a formal hearing, the contested conditions of the permit will not automatically be stayed. However, the permittee, in accordance with §1.51 of the Regulations for the Rhode Island Pollutant Discharge Elimination System (RI Code of Regulations; 250-RICR-150-10-1.51), may request a temporary stay for the duration of adjudicatory hearing proceedings. Requests for stays of permit conditions should be submitted to the Office of Water Resources at the following address:

Angelo S. Liberti, P.E.

Administrator of Surface Water Protection
Office of Water Resources
235 Promenade Street
Providence, Rhode Island 02908

All uncontested conditions of the permit will be effective and enforceable in accordance with the provisions of §1.50 of the Regulations for the Rhode Island Pollutant Discharge Elimination System (RI Code of Regulations; 250-RICR-150-10-1.50).

Appendix C

1999 Intermunicipal Agreement

TOWN OF WEST WARWICK

RESOLUTION

OF

TOWN COUNCIL

NO. 99-47

SUBJECT: INTERMUNICIPAL AGREEMENT WITH THE TOWN OF COVENTRY

RESOLVED, that the members of the West Warwick Town Council, Acting as a Sewer Commission, be authorized to sign and cause to be executed the attached Intermunicipal Agreement for Wastewater Services between the Towns of West Warwick and Coventry.

PASSED AND APPROVED ON THIS 20th DAY OF JULY, 1999.

APPROVED: Carl Brown

CARL BROWN, JR., TOWN COUNCIL PRESIDENT

ATTEST: ______________________

DAVID D. CLAYTON, TOWN CLERK

A TRUE COPY
ATTEST:

SEWER COMMISSION CLERK

FIRST AMENDED AND RESTATED

INTERMUNICIPAL AGREEMENT FOR
WASTEWATER SERVICES
BETWEEN
THE TOWN OF WEST WARWICK
AND
THE TOWN OF COVENTRY

THIS AGREEMENT made this 20th day of JULY A. D. 1999 by and between the TOWN of WEST WARWICK, a municipal corporation of the State of Rhode Island, by and through the WEST WARWICK SEWER COMMISSION, hereinafter collectively referred to as "WEST WARWICK," and the TOWN of COVENTRY, a municipal corporation of the State of Rhode Island, hereinafter referred to as "COVENTRY."

WITNESSETH:

WHEREAS, WEST WARWICK has constructed and has in operation a municipal wastewater treatment plant and other appurtenant facilities, located in WEST WARWICK, to collect, treat and dispose of the wastewater for the residents of WEST WARWICK, as well as portions of COVENTRY, WARWICK, SCITUATE, CRANSTON AND WEST GREENWICH; and

WHEREAS, the Federal government is empowered under Public Law 95-217, as amended, to make Federal grants for the construction of public treatment works, and to impose conditions on the award of such grants; and

WHEREAS, WEST WARWICK has accepted State and Federal grants for the construction of public wastewater treatment works, and must abide by the applicable State and Federal laws, rules and regulations; and

WHEREAS, WEST WARWICK wastewater treatment operation is regulated by Rhode Island Pollutant Discharge Elimination System Permit No. RI 0100153; and

WHEREAS, the State and Federal grants received by WEST WARWICK reflect inclusion of wastewater flows from COVENTRY as the basis for the design of the funded facilities as a condition of said grants; and

WHEREAS, WEST WARWICK and COVENTRY mutually agree it is in the best interest of both municipalities and the State of Rhode Island to enter into an Agreement whereby WEST WARWICK would receive, treat and dispose of wastewater from COVENTRY; and

WHEREAS, wastewater collection and disposal is a mutual problem involving financing, construction, operation and maintenance of facilities; and

WHEREAS, WEST WARWICK and COVENTRY have previously entered into an Agreement for "Sewer Construction and Sewage Disposal," dated November 28, 1983, and a supplemental Agreement regarding

"Payments Owed by the Town of COVENTRY to the Town of WEST WARWICK for Sewer Construction Costs," dated October 6, 1994; and

WHEREAS, certain modifications and/or additions have been made to the wastewater collection and treatment facilities of WEST WARWICK in order to collect and treat the wastewater from COVENTRY; and

WHEREAS, additional modifications are required to be made to the wastewater collection system in order to convey wastewater from COVENTRY; and

WHEREAS, the aforementioned previously executed Agreements only address the secondary upgrade to the status of the Regional Project, and

WHEREAS, Rhode Island Department of Environmental Management (RIDEM) developed a Consent Agreement (No. 90-6679) which mandated that the WEST WARWICK treatment system shall be upgraded to produce an effluent quality of a tertiary level. These improvements have been dictated by the need to improve the quality of the Pawtuxet River to Class C waters; and

WHEREAS, COVENTRY is obligated to share in the capital cost of the required upgrades which have been deemed necessary by RIDEM and WEST WARWICK. Percentage of COVENTRY'S share is presented in Appendix "A"; and

WHEREAS, WEST WARWICK and COVENTRY are authorized by law to enter into contracts with each other for the purpose of aiding in the prevention or abatement of water pollution and/or to make mutually suitable arrangements for the disposal of wastewater;

WHEREAS, COVENTRY, as a participating municipality has or is in the process of fulfilling its financial obligation and WEST WARWICK has fulfilled its obligations to expand their wastewater treatment facility as provided in the previous agreement dated November 28, 1983; and

WHEREAS an amendment to the original agreement dated November 28, 1983 is necessary in order to address the financial obligations to meet the requirements of RIDEM Consent Agreement (No. 90-6679) as well as updating the procedural issues in administration of the agreement before and after the completion of the project; and

WHEREAS, the acceptance and execution of this Amendment, represents the acknowledgment of the parties that the obligations of COVENTRY, as a participating municipality, and the Town of WEST WARWICK as set forth in the original agreement have been met and this amendment is intended to redefine the procedure issues to be followed by COVENTRY, as a participating community and as such, upon execution of this agreement the prior agreement dated November 28, 1983 will become null and void and of no further force and effect.

NOW, THEREFORE, in consideration of these premises and the mutual undertaking of the parties hereto, the parties agree as follows:

1. DEFINITIONS AND REPRESENTATIONS

1.1 For all purposes of this Agreement and amendments thereto, the following listed terms shall have the meanings set forth below:

A. "Average Daily Flow" shall mean the total annual volume of wastewater recorded at a metering station or other point divided by the number of days in the year.

B. "Biochemical Oxygen Demand" (BOD) means the quantity of oxygen utilized in the biochemical oxidation of organic matter under the standard laboratory procedure of five (5) days, at 20 degrees C expressed in terms of weight and concentration (milligrams per liter).

C. "Building Service Connection" shall mean the service extension from a residential, commercial, industrial or other building to the public sewer (or other place of disposal), also called a house connection. This is generally a 4 inch or 6 inch diameter pipe.

D. "Capital Cost" shall mean the costs of planning, design, financing, and construction of wastewater works, including but not limited to engineering and legal fees, easements and other interests in real estate, and amortization costs.

E. "Class C Waters" shall mean waters that are suitable for fish, shellfish and wildlife habitat; suitable for recreational boating and industrial cooling; good aesthetic values.

F. "COVENTRY Flow" means the amount of wastewater flowing from COVENTRY into the WEST WARWICK System as determined by Article 4 hereof.

G. "COVENTRY Interceptor Areas" are as defined in COVENTRY's approved Facilities Plan.

H. "COVENTRY O & M Share" means that portion of the annual cost of operation and maintenance, determined in accordance with Article 4 hereof.

I. "COVENTRY Project Share" means and is limited to the amount of the total project costs allocated to COVENTRY in accordance with the percentages of each item of the project cost listed on Appendix "A".

J. "COVENTRY System" means the sanitary sewer interceptor lines, lateral sewer lines and other appurtenances located, or to be located in the Town of COVENTRY which are intended to convey wastewater from sources in COVENTRY to the WEST WARWICK System.

K. "Disposal" shall mean the disposition of wastewater or sludge by WEST WARWICK after treatment by its wastewater treatment plant.

L. "Domestic Wastes" means liquid wastes:

(i) From the noncommercial preparation, cooking, and handling of food; or

(ii) Containing human excrement and similar matter from the sanitary conveniences of dwellings, commercial buildings, industrial facilities, and institutions. It shall not contain groundwater, storm water, surface water, or cooling water or industrial wastewater.

M. "Dwelling Unit" shall mean a house, an apartment, a group of rooms, or a single room occupied or intended for occupancy as separate living quarters. Separate living quarters are those in which the occupants have either:

(i) Direct access from the outside of the building or through a common hall; and/or

(ii) Complete kitchen facilities for the exclusive use of the occupants.

N. "Easement" shall mean a legal right for specific use of land owned by others.

O. "Fiscal year" means the annual accounting period commencing July 1 and ending June 30 of each year. The fiscal year is denoted by the calendar year in which the fiscal year ends (i.e., FY96 ends in June 1996).

P. "Holding Tank Waste" means the wastewater from a domestic Individual Sewerage Disposal System.

Q. "Industrial Wastewater" means the liquid wastes resulting from the processes employed in industrial, manufacturing, trade, or business establishments, as distinct from domestic wastes.

R. "Infiltration" shall mean the water entering a sewer system from the ground through such means as defective pipe, pipe joints, connections or manhole walls. Infiltration does not include and is distinguished from inflow.

S. "Inflow" shall mean the water discharged to a sewer system (including service connections) from such sources as roof leaders, cellar, yard, and area drains; foundation drains; cooling water discharges; drains from springs and swampy areas; manhole covers; cross-connection from sewers; catch basins; stormwater runoff; street wash waters; and drainage in general. Infiltration/inflow is the total quantity of water entering a sewer system from both infiltration and inflow.

T. "Maximum Daily Flow" shall mean the highest total volume measured at a metering station or other point over a continuous twenty-four hour period.

U. "Measured Wastewater Flow" means the total unadjusted flow volume recorded at flow metering devices, referred to in Article 4 hereof.

V. "Monthly Average" shall mean the total volume or quantity for a calendar month divided by the number of days in that month.

W. "Net Capital Cost" shall mean the capital cost after deduction of federal and state grants and other capital income such as earnings on the investment of bond proceeds.

X. "North Branch Interceptor" means an underground interceptor sewer collecting wastewater from the northeast area of COVENTRY, as well as parts of CRANSTON and SCITUATE, running parallel to the North Branch of the Pawtuxet River, and transporting said wastewater to the WEST WARWICK system at the town line on Main Street (Route 115).

Y. "Operation and Maintenance Costs" or "O & M Costs" includes the total annual expenses actually incurred by WEST WARWICK in the operation and maintenance of the Regional Wastewater Treatment Facilities pursuant to a budget covering the categories of annual operating and maintenance costs described in Article 4 hereof.

Z. "Participating Municipality" means any one of the following municipal corporations: WEST WARWICK, COVENTRY, SCITUATE, WEST GREENWICH, CRANSTON and WARWICK. The term "Participating Municipalities" is the collective designation for more than one Participating Municipality.

AA. "Peak Hourly Flow" shall mean the highest volume of wastewater recorded at a metering station or other point over a continuous sixty minute period.

AB. "Person" shall include an individual, trust, firm, joint stock company, corporation (including a quasi-government corporation), partnership, association, syndicate, municipality, municipal or state agency, fire district, club, non-profit agency or any subdivision, commission, department, bureau, agency or department of state of federal government (including quasi-government corporation) or of any interstate body.

AC. "Pretreatment" shall mean the reduction of the amount of pollutants, the elimination of pollutants, or the alteration of the nature of pollutant properties in wastewater to an acceptable state prior to or in lieu of discharging or otherwise introducing such pollutants into a water pollution control facility. The reduction or alteration can be obtained by physical, chemical, or biological processes, except as prohibited by Title 40, Code of Federal Regulations, Section 403,6(d).

AD. "Pretreatment Standards" means all applicable Federal rules and regulations implementing section 403 of the Act, as well as any nonconflicting State or local standards. In cases of conflicting standards or regulations, the more stringent thereof shall be applied.

AE. "Regional Interceptors" shall mean the interceptor sewers that will service the Participating Municipalities in WEST WARWICK. They are the Maisie Quinn Interceptor, Upper Maisie Quinn Interceptor, Maisie Quinn Connecting Sewer, Clyde Interceptor, Natick Relief Sewer and Natick Interceptor, COVENTRY North Branch, COVENTRY New London Turnpike.

AF. "Regional Project(s)" shall mean the development, design and construction work performed in connection with upgrading and expanding the existing WEST WARWICK wastewater collection and treatment system to transport, treat and dispose of wastewater from COVENTRY and other Participating Municipalities.

AG. "Regional Pumping Stations" shall mean pumping stations which service the Participating Municipalities that are located in WEST WARWICK. They are the Clyde Pumping Station and Glen Drive Pumping Station.

AH. "Regional System" shall mean those portions of the WEST WARWICK system which handle wastewater from COVENTRY and WEST WARWICK.

AI. "Regional Wastewater Treatment Facility" shall mean the wastewater treatment facility, including an arrangement of devices and structures used for treating wastewater, industrial wastes and sludges, located in WEST WARWICK which was constructed and upgraded to treat wastewater generated in the Participating Municipalities.

AJ. "Reserve Capacity" shall mean the hydraulic limits based upon the flow presented in Exhibit A and the associated organic load for Domestic Waste for BOD and total suspended solids of 250 mg/l each.

AK. "Rhode Island Department of Environmental Management" (RIDEM) shall mean the State agency which administers and regulates wastewater discharges.

AL. "Rhode Island Pollutant Discharge Elimination System" (RIPDES) means the Rhode Island system for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing discharge permits and imposing and enforcing pretreatment requirements pursuant to Title 46, Chapter 12 of the General Laws of Rhode Island and the Clean Water Act.

AM. "Sanitary Sewer" shall mean a sewer which carries sewage and to which storm, surface, and groundwater are not intentionally admitted.

AN. "Septage Waste" means the wastewater from a domestic Individual Sewage Disposal System.

AO. "Sewage" shall mean a combination of the water-carried wastes from residences, business buildings, institutions and industrial establishments.

AP. "Shall" is mandatory; "May" is permissive.

AQ. "Significant Industrial User" (SIU) means any industrial user of the Participating Municipalities wastewater treatment system whose flow exceeds:

(i) An average of 25,000 gallons per day of process wastewater to the wastewater treatment system (excluding sanitary, non-contact cooling or boiler blowdown wastewater); or

(ii) Five (5) percent or more of the average dry weather hydraulic or organic capacity of the wastewater treatment system; or

(iii) Whose wastewater concentration of BOD and total suspended solids exceeds 250 mg/l; or

(iv) A federal EPA categorical industry; or

(v) Industries with sanitary or non-toxic discharges using solvents, toxic chemicals and/or hazardous chemicals that could potentially be discharged into the sewers.

AR. "Sludge" shall mean waste containing varying amounts of solid contaminants removed from water, sanitary sewer, wastewater or industrial wastes by physical, chemical and biological treatment.

AS. "Storm Drain" (sometimes termed "storm sewer") shall mean a sewer which carries storm and surface waters and drainage, but excludes sewage and industrial wastes, other than unpolluted cooling water.

AT. "Storm Water" means any flow occurring during or immediately following any form of natural precipitation and resulting therefrom.

AU. "Total Flow" means the total amount of wastewater flowing into the WEST WARWICK system, and includes the wastewater contributed to such system by the Participating Communities.

AV. "Total Suspended Solids" means the total suspended matter that floats on the surface of, or is suspended in, wastewater, or other liquids, and which is removable by laboratory filtering.

AW. "Toxic Waste" shall mean any substance listed as toxic under section 307(a)(1) of the Clean Water Act, as amended, 33 U.S.C. 1251 et seq., listed under the Hazardous Substances Right-to-Know Act, R.I.G.L. §28-21-1 et seq., and as may otherwise be designated by the town.

AX. "User Charges" shall mean charges levied in proportion to the use of wastewater works. As required by State Law and by regulations promulgated by the U.S. Environmental Protection Agency, such charges must, to the extent possible, distribute operation and maintenance (including replacement and necessary additional requirements) cost to each user in proportion to the user's contribution to the total loading of the wastewater works, where construction of such works may have been financed in part by a Federal grant.

AY. "Wastewater" means the liquid and water-carried industrial or domestic wastes from dwellings, commercial buildings, industrial facilities, and institutions, together with any groundwater, surface water, and storm water that may be present, whether treated or untreated, which is discharged into or permitted to enter the Town's wastewater treatment system.

AZ. "Wastewater Treatment System or Wastewater Treatment Facility" means any devices, facilities, structures, equipment or works owned or used by the Participating Municipalities for the purpose of the transmission, storage, treatment, domestic or industrial wastes, including intercepting sewer, outfall sewers, sewage collection systems, pumping, power, and other equipment and their appurtenances, extensions, improvements, remodeling, additions, and alterations thereof; elements essential to provide standby treatment units and clear well facilities; and any work, including site acquisition of the land that will be an integral part of the treatment process or is used for ultimate disposal of residues from such treatment.

BA. "WEST WARWICK System" means the existing WEST WARWICK wastewater collection and treatment system that are not part of the Regional Project.

2. GENERAL AGREEMENT

2.1 WEST WARWICK agrees to receive for treatment and disposal, subject to such limitations and exceptions as provided for in this Agreement, all wastewater emanating from within COVENTRY, including all industrial and commercial wastewater. WEST WARWICK agrees to reserve 2.25 million gallons per day of the total capacity of both liquid and solid treatment with an equivalent or organic loading of 4700 pounds per day of BOD and total suspended solids, in the collection and disposal system for COVENTRY for the duration of this Agreement.

2.2 COVENTRY agrees to construct and maintain, at its own cost, the sewer collection system, including collector and interceptor sewers, pumping facilities and sewer force mains, within COVENTRY required to convey wastewater to the WEST WARWICK sewer system, except as provided for in this Agreement.

2.3 COVENTRY agrees to pay it share of the cost to upgrade the interceptor sewers and pumping stations located in WEST WARWICK. COVENTRY'S share shall be based upon a percentage of the total average daily flow of the regional wastewater flow as presented in Appendix A.

2.4 The COVENTRY sewer system shall connect with and into the WEST WARWICK sewer system at the following locations along the COVENTRY-WEST WARWICK town line:

A. the existing sewer on Main Street (Route 115);
B. a proposed sewer on Pulaksi Street;
C. the existing sewer on Tiogue Avenue (Route 3), North Road Terrace;
D. the existing sewer on New London Turnpike;
E. at other lesser points of connection where existing sewers enter WEST WARWICK, including but not limited to: Washington Street (Route 117), Harris Avenue, Park Avenue, Hebert Street, and Ames Street; and
F. at other points which are mutually agreed upon, where WEST WARWICK sewers are capable of handling additional flows. Negotiation of these points shall be in accordance with the requirements set forth in other section of this Agreement.

2.5 There are certain wastewater sources located in COVENTRY which are presently connected to the WEST WARWICK wastewater collection system. Such sources may continue to discharge wastewater to WEST WARWICK. (This provision does not include sources of wastewater covered under separate Agreements, as described in Article 11 hereof.)

2.6 For the design and construction of the North Branch Interceptor, COVENTRY shall enter into separate Agreements with the Town of SCITUATE and the City of CRANSTON.

3. PROJECT COSTS AND PAYMENT

3.1 Prior to execution of this Agreement, WEST WARWICK has completed work on upgrading and expanding the Regional Wastewater Treatment Facility to provide secondary wastewater treatment for an average daily flow of 7.89 million gallons per day of wastewater from all sources tributary to the facility. In addition, WEST WARWICK has begun work on upgrading and expanding portions of its wastewater collection system addition, including the East Natick Interceptor, portions of the Maisie Quinn Interceptor, the Clyde Pumping Station and Force Main and portions of the Clyde Interceptor, which will transport wastewater from COVENTRY to the Regional Wastewater Treatment Facility. This work included provisions for treating and disposing of an average daily wastewater flow 2.25 million gallons per day and an organic concentration of BOD and total suspended solids of 4700 pounds per day from COVENTRY.

3.2 Prior to execution of this Agreement, COVENTRY has paid to WEST WARWICK a total of approximately $1,200,427 for its share of project costs for the secondary upgrade/expansion of the WEST WARWICK wastewater facilities. In addition, on October 6, 1994, COVENTRY and WEST WARWICK entered into an Agreement whereby COVENTRY would pay to WEST WARWICK an additional $501,000 for its share of these project costs. The sum of these amounts ($1,701,427) represents COVENTRY'S cost to meet the secondary treatment requirements to accommodate for the reserved capacity of 2.25 million gallons per day (average daily flow) and an organic load of BOD and total suspended solids of 4700 pounds per day, as well as its share of all facilities planning costs for the Tertiary Treatment Project currently being proposed for the Regional Wastewater Treatment Facility.

3.3 On 28 February 1999, the Rhode Island Department of Environmental Management approved an amendment to the Tertiary Treatment Facilities Plan. The average design flow is 10,500,000 gallons per day of wastewater from all sources tributary to the facility. COVENTRY's wastewater contribution to the Tertiary Facility shall remain at 2.25 million gallons per day and an organic concentration of BOD and total suspended solids of 4700 pounds per day.

3.4 WEST WARWICK is currently completing the planning of a Tertiary Treatment Project, which will upgrade the Regional Wastewater Treatment Facility to provide advanced wastewater treatment and improve the quality of the effluent discharged to the Pawtuxet River. COVENTRY was given a final copy of the Tertiary Facilities Plan which outlines the estimated costs to design, construct and operate the proposed improvements, including the anticipated amount of any Federal and/or State grants and loan assistance to be received; the proposed wastewater flows to be used in design of the improvements; and the calculated COVENTRY share of such project costs.

3.5 WEST WARWICK is required by the Tertiary Consent Agreement RI 90-6679 to have a preliminary design report issued within six (6) months of DEM approval of the Facilities Plan, twelve (12) months later have fifty-percent design plans, and six (6) months to complete one hundred percent design plans.

3.6 Project costs for the Tertiary Treatment Project, and any other Regional Project projects, shall include the total cost of construction and equipment, the cost of design, engineering and supervisory costs, inspection, legal costs, costs of acquiring real and personal property in WEST WARWICK for said treatment facilities, fiscal costs, financing costs, and all other costs of establishing the project and making it ready for operation, including the cost of borrowing in anticipation of Federal and/or State aid. The Net Capital Cost shall be the project cost less any State and/or Federal aid received.

3.7 COVENTRY shall be responsible for its share of the Net Capital Costs of such Regional Projects follows:

$$\frac{\text{(Net Capital Cost of the Project)} \times \text{(COVENTRY'S Design Flow)}}{\text{(Total Facility Design Flow)}}$$

COVENTRY's Design Flow for each facility shall be the wastewater flow from COVENTRY tributary to the particular Regional Project facility.

3.8 COVENTRY shall pay its share of the design cost within thirty (30) days of the execution of the design contract. If there are any changes to the final design fee due to Addenda, the appropriate adjustments will be made at the conclusion of the design. COVENTRY will be invoiced, and within forty-five (45) days shall remit payment to WEST WARWICK.

3.9 At the completion of the design phase, COVENTRY shall be given the option to pay its local share of the construction cost either in a lump sum payment based upon the bid price at the start of the construction phase or monthly, plus interest. The interest shall be based upon WEST WARWICK interest cost to offset the lag State and Participating Communities reimbursement. At the conclusion of the construction phase, adjustments will be made to reflect any change orders.

3.10 The amount of such progress payments made by COVENTRY to WEST WARWICK shall not exceed ninety-eight percent (98%) of the amount calculated as due from COVENTRY, with the remaining two percent (2%) being paid upon project completion. Monthly payments will be fifteen (15) days of receipt of such statements. If payment is not received within that time frame, WEST WARWICK will assess an additional one and one half percent (1½%) interest per month from the date of the invoice.

3.11 Upon completion of the Tertiary Treatment Project or other Regional Projects, and receipt by COVENTRY of a certificate from the WEST WARWICK Treasurer's Office certifying such completion and showing the final amounts paid by WEST WARWICK and COVENTRY on account of the Regional Project, COVENTRY will pay the balance of the COVENTRY share, within thirty (30) days of the receipt of such certificate.

A. The certificate of Project Completion shall include the certification by the authorized representative for WEST WARWICK and the consulting engineer for the project. Such certificate shall not be issued prior to substantial completion of the project and use of the project facilities is approved by the appropriate Federal and/or State regulatory agencies.

B. The final amount to be paid to WEST WARWICK on account of any Regional Project shall be verified by an dependent auditor selected by COVENTRY, at its own cost, if such an audit is determined to be necessary. This end of project audit will be conducted on behalf of COVENTRY within twelve (12) months of the final payment to WEST WARWICK.

C. The final project costs to be paid by COVENTRY and WEST WARWICK shall be subject to the final audit prepared on behalf of the Federal and/or State regulatory agencies funding the project(s).

4. <u>OPERATION AND MAINTENANCE</u>

4.1 WEST WARWICK shall continue to accept wastewater flows from all sources in COVENTRY which are currently discharging to the WEST WARWICK system. WEST WARWICK shall accept wastewater from new collection facilities in COVENTRY if capacity is available at the Wastewater Treatment Facility in the Regional Interceptor and Pumping Station, up to the reserved capacity identified hereinbefore, upon at least thirty (30) days notice from COVENTRY of completion of such wastewater collection facilities.

4.2 WEST WARWICK agrees to provide adequate and qualified operating personnel for the Regional Wastewater Treatment Facility, wastewater collection system and all components thereof.

4.3 The annual cost for operation and maintenance of the Regional Wastewater Treatment Facility shall be the basis of the operation and maintenance charge. The cost shall include wages, fringe benefits, maintenance, repairs, chemicals, utility costs, equipment rentals and replacements, administration costs and other costs related to the operation of the Regional Wastewater Treatment Facility. However, the annual O & M costs (a) shall not include any principal, interest or other charges in connection with any indebtedness incurred by WEST WARWICK, and (b) shall not include any WEST WARWICK expenses not directly attributable to, and included in, such annual budget of the Regional Wastewater Treatment Facility.

A. Any and all revenue generated at or by the operation of the Regional Wastewater Treatment Facility and wastewater collection system, including but not limited to: septage receiving/treatment fees; revenues from sale of composted sludge; and Federal, State and/or regional funding for operation and maintenance, or for any use of the facilities; shall be applied to the annual operation and maintenance budget, thereby reducing the operation and maintenance costs.

4.4 In March of each calendar year, COVENTRY shall provide a list of new ownership by plat and lot.

4.5 In May of each calendar year, WEST WARWICK shall prepare a budget for the upcoming fiscal year for operation and maintenance of the Regional Wastewater Treatment Facility. Copies of the budget shall be distributed to COVENTRY no later than June 1 of each year, such that COVENTRY may plan its user charge billings accordingly.

4.6 For the purposes of determining the "COVENTRY O & M share", the total measured (or estimated) wastewater flow from COVENTRY shall be determined based on the following methodology:

A. Wastewater flows shall be determined based on water use records. Wastewater flows shall be eighty percent (80%) of the water use for the properties, based on water meter records provided by Kent County Water Authority, billed directly to the properties by WEST WARWICK. COVENTRY users not connected to a public water supply will be billed at the fixed consumption established by WEST WARWICK.

B. Significant Industrial Users shall be billed directly by WEST WARWICK in accordance with WEST WARWICK'S Sewer Ordinance based upon flow excess concentration of organic loadings (BOD and total suspended solids).

4.7 WEST WARWICK shall maintain adequate records showing wastewater flow, capital costs, operation and maintenance costs and computation of the amount due from COVENTRY. Such records, as well as all parts of the regional wastewater collection and treatment system, shall be open and available for inspection by representatives of COVENTRY upon request.

4.8 No charges shall be billed to COVENTRY for annual operation and maintenance of the Regional Wastewater Treatment Facility or the WEST WARWICK system for any portion of the COVENTRY reserve capacity which is not being used by COVENTRY. No charges shall be assessed to COVENTRY for operation and maintenance of the WEST WARWICK local wastewater collection system.

5. <u>ASSESSMENTS</u>

5.1 Any parcel of land located in COVENTRY, from which the building service connection can conveniently and economically be tied directly into a sewer line located in, owned and maintained by WEST WARWICK, shall be allowed to do so upon receiving written permission from both COVENTRY and WEST WARWICK. Consistent with the WEST WARWICK Sewer Ordinance, these parcels shall be assessed a sewer assessment by COVENTRY and shall be considered a part of COVENTRY'S sewer capacity.

5.2 Any parcel of land located in COVENTRY from which the building service connection is tied directly to a sewer line located in, owned and maintained by WEST WARWICK, and any parcel located in COVENTRY, shall be assessed an annual sewer user charge by WEST WARWICK. This annual sewer user charge shall be based on water use records, as used for and at the same rates as if the parcel was located in WEST WARWICK.

5.3 Any Significant Industrial User located in COVENTRY shall be assessed directly by WEST WARWICK in accordance with the WEST WARWICK Ordinance and Pretreatment Program for annual permit fees and excess concentrations of BOD and total suspended solids. In the event that the metering devices are not installed or the SIU is connected directly to a WEST WARWICK line, WEST WARWICK shall also assess them for flow.

5.4 All parcels located in COVENTRY which are connected to the sewer collection system, except those parcels presently being assessed by WEST WARWICK as mutually agreed upon, shall be assessed a sewer assessment by COVENTRY based on the Sewer Ordinance adopted by COVENTRY.

5.5 The amount of any sewer assessments collected by WEST WARWICK from properties located in COVENTRY which were improperly collected and from which the building service connection is not tied directly into a sewer line located in, owned and maintained by WEST WARWICK shall be credited the individual and notify the owner of COVENTRY'S assessment plans. COVENTRY has one year from the date of each annual assessment to file an appeal stating the conditions why WEST WARWICK is not entitled to that assessment. WEST WARWICK will credit a maximum of one (1) year's fees to the individual.

6. <u>REGULATIONS OF OPERATION</u>

6.1 The Participating Municipalities shall comply with the Sewer Ordinances and Industrial Pretreatment Program as may be adopted by WEST WARWICK as amended. COVENTRY shall delegate to WEST WARWICK, through adoption of an Industrial Pretreatment ordinance, the enforcement of industrial pretreatment of wastes to insure wastewater is acceptable to meet local, State and Federal standards. The Regional Wastewater Treatment Facility shall be operated in such a manner that the effluent discharge into the Pawtuxet River complies with applicable State and Federal standards.

6.2 In exercising the foregoing reservations, permissions and rights of WEST WARWICK with respect to COVENTRY, WEST WARWICK agrees that it will not impose any standard or requirement which would be arbitrary, discriminatory or unreasonable or would treat the participant or users of the COVENTRY system on a different basis than is applicable to users similarly situated in WEST WARWICK or any other participating municipality.

6.3 WEST WARWICK and COVENTRY agree to maintain complete and accurate books and records concerning all matters relative to this Agreement and the performance thereof, to retain the same for a period of at least seven (7) years following the fiscal year to which such books and records relate, and to permit the agents, accountants and other duly authorized representatives of the other party to have access to all such books and records during reasonable business hours for the purpose of examining any of the same and making extracts or copies thereof. WEST WARWICK and COVENTRY agree to make available to the representatives and agents of the other party, all facilities and equipment related to the wastewater system of each, especially all meters, metering devices and records.

7. ALTERATIONS, ADDITIONS AND EXPANSION

7.1 WEST WARWICK may be required to alter, add or expand the Regional Wastewater Treatment Facility or Regional Interceptors as a result of DEM requirement or failure of the present components, or to meet the needs of Participating Municipalities. WEST WARWICK shall notify the Participating Municipalities affected by this action. The cost for these modifications shall be shared in accordance with Article 3.

7.2 When combined flows from the Participating Municipalities reaches eighty percent (80%) of the designed capacity of the Regional Wastewater Treatment Facility for a ninety (90) day period, or when the individual flow of any of the Participating Municipalities reaches 80% of their respective design capacity for a ninety (90) day period, WEST WARWICK shall cause a new projection of wastewater flows from the Participating Municipalities to be made. The Project Management Committee shall then determine the amount of expansion capacity for treatment facilities necessary, if any, to serve the Participating Municipalities. Before any expansion of capacity is made or before any major capital alteration or change in treatment is planned, the parties shall first negotiate and agree upon appropriate changes in the terms of this Agreement to assist with such expansion or changes and the method of financing the same. The method of financing shall provide for project costs to be shared proportionately by the Participating Municipalities, in the proportion of the increased design capacities provided by the expansion for the respective municipality.

7.3 If after completion of the Regional Project, improvements, alterations or additions (hereinafter "improvements") of a capital nature which do not increase the capacity of the Regional Wastewater Treatment Facility are deemed necessary, WEST WARWICK shall notify COVENTRY and the other Participating Municipalities of the nature of the improvements and other factors. COVENTRY and the other Participating Municipalities will be responsible for their proportional share.

7.4 If COVENTRY anticipates a major increase of flow as a result of new development, whether commercial, industrial or residential, which will cause COVENTRY'S need for capacity to exceed the capacity (hydraulic and/or organic) reserved through this Agreement, it may petition WEST WARWICK to increase its capacity. WEST WARWICK shall determine the amount of capacity available, the capacity the participant requires, the capacity of sewer lines to handle this increased flow and the cost required to purchase this capacity. Cost shall be based on:

$$\frac{\text{(Additional Capacity to be purchased)} \times \text{(Total local cost of design \& construction)}}{\text{(Total capacity of WWTF)}}$$

7.5 If COVENTRY determines that it will not require the entire reserve capacity (hydraulic and organic) as set forth in this Agreement, and another Participating Municipality (or other person acceptable to WEST WARWICK) can be found who is in need of a portion of this unused capacity, COVENTRY may petition WEST WARWICK to transfer, sell, assigns or lease that portion of its reserved capacity to a Participating Municipality or third party upon such terms and conditions as COVENTRY shall deem acceptable. WEST WARWICK shall determine the amount of reserve capacity COVENTRY has available and the capacity of sewer lines to handle this increased flow.

In no event shall COVENTRY transfer, sell, assigns or lease more than ten (10%) percent of its reserve capacity in any calendar year to any Participating Municipality or third party. Any and all monies received by COVENTRY as a result of any such transfer, sale, assignment or letting shall be placed in a separate account to be used solely for server associated debt retirement, maintenance and repairs of wastewater collection facilities located within the Town of COVENTRY and/or maintenance and repairs to individual septic disposal systems.

The amount of COVENTRY'S reserved capacity and the amount paid for such capacity shall be calculated as of the date of the transfer of the capacity. This Agreement shall be amended to make the appropriate provisions for such a decrease in COVENTRY's flows.

8. <u>CONSTRUCTION OF THE COVENTRY SYSTEM IN WEST WARWICK</u>

8.1 Completion of the COVENTRY system requires the installation of a section of interceptor pipeline, hereinafter referred to as the Washington Interceptor, in WEST WARWICK. The Washington Interceptor will be located in Pulaski Street and/or Robinson Way, between the COVENTRY-WEST WARWICK town line and the South Branch of the Pawtuxet River, and will connect to the existing 30 inch diameter Maisie Quinn Interceptor at Pulaski Street on the eastern side of the South Branch of the Pawtuxet River.

8.2 COVENTRY will, at its expense, construct the Washington Interceptor, including portions of the pipeline in WEST WARWICK. Copies of the plans and specifications for such construction shall be provided to WEST WARWICK prior to executing a construction contract, for review and approval by WEST WARWICK. WEST WARWICK agrees to cooperate with COVENTRY and its agents and contractors for the purpose of enabling such construction to proceed without delay and will promptly provide or obtain all such licenses, permits and approvals as may be necessary for the construction.

8.3 COVENTRY will require any construction contract for work in WEST WARWICK to include provisions requiring the contractor to maintain liability insurance in which COVENTRY, WEST WARWICK and their respective agents shall be named as additional insured with limits of coverage not less than $5,000,000.

8.4 The completed Washington Interceptor located in COVENTRY shall be owned, operated and maintained by COVENTRY, at its expense. COVENTRY hereby gives to WEST WARWICK, at no cost, the portion of the Washington Interceptor located in WEST WARWICK. WEST WARWICK shall operate and maintain that portion of the interceptor.

8.5 WEST WARWICK agrees not to impose any restrictions, requirements or costs upon the construction, operation and maintenance of the Washington Interceptor, which are different than those restrictions, requirements or costs which are imposed on sewers constructed and maintained by WEST WARWICK.

8.6 Prior to the construction of interceptors within COVENTRY, WEST WARWICK must determine if the Regional Interceptors are adequate to handle the additional flow. If the Regional Interceptor(s) is(are) inadequate to handle the increased flow, COVENTRY, WEST WARWICK and the Regional

Participants must agree to a time frame for the upgrading prior to the construction of any interceptors within WEST WARWICK.

8.7 In the future, COVENTRY and WEST WARWICK may mutually agree to allow COVENTRY to construct other portions of its sewer system in WEST WARWICK. In such case the conditions shall be similar to those agreed to herein for the construction of the Washington Interceptor.

9. PROJECT MANAGEMENT COMMITTEE

9.1 There is hereby established a Project Management Committee. The purpose of this Committee is to oversee the Regional Project which shall entail the development of engineering plans, specifications and construction arrangements; the review of any change orders during construction; the development of policies and program that shall be applicable to all participating municipalities; and the review of any proposed improvements, additions or changes in the Regional Project. The Committee shall consist of a representative of each Participating Municipality.

9.2 The Committee will be chaired by the WEST WARWICK representative. Vacancies will be filled in the manner as original appointees. Each member shall have a weighted vote based upon the percentage of its reserved capacity. Meetings of the Committee shall be held as necessary during the development and construction of any upgrade, and quarterly thereafter, and at the call of the Chairperson to carry out the duties of the Committee. The Committee may appoint advisors who may attend and participate in all meetings except that they shall not be counted for a quorum, nor vote on Committee actions.

9.3 WEST WARWICK will act as the contracting and management agent (Owner) for the Regional Project and its Town Council acting as the Sewer Commission, will sign all contracts, advertise all bids, supervise construction and be liable for any violation of EPA or DEM Rules and Regulations.

10. SEPTAGE

10.1 WEST WARWICK agrees to accept residential septic tank and/or cesspool waste (septage) generated within the boundaries of COVENTRY for treatment. WEST WARWICK agrees to make every effort to accept all septage from COVENTRY as the process permits.

10.2 If at any time the amount of septage which the regional wastewater treatment facility is capable of accepting and treating is limited, WEST WARWICK will accept septage generated from the Participating Municipalities, in preference to septage generated in other communities.

10.3 The charge for accepting and treating septage shall be reasonable and based on the cost for providing such services set by the WEST WARWICK Sewer Commission.

11. MISCELLANEOUS CLAUSES

11.1 Notwithstanding any other provision of this Agreement, COVENTRY shall not be required to observe or perform any obligation under this Agreement unless WEST WARWICK shall have obtained and made available to COVENTRY all necessary easements, licenses, permits and approvals as required by Federal, State and local entities for completion of the regional project and COVENTRY'S wastewater collection system.

11.2 No failure or delay in performance of this wastewater disposal Agreement by either party shall be deemed to be a breach thereof when such failure or delay is occasioned by or due to any act of God, strikes, lockouts, wars, riots, epidemics, explosions, sabotage, breakage or accident to machinery or lines of pipe, the binding order of a Court or governmental authority, or any other cause, whether of the kind herein enumerated or otherwise, not within the control of the party involved.

11.3 Agreement shall be reviewed annually by both parties hereto with the intention that any inequity which may arise or any error discovered be corrected through negotiations.

11.4 If any section, subsection, sentence, clause, phrase or portion of this Agreement is for any reason held invalid or unconstitutional by any court of competent jurisdiction, such portion shall be deemed a separate, distinct and independent provision, and such holding shall not affect the validity of the remaining portions hereof.

11.5 A copy of the final construction plans and specifications, a copy of Federal and State Grant applications and offers, a copy of all contracts, a copy of all regulatory agency project inspection reports, a copy of all regulatory agency project inspection reports, a copy of the final construction cost audit shall be sent to and filed with the Town Clerk of COVENTRY and the Town Clerk of WEST WARWICK for record purposes, within forty-five (45) days of completion.

11.6 There is at present Agreement between WEST WARWICK and Woodland Manor Associates which is not now part of this Intermunicipal Agreement. Through this contract an average daily flow of 200,000 gallons per day is set aside for sewer users in the service area. No change or alteration in the Woodland Manor Agreement, no increase in flow nor any additional usage of said line shall be made by Woodland Manor Associates unless a new Agreement is made between WEST WARWICK, COVENTRY and said Woodland Manor Associates. It is understood that the capacity granted to Woodland Manor Associates is not part of the COVENTRY reserve capacity under this Agreement (Appendix B).

11.7 There is at present an Agreement between WEST WARWICK and the state of Rhode Island and Providence Plantations (State) which is not now part of this Agreement. Through this contract a minimum of 320,000 gallons per day of average flow and a maximum of 800,000 gallons per day of average flow is set aside for sewer users in the service area, which includes out-of-town users. COVENTRY is, through this contract, an out-of-town user; therefore, residential, business and industrial users located within COVENTRY's boundaries may use this sewer. It is agreed that a residential, business or industrial user who wishes to use this sewer shall be allowed to do so in accordance with the intermunicipal Agreement between WEST WARWICK and COVENTRY. Further, no change or alteration in the Agreement between the State and WEST WARWICK, no increase in flow or any additional usage of said line shall be made unless a. new Agreement is made between WEST WARWICK, COVENTRY and the State (Appendix C).

11.8 COVENTRY reserves the right to negotiate directly with any in-town industry or commercial establishment concerning connection to the COVENTRY wastewater collection system based on flow only. If said industry or commercial establishment is classified as an SIU, WEST WARWICK must be part of the negotiation process.

11.9 If WEST WARWICK hereafter enters into any Agreement of understanding with any Participating Municipality or any other municipality concerning the acceptance, transport, treatment and/or disposal of wastewater on terms and/or conditions, the basis for which is comparable, that are more favorable than the terms and/or conditions accorded COVENTRY hereunder, then WEST WARWICK shall promptly offer such more favorable terms and/or conditions to COVENTRY. An appropriate amendment to this Agreement with respect thereto shall be executed by WEST WARWICK and COVENTRY, and an appropriate credit shall be applied against future payments due from COVENTRY under this Agreement for payments previously made to WEST WARWICK by COVENTRY which would not have been required, or would have been less in amount, had such amendment been in effect as of the date of such payments. Promptly after entering into any future Agreement or understanding with any Participating Municipality or other municipality regarding wastewater, WEST WARWICK will furnish a true and exact copy of such Agreement to COVENTRY.

11.10 All connections to the regional system in COVENTRY shall be inspected at the time of construction to assure compliance with WEST WARWICK or COVENTRY Sewer Ordinances, whichever is more stringent. WEST WARWICK will perform these inspections. WEST WARWICK will invoice the applicant directly for any inspection fees. At the time COVENTRY institutes a wastewater division, COVENTRY may perform these inspections.

12. <u>EFFECTIVE DATE OF CONTRACT</u>

12.1 This Agreement shall become effective upon approval by the Town Councils of WEST WARWICK and COVENTRY, and upon execution by the respective duly authorized representatives.

12.2 This Agreement shall commence upon its execution. This document contains the understandings and agreements of the parties as they relate to the present and continued use by COVENTRY and its residents of the WEST WARWICK Treatment Facility and the present and continued services to be provided by WEST WARWICK for this use. Accordingly, this agreement shall remain in full force and effect for a period of ninety-nine (99) years unless and until it is amended by the mutual consent of all parties.

12.3 If COVENTRY terminates this Agreement, COVENTRY will forfeit its rights for the unused capacity and WEST WARWICK will take over that capacity. COVENTRY will be responsible for all overdue payments up the date of termination.

13. <u>ARBITRATION</u>

13.1 If any controversy hereafter arises out of this Agreement or out of refusal of any part to perform the whole part thereof, or if the parties of this Agreement cannot agree upon any of the costs herein enumerated or any matter requiring negotiation or Agreement herein then the following procedures shall be followed:

A. The Chief Administrative Officers of WEST WARWICK and COVENTRY shall discuss the issue or issues informally with the hope that the issue or issues will be resolved through the informal discussions. Said informal discussions will be conducted as soon as practicable but in no event later than fifteen (15) days after receipt of a written request for the scheduling of such an informal discussion.

B. If the Chief Administrative Officers of WEST WARWICK and COVENTRY are unable to resolve the issue or issues informally, then notice shall be given immediately forwarded to the legislative bodies of WEST WARWICK and COVENTRY who shall conduct informal joint discussions with the hope that the issue or issues will be resolved. These informal discussions between the legislative bodies of the respective towns shall take place as soon as practicable but in no event later than fifteen (15) days after receipt of said notice.

C. If the issue(s) are not resolved by informal discussion, either WEST WARWICK or COVENTRY may request, at any time subsequent to the expiration of sixty (60)days from the date of the commencement of the first informal discussions as set forth in subparagraph (A) above, a joint public meeting of the legislative bodies of WEST WARWICK and COVENTRY. Within fourteen (14) days of receipt of such request, a joint meeting of the legislative bodies of WEST WARWICK and COVENTRY shall be held to discuss the issue(s).

D. If the issue or issues are not resolved within ten (10) days after the joint public meeting of the legislative bodies of WEST WARWICK and COVENTRY, then, in that event, either WEST WARWICK or COVENTRY may request that the unresolved issue or issues be submitted to arbitration. Within seven (7) days after arbitration has been requested, WEST WARWICK and COVENTRY shall each select and name one arbitrator and shall immediately thereof notify each other in writing of the name and address of the person so selected. The two (2) arbitrators so selected and named shall, within ten (10) days from and after the selection, agree upon and select and name a third arbitrator. If within said ten (10) days the arbitrators are unable to agree upon the selection of a third arbitrator, such third arbitrator shall be selected in accordance with the rules and procedures of the American Arbitration Association. Whether the third arbitrator is selected by Agreement or under the rules and procedures of the American Arbitration Association, the said third arbitrator shall not be a resident of the State of Rhode Island. The arbitration procedures shall be conducted in accordance with the rules and procedures of the American Arbitration Association. The decision of the arbitration panel shall be final and binding upon WEST WARWICK and COVENTRY.

IN WITNESS WHEREOF the parties have caused this Agreement to be executed by their respective fully authorized officers and their corporate seals affixed hereto the day and year first above written.

TOWN OF WEST WARWICK

Carl Brown

Robert B. Moorehead

Town Council

TOWN OF COVENTRY

Anna Mae Lapinski

Ronald S. Wood

Town Council

Appendix D

Tiogue Lake Bacterial Study

Tiogue Lake
Bacteria Source Investigation

Town of Coventry, RI

AUGUST 2022




FUSS & O'NEILL

Table of Contents

FUSS & O'NEILL

Executive Summary

Routine water quality sampling is conducted at Tiogue Lake to monitor concentrations of the fecal indicator bacteria (FIB) enterococcus, which is used to indicate potential contamination of recreational water with pathogens capable of causing human illness. The Rhode Island Department of Health (RIDOH) has established threshold enterococcus concentrations for primary contact recreation, like swimming, in order to protect public health. Sampling conducted in June 2018 at Briar Point Beach on Tiogue Lake revealed concentrations of enterococcus exceeding the beach action value (BAV) established by the U.S. Environmental Protection Agency (EPA) and adopted by RIDOH for contact recreation. Accordingly, the Town closed the beach to swimming for several weeks until additional sampling showed waters were safe. The highest concentration recorded in 2018 for Tiogue Lake was 40 times higher than the RIDOH BAV, with additional exceedances documented before and since. Ingesting contaminated water while swimming can result in gastroenteritis, with symptoms such as vomiting, headache, and fever. Swimming in contaminated water can also cause skin rashes and ear, eye, and throat infections.

Common sources of enterococcus include stormwater runoff, non-permitted discharges to the stormwater drainage system, failing or leaking septic systems, and domestic animal and wildlife waste. Enterococcus is used as a proxy or indicator for other potential pathogens (i.e., bacteria and viruses) that are often present when enterococcus is present due to their common origin. This study focuses on identifying which of those potential sources, or other sources, are present for Tiogue Lake and makes recommendations on mitigating their impact.

To identify potential sources, Fuss & O'Neill staff conducted in-person investigations, including a sanitary survey and illicit discharge detection investigation at Tiogue Lake in March 2022, during the winter drawdown of the lake. These investigations used standard methods developed by the EPA. In addition, secondary data based on bacteria monitoring data, septic permitting and system use information were analyzed to identify patterns in observed data that indicate how additional sources of bacteria may impact the lake.

Data collected and reviewed as part of the project did not identify a single "smoking gun" bacteria source, instead indicating that the most likely sources of fecal indicator bacteria to Tiogue Lake are stormwater runoff, cesspools and septic systems, and pet and wildlife waste. To address these sources, we recommend the following measures:

- Increasing rainwater infiltration with green stormwater infrastructure
- Consider extending sewer service to unsewered areas around the lake
- Increasing the rate of cesspool removal and increasing septic system inspection and maintenance frequency
- Targeted public education campaigns

These methods also provide co-benefits by addressing the pollutants that may be linked to other recent beach closures due to harmful algal blooms.

1 Introduction

1.1 High Bacteria Concentrations

In June 2018, routine water quality sampling conducted at Briar Point Beach on Tiogue Lake revealed concentrations of the fecal indicator bacteria (FIB) enterococcus far exceeding the standards set by the Rhode Island Department of Health (RIDOH). These elevated FIB concentrations in Tiogue Lake in 2018 led the Town of Coventry to close Briar Point Beach to swimming for three weeks. The COVID-19 pandemic continued the beach closure, but FIB monitoring continued on a routine basis.

To protect beach users, RIDOH and the University of Rhode Island Watershed Watch (URI WW) regularly collect water quality samples to monitor for these and other substances that may pose health risks to humans. The standard for beach closure advisories, or Beach Action Value (BAV), set by RIDOH is 60 colony forming units per 100 milliliters of water (CFU/100mL). The highest concentration recorded in 2018 for Tiogue Lake was 40 times higher than the Beach Action Value, with additional exceedances documented before and since (*Figure 1*). The Town sought Fuss & O'Neill's assistance in identifying potential FIB sources to address these issues.

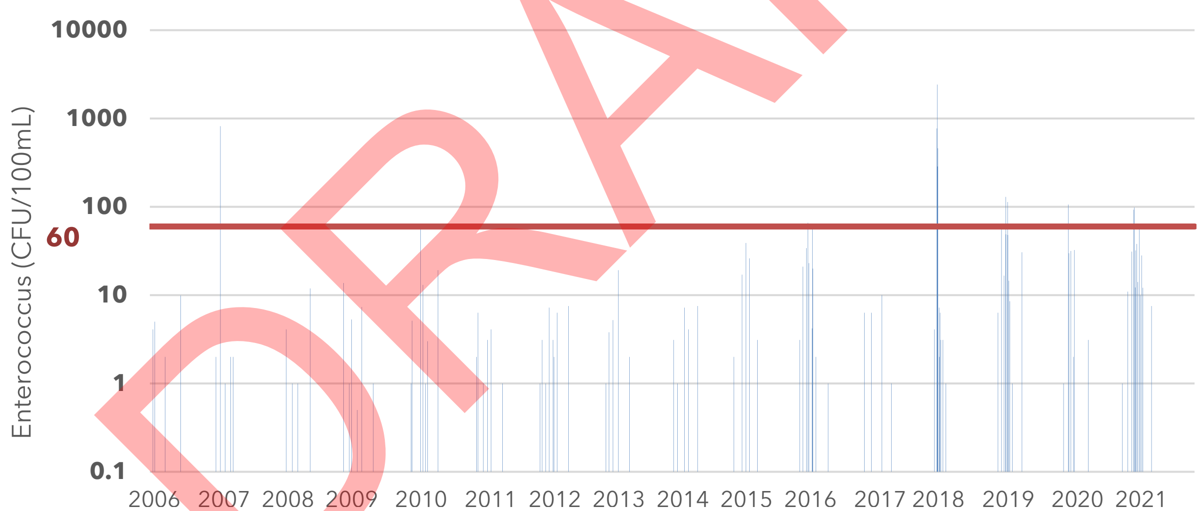

Figure 1: Enterococcus concentrations observed at Briar Point Beach, with beach action value of 60 CFU/100mL indicated by the bold horizontal line

Fecal indicator bacteria, such as enterococcus and E. coli, occur naturally in the digestive tract of humans and other warm-blooded animals. The presence of these bacteria indicates the presence of fecal matter in water. While enterococci are typically harmless to humans, their presence can indicate the presence of other viruses, bacteria, and protozoa that can cause disease in humans. Swimming or other primary contact recreation in waters with FIB concentrations exceeding the BAV can result in gastroenteritis, with symptoms such as vomiting, headache, and fever. Contact with contaminated water can also cause skin rashes and ear, eye, and throat infections.

1.2
Potential Enterococcus Sources

In developed watersheds, the most common sources of enterococcus include stormwater runoff and illicit discharges to the stormwater drainage system, failing or leaking septic systems, domestic animal and wildlife fecal waste, and improper manure storage. This study focuses on identifying which of those potential sources likely contribute to high enterococcus monitoring values at Briar Point Beach.

Rain water is generally clean. However, as soon as a raindrop hits the ground and starts flowing across surfaces, it begins collecting other materials. Stormwater runoff picks up surface pollutants like bacteria, nutrients, and sediment, carrying them into waterbodies, often without an opportunity for treatment and/or filtration. Separately, individual homes or businesses with improperly connected "gray water" lines, such as from dishwashers or laundry, or "black water" or sewage lines from septage disposal systems to the storm drain network can contribute substantial amounts of enterococcus to surface waterbodies through the storm drainage system, which should only convey stormwater runoff.

Failing or leaking septic systems can result from a number of factors, such as system age and use patterns. In particular, seasonal occupancy and system use has been shown to negatively impact septic system function for shoreline septic systems in Rhode Island (Postma et al. 1992). In addition, septic systems serving seasonally occupied homes, particularly those used as summer rentals, may have a greater potential to be overused. This overuse can occur when owners or renters have a greater number of people temporarily staying at the property, and using the septic system, than that system was designed to support. These situations can lead to septic system failure or inadequate treatment, potentially leading to enterococcus and pathogens from the system reaching a surface waterbody via groundwater.

Domestic animal and wildlife waste can also contribute to enterococcus levels if not properly managed. Pet waste that is not picked up and properly disposed of in a trash receptacle can be carried directly into waterbodies by stormwater. Wildlife, particularly wading waterfowl, wastes provide perhaps the most direct source of enterococcus and potential pathogens to a waterbody. If lake users feed waterfowl, that can create a learned behavior causing waterfowl to congregate around recreational areas. Anecdotal information provided by URI WW noted that waterfowl were historically prevalent because people fed waterfowl from the Arnold Road causeway. Indeed, bread trucks would reportedly drop off excess bread at this location. Since passage of a town ordinance against feeding wild fowl and posted signage, this behavior has been markedly reduced. Finally, though rare in the watershed, hobby farm animals generate enterococcus-containing wastes, which can be carried by stormwater runoff to surface waterbodies if not properly managed.

Although non-fecal sources of enterococcus and other FIB do exist, including plants, sand, soil, and sediments, they contribute to a background ambient level that varies with environmental and meteorological conditions, and are very unlikely on their own to result in the observed elevated concentrations.

1.3 Tiogue Lake and its Watershed Context

Tiogue Lake is a reservoir created in the 19th century by a stone dam to serve nearby mills along the southwest branch of the Pawtuxet River. The lake outlet flows north toward the Pawtuxet River under Tiogue Avenue. The watershed draining to Tiogue Lake is substantially built-out, with most development occurring between 1952 and 1972 (*Figure 2*). Based on available aerial imagery, many lakeside homes were constructed prior to 1952, and some prior to 1939. Conventional concrete tank septic systems were not developed until the 1950s and so may not be present on lots with these early constructions, which may be served by cesspools.

Different land uses contribute variable loads of enterococcus to downstream surface water bodies, depending on the intensity of the land use. Commercial and industrial land uses dominate near Interstate 95 at the southern portion of the watershed (*Figure 3*). Much of the remainder of the watershed is primarily comprised of single-family residential land uses, with minor institutional land uses from two elementary schools. All parcels in the Tiogue Lake watershed are served by the Kent County Water Authority (KCWA), which supplies water to the users from wells located outside the watershed. Parcels in the Tiogue Lake watershed are predominantly served by onsite wastewater treatment systems (OWTS), with minor areas in the western and southern parts of the watershed served by sewer.

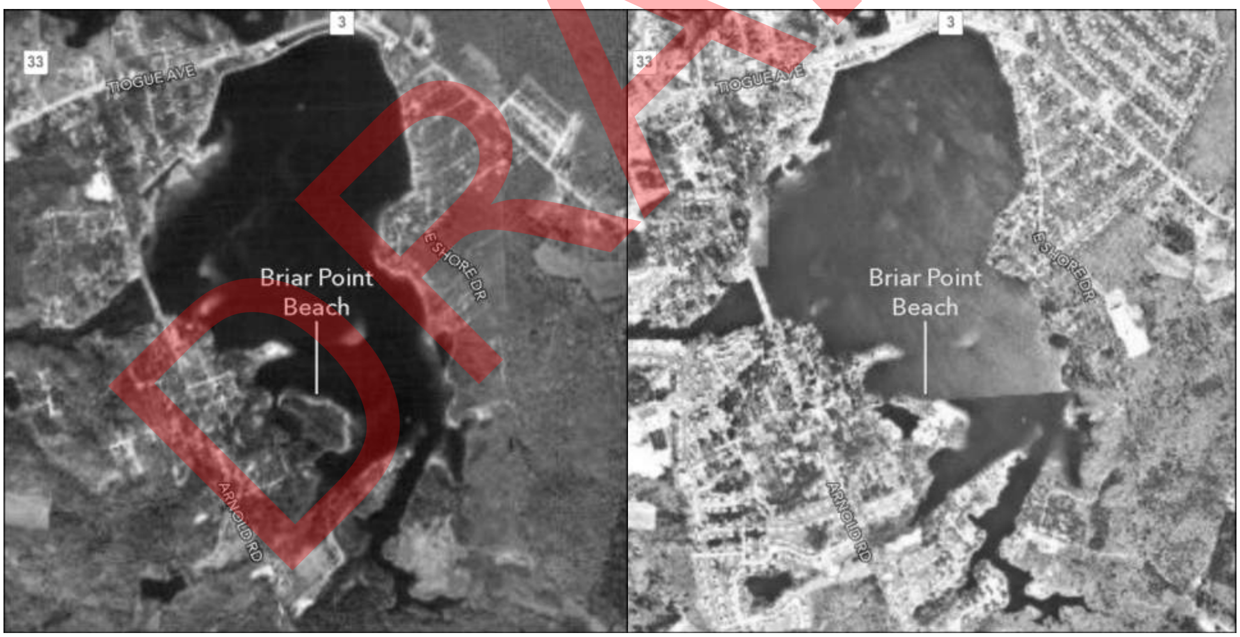

Figure 2: Tiogue Lake in 1952 (left) and substantially built out (1972)

Much of the stormwater drainage network in the watershed are closed systems, comprised of catch basins and manholes connected to outfalls. Isolated locations around the lake are served by open drainage systems, where paved swales convey stormwater runoff to the lake. While most of the 26 outfalls discharging to the lake are owned by the Town of Coventry, the drainage from state Route 3 is under the jurisdiction of the Rhode Island Department of Transportation (RIDOT). Additional privately owned drainage systems, including some stormwater best management practice (BMP) installations intended to detain stormwater or remove pollutants from it, are present in the watershed. One stormwater treatment structure was identified during this study, at the intersection of East Shore Drive and Mohawk Street.

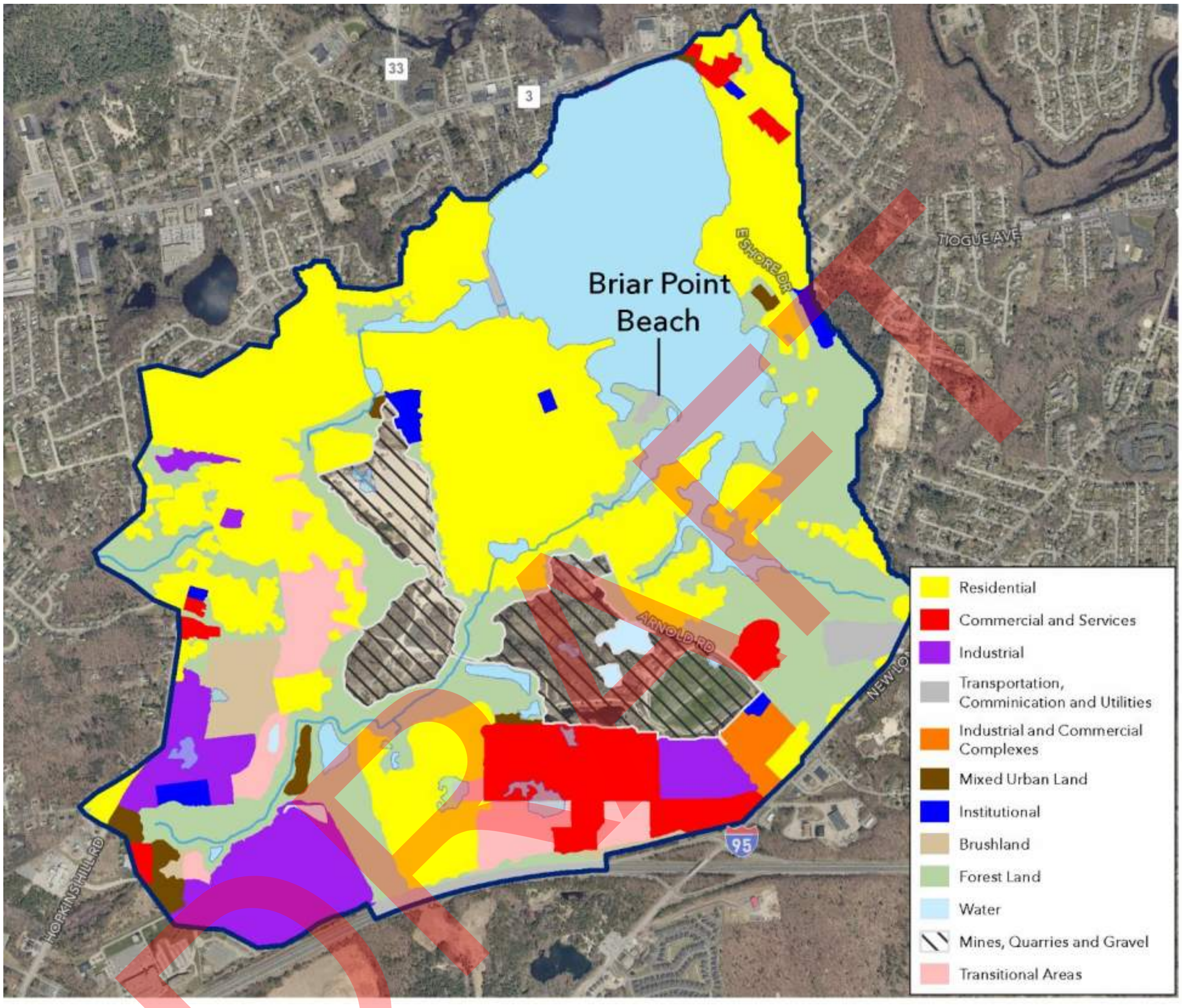

Figure 3: Current land uses in the Tiogue Lake watershed

2 Investigative Methods and Data Sources

Identifying various enterococcus sources requires different methods to determine their presence and impact on Tiogue Lake. The impact of some potential sources can be more easily quantified when sufficient information exists. Other potential sources can only be inferred from various data sources, and require additional information to determine their impact on enterococcus concentrations relative to other sources. This difference requires collecting additional data as part of this study, and analyzing existing secondary data collected by others.

2.1 In-person Investigations

To identify potential sources that could not be determined from secondary data, we conducted in-person investigations, including a sanitary survey and illicit discharge detection investigations at Tiogue Lake in late March 2022, during the winter drawdown of the lake. Fuss & O'Neill staff walked completely around the lake shore on March 16, identifying groundwater seeps not visible when the lake is at its higher summertime water level, and other observed potential sources of enterococcus, FIB, or pathogens. This sanitary survey followed procedures recommended by the EPA to visually identify potential sources of bacteria and other pathogens. Samples of flow from any identified groundwater seeps and stormwater outfalls with observed flow were collected during dry-weather conditions on a return visit on April 1.

Illicit discharge detection investigations occurred on March 16 and 23, 2022 during dry-weather conditions. The last rain event for these dates, as measured at the TF Green airport weather station, was 0.51 inches on March 12, and 0.28 inches on March 18. Where outfalls were observed to be flowing during dry weather, a sample of flow was collected and analyzed for the parameters listed in *Table 1*. Enterococcus samples were analyzed at New England Testing Laboratory in West Warwick, RI. All other parameters were analyzed using field test kits or calibrated meters, following all manufacturer instructions. All samples were delivered to the laboratory or tested in the field within specified hold times.

Table 1: Sampling parameters and illicit discharge detection action thresholds

Parameter (units)	Action Value
Temperature (°C)	None specified
Conductivity (µS/cm)	
Salinity (PPT)	
Ammonia (mg/L)	≥0.5 mg/L
Surfactants (mg/L)	≥0.25 mg/L
Chlorine (mg/L)	>0.02 mg/L
Enterococcus (MPN/100mL)	60 CFU/100mL[1]

[1] CFU and MPN are equivalent units and reflect a difference in measurement and reporting methodology only.

2.2
Secondary Data

2.2.1 Water quality monitoring data from RIDOH and Watershed Watch

The relationship between rainfall and enterococcus or other FIB concentrations can provide clues to help differentiate between localized point sources and more distributed non-point sources, in their contributions to enterococcus concentrations. If there is a temporal link between the timing of precipitation events and increased enterococcus concentrations, that may indicate a relatively larger contribution of stormwater to water quality. Conversely, if there is no temporal relationship, this indicates a non-point source of contamination, such as septic systems, wildfowl or pet waste.

To investigate the presence of this link, a cross-correlation analysis was performed on daily precipitation totals observed at the nearest National Weather Service station and the bacterial concentrations measured by RIDOH. Both data sets represent time series data, or collections of data points indexed in chronological order. A cross-correlation analysis examines the relationship between the individual time series with varying delays, or lags, between them (e.g., 0 days, ± 1 day, ± 2 days, etc.). The nearest weather station is located within the Tiogue Lake watershed, approximately 0.5 miles from Briar Point Beach, but this station has only been operational since August 2015. The nearest long-term weather station is located at TF Green Airport, approximately 7.1 miles from Briar Point Beach.

2.2.2 Septic System Failures

The Rhode Island Department of Environmental Management (RIDEM) is responsible for permitting septic systems across the state. Repairs to correct septic system failures require a permit from RIDEM, which also makes public all records related to septic system permits searchable by street address. These records include the dates of each phase of design, inspection, and approval, and so provide a timeline of when a failure is identified, a repair is approved, and the system once again conforms with the applicable regulations.

We reviewed all septic permits for streets adjacent to Tiogue Lake, with particular focus on properties abutting the lake with recent repair permit applications. These were manually categorized based on the type of work permitted, such as new system installation, failed system repair, and cesspool removal.

2.2.3 Sanitary System Use

In the absence of metered usage data from a sewer utility, we worked with KCWA to obtain metered water usage data. KCWA provides water to all homes around Tiogue Lake, which was assumed to be the source of water for sanitary flushing. Metered water use can be considered as a proxy for septic system usage, because water entering a home is discharged via the septic system. KCWA provided water usage data from summer 2016 to present from 28 properties near Briar Point Beach and seven immediately surrounding a groundwater seep on the east shore of the lake. Until 2021, KCWA billed users for water usage on a quarterly basis. After 2021, billing occurred on a monthly basis. Monthly billing data were aggregated into quarterly data to provide a consistent time series of water usage.

Because each KCWA account's water usage is measured at a set interval, the data represent a time series, or a chronologically indexed set of numbers. This time series can be analyzed by relatively simple statistical methods to identify both long-term trends as well as seasonal variation in water usage. The overall trend component was estimated using a moving average that removed seasonal and other unmeasured factors. The seasonal component was estimated by averaging each quarter of data (i.e. average of every year's first quarter usage, second quarter usage, etc.). Unmeasured factors include factors beyond the scope of this project, such as building footprint expansions and the exact timing of meter reading.

For each of the 35 properties, the results of each time series analysis for water usage data were plotted to graphically identify the extent of seasonal variation in water usage as well as any increasing, decreasing, or non-seasonally cyclical trends.

3 Findings

3.1 Sanitary Survey and Illicit Discharge Investigation

The sanitary survey identified several locations where flow was observed entering the lake, as well as potential locations where bacteria and other pollutants could reach the lake via overland flow (*Figure 4*). The most common observation during the sanitary survey was pipes located in retaining walls, none of which were flowing at the time of inspection, but which may represent weepholes or yard drains to provide an outlet for groundwater. Field notes and data sheets are included as Appendix A.

Figure 4: Potential enterococcus sources identified during sanitary survey

3.1.1 Groundwater Seeps

Three seeps were identified along the eastern shore of the lake during the initial sanitary survey and sampled during the follow-up visit. A seep indicates a hydraulic gradient pushing groundwater from subsurface to the surface. The presence of groundwater seeps indicates that depth to groundwater may be shallower in some locations than is indicated in the Rhode Island Soil Survey.

Two groundwater seeps showed enterococcus concentrations below the BAV. The seep in *Figure 5*, located between 95 and 107 East Shore Drive, had enterococcus concentrations over 400 CFU/100mL, or about 7 times higher than the BAV. This bacteria level suggests a source of bacteria to groundwater, such as a failing or poorly-sited septic system or cesspool. Because the sanitary survey occurred when the lake was drawn down and during the high groundwater season, it is difficult to determine if this groundwater seep contributes to enterococcus exceedances in the summer, when groundwater is typically lower. If this seep, and groundwater sources more generally, were substantially contributing to enterococcus levels at the beach, the water quality monitoring data would likely show this impact with more consistent BAV exceedances. Lake water samples collected nearer to the seep would be more likely to show elevated enterococcus concentrations.

Figure 5: Groundwater seep identified at 95-107 East Shore Drive, with high enterococcus concentration

3.1.2 Illicit Discharge Detection

The sanitary survey identified five of twenty-six stormwater outfalls exhibiting flow during dry-weather conditions, samples of which were collected during the return visit. All but one flowing outfall did not have a detectable enterococcus concentration; the outfall with detectable enterococcus was 20 CFU/100mL, below the BAV (*Figure 6*). The outfall on Twin Lakes Avenue was inundated, and during inspection of the first upstream drainage structure, a substantial amount of dog waste was observed on one private property on Twin Lakes Avenue (*Figure 7*).

Most other potential indicators of sanitary-related illicit discharge were similarly not detected, although two samples showed moderately elevated ammonia values of 1 mg/L. Ammonia is a component of human and animal wastes, potentially originating from sources such as leaking or failed septic systems and can also be found in fertilizer. The presence of ammonia without additional indicators of sanitary waste suggests that the ammonia found in the dry-weather flow samples may originate from groundwater influenced by fertilizer application or overapplication. Fertilizer overapplication can cause related problems in surface waterbodies, such as eutrophication and nuisance plant and algae growth.

Dry-weather flow with the observations and sampling results documented here (i.e., flow but lack of bacteria or other parameters listed in *Table 1*) indicate groundwater infiltration into stormwater pipes, and shallow groundwater depths, but not illicit discharges or cross connections to the stormwater drainage system. Shallow groundwater depths require careful design of OWTS to ensure adequate wastewater treatment by native soils.

Figure 6: Dry-weather Enterococcus sampling results from late March. Enterococcus concentrations in MPN/100mL, equivalent to CFU/100mL health standard

Figure 7: Seventeen dog waste piles were observed at time of inspection on one property along Twin Lakes Avenue

3.1.3 Other Potential Pollutant Sources

The sanitary survey visually identified other potential enterococcus and pollutant sources around Tiogue Lake. These sources necessarily rely on circumstantial evidence and may or may not represent actual enterococcus sources. In each instance we document the observed evidence (*Figures 8a-c*) and provide an explanation how that may indicate an enterococcus source.

Figure 8a: A suspected water intake located south of Tiffany Rd

Figure 8b: An unknown pipe in the retaining wall behind 62 W Shore Dr

Figure 8c: A drum containing an unknown liquid was observed in a waste pile at approximately 27 Harrington Rd

A corrugated metal pipe with a connected two-inch hose was identified along the shore south of Tiffany Road (*Figure 8a*). It is suspected that this is a water intake structure. While documenting this structure Fuss & O'Neill staff heard chickens nearby. The water intake and sound of chickens suggests a nearby hobby farm. Hobby farms and the livestock they contain generate animal waste. Proper management of this waste is important to prevent waste transport into surface waters via stormwater runoff.
Unknown pipes in retaining walls were the most frequent observation during the sanitary survey. This is likely a standard design component, i.e. a weephole, allowing groundwater to safely drain to the lake. One instance, believed to originate from 62 West Shore Drive, was observed to have a scour patch beneath the pipe (*Figure 8b*), possibly indicating greater flow, perhaps occurring only intermittently. If these pipes are connected as overflows for substandard septic systems, which may not be the case in this context, or are connected to gray water systems, they could discharge substantial quantities of enterococcus directly to the lake.

An unlabeled 55-gallon drum marked with Summit Industrial Products (*Figure 8c*) was observed to be stored along the lake shore on Harrington Avenue. Summit Industrial Products appears to produce chemical degreasers, industrial lubricants, and hydraulic fluids. While these are not sources of enterococcus bacteria, storage of such waste products or reuse of a container that may contain residual waste near the lake shore presents other risks that can be mitigated with adequate disposal in a permitted facility.

3.2
Secondary Data

3.2.1 Water Quality Monitoring Data

The cross-correlation analysis between precipitation and antecedent rainfall showed a moderate correlation between precipitation intensity and subsequent enterococcus concentrations with a lag between 4 and 5 days (*Figure 9*). This correlation (r=0.33) suggests that Briar Point Beach sees higher enterococcus values in the days after a rain event. Such a pattern is common in freshwater systems, though various temporal and spatial factors can introduce variation in beach monitoring data (EPA 2010), which may reduce the strength of the correlation.

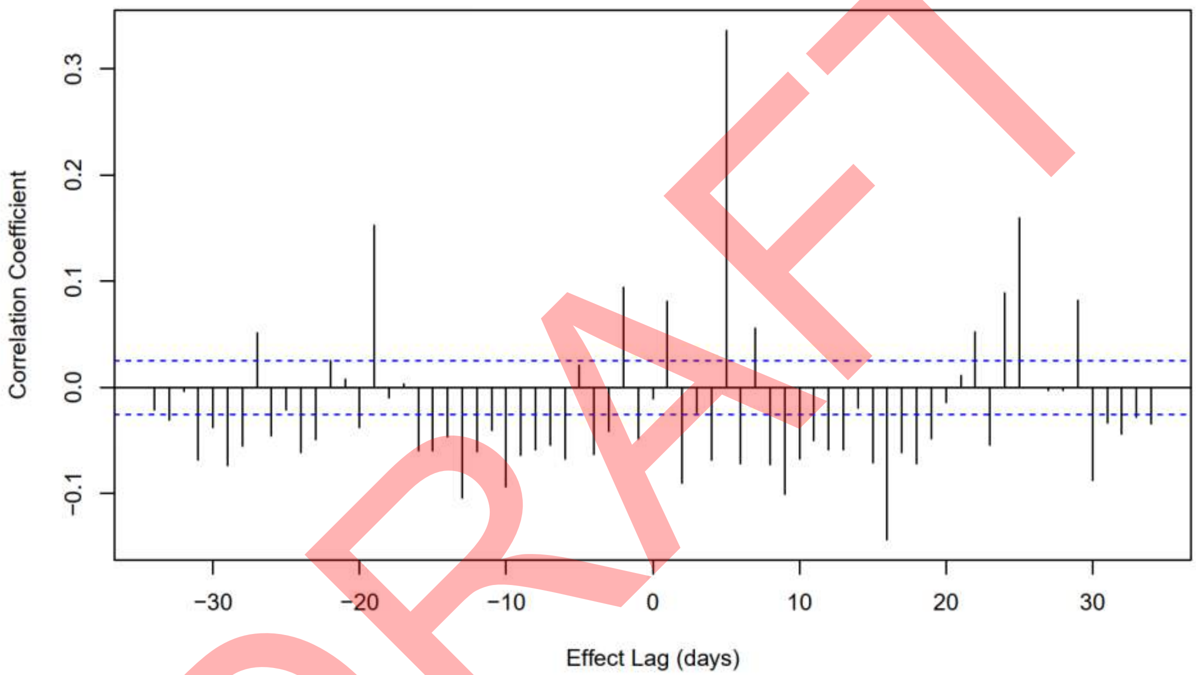

Figure 9: Correlation between rainfall with bacteria concentrations with lags and leads of ±30 days

These factors can interact in complex ways. For instance, the orientation of a beach relative to FIB sources, like stormwater outfalls and stream inlets that receive stormwater, can influence the temporal relationship between rain events and FIB concentration in a lake (Haack et al. 2003). In addition, longer gaps between prior rainfall events impacts the amount of enterococcus load on land available for runoff into Tiogue Lake. Shorter gaps between events may not leave sufficient time for enterococcus to increase between storms and become available to be washed into the lake. The exact timing of sampling relative to when rain fell may also play a role, for example when sampling occurs in the lag between rainfall and increased enterococcus concentration. Wind direction and speed can also impact how water moves through the lake, and when high-enterococcus water passes by the beach.

Plotting bacteria monitoring results against antecedent rainfall suggests not all rain events are necessarily followed by an increase in enterococcus concentration at Briar Point Beach. *Figure 10* indicates that enterococcus concentrations above the BAV most often occur after approximately 0.2 inches of precipitation have fallen in the preceding 3 days. Exceedances of the BAV do tend to follow particularly larger rain events (*Table 2*). This relatively low amount of rain indicates a brief window following a rain storm where exceedances of the BAV may occur. These exceedances may only be observed by chance in water quality monitoring data when water samples happen to be collected during that window.

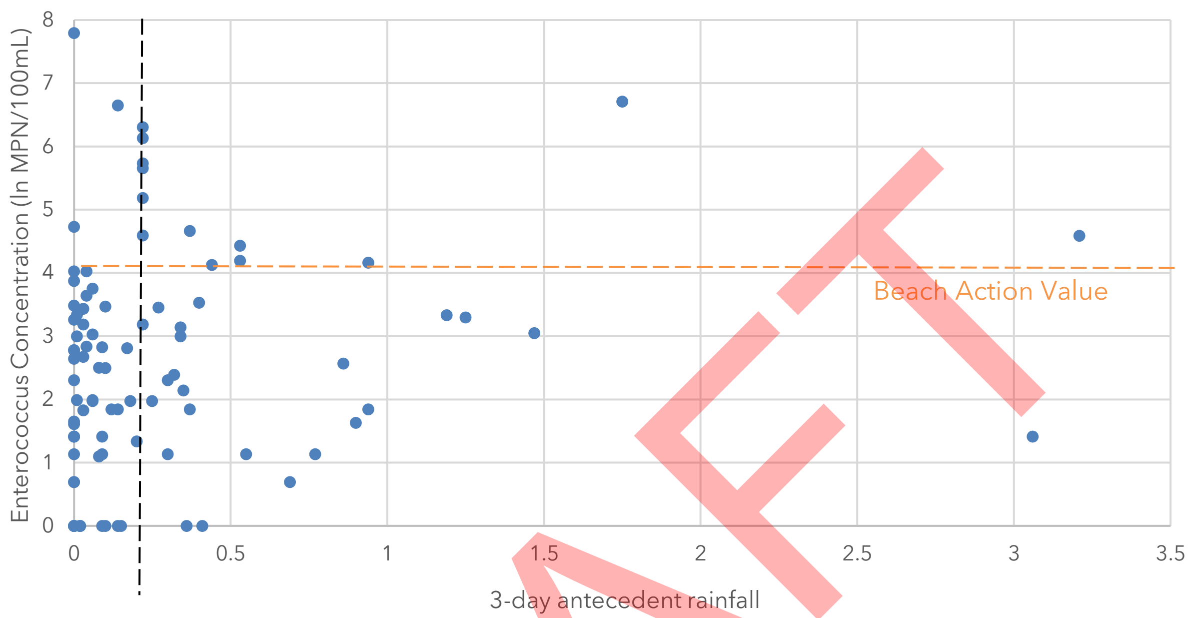

Figure 10: Antecedent precipitation and subsequent fecal indicator bacteria concentrations

Enterococcus in water quality monitoring data generally indicate the presence of human and other animal wastes, which also contain nutrients like phosphorus and nitrogen which are also found in stormwater runoff relating to land use practices. In freshwater systems, a lack of naturally occurring phosphorus often limits algal growth. The addition of phosphorus via stormwater runoff contributes to rapid algal growth, or blooms. These algal blooms can indicate the presence of certain co-occurring cyanobacteria that produce harmful toxins with the potential to cause gastrointestinal and neurological symptoms in humans. These harmful algal blooms have been recently documented by RIDOH in Tiogue Lake and caused closures at Briar Point Beach.

Table 2: Exceedances of Beach Action Value at Briar Point Beach and 72-hour antecedent precipitation

Sample Date	Enterococcus (MPN/100mL)	Rainfall in previous 72-hour period
2007-06-06	820	1.75
2016-07-01	84	0.21
2016-07-25	64	0.94
2018-06-21	770	0.19
2018-06-23	2,419	0.00
2018-06-26	285	0.22
2018-06-27	461	0.22
2019-06-26	62	0.44
2019-07-30	113	0.00
2020-07-07	106	0.37
2021-07-13	98	3.21

3.2.2 Septic System Permit Data

The review of RIDEM's septic system permit data around the lake show more than 60 septic system permit applications since 2012, 41 of which were identified as repairs. Six repair permits were open in June 2018 when the highest enterococcus concentrations were measured, two of which were near Briar Point Beach (*Figure 11*). While it is tempting to point to this geographic proximity and the open repair permits as definitive sources, all repairs have since been completed and RIDEM has issued letters of conformance indicating that these systems would not be ongoing sources of bacteria.

Figure 11: Septic system permit review results

A greater concern is the presence of cesspools in the parcels surrounding the lake. Based on RI Cesspool Act 2007 RIGL 23-19.15, as amended in 2015, all cesspools, including metal tanks, perforated concrete vaults, or covered hollows or excavations receiving sanitary sewage discharge, must be removed on a defined schedule. The Cesspool Act specifies that any cesspool must be removed and replaced with a RIDEM-approved septic system within one year of property transfer or when failing. Failure is defined in the Act when, among other conditions, a cesspool is shown to have contaminated a drinking water well or watercourse or the bottom of the cesspool contacts the groundwater table.

RIDEM records indicate removal of at least 16 cesspools since 2016. It is not documented how many parcels in the watershed are served by cesspools, but many likely remain given the age and type of development in the watershed. Removals were recorded for properties both near the lake shore in the first vacation homes constructed before 1952, but also further from the lake in areas developed later. This suggests a wider distribution of cesspools than those parcels abutting the lake, although those abutters are of greatest concern.

The presence of cesspools around the lake combined with the evidence of groundwater seeps with elevated enterococcus concentrations, and RI Soil Survey mapping indicating seasonal groundwater depths between 19-42", generates additional potential for remaining cesspools to meet the failure criteria. An expedited schedule for removal can apply if a failed cesspool creates a public health hazard, or if the property has a public sewer connection. The Cesspool Act specifically calls out drinking water intakes as a condition for a public health hazard, but proximity to a bathing beach may constitute sufficient basis to expedite cesspool removal.

3.2.3 Sanitary System Use

Time series analysis for the properties near Briar Point Beach indicated clear trend and seasonal components for each property. Summertime increases in water usage varied among properties, ranging from a 5% increase from winter baseline usage, suggesting year-round occupancy, to nearly 200% of winter baseline usage suggesting summer-only occupancy, with most properties increasing summer water usage around 25%. As noted above, seasonal septic system use can negatively impact septic system function during higher use months. In addition, based on the listed owner in some Town property records, it appears at least some waterfront homes on Tiogue Lake appear to be rental properties.

Where the trend component of a time series showed a clear increase in water use, this often corresponded to a property transfer or construction of an addition, as shown in the Town's property records. This increase may reflect different water use preferences (e.g., more intensive lawn watering) or increased occupancy and heavier septic system use. A decreasing trend at a property may also reflect lower usage following beach closure, and reduced water usage if seasonally occupied properties were less used during the COVID-19 pandemic.

While lawn watering practices likely contribute to seasonal variation in water usage, seasonal occupancy and overcapacity cannot be ruled out as contributing factors, since some short-term rental properties and seasonal septic system usage is evident from the available data. Because water usage can be used as a proxy for septic system usage, these patterns may show that septic systems contribute to enterococcus levels in Tiogue Lake. Multiple properties where water data was reviewed showed a decrease in water usage after the 2018 beach closure and COVID-19 pandemic. This decrease in water use, and associated reduction in septic system usage, may partly explain the improvement in water quality recently publicized in the Kent County Daily Times. The most recent water use data suggest that water usage and septic system use may be returning to pre-pandemic levels. If this trend is true and continues, we may expect to see additional exceedances of the BAV at Briar Point Beach in 2022 and 2023.

4 Recommended Next Steps

Based on the outcome of the sanitary survey investigation and secondary data review, multiple sources of bacteria likely contribute enterococcus to Tiogue Lake affecting exceedances of the BAV resulting in beach closures, including stormwater and wastewater sources. Additionally, while not directly indicated by the data available for this project, the continued removal of cesspools and elimination of OWTS will enhance protection of the lake. Addressing these relatively diffuse enterococcus sources is feasible, if challenging, given the built-out nature of the watershed.

Mitigating the impact of stormwater pollution and addressing bacteria loads from OWTS across the watershed is important but represents a long-term commitment, so it will be important to address other enterococcus sources in the short term by addressing seasonal OWTS loading and pet and wildlife waste through continued public education and outreach measures. Additional data collection efforts could also help refine the relationship between rainfall timing and BAV exceedances at Briar Point Beach.

The variety of these sources indicates a combination of infrastructure improvements and public outreach targeting bacteria reductions in the Tiogue Lake watershed may help address enterococcus concentrations at Briar Point Beach. The recommendations described below have the co-benefit of additionally addressing other pollutants that may be linked to the recent harmful algal blooms that have closed the beach in 2022.

4.1 Public Education

The Town has already taken steps to reduce bacteria from entering the lake, by enacting ordinances requiring dog walkers to pick up pet waste and forbidding park and public space users from feeding wildfowl. It has posted signage to those effects along the Arnold Road causeway, at Briar Point Beach, and the town boat launch on Tiogue Avenue. Pet waste bags and trash bins should continue to be made available in public spaces near the lake, and Town enforcement staff should continue to enforce those ordinances. Installing educational signage showing the link between pet waste, feeding wildfowl, and beach closures may encourage additional compliance with the ordinances.

Conducting targeted outreach to individual property owners on Twin Lakes Avenue can help reduce dog waste levels on private property at those lake side homes. Including pet waste informational materials with annual dog license renewals either town-wide or targeted to specific neighborhoods around TIogue Lake would provide additional benefits. These efforts would also count toward the Town's annual stormwater permit requirements for public stormwater education.

The Town should additionally continue to engage with residents' associations around the lake to conduct outreach to members and lake abutters about the importance of properly maintained septic systems and potentially advocate for public sewering. Additional outreach topics should include minimizing fertilizer application, maintaining buffer plantings at the lake edge, and conducting vista pruning of individual branches instead of cutting down entire trees. Maintaining a buffer between yards and the lake slows stormwater flows, allowing it more time to filter pollutants and infiltrate into the soil before reaching the lake. Removing trees near the shore can destabilize shoreline soils contributing to erosion and additional pollutant load. Vista pruning, by contrast, leaves trees and roots in place to limit erosion, while improving water views.

4.2 Stormwater Treatment

Removing pollutants from stormwater before it reaches the lake is the most effective way of mitigating its impact on Tiogue Lake. Allowing stormwater to infiltrate into the ground is the most cost-effective way of removing pollutants. Where this is not feasible, installing or constructing stormwater infrastructure that mimics the natural filtration and pollutant removal properties of soils is the next best option. In the built-out neighborhood around Tiogue Lake, identifying large areas for centralized stormwater retrofits is a challenge. Smaller, decentralized green stormwater infrastructure (GSI) practices may therefore represent the best alternative for future stormwater treatment.

GSI practices that rely on infiltration must be carefully sited because they rely on similar pollutant removal mechanisms as septic systems and if improperly sited will not function effectively to remove pollutants. These systems, which can be at surface level on a parcel or within a road right of way (ROW), or buried under roadways, sidewalks, and parking lots, typically have the highest bacteria removal efficiencies, exceeding 90% removal under ideal conditions. Where infiltration is not possible, biofiltration practices, such as bioretention planters, bioswales, and tree boxes are viable alternatives, and can remove up to 50% of bacteria loads from the stormwater they treat. The long-term success of GSI requires a commitment to maintenance, which is a critically important consideration when selecting the location and type of GSI.

Incorporating GSI installation into other planned infrastructure projects, such as road resurfacing or utility installation, can help decrease overall costs to the Town because the costs related to excavation and pavement removal and resurfacing are only paid once. Specific publicly owned locations in the Tiogue Lake watershed where GSI practices may be feasible include the elementary schools (*Figure 12*) and near Briar Point Beach (*Figure 13*). Further planning efforts would be necessary to identify additional locations where GSI components could be installed. A conceptual example of a potential GSI retrofit that can fit in space-limited ROWs around Briar Point Beach is shown in *Figure 14* as well as Appendix B. Because these areas are publicly owned, the Town would not need to coordinate access or easement agreements with private ownership interests, though outreach to nearby property owners can help with public acceptance of these systems. In addition to water quality benefits, GSI designs can provide both habitat and aesthetic benefits by incorporating native grass species into the design of these systems that allow them to better blend into the existing streetscape.

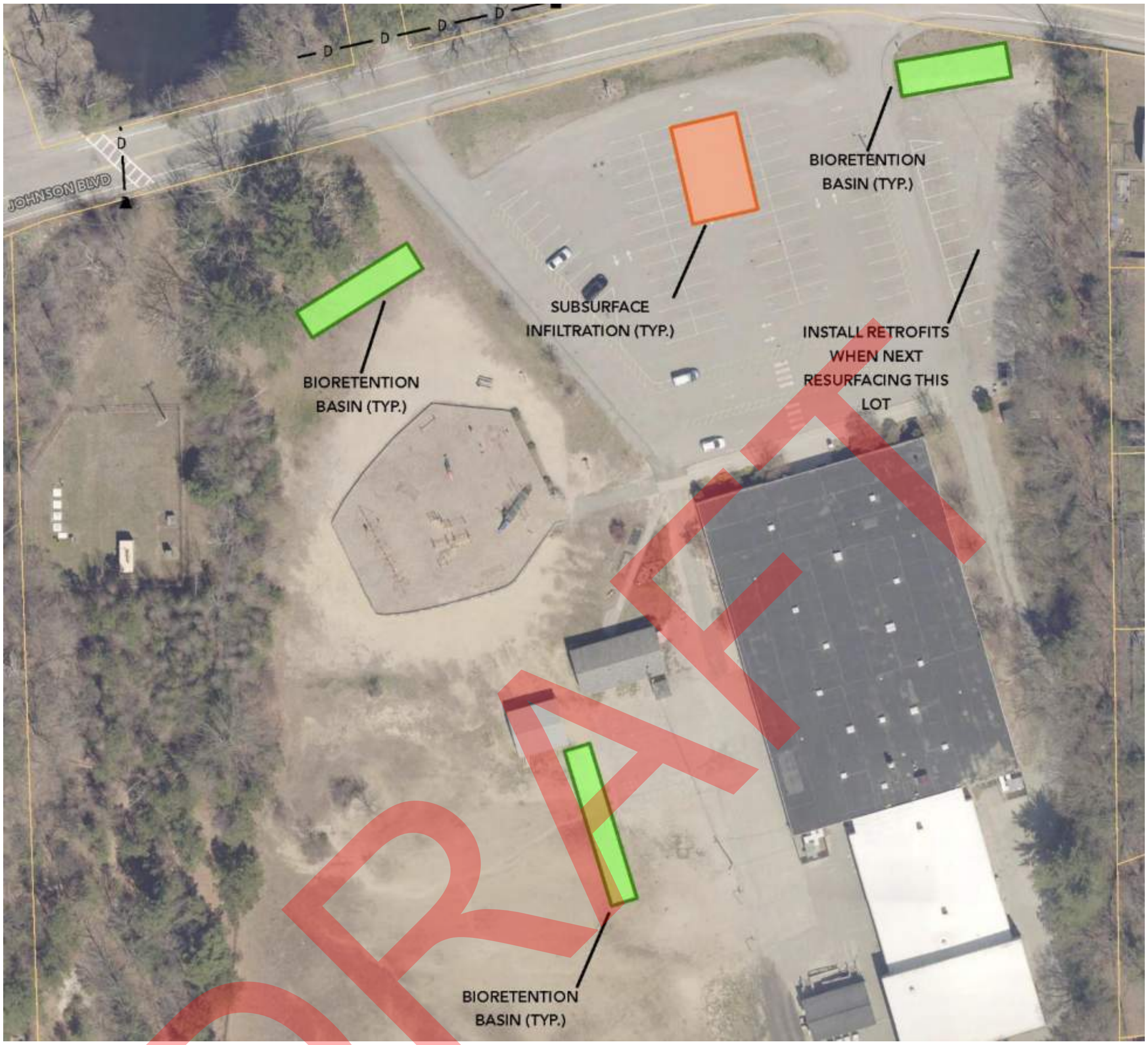

Figure 12: Potential GSI options at Hopkins Hill Elementary School. Aerial imagery and site visits indicate that channelized flow from the playground and impervious area near the pavilion discharges to a direct tributary of Tiogue Lake

Figure 13: Bioswales between roadway and sidewalk or private property

Figure 14: Potential GSI retrofit options within the ROW and on Town property near Briar Point Beach. An unmapped paved swale discharges surface flow from the southeast corner of West Shore Drive directly to Tiogue Lake

In addition, on the west side of the lake, a common development feature provides additional GSI opportunities. Holmes Road, Cove Road, Colonial Road, York Drive, Jade Road, and Lawnwood Road each have a partial cul-de-sac, also known as a street knuckle, with excess pavement that generates stormwater runoff and pollutant loading without the benefit of allowing through traffic (*Figure 15*). Removing some excess pavement and extending driveways and maintaining existing vehicle access and driveway width would reduce pollutant loading and stormwater runoff, while providing space in the ROW for additional GSI opportunities. This type of project may not change ROW boundaries or property lines, and so can likely continue to comply with the frontage requirements in the Town's zoning ordinance. Additional considerations for these types of solutions include identifying snow plowing and driveway repair responsibilities between the Town and individual homeowners. A similar project addressing recurring flooding is currently underway in Warren, RI (*Figure 16*) using funding from the Rhode Island Infrastructure Bank (RIIB).

Figure 15: Examples of partial cul-de-sacs on Holmes Road and Jade Road

Figure 16: Partial cul-de-sac pavement removal and GSI project example in Warren, RI

Existing programs in Rhode Island can help offset the costs of GSI installation. RIIB funds the Municipal Resilience Program (MRP) to help communities increase their resilience to the risks posed by climate change. GSI retrofit opportunities are one type of project that RIIB is able to fund through this program. Town participation in MRP allows access to additional grant funding currently capped at $250,000 per project, but which may increase in the coming years. There are additional funding sources for design and implementation of GSI. Programs such as the 319 Non-Point Source program, Southeast New England Program, and RIIB Green Infrastructure Acceleration program all allocate money to support GSI design and implementation. These programs should be considered when determining how to fund long-term investments in GSI in the Tiogue Lake watershed.

Based on aerial imagery, several commercial and industrial developments near Center of New England Boulevard appear to have some level of stormwater treatment, although it is not known if these practices address stormwater volume or remove pollutants from stormwater. Outreach efforts to amenable private property owners to identify opportunities to retrofit and upgrade stormwater infrastructure to remove pollutants would also help to reduce the bacteria load from the watershed.

4.3 Sewering

The Town of Coventry, with Fuss & O'Neill, is currently developing a new sewer facility plan, and a recommendation to extend sewer service to the unsewered areas around Tiogue Lake is anticipated. The sewer facility plan (FP) and the upcoming community comprehensive plan (CCP) process will coordinate with one another. Sewer planning areas identified and prioritized in the FP will incorporate demographic data such as long-term viability of onsite systems, environmental impetus for sewer extension, and affordability. The FP will consider the benefits and costs of providing public sewer around Tiogue Lake. One potential benefit of disconnecting properties from onsite septic systems and sending wastewater to a treatment facility outside the watershed, is reducing the risk of bacteria and other potential pollutants entering the lake from poorly sited or failing septic systems and cesspools.

Should the extension of public sewer to the Tiogue Lake neighborhood be deemed infeasible, alternatives exist to address pollutants from cesspool and septic systems. An important first step is identifying the location of remaining cesspools and failing septic systems. To assist this effort, the Town should assess the need to create a wastewater overlay district or including cesspools and septic systems in a Form Based Code to enforce their inspection and removal. Increasing the required inspection frequency provides a mechanism for the Town to identify system failures before property transfer, which may only happen every few decades. The Towns of Charlestown and Jamestown have adopted administrative overlay districts to address pollutants from septic systems.

The Town participates in the Community Septic System Loan Program (CSSLP), a loan program funded by the State Revolving Fund and administered by the Rhode Island Housing and Mortgage Financing Agency. Under this program, low interest loans are provided to homeowners, in participating towns, to help cover the costs associated with septic system repairs and upgrades.

4.4 Additional Data Needs

While this study identified several bacteria sources, several of the recommendations here may require a longer implementation timeframe. Until these recommendations can be implemented, Briar Point Beach remains at higher risk of additional closures due to bacteria loading. While the prior approximately monthly water quality sampling is effective at monitoring medium to longer term water quality trends, it is somewhat ineffective at capturing shorter term trends in water quality, such as stormwater-related bacteria exceedances. The Town should continue to address this gap by conducting its monitoring for bacteria during the swimming season and assess the feasibility of increasing the sampling frequency (i.e., weekly or greater frequency).

The Town might additionally consider collecting lake samples for conducting a focused, more intensive sampling program to refine the estimated storm intensity that causes BAV exceedances as well as the delay between rainfall and enterococcus levels. Such a study would allow the Town to predict when rainstorms could cause elevated enterococcus levels and use that relationship to make recommendations for preemptive beach advisories or closures based on rainfall. These short-term solutions do not address the underlying bacteria sources but do support additional public health measures while longer term fixes are pursued.

5 References

Haack, SK, LR Fogarty, and CC Wright. 2003. Escherichia coli and Enterococci at beaches in the Grand Traverse Bay, Lake Michigan: Sources, characteristics, and environmental pathways. Environmental Science and Technology, 37: 3275-3283.

Harvey, MC, DK Hare, A Hackman, G Davenport, AB Haynes, A Helton, JW Lane, Jr., and MA Briggs. 2019. Evaluation of stream and wetland restoration using UAS-based thermal infrared mapping. Water, 11: 1568.

Postma, FB, AJ Gold, and GW Loomis. 1992. Nutrient and microbial movement from seasonally-used septic systems. Journal of Environmental Health, 55: 5-10.

U.S. Environmental Protection Agency. 2010. Sampling and consideration of variability (temporal and spatial) for monitoring of recreational waters. EPA-823-R-10-005.

We gratefully acknowledge the data and information shared by the Rhode Island Department of Health staff, the Kent County Water Authority, and the University of Rhode Island Watershed Watch program and the many trained URI Watershed Watch volunteer water quality monitors who collected water samples for analysis at the state certified URI Watershed Watch Analytical Lab. For more information on the URI Watershed Watch program please visit http://web.uri.edu/watershedwatch/.

Appendix A

Field Data Sheets

20220316

LAKE TIOGUE SANITARY SURVEY
3/14 CAL

YSI	pH 4	3.61		4
	7	7.40	CAL →	7.02
	10	10.74		10.04

Cl	0	0.00
	1	0.22 ✓
	2	0.95
	3	1.65

~~SAMPLE~~

SAMPLE ID	TIME	OUTFALL
01391220316-01	1335	LARCH DR
-01D	1335	"
02	1430	ARNOLD CAUSEWAY SOUTH

EPA United States Environmental Protection Agency

Freshwater Routine Sanitary Survey for Recreational Waters

EPA 820-F-20-004
March 2021

GENERAL INFORMATION

Name of beach (if applicable): **Briar Point Beach**

Date(s) of survey: **2022-03-16**

Beach ID:

Time(s) of survey:

Name of waterbody: **Lake Tiogue**

Waterbody type: **Freshwater**

Sampling station(s)/ID:

Surveyor affiliation: **Fuss & O'Neill**

WQX organizational ID:

Name(s) of surveyor(s): **SB/WG**

Sampling location Latitude: Longitude:

Dates of swim season Start: **June** End: **September**

QUALITY ASSURANCE

Will the data collected use an approved Quality Assurance Project Plan (QAPP)? yes ✓ no

PART 1: WEATHER AND GENERAL WATERBODY CONDITIONS

Weather Conditions

Survey the weather using the method of your choice. You may use the National Weather Service as your source.

Air temperature: ______ °C or °F

Method for temperature: (check one) ☐ Liquid-in-glass therm. ☐ Electronic thermometer ☐ Weather app ✓ Weather report: from airport or weather station? ☐ Other:__

Wind speed: ______ units: ______

Wind gust speed: ______ units: ______

Wind direction: ______

Is the wind: (circle one) Onshore or Offshore

Method for wind speed: (check all that apply) ☐ Wind vane for direction ☐ Weather app ☐ Wind sock for direction/speed ☐ Anemometer for wind speed ☐ Beaufort scale for wind speed ☐ Aerovane for wind direction/speed ✓ Weather report: from airport or weather station? ☐ Other (specify):

If you collected wind speed from a local weather station, how far were you from the station: **1** mi or km

How recent was the last rain event: (circle one) **2022-03-13**
0-24 hrs 24-48 hrs 48-72 hrs 72+ hrs

Rain intensity: (circle one) Misting Light rain Moderate rain Heavy rain Other:______

Total measured rainfall: **0.51"** in or cm

Distance to the gauge/station when recording rainfall amount: **1** mi or km

Method for rainfall: (check one) ✓ Rain gauge ☐ Weather report ☐ Weather app ☐ Other (specify): **Coventry 2 NOWData**

Sky condition/amount of cloud cover: (circle one)	Sunny/ No clouds	Mostly sunny/ 1/8 to 2/8	Partly sunny/ 3/8 to 1/2	Mostly cloudy/ 5/8 to 7/8	Cloudy/ Total coverage

Method for weather conditions: (check one) ✓ Visual observations ☐ Weather app ☐ Other (specify): ______

Waterbody Conditions

~~Water flow speed: ______ units: ______~~

~~Method for water flow speed: (check one) ☐ Stick with fishing reel with water balloon on end ☐ Ball and tether ☐ Other: ___~~

~~Direction from which the wave is coming (e.g., N, SW): ______~~

~~How tall are the waves: ______ m or ft~~

~~Is the wave height measured or estimated? (circle one) Measured Estimated~~

~~Method for measuring wave height: (check one) ☐ Visual examination of wave height ☐ Graduated stick and ranging pole ☐ Other (specify):______~~

Is the stream bank/shoreline eroding? yes no

Width of riparian vegetation on river/stream left (looking downstream) (circle one) none 0-25 ft 25-50 ft 50+ ft

Width of riparian vegetation on river/stream right (looking downstream) (circle one) none 0-25 ft 25-50 ft 50+ ft

Add additional comments for general waterbody conditions.

Highly developed waterfront on most of lake shore
multiple SW outfalls
water @ ~115 Mohawk more turbid than elsewhere

...tic Organism Passage Barrier

...is the outlet drop (e.g., 3.5ft)	Severity of barrier debris, sediment, or rock for the structure with the least amount of debris (None, minor, moderate, severe)	Location (lat/long)	Description

...nor = <10% open area of structure blocked; Moderate = 10-50% open area of structure blocked; Severe = 50% open area structure blocked

...ke images to document aquatic organism passage barriers and provide detailed descriptions where possible:

PART 2: WATER QUALITY

Bacteria

List bacteria samples collected at the beach. Potential pollution sources, if applicable, can be recorded in Part 4.

Sample Point	Sample Number	Location (lat/long)	Date & Time	Parameter (enterococci, E. coli, etc.)	Comments
SEE	NOTES				

General Water Quality

Water temperature: ______ °C or °F | Water color: (circle one) Clear Blue Brown Green Red Other:______

Method for water temperature: (check one) ☑ Multiprobe ☐ Electronic meter ☐ Graduated thermometer ☐ Report from local radio station ☐ Report from NOAA weather band radio ☐ Other: ______

Has the water color changed since the last visit? yes no don't know If yes, take photographs and describe:

Select the best description of the water smell: (circle one) None Septic Algae Sulfur Other: ______

How did you measure turbidity? (check one) ☒ Observed: (circle one) Clear Slightly turbid Opaque
☐ Measured: NTU value: ______ Secchi disc depth: ______

What method was used to measure the turbidity of the water: (circle one) Simple visual observation Visual test kit Titrimetric test kit Nephelometer/Turbidimeter Other:______

Describe other measurements taken and report values: MORE SUSPENDED SED/ PARTICLES ALONG E SHORE

Additional water quality observations: [illegible]

PART 3: PEOPLE

Are there recreators (swimmers, boaters, waders, etc.) present at the beach or waterbody? yes no

Total people in water: 0 + Total people out of water: ______ = Total people at the beach or waterbody: ______

Total number of boats: ______

Report activities observed at the beach or shoreline and in the water. Quantify and take photographs, if possible.

Activity (swimming, fishing, etc.)	0					
Approximate # of people participating						

Describe notable activities that could affect water quality (Example: babies in disposable diapers in the water):

Method for numbers of people participating in various activities: (check one) ☑ Counting by surveyor ☐ Photos ☐ Counting by lifeguard ☐ Turnstiles ☐ Other:__________

PART 4: POTENTIAL POLLUTION SOURCES

Identify visible sources of pollutants up to 500 feet from the beach or waterbody boundary. Quantify and photograph sources, if possible.

Type of Source	Discharge Source Name	Discharge Source Amount (H, M, L)	Discharge Flow Rate	Discharge Volume	Discharge Source Characteristics
Wetland drainage		H			
Outfall/Pipe (stormwater)					2 RIDOT x 2, Berkshire
Leaking pit latrines/septic					
Runoff (impervious surfaces)					Restaurant Parking
Homeless encampments					
Other (specify): GW					E Shore Dr

Did you collect samples and complete the Bacteria Samples section in Part 2? yes no
If no, describe why not:

How did you identify the source of discharge? (circle one) Visual observation WWTP notification/report Other:________

How did you measure flow/velocity or volume? (circle one) Mechanical flow meter Electric flow meter USGS gauging station WWTP notification/report Orange (float) and stopwatch Other:________

Floatables and Debris

Are floatables present in the water? yes no If yes, select the types found: (check all that apply)

- ☐ Street litter (e.g., cigarette filters)
- ☐ Food-related litter (e.g., packaging/containers)
- ☐ Medical items (e.g., syringes)
- ☐ Sewage-related (e.g., tampons, condoms)
- ☐ Building materials (e.g., wood/siding)
- ☐ Fishing-related (e.g., fishing line, nets, lures)
- ☑ Household waste (e.g., household trash, plastic bags)
- ☐ Other: __________

Method for determining floatables presence: (circle one) Visual observation Cleanup event results Other: ________

Is there debris or litter present on the beach or shoreline? yes no

Select the amount (%) of debris/litter on the beach or shoreline: (circle one)
None Low (1% - 20%) Moderate (21%- 50%) High (>50%)

Select the types of debris found? (check all that apply)

- ☐ Street litter (e.g., cigarette filters)
- ☑ Food-related litter (e.g., packaging/containers)
- ☐ Medical items (e.g., syringes)
- ☐ Sewage-related (e.g., tampons, condoms)
- ☐ Natural debris (e.g., driftwood, algae)
- ☐ Building materials (e.g., wood/siding)
- ☐ Fishing-related (e.g., fishing line, nets, lures)
- ☑ Household waste (e.g., household trash, plastic bags)
- ☐ Tar/Oil (e.g., tar balls)
- ☐ Oil/Grease (e.g., oil slick)
- ☐ Other: __________

Method for determining debris presence: (circle one) Visual observation Cleanup event results Other: ________

Algae

Is algae present in the nearshore water, beach and/or shoreline? yes no don't know If present, document with photographs.

Select the amount (%) of algae in nearshore water: (circle one)
None Low (1%–20%) Moderate (21%–50%) High (> 50%)

Select the amount (%) of algae on the beach or shoreline: (circle one)
None   Low (1%–20%)   Moderate (21%–50%)   High (> 50%)

Method for determining amount and color of algae: (circle one)
Visual observation   Other: ____________

Circle the types of algae found: (check all that apply)   ☑ Periphyton (attached to rocks, stringy)   ☐ Globular (blobs of floating material)
☐ Free floating (no obvious mass of materials)   ☐ Other: ____________

Algae colors: (circle all that apply)   Light green   Bright green   Dark green   Yellow   Brown   Other:______

Is the nearshore water discolored?   yes   no   don't know

If yes, specify the color: (circle all that apply)   Clear   Green   Dark red   Brown   Yellowish   Other:______

Harmful Algae Blooms

Is there presence of harmful algal blooms?   yes   no   don't know   If yes, photograph and describe:

Method for identifying harmful algae blooms in nearshore water and beach: (circle one)
~~Field guide or internet site for taxonomic identification~~   Other: ____________

Are there mats or scum in nearshore waters? (circle all that apply)   Mats-floating   Foam   Scum   None

Are there dead fish or other dead wildlife deaths present with bloom?   yes   no

Have any illnesses (e.g., itchy throat, cough, gastrointestinal) been reported by local or state health departments?   yes was no
If yes, describe: ?? 3 septic ??

Is algal toxin monitoring conducted?   yes   no   don't know   If yes, have algal toxins been detected? ____________

Have algal species been identified?   yes   no   don't know   If yes, specify the species: ____________

Presence of Wildlife and Domestic Animals

Are wildlife and domestic animals present?   yes   no   If yes, document with photographs.

Are dead birds found on the beach?   yes   no   If yes, specify the number and species of ~~dead~~ Live birds.

Type	Number	Type	Number	Type	Number	Type	Number	Type	Number	Type	Number
Geese	20	Otters		Deer		Ducks	6	Rodents		Snakes	
~~Shorebirds~~	4	Turtles		Toads		Dogs		Beavers		Other	
~~Pigeons~~ Swans	2	Horses		Gulls	100	Frogs		Raccoons			

Method for determining presence of wildlife and domestic animals: (circle one)
Counting using hand-held counter and if necessary, binoculars   Other (specify):____________

List the number and species of birds found dead on the beach

Type	# Dead	Type	# Dead	Type	# Dead	Type	# Dead
Common loon		Black-crowned night-heron		Long-tailed ducks		Ospreys	
Herring gulls		Double crested cormorants		Horned grebes		Common tern	
Ring-billed gulls		White winged scoter		Snowy egrets		Belted kingfisher	
Mallard ducks		Red-necked grebes		Great blue herons		Other: ______	

Method for determining the number of dead birds: (circle one)
Counting using hand-held counter and if necessary, binoculars   Other:____________

Method for identifying dead birds: (circle one)
Field guide or internet site for taxonomic identification   Other:____________

Are dead fish found in the waterbody, on the beach or along the shoreline?   yes   no   If yes, specify the number of dead fish found on the beach or in/at the waterbody and take photographs:

Method for determining the number of dead fish: (circle one)   Visual observation   Other:____________

Additional comments or observations on pollution sources, algae, or animals. Describe any photos taken.

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- ☐ 56 Quarry Road, Trumbull, CT 06611
- ☐ 317 Iron Horse Way, Suite 204, Providence, RI 02908
- ☐ 1550 Main Street, Suite 400, Springfield, MA 01103
- ☐ 108 Myrtle Street, Suite 502, Quincy, MA 02171
- ☐ 540 North Commercial Street, Manchester, NH 03101
- ☐ 276 Newport Road, New London, NH 03257
- ☐ 205 Billings Farm Road, Suite 6B, White River Junction, VT 05001
- ☐ 5 Fletcher Street, Suite 1, Kennebunk, ME 04043
- ☐ 23046 Avenida de la Carlota, Suite 600, Laguna Hills, CA 92653
- ☐ Other ______

CHAIN-OF-CUSTODY RECORD 43543

Turnaround
☐ 24-Hour* ☐ 72-Hour* ☐ Other ____ (days)
☐ 48-Hour* ☒ Standard (____ days) *Surcharge Applies

PROJECT NAME	PROJECT LOCATION	PROJECT NUMBER	LABORATORY
COVENTRY	RI	20190164.A10	NET

REPORT TO: STEFAN BENGTSON
INVOICE TO: SAME
P.O. NO.:
Sampler's Signature: [signature] Date: 3/16/22

Source Codes:
MW=Monitoring Well PW=Potable Water T=Treatment Facility S=Soil B=Sediment
SW=Surface Water ST=Stormwater W=Waste A=Air C=Concrete
X=Other ______

Analysis Request: ENTEROCOCCUS

Containers: Soil VOA Vial, ☐ methanol; Soil VOA Vial, ☐ water; Glass Soil Container ( ) oz ☐ Na(SO₄)₂; Other; Other; Water VOA Vial, ☐ As is ☐ HCl; Glass Amber ( ) ml, ☐ As is ☐ H₂SO₄; Plastic - As is, ☐ 250 ml ☐ 500 ☐ 1000 ml 100mL; Plastic - H₂SO₄, ☐ 250 ml ☐ 500 ml; Plastic - HNO₃, 250 ml ☐ Filtered ☐ 0.45μ ☐ 10μ; Plastic - NaOH, 250 ml

Item No.	Transfer Check 1	2	3	4	Sample Number	Source Code	Date Sampled	Time Sampled	ENTEROCOCCUS	Plastic - As is	Comments
1					01391220316-01	ST	3/16	1335	X	1	LARCH
2					↓ -01D	ST	↓	1335	X	1	LARCH
3					↓ -02	ST	↓	1430	X	1	ARNOLD

Transfer Number	Relinquished By	Accepted By	Date	Time
1	[signature]	[signature]	3/16	15:38
2				
3				
4				

Charge Exceptions: ☐ CT Tax Exempt ☒ QA/QC ☐ Other ______
1 Duplicates ____ Blanks (Item Nos:)

Reporting and Detection Limit Requirements: ☐ RCP Deliverables ☐ MCP CAM Cert.

Additional Comments:

20220323 Tioga Lake
Sanitary Survey + TDDE

CAL CHECK

pH 4	4.01	
7	7.04	✓
10	9.99	
COND 1000	998	✓

DEP PWD 0830 TACOMA ODO 11337

RET PWD 1630 11379

42 mi

SAMPLE	TIME	LOCATION
01391220323		TRICKLE SEEP
-01	1000	1
-01D	1000	1D
-02	1020	2
-03	1105	3
-04	1130	W SHORE OR LARGE OF #2 INT ~~DOG~~ ~~BY BEACH~~
-05	1205	DIXIE
-06	1230	MID LAKE
-07	1500	YORK CULVERT

Freshwater Routine Sanitary Survey for Recreational Waters

GENERAL INFORMATION

Name of beach (if applicable): **Briar Point Beach**	Date(s) of survey: **2022-03-~~16~~** 23
Beach ID:	Time(s) of survey:
Name of waterbody: **Lake Tiogue**	Waterbody type: **Freshwater**
Sampling station(s)/ID:	Surveyor affiliation: **Fuss & O'Neill**
WQX organizational ID:	Name(s) of surveyor(s): **SB/~~WG~~** AJ
Sampling location Latitude:	Longitude:
Dates of swim season Start: **June**	End: **September**

QUALITY ASSURANCE

Will the data collected use an approved Quality Assurance Project Plan (QAPP)? yes ✓no

PART 1: WEATHER AND GENERAL WATERBODY CONDITIONS

Weather Conditions

Survey the weather using the method of your choice. You may use the National Weather Service as your source.

Air temperature: 45 °C or °F	Method for temperature: (check one) □ Liquid-in-glass therm. □ Electronic thermometer □ Weather app ✓ Weather report: from airport or weather station? □ Other:__
Wind speed: 5 units: mph	
Wind gust speed: ______ units: ______	Method for wind speed: (check all that apply) □ Wind vane for direction □ Weather app
Wind direction: N	□ Wind sock for direction/speed □ Anemometer for wind speed
Is the wind: (circle one) Onshore or Offshore	□ Beaufort scale for wind speed □ Aerovane for wind direction/speed ✓ Weather report: from airport or weather station? □ Other (specify): [illegible]

If you collected wind speed from a local weather station, how far were you from the station: **1** mi or km

How recent was the last rain event: (circle one) **2022-03-~~13~~** 20 0-24 hrs 24-48 hrs 48-72 hrs 72+ hrs	Rain intensity: (circle one) Misting Light rain Moderate rain Heavy rain Other:_____
Total measured rainfall: ~~0.51~~ .25" in or cm	Distance to the gauge/station when recording rainfall amount: **1** mi or km

Method for rainfall: (check one) ✓ Rain gauge □ Weather report □ Weather app □ Other (specify): **Coventry 2 NOWData**

Sky condition/amount of cloud cover: (circle one)	Sunny/ No clouds	Mostly sunny/ 1/8 to 2/8	Partly sunny/ 3/8 to 1/2	Mostly cloudy/ 5/8 to 7/8	Cloudy/ Total coverage

Method for weather conditions: (check one) ✓ Visual observations □ Weather app □ Other (specify): __________

Waterbody Conditions

Water flow speed: ______ units: ______

Method for water flow speed: (check one) □ Stick with fishing reel with water balloon on end □ Ball and tether □ Other: ___

Direction from which the wave is coming (e.g., N, SW): ______ How tall are the waves: ______ m or ft

Is the wave height measured or estimated? (circle one) Measured Estimated

Method for measuring wave height: (check one) □ Visual examination of wave height □ Graduated stick and ranging pole □ Other (specify):______

Is the stream bank/shoreline eroding? yes no

Width of riparian vegetation on river/stream left (looking downstream) (circle one) none 0-25 ft 25-50 ft 50+ ft	Width of riparian vegetation on river/stream right (looking downstream) (circle one) none 0-25 ft 25-50 ft 50+ ft

Add additional comments for general waterbody conditions.

Aquatic Organism Passage Barrier

What is the outlet drop (e.g., 3.5ft)	Severity of barrier debris, sediment, or rock for the structure with the least amount of debris (None, minor, moderate, severe)	Location (lat/long)	Description

* Minor = <10% open area of structure blocked; Moderate = 10-50% open area of structure blocked; Severe = 50% open area structure blocked

Take images to document aquatic organism passage barriers and provide detailed descriptions where possible:

PART 2: WATER QUALITY

Bacteria

List bacteria samples collected at the beach. Potential pollution sources, if applicable, can be recorded in Part 4.

Sample Point	Sample Number	Location (lat/long)	Date & Time	Parameter (enterococci, E. coli, etc.)	Comments
SEE NOTES					

General Water Quality

Water temperature: __________ °C or °F | Water color: (circle one) Clear Blue Brown Green Red Other:______

Method for water temperature: (check one) ☑ Multiprobe ☐ Electronic meter ☐ Graduated thermometer
☐ Report from local radio station ☐ Report from NOAA weather band radio ☐ Other: ____________

Has the water color changed since the last visit? yes no don't know If yes, take photographs and describe:

Select the best description of the water smell: (circle one) None Septic Algae Sulfur Other: ____________

How did you measure turbidity? (check one) ☒ Observed: (circle one) Clear Slightly turbid Opaque
☐ Measured: NTU value: __________ Secchi disc depth: __________

What method was used to measure the turbidity of the water: (circle one) Simple visual observation Visual test kit Titrimetric test kit Nephelometer/Turbidimeter Other:______________

Describe other measurements taken and report values:

Additional water quality observations:

PART 3: PEOPLE

Are there recreators (swimmers, boaters, waders, etc.) present at the beach or waterbody? yes no

Total people in water: 0 + Total people out of water: ______ = Total people at the beach or waterbody: ____

Total number of boats: __________

Report activities observed at the beach or shoreline and in the water. Quantify and take photographs, if possible.

Activity (swimming, fishing, etc.)						
Approximate # of people participating						

Describe notable activities that could affect water quality (Example: babies in disposable diapers in the water):

Method for numbers of people participating in various activities: (check one) ☑ Counting by surveyor ☐ Photos
☐ Counting by lifeguard ☐ Turnstiles ☐ Other:

PART 4: POTENTIAL POLLUTION SOURCES

Identify visible sources of pollutants up to 500 feet from the beach or waterbody boundary. Quantify and photograph sources, if possible.

Type of Source	Discharge Source Name	Discharge Source Amount (H, M, L)	Discharge Flow Rate	Discharge Volume	Discharge Source Characteristics
Wetland drainage					
Outfall/Pipe (stormwater)					YORK | WESTS SHORE
Leaking pit latrines/septic					DIXIE
Runoff (impervious surfaces)					
Homeless encampments					
Other (specify):					

Did you collect samples and complete the Bacteria Samples section in Part 2? yes no
If no, describe why not:

How did you identify the source of discharge? (circle one) Visual observation WWTP notification/report Other:

How did you measure flow/velocity or volume? (circle one) Mechanical flow meter Electric flow meter
USGS gauging station WWTP notification/report Orange (float) and stopwatch Other:

Floatables and Debris

Are floatables present in the water? yes no If yes, select the types found: (check all that apply)

- ☑ Street litter (e.g., cigarette filters)
- ☑ Food-related litter (e.g., packaging/containers)
- ☐ Medical items (e.g., syringes)
- ☐ Sewage-related (e.g., tampons, condoms)
- ☐ Building materials (e.g., wood/siding)
- ☐ Fishing-related (e.g., fishing line, nets, lures)
- ☑ Household waste (e.g., household trash, plastic bags)
- ☐ Other:

Method for determining floatables presence: (circle one) Visual observation Cleanup event results Other:

Is there debris or litter present on the beach or shoreline? yes no

Select the amount (%) of debris/litter on the beach or shoreline: (circle one)
None Low (1% - 20%) Moderate (21%- 50%) High (>50%)

Select the types of debris found? (check all that apply)

- ☑ Street litter (e.g., cigarette filters)
- ☑ Food-related litter (e.g., packaging/containers)
- ☐ Medical items (e.g., syringes)
- ☐ Sewage-related (e.g., tampons, condoms)
- ☐ Natural debris (e.g., driftwood, algae)
- ☐ Building materials (e.g., wood/siding)
- ☐ Fishing-related (e.g., fishing line, nets, lures)
- ☑ Household waste (e.g., household trash, plastic bags)
- ☐ Tar/Oil (e.g., tar balls)
- ☐ Oil/Grease (e.g., oil slick)
- ☐ Other:

Method for determining debris presence: (circle one) Visual observation Cleanup event results Other:

Algae

Is algae present in the nearshore water, beach and/or shoreline? yes no don't know If present, document with photographs.

Select the amount (%) of algae in nearshore water: (circle one)
None Low (1%–20%) Moderate (21%–50%) High (> 50%)

SAME AS 3/16

Select the amount (%) of algae on the beach or shoreline: (circle one)
None Low (1%–20%) Moderate (21%–50%) High (> 50%)

Method for determining amount and color of algae: (circle one)
Visual observation Other: ____________

Circle the types of algae found: (check all that apply) □ Periphyton (attached to rocks, stringy) □ Globular (blobs of floating material)
□ Free floating (no obvious mass of materials) □ Other: ____________

Algae colors: (circle all that apply) Light green Bright green Dark green Yellow Brown Other:______

Is the nearshore water discolored? yes no don't know

If yes, specify the color: (circle all that apply) Clear Green Dark red Brown Yellowish Other:______

Harmful Algae Blooms

Is there presence of harmful algal blooms? yes no don't know If yes, photograph and describe:

Method for identifying harmful algae blooms in nearshore water and beach: (circle one)
Field guide or internet site for taxonomic identification Other:____________

Are there mats or scum in nearshore waters? (circle all that apply) Mats-floating Foam Scum None

Are there dead fish or other dead wildlife deaths present with bloom? yes no

Have any illnesses (e.g., itchy throat, cough, gastrointestinal) been reported by local or state health departments? yes no
If yes, describe:

Is algal toxin monitoring conducted? yes no don't know If yes, have algal toxins been detected? ____________

Have algal species been identified? yes no don't know If yes, specify the species: ____________

Presence of Wildlife and Domestic Animals

Are wildlife and domestic animals present? yes no SAME AS 3/16 If yes, document with photographs.

Are dead birds found on the beach? yes no If yes, specify the number and species of dead birds.

Type	Number	Type	Number	Type	Number	Type	Number	Type	Number	Type	Number
Geese		Otters		Deer		Ducks		Rodents		Snakes	
Shorebirds		Turtles		Toads		Dogs		Beavers		Other	
Pigeons		Horses		Gulls		Frogs		Raccoons			

Method for determining presence of wildlife and domestic animals: (circle one)
Counting using hand-held counter and if necessary, binoculars Other (specify):____________

List the number and species of birds found dead on the beach

Type	# Dead	Type	# Dead	Type	# Dead	Type	# Dead
Common loon		Black-crowned night-heron		Long-tailed ducks		Ospreys	
Herring gulls		Double crested cormorants		Horned grebes		Common tern	
Ring-billed gulls		White winged scoter		Snowy egrets		Belted kingfisher	
Mallard ducks		Red-necked grebes		Great blue herons		Other: _____	

Method for determining the number of dead birds: (circle one)
Counting using hand-held counter and if necessary, binoculars Other:____________

Method for identifying dead birds: (circle one)
Field guide or internet site for taxonomic identification Other:____________

Are dead fish found in the waterbody, on the beach or along the shoreline? yes no If yes, specify the number of dead fish found on the beach or in/at the waterbody and take photographs:

Method for determining the number of dead fish: (circle one) Visual observation Other:____________

Additional comments or observations on pollution sources, algae, or animals. Describe any photos taken.

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☐ 108 Myrtle Street, Suite 502, Quincy, MA 02171
☐ 540 North Commercial Street, Manchester, NH 03101
☐ 276 Newport Road, New London, NH 03257
☐ 205 Billings Farm Road, Suite 6B, White River Junction, VT 05001
☐ 5 Fletcher Street, Suite 1, Kennebunk, ME 04043
☐ 23046 Avenida de la Carlota, Suite 600, Laguna Hills, CA 92653
☐ Other ______

CHAIN-OF-CUSTODY RECORD 43617

Turnaround
☐ 24-Hour* ☐ 72-Hour* ☐ Other ______ (days)
☐ 48-Hour* ☒ Standard (____ days) *Surcharge Applies

PROJECT NAME	PROJECT LOCATION	PROJECT NUMBER	LABORATORY
COVENTRY	RI	20190164.A10	NET

REPORT TO: STEFAN BENGTSON
INVOICE TO: SAME
P.O. NO.:
Sampler's Signature: [illegible] Date: 3/23/22

Source Codes:
MW=Monitoring Well PW=Potable Water T=Treatment Facility S=Soil B=Sediment
SW=Surface Water ST=Stormwater W=Waste A=Air C=Concrete
X=Other ______

Analysis Request / Containers

Item No.	Transfer Check 1	2	3	4	Sample Number	Source Code	Date Sampled	Time Sampled	ENTEROCOCCI								Soil VOA Vial, ☐ methanol	Soil VOA Vial, ☐ water	Glass Soil Container ( ) oz ☐ $Na(SO_4)_2$	Other:	Other:	Water VOA Vial, ☐ As is ☐ HCl	Glass Amber ( ) ml, ☐ As is ☐ H_2SO_4	Plastic - As is, ☐ 250 ml ☐ 500 ☐ 1000 ml	Plastic - H_2SO_4, ☐ 250 ml ☐ 500 ml	Plastic - HNO_3, 250 ml ☐ Filtered ☐ 0.45µ ☐ 10µ	Plastic - NaOH, 250 ml	Comments
1					0139/220323-01	SW	3/23	1000	X															1				SEEP 1
2					-01D	SW		1000	X															1				" 1D
3					-02	SW		1020	X															1				" 2
4					-03	SW		1105	X															1				" 3
5					-04	ST		1130	X															1				BEACH OF
6					-05	ST		1205	X															1				DIXIE
7					-06	SW		1230	X															1				MID LAKE
8					-07	ST		1500	X															1				YORK

Transfer Number	Relinquished By	Accepted By	Date	Time
1	[illegible]	[illegible]	3-23-22	15:52
2				
3				
4				

Charge Exceptions: ☐ CT Tax Exempt ☒ QA/QC ☐ Other ______
1 Duplicates ____ Blanks (Item Nos:)

Reporting and Detection Limit Requirements: ☐ RCP Deliverables ☐ MCP CAM Cert.

Additional Comments:

Appendix B

Additional Stormwater Retrofit Option Concepts

Tree box filters next to roadway

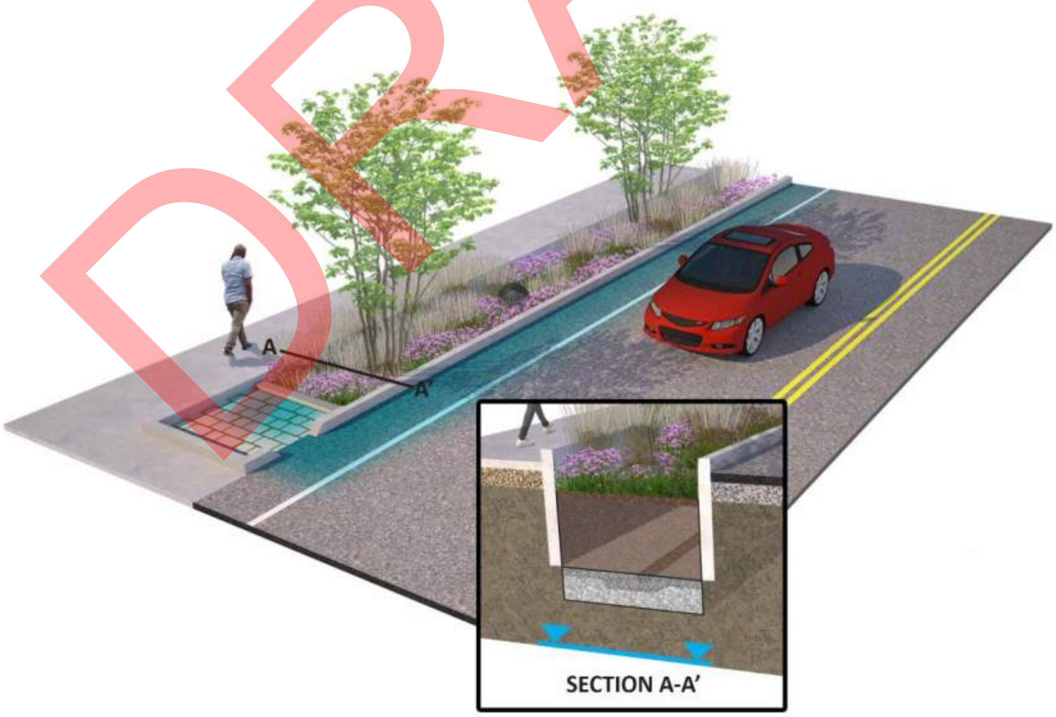

Figure 17: Curb inlet bioretention planter between sidewalk and roadway

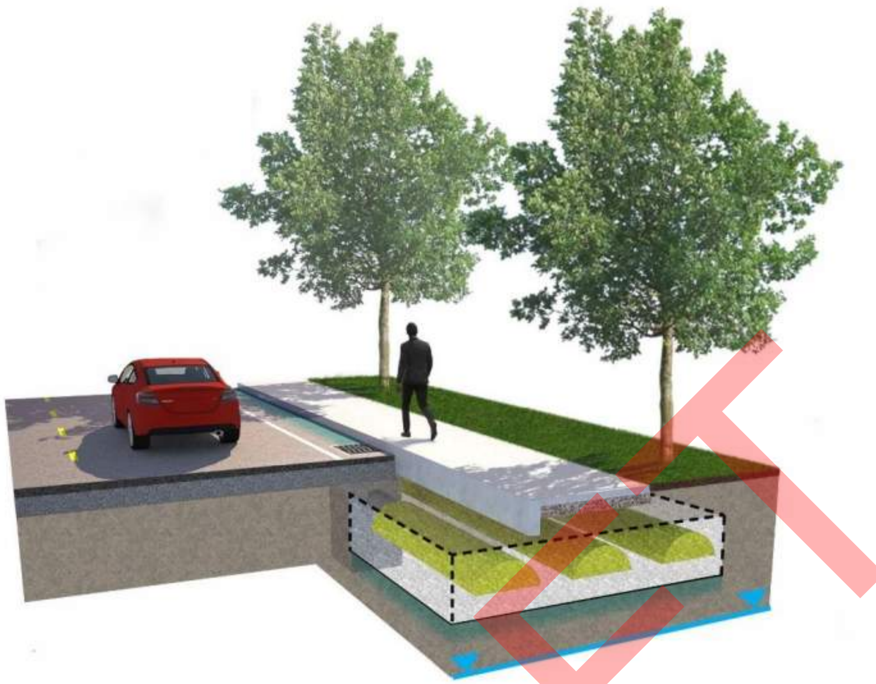

Figure 18: Subsurface infiltration chambers beneath sidewalk

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317 Iron Horse Way, Suite 204
Providence, RI 02908
www.fando.com

Appendix E

Upper Dam Pond Limnological Investigation

Upper Dam Pond Limnological Investigation

Town of Coventry

Coventry, Rhode Island

June 2019

FUSS & O'NEILL

317 Iron Horse Way, Suite 204
Providence, RI 02908

Project No. 2002514.T30

Table of Contents

Upper Dam Pond Limnological Investigation
Town of Coventry

Table of Contents

Upper Dam Pond Limnological Investigation
Town of Coventry

1 Project Purpose and Goals

Upper Dam Pond is located in Coventry, Rhode Island within the Pawtuxet River watershed. The pond's approximately 215 acre watershed contains over 50% high density residential development, including residential areas immediately adjacent to the northeast and southwest shorelines of the pond (Figure 1-2). As described by the Rhode Island Department of Environmental Management (RIDEM) in their 2007 Total Maximum Daily Load (TMDL) study of the pond (RIDEM, 2007), Upper Dam Pond receives inflow via groundwater, surface water runoff from the surrounding land, stormwater runoff (18 storm drains were identified by RIDEM draining directly to the pond), direct precipitation on the pond surface, and three intermittent streams that drain into the pond. Two streams originate in nearby swampy areas and drain into the northwest area of the pond. The third intermittent stream discharges to the western side of the pond. At the southern end of the pond, there is a public beach/access point as well as a dam and control structure. Repairs to the dam and outlet, as well as modifications to provide additional spillway capacity and more effectively manage overtopping events, were completed in 2018. Discharge from the pond flows into Middle Dam Pond, which flows into the South Branch of the Pawtuxet River.

RIDEM designated phosphorus and phosphorus-related impairments at Upper Dam Pond and identified the external and internal sources of phosphorus loading to the pond (Figure 1-1) as causes of the impairment (RIDEM, 2007). Stormwater was noted as the major external source of phosphorus loading, with wastewater from failing septic systems (i.e., onsite wastewater treatment systems or OWTS) and waterfowl waste (direct and in runoff) noted as additional potential external loading sources. Internal loading, in the form of phosphorus release from pond sediments under certain environmental conditions, was also noted as a potential major contributor to phosphorus loading. The TMDL estimated the annual phosphorus load to Upper Dam Pond to be 71 kg/year (156 lbs/yr) and required that the load be reduced to 33 kg/year (73 lbs/yr) (a reduction of 54%). In order to reach the reduction goal, RIDEM recommended the Town of Coventry address external loading sources through stormwater management, illicit discharge investigation, and waterfowl management. The TMDL also recommended that the Town work with a consultant to confirm the significance of internal cycling as a source of phosphorus to the pond and, if this is a significant source, identify appropriate measured to address internal phosphorus loading from pond bottom sediments.

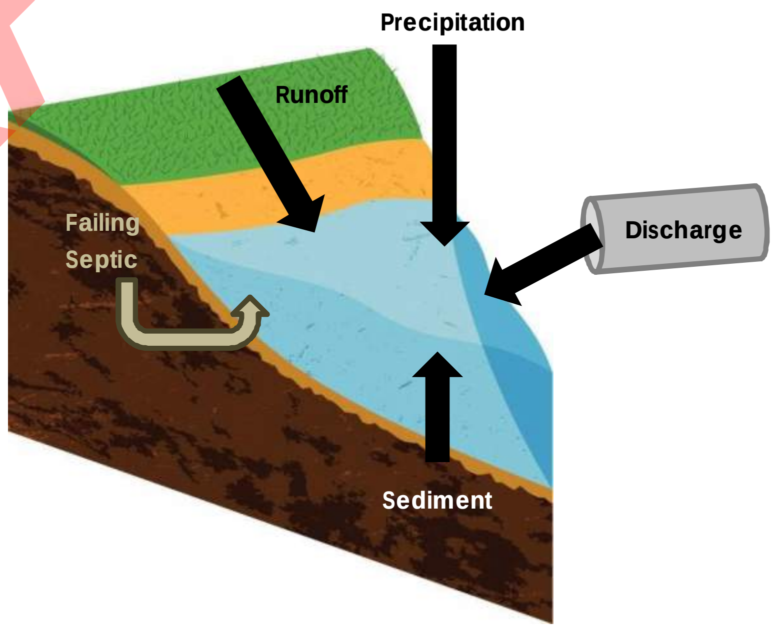


Figure 1-1 Internal and External Sources of Phosphorus Loading to a Waterbody

This limnological assessment of Upper Dam Pond was conducted to estimate the relative contribution of internal cycling to overall phosphorus loading in the pond. Field data collection in the form of a bathymetric survey and sediment and water quality sampling and calculation of internal phosphorus loading was conducted. This report documents the findings of the limnological assessment by summarizing the methods (Section 2) and results of the field work (Section 3) and the internal phosphorus loading calculation (Section 4). This report also discusses the relative significance of internal cycling on the water quality of Upper Dam Pond and recommends next steps to address the phosphorus impairment in the pond (Section 5).

Figure 1-1 Upper Dam Pond and Surrounding Area (1"=1000 feet)

2 Field Work Methods

2.1 Bathymetry and Soft Sediment Measurement

A pond bathymetry and soft sediment measurement survey of Upper Dam Pond was performed to obtain pond depth and sediment thickness data in order to create a pond bottom contour map and calculate the volume of sediment contained within the impoundment. Fuss & O'Neill staff collected bathymetric survey information from a boat using a sturdy metal rod, weighted tape measure, and a Trimble Geo7X submeter Global Positioning System (GPS).

Pond bathymetry and sediment depth in Upper Dam Pond were measured on April 18 and April 30, 2018. The pond was covered in a zig zag fashion across the eastern and western pond basins with measurement points typically separated by no more than 150 feet. The ends of each zig zag transect extended from one shore to the opposite shore. This coverage was sufficient given the limited variation in bathymetry. More intensive measuring of depths in the vicinity of the assumed former stream channel on the eastern side of the pond was conducted. There was less intensive measuring of the more shallow area on the western side of the pond with extensive plant growth.

A total of 86 survey points were recorded over the two days. At each measurement location, a weighted tape measure was lowered until slack was felt in the tape. That depth was noted as the top of soft sediment. Concurrently, an extendable rod was used to determine the depth of soft sediment at each point in order to map the extent of soft sediment on the pond bottom. The measuring pole was lowered through the water column and slowly pressed into the soft sediment until resistance was met. Resistance was defined as the sediment not yielding to moderate pressure applied by arm strength. The water surface was marked on the measuring pole and the total depth recorded. Sediment thickness was calculated as the difference between these two measurements. The GPS was used to log the location of each measurement point. All depths were recorded relative to the elevation of a survey pin (269.00 feet) located at the southwest corner of a drop inlet structure at the southern-most point of the pond. Before data collection each day, the length of the weight at the end of the tape measure and lake level relative to the pin elevation were recorded.

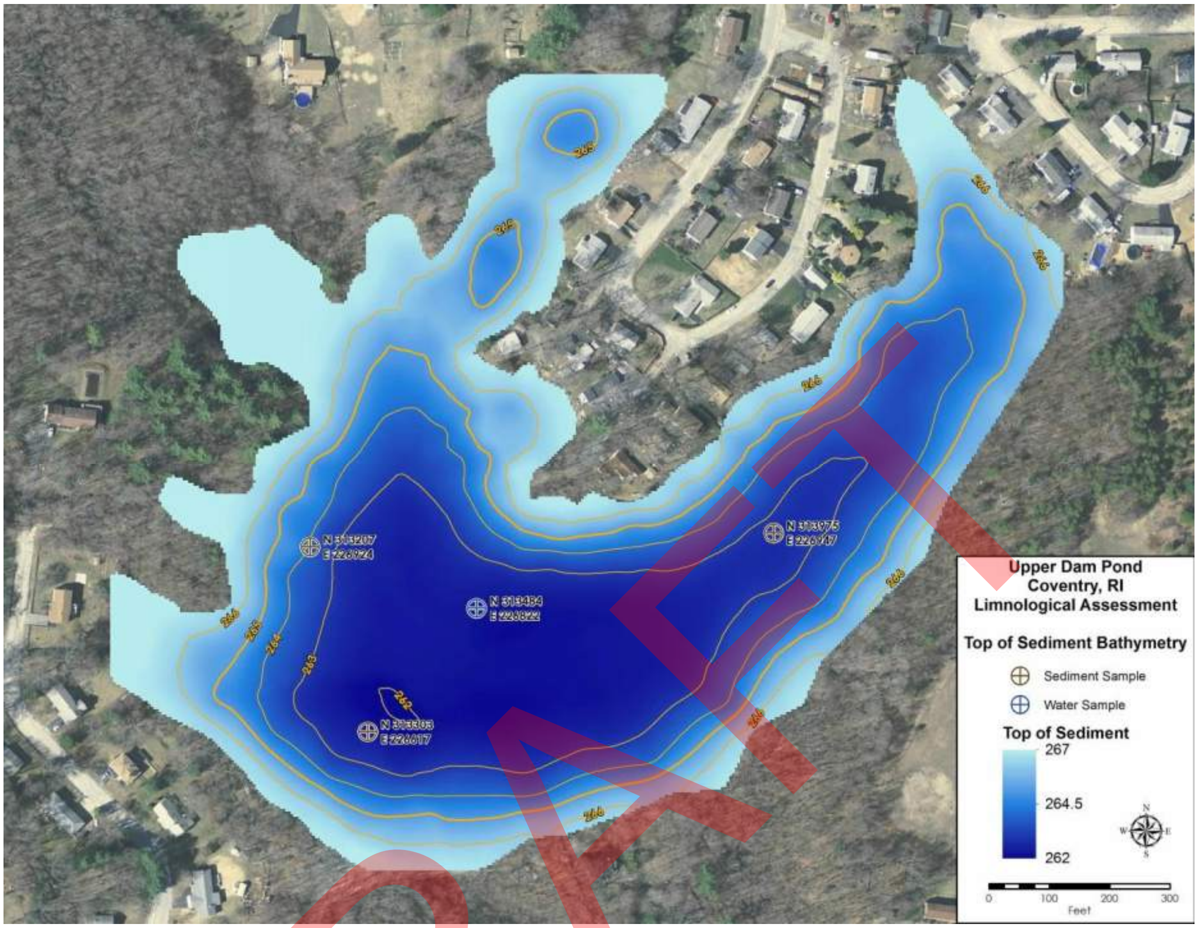


Figure 2-1 Bathymetry of Upper Dam Pond

2.2 Sediment Sampling

Sediment sampling and analysis was performed to evaluate sediment characteristics that may impact water quality. On May 21, 2018, three shallow (surficial) sediment samples were collected from pre-determined locations in the pond. Sample locations were chosen prior to the field sampling based upon the soft sediment distribution results from the bathymetric and soft sediment survey (Figure 2-2).

Samples were collected from a boat using a hand auger. Sediment sample depth was approximately 0 to 6 inches below the water/soft sediment interface. The hand auger was lowered through the water column and advanced through the soft sediment. The auger bucket was filled with sediment and pulled back into the boat, where the sediment was then placed in a stainless steel bowl to be composited. Three subsamples from each sample location were well homogenized prior to being placed in laboratory-provided glass sample jars with Teflon caps. Following collection, the samples were cooled prior to submittal to Northeast Laboratories, Inc. (NET) located in Berlin, Connecticut. Sediment was tested for loosely-sorbed phosphorus, iron-bound phosphorus, organic matter, total phosphorus and percent solids. Results from these analyses were used to provide estimates of phosphorus released from the sediments and are described in Sections 3 and 4 and Appendix A.

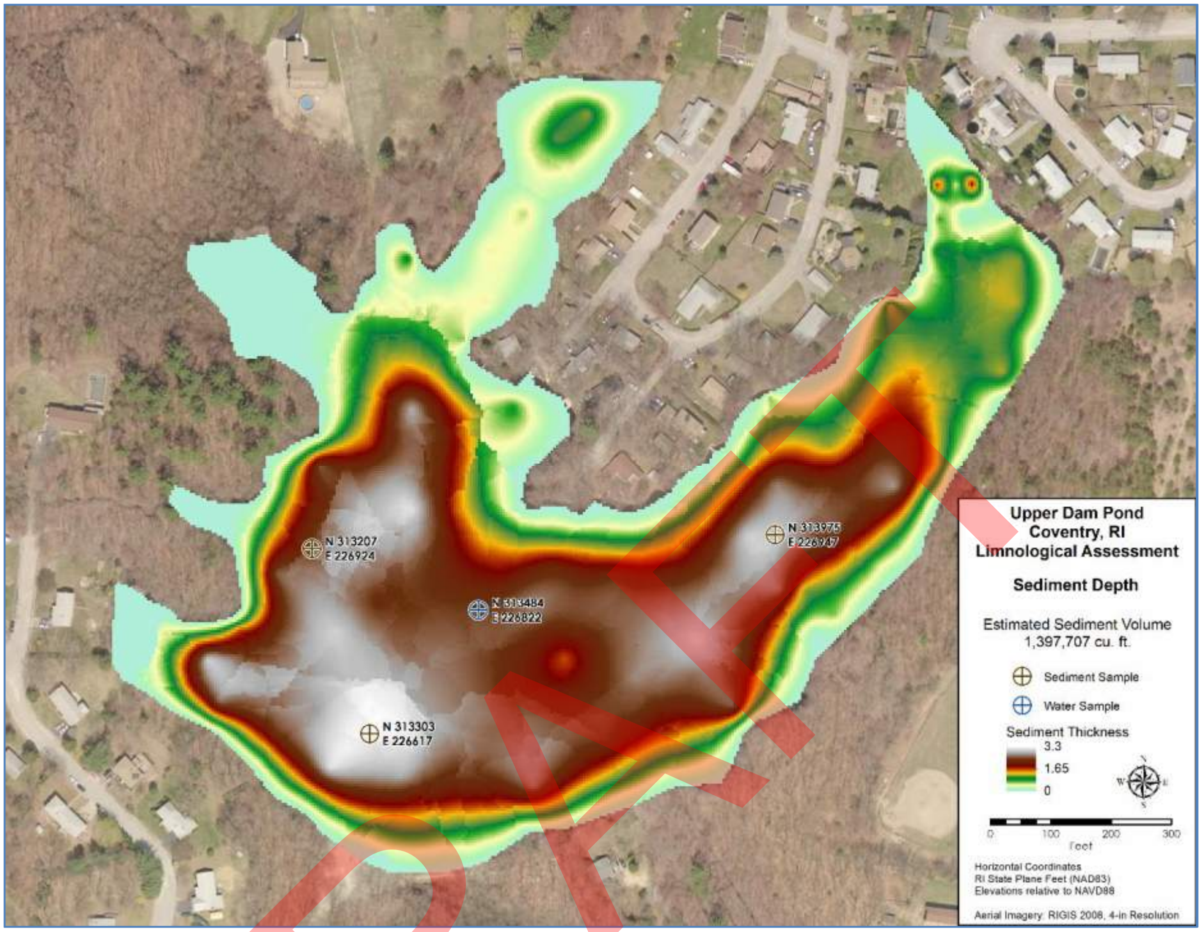


Figure 2-2 Sediment Thickness and Sediment Sample Locations

2.3 Water Quality Sampling

Water quality sampling and analysis was performed to record water quality characterize throughout the recreational season. A total of six in-lake sampling events were conducted throughout the season (Table 2-1). All water quality sampling was conducted at the location used for University of Rhode Island Watershed Watch (URIWW) sampling (41.705822 N, 71.553466 W) (Figure 2-1).

Water quality samples were collected from a boat using a VanDorn Sampler. Samples were collected at the surface (0-0.5 feet below water surface), midpoint (approximately 2 feet below water surface), and bottom (3.5-4 feet below water surface) of the water column. Water samples were collected into plastic pre-preserved sample containers supplied by the laboratories. Samples were submitted to New England Testing Laboratory, Inc. (NET) in West Warwick, Rhode Island and the University of New Hampshire/New Hampshire Lakes Monitoring Program (UNH) in Durham, New Hampshire. Water column characteristics, including temperature and dissolved oxygen profiles, were recorded at 1 foot intervals at the sampling location using either an In-Situ SmarTROLL or YSI 600XL water quality meter. Water transparency was measured using a Secchi disk.

Table 2-1
Water Quality Sampling Summary

Sample Date	Measured Water Column Characteristics	Laboratory Analytical Parameters
April 30, 2018[1]	Temperature Dissolved Oxygen	Alkalinity ($CaCO_3$) Total phosphorous Turbidity
May 21, 2018	pH Temperature Specific Conductivity Dissolved Oxygen Oxidation/Reduction Potential Secchi Disk Transparency	Alkalinity ($CaCO_3$) Total phosphorous[2] Turbidity
June 11, 2018	pH Temperature Specific Conductivity Dissolved Oxygen Oxidation/Reduction Potential Secchi Disk Transparency	Alkalinity ($CaCO_3$) Iron[3] Total phosphorous[2] Turbidity
July 16, 2018	pH Temperature Specific Conductivity Dissolved Oxygen Oxidation/Reduction Potential Secchi Disk Transparency	Alkalinity ($CaCO_3$) Iron[3] Total phosphorous[2] Turbidity
August 27, 2018	pH Temperature Specific Conductivity Dissolved Oxygen Oxidation/Reduction Potential Secchi Disk Transparency	Alkalinity ($CaCO_3$) Iron[3] Total phosphorous[4] Turbidity
September 24, 2018	pH Temperature Specific Conductivity Dissolved Oxygen Oxidation/Reduction Potential Secchi Disk Transparency	Alkalinity ($CaCO_3$) Iron[3] Total phosphorous[4] Turbidity

[1]Only one sample was collected from the midpoint (approximately 2 feet below the water surface) on April 30, 2018. Samples were collected from three sample depths (0-0.5 feet, ~2 feet, 3.5-4 feet) on the remainder of the sample dates

[2]Samples were submitted to both NET and UNH for Total Phosphorous; other parameters were analyzed at NET.

[3]Iron was only sampled when anoxic conditions were observed.

[4]Samples for Total Phosphorous were sent to UNH only; other parameters were analyzed at NET.

3 Field Work Results

3.1 Bathymetry and Soft Sediment Depth

Using the methods described above, measured soft sediment depths ranged from 0.0 to 3.2 feet, with a mean depth of 1.6 feet. Total sediment volume, calculated in ArcGIS according to methods described by Price (2002), was approximately 51,800 cubic yards (cy). Total pond water volume was calculated by the same methods as approximately 84,700 cy (52.5 acre-feet) The total volume, including sediment is 84.6 ac-ft. A sediment thickness surface was interpolated in ArcGIS using kriging (ordinary method, spherical semivariogram) to create a raster of sediment depths. Interpolation techniques only cover the extent of input data, which leaves as undefined those areas that were not accessible by boat. To compensate for that, the pond shoreline as digitized by RIGIS at 1:5000 scale was set to zero sediment depth and merged with the measured sediment depths. Interpolation was performed on this merged layer. The interpolated surface was analyzed with the Cut/Fill function in ArcGIS relative to a base surface of zero feet derived from the same lake outline obtained from RIGIS.

Those areas without sediment thickness measurements were observed to have sediment buildup, which prevented boat access. Sediment volume was estimated in this area in ArcGIS by applying various sediment and contributes an additional 2-6% to the total sediment volume given above.

3.2 Sediment

TP concentrations in the 3 sediment samples collected from Upper Pond Dam on May 21, 2018 were 107 mg/kg, 134 mg/kg, and 178 mg/kg. The lowest sediment TP concentration was measured in sediment collected from the easternmost sampling site in the pond. Both total solids and organic content measurements are consistent across samples, with percent solids ranging from 12.3% to 13.7% and percent organic matter ranging from 8.9% to 10.4%. Available sediment phosphorus (P), which is the sum of loosely-bound and iron-bound P, ranges from 52.6 mg/kg to 68.6 mg/kg.

Table 3-1
Upper Dam Pond In-Lake Sediment Samples

Sample Parameter	Analytical Laboratory	Sample 790180521-05	Sample 790180521-06	Sample 790180521-07
Total Phosphorous (mg/kg)	Phoenix Labs	107	134	178
Total Solids (%)	Northeast Laboratories	13.50%	13.70%	12.30%
Organic Matter (%)	Northeast Laboratories	10.40%	9.90%	8.90%
Iron-Bound Phos. (mg/kg)	Northeast Laboratories	43	32.6	42.6
Loosely-sorbed Phos. (mg/kg)	Northeast Laboratories	25.6	2	1.1

3.3 Water Quality

3.3.1 Temperature and Dissolved Oxygen

Water temperature in Upper Dam Pond varied from 14.2 C to 27.1 C (Figure 3-1). Water temperature was coldest in early spring with little thermal stratification. As the year progressed, the pond warmed before reaching its peak of 27 C at the surface in mid-summer. During this time a slight gradient developed, however the pond's shallow depth limited major thermal stratification. By early fall the pond cooled, mixed, and temperatures became consistent with depth. DO profiles created from the six sampling events at Upper Dam Pond reveal a significant gradient that developed in the summer, producing anoxic conditions at depth (Figure 3-2). Later in the fall, the pond became mixed and DO concentrations recovered, however remained lower than in the spring.

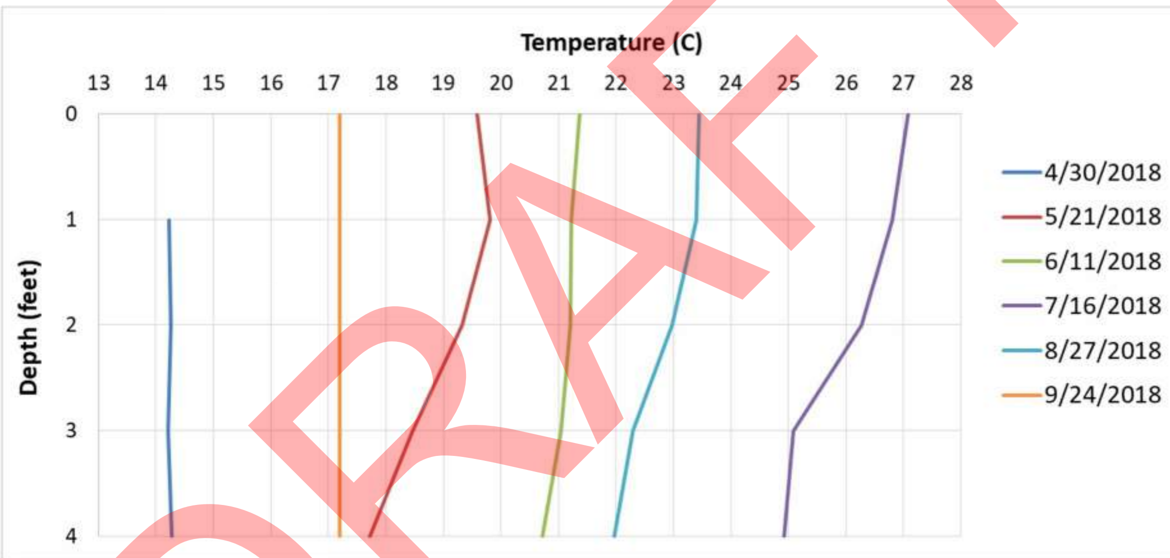


Figure 3-1 Temperature Profile in Upper Dam Pond.

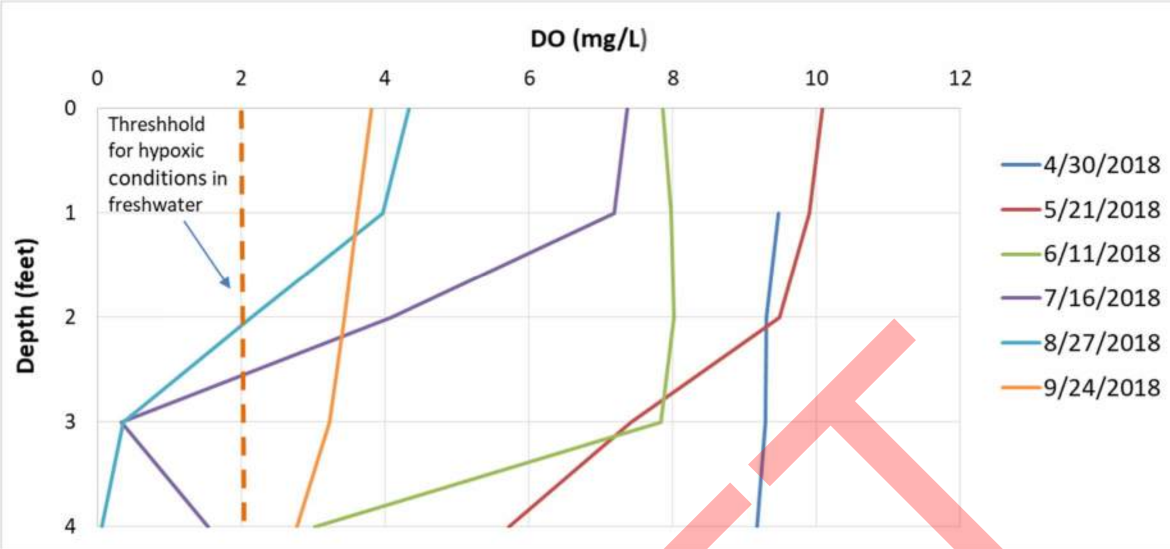


Figure 3-2 DO Profile in Upper Dam Pond.

3.3.2 Secchi Disk Depth

The trend in Secchi disk depth (transparency) mimicked seasonal changes. The depth at which the Secchi disk was observable in the water column decreased during the spring before reaching its minimum of 1.5 feet during the summer (Figure 3-3). The average Secchi transparency from the 5 sampling events was 2.5 feet.

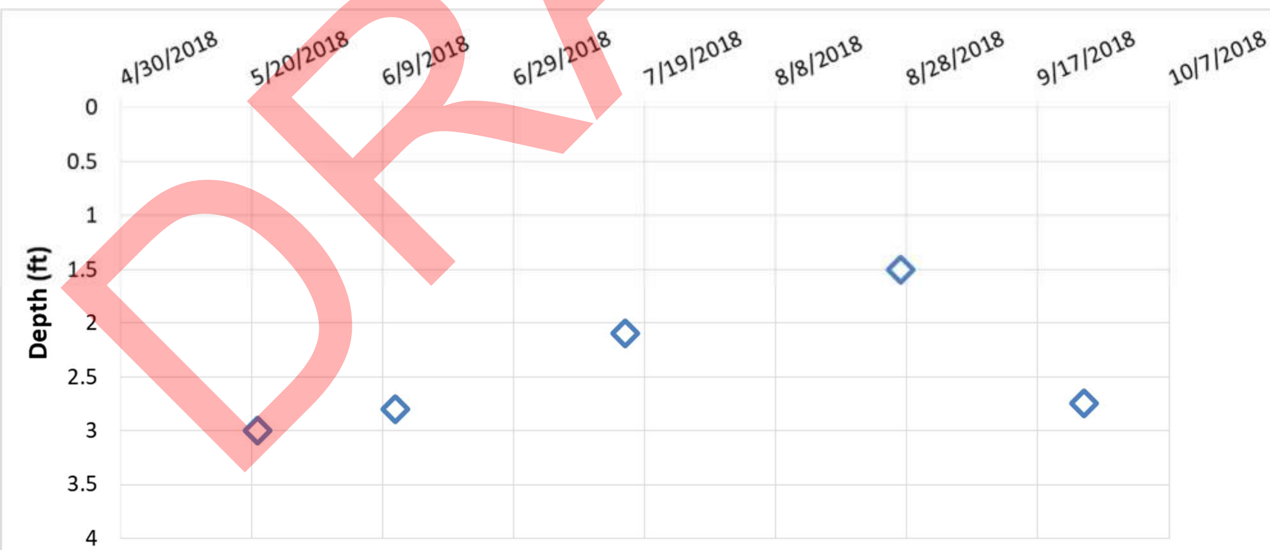


Figure 3-3 Secchi transparency in Upper Dam Pond.

3.3.3 Conductivity

Specific conductivity varied from 249 (µS/cm) to 411 (µS/cm) (Figure 3-4). Conductivity rose during the late fall before reaching its peak in mid-summer, where it subsequently decreased. Conductivity remained consistent with depth during the fall, while a slight gradient developed during the spring and summer.

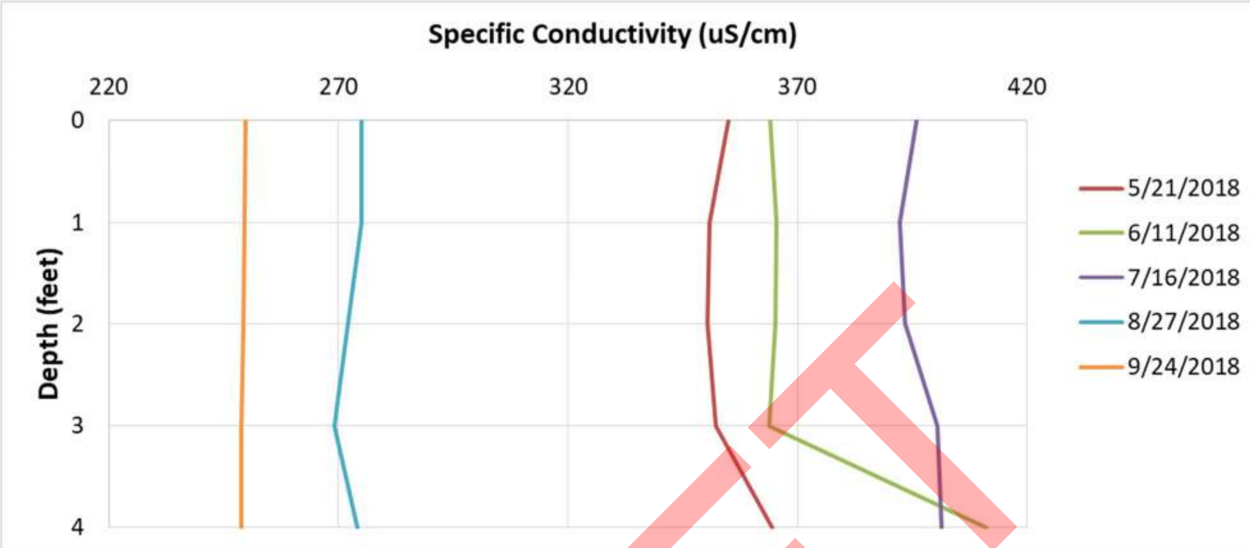


Figure 3-4 Specific Conductance Profile in Upper Dam Pond.

3.3.4 Redox Potential

Redox potential describes Upper Dam Pond's overall reducing/oxidizing capacity. Redox potential decreased greatly with depth for all but one of the six sampling events (5/21) (Figure 3-5). This pattern is in agreement with the dissolved oxygen results described earlier, as the May samples had the highest concentrations of dissolved oxygen available at depth. Lower redox potential creates conditions conducive to P release from sediments as discussed in Section 4.

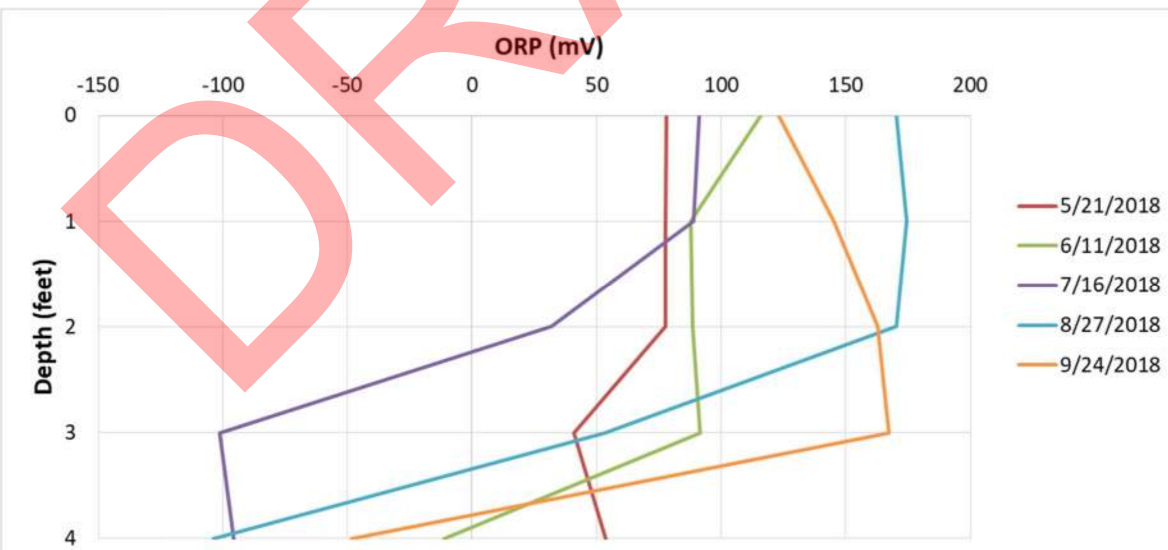


Figure 3-5 Oxidation Reduction Potential Profile in Upper Dam Pond.

3.3.5 pH

pH values in Upper Dam Pond were slightly acidic to neutral, which typical for freshwater ponds in New England. pH values varied from 5.77 to 7.07 with an average value of 6.54, with more neural measurements in the spring followed by lower pH values in the summer and fall (Figure 3-6). RIDEM Water Quality standards for pH are 6.5 – 9.0 or as naturally occurs which coincides with the majority of the samples. pH generally decreased with depth. Wu et al. (2014) demonstrated that more P is released from lake bottom sediments under alkaline conditions than acidic conditions, but the least amount of P is released under neutral pH.

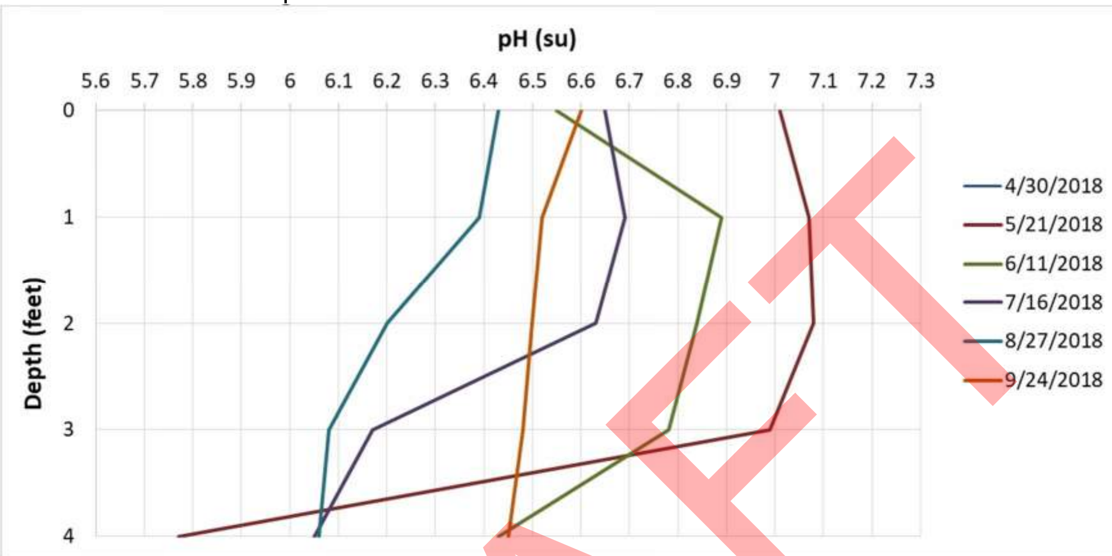


Figure 3-6 pH Profile in Upper Dam Pond.

3.3.6 Turbidity

Turbidity ranged from 0.6 NTU to 20 NTU with an average of 4.9 (Figure 3-7). Turbidity increased with depth, likely partially due to previous samples disturbing and mixing the water column for succeeding samples. The majority of samples met RIDEM's Water Quality Standard for turbidity in class B fresh waters of 10 NTU, and the only data exceeding the standard were at measured at depth.

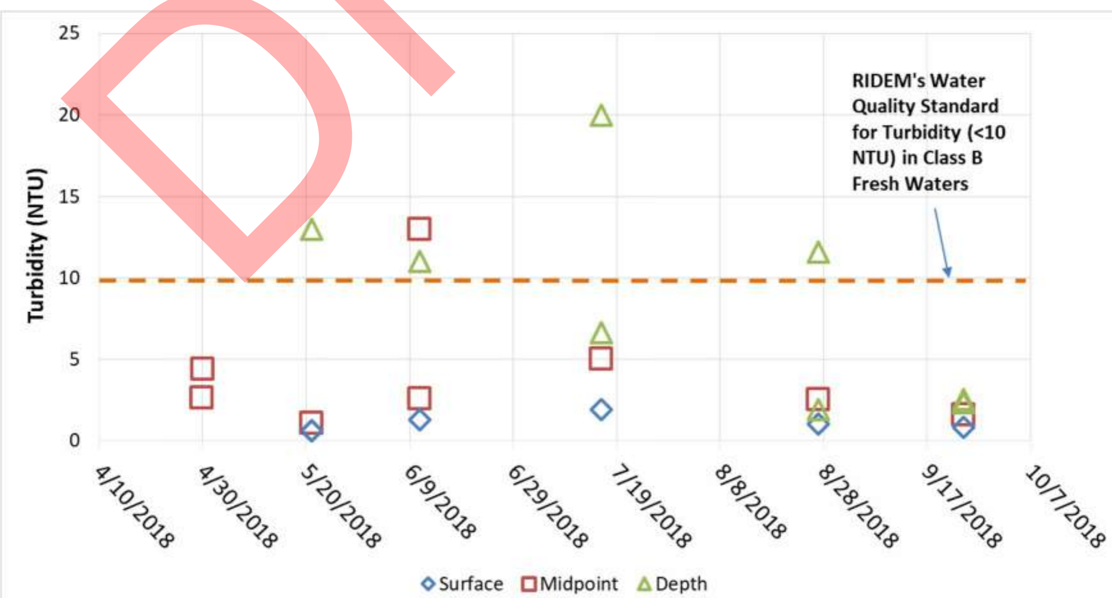


Figure 3-7 Turbidity in Upper Dam Pond.

3.3.7 Alkalinity

Alkalinity influences pH by providing a buffering capacity. Higher alkalinity means that there is less likely to be fluctuations in pH. Alkalinity ranged from 22 mg/L to 10 mg/L over the six sampling events at Upper Dam Pond (Figure 3-8). An alkalinity of 20 mg/L or higher is preferable in that there is high buffering capacity, i.e., pH is unlikely to be lowered by the input of acidic (low pH) rainfall. Data collected in this study indicate low to no sensitivity to acidification due to the majority of pH values of 10 mg/L or higher. Alkalinity values measured during this study were higher than historic alkalinity data obtained from Upper Dam Pond by URI Watershed Watch from 2004 to 2013, which had an average and median alkalinity value of 13 mg/L.

Figure 3-8 Alkalinity as CaCO3 in Upper Dam Pond.

3.3.8 Phosphorus

Total phosphorus (TP) concentrations in many of the samples from Upper Dam Pond exceeded RIDEM's recommended concentration of 25 µg/L (0.025 mg/L) for lakes, ponds, kettle holes, and reservoirs. TP was measured on all dates sampled usually directly at the surface (~0.5 foot), mid-pond depth (~2 feet) and deep-water depth (~3-4 feet depending on date) (Figure 3-9). Duplicate samples when taken were averaged for internal loading calculations in Section 4. Surface TP ranged from 10.6 µg/L (6/11/2018) to 16.3 µg/L (9/24/2018) and averaged 13.4 µg/L. Mid-pond depth samples ranged from 20.7 µg/L (5/21/2018) to 49.7 (9/24/2018) µg/L and averaged 31.9 µg/L. Deep-water pond samples ranged from 90.2 µg/L (5/21/18) to 635 µg/L (9/24/2018) and averaged 239 µg/L. These values compare well to values measured through the University of Rhode Island Watershed Watch (URIWW) that typically measured TP in May, July and late October from 2004 through 2008 and in 2013. That program measured an integrated surface sample that collected water from the surface to about the 3.3-foot depth and they typically fall within the range of the surface and mid depth samples of these more recent Upper Dam Pond TP measurements.

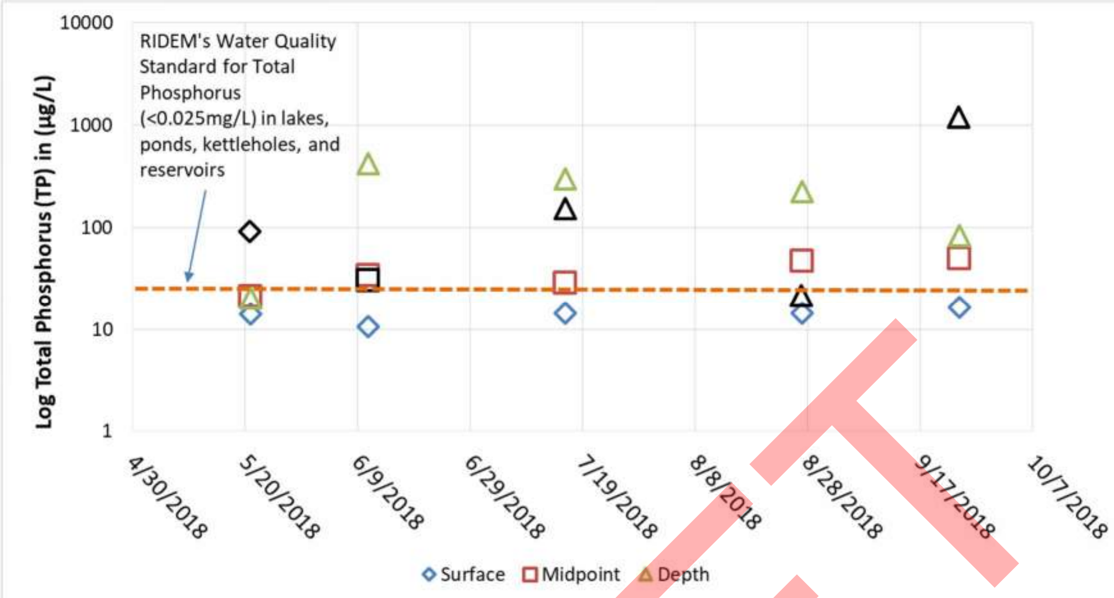


Figure 3-9 Total Phosphorus Concentration in Upper Dam Pond.

3.3.9 Total Iron

Total iron in Upper Dam Pond varied between 0.13 mg/L and 6.26 mg/L with an average value of 2.06 mg/L (Figure 3-10). The samples from depth returned the largest values of total iron. Iron concentrations are of interest since phosphorus can bind to iron in oxic conditions (i.e., when dissolved oxygen is abundant), and be subsequently released in anoxic conditions such as those observed at depth in Uppor Dam Pond in the summer months.

Figure 3-10 Total Iron in Upper Dam Pond

3.4 Visual Observations

Fuss & O'Neill field staff visited Upper Dam Pond seven times over the course of the 2018 recreational season in order to complete this limnological assessment. During the April and May visits, the pond appeared to be generally open water with some small areas of lily pads (Nymphaea odorata) on the surface, but was visibly filled with submerged vegetation (believed to be coontail, or Ceratophyllum spp.) when observed from a boat. Lily pads and watershield (Brasenia schreberi) became more abundant as the summer progressed, with the most abundant pond vegetation being observed in September. This is consistent with RIDEM observations in the 2007 TMDL which reported submergent vegetation dominated by macrophytic algae, forming dense mats in places, with lesser amounts of coontail (Ceratophyllum spp.), white water lily (Nymphaea odorata) and duckweed (Lemna spp.), although no duckweed (Lemna spp.) was observed during the 2018 field work.

In addition to the aquatic vegetation, brown pond scum (algae) was observed growing on coontail. The scum was more apparent during the early spring/summer visits, and less so in the later summer/fall visits. A sheen, likely caused by bacteria, was observed on portions of the pond in August. The photos below show the progression of pond vegetation over the 2018 sampling season.

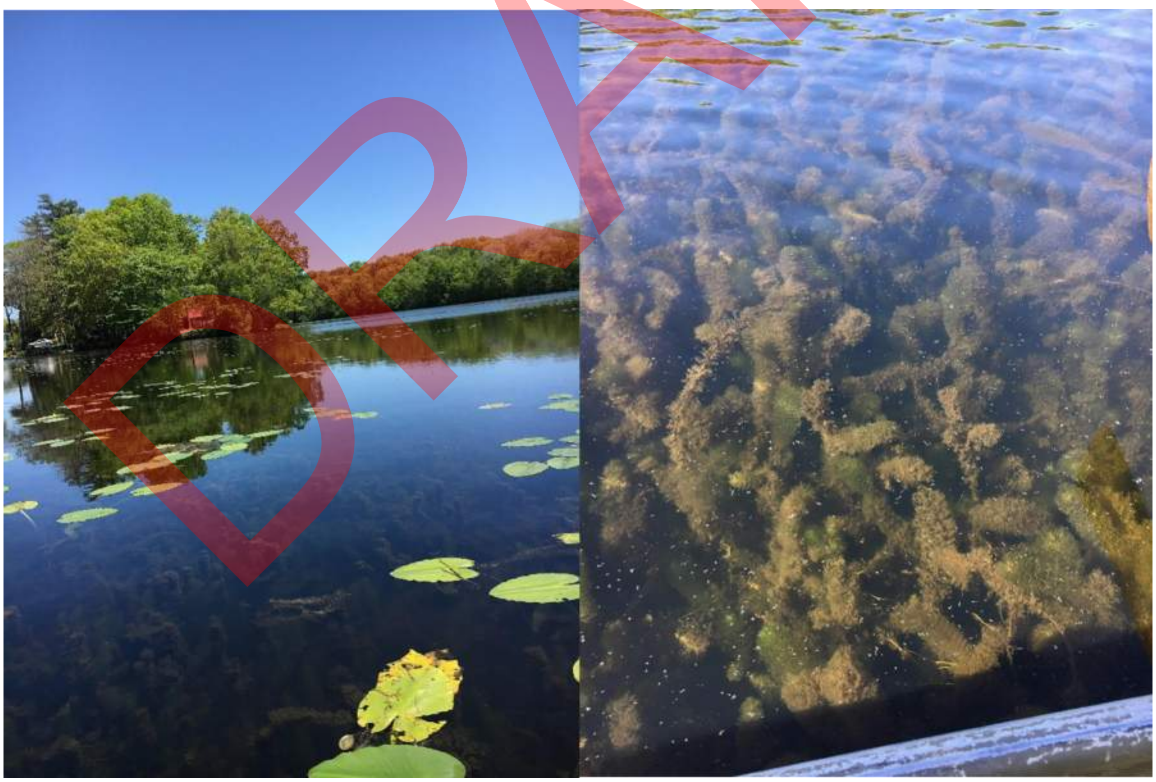


Figure 3-12 Visual Conditions May 21, 2018

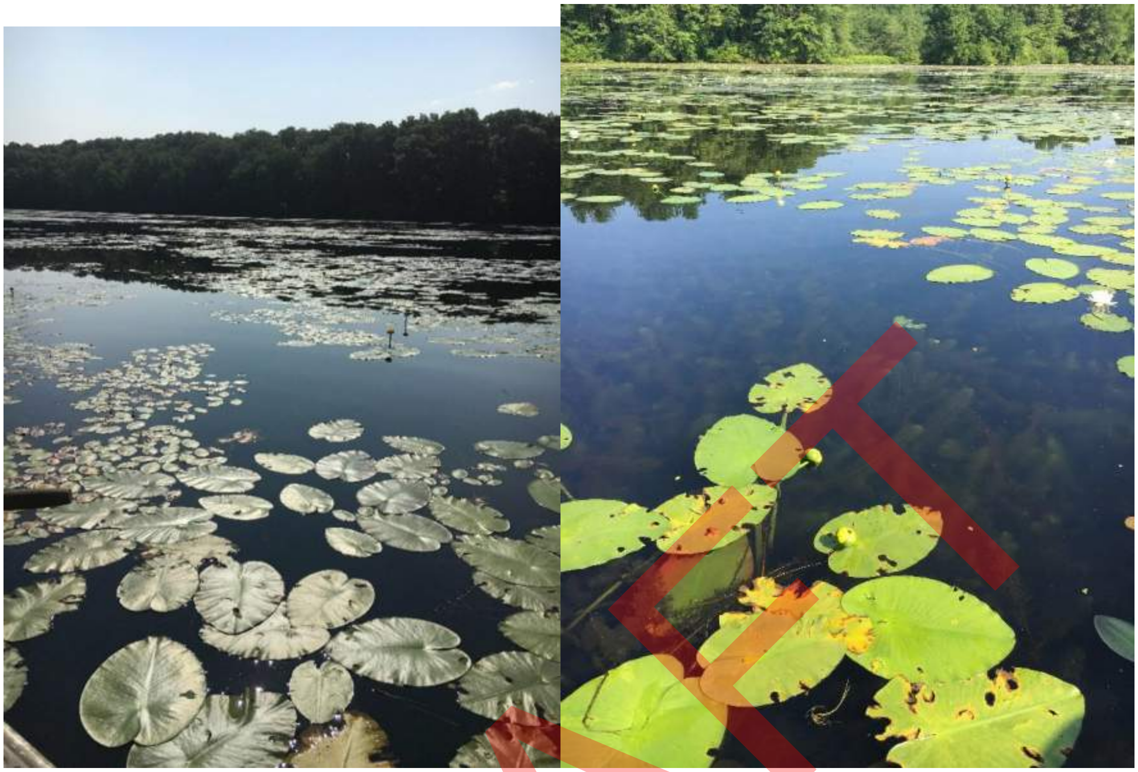


Figure 3-13 Visual Conditions July 16, 2018

Figure 3-14 Visual Conditions September 24, 2018

4 Estimations of Internal Phosphorus Loading

4.1 Approach

During the winter and spring thermal stratification, when any mixing is limited to just the surface waters, the lower waters of a lake (lower metalimnion or hypolimnion in a deep lake) can become anoxic due to chemical and biological activity associated with the breakdown of organic matter by microbes (Wetzel 1983). This can also occur right at the sediment-water interface of shallow lakes during calm conditions as releases have been documented in waters as shallow as 20 cm (Søndergaard et al 2013). In anoxic conditions, sediments that have acted as a nutrient sink with oxygen present will release phosphorus (P) into the lower waters that may eventually influence the productivity of the upper waters through mixis. Parameters such as organic content, and content of iron (Fe), aluminum, manganese, calcium, clay and other elements with the capacity to bind and release phosphorus may all influence sediment–water interactions and determine the amount of P released (Søndergaard et al., 2003). Forms of mobile P, consisting of the loosely sorbed and Fe-P redox sensitive fractions, are most likely to contribute to internal P loading (Pilgrim et al. 2007), thus the sediment samples for this study were analyzed for total, loosely-sorbed and iron bound P fractions (see Table 3-1).

There are four (4) different ways to estimate internal phosphorus load for a lake (Holdren et al 2001):

1) Net (and gross) estimates from an extensive phosphorus budget through mass balance of inflows, outflows and internal fluxes on an annual basis. This requires at least monthly measurements of P-in, P-out and the P concentration and volume of each lake strata (epilimnion, metalimnion and hypolimnion, if present).

2) Partial net estimates from in-situ P increases accumulating in the hypolimnion during summer compared to surface P.

3) Partial gross estimates from the in-situ P increases throughout the lake over the summer less the P sequestered at fall turnover.

4) Gross estimates from measured or estimated sediment phosphorus release rates and the measured or estimated anoxic area and time (i.e., the “anoxic factor” of Nürnberg 1988).

Since phosphorus measurements were limited to in-lake samples in the spring through fall, Method 1 was not used. Methods 2 and 4 above are usually more related to gross flux and thus, are overestimates in that they do not account for all settling and sediment sequestering that will occur when and after the sediments become oxic after mixis. With the scope of this study limited to spring through fall sampling, Methods 2, 3, and 4 were selected as the best approaches for estimating Upper Dam Pond internal nutrient loading. However, when reviewing the estimates, it is important to note those from Methods 2 and 4 likely represent a “worst case scenario” of internal P loading.

With sampling dates covering late April through late September, post-spring mixis through fall turnover conditions were monitored. Dissolved oxygen profiles and oxidation reduction potential measurements allowed for the calculation of anoxic areas and volumes using the GIS-based bathymetry data. This allowed for estimates of the accumulation of nutrients in the lower waters as they became anoxic and allowed for insight into how much of the gross internal load was settled and sequestered after mixis (in late September). In the 6 months of sampling in 2018, some level of anoxia occurred in the bottom waters on two sampling dates: July 16 and August 27. This observation is typical since warmer waters are less able to hold dissolved oxygen, and therefore anoxic bottom water conditions tend to occur during mid- to late-summer months.

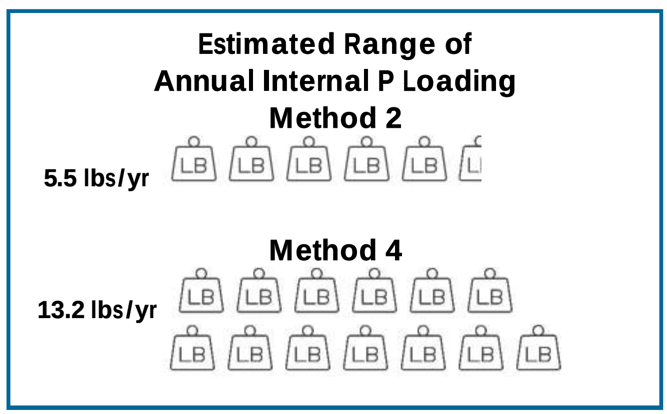
On June 11, 2018 the bottom waters approached anoxia and there was also a slight negative oxidation reduction potential in the lower waters. Similarly, on September 24, 2018 there was a significant negative oxidation reduction potential in the lower waters. Phosphorus can be released in slightly reduced conditions (as indicated by the negative oxidation potential) in shallow lakes (Moore et al 1994). Also, it is assumed that an increase in net plant respiration occurs in darkness in shallow lakes with extensive weed beds (as is found in Upper Dam Pond) that often causes at least a temporary anoxia condition at the sediment-water interface at night and early morning (Frodge et al 1991). Thus, a small anoxic zone just at the sediment-water interface was also considered for those dates in the estimates of internal loading, the extent of which was assumed to be at least 1 inch and about 2 inches above the sediment surface respectively.

For Method 3, internal P load was determined by calculating the hypolimnetic load as the difference in concentration between the bottom water and upper water TP for the measured anoxic water volume (i.e., concentration multiplied by volume equals load) divided by the relative volume of the anoxic zone to the oxic lake volume[1]. Typically, the upper surface waters (0.5 feet) had lower P concentrations than mid depth (2 feet) samples. To represent the worst-case scenario calculations reported here represent the differences between the bottom TP and upper surface readings. It was assumed the winter internal load for Upper Dam Pond was negligible given the low spring TP concentrations measured and most other studies have found this also to be the case as P release is reduced in low temperatures (Nürnberg et al. 2013).

4.2 Estimates

4.2.1 Method 2

Using Method 2 described above, the internal load for Upper Dam Pond was calculated as 2.1 lbs P by July 16 and 3.4 lbs P on August 27. The calculated anoxic lake volume extended to about 26.5% of the lake in late July and 33.7% in late August. The June



1 Note that the April 30, 2018 samples taken were only from the surface as the pond was assumed mixed. It was determined to be less than 20 µg/L as that was the initial lower limit of the lab that performed the analysis. This was corrected to a less than 1 µg/L lower limit of detection for subsequent analyses from samples collected for the rest of the study. For the calculations described in Section 4 the surface value for 4/30/2018 was set to 10.6 µg/L which was the lowest value measured for the surface (on 6/11/18) as historical values measured through the URIWW were lowest in the spring and is consistent with a non-detect for TP indicating a result less than 20 µg/L.

and September loadings were insignificant adding to less than 0.01 lbs P, with anoxic portions of the pond representing only 0.6% and 1.3% of the total pond volume. Thus, this method estimates that the summer internal P load to be approximately 5.5 lbs P (the sum of July and August loading).

4.2.2 Method 3

For Method 3 described above calculations were run using both the average of the upper and mid depth TP readings as well as using only the mid depth readings, the latter representing the worst case scenario. Gross loading was calculated in the range from 11.6 to 13.2 lbs per year. However, given that there was a marked decrease in internal lake TP that ranged from 7 to 7.9 lbs TP in September 2018 due to the reduced extent of the anoxic zone, the net TP ranged from between 3.8 and 6.1 lbs TP. As the gross P load is typically 28 to 50 percent of the net loading (Cooke et al 1993) these estimates are running at about a 60 percent decrease between gross and net. As the total iron (Fe) to total P ratio measured in the bottom waters for Upper Dam Pond in September of 2018 was very high (greater than 52) and well above 15 that would infer a high chance of P binding by Fe in oxic conditions, the higher decrease in P concentrations could be readily explained (Jenson et al 1993). In addition, the plant mass may be retaining a significant amount of nutrients due to the "sticky" nature of phosphorus.

4.2.3 Method 4

Method 4 is often used when data are lacking or as a check for one of the previous methods discussed as it relies on relationships developed from a wide range of published values for either TP or iron-bound P and the resulting measured sediment TP release rates (Nürnberg 1988). Area, volume and anoxic zone parameters estimated the number of days the lake would be anoxic at 39.9 days. This compares reasonably to the actual conditions measured in the field. This resulted in an anoxic factor estimate of 21.26 days-m^2/day. With a calculated TP release rate of 0.07 mg TP/m2-day, sediment analyses yielded relatively low sediment TP, loosely-sorbed P and iron bound P results compared to other Rhode Island lakes previously studied. This may be due to the shallowness of the lake as well as the extent of submergent and emergent plants that can sequester a significant amount of nutrients from the sediments. Thus, it is not surprising that these calculations resulted in a very low estimate of internal nutrient load (only a fraction of a pound) and this method should not be considered relevant to this study.

4.2.4 Limitations of the Approach

It should be noted that although the anoxic area in Upper Dam Pond in late September 2018 was extremely limited, the average TP in the bottom waters were the highest concentration measured through the study (635 µg/L). While the summer internal TP loading that was measured may have been reduced significantly after mixis, the senescing plant biomass may come to play late autumn and early winter as the decomposing of that plant mass may increase bottom TP (as well as reduce dissolved oxygen levels) in late fall. Thus, annual TP loading may be higher than this analysis has estimated but the productivity impact is greatly reduced as this occurs at the end of the growing season. During the growing season, plants sequester nutrients from the sediments and waters during the days of longest sunlight and warmest temperatures. By the end of the growing season, there are colder temperatures and less sunlight, so plants are broken down more slowly, nutrients do not have the same productively response. In addition, waters tend to be mixed and oxic so that nutrients are more diffuse.

4.3 Aquatic Plants

While extensive aquatic plant beds can often act as nutrient sinks both by sequestering nutrients from the water and sediments and providing absorptive surfaces for phosphorus to "stick to," and can also shade out a significant portion of the pond to further reduce algae growth during the summer growing season, in the final analysis, they can often lead to a net increase in annual internal TP loading (Barko and James 1997). They may also alter the dynamics of algal grazing fish (Jensen et al 1992) with the result of more open water algae expressed per unit P. However, a significant loss of aquatic macrophytes in a shallow pond often leads to a greater expression of open water algae and can push the pond well past the TP concentration "tipping point" from which it could be problematic to get back to a TP level that prevents algae bloom events throughout the summer. Thus, any management plan for the pond must balance the negative and positive factors that the plants provide. Also, considering that water lilies occur throughout the pond, their large mass of tubers below the sediments can complicate any attempt at dredging.

5 Conclusion and Recommendations

Based on the water and sediment quality analyses described in Sections 2 and 3 and the internal nutrient loading analysis described in Section 4, even with the use of the highest gross estimate of internal phosphorus loading of 13.2 lbs/yr, internal loading represents only approximately 8% of the total phosphorus load of 156 lbs/yr estimated by RIDEM in 2007 (Figure 5-1). Consequently, while internal loading does contribute to overall phosphorus concentrations in Upper Dam Pond, external sources (i.e., stormwater runoff, failing septic, illicit connection, and waterfowl) appear to dominate the loading and it is recommended that these sources be addressed first.

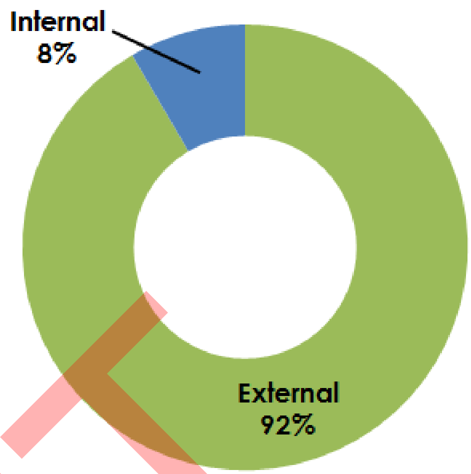


Figure 5-1 Relative Contributions of Internal and External Loading

5.1 Recommended Implementation Plan

Based on information collected in this study, as well as in the prior 2007 TMDL, a plan focused on reducing phosphorus and sediment inputs from stormwater, supported by a secondary focus on detection of illicit discharges, reduced winter-time sanding in the pond watershed, on-going response to failed/failing on-site wastewater treatment systems (OWTS), and discouraging waterfowl use of the pond is recommended.

Stormwater

In 2007, RIDEM identified 18 outfalls discharging directly to the pond. The identification and ownership of those outfalls, as well as any easements, should be confirmed and the outfalls should undergo illicit discharge detection monitoring including dry weather flow observation. In addition, seven stormwater outfalls were identified as the most significant potential sources of phosphorus to Upper Dam Pond (Figure 5-2 and Table 5-1).

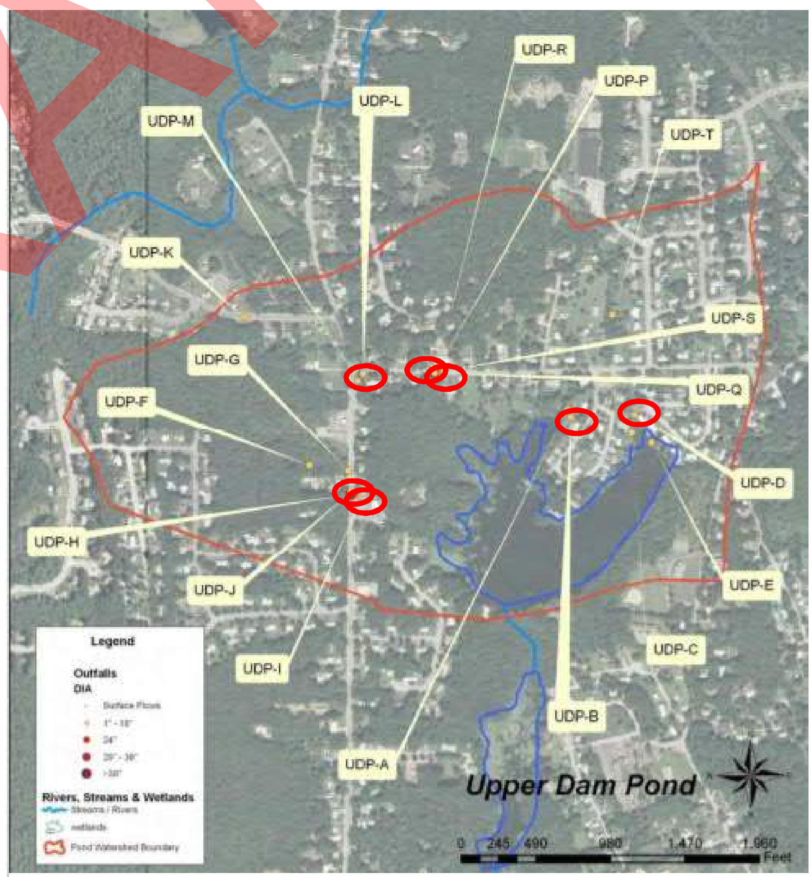


Figure 5-2 Outfalls Discharging to Upper Dam Pond

Table 5-1
Priority Outfalls Previously Identified for Upper Dam Pond

Outfall ID	Diameter (inches)	Location	Previously Reported Ownership	Notes
UPD-D	18	Pond View Dr	Town of Coventry	Discharges directly to pond
UPD-P	24	Gervais Rd	Town of Coventry	Drains residential area
UPD-Q	18	Gervais Rd	Town of Coventry	Drains residential area
UPD-I	18	Knotty Oak Rd	RI Dept of Transportation	Drains residential area
UPD-H	24	Knotty Oak Rd	RI Dept of Transportation	Discharges to a culverted tributary
UPD-L	5	Gervais Rd	Private	Suspected OWTS impact
UPD-B	5	Breezy Lake Dr	Private	Suspected OWTS impact

Options for stormwater management in the watershed will depend upon the characteristics of underlying soils, the ownership/easement status of the outfalls, and available space (in roadway rights-of-way). Soils in these areas are generally characterized by the US Department of Agriculture (USDA). Rhode Island GIS mapping shows soils along Gervais Road and Knotty Oak Road (Rt 116) are dominated by Hydrologic Soil Group C and D soils with limited infiltration capacity (Figure 5-5). However, soils in large portions of the remaining watershed are made up of B soils where these is significant potential for implementing more cost-effective stormwater controls. The USDA classification is based on the soil properties that affect the capacity of the soil to be drained and take into account factors including depth to a water table, sand content, hydraulic conductivity, and soil density.

Possible options for stormwater management should be focused on designs that remove sediments and nutrients (i.e., phosphorous). Options that disconnect runoff from roads that now drain directly to the pond and infiltrate that runoff will often be the most effective methods to manage stormwater quality problems. These options would require further analysis to confirm their feasibility include:

- Bioretention systems (Figure 5-3) are shallow, vegetated/landscaped depressions that capture, temporarily store and filter runoff. An engineered soil media is used to filter runoff thereby removing sediments and particulate-bound phosphorous while plants grown in the filter uptake dissolved nutrients. Plants in the basin are selected that are resistant to dry and wet conditions and predicted climate change impacts to temperature and rainfall, as well as road salt chlorides. Pretreatment in the form of a forebay or catch basin would be used to remove coarse particulars and allow easier maintenance.

We understand that the widths of the rights-of-way (ROWs) are limited in the neighborhoods around the pond. As a result, the best opportunities for these types of systems would be within easement areas for existing stormwater outfalls. Runoff from the outfalls could be diverted into a bioretnetion basin (depending on actual elevations and space) where the runoff would be treated.

- Tree Filters (Figure 5-4) generally consist of open bottomed systems that include one or more trees. Street runoff is directed to drain into the surface of the tree filter where it drains through an engineered soil media that also serves as a growing media for the trees. The engineered soil media removes sediment and particulate-bound phosphorous. The tree itself also uptakes some of the dissolved nutrients. Trees are selected that are resistant to dry and wet conditions and predicted climate change impacts to temperature, rainfall and pest, as well as from chlorides from road salt. Street sand will also accumulate in these filters. The best way to remove this sediment will be with a vacuum truck with a design that prevents the vacuum truck from removing the engineered soils.

  Some towns have incorporated tree filters as part of the town's street tree program. Neighbors volunteer to have trees planted in the ROW in front of their homes. A simplified design of a tree filter can then be incorporated to promote stormwater runoff to drain through the filter and disconnect from the conventional drainage system.

In addition to the installation of new BMPs, maintenance and housekeeping actions including reduced wintertime sanding, and increased street sweeping and catch basin cleaning in the watershed could be implemented to reduce sediment loads to the pond. Because phosphorus is often transported with sediment, reduction in sediment can lead to reduced phosphorus loading.

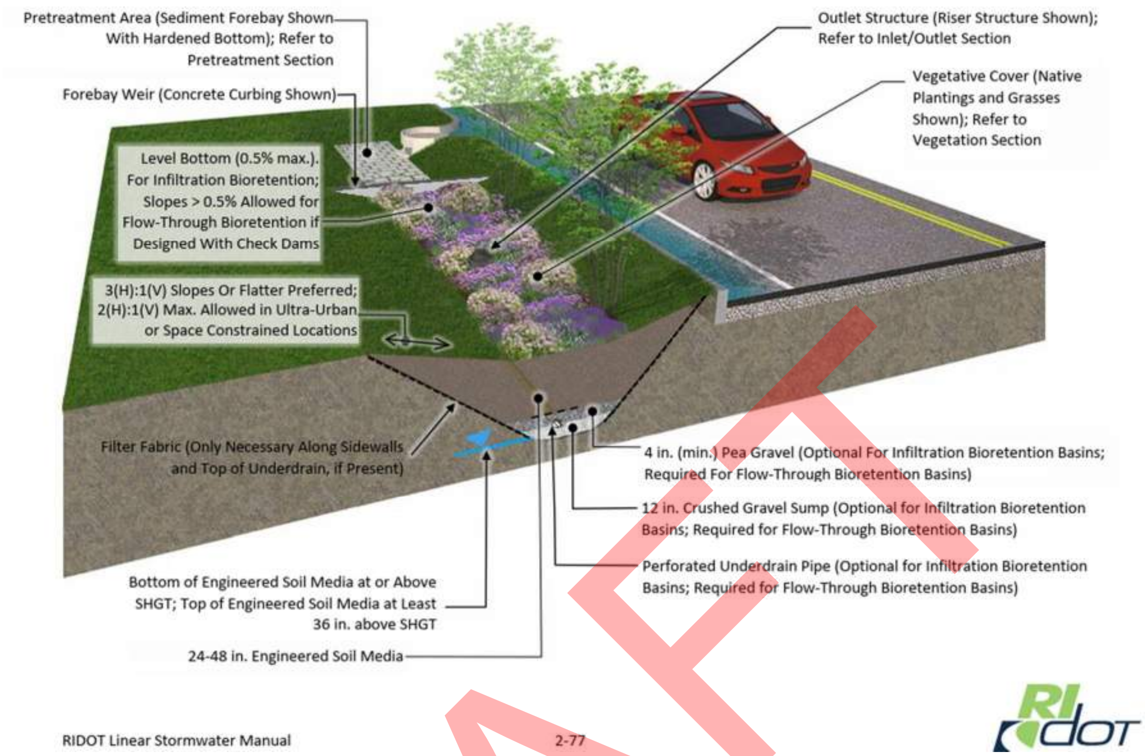


Figure 5-3 Bioretention Basin Example from RIDOT Linear Manual

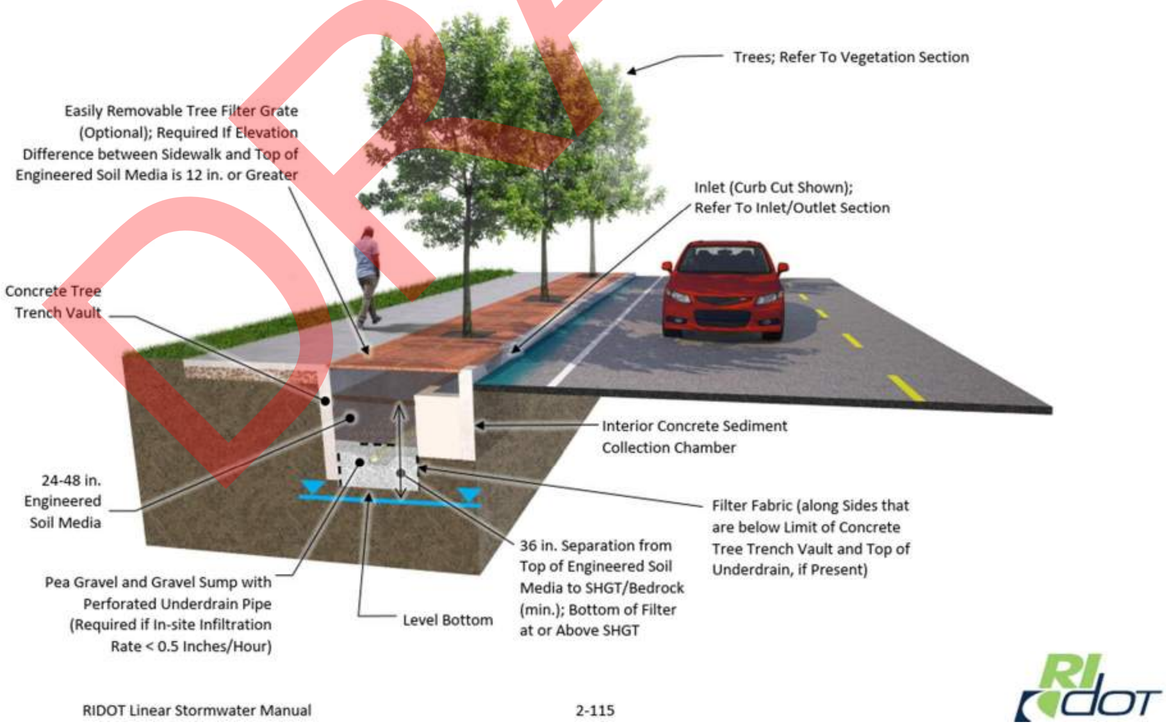


Figure 5-4 Tree Filter Example from RIDOT Linear Manual

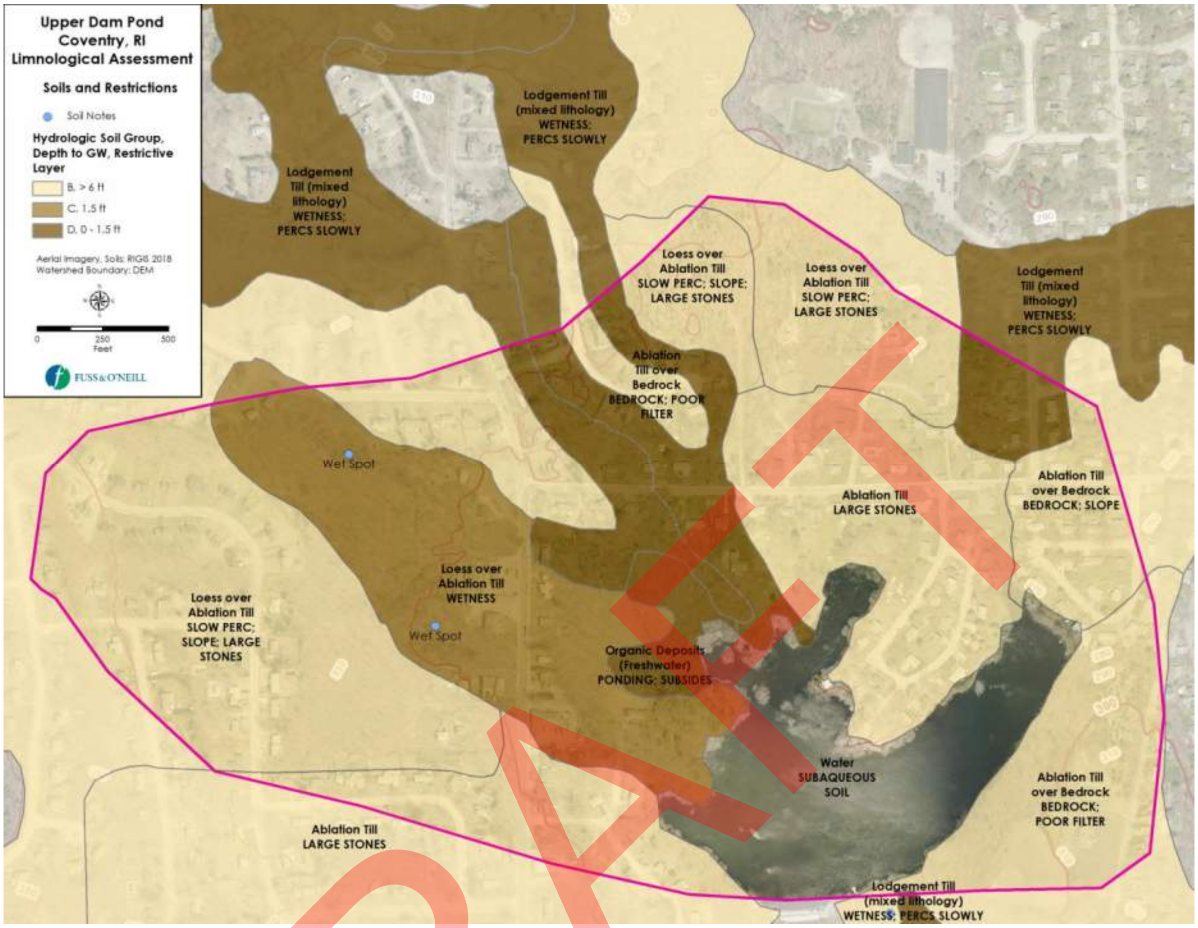


Figure 5-5 Hydrologic Soil Group Characteristics in the Upper Dam Pond Watershed

Septic Systems and Illicit Discharges

Many homes in the Upper Pond Dam watershed were constructed mid-century in the last century and therefore, increases in OWTS failures can be expected, especially given the limitations of the soils in the area. The 2007 TMDL reported suspected failures near UPD-B and UPD-L and follow up on those specific outfalls could be conducted as part of a stormwater BMP feasibility study. Because bacteria concentrations monitored for the public beach on Upper Pond Dam have not indicated elevated levels of bacteria, wide-spread, chronic OWTS failure is not indicated. However, dry weather visual screening and follow up sampling of any flowing outfalls would provide an important step in identifying and eliminating loading from any potential sources.

Waterfowl

Although not noted as a major problem either by RIDEM or during the field visits for this study, waterfowl may be contributing to phosphorus (and bacteria) loads in the pond. Signage to discourage feeding waterfowl at public access points and the establishment of an un-mowed grass buffer (as opposed to lawn to the water's edge) would discourage waterfowl use of the pond. Because such steps will require cooperation of the public and homeowners around Upper Dam Pond, education and outreach will be critical to gain cooperation and participation.

Aquatic Vegetation

In addition to the phosphorus impairment recognized in the 2007 TMDL, the submersed aquatic vegetation in the pond presents a nuisance condition for boaters. However, disturbance of the bottom sediment in which the plants are growing is not recommended unless the pond were to be substantially deepened to significantly alter the productivity dynamics in the pond. In fact, as discussed in Section 4, removal of the rooted plants may actually create conditions for algal blooms, introducing a new problem with potential health impacts for recreational users. As a result, the recommendation at this time would be to address the aquatic vegetation by mechanical methods such as mowers or harvesters (harvesters mow and collect the cut plants). The advantage of this approach is that the pond bottom habitat remains intact because most mowers or harvesters do not remove submersed plants all the way to the pond bottom. Similar to mowing a lawn, the clipped plants remain rooted in the bottom sediment and regrowth begins soon after the harvesting operation. After measures have been implemented to limit phosphorus inputs from external sources, then dredging to remove accumulated sediment and plant material would produce a more lasting beneficial effect since there will be less phosphorus input to fuel the regrowth of plants.

Mechanical mowing/harvesting can be site-specific because plants are removed only where the harvester operates and could to facilitate boating without disturbing bottom sediment. Care would need to be taken to make sure that most plant fragments could be captured in the harvesting process so that plants are not spread to currently less vegetated area of the pond. Typical costs for contracted mechanical harvesting would be on the order of $3,000 for mobilization and $1,000-2,000/day for harvesting (disposal not included), with approximately 1-2 acres covered per day. If harvesting were to be conducted across the entire approximately 21 acre pond, the cost would be approximately $50,000, with additional funds need for disposal of the plant material. Harvesting equipment could be purchased by the Town at a cost of up to $90,000 for new equipment. Boat-mounted equipment that only mows is substantially less expensive and could be purchased by the Town for approximately $3,000. However, that will not harvest the clippings and would have to be carefully used to prevent the spread of plants to other areas of the pond.

5.2 Potential Funding Sources

In Rhode Island, there are two primary funding sources that are typically available to municipalities to implement stormwater practices to address water quality issues consistent to what is now proposed for Upper Dam Pond.

- State of Rhode Island Grants: Over the last 10 years, the State of Rhode Island has approved bonds every couple of years for grant programs to fund stormwater quality projects. In the past, this funding was administered by RIDEM as part of the Bay and Watershed Restoration Fund. In 2018, the State of Rhode Island approved the Green Economy Bond which will continue to fund stormwater quality projects. While these grants are competitive, they are less competitive than other grant programs available regionally or nationally that are typically funded by USEPA. These grants historically have required a 50% match to the grant with some waivers provided for exceptional conditions.

- Southeast New England Watershed Grant Program: Over the last 5 years, the US Environmental Protection Agency (USEPA) has administered this grant program providing $22 million in funding for water quality and sustainability projects for the Narragansett Bay and Buzzard's Bay watersheds. This watershed includes almost all of Rhode Island and most of Southeastern Massachusetts and Cape Cod. These grant applications typically require a 50% match. Stormwater quality projects such as those proposed for Upper Dam Pond are fundable under this grant program, however, these grants are very competitive with less than half of the grant applications typically being funded. As a result, it is important that the projects proposed with these grant applications incorporate a unique element that provides a differentiator compared to other applications.

- Rhode Island Department of Transportation (RIDOT): While RIDOT does not have a formal grant program for stormwater quality, they are currently under a Consent Decree with USEPA to implement stormwater quality improvements for their infrastructure for every impaired watershed that is being impacted by runoff such as the Upper Dam Pond watershed. While they are responsible for implementing controls along Route 116, USEPA does allow RIDOT to partner with municipalities to address up to 25% of their stormwater quality requirements. RIDOT does have active programs where they contribute funding to municipalities to implement these types of controls so that they can record the treatment credits. One advantage of this RIDOT funding is to use it as a match for other grant programs.

6 References

Barko, J. W. & W. F. James, 1997. Effects of submerged aquatic macrophytes on nutrient dynamics, sedimentation, and resuspension. In Jeppesen, E., Ma. Søndergaard, Mo. Søndergaard & K.

Christoffersen (eds), The Structuring Role of Submerged Macrophytes in Lakes. Ecological Studies, Vol. 131. Springer Verlag, New York: 197–214.

Cooke, G. D., E. B. Welch, S. A. & P. R. Newroth, 1993. Restoration and Management of Lakes and Reservoirs, 2nd ed. Lewis Publishers, Boca Raton.

Frodge, J. D., G. L. Thomas & G. B. Pauley, 1991. Sediment phosphorus loading beneath dense canopies of aquatic macrophytes. Lake and Reservoir Management 7: 61–71.

Holdren, C., W. Jones and J. Taggert 2001. Managing Lakes and Reservoirs. 3rd Addition. North American Lake Management Society, Terrene Institute, US Environmental Protection Agency. Madison WI

Jensen, H.S., P. Kristensen, E. Jeppesen, A. Skytthe. 1992. Iron:phosphorus ratio in surface sediment as an indicator of phosphate release from aerobic sediments in shallow lakes. Hydrobiologia. 235/236, 731-743.

Jeppesen, E., J.P. Jensen, L. Søndergaard, T. Lauridsen, L.G. Pedersen & L. Jensen. 1997. Top-down control in freshwater lakes: the role of nutrient state, submerged macrophytes and water depth. Hydrobiologia 342/343: 151-164

Moore, P.A. & K. R. Reddy.1994. Role of Eh and pH on phosphorus geochemistry in sediments of Lake Okeechobee, Florida. J. Env. Qual. 23, 955-964.

Nürnberg G.K., B.D. LaZerte, P.S. Loh, & L.A. Molot. 2013. Quantification of internal phosphorus load in a large, partially polymictic and mesotrophic Lake Simcoe, Ontario. J Great Lakes Res. 39:271–279

Nürnberg GK, M. Tarvainen, A.M. Ventellä, J. Sarvala. 2012. Internal phosphorus load estimation during biomanipulation in a large polymictic and mesotrophic lake. Inland Waters. 2:147–162.

Nürnberg G. K. 1988. Prediction of phosphorus release rates from total and reductant-soluble phosphorus in anoxic lake sediments. Can J Fish Aquat Sci. 45:453–462.

Pilgrim K.M.,B.J. Huser, P.L. Brezonik. 2007. A method for comparative evaluation of whole-lake and inflow alum treatment. Water Res. 41:1215–1224.

Rhode Island Department of Environmental Management (RIDEM). 2007. Total Maximum Daily Loads for Phosphorus To Address 9 Eutrophic Ponds in Rhode Island. Available at: http://www.dem.ri.gov/programs/benviron/water/quality/rest/pdfs/eutropnd.pdf

Søndergaard M, R. Bjerring , E. Jeppesen . 2013. Persistent internal phosphorus loading during summer in shallow eutrophic lakes. Hydrobiologia. 710:95–107.

Søndergaard M, J.P. Jensen, E. Jeppesen . 2003. Role of sediment and internal loading of phosphorus in shallow lakes. Hydrobiologia. 506-509: 135-145.

Wetzel, R. G. 1983. Limnology. 2nd Ed. Saunders College Publishing. Orlando FL.

Wu, Y., Wen, Y., Zhou, J. and Wu, Y. 2014. Phosphorus release from lake sediments: Effects of pH, temperature and dissolved oxygen. KSCE Journal of Civil Engineering, 18(1):323-329.

Appendix A

Internal Loading Calculations

Upper Dam Pond		From F&O GIS Technician			
Sediment Slices	Volume (ft^3)	Area (ft^2)			
0-2	1,475,976	926,533			
2-3	456,452	539,898			
3-Bottom	352,177	375,674			
4 ft Contour	N/A	185,828		ft3	L3
Total	2,284,605		Total Vol	2,284,605	64,692,809

Method 4 Calcs

RR	0.068204	mg/m2-day		
Days Anoxic	39.93962923	days		
Anoxic Factor	21.2555602	days-m2/m2	lbs	
Lp Summer	0.124791401	kg		0.275117992

IF anoxic threshold = 2mg/L				Recalculated (corrected) volumes and areas						
Sampling Date	Area (ft^2)	Anoxic Volume (ft^3)	Total Volume (ft^3)	Anoxic Vol (ft3)	Anoxic Vol (L)	EpVol (L)	ANOXIA z	Area (ft2)	Area(m2)	% Anox
4/30/2018				0	0	64,692,809		926,533	86077.7	0
5/21/2018				9539.171	270,119	64,422,690	0.051333			0.4%
6/11/2018				14308.76	405,179	64,287,630	0.077			0.6%
7/16/2018	539,897	808,629	3,980,640	606,097	17,162,760	47,530,049	2.55ft	457,786	42529.69	26.5%
8/27/2018	539,897	808,629	3,980,640	770,836	21,827,649	42,865,161	2.07 ft	528,401	49090.07	33.7%
9/24/2018	375,675	352,177	3,980,640	28,688	812,357	63,880,452	0.154 Ft	185,828	17263.98	1.3%

IF anoxic threshold = 3mg/L			
Sampling Date	Area (ft^2)	Anoxic Volume (ft^3)	Total Volume (ft^3)
7/16/2018	539,897	808,629	3,980,640
8/27/2018	737,821	1,445,664	3,980,640

		Original Volume					Corrected Volume		
		ft3	Mil Gal	Mil L	Mil m3	m3	ft3	m3	L
	Lake volume	3,980,640	29.77519	112.7114	0.112711	112719.17	2,284,605	64692.809	64692809
		ft2	m2	hectares	m2	ft2	km2		
	Lake Area	926,533	86077.7	8.3	83000		0.08608		
		m	ft						
Calculated	Mean z	1.309505	4.296276		1.358062				
		0.751563	2.465758						
	Used for calcs	0.779431	2.55719						
		0.765497	2.511474	Averages of above					

<u>Method 2 Calcs</u>

	TP Diff mg/L	Kg P	Lbs P
4/30/2018	0		
5/21/2018	0.076	8.57E-05	0.000189
6/11/2018	0.4067	0.001032	0.002275
7/16/2018	0.2099	0.95572	2.10698
8/27/2018	0.21	1.546597	3.409628
9/24/2018	0.6182	0.006306	0.013903
		2.509741	5.532975

TP	Anox	2ft	Surface	RIWW	Sampled @ 1m depth
4/30/2018			ND 100		
5/21/2018	90.2	20.65	14.2	13.8	
6/11/2018	417.3	31.8	10.6		
7/16/2018	224.3	28.5	14.4	27	
8/27/2018	224.4	46.8	14.4		
9/24/2018	634.5	49.7	16.3		
				20.2	Late October
Seasonal Average	239.05	31.9375	13.4		

Check using historical RI data   Fall - Spring (net range by differe

	Average	2004	2005	2006	2007	2008
Dif	6.4		12		43	
ug	414033977.6		7.76E+08		2.78E+09	
Kg	0.414033978		0.776314		2.781791	
Lbs	0.91278883		1.711479		6.1328	

<u>Method 3 calcs</u>

		Kg TP	Monthly Kg diff	Monthly LBS diff
	4/30/2018	0.918638		
	5/21/2018	1.14693	0.228292	0.503298
	6/11/2018	1.531979	0.385049	0.848887
	7/16/2018	4.869127	3.337148	7.357153
	8/27/2018	6.209798	1.340672	2.955675
	9/24/2018	2.623496	-3.5863	-7.90645
Net			1.704858	3.758569
Gross			5.29116	11.66501
Percent resequestered			67.8%	

Note this is high but we didi see a large reduction in dissolved Iron between August and September that could account for most of this.

Appendix B

Field and Laboratory Data

Sampling Date	Sample Time	Sample Location	Sample Depth (ft)	Temperature C	pH (su)	DO (mg/L)	DO (%)	Specific Conductivity (us/cm)	ORP (mV)	Instrument	Secchi Disk Depth (ft)	Notes
4/30/2018	11:33	N 313484 E 226822	1	14.22	6.76	9.47	92.5%					No specific conductivity/ORP listed
4/30/2018	11:33	N 313484 E 226822	2	14.26		9.3	91.7%					No specific conductivity/ORP/pH listed
4/30/2018	11:33	N 313484 E 226822	3	14.21		9.29	91.7%					No specific conductivity/ORP/pH listed
4/30/2018	11:33	N 313484 E 226822	4	14.27		9.17	89.9%					No specific conductivity/ORP/pH listed
5/21/2018	10:30	N 313484 E 226822	0	19.59	7.01	10.08	110.0%	355	78.1	RI Insitu	3	
5/21/2018	10:30	N 313484 E 226822	1	19.81	7.07	9.9	108.6%	350.8	77.8	RI Insitu		
5/21/2018	10:30	N 313484 E 226822	2	19.33	7.08	9.48	104.1%	350.4	77.7	RI Insitu		
5/21/2018	10:30	N 313484 E 226822	3	18.47	6.99	7.42	75.0%	352.3	41	RI Insitu		Probe entered vegetation
5/21/2018	10:30	N 313484 E 226822	4	17.72	5.77	5.72	54.1%	364.5	53.5	RI Insitu		
6/11/2018	10:00	N 313484 E 226822	0	21.37	6.55	7.86	89.1%	364.1	115.9	RI Insitu	2.8	
6/11/2018	10:00	N 313484 E 226822	1	21.23	6.89	7.97	90.0%	365.3	87.9	RI Insitu		
6/11/2018	10:00	N 313484 E 226822	2	21.2	6.84	8.02	90.6%	365.2	88.5	RI Insitu		
6/11/2018	10:00	N 313484 E 226822	3	21.04	6.78	7.83	79.3%	363.8	91.7	RI Insitu		Vegetation covers meter
6/11/2018	10:00	N 313484 E 226822	4	20.72	6.43	3.02	27.5%	411.1	-11.3	RI Insitu		
7/16/2018	9:25	N 313484 E 226822	0	27.08	6.65	7.37	93.4%	395.9	91.3	RI Insitu	2.1	
7/16/2018	9:25	N 313484 E 226822	1	26.81	6.69	7.18	90.5%	392.2	88.8	RI Insitu		
7/16/2018	9:25	N 313484 E 226822	2	26.27	6.63	4.08	41.0%	393.4	32	RI Insitu		
7/16/2018	9:25	N 313484 E 226822	3	25.09	6.17	0.33	3.7%	400.4	-101.1	RI Insitu		Secchi disk lost in vegetation
7/16/2018	9:25	N 313484 E 226822	4	24.93	6.05	1.54	18.7%	401.3	-95.8	RI Insitu		
8/27/2018	8:10	N 313484 E 226822	0	23.45	6.43	4.33	50.1%	275	170.3	YSI 556 MPS #	1.5	
8/27/2018	8:10	N 313484 E 226822	1	23.39	6.39	3.96	46.0%	275	174.5	YSI 556 MPS #2		
8/27/2018	8:10	N 313484 E 226822	2	22.98	6.2	2.13	24.9%	272	170.4	YSI 556 MPS #2		Secchi disk lost in vegetation
8/27/2018	8:10	N 313484 E 226822	3	22.3	6.08	0.35	4.1%	269	53.4	YSI 556 MPS #2		
8/27/2018	8:10	N 313484 E 226822	4	21.97	6.06	0.05	0.5%	274	-103.8	YSI 556 MPS #2		
9/24/2018	7:50	N 313484 E 226822	0	17.2	6.6	3.81	40.80%	249.7	123.2	YSI ProPlus #	2.75	
9/24/2018	7:50	N 313484 E 226822	1	17.2	6.52	3.61	38.20%	249.6	145.3	YSI ProPlus #2		
9/24/2018	7:50	N 313484 E 226822	2	17.2	6.5	3.43	36.10%	249.2	162.8	YSI ProPlus #2		
9/24/2018	7:50	N 313484 E 226822	3	17.2	6.48	3.22	34.10%	248.8	167.4	YSI ProPlus #2		Secchi disk lost in vegetation
9/24/2018	7:50	N 313484 E 226822	4	17.2	6.45	2.77	28.90%	248.9	-48.3	YSI ProPlus #2		

Sample ID	Sampling Date	Sample Time	Sample Location	Sample Depth (in)	Total Phosphorus (mg/L) - NET Lab	TP- NET Lab Method	TP- NET Lab Detection Limit	Total Phosphorus (µg/L) - NH Lab	TP - NH Lab Method	TP - NH Lab Detection Limit	Alkalinity as CaCO3 (mg/L)	Alkalinity Method	Alkalinity Detection Limit	Turbidity (NTU)	Turbidity Method	Turbidity Detection Limit	Total Iron (mg/L)	Total Iron Method	Total Iron Detection Limit
1391180430-01	4/30/2018	11:33	N 313484 E 226822	24	ND	SM4500-P-E	0.1				10	SM2320-B	2	4.4	SM2130-B	0.1			
1391180430-01D	4/30/2018	11:33	N 313484 E 226822	24	ND	SM4500-P-E	0.1				22	SM2320-B	2	2.6	SM2130-B	0.1			
790180521-01	5/21/2018	10:50	N 313484 E 226822	0-6	0.02	SM4500-P-E	0.02	14.2		0.8	16	SM2320-B	2	0.6	SM2130-B	0.1			
790180521-02	5/21/2018	11:10	N 313484 E 226822	24	ND	SM4500-P-E	0.02	21.2		0.8	20	SM2320-B	2	1.1	SM2130-B	0.1			
790180521-03	5/21/2018	11:20	N 313484 E 226822	42-48	ND	SM4500-P-E	0.02	20.1		0.8	15	SM2320-B	2	13	SM2130-B	0.1			
790180521-04(D)	5/21/2018	10:55	N 313484 E 226822	0-6	ND	SM4500-P-E	0.02	90.2		0.8	17	SM2320-B	2	0.6	SM2130-B	0.1			
790180611-01	6/11/2018	10:00	N 313484 E 226822	0-6	ND	SM4500-P-E	0.02	10.6		0.8	20	SM2320-B	2	1.3	SM2130-B	0.1	0.13	EPA 6010C	0.01
790180611-02	6/11/2018	10:10	N 313484 E 226822	24	ND	SM4500-P-E	0.05	33.7		0.8	22	SM2320-B	2	2.6	SM2130-B	0.1	0.94	EPA 6010C	0.01
790180611-02D	6/11/2018	10:20	N 313484 E 226822	24	0.06	SM4500-P-E	0.05	29.9		0.8	20	SM2320-B	2	13	SM2130-B	0.1	0.4	EPA 6010C	0.01
790180611-03	6/11/2018	10:30	N 313484 E 226822	45-50	ND	SM4500-P-E	0.1	417.3		0.8	20	SM2320-B	2	11	SM2130-B	0.1	6.26	EPA 6010C	0.01
790180716-01	7/16/2018	10:00	N 313484 E 226822	0-6	ND	SM4500-P-E	0.02	14.4		0.8	20	SM2320-B	2	1.9	SM2130-B	0.1	0.42	EPA 6010C	0.01
790180716-02	7/16/2018	10:10	N 313484 E 226822	24	0.1	SM4500-P-E	0.02	28.5		0.8	23	SM2320-B	2	5	SM2130-B	0.1	0.59	EPA 6010C	0.01
790180716-03	7/16/2018	10:20	N 313484 E 226822	36-48	ND	SM4500-P-E	0.02	296.9		0.8	18	SM2320-B	2	20	SM2130-B	0.1	3.95	EPA 6010C	0.01
790180716-04 (D)	7/16/2018	10:30	N 313484 E 226822	36-48	0.22	SM4500-P-E	0.02	151.7		0.8	21	SM2320-B	2	6.6	SM2130-B	0.1	1.94	EPA 6010C	0.01
790180827-01	8/27/2018	8:40	N 313484 E 226822	0-6				14.4		0.8	20	SM2320-B	2	1	SM2130-B	0.1		EPA 6010C	0.01
790180827-02	8/27/2018	8:45	N 313484 E 226822	24				46.8		0.8	21	SM2320-B	4	2.5	SM2130-B	0.1	1.04	EPA 6010C	0.01
790180827-03	8/27/2018	8:50	N 313484 E 226822	42-48				224.4		0.8	18	SM2320-B	4	11.6	SM2130-B	0.1	1.28	EPA 6010C	0.01
790180827-04 (D)	8/27/2018	8:55	N 313484 E 226822	42-48				21.1		0.8	18	SM2320-B	4	1.9	SM2130-B	0.1	1.59	EPA 6010C	0.01
790180924-01	9/24/2018	8:25	N 313484 E 226822	0-6				16.3		0.8	13	SM2320-B	10	0.8	SM2130-B	0.1			
790180924-02	9/24/2018	8:30	N 313484 E 226822	24				49.7		0.8	13	SM2320-B	10	1.6	SM2130-B	0.1			
790180924-03	9/24/2018	8:35	N 313484 E 226822	42-48				83.2		0.8	13	SM2320-B	10	2.5	SM2130-B	0.1	4.37	EPA 200.7	0.012
790180924-04 (D)	9/24/2018	8:40	N 313484 E 226822	42-48				1186.3		0.8	13	SM2320-B	10	2.3	SM2130-B	0.1	3.89	EPA 200.7	0.012

New England Testing Laboratory, Inc.
(401) 353-3420

REPORT OF ANALYTICAL RESULTS

NETLAB Work Order Number: 8D30040
Client Project: 2002514.T30 - Upper Dam

Report Date: 07-May-2018

Prepared for:

Adam Finkleman
Fuss & O'Neill
317 Iron Horse Way
Providence, RI 02908

Richard Warila, Laboratory Director
New England Testing Laboratory, Inc.
59 Greenhill Street
West Warwick, RI 02893
rich.warila@newenglandtesting.com

Samples Submitted:

The samples listed below were submitted to New England Testing Laboratory on 04/30/18. The group of samples appearing in this report was assigned an internal identification number (case number) for laboratory information management purposes. The client's designations for the individual samples, along with our case numbers, are used to identify the samples in this report. This report of analytical results pertains only to the sample(s) provided to us by the client which are indicated on the custody record. The case number for this sample submission is 8D30040. Custody records are included in this report.

Lab ID	Sample	Matrix	Date Sampled	Date Received
8D30040-01	1391180430-01	Water	04/30/2018	04/30/2018
8D30040-02	1391180430-01D	Water	04/30/2018	04/30/2018

Request for Analysis

At the client's request, the analyses presented in the following table were performed on the samples submitted.

1391180430-01 (Lab Number: 8D30040-01)

Analysis	**Method**
Alkalinity (CaCO3)	SM2320-B
Total Phosphorous	SM4500-P-E
Turbidity	SM2130-B

1391180430-01D (Lab Number: 8D30040-02)

Analysis	**Method**
Alkalinity (CaCO3)	SM2320-B
Total Phosphorous	SM4500-P-E
Turbidity	SM2130-B

Method References

Standard Methods for the Examination of Water and Wastewater, 20th Edition, APHA/ AWWA-WPCF, 1998

Case Narrative

Sample Receipt

The samples were all appropriately cooled and preserved upon receipt. The samples were received in the appropriate containers. The chain of custody was adequately completed and corresponded to the samples submitted.

Wet Chemistry

All samples were analyzed within method specified holding times and according to NETLAB's documented standard operating procedures.

Results: General Chemistry

Sample: 1391180430-01

Lab Number: 8D30040-01 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**10**		2	mg/L	05/01/18	05/01/18
Total Phosphorous	ND		0.10	mg/L	05/01/18	05/01/18
Turbidity	**4.4**		0.1	NTU	04/30/18 17:00	04/30/18 17:00

Results: General Chemistry

Sample: 1391180430-01D

Lab Number: 8D30040-02 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**22**		2	mg/L	05/01/18	05/01/18
Total Phosphorous	ND		0.10	mg/L	05/01/18	05/01/18
Turbidity	**2.6**		0.1	NTU	04/30/18 17:00	04/30/18 17:00

Notes and Definitions

Item	Definition
Wet	Sample results reported on a wet weight basis.
ND	Analyte NOT DETECTED at or above the reporting limit.

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☐ 78 Interstate Drive, West Springfield,
☒ 317 Iron Horse Way, Suite 204, Provi
☐ 80 Washington Street, Suite 301, Poug

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CHAIN-OF-CUSTODY RECORD 35099

☐ 24-Hour* ☐ 72-Hour* ☐ Other ______ (days)
☐ 48-Hour* ☒ Standard (____ days) *Surcharge Applies

PROJECT NAME	PROJECT LOCATION	PROJECT NUMBER	LABORATORY
UPPER DAM		2002514.T30	NET

REPORT TO: STEFAN BENGTSON
INVOICE TO: SAME
P.O. NO.:
Sampler's Signature: [signature] Date: 4/30/18

Source Codes:
MW=Monitoring Well, SW=Surface Water, PW=Potable Water, ST=Stormwater, T=Treatment Facility, W=Waste, A=Air, S=Soil, C=Concrete, B=Sediment, X=Other ______

Analysis Request / Containers

Item No.	Transfer Check 1	2	3	4	Sample Number	Source Code	Date Sampled	Time Sampled	TOT PHOS	ALKALINITY	TURBIDITY	Soil VOA Vial, ☐ methanol	Soil VOA Vial, ☐ water	Glass Soil Container ( ) oz	Other: ☐ $Na(SO_4)_2$	Other:	Water VOA Vial, ☐ As is ☐ HCl	Glass Amber ( ) ml, ☐ As is ☐ H_2SO_4	Plastic - As is, ☐ 250 ml ☐ 500 ☐ 1000 ml	Plastic - H_2SO_4, ☐ 250 ml ☒ 500 ml TOT	Plastic - HNO_3, 250 ml ☐ Filtered ☐ 0.45µ pH<2	Plastic - NaOH, 250 ml ☐ 10µ	Comments
1					1391180430-01	SW	4/30/18	1133	1	1	1								1	1			
2					↓ -01D	SW	4/30/18	1133	1	1	1								1	1			

Transfer Number	Relinquished By	Accepted By	Date	Time
1	[signature]	[signature]	4/30/18	14:34
2				
3				
4				

Charge Exceptions: ☐ CT Tax Exempt ☐ QA/QC ☐ Other ______
____ Duplicates ____ Blanks (Item Nos:)

Reporting and Detection Limit Requirements: ☐ RCP Deliverables ☐ MCP CAM Cert.

Additional Comments:

New England Testing Laboratory, Inc.
(401) 353-3420

REPORT OF ANALYTICAL RESULTS

NETLAB Work Order Number: 8E21027
Client Project: 2002514.T30 - Upper Dam

Report Date: 24-May-2018

Prepared for:

Stefan Bengston
Fuss & O'Neill
317 Iron Horse Way
Providence, RI 02908

Richard Warila, Laboratory Director
New England Testing Laboratory, Inc.
59 Greenhill Street
West Warwick, RI 02893
rich.warila@newenglandtesting.com

Samples Submitted:

The samples listed below were submitted to New England Testing Laboratory on 05/21/18. The group of samples appearing in this report was assigned an internal identification number (case number) for laboratory information management purposes. The client's designations for the individual samples, along with our case numbers, are used to identify the samples in this report. This report of analytical results pertains only to the sample(s) provided to us by the client which are indicated on the custody record. The case number for this sample submission is 8E21027. Custody records are included in this report.

Lab ID	Sample	Matrix	Date Sampled	Date Received
8E21027-01	790180521-01	Water	05/21/2018	05/21/2018
8E21027-02	790180521-02	Water	05/21/2018	05/21/2018
8E21027-03	790180521-03	Water	05/21/2018	05/21/2018
8E21027-04	790180521-04	Water	05/21/2018	05/21/2018
8E21027-05	790180521-05	Water	05/21/2018	05/21/2018

Request for Analysis

At the client's request, the analyses presented in the following table were performed on the samples submitted.

790180521-01 (Lab Number: 8E21027-01)

Analysis	**Method**
Alkalinity (CaCO3)	SM2320-B
Total Phosphorous	SM4500-P-E
Turbidity	SM2130-B

790180521-02 (Lab Number: 8E21027-02)

Analysis	**Method**
Alkalinity (CaCO3)	SM2320-B
Total Phosphorous	SM4500-P-E
Turbidity	SM2130-B

790180521-03 (Lab Number: 8E21027-03)

Analysis	**Method**
Alkalinity (CaCO3)	SM2320-B
Total Phosphorous	SM4500-P-E
Turbidity	SM2130-B

790180521-04 (Lab Number: 8E21027-04)

Analysis	**Method**
Alkalinity (CaCO3)	SM2320-B
Total Phosphorous	SM4500-P-E
Turbidity	SM2130-B

790180521-05 (Lab Number: 8E21027-05)

Analysis	**Method**
Total Phosphorous	SM4500-P-E

Method References

Standard Methods for the Examination of Water and Wastewater, 20th Edition, APHA/ AWWA-WPCF, 1998

Case Narrative

Sample Receipt

The samples were all appropriately cooled and preserved upon receipt. The samples were received in the appropriate containers. The chain of custody was adequately completed and corresponded to the samples submitted.

Wet Chemistry

All samples were analyzed within method specified holding times and according to NETLAB's documented standard operating procedures.

Results: General Chemistry

Sample: 790180521-01

Lab Number: 8E21027-01 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**16**		2	mg/L	05/22/18	05/22/18
Total Phosphorous	**0.02**		0.02	mg/L	05/23/18	05/23/18
Turbidity	**0.6**		0.1	NTU	05/21/18 15:30	05/21/18 15:30

Results: General Chemistry

Sample: 790180521-02

Lab Number: 8E21027-02 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**20**		2	mg/L	05/22/18	05/22/18
Total Phosphorous	ND		0.02	mg/L	05/23/18	05/23/18
Turbidity	**1.1**		0.1	NTU	05/21/18 15:35	05/21/18 15:35

Results: General Chemistry

Sample: 790180521-03

Lab Number: 8E21027-03 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**15**		2	mg/L	05/22/18	05/22/18
Total Phosphorous	ND		0.02	mg/L	05/23/18	05/23/18
Turbidity	**13.0**		0.1	NTU	05/21/18 15:35	05/21/18 15:35

Results: General Chemistry

Sample: 790180521-04

Lab Number: 8E21027-04 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**17**		2	mg/L	05/22/18	05/22/18
Total Phosphorous	ND		0.02	mg/L	05/23/18	05/23/18
Turbidity	**0.6**		0.1	NTU	05/21/18 15:35	05/21/18 15:35

Results: General Chemistry

Sample: 790180521-05
Lab Number: 8E21027-05 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Total Phosphorous	ND		0.02	mg/L	05/23/18	05/23/18

Notes and Definitions

Item	Definition
Wet	Sample results reported on a wet weight basis.
ND	Analyte NOT DETECTED at or above the reporting limit.

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☐ 80 Washington Street, Suite 301, Poughkee

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CHAIN-OF-CUSTODY RECORD 33653

☐ 24-Hour* ☐ 72-Hour* ☐ Other ____ (days)
☐ 48-Hour* ☒ Standard (____ days) *Surcharge Applies

PROJECT NAME: Upper Dam Pond
PROJECT LOCATION: Coventry, RI
PROJECT NUMBER: 2002514. T30
LABORATORY: NET

REPORT TO: Stefan Bengtson, F+O
INVOICE TO: ↓
P.O. NO.: 2002514. T30
Sampler's Signature: [signature] Date: 5/21/18

Source Codes:
MW=Monitoring Well
SW=Surface Water
PW=Potable Water
ST=Stormwater
T=Treatment Facility
W=Waste
A=Air
S=Soil
C=Concrete
B=Sediment
X=Other ____

Analysis Request: pH<2; Total Phosphorus; Alkalinity; Turbidity

Containers: Soil VOA Vial, ☐ methanol; Soil VOA Vial, ☐ water; Glass Soil Container ( ) oz ☐ $Na(SO_4)_2$; Other:; Other:; Water VOA Vial, ☐ As is ☐ HCl; Glass Amber ( ) ml, ☐ As is ☐ 500 ☐ H_2SO_4 ☑ 1000 ml; Plastic - As is, ☐ 250 ml ☑ 500 ml; Plastic - H_2SO_4, ☐ 250 ml (None); Plastic - HNO_3, 250 ml ☐ Filtered ☐ 0.45μ ☐ 10μ (Some); Plastic - NaOH, 250 ml

Item No.	Transfer Check 1	2	3	4	Sample Number	Source Code	Date Sampled	Time Sampled	Total Phosphorus	Alkalinity	Turbidity	Comments
1					790180521-01	SW	5/21/18	1050	✓	✓	✓	Top
2					-02	↓	↓	1110 ~~1035~~	↓	↓	↓	Mid
3					-03	↓	↓	1120 ~~1110~~	↓	↓	↓	Bottom
4					-04	↓	↓	1055 ~~1120~~	↓	↓	↓	duplicate -01
5					" " -05	SW	5/21/18	4:25	✓ added CLB 5/21/18			duplicate-02

Containers: items 1–4: 1 (Glass Amber), 1 (Plastic - As is), ~~Plastic - H_2SO_4~~; item 5: ✓

Transfer Number	Relinquished By	Accepted By	Date	Time
1	K. Connell	Celicia Boyden	5/21/18	1:46
2	Celicia Boyden	[signature]	5/21/18	14:21
3				
4				

Charge Exceptions: ☐ CT Tax Exempt ☐ QA/QC ☐ Other ____
1 Duplicates ____ Blanks (Item Nos: -04)

Reporting and Detection Limit Requirements: ☐ RCP Deliverables ☐ MCP CAM Cert.

Additional Comments:

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New England Testing Laboratory, Inc.
(401) 353-3420

REPORT OF ANALYTICAL RESULTS

NETLAB Work Order Number: 8F13002
Client Project: 2002514.T30 - Upper Dam

Report Date: 20-June-2018

Prepared for:

Stefan Bengtson
Fuss & O'Neill
317 Iron Horse Way
Providence, RI 02908

Richard Warila, Laboratory Director
New England Testing Laboratory, Inc.
59 Greenhill Street
West Warwick, RI 02893
rich.warila@newenglandtesting.com

Samples Submitted :

The samples listed below were submitted to New England Testing Laboratory on 06/13/18. The group of samples appearing in this report was assigned an internal identification number (case number) for laboratory information management purposes. The client's designations for the individual samples, along with our case numbers, are used to identify the samples in this report. This report of analytical results pertains only to the sample(s) provided to us by the client which are indicated on the custody record. The case number for this sample submission is 8F13002. Custody records are included in this report.

Lab ID	Sample	Matrix	Date Sampled	Date Received
8F13002-01	790180611-01	Water	06/11/2018	06/13/2018
8F13002-02	790180611-02	Water	06/11/2018	06/13/2018
8F13002-03	790180611-02D	Water	06/11/2018	06/13/2018
8F13002-04	790180611-03	Water	06/11/2018	06/13/2018

SB:
-01 = TOP
-02 = MID
-03 = BOT

Request for Analysis

At the client's request, the analyses presented in the following table were performed on the samples submitted.

790180611-01 (Lab Number: 8F13002-01)

Analysis	Method
Alkalinity (CaCO3)	SM2320-B
Iron	EPA 6010C
Total Phosphorous	SM4500-P-E
Turbidity	SM2130-B

790180611-02 (Lab Number: 8F13002-02)

Analysis	Method
Alkalinity (CaCO3)	SM2320-B
Iron	EPA 6010C
Total Phosphorous	SM4500-P-E
Turbidity	SM2130-B

790180611-02D (Lab Number: 8F13002-03)

Analysis	Method
Alkalinity (CaCO3)	SM2320-B
Iron	EPA 6010C
Total Phosphorous	SM4500-P-E
Turbidity	SM2130-B

790180611-03 (Lab Number: 8F13002-04)

Analysis	Method
Alkalinity (CaCO3)	SM2320-B
Iron	EPA 6010C
Total Phosphorous	SM4500-P-E
Turbidity	SM2130-B

Method References

Standard Methods for the Examination of Water and Wastewater, 20th Edition, APHA/ AWWA-WPCF, 1998

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, USEPA

Case Narrative

Sample Receipt

The samples were all appropriately cooled and preserved upon receipt. The samples were received in the appropriate containers. The chain of custody was adequately completed and corresponded to the samples submitted.

Metals

All analyses were performed according to NETLAB's documented Standard Operating Procedures, within all required holding times, and with appropriate quality control measures. All QC was within laboratory established acceptance criteria. The samples were received, processed, and reported with no anomalies.

Wet Chemistry

All samples were analyzed within method specified holding times and according to NETLAB's documented standard operating procedures.

Results: General Chemistry

Sample: 790180611-01
Lab Number: 8F13002-01 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**20**		2	mg/L	06/14/18	06/14/18
Total Phosphorous	ND		0.02	mg/L	06/19/18	06/19/18
Turbidity	**1.3**		0.1	NTU	06/13/18 14:20	06/13/18 14:20

Results: General Chemistry

Sample: 790180611-02

Lab Number: 8F13002-02 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**22**		2	mg/L	06/14/18	06/14/18
Total Phosphorous	ND		0.05	mg/L	06/19/18	06/19/18
Turbidity	**2.6**		0.1	NTU	06/13/18 14:20	06/13/18 14:20

Results: General Chemistry

Sample: 790180611-02D

Lab Number: 8F13002-03 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**20**		2	mg/L	06/14/18	06/14/18
Total Phosphorous	**0.06**		0.05	mg/L	06/19/18	06/19/18
Turbidity	**13.0**		0.1	NTU	06/13/18 14:20	06/13/18 14:20

Results: General Chemistry

Sample: 790180611-03
Lab Number: 8F13002-04 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**20**		2	mg/L	06/14/18	06/14/18
Total Phosphorous	ND		0.10	mg/L	06/19/18	06/19/18
Turbidity	**11.0**		0.1	NTU	06/13/18 14:20	06/13/18 14:20

Results: Total Metals

Sample: 790180611-01
Lab Number: 8F13002-01 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Iron	**0.13**		0.01	mg/L	06/18/18	06/18/18

Results: Total Metals

Sample: 790180611-02

Lab Number: 8F13002-02 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Iron	**0.94**		0.01	mg/L	06/18/18	06/18/18

Results: Total Metals

Sample: 790180611-02D

Lab Number: 8F13002-03 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Iron	**0.40**		0.01	mg/L	06/18/18	06/18/18

Results: Total Metals

Sample: 790180611-03

Lab Number: 8F13002-04 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Iron	**6.26**		0.01	mg/L	06/18/18	06/18/18

Quality Control

General Chemistry

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: B8F0486 - Turbidity										
Blank (B8F0486-BLK1)					Prepared & Analyzed: 06/13/18					
Turbidity	0.1		0.1	NTU						
Blank (B8F0486-BLK2)					Prepared & Analyzed: 06/13/18					
Turbidity	0.1		0.1	NTU						
Duplicate (B8F0486-DUP1)		**Source: 8F12086-01**			Prepared & Analyzed: 06/13/18					
Turbidity	1.6		0.1	NTU		1.8			11.8	200
Batch: B8F0510 - Alkalinity										
Blank (B8F0510-BLK1)					Prepared & Analyzed: 06/14/18					
Alkalinity as CaCO3	ND		2	mg/L						
LCS (B8F0510-BS1)					Prepared & Analyzed: 06/14/18					
Alkalinity as CaCO3	51		2	mg/L	50.0		102	90-110		
Duplicate (B8F0510-DUP1)		**Source: 8F12086-01**			Prepared & Analyzed: 06/14/18					
Alkalinity as CaCO3	34		2	mg/L		34			0.00	20
Matrix Spike (B8F0510-MS1)		**Source: 8F12086-01**			Prepared & Analyzed: 06/14/18					
Alkalinity as CaCO3	76		2	mg/L	50.0	34	85.5	80-120		
Batch: B8F0705 - Total phosphate										
Blank (B8F0705-BLK1)					Prepared & Analyzed: 06/19/18					
Total Phosphorous	ND		0.02	mg/L						

Quality Control
(Continued)

General Chemistry (Continued)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: B8F0705 - Total phosphate (Continued)										
Blank (B8F0705-BLK2)					Prepared & Analyzed: 06/19/18					
Total Phosphorous	ND		0.02	mg/L						
LCS (B8F0705-BS1)					Prepared & Analyzed: 06/19/18					
Total Phosphorous	1.02		0.02	mg/L	1.00		102	90-110		
LCS (B8F0705-BS2)					Prepared & Analyzed: 06/19/18					
Total Phosphorous	1.04		0.02	mg/L	1.00		104	90-110		
Duplicate (B8F0705-DUP1)		**Source: 8F12014-01**			Prepared & Analyzed: 06/19/18					
Total Phosphorous	0.02		0.02	mg/L		0.02			4.08	20
Matrix Spike (B8F0705-MS1)		**Source: 8F12014-01**			Prepared & Analyzed: 06/19/18					
Total Phosphorous	1.28		0.02	mg/L	1.00	0.02	125	80-120		

Quality Control
(Continued)

Total Metals

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: B8F0629 - Hot plate acid digestion waters										
Blank (B8F0629-BLK1)					Prepared & Analyzed: 06/18/18					
Iron	ND		0.05	mg/L						
LCS (B8F0629-BS1)					Prepared & Analyzed: 06/18/18					
Iron	10.1		0.05	mg/L	10.0		101	85-115		

Notes and Definitions

Item	Definition
Wet	Sample results reported on a wet weight basis.
ND	Analyte NOT DETECTED at or above the reporting limit.

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☑ 317 Iron Horse Way, Suite 204, Pr
☐ 80 Washington Street, Suite 301, P

8F1 3002 |

CHAIN-OF-CUSTODY RECORD 37575

☐ 24-Hour* ☐ 72-Hour* ☐ Other ____ (days)
☐ 48-Hour* ☑ Standard (____ days) *Surcharge Applies

PROJECT NAME	PROJECT LOCATION	PROJECT NUMBER	LABORATORY
Upper Dam Pond	Coventry, RI	2002514.T30	NET

REPORT TO: Stefan Bengtson, F+O

INVOICE TO: ↓

P.O. NO.: 2002514.T30

Sampler's Signature: [signature] Date: 6/11/18

Source Codes:
MW=Monitoring Well PW=Potable Water T=Treatment Facility S=Soil B=Sediment
SW=Surface Water ST=Stormwater W=Waste A=Air C=Concrete
X=Other ______

Analysis Request: Total Phosphorus, Alkalinity, Turbidity, Total Iron

Containers: Soil VOA Vial, ☐ methanol; Soil VOA Vial, ☐ water; Glass Soil Container ( ) oz ☐ $Na_2(SO_4)_2$; Other:; Other:; Water VOA Vial, ☐ As is ☐ HCl; Glass Amber ( ) ml, ☐ As is ☐ H_2SO_4; Plastic - As is, ☐ 250 ml ☐ 500 ☑ 1000 ml; Plastic - H_2SO_4, ☐ 250 ml ☑ 500 ml; Plastic - HNO_3, ~~250 ml~~ ☐ Filtered ☐ 0.45μ 500 ml – pH<2; Plastic - NaOH, 250 ml

Item No.	Transfer Check 1	2	3	4	Sample Number	Source Code	Date Sampled	Time Sampled	Total Phosphorus	Alkalinity	Turbidity	Total Iron	Plastic - As is	Plastic - H_2SO_4	Plastic - HNO_3	Comments
1					790180611-01 •••	SW	6/11/18	1000				↑ HOLD	1	1	1	
2					-02 •••	↓	↓	1010					1	1	1	
3					-02D •••			1020					1	1	1	
4					-03 •••			1030					1	1	1	

* samples released for Fe analysis 6/15 per Stefan via email

Transfer Number	Relinquished By	Accepted By	Date	Time
1	K. Connell	Alex Klein	6/11/18	1105
2	Alex Klein	Fridge	6/11/18	1215
3	Fridge	NET [initials]	6/13/18	9:04
4				

Charge Exceptions: ☐ CT Tax Exempt ☐ QA/QC ☐ Other ______
____ Duplicates ____ Blanks (Item Nos:)

Reporting and Detection Limit Requirements: ☐ RCP Deliverables ☐ MCP CAM Cert.

Additional Comments:

New England Testing Laboratory, Inc.
(401) 353-3420

REPORT OF ANALYTICAL RESULTS

NETLAB Work Order Number: 8G16016
Client Project: 2002514.T30 - Upper Dam

Report Date: 20-July-2018

Prepared for:

Stefan Bengtson
Fuss & O'Neill
317 Iron Horse Way
Providence, RI 02908

DRAFT

Richard Warila, Laboratory Director
New England Testing Laboratory, Inc.
59 Greenhill Street
West Warwick, RI 02893
rich.warila@newenglandtesting.com

Samples Submitted :

The samples listed below were submitted to New England Testing Laboratory on 07/16/18. The group of samples appearing in this report was assigned an internal identification number (case number) for laboratory information management purposes. The client's designations for the individual samples, along with our case numbers, are used to identify the samples in this report. This report of analytical results pertains only to the sample(s) provided to us by the client which are indicated on the custody record. The case number for this sample submission is 8G16016. Custody records are included in this report.

Lab ID	Sample	Matrix	Date Sampled	Date Received
8G16016-01	790180716-01	Water	07/16/2018	07/16/2018
8G16016-02	790180716-02	Water	07/16/2018	07/16/2018
8G16016-03	790180716-03	Water	07/16/2018	07/16/2018
8G16016-04	790180716-04	Water	07/16/2018	07/16/2018

Request for Analysis

At the client's request, the analyses presented in the following table were performed on the samples submitted.

790180716-01 (Lab Number: 8G16016-01)

Analysis	**Method**
Alkalinity (CaCO3)	SM2320-B
Iron	EPA 6010C
Total Phosphorous	SM4500-P-E
Turbidity	SM2130-B

790180716-02 (Lab Number: 8G16016-02)

Analysis	**Method**
Alkalinity (CaCO3)	SM2320-B
Iron	EPA 6010C
Total Phosphorous	SM4500-P-E
Turbidity	SM2130-B

790180716-03 (Lab Number: 8G16016-03)

Analysis	**Method**
Alkalinity (CaCO3)	SM2320-B
Iron	EPA 6010C
Total Phosphorous	SM4500-P-E
Turbidity	SM2130-B

790180716-04 (Lab Number: 8G16016-04)

Analysis	**Method**
Alkalinity (CaCO3)	SM2320-B
Iron	EPA 6010C
Total Phosphorous	SM4500-P-E
Turbidity	SM2130-B

Method References

Standard Methods for the Examination of Water and Wastewater, 20th Edition, APHA/ AWWA-WPCF, 1998

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, USEPA

Case Narrative

Sample Receipt

The samples were all appropriately cooled and preserved upon receipt. The samples were received in the appropriate containers. The chain of custody was adequately completed and corresponded to the samples submitted.

Metals

All analyses were performed according to NETLAB's documented Standard Operating Procedures, within all required holding times, and with appropriate quality control measures. All QC was within laboratory established acceptance criteria. The samples were received, processed, and reported with no anomalies.

Wet Chemistry

All samples were analyzed within method specified holding times and according to NETLAB's documented standard operating procedures.

Results: General Chemistry

Sample: 790180716-01

Lab Number: 8G16016-01 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**20**		2	mg/L	07/17/18	07/17/18
Total Phosphorous	ND		0.02	mg/L	07/17/18	07/17/18
Turbidity	**1.9**		0.1	NTU	07/16/18 16:00	07/16/18 16:00

Results: General Chemistry

Sample: 790180716-02

Lab Number: 8G16016-02 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**23**		2	mg/L	07/17/18	07/17/18
Total Phosphorous	**0.10**		0.02	mg/L	07/17/18	07/17/18
Turbidity	**5.0**		0.1	NTU	07/16/18 16:00	07/16/18 16:00

Results: General Chemistry

Sample: 790180716-03
Lab Number: 8G16016-03 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**18**		2	mg/L	07/17/18	07/17/18
Total Phosphorous	ND		0.02	mg/L	07/17/18	07/17/18
Turbidity	**20.0**		0.1	NTU	07/16/18 16:05	07/16/18 16:05

Results: General Chemistry

Sample: 790180716-04
Lab Number: 8G16016-04 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**21**		2	mg/L	07/17/18	07/17/18
Total Phosphorous	**0.22**		0.02	mg/L	07/17/18	07/17/18
Turbidity	**6.6**		0.1	NTU	07/16/18 16:05	07/16/18 16:05

Results: Total Metals

Sample: 790180716-01
Lab Number: 8G16016-01 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Iron	**0.42**		0.01	mg/L	07/17/18	07/18/18

Results: Total Metals

Sample: 790180716-02

Lab Number: 8G16016-02 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Iron	**0.59**		0.01	mg/L	07/17/18	07/18/18

Results: Total Metals

Sample: 790180716-03
Lab Number: 8G16016-03 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Iron	**3.95**		0.01	mg/L	07/17/18	07/18/18

Results: Total Metals

Sample: 790180716-04

Lab Number: 8G16016-04 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Iron	**1.94**		0.01	mg/L	07/17/18	07/18/18

Quality Control

General Chemistry

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: B8G0510 - Turbidity										
Blank (B8G0510-BLK1)					Prepared & Analyzed: 07/16/18					
Turbidity	0.1		0.1	NTU						
Blank (B8G0510-BLK2)					Prepared & Analyzed: 07/16/18					
Turbidity	0.1		0.1	NTU						
LCS (B8G0510-BS1)					Prepared & Analyzed: 07/16/18					
Turbidity	1.0		0.1	NTU	1.00		100	90-110		
LCS (B8G0510-BS2)					Prepared & Analyzed: 07/16/18					
Turbidity	1.0		0.1	NTU	1.00		95.0	90-110		
Duplicate (B8G0510-DUP1)		**Source: 8G16016-01**			Prepared & Analyzed: 07/16/18					
Turbidity	1.7		0.1	NTU		1.9			11.1	20
Batch: B8G0559 - Total phosphate										
Blank (B8G0559-BLK1)					Prepared & Analyzed: 07/17/18					
Total Phosphorous	ND		0.02	mg/L						
Blank (B8G0559-BLK2)					Prepared & Analyzed: 07/17/18					
Total Phosphorous	ND		0.02	mg/L						
LCS (B8G0559-BS1)					Prepared & Analyzed: 07/17/18					
Total Phosphorous	1.09		0.02	mg/L	1.00		109	90-110		
LCS (B8G0559-BS2)					Prepared & Analyzed: 07/17/18					
Total Phosphorous	1.09		0.02	mg/L	1.00		109	90-110		

Quality Control
(Continued)

General Chemistry (Continued)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: B8G0559 - Total phosphate (Continued)										
Duplicate (B8G0559-DUP1)		**Source: 8G13020-01**			Prepared & Analyzed: 07/17/18					
Total Phosphorous	0.09		0.02	mg/L		0.08			8.00	20
Matrix Spike (B8G0559-MS1)		**Source: 8G13020-01**			Prepared & Analyzed: 07/17/18					
Total Phosphorous	1.14		0.02	mg/L	1.00	0.08	106	80-120		
Batch: B8G0572 - Alkalinity										
Blank (B8G0572-BLK1)					Prepared & Analyzed: 07/17/18					
Alkalinity as CaCO3	ND		2	mg/L						
LCS (B8G0572-BS1)					Prepared & Analyzed: 07/17/18					
Alkalinity as CaCO3	45		2	mg/L	50.0		90.8	90-110		
Duplicate (B8G0572-DUP1)		**Source: 8G03008-02**			Prepared & Analyzed: 07/17/18					
Alkalinity as CaCO3	29		2	mg/L		30			3.17	20
Matrix Spike (B8G0572-MS1)		**Source: 8G03008-02**			Prepared & Analyzed: 07/17/18					
Alkalinity as CaCO3	76		2	mg/L	50.0	30	90.8	80-120		

Quality Control
(Continued)

Total Metals

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: B8G0554 - Hot plate acid digestion waters										
Blank (B8G0554-BLK1)					Prepared: 07/17/18 Analyzed: 07/18/18					
Iron	ND		0.05	mg/L						
LCS (B8G0554-BS1)					Prepared: 07/17/18 Analyzed: 07/18/18					
Iron	11.4		0.05	mg/L	10.0		114	85-115		

Notes and Definitions

Item	Definition
Wet	Sample results reported on a wet weight basis.
ND	Analyte NOT DETECTED at or above the reporting limit.

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8 G 1 60163

CHAIN-OF-CUSTODY RECORD 40284

☐ 24-Hour* ☐ 72-Hour* ☐ Other ____ (days)
☐ 48-Hour* ☑ Standard (____ days) *Surcharge Applies

PROJECT NAME	PROJECT LOCATION	PROJECT NUMBER	LABORATORY
Upper Dam Pond	Coventry, RI	2002514.T30	NET

REPORT TO: Stefan Bengtson, FIO

INVOICE TO: ↓

P.O. NO.: 2002514.T30

Sampler's Signature: [signature] Date: 7/16/18

Source Codes:
MW=Monitoring Well PW=Potable Water T=Treatment Facility S=Soil B=Sediment
SW=Surface Water ST=Stormwater W=Waste A=Air C=Concrete
X=Other Field Blank

Analysis Request: Total Phosphorus; Alkalinity; Turbidity; Total Iron *

Containers: Soil VOA Vial, ☐ methanol; Soil VOA Vial, ☐ water; Glass Soil Container ( ) oz; ☐ Na(SO$_4$)$_2$; Other:; Other:; Water VOA Vial, ☐ As is ☐ HCl; Glass Amber ( ) ml, ☐ As is ☐ H$_2$SO$_4$; Plastic - As is, ☐ 250 ☐ 500 ☑ 1000 ml; Plastic - H$_2$SO$_4$, ☐ 250 ml ☑ 500 ml; Plastic - HNO$_3$, ~~250~~ 500 ml ☑ Filtered ☐ 0.45μ ☐ 10μ; Plastic - NaOH, 250 ml

Item No.	Transfer Check 1 2 3 4	Sample Number	Source Code	Date Sampled	Time Sampled	Total Phosphorus	Alkalinity	Turbidity	Total Iron *	Plastic - As is	Plastic - H$_2$SO$_4$	Plastic - HNO$_3$	Comments
1		790 180716-01	SW	7/16/18	1000	✓	✓	✓		1	1	1	
2		-02	↓	↓	1010	✓	✓	✓		1	1	1	
3		-03	↓	↓	1020	✓	✓	✓	✓	1	1	1	
4		-04	↓	↓	1030	✓	✓	✓	✓	1	1	1	duplicate
~~5~~		~~-05~~	~~X~~		~~1055~~	~~✓~~	~~✓~~	~~✓~~		1	1	1	

Cancelled per Stefan [initials] 7/16

Transfer Number	Relinquished By	Accepted By	Date	Time
1	K. Connell	A. KLEIN		
2	A. KLEIN	[signature]	7/16/18	11:41
3				
4				

Charge Exceptions: ☐ CT Tax Exempt ☐ QA/QC ☐ Other ____
____ Duplicates ____ Blanks (Item Nos:)

Reporting and Detection Limit Requirements: ☐ RCP Deliverables ☐ MCP CAM Cert.

Additional Comments:
* Hold iron analysis on -01, -02, -05 [initials]
Hold [illegible] for all per Stefan 7/17 [illegible]

DRAFT

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☑ 317 Iron Horse Way, Suite 204
☐ 80 Washington Street, Suite 30

8 G 1 60163

CHAIN-OF-CUSTODY RECORD 40284

☐ 24-Hour* ☐ 72-Hour* ☐ Other ____ (days)
☐ 48-Hour* ☑ Standard (____ days) *Surcharge Applies

PROJECT NAME	PROJECT LOCATION	PROJECT NUMBER	LABORATORY
Upper Dam Pond	Coventry, RI	2002514.T30	NET

REPORT TO: Stefan Bengtson, F&O
INVOICE TO: ↓
P.O. NO.: 2002514.T30
Sampler's Signature: [signature] Date: 7/16/18

Source Codes:
MW=Monitoring Well PW=Potable Water T=Treatment Facility S=Soil B=Sediment
SW=Surface Water ST=Stormwater W=Waste A=Air C=Concrete
X=Other Field Blank

Analysis Request: Total Phosphorus; Alkalinity; Turbidity; Total Iron *

Containers: Soil VOA Vial, ☐ methanol; Soil VOA Vial, ☐ water; Glass Soil Container ( ) oz ☐ $Na(SO_4)_2$; Other:; Other:; Water VOA Vial, ☐ As is ☐ HCl; Glass Amber ( ) ml, ☐ As is ☐ H_2SO_4; Plastic - As is, ☐ 250 ml ☐ 500 ☑ 1000 ml; Plastic - H_2SO_4, ☐ 250 ml ☑ 500 ml; Plastic - HNO_3, ☐ ~~250~~ 250 ml ☐ ~~Filtered~~ ☐ 0.45µ ☐ 10µ; Plastic - NaOH, 250 ml

Item No.	Transfer Check 1 2 3 4	Sample Number	Source Code	Date Sampled	Time Sampled	Total Phosphorus	Alkalinity	Turbidity	Total Iron *	Plastic - As is	Plastic - H_2SO_4	Plastic - HNO_3	Comments
1		790 180716-01	SW	7/16/18	1000	✓	✓	✓		1	1	1	
2		-02	↓	↓	1010	✓	✓	✓		1	1	1	
3		-03	↓	↓	1020	✓	✓	✓	✓	1	1	1	
4		-04	↓	↓	1030	✓	✓	✓	✓	1	1	1	duplicate
~~5~~		~~-05~~	~~X~~	↓	~~1055~~	~~✓~~	~~✓~~	~~✓~~		1	1	1	

Cancelled per Stefan gol 7/16

Transfer Number	Relinquished By	Accepted By	Date	Time
1	K. Connell	A. KLEIN		
2	A. KLEIN	[signature]	7/16/18	11:41
3				
4				

Charge Exceptions: ☐ CT Tax Exempt ☐ QA/QC ☐ Other ____
____ Duplicates ____ Blanks (Item Nos:)

Reporting and Detection Limit Requirements: ☐ RCP Deliverables ☐ MCP CAM Cert.

Additional Comments:
* Hold iron analysis on -01, -02, -05 gol

New England Testing Laboratory, Inc.
(401) 353-3420

REPORT OF ANALYTICAL RESULTS

NETLAB Work Order Number: 8H27016
Client Project: 2002514.T30 - Upper Dam

Report Date: 04-September-2018

Prepared for:

Stefan Bengtson
Fuss & O'Neill
317 Iron Horse Way
Providence, RI 02908

Richard Warila, Laboratory Director
New England Testing Laboratory, Inc.
59 Greenhill Street
West Warwick, RI 02893
rich.warila@newenglandtesting.com

Samples Submitted :

The samples listed below were submitted to New England Testing Laboratory on 08/27/18. The group of samples appearing in this report was assigned an internal identification number (case number) for laboratory information management purposes. The client's designations for the individual samples, along with our case numbers, are used to identify the samples in this report. This report of analytical results pertains only to the sample(s) provided to us by the client which are indicated on the custody record. The case number for this sample submission is 8H27016. Custody records are included in this report.

Lab ID	Sample	Matrix	Date Sampled	Date Received
8H27016-01	790180827-01	Water	08/27/2018	08/27/2018
8H27016-02	790180827-02	Water	08/27/2018	08/27/2018
8H27016-03	790180827-03	Water	08/27/2018	08/27/2018
8H27016-04	790180827-04	Water	08/27/2018	08/27/2018

Request for Analysis

At the client's request, the analyses presented in the following table were performed on the samples submitted.

790180827-01 (Lab Number: 8H27016-01)

Analysis	Method
Alkalinity (CaCO3)	SM2320-B
Turbidity	SM2130-B

790180827-02 (Lab Number: 8H27016-02)

Analysis	Method
Alkalinity (CaCO3)	SM2320-B
Iron	EPA 6010C
Turbidity	SM2130-B

790180827-03 (Lab Number: 8H27016-03)

Analysis	Method
Alkalinity (CaCO3)	SM2320-B
Iron	EPA 6010C
Turbidity	SM2130-B

790180827-04 (Lab Number: 8H27016-04)

Analysis	Method
Alkalinity (CaCO3)	SM2320-B
Iron	EPA 6010C
Turbidity	SM2130-B

Method References

Standard Methods for the Examination of Water and Wastewater, 20th Edition, APHA/ AWWA-WPCF, 1998

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, USEPA

Case Narrative

Sample Receipt

The samples were all appropriately cooled and preserved upon receipt. The samples were received in the appropriate containers. The chain of custody was adequately completed and corresponded to the samples submitted.

Metals

All analyses were performed according to NETLAB's documented Standard Operating Procedures, within all required holding times, and with appropriate quality control measures. All QC was within laboratory established acceptance criteria. The samples were received, processed, and reported with no anomalies.

Wet Chemistry

All samples were analyzed within method specified holding times and according to NETLAB's documented standard operating procedures.

Results: General Chemistry

Sample: 790180827-01

Lab Number: 8H27016-01 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**20**		2	mg/L	08/29/18	08/29/18
Turbidity	**1.0**		0.1	NTU	08/28/18 16:50	08/28/18 16:50

Results: General Chemistry

Sample: 790180827-02

Lab Number: 8H27016-02 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**21**		4	mg/L	08/29/18	08/29/18
Turbidity	**2.5**		0.1	NTU	08/28/18 16:50	08/28/18 16:50

Results: General Chemistry

Sample: 790180827-03
Lab Number: 8H27016-03 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**18**		4	mg/L	08/29/18	08/29/18
Turbidity	**11.6**		0.1	NTU	08/28/18 16:50	08/28/18 16:50

Results: General Chemistry

Sample: 790180827-04

Lab Number: 8H27016-04 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**18**		4	mg/L	08/29/18	08/29/18
Turbidity	**1.9**		0.1	NTU	08/28/18 16:50	08/28/18 16:50

Results: Total Metals

Sample: 790180827-02
Lab Number: 8H27016-02 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Iron	**1.04**		0.01	mg/L	08/28/18	08/28/18

Results: Total Metals

Sample: 790180827-03

Lab Number: 8H27016-03 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Iron	**1.28**		0.01	mg/L	08/28/18	08/28/18

Results: Total Metals

Sample: 790180827-04

Lab Number: 8H27016-04 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Iron	**1.59**		0.01	mg/L	08/28/18	08/28/18

Quality Control

General Chemistry

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: B8H1164 - Alkalinity										
Blank (B8H1164-BLK1)					Prepared & Analyzed: 08/29/18					
Alkalinity as CaCO3	ND		2	mg/L						
LCS (B8H1164-BS1)					Prepared & Analyzed: 08/29/18					
Alkalinity as CaCO3	53		2	mg/L	50.0		105	90-110		
Duplicate (B8H1164-DUP1)		**Source: 8H22014-01**			Prepared & Analyzed: 08/29/18					
Alkalinity as CaCO3	66		2	mg/L		63			4.08	20
Matrix Spike (B8H1164-MS1)		**Source: 8H22014-01**			Prepared & Analyzed: 08/29/18					
Alkalinity as CaCO3	116		2	mg/L	50.0	63	105	80-120		
Batch: B8H1276 - Turbidity										
Blank (B8H1276-BLK1)					Prepared & Analyzed: 08/28/18					
Turbidity	0.1		0.1	NTU						
Blank (B8H1276-BLK2)					Prepared & Analyzed: 08/28/18					
Turbidity	ND		0.1	NTU						
Duplicate (B8H1276-DUP1)		**Source: 8H27016-01**			Prepared & Analyzed: 08/28/18					
Turbidity	0.9		0.1	NTU		1.0			4.30	200

Quality Control
(Continued)

Total Metals

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: B8H1055 - Hot plate acid digestion waters										
Blank (B8H1055-BLK1)					Prepared & Analyzed: 08/28/18					
Iron	ND		0.01	mg/L						
LCS (B8H1055-BS1)					Prepared & Analyzed: 08/28/18					
Iron	10.9		0.05	mg/L	10.0		109	85-115		

Notes and Definitions

Item	Definition
Wet	Sample results reported on a wet weight basis.
ND	Analyte NOT DETECTED at or above the reporting limit.

FUSS & O'NEILL
(860) 646-2469 • www.FandO.com

☑ 146 Hartford Road, Manchester, CT 06040
☐ 56 Quarry Road, Trumbull, CT 06611
☐ 1419 Richland Street, Columbia, SC 29201
☐ 78 Interstate Drive, West Springfield
☐ 317 Iron Horse Way, Suite 204, Prov
☐ 80 Washington Street, Suite 301, Po

8 H 2 7016 j

CHAIN-OF-CUSTODY RECORD 39362

☐ 24-Hour* ☐ 72-Hour* ☐ Other ______ (days)
☐ 48-Hour* ☑ Standard (____ days) *Surcharge Applies

Project Name	Project Location	Project Number	Laboratory
Upper Dam Pond	Coventry, RI	2002.514.T30	NET

Report To: Stefan Bengtson + Kristin Connell, F&O
Invoice To: ↓
P.O. No.: 2002.514.T30
Sampler's Signature: [signature] Date: 8/27/18

Source Codes:
MW=Monitoring Well, SW=Surface Water, PW=Potable Water, ST=Stormwater, T=Treatment Facility, W=Waste, S=Soil, C=Concrete, B=Sediment, A=Air, X=Other ______

Analysis Request: Alkalinity, Turbidity, Total Iron

Containers: Soil VOA Vial, ☐ methanol; Soil VOA Vial, ☐ water; Glass Soil Container ( ) oz ☐ $Na(SO_4)_2$; Other:; Other:; Water VOA Vial, ☐ As is ☐ HCl; Glass Amber ( ) ml, ☐ As is ☐ H_2SO_4; Plastic - As is, ☐ 250 ml ☐ 500 ☑ 1000 ml; Plastic - H_2SO_4, ☐ 250 ml ☐ 500 ml; Plastic - HNO_3, ~~250~~ 500 ml ☐ ~~Filtered~~ ☐ 0.45µ ☐ 10µ; Plastic - NaOH, 250 ml; Comments

Item No.	Transfer Check 1 2 3 4	Sample Number	Source Code	Date Sampled	Time Sampled	Alkalinity	Turbidity	Total Iron	Plastic - As is	Plastic - HNO_3
1		790180827-01	SW	8/27/18	0840	✓	✓		1	1
2		↓ -02	↓	↓	0845	↓	↓	✓	1	1
3		-03			0850			↓	1	1
4		-04			0855				1	1

Transfer Number	Relinquished By	Accepted By	Date	Time
1	K. Connell	B. [signature]	8/27/18	10:32
2				
3				
4				

Charge Exceptions: ☐ CT Tax Exempt ☐ QA/QC ☐ Other ______
____ Duplicates ____ Blanks (Item Nos:)

Reporting and Detection Limit Requirements: ☐ RCP Deliverables ☐ MCP CAM Cert.

Additional Comments:
One field duplicate included

DRAFT

Sample Number	Sampling Date	Sampling Time (24:00)	Total Phosphorus (μg/l)
790180521-01	5/21/2018	10:55	14.2
790180521-02	5/21/2018	11:10	21.2
790180521-02 Dup	5/21/2018	11:10	20.1
790180521-03	5/21/2018	11:20	90.2
790180521-FB	5/21/2018	13:00	< 0.8
790180611-01	6/11/2018	10:00	10.6
790180611-02	6/11/2018	10:10	33.7
790180611-02D	6/11/2018	11:20	29.9
790180611-03	6/11/2018	11:30	417.3
790180716-01	7/16/2018	10:00	14.4
790180716-02	7/16/2018	10:10	28.5
790180716-03	7/16/2018	10:20	296.9
790180716-04	7/16/2018	10:30	151.7
790180716-05	7/16/2018	10:55	0.8
790180827-01	8/27/2018	8:40	14.4
790180827-02	8/27/2018	8:45	46.8
790180827-03	8/27/2018	8:50	224.4
790180827-04	8/27/2018	8:55	21.1
790180827-05	8/27/2018	9:30	< 0.8
790180924-01	9/24/2018	8:25	16.3
790180924-02	9/24/2018	8:30	49.7
790180924-03	9/24/2018	8:35	83.2
790180924-04	9/24/2018	8:40	1186.3
790180924-05	9/24/2018	9:10	< 0.8

Total Phosphorus detection limit is 0.8 micrograms per liter

Notes:
May 21, 2018 field blank (FB) measured 0.7 ug/l and was below detectible limits.
Both May 21 and June 11 Bottom Samples (# 03) contained visible organic particulate debris.
Samples 03 and 04, from July 16, contained visible organic particulate debris.
Samples 02 and 03, from August 27, contained visible organic particulate debris; the site 03 sample also smelled stongly of hydrogen sulfide.
The August 27, 2018 field blank measured 0.0 ug/l and was below detectible limits.
Samples 02 and 03, from September 24, contained visible organic particulate debris; the site 03 sample also smelled stongly of hydrogen sulfide.
The September 24, 2018 field blank measured 0.6 ug/l and was below detectible limits.

New England Testing Laboratory, Inc.
(401) 353-3420

REPORT OF ANALYTICAL RESULTS

NETLAB Work Order Number: 8I24011
Client Project: 2002514.T30 - Upper Dam

Report Date: 01-October-2018

Prepared for:

Stefan Bengtson
Fuss & O'Neill
317 Iron Horse Way
Providence, RI 02908

Richard Warila, Laboratory Director
New England Testing Laboratory, Inc.
59 Greenhill Street
West Warwick, RI 02893
rich.warila@newenglandtesting.com

Samples Submitted :

The samples listed below were submitted to New England Testing Laboratory on 09/24/18. The group of samples appearing in this report was assigned an internal identification number (case number) for laboratory information management purposes. The client's designations for the individual samples, along with our case numbers, are used to identify the samples in this report. This report of analytical results pertains only to the sample(s) provided to us by the client which are indicated on the custody record. The case number for this sample submission is 8I24011. Custody records are included in this report.

Lab ID	Sample	Matrix	Date Sampled	Date Received
8I24011-01	790180924-01	Water	09/24/2018	09/24/2018
8I24011-02	790180924-02	Water	09/24/2018	09/24/2018
8I24011-03	790180924-03	Water	09/24/2018	09/24/2018
8I24011-04	790180924-04	Water	09/24/2018	09/24/2018

Request for Analysis

At the client's request, the analyses presented in the following table were performed on the samples submitted.

790180924-01 (Lab Number: 8I24011-01)

Analysis	**Method**
Alkalinity (CaCO3)	SM2320-B
Turbidity	SM2130-B

790180924-02 (Lab Number: 8I24011-02)

Analysis	**Method**
Alkalinity (CaCO3)	SM2320-B
Turbidity	SM2130-B

790180924-03 (Lab Number: 8I24011-03)

Analysis	**Method**
Alkalinity (CaCO3)	SM2320-B
Iron	EPA 200.7
Turbidity	SM2130-B

790180924-04 (Lab Number: 8I24011-04)

Analysis	**Method**
Alkalinity (CaCO3)	SM2320-B
Iron	EPA 200.7
Turbidity	SM2130-B

Method References

Methods for the Determination of Metals in Environmental Samples EPA-600/R-94/111, USEPA, 1994

Standard Methods for the Examination of Water and Wastewater, 20th Edition, APHA/ AWWA-WPCF, 1998

Case Narrative

Sample Receipt

The samples were all appropriately cooled and preserved upon receipt. The samples were received in the appropriate containers. The chain of custody was adequately completed and corresponded to the samples submitted.

Metals

All analyses were performed according to NETLAB's documented Standard Operating Procedures, within all required holding times, and with appropriate quality control measures. All QC was within laboratory established acceptance criteria. The samples were received, processed, and reported with no anomalies.

Wet Chemistry

All samples were analyzed within method specified holding times and according to NETLAB's documented standard operating procedures.

Results: General Chemistry

Sample: 790180924-01

Lab Number: 8I24011-01 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**13**		10	mg/L	09/26/18	09/26/18
Turbidity	**0.8**		0.1	NTU	09/24/18 17:30	09/24/18 17:30

Results: General Chemistry

Sample: 790180924-02
Lab Number: 8I24011-02 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**13**		10	mg/L	09/26/18	09/26/18
Turbidity	**1.6**		0.1	NTU	09/24/18 17:30	09/24/18 17:30

Results: General Chemistry

Sample: 790180924-03

Lab Number: 8I24011-03 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**13**		10	mg/L	09/26/18	09/26/18
Turbidity	**2.5**		0.1	NTU	09/24/18 17:30	09/24/18 17:30

Results: General Chemistry

Sample: 790180924-04

Lab Number: 8I24011-04 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Alkalinity as CaCO3	**13**		10	mg/L	09/26/18	09/26/18
Turbidity	**2.3**		0.1	NTU	09/24/18 17:30	09/24/18 17:30

Results: Total Metals

Sample: 790180924-03

Lab Number: 8I24011-03 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Iron	**4.37**		0.012	mg/L	09/25/18	09/26/18

Results: Total Metals

Sample: 790180924-04
Lab Number: 8I24011-04 (Water)

Analyte	Result	Qual	Reporting Limit	Units	Date Prepared	Date Analyzed
Iron	**3.89**		0.012	mg/L	09/25/18	09/26/18

Quality Control

General Chemistry

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: B8I0986 - Turbidity										
Blank (B8I0986-BLK1)					Prepared & Analyzed: 09/24/18					
Turbidity	ND		0.1	NTU						
Blank (B8I0986-BLK2)					Prepared & Analyzed: 09/24/18					
Turbidity	ND		0.1	NTU						
Duplicate (B8I0986-DUP1)		**Source: 8I24011-01**			Prepared & Analyzed: 09/24/18					
Turbidity	0.8		0.1	NTU		0.8			1.29	200
Batch: B8I1028 - Alkalinity										
Blank (B8I1028-BLK1)					Prepared & Analyzed: 09/26/18					
Alkalinity as CaCO3	ND		2	mg/L						
LCS (B8I1028-BS1)					Prepared & Analyzed: 09/26/18					
Alkalinity as CaCO3	50		2	mg/L	50.0		99.9	90-110		
Duplicate (B8I1028-DUP1)		**Source: 8I24011-01**			Prepared & Analyzed: 09/26/18					
Alkalinity as CaCO3	13		10	mg/L		13			0.00	20
Matrix Spike (B8I1028-MS1)		**Source: 8I24011-01**			Prepared & Analyzed: 09/26/18					
Alkalinity as CaCO3	66		10	mg/L	50.0	13	105	80-120		

Quality Control
(Continued)

Total Metals

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: B8I0940 - Hot plate acid digestion waters										
Blank (B8I0940-BLK1)					Prepared & Analyzed: 09/25/18					
Iron	ND		0.050	mg/L						
LCS (B8I0940-BS1)					Prepared & Analyzed: 09/25/18					
Iron	10.6		0.050	mg/L	10.0		106	85-115		

Notes and Definitions

Item	Definition
Wet	Sample results reported on a wet weight basis.
ND	Analyte NOT DETECTED at or above the reporting limit.

FUSS & O'NEILL
(860) 646-2469 • www.FandO.com

☑ 146 Hartford Road, Manchester, CT 06040
☐ 56 Quarry Road, Trumbull, CT 06611
☐ 1419 Richland Street, Columbia, SC 29201

8 I 2 4011

CHAIN-OF-CUSTODY RECORD 39364

Turnaround
☐ 24-Hour* ☐ 72-Hour* ☐ Other ____ (days)
☐ 48-Hour* ☑ Standard (____ days) *Surcharge Applies

PROJECT NAME	PROJECT LOCATION	PROJECT NUMBER	LABORATORY
Upper Dam Pond	Coventry, RI	2002514.T30	NET

REPORT TO: Stefan Bengtson + Kristin Connell, F&O
INVOICE TO: ↓
P.O. NO.: 2002514.T30
Sampler's Signature: [signature] Date: 9/24/18

Source Codes:
MW=Monitoring Well PW=Potable Water T=Treatment Facility S=Soil B=Sediment
SW=Surface Water ST=Stormwater W=Waste A=Air C=Concrete
X=Other ____

Item No.	Transfer Check 1	2	3	4	Sample Number	Source Code	Date Sampled	Time Sampled	Alkalinity	Turbidity	Total Iron	Soil VOA Vial, ☐ methanol	Soil VOA Vial, ☐ water	Glass Soil Container ( ) oz	Other:	Other:	Water VOA Vial, ☐ As is ☐ HCl	Glass Amber ( ) ml, ☐ As is ☐ H_2SO_4	Plastic - As is, ☐ 250 ml ☐ 500 ☑ 1000 ml	Plastic - H_2SO_4, ☐ 250 ml ☐ 500 ml	Plastic - HNO_3, 250 ml ☑ Filtered ☐ 0.45µ ☐ 10µ / pH<2	Plastic - NaOH, 250 ml	Comments
1					79180924-01	SW	9/24/18	0825	✓	✓									1		2		
2					-02	↓	↓	0830	↓	↓									1		2		
3					-03	↓	↓	0835	↓	↓	✓								1		2		
4					-04	↓	↓	0840	↓	↓	✓								1		2		

Transfer Number	Relinquished By	Accepted By	Date	Time
1	[signature]	[signature]	9/24/18	9:53
2				
3				
4				

Charge Exceptions: ☐ CT Tax Exempt ☐ QA/QC ☐ Other ____
1 Duplicates ____ Blanks (Item Nos:)

Reporting and Detection Limit Requirements: ☐ RCP Deliverables ☐ MCP CAM Cert.

Additional Comments: Hold -01, -02 for total iron
One field duplicate included

End of Report

Appendix F

Town Survey Documents

Town of Coventry
1670 Flat River Road Coventry, RI 02816
https://www.coventryri.org/

August 31, 2022

RE: Coventry Wastewater Planning Study

Dear Town of Coventry Resident:

The Town of Coventry (Town) has hired Fuss & O'Neill Inc., to conduct a study that will be used to determine the community's wastewater disposal needs and to develop a written plan. The study and planning are required by State regulation.

Four wastewater management options will be evaluated: 1) individual conventional septic systems, 2) decentralized management, 3) small community septic system(s) and 4) centralized public sewers. The study will recommend the most feasible and economically viable solution for pre-determined areas, districts, or neighborhoods. This process will help the Town to make fact-based decisions based on the long term needs of the community.

A major aspect of this study seeks residents' participation in completing the enclosed questionnaire. This questionnaire will be kept confidential and will only be used for data collection by the engineering firm for the study. **Prompt responses will help to complete the study efficiently and effectively. Please complete and return the enclosed survey within the next 2 to 3 days to our Consulting Engineer.** Resident input is a vital component to ensure a successful study. The attached questionnaire will take approximately 10 minutes to complete. A self-addressed postage paid envelope has been provided for your convenience.

Should you have any questions contact Lindsay Silcox of Fuss & O'Neill Inc. at 860-646-2469 ext. 5319 or Benjamin Marchant (Town of Coventry Town Manager) at bmarchant@coventryri.org.

Thank you, in advance, for your cooperation and prompt response.

Sincerely,

Benjamin Marchant
Town of Coventry Town Manager

WASTEWATER DISPOSAL QUESTIONNAIRE

Street Address: ____________________ (Required)

Name: ____________________ (Optional)

Telephone: ____________________ (Optional)

Email: ____________________ (Optional)

Is your property used seasonally ONLY?
☐ Yes ☐ No

How long have you owned or lived at this location? ______ years

Age of main building: ______ years

Number of bedrooms: ______

Number of residents: ______

Do any residents who currently use the property in a seasonal manner, plan to transition to year-round occupancy? If so, how many and when?
☐ None ______ in ______
(People) (Years)

Property Use
☐ Single family residential
☐ Vacant
☐ Other: ____________________

Septic System Location
☐ Front yard ☐ Left of Main Building
☐ Backyard ☐ Right of Main Building
☐ Other: ____________________

Do you have a separate leaching field or dry well for "gray water" (sinks, showers, washing machine)? ☐ Yes ☐ No ☐ Don't Know

What type of wastewater disposal system do you have?
☐ Septic Tank to a Leaching Field
☐ Cesspool
☐ Dry Wells
☐ Pressure Distribution
☐ Surface Discharge
☐ Don't Know
☐ Other: ____________________

Do you share the wastewater disposal system with another entity (i.e. multi-tenant building, neighbor)?
☐ Yes, who: ____________________ ☐ No

How old is your septic system disposal (leaching) field? ______ ☐ Don't know
(Years)

Are any of the following connected to your wastewater disposal system?
☐ Washing Machine ☐ Water Softener
☐ Dishwasher ☐ Water Chlorinator
☐ Garbage Disposal ☐ Jacuzzi Tub
☐ Sump Pump

For Restaurants, Schools, or other Commercial Kitchens ONLY: Are any of the following connected to your wastewater disposal system?
☐ Oil/Water Separator
☐ Grease Trap

Approximately how often do you get your septic tank pumped?
☐ More than 5 years ☐ Once per year
☐ Every 3 to 5 years ☐ More than once per year
☐ Once every 2 years ☐ Never

How much would you guess it might cost to replace a septic system disposal (leaching) field? $__________
☐ I paid for a replacement before
☐ I've never paid for a replacement

Has your wastewater disposal system ever been repaired?
☐ Yes ☐ No ☐ Don't Know
Number of repairs: ____________________
Date of repairs: ____________________
(MONTH/YEAR)

Do you have any of the following problems with your wastewater disposal system?
☐ This property has never had any problems

	Spring	Summer	Fall	Winter
Disposal field is muddy	☐	☐	☐	☐
Drains slowly or backs up	☐	☐	☐	☐
Flows onto ground surface	☐	☐	☐	☐
Odors	☐	☐	☐	☐
Other (Describe)	☐	☐	☐	☐

____

Does the problem seem to be linked to a specific activity (washing clothes, heavy rains, visitors, etc)?

____

____

SURVEY CONTINUES ON BACK

WASTEWATER DISPOSAL QUESTIONNAIRE

What was done? (Check all that apply)

- ☐ Replace septic tank
- ☐ Add to leaching field
- ☐ Replace leaching field
- ☐ Replace septic tank baffle
- ☐ Not Applicable
- ☐ Other: ______________________________

What was the approximate repair cost? _____

Are you aware of other wastewater disposal problems in your neighborhood? ☐ Yes ☐ No

What type of water supply do you have?

- ☐ Unknown Water Supply
- ☐ Private Well: ☐ Dug Well ☐ Drilled Well
- ☐ Community Well
- ☐ Public Water

If you have a well, have you had your water tested?

- ☐ Yes Reason: ______________________
- ☐ No

Do you have any of the following low-flow appliances?

- ☐ Front Loading Washing Machine
- ☐ Faucet flow restrictors
- ☐ Toilet with 1.6 gallon per flush (or less)
- ☐ Low-flow showerheads
- ☐ Other: ______________________________

Have you ever experienced flooding or surface drainage problems on your property?

☐ Yes ☐ No ☐ Don't Know

Are you aware of any local wells or springs that may have been adversely affected by septic system flow? ☐ Yes ☐ No

Even if no obvious problems exist, are you concerned that your septic system is not properly treating the wastewater which passes through it? ☐ Yes ☐ No

How concerned are you that installed septic systems will have an adverse affect on ground and surface water quality in your area?

- ☐ Extremely Concerned
- ☐ Very Concerned
- ☐ Concerned
- ☐ Somewhat concerned
- ☐ Not concerned

PLEASE COMPLETE BOTH SIDES OF SURVEY.

COMPLETE AND RETURN SURVEY BY <u>September 15th</u>

TOWN OF COVENTRY

Comments:

____

____

____

____

____

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____

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____

[redacted] [redacted]

WASTEWATER PLANNING FOR
Town of Coventry, RI

WHY?

Sewer Facility Plan Update Required by RIDEM

Facility Planning by Town of Coventry's Consultant
Fuss and O'Neill Inc.
(Summer 2022 – Winter 2023)

Public Awareness

PARCELS WITH ON-SITE SYSTEMS

Systems compliant with standards may remain.

Repair or replace with advanced system.

RESOURCES AVAILABLE TO YOU:

Community Septic System Loan Program (CSSLP)

https://www.Rihousing.Com/community-septic-system-loan-program-csslp/

Licensed Inspectors, Designers

https://dem.Ri.Gov/environmental-protection-bureau/water-resources/permitting/septic-onsite-wastewater-treatment-3

SEWER FACILITY PLANNING

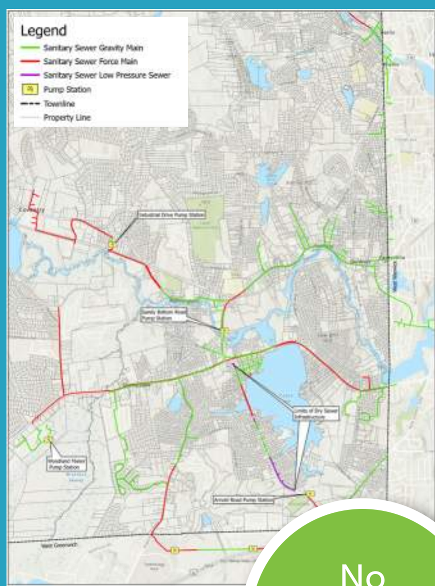
Planning areas based on sensitive areas, constricted lot sizes with failed ISDS.

Recommendations may include shared treatment and groundwater discharge, or sewer extension with goal to minimize assessments, especially for areas with limited income.

Need will determine priority for phased sewer extension or community-based shared systems.

PARCELS ALREADY SEWERED

Tiogue Avenue, and areas in Eastern Districts will continue to have sewer service and receive usage invoices.



Not every parcel needs sewer access.

No Planned Changes

PUBLIC PARTICIPATION

A questionnaire will be mailed directly to neighborhoods in Eastern Districts.

If you receive the questionnaire, please respond!

Before the facility plan is finalized, the public will be invited to participate in:

OPEN HOUSE	PUBLIC HEARING
FALL 2022	WINTER 2022

Dates will be posted on the Town's website.

https://www.coventryri.org/sewer-authority

Your participation is important!

Appendix G

Fish and Wildlife Service Official Species List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104

In Reply Refer To: September 12, 2023
Project Code: 2023-0128000
Project Name: Coventry, RI Sewer Facility Plan

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

Updated 4/12/2023 - Please review this letter each time you request an Official Species List, we will continue to update it with additional information and links to websites may change.

About Official Species Lists

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Federal and non-Federal project proponents have responsibilities under the Act to consider effects on listed species.

The enclosed species list identifies threatened, endangered, proposed, and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested by returning to an existing project's page in IPaC.

Endangered Species Act Project Review

Please visit the "**New England Field Office Endangered Species Project Review and Consultation**" website for step-by-step instructions on how to consider effects on listed species and prepare and submit a project review package if necessary:

https://www.fws.gov/office/new-england-ecological-services/endangered-species-project-review

NOTE Please do not use the **Consultation Package Builder** tool in IPaC except in specific situations following coordination with our office. Please follow the project review guidance on our website instead and reference your **Project Code** in all correspondence.

Northern Long-eared Bat - (**Updated 4/12/2023**) The Service published a final rule to reclassify the northern long-eared bat (NLEB) as endangered on November 30, 2022. The final rule went into effect on March 31, 2023. You may utilize the **Northern Long-eared Bat Rangewide Determination Key** available in IPaC. More information about this Determination Key and the Interim Consultation Framework are available on the northern long-eared bat species page:

https://www.fws.gov/species/northern-long-eared-bat-myotis-septentrionalis

For projects that previously utilized the 4(d) Determination Key, the change in the species' status may trigger the need to re-initiate consultation for any actions that are not completed and for which the Federal action agency retains discretion once the new listing determination becomes effective. If your project was not completed by March 31, 2023, and may result in incidental take of NLEB, please reach out to our office at newengland@fws.gov to see if reinitiation is necessary.

Additional Info About Section 7 of the Act
Under section 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to determine whether projects may affect threatened and endangered species and/or designated critical habitat. If a Federal agency, or its non-Federal representative, determines that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Federal agency also may need to consider proposed species and proposed critical habitat in the consultation. 50 CFR 402.14(c)(1) specifies the information required for consultation under the Act regardless of the format of the evaluation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

https://www.fws.gov/service/section-7-consultations

In addition to consultation requirements under Section 7(a)(2) of the ESA, please note that under sections 7(a)(1) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species. Please contact NEFO if you would like more information.

Candidate species that appear on the enclosed species list have no current protections under the ESA. The species' occurrence on an official species list does not convey a requirement to consider impacts to this species as you would a proposed, threatened, or endangered species. The ESA does not provide for interagency consultations on candidate species under section 7, however, the Service recommends that all project proponents incorporate measures into projects to benefit candidate species and their habitats wherever possible.

Migratory Birds

In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see:

https://www.fws.gov/program/migratory-bird-permit

https://www.fws.gov/library/collections/bald-and-golden-eagle-management

Please feel free to contact us at **newengland@fws.gov** with your **Project Code** in the subject line if you need more information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat.

Attachment(s): Official Species List

Attachment(s):

- Official Species List

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

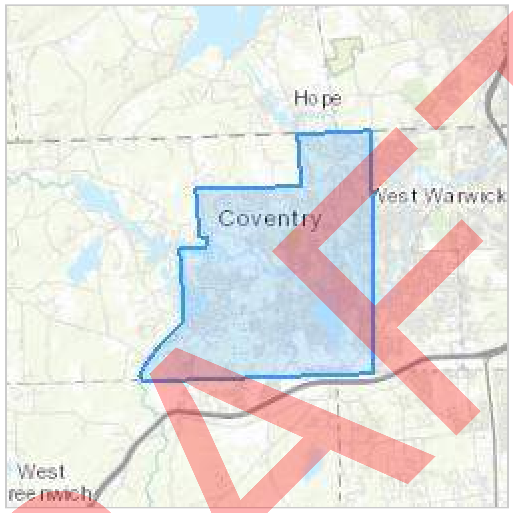
This species list is provided by:

New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
(603) 223-2541

PROJECT SUMMARY

Project Code: 2023-0128000
Project Name: Coventry, RI Sewer Facility Plan
Project Type: Wastewater Pipeline - New Constr - Below Ground
Project Description: Sewer Facility Planning for Coventry, Rhode Island
Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@41.68887305,-71.5699520508652,14z



Counties: Kent and Providence counties, Rhode Island

ENDANGERED SPECIES ACT SPECIES

There is a total of 3 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Endangered

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

FLOWERING PLANTS

NAME	STATUS
Small Whorled Pogonia *Isotria medeoloides* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1890	Threatened

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

IPAC USER CONTACT INFORMATION

Agency:	Coventry town
Name:	Ryan Morais
Address:	146 Hartford Road
City:	Manchester
State:	CT
Zip:	06040
Email	rmorais@fando.com
Phone:	8605739108

Appendix H

Planning Area Prioritization Matrix by Planning Area

Appendix H
Matrix Rank Summary
Town of Coventry, RI

Planning Area	Environmental Impacts		Affordability						OWTS Problem Areas					Site Suitability			Total
	Distance to Waterbody	Wetlands Landtype	Median Household Income	Cost to Construct Sewers	Pump Stations Required	Proximity to Existing Sanitary System	ARPA Funding	Depth to Bedrock	Cesspool Reported	Age of System Reported	Repairs Reported	Problems Reported	Concerned about OWTS	Median Lot Size	Density	Soils	
1	5	2	1	3	5	5	0	4	2	5	2	2	3	3	5	5	52
2	4	2	1	3	5	5	0	4	3	5	5	4	5	4	5	5	60
3	5	5	1	5	5	5	0	2	1	1	1	4	1	5	1	4	46
4	2	5	3	3	5	5	0	2	1	1	1	1	1	3	1	5	39
5	3	3	3	1	5	5	0	5	5	3	3	3	3	3	5	1	51
6	4	3	3	1	5	5	0	5	5	2	2	2	2	4	5	1	49
7	5	3	3	5	5	5	0	5	1	1	1	1	1	1	1	1	39
8	4	2	3	1	5	5	0	5	2	2	4	2	2	3	5	1	46
9	5	3	3	1	5	5	10	5	2	2	3	3	3	2	5	4	61
10	2	3	3	1	5	5	0	4	3	2	3	2	2	2	4	3	44
11	5	2	3	1	5	5	0	5	3	2	1	2	3	4	5	5	51
12	4	4	5	1	5	5	0	3	4	4	5	4	4	3	5	2	58
13	4	3	5	1	5	5	0	1	1	1	1	1	1	3	5	5	42
14	4	4	5	1	5	5	0	1	3	1	1	2	2	3	5	1	43
15	3	3	5	1	5	5	0	2	5	2	3	2	3	3	5	2	49
16	2	5	2	3	5	3	0	1	3	2	2	3	2	4	5	3	45
17	4	5	2	3	5	1	0	3	2	4	2	5	3	5	4	5	53
18	4	5	2	1	1	1	0	4	3	3	2	2	3	5	5	5	46
19	4	3	2	2	5	1	0	4	2	2	1	2	2	5	5	4	44
20	2	3	2	3	5	1	0	5	2	4	3	3	3	5	4	1	46
21	4	4	5	3	5	5	0	1	5	3	4	2	3	5	5	1	55
22	2	5	1	1	5	1	0	1	1	4	3	4	3	4	4	5	44
23	3	5	1	4	5	5	0	3	1	2	1	1	2	4	4	2	43
24	2	3	4	4	5	5	0	2	4	2	1	3	2	4	4	1	46
25	5	5	4	5	5	5	0	2	1	1	1	1	1	1	1	1	39
26	3	2	4	1	5	5	0	5	5	2	2	2	3	5	5	1	50
27	5	4	4	1	5	5	0	2	1	1	1	1	1	4	4	1	40
28	5	5	4	1	5	5	0	3	2	1	1	1	1	3	3	1	41
29	5	3	3	1	5	5	0	5	1	1	1	1	1	1	5	4	42
30	2	4	3	1	5	5	0	5	1	1	1	1	1	2	5	5	42
31	5	3	2	1	5	1	0	2	3	1	1	1	1	3	5	4	38

Appendix I

Planning Area Prioritization Matrix by Rank

FUSS & O'NEILL

Appendix I
Matrix Rank Summary
Town of Coventry, RI

Planning Area	Environmental Impacts		Affordability						OWTS Problem Areas					Site Suitability			Total
	Distance to Waterbody	Wetlands Landtype	Median Household Income	Cost to Construct Sewers	Pump Stations Required	Proximity to Existing Sanitary System	ARPA Funding	Depth to Bedrock	Cesspool Reported	Age of System Reported	Repairs Reported	Problems Reported	Concerned about OWTS	Median Lot Size	Density	Soils	
9	5	3	3	1	5	5	10	5	2	2	3	3	3	2	5	4	61
2	4	2	1	3	5	5	0	4	3	5	5	4	5	4	5	5	60
12	4	4	5	1	5	5	0	3	4	4	5	4	4	3	5	2	58
21	4	4	5	3	5	5	0	1	5	3	4	2	3	5	5	1	55
17	4	5	2	3	5	1	0	3	2	4	2	5	3	5	4	5	53
1	5	2	1	3	5	5	0	4	2	5	2	2	3	3	5	5	52
5	3	3	3	1	5	5	0	5	5	3	3	3	3	3	5	1	51
11	5	2	3	1	5	5	0	5	3	2	1	2	3	4	5	5	51
26	3	2	4	1	5	5	0	5	5	2	2	2	3	5	5	1	50
6	4	3	3	1	5	5	0	5	5	2	2	2	2	4	5	1	49
15	3	3	5	1	5	5	0	2	5	2	3	2	3	3	5	2	49
3	5	5	1	5	5	5	0	2	1	1	1	4	1	5	1	4	46
8	4	2	3	1	5	5	0	5	2	2	4	2	2	3	5	1	46
18	4	5	2	1	1	1	0	4	3	3	2	2	3	5	5	5	46
20	2	3	2	3	5	1	0	5	2	4	3	3	3	5	4	1	46
24	2	3	4	4	5	5	0	2	4	2	1	3	2	4	4	1	46
16	2	5	2	3	5	3	0	1	3	2	2	3	2	4	5	3	45
10	2	3	3	1	5	5	0	4	3	2	3	2	2	2	4	3	44
19	4	3	2	2	5	1	0	4	2	2	1	2	2	5	5	4	44
22	2	5	1	1	5	1	0	1	1	4	3	4	3	4	4	5	44
14	4	4	5	1	5	5	0	1	3	1	1	2	2	3	5	1	43
23	3	5	1	4	5	5	0	3	1	2	1	1	2	4	4	2	43
13	4	3	5	1	5	5	0	1	1	1	1	1	1	3	5	5	42
29	5	3	3	1	5	5	0	5	1	1	1	1	1	1	5	4	42
30	2	4	3	1	5	5	0	5	1	1	1	1	1	2	5	5	42
28	5	5	4	1	5	5	0	3	2	1	1	1	1	3	3	1	41
27	5	4	4	1	5	5	0	2	1	1	1	1	1	4	4	1	40
4	2	5	3	3	5	5	0	2	1	1	1	1	1	3	1	5	39
7	5	3	3	5	5	5	0	5	1	1	1	1	1	1	1	1	39
25	5	5	4	5	5	5	0	2	1	1	1	1	1	1	1	1	39
31	5	3	2	1	5	1	0	2	3	1	1	1	1	3	5	4	38

Appendix J

Pump Station Evaluation Report

Woodland Manor
Wastewater Pump Station Evaluation

Town of Coventry
Coventry, Rhode Island

December 2013

FUSS & O'NEILL

317 Iron Horse Way, Suite 204
Providence, RI 02908

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Woodland Manor
Wastewater Pump Station Evaluation
Town of Coventry, Rhode Island

Appendices

End of Report

FUSS & O'NEILL

1 Executive Summary

Fuss & O'Neill was retained by the Town of Coventry, RI in October 2013 to perform evaluations of the major components of the existing private pump station and a flow meter station to identify existing defects and potential future repairs for the system.

Woodland Manor Pump Station

Based on a review of the limited existing data, visual inspection of the major mechanical, electrical and structural components of the Woodland Manor wastewater pump station, ultrasonic bearing testing, megger testing and thermographic imaging of the pumps, Fuss & O'Neill recommends the following improvements:

- Site re-grading, removal of stained/contaminated soil and backfill with new soil (further evaluation me be required)
- Repair roof flashing and membrane
- Replace steel door to storage closet
- Prep and repaint walls and slab
- Provide hoist foundation and Crane for equipment removal
- Provide new valves and pressure gauges
- Provide new heater, dehumidifier and exhaust fan
- Rebuild existing pumps as required
- Replace existing sump pump
- Replace existing with new electrical equipment
- Replace existing diesel generator set and concrete pad with a new automatic transfer switch (ATS)
- New control panel and programming
- New Bioxide double-walled tank and chemical feed pump for odor control
- Provide shredder (bypass pumping)
- Replace corroded suction piping within the wet well

The budgetary level opinion of cost for the improvements to the Woodland Pump Station in 2013 dollars ranges from:

Short Term Improvements	$140,000 to $214,000 (within the first year)
Long Term Improvements	$153,000 to $233,000

Detailed opinion of cost information is provided in *Appendix A*.

Flow Meter Station

Flow Meter Station located off Tiogue Avenue was inspected visually, and following upgrades are recommended:

- New Autodialer
- Alarm programming
- Control and telephone service wiring (alarms) improvements

The budgetary level opinion of cost for the improvements to the Flow Meter Station ranges from $4,300 to $6,500. Detailed opinion of cost information is provided in *Appendix A*.

2 Introduction

The Town of Coventry, Rhode Island is in the process of transferring ownership of a private pump station and two force mains to the Town. The Woodland Manor pump station is a "suction-lift" style facility installed in the late 1970s or early 1980s. The effluent from Woodland Manor is conveyed through a 10-inch PVC force main approximately 18,000 feet to its terminus at a manhole in a congested area in Tiogue Avenue.

There is a 6-inch force main located on Reservoir Road that convey wastewater from the Westwood Estates pump station to the Woodland sewer force main at intersection of Reservoir Road and Tiogue Avenue, approximately 3,000 feet from the pump station. Town is interested to purchasing this 6-inch force main in the Reservoir Road right of way.

There is an existing flow meter station located along the sewer force main at the intersection of Tiogue Avenue and Darton Street in the Town of Coventry. See overall Woodland Sewer System Map in *Appendix B*.

3 Project Understanding

Fuss & O'Neill was hired by the Town of Coventry to conduct an evaluation of the major components of the existing private pump station and a flow meter station to identify existing defects and potential future repairs for the systems.

It's our understanding that the Town, prior to taking ownership of the Woodland pump station and two force main systems (10-inch and 6-inch), was interested in an evaluation of the major components of the existing pump station. The focus of the evaluation was on equipment that would be costly to repair or replace in the future. We understand the Town would like to purchase these two force mains in order to expand their sewer system.

Fuss & O'Neill provided the following services for the pump station system evaluations:

- Conducted visual observation of pumps and piping components during several pumping events.
- Visually evaluated and assessed the standby generator at Woodland Manor Station
- Visually evaluated electrical, HVAC, telemetry and controls systems and switch gear.
- Visually evaluated the condition of alarms, level control, and lighting.
- Conducted megger tests, ultrasonic bearing tests and vibration monitoring for the existing pumps at each facility

- Performed thermographic imaging for each of the pumps to ascertain potential areas of excessive friction.
- Observed the building and site for structural defects, deficiencies and potential concerns.
- Observed the flowmeter manhole and pipe materials.
- Conducted cursory hydraulic capacity testing on each of the pumps based on the pressure gauge readings within the pump station and correlated with readings at the flowmeter located at the discharge pipe to obtain pump flow and head.
- Prepared an evaluation summary report with a list of recommendations for the facility
- Prepared a budgetary level opinion of cost

The following sections describe the results of the investigation and evaluation of the existing conditions at the pump station and the flow meter station. It also provides recommendations and a budgetary level opinion of cost for the short term (within the first year) and long term recommended improvements.

3.1 Evaluation Criteria

Existing condition of the pump station were evaluated based on standards presented in:

- TR-16: Guides for the Design of Wastewater Treatment Works, by the New England Interstate Water Pollution Control Commission, 2011.
- NFPA 820: Standard for Fire Protection in Wastewater Treatment and Collection Facilities, 2008.
- 10 States Standards: Recommended Standards for Wastewater Facilities, 2004 Edition.

Physical evaluations were conducted to examine the conditions of the existing wastewater pumping equipment, piping, and instrumentation. Site conditions and structural features were also documented to determine if improvements were necessary.

4 Existing Facilities

4.1 Woodland Manor Pump Station

[redacted]

The Woodland Manor Pump Station (pictured) is a private sewer pump station located at 22 Woodland Drive in Coventry, Rhode Island. The facility collects wastewater flows from the Woodland Manor apartment complex and the commercial users in the area. See overall Woodland Sewer System Map in *Appendix B*.

The Pump Station site consists of an underground wet well, a pump/control building, and an emergency generator with a fuel tank. The system also has a Bioxide tank (975 gallons) for odor control outside of the building.

4.1.1 Existing Conditions Assessment

4.1.1.1 Civil Site Features

The pump station is located in a fenced in area. The chain link fence has a minimum height of 5 feet 6 inches tall and an average height of at least 6 feet 0 inches tall. A locked, gated vehicular entrance to the site is located on the north side of the site. The fence is in fair condition with localized areas of rusting and one minorly bent corner post.

[redacted]

[redacted]

In general, the ground slopes towards the rear of the site (from north to south); however, there are minor soil settlements throughout the site. Much of the soil along the west side of the building is level or slopes towards the building. This does not allow for provide positive drainage away from the building. This condition can allow rainwater to accumulate against the foundation and may allow water to migrate through the foundation wall into the building.

Oil from the generator has spilled onto the soil immediately adjacent to the generator on the south side of the generator pad. The extent of this spill is not known at this time and may extend beneath the existing generator pad. Further investigation of the soils around the pad should be completed to determine if additional contamination is present and if remediation is necessary.

4.1.1.2 Pump Station Building

[redacted]

The existing pump station is a single-story concrete masonry block (CMU) building with a footprint of approximately 22 feet by 22 feet. The mean roof height of the building is 12 feet above grade and the finished floor elevation is approximately 5 feet below grade creating a space with an overall interior height of approximately 17 feet from finished floor to roof. A 5 foot 8 inch by 5 foot 8 inch storage closet, accessed by a door on the east side of the station is located in the northeast corner of the building. The roofing system consists of a ballasted single-ply membrane. The roof appears to pitch toward the west side of the building, where it is drained by a scupper and downspout. Rainwater exits the downspout on the ground surface in the vicinity of the building.

There is an electric unit heater, dehumidifier and sump pump within the pump station building. Also, there is a potable water supply inside the building that seems in good condition and includes the following:


[redacted]


[redacted]

- Neptune Water Meter
- Double Check Valve Assembly (backflow preventer)
- Air Release Valve
- Isolation Ball Valves
- Water Expansion Tank
- Pipe Drain/Hose Bibb
- ¾ inch Copper Pipe

4.1.1.3 Pump Station Wet well

The wet well is constructed of cast-in-place concrete. Wet wells are utilized for storing wastewater flows prior to pump operation, allowing for proper pumping and level control, maintaining sufficient submergence of the pump suction inlet, preventing excessive deposition of solids, and providing ventilation of incoming sewer gases. Dependent upon the size and use of the facility, the installation of pump protection (shredder) in the wet well is generally recommended to protect pumps from clogging.


[redacted]

The wet well dimension and storage volume is unknown. There is a 30-inch manhole cover on top with a steel access ladder.

The wet well floats have been replaced with an air bubbler system (levels are usually used to control pump operation). The pumps typically perform in a lead lag arrangement where two pumps are pumping in series each time. All pumps can operate at the same time if the wet well levels increase to the "High- High" level. When this occurs, all four pumps would be activated.

4.1.1.4 Structural/ Architectural

The pump station building is generally in good condition; however, we observed some minor deficiencies that can lead to future problems if not corrected. The observed deficiencies include:

- The concrete beam forming the western edge of the storage closet floor is in fair to poor condition. About 50% of the vertical surface on the western face of the concrete beam is spalling. At this time, none of the layers have fallen off; therefore, we were unable to determine the depth of the spalling.
- The concrete slab forming the storage closet floor is in fair condition. Over 50% of the floor surface has spalled, deeper than 1-inch in some areas.
- The steel frame and bottom of steel door that provides access to the storage room is rusted.
- Some of the roof flashing on the east side of the building is missing and one piece is displaced.
- The roof scupper is clogged with leaves and the downspout is not adequately connected to the scupper or to the extension leader on the ground.
- A section of the roof membrane along the edge of the roof adjacent to the scupper appears to be coming loose, which may be allowing water to enter the building in that area. The ceiling of the pump station was water stained in the vicinity of this deficiency.
- The exterior concrete masonry unit (CMU) walls were cracked, primarily in joints between blocks, in a few locations throughout the perimeter of the building. The cracks were minor in nature (hairline).
- The paint is peeling from the underside of the storage closet slab, the beams supporting the storage closet slab and the bottoms of the outside and inside faces of the storage closet walls.

[redacted]

4.1.1.5 Mechanical Systems

There are four Gorman-Rupp self-priming centrifugal sewage pumps that are arranged in sets of two in series. When two pumps are arranged in series, their resulting pump performance curve is obtained by adding their heads at the same flow rate. All four are identically sized. See *Appendix C* for existing G-R information and pump curves.

[redacted]

Original design information pertaining to the pumps was not available. Therefore, pump capacity was estimated during the site visit. One of the pressure gauges (#1B) during pumping showed 45 psi (104 feet), the head of 52 feet for each pump was determined based on this reading (104'/2 = 52'). Two of the four existing pressure gauges were not working;

A flow of 240 gpm was obtained when monitoring the flows documented from the existing flow meter. Each set of pumps ran for approximately 3-4 minutes every 40 minutes on an alternating basis at the time of survey. The characteristics for the pumps are summairzed in **Table 4-1** below.

Table 4-1: Woodland Manor Pump Station

Number of Pumps	4 (two sets of pumps in series)
Pump Model (#1A, 1B & 2B)	Gorman-Rupp T6A3-B
Pump Model (#2A)	Gorman-Rupp T6A60-B
Pump Capacity	240 gpm @ 52 feet (104'/2)
Pump Motor Size	40 HP, 60 HZ
Power	3 Phase
Voltage	460
Discharge Size	6 inches

Based on the Gorman-Rupp information obtained, the pumps have been replaced in the past, and the last dates of supply that G-R had are as follows:

Pump #1A	1995
Pump #1B	2000
Pump #2A	1998
Pump #2B	1980

The Gorman-Rupp centrifugal sewage pumps draw in wastewater from the wet well. Suction inlet piping is extended through the pre-cast concrete walls of the wet well using 6-inch DI piping. A isolation valve is installed on each suction line to allow operators to isolate each pump in series for maintenance. The discharge line on each series consists of a 6-inch ductile iron piping that incorporates a check valve, air relief valve and isolation valve. Pumps discharges are connected by a wye inside the building. The discharge piping then increases to 8-inch diameter with a flow meter and a gate valve. The piping then penetrates the wall going out to the system.

The check valves have been replaced and appear to be in good condition. One of the air relief valves also has apparently been replaced and is in good condition. The isolation valves are original and need to be replaced. There are four pressure gauges installed to monitor the suction and discharge pressures, only one is working properly and the other three needs to be replaced.
The building has a sump pump that is operational, but needs to be replaced with a larger capacity pump to handle the expected flows. There were signs of water accumulated on the pump station floor on the day of the inspection. There is no chain hoist or crane for removal of pumps and motors for maintenance, overhaul, and replacement.

Sump Pump

[redacted]

4.1.1.6 Pump Testing

On October 16th 2013 observation, testing and data collection of the pumps was completed using predictive maintenance test equipment to evaluate their condition. The pumps were observed under load with ultrasonic and thermal test gear, as well as tested off line with an electrical insulation tester (megger test). A visual inspection was performed on pump lubricating oil. Electrical controls were assessed for evidence of arc flash and related labeling. A brief explanation of the test(s) follows. Pump test summaries and data are included in Section 4.1.2.4 and in *Appendix D*.

- Ultrasonic bearing testing was performed to assess the condition of the pump and motor bearings, as well as to look for abnormal friction and wearing conditions. This form of testing provides both quantitative and qualitative data on bearing condition, and lubrication state. This testing allows the analyst to perform spectrum analysis in both the fast Fourier transform (FFT) and time domain as would be done in vibration testing. For most equipment ultrasonic testing will pick up problems sooner than vibration testing. For these reasons, ultrasonic testing was performed as well as vibration testing. Another benefit of this type of testing is it allows the analysts to listen to a representation of frequencies normally above the range of human hearing (20 K hertz – 100 K hertz) to hear bearing defects, rubbing, and lubrication problems which cannot be heard with a stethoscope, or normal audio amplification. Pump bearing test data did not uncover any major bearing defects.

- A thermographic imaging system (Infrared camera) was used to look for abnormal heating patterns in the electric motors and pumps. Thermography converts infrared heat radiation, invisible to the human eye, to visible images. The thermographic image represents the coldest object in the frame as black, and the warmest object as white much like a film negative. These images are reviewed to look for abnormal and excessive heating patterns that would result from electrical and mechanical defects in the equipment.

- Electrical insulation testing (Megger testing) was performed at the motor control centers to evaluate the motor winding insulation, as well as the motor power conductor condition from the motor control center to the motor. This testing measures the resistance of the insulation with a test voltage equal to or greater than what would be applied under operating conditions to look for a weakness, or break down of the insulation system that could lead to a short and failure of the motor.

- Oil condition in all four pumps was looked at visually to assess the condition and look for contaminates (dirt, moisture, metal, etc..) indicative of poor maintenance, infiltration or failing components.

The results of the testing are described in Section 4.1.2.4

4.1.1.7 Odor Control System

The Siemens Bioxide system was installed in 2006 and includes a control unit and one chemical pump inside the building. The existing 975 gallon tank is located outside the building in a concrete containment dike that was already in place for a previous chemical used. It was not supplied by Siemens.

The concrete containment dike is 78 inches square with a 7 inch side wall height. The containment area is not sized properly to handle the entire chemical spillage volume from the tank. The containment dike has a floor drain pipe into the wet well.

The tank fill line is outside of the dike and potential leakage from a tanker hose connection, pumping, and disconnection would not be contained within the containment dike.

[redacted]

[redacted]

4.1.1.8 Electrical Power/Generator

The pump station electrical service entrance is underground from a padmount transformer on site. The transformer is owned by National Grid, the power company. The power consumption meter is mounted on the transformer enclosure. The electrical service is rated at 225 Amps, 480Y/277 Volts, three-phase, 4-wire.

The pump station was built in the early 1980's. The electrical equipment is original to the station construction and consists of a main circuit breaker, automatic transfer switch, panelboards, transformer and motor control center.

The main breaker is rated at 225 Amps, 3-phase. The enclosed circuit breaker and was manufactured by ITE and is in good physical condition.

The automatic transfer switch was manufactured by Westinghouse Electric and is rated at 225 Amps, 480Y/277 Volts, three-phase, and is a 3 pole, dual breaker style transfer switch. The automatic transfer switch is wired with 300 MCM, Type THW aluminum wire, which is rated for 230 Amps. The wire is terminated to the transfer switch with "Mac-Adapter" high pressure aluminum adapters, which provide better aluminum cable connections. The enclosure is rusted and all the feeder connectors are corroded. The overall condition of the transfer switch is poor.

There are two panelboards. The first panelboard is an 18 pole, main breaker type, rated at 225 Amps, 480Y/277 Volts, three-phase, 4-wire. The second panelboard, which is fed through a 7.5 kVA step-down transformer, is an 18 pole main breaker type, rated at 100 Amps, 120/240 Volts, single phase, 3-wire. The panelboards were manufactured by ITE Gould and are Type CDP. The transformer was manufactured by Westinghouse Electric. This equipment is in fair to good condition.

Interior lighting is vapor-tight fluorescent lighting. Exterior lighting is wall-pack type HID. The lighting is in good condition.

There is a 3 kW, 208 Volt, single-phase electric unit heater, which is mounted on the ceiling near the entrance door and is in good condition.

There is a fire alarm system and intrusion alarm security system with exterior cameras. The fire alarm system is connected to the security system. The systems are in good condition.

The stand-by generator was manufactured by Consolidated Power Systems. The generator is an exterior enclosed unit, driven by a Detroit Diesel engine. The generator is rated for 135kW, 480Y/277 Volts, three-phase, 4-wire. The generator has 995 hours of operation.

[redacted]

The condition of the generator is poor.

- The generator enclosure is rusting and difficult to latch the doors.

- There is an engine oil leak, which is not uncommon with Detroit Diesel engines, which has covered the entire side of the engine and concrete pad.

[redacted]

The fuel tank for the generator is located next to the generator. The tank is a single wall steel tank (approximately 1,000 gallons) on a concrete pad (5 foot x 12 foot).

[redacted]

Fuel lines are exposed steel pipe on the tank and they are connected to the generator underground without any secondary containment system. The tank is in fair physical condition, but does not meet Code for fuel containment.
Based on the condition of the generator, testing of the generator is not warranted.

4.1.1.9 Control System

The motor control center is located in the Pump Station floor level and was manufactured by Allen-Bradley and is a Model 2100, rated at 600 Amps, 600 Volts, 3-phase. The motor control center was modified by Gorman Rupp Pump Company to include the pump controls. The motor control center consists of four motor starter sections and a pump control section. The enclosure is severely rusted. The condition of the motor control center is poor.

The pump control section was manufactured by Gorman Rupp and consists of Hand-Off-Auto selector switches, elapse time meters, and control function status pilot lights. The system is in good condition.

Each pump is a two stage unit with a first and second stage motor. The pumps are controlled by the Siemens bubbler system.

The pump motors are 40 horsepower, 230/460 Volts, 3-phase, 1755 RPM. The motor full load amps based on the nameplate is 47.5 Amps at 460 Volts.

[redacted]

The station flow is measured by a magnetic flowmeter at the discharge pipe, manufactured by Brooks located inside the pump station building. Flow measurement is recorded on a BIF round chart meter. At the time of site visit the chart recorder was not operating properly.

[redacted]

4.1.2 Deficiencies & Rehabilitation Needs

Based on our visual inspection and evaluation of the pump station building and equipment, we recommend the following improvements and upgrades to address the deficiencies and issues that were identified:

4.1.2.1 Civil Site Features

- Re-grade the site around the building to direct the flow of water away from the foundation. Fill in depressed areas throughout the site with new topsoil. Re-seed all affected areas once grading and filling are complete.
- The oil spill will need to be investigated further to determine if there is contamination present. If found, the area should be cleaned, including removal and proper disposal of the contaminated soils. Clean fill should be installed and the area re-seeding.

4.1.2.1 Pump Station Wet Well

During the visual observation it was noticed there was an excessive amount of debris, rags, plastics and grease that have accumulated in the wet well which could clog the pumps and valves. Based on the daily log, maintenance staff stated that they have to regularly clean and unclog check valves, air release valves and isolation valves. FG Lees, the maintenance plumber for the station, stated that they used to clean the wet well quarterly. The following is recommended for wet well improvements:

[redacted]

- Clean wet well immediately
- Replace corroded suction piping within the wet well
- Install a shredder unit at the upstream sewer manhole to prevent large or stringy objects in the wastewater flow from potentially clogging and damaging the pumps.
- Install screens on the wet well exhaust vent piping to eliminate access for rodents and birds.

4.1.2.2 Structural/ Architectural

- Remove all spalling and loose concrete from the face of the beam in the storage closet. Repair the beam with a cementitious repair material, such as SikaTop 123 Plus, that is specified for use on vertical surfaces.
- Remove all spalling and loose concrete from the storage closet floor. Install a new self-leveling, cementitious topping mortar, such as Sika MonoTop 611, to patch and level the floor.
- Replace the steel door accessing the storage closet.
- Replace and repair the roof flashing as required around the perimeter of the building.
- Clean out the debris from the roof scupper and re-attach the downspout.
- Repair the roof membrane to ensure an adequate seal along the perimeter of the roof.
- The interior walls and underside of the storage closet slab should be repainted.
- Provide hoist system to support removal of pumps and motors for maintenance, overhaul, and replacement.

Roof Scupper

Storage Closet

4.1.2.3 Mechanical Systems

- Replace pressure gauges on the suction and discharge piping for pump #2A & #2B.
- Replace pressure gauges on the suction and discharge piping for pump #1A.
- Remove and replace the sump pump within the pump station with a larger system that can handle larger flows.
- Replace original isolation valves
- Repair or replace Mag-Meter chart recorder if continual recording of flows is desired
- Provide pump rotating assembly (wear plate, seals, bearings and cover plate, necessary O-rings and gaskets for pump rebuild)
    - Rebuild pumps as needed.

4.1.2.4 Pump Testing Results

- All pump motor bearing ultrasonic test results indicated bearings require lubrication as soon as possible to prevent further damage. See *Appendix D, Exhibit 1* for ultrasound test results and comments.
- Pump motor 1B and 2B bearings showed minor defects and early stage bearing failure frequencies during ultrasonic testing (Note: given the duty cycle of the pumping operations, the bearings could last several years with these types of defects). See *Appendix D, Exhibits 2 and 3* for spectral analysis of motor 1B and 2B bearing defects. We recommend re-lubricating the bearings and regular ultrasonic, and or vibration monitoring as part of a predictive maintenance strategy.
- Motor winding insulation (megger) test results suggest motor windings are all serviceable at this time. Trending over time would give a better indication of the condition. Comparable readings on all four motors indicate motor insulation is currently in good condition. See *Appendix D, Exhibit 4* for insulation (Megger) test results. We recommend annual insulation testing as part of a preventive predictive maintenance strategy.
- Thermal survey did not uncover abnormal heating patterns in the pumping equipment. (Not conclusive - Each set of pumps ran 3-4 minutes approximately every 40 minutes on a rotating basis at time of survey. This is not adequate for heat buildup. It is also important to note that abnormal heating patterns often do not manifest until late stages of failure). See *Appendix D, Exhibit 5* for thermal results.
- Pump lubricating oil observations showed lube to be in good condition (sight glass, and samples grabbed from fill ports). Lube appeared to be clean and contamination free on all four pumps. This is a good indication that the oil changes have been performed on schedule and the bearings and seals are in good condition. The one exception was that Pump 2B appeared to be overfilled. An unsuccessful attempt was made at the time of the survey to drain a small amount from the bottom drain plug to make sure water did not leak in and displace the lubrication (did not detect contamination at the sight glass). We do recommend that this be performed to confirm, and to drain the unit to the proper level and monitored to prevent damage.
- Review of electrical documents at the site, and lack of Arc Flash labeling on the electrical gear suggests that an Arc Flash assessment has not been completed, and the site is not currently in

compliance with N.F.P.A 70E. We recommend that an Arc Flash study, and short circuit calculations on site electrical gear be performed to assure that short circuit energy falls within N.F.P.A. 70E tabular method guidelines. Appropriate labeling of site equipment as required by N.F.P.A. 70e and possible training if needed should also be included.

In general, the pumps appear to have been replaced, and/or overhauled in the past few years and appear to be in good condition with the exceptions noted above. Motor life for this type of motor and application it typically 15 to 20 years before overhaul, or replacement. Typically, the life can be extended by many years for less than fifty percent of the cost of a new one with a bearing replacement, and a recoating of the winding insulation by a qualified motor shop as long as this is done before failure. Though it is possible this motor overhaul has been performed in the past, there is no indication in the maintenance log at the site that this has been done.

4.1.2.5 Odor Control System

- Provide a second (redundant) chemical injection pump for the Bioxide system.
- Provide a new double walled high density polyethylene chemical storage tank
- Relocate the fill line within the concrete containment area to prevent any potential leakage from the tanker escaping the containment area.

4.1.2.6 Electrical Power/Generator

- The electrical system components are over 30 years old, which is beyond the design life of the equipment. The rust on much of the equipment and visible corrosion on wire connections makes its safe operation questionable. Based on the physical condition and age of the pump station equipment, the system should be completely replaced.
- The generator's condition is poor. Based on the oil leaks observed and the physical condition of the generator and enclosure, the system should be completely replaced.
- The generator fuel storage system does not meet the current Code in regard to containment requirements.

4.1.2.7 Control System

- The electrical control system components are over 30 years old, which is beyond the design life of the equipment. The rust on much of the equipment and visible corrosion makes its safe operation questionable. Based on the physical condition and age of the pump control equipment the system should be completely replaced.
- There is no remote monitoring system in place.
- A new Instrumentation/Control System Panel should be considered. The new control system should be PLC based with an Operator Interface Panel (OIT) and with remote monitoring/alarm functions. At a minimum, an auto dialer for alarms should be considered. An enhancement to consider would be a full SCADA system, which would be more expensive.

4.2 Force Main

4.2.1 Existing Conditions Assessment

The force main from the Woodland Manor Pump Station building connects to the 10-inch PVC, gasketed joint force main at Nooseneck Hill Road and runs approximately three miles east to Tiogue Avenue (Rhode Island State Route 3) and discharges into the City of West Warwick's gravity sewer manhole located at the Town Line.

There is an existing flow meter station located along the sewer force main at the intersection of Tiogue Avenue and Darton Street in the Town of Coventry.

The force main in the Reservoir Road is a 6-inch force main that convey wastewater from the Westwood Estates pump station to the Woodland sewer force main at intersection of Reservoir Road and Tiogue Avenue.

4.2.2 Deficiencies & Rehabilitation Needs

We were not able to evaluate the discharge manhole during the site visit; however we have contacted the pump station maintenance operator and talked to Rick Lees of FG Lees and asked some questions about the force main. He stated that within 20 +/_ years there have been couple of leaks and only 2-3 breaks of the force main. Two of the breaks were man made during construction.

At this point, based on the anecdotal information provided by Rick Lees, we assume the force main is in a good condition, free of debris and does not require cleaning or replacing.

4.3 Flow Meter Station

4.3.1 Existing Conditions / Electrical Power

The force main flow meter station consists of a service entrance/control enclosure and a meter manhole. The control system was manufactured by Boydco Inc.

The control enclosure was manufactured by APX and is constructed of sheet aluminum and aluminum framing. The enclosure includes a service entrance panelboard, flow meter system panel and electric strip heaters.

The service entrance/control enclosure is fed underground from a nearby National Grid Utility Pole, #45. The electric service meter is mounted on the exterior of the enclosure which connects to the service entrance panelboard. The service is single phase, 3-wire and is rated for 100 Amps, 120/240

Volts, s. The service entrance panelboard is a main circuit breaker, 12 pole load center, with a 100 Amp main breaker. The system is grounded to a ground rod in the base of the enclosure.

The flow meter system, manufactured by Thermo Scientific, is a Model SX40 and is a dual frequency doppler clamp-on flow element. It is strapped onto the force main in the manhole.

[redacted]

[redacted]

The electrical control system components are in good condition. There was a totalized flow of 240,175,520 gallons but no flow during our observation. There was no flow totalizer at the Woodland Pump Station to compare values.

4.3.2 Deficiencies & Rehabilitation Needs

- There are no deficiencies or rehabilitation needs for the electrical system.

4.3.2.1 Control System

- There is no remote monitoring of flow or alarms to a central monitoring station.
- A security system (intrusion alarm) should be considered for the service/control enclosure.

5 Budgetary Opinion of Cost

The opinion of capital cost for the improvements to the existing pump station include a 25% engineering and miscellaneous. Once the costs were developed, a range of -15% to 30% was presented since the cost is budgetary and the improvements proposed have only been conceptualized. The budgetary level opinion of cost is $343,000 for the Woodland Pump Station and $5,000 for the flow meter station (See Table 5-1). Detailed information related to these costs is included in *Appendix A.*

TABLE 5-1 OPINION OF COST SUMMARY

PUMP STATION NO.	PUMP STATION NAME	TOTAL COST
1	Woodland Pump Station Improvements	
1a	Short Term Improvements (Within a fist year)	$131,300
	Engineering & Miscellaneous (25%)	$32,800
	Subtotal	**$164,000**
	Range -15% to +30% ($140,000 to $214,000) Rounded	
1b	Long Term Improvements	$143,200
	Engineering & Miscellaneous (25%)	$35,800
	Subtotal	**$179,000**
	Range -15% to +30% ($153,000 to $233,000) Rounded	
	SUBTOTAL WOODLAND PUMP STATION	**$343,000**
2	Flow Meter Station Improvements	$4,000
	Engineering & Miscellaneous (25%)	$1,000
	SUBTOTAL FLOW METER STATION	**$5,000**
	Range -15% to +30% ($4,300 to $6,500)	

Appendix A

Budgetary Opinion of Capital Cost

Appendix B

Overall Woodland Sewer System Map

Appendix C

Existing Gorman-Rupp (G-R) Pumps

Appendix D

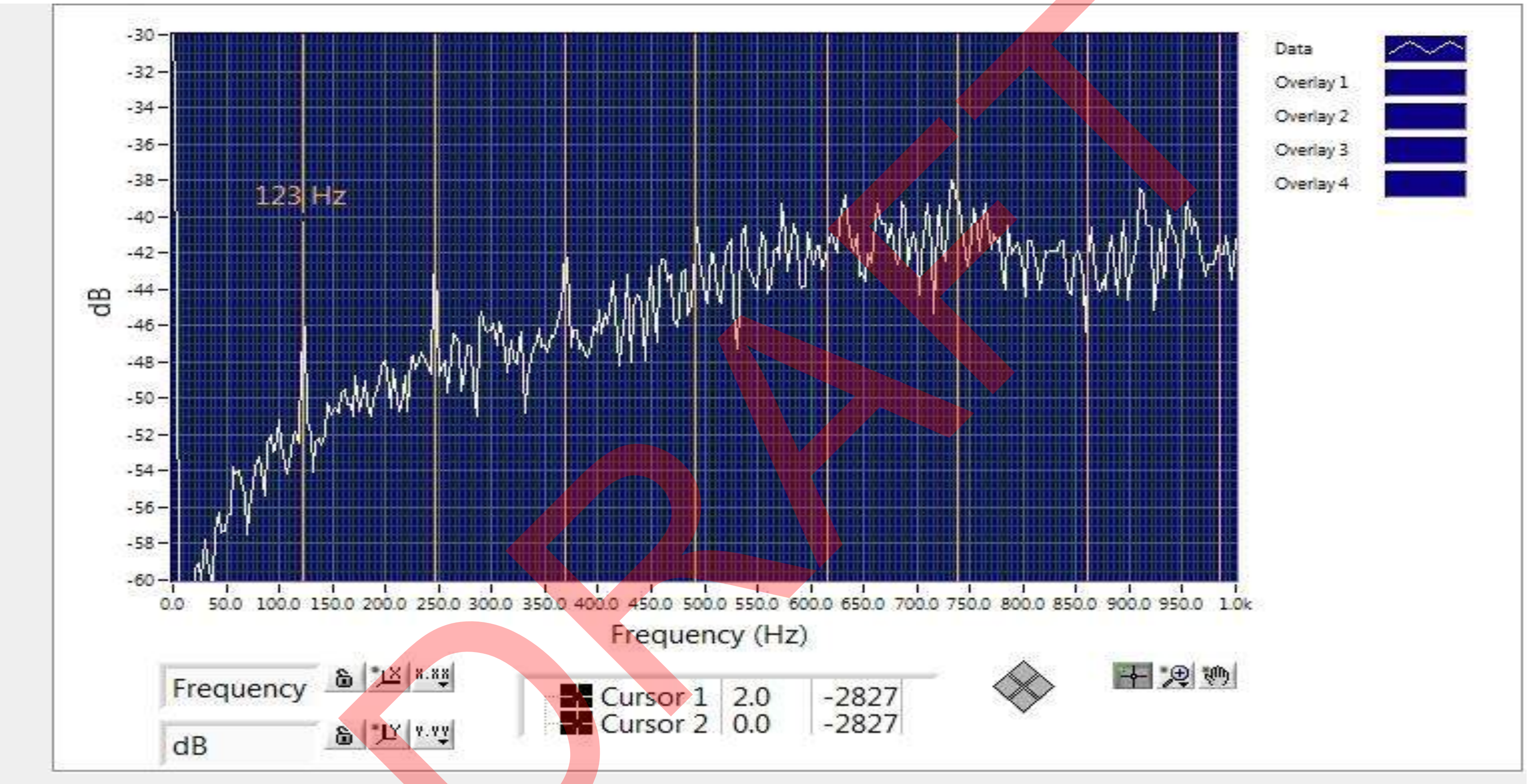
Testing Results

FUSS & O'NEILL

Exhibit 1

Ultrasonic Data ~ Woodland Manor Pump Station							
Date	Location Name	Point Name	Point Number	dB	Frequency	Sensitivity	Comments
10/16/2013 10:50	PUMP 1A	MTR-OB	1	41	30	45	Noise time domain 50 percent scale - Indicative of need for Relubrication
10/16/2013 10:50	PUMP 1A	MTR-IB	2	33	30	53	Noise time domain - less saturated than all other motor bearings - Relube ASAP
10/16/2013 10:52	PUMP 1A	PU-BOTH	3	43	30	43	FFT Clean
10/16/2013 11:14	PUMP 1B	MTR-OB	4	46	30	39	Time domain noisy peaking 100 percent full scale - indicative of a very dry bearing - Relube ASAP
10/16/2013 11:15	PUMP 1B	MTR-IB	5	48	30	37	Time domain noisy - 124 hertz spike starting in FFT - Bearing sounds dry - Relube ASAP
10/16/2013 11:16	PUMP 1B	PU-BOTH	6	46	30	39	Time Domain Very Noisy -
10/16/2013 11:35	PUMP 2A	MTR-OB\	7	49	30	37	FFT clean - Time domain very noisy - Bearing sounds dry - Relube ASAP
10/16/2013 11:36	PUMP 2A	MTR-IB	8	49	30	37	FFT Clean - Time Domain is very noisy - Relube ASAP
10/16/2013 11:37	PUMP 2A	PU-BOTH	9	42	30	44	FFT clean waveform
10/16/2013 11:58	PUMP 2B	MTR-OB\	10	49	30	38	Time Domain is noisy - Relube ASAP
10/16/2013 11:59	PUMP 2B	MTR-IB	11	47	30	39	123 Hz harmonic present - Noisy time domain - Relube as soon as possible
10/16/2013 12:00	PUMP 2B	PU-BOTH	12	41	30	45	FFT Clean Waveform

Exhibit 2



Pump 2B motor inboard bearing 123 Hertz Harmonic

FUSS & O'NEILL

Exhibit 3

Pump 1B motor inboard bearing Small 124 Hertz Spike

Exhibit 4

Motor Insulation Resistance Testing ~ Woodlands Manor Pump Station

Date	Location Name	Point Name	Resistance test	
10/16/2013	PUMP 1A	Motor	1.46	Gig Ohms
10/16/2013	PUMP 1B	Motor	1.55	Gig Ohms
10/16/2013	PUMP 2A	Motor	1.77	Gig Ohms
10/16/2013	PUMP 2B	Motor	1.58	Gig Ohms

Exhibit 5

Thermal imaging ~ Woodland Manor pump station

Date	Location Name	Point Name	Thermal Imaging (infrared)
10/16/2013	PUMP 1A	Motor	No abnormal heating patterns observed
10/16/2013	PUMP 1A	Pump	No abnormal heating patterns observed
10/16/2013	PUMP 1B	Motor	No abnormal heating patterns observed
10/16/2013	PUMP 1B	Pump	No abnormal heating patterns observed
10/16/2013	PUMP 2A	Motor	No abnormal heating patterns observed
10/16/2013	PUMP 2A	Pump	No abnormal heating patterns observed
10/16/2013	PUMP 2B	Motor	No abnormal heating patterns observed
10/16/2013	PUMP 2B	Pump	No abnormal heating patterns observed

Appendix K

Sewer CIP Recommendations from Weston & Sampson

March 15, 2021

Coventry, RI

Mr. Kevin McGee
Town of Coventry
Public Works Director
1670 Flat River Road
Coventry, RI 02816

Evaluation of the Sandy Bottom Wastewater Pump Station

Mr.:

On January 12, 2021, John Ellis and Paul Provost were present at the Sandy Bottom wastewater pump station to perform evaluation. This report contains the evaluation including short term and long term recommended improvements. Below is an index of information contained in this report:

Section 1 – Sandy Bottom Pump Station Evaluation

Section 2 – Short Term and Long-Term Capital Improvements and Estimated Costs Summary

We are pleased to provide this service to you. Please call me to discuss the observations and recommendations made in this report.

If you have any questions, please call me at (978) 265-2947 or e-mail me at ellisj@wseinc.com

Sincerely,

Weston & Sampson CMR, Inc.

John Ellis
General Manager

\CMR\Coventry RI Pump Station Evaluation\Sandy Bottom Evaluation.doc

Sandy Bottom Wastewater Pump Station
Installed Circa 2003

Description

This station was built in 2004 as part of "The Town of Coventry Fast Track Sewer Project". The station is a flooded suction type station housing two 50HP centrifugal pumps. The pumps and controls are in a custom-built concrete building. There is a standby generator located in an above grade enclosure on a concrete pad. The system is a duplex sewer pump system that draws the wastewater from a concrete wet well.

The following activities were performed at this station:

1. Exterior Inspection.

2. Inspection of Electrical Panels, Breakers, and Control Panels.

3. Miscellaneous Inspection and Operation:
   - Pumps and Motors
   - Check and Gate Valves
   - Mechanical Piping
   - Standby Generator
   - Wet well walls and Interior
   - HVAC systems

The following is a list of deficiencies made during the evaluation:

Exterior -

1. The lighting is poor and non-energy efficient type. We recommend upgrading to energy efficient LED type lighting on all sides.

2. The entrance road has settled at the gate. We recommend the driveway to be raised and resurfaced. This includes raising and upgrading the valve vault hatch with a new H-20 rated hatch as it continues to flood out during storm events.

Control Room –

1. The existing pump control panel is nearing 20 years old and uses an Allen Bradley PLC with a bubbler type level control system and the PLC is outdated and obsolete. We recommend the level control panel to be replaced with a new PLC with operator interface screen and a submersible level transmitter be installed in place of the bubbler system in each of the two wet wells.

2. Both 50 Hp Variable Frequency Drives "VFDs" are operational however they are showing signs of wear and are deteriorating. The VFD-1 is still the original Robicon, and VFD-2 was replaced approximately seven years ago with a Square D 50 HP. We recommend replacing both with new VFD's.

3 The SF1 supply fan 1.5 HP VFD is deteriorated. We recommend upgrading with a new VFD and connecting to HVAC control unit.

4. The gas detection system requires replacement sensors, testing and calibration.

5. The telephone autodailer is deteriorated and unreliable. A new Mission cell type SCADA unit should be installed in place.

6. The sewer grinder control panel is deteriorated, and the PLC requires replacement. We recommend replacing panel when the grinder is replaced.

7. The mini split Mitsubishi Mr. Slim unit used to cool the motor control cabinet and VFDs is not operating properly and requires service. Service mini split unit.

Mid-Level Pump Room –

1. Both "Ross Valve" surge control valves are leaking oil. Recommend these valves be serviced.

2. The flow meters are deteriorated – FIT 18A is damaged beyond repair and FIT 18B requires calibration. We recommend replacing with a new meter.

Pump Room –

1. Pump No. 1 and Pump 2 are the original pumps and are approximately 20 years old and require rebuilding. We recommend both pumps be rebuilt.

2. The Packing on the future pump discharge gate is leaking. We recommend replacing bolts and repacking valve.

3. The discharge check valves on each pump is wearing. We recommend the check be replaced.

4. The four sump pump level floats are severely deteriorated and require replacement.

5. On the discharge of sump pump No.2 both 2-inch check valves are stuck open and require replacement.

Wet Well –

1. The wet well contain large amounts of grease. We recommend the wet well be pumped and cleaned.

2. The sewerage grinder is severely worn, and cutters need replacement. We recommend replacing the unit with a new grinder.

3. The supply fan SF-2 was found with a bad motor with open windings, This motor requires replacement.

Generator –

1. The generator requires continued annual service.

Estimated Costs –

The following table displays the recommended short-term and long-term improvements and their estimated costs. We recommend that the short-term improvements are completed within the next year, and the long-term improvements are completed within the next two to five years.

Recommended Short and Long Term
Capital Improvements and Estimated Costs
Sandy Bottom Pump Station

Observation	**Recommendation**	**Estimated Cost (1)**
Short Term – 1 Year		
Exterior –		
The lighting is poor and non-energy efficient type.	Upgrade to energy efficient LED type lighting on all sides.	$4,000
Control Room -		
The SF1 supply fan 1.5 HP VFD is deteriorated.	Replace VFD with new.	$1,500
The telephone autodailer is deteriorated and unreliable	Upgrade to a new cell-based mission SCADA unit.	$7,000
The gas detection system requires testing replacement of sensors and calibration	Calibrate system and replace sensors as required	$5,000

Observation	Recommendation	Estimated Cost (1)
The mini split Mitsubishi Mr. Slim unit used to cool the motor control cabinet and VFDs is not operating properly and requires service.	Have unit serviced by an authorized Mitsubishi service rep.	$1,500
Mid-Level Pump Room -		
Both "Ross Valve" surge control valves are leaking oil.	Service both valves	$2,000
PRV service on water feed.	Continue PRV inspections and service	***By Town***
Pump Room -		
The Packing on the future pump discharge gate is leaking.	Repair packing.	$1,500
The four sump pump level floats are severely deteriorated and require replacement	Replace all four floats.	$1,500
The sump pump check valves for No.2 are not closing and require replacement.	Replace sump pump check valves.	$2,500
Wet Well -		
The wet wells contain large amounts of grease.	Pump and clean both wet wells	$10,500
The sewerage grinder is severely worn, and cutters need replacement.	Replace Muffin Monster sewerage grinder with a new unit.	$30,000
Generator -		
Generator has been serviced	Continue generator service each year.	$2,000

Observation	Recommendation	Estimated Cost (1)
	Subtotal -	$69,000
	15% Contingencies -	$10,350
	Total (Short Term)	$79,350
Observation	**Recommendation**	**Estimated Cost (1)**
Long Term 2-5 Years		
Exterior --		
The entrance road has settled at the gate and the valve vault floods each storm event.	Driveway to be raised, resurfaced, and repaved and valve vault raised to include H-20 loading hatch.	$16,000
Control Room -		
The existing pump control panel is nearing 20 years old and uses an Allen Bradley PLC with a bubbler type level control system and the PLC is outdated and obsolete.	Replaced with a new PLC with operator interface screen and a submersible level transmitter be installed in place of the bubbler system in each of the two wet wells.	$40,000
Both 50 Hp Variable Frequency Drives "VFDs" are operational however they are showing signs of wear and are deteriorating.	Replace both 50 HP 480-volt VFDs with new VFD's.	$10,000

Observation	Recommendation	Estimated Cost (1)
The sewer grinder control panel is deteriorated, and the PLC requires replacement.	Replace panel with a new up to dated panel.	$8,000
Mid-Level Pump Room-		
The flow meters are deteriorated – FIT 18A is damaged beyond repair and	Replace unit with a new doppler unit	$4,500
Pump Room-		
Pump No. 1 and Pump 2 are the original pumps and are approximately 20 years old and require rebuilding.	Rebuild both pumps No.1 and No.2	$40,000
The check valves are wearing.	Replace both check valves.	$20,000
	Subtotal -	$138,500
	15% Contingencies -	$20,775
	Total (Long Term) -	$159,275
	Total Short and Long Term -	**$238,625**

(1) Includes labor and installation.
(2) Contingency numbers were rounded for budgetary purposes.

Coventry Sandy Bottom Main Breaker Proposal

Ferrara, Sal <ferraras@wseinc.com>
Wed 12/8/2021 2:31 PM
To: Frost, Thomas <frostt@wseinc.com>;Provost, Paul <provostp@wseinc.com>
Cc: Richard, Steve <richards@wseinc.com>;Sullivan, Courtney <SullivanC@wseinc.com>;Ciaramitaro, Vito <ciaramitarov@wseinc.com>;Colson, Paul <colsonp@wseinc.com>;David, Andrea C. <davida@wseinc.com>;Ellis, John <ellisj@wseinc.com>;Sampson, Daniel <Sampson.Daniel@wseinc.com>;Militello, Frank <MilitelloF@wseinc.com>

Tom./Paul,

Cost to replace the main breaker at Sandy Bottom. Let me know if we need to address this to the Town Directly. It is costly.

Remove and replace the 800 AMP Main Breaker at the Sandy Bottom Pump Station in Coventry RI.

Scope of Services –

Sandy Bottom Rd

1. CMR will provide Electrician to assist our sub-contractor in replacing the existing failing 800 AMP Main Breaker.
2. Remove and replace the 800 AMP Breaker with updated unit. The existing breaker is no longer made or available for purchase.
3. Perform Start up and Testing .

NOTE:

- Due to supply chain issues, Weston & Sampson will only hold this price for 14 Days. Delivery of this breaker is currently 10 Week.
- Any unforeseen issues other than the work in the above scope will be billed time and materials fallowing approval by owner. Weston & Sampson reserves the right to stop all work until unforeseen extra work has been approved by owner.

Estimated Cost –

The estimated cost items 1 through 3 of the above Scope of services is a lump sum of 26,000.

Please let me know if you wish to proceed.

Thank you.

Sal Ferrara
General Manager

Weston & Sampson
55 Walker's Brook Dr. Suite 100, Reading Ma. 01867 (HQ)
cell: 978-815-1439
tel: 978-532-1900
westonandsampson.com

Facebook | Twitter | LinkedIn

evoqua
WATER TECHNOLOGIES

March 10, 2022

Mr. Tom Frost
Weston & Sampson Engineers
5 Centennial Drive
Peabody, MA 01960
Phone: (978) 532-1900
FAX: (978) 977-0100
Email: frostt@wseinc.com

RE: BELLOWS PUMP
TOWN OF COVENTRY, RI – WOODLAND MANOR PS
Evoqua Quote No. 2022-517802

Dear Mr. Frost,

Thank you for your interest in Evoqua Water Technologies LLC. We would like to offer you the following proposal to supply a replacement bellows pump.

PRICING SUMMARY:

Item	Part No Description	Qty	Net Price	Ext. Price
1	**W2T201442** PUMP,BELLOWS 0.375 IO 019.0 GPD 40PSI Reference Model # 15907-001	1 EA	$1,149.71	$1,149.71

Total Net Price: $1,149.71

Freight to jobsite is pre-paid and included.

Terms of Payment are NET 30 days from date of invoice. This price does not include any applicable taxes.

Due to current volatility in the market, pricing associated with this quote will remain firm for a period of thirty (30) days. If we are not in receipt of an order by the end of this firm price period, we reserve the right to modify the prices quoted.

The attached Terms and Conditions are considered a part of this proposal and shall prevail.

Thank you for considering Evoqua Water Technologies for your odor control needs. If you have any questions or need additional information, please feel free to contact me at any time.

Sincerely,

Todd Gaignat

Todd Gaignat
Technical Sales Representative
Cell Phone: (302) 275-4072
Email: todd.gaignat@evoqua.com

EVOQUA

WATER TECHNOLOGIES

RE: **BELLOWS PUMP**
TOWN OF COVENTRY, RI – WOODLAND MANOR PS
Evoqua Quote No. 2022-517802

Evoqua will process your order when we receive acceptance of this proposal, by signing below and returning to municipalservices@evoqua.com or via fax to: (941) 359-7985.

Company Name: ______________________________

This ____ day of ______________________ Month ________ Year

By: ______________________________

Title: ______________________________

P.O.Number______________________________

NOTE: Effective April 2022, you may be assessed a 3% fee if paying via Credit Card. Find more info on our website here > https://www.evoqua.com/en/about-us/terms-conditions-sale-products-services/credit-card-fee-faqs . Ask us how to avoid paying fees by migrating to ACH CTX payment type.

EVOQUA WATER TECHNOLOGIES LLC

Standard Terms of Sale

1. **Applicable Terms.** These terms govern the purchase and sale of equipment, products, related services, leased products, and media goods if any (collectively herein "Work"), referred to in Seller's proposal ("Seller's Documentation"). Whether these terms are included in an offer or an acceptance by Seller, such offer or acceptance is expressly 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 specifically provides otherwise, freight, storage, insurance and all taxes, levies, duties, tariffs, permits or license fees or other governmental charges relating to the Work or any incremental increases thereto shall be paid by Buyer. If Seller is required to pay any such charges, Buyer shall immediately reimburse Seller. If Buyer claims a tax or other exemption or direct payment permit, it shall provide Seller with a valid exemption certificate or permit and indemnify, defend and hold Seller harmless from any taxes, costs and penalties arising out of same. 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 by Seller. Back charges without Seller's prior written approval shall not be accepted.

3. **Delivery.** Delivery of the Work shall be in material compliance with the schedule in Seller's Documentation. Unless Seller's Documentation provides otherwise, delivery terms are ExWorks Seller's factory (Incoterms 2010). Title to all Work shall pass upon receipt of payment for the Work under the respective invoice. Unless otherwise agreed to in writing by Seller, shipping dates are approximate only and Seller shall not be liable for any loss or expense (consequential or otherwise) incurred by Buyer or Buyer's customer if Seller fails to meet the specified delivery schedule.

4. **Ownership of Materials and Licenses.** All devices, designs (including drawings, plans and specifications), estimates, prices, notes, electronic data, software 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 Work. Buyer shall not disclose any such material to third parties without Seller's prior written consent. Buyer grants Seller a non-exclusive, non-transferable license to use Buyer's name and logo for marketing purposes, including but not limited to, press releases, marketing and promotional materials, and web site content.

5. **Changes.** Neither party shall implement any changes in the scope of Work described in Seller's Documentation without a mutually agreed upon change order. Any change to the scope of the Work, delivery schedule for the Work, any Force Majeure Event, any law, rule, regulation, order, code, standard or requirement which requires any change hereunder shall entitle Seller to an equitable adjustment in the price and time of performance.

6. **Force Majeure Event.** Neither Buyer nor Seller shall have any liability for any breach or delay (except for breach of payment obligations) caused by a Force Majeure Event. If a Force Majeure Event exceeds six (6) months in duration, the Seller shall have the right to terminate the Agreement without liability, upon fifteen (15) days written notice to Buyer, and shall be entitled to payment for work performed prior to the date of termination. "Force Majeure Event" shall mean events or circumstances that are beyond the affected party's control and could not reasonably have been easily avoided or overcome by the affected party and are not substantially attributable to the other party. Force Majeure Event may include, but is not limited to, the following circumstances or events: war, act of foreign enemies, terrorism, riot, strike, or lockout by persons other than by Seller or its sub-suppliers, natural catastrophes or (with respect to on-site work), unusual weather conditions.

7. **Warranty.** Subject to the following sentence, Seller warrants to Buyer that the (i) Work shall materially conform to the description in Seller's Documentation and shall be free from defects in material and workmanship and (ii) the Services shall be performed in a timely and workmanlike manner. Determination of suitability of treated water for any use by Buyer shall be the sole and exclusive responsibility of Buyer. The foregoing warranty shall not apply to any Work 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. The Seller warrants the Work, or any components thereof, through the earlier of (i) eighteen (18) months from delivery of the Work or (ii) twelve (12) months from initial operation of the Work or ninety (90) days from the performance of services (the "Warranty Period"). If Buyer gives Seller prompt written notice of breach of this warranty within the Warranty Period, Seller shall, at its sole option and as Buyer's sole and exclusive remedy, repair or replace the subject parts, re-perform the Service or refund the purchase price. Unless otherwise agreed to in writing by Seller, (i) Buyer shall be responsible for any labor required to gain access to the Work so that Seller can assess the available remedies and (ii) Buyer shall be responsible for all costs of installation of repaired or replaced Work. 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 Work 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 (i) damage caused by chemical action or abrasive material, misuse or improper installation (unless installed by Seller) and (ii) media goods (such as, but not limited to, resin, membranes, or granular activated carbon media) once media goods are installed. THE WARRANTIES SET FORTH IN THIS SECTION 7 ARE THE SELLER'S SOLE AND EXCLUSIVE WARRANTIES AND ARE SUBJECT TO THE LIMITATION OF LIABILITY PROVISION BELOW. SELLER MAKES NO OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE.

8. **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.

9. **Assignment.** Neither party may assign this Agreement, in whole or in part, nor any rights or obligations hereunder without the prior written consent of the other party; provided, however, the Seller may assign its rights and obligations under these terms to its affiliates or in connection with the sale or transfer of the Seller's business and Seller may grant a security interest in the Agreement and/or assign proceeds of the agreement without Buyer's consent.

10. **Termination.** Either party may terminate this agreement, upon issuance of a written notice of breach and a thirty (30) day cure period, for a material breach (including but not limited to, filing of bankruptcy, or failure to fulfill the material obligations of this agreement). If Buyer suspends an order without a change order for ninety (90) or more days, Seller may thereafter terminate this Agreement without liability, upon fifteen (15) days written notice to Buyer, and shall be entitled to payment for work performed, whether delivered or undelivered, prior to the date of termination.

11. **Dispute Resolution.** Seller and Buyer shall negotiate in good faith to resolve any dispute relating hereto. If, despite good faith efforts, the parties are unable to resolve a dispute or claim arising out of or relating to this Agreement or its breach, termination, enforcement, interpretation or validity, the parties will first seek to agree on a forum for mediation to be held in a mutually agreeable site. If the parties are unable to resolve the dispute through mediation, then any dispute, claim or controversy arising out of or relating to this Agreement or the breach, termination, enforcement, interpretation or validity thereof, including the determination of the scope or applicability of this agreement to arbitrate, shall be determined by arbitration in Pittsburgh, Pennsylvania before three arbitrators who are lawyers experienced in the discipline that is the subject of the dispute and shall be jointly selected by Seller and Buyer. The arbitration shall be administered by JAMS pursuant to its Comprehensive Arbitration Rules and Procedures. The Arbitrators shall issue a reasoned decision of a majority of the arbitrators, which shall be the decision of the panel. Judgment may be entered upon the arbitrators' decision in any court of competent jurisdiction. The substantially prevailing party as determined by the arbitrators shall be reimbursed by the other party for all costs, expenses and charges, including without limitation reasonable attorneys' fees, incurred by the prevailing party in connection with the arbitration. For any order shipped outside of the United States, any dispute shall be referred to and finally determined by the International Center for Dispute Resolution in accordance with the provisions of its International Arbitration Rules, enforceable under the New York Convention (Convention on the Recognition and Enforcement of Foreign Arbitral Awards) and the governing language shall be English.

12. **Export Compliance.** Buyer acknowledges that Seller is required to comply with applicable export laws and regulations relating to the sale, exportation, transfer, assignment, disposal and usage of the Work provided under this Agreement, including any export license requirements. Buyer agrees that such Work shall not at any time directly or indirectly be used, exported, sold, transferred, assigned or otherwise disposed of in a manner which will result in non-compliance with such applicable export laws and regulations. It shall be a condition of the continuing performance by Seller of its obligations hereunder that compliance with such export laws and regulations be maintained at all times. BUYER AGREES TO INDEMNIFY AND HOLD SELLER HARMLESS FROM ANY AND ALL COSTS, LIABILITIES, PENALTIES, SANCTIONS AND FINES RELATED TO NON-COMPLIANCE WITH APPLICABLE EXPORT LAWS AND REGULATIONS.

13. **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 WORK, INCLUDING WITHOUT LIMITATION ANY LIABILITY FOR ALL WARRANTY CLAIMS OR FOR ANY BREACH OR FAILURE TO PERFORM ANY OBLIGATION UNDER THE CONTRACT, SHALL NOT EXCEED THE PURCHASE PRICE PAID FOR THE WORK. THESE LIMITATIONS APPLY WHETHER THE LIABILITY IS BASED ON CONTRACT, TORT, STRICT LIABILITY OR ANY OTHER THEORY.

14. **Rental Equipment / Services.** Any leased or rented equipment ("Leased Equipment") provided by Seller shall at all times be the property of Seller with the exception of certain miscellaneous installation materials purchased by the Buyer, and no right or property interest is transferred to the Buyer, except the right to use any such Leased Equipment as provided herein. Buyer agrees that it shall not pledge, lend, or create a security interest in, part with possession of, or relocate the Leased Equipment. Buyer shall be responsible to maintain the Leased Equipment in good and efficient working order. At the end of the initial term specified in the order, the terms shall automatically renew for the identical period unless canceled in writing by Buyer or Seller not sooner than three (3) months nor later than one (1) month from termination of the initial order or any renewal terms. Upon any renewal, Seller shall have the right to issue notice of increased pricing which shall be effective for any renewed terms unless Buyer objects in writing within fifteen (15) days of issuance of said notice. If Buyer timely cancels service in writing prior to the end of the initial or any renewal term this shall not relieve Buyer of its obligations under the order for the monthly rental service charge which shall continue to be due and owing. Upon the expiration or termination of this Agreement, Buyer shall promptly make any Leased Equipment available to Seller for removal. Buyer hereby agrees that it shall grant Seller access to the Leased Equipment location and shall permit Seller to take possession of and remove the Leased Equipment without resort to legal process and hereby releases Seller from any claim or right of action for trespass or damages caused by reason of such entry and removal.

15. **Miscellaneous.** These terms, together with any Contract Documents 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. To the extent the Agreement is considered a subcontract under Buyer's prime contract with an agency of the United States government, in case of Federal Acquisition Regulations (FARs) flow down terms, Seller will be in compliance with Section 44.403 of the FAR relating to commercial items and those additional clauses as specifically listed in 52.244-6, Subcontracts for Commercial Items (OCT 2014). 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. The Agreement shall be governed by the laws of the Commonwealth of Pennsylvania without regard to its conflict of laws provisions. Both Buyer and Seller reject the applicability of the United Nations Convention on Contracts for the international sales of goods to the relationship between the parties and to all transactions arising from said relationship.

Appendix L

Coventry Onsite Wastewater Management Plan
October 2003

COVENTRY, RHODE ISLAND

REPORT FOR DEPARTMENT OF PUBLIC WORKS

ONSITE WASTEWATER MANAGEMENT PLAN

OCTOBER 2003

Weston&Sampson ENGINEERS, INC.

Report

DRAFT

Weston & Sampson Engineers, Inc.
Five Centennial Drive
Peabody, MA 01960-7985
www.westonandsampson.com
Tel: 978-532-1900 Fax: 978-977-0100

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1.0

1.1 Background

Over 99 % of the residences in Coventry rely on individual sewage disposal systems (ISDS) for treatment and disposal of wastewater. Existing ISDS that are sited, designed and maintained properly provide adequate domestic wastewater disposal (Figure 1-1 and 1-2). However, responses to a 1992 needs questionnaire confirmed a preponderance of ISDS problems in several areas of eastern Coventry. The questionnaire was sent out to 6,250 homes and businesses in eastern Coventry. The results of the questionnaire were compiled and included in the 1995 Wastewater Facilities Plan completed by Weston & Sampson Engineers, Inc. As part of the study, the canvassed area was divided into 35 needs study areas. The Wastewater Facilities Plan concluded that several areas of eastern Coventry are experiencing significant ISDS problems which cannot be economically resolved through on-site solutions such as system rehabilitation or reconstruction.

The Wastewater Facilities Plan suggested that sanitary sewers be constructed to serve approximately half of the total properties in Coventry. The remaining properties were to continue to rely on ISDS. Many of the areas outside of the suggested sewer area were experiencing ISDS problems, but it was not deemed feasible to install sewers in these areas. In all areas that were to continue to rely on ISDS, a public information program was recommended. For several areas without sewer, future consideration of a Wastewater Management District (WWMD) was suggested.

The Wastewater Facilities Plan was approved by the Department of Environmental Management (DEM) in 1995. However, as of this date, none of the Wastewater Facilities Plan recommendations have been implemented. No sewer system was constructed, and 99% of Coventry is still reliant on onsite systems. As such, onsite ISDS systems represent the Town's only significant option for wastewater management, and these ISDS systems form a critical part of Coventry's infrastructure.

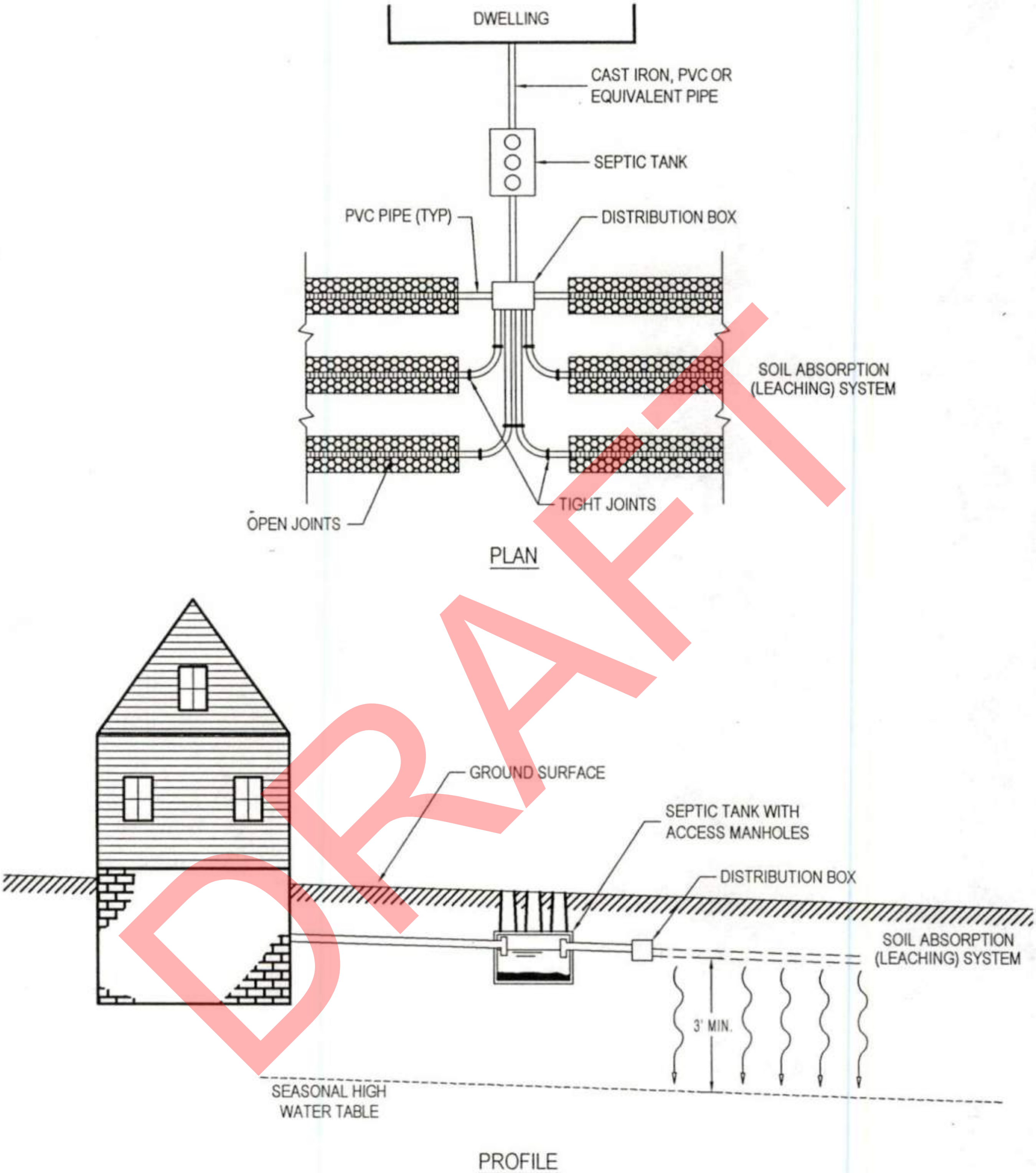

FIGURE 1-1
TOWN OF COVENTRY, RHODE ISLAND
TYPICAL SEPTIC SYSTEM
WASTEWATER STRATEGIC PLAN
SCALE : NOT TO SCALE

COVENTRY RI FIG 1-1

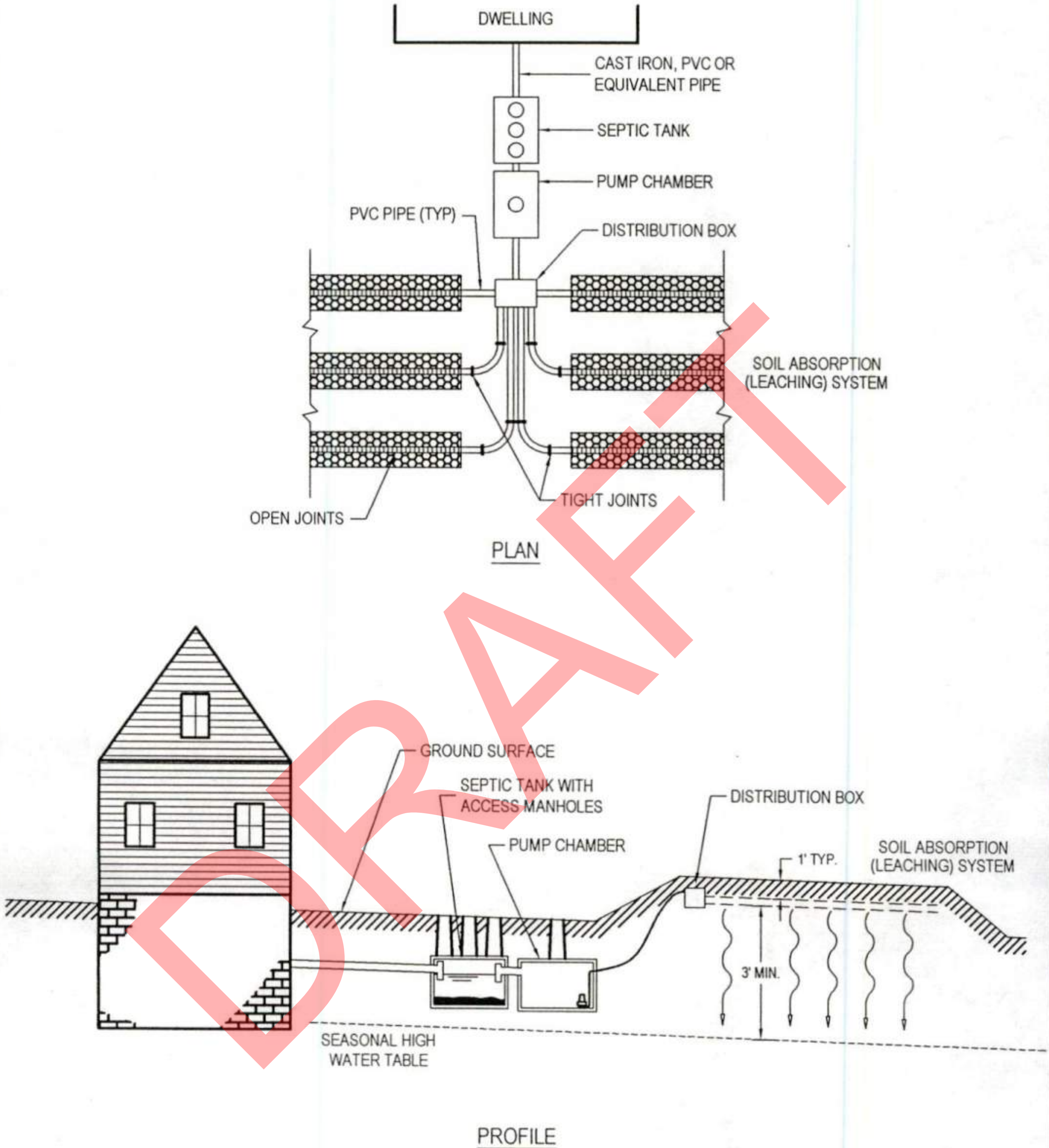

FIGURE 1-2

TOWN OF COVENTRY, RHODE ISLAND

TYPICAL MOUNDED SEPTIC SYSTEM

WASTEWATER STRATEGIC PLAN

SCALE : NOT TO SCALE

COVENTRY RI FIG 1-2

Weston & Sampson

An Onsite Wastewater Management (OWM) plan could help to protect environmentally sensitive areas from failing/failed ISDS. The plan would also assist in alleviating problems in densely developed neighborhoods with high intensity wastewater usage, such as older neighborhoods with multi-family housing on small lots.

The responsibility for maintenance and pumping of the ISDS has traditionally been that of the individual property owner. Some of the factors that have inhibited implementation of municipal onsite management include:

- Little state and/or federal grants/loans are available for onsite system management.
- Individual homeowners do not want government involved with facilities on their private property.
- Homeowners feel that the maintenance and repair of onsite systems is a private issue and that homeowners are fully capable of making decisions on the maintenance and upkeep of their facilities.
- Access to private property and system ownership issues become potentially intrusive and therefore unattractive to the homeowner.
- Costs of repairs/replacements of systems are often seen as inequitable, because site conditions vary and require added components for transmission or additional levels of treatment.

In recent years 14 Rhode Island communities have initiated projects to plan and implement onsite wastewater management programs for repair, replacement and maintenance of onsite wastewater systems. The Department of Environmental Management's approval of an OWM grant request has enabled the town of Coventry to develop an OWM plan. The objective of an OWM Plan is to raise the level of performance of ISDS through improved and/or enhanced management. Enhanced management includes factors such as public education, establishment of measurable performance standards, system inspection and maintenance (I&M), and system monitoring and enforcement. The program's components often become more comprehensive (and potentially more complicated) as the sensitivity of the environment (receiving waters) and/or the degree of treatment complexity increases.

Obtaining access to the Community Septic System Loan Program (CSSLP) is considered one of the most important goals of this plan because the cost associated with ISDS repairs and upgrades is the primary factor preventing homeowners from repairing and upgrading their ISDS. Currently, there is very little financial assistance available to the residents of Coventry. The town utilizes the Community Development Block Grant (CDBG) for assisting in repairing/replacing ISDS. In 1999, the town received $41,500 through a CDBG pilot project. The $41,500 was enough to cover six ISDS upgrades; however, this source is no longer supplying enough funds for the community's needs. For instance, in the year 2000, only two upgrades were funded with $12,200 used from the CDBG housing rehabilitation fund. In 2001, only one upgrade that cost $10,400 was funded from the same source.

1.2 Community Septic System Loan Program (CSSLP)

As stated above, one goal of this OWMP is to become eligible for the CSSLP. The CSSLP provides low-interest loans for septic system upgrades. The program is administered by the DEM, the Clean Water Finance Agency (CWFA) and the RI Housing and Mortgage Finance Corporation (RI Housing). Funding was established in the spring of 1999 through the Clean Water State Revolving Fund Program (SRF). The CWFA earmarks $1 million a year for the CSSLP, but they have additional funds to support extra funding if needed. CWFA says that, if a community uses up its CSSLP loan money, a community can request another separate loan. According to the CWFA, to date, CSSLP loans have been given to the following communities:

- Charlestown $250,000
- Glocester $250,000
- New Shoreham $250,000
- South Kingstown $300,000
- North Kingstown $300,000

A copy of the CWFA's Loan Policies and Procedures for the "Community Septic System Loan Program" is in Appendix C. In summary, the process is as follows:

1) Receive DEM approval of OWMP.
2) Submit SRF loan application (Appendix C).
3) Obtain Certificate of Approval from DEM.
4) Submit a letter to CWFA requesting a loan.

The OWMP acts as the project, and the town signs a loan agreement as borrower. A zero percent (0%) interest rate is provided to the town, but the town must pay its own out of pocket borrowing costs (i.e. Coventry's legal counsel or financial advisor fees for the process of writing the loan with CWFA). A typical borrowing fee is approximately $2500. The town must assign a town employee to act as liason between the homeowner and the RI Housing. The town liason informs the public that loans are available and provides informational packets to interested homeowners. The informational packets are provided to the liason by RI Housing. RI Housing will act as the homeowner loan administrator.

RI Housing will accept applications from property owners; coordinate payments to septic system installers/property owners; collect repayments from property owners; credit property owner repayments to Coventry's principle payment; make monthly reports to both CWFA and Coventry.

A homeowner can receive a 3, 5, 7 or 10-year loan at four percent (4%) interest. The four percent acts as a flat fee to the homeowner; there are no loan origination or application fees charged to the homeowner. The four percent (4%) pays the administration expenses of Rhode Island Housing and the CWFA, as well as grows the SRF fund. CWFA recommends a maximum loan of $15,000 for a conventional septic system but allows the community to decide on its own limits. The following are examples of specific criteria that the community can decide:

- The number of estimates required from licensed installers.
- What type of property can qualify.
- Qualifications can be limited to owner occupied or limiting the number of housing units per structure.

A homeowner is considered to have defaulted on the loan for lack of payments, after several months and attempts by RI Housing to receive payment. CWFA allows the town to decide how to handle the default. The town can use processes such as a lien on the property or a tax sale to get the money back; however, the town is only liable for the principal.

1.3 OWMP Process

The DPW, Sheila Patnode--Director of Public Works, initiated the process of establishing an OWMP Committee. Sheila Patnode solicited members from the town staff, Brent Narkawicz—Director of Planning and Development, and Town Council—William Hall. The DPW then advertised in the local newspaper for residents to volunteer for the OWMP Committee. Two residents responded and filled out *Citizen Applications for Membership on Board or Commission*. Each of the residents, Roy Pruett and Roger Plante, accepted a position on the Committee. Since there were only two residents at large on the Committee, it was suggested that a member of the Johnson's Pond Civic Association be invited; Arnold Blasbag was suggested and accepted the invitation.

The Committee's kickoff meeting was held at the town offices on August 1, 2002. WSE took the minutes for this meeting; Roy Pruett offered to take minutes of future meetings. The Committee was introduced to the consultant and staff and provided the history of wastewater management in Coventry, the objectives and tasks required of the grant, and the five EPA model program options. All meeting advertisements and minutes are provided in Appendix A. Roy Pruett, with assistance from the Committee, wrote the following mission statement:

> *The Town of Coventry remains committed to the health and well being of its residents and their environment. Currently, 99% of town residents rely upon individual sewage disposal systems. Preventing contaminates from reaching our groundwater is a far easier task than cleaning up contaminated groundwater. The development of an Onsite Wastewater Management Plan will minimize*

wastewater contamination and ensure the health of future generations residing in Coventry.

The Committee will continue to serve until the adoption of the OWMP or until the Town Council votes that the mission of the Committee is complete.

Subsequent Committee meetings to discuss the draft OWMP were held on August 29, 2002, and September 9, 2002. At the September 9, 2002, meeting, Roger Plante and Roy Pruett reported on their interviews with local septic haulers. A report by Roy Pruett detailing these interviews is included in Appendix B. The first public meeting to present the draft OWMP was held on September 12, 2002, in the Auditorium at the Middle School. Despite advertisements posted in multiple locations, there was only one attendee. A Committee meeting was held on September 20, 2002, to finalize the OWMP. On September 23, 2002, the Consultant and the DPW presented the final recommendations to the Town Council. On October 2, 2002, a public meeting was held at the Coventry Health and Human Services Building. The final public meeting was held on October 7, 2002, following a work session with the Town Council. Town Council adopted this plan on October 7, 2002; a copy of the resolution is provided in the Appendix A.

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2.0

2.1 Management Areas Characterized

2.1.1 Water Quality

Each state must report every two years on the health of its waters to the EPA. This report is called the 305(b) report and is used to develop a list of "impaired waters," otherwise known as the 303(d) list (Appendix B). The criteria for being "impaired" is pollutant specific and is defined by the levels that must be maintained to be protective of various uses, such as fish consumption, aquatic life, drinking water, and swimming. Rhode Island submitted its 303(d) list to EPA late in 2000. The list cited problems with a section of the South Branch of the Pawtuxet River and the Quidnick Reservoir. However, neither impaired waterbody was considered polluted by fecal contaminants or common indicators (pathogens, nutrients or excess algal growth). At this time, there is no water quality data available to prioritize what surface waters may be impaired as a result of failing or substandard septic systems.

2.1.2 ISDS Conditions

There are an estimated 11,000 ISDS systems in the Town of Coventry. Since Coventry is almost exclusively reliant on ISDS for wastewater disposal, there is significant potential for surface and groundwater contamination due to failing or substandard septic systems in Coventry. This can happen when a system is not designed to current standards; for instance, there is an inadequate separation between an ISDS and the groundwater table, the system is undersized, or the site conditions do not support an ISDS.

One example of a substandard ISDS is a cesspool. A cesspool is a buried chamber which receives sanitary discharge with the purpose of both collecting solids and discharging liquids to the surrounding soil. A cesspool is not an approved method for ISDS installation, and DEM considers a cesspool to be substandard. Current ISDS regulations require the installation of a septic tank, which settles solids and contains solids which provide a period of anaerobic biological treatment, and a separate soil absorption (infiltration) system, consisting of either series of leaching trenches or a leaching bed.

A malfunctioning ISDS typically results from inadequate soil absorption of wastewater flows. Failures are often attributable to one or more of the following causes:

- Soils clogged from improper use or age of system.
- Site conditions inappropriate for system.
  - Insufficient separation between leach field and impermeable soil layer.
  - Soils too permeable for sufficient treatment prior to groundwater.
  - Insufficient separation between leach field and groundwater table.
  - Lot size insufficient.
- Broken or clogged system components.
- System incorrectly designed or constructed.
- Lack of proper maintenance pumping of the septic tank; allowing solid carry-over into the leach area.
- Excessive or extraneous flows resulting in hydraulic overloading.

The Wastewater Facilities Plan (FP) finalized in May 1995 documented types and location of failures. The FP focused on eastern Coventry because of the population densities and land use. The eastern third of the town is characterized by urban-suburban development and the rest of town is rural with significant portions of agricultural land and open space. Furthermore, the population is dense in the east and sparse in the west. The western areas of town consist of large (two to five acres) lots. This decision was substantiated by a DEM ISDS record review. The record review found 441 repairs had been filed for eastern Coventry for a total of 6,418 homes inside of the study area resulting in a percent repaired of 6.9 percent. The other two-thirds of Coventry only had 91 repairs for the 5,370 homes that were outside of the study areas. This resulted in a percent repaired of 1.7 percent. Therefore, though the Committee did locate a few outlying areas, the same focus is true of this OWMP. Section 3.4, Existing Individual Sewage Disposal Systems, of the FP evaluated the number, type and condition of ISDS in Coventry. This section has been appended in Appendix B.

Table 1, *Types of Existing ISDS Systems*, provides percentages for each of the type of ISDS systems that exist within Coventry. The percentages are based on results from the questionnaire conducted as part of the FP. As can see from the table, several areas have a high occurrence of cesspools.

Figure 2, *Onsite Management Priority Areas*, highlights the areas in town that are considered priorities for wastewater management solutions. These areas were originally identified by the FP and later supplemented by Committee recommendations. The areas shown in light purple are areas added by the Committee. A number of study areas identified in the FP are proposed for sanitary sewer. Two FP study areas, numbers 27 and 28, were originally proposed in the Phase 3 Sewer Program; because of the distance from other proposed sewer areas, the FP Update removed these two areas from the sewer program. The Committee recognizes that the highlighted areas are not inclusive of all onsite wastewater problems in town. Therefore, lots that remain outside of the priority areas will be considered for approval in the loan program. The criteria for the loan program are discussed in Section 4.3, Coventry CSSLP Details.

Figure 3, *Onsite Management Areas*, highlights two different types of parcels; the red parcels indicate those properties currently serviced by sanitary sewers and the blue parcels indicate those properties identified by the OWM Committee as having significant need. The majority of anticipated need in town is in the areas highlighted by blue.

2.1.3 CCSLP – Anticipated Needs

The Town of Coventry is the largest community in the State of Rhode Island not served by a community sewer system. Therefore, Coventry has more ISDS than any other town in Rhode Island. The number of systems in town coupled with the many older residential areas of eastern Coventry that were developed with average lots less than 10,000 square feet (in some cases less than 5,000 square feet) indicates a higher number of ISDS problems than those experienced in nearby towns. Table 3, *Anticipated Needs for CSSLP – Unsewered Scenario*, utilizes the FP data on ISDS Repair Records from 1887 – 1992 to estimate a dollar value for expected repairs using funds from the CSSLP. Table 3 anticipates needs if the sewer project does not go forward.

Table 4, *Anticipated Needs for CSSLP – Sewered Scenario*, anticipates the amount needed if the sewer project does proceed. The worse case scenario is the one outlined on Table 3; this provides a total expected annual cost of $1,006,200 for the entire town. Therefore, the town's request to the CSSLP is in the amount of $1,006,200. The Town of Coventry requests an initial capitalization of the program in the amount of $500,000.

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Table 1
Types of Existing ISDS Systems

Subarea Number	Number of Homes	Septic Tank with Leach Field[1]	Septic Tank with Leach Pit[1]	Cesspool[1]	Tight Tank[1]	Drywell for Wash Water[1]
Phase 1 -- Facilities Plan						
6	99	57%	0%	38%	0%	0%
7	207	44%	5%	37%	4%	1%
16	290	23%	4%	66%	1%	1%
21	106	33%	2%	57%	0%	0%
Phase 2 -- Facilities Plan						
3	167	46%	7%	43%	0%	2%
4	245	70%	7%	23%	0%	0%
5	297	62%	9%	26%	1%	0%
8	346	75%	5%	17%	2%	0%
9	109	69%	6%	20%	2%	2%
10	316	57%	3%	36%	1%	0%
11	288	73%	1%	24%	1%	0%
12	373	34%	2%	63%	1%	0%
17	314	33%	4%	54%	1%	3%
18	89	27%	5%	51%	3%	0%
19	90	34%	3%	60%	0%	0%
22	163	34%	4%	58%	2%	0%
23	190	57%	3%	39%	0%	1%
26	196	40%	10%	49%	0%	1%
Phase 3 -- Facilities Plan						
1	269	67%	5%	25%	1%	0%
2	154	57%	3%	35%	2%	0%
13	37	0%	0%	100%	0%	0%
14	303	86%	2%	9%	0%	0%
15	211	15%	5%	78%	0%	0%
20	109	16%	10%	55%	0%	0%
24	183	69%	2%	27%	0%	0%
25	91	69%	3%	29%	0%	0%
30	151	58%	3%	38%	0%	0%
31	111	38%	13%	50%	0%	0%
32	146	94%	0%	5%	0%	0%
Previously Designated for Sewer -- Facilities Plan[3]						
27	214	94%	3%	3%	0%	0%
28	137	55%	5%	34%	0%	0%
Additional Needs Areas -- OWMP						
Additional Areas[2]	268	46%	7%	43%	0%	2%

Notes:

[1]Percentages are based on results from the questionnaire conducted as part of the FP.

[2]The OWMP Committee identified additional need areas in town. These areas consist of very small lots, located along town water bodies.

[3]Areas 27 and 28 were previously designated for sewer in the FP. The FP Update removed these areas from the recommended sewer program.

Table 2

Occurrence and Types of ISDS System Problems

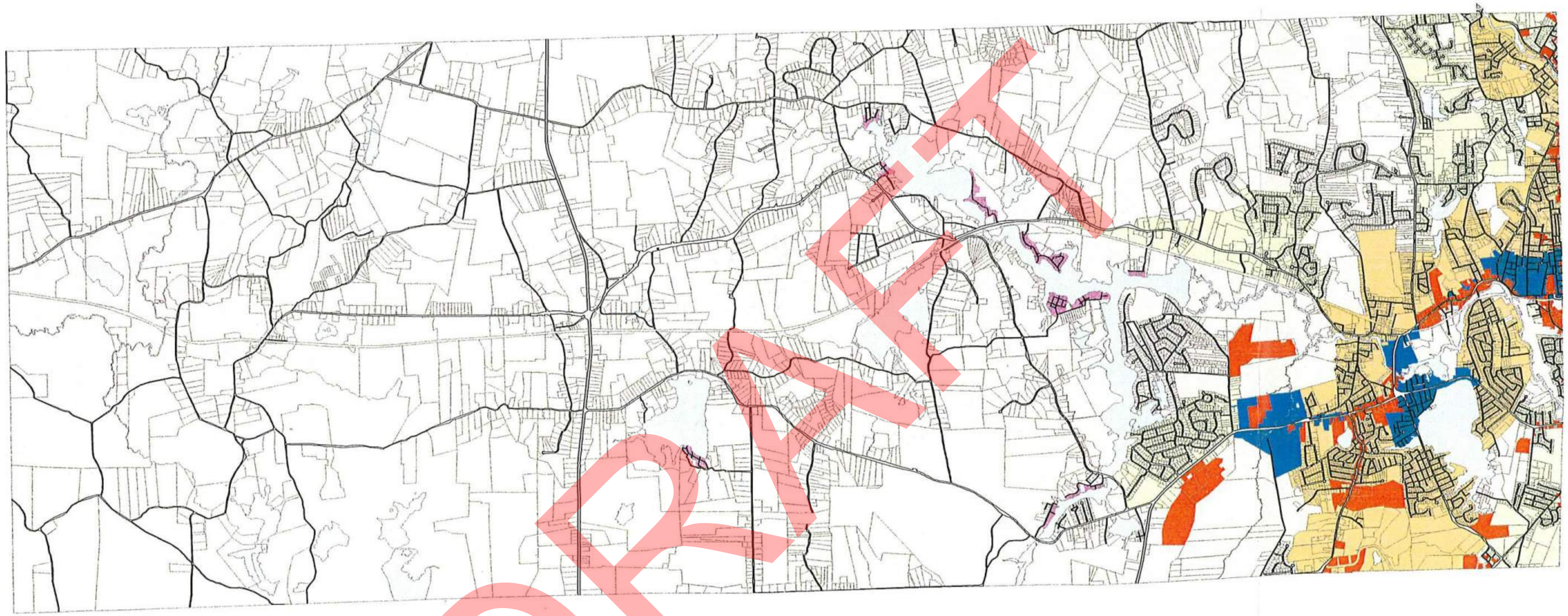
Subarea Number	Number of Homes	Systems Experiencing Problems[1]	Frequent Cleanouts[1]	System Backups[1]	Odor Problems[1]	Surface Breakout[1]	Limitation of Usage[1]
Phase 1 -- Facilities Plan							
6	99	53%	80%	30%	20%	10%	70%
7	207	31%	18%	71%	25%	14%	61%
16	290	31%	33%	45%	13%	15%	73%
21	106	20%	44%	33%	44%	33%	22%
Phase 2 -- Facilities Plan							
3	167	22%	42%	58%	25%	25%	50%
4	245	18%	88%	71%	41%	59%	0%
5	297	30%	35%	53%	29%	26%	44%
8	346	23%	27%	67%	10%	13%	77%
9	109	34%	29%	59%	29%	35%	35%
10	316	29%	49%	57%	20%	17%	63%
11	288	27%	37%	58%	26%	29%	45%
12	373	22%	53%	41%	19%	9%	72%
17	314	19%	22%	48%	22%	35%	43%
18	89	21%	43%	71%	43%	14%	43%
19	90	21%	43%	43%	14%	29%	57%
22	163	30%	38%	69%	19%	25%	56%
23	190	28%	24%	60%	24%	28%	48%
26	196	24%	40%	55%	30%	25%	45%
Phase 3 -- Facilities Plan							
1	269	22%	41%	64%	41%	36%	50%
2	154	36%	62%	43%	29%	14%	57%
13	37	50%	50%	50%	0%	0%	100%
14	303	23%	60%	50%	40%	30%	30%
15	211	27%	50%	44%	19%	31%	50%
20	109	11%	0%	0%	0%	33%	67%
24	183	21%	32%	32%	26%	26%	47%
25	91	29%	50%	50%	20%	20%	60%
30	151	22%	27%	53%	13%	13%	73%
31	111	13%	0%	100%	0%	0%	100%
32	146	26%	35%	65%	35%	18%	47%
Previously Designated for Sewer -- Facilities Plan[3]							
27	214	23%	7%	40%	40%	20%	40%
28	137	11%	33%	50%	33%	33%	33%
Additional Needs Areas -- OWMP							
Additional Areas[2]	268	22%	42%	58%	25%	25%	50%

Notes:

[1]Percentages are based on results from the questionnaire conducted as part of the FP.

[2]The OWMP Committee identified additional need areas in town. These areas consist of very small lots, located along town water bodies.

[3]Areas 27 and 28 were previously designated for sewer in the FP. The FP Update removed these areas from the recommended sewer program.



FOCUS AREA

Legend

PHASE 1 (REMAINDER): SEWER PROGRAM
DEVELOPED LOTS 608
WATERFRONT LOTS ... 32
STATE CODE 5 8
STATE CODE 6 63
STATE CODE 7 2

PHASE 2: SEWER PROGRAM
DEVELOPED LOTS .. 3,367
STATE CODE 5 14
STATE CODE 6 30
STATE CODE 7 17

TOTAL DEVELOPED PARCELS = 10,981

PHASE 3: SEWER PROGRAM
DEVELOPED LOTS .. 2,308
STATE CODE 5 0
STATE CODE 6 19
STATE CODE 7 18

IDENTIFIED IN ONSITE WASTEWATER MANAGEMENT PLAN
DEVELOPED LOTS 269
STATE CODE 5 0
STATE CODE 6 0
STATE CODE 7 0

SEWERED PROPERTIES
DEVELOPED LOTS 335
STATE CODE 5 6
STATE CODE 6 63
STATE CODE 7 10

FIGURE 2
ONSITE MANAGEMENT PRIORITY AREAS

ONSITE WASTEWATER MANAGEMENT PLAN
COVENTRY, RHODE ISLAND

5,000 0 5,000 10,000 FEET

N

GIS Weston&Sampson Services

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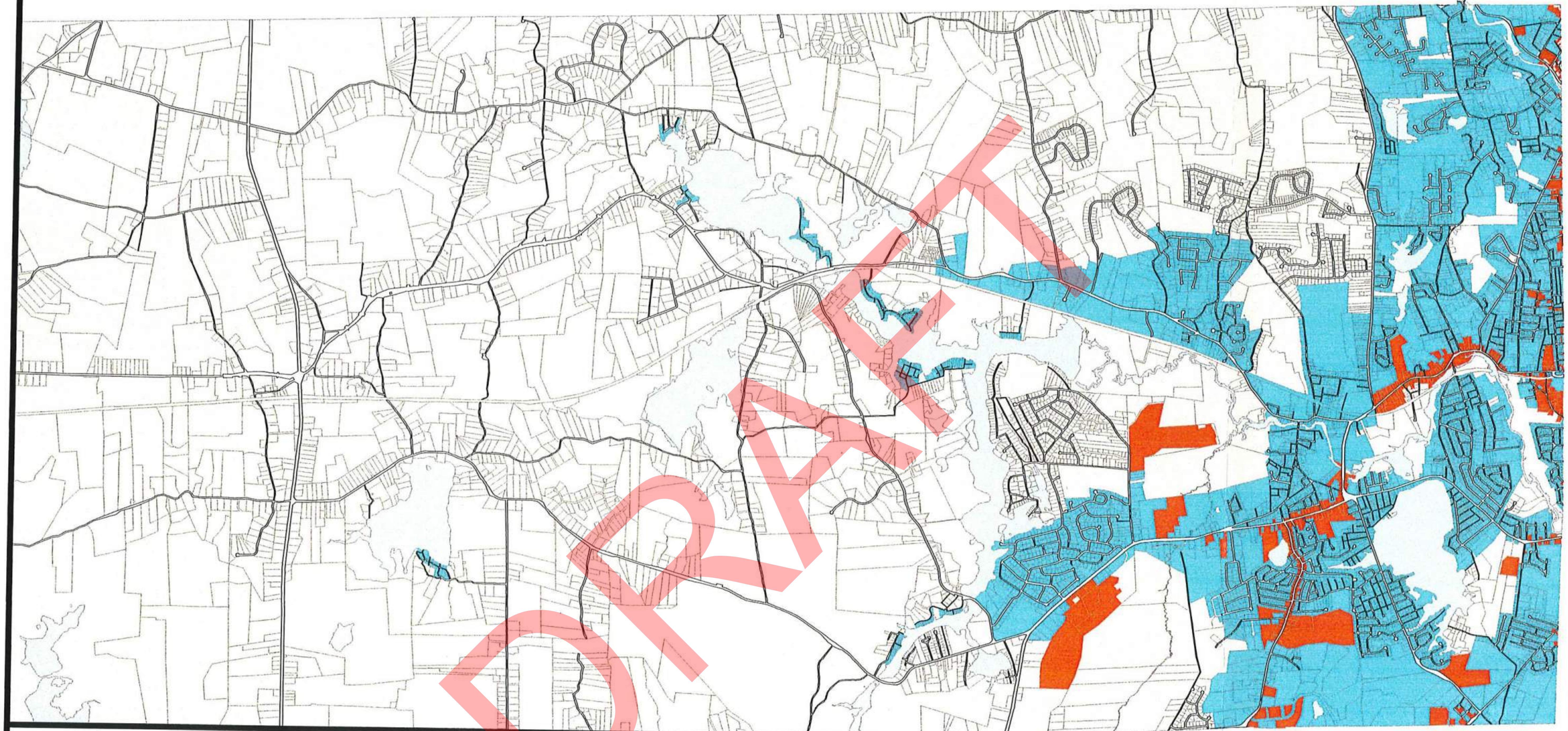
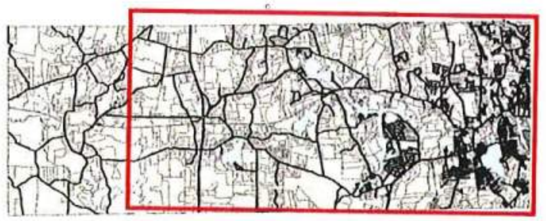


FOCUS AREA



LEGEND

SEWERED PROPERTIES

UNSEWERED PROPERTIES IDENTIFIED AS ONSITE WASTEWATER MANAGEMENT PRIORITY AREAS

FIGURE 3
ONSITE MANAGEMENT PRIORITY AREAS

ONSITE WASTEWATER MANAGEMENT PLAN

COVENTRY, RHODE ISLAND

3,500 0 3,500 7,000 FEET

GIS Weston&Sampson Services

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Table 3
Anticipated Needs for CSSLP -- Unsewered Scenario

Subarea Number	Number of Homes	Number of Repairs[1]	Percent of Repairs Expected [2]	Number of Repairs to Fund[3]	Annual Cost Per Area [4]
Phase 1 -- Facilities Plan					
6	99	13	13.1%	3	$23,400
7	207	17	8.2%	3	$23,400
16	290	23	7.9%	5	$39,000
21	106	8	7.5%	2	$15,600
			SUBTOTAL	13	$101,400
Phase 2 -- Facilities Plan					
3	167	12	7.2%	2	$15,600
4	245	15	6.1%	3	$23,400
5	297	22	7.4%	4	$31,200
8	346	27	7.8%	5	$39,000
9	109	9	8.3%	2	$15,600
10	316	23	7.3%	5	$39,000
11	288	8	2.8%	2	$15,600
12	373	25	6.7%	5	$39,000
17	314	18	5.7%	4	$31,200
18	89	6	6.7%	1	$7,800
19	90	3	3.3%	1	$7,800
22	163	13	8.0%	3	$23,400
23	190	13	6.8%	3	$23,400
26	196	14	7.1%	3	$23,400
			SUBTOTAL	43	$335,400
Phase 3 -- Facilities Plan					
1	269	15	5.6%	3	$23,400
2	154	10	6.5%	2	$15,600
13	37	4	10.8%	1	$7,800
14	303	19	6.3%	4	$31,200
15	211	5	2.4%	1	$7,800
20	109	9	8.3%	2	$15,600
24	183	11	6.0%	2	$15,600
25	91	8	8.8%	2	$15,600
30	151	12	7.9%	2	$15,600
31	111	5	4.5%	1	$7,800
32	146	11	7.5%	2	$15,600
			SUBTOTAL	22	$171,600
Previously Designated for Sewer -- Facilities Plan[5]					
27	214	7	3.3%	1	$7,800
28	137	11	8.0%	2	$15,600
			SUBTOTAL	3	$23,400
Additional Needs Areas -- OWMP					
Added Areas [6]	268	32	11.9%	6	$46,800
Rest of Town	5370	209	3.9%	42	$327,600
			TOTAL	129	$1,006,200

Notes:

[1]*Number of Repairs* is the number of systems that had repairs or upgrades based on the ISDS file review conducted between 1987-1992.

[2]*Percent of Repairs Expected* is calculated by dividing *Number of Repairs* by the *Number of Homes*. Exceptions: Entire Town and Added Areas are calculated using the *Percent of Systems* found in the FP for the Entire Town.

[3]The *Number of Repairs to Fund* is the *Number of Repairs* divided by 5 years to annualize the five year data.

[4]Annual cost is calculated by multiplying the estimated *Number of Repairs to Fund* by the average cost to repair a system. The average cost is based on the average cost ($7,800) of CDBG funded systems from 1999-2001.

[5]Subareas 27 and 28 were included for sewering in the Facilities Plan but were removed in the FP Update.

[6]The added areas are problem areas that were designated by the OWMP Committee and not previously included in the FP. The number of repairs/upgrades are from RIDEM data for the years 1992-2002; data was converted to five years for compatibility with FP data.

Table 4
Anticipated Needs for CSSLP -- Sewered Scenario

Subarea Number	Number of Homes	Number of Repairs[1]	Percent of Repairs Expected [2]	Number of Repairs to Fund[3]	Annual Cost Per Area [4]
Phase 2 Sewer Program -- Facilities Plan					
3	167	12	3.6%	1	$7,800
4	245	15	3.1%	2	$15,600
5	297	22	3.7%	2	$15,600
8	346	27	3.9%	3	$23,400
9	109	9	4.2%	1	$7,800
10	316	23	3.6%	2	$15,600
11	288	8	1.4%	1	$7,800
12	373	25	3.4%	2	$15,600
17	314	18	2.9%	2	$15,600
18	89	6	3.4%	1	$7,800
19	90	3	1.7%	0	$0
22	163	13	4.0%	1	$7,800
23	190	13	3.4%	1	$7,800
26	196	14	3.6%	1	$7,800
			SUBTOTAL	20	$156,000
Phase 3 Sewer Program -- Facilities Plan					
1	269	15	5.6%	3	$23,400
2	154	10	6.5%	2	$15,600
13	37	4	10.8%	1	$7,800
14	303	19	6.3%	4	$31,200
15	211	5	2.4%	1	$7,800
20	109	9	8.3%	2	$15,600
24	183	11	6.0%	2	$15,600
25	91	8	8.8%	2	$15,600
30	151	12	7.9%	2	$15,600
31	111	5	4.5%	1	$7,800
32	146	11	7.5%	2	$15,600
			SUBTOTAL	22	$171,600
Previously Designated for Sewer -- Facilities Plan[5]					
27	214	7	3.3%	1	$7,800
28	137	11	8.0%	2	$15,600
			SUBTOTAL	3	$23,400
Additional Needs Areas -- OWMP					
Added Areas [6]	268	32	11.9%	6	$46,800
Page Subtotal					$397,800
Rest of Town	5370	209	3.9%	42	$327,600
			TOTAL	93	$725,400

Notes:

[1] *Number of Repairs* is the number of systems that had repairs or upgrades based on the ISDS file review conducted between 1987-1992.

[2] *Percent of Repairs Expected* is calculated by dividing *Number of Repairs* by the *Number of Homes*. Exceptions: Phase 2 is calculated assuming that half of the properties will wait for sewer rather than repairing their system. Entire Town and Added Areas are calculated using the *Percent of Systems* found in the FP for the Entire Town.

[3] The *Number of Repairs to Fund* is the *Number of Repairs* divided by 5 years to annualize the five year data.

[4] Annual cost is calculated by multiplying the estimated *Number of Repairs to Fund* by the average cost to repair a system. The average cost is based on the average cost ($7,800) of CDBG funded systems from 1999-2001.

[5] Subareas 27 and 28 were included for sewering in the Facilities Plan but were removed in the FP Update.

[6] The added areas are problem areas that were designated by the OWMP Committee and not previously included in the FP. The number of repairs/upgrades are from RIDEM data for the years 1992-2002; data was conerted to five years for compatibility with FP data.

3.0

3.1 Onsite Management Alternatives

3.1.1 EPA Guidelines

In the U.S. Environmental Protection Agency (EPA) 'Guidelines For Management of Onsite/Decentralized Wastewater Systems', five separate model programs are provided.

- Model Program 1, System Inventory and Awareness of Maintenance Needs, is a minimum level of management. Program 1 is intended to raise the municipality's awareness of the type and condition of the systems within the community and to raise the homeowners' awareness of system needs.
- Model Program 2, Management Through Maintenance Contracts, is designed to ensure that maintenance contracts with trained operators are in place for more complex system designs.
- Model Program 3, Management Through Operating Permits, is suggested where specific water quality criteria needs to be achieved; operating permits are renewable when the owner demonstrates that the system is in compliance with the conditions of the permit.
- Model Program 4, Utility Operation and Maintenance, is utilized in areas of sensitive resources. Greater control over an onsite system's operation and maintenance is achieved through a wastewater utility.
- Model Program 5, Utility Ownership and Management, is similar to Program 4 but ownership of the individual systems is now with the utility. This increased control reduces the likelihood of dispute between the system operator and the property owner.

Table 5 provides a matrix that breaks down the EPA models. The matrix compares the objectives, benefits and limitations of each program. The management requirements become progressively more rigorous from the first level to the fifth level. Each of the program levels have been successfully employed in the United States.

Table 5
Model EPA Onsite Wastewater Management Program Options

Program	Objectives	Benefits	Difficulties
1. System Inventory and Awareness	Inventory; ensure sited and installed properly, inspected, maintained and repaired as necessary; and periodically provide owners with O&M info.	Easy/inexpensive. Not much resistance.	No operating component. Can't ID problems.
2. Mgmt thru Maintainence Contracts	Maintenance contract required on Alternative Systems to assure timely response.	Reduces risk of failure and contamination from failure.	Difficult tracking & enforcing.
3. Mgmt thru Operating Permits	Establish specific & measureable performance requirements, renewable operating permits and monitoring with maintenance agreements	Enforces mgmt of systems. Reduces risk of failure and contamination.	Same problems as #2. Needs higher level of expertise to implement.
4. Utility O & M	O&M through a professional utility.	O&M performed regularly. Problems ID'd before failure. Reduces burden on local gov't.	Utility must be tech & financially viable. Conflicts between owner & operator. Requires authorizing legislation.
5. Utility Ownership & Mgmt	Ownership and O&M thru pro. utility.	Reduce risk of system failure. Allows area-wide planning. Avoids conflict.	Easements required. Greater financial investment. Utility must be tech & finan. viable. Requires authorizing legislation.

3.1.2 Rhode Island OWMPs

Within Rhode Island, there are 13 municipalities that have standards for ISDS design beyond the State's regulations. The most common design standards that go beyond state standards include stricter setback requirements, certified watertight tanks upon installation, installation of effluent filters and access risers, and the prohibition of garbage disposals.

There are seven municipalities that have management plans in place and there are four communities that require the use of innovative/alternative technologies for certain circumstances. The most common management program includes requiring inspection and pumping and maintenance contracts for systems with mechanical components. Table 6 provides a matrix with management program details for each of the seven communities.

3.2 OWMP Committee Options

The following options were explored by the OWMP Committee:

3.2.1 System Inventory and Awareness of Maintenance Needs

Problem: One of the largest problems that became apparent in the FP questionnaire process was that residents do not understand ISDS operation and maintenance requirements.

Solution: To assist property owners in the understanding of their systems, the town of Coventry will provide additional ISDS education and guidance. Guidance and education will be provided through the use of the town's website, brochures/mailers, and library resources. The following are examples of guidance required:

- Proper inspection, operation and maintenance of the ISDS.
- Recommended upgrades to the ISDS.
- Use of alternative and innovative septic systems.
- ISDS inspectors and contractors.
- Protection of sensitive resources.

- Proper disposal of hazardous waste.
- Water conservation.
- Availability of financial assistance.

The town currently has frequently asked questions regarding ISDS on its website (http://www.town.coventry.ri.us/planning.htm) under the Planning Department page (see Appendix D). A new page is being developed by the Department of Public Works; this web page will provide additional information regarding concerns specific to Coventry, outcomes to the OWMP, and links to the DEM and the University of Rhode Island (URI) websites. DEM and URI each have extensive ISDS guidance (Appendix D) provided for general viewing on their websites.

The DPW reserved a display case in the Public Library for one month for dedication to the OWMP. The case will be used to display ISDS information.

Problem: The town does not have detailed data as to the location, type, and condition of ISDS in town.

Solution: The town should devise a form for the recording of ISDS upgrades, repairs, and new installations. The completed form would be required with the record drawing submission. The town has a Geographical Information System (GIS). The data gained on the aforementioned ISDS form should be entered into an ISDS layer within the town's GIS. Furthermore, the town's GIS could be used to track ISDS inspections and maintenance within the town. This could be handled by appropriating funds to add time for GIS personnel to be dedicated to this task or by offering an internship to a student.

Problem: One problem identified in the questionnaire is that, in many cases, pumping is not happening often enough.

Solution: The town could provide an incentive for ISDS pumping and/or inspection. The incentive could be in the way of a property tax credit or a town-sponsored rebate. One idea is for